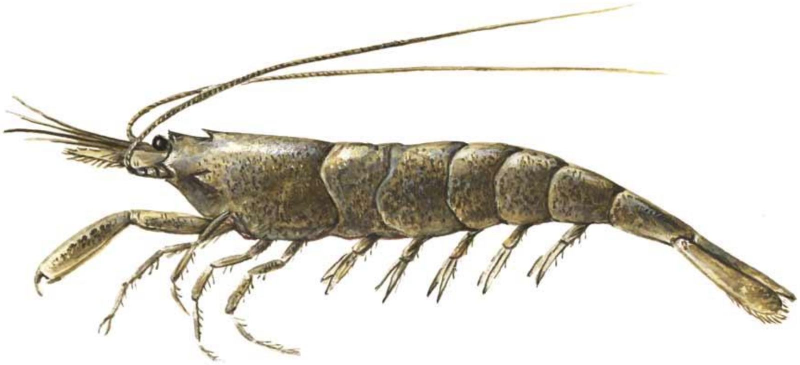
MSC SUSTAINABLE FISHERIES CERTIFICATION

North Sea Brown Shrimp



Peer Review Draft Report

January 2017

Prepared For: **German Brown Shrimp Steering Group GbR; Danish Fishermen Producers' Organisation; Coöperatieve Visserij Organisatie (CVO)**

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Glossary

ASCOBANS	(Bonn Convention’s) Agreement on the Conservation of Small Cetaceans in the Atlanto-Scandian and Baltic.
ACOM	ICES Advisory Committee
AEWA	Agreement on the Conservation of African-Eurasian Waterbirds
AIS	Automatic Identification System
BfN	Bundesamt für Naturschutz - German Federal Agency for Nature Conservation
Bpa	Precautionary reference point for spawning stock biomass

Blim	Limit biomass reference point, below which recruitment is expected to be impaired.
Bmsy	Biomass corresponding to the maximum sustainable yield
BMEL	Bundesministerium für Ernährung und Landwirtschaft- German Federal Ministry of Food and Agriculture
CBD	Convention on Biological Diversity
CFP	EU Common Fisheries Policy
CITES	Convention on International Trade in Endangered Species
CMO	EU's Common Organisation of the Market
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CR	Council Regulation
CVO	Coöperatieve Visserij Organisatie
DCF	Data Collection Framework
DFA	Danish Fishermen's Association
DFPO	Danske Fiskeres Producent Organisation
DFS	Dutch Demersal Fish Survey
DYFS	German Demersal Young Fish Survey
EAPO	European Association of Producers Organisations
EC	European Commission
EEZ	Exclusive Economic Zone
EFCA	European Fisheries Control Agency
EIA	Environmental Impact Assessment
ETP	Endangered, threatened and protected species
EU	European Union
F	Fishing Mortality
Flim	Limit reference point for fishing mortality that is expected to drive the stock to the biomass limit
Fmsy	Fishing mortality giving maximum sustainable yield
FAM	MSC's Fisheries Assessment Methodology
FAO	United Nations Food and Agriculture Organisation
FMC	Danish Fisheries Monitoring Control
GES	Good Environmental Status, Marine Strategy Framework Directive
GK	Garnalenvergunning Kustwateren – Dutch fishing licence for Wadden Sea and coastal waters
GV	Garnalenvergunning Visserijzone - Dutch fishing licence for coastal waters only
HCR	Harvest Control Rule
ICES	International Council for the Exploration of the Sea
LPUE	Landings per Unit Effort
LTL	Low Trophic Level species
LTMP	Long Term Management Plan
M	Natural mortality
MARPOL	International Convention for the Prevention of Pollution from Ships
MCS	Monitoring, Control and Surveillance
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NAO	North Atlantic Oscillation index
NGO	Non-Governmental Organisation
NSAC	North Sea Advisory Council
OSPAR	Oslo-Paris Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic)
P1	MSC Principle 1
P2	MSC Principle 2
P3	MSC Principle 3
PI	MSC Performance Indicator
PKB	Key Planning Decision Wadden Sea
PO	Producer Organisation
PRI	Point of Recruitment Impairment
PSA	Productivity Susceptibility Analysis
RAC	Regional Advisory Council

RBD	River Basin District
RBF	Risk Based Framework
RTC	Real Time Closures
SAC	Special Area of Conservation
SG	Scoring Guidepost (MSC)
SI	Scoring Issue (MSC)
SPA	Special Protection Areas
SSB	Spawning Stock Biomass
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNCLOS	United Nations Convention on the Law of the Sea
UNFAS	United Nations Fish Stocks Agreement
UoA	Unit of Assessment
UoC	Unit of Certification
VME	Vulnerable Marine Ecosystem
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
WFD	Water Framework Directive
WWF	World Wide Fund For Nature
Z	Total mortality

1 Executive Summary

This report provides details of the MSC assessment process for the North Sea Brown Shrimp fishery for German Brown Shrimp Steering Group GbR, Danish Fishermen Producers' Organisation and Coöperatieve Visserij Organisatie (CVO). The assessment process began on 28th January 2016 and was concluded (to be determined at a later date).

A comprehensive programme of stakeholder consultations were carried out as part of this assessment, complemented by a full and thorough review of relevant literature and data sources.

A rigorous assessment of the wide ranging MSC Principles and Criteria was undertaken by the assessment team and a detailed and fully referenced scoring rationale is provided in the assessment tree provided in Appendix 1 of this report.

The Target Eligibility Date for this assessment is the date of PCDR publication.

The assessment team for this fishery assessment comprised of Julian Addison whose role included team lead and primary Principle P1 specialist; Gudrun Gaudian who was primarily responsible for evaluation of Principle 2 and Paul Knapman who was primarily responsible for evaluation of Principle 3. Paul MacIntyre was the traceability expert advisor.

Strengths of the fishery include:

The client group has established a good working relationship across three EU member states with the intention of working to a common goal of achieving and maintaining MSC certification;

An industry-led management plan has been developed and implemented;

The management of primary and secondary species;

The overarching governance and policy with respect to management of the fishery.

Weaknesses of the fishery

The management plan has not been in operation for a long time and so information and evidence to support and demonstrate its effectiveness is limited at present.

Determination

On completion of the assessment and scoring process, the assessment team concluded that the fishery is recommended for certification.

Conditions

A number of criteria which contribute to the overall assessment score scored less than the unconditional pass mark, and therefore trigger a binding condition to be placed on the fishery, which must be addressed in a specified timeframe (within the 5 year lifespan of the certificate). Full explanation of these conditions is provided in **Appendix 1.3** of the report, but in brief, the areas covered by these conditions are related to:

- The harvest strategy;
- The collation and analysis of quantative information on primary, secondary and ETP species;
- Compliance with management requirements to protect specified habitats;
- Collation of information that allows identification of fishing impacts on habitats;
- Established decision-making processes;
- Availability of information on the fishery’s performance and management;
- Monitoring, control and surveillance;
- Review of the management system.

For interested readers, the report also provides background to the target species and fishery covered by the assessment, the wider impacts of the fishery and the management regime, supported by full details of the assessment team, a full list of references used and details of the stakeholder consultation process.

Acoura Marine Ltd. confirm that this fishery is within scope.

2 Authorship and Peer Reviewers

2.1 Assessment team

All team members listed below have completed all requisite training and signed all relevant forms for assessment team membership on this fishery.

Assessment team leader: Julian Addison

Primarily responsible for assessment under Principle 1:

Dr Julian Addison is an independent fisheries consultant with 30 years' experience of stock assessment and provision of management advice on shellfish fisheries, and a background of scientific research on shellfish biology and population dynamics and inshore fisheries. Until December 2010 he worked at the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in Lowestoft, England where he was Senior Shellfish Advisor to Government policy makers, which involved working closely with marine managers, legislators and stakeholders, Government Statutory Nature Conservation Organisations and environmental NGOs. He has experienced shellfish management approaches in North America as a visiting scientist at DFO in Halifax, Nova Scotia and at NMFS in Woods Hole, Massachusetts. For four years he was a member of the Scientific Committee and the UK delegation to the International Whaling Commission providing scientific advice to the UK Commissioner. He has worked extensively with ICES and was Chair of the Working Group on the Biology and Life History of Crabs, a member of the Working Group on Crangon Fisheries and Life History and a member of the Steering Group on Ecosystems Function. He has recently completed or is currently undertaking MSC full assessments for the Newfoundland and Labrador snow crab fishery, the Ireland and Northern Ireland bottom grown mussel fisheries, both the Estonia and Faroe Islands Barents Sea cold water prawn fisheries, the Nephrops fishery in the Skagerrak and Kattegat, the Swedish shrimp fishery in the Skagerrak and Norwegian Deep and the Eastern Canada offshore lobster fishery. He has also undertaken various MSC pre-assessments and surveillance audits and has carried out peer reviews of MSC assessments in both Europe and North America of lobster, cold water prawn, razorfish, cockle and scallop fisheries. Other recent work includes a review of the stock assessment model for blue crabs in Chesapeake Bay, USA, and an assessment of three Alaskan crab fisheries under the FAO-based Responsible Fisheries Management scheme.

Expert team member: Gudrun Gaudian

Primarily responsible for assessment under Principle 2

Dr Gudrun Gaudian is an experienced marine ecologist and taxonomist, including coastal and marine surveys, EIA's for development and tourism, and research projects in tropical and temperate seas. Work experience also includes coastal and marine management issues, such as identifying sustainable coastal development projects, as well as addressing conservation issues, including selection and planning of marine parks and reserves, sustainable utilisation of natural resources and community based management programmes. Projects have been undertaken in temperate, polar and tropical marine regions. For some years now, Dr Gaudian has been working in fisheries certification applying the Marine Stewardship Council standard for sustainable fisheries, currently concentrating on Principle 2 of the Standard. Furthermore, Dr Gaudian holds an LLM degree in Environmental Law and Management, giving a deeper understanding of law and policy dealing with such relevant issues as the Common Fisheries Policy, water and waste management, and international environmental law including EU environmental policy.

Expert team member: Paul Knapman

Primarily responsible for assessment under Principle 3

Paul is based in Halifax, Nova Scotia, Canada and has recently returned to Fisheries Consultancy. He was the General Manager of Intertek Fisheries Certification a Conformity Assessment Body (CAB) that focused their work on Marine Stewardship Council (MSC) fisheries and chain of custody assessment / certification. He has extensive experience of MSC related work having been the Lead Assessor / Auditor and/or technical reviewer for 50+ client fisheries throughout the world. He was previously Head of an inshore fisheries management organization in the UK, a senior policy advisor to the UK government on fisheries and environmental issues, a British Fisheries Officer and a fisheries consultant to clients in Europe and Canada.

Expert advisor: Paul MacIntyre

Paul started working in the Aquaculture sector in 1975, managing salmon farms and processing factories for a large multi-national before transferring in 1990 to aquaculture audit and inspection.

During the last 25 years Paul has carried out over 3,000 audits and inspections of aquaculture and fish processing operations across the UK salmon and trout industry and internationally in the cod, tilapia and shrimp aquaculture sectors. Paul's primary interest is salmonids however my role as Aquaculture Director with Acoura Marine has involved him in the development and trial audit of a number of new aquaculture and agricultural standards. Paul is a qualified Lead Assessor and approved to audit BRC, MSC / ASC Chain of Custody, GlobalGAP, Organic Aquaculture, Freedom Food, Label Rouge, Best Aquaculture Practices, ASC Salmon and Friend of the Sea. Paul also audits to UK and French retailer standards.

2.1.1 Peer Reviewers

The MSC's Peer Review College compiled a shortlist of potential peer reviewers to undertake the peer review for the North Sea brown shrimp fishery. Two peer reviewers are required and will be selected by the Peer Review College from the following list:

- Sten Munch-Petersen
- Colin Bannister
- Gerald Ennis
- Robert O'Boyle

From this list the following two peer reviewers were selected:

Sten Munch-Petersen
Sten Munch-Petersen is now retired as Senior Scientific Advisor at DTU Aqua (the former Danish Institute for Fisheries Research (DIFRES)) but is still active as emeritus. His extensive experience includes: fish stock assessment and biology; expert advisory roles to fishery management bodies; and, design of sampling programmes for the gathering of fisheries data. He has had a number of significant appointments, including: In 1989-1991 and 2003-2005 he was chairman of the ICES Pandalus Assessment WG (since 2005 the joint NAFO-ICES NIPAG group); in 2000-2003 he was Danish member of ICES Advisory Committee on Fisheries Management (ACFM); and, from 1999 to 2007 he was the Danish member of The Scientific Technical and Economic Committee for Fisheries of the European Commission (STECF). He has previously reviewed several MSC assessments, e.g. Canadian shrimp fisheries (2008 and 2010), the Faroese Smelt fishery and Icelandic fishery for Lumpfish.

Gerald Ennis
Following undergraduate and graduate degrees at Memorial University of Newfoundland in the 1960s, Dr. Ennis completed a Ph.D. in marine biology at the University of Liverpool in the early 1970s. He retired in 2005 following a 37-year research career with the Science Branch of the Department of Fisheries and Oceans. He has produced an extensive list of

scientific/technical reports and journal articles (40 in the primary, peer reviewed literature) focused primarily on lobster fishery and population biology and on various aspects of larval, juvenile and adult lobster behavior and ecology in Newfoundland waters. As Head of Shellfish Section for 27 years, Dr. Ennis oversaw research projects lead by 4-5 other scientists focused primarily on fisheries management related research on northern shrimp, snow crab, scallops, squid and other shellfish throughout the Newfoundland-Labrador area of the Northwest Atlantic. Throughout his career, Dr. Ennis was heavily involved in the review and formulation of scientific advice for management of shellfish in Atlantic Canada as well as the advisory/consultative part of managing the Newfoundland lobster fishery. Since retiring, Dr. Ennis has published several articles aimed at presenting fishery science primarily to harvesters and has participated in most aspects of the MSC certification process for several Atlantic Canada fisheries.

2.1.2 RBF Training

Julian Addison has been fully trained in the use of the MSC's Risk Based Framework (RBF). RBF was not used for this fishery assessment.

3 Description of the Fishery

3.1 Unit(s) of Assessment (UoA) and scope of certification

Acoura Marine Ltd confirm that the fishery is within scope of the MSC certification sought following the assessment as defined below.

3.2 UoA and proposed Unit of Certification (UoC)

The following UoA was used as it is compliant with client wishes for assessment coverage and in full conformity with MSC criteria.

Species:	Brown shrimp (*Crangon crangon*) it is also known as 'Noordzee Garnalen' in the Netherlands, 'Nordseekrabben' in Germany and 'Hesterejer' or 'Sandrejer' in Denmark
Stock:	North Sea Continental Brown Shrimp
Geographical area:	North Sea (FAO Statistical Area 27/ ICES Area IVb and IVc)
Harvest method:	Brown shrimp lightweight beam trawl, with bobbin/roller groundrope. 20 mm minimum mesh. 10 m maximum beamlength.
Client Group:	Danish Fishermen PO (DFPO) German Brown Shrimp Steering Group GbR Coöperatieve Visserij Organisatie (CVO)
Other Eligible Fishers:	The small number of active vessels in the Netherlands and Germany which are not currently members of the respective POs and may join under the terms of the management plan.

The proposed Unit Of Certification for this fishery is as below:

Species:	Brown shrimp (*Crangon crangon*) it is also known as 'Noordzee garnalen' in the Netherlands, 'Nordseekrabben' in Germany and 'Hesterejer' or 'Sandrejer' in Denmark
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3.3 Final UoC(s)

(PCR ONLY)

The final Unit Of Certification for this fishery is as defined below. This has not changed throughout the process. Alternatively provide rationale for why this has changed.

Species:	
Stock:	
Geographical area:	
Harvest method:	
Client Group:	
Other Eligible Fishers:	

3.3.1 Total Allowable Catch (TAC) and Catch Data

Table 1 TAC and Catch Data

TAC	**Year**	2016	**Amount**	Not applicable
UoA share of TAC	**Year**	2016	**Amount**	Not applicable
UoC share of total TAC	**Year**	2016	**Amount**	Not applicable
Total green weight catch by UoC	**Year (most recent)**	2015	**Amount**	30,454 tonnes
	Year (second most recent)	2014	**Amount**	35,450 tonnes

3.4 Overview of the fishery

Clients organisational structure

There are three separate organisations which make up the Client Group for this fishery certification - Coöperatieve Visserij Organisatie (CVO) in the Netherlands, a coalition of four Producer Organisations in Germany forming the German Brown Shrimp Steering Group, MSC-GbR, and the Danske Fiskeres Producent Organisation, DFPO, from Denmark.

The Cooperative Fisheries Organisation (CVO) is an association of Producers Organisations which are active in the cutter fishery of the North Sea, Wadden Sea and coastal waters, Skagerrak, and the English Channel. The following Producers Organisations are affiliated with the CVO:

- Cooperative Producers Organisation and Management Group Delta Zuid U.A.
- Cooperative Producers Organisation Nederlandse Vissersbond U.A.
- Cooperative Producers Organisation and Management Group Texel U.A.
- Cooperative Producers Organisation and Management Group Wieringen U.A.
- Cooperative Producers Organisation and Management Group West U.A.
- Cooperative Producers Organisation for Fisheries Urk U.A.
- International Shrimp Producers Organisation Rousant U.A.

The CVO states that it strives towards a sustainable commercial fishery by:

1. Working towards the certification of fishery products with internationally recognized sustainability labels, such as the Marine Stewardship Council (MSC) and Friend of the Sea (FOS);
2. Being active in the promotion of certified fish of members of the affiliated PO's.

The CVO is client for certification of fishery products which are provided by its members. These products are flatfish species such as sole and plaice and crustaceans like Nephrops and Brown Shrimp. The CVO fleet consists of cutters which are members of the PO's affiliated with the CVO. The members of the PO's, which are member of the CVO, cover a large part of the Dutch trawlers operating in the North Sea.

The German MSC-GbR consists of four POs:

- Erzeugergemeinschaft der Deutschen Krabbenfischer GmbH (ca. 100 vessels);
- Erzeugergemeinschaft Küstenfischer der Nordsee GmbH (ca. 28 vessels);
- Erzeugergemeinschaft Tönning, Eider, Elbe und Weser w.V. (ca. 22 vessels); and,
- Fischereigenossenschaft Elsfeth e.G. (ca. 7 vessels).

The POs are based in Niedersachsen and Schleswig-Holstein and recognized by the competent authorities in accordance with European law. Increasing sustainability and promoting the economic base of the associated fishermen are two important duties of POs. Thus the POs combined in the MSC GbR decided to apply for the MSC-certification together with the POs from Denmark and the Netherlands.

The Danske Fiskeres Producent Organisation or Danish Fishermen's Producers Organisation (DFPO) obtained official recognition as an EU Producers Organisation (PO) in 1974, with the overarching objective of creating a balance between supply and demand in the market place for species to which minimum prices are applied under EU regulations. Additionally, the DFPO also oversees the withdrawal of fish from the market where landings are unable to obtain minimum withdrawal prices. Sole is one of the species that fall within the EU minimum price scheme along with the other main commercial species landed by the EU fleet. DFPO members land approximately 95 % of the total Danish catches of these species (herring is excluded from this figure). All active Danish vessels are eligible for membership of the DFPO. Members pay a landings levy to the DFPO for all landings of relevant species and in return the DFPO offers a safety-net in the form of guaranteed minimum payments, if members cannot sell their fish at the minimum prices stipulated by the EU. The members are then entitled to receive a guarantee payment or refund, which is generally at the same level as the withdrawal price itself.

The DFPO is structured as follows:

- Members Council: responsible for statute changes, election of chairman and board, and outlining official policy in relevant fields of responsibility.
- Chairman and board: responsible for setting minimum prices (regulations permit EC guide prices to be altered within +/- 10 %, according to current market situation). The board also fixes the level of guaranteed payment to members in case of withdrawals from the market.
- Secretariat: 21 employees (common with the Danish Fishermen's Association (DFA)), including a 1 DFPO chairman (and 1 DFA chair plus 2 vice-chairs), and responsible for all administrative matters.

DFPO cooperates closely with the Danish Fishermen's Association on most fishing related matters, nationally as well as internationally. DFPO also represents its members on a number of committees under the Danish Ministry of Food, Agriculture and Fishing. DFPO is also a member of the European Association of Producers Organisations (EAPO). In addition, the DFPO also undertakes some business operations such as the production, and the leasing out of cold storage facilities to members primarily located in the smaller fishing ports. Unlike some other European Producer Organisations, the DFPO do not play any role in holding vessel quota, monitoring uptake or undertaking quota trading.

Description of the fishery area under evaluation

The assessment covers Dutch, German and Danish vessels catching brown shrimp (*Crangon crangon*) in the North Sea (FAO Statistical Area 27/ ICES Area IVb and IVc) using a lightweight beam trawl. The fishery operates mainly within 12 nautical miles (nm) (also known as Territorial Waters) from the coast of Denmark, Germany and the Netherlands. But fishing for brown shrimp may extend beyond 12 nm in waters up to 30m deep. The brown shrimp is also known as 'Noordzee garnalen' in the Netherlands, 'Nordseekrabben' in Germany and 'Hesterejer' or 'Sandrejer' in Denmark, and is fished by Dutch, German, Danish, Belgian and French vessels along the coastal areas of the eastern North Sea and also by United Kingdom vessels on the western side of the North Sea. Although brown shrimp in the North Sea is considered to be a single stock, the geographical separation of the UK fisheries from those on the eastern side of the North Sea suggests that the coastal fisheries in the eastern North Sea should be assessed separately from the UK fisheries. In the original proposed Unit of Assessment and Unit of Certification, Belgian and French fishers were listed as other eligible fishers. After discussions with the Client, Acoura Marine submitted a request to the MSC on 3 August 2016 for a variation in the original UoA and UoC to remove French and Belgian vessels from the list of "other eligible fishers". The rationale for the change in UoA and UoC was that the proposal would reduce scale and speed up the certification process, although the clients confirmed that they would still pursue an expansion of the fishery to include French and Belgian vessels at a point to be decided in the future. The variation was agreed by MSC on 11 August 2016 and posted on the MSC website on 16 August 2016.

Fishing practices

Vessels

Approximately 65-70% of the total North Sea fleet are German and Dutch vessels. Most German vessels are smaller than 20 m in length with engine power of around 200 kilo watts (kW), whereas 60% of the Dutch fleet are larger than 20 m with engine powers greater than 200 kW. Typical Dutch and German vessels are shown in Figures 1 and 2. However the maximum permitted engine power of shrimp trawlers within the 12-mile zone and the plaice box is 221 kW as defined under EU Council Regulation 850/98. Under the newly developed Brown Shrimp Management Plan, the number of vessels and combined kW in each national fleet (Netherlands, Germany and Denmark) shall not exceed the level officially registered by the authorities in each country on 1 January 2015.

Figure 1 Example of a typical Dutch shrimp vessel

Figure 2 Example of a typical German shrimp vessel

Fishing gear

Brown shrimps are targeted using bottom trawls with small mesh sizes ranging from 16-26 mm. With a 21.7 mm mesh size, 39mm is the size at which 50% of shrimps are retained in the gear with that mesh size (Polet et al., 2000) which means that sub-commercial sized shrimps (<50 mm) and immature female shrimps (length at 50% maturity is 55 mm) are caught in the fishery. The use of sieve or veil nets which avoid the capture of larger bycatch fish species is obligatory under EU Council Regulation 850/98. Sieve nets are cone-shaped nets inserted into standard trawls which direct unwanted by-catch to an escape hole in the body of the trawl (Revill and Holst, 2004) (Figure 3). The escape hole may be covered with an 80 mm mesh to allow the capture of commercial size fish. More detailed information on bycatch reduction strategies and previous and current gear research is provided in section 3.6.6. Following capture, the shrimps are sieved on-board, and small, non-commercial-sized shrimps and other bycatch are discarded. Survival of discarded shrimp is high (Lancaster and Frid, 2002). The catch is then boiled aboard the vessel prior to landing. The catch undergoes a further sieving process ashore ensuring that only shrimps with a carapace width greater than 6.5 mm (45-50 mm total length) are retained as set in EU Regulation 2406/96.

Fishing with electrical pulse for shrimp is currently illegal, although a few shrimp vessels in the Netherlands have been given an exemption to the regulation as part of a research project to evaluate the potential impact of the gear on the ecosystem. It should be emphasised that fishing with an electrical pulse does not form part of the UoA being assessed.

Figure 3 Example of a sieve net employed by a German shrimp vessel

<u>History of the fishery</u>

Landings from the German fleet have been reported since the 1950s, for the Dutch, Belgian, Danish and UK fleet since the 1970s, and for the French fleet since 2000, but it is only since 1994 that reported landings are considered complete and reliable (Figure 4). Since then, landings of shrimps for consumption (known as consumption shrimp) have continued to increase, and in recent years, landings have always been above 30,000 tonnes with the German and Dutch fleets accounting for more than 80% of the overall landings (Figure 5). Low landings were observed in 1977, 1984 and in particular in 1990, but on each occasion, landings returned to average levels in the following year, providing evidence that recruitment was not impaired following a poor year.

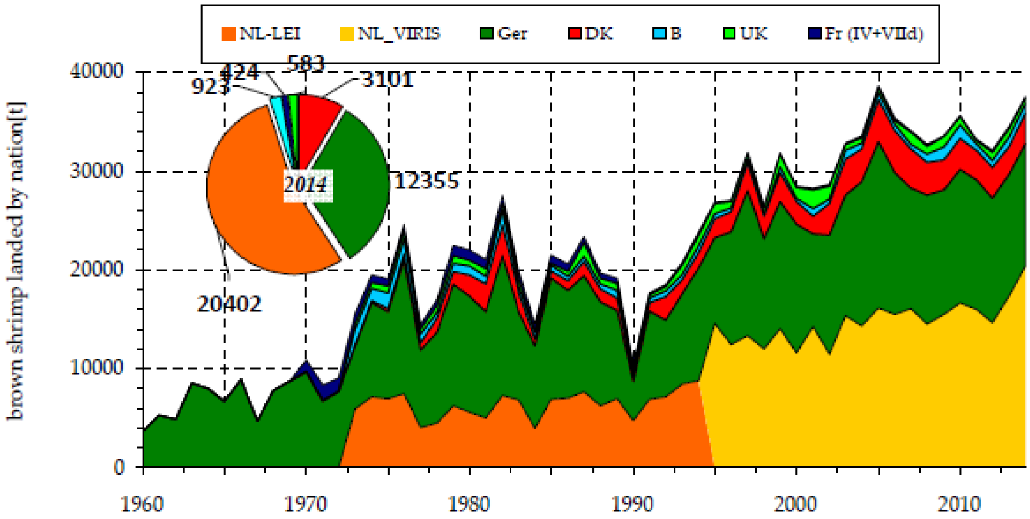

Figure 4 Crangon landings (tonnes) from the North Sea by country. Inserted pie chart landings in tonnes and percentage by country for the year 2014. (source: ICES WGCRAN 2015)

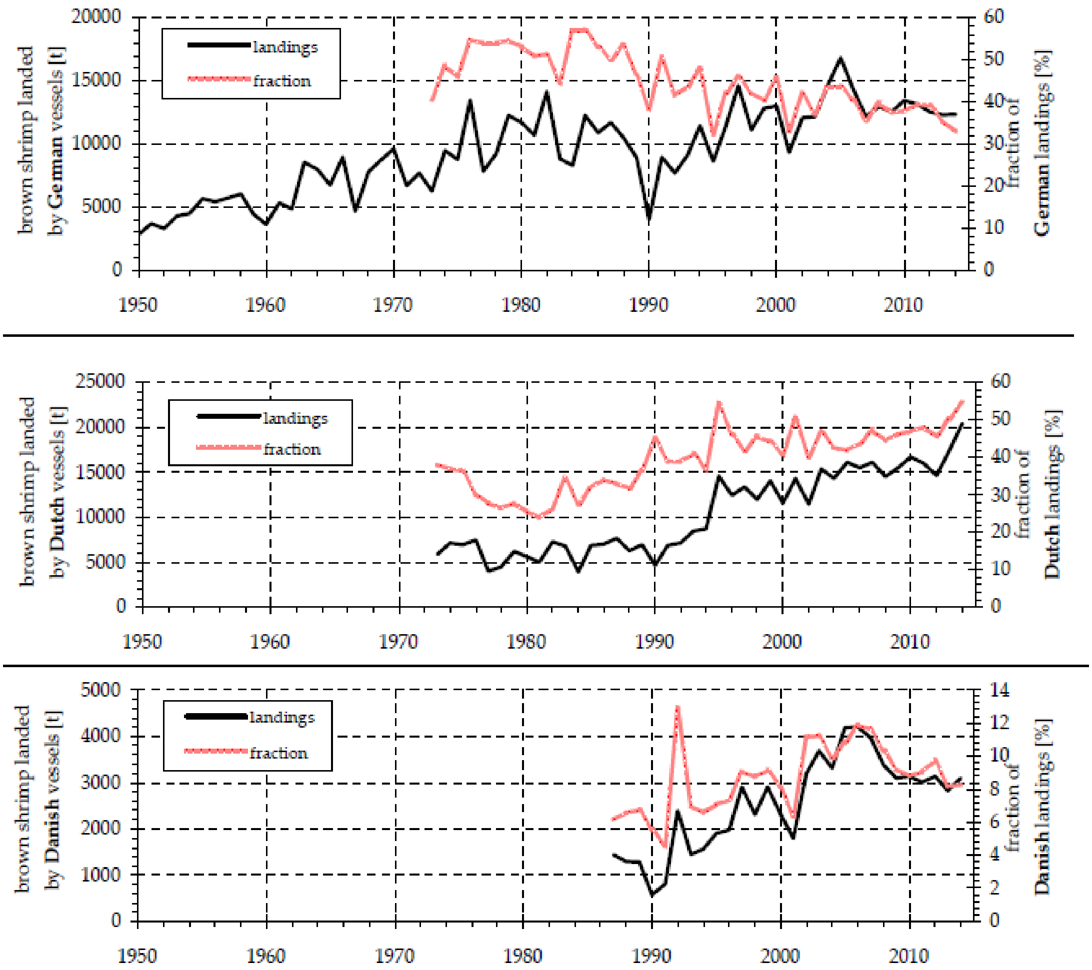

Figure 5 Shrimps for consumption landed (tonnes) by German (top panel), Dutch (middle panel) and Danish (bottom panel) vessels (black lines), and percentage of total landings for all nations in the North Sea (red lines). (Source: ICES WGCRAN 2015).

Management practices and history

Scientific advice on management of the Crangon fishery has been provided through ICES since the first meeting of the Working Group on Crangon in 1979 (ICES, 1979). Historically the Crangon fishery was considered to be unmanaged. A cap on licences and some technical measures (e.g. minimum mesh size, use of sieve nets to reduce bycatch) had been implemented but there was no quota on landings or restrictions on overall fishing effort in place. One of the main reasons that Crangon stocks were unregulated was that historically natural mortality of commercial size shrimps (>50mm), primarily through predation, was considered to be significantly higher than fishing mortality and that therefore management of the exploitation rate in the fishery was not considered necessary. However with the decline in predator abundance, new research suggesting that fishing mortality had become the principal component of total mortality in the stock, and evidence from comparison of estimated observed fishing mortality with Fmsy proxies calculated from yield-per-recruit models that the population was growth-overfished, there were increasing calls for the introduction of a management regime for Crangon.

In 2013 ICES convened a workshop to investigate the necessity for management of Crangon stocks (ICES, 2013), in terms of both the impact of the brown shrimp fisheries on the Crangon stock, but also the impact on other commercially-exploited fish stocks in relation to multispecies and mixed fisheries considerations. The ICES Workshop noted that previously it had been considered that the Crangon stock could not be easily overfished because natural mortality was significantly higher than fishing mortality. This conclusion was based on the stock being swiftly re-built after the very low year in 1990, little or no relationship between stock size and recruitment and the analysis by Welleman and Daan (2001) which showed that total landings of shrimps were low in comparison with shrimps consumed by predators. The ICES Workshop concluded that the shrimp population is “bottom-up” controlled by the carrying capacity of the habitat and that there is currently no recruitment overfishing. The analysis of Welleman and Daan (2001) has since been updated by Temming and Hufnagl (2014) who concluded that landings of commercial sized shrimps now exceeds the number eaten by predators, primarily due to the decline in predator abundance.

Whilst there is still no evidence that the shrimp stock is recruitment overfished, there are now various reasons why the stock could be considered to be growth overfished. Firstly, at present the fisheries induced mortality is about 3 to 5 times the predator induced mortality, and in comparison a recent meta-analysis of fisheries data by Zhou et al. (2012) estimated that Fmsy was 0.87 times the natural mortality rate across a range of species/fisheries. Secondly, in the 2010-2011 season prices for shrimp dropped to such a low level that most of the fleet were “on strike” and stopped fishing in April and May 2011. The result of this strike was that LPUE increased dramatically after the strike, even after correcting for the strong 2010-2011 year class (Figure 6). This confirms that the reduction in fishing effort leads to an increased LPUE immediately on resumption of fishing and that reduced mortality on undersized shrimps can also lead to increased yields.

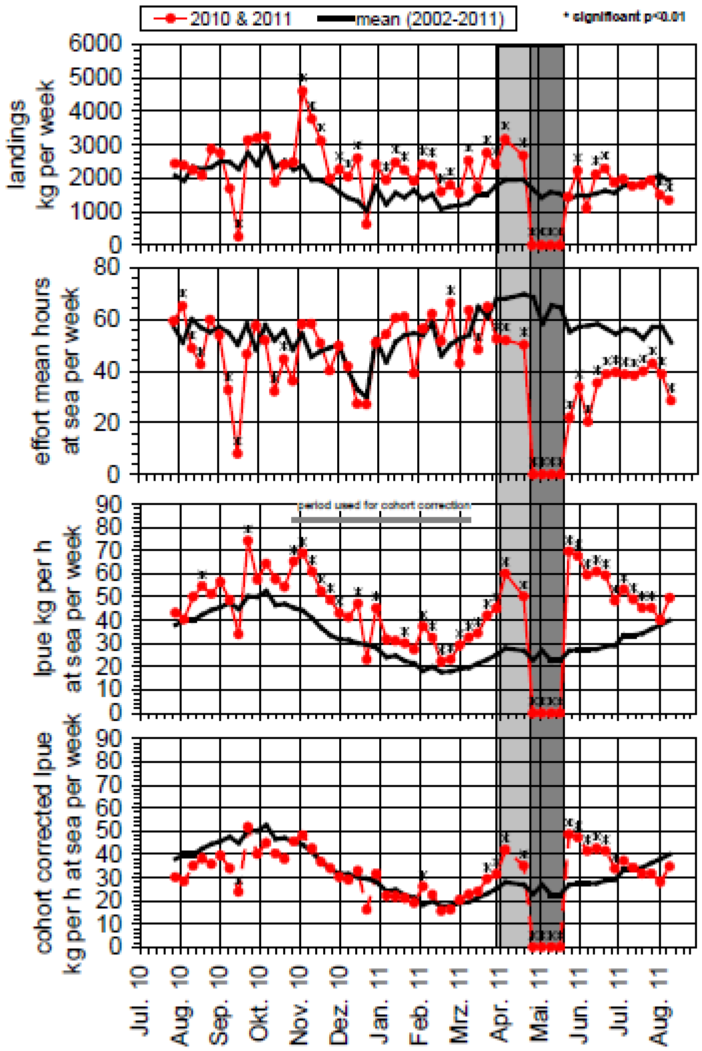

Figure 6 Weekly landings, effort, LPUE and LPUE corrected for cohort size for the German fleet. Red line is observed values in 2010 and black line is the mean value for 2002-2011. Light grey shaded area represents significantly reduced fishing effort and dark grey shaded area represents the industrial action ('strike') period.

Thirdly, a yield-per-recruit model has been developed for the shrimp stock by Temming and Damm (2002) and modified by Hufnagl and Temming (2011). The model includes a spawning index, temperature dependent growth rates, stage and season-specific mortality rates, seasonal effort patterns of the fleet, and total mortality rates of adult shrimps. Annual values of total mortality (Z) can be estimated using length-based methods, and then split into estimates of fishing mortality (F) and natural mortality (M) using estimates of predator biomass and consumption by predators of shrimps >50 mm. These estimates of observed F were compared with model-derived F_{max}, the fishing mortality at which the maximum landings can be achieved, and in all recent years, it was concluded that current fishing mortality exceeded F_{max}, indicating growth overfishing. (Further details of the yield-per-recruit model can be found in 3.5.4).

Fourthly, the demographic structure of the shrimp stock appears to have changed in recent years. The fraction of shrimps larger than 60 mm has declined from 30% in the 1970s and 1980s to 20% now, and similarly the fraction of shrimps larger than 70mm has declined from 10% to 2%. This is likely to be due to increased mortality, but may also be due to higher productivity in the 1980s when there were high levels of eutrophication. With mean-length-at maturity around 55 mm (Oh et al., 1999) and the number of eggs increasing with increasing size of shrimps, the reduction in fraction of larger shrimp in the population would cause a reduction in egg production.

Finally, estimates of total annual production from the swept area method (see later section 3.5.4) suggest that in some years landings may be equivalent to the total annual production.

On the basis of the above review of information, the ICES Workshop (ICES 2013) concluded that management of the shrimp stock was necessary through the control on unnecessary fishing effort. This should improve yield from the fishery as well as reduce the impact of the fishery on the wider ecosystem. As most fishing activity of the Dutch, German and Danish fleets occurs within the coastal areas and the Wadden Sea, much of which has been designated as Natura 2000 sites, there is an onus also on Member States to control shrimp fishing. Stakeholders have been keen to develop a management plan in conjunction with seeking MSC certification, but recent efforts have collapsed because the Dutch Consumers Authority (NMA) have not permitted any agreements amongst stakeholders about prices, markets and most importantly, landings.

The ICES Workshop reviewed potential methods of assessing stock status and managing the stock and concluded that *Crangon crangon* is a short-lived species with the vast majority of the annual catch having recruited to the fishery during that year. Age determination is not possible and so standard age-based analytical stock assessment approaches which estimate MSY and Bmsy are not appropriate. The ICES Working Group on Crangon Fisheries and Life History (WGCRAN) therefore concluded that management based on monitoring of LPUE data and subsequent effort reductions if LPUE dropped below reference levels would be the best option for managing this short-lived species.

Following the ICES Workshop, Germany and the Netherlands requested ICES to provide advice on the potential need for management of brown shrimp. Consequently ICES advised that management incorporating a reduction in fishing effort would be beneficial because of the currently observed growth overfishing, would lessen the environmental impact of the fishery, and in the long term management would be advisable if main predator stocks such as whiting and cod recover. ICES did warn however that for a short-lived species, management would need to be on a short time scale which would inevitably have time and resource implications.

ICES advised that the development of a harvest control rule (HCR) based on a comparison of the most recent commercial landings per unit effort (LPUE) data with pre-defined trigger levels (based on previous LPUE data) was the most appropriate approach for this short-lived species for which a conventional age-based stock assessment is not possible. This approach has been developed already by the fishing industry and relies on close to real-time monitoring of LPUE and swift response mechanisms. ICES noted that such an approach follows the general principle of a precautionary approach aimed at guaranteeing an escapement biomass. ICES suggested a six-step roadmap to implementing an HCR.

(1) Assimilating data on fishing effort in a standard format, developing a fleet inventory, analysing spatial distribution of fishing effort,
(2) Agreement on the design of the HCR including the definition of trigger values, and effort reduction levels required if those trigger values are reached, and consideration of spatial aspects of the fleet and how any effort reductions are implemented across the fleet
(3) Development of a monitoring strategy
(4) Testing and fine-tuning of the monitoring strategy
(5) Evaluation and adjustment of the HCR
(6) Application and re-evaluation of the monitoring strategy and trigger values

In addition to addressing potential management approaches for the Crangon fishery, ICES also advised that Crangon should be taken into account within the framework of ICES advice regarding North Sea mixed fisheries because of the significant bycatch of other species in the small-meshed net Crangon fisheries, and in relation to multispecies interactions because future recovery of gadoid populations could have an impact on shrimp population dynamics.

As noted above, a management plan for the brown shrimp fishery has been under development for a number of years by the fishing industry through the Producer Organisations in the Netherlands (Coöperatieve Visserij Organisatie (CVO)), Germany (MSC-GbR) and Denmark (Danish Fishermen Producer Organisation (DFPO)). The management plan was formally adopted on 1 December 2015 and came into force on 1 January 2016. The objective of the management plan is, "a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimised effects on the marine ecosystem." The Management Plan sets out details of the harvest strategy including (a) the development of reference points and harvest control rules (HCRs) and proposed increases in the mesh size of the cod-end, (b) an ecosystem approach to management of the fishery through considering alternative methods for reducing unwanted bycatch and the recording of captures of all ETP species and (c) the management structures and processes and the regulations applying to vessels in the Management Plan, links with the North Sea Advisory Council (NSAC), monitoring control and surveillance, and the penalties applied for infringements against any of the rules in the management plan. As such, elements of the Management Plan are discussed in greater detail in sections 3.5 to 3.7 in relation to Principles 1, 2 and 3.

Alongside the ICES advice on developing a management plan for Crangon and the management plan drawn up in relation to potential MSC certification, two sets of proposals have been made by WWF and the North Sea Advisory Council (NSAC). In 2015 prior to the completion of the industry's Brown Shrimp Management Plan, WWF produced an advisory document to inform a long term management plan for the brown shrimp stocks in the North Sea. The advice was based on a review of management goals for tropical shrimp trawl fisheries (Macfadyen et al., 2013), but made specific recommendations for the North Sea brown shrimp fishery including the need for increased data and knowledge particularly on the ecosystem effects of shrimp fishing, a reduction in fishing capacity and intensity, increased monitoring and reduction of bycatch and discards, the need for increased spatial closures to address the impacts of shrimp fishing gear on benthic habitats, and increased control and enforcement.

NSAC has a Brown Shrimp Focus Group which is in the process of developing a long term management plan (LTMP) for brown shrimp alongside the already implemented Brown Shrimp Management Plan developed by the industry for the MSC certification process. The LTMP would cover conservation, social and economic objectives.

A full description of the legislative framework, the role of national authorities and involvement of other entities under which the brown shrimp fishery operates across the Netherlands, Germany and Denmark can be found in section 3.7.2.

3.5 Principle One: Target Species Background

3.5.1 Biology and life history of brown shrimp (*Crangon crangon*)

Taxonomy and distribution

The brown shrimp, *Crangon crangon*, is a decapod crustacean of the family Crangonidae, which is distributed from Iceland in the North Atlantic (Gunnarson et al., 2007) to the North Sea and Baltic Sea (Dornheim, 1969), but is also found in the Black Sea and Mediterranean (Labat, 1977). It's primary habitat is soft bottom substrates but it is also found on sandy shores (Beyst et al., 2001), and although it is generally found close to the coast in shallow waters, Crangon may be found throughout the North Sea, although shrimp abundance is very low below 40m water depth (Callaway et al., 2002). Crangon exhibits high tolerance and adaptability being found from near-freshwater estuaries to salinities up to 30 psu, and in environments where temperatures may range from 0 degrees to 35 degrees Celsius (C). Bottom-up factors such as habitat limitation have been cited as the main population driver (e.g. Kuipers and Dapper, 1981) as preliminary analyses suggest only very weak relationships between stock biomass and future recruitment.

A series of genetics studies showed that gene flow is established primarily by oceanographic barriers and that the population is well mixed over large areas and particularly within the North Sea (Bulnheim and Schwenzer, 1993; Weetman et al., 2007; Luttikhuizen et al., 2008). In the most recent study, Luttikhuizen et al. (2008) revealed four groups: north-eastern Atlantic including the whole North Sea, western Mediterranean, Adriatic Sea and Black Sea, suggesting a single stock in the area prosecuted by the North Sea brown shrimp fishery.

The conclusions from the genetic studies are backed up by the observed extensive migrations and larvae drift of Crangon both of which favour genetic exchange between areas. Connectivity studies investigating drift, selective tidal stream transport and migration patterns demonstrate that adult shrimp populations in the North Sea between 5 and 40 m depths provide the larvae recruitment to all areas (Temming et al., 2013). Whilst for management purposes it seems reasonable to consider the whole North Sea population as a single stock, drift studies suggest that shrimps from the Dutch coast may provide the larvae for the southern area of the fishery whereas shrimps from the Schleswig Holstein coast may provide larvae to the German and Danish part of the fishery.

In conclusion, although the potential for some sub-structure in the stock should be investigated, current evidence confirms that the area fished by Danish, German, Dutch, Belgian and French vessels constitutes a single stock.

Life cycle

Egg-bearing (berried) female shrimps are present in the population throughout the whole year, but are less common in the autumn than other times of the year (Kuipers and Dapper, 1984). Female length at maturity is reached within one year at around 55 mm length, when 50% of females will carry eggs. Fecundity of the mature females ranges from 2,000 to 10,000 eggs depending on size of female. Egg production can be separated into summer and winter eggs with the size and number of eggs dependent on season. Egg development is temperature dependent with larvae hatching after 18 to 45 days (Redant, 1978). Following hatching, the larvae remain in the pelagic environment for around one month (Criales and Anger, 1986) going through five instars prior to becoming post-larvae, after which the juveniles become the first benthic stage in the life cycle. Juveniles of 7 to 15 mm length originating from winter egg production (Temming and Damm, 2002) move into the shallow waters of the Wadden Sea in late spring or early summer (Boddeke, 1976). These shallow, high-temperature nursery areas provide abundant food and shelter from predation resulting in high growth rates (Boddeke et al., 1986). As the shrimps grow, they migrate to deeper areas from the tidal flats and juveniles of 20 to 30 mm length are found in sub-littoral areas and tidal gullies (Beukema, 1992). Size of shrimp is therefore correlated with water depth with most adult shrimp found in water between 5 and 30 m (Kuipers and Dapper, 1981). Changes in habitat and water depth with size are described in **Figure 7**.

The first large recruitment wave from the winter egg production is followed by a series of smaller recruitment waves, which originate from the spring and summer spawnings, which benefit from shorter egg development times and larger numbers of eggs produced in the warmer temperatures. Growth rates are sex-specific with commercial catches (shrimps > 50mm) dominated by females. The faster growing individuals from the winter egg recruits produce a steep increase in commercial catches in August and September. Shrimp from this cohort do not carry eggs until November, and this egg production is based upon shrimps that survive the autumn fishery or from slower-growing individuals which were not commercial size during the autumn fishery. The surviving larger shrimp will also spawn again in spring and early summer and become the target of the winter and spring fisheries. The maximum observed length of shrimp from scientific surveys is 109 mm, but the average asymptotic length is 79 mm. Brown shrimps are generally short-lived (1.5 – 2.0 years) but within the fishing area, coefficients of total mortality (predation and fishing) are above 5 y^{-1}, so that less than 1% of each cohort survives for longer than a year. The life cycle dynamics may vary geographically over the distributional range of Crangon (ICES, 2015).

There is no recruitment index for the brown shrimp stock, and preliminary analyses suggest only a very weak relationship between stock biomass and future recruitment. The systems carrying capacity is likely to be the main factor limiting populations evidenced by the observation that the stock recovered from its lowest observed stock level in 1990 in less than two years (Berghahn, 1996).

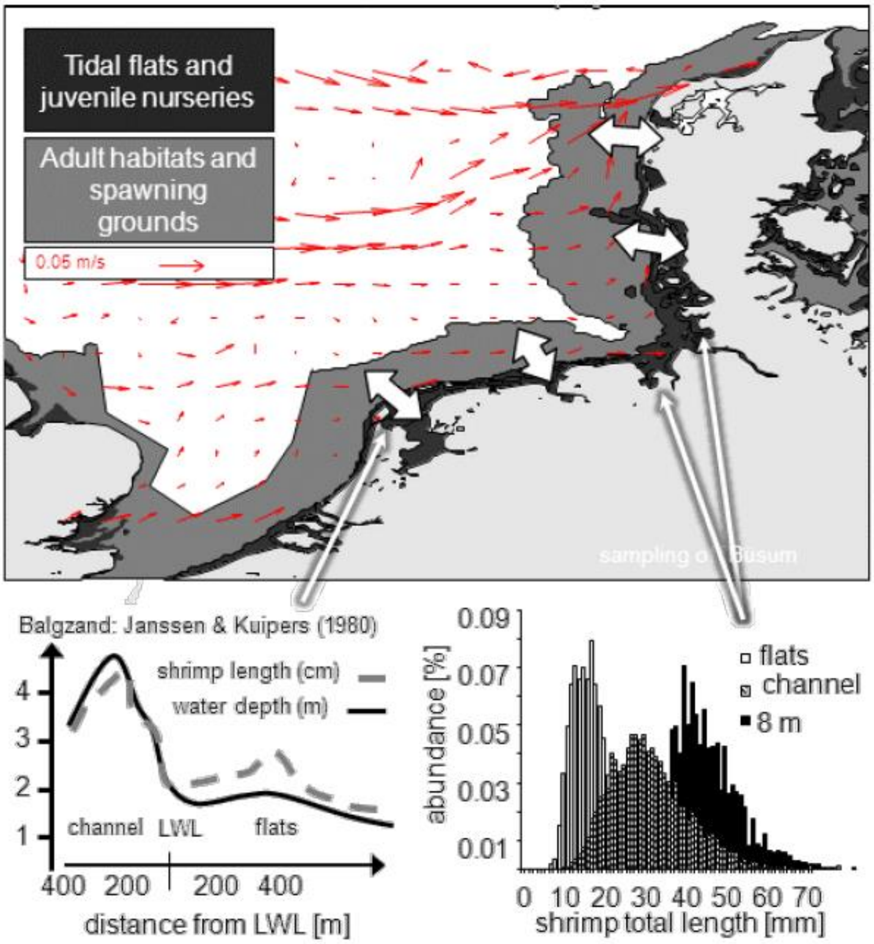

Figure 7 Diagrammatic representation of change in habitat and depth with size of Crangon. Arrows on upper figure represent average annual currents based on HANSOM oceanographic model. Lower panels represent relationship between shrimp size and depth from Janssen and Kuipers (1980) study in Dutch Balgzand area and sampling on German coast by Hufnagl et al., 2010. (Source: Temming et al., 2013)

Feeding and predators

Crangon crangon feeds on almost any animal material including polychaetes, molluscs, small arthropods and fish, and may also consume algae especially *Ulva lactuca* and *U. intestinalis* (Dolmer et al., 2001; Kamermans and Huitema, 1994; Oh *et al*., 2001). Crangon is an important prey species for a number of predators, including small fish, birds and the shore crab (*Carcinus maenas*). The most important small fish predator is the goby, (*Pomatichistus microps*) which along with other small fish such as common seasnail (*Liparis liparis*) and the armed or hook-nosed bullhead (*Agonus cataphractus*), feed exclusively on small shrimp with the majority of their prey between 10 and 30 mm in length (Redant, 1978; Jansen, 2002). Whiting (*Merlangius merlangus*) is the most important of the large predators due to its regular large year-classes. Other significant larger fish predators include cod (*Gadus morhua*), dab (*Limanda limanda*) and pouting (*Trisopterus luscus*). With the exception of those shrimp preyed upon by cod (Daan, 1989; Jansen, 2002) most shrimp consumed are less than 50 mm in length. In contrast the fishery targets shrimps greater than 50 mm in length, and so there is little competition for shrimp between natural predators and the fishery, with mortality from the fishery following sequentially from predation. The fishery may therefore be less successful in years such as 1990 when there has been an outburst of gadoid species.

Role of *Crangon crangon* within the ecosystem

Brown shrimp is a low trophic level (LTL) species, and for the purposes of this certification assessment, it is necessary to determine whether Crangon is a key LTL as defined by paragraphs SA2.2.8-SA2.2.10 of the MSC Fisheries Certification Requirements v2.0. This question has been considered previously by Temming et al. (2013), by the ICES Workshop on the Necessity for Management of Crangon and Cephalopods (WKCCM) and by ICES in response to a special request by Germany and the Netherlands on the potential need for management of brown shrimp in the North Sea (ICES, 2014).

MSC CR v2.0 defines various species types by default as key LTL stocks, but *Crangon crangon* is not included in that list. However, Crangon could be considered as a key LTL stock if it meets two of the following criteria as set out in SA2.2.9ai-iii:

- A large portion of the trophic connections in the ecosystem involves this stock, leading to significant predator dependency;
- A large volume of the energy passing between lower and higher trophic levels passes through this stock;
- There are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels, such that a high proportion of the total energy passing between lower and higher trophic levels passes through this stock (i.e. the ecosystem is 'wasp-waisted')

To assess whether Crangon meets these criteria, it is important to define the geographical scale at which we are evaluating the trophic connections of Crangon. As noted above, lack of any genetic differentiation between Crangon stocks in the North Sea and studies of larvae drift confirm connectivity between Crangon populations across the eastern North Sea, suggesting that the distribution of the Crangon stock should be considered as the whole North Sea.

In relation to the above criteria, most predators of Crangon could be considered to be opportunistic feeders, and therefore there are likely to be many trophic connections involving the Crangon stock, although energy flow across the connections may be low. An Ecopath model of the North Sea (Mackinson and Daskalov, 2007) considered all shrimp species as a functional group, but assuming that Crangon accounts for around one third of that biomass, the model estimated that as food for predators Crangon represents approximately 0.2 $t/km^{-2}/yr.^{-1}$. This is a very small figure in comparison with other consumed food such as polychaetes and small mobile epifauna, and with the channelling of energy from small fish species through to higher trophic levels of 7.8 $t/km^{-2}/yr.^{-1}$, it can be concluded that there is not a major flow of energy from Crangon through to higher trophic levels.

On the scale of the North Sea, it can be concluded therefore that Crangon is not a key LTL species. On a smaller geographical scale, in the Wadden Sea, the role of Crangon in the ecosystem energy flow is also very limited with most of the benthic production coming from microbenthic species (Baird et al., 2004). Most predators in the coastal areas also occur in the wider North Sea, but some species such as the goby, (*Pomatichistus microps*), are found only in the shallow coastal areas and so may be more dependent on Crangon as a prey item. Nevertheless on a stock-wide basis, it is highly unlikely that Crangon is a key LTL species in terms of energy flow through trophic levels.

In addition to the criteria on trophic connections, the stock must meet all of the following criteria set out in SA2.2.9bi:

The species feeds predominantly on plankton; has a trophic level of about 3; is characterised by small body size, early maturity, high fecundity, and short life span (default values: <30 cm long as adults, mean age at maturity ≤2, >10,000 eggs/spawning, maximum age <10 years respectively); and forms dense schools.

Whilst Crangon meets many of these life history criteria, copepods form only part of its diet, it is only very rarely that individuals grow to a size (i.e. over 80 mm) at which they have 10,000 eggs per spawning (Temming et al., 2013), and Crangon does not form dense schools. It can be concluded that Crangon does not meet all of these life history criteria.

In terms of energy flow between trophic levels and life history traits it can be concluded that at the scale of the fishery, Crangon cannot be considered to be a key LTL species, a conclusion drawn also by Temming et al., (2013) and ICES (2013, 2014).

3.5.2 Harvest strategy

General / overarching

The overarching legislation under which the harvest strategy for the brown shrimp fishery within the territorial waters of the Netherlands, Germany and Denmark has been developed is the EU's Common Fisheries Policy (CFP) which was revised under EU Regulation No. 1380/2013 and came into effect on 1 January 2014.

One of the key objectives of the CFP is that:

"The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield."

Further details on the objectives of the CFP can be found below in section 3.7.2.

In addition to EU Fisheries Control and Technical Conservation Measures, there are various national regulations as outlined below and the key elements of the Harvest Strategy for the brown shrimp fishery are set out in the Brown Shrimp Management Plan.

EU regulations

The main EU management measures in the brown shrimp fishery include mandatory fishing licences, access to the fishery is restricted to national vessels out to 3 nm (although there are access agreements in place for the 3 nm to 12 nm zone as set out in Table 12), vessel number and engine capacity restrictions within the "Plaice Box", and there is a maximum total engine power of fishing vessels for each member state authorised to use beam trawls. As brown shrimp is not a TAC species, the fishery is not yet subject to the "landings obligation", whereby all fish (or crustaceans) must be retained aboard fishing vessels and landed. The landings obligation, commonly known also as the discard ban, is not expected to be introduced for the shrimp fishery until 2019, and then only in relation to bycatch of TAC-regulated species.

Technical conservation measures are set out primarily in Council Regulation No 850/98, and these include a maximum aggregate total beam length of 24 m, a minimum mesh size of 16 mm and the requirement for all fishers in the brown shrimp fisheries to use a sorting grid in order to reduce discarding of juvenile commercial fish species. In practice most shrimp vessels use a sieve net.

There are a number of EU regulations that relate to the requirement to monitor fishing activity and these are outlined below under section 3.7.5 monitoring.

National regulations

In addition to EU regulations, the Netherlands, Germany and Denmark all have their own national regulations. In the Netherlands, there is a limit of 220 shrimp fishing licences. The licences are issued only if an appropriate assessment under the EU Habitats Directive concludes that the current level of fishing activity has no impact on the features of the Natura 2000 sites. Dutch vessels are restricted in the number of days that they can fish with weekend closures of the fisheries, and there are some areas in the Wadden Sea that are closed to shrimp fishing, either permanently or seasonally. In Germany all brown shrimp vessels are required to hold a general fishing licence, although unlike the Netherlands, appropriate assessments are not required. There are also some areas closed to shrimp fishing in German waters. In Denmark, all shrimp vessels require a shrimp fishing licence, but an appropriate assessment is not required to allow shrimp fishing within Natura 2000 sites. Shrimp fishing is not permitted within the Danish Wadden Sea and no trawling is allowed within 3 nm of the coastline. There are some voluntary restrictions within the Danish fleet on the number of fishing days. Within Denmark, vessels within the Danish Fishermen Producer Organisation (DFPO) are covered by a “Code of Conduct”, which seeks to minimise unwanted catches and discards, minimise the environmental consequences of fishing, cooperate with other stakeholders and participate fully in all data collection and monitoring programmes.

Elements of the harvest strategy

Crangon is a short-lived species with the vast majority of the annual catch having recruited to the fishery during that year. The short life cycle and the high production/biomass ratio precludes the identification of a stock-recruitment relationship. In consequence, standard age-based analytical stock assessment approaches which estimate Maximum Sustainable Yield (MSY) and B_{MSY} (the biomass that would provide the highest long-term average catch for a stock) are not appropriate. The main goal of the harvest strategy therefore is to ensure that each cohort is harvested in such a manner as to avoid both recruitment and growth overfishing. A key element of the harvest strategy designed to avoid recruitment overfishing is one of “constant escapement”, i.e. to ensure that sufficient female shrimps in each cohort survive to generate sufficient egg production for future recruitment. The key tool to allow this to occur when cohorts are small is the reduction of fishing mortality to allow females to grow larger which coupled with an exponential relationship between egg production and shrimp size ensures that recruitment does not fail. This is the rationale underlying the harvest control rule (see below). In addition to avoiding any likelihood of recruitment overfishing, the harvest strategy has set a mesh size above that set out in EU regulations, has increased this mesh size in January 2016, and will implement two further increases in mesh size by 2020 so that the maximum yield can be achieved for each individual cohort, i.e. to avoid growth over-fishing.

The harvest strategy for the brown shrimp fishery is set out in the Brown Shrimp Management Plan which was developed by the fishing industry through the Producer Organisations in the Netherlands (Coöperatieve Visserij Organisatie (CVO)), Germany (MSC-GbR) and Denmark (Danish Fishermen Producer Organisation (DFPO)). The management plan was formally adopted on 1 December 2015 and came into force on 1 January 2016.

The objective of the management plan is “a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimised effects on the marine ecosystem.” The Management Plan sets out details of the harvest strategy including harvest control rules

(HCRs), an ecosystem approach to management of the fishery, and the regulations applying to the fishery.

Management Plan regulations

There are strict regulations on capacity and effort in the fishery. Vessels must be members of the Producer Organisations (POs), and there is a cap on the number of vessels and combined kW power set at the level registered by the authorities in the Netherlands, Germany and Denmark on 1 January 2015. Vessels are restricted to 200 days at sea per year.

There are also a series of regulations covering the trawls used in the shrimp fishery. The combined beam length must be less than 20 m, the combined weight of the gear must be less than 4,000 kg, and there is a minimum mesh size of 20 mm. To minimise the catch of bycatch species, the trawl must contain a sieve net with a maximum opening of 70 mm or a sorting grid with a maximum bar spacing of 20 mm. Catches must be sorted on board with a bar spacing adjusted to commercial size shrimp, and must also be sorted on land at the sieving station with a sieve with a minimum opening of 6.8 mm. The waste resulting from the sieving, termed the sievage, must not exceed 15% of the total landings from a vessel over a period of two calendar weeks. In addition to these regulations on the design of the trawls, pulse fishing (fishing using trawls which emit electrical pulses) is not permitted within the Management Plan.

Monitoring

Under EU Council Regulation 2847/1993, all vessels over 12 m in length must carry satellite Vessel Monitoring Systems (VMS) and all vessels over 15 m in length must carry Automatic Identification System (AIS) on board (Council Regulation 1224/1998). Under EU Council Regulation 2847/1993 all vessels ≥10 m in length must make landings declarations in log books, and all vessels of ≥12 m must make returns using electronic log books (Council Regulation 850/1998).

In addition, under the Brown Shrimp Management Plan, independent control agencies set up as part of the Management Plan will carry out regular inspections of vessels, sieving stations (processing plants) and the POs themselves. There are also plans to introduce "Black box" monitoring systems on all vessels in the Netherlands from 1 January 2017 which will provide a much more detailed description of fishing activity than currently provided by VMS or AIS.

Reference points, harvest control rules and uncertainties therein

Landings per unit effort (LPUE) data (expressed as kg per hour at sea) are used as an indicator of the status of the stock. The key management strategy is that in years when the size of the recruiting shrimp cohort is low such that LPUE falls below a predetermined precautionary level, fishing effort is reduced to ensure that there is no likelihood that recruitment would be impaired. For the brown shrimp stock, ICES advice (ICES, 2014) is that management based on LPUE data and effort reductions is currently the best management practice when considering short-lived species such as Crangon. Observed monthly average LPUE data for all vessels collected from electronic log books and auction data are compared with the pre-determined reference values of LPUE (Table 2). The reference values are based upon the average of the monthly LPUE values observed in 2002 (a poor year) and 2007 (a good year). A series of 5 reference values are defined as a percentage of this average monthly LPUE. The lowest reference point (no. 5) is set at 50% and is considered to be equivalent to a limit reference point. The upper reference point (no. 1) is set at 70% and is considered to be a threshold above which management wishes the fishery to remain. If observed LPUE in any month drops below reference value 1, then the number of hours per week that each vessel may fish is reduced in line with the harvest control rules set out in Table 3. Note, that even below the lowest reference point, a very low level of fishing is permitted in order to ensure that the monitoring of the stock is continued. The management action is activated very quickly within a fishing season if LPUE drops below the reference values. LPUE data is collected for a calendar month, analysed within a week of the end of the month, and fishers are advised by the end of that week if the number of fishing hours in the upcoming week must be reduced based on the HCR set out in Table 3. If observed LPUE remains below reference value 1, then monitoring frequency is increased and the average LPUE is calculated over a two week period rather than a monthly period.

The key rationale underlying the development of the HCRs was to ensure that in years of low shrimp abundance there would be no likelihood of recruitment impairment. The management plan is also focussed on keeping the fishery within the target range above 70% of the average LPUE observed historically. In that sense, the upper threshold could be considered to work in a similar way to the ICES reference point MSYBtrigger above which management aims to keep the stock in order that it may be within a target range around Bmsy. It should be emphasised that more than one recruitment pulse per year, variations in year-class strength, temperature and predation rates make it inappropriate to calculate within-year fishing mortality rates, and consequently there is no direct link between in-season LPUE values and a target reference point framed in terms of Maximum Sustainable Yield (MSY). Nevertheless, triggering of the HCRs when LPUE drops below the reference points will act as a precautionary measure in order to avoid growth as well as recruitment overfishing.

Table 2 Monthly reference values used for management measures in the brown shrimp fishery. The reference values (1 to 5) represent a percentage of the average monthly LPUE observed in a poor year (2002) and a good year (2007) (source: Brown Shrimp Management Plan).

LPUE-data from TEMMING ET AL., 2013.

Monthly average of LPUE (landings in kgs per hours at sea) of the German shrimp fleet

Month	2002	2007	Average 2002&2007	Precautionary Ref (70%)	Ref 2 (65%)	Ref 3 (60%)	Ref 4 (55%)	Limit Ref (50%)
1	10,74	36,00	23,37	16,36	15,19	14,02	12,85	11,69
2	13,01	22,40	17,71	12,39	11,51	10,62	9,74	8,85
3	14,18	26,17	20,18	14,12	13,11	12,11	11,10	10,09
4	12,58	27,98	20,28	14,20	13,18	12,17	11,15	10,14
5	13,28	25,29	19,29	13,50	12,54	11,57	10,61	9,64
6	16,01	18,75	17,38	12,17	11,30	10,43	9,56	8,69
7	24,27	24,24	24,26	16,98	15,77	14,55	13,34	12,13

8	37,71	25,91	31,81	22,27	20,68	19,09	17,50	15,91
9	42,81	32,04	37,43	26,20	24,33	22,46	20,58	18,71
10	48,73	27,05	37,89	26,52	24,63	22,73	20,84	18,95
11	37,36	21,92	29,64	20,75	19,27	17,78	16,30	14,82
12	31,75	16,18	23,97	16,78	15,58	14,38	13,18	11,98

Table 3 Harvest control rules which are activated when observed LPUE drops below the pre-determined reference points set out in **Table 2** (Source: Brown Shrimp Management Plan).

Option	Proxy	Management measure
1	LPUE > Ref 1	No particular measure needed since stock is above precautionary limit
2	Ref 1 > LPUE > Ref 2	Precautionary buffer reference value. Vessels may be at sea for a maximum of 72 hours per calendar week, calculated from departure to arrival in the harbor.
3	Ref 2 > LPUE > Ref 3	Vessels may be at sea for a maximum of 60 hours per calendar week, calculated from departure to arrival in the harbor.
4	Ref 3 > LPUE > Ref 4	Vessels may be at sea for a maximum of 48 hours per calendar week, calculated from departure to arrival in the harbor.
5	Ref 4 > LPUE > Ref 5	Vessels may be at sea for a maximum of 36 hours per calendar week, calculated from departure to arrival in the harbor.
6	LPUE < Ref 5	Limit reference value. Vessels may be at sea for a maximum of 24 hours per calendar week, calculated from departure to arrival in the harbor.

Provisional reference points and HCRs were devised prior to the implementation of the Brown Shrimp Management Plan. Following a detailed investigation of the robustness of these provisional reference points and HCRs to uncertainty by an independent group of scientists from the University of Hamburg and the Thünen Institute (Temming et al., 2013), revised HCRs were developed and have now been implemented within the management plan (Tables 1 and 2). The analysis of Temming et al. looked specifically at the variation in LPUE data, and concluded that due to the very high scatter in the LPUE data from the different vessels in the fleet and seasonal variations in LPUE that it was advisable to include the whole fleet in the monitoring (this has now been implemented). The initial proposed HCR used two reference values of LPUE, one for each half of the year, and the Temming study suggested that seasonal variations should be taken into account because it is most important to apply the HCR in autumn to ensure an adequate spawning stock for the coming winter, but also applying the HCR in spring provides an additional precautionary approach. Following the review by Temming et al., monthly LPUE reference points have been implemented. In addition, to minimise uncertainty in the calculation of LPUE the study recommended that mean trip LPUEs are weighted by effort in terms of fishing hours as this would give proportionally more weight to longer fishing trips with more hauls, and that LPUE values should be calculated after sieving on the 6.8 mm sieves to ensure that LPUE values are not artificially inflated by high numbers of undersized shrimps. The study recommended that a policy should be established to minimise the landing of small shrimp, and this has now been limited to 15% of the total landing by vessel. The study also noted that the trigger for implementing the HCRs needs to be precautionary, but not too high as to invoke the HCRs even in strong cohort years, and suggested that a trigger of 25% below the historical mean LPUE was possibly too high. The final implemented HCR uses a trigger of 30% below the mean LPUE.

Model simulations by Temming et al. suggested that the planned reduction in hours at sea to 72 that is triggered by a fall below the first reference point may not be sufficient to recover cohort egg production to that of a normal year (the aim of such a reduction in effort) and recommended a reduction in hours of 30%. Currently the Dutch fleet is restricted to 108 hours per week because of the weekend closure, so reduction in permitted hours fishing to 72 hours per week would represent a reduction of over 30%. The Temming et al. study also noted that (as with all fisheries) LPUE values from individual vessels may increase over time due to “technological creep” thus masking a stock decline. The most obvious change in efficiency would be due to the introduction of electric pulse fishing which can increase efficiency by 50%, but this gear is currently prohibited in the shrimp fishery. The study recommends maintaining an inventory of the fleet which is regularly updated to identify any changes in fishing gear which could increase efficiency, and therefore LPUE reference points could be revised if necessary. The best solution to avoiding uncertainties due to technological creep would be to use a standardised reference fleet or survey for the monitoring of LPUE.

In summary, the study of Temming et al. identified the main uncertainties within the application of the HCRs, and the system that was finally implemented takes into account those main uncertainties. In addition, a study by Steenbergen et al. (2015) concluded that the HCRs should achieve their objectives but noted that reductions in fishing effort results inevitably in higher densities of shrimp and hence individuals will start to compete for food. In consequence, individuals may grow more slowly, take longer to reach commercial size and remain vulnerable to discarding for a longer time, and Steenbergen et al. warned that large within year reductions in fishing effort may have unexpected effects on the size composition of shrimps including discard rates. Despite the detailed investigations into performance of the HCRs, there were still some concerns raised by stakeholders during the site visit that not all uncertainties had been taken into account during the setting of LPUE reference points and the consequent HCRs.

Firstly, the threshold level for triggering the HCRs was reduced from 75% to 70% of the LPUE reference values. This occurred because the implementation of the new HCRs coincided with the increase in mesh size to 22mm which is expected to lead to a lower catch rate of marketable sized shrimps initially (see analysis by Günther, Hufnagl & Temming, 2016) and hence it was necessary to reduce the threshold level at which the HCR would be triggered. In addition, the Temming et al. (2013) review had advised that the threshold levels should not be set too high such that the HCRs were triggered in years when there was a strong cohort of recruits, and recommended that threshold levels should be set below 75%.

Secondly, there was some concern expressed about the suitability of using 2002 and 2007 as reference years for setting the LPUE reference points. Originally the reference levels were going to be set based on the 1990 LPUE levels as this was the lowest LPUE observed in the time series and the stock had demonstrably recovered from that level within two years. However, there was a lack of reliable and standardized monthly LPUE data for 1990 (Clients, pers. comm.) and so more recent reliable data were used from a relatively poor year (2002) and a relatively good year (2007). As the LPUE in both these years was substantially above that observed earlier in the times series (Figure 8), the reference LPUE levels were considered to be highly precautionary.

Thirdly, during the site visit various stakeholders noted that a single LPUE reference point was used to cover the whole fishery including vessels from the Netherlands, Germany and Denmark, and that it would be more appropriate that variation in national fleets should be taken into account in setting reference points. However analysis by Temming et al. (2013) showed that heterogeneity amongst the individual fleets of the Netherlands, Germany and Denmark is greater than that between the national fleets. An analysis presented by Günther et al. (2016) in response to Danish fishermen's concern that estimated LPUEs for the whole fleet would not give sufficient weighting to the small Danish fleet concluded that a single LPUE for the whole fleet from all nations provides a more precautionary set of reference points than disaggregating into separate reference points for the different fleets, and that as the Crangon fishery across all national fleets is considered to be a single stock, then reference points should be set at a single value for all fleets.

Fourthly, it was noted that long term LPUE values are expected to be higher following current and future mesh size increases (although there may be a short term reduction in LPUE), and hence the current LPUE reference levels may no longer be appropriate in the long term. Model estimates of the change in catch rate following mesh size increases are available from the CRANNET Project and from additional work contracted to the University of Hamburg, but the Steering Group decided that they will consider adjustments to the LPUE reference points in due course when empirical information on catch rates and size distribution of catches are available following the increase in mesh size (see below for details of newly implemented sampling programme).

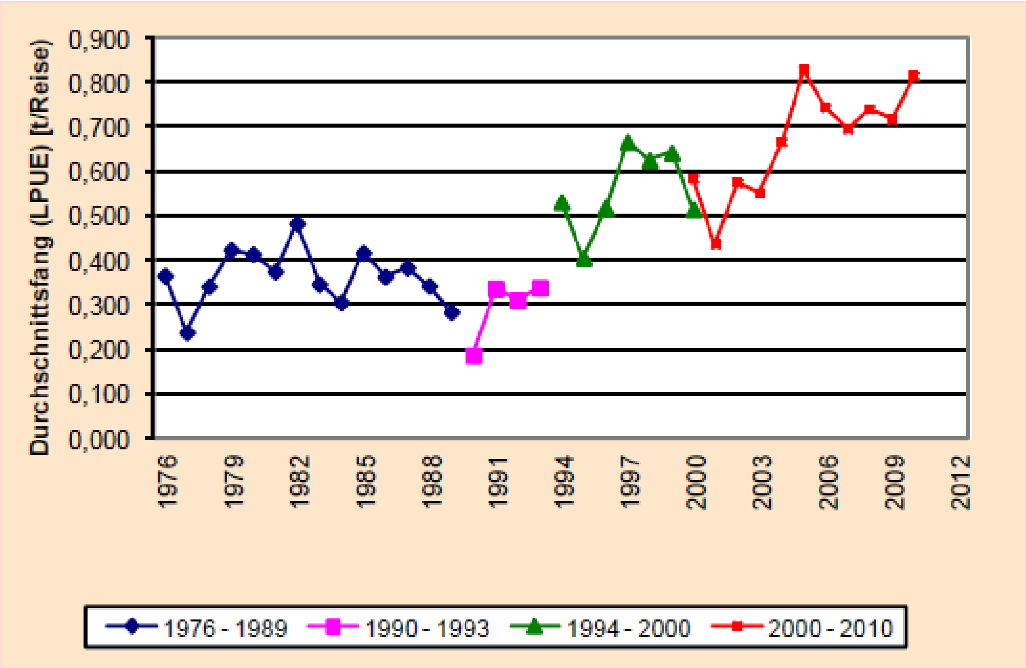

Figure 8 Development of standard landings per unit of effort (LPUE, t/trip) of German shrimp fleet based on 1976 to 2010 data for recorded shrimp trips (corrected). (Source: Neudecker et al., 2011)

The Temming et al. (2013) analysis of robustness of the HCRs was undertaken on the German fleet and a similar analysis using data from the Dutch and Danish fleets would be informative. For example, Dutch vessels are in general larger than German vessels and therefore have longer trip durations and Dutch vessels may have larger LPUE values than German vessels fishing on the same grounds. A fleet inventory and a multivariate analysis may show whether LPUEs from different national fleets need to be used as future correction factors for observed LPUEs. The development of such an inventory and consequent analysis of the data form part of the Management Plan.

Review of harvest strategies

The Management Plan which underpins the harvest strategy for the fishery has been under development for a number of years, and elements of the Management Plan, particularly the harvest control rules have been reviewed fully during their development. In addition, the management plan sets out proposed changes in the harvest strategy to take place over the period 2016 to 2020. The key change is the implementation of an increase in mesh size from 20 mm to 26 mm over the period 2016 to 2020. The planned increases are based on the results from the CRANNET Project which investigated selectivity parameters for a wide range of cod ends during five scientific surveys in 2013 and 2014 and conducted population dynamics modelling to evaluate the effects of potential changes in cod end mesh size and / or geometry. The Project results showed that cod ends with (a) mesh openings of 26 mm with diamond meshes (b) mesh openings of 26 mm with T90 meshes and (c) mesh openings of 24 mm with square meshes were most successful in reducing the catches of undersized brown shrimp (<50 mm) in comparison with currently used cod ends with 20 mm mesh openings and diamond meshes. All three designs resulted in initial losses of commercial size shrimps (>50 mm) but modelling showed that the fast growth rate of brown shrimps ensures that such initial short term losses would be recovered or would translate into long term, increased catches by the end of the season. In addition, the new design of cod ends showed an average loss of 20% of fish bycatch in comparison with the current cod ends.

The CRANNET Project showed that growth overfishing in the shrimp stock can be mitigated through an increase in mesh size, allowing the harvesting of shrimp at a larger size. As larger shrimp produce larger numbers of eggs, such a strategy would also reduce any risk of recruitment overfishing. Based on the results of the CRANNET Project, the Management Plan therefore aims to increase the mesh size in the cod end from the current mesh of 20 mm to 26 mm by 1 May 2020. Whilst models predict increased catches with the increased mesh size, there will be inevitable short-term losses in catch caused by the reduced capture of smaller shrimps, and fishers may compensate by increasing their fishing effort. The Management Plan therefore aims to introduce the change in mesh size in three stages, from 20 mm to 22 mm in 2016, from 22 mm to 24 mm in 2018 and then from 24 mm to 26 mm in 2020. Such stepwise increases will reduce the impact of any short-term losses and reduce the likelihood of initial increases in fishing effort, and will also allow evaluation of the model's predictions of increased catches for the fishery, and take any additional measures necessary if fishing effort has increased to the extent that the benefits of the increased mesh size are greatly reduced.

As the Management Plan has only recently become operational, the Steering Group will request scientific advice on an annual basis from the relevant scientific institutes and the ICES Working Group to evaluate whether the Management Plan is succeeding in its objectives, primarily to ensure that there is progress toward the target of high long-term sustainable yields, the avoidance of recruitment overfishing and the minimising of unwanted bycatches. The Steering Group has agreed a contract with the University of Hamburg to provide this scientific oversight.

Following the increase in mesh size (initially to 22 mm, but then subsequently to 24 mm & 26 mm), a detailed sampling programme has been implemented to evaluate changes in the size distribution of shrimps in the cod-end, the size distribution of consumption shrimps (after routine processing of catch on board) and the non-shrimp by-catch (Günther, 2016). We would expect to observe an initial decrease in the proportion of shrimps in the catch that are undersized, a long term increase in the size of shrimps both in the cod end and after processing, and a decrease in the non-shrimp bycatch. To evaluate these changes, the new sampling programme will be comparing catch compositions using the 22 mm cod end on a commercial vessel with catch compositions using a 20 mm cod end fished simultaneously on the same vessel. In addition, these catch compositions using the 22 mm cod end will be compared with catch compositions observed during the Demersal Young Fish Survey (which uses a 20 mm cod end) in the same fishing area and at the same time. Sampling will take place during April, July-September and November when it is considered that any signals of change in catch composition are least likely to be masked by inherent natural variations due to temperature, recruitment variation etc. The focus of the sampling will be on September, as this is when the annual Demersal Young Fish Survey takes place. Vessels from all nations involved in the MSC process (Netherlands, Germany, and Denmark) will participate in the sampling campaign permitting an analysis of temporal, spatial and vessel variability in catch compositions. It is hoped that this sampling programme will be a forerunner of an extended self-sampling programme.

The Steering Group has undertaken a full review of measures to reduce unwanted bycatch of both brown shrimp and bycatch species, and has provided detailed rationales on which measures are considered to be most effective and most likely to achieve their objectives. The Clients' review is re-produced in full in Appendix 4. Whilst there is a history in the brown shrimp fishery over the last 25 years of work on the effectiveness of alternate measures, and it would be reasonable to assume that such work will continue, the Management Plan states explicitly that regular reviews will be undertaken to consider alternative approaches to the existing technical measures to avoid unwanted catches of both target and bycatch species.

In summary, there has been significant review of many elements of the Management Plan during its development over the last few years and modifications have been made, for example following the Temming et al. review. However the Management Plan has only just become operational, and undoubtedly there will need to be some additional adjustments in the future. In particular, the LPUE reference points and the HCRs may need adjustment as experience with implementing the HCRs grows.

3.5.3 Data collection / Information

The Management Plan requires a fleet register of the size and power of all vessels participating in the Management Plan to complement fleet data already collected by the national authorities. The register will be extended to include information on beam length and gear weight to ensure that the vessels comply with the regulations of the Management Plan. In addition, vessels must participate in any data collection required by the Steering Committee for the purposes of stock monitoring.

Fishing positions of all vessels participating in the Management Plan will be recorded through a vessel monitoring system (VMS). Measures can be taken if fishing occurs in prohibited or sensitive areas. Control and enforcement of prohibited areas is a task for the national authorities. In addition, there are plans in the Netherlands fishery to introduce a "Black box" monitoring system from 1 January 2017 which will provide much more detailed information on fishing activity in relation to closed areas.

The key data used in the assessment of the shrimp stock are the commercial landings per unit effort (LPUE) data, and estimates of fishing mortality in relation to fishing mortality reference points estimated from a yield-per-recruit model.

The Management Plan will monitor the fishing effort of all vessels using two metrics. Firstly hours-at-sea and kw-hours at sea will be recorded as this allows comparison with historical fishing effort and LPUE data upon which the reference points have been based. In addition, hours-fishing and kw-hours–fishing will also be monitored for future reference and these metrics are considered to provide a better index of fishing effort, and these data will be used for future refinement of the HCRs. Temming et al. (2013) recommended the use of fishing hours in preference to hours at sea, as the latter can be significantly influenced by time taken to steam to the fishing grounds and therefore different sectors of the fleet may exhibit different ratios of fishing time to total trip time. The ICES Working Group (ICES, 2015) has been working for many years on standardising units of LPUE across all national fleets but by 2015 this had still not been achieved. The Management Plan does therefore monitor both total hours at sea and hours fishing, and along with examination of VMS records and spatial distribution of effort and LPUE, this allows the identification of any systematic changes in fishing behaviour which might create biases in the estimates of LPUE.

Estimates of fishing mortality reference points based on a MSY approach have been developed using a yield-per-recruit model (Hufnagl et al., 2010; Hufnagl and Temming, 2011; Hufnagl et al., 2013). The model benefits from reliable growth and mortality rate information that has become available only in recent years. The model allows the calculation of F_{max} (the fishing mortality level at which yield-per-recruit would be maximised) and $F_{0.1}$ (the value of F at which the initial slope of the yield-per-recruit curve has decreased to 10% of its initial value).

Estimates of total and fishing mortality can be calculated from predator abundance data. Stock numbers for the predators are derived from age-based assessment data for the total North Sea and are multiplied with the quarterly consumption rates per individual by age class, and the average share of brown shrimp in the diet of the predators (Temming and Hufnagl, 2014). Total mortality of brown shrimp estimated from using length-based methods is then split into natural mortality (M) and fishing mortality (F) using the total consumption of the predators and the North Sea wide landings (Temming and Hufnagl, 2014).

In addition to the fishery-dependent data on observed LPUE trends and the estimation of the total mortality from length-based methods, there are two fishery-independent annual surveys which provide trends in abundance of brown shrimps. The Dutch Demersal Fish survey (DFS) has been conducted annually in the autumn since 1970 and covers the area from the southern Dutch border up to Esbjerg in Denmark, and includes the Dutch Wadden Sea, and both the Ems-Dollard and Schelde estuaries. The surveys use 3 m and 6 m beam trawls with tickler chains and a 20 mm mesh size in the cod end (Tulp et al., 2008) and are conducted primarily in deeper water on a fixed station grid.

The German Demersal Young Fish Survey (DYFS) has been undertaken by the Thünen Institute for Sea Fisheries every autumn since 1974 (Neudecker, 2001). The survey uses a 3 m beam trawl without a tickler chain and has a mesh size of 20 mm. The survey covers primarily shallow waters and has no fixed stations.

The annual survey data can also be used to obtain a depth- and area-stratified swept area estimate of brown shrimp biomass, which along with an estimate of the production/biomass ratio can be used to calculate total annual adult biomass production (Tulp et al., 2016). Whilst the survey data provide useful information on stock trends and have been used to estimate population structure and predator abundance, the surveys are targeted primarily at adult shrimp, and the timing of the surveys in the autumn mean that the main period of reproduction when the females are berried is missed. In addition comparison of the survey station positions with fishing positions described by VMS data confirm that the surveys do not cover the whole distribution of the shrimp stock.

Discard monitoring has been carried out since 2008 as part of the Data Collection Framework (DCF EC no. 199/2008), and 4 to 8 trips per year are undertaken through an observer programme in both the Netherlands and Germany. Denmark also takes part in discard sampling. Across the Dutch, German and Danish fleets, over 30% by weight of the catch are discarded small shrimps (ICES 2015). Studies in the UK suggested that survival of discarded shrimps may be as high as 80% (Lancaster and Frid, 2002).

In addition to the collection of data on brown shrimp, the Management Plan also requires the recording of all endangered, threatened and protected (ETP) species on an ETP registration sheet (either paper or electronic). ETP species identification guides are provided to aid the fishers whilst at sea. The Management Plan requires that all viable specimens of ETP species must be released as rapidly and with as much care as possible.

3.5.4 Stock assessment

Crangon is a short-lived species with the vast majority of the annual catch having recruited to the fishery during that year. Age determination is not possible and so standard age-based analytical stock assessment approaches which estimate MSY and B_{MSY} are therefore not appropriate. The ICES Working Group on Crangon Fisheries and Life History (WGCRAN) concluded that management based on monitoring of LPUE data and subsequent effort reductions if LPUE dropped below reference levels would be the best option for managing this short-lived species.

Methodology

There are two key stock assessment approaches utilised in this fishery – the evaluation of trends in LPUE, standardised across fleets, and the comparison of estimates of observed fishing mortality with Fmsy proxies.

Trends in LPUE – standardisation across fleets

Trends in LPUE are available on an annual and monthly basis for all fleets which can be used as an indicator of stock status. These indicators can provide a picture of how fishing pressure may be changing over time within the fishery, but are also used on a monthly basis as reference points which may trigger reductions in fishing effort as part of the HCRs.

Yield-per-recruit model and estimates of fishing mortality

A yield-per-recruit model has been developed for the shrimp stock initially by Temming and Damm (2002) and subsequently extended and validated by Rückert (2011) and then modified by Hufnagl and Temming (2011). The model was developed initially in order to replicate observed seasonal trends in landings in the fishery and hence further understand brown shrimp population dynamics. The model is described schematically in Figure 9.

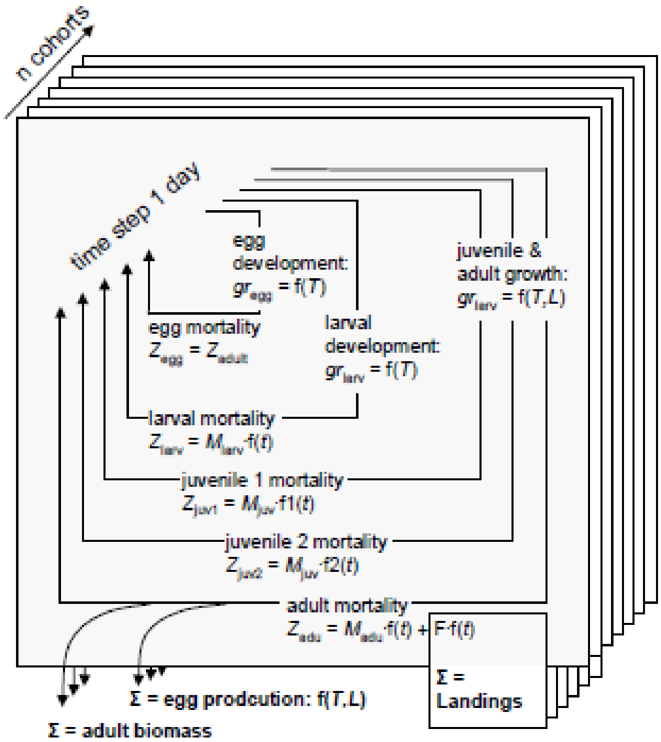

Figure 9. Schematic representation of the yield-per-recruit cohort model (Source: Hufnagl and Temming 2011)

The model incorporates detailed biological information on each stage of the cohort of the brown shrimp. The model simulates daily cohorts through their life up to a maximum age of 2 years, with the size of cohort determined by a spawning (egg abundance) index. Growth and mortality rates are modelled separately for eggs, larvae, small juveniles (6-20mm), large juveniles (20-50mm) and adults. Within each cohort males and females are treated separately and growth rates differ between size classes. Egg development rates are based on Redant (1978), larvae development rates on Criales and Anger (1986) and adult growth rates on Hufnagl and Temming (2011). One of the key elements of the model is that within each life stage, growth rate of individuals is variable. Natural mortality is modelled to decline with size, with juvenile shrimps assumed to have an annual M of 10.36 y^{-1}, and then M declining linearly with total length (mm) to an assumed M of 1.5 y^{-1} for adults greater than 50 mm. The level of M is based on an analysis of predation rates, landings and total mortality. Hufnagl et al., (2010, 2011) estimated total mortality at 5.3 y^{-1} through the application of length-based methods. Predation rates were calculated using abundance of cod and whiting and their consumption rate of shrimps through an update of the analysis of Wellemann and Daan (2001) and fishing mortality is approximately 2.5 times natural mortality. With a total mortality estimate of 5.3 y^{-1}, the model therefore uses values of F and M of 3.8 and 1.5 y^{-1} respectively. The model includes seasonality of natural mortality driven by temperature and predator abundance, and it is the incorporation of this seasonally varying natural mortalities which is the key element of the model which ensures that the results of the simulation model matches the observed seasonal patterns of commercial landings and egg production.

A full list of parameters and their sources are described in Table 4.

Table 4 Yield-per-recruit model – parameter descriptions, ranges and sources (Source: Hufnagl et al., 2011).

	Parameter	Description	Equation / Source	Value (parameter range)	Unit
1	SI	Seasonality of egg abundance (spawning index)	Temming & Damm (2002), Rückert 2011	0.89, 0.64, 0.78, 1.12, 1.78, 2.37, 1.88, 1.11, 0.31, 0.22, 0.53, 0.74	monthly multiplier of F_{adult}
2	GR_{egg}	Egg development rate	$1031.44 \cdot T^{-1.354}$, Redant (1978)	117 (5°C), 46 (10°C), 26 (15°C)	days
3	GR_{larvae}	Larval development rate	$(5.5/0.00584) \cdot T^{-1.347}$, Criales & Anger(1986), Temming & Damm (2002)	108 (5°C), 42 (10°C), 24 (15°C)	days
4	GR_{male}	Growth rate males	$0.03424 \cdot T - 0.00187 \cdot e^{0.08777 \cdot T} \cdot L$, Hufnagl & Temming (2011)	0.14 (5°C, 10 mm), 0.44 (15°C, 10 mm), 0.12 (15°C, 65 mm)	$mm \cdot day^{-1}$
5	GR_{female}	Growth rate females	$0.04028 \cdot T - 0.002 \cdot e^{0.08777 \cdot T} \cdot L$, Hufnagl & Temming (2011)	0.17 (5°C, 10 mm), 0.53 (15°C, 10 mm), 0.03 (15°C, 65 mm)	$mm \cdot day^{-1}$
6	$cvGR$	Growth variability	Hufnagl & Temming (2011)	30	%
7	WW	wet weight	$4.625 \cdot 10^{-6} \cdot L^{3.084}$, Hufnagl et al. (2010)		
8	Z_{egg}	Level of total egg mortality	related to adult mortality (see also below)	5.3	a^{-1}
9	M_{larvae}	Level of larval mortality	Peterson & Wroblewski (1984)	10.36-12.93	a^{-1}
10	sM_{larvae}	Seasonality of larval mortality	temperature/predator related, Rückert (2011)	0.23, 0.23, 0.27, 0.28, 0.57, 1.13, 1.70, 2.25, 2.25, 1.70, 1.13, 0.28	monthly mutiplier of M_{larvae}
11	$M_{juvenile}$	Level of juvenile mortality	linear interpolated from 10.36 (6 mm) to M_{adult}	$(M_{adult} - 10.36)/(50-6)$	a^{-1}
12	$sM_{juvenile}$	Seasonality of juvenile mortality	temperature/predator related, Rückert (2011)	0.26, 0.26, 0.28, 0.30, 0.51, 1.10, 1.65, 2.19, 2.21, 1.75, 1.17, 0.33	monthly mutiplier of $M_{juvenile}$
13	M_{adult}	Level of adult natural mortality	Update of Welleman & Daan (Temming & Hufnagl in prep.)	3.8	a^{-1}
14	sM_{adult}	Seasonality of adult natural mortality	predator occurrence related, this study + Rückert (2011)	0.33, 0.33, 0.33, 0.33, 0.33, 0.95, 1.53, 2.01, 2.15, 2.01, 1.28, 0.44	monthly mutiplier of M_{adult}
15	F_{adult}	Level of fishing mortality	Calculated based on total mortality and consumption of predators to landings ratio	3.8	a^{-1}
16	sF_{adult}	Seasonality of fishing mortality	based on fishing effort (horse power hours at sea) ICES 2012	0.16, 0.20, 0.80, 1.65, 1.47, 1.28, 1.17, 1.23, 1.28, 1.23, 1.03, 0.48	monthly mutiplier of F_{adult}

In summary the yield-per-recruit cohort model includes a spawning index, temperature dependent growth rates, stage and season-specific mortality rates, seasonal effort patterns of the fleet, and total mortality rates of adult shrimps.

Annual values of F are based on the estimation of total mortality using length-based methods, and then by partitioning total mortality into fishing and natural mortality. These estimates of F are then compared with model-derived F_{max}, the fishing mortality at which the maximum landings can be achieved, or with $F_{0.1}$, the value of F at which the initial slope of the yield-per-recruit curve has decreased to 10% of its initial value. In all recent years, it was concluded that current fishing mortality exceeded F_{max}, indicating growth overfishing.

Two additional approaches that are not formally part of the assessment, but could provide additional information on stock status, and could be used to develop secondary indicators of stock status, use data from the DFS and DYFS surveys. The survey data could be used as indicators of fishing pressure through, for example, indicators based on the proportion of large shrimps, and could also be used to provide swept area biomass estimates for brown shrimp (Tulp et al., 2016).

3.5.5 Current status of stock and management advice

Temming and Hufnagl (2014) estimated total mortality from length-based methods and used estimates of predator biomass and consumption by predators of shrimps >50 mm to split total mortality (Z) into fishing mortality (F) and natural mortality (M). In recent years fishing mortality has become the major component of total mortality (Figure 10). Annual values of fishing mortality (F) were compared with model-derived F_{max}, the fishing mortality at which the maximum landings can be achieved, and in all recent years, it was concluded that current fishing mortality exceeded F_{max} and $F_{0.1}$ (Figure 11) indicating growth overfishing (Temming and Hufnagl, 2014; ICES, 2015). The assessment demonstrated that the decline of key predators in combination with a shift in distributional range of the predators has caused a situation where the fishery has become the main source of mortality of adult / commercial size shrimps. This result is in stark contrast to historical assessments when natural mortality was considered to be very much higher than fishing mortality and hence the need for management of the brown shrimp stock through control of fishing mortality had been considered to be unnecessary.

Fishing effort has increased significantly in recent years following the industrial action ('strike') in 2011 with fishing effort from 2012 to 2014 significantly higher than the average level observed in 2002 to 2010 (Figure 12) (ICES, 2015). Despite a recent concurrent increase in landings, the LPUE in the last three years was lower than the long-term average in all three countries (Figure 13) reflecting the high fishing pressure currently in the fishery.

The fraction of large shrimps (>60 mm and >70 mm) caught in the Dutch Demersal Fish Survey (DFS) and the German Demersal Young Fish Survey (DYFS) conducted in the autumn has declined over recent years. Between 2003 and 2008, the proportion of shrimps >60mm increased from 15 to 20%, but in the most recent surveys the proportion varied between 13% and 18% (Figure 14). The data from these stock surveys provides further evidence of high fishing pressure.

Tulp et al. (2016) used data from the autumn young fish surveys to obtain a depth and area-stratified swept-area estimate of shrimp biomass for the period 1970 to 2015. Total commercial size shrimp biomass varied between 4,000 and 21,000 t (Figure 15). In conjunction with an estimate of production / biomass ratio, total adult annual biomass production ranged between 38,000 and 216,000 t and overlapped at the lower end with total annual commercial landings (Figure 16) indicating that in some years (1977, 1998, 2007), the larger part of the total brown shrimp production was harvested.

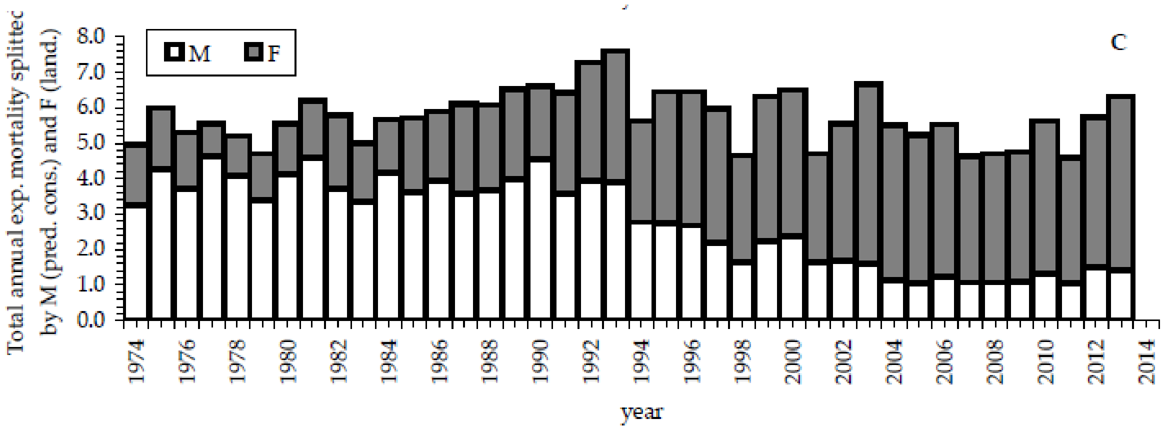

Figure 10 Estimates of total mortality (Z) split into fishing mortality (F) and natural mortality (M) using the consumption to landings ratio (Source: ICES, 2015).

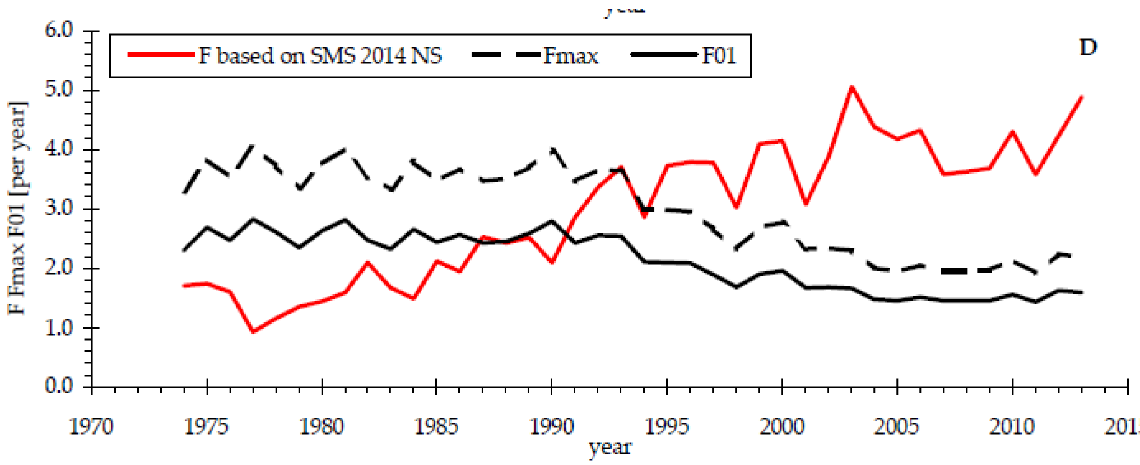

Figure 11 Estimates of observed fishing mortality (F) in relation to Fmax and F0.1 calculated from the yield-per-recruit model (Source: ICES, 2015).

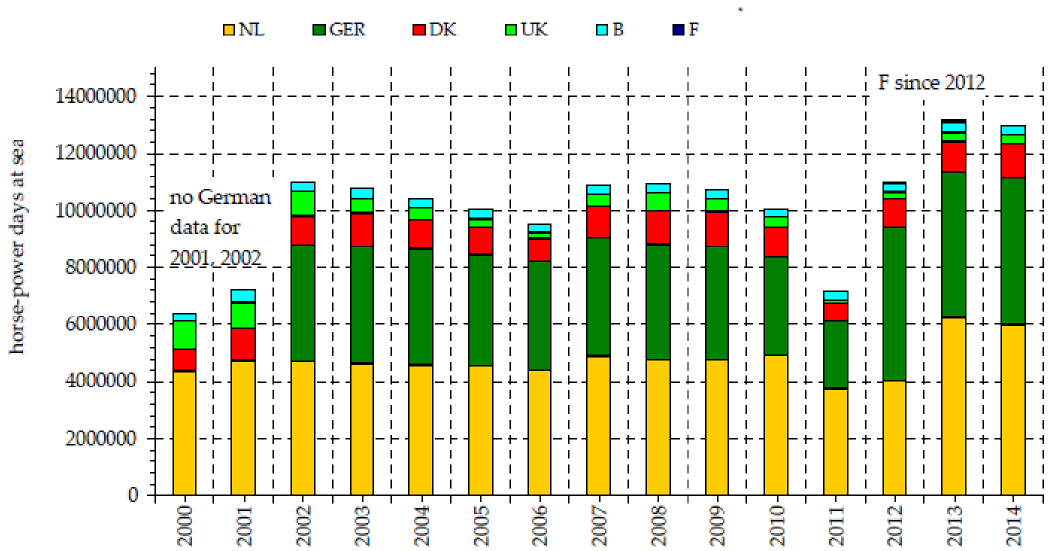

Figure 12 Cumulative fishing effort in horse-power days at sea per nation from 2000 to 2014 Dutch data are based on days at sea, all other countries data are based on hours at sea / 24) (Source: ICES, 2015).

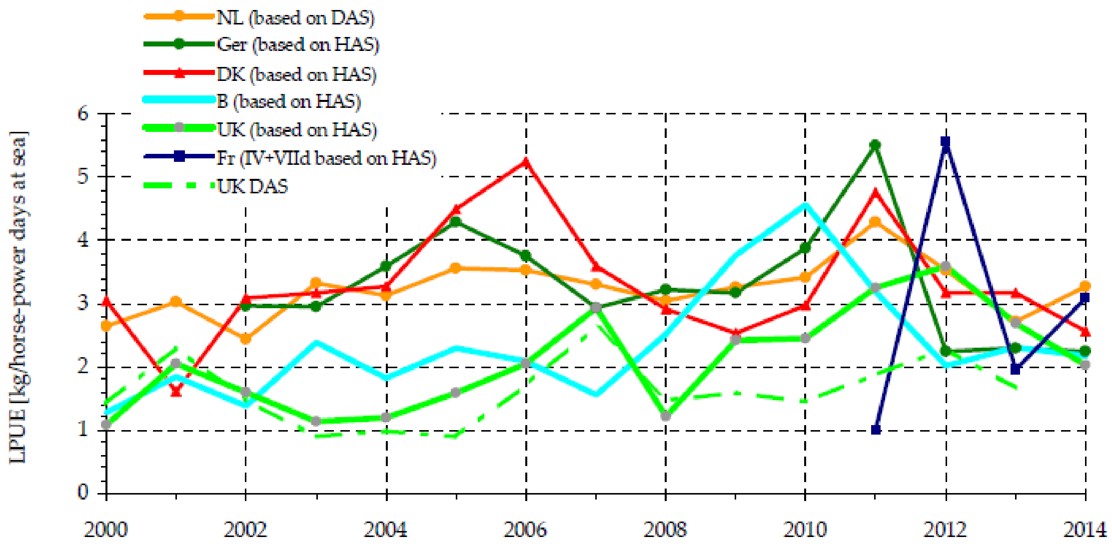

Figure 13 Annual landings per unit effort by nation in kg per horse-power days at sea (Dutch data are based on days at sea, all other countries data are based on hours at sea / 24) (Source: ICES, 2015).

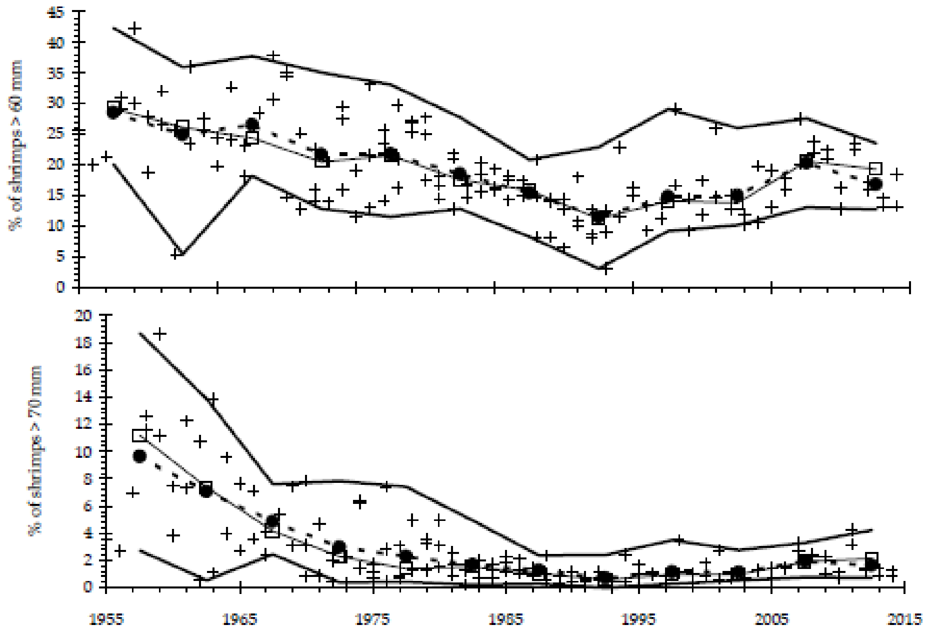

Figure 14 Fraction of shrimps >60mm (upper panel) and >70mm (lower panel) estimated from the German Demersal Young Fish Survey (DYFS) and the Dutch Demersal Fish Survey (DFS) and German bycatch series.

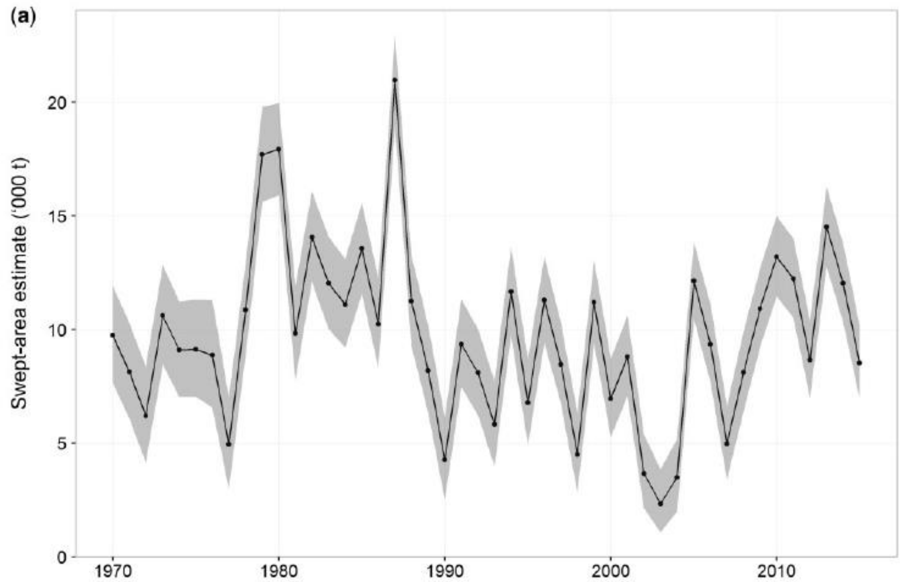

Figure 15 Swept-area estimate and confidence limits of large-sized brown shrimp >50mm (Source: Tulp et al., 2016).

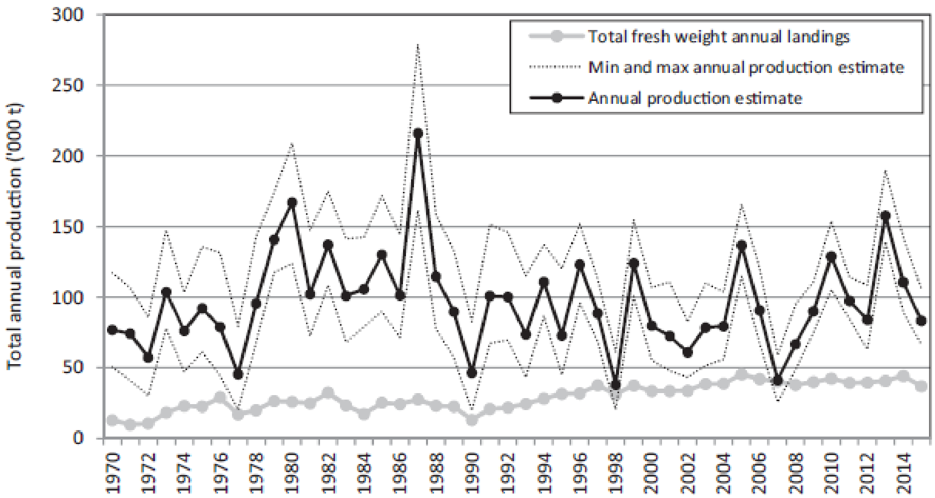

Figure 16 Total annual production in the period 1970-2015 and total landings by the brown shrimp fishing fleet as estimated based on the swept-area estimate. Indicated are the mean, minimum and maximum estimates based on uncertainties as described in Tulp et al. (2016).

Postscript

An interim report of the ICES Working Group on Crangon Fisheries and Life History (WGCRAN) meeting held in Oostende in May 2016 was published on the ICES website in November 2016. The report updated the stock assessment results presented in the 2015 report. Total landings of brown shrimps decreased to 31,375 tonnes in 2015, and there was also a slight decrease in fishing effort in comparison with the two previous years. In consequence there was a reduction in landings per unit effort (LPUE). Total mortality of shrimp >50 mm was estimated to be 5.8 per annum in 2015 in comparison with an estimate of 5.3 per annum for 2014. There was a reduction in large shrimps observed in the autumn stock surveys.

3.6 Principle Two: Ecosystem Background

3.6.1 Habitat and ecosystem features

Geographically, the area under assessment stretches along the North Sea coasts of Holland, Germany and Denmark (Figure 17), a marine ecological system managed under three political jurisdictions. It is a large, temperate, relatively flat coastal wetland environment, formed by the intricate interactions between physical and biological factors that have given rise to a multitude of transitional habitats with tidal channels, sandy shoals, sea-grass meadows, mussel beds, sandbars, mudflats, salt marshes, estuaries, beaches and dunes. The Wadden Sea is a depositional coastline, distinctive in being almost entirely a tidal flat and barrier system with significant river influences, such as the Eider, Elbe, Weser, Ems and Oosterschelde. Freshwater inflow reduces salinity and the transport of particulate matter from the river into the Wadden Sea affects turbidity, thus in turn affecting primary production and predator-prey-relationships. Highly dynamic natural processes are uninterrupted across much of the area, creating a variety of different barrier islands, channels, flats, gullies, saltmarshes and other coastal and sedimentary features. In the context of this fishery assessment, it is important to note that this is a highly dynamic area. The productivity of biomass in the Wadden Sea is high, most significantly demonstrated in the numbers of fish, shellfish and birds supported by the area. The Wadden Sea is also an important site for migratory birds.

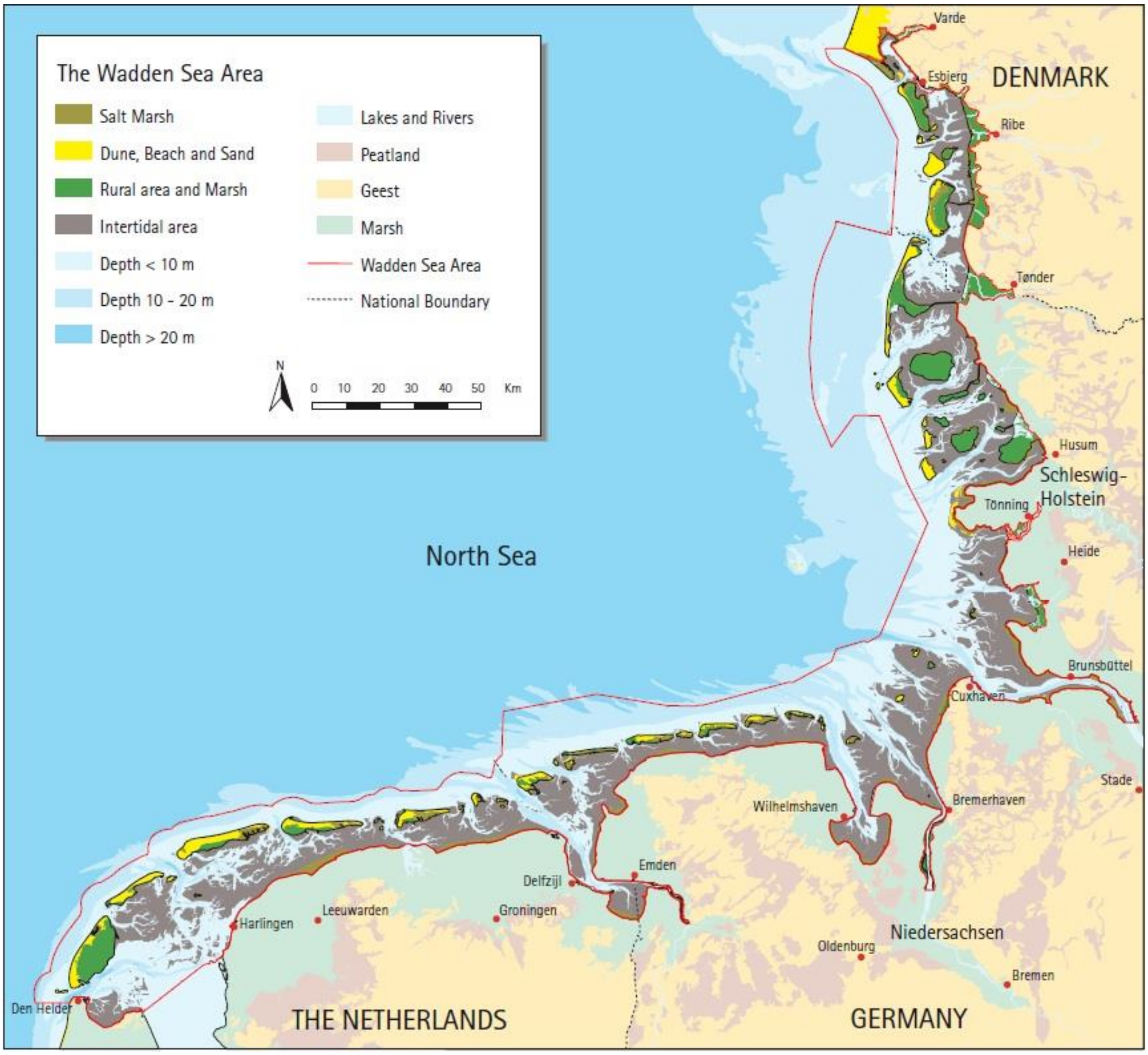

Figure 17 Map of the Wadden Sea, showing depth contours and major habitat types, including the intertidal area.

The Wadden Sea, North Sea and Zeeland coastal waters are the major brown shrimp harvesting areas (Figure 18): closer to the coast during the summer, when the subtidal waters have been warmed by the sun, and further out to sea in the winter, where the waters have retained warmth. Therefore the main fishing grounds for brown shrimp are down to the 20 m depth contour. The preferred fishing ground is an extended flat sea bottom with no structures, which could cause damage to the fishing gear. Furthermore, the fishers avoid areas with rocks or bigger stones distributed on the seafloor, because the light fishing gear can get entangled, and in strong tidal conditions this can cause the vessel to capsize. Patches with coarse sediment or mussel shell debris are avoided as well, because these can damage or even cut the net material. For the German vessels, over the last decade, there has been somewhat of a shift from fishing in the inner to fishing more in the outer Wadden Sea.

Brown shrimp are harvested throughout the year, with clear seasonal peaks in April and May and in the autumn. Shrimp levels vary from year to year, and sometimes from season to season. Brown shrimp is among the top three species caught in the North Sea with respect to landings, is a major food item found in whiting and cod stomachs, and is itself an important predator of in- and epifauna in intertidal areas that is assumed to control plaice and mussel recruitment.

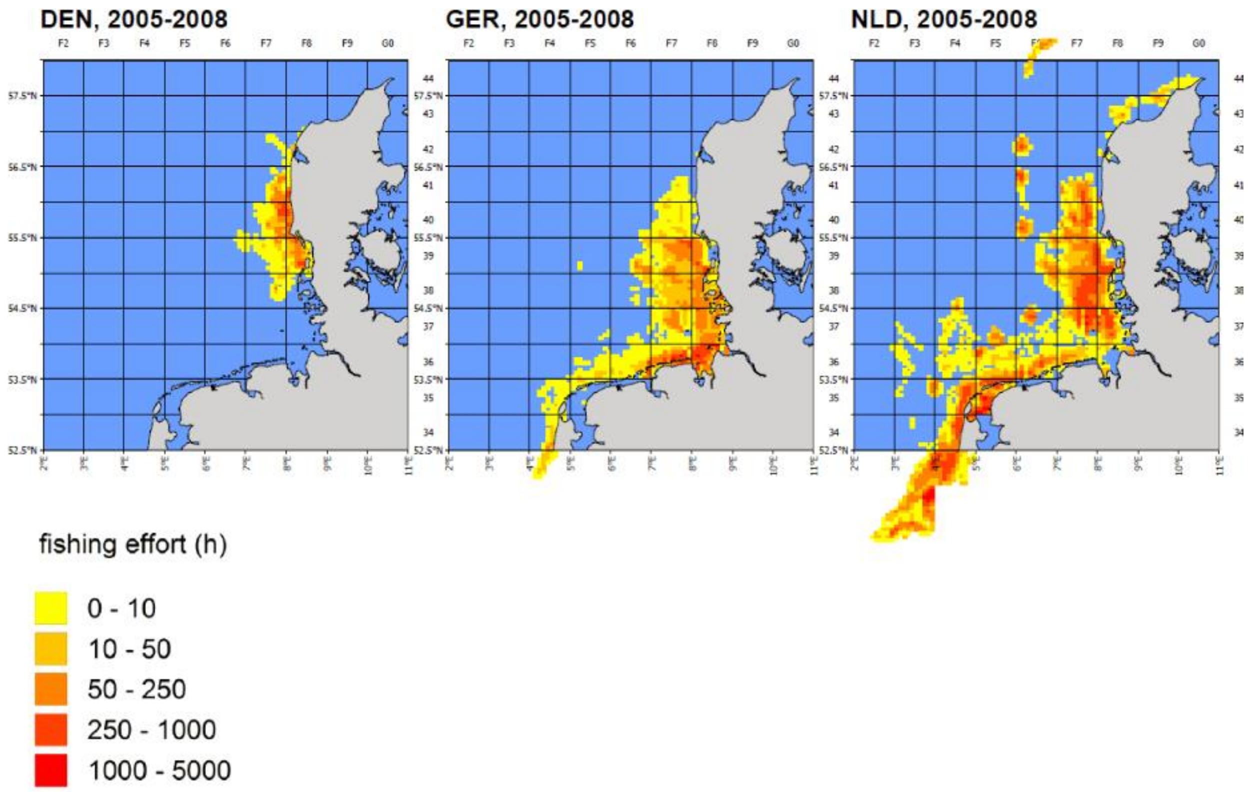

Figure 18 Fishing effort for the Danish (DEN), German (GER) and Dutch (NL) shrimp fishery for the years 2005 - 2008 based on VMS-data (Source: Aviat et al. 2011).

Fishing occurs in highly dynamic areas with strong tidal currents with up to 3 knots, and where storms regularly move large amounts of sediments, thus redistributing the topography and shifting creeks. Over recent decades, changes in the benthos of the Wadden Sea have been observed, such as shifts in species composition of the communities, the disappearance of oyster beds, and there has been a distinct decline in the occurrence of *Sabellaria* reefs, for example. Such changes may not necessarily be as a result of fishing gears but other anthropogenic factors, such as civil engineering projects like dams, dykes and causeways (Vorberg, 2000).

The natural habitat of brown shrimp is sandy sediments. They share this habitat with other epibenthic species such as molluscs, fish – in particular flat fish, and crabs. EMODnet

provides a broad categorization of the relevant seafloor areas, showing predominantly sandy/ muddy sediments (

Figure **19**) of varying composition and configuration depending on the distance from the shore. For example, the more mud based sediments occur nearer the shore as there the current speeds are reduced, whereas coarse sediment is found in tidal areas with high current speed. The only structures regularly occurring in this area are water current induced sand ripples, which reach from a few centimetres to up to 2 m height (mega ripples) depending on the velocity of the current. The bathymetry of the Wadden Sea is shown in Figure 20, clearly showing that fishing predominantly occurs in the shallower areas (with reference to Figure 18).

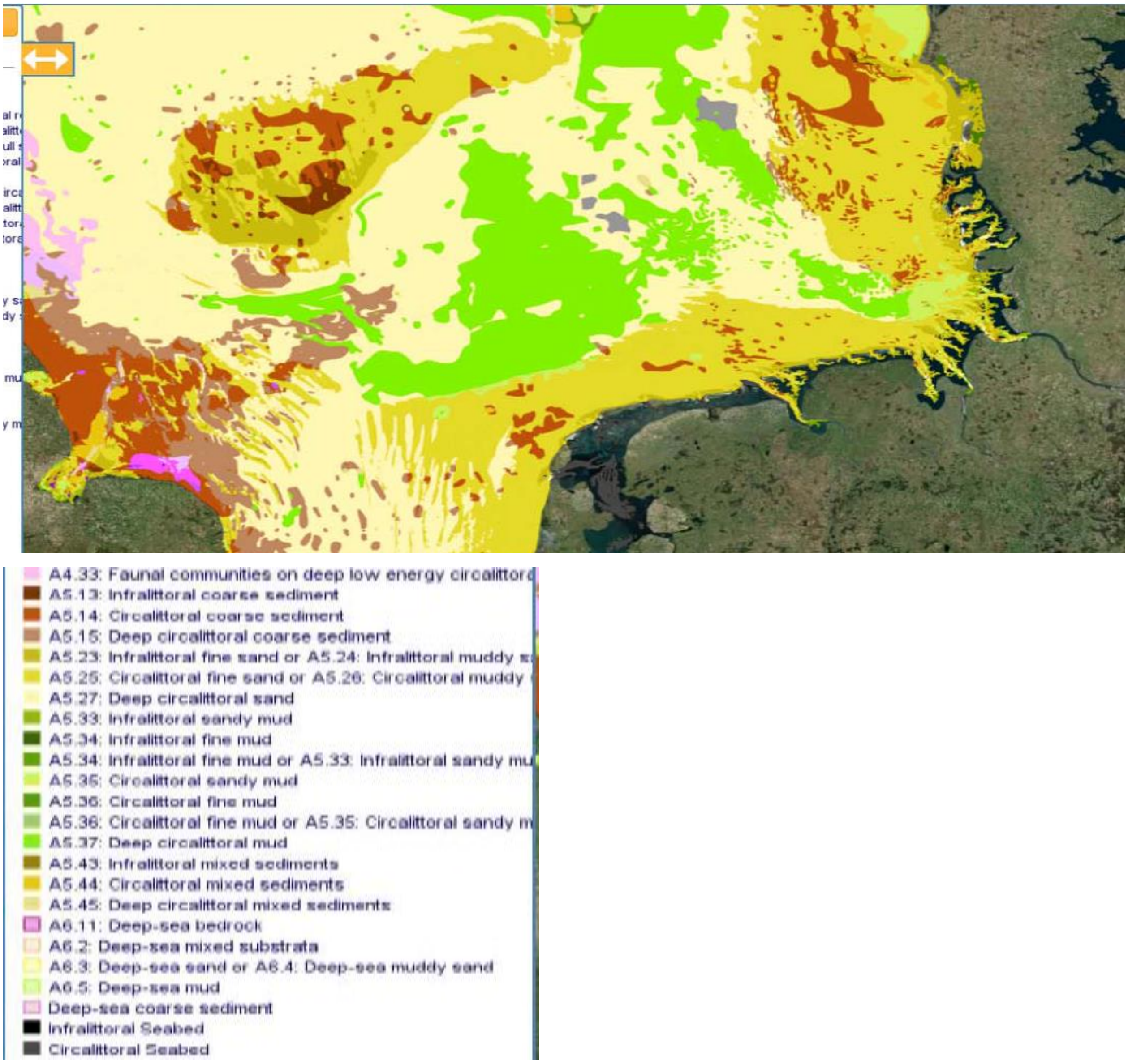

Figure 19 Sediment characterization of the seafloor in the Wadden Sea area – after EMODnet (Source: http://www.emodnet-seabedhabitats.eu/default.aspx?page=1974&LAYERS=HabitatsNorthCelt2015&zoom=6&Y=53.57761098696424&X=6.0329032129738875)

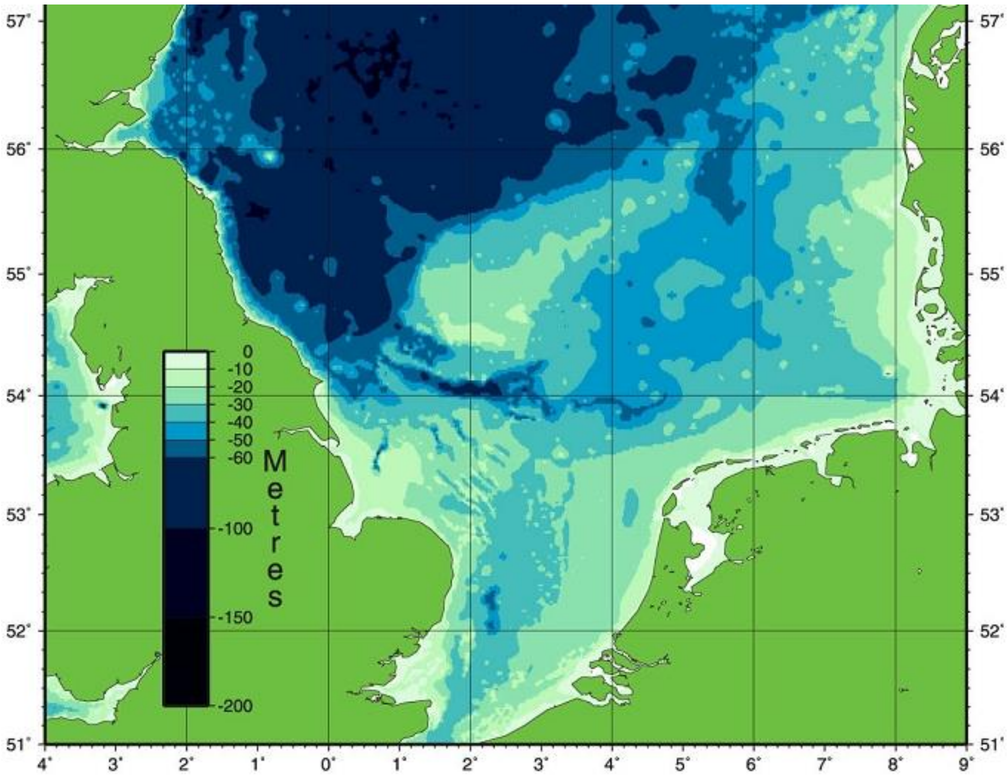

Figure 20 Bathymetry of the Wadden Sea (Source: www.doggerbank.nl).

3.6.2 Habitat types

Habitat categories, as defined by the MSC methodology (SA3.13.2) is based on the following habitat characteristics:

- substratum – i.e. sediment type;
- Geomorphology – i.e. seafloor topography;
- Biota – characteristic flora and/or fauna groups (e.g. kelp dominated, seagrass beds, mixed epifauna).

The most commonly encountered habitat, as defined by the MSC methodology (SA3.13.3.1) is sandy/mud (Figure 19) sediment type, predominantly evenly flat apart from sediment ripples caused by currents. Few sessile epifauna live in this high energy environment, where the sediments become displaced frequently by storms and tidal movements. This habitat regularly comes into contact with the gear used in the UoA, considering the geographical overlap of fishing effort with the habitat's range.

A further distinctive hydrological feature of the Wadden Sea is the continuous series of tidal basins which are analogues to riverine catchment areas (CWSS 2008). However, they differ from these by having alternating flow directions with the tides (Figure 21). The existence of tidal basins is interrelated with the existence of barrier islands or high sands. Between adjacent islands, the tidal flow is compressed, forming tidal inlets up to 30 m in depth (e.g. Lister Deep between Sylt and Rømø), scoured by strong currents. Behind the barrier islands most inlets furcate into major gullies (channels) and these branch into smaller and smaller tidal creeks or runnels in a recurrent fractal pattern. In the back-barrier area, flood waters of adjacent tidal inlets meet at tidal divides (watersheds). Seaward of tidal inlets, ebb deltas form with highly turbulent waters. Here ebb currents interfere with waves and the long-shore current. As a result, transported sand accumulates in the form of highly dynamic bars and shoals. Altogether, a series of 33 such tidal inlets with their back-barrier basins and ebb deltas have been identified as recurrent features of the hydrography of the Wadden Sea. They are connected by some overflow across tidal divides in the back-barrier area and by the tidal flow and long-shore current seaward of the islands. The tidal gullies are used by many marine species as a refuge from the retreating seas at low tide.

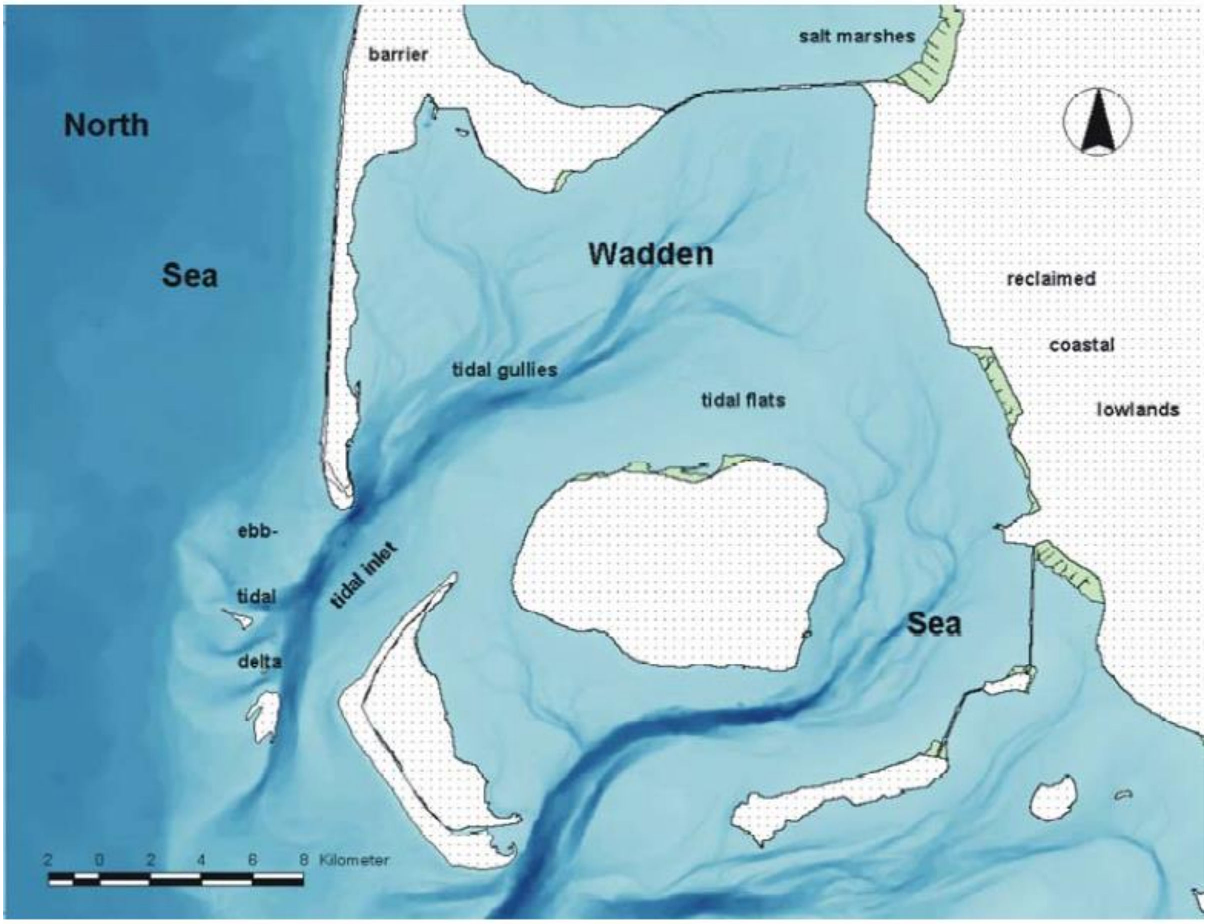

Figure 21 Geomorphological elements of the Wadden Sea, the tidal basin, showing the tidal gullies (Source: CWWS 2008).

3.6.3 Vulnerable Marine Ecosystems VME

The possibility and potential of encountering VMEs has been assessed.

Vulnerable Marine Ecosystem (VME) types are defined in the MSC CR v2.0 Guidance (GSA3.13.3.2) using FAO guidelines:

- Uniqueness or rarity – an area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas or ecosystems
- Functional significance of the habitat – discrete areas or habitats that are necessary for survival, function, spawning/reproduction, or recovery of fish stocks; for particular life-history stages (e.g., nursery grounds, rearing areas); or for ETP species
- Fragility – an ecosystem that is highly susceptible to degradation by anthropogenic activities
- Life-history traits of component species that make recovery difficult – ecosystems that are characterised by populations or assemblages of species that are slow growing, are slow maturing, have low or unpredictable recruitment, and/or are long lived
- Structural complexity – an ecosystem that is characterised by complex physical structures created by significant concentrations of biotic and abiotic features

It is the intent of the MSC to also apply FAO guidance to shallow, inshore waters, and therefore the definition of VME includes other species groups and communities, such as seagrass beds, biogenic reefs such as *Sabellaria* reefs.

Sabellaria reefs

Reefs of *Sabellaria spinulosa* have been known along the German North Sea coast for more than 100 years. In the past about 20 reefs were recorded in the Wadden Sea area, Vorberg recorded three in 1995 (Vorberg, 1995), but by 2009 (QSR, 2009) no reefs were found. Since shrimp fisheries appear to be of little significance as a cause of the decline in *Sabellaria* reefs in the Wadden Sea, other factors are being considered, relating to the natural biology and development of the *Sabellaria* worms. The natural development is characterized by four developmental stages (larval settlement, growth, stagnation and destruction), whereby each one is influenced by numerous factors such as currents, weather conditions, competition for food and space, coastal engineering, and sediment dumping. Currents play a crucial role in all the developmental phases, such as the distribution of the planktonic larvae, as well as in the supply of tube-building material and nutrition.

Although single individuals of this species can be found throughout the entire Wadden Sea, reef-like structures occur only in a few locations. It is believed that only under certain conditions reefs are built but there is a serious lack of knowledge of the primary conditions for the genesis and further development of those reefs. *Sabellaria* reefs are not known in the Dutch or Danish Wadden Sea, although, at least in the Dutch Wadden Sea, individuals of these species are sporadically found (Vorberg 1995).

Sabellaria larvae are found offshore, and they used to be found in the Wadden Sea, it appears, though, that changes in the current patterns prevent the transportation of a sufficient quantity of larvae into the Wadden Sea (Figure 22). Changes in current patterns also mean changes for the reef itself. Faster currents can lead to erosion, slower currents to sedimentation. Conversely, if a *Sabellaria* reef survives for decades at one particular location, as applies to two reefs in the North Sea (Vorberg, 1997), there is evidence of little or no fluctuation in current conditions. Changes in current patterns are also caused by anthropogenic activities, such as building of causeways to the islands, dyking, jetties, coastal-protection structures, dredging work and sediment dumping. It appears that these factors may be more important in relation to changes observed in the Wadden Sea than the impact of the shrimp fishery.

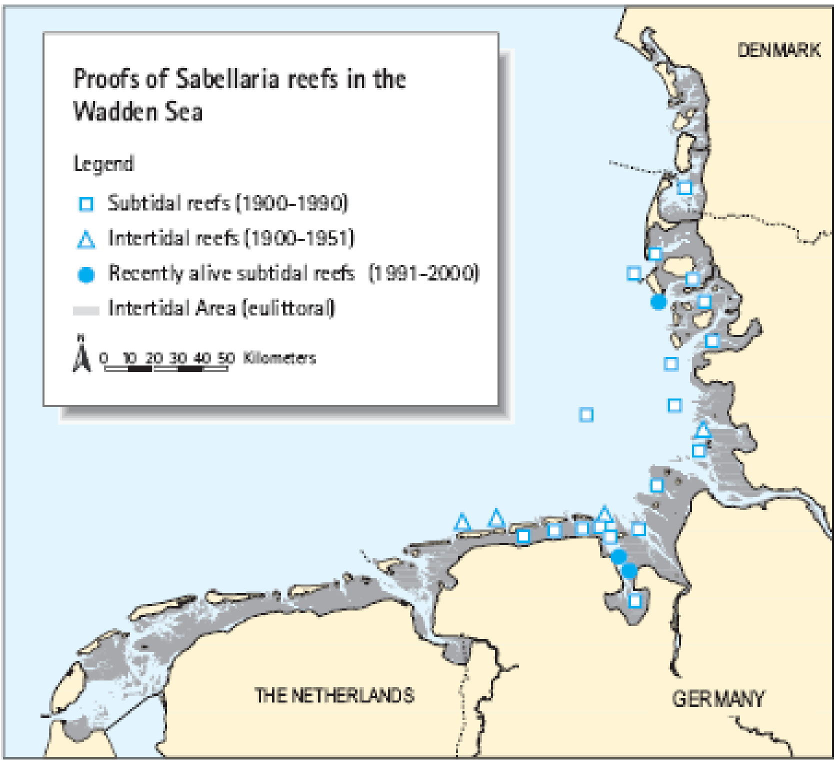

Figure 22 Changing occurrences of *S. spinulosa* reefs in the Wadden Sea (Source: Essink et al 2005; Wadden Sea Secretariat 2005)

Vorberg (2000) studied the impact of shrimp trawling (beam trawls) on *Sabellaria* reefs. Compared to demersal beam trawl fisheries, shrimp trawling is a lighter gear (the force due to weight exerted by the shrimping gear is only half that of flatfish beam trawl gears), the parts of the fishing gear that make contact with the sea bottom are mainly the shoes or rollers (at the ends of the beam) and the rollers of the ground rope. Tickler chains are not used. Therefore shrimp trawls can be regarded as relatively light fishing gear with low impact on the sea bottom (Rumohr et al., 1994; Vorberg, 1997). Stock et al (1996) assessed Crangon fisheries along the German North Sea coast as non-destructive. Findings show that contact with a *Sabellaria* reef has no long term detrimental effect, the reef area affected by the shoes regrows within a few days, provided the worms themselves have not been killed (Vorberg 2000). Fishers actively avoid *Sabellaria* reefs for fear of gear /rope entanglement, Thus former reports of shrimp fishers destroying such reefs need to be treated with caution (Vorberg 2000), as the vessels do not have the horse power capacity to deal with entanglement.

Seagrass meadows *Zostera noltii* and *Z. marina*

Seagrass stabilises the substratum as well as providing shelter and a substrate for many organisms. Where the habitat is well developed the leaves may be colonised by diatoms and algae, as well as stalked jellyfish and anemones. The infauna is generally similar to species occurring in shallow areas in a variety of substrata (e.g. amphipods, polychaete worms, bivalves and echinoderms), and can be rich within the bed. The shelter provided by seagrass beds makes them important nursery areas for flatfish and, in some areas, for cephalopods. The diversity of the species will depend on environmental factors such as exposure and density of the microhabitats, but it is potentially highest in the perennial, fully marine, subtidal communities and may be lowest in intertidal, estuarine, annual beds (in Tullrot 2009). The distribution of seagrass beds is shown in Figure 23.

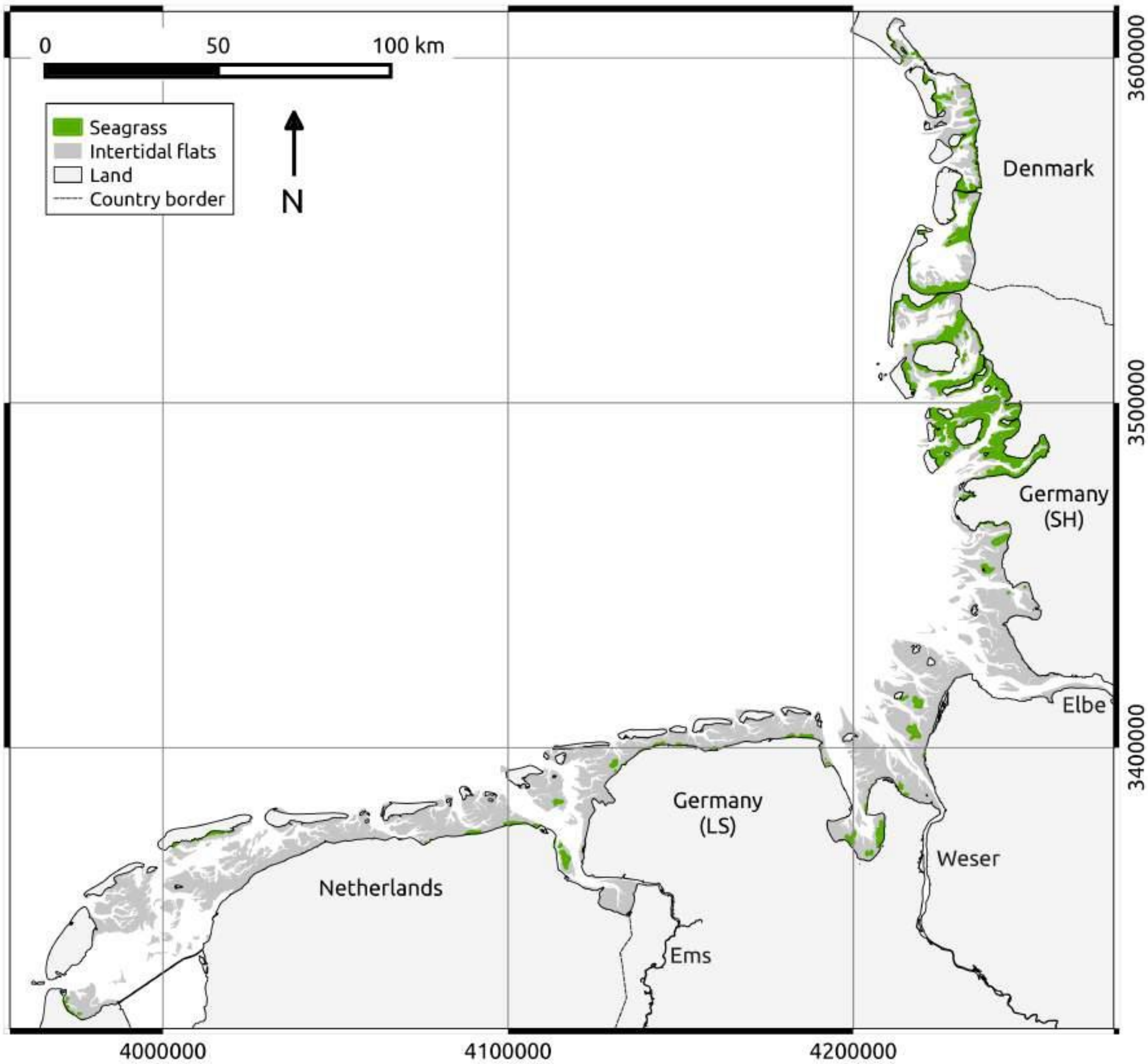

Figure 23 Overview of seagrass distributions in the entire Wadden Sea on the basis of surveys between 1988 and 2011 (Source: Folmer 2014).

There was mass die-back of *Z. marina* throughout Western Europe and elsewhere during the 1920s and mid-1930s due to a wasting disease. More recently, declines have also been reported in the Wadden Sea and the UK for both *Z. marina* and *Z. noltii* (in Tullrot 2009). Affected areas are slow to recover. Physical disturbance, nutrient enrichment, marine pollution, disease, increased turbidity, introduction and competition from alien species are all factors which affect *Zostera* beds and can threaten the extent and quality of this habitat (Anon, 2000). In addition, natural variations in environmental conditions may have a marked effect (in Tullot 2009). After the dramatic eutrophication-induced decline of intertidal seagrasses in the 1970s, the Wadden Sea has shown diverging developments. In the northern Wadden Sea, seagrass beds have expanded and become denser, while in the southern Wadden Sea, only small beds with low shoot densities are found (Folmer et al 2016).

Seagrass (*Zostera noltii* and *Z. marina*) is restricted to the shallow intertidal zone of the Wadden Sea due to their dependence of light. The shrimp fishery does not take place in these areas, hence there is no direct impact of the shrimp vessel gears on seagrass beds.

Blue mussel beds *Mytilus edulis*

The interpretation manual of EU habitats (EU 2013) defines blue mussel beds as reefs in the sense of the EU Habitat Directive (under habitat type 1170, whereby 'reefs can be either biogenic concretions or of geogenic origin; they are hard compact substrata on solid and soft bottoms, which arise from the sea floor in the sublittoral and littoral zone'). Littoral mussel beds[1] are also elements of habitat types 1140 (Mudflats and sandflats not covered by seawater at low tide) under the Habitats Directive. Because of their importance for the Wadden Sea ecosystem, mussel bed habitats are under protection and trilateral targets have been agreed upon. Mussel beds are a food source for various species of birds, and thus they are also relevant for conservation objectives under the Birds Directive. There is a relationship between the density of mussel beds and water quality because mussels filter phytoplankton from the water column. In addition mussel beds are relevant for biodiversity, ecosystem processes and local geomorphological processes, i.e. mussel beds are ecosystem engineers in that they locally influence sediment properties of the mudflats and thereby affect other species (Folmer 2014). Figure 24 and Figure 25 present the distribution and occurrence of natural mussel beds in the Wadden Sea area.

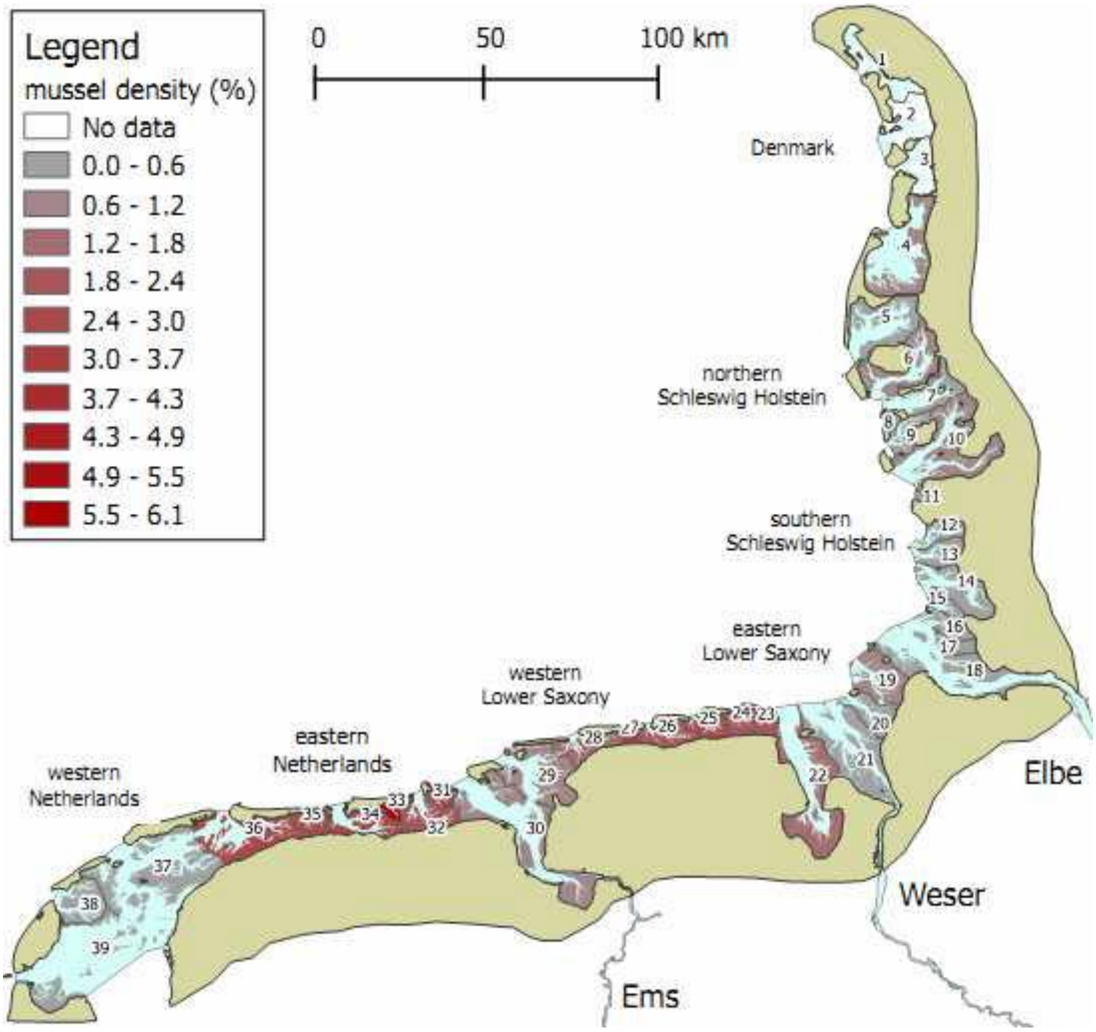

Figure 24 Tidal basins of the Wadden Sea with average densities of mussel beds between 1999 – 2009. Densities are defined as the percentage area mudflat that is covered by mussel beds (Source: Folmer 2012).

[1] NB: The natural mussel beds described here are not to be confused with the blue mussel culture plots

There are large differences in densities of mussel beds between the different types of tidal basins. Particularly, the more sheltered tidal basins in the eastern Dutch Wadden Sea and western Lower Saxony have relatively high densities while in the more exposed tidal basins in southern Schleswig Holstein - which lack barrier islands – mussel beds are virtually absent.

Occurrence frequency measures how often a location was occupied by a mussel bed in the period 1999 - 2009. The map with occurrence frequency (Figure 25) was constructed as follows: 1. a grid with cells of 250 × 250 m was created to cover the intertidal mudflats; 2. only the cells that intersect with the mudflats were retained. 3. the occurrence frequency is calculated by counting the number of years between 1999 and 2009 that each grid cell intersected with a mussel bed. The patchwork of cells gives a map that presents the occurrence frequency at each location (Folmer, 2012)

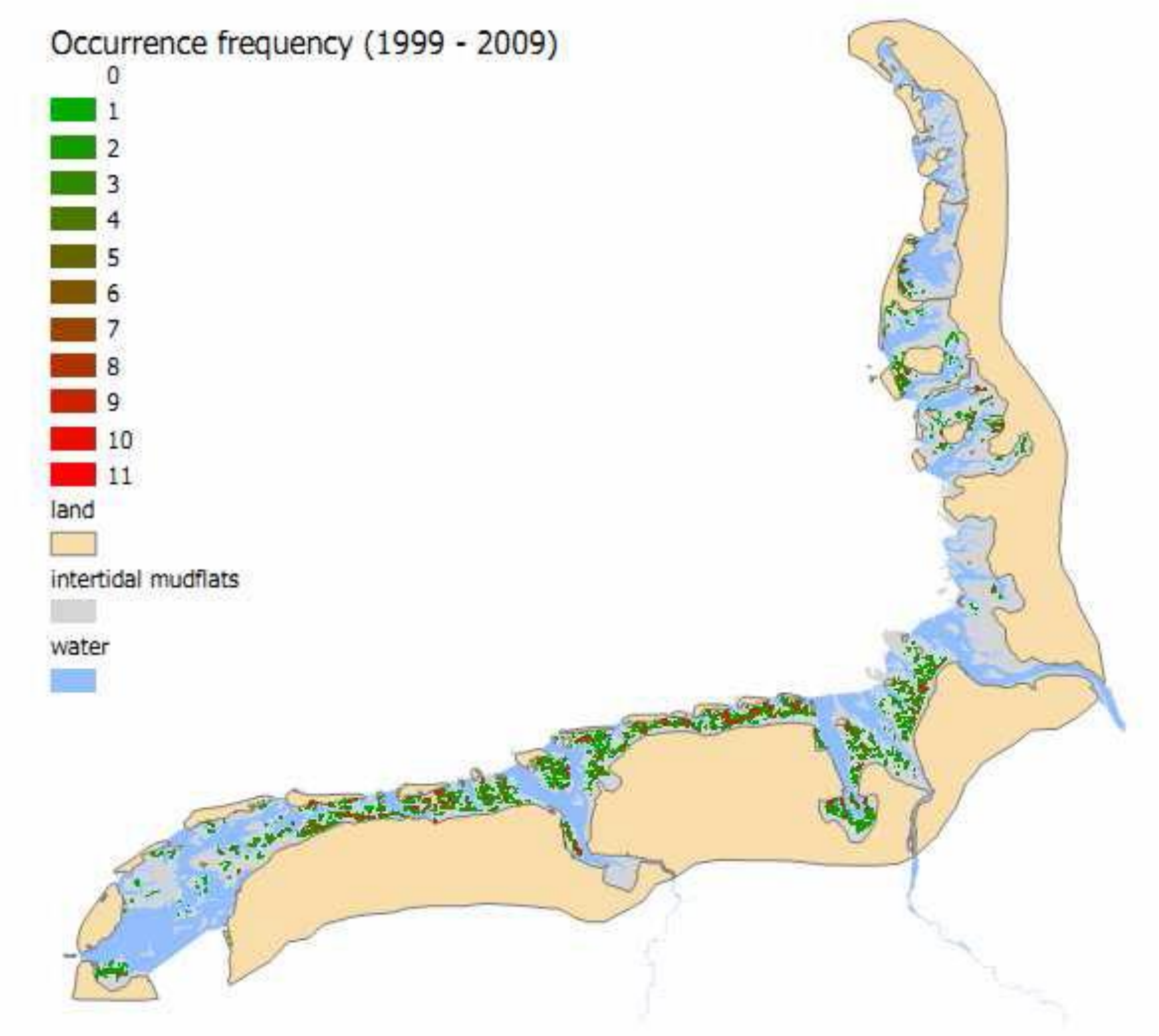

Figure 25 Occurrence frequency of mussel beds between 1999 and 2009. The more often a cell is occupied in the period 1999 – 2009 the more intensely red the cell is coloured (Source: Folmer 2012)

Source: Folmer 2012

Figure 24 shows pronounced differences in the occurrence frequency between the tidal basins of the Wadden Sea. Particularly, littoral blue mussel beds most regularly occur in the relatively sheltered tidal basins of the eastern Dutch and western Lower Saxony Wadden Sea while mussel beds are virtually absent in the tidal basins of southern Schleswig-Holstein that lack barrier islands. The occurrence frequency may be explained by the predominating south-western winds in the Wadden Sea area.

Few natural beds of blue mussels (*Mytilus edulis*) are known in the subtidal. Reference to a site off Sylt has been found in the available literature (Nehls et al 2009). All subtidal blue mussel beds are exploited by mussel (seed) fisheries, except for a part of the Hornum Deep (Schleswig-Holstein), which has been a zero use area since 1997. Recent agreements between mussel growers and nature conservation organisations in The Netherlands have resulted in plans to close parts of the subtidal mussel beds for fisheries (Keus, et al 2014). Many existing intertidal mussel beds are culture plots for mussel farming where shrimp fishing is not allowed. In other areas, mussels are grown on ropes, again a farming practice, and no shrimp fishing is allowed in the area.

***Lanice conchilega* – Lanice fields**

The polychaete *Lanice conchilega* constructs small tubes of fine sand particles or shell fragments. Lanice can occur in dense fields of a few hundred to several thousands of individuals per square meter. Extended beds were found in the course of a seabed mapping survey in the Osterems area between the East Frisian islands of Borkum and Memmert. Some small stretches of subtidal *Lanice* fields were found the Dutch Wadden Sea near Texel in a study on acoustic (side-scan sonar) type signatures of different macrobenthic species. They were visible on sidescan sonar images and found in grab samples taken on the spot. No monitoring programs exist which can give insight into the development and distribution of this habitat forming species (Marencic, 2009), no distribution maps could be found. It is not clear whether Lanice fields constitute a biogenic reef or a transient aggregation of polychaetes.

Effect of gear on benthos

It was pointed out by Aviat et al (2011) that despite public perception and 'misinformation in the media', shrimp trawling has little impact on the benthos, due to the comparative lightness of the gear, compared with the flatfish trawl fishery. The flatfish trawl is a heavy and rigid beam trawl equipped with about a dozen or more heavy chains to stir up flat fish from the bottom and trawled at speeds of about 6 knots by large and powerful vessels. By comparison, the much lighter shrimp trawl has no chains but a roller gear that hops and rolls over the sea bed stirring up shrimp mainly by the hydrostatic pressure in front of it. The shrimp beam trawl is towed over the sea bed at about 3 knots, although some vessels with newly developed net types of lighter and thinner yarn may fish at speeds of up to 6 knots (Aviat et al, 2011). However, since fishing occurs in highly dynamic areas with strong tidal currents with up to 3 knots, it is thought that any tracks left by the 'shoes' or rollers are soon covered over. Furthermore, storms regularly move large amounts of sediments, thus redistributing the topography and shifting creeks.

Investigations on the effects of the beam trawls used in shrimp fisheries revealed, that the fishing gear has a low impact on sandy sediment (Vorberg 1997, Løkkeborg 2005). Sensitive habitats like sea moss (*Sertularia cupressina*) or *Lanice conchilega* meadows remain undisturbed after the passage of the gear (Rumohr et al. 1994). An independent appropriate assessment (AA[2]) was conducted in 2013 in relation to the effect of shrimp fishing in Natura 2000 sites within the Dutch Wadden Sea. It concluded that current levels of shrimp fishing had no significant effect on the integrity of the Natura 2000 features. The appropriate assessment is valid until 2019 when a further assessment will take place.

Research on the effects of trawling in general (not specifically shrimp trawls) conducted by van Denderen et al (2015) showed that trawl and natural disturbance affect benthic communities in similar ways, where both sources of disturbance caused declines in long-lived, hard-bodied (exoskeleton) and suspension-feeding organisms. Given these similar

[2] An Appropriate Assessment (AA) is the underlying document for the purpose of the Nature Protection licence under Dutch jurisdiction.

impacts, there was no detectable trawling effect on communities exposed to high natural disturbance, which is similar to the Wadden Sea environment, with its strong currents.

Despite a long tradition of commercial exploitation of brown shrimp in the North Sea, there are knowledge gaps of the biology, ecology and population dynamics of this species. This is important, as such information feeds into population models and stock assessment models and will lead to possible conservation measures for the currently unregulated stock. The Thünen Institute in Hamburg, for example, is conducting a long term research project (started in 2001) to address some of these information gaps, and preliminary results of the long-term dataset analysis showed a significant relationship between fluctuations of the brown shrimp stock size with environmental parameters. With these results, it becomes possible to predict the development of the *Crangon* stock in German coastal waters for the forthcoming year. Furthermore, the research provides factual background for the development of conservation measures such as closed seasons or areas (protection of the spawning stock, reduction of bycatch).

3.6.4 Protected Areas

Marine protected areas are not the same as closed areas or no-take zones. Within the network of protected areas in the Wadden Sea, use of these areas is managed through either zoning or specified management plans; few areas are closed to all fishing – no-take-zones, as described below.

In managing potential habitat and ecosystem impacts, industry and management authorities are guided by Dutch, German and Danish governments' commitment to a number of relevant international conventions and European Directives.

EU Directives

The European Union environmental legislation is of specific significance for the Wadden Sea with respect to the transboundary nature of the legislation, as it crosses several jurisdictions. Of the comprehensive list of environmental legislation, the Habitats, Birds and the Water Framework Directives, as well as the Marine Strategy Framework Directive are the most relevant pieces of legislation for the protection and sustainable use of the Wadden Sea. According to the Birds Directive, (79/409/EEC) member states must classify the most suitable territories for the conservation of the species listed in the Annex 1 of the Directive, as 'Special Protection Areas' (SPAs). Basically, the entire Wadden Sea Area has been designated as SPA (Figure 26). Exceptions are the main shipping lanes and some adjacent offshore areas. The Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive), adopted in 1992, complements the 1979 Birds Directive. It has the aim of ensuring that biodiversity is maintained through conservation of important, rare or threatened habitats and the habitats of certain species.

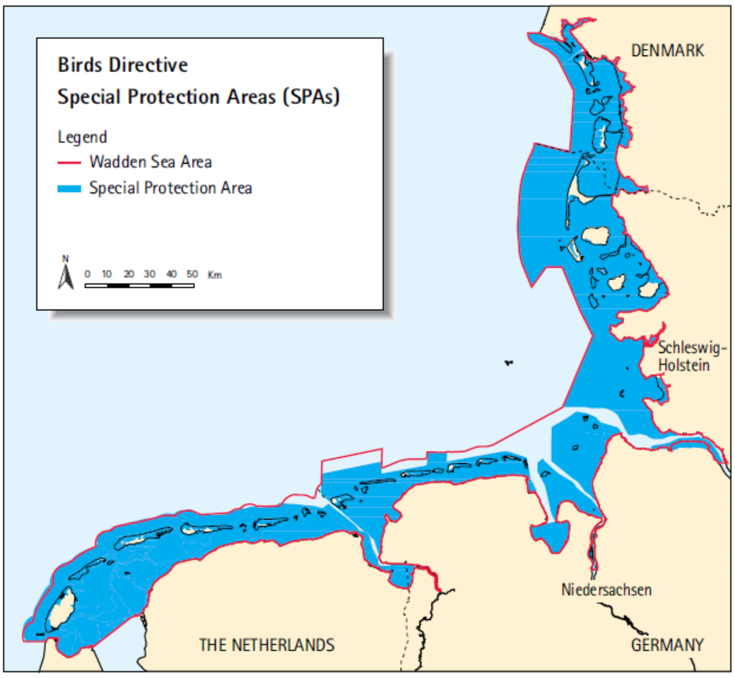

Figure 26 Special Areas of Protection (SPA) under the EU Birds Directive (Source Marencic, 2009).

Under the framework of the Habitats Directive a coherent ecological network of protected areas, called Natura 2000 sites, is being established. Natura 2000 sites are Special Areas of Conservation (SACs) designated according to the Habitats Directive (Figure 27) and the SPAs of the Birds Directive. The Wadden Sea is part of Natura 2000 and subject to the provisions of the Habitats Directive, of which Article 6 is a crucial one. Article 6 stipulates that for SACs, member states shall establish the necessary conservation measures involving, if need be, appropriate management plans specifically designed for the sites or integrated into other development plans. Member states shall also take appropriate steps to avoid, in the SACs, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive.

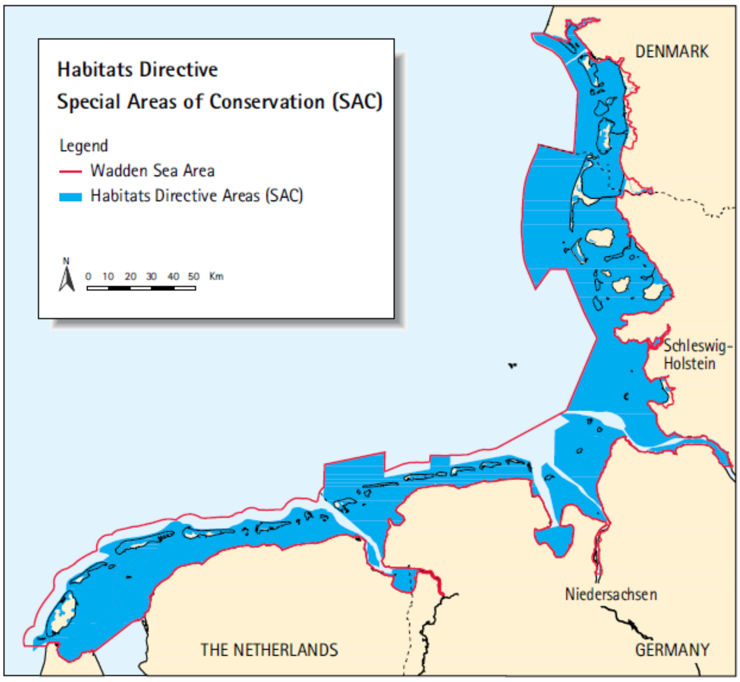

Figure 27 Special Areas of Conservation in the Wadden Sea under the Habitats Directive (Source: Marencic, 2009

A plan or a project likely to have a significant effect on the areas shall be subject to an appropriate assessment of its implications for the site. Only if it will not adversely affect the designated conservation area shall a competent authority agree to the plan or project. These provisions are legally enforceable by the European Court of Justice. Thus, in order to get a shrimp fishing licence, fishers in the Netherlands have to conduct an Environmental Impact Assessment (EIA) as the activity of fishing is considered a 'plan or a project'. In Germany, extensive ecosystem research was conducted prior to the establishment of the national parks, of which the effects of shrimp fishery was a major part. The results concluded that shrimp fishing should be allowed in the national parks (which are now announced as N2000 sites), as the effect of the shrimp beam was rated as background disturbance compared to the natural sedimentary dynamics in this area. In other words, the research into the effect of shrimp fishing was conducted by government in Germany, rather than the licence applicant. In Denmark, shrimp fishers are not allowed to the East of the Shrimp line for reasons of nature conservation (this was established by National Order 720/2001), a stipulation repeated in the licence. In addition, the Danish fleet has for many years been operating with a 'summer restriction (i.e. from June to August fishing is not allowed from Friday 9am to Sunday 6pm) through self-management.

Three habitat types are relevant in the Wadden Sea concerning Annex I of the EU Habitats Directive. In The Netherlands, the subtidal habitat is classified as habitat 1110 (sandbanks which are slightly covered by sea water all the time). In Germany and Denmark an additional habitat type 1170 (reefs) is recognized. The Dutch government does not consider subtidal reefs as a separate habitat type and includes reefs in the habitat 1110 description. Habitat 1110 extends over about 120,000 ha in the Dutch Wadden Sea, of which 0.1% is closed for all commercial activities and thereby about 120 ha are valid as undisturbed subtidal area. The closed areas for shrimping are part of the accord that the fishermen, government and the NGO's have signed (VIBEG[3]) in order to achieve the conservation objectives of the Natura 2000 sites

[3] http://www.nsrac.org/wp-content/uploads/2012/03/VIBEG-Agreement.pdf
https://www.government.nl/latest/news/2012/10/08/fishing-in-natural-areas-to-be-limited

In Germany, the entire Wadden Sea national parks of both Schleswig-Holstein (452,000 ha) and Lower Saxony (278,000 ha) were reported as habitats to the European Commission, including habitat types 1110 (submerged sandbanks) and 1160 (large shallow inlets and bays) and, 1170 (reefs) (Wadden Sea Ecosystem report, 2009). 'Sandbanks' do not occur in the inner Wadden Sea. The Amrumbank is located in the outer Wadden Sea, 20 km west of the island of Amrum. It is a Natura 2000 site (FFH in German) and partly sits in the Schleswig-Holstein National Park. Recent investigations of VMS-data by Kuechly et al. (2015) demonstrated reduced fishing effort in this area. There are no 'reefs' in the inner Wadden Sea of Germany, but in the outer Wadden Sea several 'reefs' in German waters have been designated as Natura 2000 sites:

- Sylter Außenriff: 5320 km² west off the island of Sylt, from which 153 km² are designated as reefs and 87.2 km² as sandbank
- Helgoland Felssockel: 55 km² around the island of Helgoland
- Steingrund: 174 km² east of the island of Helgoland
- Borkum Riffgrund: 626 km² north of the island of Borkum, from which 22.8 km² are designated as reefs and 521 km² as sandbank.

All of these reefs are characterized by rocks and stones, which the shrimp fishery avoids for safety reasons and gear protection. Shrimp fishing effort in these Natura 2000 sites is negligible (Kuechly et al. 2015).

The Council Directive 2000/60/EC on establishing a framework for community action in the field of water policy (Water Framework Directive, WFD) aims at a coordination of all water-related measures on a European level. The key elements of the WFD include the protection of all waters, surface and ground waters in a holistic way and achieving good quality (‘good status’) by 2015. A first analysis of pressure and impacts was reported by the member states in 2005. River Basin Management Plans have been prepared in 2009 based on the results of an operational monitoring program. The Wadden Sea has been assigned to 6 different River Basin Districts (RBDs) differentiated in coastal and transitional waters (Figure 28). These RBDs are the main management units of the WFD and cover all types of surface and ground waters. Coastal waters cover the areas up to 1 nautical mile (nm) from the baseline, and with regard to chemical status it includes the territorial waters (up to 12 nm). This Directive also affects the management of the Wadden Sea with regards to habitat and species protection.

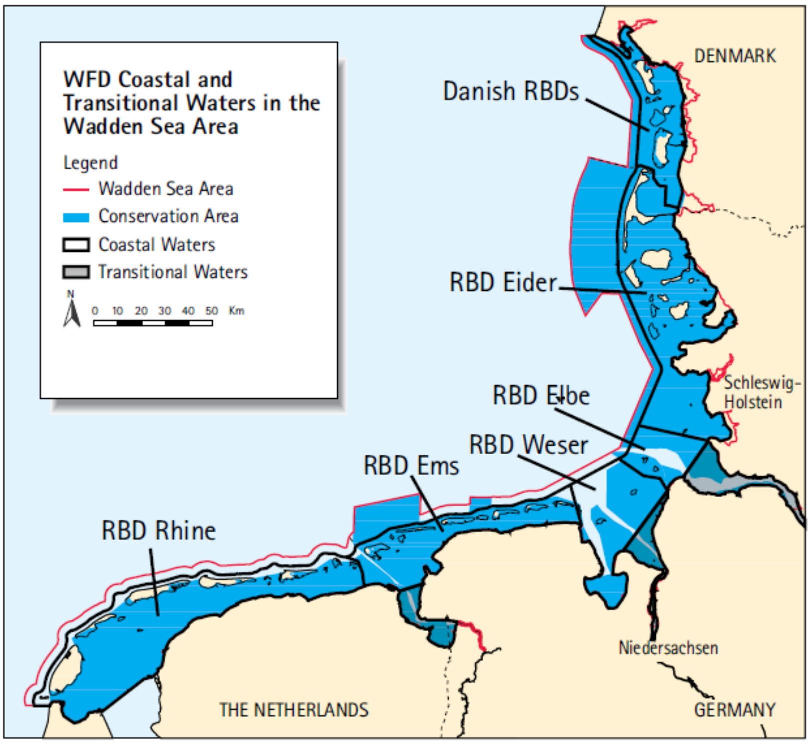

Figure 28 Coastal and Transitional waters in the Wadden Sea as defined by the Water Framework Directive (Source: Marencic, 2009)

The main goal of the Marine Strategy Framework Directive (Directive 2008/56/EC) is to achieve Good Environmental Status of EU marine waters by 2020. The Directive defines Good Environmental Status (GES) as: *"The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive" Article 3.* In Annex I, eleven qualitative descriptors are set out which describe what the environment will look like when GES has been achieved. In the context of this MSC assessment of the shrimp fishery those descriptors relating to the Wadden Sea ecosystem health and function are particularly relevant, which is one of the components of the MSC assessment.

The Common Fisheries Policy (CFP – EU 1380/2013) aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable. To this day, the impact of fishing on the marine environment is not fully understood. For this reason, the CFP adopts a cautious approach which recognises the impact of human activity on all components of the ecosystem. It seeks to make fishing fleets more selective in what they catch, and to phase out the practice of discarding unwanted fish.

In addition to the EU Directives highlighted above, the Wadden Sea countries are contractual parties to a number of international agreements, conventions and treaties, in particular, the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention) (Figure 29), the Convention on Biological Diversity (CBD), Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention) also covering the Agreement on the Conservation of Seals in the Wadden Sea (Seal Agreement), the Agreement on the Conservation of African-Eurasian Waterbirds (AEWA) and the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).

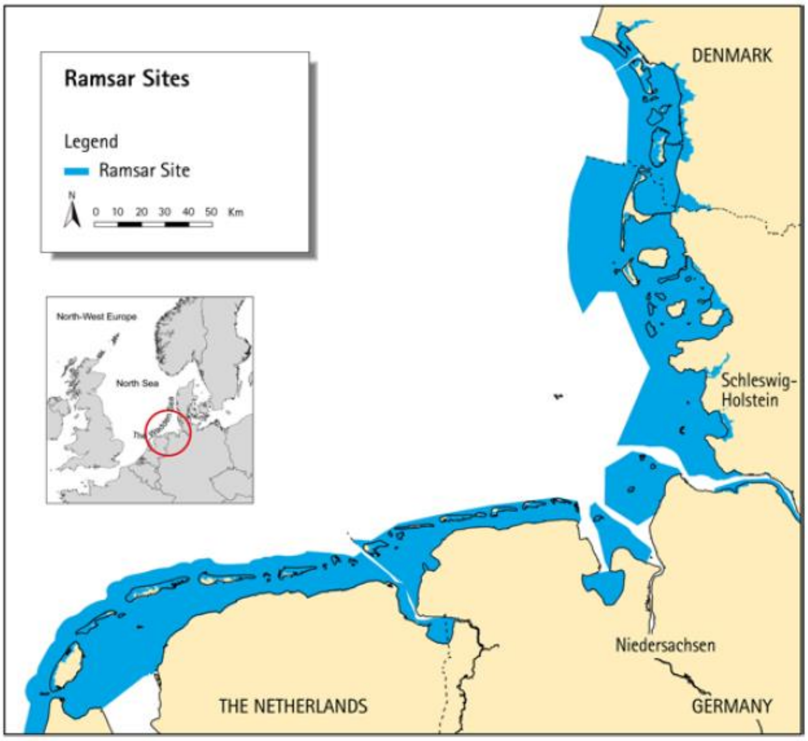

Figure 29 Ramsar sites are wetlands of international importance (Source: Marencic, 2009).

The German and Dutch parts of the Wadden Sea have been designated as Man and Biosphere (MAB) Reserves in 2009[4], under the United Nations Educational, Scientific and Cultural Organization (UNESCO), with an extension in 2014 to include the Danish Wadden Sea. It was thus inscribed for being the largest unbroken system of intertidal sand and mudflats in the world (Figure 30). This also brings particular management issues into the mix.

[4] http://whc.unesco.org/en/list/1314

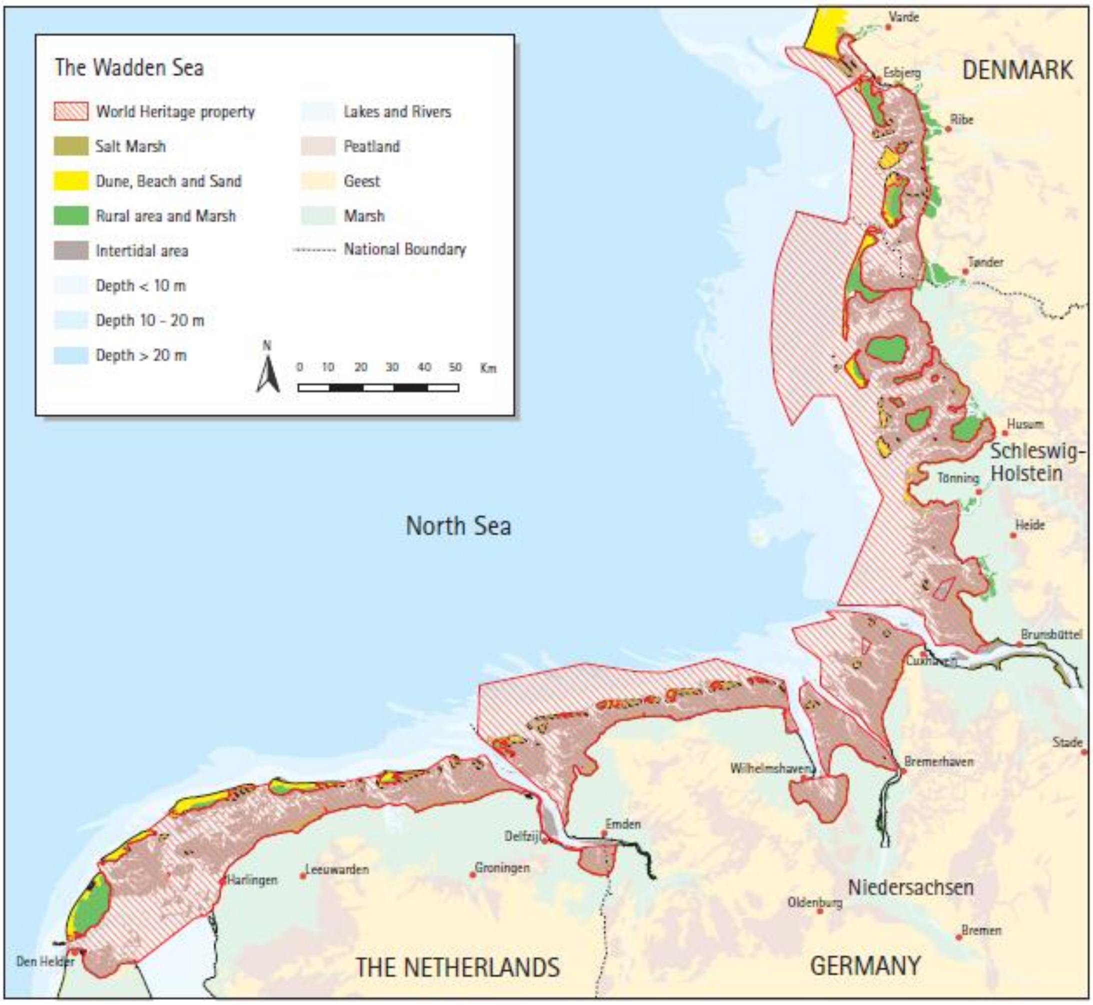

Figure 30 The Wadden Sea UNESCO site, as of 2014 (Source: http://whc.unesco.org/en/list/1314).

Nationally protected areas closed to shrimp fishing

Within the Wadden Sea, actual fishing grounds suitable for the shrimp fishery are limited. More than 50% of the inner Wadden Sea area is an intertidal zone, where the water is too shallow, and extensively tidal, thus fishing for shrimp is not possible. In the remaining subtidal areas the shrimp fishery has to be aware of and avoid mussel farming activities, shrimp fishing on or nearby subtidal mussel culture plots and on mussel seed collection sites is prohibited. In addition, areas for other purposes have been established, where fishing is restricted or prohibited. Generally, there are no substantial differences in policies and practices within the Trilateral Cooperation Area[5], except for Denmark where shrimp fishery is not allowed within the line of barrier islands (Marencic et al 2009), known as the Shrimp line.

Under national legislation, considering EU environmental legislation and conventions, several closed areas have been set up (Figure 31) in the individual countries, to be used as ecological reference areas, for example.

[5] http://www.waddensea-secretariat.org/; The three countries bordering the Wadden Sea, the Netherlands, Germany and Denmark, make up the Trilateral Wadden Sea Cooperation which was established in 1978. They meet every four years to discuss the forming or upgrading of the protective policy for the Wadden Sea area. In 1997, the three countries signed the first Wadden Sea Plan. The cooperation between the three countries is supported by the Common Wadden Sea Secretariat (CWSS).

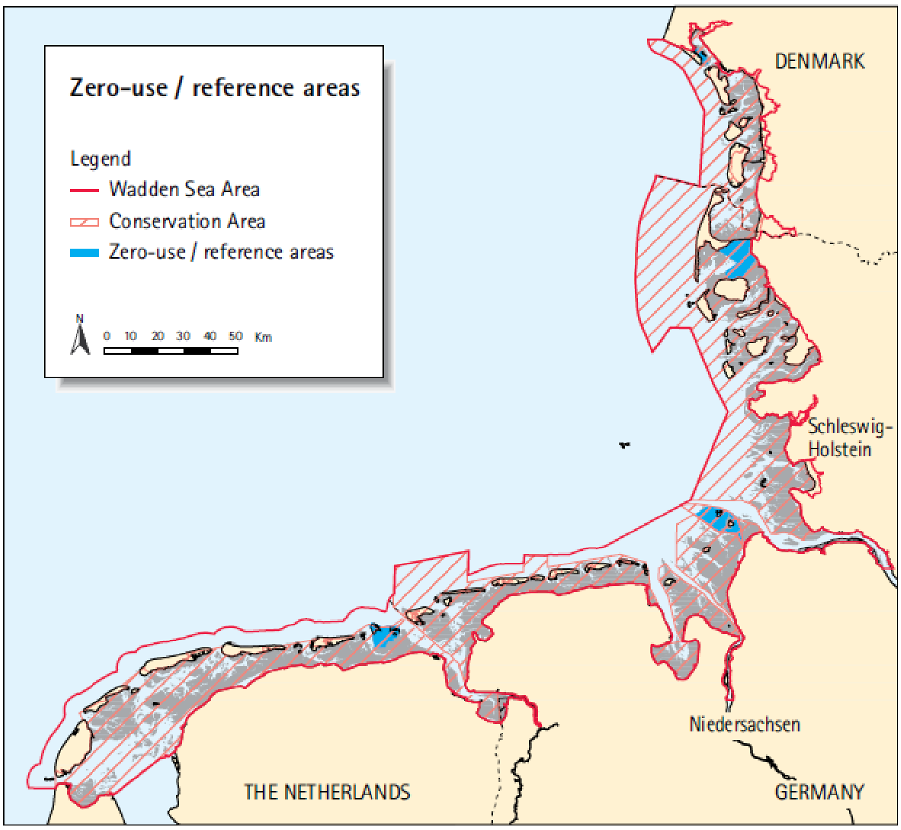

Figure 31 Location of zero-use/ reference areas in the Wadden Sea (Source: Marencic 2009).

Netherlands: The protection of the Dutch part of the Wadden Sea combines a unique national physical planning approach (the Key Planning Decision Wadden Sea (PKB) with a designation of the nominated areas under the Nature Conservation Act, 1998. The PKB has the status of a law and its objectives and conditions are binding upon all state, regional and local authorities. The PKB, in combination with the Nature Conservation Act 1998 (article 20) or the Criminal Code (article 461), allows for closing of zones in the area for public admittance for the whole or part of the year. The delimitation of these zones can be updated each year. It concerns mainly zones that are important for seals and breeding birds. About a quarter of the tidal flats have been closed to the cockle and mussel fishery.

The Dutch North Sea coastal area is divided into zones I – IV, where in Zone I fishing and any other activities are prohibited, this zone is only accessible for research purposes (see also Figure 31). In Zone II activities, which affect the sea bottom (e. g. fisheries with beam trawls), are prohibited. In Zone III fishing according to best practices is allowed, under licence. In Zone IV fishing is unrestricted. Figure 32 shows the various user zones.

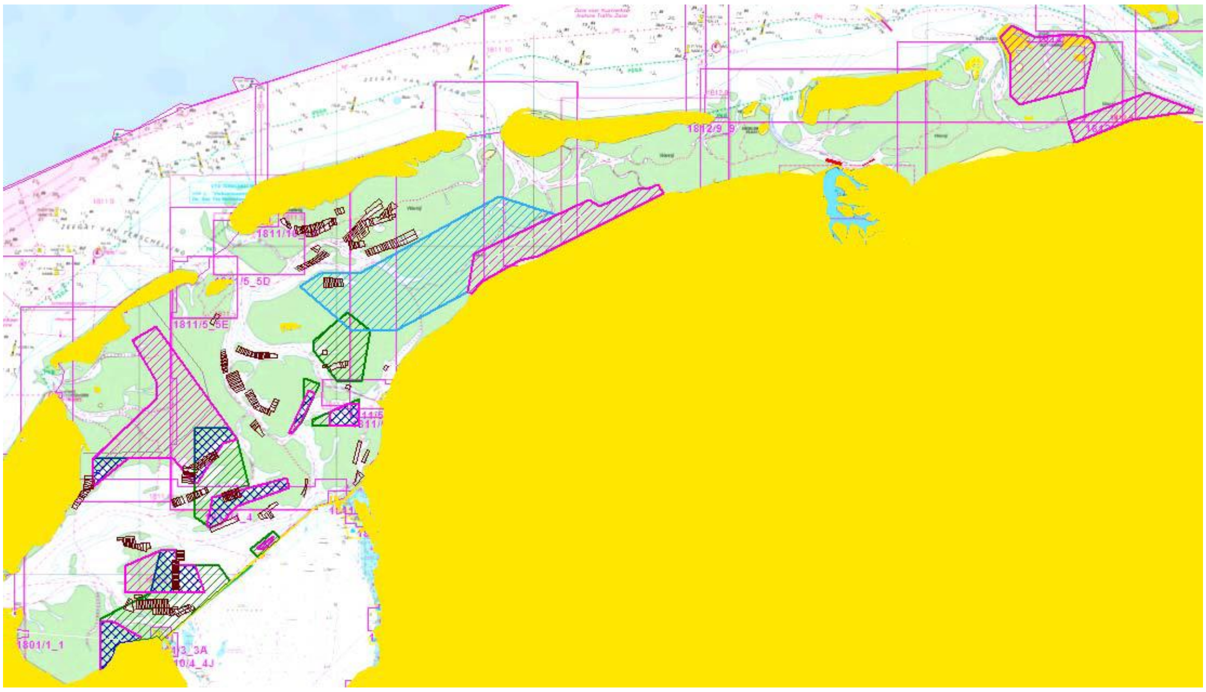

Figure 32 Use zones in the Dutch Wadden Sea: dark green and dark blue and purple areas = closed to shrimp fishing all year round; Mussel farming sites (brown fields) are blocked for shrimp fishery, but when mussel banks disappear shrimp fishery is allowed in these areas; light blue area is closed for shrimp fishing in august (except the main tidal channel) (Source: Client).

In the eastern part of the Dutch Wadden Sea, a reference area has been designated (see Figure 31). This area is about 7,400 ha, which is about 3% of Dutch Wadden Sea, and it includes all the important ecological features. It has been closed for shellfish fisheries since 1993. In the reference area, exploitation of biotic and abiotic resources and other disturbing activities is not allowed. The area serves for comparative monitoring and research in the Wadden Sea.

Germany: In Germany, the Wadden Sea is protected by National Park laws. Every federal state along the North Sea coast has its own National Park, and its own legislation: the National Park Schleswig-Holsteinisches Wattenmeer, the National Park Hamburgisches Wattenmeer and the National Park Niedersächsisches Wattenmeer. The objectives of the national parks are to protect the Wadden Sea and to allow natural processes to take place with a minimum degree of disturbance. These National Parks are divided into two or three zones, each with different degrees of protection. Zone 1 includes the ecologically most valuable areas and thus strict regulations apply, including extensive restrictions to public admittance. In Zone II, utilization and activities are allowed under such conditions that the overall protection objectives are not impaired. Management of the region is covered by State and nature conservation organizations.

The Hamburg National Park (Figure 33), is divided into two zones. Zone 1 (the core zone) is reserved for the establishment and succession of natural dynamics, covering about 92% of the National Park. Public access is prohibited (including no fishing for shrimp and shellfish) with the exception of (mainly tidal flat) walking routes. Zone II (about 8 %) is reserved for recreation and sustainable tourism. Commercial fishery is forbidden with the exception of shrimp fishing along three tidal inlets within the core zone which are also the only designated and marked navigable waters in the Conservation Area (narrow shipping routes, less than 1% of the area). Hunting is prohibited within the entire National Park (Wadden Sea Ecosystem No. 25, 2009).

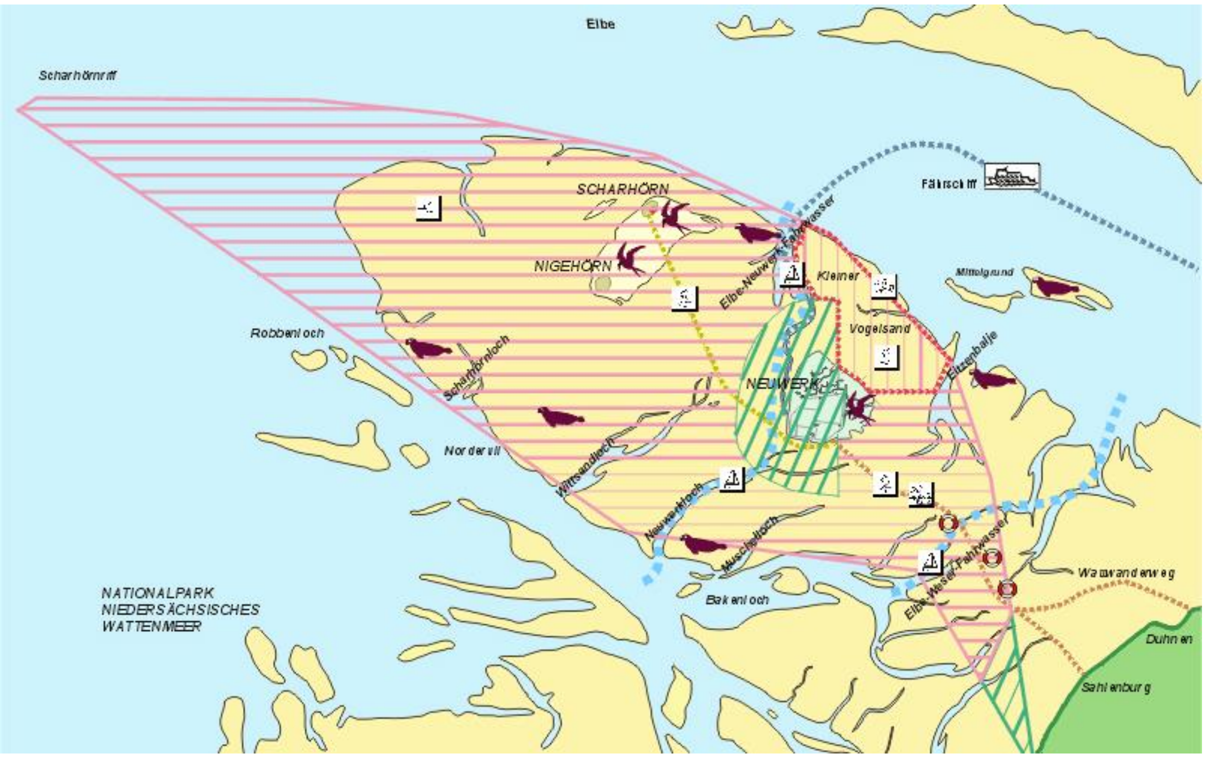

Figure 33 The Hamburg national park (Source: Client).

The Schleswig Holstein National Park (Figure 34) covers about 4,410 km^2 (441,000ha), including a whale protection area. The National Park is divided into two zones, in which different activities are allowed. Public access is prohibited in Zone 1 (except in tidal areas adjacent to the coast; tidal flat waling routes; commercial fishing as stipulated in Section 6(2) of the Act). Within this core zone (zone 1) an area of 12,500 ha has been designated as a closed area (zero use; see Figure 31). There is a voluntary regulation (since 2003) to avoid some areas during the shellduck moulting season.

Figure 34 Zonal map of the Schleswig Holstein National Park (Source: Client)

Denmark: the Danish Wadden Sea National Park covers an area of almost 146,000 ha. The complete inner Wadden Sea is declared as a zero-use area. The fishing grounds are restricted to the deeper parts of the coastal area (Figure 35) west of the black dotted line.

Figure 35 Protected areas in the Danish Wadden Sea, the green areas are eelgrass beds, and the blue dots are mussel beds; black dotted line delineates fishing zone (Source: Client).

A study by Berghahn et al (2005) tried to find out whether no-take-zones would re-instate themselves into ecological area as might have existed in earlier times. It was argued that the driving forces behind changes in the species composition and habitat distribution in the Wadden Sea are due to long term natural variability of abiotic factors, as well as large coastal engineering projects. Compared with these, shrimp fisheries in the Wadden Sea is considered relatively minor, and it is proposed that the establishment of no-take-zones will not result in the recovery and re-colonisation of missing species in habitats (such as oyster beds – *Ostrea edulis*), *Sabellaria* reefs, and white weed (*Sertularia cupressina*)

3.6.5 Ecosystem considerations

The relevant descriptors to achieve Good Environmental Status (GES), as defined in the Marine Strategy Framework Directive[6] (Directive 2008/56/EC), in relation to the Wadden Sea ecosystem health and function, include for example: Elements of food webs ensure long-term abundance and reproduction (Descriptor 4); The sea floor integrity ensures functioning of the ecosystem (Descriptor 6). Other descriptors deal with marine litter and concentration of pollutants, which affect the marine ecosystem health and function. The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international

[6] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive); “The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive” Article 3

convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. Amongst other issues, the Convention deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex V is the complete ban imposed on the disposal into the sea of all forms of plastics. Annex IV contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted (i.e. broken or crushed into small pieces) and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land. All three countries have ratified the MARPOL Convention, and thus relevant legal instruments and logistical structures are in place to enable the implementation of this Convention.

The Wadden Sea is a highly dynamic tidal area, with underlying strong tidal currents, sea-ice cover in cold winters, and intense seasonal storms. Just 27% of the Wadden Sea is subtidal (Wadden Sea Ecosystem No. 25, 2009). As an open system, it is influenced by inflowing freshwater from significant rivers, as well as the open North Sea, and by extension, the Northeast Atlantic. Thus the inter-dependencies of biotic and abiotic factors driving the ecosystem are not easy to tease apart, and adding shrimp fishing to the mix, adds further complexity. Furthermore, anthropogenic impacts such as construction works (onshore and off-shore) causing significant sediment shifts, pollution, eutrophication and introduction of invasive species (the list is extensive - Have v.d. et al, 2015; Folkert, 2015) as well as climate change, add to the complexity of effects on the ecosystem, and thus direct cause and effect is not necessarily obvious, nor is it easy to pin long-term ecological changes to any one cause. For example, effects of climate change are not only related to sea-temperature changes, but also sea-level rise, and thus associated sediment loss and/or redistribution (CPSL 2010).

That said, the ecosystem component of this assessment addresses system-wide issues, primarily impacted indirectly by the fishery, such as ecosystem structure, trophic relationships, and biodiversity. Brown shrimp is a lower trophic-level species, but the importance of brown shrimp as a food source depends on the spatial scale. On a wider scale in the North Sea the importance of brown shrimp is expected to be minor, but in the local coastal areas where brown shrimp is distributed it is an important food component in the diet of a number of species, even though its role in the energy flow is not dominant. Its role can therefore not be ignored and substantial changes in coastal areas can be expected if the brown shrimp population is largely reduced, e.g. in the case of recruitment overfishing (ICES 2014).

A large variety of species feed on brown shrimp in the North Sea. These include a large number of benthic and pelagic fish species, crustaceans, and sea- and shore-birds. No fish species relies solely on brown shrimp, and the shrimp diet of fish consists almost exclusively on the juvenile shrimp stages at sizes smaller than 50 mm. Only a small number of fish species consume larger shrimp of marketable size, most importantly cod and whiting; although they feed mainly on the smaller, juvenile shrimp. These two fish species are widely distributed in the North Sea; brown shrimp is thus only important on a local scale (corresponding to the areas and depths where brown shrimp is distributed) and only for parts of the predator population, mainly the juvenile fish. While brown shrimp is taken in large amounts by these predators and hence represents an important energy source, brown shrimp is neither a preferred nor an optimal prey for the growth of these species. On the other hand, several of the small predator fish species, which prey intensively on smaller brown shrimps (< 50 mm), may be more dependent on this food source, since their populations are mainly distributed in the same depth range as brown shrimp (ICES 2014).

A comprehensive investigation of the Wadden Sea ecosystem was initiated in Schleswig Holstein in 1989. This 7-year ecosystem research project resulted in 35 reports, 60 university thesis' and more than 150 scientific papers (Stock et al. 1996). The results of this project served as the basis for a new version of the Schleswig Holstein National Park law, which came into force in 1999. This approach is considered to represent a good example of evidence-based practice in management and nature conservation (Oeschger 2000). Concerning fishing activities, the thus updated national parks law determined that commercial shrimp fishery within the National Park area is permitted at the previously existing level and manner. The content of this law was adopted into the National Park of Lower Saxony and is valid until today in both federal countries (Client, pers.com.)

There is possible competition between the shrimp fishery and gadoid predators, i.e. cod and whiting. A massive invasion of whiting in 1990 subsequently led to a very poor brown shrimp fishing season in autumn of 1990 and spring of 1991 (Berghahn, 1996). Currently competition between fisheries and cod and whiting stocks for adult shrimp is unlikely because of the very low abundance of these stocks. If gadoids recover, two effects can be expected: 1) increased competition (fishery versus predators) for adult shrimp and, hence, lower commercial catches, and 2) substantially increased predation of small (< 50 mm) brown shrimp, issues which need to be taken into account in future stock management decisions.

The predator–prey interactions have increased in complexity with the gradual build-up of three marine mammal populations in the coastal areas inhabited by brown shrimp, namely harbour seals, harbour porpoise, and grey seals. The combined assembly consumes an estimated total of 145, 000 t fish annually; many of these will be brown shrimp predators (Temming and Hufnagl, 2014).

In a study by Steenbergen and Rosenberg (2012) it was shown that 11% of the catch was benthic organisms. The observer report for both Germany and the Netherlands (Tables 7 and 9) listed benthic organisms to species level where possible. A diversity of primarily crustaceans as well as molluscs and echinoderms are scooped up in the haul. Similarly to fish bycatch (described in Section 3.6.6) the benthic species are sorted quickly and released back into the water. Survivability studies, summarised in Revill 2012, showed that these species have a high chance to survive. This survivability may be enhanced, as the species already live in the high energy environment of the Wadden Sea is. It is therefore highly likely that the removal of benthos bycatch, quickly returned to the sea, will not have a lasting detrimental effect on the benthic ecosystem, in particular as the species are well adapted to survive in this high energy environment.

A breeding success monitoring programme for sea birds has been ongoing in the Wadden Sea (Thorup et al 2016), focusing on the number of fledged young per breeding pair in a number of study plots. Ten characteristic breeding species in the Wadden Sea were selected for the programme, representing different habitats and feeding strategies. It was found that predation (feral cats, hedgehogs, foxes, introduced to islands) and flooding, as a result of storm tides during the breeding season, are among the most frequent causes for failure (Thorup et al 2016). Also, the Wadden Sea is the single most important staging, moulting and wintering area for water birds on the East Atlantic flyway. Ongoing monitoring observations (Laursen et al 2010) suggest that winter conditions expressed by the North Atlantic Oscillation index (NAO) and the water temperature in the Wadden Sea in April have an influence on the species´ survival/distribution (winter climate) and reproductive success (water temperature in April, Laursen et al 2010). For some of the species showing a decline trend, it is suggested that possible causes may well be the physical, ecological and climatic conditions in the Wadden Sea. It is also acknowledged, that conditions outside the area are affecting numbers and trends of other species. The bird species can take a large number of different food items in the Wadden Sea and when one food source is at a low level they can shift to other more abundant food types. The extensive list of food preferences investigated did not include Brown shrimp. None of the studies showed a direct link to fisheries, in particular shrimp fisheries.

3.6.6 Primary and Secondary Species

The Brown Shrimp fishery is carried out in coastal zones and estuaries with small meshed nets. The discarding practices associated with it have been regarded as a problem for many years, indeed since the 1930s, as summarised by Polet (2003) and Neudecker & Damm (2010). A study by Neudecker et al (1999) identified 64 different species on the basis of more than 12,000 hauls. Data on the relative occurrence of the species in the hauls (i. e. species which occur in each haul achieve 100 %) allow the exclusion of exotic or extremely rare species. Recent developments in gear design, such as inclusion of a sieve net for example, will impact on the bycatch composition and quantities caught. Currently, brown shrimp catches contain about 30% shrimps of commercial size, 30% fish bycatch and 30% undersized shrimps (ICES WGCRAN, 2015). Updated calculations indicate that the plaice bycatch of the Dutch brown shrimp fleet alone sums up to about 12–17% of the plaice SSB (ICES WGCRAN 2015). However, these proportions are not seen in the study by Steenbergen & Rosenberg (2012), which is based on 120-140 hauls. The results presented (Figure 36) give a proportion of 11% of fish bycatch, another 11% of benthic species and 78% brown shrimp.

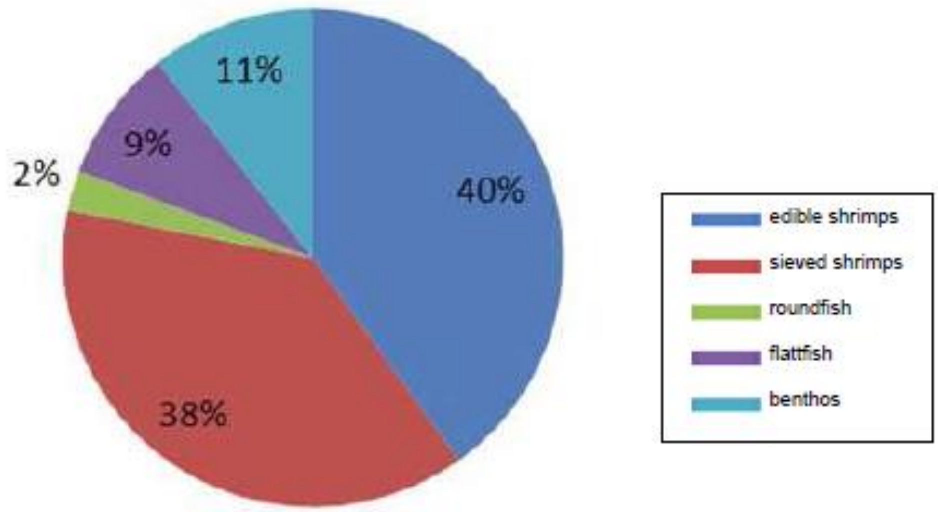

Figure 36 Results from bycatch investigations based on 120-140 hauls (Source: Steenbergen & Rosenberg, 2012)

A study by Stepputtis et al (2014) expressed the bycatch by species as a proportion of the total catch, Figure 37is based on 132 hauls. It needs to be noted though that this study concerned the investigation of pulse trawl in the German brown shrimp fishery, however the graph represents the data on the trawl gear only, pulse gear data were not used. However, it still provides an idea of proportionality, in that it shows which species are most commonly bycaught as percentage of the total catch. Figure 37 shows that it is smelt and plaice (*Osmerus eperlanus*).

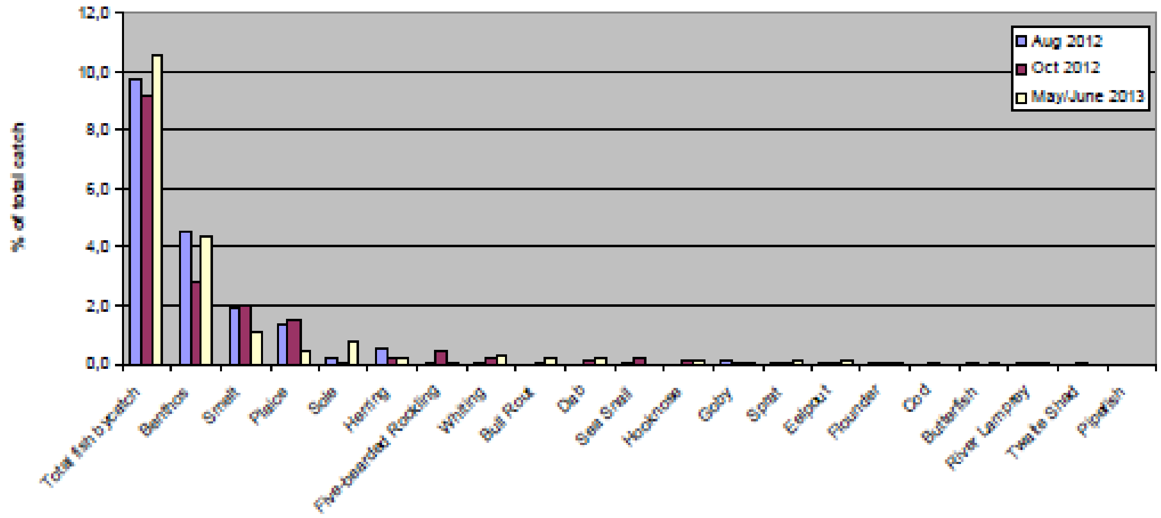

Figure 37 Percentage of frequently occurring fish species in relation to the total catch (expressed in average value of the hauls of the respective season (132 hauls in total) (Source: Client and from Stepputtis et al, 2014).

Fishing also occurred within the Elbe estuary, which explains the higher numbers of smelt caught. Smelt is diadromous, i.e. migrating between fresh and salt water. The by-catch and discarding of juvenile (flat)fish species, in particular plaice, in the brown shrimp fishery is extensively reported and a well-recognised issue (Revill and Holst, 2004; Catchpole et al, 2008; Neudecker & Damm 2010). Reduction of juvenile plaice in the bycatch of the brown shrimp fishery has been considerable over the last 60 years, achieved by technical measures and devices designed to reduce numbers caught as well as reducing mortality during the sorting process.

Information from these studies mentioned above is used in order to decide which of the species in the bycatch can be regarded as ‘main’, for both the primary species and secondary species. This extrapolation is necessary, as the data from the observer reports is not given in weight as a proportion of the total catch from these studies

Shrimp bycatch and discards are discussed under Principle 1 above. Collection of discard data is enforced through the Data Collection Framework (DCF) of the European Commission (EC). To comply with this ruling, shrimp trawlers have been monitored by on board observer programmes since 2008 for the Netherlands and since 2006 for Germany. Germany and the Netherlands are running an observer programme to monitor the catch and discards in the shrimp fishery, both countries use the same protocol on board, about eight trips are monitored per year (as already mentioned above). IMARES and the Thünen Institute collaborate on this observer project, data of four years of DCF data sampling for the Netherlands and Germany is available in the analysis presented in ICES WGCRAN 2015.

Methodologies of sampling and analysis are presented in a report by Steenbergen et al (2015). Based on these observer programmes there is only limited data available on both bycatch and discards. In the period of 2009 to 2012, 26 trips where conducted by the Netherlands and 24 by Germany (Steenbergen et al 2015). During these trips 167 hauls where sampled by each country in 44 and 47 days respectively. Results presented provide an indication of the catches throughout the year and throughout the German and the Dutch fishing areas. Because of low sampling coverage and large variation between hauls the discard numbers presented in the Steenbergen et al 2015 report were not thought to be suitable by the authors to raise to the entire fleet level per year. Hence, such estimates were not presented in the observer report.

The Danish observer data for 2014 provided by DTU Aqua is also based on on-board sampling, before sorting. By-catch composition was similar for both the German and Dutch monitoring programmes (where direct comparison can be made). Most abundant fish species in the discard fraction was the goby which is present in 92% of the Dutch hauls and 95% of the German hauls. In following order; plaice, herring, whiting, dab and sole were among the most frequently caught commercial species. In Germany cod was also observed in 31% of the hauls while in the Netherlands cod is only observed in 4% of the hauls. By-catch species composition is similar for the Danish fishery, although the Danish fishery showed sandeel as well.

In 2012 a two year project was started in the Netherlands to monitor discards in *Crangon* fisheries in cooperation with the fishers (ICES WGCRAN 2015). A reference fleet of 24 vessels along the whole Dutch coastline took a once monthly sample from their (fish and benthic) discards. These samples were picked up at the harbour and analysed at the lab. In this way it was possible to get around 400 samples / year of the (composition of) discards in *Crangon* fisheries. The results are thus far only available in a Dutch report (Glorius *et al.*, 2015). The aims of the project were to: a) quantify the bycatch of the Natura 2000 species Twait shad (*Allosa fallax*), European river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) (further discussed under ETP below); and b) quantify the bycatch of (juvenile) fish. River Lamprey was found in 14% of the trips and Twait shad in 27% of the trips. Sea Lamprey was not present in any of the samples during the sampling period.

Data from this project were also used to estimate the effect of the bycatch in the shrimp fisheries on SSB of plaice. Depending on the value used for natural mortality, the estimate of the effect of shrimp fisheries on the reduction in SSB arrives at 14–20% (assuming all bycatch dies). Using a survival rate of 20% (not including predation by birds) the reduction in SSB is 12- 17%. Neudecker and Damm (2011) studied the bycatch situation in the German brown shrimp fishery with particular reference to plaice. They concluded that the share of young plaice in the bycatch was low enough not to significantly affect the stock in the Southern North Sea. Similarly, Aviat et al (2011) stated that the high level of plaice discards in the brown shrimp has not hindered the plaice stocks to develop to their highest stock levels as calculated by ICES. The flat fish fishery itself is considered much more problematic (Neudecker & Damm, 2010) by producing extreme mortalities in the stocks and low survival rates (due to fishing method and gears).

It is thought (Aviat et al 2011) that the observer sampling of the brown shrimp fisheries is not sufficient with respect to the high seasonal, spatial and temporal variability of catch, bycatch and discards of the fleets and by vessel types, as only 0.01% of the hauls are investigated (67 DCF hauls (in 2010) versus approximately 500 000 hauls in the EU brown shrimp fisheries – Aviat et al 2011 [in Section 1.4.2 of that report]). The observer data showed that brown shrimp comprise between 50 to 80% of the total catch. Similarly, a study by Steenbergen (2015) on observer data from Dutch and German vessels collected between 2009 and 2012 showed that sampling coverage in number of effort days was 0.1% or lower for all years sampled, for both the Dutch and German sampling programme[7].

Observer reports from all three countries were made available to the assessment team. Denmark provided the actual bycatch data in Excel format (Table 5, data made available by DTU Aqua), whereas for The Netherlands and Germany the data had been processed (Table 6, Table 7, Table 8 and
Table 9- Steenbergen et al 2015) as part of the observer report. This therefore makes direct comparison between the fisheries difficult. In addition, the Danish data is for 2014, the Dutch and German observer data is the total from 2009-2012, again making actual comparisons

[7] NB: Comparing the two studies for 2010 DCF sampling programme showed that there appear to be differing numbers of hauls used for the analysis, but the numbers of hauls sampled remain small compared to the overall number of hauls per year.

difficult. For the German and Dutch fisheries, bycatches and discards are available from the observer sampling programme 2009-2012. This represents less than 0.1% of sampling coverage in number of effort days for all years sampled, for both the Dutch and German sampling programme. The data tables provide standard deviations for catches, which are high (Steenbergen et al 2015), which can be a reflection of the high variability of the Wadden Sea ecosystem and therefore estimates may be skewed. The observer report stated that because it was unclear what probability function should be used to estimate confidence intervals for example, this was therefore not done and no attempt was made to raise the bycatch to the total amounts for the fleets because of the perceived errors. Bycatch quantities were only provided in the form of numbers, not weight.

The tables were used to calculate Primary and Secondary species. Primary species (1º - descriptor symbol used in Table 5 and the following tables) are those which are managed (CR v2 GSA3.1), i.e. species of commercial value with management tools controlling exploitation. Furthermore, Primary species are divided into ‘main’ and ‘minor’ groups. ‘Main’ are those species where the catch of that species comprises 5% or more by weight of the total catch of all species by the UoA; it is also ‘Main’ if the species is classified as ‘less resilient’ and the catch of that species comprises 2% or more by weight of the total catch of all species. Therefore it is important that the total catch of all species by the UoA is known. All other primary species not considered ‘main’ shall be considered ‘minor’ species.

Secondary species (2º) include fish that are not managed according to reference points and all species that are out of scope of the standard (birds/ mammals/ reptiles/ amphibians). These ‘out of scope’ species, if they are not ETPs, are considered ‘main’ (whereby percentage thresholds apply – see SA3.4.1-5), unless they can be released alive (SA3.4.3). Once that has been established, those Secondary species within scope are assessed as to whether they are ‘main’ (catch percentage thresholds apply) or not.

Information provided on bycatch species was difficult to evaluate across the three countries involved. There was detailed observer information, but information available for this assessment was limited to a descriptive summary report and table of catch estimates. Information has been used to determine main species and likely risks to those species, but this has required various precautionary assumptions to evaluate the relevant status performance indicators. A first task is to define the main species. For the species listed, the relevant test is to determine whether they make up 5% or more of the catches. The table of catches provided for the Danish fishery (Table 5) indicated that all catches except for brown shrimp were below 5%. However, this information on species caught and how the data were derived was less complete than that provided for the German and Dutch fisheries, but at least it was given in weights, rather than individuals in numbers of hauls per hour.

Table 5 Estimated discards and landings in the Danish brown shrimp fishery 2014. Total catch is known, thus percentage can be calculated. (1° = Primary; 2° = Secondary; M = Main; ETP) (Source: DK Client, 2015. DTU Aqua)

Art	Species	Landing kg	Discard kg	Total kg	% of total catch	Managed?
Rejer	Shrimp	0	941	941	0.018	2°
Tangnål	Pipefish	0	32	32	0.001	2°
Almindelig tangnål	Deep snouted pipefish	0	146	146	0.003	2°
Ansjos	Anchovies	0	959	959	0.019	2°
Brisling	Sprat	0	40,446	40,446	0.791	1°
Firetrådet havkvabbe	Fourbeard Rockling	0	875	875	0.017	2°

Art	Species	Landing kg	Discard kg	Total kg	% of total catch	Managed?
Glastunge	Solenette	0	5,174	5,174	0.101	2°
Grå knurhane	Grey gurnard	0	173	173	0.003	2°
Hestereje	Brown Shrimp	3,100,200	1,578,062	4,678,262	91.512	Target species
Hvilling	Whiting	0	14,261	14,261	0.279	1°- M
Ising	Dab	0	129,379	129,379	2.531	1° [8]
Kulmule	Hake	0	28	28	0.001	1°
Sort kutling	Black Goby	0	243	243	0.005	2°
Lille tangnål	Nilssons pipefish	0	57	57	0.001	2°
Panserulk	Hooknose	0	10,165	10,165	0.199	2°
Plettet fløjfisk	Spottet dragonet	0	2,494	2,494	0.049	2°
Alm. reje	Baltic Prawn	150	0	150	0.003	2°
Rødspætte	Plaice	0	27,504	27,504	0.538	1°- M
Rødtunge	Lemon sole	0	34	34	0.001	2°
Sandrokke[9]	Sandy ray	0	46	46	0.001	IUCN - endangered
Sild	Herring	0	106,804	106,804	2.089	1° - M
Skrubbe	Flounder	0	918	918	0.018	1°
Skærising	Witch	0	12	12	0.000	2°
Slethvarre	Brill	0	4	4	0.000	1°
Smelt	European Smelt	0	9,430	9,430	0.184	2°
Snippe	Snake Pipefish	0	565	565	0.011	2°
Stribet fløjfisk	Dragonet	0	6,150	6,150	0.120	2°
Svømmekrabbe	Sandy swimming crab	0	31,796	31,796	0.622	2°
Særfinnet ringbug	Montagus Seasnail	0	137	137	0.003	2°
Tangsnarre	Sea Stickleback	0	2	2	0.000	2°
Tangspræl	Rock Gunnel	0	194	194	0.004	2°
Havtobis	Lesser sandeel	0	3,120	3,120	0.061	1°
Tobiskonge	Greater sandeel (*Hyperoplus lanceolatus)*	0	1,958	1,958	0.038	2°
Torsk	Cod	0	1,003	1,003	0.020	1° - M
Trepigget hundestejle	Three-spined Stickleback	0	1,324	1,324	0.026	2°
Tretrådet havkvabbe	Three-bearded Rockling	0	12	12	0.000	2°
Tunge	Sole	0	24,140	24,140	0.472	1°- M
Tungehvarre	Mediterranean Scaldfish	0	2,005	2,005	0.039	2°
Ulk	Sculpin	0	432	432	0.008	2°
Ålebrosme	Vahl's Eelpout	0	215	215	0.004	2°
Ålekvabbe	Eelpout	0	10,588	10,588	0.207	2°
Total		**3,100,350**	**2,011,828**	**5,112,178**		

[8] Although at the 2% less resilient threshold for primary main, it was decided that dab can be successfully released alive (Berghahn & Purps,1998).

[9] It seems unlikely that observers/ shrimp fishers have caught such a ray, as according to fishbase.org the distribution map shows, that sandy rays do not appear along the shoreline of France, Belgium, The Netherlands, Germany and Denmark (Client- pers. comm).

The bycatch species in Table 5,Table 6 and Table 7 were sorted into Primary and Secondary species. Although none of the primary species met the ‘main’ criteria, as none either met the 5% or 2% (less resilient) threshold, this could not be clearly decided from the observer data from Germany and the Netherlands, as the data was not available in that format (i.e. percentage of total catch in weight), Therefore the criteria used to determine primary and secondary species for Germany and the Netherlands meant that those species had to be categorized as such in the Danish fishery too, to harmonize across the three countries. For the Danish fishery, none of the secondary species were ‘main’, as none met the 5% or 2% threshold. and/or ‘out of scope’. Secondary ‘main’ species were determined based on the number of hauls they occurred in, and thus frequency of encounter, as no other quantitative criteria were available (weight of catch).

The number of different species in the bycatch is large in this fishery, a reflection of the gear type, seasonality and location, whereby much of the bycatch would be juveniles. It is recommended to conduct a Productivity Susceptibility Analysis (PSA)[10] on all those species for which no reference points are available. PSA is a semi-quantitative and rapid risk assessment tool that relies on the life history characteristics of a stock (i.e., productivity) and its susceptibility to the fishery in question. This would constitute a risk analysis for each species, calculating an individual score for each species (see also Patrick et al 2009) In the case of this fishery, where so many species are involved, the client should provide such a list of PSA scores for each bycatch species, as part of the regular bycatch analysis.

Table 6 Estimates of discarded fish species in Dutch brown shrimp fishery in the period 2009-2012. Observed occurrences in samples. Average numbers per hour observed in sampled hauls and standard deviation (SD). (Primary species 1º, Secondary species 2º; M = main) (Source: Steenbergen et al, 2015)

Species name	English	#of hauls present	Mean nr/ hr	SD	1º or 2º
Pomatoschistus sp.	Goby	154	1030	2436	2° - M
Pleuronectes platessa	Plaice	144	798	1779	1°- M
Clupea harengus	Herring	127	402	1438	1° - M
Syngnathus sp.	Pipefish sp.	123	203	473	2°- M
Agonus cataphractus	Hooknose	110	42	78	2°- M
Merlangius merlangus	Whiting	103	63	127	1° - M
Osmerus eperlanus	European smelt	97	148	339	2°
Limanda limanda	Dab	85	69	160	1°
Sprattus sprattus	European sprat	85	155	437	2°
Myoxocephalus scorpius	Bull-rout	71	31	68	2°
Ciliata mustela	Fivebeard rockling	57	10	22	2°
Solea solea	Sole	55	12	32	1° - M
Callionymus lyra	Common dragonet	46	27	81	2°
Liparis sp.	Sea snail sp.	43	24	80	2°
Zoarces viviparus	Viviparous blenny	43	12	33	2°
Platichthys flesus	Flounder	38	13	42	1°
Buglossidium luteum	Solenette	36	21	74	2°
Hyperoplus lanceolatus	Greater sand eel	34	7.7	39.9	2°
Arnoglossus laterna	Scaldfish	29	6.1	20.5	2°
Trisopterus luscus	Bib	18	4.4	20.0	2°

[10] The productivity and susceptibility of a stock is determined by providing a score ranging from 1 (low) to 3 (high) for a standardized set of attributes related to each index. When scoring these attributes, the user has the ability to also assess the data quality associated with each attribute score, and customize the analysis by weighting these attributes according to the fishery. The scores for the productivity and susceptibility indices are then automatically calculated and graphically displayed on an x-y scatter plot. Stocks that receive a low productivity score and high susceptibility score are considered to be at a high risk of becoming depleted, while stocks with a high productivity score and low susceptibility score are considered to be at low risk of becoming depleted; http://nft.nefsc.noaa.gov/PSA.html

Species name	English	#of hauls present	Mean nr/ hr	SD	1º or 2º
Pholis gunnellus	Rock gunnel	17	2.5	11.3	2°
Microstomus kitt	Lemon sole	16	2.9	13.3	2°
Gasterosteus aculeatus	Three-spined stickleback	14	0.9	3.4	2°
Dicentrarchus labrax	European seabass	11	1.1	4.5	1°
Trachurus trachurus	Atlantic horse mackerel	10	1.6	8.3	2°
Chelidonichthys lucerna	Tub gurnard	9	1.0	5.3	2°
Eutrigla gurnardus	Grey gurnard	8	0.4	2.1	2°
Gadus morhua	Cod	7	0.5	2.8	1° - M
Echiichthys vipera	Lesser weever	5	0.3	1.6	2°
Callionymus reticulatus	Reticulated dragonet	4	0.3	2.4	2°
Gymnocephalus cernuus[11]	Ruffe	4	1.0	9.6	2°
Lampetra fluviatilis	River lamprey	4	0.2	1.7	ETP
Mullus surmuletus	Surmullet	4	0.3	2.5	2°
Ammodytes sp.	Sand eel sp	3	0.9	7.6	1°
Scophthalmus rhombus	Brill	3	0.4	2.9	1°
Trisopterus minutus	Poor cod	3	0.4	3.2	2°
Cyclopterus lumpus	Lumpsucker	2	0.2	1.5	2°
Enchelyopus cimbrius	Fourbeard rockling	2	0.2	1.8	2°
Perca fluviatilis	European perch	2	0.3	3.0	2°
Scophthalmus maximus	Turbot	2	0.2	2.3	1°
Alosa fallax	Twaite shad	1	0.2	2.8	ETP
Atherina sp.	Sand smelt	1	0.1	0.8	2°
Belone belone	Garfish	1	0.1	1.1	2°
Gaidropsarus vulgaris	Three-bearded rockling	1	6.6	84.6	2°
Gobius niger	Black Goby	1	0.1	1.2	2°
Lipophry pholis[12]	Shanny	1	0.2	2.8	2°
Petromyzon marinus	Sea lamprey	1	0.2	2.8	2° [13]
Scomber scombrus	Atlantic mackerel	1	0.1	1.1	1°

Table 7 Estimates of discarded benthic species in Dutch brown shrimp fishery in the period 2009-2012. Observed occurrences in samples. Average numbers per hour observed in sampled hauls and standard deviations (SD). (Source: Steenbergen et al, 2015)

Name	English name	# Hauls present	Mean nr /hr	SD
Carcinus maenas	Common shore crab	116	194	398
Liocarcinus holsatus	Flying crab	114	532	1645
Ophiuridae	Brittle stars	47	28	77
Loligo sp. [14]	Loligo	44	15	64
Anthozoa	Sea anemones	26	7	36
Pagurus sp.	Hermit crabs	24	3.2	11.9
Ensis sp.	Razor clams	20	19	149
Mytilus edulis	Blue mussel	17	12	69
Cerastoderma edule	Cockle	8	0.6	3.7
Macoma balthica	Baltic macoma	7	15	188

[11] Although this species only occurs in fresh- or brackish water; not relevant for the Wadden or North Sea (Client – pers.com)

[12] Unbelievable that this species was ever caught in shrimp fishing. It is strictly related to the shallow water of rocky shores (Client – pers.com.)

[13] Currently, sea lamprey is of relatively low conservation concern: http://www.iucnredlist.org/details/16781/0; not listed in Habitats Directive

[14] This species is pelagic not benthic (Client – pers.com.)

Name	English name	# Hauls present	Mean nr /hr	SD
Sepiola sp. [15]	Bobtail squid	7	0.5	2.9
Echinocardium cordatum	Sea potato	6	0.8	6.1
Pleurobrachia pileus [16]	Sea gooseberry	6	19	154
Ascidiacea	Sea squirts	5	1.1	7.4
Palaemon sp.	Caridean shrimp	8	4	48
Liocarcinus marmoreus	Marbled swimming crab	3	0.2	1.5
Macropodia	Spider crabs	3	0.2	1.4
Necora puber	Velvet swimming crab	3	0.2	1.3
Palaemon sp.	Caridean shrimp	3	4	48
Spisula sp.	Spisula	2	0.2	1.7
Pandalus sp.	Pandalus	2	0.2	2
Cancer pagurus	Brown crab	1	0	0.04
Cephalopoda [17]	Cephalopods	1	0.07	0.9
Corystes cassivelaunus	Helmet crab	1	0.06	0.7
Eriocheir sinensis	Chinese mitten crab	1	0.1	1.6
Hinia sp.	Whelks	1	0.03	0.4
Isopoda	Isopods	1	0.01	0.2
Liocarcinus depurator	Harbour crab	1	0.55	7.1
Nereis sp.	Nereis	1	0.04	0.6
Pholadidae	Piddocks	1	0.2	1.9
Portumnus latipes	Pennant's swimming crab	1	0.1	1.3
Psammechinus miliaris	Shore sea urchin	1	0.06	0.8
Thia scutellata	Thumbnail crab	1	0.06	0.8

Table 8 Estimates of discarded fish species in the German brown shrimp fishery in the period 2009-2012. Observed occurrences in samples. Average numbers per hour observed in sampled hauls and standard deviations (SD). (Source: Steenbergen et al, 2015)

Name	English name	# Hauls present	Mean nr /hr	SD	1º or 2º
Pomatoschistus sp.	Gobies	158	3719	13850	2° - M
Pleuronectes platessa	Plaice	142	2161	7705	1°
Osmerus eperlanus	European smelt	142	785	1355	2°- M
Syngnathus sp.	Pipefish sp.	138	286	551	2° - M
Agonus cataphractus	Hook-nose	134	258	475	2° - M
Merlangius merlangus	Whiting	109	173	347	1°
Sprattus sprattus	Sprat	104	175	424	1°
Liparis sp.	Seasnail sp.	87	166	650	2°
Clupea harengus	Herring	85	135	515	1°
Limanda limanda	Dab	67	270	836	1°
Solea solea	Sole	65	49	136	1°

[15] Mostly pelagic, but sometimes digging in the sediment (Client, pers.com.)
[16] This species is pelagic not benthic. (Client, pers.com.)
[17] Unspecific determination; mostly pelagic species (Client pers.com.)

Name	English name	# Hauls present	Mean nr /hr	SD	1° or 2°
Callionymus lyra	Common dragonet	60	42	111	2°
Platichthys flesus	Flounder	56	36	128	1°
Myoxocephalus scorpius	Bull-rout	52	15	32	2°
Ciliata mustela	Fivebeard rockling	44	18	41	2°
Arnoglossus laterna	Scaldfish	38	12	28	2°
Buglossidium luteum	Solenette	37	26	77	2°
Ammodytes sp.	Sand eel sp	32	10	29	1°
Gadus morhua	Cod	31	10	62	1°
Microstomus kitt	Lemon sole	29	25	107	2°
Pholis gunnellus	Rock gunnel	28	8.2	28.2	2°
Zoarces viviparus	Viviparous blenny	24	5.6	17.8	2°
Callionymus reticulatus	Reticulated dragonet	15	4.2	19.6	2°
Chelidonichthys lucerna	Tub gurnard	11	2.1	10.4	2°
Trachurus trachurus	Atlantic horse mackerel	10	5.6	32.9	2°
Lampetra fluviatilis	River lamprey	10	1.6	7.8	ETP
Gasterosteus aculeatus	Three-spined stickleback	8	1.6	10.1	2°
Eutrigla gurnardus	Grey gurnard	6	0.9	5.3	2°
Scophthalmus maximus	Turbot	6	0.8	5.9	1°
Alosa fallax	Twait shad	6	0.7	4.6	ETP
Anguilla anguilla	Eel	4	0.01	0.10	ETP
Trisopterus luscus	Bib	3	0.5	4.2	2°
Callionymus maculatus	Spotted dragonet	2	0.5	4.3	2°
Hyperoplus lanceolatus	Greater sandeel	1	0.2	3.1	2°
Echiichthys vipera	Lesser weever	1	0.2	2.7	2°
Salmo salar	Atlantic salmon	1	0.03	0.43	1°
Alosa[18]	Shad sp	1	0.00	0.05	ETP

Table 9 Estimates of discarded benthic species in the German brown shrimp fishery in the period 2009-2012. Observed occurrences in samples. Average numbers per hour observed in sampled hauls and standard deviations (SD). (Source: Steenbergen et al, 2015)

Name	English name	# Hauls present	Mean nr /hr	SD
Portunidae	Swimming crabs	144	3321	9601
Carcinus maenas	Common shore crab	110	293	633
Pandalus sp.	Pandalus	84	257	996
Asterias rubens	Common starfish	61	22	46
Ophiuridae	Brittle stars	58	1447	7303

[18] Allis shad (Alosa alosa) is extremely rare in the North Sea if not extinct (Client – pers.com.), thus this could be Twaite shad

Name	English name	# Hauls present	Mean nr /hr	SD
Crangon allmanni	Crangon allmani	49	5528	17585
Pagurus sp.	Hermit crabs	36	11	33
Anthozoa	Sea anemones	20	103	632
Alloteuthis subulata [19]	Common squid	13	18	120
Macropodia	Spider crabs	9	7.6	60.9
Mytilus edulis	Blue mussel	6	49	319
Hyas sp.	Hyas species	5	2.9	18.2
Ensis sp.	Razor clams	5	1.3	9.0
Loligo sp. [20]	Loligo species	4	0.7	4.71
Asteriidae	Starfish species	3	2.6	20.7
Cancer pagurus	Brown crab	3	0.01	0.08
Cephalopoda[21]	Chephalopods	2	1.6	14.7
Aphrodita aculeata	Sea mouse	2	0.8	9.7
Corystes cassivelaunus	Helmet crab	2	0.6	6.9
Astropecten irregularis	Sand sea star	2	0.4	4.6
Liocarcinus depurator	Harbour crab	1	0.6	8.0
Eriocheir sinensis	Chinese mitten crab	1	0.5	6.2
Sepiola sp	Bobtail squid	1	0.1	1.6

Based on brown shrimp fishery bycatch observations and studies described above as well as the IUCN WGCRAN 2015 report, primary 'main' species were decided for scoring purposes in PI2.1. If and when more appropriate data becomes available, such as the total weight of the species in the bycatch and the weight of the total catch, then clearer calculations can be made to determine 'main' species.

The most abundant fish species in the bycatch of both countries are gobies followed by plaice. The plaice observed in the catches were all juveniles <18 cm. Following the observations on the sampling trips and given the small sizes of the commercial fish in the catches, and the fact that shrimp fisheries is mainly a single species fisheries, one can assume that the vast majority of all bycatch in the brown shrimp fisheries is discarded (in Steenbergen et al 2015).

The bycatch of benthic organisms is considered under secondary minor species in the evaluation of the impact of the fishery (as defined in SA3.4.5). These benthic organisms are primarily different species of crabs, echinoids, and starfish, whereby crabs are found in most of the hauls. Similarly to fish bycatch (described in Section 3.6.6 under on board handling) the benthic species are sorted quickly and released back into the water. Survivability studies, summarised in Revill 2012, showed that these species have a high chance to survive. This survivability may be enhanced, as the benthic species live in the high energy environment of the Wadden Sea and thus possibly can cope with the brief moments through the sorting process.

Bycatch reduction strategies and gear research

[19] This species is pelagic not benthic. (Client pers.com.)
[20] This species is pelagic not benthic. (Client pers.com.)
[21] Unspecific determination; mostly pelagic species (Client pers.com.)

EC Fisheries Technical Conservation Regulation (Council Regulation 850/98) requires that vessels engaged in brown shrimp beam trawl fisheries in Community waters must use trawls fitted with either a sieve net (Figure 38) (also known as veil net; Revill and Holst, 2004) or a selection grid. The legislation details the specifications of the sieve nets or sorting grids that must be used. Sieve nets are cone shaped nets inserted into standard trawls which direct unwanted by-catch to an escape hole cut into the body of the trawl. The target species passes through the mesh of the sieve net and is retained in the cod end. Sieve nets have been mandatory in the Danish brown shrimp fisheries for many years and are now uniformly mandatory in EU waters under the E.C. Fisheries Technical Conservation Regulation 850/98.

Mesh sizes of the sieve nets in the client fisheries are a maximum of 70 mm, in conformity with EU Regulation (EC) No. 254/2002 with technical measures, and as laid out in the North Sea Brown Shrimp Management Plan[22]. As the sieve net sorts out larger animals during the actual fishing process, flatfish such as plaice, starting at sizes of approx. 8 to 12 cm, are sieved out and no longer appear in the by-catch (Wienbeck 1993; Neudecker and Damm 2010). All remaining animals and similar sized objects, which are still caught, are emptied into the hopper of the vessel, and are transferred to rotating sieves operated with high amounts of running sea water to increase survival rates (Aviat 2011). This on-board process is described in more detail below.

Research into the selectivity of sieve nets (Polet 2003), mounted in front of the cod end has shown that the selectivity of the sieve net for Age 0 fish is very low. Therefore, this device is of rather low value in areas where large amounts of these small fish are caught, such as the Wadden Sea. In addition, the use of the sieve net leads to a significant reduction in unwanted bycatch of invertebrates and non-commercial fish species, which would reduce the impact of the fishery on the marine environment in general. However, the sieve net does lead to losses of commercial shrimp in certain areas and season.

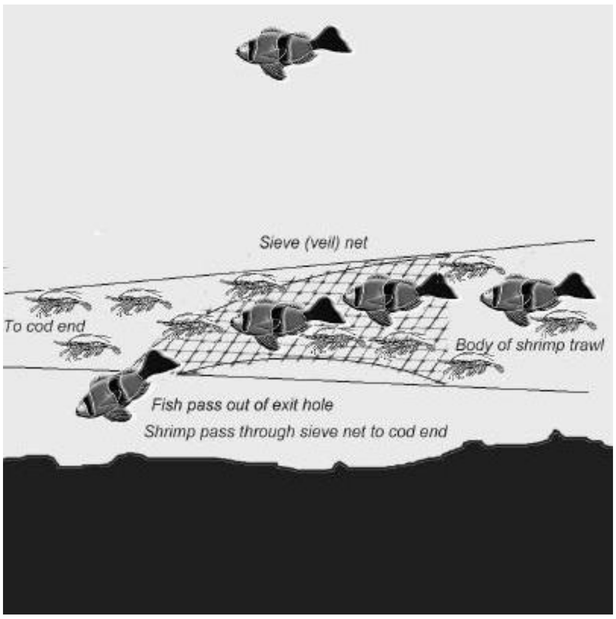

Figure 38 Selectivity of the sieve (veil) net (Source: Holst and Revill, 2004)

New methods for improving gear efficiency and reducing bycatch continue to be investigated, including the effects of using different mesh types and width in the cod end of

[22] http://www.nsrac.org/wp-content/uploads/2015/11/Paper-5.1a-Brown-Shrimp-Mgmt-Plan1.pdf

conventional gears. Experiments showed that cod ends with T0 or T90 meshes and a mesh size of 26 mm or square mesh cod ends (T45) with a mesh size of 24 mm significantly reduced discards of undersized shrimp. This effect depended on the season, whereby it was more pronounced in summer than in autumn. In summary, it could be shown that increasing the mesh size will decrease the bycatch of undersized shrimps and will - in a situation of a high F/M ratio - lead to increased catch weights and in general larger shrimps in the catch and the population (CRANNET[23]). Steenbergen et al (2011) investigated the use of a ‘letterbox’ as part of the net configuration, in order to reduce plaice bycatch. The letterbox is a new gear adjustment that consists of a release hole transversely over the net. The idea is that the shrimps go over the hole in the net, while flatfish can escape through the release hole. It was concluded that the letterbox could be a good alternative for the sievenet, especially in spring, when there is a high abundance of juvenile plaice in the Wadden Sea. The study noted, however, that the adjustment was not as effective as the sievenet for all species.

The use of optimized cod ends also showed a decrease in the numbers of various by-catch species (Catchpole 2009), although by-catch results were significantly influenced by fishing grounds and season. Furthermore, the type of cod end mesh affected catchability of particular fish species to different extent. Flatfish such as plaice (*Pleuronectes platessa*) experienced better sparing effects when cod ends with T0 mesh compared to cod ends with T45 or T90 mesh were used. In contrast, beneficial sparing effects were found for roundfish species such as goby (*Pomatoschistus* spp.) and hooknose (*Agonus cataphractus*) when square mesh cod ends were used (Figure 39). Square-mesh netting or T90 netting can be used in the construction of the whole codend. These materials provide more consistent selectivity, as the meshes remain uniformly open under tension in the trawl. In traditional diamond-mesh codends there are only certain areas in which the meshes are spread to allow fish to escape. With square-mesh or T90 codends the meshes are more likely to remain open, which creates more opportunities for fish to escape. Square-mesh codends have consistently been shown to be more selective. For example, the use of a square-mesh codend in combination with a selection grid is mandatory in Sweden’s Nephrops otter trawl fishery. However, this is not necessarily appropriate for the brown shrimp fishery, where the target species is small.

[23] https://www.thuenen.de/en/sf/projects/optimised-brown-shrimp-fishery-crannet/

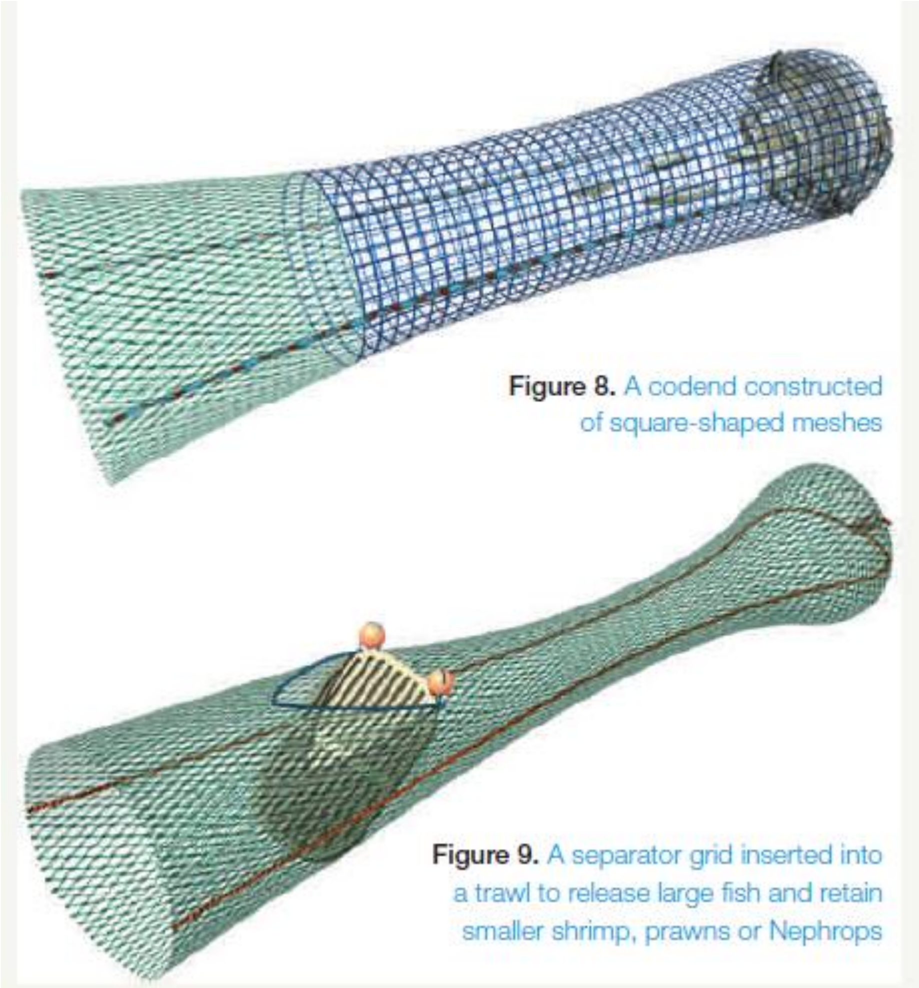

Figure 39 Drawings showing a codend constructed of square shaped meshes, and the position of a separator grid in relation to the cod-end. (Source: Catchpole, 2009)

Selection grids consist of a series of longitudinal bars positioned at the entrance to the codend. The grid acts as a barrier to the passage of fish too large to pass between the bars, which instead are guided to an escape hole in the upper section of the net. Vessels fishing for brown shrimp in UK waters, for example, must use a grid with a bar spacing of no more than 20 mm, fitted so that fish cannot reach the codend without passing through the grid. This is also true for the vessels participating in this fishery, as outlined in the Brown Shrimp Management Plan (C3.1). Research on the use of selective sorting grids in front of the cod-end, to reduce by-catch, has had mixed results, depending on the fishing grounds, as the grid was prone to clogging-up by benthic organisms such as starfish. This made its unacceptable to fishers, despite some clear advantages such as catch reduction of Age 1+ fish, non-commercial fish and invertebrates (Polet 2003).

On-board handling and survivability

Steenbergen et a (2015) provided a detailed description of on-board handling of the catch, the first stage of which is of particular relevance here, as it gives an indication about how speedily the catch is handled. In the process of separating marketable shrimp from undersized shrimp and bycatch, the catch is sieved three times; two times on board of the shrimp vessels (Figure 40) and one time at the auction.

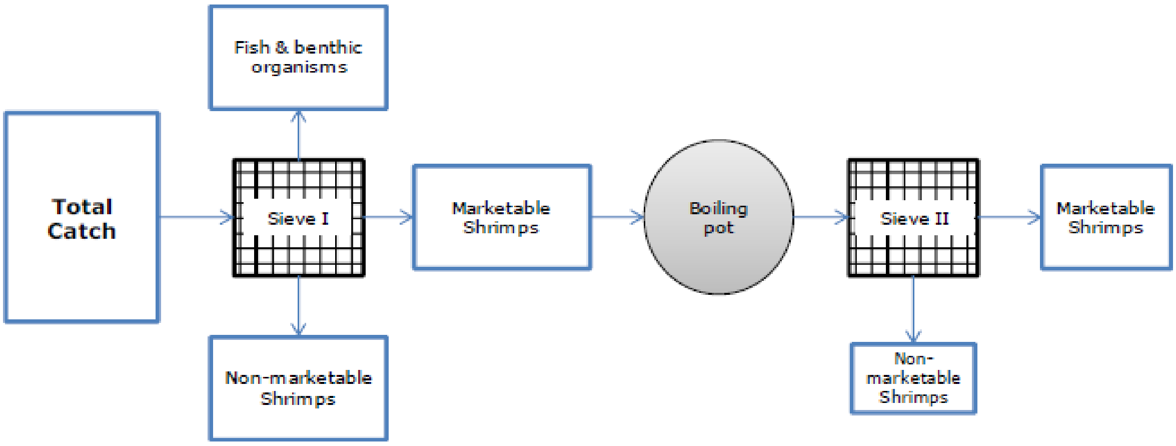

Figure 40 The sorting procedure of shrimp on board of shrimp vessels (Source: Adapted from Tulp et al, 2010)

1) The first sieve (I) separates the marketable sized shrimps from small non-marketable sized shrimps, fish, benthic organisms, seaweed and shells. The shrimp sorting devices used in this step are coaxial sieving drums that make a rotating movement (Figure 41, left side) or trembling sieves (Figure 41, right side). The drums separate organisms based on their shape and size. Because marketable sized shrimps are separated based on their shape and size it is possible that species with similar body shape and size, e.g. goby or hooknose, are retained in this part of the catch.

2) Marketable sized shrimps are cooked in the boiling pot, after which another sieve (II) separates the retained small shrimps from the marketable shrimps (Figure 41, right side). Some fish, like goby, dissolve in the cooking process. Fish or other organisms that do not dissolve in the cooking process are removed by hand, and clean shrimp ready for landing remains.

3) Ashore the landed shrimps are sieved into different size categories (at auctions in the Netherlands, at central sieving stations of the producer organisations in Germany), creating some extra runoff called “sievage” (in Dutch “ziftsel”, in German “Siebkrabben”; Neudecker et al. 2006).

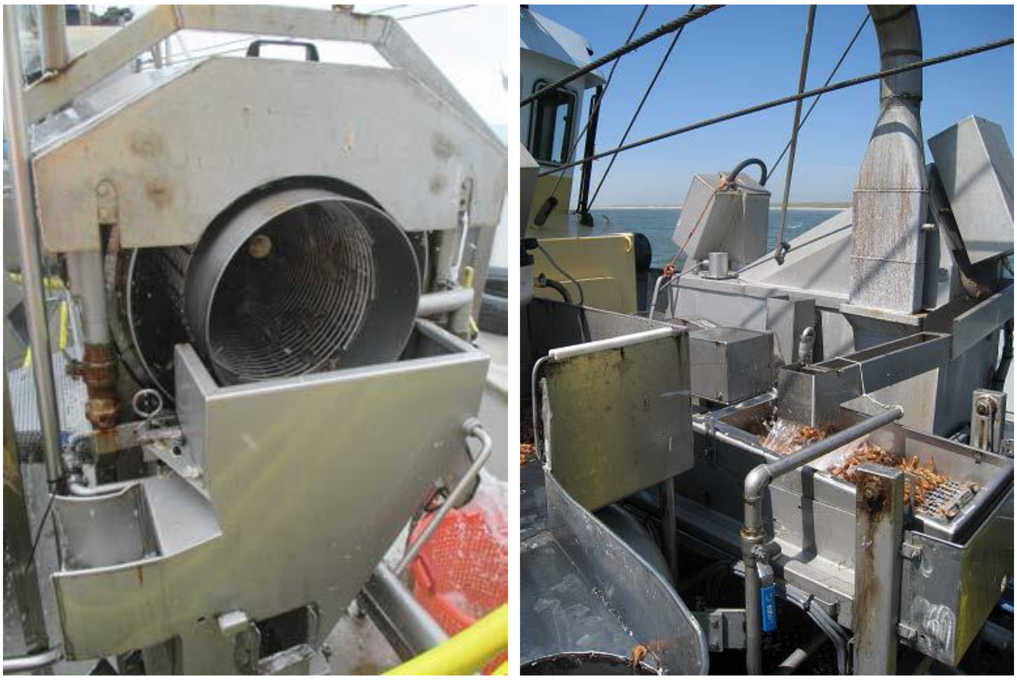

Figure 41 Sieving devices on board of shrimp vessels: coaxial sieving drums (left), trembling sieve (right) (Source: Steenbergen et al, 2015).

Survival experiments on discards in the shrimp fishery indicate that discard survival is variable, depending on many factors, such as exposure on deck, seasonality, water temperature, air temperature, body size, age of fish, depth caught, catch composition, haul duration, breeding and health status of fish etc. A brief overview was given by Steenbergen et al (2015). Boddeke (1989) showed that the main causes of fish mortality were the sorting of the catch on board by means of mechanical sorting sieves and the duration of the catch on board, especially during warm sunny weather. He estimated mortality of juvenile plaice (*Pleuronectes platessa*) to range between 5% and 90%. Berghahn *et.al.* (1992) described a 100 % mortality rate for whiting (*Merlangius merlangus*), 10% for bull-rout (*Myoxocephalus scorpius*), hooknose (*Agonus cataphractus*), and viviparous blenny (*Zoarces viviparus*). Mortality of flatfish discards depended strongly on the species, the size of the individual fish and catch processing conditions, and ranged from 0 to 83%. No differences could be detected in the survival after sorting on different machines. However, due to better sorting efficiency, the rotary sieve may reduce mortality of fish in the by-catch (Berghahn *et. al.*, 1992). Mortality of shrimp discards in Dutch and German coastal waters is likely to be low. Gamito et al (2003) estimated mortality of brown shrimps in the beam trawl fishery in the Tagus estuary. Mortality was estimated to be 0% for water temperatures below 20°C. For temperatures above 20°C mortality increased considerably depending on temperature, fishing and sorting time.

A summary of recent studies on survivability of discards in the demersal trawl fishery has been published by STECF (2014). In general, the studies showed that elasmobranchs, specifically species of ray, have the highest and most consistent levels of discard survival. Survival rates are typically in excess of 50% across all gears and greater than 80% in many cases. Studies which have looked at flatfish species including plaice (*Pleuronectes platessa*) and sole (*Solea solea*) and dab (*Limanda limanda*) show variable results between species, with plaice exhibiting higher (~40 – 80%) levels than sole and dab. Survival of plaice has also been shown to be length dependent, with smaller individuals showing lower survival rates than older fish. Survival was also shown to decrease during spawning periods.

To quantify survival rates and to understand the factors that may influence survival e.g. physical injury, stress etc., many experiments use captive conditions where animals are monitored in tanks or pens. While this provides a scientific approach, it protects discarded animals from potential predators (sea birds, marine mammals, other fish etc.) that they may otherwise have encountered post discarding. The capture and discarding process is likely to result in a range of injuries and other traumas e.g. oxygen depletion, elevated stress, infection and disease that may severely limit an individual's ability to evade predation in the wild. Therefore, with experimental induced mortality accounted for, the survival estimates from captive observation studies are likely to represent over-estimates of actual survival (STECF 2014).

In the fisheries under assessment, the fish caught as bycatch are mainly juveniles. The on-deck sorting procedure aims for rapid sorting and release back into the water, in order to ensure the highest possible survival rate (Site visit pers. com. with fishers). Flatfish species (plaice, sole, dab, flounder) and the typical Wadden Sea resident species (rockling, bull rout, sea snail, hooknose, eelpout, butterfish, and pipefish) appear to show a high survival rate (Berghahn et al. 1992), depending on trawl duration, temperature and catch composition (pers.com. with fishers at site visit) [24].. It appears that gobies are able to survive the catching and sorting procedure fairly well, which may be due to the general ability to live in such a high energy environment of the Wadden Sea. Roundfish (smelt, herring, whiting, sprat, cod and Twaite shads) by comparison appear to be more sensitive to handling, the mortality rate is generally 100% (pers.com. fishers interviews). These observations seem to be backed up by survivability studies outlined above.

3.6.7 Endangered, Threatened and Protected species – ETPs

The MSC CRv2 SA3.1.5 provides a detailed definition of what constitutes an ETP species. It includes all those species which are recognized by national ETP legislation, species as listed in binding international agreements such as CITES Appendix 1 and the Wadden Sea Seals Agreement, relevant EU Regulations (as they are directly transposed into national legislation) including the Habitats Directive and Birds Directive, as well as the annual Regulation on fishing opportunities which lists Prohibited Species. Furthermore, the list includes species that are listed in the IUCN Red List as vulnerable endangered or critically endangered.

Sturgeon (*Acipenser sturio*) and Houting (*Coregonus oxyrinchus*) are fish species listed in the Habitat Directive for the area. Both species are regarded as extinct or missing in the North Sea, which is attributed to dyke building and industrialisation projects over the last century in the shallow Wadden Sea. The species are therefore of no relevance in shrimp fishery bycatches. Extensive restocking of sturgeon takes place every year in German rivers, and therefore occasional catches of sturgeon were reported from German waters (Spratte & Gessner 2014). A €13million restoration project of the Danish houting, partly funded by the European Union's LIFE programme and the Danish Natural Agency, was successfully undertaken in 2005–2013[25]. Due to the high protection status of both species, guidelines for action and a registration system already exist. Sturgeon and houting are listed in the ETP species wheelhouse guide and on the fish bycatch registration form as part of the shrimp fishery management plan.

The Observer reports, which give information on discarded bycatch as analysed in the previous section above, also provide information on ETPs that may have been caught (Table 11). The observer data for Denmark shows that 'Sandy ray' was caught. This may indicate, that skates and rays can be by-caught in the brown shrimp fishery, in particular the Danish

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[24] River lampreys also showed a high survival rate, but they are not Wadden Sea residents but diadromous species which pass the WS on their way from the sea to the rivers (Client pers.com.)

[25] http://naturstyrelsen.dk/media/nst/89829/THE%20HOUTING%20project.pdf

fishery, as the Danish vessels operate further offshore. None were listed for the Dutch and German brown shrimp fishery. However, it was suggested by the Client (pers.com.) that this may be a determination error by the observers, instead it might more likely be Thornback ray (*Raja clavata*) which is a similar species and can occur in the bycatch.

The European Commission publishes an annual regulation setting out fishing opportunities, or Total Allowable Catches, for EU Member States. This also includes a list of endangered/ protected species which vessels are prohibited from catching (Table 10, adapted from Council Regulation (EU) 2015/104, and 2016/72). EU vessels may be prohibited from retaining on board, transhipping or to landing the species caught in a number of ICES areas and by using a variety of gear types. When accidentally caught, species should not be harmed and should be promptly released. Article 12 of Regulation 2015/104 and Article 13 of 2016/72 include further details, relevant to ICES areas IV a,b, pertinent to this fishery assessment.

Table 10 EU Prohibited catches of sharks, rays and skates (Source: EU Reg 2015/104)

English	Species
Starry ray	*Amblyraja radiata*
Common skate	*Dipturus batis* complex (*D. cf. flossada* and *D. cf. intermedia*)
Guitarfishes	*Rhinobatidae*
Kitefin shark	*Dalatias licha*
Birdbeak dogfish	*Deania calcea*
Leafscale gulper shark	*Centrophorus squamosus*
Great lanternshark	*Etmopterus princeps*
Portugues dogfish	*Centrosymnus coelolepsis*
Porbeagle	*Lamna nasus*
Angel shark	*Squatina squatina*

Table 11 ETP species as recorded in Observer reports. (Danish data for 1 year – 2014 – Dutch and German data for 2009-2012 combined) (Source: From client)

<table>
<tr><th>Species</th><th>English</th><th>Which fishery</th><th>Protection</th><th>Quantity</th></tr>
<tr><td>Leucoraja circularis</td><td>Sandy ray</td><td>DK</td><td>IUCN endangered[26]</td><td>0.001% of total catch for 2014</td></tr>
<tr><td rowspan="2">Alosa fallax</td><td rowspan="2">Twaite shad</td><td>NL</td><td rowspan="2">Habitats Directive Appendix II, V (2007)</td><td>Found in 1 haul</td></tr>
<tr><td>D</td><td>Found in 6 hauls</td></tr>
<tr><td>Alosa sp[27]</td><td></td><td>D</td><td>Habitats Directive Appendix II, V, (2007)</td><td>Found in 1 haul</td></tr>
<tr><td>Anguilla anguilla</td><td>Eel</td><td>D</td><td>CITES App II</td><td>Found in 4 hauls</td></tr>
<tr><td rowspan="2">Lampetra fluviatilis</td><td rowspan="2">River lamprey</td><td>D</td><td rowspan="2">Habitats Directive Appendix II, (2007)</td><td>Found in 10 hauls</td></tr>
<tr><td>NL</td><td>Found in 4 hauls</td></tr>
<tr><td>Salmo salar</td><td>Atlantic salmon</td><td>D</td><td>Habitats Directive Appendix II – but only for freshwater sites, NOT for marine and estuarine sites</td><td>Found in 1 haul</td></tr>
</table>

[26] According to fishbase.org and iucnredlit.org
[27] Most likely also Alosa fallax (Client pers.com.)

During the assessment of the fishery, the assessment team have considered the above list of species in the context of the potential interactions with the brown shrimp trawl gear. The result of this analysis determined the Outcome Status score. To score well, a fishery must be conducted in a manner that ensures ETP impacts fall within acceptable limits (as defined under legislation and /or binding agreements that are in place).

Allis shad *Alosa alosa*[28]

The brown shrimp beam-trawl fishery is known to capture Allis shad, although estimated quantities are very low and, even if some of these fish are Allis shad (they are difficult to distinguish externally from Twaite shad), these are likely to be within acceptable limits. The Allis shad is found in the eastern Atlantic in waters bordering most of Europe and north western Africa. They primarily live at sea on feeding grounds and migrate to their spawning grounds between April and June once they are sexually mature. Adults in the sea begin to move towards the coast in February and congregate near or in estuaries. Adults may migrate up to 700 km from the sea into major rivers and occasionally into the largest tributaries of these rivers to spawn. After spawning, adults return to the sea but many die before reaching it. Only 5-6% of the adults spawn more than once in their lifetime. After 3-4 months juveniles (8-12 cm length) move towards the sea until mature. Individual fish apparently return to their natal spawning site. Populations have been reduced primarily by overfishing, pollution, and habitat destruction. The fish is marketed fresh and frozen. The species is listed in Appendix III of the Bern Convention (2002) and listed in Annex II and V of the EC Habitats Directive (2007).

Twaite shad *Alosa fallax*

The species range extends from the British Isles and southern Norway to Morocco, including the Baltic, Mediterranean and Black Seas. It is an amphihaline species, schooling and strongly migratory. Adults are usually found in open waters along the coast; juveniles are usually found along estuaries and near the shore, possibly making vertical diurnal movements synchronized with the tides. They remain in estuaries for over one year. The species migrates to major rivers to spawn, it is also reported to spawn in small rivers. Hybridization between this species and the Allis shad (*Alosa alosa*) has been reported from the Rhine as well as rivers in France and Algeria. There is some evidence that indicates that shad hybrids may reproduce. The species is listed in Appendix III of the Bern Convention (2002), and in Annex II and V of the EC Habitats Directive (2007).

Eel *Anguilla anguilla*

The species inhabits all types of benthic habitats from streams to shores of large rivers and lakes. Naturally found only in water bodies connected to the sea. Their high fat content and benthic feeding habits in continental waters make them vulnerable to the bioaccumulation of pollutants, such as heavy metals and organic contaminants, that may result in organ damage and impaired migration capability and lowered genetic variability. Review of information supports the view that the European eel population as a whole has declined in most areas, the stock is outside safe biological limits and current fisheries not sustainable. There is obvious decreasing of the stocks for all the continental native distribution area (www.fishbase.org). It is a CITES Appendix II species.

Sandy ray *Leucoraja circularis*

The species range extends in the Eastern Atlantic from Iceland, southern Norway, Skagerrak and Morocco, including western Mediterranean. It is found in offshore shelf waters and on upper slope, mainly around the 100 m line. Depth range is from 70-275m. The species feeds on all kinds of bottom animals. It is oviparous, distinct pairing with embrace. The young may

[28] Fishbase.org

tend to follow large objects, such as their mother. The eggs are oblong capsules with stiff pointed horns at the corners deposited in sandy or muddy flats. The maximum length for the female is 117 cm. The species is listed on the IUCN Red List as endangered[29].

River lamprey *Lampetra fluviatilis*

The European river lamprey is found in coastal waters around almost all of Europe from the north-west Mediterranean Sea north to the lakes of Finland, Scotland, Norway and Russia, including rivers in the Alps. Adults live in coastal waters and estuaries and spawn in strong-current habitats of rivers and streams. The European river lamprey has a reproduction cycle similar to that of salmon. River lampreys migrate upstream from the sea to spawning grounds in autumn and winter, migration is mainly nocturnal and ceases at low temperatures. Spawning season starts when water temperature rises above 9°C, after spawning, the adults die. The young larvae, known as ammocoetes, spend several years in soft detritus rich sediment before migrating to the sea as adults and after metamorphosis (from late summer to late autumn), most juveniles overwinter in freshwater and migrate to the sea in spring. At sea, adults prey on a wide variety of fish species, mostly Clupeidae and Gadidae, feeding on body tissues of prey, which is usually killed while its flesh is excavated. Populations are recovering after pollution problems in central and western Europe are being resolved. It is thought that these fish spend two to three years in marine habitats before making the return trip to spawn. Like many Lampreys, this species feeds as an ectoparasite and parasite of fish. It clings on to the flanks or gills of the fish with its sucker and rasps at the tissues below.

Monitoring and recording of ETPs

The information for this assessment is based exclusively on observer data. The client fisheries have started to implement an on-board ETP recording system on the brown shrimp fishing vessels. Fishers in the Danish fishery have a detailed species identification booklet available in the wheelhouse, which includes fish species, skates, sharks, and rays, benthic species and mammals and birds. The Dutch and German fishing vessels have implemented the same recording ETP sheet and A4-sized identification guide specific for the brown shrimp fishery. There is as yet little data on ETP records directly from the fishing vessels, although some vessels in the Danish fishery have returned records on lampreys for 2015.

[29] Considering the depth and geographic distribution as described by fishbase.org, it is unlikely that the sandy ray was caught in the bycatch and may therefore be a misidentification (Client pers.com)

3.7 Principle Three: Management System Background

The intent of Principle 3 (P3) is to ensure that there is an institutional and operational framework appropriate to the size and scale of the UoA for implementing Principles 1 and 2, and that this framework is capable of delivering sustainable fisheries in accordance with the outcomes articulated in these Principles.

In the following a description of the broad, high-level context of the fishery management system and the fishery specific management system is provided with the intent of supporting the scoring rationales used in Appendix 1.1 of this report.

3.7.1 Area of operation of the UoA and jurisdictions

The fishery (as described in the UoA, see page 11) operates mainly within 12 nautical miles (nm) (also known as the Territorial Waters) from the coast of Denmark, Germany and the Netherlands. In some instances, particularly off the coast of Denmark, fishing for brown shrimp may extend beyond 12 nm, as indicated by Figure 18, in waters usually <30m deep.

Access to fishing within 12 nm from the coasts of EU member states is limited to licensed vessels from the member state and those member states that have traditionally fished in those waters. The following table shows the access arrangements in the UoA:

Table 12 Access arrangements in the UoA

Territorial Waters of:	Access available to:	Area within which access is allowed:
Denmark	Germany	6 - 12 nm from Danish / German border to Blåvands Huk
Germany	Denmark	3 - 12 nm Danish / German border to the northern tip of Amrum at 54°43′N
	Netherlands	3 - 12 nm
Netherlands	Germany	3 - 12 nm
	Belgium	3 - 12 nm
	France	6 - 12 nm

(Adapted from Annex I of the CFP
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:354:0022:0061:EN:PDF)

Access to fishing beyond 12 nm miles is available to any EU member state licensed fishing vessel, however, the distribution of brown shrimp means it is not economical for other EU member state vessels to prosecute the brown shrimp fishery in this region of the North Sea.

With the brown shrimp stock distributed between the territorial waters of the three EU member states and with access being available to multiple EU member states this fishery falls into the MSC jurisdictional category of a “shared stock” (MSC FCR v2.0 SA4.1.1).

3.7.2 Legislative Framework

The Common Fisheries Policy (CFP) is the principal legislative instrument for fisheries management in the EU. A new CFP came into effect on 1st January 2014, with EU Regulation No 1380/2013 amending the previous CFP.

The EU is a contracting party to the United Nations Convention on the Law of the Sea (UNCLOS) and United Nations Fish Stocks Agreement (UNFSA) and the CFP contributes to the EU's implementation of its international obligations to UNCLOS and UNFSA.

The CFP also commits the EU member states to obligations and commitments set out in international Treaties and Agreements (e.g. Convention on Biological Diversity), through EU Directives[30] (e.g. 2008/56/EC Marine Strategy Directive, 2009/147/EC Birds Directive, 92/43/ECC Habitats Directive).

Objectives of the Common Fisheries Policy (CFP)

Article 2 of the CFP sets out its objectives:

1. The CFP shall ensure that fishing and aquaculture activities are environmentally sustainable in the long-term and are managed in a way that is consistent with the objectives of achieving economic, social and employment benefits, and of contributing to the availability of food supplies.

2. The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.

In order to reach the objective of progressively restoring and maintaining populations of fish stocks above biomass levels capable of producing maximum sustainable yield, the maximum sustainable yield exploitation rate shall be achieved by 2015 where possible and, on a progressive, incremental basis at the latest by 2020 for all stocks.

3. The CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavour to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment.

4. The CFP shall contribute to the collection of scientific data.

5. The CFP shall, in particular:

(a) gradually eliminate discards, on a case-by-case basis, taking into account the best available scientific advice, by avoiding and reducing, as far as possible, unwanted catches, and by gradually ensuring that catches are landed;

(b) where necessary, make the best use of unwanted catches, without creating a market for such of those catches that are below the minimum conservation reference size;

(c) provide conditions for economically viable and competitive fishing capture and processing industry and land-based fishing related activity;

(d) provide for measures to adjust the fishing capacity of the fleets to levels of fishing opportunities consistent with paragraph 2, with a view to having economically viable fleets without overexploiting marine biological resources;

(e) promote the development of sustainable Union aquaculture activities to contribute to food supplies and security and employment;

(f) contribute to a fair standard of living for those who depend on fishing activities, bearing in mind coastal fisheries and socio-economic aspects;

[30] An EU Directive is a legal act, which requires EU member states to achieve a particular result without dictating the means of achieving that result. EU Directives are usually transposed into national law.

(g) contribute to an efficient and transparent internal market for fisheries and aquaculture products and contribute to ensuring a level–playing field for fisheries and aquaculture products marketed in the Union;

(h) take into account the interests of both consumers and producers;

(i) promote coastal fishing activities, taking into account socio-economic aspects;

(j) be coherent with the Union environmental legislation, in particular with the objective of achieving a good environmental status by 2020 as set out in Article 1(1) of Directive 2008/56/EC, as well as with other Union policies.

3.7.3 European Institutions

European Council[31]

The European Council defines the EU's overall political direction and priorities. Its policy orientations feed into the work of the Council, the European Parliament, the European Commission and the EU member states. The members of the European Council are the heads of state or government of the 28 EU member states. The work of the European Council is coordinated by its President, who prepares, chairs and leads the meetings, aiming to build consensus among its members. Together with the President of the European Commission, they represent the EU at its highest level.

Council of the European Union[32]

The Council of the EU (“The Council” or “Council of Ministers”, as it is sometimes referred to) is where national ministers (e.g. Fisheries Minister) from each EU country meet to represent his/her country and express its view, negotiate, develop policies and adopt EU law. Legislative Acts, which are directly relevant to EU citizens are negotiated and adopted by the Council, usually in conjunction with the European Parliament. The Council meets in different formations, called conjurations, depending on the issues, e.g. Fisheries ministers usually meet four times a year in the Fisheries Council. There are ten Council conjurations, covering the whole range of EU policies.

European Parliament[33]

The Parliament acts as a co-legislator, sharing with the Council the power to adopt and amend legislative proposals and to decide on the EU budget. It also supervises the work of the Commission and other EU bodies and cooperates with national parliaments of EU countries to get their input. The Members of the European Parliament are directly elected by voters in all Member States to represent people’s interests with regard to EU law-making and to make sure other EU institutions are working democratically**.**

The Committee on Fisheries (PECH)[34] is a committee of the European Parliament. It is responsible for:

- The operation and development of the CFP and its management;
- The conservation of fishery resources, the management of fisheries and fleets exploiting such resources, and marine and applied fisheries research;
- The common organisation of the market in fishery and aquaculture products and the processing and marketing thereof;
- Structural policy in the fisheries and aquaculture sectors, including the financial

[31] European Council http://www.consilium.europa.eu/en/european-council/
[32] Council of the European Union http://www.consilium.europa.eu/en/homepage/?lang=en
[33] European Parliament http://www.europarl.europa.eu/portal/en.
[34] The Committee on Fisheries (PECH) http://actionguide.info/m/orgs/319/

instruments and funds for fisheries guidance to support these sectors;
- The integrated maritime policy as regards fishing activities;
- Sustainable fisheries partnership agreements, regional fisheries organisations and the implementation of international obligations in the field of fisheries.

European Commission[35]

The European Commission is the executive of the EU and promotes its general interest. The Commission's main roles are to:

- Propose legislation, which is then adopted by the co-legislators (i.e. the European Parliament and the Council of Ministers);
- Enforce EU legislation (where necessary with the help of the Court of Justice of the EU);
- Set objectives and priorities for action and work towards delivering them;
- Manage and implement EU policies and the budget;
- Represent the EU outside Europe (e.g. negotiating trade agreements between the EU and other countries).

Departments within the Commission, known as Directorate General (DG) or services, are each responsible for particular policy areas, e.g. DG for Maritime Affairs and Fisheries (also referred to as DG MARE).

The DGs draft laws, manage EU funding initiatives, conduct public consultations and communications.

The Commission also administers a number of executive agencies, e.g. European Fisheries Control Agency[36], which has been established to encourage closer collaboration and exchange of best practice in enforcing EU regulations within the EU.

The Commission has its own fisheries inspectors (national inspectors seconded to the Commission) who regularly visit national authorities, often at no or short notice, to check they are applying EU rules appropriately. If national authorities are under performing corrective action is required and if they persist sanctions and penalties can be imposed.

The Commission is also able to call upon the services of its Scientific, Technical and Economic Committee for Fisheries (STECF)[37] in order to provide advice related to marine biology, marine ecology, fisheries science, fishing gear technology and fishery economics. The Commission nominates the members of the STECF. Acting in co-operation with officials of the Commission the Committee may form internal working groups, whose meetings can also be attended by invited experts. The Commission provides the secretariat of the Committee and of the working groups.

The STECF may be consulted by the Commission on all issues connected with access, resource and regulation of EU fisheries. The opinion of STECF is sought in the process of setting annual Total Allowable Catches (TACs) and quotas. The Committee produces an annual report on the situation as regards fisheries resources and on developments in fishing activities. It also reports on the economic implications of EU fisheries resource status.

Implementing the CFP

[35] European Commission http://ec.europa.eu/fisheries/about_us/index_en.htm
[36] European Fisheries Control Agency http://efca.europa.eu/
[37] Scientific, Technical and Economic Committee for Fisheries (STECF) https://stecf.jrc.ec.europa.eu.

Within the framework of the CFP, EU member states adopt fisheries conservation and management measures through EU Fisheries Regulations[38] and through the amendment and provisions of their own national Fisheries Acts. In so doing, they are required to act in a manner that is fully consistent with UNCLOS and UNFSA.

Similarly, EU member states adopt their own national legislation in order to deliver requirements associated with the nature conservation and Good Environmental Status (GES) Directives highlighted in the Legislative framework section above.

3.7.4 National Institutions

Denmark

The Danish Agrifish Agency[39] (NaturErhvervstyrelsen) is part of the Ministry of Environment and Food[40] (Miljø- og Fødevareministeriet) and is the authority responsible for monitoring and enforcing EU and national fisheries conservation policies. The agency carries out shore and sea based inspections.

Other regulatory, scientific and enforcement bodies are integrated in the management process, such as the Danish Fishing Monitoring Center[41] (Center for Kontrol Fiskerikontrol - FMC) and the National Institute of Aquatic Resources[42] (Institut for Akvatiske Ressourcer or DTU Aqua.

The FMC is responsible for coordinating and administering fisheries monitoring and inspections. DTU Aqua is responsible for developing methods, models and tools for estimating and evaluating the effects of management measures and regulations of fisheries and providing advice to the national government and EU.

The CFP is enacted into law through the Danish Fisheries Act (Bekendtgørelse af fiskerilov). The Fisheries Act also implements some parts of the Habitats and Birds Directives.

The Danish Nature Agency[43] (Naturstyrelsen) is also part of the Ministry of Environment and Food which is the authority responsible for the government's policies concerning the environment and nature conservation. This includes the administration of Natura 2000 sites established under the Habitats and Birds Directive. The Habitats and Bird Directive is also implemented through the Nature Conservation Act.

Germany

In Germany, there are two levels of government responsible for sea fisheries management: the federation (national level) and the Länder (federal states, provinces, or regional level). There is a third level of government - municipalities (local level) – but they do not have any sea fisheries responsibilities.

The Federal Ministry of Food and Agriculture[44] (Bundesministerium für Ernährung und Landwirtschaft - BMEL) is the competent authority on fisheries and aquaculture at the

[38] An EU regulation is a legal act that becomes immediately enforceable as law in all member states.

[39] The Danish Agrifish Agency (NaturErhvervstyrelsen) http://agrifish.dk/fisheries/

[40] Ministry of Environment and Food (Miljø- og Fødevareministeriet) http://en.mfvm.dk)

[41] Danish Fishing Monitoring Center[41] (Center for Kontrol Fiskerikontrol – FMC) http://naturerhverv.dk/om-os/om-styrelsen/organisation/kontrol-fiskeri/center-for-kontrol/fiskerikontrol/

[42] National Institute of Aquatic Resources (Institut for Akvatiske Ressourcer or DTU Aqua) http://www.aqua.dtu.dk/english/Research/Fisheries-management).

[43] The Danish Nature Agency (Naturstyrelsen http://www.aqua.dtu.dk/english/Research /Fisheries-management)

[44] The Federal Ministry of Food and Agriculture (Bundesministerium für Ernährung und Landwirtschaft – BLE http://www.bmel.de/EN/Homepage/homepage_node.html)

federal level. It drafts policies, guidelines, promotes actions especially at the EU level and enacts fisheries law.

The CFP is enacted into law by the Marine Fisheries Act (Seefischereigesetz).

The Länder have responsibility for coastal and inland water fisheries and have the authority to enact their own laws and execute federal laws within territorial waters. There are two Länder within the geographic scope of the fishery: Lower Saxony[45] (Niedersächsischen) and Schlewig-Holstein[46].

The Lower Saxony Fishery Act and Fishery Regulation, and the Schleswig-Holstein Fishery Act apply within the coastal region.

BMEL relies on a number of federal research institutes for fisheries advice. The Thünen Institute[47] is in charge of marine and fisheries issues (it also covers rural development, forestry and climate change). It comprises, among others, The Institute of Sea Fisheries[48] (Institute für Seefisherei), the Institute of Fisheries Ecology[49] (Institute für Fishereiökologie) and the Institute for Baltic Sea Fisheries[50] (Institut für Ostseefischerei).

There is also a national / federal and state / Länder structure to nature conservation. The German Federal Agency for Nature Conservation[51] (Bundesamt für Naturschutz – BfN) is the German government's scientific authority with responsibility for national and international nature conservation. BfN reports to the German Ministry for the Environment, Nature Conservation, Buildings and Nuclear Safety[52] (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit BMUB).

The Federal Nature Conservation Act transposes the Habitats Directive. Implementation of Natura 2000 within territorial waters is the responsibility of the Länder and monitoring and reporting on the status of these protected areas is the responsibility of BfN.

Netherlands

Fisheries comes under the responsibility of the Ministry of Economic Affairs[53] (Ministerie van Economische Zaken) and The Dutch Food and Safety Authority[54] (Nederlandse Voedsel- en Warenautoriteit (NVWA)) is the department responsible for compliance with EU and national regulations.

The Fisheries Act (Visserijwet) transposes EU requirements and enacts national regulations.

The Institute for Marine Resources and Ecosystem Studies[55] (Wageningen Marine Research, which used to be IMARES) is the government science provider and has been

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[45] Lower Saxony (Niedersächsischen) and Schleswig-Holstein http://www.lower-saxony.de/portal/live.php?navigation_id=28532&_psmand=1016

[46] Schleswig-Holstein http://www.schleswig-holstein.de/EN/StateGovernment/state_government_node.html

[47] The Thünen Institute (https://www.thuenen.de/en/)

[48] The Institute of Sea Fisheries (Institute für Seefisherei https://www.thuenen.de/en/sf/),

[49] The Institute of Fisheries Ecology (Institute für Fishereiökologie https://www.thuenen.de/en/fi/)

[50] The Institute for Baltic Sea Fisheries (Institut für Ostseefischerei https://www.thuenen.de/en/of/).

[51] The German Federal Agency for Nature Conservation (Bundesamt für Naturschutz – BfN https://www.bfn.de)

[52] The German Ministry for the Environment, Nature Conservation, Buildings and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit BMUB http://www.bmub.bund.de/en/).

[53] Ministry of Economic Affairs (Ministerie van Economische Zaken https://www.government.nl/ministries/ministry-of-economic-affairs

[54] The Netherlands Food and Consumer Product Safety Authority (Nederlandse Voedsel- en Warenautoriteit (NVWA) https://www.nvwa.nl

[55] The Institute for Marine Resources and Ecosystem Studies (IMARES) http://www.wageningenur.nl/en/Expertise-Services/Research-Institutes/imares.htm

particularly active in contributing research to management of the brown shrimp fishery. The main responsibility for nature conservation is with the Ministry of Infrastructure and the Environment[56] (Ministerie van Infrastructuur en Milieu (IenM)) and the Nature Conservation Act (Natuurbeschermingswetvergunning) is applied by the Ministry of Economic Affairs.

3.7.5 EU and National Fisheries Management Measures

EU fisheries control and technical measures have been the main management measures applied by the EU member state authorities in the fishery, they include:

- Mandatory fishing licences (Council Regulation EC NO.1224/2009)
- Access restrictions - exclusive access to national fleets within 3 nm; restricted access to other EU member states within 6-12 nm - as indicated in Table 12 above (EU Regulation No 1380/2013)
- Vessel number and engine capacity restrictions - Within the “Plaice Box” – a zone along the Danish, German, Dutch coasts (Figure 42) established in 1989 to protect juvenile plaice (EU Council Regulation 4193/88) - only officially listed beam trawl vessels from each EU member state are able to operate. These vessels must not exceed 24 m total length and have an engine power of ≤ 221 kW / 300 hp. The list of vessels is not extendable, but it is possible to replace a vessel if another vessel leaves the fleet. The total engine power of each EU member state vessel list must not exceed the total engine power that was in place at 1st January 1998.
- Maximum aggregate beam length (max 24 m) (Council Regulation No 850/98)
- Minimum mesh size (16 mm) (Council Regulation No 850/98);
- Maximum total engine power of fishing vessels for each member state authorised to use beam trawls (Commission Regulation 1922/1999);
- Use of sieve nets or other mechanisms to ensure selectivity (Council Regulation No 850/98);
- Satellite Vessels Monitoring Systems (VMS) – required on all vessels >12 m (Council Regulation 1224/2009 (§9));
- Automatic Identification System (AIS) for all vessels >15 m (Council Regulation 1224/2009 (§10));
- Logbooks and landing declarations – for vessels ≥10 m (Council Regulation 1224/2009 (§14) as amended)
- Electronic logbooks for vessels ≥12m (Council Regulation 1224/2009 (§15)); and,
- Mutual administrative assistance between EU member states (EU Regulation No 1380/2013).

[56] The Ministry of Infrastructure and the Environment (Ministerie van Infrastructuur en Milieu (IenM) https://www.government.nl/ministries/ministry-of-infrastructure-and-the-environment

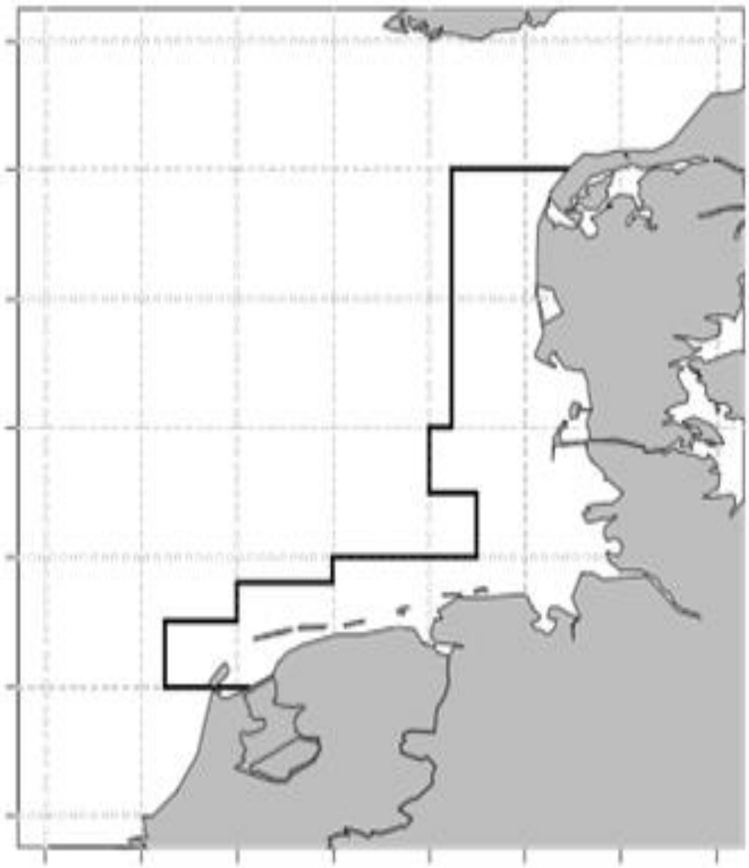

Figure 42 The location of the Plaice Box

(From http://ec.europa.eu/fisheries/documentation/studies/revision-of-the-plaice-box_en.pdf)

- "Landings obligation"- is a new approach to management whereby, all fish subject to a quota must be retained aboard fishing vessels and landed. The landings of these species are counted against the quota allocated to each fishing vessel. The landings obligation is being phased in over a number of years, starting in 2015 with pelagic fisheries, extending to demersal fisheries in 2016, and being fully implemented across all TAC species by 2019. This regulation has not yet been applied to the brown shrimp fishery (EU Regulation No 1380/2013).

There are also additional national management measures applied by the EU member states to their licenced vessels either under their national fisheries or nature conservation acts. They include:

Table 13 National management measures applied by EU member states that affect their respective licenced brown shrimp vessels in the UoA

Netherlands:
Licensing • The number of shrimp fishing licences is capped at 220. The Dutch government intend to reduce the number of vessels, particularly latent effort, through the development of a government buy out scheme (IJlstra, 2016, pers comm, 29 March);

Netherlands:
• The issuing of annual shrimp fishing licences is subject to an "appropriate assessment", in accordance with Article 6 of the Habitats Directive (transposed in the Nature Conservation Act 1998, through articles 19 f & g). Article 6 says, "Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public." An independent appropriate assessment[57] was conducted in 2013 in relation to the effect of shrimp fishing in Natura 2000 sites within the Wadden Sea, Oosterschelde, Westerschelde, Voordelta, the North Sea coastal zone and the Vlakte van de Raan. It concluded that current levels of shrimp fishing had no significant effect on the Natura 2000 features and highlighted that the closing of some relatively small areas to shrimp and mussel fishing was a possible measure for improving the conservation status of the habitat. An updated assessment is being conducted and is expected to be published in the summer of 2016 (Prent, 2016, pers comm, 21st July). • An agent can make applications for licences on behalf of harvesters, in most instances, this is done on their behalf by their Producer Organisation (PO). Conditions can be placed on licenses. Successful applicants must take into account the relevant conservation objectives of Natura 2000 sites and ensure no harm to these or existing nature reserves. • Two shrimp fleets are distinguished by the type of fishing licence: o "Garnalenvergunning Kustwateren (GK)", vessels licenced to fish for shrimp in the Wadden Sea and all coastal waters; o "Garnalenvergunning Visserijzone (GV)", vessels licenced to fish for shrimp in coastal waters only (i.e. not the Wadden Sea). There are 87 GK and 111 GV active licences. If a vessel owner wanted to enter the fishery with a new or existing vessel, using either a GK or GV licence, they would have to purchase a licence(s) that had an equivalent engine capacity. If engine capacity in excess of the licence is bought this can be saved for possible use in the future, e.g. on a different boat. • Estimates of the number of fishing days in each area by each fleet were calculated in the appropriate assessment. If these increase the Ministry of Economic Affairs have indicated they may modify the conditions of the licence. The accuracy of the number of days fished in each area by the two

[57] https://tisson.tecart.de/public/index.php?op=common_main

Netherlands:
fleets will be improved in the next appropriate assessment as they will be based on VMS data (Prent, 2016, pers comm, 21st July). Using information from a 2014 licence application response provided by the Dutch client, the following shows an indication of the number of fishing days by area and fleet:

Area	GK Fleet Fishing Days	GV Fleet Fishing Days
Wadden Sea	5,770	0
North Sea coastal zone	862	1923
Voordelta		1306
Oosterschelde		250
Westerschelde		500

- In order to obtain a shrimp fishing licence, vessels have to demonstrate they have appropriate sorting equipment on-board (Aviat et al, 2011)[58].

Restricted number of fishing days

- There is no fishing allowed for Dutch vessels between 12:00 Friday until 00:00 Sunday. This is referred to as the "weekendverbod" (Weekend closure).
- Dutch vessels are allowed to fish for 108 hours in Dutch waters (Monday 00.00 hours – Friday 12.00 = 108 hours in total) per 7 day week (starting on Monday 00.00 and ending on Sunday 00.00).
- Dutch vessels are allowed to fish in waters outside of Dutch territorial waters for 216 hours in 14 days. The majority of this fishing happens in the Sylt, i.e. German waters).

  http://wetten.overheid.nl/BWBR0024539/2016-06-07#Hoofdstuk3.

Closed areas

- A number of areas are either permanently or seasonally closed to shrimp fishing in the Wadden Sea – see Figures 31 - 35. The closed areas are part of an accord that the fishermen, government and the ENGO's have signed (Visserij in beschermde gebieden [Fishing in Protected Areas] – VIBEG)[59] in order to achieve the conservation objectives of the Natura 2000 sites.

  http://www.nsrac.org/wp-content/uploads/2012/03/VIBEG-Agreement.pdf

Enhanced VMS

- From 1st January 2017, amendments to the Nature Conservation Act, will require all Dutch licensed vessels that fish in Natura 2000 sites to operate an additional "black box" that will report the location of the vessel and when it is fishing, i.e. when the trawl winches are in use. The intention had been for the box to report the engine capacity however the additional cost that fishermen

[58] Aviat et al, 2011 http://www.europarl.europa.eu/studies)

[59] (Visserij in beschermde gebieden [Fishing in Protected Areas] – VIBEG) http://www.nsrac.org/wp-content/uploads/2012/03/VIBEG-Agreement.pdf

Netherlands:
would have to incur for this as well as some technical difficulties have meant this facet of the system is not yet in place. In the meantime, the Dutch also use AIS to monitor whether a vessel enters a closed area. The EU required VMS only sends out a signal every 2 hours whereas AIS provides real-time location.

Germany:
Licensing • A general fishing license is issued to all fishing vessels. Vessels eligible to fish inside the plaice box with beam trawls are issued with a special license. The approach to meeting the requirements of the Habitats and Birds Directive is dealt with differently compared to the Netherlands. Shrimp fishing licences are not renewed annually and shrimp fishing is considered to be an on-going activity. In the development and designation process of Natura 2000 sites (and previously national parks), independent assessments of activities such as shrimp fishing were undertaken (Rumohr et al., 1994; Vorberg, 1997). Stock et al, 1996). Given the dynamic hydrography and sedimentology of the environment, the effects of shrimp fishing were considered to be within acceptable limits. On-going monitoring of the habitats and species and measurement against conservation objectives ensures their maintenance and/or where necessary additional management action (Oberdörffer, 2016, pers comm, 7th July).
Closed areas • There are small closed areas Figures 31 - 35: o Schleswig-Holstein - south of the Hindenburgdamm (to the island of Sylt). o Hamburg - tidal creeks around the isle Neuwerk o Lower Saxony (Niedersachsen) - small areas listed in the annex of the national park law There is also seasonal voluntary closed areas in Schleswig-Holstein to minimise disturbance to moulting shelducks (*Tadorna tadorna*)
Enhanced VMS • The German authorities are consulting stakeholders about enhancing the frequency with which the VMS sends out a signal. The EU requirement is for a signal to be emitted every 2 hours, BMEL are looking to increase the frequency to every 10 minutes and, if vessels are within 4 nm of an area closed to fishing the frequency of signals can be increased. Transiting a restricted area has to be at a speed of at least 6 knots, i.e. a speed that is too fast to trawl (Wessendorf, 2016, pers comm. 18th July) • The group that represents the German POs MSC's certification initiative is in contact with the companies that provide the blue mussel fishery in Niedersachsen with a black box that provides enhanced monitoring, e.g. when a vessel is fishing (Oberdörffer, 2016, pers comm, 7th July).

Denmark:

Licensing • The number of shrimp fishing licenses is capped at 28. Anyone wishing to enter the fishery will need to buy one of these existing licenses and not exceed the engine capacity associated with that license. • Brown shrimp fishing licenses are not subject to annual renewal and not considered to be new plans or projects. As such they are not subject to an appropriate assessment.
Closed areas • The "Shrimp Line"[60] created by the "Brown Shrimp Order" https://www.retsinformation.dk/Forms/R0710.aspx?id=8330 restricts fishing for shrimp to the seaward side of the outer islands. Therefore, there is no fishing for shrimp in the Danish Wadden Sea. • There is no trawling allowed within 3 nm of the coast. This is intended to protect nesting birds from disturbance.
Restricted number of fishing days • The Danish fleet have, for many years, operated a voluntary 12-week period within which fishing is not permitted from Friday 09.00 to Sunday 18.00.

3.7.6 Monitoring, Control and Surveillance (MCS)

Fisheries rules and control systems that stem from the CFP are agreed at an EU level, but implemented by the member states through their national authorities and inspectors:

Denmark

The following information was provided through interview and correspondence with Ulla Wiborg, Martin Andersen and Jacob Handrup (NaturErhvervstyrelsen - the Danish Agrifish Agency).

The Agency has two central fishery units based in Copenhagen (Fisheries Control and EU & Fisheries Regulation) as well as regional offices in Kolding and Hvide Sande.

The Fisheries Control Unit develops, plans and coordinates enforcement of EU and national regulations. Fisheries inspectors conduct shore based inspections and three dedicated fisheries patrol boats provide a platform from which sea based inspections take place. One vessel is permanently based in the North Sea, the other operate in the Kattegat, Skagerrak and Baltic Seas. There are approximately 150 inspectors and administrative staff in the Fisheries Control Unit.

Fisheries Control administers the fleet register, landings/logsheet data, sales notes and VMS through a Fisheries Monitoring Control (FMC) in Kolding. Cross-checking obligatory information provided by fishermen with VMS and other surveillance and inspection reports confirms compliance.

The FMC also acts as a 24 hour / 365 day service centre for the fishing industry. Fishermen are able to contact the FMC to check on any restrictions, licence conditions, etc.

[60] The "Shrimp Line" https://www.retsinformation.dk/Forms/R0710.aspx?id=8330

Non-compliance may be dealt with through an administrative or judicial system, depending on the severity of the infringement. Denmark was one of the first member states to adopt a points system, in accordance with EU Regulation 1224/98, whereby infringements result in fines and points against a license. On reaching a maximum number of points the vessels fishing license is suspended.

Deployment of enforcement resources is based on risk assessment. The brown shrimp fishery is considered to be low risk with the most common non-compliance being inaccurate estimates of catch in logbooks exceeding the 10% tolerance. Systematic non-compliance is not considered to be an issue in this fishery.

The following table shows the number of at-sea and shore-based inspections carried out on the brown shrimp fishery between 2013 and, to date, in 2016.

Year	Number of inspections
2013	12
2014	29
2015	19
2016	18
Total	**78**

The following table provides a summary of the non-compliance and action taken in the brown shrimp fishery between 2008 and 2015.

Year	Offence	Sanction
2008	Illegal fishing gear	Warning
2009	Inaccurate logbook record	Warning
2010	Inaccurate logbook record	Fine
2010	Inaccurate logbook record	Fine
2015	Illegal gear and missing logbook registration	Fine

VMS is used to monitor closed areas and signals have been increased from 2 to 1 hour intervals. If any vessel is close to a closed area the FMC contact the vessel and warn them.

Vessels are subject to testing of engine capacity by the Danish Maritime Service, resulting in the issuance of an engine certificate that must be carried and available to inspection at all times. As part of routine inspections, Fisheries Officers also make visual inspections of the engines and the fisheries patrol vessels are equipped to check and verify engine rating.

The Fisheries Control Unit is subject to regular short notice visits by EU inspectors checking that EU regulations are being applied correctly. Joint Deployment Plans (JDP) where member states pool their inspection and enforcement resources are in operation for high risk fisheries. Given the low risk associated with the brown shrimp fishery, liaison with other member states is generally limited to the sharing of landing data when vessels visit from other member states. If an enforcement authority raises any concerns to another member states authority, a coordinated response, which may include an inspection, will take place.

The EU & Fisheries Regulation Unit's primary role is to strengthen the policy-making and regulatory aspects of the fisheries sector, this includes working with the Ministry of Environment on the Habitats Directive implementation. Other areas of responsibility include: the CFP, EU and national resource and conservation policy, fisheries agreements with third countries, market policy; nature conservation and environmental policy with respect to fisheries; national policy and regulation on commercial fishing, aquaculture and recreational fisheries.

The development and implementation of the industry lead Brown Shrimp Management Plan is considered to be an extension of the self-management approach that has been adopted in the fishery in Denmark for some years. It is generally viewed as a positive development with respect to communication with identified and coordinated groups. Given the plan, in its present form, is still in its early stages of implementation the authorities are not able to provide a view on its effectiveness, but it is hoped it will develop and prove to be an important element in the management of the fishery.

Germany

The following information was provided through interview and correspondence with Lutz Wessendorf, Head of Unit 522, BLE, Hamburg (Wessendorf, 2016, pers comm. 18th July).

At the federal level, BLE have responsibility for enforcing EU and national regulations. While their MCS focus is primarily on fisheries and vessels beyond territorial waters, their regulation of the plaice box, collection and analysis of logbook data and monitoring of VMS data apply to the brown shrimp fishery. VMS data is confidential but can be provided to POs if vessel owners provide permission to do so.

BLE work closely with their member state counterparts, particularly in neighboring member states. They meet regularly, every 2 months or so, to discuss different fishery issues and share information including, more recently, the application of *Natura 2000* beyond territorial waters.

BLE operate three offshore fisheries patrol vessels, crewed by approximately 200 seamen, undertaking 400-450 at-sea inspections a year. With the brown shrimp fishing effort being concentrated in coastal waters, the number of at-sea inspections of vessels in the brown shrimp fleets is low on the federal levels priorities in comparison to other fleets.

An administrative system for dealing with any non-compliance is applied. A list of infringements and the associated level of financial penalty is made available to fishermen. BLE fisheries inspectors can apply fines after fisheries inspectors have detected infringements. If fishermen contest an offence, it is processed through the judicial system, which includes an appeals procedure. Overall compliance in the brown shrimp fishery is considered to be good with no systematic non-compliance issues reported. Leaving port with a non-functioning VMS and the margin of tolerance on logbooks weights (i.e. estimated catches of regulated (quota) species should be within 10% of actual landing figures) are examples of non-compliance that may be more common than others. These are dealt with by warnings, fines and/or endorsements against fishing licenses.

BLE use a third party independent certification company to check that engine capacity is not being exceeded on any new vessel entering the fishery or old vessels having new engines installed. This was subject to an EU Commission audit in 2015 with no major issues being identified. Two other EU Commission audits were conducted in 2015 in relation to data collection, neither of which reported any major findings. BLE are subject to regular EU Commission audits, as are other member states.

BLE also works closely with the two Länder - Lower Saxony (Niedersachsen) and Schleswig-Holstein - whose main focus are the fisheries in the territorial waters of the North Sea.

The following information was provided through interview and correspondence with Olaf

Prawitt, Ministry of Agriculture, responsible for the Lower Saxony fishery control agency ("Staatliches Fischereiamt Bremerhaven") (Prawitt, 2016, pers comm 2nd September).

The Länder have shared jurisdiction with BLE in the territorial waters (12 nm). They have fisheries inspectors that conduct shore and sea-based inspections and inshore patrol vessels capable of operating to the 12 nm limit. They have the legal authority to create and enforce their own regulations, which cannot be less restrictive than EU regulations.

Developing and implementing regulations within the 3-12 nm, i.e. where all three member states are able to fish for shrimp, is administratively more challenging, owing to the need for multinational consultation on any new regulations. Therefore, the Länder regulate the fishery in accordance with EU and national regulations, e.g. fishing gear requirements, monitoring and control of landings, cross-checks of logsheets/landing declarations/sales notes, areas restricted to fishing.

Approximately 95% of the German shrimp fleet operates within the 12 nm throughout the year and so the Länder have jurisdiction over the majority of the German shrimp fleet as well as visiting Dutch and Danish vessels.

While obligated to operate in accordance with the CFP and its overarching objectives, the Länder set their own fisheries objectives that reflect the social and cultural importance and political priorities for the region. The following are examples of objectives set by Lower Saxony Ministry of Agriculture, for the brown shrimp fishery:

Long-term objectives:
- Sustaining the number of vessels in order to maintain the supply of seafood and support and maintain the cultural identity of the coastal communities;
- Re-development of the brown shrimp processing sector.

Short-term objectives:
- Stabilising economic sustainability;
- Reducing the average age of the vessels;
- Improving the knowledge of the environmental impact of brown shrimp fisheries on bottom habitats and communities;
- Decreasing the bycatch and the catch of undersized shrimp;
- Minimising possible impact on bottom structures and the bottom community;
- Increasing the energy efficiency of shrimp fishing / reducing the carbon footprint.

Progress toward meeting the objectives is reported on an annual basis.

The Länder's fisheries administrations are funded through the Länder (⅓) and Federal (⅔) budgets. They have also been successful in applying and being rewarded with co-funding for projects through the European Maritime Fisheries Fund[61]. These funds have been directed to fisheries research e.g. CRANNET[62], the development of more selective sorting devices on fishing vessels, improvements on fishing vessels to meet new hygiene requirements, a future project to assess the impact of shrimp fishing on seabed habitat, new patrol vessels.

Regular meetings with BLE take place (at least 4 times a year) to discuss the various fisheries that operate within the 12 nm. Regular meetings, directly related to the shrimp fishery, also take place with fishing industry organisations over the course of the year, as

[61] European Maritime Fisheries Fund http://ec.europa.eu/fisheries/cfp/emff/index_en.htm
[62] CRANNET https://www.thuenen.de/index.php?id=4185&L=1

well as other meetings with multiple stakeholders, related to the many issues and competing uses that overlap with fisheries within the coastal zone, e.g. renewable energy developments, spatial planning, implementation of EU Directives.

In general, the compliance in the brown shrimp fishery is considered to be good. Infringements in the shrimp fishery are not differentiated from other fisheries so exact numbers are not easily accessible, however, low numbers per year are the norm. The main infringements are considered to be relatively minor, e.g. estimations of the landing weight outside the 10% tolerance.

Infringements are dealt with administratively unless contested by fishermen, then they may proceed within the judicial system. Financial penalties and license endorsements are imposed.

The adoption and implementation of the Brown Shrimp Management Plan is welcomed as a positive initiative.

Netherlands

The following information was provided through interview with Leon Bouts, Inspector with the NVWA (Bouts, 2016, pers comm. 27th July).

With respect to their fishery related work the NVWA has two units: Inspection/control; Policy/strategy.

The inspection/control unit focuses on the enforcement of European and national regulations. At sea inspections of vessels and on-shore inspections of landing facilities and auctions takes place.

An offshore patrol vessel operates outside of the Wadden Sea and 5 vessels (rigid inflatable boats - RIBs) operate in the inshore areas. Integration with other government departments such as the coastguard and customs means that resources such as vessels or planes can be tasked to support fisheries inspection work.

The deployment of enforcement resources is based on risk analysis. The brown shrimp fishery is considered to be a low to medium risk fishery. In the absence of brown shrimp quotas, the focus of at sea inspections is on the vessels fishing gear, e.g. proper use of the sieve net and minimum mesh size and sorting/sieving equipment. Shore based inspections regularly check on the amount of small shrimp being discarded at sieving stations which acts a secondary check on the effectiveness of the on-board sorting/sieving equipment. Fishery specific inspection data is not available, meaning it is recorded at a higher level which does not easily distinguish the fishery.

An independent company, contracted by NVWA, monitors engine capacity. If a vessel has a new engine or work done on an existing engine, an inspector checks the engine capacity. This includes undertaking sea trials and engine monitoring with specialist equipment. Engine components that may increase the engines capacity have to be fixed with a tamper-proof seal. The vessel owner has to submit details of the seals on the engines as part of their annual fishing licence application. The details of the sealed engine components have to be kept on board the vessel. This allows fishery officers, with non-specialist mechanical qualifications, to more easily check that engine capacity is being adhered to.

A recent inspection by EU Commission inspectors on the monitoring and management of engine capacity concluded that the Netherlands operates a system beyond EU requirements.

A new black box that incorporates VMS and monitors the vessels fishing winches will be required on all vessels from 1st January 2017. This will improve the ability to monitor where vessels are fishing. At present AIS information is shared by the coastguard and used to monitor areas where fishing is restricted. Anyone thought to be fishing in these areas has to be observed in order to confirm they are fishing. In-shore fisheries patrol vessels and, on occasion aerial surveillance, using one of the coastguard two planes, is tasked to do this.

Overall compliance in the brown shrimp fishery is considered to be good with no systematic non-compliance issues reported. More common offences are improperly fitted sieve nets, on board sorting/sieving machines not effectively returning small shrimp over the side and excessive small shrimp being landed at shore based sieving stations. An on-going legal challenge to the selection and designation of some of the *Natura 2000* sites by the fishing industry means that some fishermen are, not recognizing the restrictions in some areas. However, the restrictions remain in place unless the outcome of the legal challenge results in changes.

Infringements may be dealt with through an administrative or judicial system, depending on the severity of infringement. Both approaches have an appeals procedure. NVWA also operate a points system, in accordance with EU Regulation 1224/98, whereby infringements result in points against a license. On reaching a maximum number of points the vessels fishing license is suspended. The suspension of a license is considered to be the most effective deterrent.

Multi-annual risk assessment of all the Netherlands fisheries is undertaken and regular liaison and information sharing takes place with neighboring and other member states.

The Netherlands aims to adopt a co-management approach to managing its fisheries. The industry's approach to voluntary management of the brown shrimp fishery is welcomed at a political level, however, the less than 100% consensus to the approach by the Netherlands licensed brown shrimp fleet does make it politically more challenging.

3.7.7 Fishing industry organisations

Producer Organisations

Described as, "…*one of the pillars of the CFP*", the Common Organisation of the Market (CMO)[63] is the EU policy for managing the market in fishery and aquaculture products. It is intended to strengthen the role of those involved in the production of fish and provide producers with responsibility for ensuring the sustainable exploitation of natural resources and be equipped to better market their products. Producer Organisations (POs) are officially recognised bodies set up by fishery or aquaculture producers to fulfill this role.

The European Commission Fisheries website describes POs[64] as being, "…*in charge of the day-to-day management of fisheries and play an essential role in running the Common Fisheries Policy and the Common Organisation of the Markets as they:*

- *guide producers towards sustainable fishing and aquaculture, in particular by collectively managing the activities of their members;*
- *help them match supplies with market demands; and,*
- *support them in creating added value*."

[63] the Common Organisation of the Market (CMO) http://ec.europa.eu/fisheries/cfp/market/index_en.htm

[64] http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuId=FTU_5.3.5.html

The website goes on to describe how POs contribute to meeting the objectives of the CFP by taking measures to channel the supply and marketing of their members' products, promote them through certification schemes, quality seals, geographical designations and so on. They may also promote vocational training, the use of information and communication technologies (ICTs) and work towards reducing the environmental impact of the fishing or aquaculture activities of their members.

Within the 2014 reform of the CFP, a far-reaching reform of the CMO was deemed necessary, whereby market-oriented instruments would contribute, directly or indirectly, to meeting the main CFP objectives. To address overfishing and unsustainable practices and move away from production strategies based solely on volume, a new CMO was outlined in the proposal for a regulation on the common organisation of the markets in fishery and aquaculture products (COM(2011) 0416), intended to support:

- the empowerment of POs and their co-management of access rights as well as production and marketing activities;
- market measures that increase the bargaining power of producers (in fisheries and aquaculture) improve prediction, prevention and management of market crises and foster market transparency and efficiency;
- market incentives and premiums for sustainable practices; partnerships for sustainable production, sourcing and consumption; certification (ecolabels), promotion and provision of information to consumers;
- additional market measures on discards.

Four POs from Germany, seven POs from the Netherlands and one PO from Denmark have established the "Brown Shrimp Cooperative MSC Group" with the aim of working cooperatively toward attaining MSC certification of the fishery.

Table 14 The POs involved in the Brown Shrimp Cooperative MSC Group

German POs
• Erzeugergemeinschaft Küstenfischer der Nordsee GmbH. • Erzeugergemeinschaft der Küstenfischer Tönning, Eider, Elbe und Weser e.V. • Erzeugergemeinschaft Elsfleth e.G. • Erzeugergemeinschaft der Deutschen Krabbenfischerei GmbH
Netherlands POs
• Coöperatieve Producentenorganisatie en Beheergroep Delta Zuid U.A. • Coöperatieve Producentenorganisatie Nederlandse Vissersbond U.A. • Coöperatieve Producentenorganisatie en Beheergroep Texel U.A. • Coöperatieve Producentenorganisatie en Beheergroep Wieringen U.A. • Coöperatieve Producentenorganisatie en Beheergroep West U.A. • Coöperatieve Producentenorganisatie voor de Visserij Urk U.A. • Internationale Garnalen Producenten Organisatie Rousant U.A.
Denmark PO

- Danmarks Fiskeriforening Producent Organisation (DFPO) http://fiskeriforening.dk

In order to represent the four German POs within the Group, a separate entity has been established, and is called "MSC GbR".

The seven POs from the Netherlands are represented by their Cooperative Association, the Coöperatieve Visserij Organisatie (CVO)[65]. The Danish fishery is represented by the single Danish PO, Danmarks Fiskeriforening Producent Organisation[66] (DFPO).

The Brown Shrimp Cooperative MSC Group represents the majority of licensed shrimp vessels operating in the fishery with a current membership of 404 vessels.

Official numbers from the three EU member states show a total of 461 licensed vessels able to fish for shrimp. Not all of these are active and some will not fish for shrimp all year round:

Table 15 The number of licensed shrimp vessels in the Netherlands, Germany and Denmark and the number of licensed shrimp vessels represented by the Brown Shrimp Cooperative MSC Group

Country	No. Licensed vessels	No. Licensed Vessels in Group
Denmark	28 (28 actively fishing)	28 (members of DFPO)
Germany	213 (200 actively fishing)	188 (30 vessels are German flagged and Dutch owned, are members of Dutch POs and part of the client group
Netherlands	220 (198 actively fishing, 22 inactive licenses)	188 (members of Dutch POs) (79 GK and 109 GV licenses)
Totals	**461 (426 actively fishing)**	**404**

The MSC initiative began in 2005/2006. It was stimulated, and momentum was maintained by a number of drivers, including: high shrimp landings resulting in over supply and resultant poor prices for fishermen and production capacity issues for processors; the industry attempting to manage supply to improve prices but, in so doing, being found in breach of Dutch and EC regulations on restricting and distorting competition; the largest buyer and processor of shrimp, Hieploeg[67] encouraging the industry toward MSC certification[68]; and, attention being directed on the fishery from stakeholders and national administrations as a result of it operating in areas of coastal waters with numerous national, European and International nature conservation designations and protections.

Part of the initiative has been the development of a Brown Shrimp Management Plan.

3.7.8 The Brown Shrimp Management Plan

The Management Plan is attached in Appendix 2 of this report. The plan was adopted and became operational on 1st January 2016. The following summarises key aspects of the plan.

[65] The Coöperatieve Visserij Organisatie (CVO) http://cvo-visserij.nl
[66] Danmarks Fiskeriforening Producent Organisation (DFPO) http://fiskeriforening.dk
[67] Hieploeg http://www.heiploeggroup.com
[68] http://www.heiploeggroup.com/en/innovation/innovation-to-further-sustainability

Objective

The stated objective of the plan is, "…*a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimized effects on the marine ecosystem*."

Decision making

A Steering Committee with one representative and a deputy from the three constituent parties is the main decision making body associated with the plan. Decisions on changes and matters resulting from the management plan are made by consensus. A Working Group, the constituency of which is unspecified, helps the Steering Committee and the constituent POs provide active support.

The Steering Committee may also invite observers, experts or presenters to participate in their meetings.

Meetings take place as often as necessary and, minimally once a year.

Managing capacity, fishing effort, discards and catchability

The plan specifies those vessels covered by the plan, their capacity, effort and gear requirements:

Capacity
Vessels have to be a member of an associated PO and their inclusion must not cause the capacity cap based on the respective participating countries number of vessels and combined kW engine power to exceed values established on 1st January 2015, i.e.:

Denmark:	28 vessels	@ 5,213 kW
Germany:	213 vessels	@ 41,198 kW
The Netherlands:	198 vessels	@ 40,410 kW

Other POs may join the management plan. If these are not from the existing three countries they will be restricted to a capacity cap based on their country's number of vessels and combined kW engine power as of 1st January 2015.

The plan does have a caveat to allow an increase beyond a member country's cap if the Steering Committee have scientific advice that shows doing so would not, "*move the fishery away from the target of high long-term sustainable yield*", or, they have agreed, "*other measures that counteract the effect of increasing capacity on the long- term yield*".

Effort
Vessels can only be at sea for a maximum of 200 days (4,800 hours) a year. If an increase in average effort of the vessels is considered to be working against the target of high long-term sustainable yields additional unspecified measures to reduce or counteract the increase will be put in place.

The combined length of the beams, including the shoes, must not exceed 20 m and their combined weight including the net, footropes and other attachments, out of the water, must not exceed 4,000 Kgs.

Catch
Trawl nets must contain either a sieve net or a sorting grid with a maximum opening of 70 or 20 mm respectively and be placed in accordance with EU technical regulations.

Catches must be sorted on-board using sorting machines with a bar spacing adjusted to the size of marketable brown shrimp and use a constant water flow to help survival of discarded catch.

Sieving stations on land must use sieves with a minimum bar width of 6.8 mm and a minimum surface area of 1 m^2. Shrimps that fall through the sieve (referred to as “sievage”) must be crushed, unless it can be shown to be used for non-human consumption purposes, e.g. aquarium fish food.

The average amount of sievage over a 2 consecutive week period per calendar month must not exceed 15% of the total landing of brown shrimp (including the undersize shrimp, i.e. sievage). Penalties apply if this is breached – see “Penalties for infringments” below and Appendix 2.

Catchability
The initial minimum mesh size of trawls was set at ≥20 mm however, with the intent of achieving the highest long-term sustainable yield (an approximate to the maximum sustainable yield [MSY]) incremental increases in mesh size are planned. The first of these was put in place on 1st May 2016 with a minimum mesh increase to ≥22 mm.

The Steering Committee will put in place monitoring using a “*relevant scientific institution*” to see whether the predicted beneficial effects in long term yield from the mesh increase are being realised. If it is concluded that a larger mesh size would result in further increased yields, 2 mm increases in mesh size will take place in 2018 and 2020, to a minimum size of 26 mm.

Harvest Control Rules (HCR)

Five reference points based on 70%, 65%, 60%, 55% and 50% of the average monthly LPUE observed in 2002 (a very low year) and 2007 (an average year) are used as the basis for providing precautionary triggers for restricting weekly fishing effort.

At the end of a calendar month the LPUE data from electronic logbook and auction data is compared to the 2002 and 2007 seasons average. If the LPUE drops below the precautionary reference point of 70% (reference value 1), then fishing for all vessels in the next two calendar weeks is limited to a predetermined number of hours. As long as the average LPUE remains below reference value 1, the monitoring of LPUE is calculated over two weeks, rather than a calendar month.

The fishing effort is reduced in a step-wise fashion as the observed LPUE drops below each successive reference point. The aim of reducing fishing effort is to allow smaller shrimp to grow to a larger size during the season before capture and to ensure that observed F is close to F_{max}, a proxy for Fmsy.

Ecosystem Considerations

The plan considers unwanted catch (specified in the plan as undersized brown shrimp, common fish/invertebrates, rare or protected species), ETP species, seabed habitats, in-organic and oil waste.

Unwanted catch
Facets of the plan include: the incremental increase in mesh size, the obligatory selectivity devices and water flow while sorting catch on-board; are highlighted as contributing to minimising unwanted catch. The plan also commits the Brown Shrimp Cooperative MSC Group to review at least every five years alternative technical measures to further minimise unwanted catches, and adopt, where practical.

ETP species
All vessels have been supplied with an identification guide to help fishermen identify any rare fish species. There is a requirement to report catch or observations on an ETP species registration form and submit to their respective PO administrator. Any specimen that is considered likely to survive must be released as quickly and carefully as possible.

Seabed habitats
The relatively light-weight of the fishing gear, a naturally highly disturbed ecosystem and the closure of areas to fishing, particularly in the inner Wadden Sea, are highlighted as being existing measures that mitigate the impact of the fishery on seabed habitats.

The plan commits to monitoring VMS mapping to monitor the risk of fishing in areas of known sensitive habitats.

Waste and oil
All in-organic waste (including any caught during the fishing operation) must be brought ashore, and handed over to the relevant service (Fishing for litter, national harbor recycling initiatives, etc.).

Waste oil or wastewater containing oil must be stored responsibly and brought to shore for proper disposal.

Enforcement of the plan

An independent control agency based in Germany Landwirtschaftskammer[69] is used to provide a full time inspector who is responsible for monitoring and reporting on compliance of the plan. An independent consultant based in the Netherlands working 3 days a week supports the inspector. They only monitor the management plan requirements and not any national or EU regulation. It is noted that the technical conservation requirements, e.g. mesh size, beam width are equivalent or more restrictive than any national or EU regulation.

Members are obliged to allow inspections, if they refuse they will be deemed as being non-compliant.

The plan commits to at least 20% of the vessels working to the plan in each country being inspected annually; the member POs being inspected at least once a year; and sieving stations at least twice a year.

Inspections follow a protocol to ensure standardised and comparable inspections of POs and member fleets.

Inspection reports are provided every 3 months to the Steering Committee.

Penalties for infringements

The process of warning and penalising a member for an infringement is set out in an annex to the management plan. A right of appeal is also provided.

The member POs are responsible for ensuring compliance with the management plan by their members. In the event of an infringement by a PO or sieving station, the Steering Committee is responsible for ensuring that the appropriate penalty is applied.

A table detailing the penalties for an infringement of any of the articles of the plan is set out

[69] Landwirtschaftskammer https://www.landwirtschaftskammer.de

in an annex to the management plan – see Appendix 2 of this report.

Information on the fisheries performance and management action is made available to the harvesters via PO newsletters and their websites. PO representatives are also very active in communicating and corresponding with their members. There is a commitment to their membership to provide explanations for any actions or lack of action associated with findings and relevant recommendations from research, monitoring evaluation and review activity.

Additional members

It is the stated intent of the Brown Shrimp Cooperative MSC Group that if the fishery were successfully certified against the MSC standard, they would be willing to extend their certification through the MSC process to potentially include those vessels that are not presently part of the Group, including Belgium and French vessels, subject to them, as well as auctions / POs, being compliant with the rules and regulations of the group Management Plan.

Stakeholder input to the Management Plan

In 2015 the Brown Shrimp Cooperative MSC Group invited input from ENGOs, through the North Sea Advisory Council (NSAC) (see below), into the development of the management plan. Submissions were received from WWF, North Sea Foundation and Waddenvereniging provided input (see minutes of meetings at http://www.nsrac.org).

The management plan commits the Brown Shrimp Cooperative MSC Group to annually present the management plan and any changes to the North Sea Advisory Council (NSAC) (see section below), as well as the results of the scientific evaluation and monitoring of progress. The plan also states that the Group, "…*will encourage advice from the NSAC, and include any changes that the Steering Committee finds would help in fulfilling the objectives of the plan*."

Other important contributors to the Management Plan

North Sea Advisory Council (NSAC)

The NSAC[70] is one of seven Advisory Councils - a further 4 are planned[71]. They are stakeholder-led organisations that provide the European Commission and EU countries with recommendations on fisheries management issues and socio-economic aspects of management. They have been established with the intent of providing a more practical and applicable approach to management in the context of fisheries operating in distinctly different geographical regions within the EU.

As bodies pursuing, "...*an aim of general European interest"*, they receive EU financial assistance.

The NSAC was established in 2004. The stated aim of NSAC is, "…*to work towards integrated and sustainable management of North Sea fisheries in the wider context of the sustainability of the marine environment*."

The NSAC has a General Assembly and an Executive Committee. The Executive Committee of 25 members is appointed by the General Assembly to undertake the work of the NSAC. There is no limit to the number of General Assembly members. The Executive Committee has a membership based on a 60% / 40% split between organisations with fishing interests

[70] The NSAC http://www.nsrac.org
[71] http://ec.europa.eu/fisheries/partners/advisory-councils/index_en.htm

and other interest groups. This gives fishing members 15 places and other interest groups 10 places in the Executive Committee:

Fishing Members	
Association des Industries du Poisson de l'U.E – Comite des Organisations Nationales des Importeurs et Exportateurs de Poisson de l'U.E (AIPCE-CEP)	www.aipce-cep.org
Comite National de Peche Maritimes et des Elevages Marins (CNPMEM)	www.comite-peches.fr
Danmarks Fiskeriforeing (2 Seats)	www.dkfisk.dk
European Transport Workers Federation (ETF)	http://www.etf-europe.org/
National Federation of Fishermen's Organisations (NFFO)	www.nffo.org.uk/
Polnocnoatlantycka Organizacja Producentow (PAOP)	http://www.paop.pl/
Rederscentrale	www.rederscentrale.be/
Scottish Fishermen's Federation (SFF)	www.sff.co.uk
Scottish Fishermen's Organisation (SFO)	www.scottishfishermen.co.uk
Stichting van de Nederlandse Visserij (2 seats)	
Swedish Fishermen Federation	http://www.yrkesfiskarna.se/
Union des Armateurs á la Pêche de France (UAPF)	
Verband der Deutschen Kutter Und Kusterenfischer	http://www.deutscher-fischerei-verband.de
Other Interest Members*	
Birdlife International	www.birdlife.org
Client Earth	http://www.clientearth.org/
Dutch Elasmobranch Society (NEV)	http://www.elasmobranch.nl
Environmental Defense Fund	www.edf.org
European Anglers' Alliance (EAA)	www.eaa-europe.eu
Marine Conservation Society (MCS)	www.mcsuk.org/
Oceana	www.oceana.org
North Sea Foundation	www.noordzee.nl www.seas-at-risk.org
World Wildlife Fund for Nature (WWF	http://wwf.org/

*as of April 2016 there was a vacancy.

The principal objective of the NSAC is to prepare and provide advice on the management of the fisheries of the North Sea on behalf of stakeholders in order to promote the objectives of the CFP. This is to be done within the general aim of attaining the sustainable management of fisheries, incorporating an ecosystem based approach and based of the precautionary principle (http://www.nsrac.org).

Each year the NSAC agrees a workplan with its members which is approved by the European Commission. The workplan identifies specific areas of work that will be addressed and sets out the meeting schedule for the year.

The work of the NSAC is delivered by 3 Working Groups: Demersal, Skagerrak & Kattegat and Spatial Planning. These groups each meet 2 to 4 times a year to consider and discuss a number of current and emerging topics and to develop advice and policy on behalf of the NSAC membership. Once finalised, advice developed by the Working Groups is presented to the Executive Committee for approval.

A Working Group may be supported by a number of Focus Groups. Focus Groups are smaller groups which are set up to draft advice on one specific topic. Focus Groups are flexible in their approach drawing in representatives and experts from a number of sources including scientists, fishers, environmental specialists, economists and others. They are short lived, concluding once the piece of work they are addressing is finalised.

A North Sea Brown Shrimp Focus Group has been established under the auspices of the Demersal Working Group. This forum has been used to discuss and consult on the development of the North Sea Brown Shrimp Management Plan. The plan explicitly commits the Brown Shrimp Cooperative group to present, at least on an annual basis, the results of scientific evaluation and monitoring of progress associated with the plan and will invite advice from the NSAC, taking into account and including changes that the Steering Committee consider helps fulfill the objectives of the plan.

Scientific advice

International Council for the Exploration of the Sea (ICES)[72]

ICES is an intergovernmental organization whose main objective is to increase the scientific knowledge of the marine environment and its living resources and to use this knowledge to provide unbiased, non-political advice to competent authorities.

ICES science and advice considers both how human activities affect marine ecosystems and how ecosystems affect human activities.

ICES produces scientific publications, information and management advice requested by member countries and international organizations and commissions. This includes the EU Commission and EU member states. They undertake their work through committees, expert groups and workshops. One such workshop was convened in 2014 following a request from the German and Dutch governments to provide advice on the potential need for management of the brown shrimp fisheries in the North Sea and in so doing the pros and cons of a management on the long-term sustainability of the fishery, potential management approaches and a roadmap for development and implementation, and to indicate research needs and required stakeholder feedback to inform the process. The adopted Brown Shrimp Management Plan draws heavily on this.

National Scientific Institutes
As highlighted in section 3.7.4 above there are a number of national institutes that contribute science and policy advice on the brown shrimp fishery. In the Netherlands Wageningen Marine Research (used to be IMARES) has been active in this area for many years as has the Thünen Institute in Germany, along with the University of Hamburg and they are expected to continue to contribute to the science and policy process at a national level and through the on-going evaluation, development and adaptive management approach set out in the Brown Shrimp Management Plan.

[72] http://www.ices.dk/Pages/default.aspx

4 Evaluation Procedure

4.1 Harmonised fishery assessment

MSC FCR v2.0 states, “The aim of harmonisation is to avoid the perversity that two essentially similar fisheries receive materially different scores (materially in the number, and text, of conditions, or in the overall outcome, whether a pass or a fail). Fisheries that are identical should receive identical scores. Any other result undermines the credibility of the MSC”.

There are no other brown shrimp fisheries that are certified or in assessment in the North Sea. Furthermore, there are no other fisheries in the North Sea that use the similar light weight beam trawls with small mesh. Therefore, there are no Principle 1 or 2 issues that need to be harmonised. There are, however, multiple certified and a small number of in-assessment fisheries that operate in the North Sea that share aspects of the “Governance and Policy” component of Principle 3 (the PIs pre-fixed with 3.1), i.e. focusing on the high level context of the fishery management system within the UoA. The majority have been assessed using MSC FAM v2 and Fisheries Certification Requirements (FCR) v1.3. In so doing, they include PI 3.1.4 that relates to incentives and subsidies, which is no longer included in FCR v2.0, i.e., the version being used in this assessment. One fishery has been assessed and certified using v2.0.

The following table compares the scores assigned to PIs pre-fixed with 3.1 for MSC certified fisheries in the North Sea with the scores for North Sea brown shrimp fishery:

Table 16. A list of MSC certified and in assessment fisheries that operate within the North Sea (FAO Statistical Area 27/ ICES Area IVb and IVc) and the scores that were assigned for their “Governance and Policy” component of Principle 3. Fisheries that scored below 80 for any PI are highlighted. The brown shrimp scores are included as the last entry in the table.

MSC Certified Fisheries	3.1.1	3.1.2	3.1.3	3.1.4
CVO North Sea plaice and sole	90	85	100	85
DFA Dutch North Sea *ensis* (reassessment commenced Oct 2016)	95	75	100	80
DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, sprat and Norway pout	In assessment			
DFPO Denmark North Sea plaice	90	85	100	85
DFPO Denmark North Sea & Skagerrak haddock	80	80	100	90
DFPO Denmark North Sea & Skagerrak saithe	95	85	100	80
DFPO Denmark North Sea & Skagerrak cod	95	85	100	80
DFPO Denmark North Sea, Skagerrak & Kattegat hake	85	80	100	90
DFPO Denmark North Sea sole	90	85	100	90
DFPO Limfjord mussel and cockle fishery	100	100	90	90
DPPO & DFPO North Sea herring	85	100	100	100
Dutch Oyster Association oyster	100	95	100	80
FROM Nord North Sea and Eastern Channel pelagic trawl herring	85	100	100	100
Ekofish Group-North Sea twin rigged otter trawl plaice	95	95	100	80
Germany Lower Saxony mussel dredge and mussel culture	100	85	90	90
Germany North Sea saithe trawl	100	85	90	80

MSC Certified Fisheries	3.1.1	3.1.2	3.1.3	3.1.4
Hastings Fleet mackerel drift net	90	90	80	80
Limfjord oyster dredge	90	90	90	90
MINSA North East Atlantic mackerel	65	95	90	80
Netherlands blue shell mussel	95	85	90	85
Norway North Sea and Skagerrak herring	85	100	100	100
Osprey Trawlers North Sea twin-rigged plaice	90	90	85	75
Pelagic Freezer Trawler Association North Sea herring	95	100	100	100
Schleswig-Holstein blue shell mussel	100	70	100	-
Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea cod	95	85	100	85
SFSAG North Sea haddock	100	100	90	100
SFSAG North Sea saithe	100	100	100	100
SPFPO Swedish North Sea herring	95	85	100	80
Sweden Skagerrak, Kattegat and the Norwegian Deep cold-water prawn	100	95	90	80
UK Fisheries/DFFU/Doggerbank Group saithe	95	95	100	90
Vilsund Blue a/s Limfjord mussel & cockle dredge	100	90	90	90
North Sea brown shrimp	100	95	100	-

The brown shrimp assessment team reviewed the scoring rationales for the three highlighted fisheries in Table 16. A summary of the rationales for the scores of <80 are provided below:

- The MINSA North East Atlantic mackerel fishery scored PI 3.1.1 at 65, owing to a lack of international agreement on the exploitation of the target stock and an effective dispute mechanism.
- The DFA Dutch North Sea *ensis* fishery scored PI 3.1.2 at 75, owing to the lack of effective consultation by national authorities with respect to the management plan for the *ensis* fishery.
- The Schlewwig-Holstein blue mussel fishery scored PI 3.1.2 at 70, owing to a lack of effective consultation by national authorities with respect to the licencing policy for the mussel fishery.

The brown shrimp assessment team consider that the deficiencies highlighted in these assessments are fishery specific and do not apply to the brown shrimp fishery and so harmonisation of the scores is not required.

Furthermore, comparison of the scores assigned for all of the other certified fisheries in Table 16 are not considered to be materially different to those assigned for the brown shrimp fishery and so considered to be harmonised.

4.2 Previous assessments

The German and Dutch North Sea brown shrimp fisheries initially entered full assessment separately in 2013. No assessment reports were published and both assessments were withdrawn from assessment in 2015. The clients worked together and, with the Danish industry, prepared for this current assessment.

4.3 Assessment Methodologies

This assessment of the North Sea Brown Shrimp Fishery was conducted using the FCR version 2.0 (MSC 2014), and with the MSC Full Assessment Reporting Template version 2.0. The default assessment tree was adopted, with no changes made to the text of any default Performance Indicator (PI). The risk-based framework (RBF) was not used.

4.4 Evaluation Processes and Techniques

4.4.1 Site Visits

Notifications of each key step in the assessment process were provided to the MSC, uploaded by the MSC to their website, and advertised through the MSC's 'Fisheries Update'. Known stakeholders were also contacted and advised of the key steps.

The site visit was conducted from the 29th February to the 4th of March, 2016. At least 30 days prior to the site visit, notification of the site visit was made through the MSC's Fisheries Update.

Meetings were held in Schipol Airport Meeting Centre, Utrecht, Den Oever Port, Buesum, Mariahoek and Hamburg. The audit team sought information from all stakeholders on the key aspects associated with the MSC Principles and traceability. They also had chance to review two sieving stations, observe a vessel inspection and inspect a number of shrimp vessels, the fishing gear and sorting equipment.

The following table identifies who participated in the site visit information gathering exercise:

Nature of Organisation	Organisation	Name
All Week		
German Client	Erzeugergemeinschaft der Deutschen Krabbenfischer	Philipp Oberdoeffer
Dutch Client	CVO	Paulien Prent
Acoura	Assessor on behalf of Acoura	Julian Addison
Acoura	Acoura	Billy Hynes
Acoura	Assessor on behalf of Acoura	Gudrun Gaudian
Acoura	Assessor on behalf of Acoura	Paul Knapman
Weds 2 March Onwards		
Danish Client	DFPO	Jonathan B Jacobsen
MSC	MSC FAM	Shaun Mclennan
Date 29th Feb		
Dutch Scientists	IMARES	Tobias Van Kooten
Dutch Scientists	IMARES	Josien Steenberger
Processors	Klaas Puul	Cees Machelsen
Processors	Klaas Puul	Kees Tujip
Ministry	Ministry of Economy	Ton Ljustra
Dutch NGOs	Waddenvereniging	Wouter Vander Hej
Dutch NGOs	Consultant for WWF & NSF	Bruce Robson
Dutch NGOs	NSF	Ann Doecksen
Dutch NGOs	Natuurminumenten	Wilfred Alblas
Dutch Client	President of CVO	Johan K. Nooitgedagt
Date 1st March		

Dutch Client	President of CVO	Johan K. Nooitgedagt
Client Project Manager	Zuidema Project Management	Jan-Martien Zuidema
Dutch Fishermen	Red Gebr de Visser	Cole Visser
Dutch Fishermen	Visafslag Hollands Noorden	Gerland Smied
Dutch Fishermen	PO Wiegma	Gert Yan Wiegma
Dutch Fishermen	PO Wiegma	Jan de Haan
Independent Ecologist	Ziltwater	Zwanette Jager
Date 2nd March		
Danish Fisher	Romo Fishers	Lasse Guldbergsorn
MSC	MSC Outreach	Vivien Kudelka
German Fisher	German Fisher	Jan Möller
German Fisher	German Fisher	Stefan Schneidereit
German Fisher	German Fisher	Rainer Möller
German NGOs	LWK	Holger Tilch
German NGOs	Schutzstation Wattenmeer	Alea Meuser
German NGOs	Schutzstation Wattenmeer	Rainer Borcherding
German NGOs	National Parks	Eva Lager
German NGOs	National Parks	Britta Diederichs
German NGOs	WWF Germany	Hans-Ulrich Rösner
Client Project Manager	HMPP	Björn Sellschopp
Date 3rd March		
German Science	Thunen Institute	Gerd Kraus
German Science	Thunen Institute	Torsten Schulze
German Science	Uni Hamburg	Axel Temming
German Science	Uni Hamburg	Marc Hufnagl
Processor	Heiploeg	Dirk-Jan Paleviet
Processor	Heiploeg	Thomas Collande
Processor	Heiploeg	Rüdiger Kock
German Science	JaFiCon	Thomas Neudecker
Date 4th March		
Client Project Manager	Marine Science Service	Ralf Vorberg
German Science	Uni Hamburg, Umweltbundesamt Berlin	Rüdiger Berghahn

4.4.2 Evaluation Techniques

Several sources of information provided the basis of the conclusions of this assessment, including a review of information and references provided by the client prior to the site visit, information and data sourced during site visit meetings held with stakeholders involved with the fishery, and review of literature and information provided following site visit meetings. Peer review and stakeholder comment on the draft report also provide a very important contribution to the assessment process.

The MSC Principles and Criteria set out the requirements for sustainable fishing. These Principles and Criteria have subsequently been used to develop a standardized, default assessment tree (within the MSC Certification Requirements), including Performance Indicators (PIs) and Scoring Issues (SIs), by the MSC and its advisory boards, which have been used in the assessment of this fishery.

Each SI may be scored at three scoring guideposts (SGs), which define the level of performance that is required to achieve 100, 80 (the passing score), and 60 scores; 100 represents a theoretically ideal level of performance and 60 a measurable shortfall. If a fishery does not meet the minimum SG 60 level of performance for any SI, the fishery would fail its assessment.

For each PI, the performance of the fishery is evaluated, and a score issued. In order for the fishery to achieve certification, an overall weighted average score of 80 is necessary for each of the three Principles and no SI should score less than 60. Scores are issued using a minimum increment of five. Average scores for each Principle are rounded to one decimal place.

Following the review and synthesis of information available, the assessment team discussed each individual SI to assess the evidence is present to assess the level of performance that the fishery achieved. Justification of the scoring is provided in the scoring table presented in Appendix 1. Scores for each PI were determined based on guidance outlines in Section 7.10 of the Fisheries Certification Requirements v2.0. Scores were agreed by each team member.

The elements that were scored for each PI under Principle 1 and 2 are listed in Table 17 below. Scores allocated for each PI were entered into the MSC Fishery Assessment Scoring Worksheet in order to attain the overall Principle scores; these scores are shown in section 6.2 of this report.

Table 16 Scoring elements

Component	Scoring elements	Main / Not main	Data-deficient?
P1	Brown shrimp (*Crangon crangon*)	Main	No
P2 – Primary species	Plaice (*Pleuronectes platessa*)	Main	No
	Sole (*Solea solea*)	Main	No
	Herring (*Clupea harengus*)	Main	No
	Whiting (*Merlangius merlangus*):	Main	No
	Cod (*Gadus morhua*):	Main	No
	Sprat (*Sprattus sprattus*)	Minor	No
	Hake (*Merluccius merluccius*)	Minor	No
	Sandeel (*Ammodytes* spp)	Minor	No
	Sea bass (*Dicentrarchus labrax*)	Minor	No
	Atlantic mackerel (*Scomber scombrus*):	Minor	No
	Brill (*Scophthalmus rhombus*)	Minor	No
	Turbot (*Scophthalmus maximus*)	Minor	No
	Dab (*Limanda limanda*)	Minor	No
	Flounder (*Platychthys flesus*)	Minor	No
	Salmon (*Salmo salar*)	Minor	No
P2 – Secondary species	Gobies (*Pomatoschistus sp*.)	Minor	No
	European smelt (*Osmerus eperlanus*)	Minor	No
	Hook-nose (*Agonus cataphractus*)	Minor	No
P2 - ETP	River lamprey (*Lampetra fluviatilis*)	N/A	No
	Twaite shad (*Alosa fallax*)	N/A	No
	European eel (*Anguilla anguilla*)	N/A	No
P2 - Habitat	Muddy sand	N/A	No

Component	Scoring elements	Main / Not main	Data-deficient?
P2 - VME	Sabellaria reefs	N/A	No
	Seagrass beds (*Zostera noltii* and *Z. marina*)	N/A	No
	Mussel beds (*Mytilus edulis*):	N/A	No
P2 - Ecosystem	Brown Shrimp (*Crangon crangon*)	N/A	No
	Benthic ecosystems associated with: muddy sand, sabellaria, seagrass, mussels beds	N/A	No

5 Traceability

5.1 Eligibility date

The target eligibility date for the fishery is the date of PCDR publication. It is considered that the existing enforcement and monitoring of the fishery, is sufficiently robust to give confidence in the proposed eligibility date. Vessels within the client group land to designated ports and to sievage stations that will have chain of custody certification.

5.2 Traceability within the fishery

Traceability of product from the sea to the consumer is important so as to ensure that the MSC standard is maintained. There are several aspects to traceability that the MSC require to be evaluated: Traceability within the fishery; at-sea processing; at the point of landing; and subsequently the eligibility of product to enter the chain of custody. Key traceability elements are as follows:

- Vessels are licenced to fish for brown shrimp – which has a relatively well defined distribution.
- At-sea monitoring is undertaken via enforcement vessels and aircraft;
- VMS monitoring is undertaken on all vessels over 12 m in length, and all vessels over 15 m in length must carry Automatic Identification System (AIS);
- Trans-shipping of products is not permitted;
- Landing at sieving stations is restricted to client group members.
- At-sea processing is limited to boiling the catch on-board. No risks of mixing certified and non-certified shrimp have been identified with this process.
- The UoC extends throughout the distribution of brown shrimp in the North Sea and so there is no risk of certified product within the UoC being mixed with product from outside the UoC.
- The two key buyers on brown shrimp already hold MSC chain of custody certifications and so have demonstrated their ability to ensure chain of custody requirements are met.

Table 17 below reviews and summarises the possible traceability risks in the fishery.

Table 17 Traceability factors within the fishery:

Traceability Factor	Description of risk factor if present. Where applicable, a description of relevant mitigation measures or traceability systems (this can include the role of existing regulatory or fishery management controls)
Potential for non-certified gear/s to be used within the fishery.	There are no other forms of commercial fishing gear that are able to legally use small enough mesh that will allow them to catch brown shrimp. So there is no risk in non-certified gear/s being used within the fishery.
Potential for vessels from the UoC to fish outside the UoC or in different geographical areas (on the same trips or different trips)	The UoC has been described such that it encompasses the distribution of brown shrimp in the North Sea. There is a brown shrimp fishery on the east coast of England in and around The Wash. However, none of the vessels in the UoC have access to that fishery. Therefore, there is no risk of vessels being able to fish outside of the UoC and still being able to catch brown shrimp.
Potential for vessels outside of the UoC or client group fishing the same stock	There are vessels that are able to fish for brown shrimp that are not presently part of the client group. Only vessels that are members of the client group are able to land to the sievage stations.
Risks of mixing between certified and non-certified catch during storage, transport, or handling activities (including transport at sea and on land, points of landing, and sales at auction)	The vessels that are not in the client group are not able to land to the sievage stations. The client group is aware of the chain of custody requirements beyond the point of landing – this was confirmed by the assessment team during the site visit to sievage stations at Den Oever and Buesum. The risk of mixing certified and non-certified catch during storage, transport, or at points of landing or auction is considered to be minimal.
Risks of mixing between certified and non-certified catch during processing activities (at-sea and/or before subsequent Chain of Custody)	Brown shrimp is cooked on board vessels while at sea. The risk of mixing certified and non-certified processed product at sea is considered to be minimal, for reasons described above. The two main buyers of brown shrimp already have chain of custody certification for other certified product and so are well versed in the traceability requirements set by MSC. The risk to chain of custody post landing is therefore considered to be minimal.
Risks of mixing between certified and non-certified catch during transhipment	No transhipment is allowed in the fishery nor is there any incentive to do so. So there is considered to be no risk with respect to traceability.
Any other risks of substitution between fish from the UoC (certified catch) and fish from outside this unit (non-certified	No other risks of substitution between fish from the UoC (certified catch) and fish from outside this UoC (non-certified catch) before subsequent chain of custody is required were identified by the assessment team or highlighted by stakeholders at the site visit.

Traceability Factor	Description of risk factor if present. Where applicable, a description of relevant mitigation measures or traceability systems (this can include the role of existing regulatory or fishery management controls)
catch) before subsequent Chain of Custody is required	

5.3 Eligibility to enter further chains of custody

The limit of identification of landings is the landing of brown shrimp at authorised ports where appropriate recording and monitoring of landings may take place. The list of authorised ports is provided in Appendix 7.

To be eligible to carry the MSC logo, product from the certified fishery must enter into separate Chain of Custody certifications at landing unless the shrimp are sold while at sea thereby covered by the purchasers' Chain of Custody.

5.4 Eligibility of Inseparable or Practicably Inseparable (IPI) stock(s) to Enter Further Chains of Custody

There is another Crangon species, *C. allmanni*, which can occasionally be caught in the trawls in the brown shrimp (*C. crangon*) fishery. However *C. allmanni* is a deeper water species, found in depths from 20 m to 250 m so it is not commonly found in the shallower areas in which the brown shrimp fishery primarily takes place. It can sometimes be difficult to distinguish *C. allmanni* from *C. crangon*, particularly for small individuals but, when boiled, *C. allmanni* has a very distinctive pink colour which makes it clearly distinguishable from *C. crangon*. As the catches of *C. crangon* are generally boiled on board, there is no chance that *C. allmanni* will be mistaken for *C. crangon*, and any individuals of *C. allmanni* are discarded because they have no commercial value. As *C. allmanni* are not caught in significant numbers when targeting *C. crangon*, and the two species are readily distinguishable on board the vessel following boiling, the assessment team concluded that *C. allmanni* should not be considered as an Inseparable or Practicably Inseparable (IPI) species.

Once through the sieving stations, the shrimp undergo a hand peeling process at which point any *C. allmanni* caught is easily identified and removed as they are of no commercial value.

6 Evaluation Results

6.1 Principle level scores

Table 5: Final Principle Scores

Final Principle Scores	
Principle	**Score**
Principle 1 – Target Species	80.0
Principle 2 – Ecosystem	80.3
Principle 3 – Management System	84.8

6.2 Summary of PI level scores

Principle	Component	Wt.	Performance Indicator (PI)		Wt.	Score
One	Outcome	0.333	1.1.1	Stock status	0.5	70
			1.1.2	Stock rebuilding	0.5	90
	Management	0.667	1.2.1	Harvest strategy	0.25	75
			1.2.2	Harvest control rules & tools	0.25	80
			1.2.3	Information & monitoring	0.25	80
			1.2.4	Assessment of stock status	0.25	85
Two	Primary species	0.2	2.1.1	Outcome	0.333	80
			2.1.2	Management strategy	0.333	95
			2.1.3	Information/Monitoring	0.333	70
	Secondary species	0.2	2.2.1	Outcome	0.333	80
			2.2.2	Management strategy	0.333	90
			2.2.3	Information/Monitoring	0.333	70
	ETP species	0.2	2.3.1	Outcome	0.333	80
			2.3.2	Management strategy	0.333	85
			2.3.3	Information strategy	0.333	70
	Habitats	0.2	2.4.1	Outcome	0.333	95
			2.4.2	Management strategy	0.333	75
			2.4.3	Information	0.333	75
	Ecosystem	0.2	2.5.1	Outcome	0.333	80
			2.5.2	Management	0.333	80
			2.5.3	Information	0.333	80
Three	Governance and policy	0.5	3.1.1	Legal &/or customary framework	0.333	100
			3.1.2	Consultation, roles & responsibilities	0.333	95
			3.1.3	Long term objectives	0.333	100
	Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.25	80
			3.2.2	Decision making processes	0.25	70
			3.2.3	Compliance & enforcement	0.25	65
			3.2.4	Monitoring & management performance evaluation	0.25	70

Overall weighted Principle-level scores	**Score**
Principle 1 - Target species	**80.0**
Principle 2 - Ecosystem	**80.3**
Principle 3 - Management	**84.8**

6.3 Summary of Conditions

Table 6 is for summary purposes only. See Appendix 1.3 of this report template for full requirements for documenting conditions in accordance with the MSC scheme requirements.

Table 6: Summary of Conditions

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/NA)
1	The Client shall ensure that by the fourth surveillance audit evidence exists that the harvest strategy is achieving its objectives even if it has not been fully tested.	1.2.1	N
2	The Client shall ensure that by the fourth surveillance audit there is quantitative information available to adequately assess the impact of the UoA on the main primary species with respect to status.	2.1.3	N
3	The Client shall ensure that by the fourth surveillance audit there is adequate quantitative information to assess the impact of the UoA on main secondary species with respect to their status.	2.2.3	N
4	The Client shall ensure that by the fourth surveillance audit there is adequate information to measure trends and support a strategy to manage impacts on ETP species.	2.3.3	N
5	The Client shall ensure that by the fourth surveillance audit there is some quantitative evidence that the UoA complies with its management requirements and with protection measures afforded to VMEs by other MSC UoAs / non-MSC fisheries, where relevant.	2.4.2	N
6	The client shall ensure by the fourth surveillance audit that information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.	2.4.3	N
7	The client shall ensure by the fourth surveillance audit that: 1. There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives. 2. Information on the fishery's performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	3.2.2	N
8	The client shall ensure by the fourth surveillance audit that:	3.2.3	N

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/NA)
	1. A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. 2. Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence. 3. Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.		
9	The client shall ensure by the fourth surveillance audit the fishery-specific management system is subject to regular internal and occasional external review.	**3.2.4**	**N**

6.4 Recommendations

Given the recent implementation of the management plan and the clear commitment to review the plan, the assessment team have set out below some recommendations that may further enhance the management and make a positive contribution to ongoing efforts to ensure the long term sustainability of the fishery. The recommendations are not obligatory requirements nor are they auditable.

The assessment team recommends that:

1. In addition to the current technical measures, the Client should at a future review, evaluate the potential benefits of seasonal or real time closures (RTCs) (PI 1.2.1).
2. A full inventory of all vessels is maintained and updated on an annual basis and that the Steering Group reports annually on whether any systematic changes in fishing vessels or gear or fishing behaviour had been identified which could increase efficiency, and would therefore require the revision of the current LPUE reference points (PI 1.2.2).
3. Consideration be given to developing a fishery-independent survey approach to monitoring monthly LPUE patterns in relation to reference values in preference to the current approach of monitoring commercial LPUE (PI 1.2.2).
4. Standardised LPUE data should be collected across all national fleets (PI 1.2.3).
5. Robust estimates of the level of small shrimp discarded should be obtained (PI 1.2.3).
6. The brown shrimp stock assessment should undergo regular full external peer review either through the ICES Review Group process or through commissioned peer reviews (PI 1.2.4).
7. A Productivity Susceptibility Analysis (PSA) is conducted on all those species for which no reference points are available. PSA is a semi-quantitative and rapid risk assessment tool that relies on the life history characteristics of a stock (i.e., productivity) and its susceptibility to the fishery in question. This would constitute a risk analysis for each species, calculating an individual score for

each species (see also Patrick et al 2009). In the case of this fishery, where so many species are involved, the client should provide such a list of PSA scores for each bycatch species, as part of the regular bycatch analysis (PIs 2.2.3).

8. In the interest of transparency and to allay concerns some stakeholders have expressed about the effective implementation of the management plan, the following additional information is made publicly available (PI 3.2.2):
    - Any non-compliance of the management plan and action taken including penalties/sanctions;
    - Maps showing the location of all closed areas and overlays of VMS or AIS data; and,
    - Monthly sievage and LPUE reports.
9. Future iterations of the management plan include an explicit statement that the precautionary approach, as defined by MSC, will be adopted within the decision making process (PI 3.2.2).

6.5 Determination, Formal Conclusion and Agreement

Following this decision by the assessment team, and review by stakeholders and peer-reviewers, the determination will be presented to Acoura's decision making entity that this fishery has passedit assessment and should be certified.

(REQUIRED FOR PCR)

1. The report shall include a formal statement as to the certification action taken by the CAB's official decision-makers in response to the Determination recommendation.

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Appendix 1 Scoring and Rationales

Evaluation Table for PI 1.1.1 – Stock status

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Stock status relative to recruitment impairment			
	Guide post	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	Y
	Justification	Recruitment of Crangon is driven more by environmental factors and abundance of predators (in years when predator abundance is high) than by the level of stock biomass and the exploitation rate in the fishery. Studies show that it is possible to predict recruitment based on environmental factors such as wind, water temperature, freshwater run-off etc. The Crangon stock is distributed over a very wide geographical area and there is evidence from the autumn stock surveys and fisheries data that in all years there are high numbers of small shrimps. There is no evidence that recruitment has ever been impaired in the recent history of the fishery. The main indicator of stock biomass, landings per unit effort (LPUE), was at its lowest level in 1990 when predator abundance was high, but the stock fully recovered within two years, providing evidence that even at the lowest point in the time series of biomass, there was no evidence that recruitment was impaired. Current estimates of stock biomass based on time trends of LPUE are now very much higher than the lowest level observed in 1990. To meet the SG100, evidence would normally be based on a quantitative rationale, i.e. 95% confidence intervals from an analytical assessment. Without a formal analytical assessment of the Crangon stock, such quantitative evidence is not available, but the assessment team considered that the evidence presented above can be interpreted as to there being a high degree of certainty that the stock is currently above the PRI. The SG100 is met therefore.		
b	Stock status in relation to achievement of MSY			
	Guide post		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		N	N
	Justification	Crangon is a short-lived, fast-growing, highly productive species, so the fishery is based primarily on annual production, and in consequence there is no conventional full analytical assessment of the brown shrimp stock which allows a determination of long term maximum sustainable yield (MSY) and associated reference points. As estimates of stock biomass are difficult to obtain, ICES scientific advice is that ensuring that the highest possible yield from each year's cohort of recruits is the best management approach. As a proxy to assessing the status of the brown shrimp stock in relation to an estimate of long term MSY, the approach has therefore been to assess current annual fishing mortality against two proxies for Fmsy (F_{max} and $F_{0.1}$). Fishing at F_{max} or $F_{0.1}$ would be expected to provide the highest possible yield-per-recruit from each annual cohort of recruits. A yield-per-recruit model developed specifically for Crangon allows the estimation of both F_{max} and $F_{0.1}$. Current fishing mortality can be estimated by determining total mortality		

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	of commercial sized brown shrimp, and then partitioning that total mortality into fishing and natural mortality using information on predator abundance and consumption rates of brown shrimp. In all recent years, prior to the 2016 increase in mesh size the estimated fishing mortality has been significantly higher than F_{max} and $F_{0.1}$, indicating that current fishing mortality is above the level that would give the highest long-term sustainable yield. It can be concluded therefore that the stock is not at a level consistent with MSY. In addition, modelling results from the CRANNET Project demonstrate that yield-per-recruit could be increased significantly by increasing the current minimum mesh size, and simulation studies of the application of the harvest control rules (which reduce fishing effort mid-season if observed LPUE drops below the LPUE reference points) demonstrate that the brown shrimp stock is currently growth-overfished. The SG80 is not met therefore and PI 1.1.2 is scored. [Assessment team's note: Whilst the SG80 is not met for this performance indicator and the MSC CRv2.0 requires that each performance indicator that receives a score of less than 80 should have its own condition, the MSC Interpretations Page advises that "*In the case that the stock is depleted, and PI 1.1.1 scoring issue (b) scores less than 80, the CAB may present a rationale that PI 1.1.3 in CRv1.3 fulfils the requirements of that condition.*" The assessment team therefore has not raised a condition as they considered that the scoring of PI 1.1.2 (previously PI 1.1.3 in CRv1.3) fulfils the need of a condition.]		
References	Berghahn, 1996 Neudecker et al., 2011 Temming and Hufnagl, 2014 ICES 2015 CRANNET report Steenbergen et al., 2015 Siegel et al. 2005		
Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	Within seasons: Limit reference point for monthly LPUE	The limit reference point is set as 50% of the Average LPUE per month in 2002 and 2007 (see Table 2). The monthly values vary from 8.7 to 19 kg/hour at sea.	The limit reference point varies from month to month, so it is not possible to provide up-to-date information on current stock status in relation to the reference points.
Reference point used in scoring stock relative to MSY (SIb)	Within seasons: Trigger reference point for monthly LPUE. (The harvest strategy aims to keep LPUE within a target range above this reference point. The value of the LPUE reference point cannot be directly related to Bmsy, but the aim is to keep the LPUE at a level which could be considered to be similar or consistent with Bmsy.)	The trigger reference point is set as 70% of the Average LPUE per month in 2002 and 2007 (see Table 2). The monthly values vary from 12.2 to 26.5 kg/hour at sea.	The trigger reference point varies from month to month, so it is not possible to provide up-to-date information on current stock status in relation to the reference points.

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	Annual F_{max}, $F_{0.1}$	F_{max} = 1.6 $F_{0.1}$ = 2.2	Current estimated F = 4.9 F/F_{max} = 3.1, $F/F_{0.1}$ = 2.2
OVERALL PERFORMANCE INDICATOR SCORE:			**70**
CONDITION NUMBER (if relevant): Whilst the SG80 is not met for this performance indicator and the MSC CRv2.0 requires that each performance indicator that receives a score of less than 80 should have its own condition, the MSC Interpretations Page advises that, "*In the case that the stock is depleted, and PI 1.1.1 scoring issue (b) scores less than 80, the CAB may present a rationale that PI 1.1.3 in CRv1.3 fulfils the requirements of that condition.*" The assessment team therefore has not raised a condition as they considered that the scoring of PI 1.1.2 fulfils the need of a condition.			

Evaluation Table for PI 1.1.2 – Stock rebuilding

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guide post	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	Y		N
	Justification	Crangon is a short-lived, fast-growing, highly productive species for which two generations is less than 5 years. The re-building strategy set out in the Brown Shrimp Management Plan is considered by the Steering Committee of the Brown Shrimp Cooperative MSC Group as an MSY-strategy as it aims to avoid growth overfishing by maximising landings per recruit within an individual cohort of shrimps through improving selectivity to reduce the catch of small shrimp. This will be achieved by increasing the mesh size in stages from 20 mm to 26 mm and reducing the rows of mesh in the trawl net based on evidence from the CRANNET Project. The re-building strategy will also monitor the level of fishing effort, and if fishing effort appears to be increasing in response to the new gear regulations, then measures such as buy-back and capping of licenses will be taken to reduce fishing effort. This multi-year plan is expected to be complete by 1 May 2020. In addition, within a fishing season, the introduction of a harvest control rule will permit the level of fishing effort to be reduced immediately if LPUE drops below the reference levels, and whilst the HCR is designed primarily in order to avoid any risk of recruitment impairment, such in season reductions in fishing effort will also increase the yield-per-recruit of shrimps in each cohort and reduce the risk of growth overfishing. The re-building strategy aims to ensure that yield-per-recruit from each cohort of shrimps is maximized by 2020. The SG60 therefore is met. The re-building strategy recognises that there will be inevitable short term losses associated with an increase in mesh size, and therefore the increase will be introduced in three stages. The three-stage process incorporates continuous scientific monitoring within the timeframe set out to allow for a scientific evaluation of the re-building strategy. It cannot be concluded therefore that the shortest practicable timeframe is specified, and therefore the SG100 is not met.		
b	Rebuilding evaluation			
	Guide post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	Y	Y	Y
	Justification	The re-building strategy is based upon reducing fishing effort to allow cohorts of brown shrimps to grow to an optimum harvesting size, primarily by improving the selectivity of the trawl by reducing the catches of undersized shrimps. This		

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe
		approach has been developed through experimental fishing studies (CRANNET report) and detailed simulation modelling (e.g. Temming and Hufnagl, 2014; CRANNET report), which clearly demonstrate that reductions in fishing effort and changes in gear selectivity are highly likely to be successful in optimizing harvest rates within the fishery and rebuilding the stock within the specified timeframe. In-season monitoring of LPUE is in place, and if the LPUE drops below pre-defined reference points, fishing effort will be reduced to allow additional growth of individuals in the current cohort. Simulation modelling by Steenbergen et al., provided strong evidence that such reductions in fishing effort mid-season would provide additional yield from the fishery. Previous observations from the brown shrimp fishery also show that reductions in fishing effort within season can lead to increased yield from the year's cohort. In the 2010-2011 season prices for shrimp dropped to such a low level that most of the fleet were "on strike" and stopped fishing in April and May 2011. The result of this strike was that LPUE increased dramatically after the strike, even after correcting for the strong 2010-2011 year class. This confirms that for fast-growing species such as Crangon, a reduction in fishing effort leads to an increased LPUE immediately on resumption of fishing and that reduced mortality on undersized shrimps can also lead to increased yields. It is highly likely therefore from both modelling studies and previous performance that the stock will be rebuilt within the specified timeframe. The SG100 therefore is met.
References		Brown Shrimp Management Plan Temming and Hufnagl, 2014 Steenbergen et al., 2015 CRANNET report ICES 2015
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Harvest strategy design			
	Guide post	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	Y	Y
	Justification	The harvest strategy is underpinned by the EU Common Fisheries Policy for which one of the key objectives is that: "The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield." A suite of EU Fisheries Control and Technical Conservation measures apply to the brown shrimp fishery, and there are various national regulations that apply to the fleets of the Netherlands, Germany and Denmark. The harvest strategy is embedded within the Brown Shrimp Management Plan which came into force in January 2016. The objective of the Management Plan is a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimized effects on the marine ecosystem. This Management Plan has not been ratified by national governments, but all vessels within the UoC will be subject to the regulations and controls detailed in the Management Plan. Key elements of the harvest strategy are a limit on the number of vessels by country and the overall fishing power (kW), a limit on annual days-at-sea fishing, and a range of regulations determining the nature of the gear permitted in the fishery. These include beam length, weight of the gear, a minimum mesh size of 20mm in any part of the gear, and the requirement that the trawl must contain a sieve net with a maximum opening of 70 mm, or a sorting grid with a maximum bar spacing of 20mm. All catch must be sorted on board to ensure high survival of unwanted catch. The harvest strategy also includes a limit on the number of days that can be fished each week if LPUE rates drop below reference levels as set out in the harvest control rule (see rationale for PI 1.2.2). There is currently no TAC in the fishery, and no minimum landing size. There are significant discards of non-commercial size shrimps (<50mm), but the survival rate of discarded brown shrimp is considered to be high. The shrimp fishery is based essentially on harvesting the annual recruits to the fishery, and without a conventional analytical stock assessment, there is no formal evaluation of MSY. The basic harvest strategy is therefore one of 'constant escapement' similar to other shrimp fisheries with a short-life cycle, i.e. ensure enough shrimps reproduce and provide recruitment to the next generation. This is the underlying rationale for the LPUE-based harvest controls rules (see PI 1.2.2), although in-season reductions in fishing effort triggered by the harvest control rules will also mitigate against growth overfishing. In addition the harvest strategy seeks to ensure that each cohort of recruiting shrimps is harvested optimally through setting a minimum mesh size and requiring that all catches are sorted on board to ensure that survival of discarded smaller shrimps is maximised. Recent experimental fishing studies and simulation modelling concluded that current yield-per-recruit could be increased through more selective fishing gear and therefore the harvest strategy includes step-wise increments in mesh size.		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
		As part of the harvest strategy, there is a requirement within the Management Plan to provide LPUE data through log books, landings declarations at auctions and electronic log books for larger vessels. All vessels must have VMS on board, and within the Netherlands fishery, there are plans to introduce a "black box" system from 1 January 2017 which will provide more detailed information on fishing vessel activity in relation to closed areas. In conclusion, the assessment team considered that the harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80. The SG100 is met.		
b	Harvest strategy evaluation			
	Guide post	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	N	N
	Justification	The harvest strategy contains a series of elements that are considered appropriate to managing a shrimp fishery. Prior experience of other fisheries has shown that limits on the number of licences and limits on the number of days fishing, minimum mesh sizes, gear restrictions that reduce capture and discarding of small individuals of both shrimps and bycatch species, and in-year monitoring and control of fishing effort in response to changes in LPUE has proved to be a successful strategy for achieving stock management objectives. Past experience in this fishery when fishing effort was very low or zero (industrial action('strikes')) demonstrated that periods of low or zero fishing effort were followed by high catch rates of large shrimps. The SG60 therefore is met. At present there is good evidence that large numbers of small shrimps are being harvested before they reach an optimum size, and that landings per recruit could be significantly increased. The Management Plan incorporates a strategy for improving the landings per recruit through incremental increases in the minimum mesh size, but such measures have yet to be fully implemented. Whilst the Management Plan includes a strategy for ensuring that too many small shrimps are not discarded, this relates primarily to minimum commercial size not to optimum yield size. So the harvest strategy is working as far as the minimum commercial size is concerned as catches are sieved on board, and then also sieved at the processing factories, but from a stock management viewpoint the strategy does not appear to be working as the mesh size is too low and sieving still lands shrimps that are too small. Within the Management Plan, the limits on fishing effort include a limit on the number of licences, a limit on the number of days fishing and on engine power, but it is clear that there is still scope within the Management Plan for fishing effort to increase through, for example, some vessels fishing more days than they had fished previously. In addition, outside the Management Plan there appear to be a number of dormant licences, and it is not clear that total fishing effort has been fully capped. The assessment team concluded therefore that the harvest strategy has yet to achieve its objectives because the current mesh size allows the capture of too many small shrimps (resulting in growth overfishing of individual cohorts) and there is the potential for an increase in fishing effort both within the Management Plan and through the activation of dormant licences. SG80 therefore is not met and a condition is raised. The Brown Shrimp Management Plan was implemented in January 2016, and therefore it has not yet been fully evaluated and so SG100 is not met.		
	Harvest strategy monitoring			

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
c	Guide post	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
	Justification	Log books, either paper or electronic, record monthly LPUE, and VMS is installed on all but 8 vessels in the fleet to allow the checking of vessel positions in relation to closed areas. Vessel boardings are carried out to check gear and whether engine power regulations are being observed, and both POs and sieving stations are also inspected by independent control agencies. The SG60 is met.		
d	Harvest strategy review			
	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			N
	Justification	The harvest strategy that is embedded within the Brown Shrimp Management Plan was implemented in January 2016. Section D of the Management Plan states that the Brown Shrimp Co-operative MSC Group will acquire scientific advice from a relevant scientific institution every year to enable an evaluation of whether the Management Plan is delivering on its objectives. For example, a detailed sampling programme has been implemented to evaluate changes in mesh size. However, as the Management Plan was implemented only this year, it cannot yet be considered to have been reviewed and improved as necessary. The SG100 is not yet met.		
e	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Sharks are not a target species and therefore this scoring issue is not scored.		
f	**Review of alternative measures**			
	Guide post	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Justification	There are significant catches of small unwanted shrimp (and other non-target species) in the trawl, and there is a long history of evaluation of measures for reducing the level of unwanted catches through, for example, changes in mesh size, the use of sorting grids, and the mandatory use of a sieve net. Regulations have been introduced in the past and form part of the current Brown Shrimp Management Plan, and new regulations on increasing the mesh size will be implemented on 1 May 2016. The Client has carried out a thorough review of alternative measures for reducing unwanted catches, and this review is reproduced in Appendix 4. The Management Plan requires that the measures for reducing unwanted catch are reviewed regularly, and the Steering Group has commissioned the University of Hamburg to carry out a review of the effectiveness of the increase in mesh size currently being implemented within the Management Plan. The SG80		

PI 1.2.1		There is a robust and precautionary harvest strategy in place	
		therefore is met, but as the review of alternative measures has not previously taken place on a biennial basis, SG100 is not met. The assessment team considered that the review of alternative measures undertaken by the Client and reproduced in Appendix 4 fulfils the requirements needed to meet the SG80, but recommends that in addition to the current technical measures, the Client should at a future review evaluate the potential benefits of seasonal or real time closures (RTCs).	
References		Brown Shrimp Management Plan EU Common Fisheries Policy EU Council Regulation 850/98	
OVERALL PERFORMANCE INDICATOR SCORE:			**75**
CONDITION NUMBER (if relevant):			**1**

Evaluation Table for PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	Y	N
	Justification	There are harvest control rules in place which are triggered by changes in LPUE observed during each month. There are 5 reference points based on 70%, 65%, 60%, 55% and 50% of the average monthly LPUE observed in 2002 (a poor year) and 2007 (an average year). If the LPUE drops below the precautionary reference point (reference point 1) of 70%, then restrictions to weekly fishing effort are triggered. The fishing effort is reduced in a step-wise fashion as the observed LPUE drops below each successive reference point, and when LPUE drops below the limit reference value of 50%, then vessels are permitted to fish/ be at sea only a single day per week. The aim of reducing fishing effort within season is to allow smaller shrimps to grow to a larger size during the season before capture and to ensure that there is no risk of recruitment failure. The LPUE reference points are considered to be highly precautionary and therefore even if the observed LPUE drops below reference point 5 (the limit reference point) the stock would still be considered to be well above the point at which recruitment would be impaired. It can be concluded therefore that well-defined HCRs are in place which reduce the exploitation rate as the point of recruitment impairment is approached. The key rationale underlying the HCRs is to ensure that recruitment impairment does not occur, and the planned increase in mesh size over the next 4 years outlined in the Management Plan is the key element within the harvest strategy which is being implemented to ensure that the estimated fishing mortality is maintained at the Fmsy proxies, which would ensure that the stock is kept at a level consistent with or above MSY. However the Management Plan is also focussed on keeping the fishery within the target range above 70% of the average LPUE observed historically (reference point 1). In that sense, although there is no direct link between in-season LPUE values and a target reference point framed in terms of Maximum Sustainable Yield (MSY), the upper threshold could be considered to work in a similar way to the ICES reference point MSYBtrigger above which management aims to keep the stock in order that it may be within a target range around Bmsy.The SG80 therefore is met. The approach is unlikely to keep the stock fluctuating at or above a target level consistent with MSY, so SG100 is not met.		
b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
	Met?		Y	N
	Justification	The robustness of the setting of the LPUE reference points and the HCRs to uncertainty have been investigated in detail by Temming et al. (2013) and Steenbergen et al. (2015). Uncertainties in relation to the level at which the LPUE reference points should be set were considered and the agreed reference levels of 2002 and 2007 were considered to be highly precautionary, as observed LPUEs in these years were significantly higher than the lowest observed value in the time series. The use of the whole fleet to obtain an estimate of current LPUE was considered essential to take into account variation between the various sectors of the fleet, and that seasonal variations should be taken into account, hence the use of monthly LPUE reference points. Heterogeneity within the various national fleets was observed to be greater than between national fleets, and so a single LPUE for all national fleets was considered appropriate, particularly given that the national fleets are all fishing a single North Sea-wide stock. An analysis presented by Günther et al. (2016) in response to Danish fishermen's concern that estimated LPUEs for the whole fleet would not give sufficient weighting to the small Danish fleet concluded that a single LPUE for the whole fleet from all nations provides a more precautionary set of reference points than disaggregating into separate reference points for the different fleets. The current LPUE reference points are based on kg / hour at sea, but the Management Plan includes future collection of effort data in terms of hours at sea, kw hours at sea, and also hours fished and kw hours fished, the latter of which are considered to give better estimates of LPUE, and hence reduce uncertainty. Following the review of the robustness of the HCRs to uncertainties, the assessment team concluded that the HCRs have been set at a precautionary level and are likely to be robust to the <u>main</u> uncertainties. The SG 80 therefore is met. However not all uncertainties are taken into account and therefore the SG100 is not met. One uncertainty that is not taken into account by the HCRs is changes in LPUE of individual vessels due to "technological creep". It is recommended therefore that a full inventory of all vessels is maintained and updated on an annual basis and that the Steering Group reports annually on whether any systematic changes in fishing vessels or gear or fishing behaviour had been identified which could increase efficiency, and would therefore require the revision of the current LPUE reference points. The assessment team also recommends that consideration be given to developing a fishery-independent survey approach to monitoring monthly LPUE patterns in relation to reference values in preference to the current approach of monitoring commercial LPUE.		
c	**HCRs evaluation**			
	Guidepost	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	Y	N
	Justification	Prior experience in the Crangon fishery shows that if you close an area or after an industrial action('strike'), then you catch large numbers of large shrimps, so the reduction in fishing effort is a suitable tool for increasing the yield from an individual cohort of shrimps. All available modelling studies also demonstrate that reductions in fishing effort and improvements in selectivity of the gear lead to higher yield-per-recruit from an individual cohort. The SG80 therefore is met.		

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place	
		Whilst reductions in the number of days fishing were implemented in the fisheries in 2016 in response to observed reduced LPUEs, and catch rates increased after the effort reduction, the new HCRs have yet to be fully tested under a range of observed LPUEs, and so to date there is not sufficient evidence to conclude that the tools in use are effective in achieving the exploitation levels required under the HCRs. The SG100 is not met. For example, it is not clear how fishers' behaviour may change in relation to significant restrictions in days at sea, how markets will respond to changes in size compositions of landings, and how predation rates may change in response to increased abundance of large shrimps. For example, there have been recent significant increases in abundance of marine mammals in areas of high shrimp abundance.	
References		Brown Shrimp Management Plan Temming et al. 2013 Steenburgen et al. 2015 Günther et al. 2016	
OVERALL PERFORMANCE INDICATOR SCORE:			**80**
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
	Justification	Recent genetic studies backed up by the observed extensive migrations and larvae drift of Crangon, both of which favour genetic exchange between areas, provide evidence that there is a single brown shrimp stock across the North Sea. Detailed information is available on fleet composition through a fleet inventory which in an integral part of the Management Plan, but this information should also be known for national fleets anyway. Brown shrimp stock structure is monitored through both landings and through the DFS and DYFS fishery-independent stock surveys, which are used in the swept area methodology to provide biomass and production estimates. All fishery removals are recorded along with fishing effort data, ensuring that LPUE data are recorded on electronic log books for vessels > 12m, and on paper log books for vessels > 10m. Landings at auctions are also declared. Fishing activity is also recorded through VMS data on all vessels. The assessment team considered that SG80 therefore is met. Whilst there is a range of information on brown shrimp stocks, the information could not be considered to be comprehensive, and does not include any environmental information. SG100 therefore is not met.		
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
	Justification	Stock removals and LPUE (which act as a proxy for stock abundance) are monitored through both log books and auction data with sufficient frequency throughout the season to support the harvest control rule which triggers reductions in fishing effort when the observed LPUE drops below the LPUE reference values. In the past there have been some inconsistencies across national fleets in the units used for estimating LPUE, but work is ongoing to provide standardised LPUE data.		

PI 1.2.3		**Relevant information is collected to support the harvest strategy**		
		The assessment team recommends the collection of standardised LPUE data across all national fleets. Estimates of total and fishing mortality can be calculated from predator abundance data. Stock numbers for the predators are derived from age-based assessment data for the total North Sea and are multiplied with the quarterly consumption rates per individual by age class, and the average share of brown shrimp in the diet of the predators. Total mortality of brown shrimp estimated from using length-based methods is then split into natural mortality (M) and fishing mortality (F) using the total consumption of the predators and the North Sea-wide landings. The estimated observed fishing mortality can then be compared with the Fmsy proxies of F_{max} and F0.1 calculated from the yield-per-recruit model. The SG80 therefore is met. There is a good understanding of the inherent uncertainties in the data, although there appears to be little data from observer programmes on the discard rate of small shrimps. Survival rates of discarded small shrimp are estimated to be relatively high. The assessment team recommends that robust estimates of the level of small shrimp discarded should be obtained. It is not clear that the assessment and management of the Crangon stock is robust to all uncertainties, so SG100 therefore is not met.		
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
	Justification	There are significant catches of brown shrimps by German and Dutch vessels that are not currently part of the PO and by Belgian and French shrimp trawlers. These catches are accurately and systematically recorded. Recreational fishing for brown shrimp is not permitted in the Netherlands. In Germany, recreational fishing is regulated by the federal states and the controlling authorities consider that catches are minimal in comparison with the commercial fishery. There is no recreational fishing for brown shrimps in Denmark. There are unlikely to be any significant catches of brown shrimps from other trawl fisheries in the North Sea as the mesh size in the other trawl fisheries will be such that all Crangon are likely to escape.		
References		Brown Shrimp Management Plan ICES 2015 Temming and Hufnagl, 2014		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				

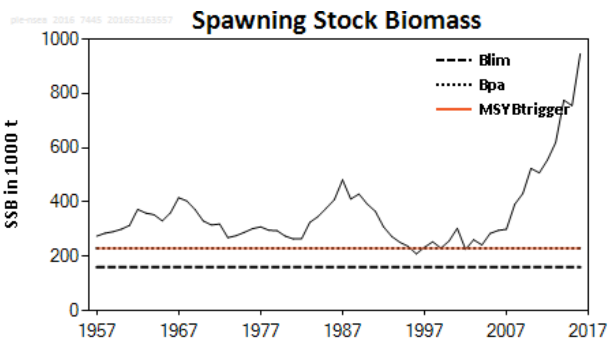
Evaluation Table for PI 1.2.4 – Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	Y
	Justification	There is no analytical stock assessment of the brown shrimp stock, and so there is no formal evaluation of MSY. However the assessment is based upon comparison of observed fishing mortality with Fmsy proxies generated from a yield-per-recruit model developed specifically for the brown shrimp fishery, which includes temperature-driven mortality rates and variable growth rates within each life stage. The yield-per-recruit model, which was originally designed to try and describe observed seasonal patterns of LPUE in relation to periods of recruitment, takes into account all of the major features of the life cycle of Crangon. Estimates of total and fishing mortality can be calculated from predator abundance data. Stock numbers for the predators are derived from age-based assessment data for the total North Sea and are multiplied with the quarterly consumption rates per individual by age class, and the average share of brown shrimp in the diet of the predators. Total mortality of brown shrimp estimated from using length-based methods is then split into natural mortality (M) and fishing mortality (F) using the total consumption of the predators and the North Sea-wide landings. The estimated observed fishing mortality can then be compared with the Fmsy proxies of Fmax and F0.1 calculated from the yield-per-recruit model. In addition to the estimation of fishing mortality, the assessment also considers trends in LPUE from commercial data recorded in log books and at auction stations. The in-year evaluation of LPUE is an appropriate method of assessment for a short-lived, highly productive species such as Crangon, and is a method used for many other shrimp fisheries worldwide, including many that are MSC certified. Additional stock indicators could also be used in future stock assessments. For example, the fraction of larger shrimps in the total population of brown shrimps recorded during the German and Dutch Young Fish Surveys could be used as an indicator of exploitation rate, and there is an annual estimate of biomass from the surveys using a swept-area trawl method, which could be used as an indicator of stock biomass or used in conjunction with landings to provide an estimate of fishing mortality. The assessment team considers that the assessment takes into account the major features relevant to the biology of the species and the nature of the fishery and therefore the SG100 is met.		
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
	Justification	The assessment compares monthly LPUE data collected from log books and auction data against 5 pre-defined reference points calculated as 70%, 65%, 60%, 55% and 50% of the average monthly LPUE in 2002 (a poor year) and 2007 (an average year). Reference point 1 (70% of average 2002/2007 LPUE) acts as a precautionary threshold below which restrictions are imposed on fishing effort. The limit reference point (reference point 5) is defined as 50% of average 2002/2007 LPUE below which fishing is restricted to 24 hours per calendar week. These		

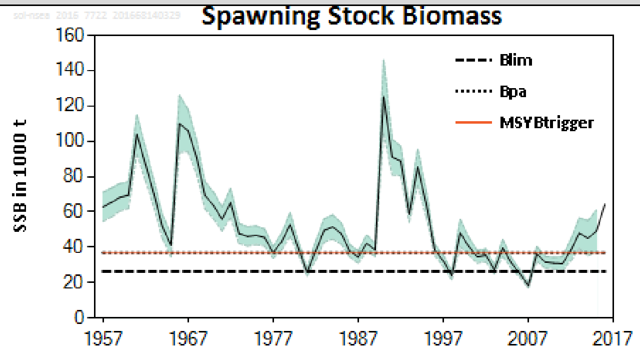
PI 1.2.4		There is an adequate assessment of the stock status		
		reference points are appropriate for the shrimp stock and can be estimated on a weekly basis, following which controls on fishing effort can be implemented. The SG80 is met.		
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	N
	Justification	The yield-per-recruit model used to estimate Fmsy proxies incorporates uncertainty in relation to variation in individual growth rates within each life stage, and includes seasonality of natural mortality driven by temperature and predator abundance. An analysis of the robustness to uncertainty of the LPUE reference points used in the harvest control rules was undertaken prior to the implementation of the Management Plan. The resulting changes in the LPUE reference points and the HCRs implemented in the final version of the Management Plan ensured that uncertainty has been taken into account and that the LPUE reference points are set at a precautionary level. The SG80 therefore is met. The assessment does not evaluate stock status relative to reference points in a probabilistic way and therefore SG100 is not met.		
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			N
	Justification	The assessment of total mortality from length-based methods is a standard approach, and this total mortality is then partitioned into fishing and natural mortality. The estimated fishing mortality is then compared with Fmsy proxies, F_{max} and $F_{0.1}$ estimated from the yield-per-recruit model. This is a standard method of estimating the level of fishing mortality against MSY-based reference points. Using LPUE as an indicator of stock biomass is a conventional approach to assessment of crustacean stocks, but the other current assessment approach using in-year evaluation of trends in LPUE as reference points is relatively new for this fishery, so has not yet been tested and shown to be robust. Alternative assessment approaches have been considered but have not been rigorously explored. The SG100 is not met.		
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
	Justification	The assessment of stock status receives peer review during the ICES Crangon Working Group by Crangon scientists from the Netherlands, Germany, Denmark, France, UK, Belgium and Ireland and potentially other countries (e.g. Canada, United States). The yield-per-recruit model has been published in peer-reviewed journals. Additionally the assessment of stock status includes the comparison of observed LPUE with pre-determined reference points as defined within the HCR, and the reference points and HCR were fully peer-reviewed by a team of German scientists from the University of Hamburg and the Thünen Institute prior to their		

PI 1.2.4		There is an adequate assessment of the stock status	
		implementation. The assessment team considers this to be an internal peer review. The assessment is therefore subject to peer review and SG80 is met. Any assessments undertaken and/or agreed by the ICES Crangon Working Group do not progress through the ICES Review Group process, so the assessment cannot be considered to have been internally and externally peer-reviewed. SG100 is not met. The assessment team recommends that the brown shrimp stock assessment should undergo regular full external peer review either through the ICES Review Group process or through commissioned peer reviews.	
References		Brown Shrimp Management Plan Temming and Hufnagl, 2014 Temming et al. (2013) ICES 2015 Tulp et al. (2016)	
OVERALL PERFORMANCE INDICATOR SCORE:			**85**
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 2.1.1 – Primary species outcome

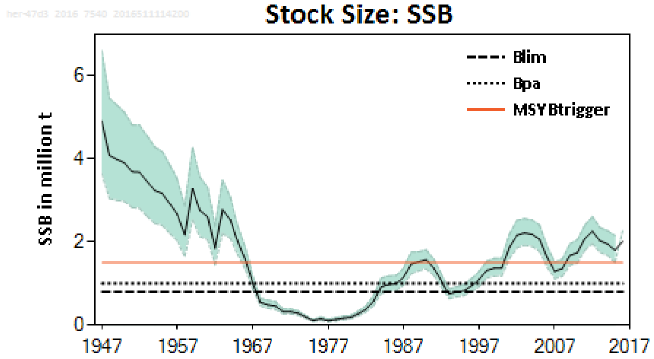
PI 2.1.1		**The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Main primary species stock status			
	Guide post	Main primary species are **likely** to be above the PRI OR If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding.	Main primary species are **highly likely** to be above the PRI OR If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY.
	Met?	Y	Y	N
	Justification	Based on the ICES Crangon WG report 2015, the following species have been designated 'main' (the catch of that species comprises 5% or more by weight of the total catch of all species by the UoA) as no percentage weight of total catch was available from all three client countries. The evaluation as to whether the PRI (Point of Recruitment Impairment) issue is met, ICES advice for 2016 for each species was consulted. <u>Plaice</u> (*Pleuronectes platessa*) Y, Y, Y - SG100 met: The combined North Sea and Skagerrak stock is well above MSY Btrigger, has increased in the past ten years, and has been at a record high for the last five years. Recruitment has been around the long-term average since the mid-1990s. In recent years, fishing mortality (F) has been estimated at around FMSY.  Source: ICES Advice for plaice, June 2016 <u>Sole</u> (*Solea solea*): Y, Y, Y - SG100 met: The spawning-stock biomass (SSB) has increased since 2007 and has been estimated at above MSY Btrigger since 2012. Fishing mortality (F) has declined since 1997 and is estimated to be at FMSY in 2015. Recruitment (R) has fluctuated without trend since the early 1990s.		

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.



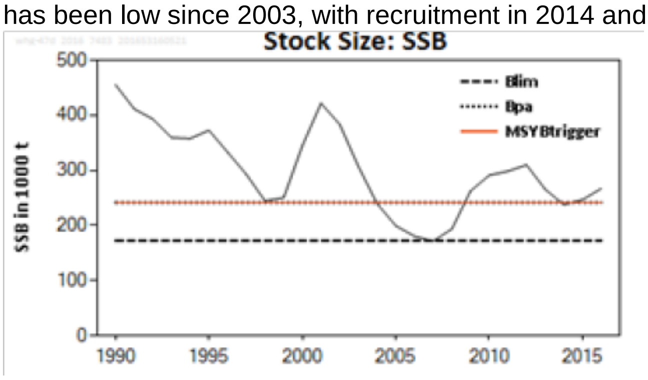
Source: ICES Advice for sole, June 2016

Herring (*Clupea harengus*): Y,Y, Y - SG100 met
Recruitment (R) was below average between 2003 and 2013. In 2014 R was strong and comparable to levels seen before 2003. Recruitment in 2015 is among the lowest in the time-series and 2016 recruitment is estimated to be low again. The spawning-stock biomass (SSB) has been above MSY Btrigger since 2009. Fishing mortality (F) has been below FMSY since 1996. Btrigger was provided for the 2016 stock advice.



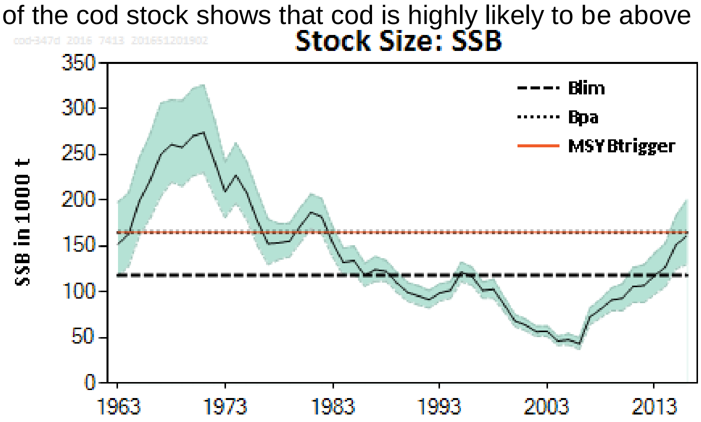
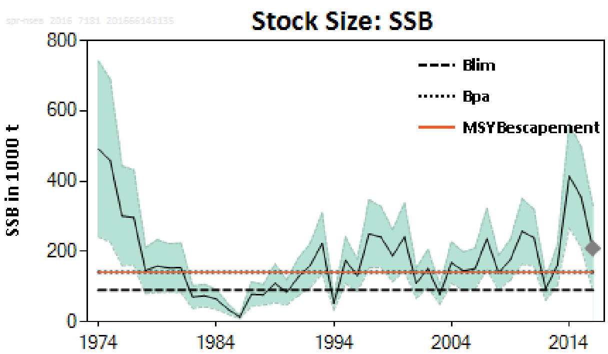
Source: ICES Advice for herring, May 2016

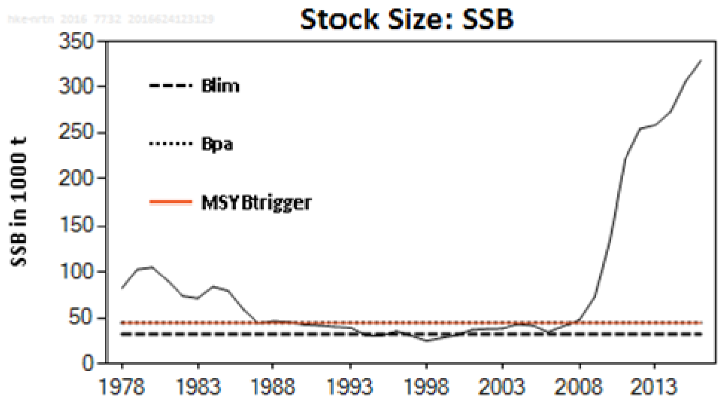
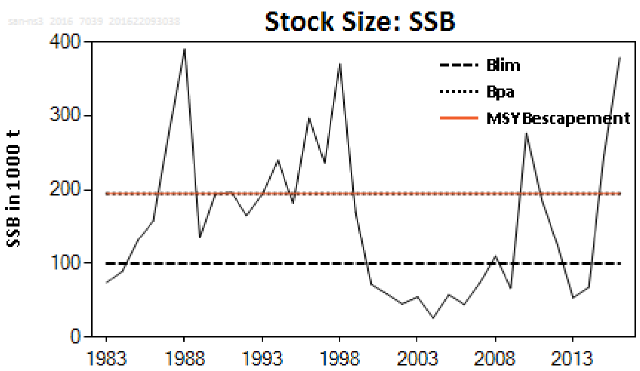
Whiting (*Merlangius merlangus*): Y, Y, N - SG80 met
Spawning-stock biomass (SSB) has fluctuated around MSY Btrigger. Fishing mortality (F) has been above FMSY throughout the time-series. Recruitment (R) has been low since 2003, with recruitment in 2014 and 2015 above previous years.



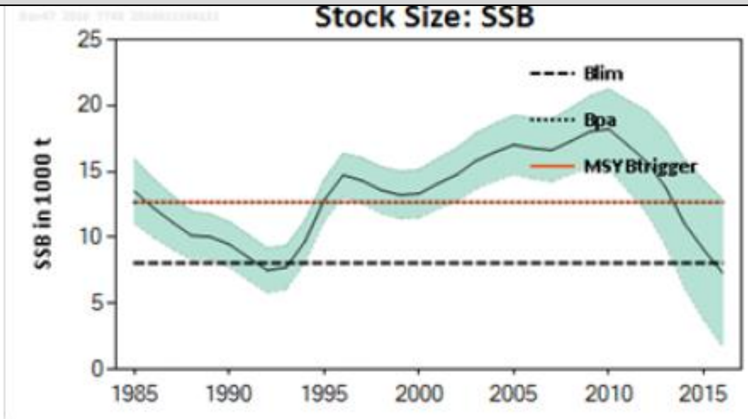
Source: ICES Advice for whiting, June 2016

Cod (*Gadus morhua*): Y,Y, N - SG80 met
Fishing mortality (F) has been declining since 2000 and is estimated to be above FMSY. Spawning-stock biomass (SSB) has increased from the historical low in 2006 and is close to MSY Btrigger. Recruitment since 1998 remains poor. Since the implementation of the cod management plan, fishing mortality rates have been reduced and the stock has increased since 2006, in spite of continued low

PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.		
		recruitment. Furthermore, the decrease in F has led to an increase in the number of older fish in the population in recent years. The overall reporting of catch data provided to ICES has improved during 2012–2015 through such aspects as the fully documented fisheries (FDF) programme and increased coverage by the Scottish industry/science observer sampling scheme. The continuing trend of improvement of the cod stock shows that cod is highly likely to be above PRI.  Source: ICES Advice for cod, June 2016 The overall score is 80, as not all elements met SG100, and a partial score is not possible.		
b	Minor primary species stock status			
	Guide post			Minor primary species are highly likely to be above the PRI OR If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species
	Met?			N
	Justification	Minor primary species are all those primary species not considered ‘main’, i.e., where the definition of ‘main’ does not apply. <u>Sprat</u> (*Sprattus sprattus*) – Y – SG100 met The spawning-stock biomass (SSB) has been at or above MSY $B_{escapement}$ since 2013. Fishing mortality (F) has shown an increase in the last two years. Recruitment (R) in 2015 is estimated to be above the long term average.  Source: ICES Advice for sprat, June 2016 <u>Hake</u> (*Merluccius merluccius*) – Y, SG100 is met.		

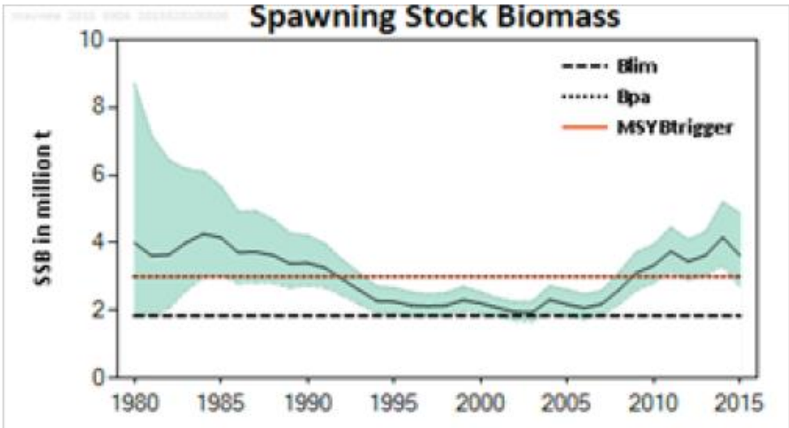
PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
		The spawning-stock biomass (SSB) has increased significantly since 2006 and is well above MSY Btrigger. Fishing mortality (F) has decreased significantly over the last decade and has been below FMSY since 2011. Recruitment (R) has been around average since 2009.  Source: ICES Advice for hake, June 2016 Sandeel (*Ammodyctes* spp) N – SG100 not met. The spawning-stock biomass (SSB) in sandeel area 3 (SA 3) was below the lower biomass limit Blim in 2013 and 2014 and has increased to above the precautionary biomass level Bpa (= MSY Bescapement) in 2015 and 2016. Recruitment in 2014 was high, but recruitment in 2015 is estimated to be low. Not 'highly likely' to be above PRI as the stock fluctuates considerably.  Source: ICES Advice for sandeel, February 2016. Sea bass (*Dicentrarchus labrax*) - N – SG100 not met. Although this species is rare in the fish bycatch of the Dutch shrimp fishery and absent in Germany and Denmark (Client pers.com.) it has to be scored. SSB peaked in 2010 and has been declining since. Spawning-stock biomass (SSB) is now below Blim. The fishing mortality (F) shows an increasing trend but has declined slightly in recent years. Recruitment has been very poor since 2008; however, the 2013 estimate shows above-average recruitment.

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.



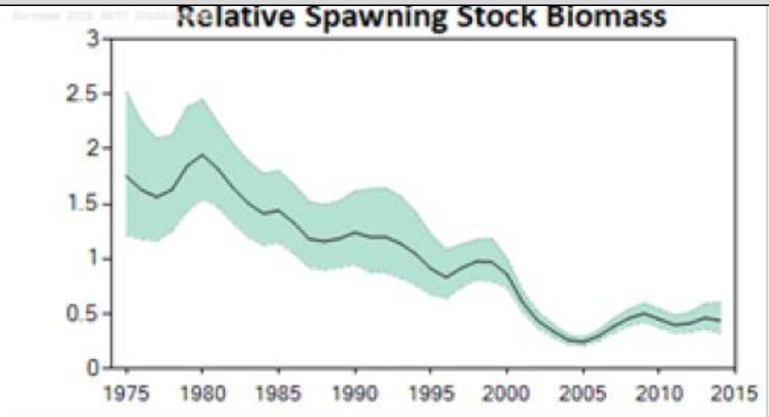
Source: ICES Advice for Sea bass, June 2016.

Atlantic mackerel (*Scomber scombrus*): SG100 met
The Spawning Stock Biomass (SSB) is estimated to have increased since the early 2000s and has been above MSY-Btrigger since 2009. The Fishing Mortality (F) has been declining since the mid-2000s, but remains above Fpa (or Fmsy). The Recruitment (R) shows an increasing trend since the late 1990s with two large year classes (2002 and 2006). The 2011-year class is estimated to be well above average (third in magnitude since 1990), in contrast recruitment for 2013 appears to be the lowest since 2003. The stock has been above Btrigger for two generations.



Source: ICES Advice for mackerel September 2015

Brill (*Scophthalmus rhombus*) and Turbot (*Scophthalmus maximus*) are managed under a combined TAC and are thus considered minor primary species. Management of these stocks under a combined species TAC prevents effective control of the single species exploitation rates and will lead to the overexploitation of either species.
Brill is mainly a bycatch species. There are no MSY $B_{trigger}$ and B_{pa} and B_{lim} for brill, nor is there any SSB information. The standardized lpue from the Dutch beam-trawl fleet (vessels > 221 kW) was applied as the index of stock development.

PI 2.1.1		**The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.**
		 Source: ICES Advice for turbot, June and August 2015. There are no MSY $B_{trigger}$ and B_{pa} and B_{lim} for turbot. One cannot state that the species are highly likely above PRI, SG100 is not met. Dab (*Limanda limanda*) and flounder (*Platychthys flesus*) are managed under a combined TAC and are thus considered minor primary species. Management of dab and flounder under a combined species TAC prevents effective control of the single-species exploitation rates and could lead to overexploitation of either species. There are no MSY $B_{trigger}$ and B_{pa} and B_{lim} for dab, nor is there any SSB information. A mature biomass index based on the IBTS survey was applied as the indicator of stock development. Flounder is mainly a bycatch species in the demersal fisheries for North Sea plaice and sole. There are no MSY $B_{trigger}$ and B_{pa} and B_{lim} for flounder, nor is there any SSB information. The available survey information for flounder indicates no clear trend in stock biomass, although it has been lower for the last four years. One cannot state that the species are highly likely above PRI, SG100 is not met. Salmon (*Salmo salar*) – No – SG100 not met It cannot be determined with certainty which part of the NEAC stock complex the salmon recorded belongs to, there are management systems in place for the different NE Atlantic salmon stock complexes (ICES Advice May 2016). Not all primary minor species meet the SG100, and a partial score is not allowed. Hence overall SG100 is not met.
References		ICES 2016, Book 6.3.36 - Plaice (*Pleuronectes platessa*) in Subarea 4 (North Sea) and Subdivision 3.a.20 (Skagerrak); ICES 2016, Book 6.3.49 - Sole (*Solea solea*) in Subarea 4 (North Sea) ICES 2016, Book 6.3.18 Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak, Kattegat, and eastern English Channel) ICES 2016, Book 6.3.56. Whiting (*Merlangius merlangus*) in Subarea 4 division 7d (North Sea and eastern English Channel) ICES 2016, Book 6.3.3 Cod (*Gadus morhua*) in Subarea 4, Division 7.d and Subdivision 3.a.20 (North Sea, eastern English Channel, Skagerrak) ICES 2015, Book 9.3.25, Mackerel (*Scomber scombrus*) in subareas I-VII and XIV and Divisions VIIIa-e and IXa (Northeast Atlantic) ICES 2015, Book 6.3.13; Horse mackerel (*Trachurus trachurus*) in divisions IIIa, IVb,c and VIId (Skagerrak, Kattegat, Southern and Central North Sea, Eastern English Channel) ICES 2016, Book 5.3.57; Sea bass (*Dicentrarchus labrax*) in divisions 4b-c, 7a and 7d-h (Central and Southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea. ICES 2016, Book 6.3.51 Sprat (*Sprattus sprattus*) in Subarea 4 (North Sea)

PI 2.1.1	**The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.**	
	ICES 2016 Book 9.3.32; Hake (*Merluccius merluccius*) in subarea 4,6, and 7, and divisions 31.8a-b, and 8d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay. ICES 2016, Book 6.3.39 Sandeel (*Ammodytes* spp.) in Divisions 3a, 4a, and 4b, SA 3 (Skagerrak and Kattegat, North and Central North Sea) ICES 2015, Book 6.3.2 Brill (*Scophthalmus rhombus*) in Subarea IV and Divisions IIIa and VIId, e (North Sea, Skagerrak and Kattegat, English Channel) ICES 2015, Book 6.3.7 Dab (*Limanda limanda*) in Subarea IV and Division IIIa (North Sea, Skagerrak and Kattegat) ICES 2015, Book 6.3.54 Turbot (*Scophthalmus maximus*) in Subarea IV (North Sea) ICES 2015, Book 6.3.8 Flounder (*Platichthys flesus*) in Subarea IV and Division IIIa (North Sea, Skagerrak and Kattegat) ICES 2016, Book 10.2 Atlantic salmon from the Northeast Atlantic	
OVERALL PERFORMANCE INDICATOR SCORE:		**80**
CONDITION NUMBER (if relevant):		**-**

Evaluation Table for PI 2.1.2 – Primary species management strategy

PI 2.1.2		**There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to above the point where recruitment would be impaired.	There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the point where recruitment would be impaired.	There is a **strategy** in place for the UoA for managing main and minor primary species.
	Met?	Y	Y	Y
	Justification	By definition of 'primary species', which are species of commercial value with management tools controlling exploitation, all elements listed under PI 2.1.1 meet 80. These tools, which comprise a strategy as they are regularly reviewed through the ICES process, include: a requirement for accurate information on landings (via log book and sales notes), stock assessments and management rules such as reference points, harvest control rules, quotas and recovery plans where necessary (e.g. cod). The nature of the fishery is such, that only the target species, Brown Shrimp, is retained. Therefore a strategy is in place to reduce any bycatch, of both primary and secondary species. As the sieve net sorts out larger animals during the actual fishing process, flatfish such as plaice, starting at sizes of approx. 8 to 12 cm, are sieved out and no longer appear in the by-catch (Wienbeck 1993, Neudecker and Damm 2010). All remaining animals and similar sized objects, which are still caught, are emptied into the hopper of the vessel, and are transferred to rotating sieves operated with high amounts of running sea water to increase survival rates (Aviat 2011). This on board process is efficient and quick and described in detail in Section 3.6.6 of this report.		
b	Management strategy evaluation			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	Y	Y
	Justification	Testing has shown that a 70 mm sieve net is effective in reducing the bycatch of marketable (and therefore primary) species in the shrimp net. Minimum landing sizes are effective at ensuring that undersized commercial species are not retained. Log books, registered landing ports and effectives monitoring, control and surveillance give high confidence that the measures designed to minimise the level of retention on non-target species are effective. All shrimpers longer than 10m have to fill in a logbook, all shrimpers longer than 12 m have VMS and the electronic logbook and all shrimpers longer than 15 m have AIS on board. There are regulations for mesh size, beam length, sorting devices (in the net and on board) and the restrictions for the plaice box (<24 m / <221 kW). Survival experiments on discards in the shrimp fishery indicate that discard survival is variable, and a brief overview was given by Steenbergen et al (2015). This is discussed in detail in Section 3.4.2.2 of the report. Survivability of flatfish is greater		

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
		than roundfish (Berghahn et al 1998), and can be up to 100%, depending on the speed by which the catch is sorted in the rotating sieves. Research has shown that if fish are released below the water line, mortality due to bird predation is much reduced (pers.com with client). SG 100 is met		
c	Management strategy implementation			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a).
	Met?		Y	Y
	Justification	All TAC fisheries, as the primary species are by definition, have associated compliance tools in place. The requirement for all vessels to fish with a 70 mm sieve net when targeting shrimp came into force on 1st January 2003. This is a key element of the strategy to minimise capture (and retention) of market size fish species. This has been implemented successfully and is enforced appropriately. The other key element of the strategy which prevents any fish which are brought on board from being retained is the minimum landing size (MLS) for key commercial species. These have also been implemented for many years as part of EU fisheries management, and has been successful in the prevention of the sale of undersized fish in the Netherlands. Technical measures such as sieve net and rotating sorting drum are used throughout the fishery. SG100 is met.		
d	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not applicable – none of the primary species are sharks.		
e	Review of alternative measures			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Justification	The sieve net was introduced to the brown shrimp fishery in order to reduce bycatch. Alternative measures have been researched, such as the sorting grid and letter box, as discussed in Section 3.6.6. of the report. The letterbox also reduced bycatch of plaice and other flatfish species. The Client has carried out a thorough review of alternative measures for reducing unwanted catches, and this review is reproduced in Appendix 4. The Management Plan requires that the measures for reducing unwanted catch are reviewed		

PI 2.1.2		**There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**
		regularly, and the Steering Group has commissioned the University of Hamburg to carry out a review of the effectiveness of the increase in mesh size currently being implemented within the Management Plan. The assessment team considered that the review of alternative measures undertaken by the Client and reproduced in Appendix 4 fulfils the requirements needed to meet the SG80. The SG80 is met, but as the review of alternative measures has not previously taken place on a biennial basis, SG100 is not met. The assessment team recommends that in addition to the current technical measures, the Client should at a future review evaluate the potential benefits of seasonal or real time closures (RTCs).
References		Steenbergen et al (2015); Berghahn 1998; Wienbeck 1993; Neudecker and Damm 2010
OVERALL PERFORMANCE INDICATOR SCORE:		**95**
CONDITION NUMBER (if relevant):		**-**

Evaluation Table for PI 2.1.3 – Primary species information

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impact on main primary species			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species.	Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status.
	Met?	Y	N	N
	Justification	Observer reports are available for all three countries involved in this fishery. Information provided on bycatch species for all three countries was difficult to evaluate and compare across countries. There was detailed observer information, but information available for this assessment was limited to a descriptive summary report and table of catch estimates (Observer report Netherlands and Germany: Steenbergen et al 2015); Denmark provided their observer report in a different format using proportions of total catch. For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled. The tables provide standard deviations for catches, which are high (Steenbergen et al 2015), partly reflecting the variability in species encountered at different seasons and locations, therefore estimates will be skewed. The observer data provided by Denmark cover 2014. In order to determine main primary species, ICES WGCRAN report information had to be used as well. Although there is some quantitative information available, it is not adequate to assess the impact of the UoA on the main primary species with respect to status. SG80 is not met.		
b	Information adequacy for assessment of impact on minor primary species			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?			N
	Justification	For the same reasons outlined in a) above, quantitative information is insufficient in order to estimate the impact of the UoA on minor primary species with respect to status.		
c	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage **main** primary species.	Information is adequate to support a **partial strategy** to manage **main** Primary species.	Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the

PI 2.1.3	Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
			strategy is achieving its objective.
Met?	Y	Y	N
Justification	Observer data and analysis (Steenbergen et al 2015), as well as research into survivability of species (Berghahn et al 1998) is adequate to support a partial strategy to manage main primary species, such as the statutory introduction of sieve nets (Wienbeck 1993, Neudecker and Damm 2010, Polet 2003), research into other types of pre-haul selection (letter box [Steenbergen 2011], sorting grid (Catchpole 2009]), as well as improvement of on-board sorting and sieving of the haul (Aviat et al 2011). This was discussed in detail in Section 3.6.6. SG80 is met. For the same reasons outlined in a) above, information is inadequate to support a strategy to manage all primary species and to evaluate with a high degree of certainty whether the strategy is achieving its objective. SG100 is not met.		
References	Steenbergen et al 2015; Steenbergen 2011; Catchpole 2009; Wienbeck 1993, Neudecker and Damm 2010, Polet 2003, Observer data		
OVERALL PERFORMANCE INDICATOR SCORE:			70
CONDITION NUMBER (if relevant):			2

Evaluation Table for PI 2.2.1 – Secondary species outcome

<table>
<tr><td colspan="2">PI 2.2.1</td><td colspan="3">The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="4">a</td><td colspan="4">Main secondary species stock status</td></tr>
<tr><td>Guide post</td><td>Main Secondary species are likely to be within biologically based limits.
OR
If below biologically based limits, there are measures in place expected to ensure that the UoA does not hinder recovery and rebuilding.</td><td>Main secondary species are highly likely to be above biologically based limits
OR
If below biologically based limits, there is either evidence of recovery or a demonstrably effective partial strategy in place such that the UoA does not hinder recovery and rebuilding.
AND
Where catches of a main secondary species outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that also have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.</td><td>There is a high degree of certainty that main secondary species are within biologically based limits.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Secondary species include fish that are not managed according to reference points. It also includes all species that are out of scope of the standard (birds/ mammals/ reptiles/ amphibians), if they are not ETPs. Those secondary species within scope are assessed as to whether they are ‘main’ (catch percentage thresholds apply) or not. This was done in Tables 5, 6 and 8 in section 3.6.6 based on data from observer reports.

In the Danish fishery bycatch 27 secondary species of fish were recorded, none of these were ‘main’. The observer report for the German and Dutch fishery recorded 22 and 33 secondary species respectively. For the Dutch and the German fishery the data presented in the observer reports did not allow a percentage of total catch calculation. Therefore no clear secondary main species was identifiable. The decision was therefore made to allocate the label ‘main’ to those fish species which occur in more than 100 hauls. There is no available information to determine status of these species, and therefore status regarding biological limits. There is some research on post capture survivability (Berghahn 1998; Berghahn et al 1992), which showed that survivability can be high, in particular if on-board handling procedures allow for plenty of flushing, as described in Section 3.6.6.

Gobies (Pomatoschistus sp.) were the most commonly encountered bycatch, although the standard deviation associated with the hauls is large, indicating much variation between the samples, which could be due to seasonality. There are several species of gobies which can be encountered in that part of the North Sea, fishbase</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.2.1</td><td colspan="3">The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.</td></tr>
<tr><td></td><td></td><td colspan="3">maps indicated at least 5 species. The data does not differentiate between the species. Available information on the species shows it to be a highly productive species, with high fecundity and fast growing and fast maturing. This makes it highly resilient. The species lives in shallow, high energy areas, down to a depth of 12m.
SG80 is met.

European smelt (Osmerus eperlanus)
According to fishbase, this species inhabits marine waters, estuaries and large lakes. A midwater species, rarely far from shore, primarily anadromous in the west and lacustrine in the east; shoaling at least during spawning season. The essential part of its life is spent in the estuarine zone, with just short incursions in the littoral zone. The migratory form is grouping together in the estuarine zone for reproduction, spawning in tributaries of lakes or along shallow shores of lakes and rivers on sand, gravel, stones and plant material, preferably in fast-flowing water. It is fecund producing up to 50,000 eggs. The species feeds on shrimps and small crustaceans; larger individuals feed on small fish. Based on the biology, the species is resilient and fecund, as studies in the Elbe estuary have shown a high growth rate.
SG 80 is met.

Pipefish sp. (Syngnathus sp.)
There are three different species of pipefish known in the nearshore area of the North Sea (S. rostellatus, S. acus and S. typhle). No distinction was made in the observer reports, but the most relevant (>90%) bycatch species in brown shrimp fishery is S. rostellatus. Pipefish live in marine and brackish waters down to a depth of 110m. Commonly, they live amongst algae and eel-grass (Zostera). The genus is ovoviviparous (brood pouch) and can reproduce several times a year. For some species growth rates are high. From the data available, it is possible to infer that pipefish are resilient and fecund.
SG80 is met.

Hook-nose (Agonus cataphractus)
These small fish (max length 21cm) can live in inshore waters, preferring sandy bottoms. They have been found to a depth of 270m. They feed on polychaetes and bottom crustaceans. They reproduce after one year, laying up to 3000 eggs. The small size, short life span and growth rate, and high fecundity make it a resilient species.

SG80 is met.</td></tr>
<tr><td>b</td><td colspan="4">Minor secondary species stock status</td></tr>
<tr><td></td><td>Guide post</td><td></td><td></td><td>Minor secondary species are highly likely to be above biologically based limits.

OR

If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species</td></tr>
<tr><td></td><td>Met?</td><td></td><td></td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The tables in Section Error! Reference source not found. provide a detailed list of the minor secondary species encountered as part of the observer sampling</td></tr>
</table>

PI 2.2.1		**The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.**	
		programme. The list of species is extensive, the more commonly encountered species include seasnail, dragon net, bullrout, rockling and European smelt, as well as blennies, sticklebacks, gurnards, weever fish and bib, to name a few. There is little information on most minor species to determine biologically based limits, and therefore to state with any confidence that SG100 is met	
References		http://www.fishbase.se/summary/Pomatoschistus-microps.html http://www.fishbase.org/identification/SpeciesList.php?genus=Syngnathus http://www.fishbase.se/summary/Osmerus-eperlanus.html http://www.fishbase.se/summary/Agonus-cataphractus.html	
OVERALL PERFORMANCE INDICATOR SCORE:			**80**
CONDITION NUMBER (if relevant):			**-**

Evaluation Table for PI 2.2.2 – Secondary species management strategy

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **strategy** in place for the UoA for managing main and minor secondary species.
	Met?	Y	Y	Y
	Justification	The nature of the fishery is such, that only the target species, Brown Shrimp, is retained, although in the Danish fishery data provided for 2014, Baltic prawn was also landed (150kg which constituted 0.003% of the total catch). Therefore a strategy is in place to reduce any bycatch, of both primary and secondary species. As the sieve net sorts out larger animals during the actual fishing process, flatfish such as plaice, starting at sizes of approx. 8 to 12 cm, are sieved out and no longer appear in the by-catch (Wienbeck 1993, Neudecker and Damm 2010). All remaining animals and similar sized objects, which are still caught, are emptied into the hopper of the vessel, and are transferred to rotating sieves operated with high amounts of running sea water to increase survival rates (Aviat 2011). This on board process is efficient and quick and described in detail in Section 3.6.6 of this report. SG100 is met.		
b	Management strategy evaluation			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.
	Met?	Y	Y	Y
	Justification	Testing has shown that a 70 mm sieve net is effective in reducing the bycatch of marketable species in the shrimp net. The sieve nets are mandatory due to an EU regulation. Minimum landing sizes are effective at ensuring that undersized commercial species are not retained. Log books, registered landing ports and effective monitoring, control and surveillance give high confidence that the measures designed to minimise the level of retention on non-target species are effective. All shrimpers longer than 10 m have to fill in a logbook, all shrimpers longer than 12 m have VMS and the electronic logbook and all shrimpers longer than 15 m have AIS on board. There are regulations for mesh size, beam length, sorting devices (in the net and on board) and the restrictions for the plaice box (<24 m / <221 kW). Survival experiments on discards in the shrimp fishery indicate that discard survival is variable, and a brief overview was given by Steenbergen et al (2015) and Revill, 2012). Research showed that, for example, the survival rate of Hooknose is high (Berghahn & Vorberg 1998). This is discussed in detail in section 3.6.6 of the report.		

PI 2.2.2		**There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**		
		Survivability of flatfish is greater than roundfish (Berghahn & Vorberg, 1998), and can be up to 100%, depending on the speed by which the catch is sorted in the rotating sieves. Research has shown that if fish are released below the water line, mortality due to opportunistic feeding by birds is much reduced (pers.com with fishers and management). There is ongoing research and monitoring to improve the efficiency of on-board sorting, which increases survivability. SG 100 is met		
c	Management strategy implementation			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Y	N
	Justification	Technical measures such as sieve net and rotating sorting drum are used throughout the fishery. The requirement for all vessels to fish with a 70 mm sieve net when targeting shrimp came into force on 1st January 2003. This is a key element of the strategy to minimise capture (and retention) of market size fish species, as well as by-catch. This has been implemented successfully and is enforced appropriately. The other element of the strategy which prevents any fish which are brought on board from being retained is the minimum landing size (MLS) for commercial species. These have also been implemented for many years as part of EU fisheries management, and has been successful in the prevention of the sale of undersized fish in the Netherlands, for example. SG80 is met In order to meet SG100 a time series of quantitative data would provide clear evidence that objectives are met.		
d	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not relevant		
e	Review of alternative measures to minimise mortality of unwanted catch			
	Justification	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Guide post	The sieve net was introduced to the brown shrimp fishery in order to reduce bycatch. Alternative measures have been researched, such as the sorting grid and letter box, as discussed in Section 3.6.6 of the report. The letterbox also reduced bycatch of plaice and other flatfish species.		

PI 2.2.2		**There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**
		The Client has carried out a thorough review of alternative measures for reducing unwanted catches, and this review is reproduced in Appendix 4. The Management Plan requires that the measures for reducing unwanted catch are reviewed regularly, and the Steering Group has commissioned the University of Hamburg to carry out a review of the effectiveness of the increase in mesh size currently being implemented within the Management Plan. The SG80 therefore is met, but as the review of alternative measures has not previously taken place on a biennial basis, SG100 is not met. The assessment team considered that the review of alternative measures undertaken by the Client and reproduced in Appendix 4 fulfils the requirements needed to meet the SG80. The assessment team recommends that in addition to the current technical measures, the Client should at a future review evaluate the potential benefits of seasonal or real time closures (RTCs).
References		Steenbergen et al (2015); Berghahn & Vorberg, 1998; Revill 2012; Wienbeck 1993; Neudecker and Damm 2010; Aviat 2011
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		**-**

Evaluation Table for PI 2.2.3 – Secondary species information

PI 2.2.3		**Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts on main secondary species			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status. OR **If RBF is used to score PI 2.2.1 for the UoA:** Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status. OR **If RBF is used to score PI 2.2.1 for the UoA:** Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status.
	Met?	Y	N	N
	Justification	Observer reports are available for all three countries involved in this fishery. Information provided on bycatch species for all three countries was difficult to evaluate and compare across countries. There was detailed observer information, but information available for this assessment was limited to a descriptive summary report and table of catch estimates (Observer report Netherlands and Germany: Steenbergen et al 2015); Denmark provided their observer report in a different format using proportions of total catch. For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled. The tables provide standard deviations for catches, which are very high (Steenbergen et al 2015), therefore estimates will be skewed. The observer data provided by Denmark cover 2014. In order to determine main secondary species, it was decided to use the number of hauls the species occurred in – if it occurred in more than 100 hauls it was considered 'main'. By definition, secondary species have been little researched to stock level. Fishbase provided some general biological and ecological/ geographical information which was used to assess resilience. Although there is some quantitative information available, it is not adequate to assess the impact of the UoA on the main secondary species with respect to status. SG80 is not met. The number of different species in the bycatch is large in this fishery, a reflection of the gear type and location, whereby much of the bycatch would be juveniles. It is recommended to conduct a Productivity Susceptibility Analysis (PSA) on all those species for which no reference points are available. Recommendation 7 is raised.		
b	**Information adequacy for assessment of impacts on minor secondary species**			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.
	Met?			N

PI 2.2.3		**Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.**		
	Justification	For the same reasons outlined in a) above, quantitative information is insufficient in order to estimate the impact of the UoA on minor secondary species with respect to status.		
c	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage **main** secondary species.	Information is adequate to support a **partial strategy** to manage **main** secondary species.	Information is adequate to support a **strategy** to manage **all** secondary species, and **evaluate** with a **high degree of certainty** whether the strategy is **achieving its objective**.
	Met?	Y	Y	N
	Justification	Observer data and analysis (Steenbergen et al 2015), as well as research into survivability of species (Berghahn et al 1998, Revill 2012) is adequate to support a partial strategy to manage main secondary species, such as the statutory introduction of sieve nets (Wienbeck 1993, Neudecker and Damm 2010, Polet 2003), research into other types of pre-haul selection (letter box [Steenbergen 2011], sorting grid (Catchpole 2009]), as well as improvement of on-board sorting and sieving of the haul (Aviat et al 2011). This was discussed in detail in Section 3.6.6. SG80 is met. Quantitative data from observer reports is inadequate. SG100 is not met.		
References		Steenbergen et al 2015; Berghahn et al 1998; Revill 2012; Wienbeck 1993; Neudecker and Damm 2010; Polet 2003		
OVERALL PERFORMANCE INDICATOR SCORE:				**70**
CONDITION NUMBER (if relevant):				**3**

Evaluation Table for PI 2.3.1 – ETP species outcome

PI 2.3.1		**The UoA meets national and international requirements for the protection of ETP species** **The UoA does not hinder recovery of ETP species**		
Scoring Issue		SG 60	SG 80	SG 100
a	Effects of the UoA on population/stock within national or international limits, where applicable			
	Guide post	Where national and/or international requirements set limits for ETP species, the effects of the UoA on the population/stock are known and **likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population/stock are known and **highly likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty** that the **combined effects of the MSC UoAs** are within these limits.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	The observer reports recorded all bycatch, including ETP species (see Section 3.6.7). The ETP species recorded for this shrimp fishery are: River lamprey (*Lampetra fluviatilis*), Twaite shad (*Alosa fallax*), and eel (*Anguilla anguilla*). The Sandy ray (*Leucoraja circularis*) is listed on the IUCN Red List as endangered, but is not listed under national or EU regulation. In Germany catches of lampreys are forbidden by national laws (Fischereigesetze von Niedersachsen und Schleswig-Holstein) and for Twaite shad and eel minimum length and seasonal restrictions are mandatory. In the Dutch national fishery law (visserijwet) a minimum length is set for lampreys and eel and the catch of Twaite shad is forbidden. There are no restrictions in Denmark, because ETP species occur only in small numbers due to the absence of rivers where diadromous species can ascend for spawning. No national or international requirements that set limits for these ETP species could be identified.		
b	Direct effects			
	Guide post	Known direct effects of the UoA are likely to not **hinder recovery** of ETP species.	Known direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	Y	Y	N
	Justification	The direct effect of fishing on ETP species would be from direct capture and subsequent post capture mortality. The observer reports indicate that ETP species were found in few of the hauls. Larger, adult sized specimen of the ETP species are sorted via the sieve net, and thus escape and are not caught. Smaller sized specimen end up in the cod-end and hauled on board where the haul is sieved using specially designed equipment to increase the survivability of the bycatch (as described in Section 3.6.6). Any ETP species, as part of the bycatch, is released back into the water. Considering that ETP species were observed in few of the hauls, and that adults would escape through the sieve net, it is considered that SG80 is met. No survivability studies on these ETP species could be found. SG100 is not met.		
c	Indirect effects			
	Guide post		Indirect effects have been considered and are thought to be **highly likely** to not create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.

PI 2.3.1		**The UoA meets national and international requirements for the protection of ETP species** **The UoA does not hinder recovery of ETP species**		
	Met?		Y	N
	Justification	Indirect effects, other than direct capture, could be caused by competition for food resources, environmental degradation, ghost fishing or impacts from pollution or litter. These have been considered by the assessment and are thought to be unlikely to create unacceptable impacts. No significant indirect effects of the fishery on ETP species have been identified or are thought likely given the present level of knowledge in relation to the life history of potentially impacted species. SG80 is met.		
References		Observer reports; description of net design and onboard handling in Section 3.6.6		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				**-**

Evaluation Table for PI 2.3.2 – ETP species management strategy

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The UoA has in place precautionary management strategies designed to:
• meet national and international requirements;
• ensure the UoA does not hinder recovery of ETP species.

Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="4">a</td><td colspan="4">Management strategy in place (national and international requirements)</td></tr>
<tr><td>Guide post</td><td>There are measures in place that minimise the UoA-related mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.</td><td>There is a strategy in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.</td><td>There is a comprehensive strategy in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">There are several important elements to the strategy for minimizing the effect of the fishery on ETP species, these include research into the population levels of ETP species, research into the effect of fisheries on these species, regulatory measures to minimise effects, and fleet specific initiatives.
At an overarching level, the EU has a high level strategy for the protection of endangered species. For example, the EU Habitats (Council Directive 92/43/EEC) and Birds (Council Directive 79/409/EEC) Directives require member states to protect certain areas to ensure the favourable status of endangered species. Under the Habitats Directive, Twaite shad and River lamprey are listed under Annex II and V, identifying them for protective measures such as setting aside Natura 2000 sites. Each client fishery country has established such designated areas.
The EU also requires member states to carry out observer work to quantify the impact of fisheries on ETP species. For example, under EU Regulation 812/2004 (laying down measures concerning incidental catches of cetaceans in fisheries) member states are required to report annually with estimates of the overall incidental catches of cetaceans in each of the fisheries concerned. The fact that trawl fisheries (including shrimp fisheries such as the one under assessment) are not specified as requiring a certain level of coverage reflects the fact that the perceived level of risk of incidental capture in these fisheries is considered low.
Collection of discard data is enforced through the Data Collection Framework (DCF) of the European Commission (EC). To comply with this ruling, shrimp trawlers have been monitored by on board observer programmes since 2008 for the Netherlands and since 2006 for Germany.
The annual EU fishing opportunities legislation always includes a list of prohibited species, which must be promptly released without harm if accidentally caught. For MSC scoring purposes, these are therefore also included in the ETP list.
Furthermore, on-board operational practices form an important element of the strategy, with the sieve net in particular playing a key role in avoiding bycatch, and rapid on-board processing with plenty of water to improve survivability.
SG80 is met.</td></tr>
<tr><td rowspan="2">b</td><td colspan="4">Management strategy in place (alternative)</td></tr>
<tr><td>Guide post</td><td>There are measures in place that are expected to ensure the UoA does not</td><td>There is a strategy in place that is expected to ensure the UoA does not</td><td>There is a comprehensive strategy in place for managing ETP species, to ensure</td></tr>
</table>

PI 2.3.2		**The UoA has in place precautionary management strategies designed to:** • **meet national and international requirements;** • **ensure the UoA does not hinder recovery of ETP species.** **Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.**		
		hinder the recovery of ETP species.	hinder the recovery of ETP species.	the UoA does not hinder the recovery of ETP species
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not relevant		
c	Management strategy evaluation			
	Guide post	The measures are **considered likely** to work, based on **plausible argument** (e.g. general experience, theory or comparison with similar fisheries/species).	There is an **objective basis for confidence** that the measures /strategy will work, based on **information** directly about the fishery and/or the species involved.	The strategy/ comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a **quantitative analysis** supports **high confidence** that the strategy will work.
	Met?	Y	Y	N
	Justification	Research has shown that a 70 mm sieve net is effective in reducing the bycatch, including ETP species, in the shrimp net. Log books, registered landing ports and effective monitoring, control and surveillance give high confidence that the measures designed to minimise the level of retention on non-target species are effective. Survival experiments on discards in the shrimp fishery indicate that discard survival is variable, and a brief overview was given by Steenbergen et al (2015) and Revill, (2012). This is discussed in detail in section 3.6.6 of the report. Survivability of flatfish is greater than roundfish (Berghahn & Vorberg, 1998), and can be up to 100%, depending on the speed by which the catch is sorted in the rotating sieves. Research has shown that if fish are released below the water line, mortality due to bird predation is much reduced (pers.com with fishers and management). SG80 is met Although observer reports are available, quantitative analysis of bycatch covers too few hauls to provide high confidence. SG100 is not met.		
d	Management strategy implementation			
	Guide post		There is some **evidence** that the measures/ strategy is being implemented successfully.	There is **clear evidence** that the strategy/comprehensive strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a) or (b).
	Met?		Y	Y
	Justification	Technical measures such as sieve net and rotating sorting drum are used throughout the fishery. The requirement for all vessels to fish with a 70 mm sieve net when targeting shrimp came into force on 1st January 2003. This is a key element of the strategy to minimise capture (and retention) of market size fish species, as well as by-catch, and as a consequence adult sized ETP species. This has been implemented successfully and is enforced appropriately via regular on-board inspections. Collection of discard data is enforced through the Data Collection Framework (DCF) of the European Commission (EC). To comply with		

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The UoA has in place precautionary management strategies designed to:
• meet national and international requirements;
• ensure the UoA does not hinder recovery of ETP species.

Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</td></tr>
<tr><td></td><td></td><td colspan="3">this ruling, shrimp trawlers have been monitored by on board observer programmes since 2008 for the Netherlands and since 2006 for Germany
SG100 is met</td></tr>
<tr><td>e</td><td colspan="4">Review of alternative measures to minimize mortality of ETP species</td></tr>
<tr><td></td><td>Guide post</td><td>There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species.</td><td>There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.</td><td>There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The sieve net was introduced to the brown shrimp fishery in order to reduce bycatch, including ETP species. Alternative measures have been researched, such as the sorting grid and letter box, as discussed in Section 3.6.6 of the report. The letterbox also reduced bycatch of plaice and other flatfish species.
The Client has carried out a thorough review of alternative measures for reducing unwanted catches, and this review is reproduced in Appendix 4. The Management Plan requires that the measures for reducing unwanted catch are reviewed regularly, and the Steering Group has commissioned the University of Hamburg to carry out a review of the effectiveness of the increase in mesh size currently being implemented within the Management Plan. The SG80 therefore is met, but as the review of alternative measures has not previously taken place on a biennial basis, SG100 is not met.
The assessment team considered that the review of alternative measures undertaken by the Client and reproduced in Appendix 4 fulfils the requirements needed to meet the SG80.

The assessment team recommends that in addition to the current technical measures, the Client should at a future review evaluate the potential benefits of seasonal or real time closures (RTCs).</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Steenbergen et al (2015) and Revill, (2012); Berghahn & Vorberg, 1998; Council Directive 92/43/EEC – Habitats; Birds - Council Directive 79/409/EEC; EU Regulation 812/2004 (laying down measures concerning incidental catches of cetaceans in fisheries); Commission Regulation (EC) No. 665/2008 of the 14 July 2008, establishing the Data Collection Framework</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>85</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td>-</td></tr>
</table>

Evaluation Table for PI 2.3.3 – ETP species information

PI 2.3.3		Relevant information is collected to support the management of UoA impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts			
	Guide post	Qualitative information is **adequate to estimate** the UoA related mortality on ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species.	Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.	Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species.
	Met?	Y	Y	N
	Justification	Observer reports are available for all three countries involved in this fishery. There was detailed observer information, which either consisted of a descriptive summary report and table of catch estimates from hauls (Observer report Netherlands and Germany: Steenbergen et al 2015); or proportions of total catch (Denmark). For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled. The tables provide standard deviations for catches, which are very high (Steenbergen et al 2015), therefore estimates will be skewed. The observer data provided by Denmark cover 2014. Available data showed that ETP catches were low (either recorded in few of the hauls, or a very low percentage of the catch). The quantitative data provided is adequate to assess the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. SG80 is met.		
b	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage the impacts on ETP species.	Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species.	Information is adequate to support a **comprehensive strategy** to manage impacts, minimize mortality and injury of ETP species, and evaluate with a **high degree of certainty** whether a strategy is achieving its objectives.
	Met?	Y	N	N
	Justification	Observer reports are available for all three countries involved in this fishery. Information provided on bycatch species, including ETP species, for all three countries was difficult to evaluate and compare across countries. There was detailed observer information, but information available for this assessment was		

PI 2.3.3		Relevant information is collected to support the management of UoA impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.
		limited to a descriptive summary report and table of catch estimates (Observer report Netherlands and Germany: Steenbergen et al 2015); Denmark provided their observer report in a different format using proportions of total catch. For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled. The observer data provide standard deviations for catches, which are very high for some of the bycatch (Steenbergen et al 2015), and therefore estimates will be skewed, but for ETP species standard deviation was low, as these species occurred in few hauls. The observer data provided by Denmark covers 2014. Although there is some quantitative information available, it is not adequate to measure trends and support a strategy. SG80 is not met.
References		Observer reports; Steenbergen et al 2015.
OVERALL PERFORMANCE INDICATOR SCORE:		**70**
CONDITION NUMBER (if relevant):		**4**

Evaluation Table for PI 2.4.1 – Habitats outcome

PI 2.4.1		**The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Commonly encountered habitat status			
	Guide post	The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Y	Y	Y
	Justification	The most commonly encountered habitat is muddy sandy substrate, as this is the natural habitat of brown shrimp. The whole area of the Wadden Sea is predominantly mud/sandy bottom (see Figure 19). The shrimp trawl is designed to fish on such substrate, as described in detail in the main body of the report as well as in Section 3.6.6. Fishing occurs in a highly dynamic area, with considerable tidal currents. Research has been conducted as to the impact of the fishing gear on such an area, and it was found that there is little difference between the natural dynamic disturbance and the fishing gear disturbance (van Denderen et al 2015). Fishing occurs in highly dynamic areas with strong tidal currents with up to 3 knots, it is thought that any tracks left by the 'shoes' (which hold the beam) are soon covered over (Aviat et al 2011). Furthermore, storms regularly move large amounts of sediments, thus redistributing the topography and shifting creeks. Aviat et al (2011) showed that shrimp trawling has little impact on the benthos, due to the comparative lightness of the gear, compared with the flatfish trawl fishery for example – which uses heavier gear. SG100 is met.		
b	VME habitat status			
	Guide post	The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.
	Met?	Y	Y	Y
	Justification	Section 3.6.3 of the report defines VMEs in the context of this fishery and describes in detail the possible VMEs found in the Wadden Sea. To inform the issue as to whether the UoA impacts on VME habitats and to what extent, the assessment team have referred to a range of sources, such as habitat maps, published gear impact studies, known locations of vulnerable species, and spatial information on the shrimp fishing vessels. OSPAR list a number of sensitive habitats in the northeast Atlantic, including the North Sea. A series of maps which clearly show the location and distribution of sensitive habitats in the OSPAR area are available on the OSPAR website (http://www.searchnbn.net/hosted/ospar/ospar.html). The assessment team have carried out a review of these maps, comparing locations of known sensitive / vulnerable habitats, with the location of fishing vessel activities. The habitats relevant to this shallow water fishery are *Sabellaria spinulosa* reefs, *Zostera* beds, and mussel beds.		

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.		
		This review showed that there was negligible overlap between the location of the fishery under assessment and known locations of most sensitive or vulnerable seabed habitats. The principle apparent overlap is in relation to *Sabellaria spinulosa* reefs, which according to the OSPAR maps do occur in the location of the fishery. Sabellaria reefs: Research showed that gear contact with a Sabellaria reef has no long term detrimental effect, the reef area affected by the shoes regrows within a few days, provided the worms themselves have not been killed (Vorberg 2000). Fishers actively avoid Sabellaria reefs for fear of gear /rope entanglement, Thus former reports of shrimp fishers destroying such reefs need to be treated with caution (Vorberg 1995), as the vessels do not have the horse power capacity to deal with entanglement, and their gears are lighter other bottom trawl gear (see Section 3.6.6). SG100 is met. Seagrass beds: Seagrass (*Zostera noltii and Z. marina*) is restricted to the shallow intertidal zone of the Wadden Sea due to their dependence on light. The brown shrimp fishery does not take place in these areas, hence there is no direct impact of the shrimp vessel gears on Seagrass beds. SG100 is met. Mussel beds (*Mytilus edulis*): Shrimp fishing does not occur over intertidal nor subtidal mussel beds; subtidal mussel beds are not common, as mussels need a hard substrate to grow on, an example can be found off Sylt (Natural 2000 site (FFH Gebiet) 'Sylter Aussenriff', although it is not clear from the site description whether the mussel bank is part of the protected site) as it would damage the net. Fishers are not allowed to fish over mussel farming sites. SG100 is met		
c	**Minor habitat status**			
	Guide post			There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.
	Met?			N
	Justification	The geophysical map of the area (Figure 19) indicated that the substrate is predominantly fine sand, sand and mud, with the occasional shallow coarse and mixed sediment. The vessels will only fish over the sandy/muddy areas, as this is where the shrimp is predominantly found, and where the nets will not get snagged Minor habitats, using the MSC definition, would include all those refuge areas which allow organisms to survive during low tide, when the mudflats and sand flats of the Wadden Sea are exposed. The channels in the Wadden Sea are too deep to dry up during low tide. The tidal currents have carved out these channels, with the largest channels more than 40 meters deep. These deep channels are the navigational routes for ships. This is also where benthic animals, marine mammals and fish retreat to when the mud flats and sand flats of the Wadden Sea are exposed at low tide. The tidal flat fishermen catch shrimp and flatfish here. Mussels are farmed on the edges of channels. Although it is highly unlikely that the UoA has an irreversible impact on these highly dynamic channels, no evidence in terms of research could be found. SG100 not met.		
References		http://www.emodnet-seabedhabitats.eu/ www.searchnbn.net/hosted/ospar/ospar.html Vorberg, 2000; Vorberg 1995; van Denderen et al 2015; Aviat et al 2011 section 3.6.6 of main report		

PI 2.4.1	The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.
OVERALL PERFORMANCE INDICATOR SCORE:	**95**
CONDITION NUMBER (if relevant):	**-**

Evaluation Table for PI 2.4.2 – Habitats management strategy

PI 2.4.2		**There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats.
	Met?	Y	Y	N
	Justification	There are measures in place, amounting to a partial strategy, which include: Fishing behaviour: brown shrimp fishing occurs over sandy/ muddy habitats – the commonly encountered geomorphology, as this is where the shrimp are. It does not occur in shallow intertidal areas where seagrass beds may be found, or over *Sabellaria* beds, as the light fishing gear would snag and could possibly be damaged. Fishing occurs in high energy areas. *Sabellaria* reefs are not known to exist in the Dutch and Danish Wadden Sea. In the German Wadden Sea no more reefs have been noted since the end of the 1990s and it is therefore concluded that those formerly known reef sites have vanished (Client – pers.com.). Thus, as the only VMEs under consideration here are *Sabellaria* reefs and seagrass beds, the UoA does not cause serious or irreversible harm. these are not impacted by the UoA Gear configuration: the fishing gear is light with shoes on either end of the beam, and rubber rollers to hold the net down. There is no tickler chain. Location and protected areas: All shrimpers >10m have to fill in a logbook, all shrimpers >12m have VMS and the electronic logbook and all shrimpers >15m have AIS on board. This allows independent verification on where the fishers operate, as the VMS and AIS can distinguish between fishing and steaming. The location of protected and closed areas (as described in detail in Section 3.6.4) is known to the fishers. The signal from the VMS changes when approaching within 4nm of a N2000 thus alerting the vessel, this alarm can be set remotely. The Dutch shrimp fishers have to conduct and EIA as part of their fishing licence for shrimp. For the German fishers, the government conducts the research to assess the effect of the fishery, and the licence does not have to be renewed yearly. The effects of the shrimp fishery were evaluated as part of establishing the national parks in Germany, and were found to be low; they were rated as background disturbance compared to natural physical disturbance and sedimentary dynamics within the Wadden Sea system. The Danish fishers cannot fish to the east of the Shrimp line. SG80 is met SG100 is not met as it has not been possible to obtain and verify observer and compliance data (VMS) on non-MSC fisheries. Furthermore, a strategy requires monitoring of the fishing activity and feedback mechanisms.		
b	Management strategy evaluation			
	Guide post	The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved.
	Met?	Y	Y	N
	Justification	VMS and AIS data show where the fishing vessels are in relation to protected areas. The fishing gears and vessels are checked regularly by independent inspectors to assess compliance with the rules and regulations governing gear and		

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.		
		equipment. These checks are further described in detail under Principle 3 of the report. There are areas closed to any fishing in the Wadden Sea (see Figure 31), as well as an extensive network of marine protected areas (with relevant management systems in place which are carried out via government and /or government appointed agencies), the co-ordinates of which are known to the vessels and can be checked and verified via VMS configuration. It is highly unlikely that the vessels would fish over reefs, as it will damage the gear – the gear is relatively light and designed to fish over sandy/muddy bottom. SG80 is met. Testing is done in the form of monitoring the vessels, and their position in relation to sensitive areas. It has not been possible to verify VMS positions for the most recent fishing years for all three countries. Real time monitoring in the form of habitat surveys to measure possible changes, were not available. SG100 is not met		
c	Management strategy implementation			
	Guide post		There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully.	There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?		Y	N
	Justification	Regular independent verification of the fishing gear and vessels is conducted on all vessels and reports available. VMS plots are available and can be checked, depending on the in-country legal situation regarding data release. The VMS plots are regularly checked by the fisheries managers. The Automatic Identification System (AIS) for fishing vessels, which is an inbuilt tracker as part of standard maritime safety, is not available on smaller vessels, although it has been implemented on all vessels over 15 m. AIS is designed for all marine traffic and the signal travels via satellite to the AIS base stations. SG80 is met In order to meet SG100, it has to be shown that the strategy is implemented across all MSC/non-MSC shrimp fisheries.		
d	**Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs**			
	Guide post	There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs.	There is **some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	Y	N	N
	Justification	Section 3.6.3 of the report defines VMEs in the context of this fishery and describes in detail the possible VMEs found in the Wadden Sea. The UoA is defined as those vessels fishing for brown shrimp in the Wadden Sea area. Those vessels applying for MSC certification includes all shrimp vessels in Germany and Denmark, and the majority of shrimp vessels in the Netherlands (about 10 vessels are not part of the PO, and few vessels use pulse for shrimp fishing, and are thus not part of the UoA – Client pers.com.). There are currently no certified brown shrimp fishers. There are, however non-MSC brown shrimp		

PI 2.4.2	There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.
	fisheries, besides those few vessels which are not part of the PO - and these are Belgian shrimp vessels (5), there are no French shrimp vessels – as these vessels are small in size and to steam to the Wadden Sea is too far away (Client, pers.com.). The shrimp fishery is governed by standard EU fisheries rules outlined above (i.e. Plaice box, net size, sieve net, log-books, VMS etc.), and this applies to all shrimp vessels, including Belgian and French and those not part of the PO. These vessels also have to comply with marine protected are legislation and rules, such as not fishing in closed areas, for example. Furthermore, they are not allowed to fish near mussel beds, nor would it be in their interest, as it damages the gear. The shrimp fishery does not fish over seagrass beds, as these are either located in too shallow and/or intertidal areas, or within the no-access zone in Danish waters. The location of *Sabellaria* reefs had been mapped in the past, but those reefs have now vanished. The Plaice box, established in 1994 and situated north of the Dutch and German Wadden Islands and west of the Danish Wadden Islands, is an area closed for the whole year to beam trawlers with a capacity greater than 300 HP. Although this may not be directly relevant to shrimp fishers, as their engine capacity is no greater than 300hp as part of the brown shrimp management plan[73], it nonetheless further reduces impact on the marine habitat by keeping out the larger vessels. Observer programmes and inspection programmes, as stipulated by EU fisheries regulations, are used to check the location and behaviour of the shrimp fishery, for both MSC shrimp fisheries and non-MSC fisheries. Considering that all shrimp fishers fishing in the Wadden Sea have to comply with EU fisheries rules as well as national and regional protected area management rules, there should be sufficient evidence to meet SG80. However, a recent report by WWF, looking at VMS plots in the German Wadden Sea area, found that although on the whole there is evidence that closed areas are avoided (Kuechly et al. 2016), they none-the-less highlighted the observation that shrimp fishing had been taking place in the Hörnumtief no-take-zone (Schleswig Holstein, see also Figure 31). The information presented could not differentiate whether it was one fisher only, and it is not clear what enforcement action was taken[74].. A field research experiment conducted by Glorius et al (2015), to assess the effects of shrimp fishing, was affected by fishers fishing through the plots, despite a voluntary agreement not to (Client pers.cm.). This questions the ability of the fishers/vessels to identify closed areas or research areas temporarily closed to fishing (even if voluntary) Although there is qualitative evidence that there is compliance with habitat management measures, some quantitative evidence seems to suggest that not all vessels comply. SG80 is not met.
References	Kuechly et al. 2016; Glorius et al 2015 www.gov.uk/government/publications/automatic-identification-system-ais-for-fishing-vessels
OVERALL PERFORMANCE INDICATOR SCORE:	**75**
CONDITION NUMBER (if relevant):	**5**

[73] For each participating country, the number of shrimp vessels and combined kW shall not be higher than the number of vessels and combined kW officially registered by the authorities of the country on 1 January 2015. That means an average of 186.2hp (DK), 193.4hp (D), 204.1hp (NL) – as outlined in the Brown Shrimp Management Plan

[74] Compliance with spatial regulations is inherently the job of the relevant authorities who have implemented the closures. The Client Group is not able to monitor and take action on individual vessels that may breach these regulations, as it only has legal access to anonymized VMS data. In the event of systematic non-compliance with closures, the Group can and will however take action at fleet level: information, warning of the consequences for the fleet, peer pressure etc. (Client – pers.com)

Evaluation Table for PI 2.4.3 – Habitats information

<table>
<tr><td colspan="2">PI 2.4.3</td><td colspan="3">Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td colspan="4">Information quality</td></tr>
<tr><td>Guide post</td><td>The types and distribution of the main habitats are broadly understood.
OR
If CSA is used to score PI 2.4.1 for the UoA:
Qualitative information is adequate to estimate the types and distribution of the main habitats.</td><td>The nature, distribution and vulnerability of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA.
OR
If CSA is used to score PI 2.4.1 for the UoA:
Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.</td><td>The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Extensive habitat surveys have been conducted and are still ongoing as part of designations for Natura 2000 sites, as outlined in Section 3.6.3, National Park status in Germany and Holland and Denmark. Habitat mapping is also being conducted as part of UNESCO World Heritage Site status and monitoring reports (undertaken through the Trilateral Wadden Sea Cooperation). Monitoring of and research into habitat types occurs as part of the Trilateral Wadden Sea cooperation. The European Marine Observation and Data Network, EMODnet, provides updated details of habitats as well as geomorphology of the Wadden Sea area (amongst other areas). SG100 is met</td></tr>
<tr><td rowspan="3">b</td><td colspan="4">Information adequacy for assessment of impacts</td></tr>
<tr><td>Guide post</td><td>Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.

OR

If CSA is used to score PI 2.4.1 for the UoA:

Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.</td><td>Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.

OR

If CSA is used to score PI 2.4.1 for the UoA:

Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.</td><td>The physical impacts of the gear on all habitats have been quantified fully.</td></tr>
<tr><td>Met?</td><td>Y</td><td>N</td><td>N</td></tr>
</table>

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
	Justification	The commonly encountered main habitat is sandy/muddy bottom, where shrimp predominantly live. The Wadden Sea is a highly dynamic system with strong tidal currents and consequently extensive shifting of sediments. This dynamic system is broadly understood. Aviat et al (2011) pointed out that despite public perception and 'misinformation in the media', shrimp trawling has little impact on the benthos, due to the comparative lightness of the gear and gear configuration, compared with the flatfish trawl fishery. Van Denderen et al (2015) showed that trawl and natural disturbance affect benthic communities in similar ways, and given these similar impacts, there was no detectable trawling effect on communities exposed to high natural disturbance, which is similar to the Wadden Sea environment, with its strong currents. VMS maps and vessel logs are available for all shrimp fishing vessels to show where they fish and when. These are checked and verified independently by the relevant authorities. SG60 is met. However, this information was not available to the assessment team in a format that allowed cross comparison across all three countries within a particular time period to assess the intensity of the use of the fishing gear over the main habitat area. SG80 is not met. It cannot be confirmed that the physical impacts of the gear on all habitats have been quantified fully. SG100 is not met.		
c	Monitoring			
	Guide post		Adequate information continues to be collected to detect any increase in risk to the main habitats.	Changes in all habitat distributions over time are measured.
	Met?		Y	Y
	Justification	The Wadden Sea is part of Natura 2000 and subject to the provisions of the Habitats Directive and Birds Directive, which requires monitoring of the Natura 2000 sites (see Article 6 and 11 – Habitats Directive), and to maintain favourable conservation status (as mentioned for example in the Preamble of the Habitats Directive). Continuous monitoring of VMS of the shrimp fishers allows for changes in fishing patterns to be noted, and thus risk evaluations to habitats to be made. At SG80 this is for 'main' habitats, which in this fishery is extensive sandy/muddy substrate areas, the natural habitat of brown shrimp. SG80 is met. The Trilateral Wadden Sea Cooperation, set up as part of implementing the UNESCO World Heritage site ongoing requirements, monitors and assesses the quality of the Wadden Sea ecosystem in collaboration with national and regional authorities and scientific institutions as a basis for effective protection and management. Scientific papers are published regularly (see Section 3.6.6 for example for *Sabellaria* reefs, Seagrass beds and mussel beds). SG100 is met.		
References		http://www.waddensea-secretariat.org/trilateral-cooperation/about-the-cooperation van Denderen et al 2015; Habitats Directive 92/43/EEC – as amended; Aviat et al 2011; http://whc.unesco.org/en/list/1314 http://www.emodnet-seabedhabitats.eu/		
OVERALL PERFORMANCE INDICATOR SCORE:				**75**
CONDITION NUMBER (if relevant):				**6**

Evaluation Table for PI 2.5.1 – Ecosystem outcome

PI 2.5.1		**The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Ecosystem status			
	Guide post	The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Y	Y	N
	Justification	As with many fisheries the most obvious ecosystem impact of the fishery is likely to be caused by the removal of large quantities of the target species and the impact that this in turn has on food web dynamics. *C.crangon* is a lower trophic-level species, but the importance of *C. crangon* as a food source depends on the spatial scale. On a wider scale in the North Sea the importance of *C.crangon* is expected to be minor, but in the local coastal areas where *C.crangon* is distributed it is an important food component in the diet of a number of species, even though its role in the energy flow is not dominant. Research has shown, as described in Section 3.6.5, that predators are not reliant on brown shrimp only, and switch to other prey when necessary. Under Principle 2 it has been shown that the level of bycatch (whether retained or discarded) is kept low by the use of sieve nets and speedy on-board sorting techniques and that any bycatch brought on board is likely to be small (year 0) and with reasonable prospect of post capture survival. The predator–prey interactions have increased in complexity with the gradual build-up of three marine mammal populations in the coastal areas inhabited by brown shrimp, namely harbour seals, harbour porpoise, and grey seals. The combined assembly consumes an estimated total of 145 000t fish annually; many of these will be brown shrimp predators (Temming and Hufnagl, 2014). Other ecosystem impacts have also been considered – these include unintended consequences of operation such as lost gear, fuel and oil pollution, waste and litter. The client has ratified the MARPOL convention and is thus responsible for dealing with any pollution issues. This was discussed in Section 3.6.5. The UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. SG80 is met Although there is some evidence in the form of individual species and groups studies, such as population trends in seabirds, gadoid/ brown shrimp interactions, the system is too physically dynamic in order to tease out the separate ecosystem components quantitatively over a long time series. SG100 is not met.		
References		Berghahn 1996; Thorup et al 2016; Laursen et al 2010; ICES Advice on BS 2014; Temming & Hufnagl, 2014; MARPOL;		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				**-**

Evaluation Table for PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary which take into account the **potential impacts** of the fishery on key elements of the ecosystem.	There is a **partial strategy** in place, if necessary, which takes into account **available information and is expected to restrain impacts** of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place.
	Met?	Y	Y	N
	Justification	Sustainable management of fisheries within the waters of the European Union are facilitated and effected under the framework of the Common Fisheries Policy. For the future, the CFP recognises the need to manage fisheries collectively on a multispecies basis as well as recognising the need to increasingly take into account ecosystem aspects and influences in formulating future fishery management policy and in developing management plans. Significant advances are being made at scientific level principally through ICES e.g. Working Group on Multispecies Assessment Methods (WGSAM), in order to support the development of multispecies assessment methodologies. The Clients' commitment to the CFP supports future developments with respect to fisheries management at European level and forms the basis of a partial strategy that is increasingly expected to take into account and restrain ecosystem impacts of the fishery in the future. In the case of the brown shrimp fishery, the client has initiated the establishment of a brown shrimp management plan, covering the Wadden Sea, and the plan specifically addresses the ecosystem aspect of the fishery – its stated objective is: *The objective of this management plan is a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimized effects on the marine ecosystem.* While implementation of a full ecosystem approach to fisheries management is still some way off and in depth scientific debate is taking place at an international level as to the best ways to implement such a policy (such as discussions on how best to implement the Landings Obligation aspect of the reformed CFP for demersal fisheries – at a practical level), some measures are in place in the interim to identify and avoid or reduce ecosystem impacts of the fishery where possible. A full suite of management measures apply to the shrimp fishery at fleet level across all three countries involved, including vessel licensing, total licence capping, effort restrictions (days at sea); while a second tier of technical control measures, such as gear design, on board sorting design and gear restrictions (no pulse) adds to the partial strategy to manage ecosystem impacts of the fishery. In addition, the client promotes research into reducing ecosystem impacts of fishing and has supported research into net design specific for the shrimp fishery, as well as bycatch reduction devices, for example, in order to reduce ecosystem impacts. Further provisions of European law designed to protect the marine environment and marine ecosystems, such as the Marine Strategy Framework Directive 2008/56/EC, in conjunction with the Habitats Directive (92/43/EEC) are playing an important role		

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.		
		in limiting fishery related ecosystem impacts. The Marine Strategy Framework also aims to establish a network of Marine Protected Areas by 2020.SG80 is met. The brown shrimp management plan has not been in place for long enough (it came into force on the 1st January 2016) and therefore the data time series on some of the measures is too short to establish whether all the main impacts of the UoA on the ecosystem are addressed. This will be available once feedback is provided into the management plan through ongoing information collection. SG100 is not met		
b	Management strategy evaluation			
	Guide post	The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or ecosystem involved
	Met?	Y	Y	N
	Justification	Measures are in place to identify and avoid or reduce ecosystem impacts of the fishery where possible (through e-logs, ETP logs, VMS). A full suite of management measures, as listed in the Brown Shrimp management plan, apply to brown shrimp at fleet level across all three countries, including vessel licensing, licence capping, and effort limitation, as well as technical control measures on gears and vessels. SG60 is met. The partial strategy outlined under a) takes account of the benthic ecosystem in terms of trawling per se, including bycatch reduction measures. Experiments have been conducted on the effects of the gear on the benthos, in relation to the high energy environment in which fishing takes place. Experiments have improved gear selectivity to reduce bycatch. In addition, existing fishery management measures (e.g. licensing and days at sea) limit the impact of the fishery on the ecosystem. SG80 is met. As in a) above, the brown shrimp management plan has not been implemented for long enough to allow testing. SG100 not met.		
c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Y	N
	Justification	Compliance reports, provided by the client, show that gear specifications are implemented; e-logs and VMS plots indicate that days at sea and information collection requirements are being implemented throughout the fleet. VMS plots indicate where the fishers comply with Natura 2000 requirements and National Parks rules. Fishers participate in research to improve gears so as to reduce ecological impacts. SG80 is met. As in b) above, the Brown Shrimp management plan has not been implemented for long enough to build up clear evidence over at least one year. SG100 is not met.		
References		Brown Shrimp Management Plan Marine Strategy Framework Directive 2008/56/EC; Habitats Directive (92/43/EEC		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**

PI 2.5.2	**There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.**
CONDITION NUMBER (if relevant):	**-**

Evaluation Table for PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	Information is adequate to **identify** the key elements of the ecosystem.	Information is adequate to **broadly understand** the key elements of the ecosystem.	
	Met?	Y	Y	
	Justification	Information is adequate to broadly understand the key elements of the ecosystem. Key elements include the trophic structure of the Wadden Sea ecosystem such as prey, predators and competitors; community composition, productivity patterns and characteristics of biodiversity. The Common Wadden Sea Secretariat initiates extensive research into the ecosystem of the Wadden Sea (see also Sections in 3.6.4). SG80 is met		
b	Investigation of UoA impacts			
	Guide post	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**.	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**.
	Met?	Y	Y	N
	Justification	The main impacts of this fishery on the ecosystem consist of fishery removal and physical impact on the benthos. Main interactions between the fishery and the ecosystem elements listed under a) can be inferred from existing information, and have been investigated for demersal shrimp trawl (van Denderen et al, 2015; Vorberg 1997; Løkkeborg 2005; Rumohr et al. 1994), as well as the detailed overview given in Section 3.6.5 of this report. SG80 is met Although the Common Wadden Sea Secretariat as well as various research institutes (Thuenen in Germany for example, IMARES/Wageningen Marine Research in Holland), there remain knowledge gaps, as highlighted by the Thuenen Institut for example (pers.com), as it is inherently difficult to conduct field research on such a dynamic system. SG100 is not met.		
c	Understanding of component functions			
	Guide post		The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**.	The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood**.
	Met?		Y	N
	Justification	The main functions of the components (i.e. target species, primary, secondary and ETP species and Habitats) in the ecosystem are known. Sections in 3.6 of the main report outline the array of data that are collected in relation to the fishery. The range of data is sufficient to inform about the main functions of the components in the ecosystem. SG80 is met Observer reports are not consistent across all three clients, and neither are they frequent enough in order to understand the impact of the UoA on secondary and ETP species. There is little information available in the scientific literature to understand the impact of the UoA on benthic non-fish species in the bycatch. SG100 is not met.		

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
d	Information relevance			
	Guide post		Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred.	Adequate information is available on the impacts of the UoA on the components **and elements** to allow the main consequences for the ecosystem to be inferred.
	Met?		Y	N
	Justification	There is adequate information available on the impact of shrimp trawl fishery on these components to allow some of the main consequences for the ecosystem to be inferred. This has been discussed in detail in the main Sections (3.6.1 and 3.6.2 and 3.6.6) of this report. SG80 is met As in c) above, Observer reports are not consistent across all three countries, and nor are they frequent enough to meet this SG. SG100 is not met.		
e	Monitoring			
	Guide post		Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?		Y	N
	Justification	Data is routinely collected on a regular basis to allow for the detection of any change or increase in risk level to the main ecosystem components. Relevant data collected include landings data for the target species, discard data from observer trips and reports, and spatial data in relation to fishing effort (via EU logbooks and VMS). The client has implemented data logging on ETP species on each vessel. SG80 is met. As in c) above, Observer reports are not consistent across all three countries, and nor are they frequent enough to meet this SG. SG100 is not met.		
References		http://www.waddensea-secretariat.org/ van Denderen et al, 2015; Vorberg 1997; Løkkeborg 2005; Rumohr et al. 1994; Observer reports		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				**-**

Evaluation Table for PI 3.1.1 – Legal and/or customary framework

The “Governance and Policy” component of Principle 3 (the PIs pre-fixed with 3.1) focuses on the high level context of the fishery management system within the UoA.

		The management system exists within an appropriate legal and/or customary framework which ensures that it: • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Compatibility of laws or standards with effective management			
	Guide post	There is an effective national legal system **and a framework for cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and **organised and effective cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and **binding procedures governing cooperation with other parties** which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	(Y)	(Y)	(Y)
	Justification	The brown shrimp stock is distributed between the territorial waters and EEZs of the three European Union (EU) member states (Denmark, Germany, Netherlands). Other EU member states (France, Belgium) have access to the resource. As a result, the UoA is a “shared stock” in terms of the jurisdictional category described in MSC FCR v2.0 SA4.1.1. The EU is a contracting party to the United Nations Convention on the Law of the Sea (UNCLOS) and United Nations Fish Stocks Agreement (UNFSA) and the Common Fisheries Policy (CFP) contributes to the EU’s implementation of its international obligations to UNCLOS and UNFSA. The CFP is the principal legislative instrument for fisheries management in the EU. A new CFP came into effect on 1st January 2014, with EU Regulation No. 1380/2013 amending the previous CFP. The CFP also commits the EU and Member States to obligations and commitments set out in international Treaties / Agreements (e.g. Convention on Biological Diversity), and through European Directives, (e.g. 2008/56/EC Marine Strategy Framework Directive, 2009/147/EC Birds Directive, 92/43/ECC Habitats Directive). Within the framework of the CFP, fisheries rules and control systems are agreed on at an EU level, but implemented by the member states through their national authorities and inspectors. Member States also adopt fisheries conservation and management measures through the amendment and provisions of their own national Fisheries Acts. In so doing, they are required to act in a manner that is fully consistent with UNCLOS and UNFSA. Similarly, Member States adopt their own national legislation in order to deliver requirements associated with the nature conservation and Good Environmental Status (GES) Directives highlighted above. The European Fisheries Control Agency (EFCA) has been established to encourage closer collaboration and exchange of best practice on applying EU fisheries regulations. The agency undertakes joint control campaigns, where inspectors from different EU countries join forces. EU Commission inspectors also conduct inspections of national administrations, ensuring appropriate and effective application of the regulations. Advisory Councils (ACs) - stakeholder organisations composed of representatives from the fishing industry and from other interest groups, e.g. environmental organisations, anglers, trade- and processors - have been established to provide the Commission and EU Member States with recommendations on fisheries management matters. The North Sea Advisory Council (NSAC) provides the forum		

	The management system exists within an appropriate legal and/or customary framework which ensures that it: • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**			
		for this specific fishery. The NSAC has established a Brown Shrimp Focus Group that has been discussing and providing advice on the fishery and management plan. The overarching CFP, EU nature conservation and GES Directives and the Member States national fisheries and nature conservation legislation combine to create effective national systems and binding procedures governing cooperation with other parties which deliver management outcomes consistent with MSC Principles 1 and 2, thereby meeting SG 100.		
b	Resolution of disputes			
	Guide post	The management system incorporates or is subject by law to a **mechanism** for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes which is **considered to be effective** in dealing with most issues and that is appropriate to the context of the UoA.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes that is appropriate to the context of the fishery and has been **tested and proven to be effective**.
	Met?	(Y)	(Y)	(Y)
	Justification	The EU legal system provides for resolution of disputes between actors from the same or different EU member state. The Court of Justice for the European Union ensures EU law is interpreted and applied in the same way in all EU countries, and settles legal disputes between national governments and EU institutions. It can also, in certain circumstances, be used by individuals, companies or organisations to take action against an EU institution, if they feel it has somehow infringed their rights. The national judicial systems of the Member States provide effective transparent mechanisms for the resolution of legal disputes. Section 19 of the Danish Fisheries Act, 2006 incorporates transparent mechanisms for resolution of appeals and complaints (i.e., disputes) about fisheries management decisions made by delegated authorities and/or the Fisheries Minister. The national judicial system also provides a means of appeal and resolution. There are two recent examples: (i) The Danish Society for Nature Conservation challenged a decision to allow mussel dredging in a Natura 2000 area; the EU Commission opened a procedure against Denmark but the case was dropped due to lack of merit before it went to the EU court in Strasbourg. (ii) Three Danish vessels that were caught fishing in area outside 12 nm that Sweden and Denmark had closed appealed the decision in the Danish court system and lost in the High court of appeal. Section 16 of the German Fisheries Act (Seefischereigesetz), provides for a dispute resolution process. The public judicial system also offers a route for appeal to a dispute and ultimately recourse to the EU court of justice. In the Netherlands an established and tested legal framework exists. The Fisheries Act (Visserijwet 1963) establishes an institutional framework, and within this there are transparent mechanisms for resolution of legal disputes. All the judgements of the Dutch court cases can be found on-line: http://uitspraken.rechtspraak.nl/#. The management system incorporates and is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery, and has been tested and proven to be effective, thereby meeting the SG 100.		
	Respect for rights			

<table>
<tr><td colspan="2"></td><td colspan="3">The management system exists within an appropriate legal and/or customary framework which ensures that it:
• Is capable of delivering sustainability in the UoA(s); and
• Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and
• Incorporates an appropriate dispute resolution framework.</td></tr>
<tr><td rowspan="3">c</td><td>Guide post</td><td>The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td></tr>
<tr><td>Met?</td><td>(Y)</td><td>(Y)</td><td>(Y)</td></tr>
<tr><td>Justification</td><td colspan="3">Through the CFP, the EU management system creates, respects, and ensures legal rights, which are expressly created or established for the practices of people dependent on fishing for their food or livelihood. The CFP access arrangements within the 12 nm zones of EU member states are considered a key mechanism. The CFP states that, “Existing rules restricting access to resources within the 12 nm zones of Member States have operated satisfactorily, benefitting conservation by restricting fishing effort in the most sensitive part of Union waters. Those rules have also preserved the traditional fishing activities on which the social and economic development of certain coastal communities is highly dependent. Those rules should therefore continue to apply. Member States should endeavour to give preferential access for small-scale, artisanal or coastal fishermen.”
At the EU member state level, the mandatory issuing of fishing licences could also be viewed as a way of implicitly or explicitly committing to the legal rights of people dependent on fishing for food and livelihood, e.g. in Denmark, it is illegal to hold a license (or quota) without being a commercial fisherman (which means at least 60% of your income is from fishing). This means that the legal ownership and control stays in the coastal fishing communities (because licenses/quotas cannot be held by non-fishermen/non-fishing companies). Furthermore, licenses issued by member states have conditions that specify gear and operational requirements that may directly or indirectly contribute and be consistent with MSC Principles 1 and 2. Therefore, it is considered that the management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2, thereby meeting SG 100.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">The Common Fisheries Policy CFP
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:354:0022:0061:EN:PDF

EC Marine Strategy Directive
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056

EC Birds Directive
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147

EC Habitats Directive
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

EC 2007/409/EC establishing Advisory Councils
http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:c11128&from=EN

Danish Fisheries Act (Bekendtgørelse af fiskerilov)</td></tr>
</table>

	The management system exists within an appropriate legal and/or customary framework which ensures that it: • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
	https://www.retsinformation.dk/forms/R0710.aspx?id=162022. Danish Habitat Act https://www.retsinformation.dk/Forms/R0710.aspx?id=177832 . German Marine Fisheries Act (Seefischereigesetz) http://www.bmel.de/EN/Homepage/homepage_node.html The German Federal Nature Conservation Act http://germanlawarchive.iuscomp.org/?p=319 Lower Saxony Fishery Act and Fishery Regulation http://www.voris.niedersachsen.de/jportal/?quelle=jlink&query=BNatSchGAG+ND&psml=bsvorisprod.psml&max=true Schlewig-Holstein Fishery Act http://www.gesetzerechtsprechung.sh.juris.de/jportal/?quelle=jlink&query=NatSchG+SH&psml=bsshoprod.psml&max=true The Netherlands Fisheries Act (Visserijwet) http://faolex.fao.org/cgibin/faolex.exe?rec_id=012444&database=FAOLEX&search_type=link&table=result&lang=eng&format_name=@ERALL. The Netherlands Nature Conservation Act http://www.envir-advocaten.com/en/nature-conservation-law North Sea Advisory Council http://www.nsrac.org The European Fisheries Control Agency http://www.efca.europa.eu

OVERALL PERFORMANCE INDICATOR SCORE:	**100**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 3.1.2 – Consultation, roles and responsibilities

<table>
<tr><td colspan="2">PI 3.1.2</td><td colspan="3">The management system has effective consultation processes that are open to interested and affected parties.
The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="4">a</td><td colspan="4">Roles and responsibilities</td></tr>
<tr><td>Guide post</td><td>Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.</td><td>Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.</td><td>Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.</td></tr>
<tr><td>Met?</td><td>(Y)</td><td>(Y)</td><td>(Y)</td></tr>
<tr><td>Justification</td><td colspan="3">Sections 3.7.3 and 3.7.4 of this report provide descriptions of the key roles and responsibility in the fishery management process.
Organisations and their roles are well defined at both EU and national levels, they include:

The European institutional structures:
o Council of the EU
o European Parliament,
o European Commission

National administrations:
Denmark
o Danish Agrifish Agency (NaturErhvervstyrelsen)
o Danish Nature Agency (Naturstyrelsen)
o National Institute of Aquatic Resources (Institut for Akvatiske Ressourcer - DTU Aqua)
o Danish Fishing Monitoring Center (Center for Kontrol Fiskerikontrol).

Germany
o German Federal Ministry of Food and Agriculture (Bundesministerium für Ernährung und Landwirtschaft)
o Lower Saxony and Schlewig-Holstein.
o The German Federal Agency for Nature Conservation (Bundesamt für Naturschutz
o The Thünen Institute

Netherlands
o Ministry of Economic Affairs (Ministerie van Economische Zaken)
o Dutch Food Safety Authority (Nederlandse Voedsel- en Warenautoriteit (NVWA))
o Institute for Marine Resources and Ecosystem Studies (Wageningen Marine Research, which used to be IMARES)
o Ministry of Infrastructure and the Environment (Ministerie van Infrastructuur en Milieu)

External scientific advice
o ICES

Management, policy advice and stakeholder participation
o North Sea Advisory Council (NSAC)</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.1.2</td><td colspan="3">The management system has effective consultation processes that are open to interested and affected parties.
The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</td></tr>
<tr><td></td><td></td><td colspan="3">o ENGOs

Industry representation
o Producer Organisations
o Brown Shrimp Cooperative MSC Group

Administration of the Management Plan
o Working Group
o Steering Committee
o Independent Control (i.e. Landwirtschaftskammer & Zuidema Projectmanagement)

Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction, thereby meeting the SG 100.</td></tr>
<tr><td>b</td><td colspan="4">Consultation processes</td></tr>
<tr><td></td><td>Guide post</td><td>The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.</td><td>The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.</td><td>The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.</td></tr>
<tr><td></td><td>Met?</td><td>(Y)</td><td>(Y)</td><td>(N)</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The CFP has undergone three reviews: 1992, 2002 and 2014. The last full review took effect on 1st January 2014 after lengthy public consultation by the EU Commission that began in 2009. The CFP has also undergone mid-term review. Each review has consulted and invited input from stakeholders in an open and transparent manner. This process has included the publication of submissions by stakeholders and consideration of the information obtained when publishing the outcomes of the reviews.
The 1992 review of the CFP resulted in the formation of Regional Advisory Councils (RACs), now referred to as Advisory Councils (ACs). These are stakeholder-led organisations that provide the Commission and EU countries with recommendations on fisheries management matters within their region. This may include advice on conservation and socio-economic aspects of management, and on simplification of rules and the contribution of data for fisheries management and conservation measures.
The North Sea Advisory Council (NSAC) has established a Focus Group through which the management of North Sea shrimp stocks can be discussed and advice based on stakeholder input, including local knowledge, is sought and used to provide recommendations to the Commission.
The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained thereby meeting the SG 80.</td></tr>
</table>

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
		The SG 100 is not met owing to the lack of evidence to show that the management system demonstrates consideration of the information and explains how it is used or not used.		
c	Participation			
	Guide post		The consultation process **provides opportunity** for all interested and affected parties to be involved.	The consultation process provides **opportunity and encouragement** for all interested and affected parties to be involved, and **facilitates** their effective engagement.
	Met?		(Y)	(Y)
	Justification	As indicated in SIb above, all interested and affected parties, e.g. fishermen, trade- and processors, ENGOs, scientists, are encouraged to participate in dialogue and consultation of the fisheries management system. As well as regular public consultation on the EU CFP, the EU Commission has created and funded the Advisory Councils (ACs) as a means to encourage, aid and help consultation. It is therefore considered the consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement thereby meeting the SG 100.		
References		NaturErhvervstyrelsen http://agrifish.dk/fisheries/ Naturstyrelsen http://www.aqua.dtu.dk/english/Research /Fisheries-management Institut for Akvatiske Ressourcer http://www.aqua.dtu.dk/english/Research/Fisheries-management Bundesministerium für Ernährung und Landwirtschaft http://www.bmel.de/EN/Homepage/homepage_node.html Bundesamt für Naturschutz https://www.bfn.de Thünen Institute https://www.thuenen.de/en/ Ministerie van Economische Zaken https://www.government.nl/ministries/ministry-of-economic-affairs IMARES http://www.wageningenur.nl/en/Expertise-Services/Research-Institutes/imares.htm Ministerie van Infrastructuur en Milieu https://translate.google.ca/translate?hl=en&sl=nl&u=https://nl.wikipedia.org/wiki/Ministerie_van_Infrastructuur_en_Milieu&prev=search Landwirtschaftskammer https://www.landwirtschaftskammer.de		

PI 3.1.2	**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**	
	ICES http://www.ices.dk/ Common Fisheries Policy reform: http://ec.europa.eu/fisheries/reform/index_en.htm http://ec.europa.eu/fisheries/reform/consultation/index_en.htm	
OVERALL PERFORMANCE INDICATOR SCORE:		**95**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 3.1.3 – Long term objectives

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	Long-term objectives to guide decision-making, consistent with the MSC fisheries standard and the precautionary approach, are **implicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach are **explicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach, are **explicit** within **and required by** management policy.
	Met?	(Y)	(Y)	(Y)
	Justification	As shown in section 3.7.2 of this report, Article 2 of the CFP sets out clear long-term objectives that guide decision-making. The precautionary approach, as defined by UNFA, is explicit within the CFP. All EU member state fisheries policy is established in accordance with the CFP. It is therefore considered that clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach, are explicit within and required by management policy, thereby meeting the SG 100.		
References		The Common Fisheries Policy CFP http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:354:0022:0061:EN:PDF		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.1 Fishery-specific objectives

The "Fishery-specific management system" component of Principle 3 (the PIs pre-fixed with 3.2) focuses on the management system directly applied to the fishery. In this instance, there are three aspects of the management that need to be taken into account – the EU, where it is specific to the fishery, member state administration/management and the voluntary approach being adopted by the client group through their Brown Shrimp Management Plan.

PI 3.2.1		The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	**Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system.	**Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.	**Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.
	Met?	(Y)	(Y)	(N)
	Justification	The three respective member states are obliged to meet the objectives set out by the EU's CFP (see section 3.7.2) for the management of their fisheries. Their national fisheries and nature conservation related acts also confirm their commitment and/or specify complimentary objectives that are consistent with achieving the outcomes expressed in MSC Principles 1 and 2. The Brown Shrimp Management Plan states a single overarching objective: "*The objective of this management plan is a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimized effects on the marine ecosystem*." While it is expressed as a single objective it is consistent with achieving the outcomes expressed by MSCs Principle 1 and 2. Other, less clearly explicit objectives within the management plan include, "avoiding recruitment overfishing"; "avoid unmanaged increases in effort"; and, "minimizing unwanted by-catch". The fishery therefore achieves SG 80 as short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the national and industry led brown shrimp fishery management system. The SG 100 is not achieved because the objectives are not defined in such a way that the performance against them can be measured.		
References		The Common Fisheries Policy CFP http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:354:0022:0061:EN:PDF Danish Fisheries Act (Bekendtgørelse af fiskerilov) https://www.retsinformation.dk/forms/r0710.aspx?id=162022 German Fisheries Act (Seefischereigesetz) http://www.gesetze-im-internet.de/seefischg/index.html Netherlands Fisheries Act (Visserijwet) http://wetten.overheid.nl/BWBR0002416/2011-04-01 Danish Nature Conservation Act (Naturbeskyttelsesloven) http://faolex.fao.org/docs/html/den125733.htm		

PI 3.2.1	The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.	
	German Nature Conservation and Landscape Act (Gesetz über Naturschutz und Landschaftspflege) http://www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Naturschutz/bnatschg_en_bf.pdf Netherlands Nature Conservation Act 1998 as amended (Natuurbeschermingswetvergunning) (which will be amended in 2017 incorporating the Fauna and Flora, Forestry and Nature Conservation Acts) The Brown Shrimp Fishery Management Plan Version 1.0 (2016)	
OVERALL PERFORMANCE INDICATOR SCORE:		**80**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 3.2.2 – Decision-making processes

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Decision-making processes			
	Guide post	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	(Y)	(N)	
	Justification	The national authorities and, in the case of Germany regional authorities too, have policy and fisheries control and enforcement units that have established internal and external decision making processes that result in measures and strategies to support the management of the brown shrimp fishery and deliver the objectives established by their respective fisheries and nature conservation acts, e.g. regular internal and external (between member states) control and enforcement meetings to review and re-direct effort as a result of any identified compliance issues (see section 3.7.6). The Brown Shrimp Management Plan identifies a Steering Committee as the main decision-making body. Their decision-making process requires a consensus of the three Committee members (or their deputy). The Steering Committee receives support as necessary from a "Working Group". The membership of the group is not specified in the Management Plan, this will be established depending on the subject being considered by the Committee (Oberdörffer, 2016, pers comm, 4 March). Decisions such as the incremental increase in mesh size and the implementation of the harvest control rules will contribute to the overarching objective of the management plan. It is therefore considered that there are decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives so meeting the SG 60. *The MSC CR guidance (GSA 4.8) says, "established" decision-making processes should be understood to mean that there is a process that can be immediately triggered for fisheries-related issues, the process has been triggered in the past and has led to decisions about sustainability in the fishery. These processes may or may not be formally documented or codified under an official statute.* Using the MSC guidance, it is not possible to say that there are "established" decision-making processes owing to the short period of time within which the Management Plan has been operational. The Management Plan was adopted on 1st December 2015 and came into force on 1st January 2016. The decision making process has not yet been triggered and so for this reason the SG 80 is not met.		
b	Responsiveness of decision-making processes			
	Guide post	Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take	Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.		
			account of the wider implications of decisions.	
	Met?	(Y)	(Y)	(N)
	Justification	The brown shrimp fishery has operated for many years within an EU and national framework of regulations and management measures. In comparison to other EU demersal fisheries, the level of regulation is considered to be relatively low. The measures and regulations that apply demonstrate decision-making processes at an international, national and, in the case of Germany, at the regional level too. These measures and regulations have, and continue to be, informed and respond to issues identified in research, monitoring, evaluation and consultation. There is a strong commitment to consultative processes by the EU and national administrations which aids transparency and helps to take account of the wider implications of decisions. The Brown Shrimp Management Plan sets out key serious and important decisions that the Steering Committee will make in the short, medium and longer term, e.g. incremental mesh size increase, fleet capacity, increase in the average effort of vessels, unwanted catch. In so doing, the plan identifies that advice will be sought with respect to research, monitoring and evaluation by using scientific advice from a relevant scientific institution. Advice on fulfilling the objectives of the plan from stakeholders will also be encouraged, through participation at the North Sea Advisory Council (NSAC). The plan explicitly identifies the need to be adaptive in its approach with respect to achieving high long term sustainable yields and the necessity for being adaptive is also implied with respect to recognizing the need to re-evaluate or refine the management plan or elements therein based on scientific advice and monitoring. With the plan only being implemented at the beginning of 2016, evidence of decision making by the Steering Committee is not yet available, however, the development of the management plan over several years, does provide clear evidence that the decision making process has responded to serious and other important issues identified in relevant research, monitoring, evaluation, e.g. drawing directly from scientific studies and advice from ICES in the adoption of LPUE, consulting with the NSAC on the draft management plan, and therefore gives the assessment team evidence and confidence that identified decision milestones will be adhered to. The SG 80 is therefore considered to have been met. The SG 100 is not met as it cannot be said that decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation.		
c	Use of precautionary approach			
	Guidepost		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		(Y)	
	Justification	For the purposes of scoring this PI, the MSC interpret the precautionary approach to mean being cautious when information is uncertain, unreliable or inadequate and that the absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures. The CFP explicitly requires the precautionary approach to be applied to fisheries management. Any management measure that is implemented within the fishery, e.g. the plaice box, is therefore required to apply the precautionary approach. The Brown Shrimp Management Plan has adopted harvest control rules using a precautionary approach. In the absence of scientific information that would allow a conventional stock assessment and annual total allowable catches (TAC), a reference LPUE figure has been set using two reference years - a year when the		

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.**		
		average LPUE was low and a year when it was average, i.e. using caution. In this way, if catch levels fall below predetermined levels then the hours available for fishing are reduced. Stakeholders, including the ICES Working Group on Crangon have recognized and endorsed this as an appropriate precautionary approach to managing the fishery. There are no other explicit examples of a precautionary approach to decision making within the management plan. The assessment team concludes that the decision-making process uses the precautionary approach based on best available information thereby meeting the SG 80. The assessment team recommends that future iterations of the management plan include an explicit statement that the precautionary approach, as defined by MSC, will be adopted within the decision making process.		
d	Accountability and transparency of management system and decision-making process			
	Guide post	Some information on the fishery's performance and management action is generally available on request to stakeholders.	**Information on the fishery's performance and management action is available on request**, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders **provides comprehensive information on the fishery's performance and management actions** and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	(Y)	(N)	(N)
	Justifi cation	Through interview and correspondence during the information gathering phase of this assessment, national authorities considered they responded to information requests on the fishery's performance and management and provided explanations for any actions, or lack of action, associated with findings and recommendations from research, monitoring, evaluation and review activity. Stakeholders interviewed, in general, considered this to be the case. However, as part of the ENGO consortium submission, the assessment team was provided with correspondence from an industry representative to Dutch regulatory authorities requesting a response to their concerns of breeches to the weekend fishing restrictions. Responses were not apparently forthcoming and, on follow up by the assessment team to see how this issue was dealt with, no response was received by the time of completing this draft report. With respect to the implementation of the management plan, information on the fisheries performance and management action is made available to the harvesters via PO newsletters and their websites. PO representatives are also very active in communicating and corresponding with their members. There is a commitment to their membership to provide explanations for any actions or lack of action associated with findings and relevant recommendations from research, monitoring evaluation and review activity. There is an explicit commitment within the management plan for the Brown Shrimp Cooperative MSC Group to present results of any scientific evaluation and monitoring of progress and changes to the plan to the NSAC, i.e. where non-fishing key stakeholder groups are represented, and have already participated in discussions related to the management of this fishery.		

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.		
		It is too early into the adoption and implementation of the management plan to have evidence that access to information is available to all stakeholders, so while the fishery meets the SG 60 it does not achieve the SG 80. The assessment team recommends that, in the interest of transparency and to allay concerns some stakeholders have expressed about the effective implementation of the plan the following additional information is made publicly available: • Any non-compliance of the management plan and action taken including penalties/sanctions; • Maps showing the location of all closed areas and overlays of VMS or AIS data, and, • Monthly sievage and LPUE reports.		
e	Approach to disputes			
	Guide post	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	(Y)	(Y)	(Y)
	Justification	There is no evidence that the management authorities or the fishery has shown disrespect or defiance of the law, nor repeatedly violated the same law or regulation necessary for the sustainability of the fishery. There is also no evidence of any legal challenges or any judicial action through the courts. Prior to the implementation of the management plan there was no legal challenge or judicial review of the fishery. In the opinion of the assessment team, the high importance MSC certification has for the fishery and the co-management approach that has evolved and been implemented in an attempt to achieve certification, have helped to reduce the likelihood of a legal dispute. Therefore, the management system and the fishery is considered to act proactively to avoid legal disputes and would act rapidly to implement judicial decisions arising from legal challenges, thereby achieving the SG 100.		
References		The Brown Shrimp Management Plan Version 1.0 (2016) North Sea Advisory Council (NSAC) http://www.nsrac.org/?s=brown+shrimp ICES advice in response to a special request by the Netherlands and Germany http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/Special%20Requests/Germany_NL_Crangon_advice.pdf		
OVERALL PERFORMANCE INDICATOR SCORE:				**70**
CONDITION NUMBER (if relevant):				**7**

Evaluation Table for PI 3.2.3 – Compliance and enforcement

<table>
<tr><td colspan="2">PI 3.2.3</td><td colspan="3">Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="4">a</td><td colspan="4">MCS implementation</td></tr>
<tr><td>Guide post</td><td>Monitoring, control and surveillance mechanisms exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.</td><td>A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.</td><td>A comprehensive monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.</td></tr>
<tr><td>Met?</td><td>(Y)</td><td>(N)</td><td>(N)</td></tr>
<tr><td>Justification</td><td colspan="3">A monitoring, control and surveillance (MCS) system has been implemented in the fishery through national administrations and also through the implementation of the tri-lateral management plan.
The national administrations include resources and systems to support the MCS of the fishery as set out in section 3.7.6. The national authorities consider the fishery to be a low risk with relatively few and minor instances of non-compliance.
Evidence shows non-compliance is dealt with accordingly through official warnings, fines and endorsement of fishing licenses depending on the severity of the offence.
Implementation of the management plan requirements is supported by an independent control agency, the Landwirtschaftskammer, based in Germany. The agency provides a full time inspector who is responsible for monitoring and reporting on compliance of the plan. An independent consultant, Zuidema Project management, based in the Netherlands working 3 days a week supports the inspector. They only monitor the management plan requirements. These relate to:
Hours/days fished;
Beam length;
Weight of fishing gear;
Mesh size;
Use of specified sieve net/sorting grid;
On-shore sieve dimensions;
Quantity of sievage, i.e. the brown shrimp that falls through the shore sieve;
Data collection, including ETP species info.
The plan commits to inspection of at least 20% of the vessels working to the plan in each country being inspected annually – using membership figures as of April 2016 that would be at least 6 Danish vessels and 38 vessels in Germany and the Netherlands, respectively. Each member PO is to be inspected at least once a year; and sieving stations at least twice a year.
Inspections follow a protocol to ensure standardised and comparable inspections of POs and member fleets. A process for penalising any infringements of the plan requirements are also set out in the management plan along with an Annex that describes the penalties.
Inspection reports are provided every 3 months to the Steering Committee.
The assessment team observed an inspection of a sieving station and inspection of a vessel during the site visit in Büsum, Germany. The team also received copies of sievage station and vessel inspection reports.
Infringements are reported on PO websites. The assessment team were provided with access to a secure section of the CVO website open only to CVO members, which shows infringements of management plan requirements going back to 2013, i.e. prior to implementation of the existing management plan.</td></tr>
</table>

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
		All the infringements related to vessel sievage values in excess of 15%. Initial infringements result in warning letters sent by the POs. Subsequent infringements result in fines. The website clearly shows fines against particular vessels, including an instance of a repeat infringement and increased fine. It is unclear if the naming and potential shaming of vessels provides an added deterrent. A MCS system clearly exists and is implemented within the brown shrimp fishery. Information provided by the national authorities and the tri-lateral management group provides a reasonable expectation that they are effective, thereby meeting the SG 60. Given the relatively short period of time the existing management plan has been in place the assessment team were unable to conclude that an ability to enforce relevant management measures and strategies has been demonstrated. Therefore the SG 80 is not met.		
b	Sanctions			
	Guide post	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, **are consistently applied** and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and **demonstrably** provide effective deterrence.
	Met?	(Y)	(N)	(N)
	Justification	The national authorities impose sanctions on vessels in breech of national and/or EU regulations. Sanctions range from warnings and administrative fines to formal prosecution. Non-compliance may be dealt with through an administrative or judicial system, depending on the severity of the infringement. The member states implement a points system, in accordance with EU Regulation 1224/98, whereby infringements result in fines and points against a license. On reaching a maximum number of points the vessels fishing license is suspended. The suspension of a fishing license is considered to be a very effective deterrent by the authorities. The assessment team did not hear or see evidence that showed inconsistence in the application of national or EU regulations. The national administrators highlighted the low level of non-compliance within the fishery as an indicator that sanctions were effective. With respect to the management plan, an Annex sets out sanctions applied to non-compliance with the requirements of the plan. Failure to meet requirements is reported by independent inspectors to POs. Failure of a PO to act is reported by the independent inspectors to the Steering Committee who then take action against the PO. Access to the CVO website showed that, since implementation of the plan, penalties had been imposed on a number of vessels due to excessive sievage levels. The assessment team concludes that sanctions to deal with non-compliance exist and there is evidence that they are applied, thereby meeting the SG 60. Evidence was not available to demonstrate that sanctions are consistently applied with respect to the implementation of the management plan requirements. Therefore, SG 80 is not met.		
c	Compliance			
	Guide post	Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	**Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
	Met?	(Y)	(N)	(N)
	Justification	National administrations confirmed that the fishery generally complies with EU and national regulations and that this is reflected in the relatively low number of sanctions applied. With respect to providing information of importance to the management of the fishery, logbooks and landing declarations for vessels over ≥10 m have to be submitted within 48 hours of landing and electronic logbook transmission for vessels ≥12m (Council Regulation 1224/2009) have to be transmitted every 24 hours. While a more common infringement reported to the assessment team was the late transmission or inaccurate estimate of landings, i.e. a tolerance of 10% is allowed, this is not considered to be a significant issue. Vessels operating under the current management plan have done so since the beginning of 2016, information provided by the independent inspectors indicates general compliance with the management plan requirements. Information of importance with respect to the management plan includes recording ETP species interactions. At the time of the site visit no interactions had been reported. The assessment team concludes that fishers are generally compliant with the management system and there is evidence, when required, that fishers provide information of importance to the effective management of the fishery. The SG 60 is therefore met. The SG 80 is not met as the fishery management plan has not been in place long enough to provide evidence to demonstrate fishers comply with the management plan.		
d	Systematic non-compliance			
	Guide post		There is no evidence of systematic non-compliance.	
	Met?		(Y)	
	Justification	The late submission/transmission of logbooks or estimating catches within the 10% permitted tolerance is not uncommon but it is not considered to be a systematic problem by the national administrations with respect to EU regulations. There were no national regulations that were considered to be regularly breeched in a systematic way. With respect to the management plan, there was evidence that sievage levels beyond the 15% maximum was a more common transgression by fishers, however, the number of vessels and the small number of repeat offenders is not considered to provide evidence of systematic non-compliance. Therefore the SG 80 is met. The assessment team recommends that given the recent implementation of the management plan this scoring issue should be re-visited at subsequent annual audits if the fishery is successfully certified against the MSC standard.		
References		The Brown Shrimp Fishery Management Plan Version 1.0 (2016) Landwirtschaftskammer (https://www.landwirtschaftskammer.de) Council Regulation 1224/2009 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0404&from=EN CVO website www.garnalenvisserij.com & www.cvo-visserij.nl.		
OVERALL PERFORMANCE INDICATOR SCORE:				**65**
CONDITION NUMBER (if relevant):				**8**

Evaluation Table for PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4		**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Evaluation coverage			
	Guide post	There are mechanisms in place to evaluate **some** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **key** parts of the fishery-specific management system	There are mechanisms in place to evaluate **all** parts of the fishery-specific management system.
	Met?	(Y)	(Y)	(N)
	Justification	National administrations evaluate the management of the fishery and regularly correspond and/or meet to review the fishing activity and any issues associated with their respective fleets fishing in their and, other member state waters, e.g. the monitoring of the list of vessels eligible to fish in the plaice box. The management plan has identified instances where a review or re-evaluation of key parts of the management plan will take place, i.e.: • Scientific institutions will be consulted and their advice sought on whether the incremental mesh size increase is resulting in improved yields and whether future increases will continue to do the same; • A review of alternatives to the existing technical measures for minimizing unwanted catches, at least every 5 years or as alternatives become available; • Scientific advice from a relevant scientific institution every year to enable an evaluation of whether the management plan is delivering on its objectives, including (but not necessarily limited to); reaching the target of high long-term sustainable yields; avoiding recruitment overfishing, minimizing unwanted by-catch. It is therefore considered that there are mechanisms in place to evaluate key parts of the fishery-specific management system thereby meeting the SG80. The fishery does not meet the SG 100 as the mechanisms to evaluate the management plan do not explicitly evaluate all parts of the management system.		
b	Internal and/or external review			
	Guide post	The fishery-specific management system is subject to **occasional internal** review.	The fishery-specific management system is subject to **regular internal** and **occasional external** review.	The fishery-specific management system is subject to **regular internal** and **external** review.
	Met?	(Y)	(N)	(N)
	Justification	National administrations undertake internal reviews of the management of the fishery and regularly correspond and/or meet to review the fishing activity and any associated issues of their respective fleets fishing in their and other member state waters. EU Commission inspectors regularly make short or no-notice visits to audit the implementation of EU regulations by the member states, e.g. engine capacity requirements. As shown in SIa above, the management plan provides a commitment to have external scientific institutions review key aspects of the management plan. Some of these will occur on an annual basis. The decision making body – the Steering Committee – are shown as meeting at least once a year and identified as taking decisions on, "…*matters that follow from*" the management plan. While not explicit in what that means in practical terms it was made clear to the assessment team by members of the Steering Committee that this will include a regular review of all the elements that contribute to the management plan.		

PI 3.2.4		**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**	
		Given there will be a regular internal review of the management plan it is considered that SG 60 is met. The SG 80 and 100 are not met as it has not been made explicitly clear in the management plan that all its elements will be subject to either occasional or regular external review, e.g. the effectiveness of the independent control has not been identified as being subject to an external review.	
References		The Brown Shrimp Management Plan Version 1.0 (2016)	
OVERALL PERFORMANCE INDICATOR SCORE:			**70**
CONDITION NUMBER (if relevant):			**9**

Appendix 2 Conditions

Condition 1

Performance Indicator	1.2.1 There is a robust and precautionary harvest strategy in place
Score	75
Rationale	SI (b) SG80 - The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives. At present there is good evidence that large numbers of small shrimps are being harvested before they reach an optimum size, and that landings per recruit could be significantly increased. The Management Plan incorporates a strategy for improving the landings per recruit through incremental increases in the minimum mesh size, but such measures have yet to be fully implemented. Whilst the Management Plan includes a strategy for ensuring that too many small shrimps are not discarded, this relates primarily to minimum commercial size not to optimum yield size. So the harvest strategy is working as far as the minimum commercial size is concerned as catches are sieved on board, and then also sieved at the processing factories, but from a stock management viewpoint the strategy does not appear to be working as the mesh size is too low and sieving still lands shrimps that are too small. Within the Management Plan, the limits on fishing effort include a limit on the number of licences, a limit on the number of days fishing and on engine power, but it is clear that there is still scope within the Management Plan for fishing effort to increase through, for example, some vessels fishing more days than they had fished previously. In addition, outside the Management Plan there appear to be a number of dormant licences, and it is not clear that total fishing effort has been fully capped. The assessment team concluded therefore that the harvest strategy has yet to achieve its objectives because the current mesh size allows the capture of too many small shrimps (resulting in growth overfishing of individual cohorts) and there is the potential for an increase in fishing effort both within the Management Plan and through the activation of dormant licences.
Condition	The Client shall ensure that by the fourth surveillance audit evidence exists that the harvest strategy is achieving its objectives even if it has not been fully tested.
Milestones	**At the first audit:** The Client will provide evidence that demonstrates the mesh size has been increased from 20 to 22 mm, that the total fishing effort has been estimated and that the scope for any increase in total fishing effort has been fully investigated. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 75 **At the second audit:** The Client will provide evidence that the mesh size has been increased from 22 to 24 mm, that any changes in total fishing effort have been estimated and that, if necessary, options for capping the total fishing effort have been evaluated. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 75 **At the third audit:** The Client will provide evidence that benefits of the previous mesh size increases have been fully evaluated, that any changes in total fishing effort have been estimated and that, if necessary, mechanisms for capping the

	total fishing effort have been agreed. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 75 **At the fourth audit:** The Client will provide evidence that the mesh size has been increased to 26 mm and that the mesh size is now at a level that ensures that growth overfishing does not occur, that any changes in total fishing effort have been estimated and that, if necessary, mechanisms for capping the total fishing effort have been implemented. It is considered that the successful completion of this and previous milestones will demonstrate that evidence exists that the harvest strategy is achieving its objectives even if it has not been fully tested. This will result in a rescoring of this PI to at least 80.
Client action plan	Model calculations and analysis of length distribution indicate a growth overfishing for the shrimp-stock. An increase in average size would make the stock less vulnerable because bigger females produce more eggs. And catching shrimps at a bigger size would possibly result in higher catches with less effort. Model calculations within the CRANNET project indicate a mesh opening of 26 mm as an optimum. Counteracting the catch of shrimps below commercial size is approached by the MSY-strategy in the management plan. Legally the minimum mesh size for the shrimp fishery is 16 mm. From January 1st 2016 the minimum mesh size is 20 mm and from May 1st 2016 the minimum mesh size is 22 mm. Stock effects due to the mesh size increase will be monitored by the Institute of fishery science from the University of Hamburg. If the predicted benefits can be proven by the monitoring the fleet will increase the mesh size stepwise to 26 mm until 2020. **Surveillance 1:** The Group will provide a report from the independent control showing the results of the on board controls with focus on the mesh size measurements. Additionally the Group will provide a report from the University of Hamburg with intermediate results of the scientific monitoring and a presentation of the development of fishing effort (hours at sea per year) over the last including an estimation of possible/dormant effort increase. years. **Surveillance 2:** The Group will provide a report from the independent control showing the results of the on board controls with focus on the mesh size measurements. And they will provide a first summary of the fleet inventory. Additionally, the Group provides a report of the scientific monitoring with an evaluation of the mesh size increase to 22 mm. Depending on the results of the monitoring the fishery will shift to a mesh size of 24 mm from 1st May 2018 and provide other possible measures to reduce fishing mortality. Any alternative measure will be backed up by scientific advice. **Surveillance 3:** The Group will provide a report from the independent control showing the results of the on board controls with focus on the mesh size measurements. The Group will provide an update of the fleet inventory. The Group will provide a scientific report with intermediate results from the monitoring of the effect of the mesh size increase to 24 mm or the effect of the alternative measures. If this report indicates a significant increase in fishing effort the Group will present appropriate measures to counteract this development based on scientific advice. **Surveillance 4:** The Group will provide a report from the independent control, showing general compliance with the rules of the management plan. The Group will provide a report from independent scientist with an evaluation of the measures in the management plan to decrease F and an up-to-date estimation of F demonstrating that growth overfishing is no longer indicated.

	Intended Outcome At the 4th surveillance audit the Group will provide evidence that fishing mortality is reduced to a level where sustainable harvesting is guaranteed and the stock management is working as predicted.
Consultation on condition	The institute of fishery science from the University of Hamburg will support the client with scientific advice and independent monitoring (see contract attached).

Condition 2

Performance Indicator	2.1.3 Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species
Score	70
Rationale	SI (a) SG80 - some quantitative information is available to adequately assess the impact of the UoA on the main primary species with respect to status. Information provided on bycatch species for all three countries was difficult to evaluate and compare across countries. There was detailed observer information, but information available for this assessment was limited to a descriptive summary report and table of catch estimates (Observer report Netherlands and Germany: Steenbergen et al 2015); Denmark provided their observer report in a different format using proportions of total catch. For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled, so sampling errors are relatively high. The tables provide standard deviations for catches, which are high (Steenbergen et al 2015), therefore estimates will be skewed. The observer data provided by Denmark cover 2014. In order to determine main primary species, ICES WGCRAN report information had to be used as well. Although there is some quantitative information available, it is not adequate to assess the impact of the UoA on the main primary species with respect to status. SG 80 is not met.
Condition	The Client shall ensure that by the fourth surveillance audit there is quantitative information available to adequately assess the impact of the UoA on the main primary species with respect to status.
Milestones	**At the first audit:** The client group will provide evidence of working together to to establish harmonised data presentation across all three observer programmes. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 70 **At the second audit:** The client will provide evidence of working together to implement a harmonised programme to collect and analyse quantitative data on bycatch. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 70 **At the third audit:** The client will provide evidence that a harmonised programme of relevant and clear information on bycatch has been established across all fisheries. Interim score: 70

	This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. **At the fourth audit:** The client will provide evidence that there is quantitative information available to adequately assess the impact of the UoA on the main primary species with respect to their status. It is considered that the successful completion of this and previous milestones will result in a rescoring of this PI to at least 80.
Client action plan	The Brown Shrimp fishery has been the subject of a number of scientific projects regarding bycatch estimation and mitigation. Although the overall results of these projects are similar, the data are collected under different protocols and circumstances. This means that the impact on main primary species is difficult to assess. The Brown Shrimp Cooperative MSC Group (henceforth 'the Group') will work across at least the three countries (and if possible all countries in the fishery) to provide harmonized quantitative data on bycatch. Consultations with the national authorities responsible for the on board observer programs running in the course of the Data Collection Framework (DCF) of the European Commission (EC) will harmonize and expand the collection of quantitative bycatch data. In addition, the Group's own scientific research and monitoring program will provide new information including seasonal trends. **Surveillance 1**: The Group will provide evidence of working together with the competent institutions in all three countries responsible for the on board observer programs running in the course of the Data Collection Framework (DCF) of the European Commission (EC) to achieve harmonized quantitative bycatch data, formatted so that catch fractions for each species can be calculated. In order to fulfill requirements to a quantitative sampling based on total catches the Group considers additional sampling activities in consultation with national authorities and representatives of the ICES WGCRAN. **Surveillance 2**: The Group will provide first harmonized quantitative bycatch data and first results of the additional monitoring program if applicable. **Surveillance 3 & 4**: The Group will provide updated harmonized quantitative bycatch data and analyzed results of the Group's monitoring program if applicable. Bycatch species that make up more than 1 % of the total catches, or are inherently vulnerable, will be subject to a PSA analysis (unless already assessed by ICES) to ascertain the level of risk the fishery poses to these species. **Intended Outcome** At the 4th surveillance audit the Group will provide evidence that there is quantitative information available to adequately assess the impact on main primary species with respect to their status.
Consultation on condition	Consultations were started with the national institutions responsible for the execution of the EU data collection program in order to harmonize and improve the data sampling. In addition, consultations were started to officially set the topics on the agenda of the next ICES WGCRAN-meeting in May in Hamburg.

Condition 3

Performance Indicator	2.2.3 Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.
Score	70

Rationale	**SI (a) SG80 - some quantitative information is available to adequately assess the impact of the UoA on main secondary species with respect to their status.** Although observer reports are available for all three countries involved in this fishery, information provided on bycatch species for all three countries was difficult to evaluate and compare across countries. There was detailed observer information, but information available for this assessment was limited to a descriptive summary report and table of catch estimates (Observer report Netherlands and Germany: Steenbergen et al 2015); Denmark provided their observer report in a different format using proportions of total catch. For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled, so sampling errors are relatively high. The tables provide standard deviations for catches, which are high (Steenbergen et al 2015), therefore estimates will be skewed. The observer data provided by Denmark cover 2014. In order to determine main secondary species, it was decided to use the number of hauls the species occurred in – if it occurred in more than 100 hauls it was considered 'main'. Although there is some quantitative information available, it is not adequate to assess the impact of the UoA on the main secondary species with respect to status
Condition	The Client shall ensure that by the fourth surveillance audit there is adequate quantitative information to assess the impact of the UoA on main secondary species with respect to their status.
Milestones	**At the first audit:** The client group will provide evidence of working together to to establish harmonised data presentation across all three observer programmes. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 70 **At the second audit:** The client will provide evidence of working together to implement a harmonised programme to collect and analyse quantitative data on bycatch. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 70 **At the third audit:** The client will provide evidence that a harmonised programme of relevant and clear information on bycatch has been established across all fisheries. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim score: 70 **At the fourth audit:** The client will provide evidence that there is quantitative information available to adequately assess the impact of the UoA on the main secondary species with respect to their status. It is considered that the successful completion of this and previous milestones will result in a rescoring of this PI to at least 80.
Client action plan	The Brown Shrimp fishery has been the subject of a number of scientific projects regarding bycatch estimation and mitigation. Although the overall results of these projects are similar, the data are collected under different protocols and circumstances. This means that the impact on main secondary species is difficult to assess.

	The Brown Shrimp Cooperative MSC Group will work across at least the three countries (and if possible all countries in the fishery) to provide harmonized quantitative data on bycatch. Consultations with the national authorities responsible for the on board observer programs running in the course of the Data Collection Framework (DCF) of the European Commission (EC) will harmonize and expand the collection of quantitative bycatch data. In addition, the Group's own scientific research and monitoring program will provide new information including seasonal trends. **Surveillance 1:** The Group will provide evidence of working together with the competent institutions in all three countries responsible for the on board observer programs running in the course of the Data Collection Framework (DCF) of the European Commission (EC) to achieve harmonized quantitative bycatch data, formatted so that catch fractions for each species can be calculated. In order to fulfill requirements to a quantitative sampling based on total catches the Group considers additional sampling activities in consultation with national authorities and representatives of the ICES WGCRAN. **Surveillance 2:** The Group will provide first harmonized quantitative bycatch data and first results of the additional monitoring program if applicable. **Surveillance 3 & 4**: The Group will provide updated harmonized quantitative bycatch data and analyzed results of the Group's monitoring program if applicable. Bycatch species that make up more than 1 % of the total catches, or are inherently vulnerable, will be subject to a PSA analysis (unless already assessed by ICES) to ascertain the level of risk the fishery poses to these species. **Intended Outcome** At the 4th surveillance audit the Group will provide evidence that there is quantitative information available to adequately assess the impact on main secondary species with respect to their status.
Consultation on condition	Consultations were started with the national institutions responsible for the execution of the EU data collection programme in order to harmonise and improve the data sampling. In addition, consultations were started to officially set the topics on the agenda of the next ICES WGCRAN-meeting in May in Hamburg.

Condition 4

Performance Indicator	2.3.3 Relevant information is collected to support the management of UoA impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.
Score	70
Rationale	**SI (b) SG80 - Information is adequate to measure trends and support a strategy to manage impacts on ETP species.** Although observer reports are available for all three countries involved in this fishery, information provided on bycatch species, including ETP species, for all three countries was difficult to evaluate and compare across countries. There was detailed observer information, but information available for this assessment was limited to a descriptive summary report and table of catch estimates (Observer report Netherlands and Germany: Steenbergen et al 2015); Denmark provided their observer report in a different format using proportions of total catch. For the German and Dutch fisheries, catches and discards are available for the observer sampling programme 2009-2012. This represents less than 1% of days-at-sea sampled, so sampling errors are relatively high. The observer

	data provide standard deviations for catches, which are very high for some of the bycatch (Steenbergen et al 2015), and therefore estimates will be skewed, but for ETP species standard deviation was low, as these species occurred in few hauls. The observer data provided by Denmark covers 2014. Although there is some quantitative information available, it is not adequate to measure trends and support a strategy. SG80 is not met.
Condition	The Client shall ensure that by the fourth surveillance audit there is adequate information to measure trends and support a strategy to manage impacts on ETP species.
Milestones	The Brown Shrimp fishery has been the subject of a number of scientific projects regarding bycatch estimation and mitigation, including by default ETP species. Although the overall results of these projects are similar, the data are collected under different protocols and circumstances. This means that the impact on ETP species is difficult to assess. The Brown Shrimp Cooperative MSC Group will work across at least the three countries (and if possible all countries in the fishery) to provide harmonized quantitative data on ETP species bycatch. Consultations with the national authorities responsible for the on board observer programs running in the course of the Data Collection Framework (DCF) of the European Commission (EC) will harmonize and expand the collection of quantitative bycatch data. In addition, the Group's own scientific research and monitoring program will provide new information including seasonal trends. **Surveillance 1:** The Group will provide evidence of working together with the competent institutions in all three countries responsible for the on board observer programs running in the course of the Data Collection Framework (DCF) of the European Commission (EC) to achieve harmonized quantitative bycatch data, including ETP species, formatted so that catch fractions for each species can be calculated. In order to fulfill requirements to a quantitative sampling based on total catches the Group considers additional sampling activities in consultation with national authorities and representatives of the ICES WGCRAN. Interim score: 70 **Surveillance 2:** The Group will provide first harmonized quantitative bycatch data on ETP species and first results of the additional monitoring program if applicable. Interim score: 70 **Surveillance 3**: The Group will provide updated harmonized quantitative bycatch data on ETP species and analyzed results of the Group's monitoring program if applicable. The Group will provide evidence that there is quantitative information available to adequately assess the impact on ETP species with respect to their status and trends. Interim score: 75 **Surveillance 4**: The Group will provide further updated harmonized quantitative bycatch data on ETP species and analyzed results of the Group's monitoring program if applicable. The Group will provide further evidence that there is quantitative information available to adequately assess the impact on ETP species with respect to their status, and assessing trends, so that a strategy can be supported to manage impacts on ETP species. Score: 80
Client action plan	The Brown Shrimp fishery has been the subject of a number of scientific projects regarding bycatch estimation and mitigation. Many of these have included ETP species to the extent that they were present in the sampled hauls, but the data were collected under different protocols and circumstances. This means that comparison or aggregation is not possible. As bycatches of ETP species by definition are rare, the mandatory DCF discard sampling does not have adequate coverage to monitor these in any meaningful way. Therefore, the Group has implemented registration

	of all bycatches of ETP species on the participating vessels. These data will be analyzed across the fleet and presented at the surveillances. **Surveillance 1:** The Group will provide ETP species data from the first year of registration and evidence of a close cooperation with the competent institutions in all three countries. **Surveillance 2:** The Group will provide updated ETP species data and preliminary analysis of the figures. **Surveillance 3 & 4**: The Group will provide updated ETP species data and analyzed results. ETP species will be subject (if necessary) to a PSA analysis to ascertain the level of risk the fishery poses to these species **Intended Outcome:** At the 4th surveillance audit the Group will provide evidence that there is adequate information available to measure trends and support a strategy to manage impacts on ETP species.
Consultation on condition	N/A

Condition 5

Performance Indicator	2.4.2 There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.
Score	75
Rationale	**2.4.2 (d) SG80 - There is some quantitative evidence that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs / non-MSC fisheries, where relevant.** The shrimp fishery is governed by standard EU fisheries rules outlined above (i.e. Plaice box, net size, sieve net, log-books, VMS etc.), and this applies to all shrimp vessels, including Belgian and French and those not part of the PO. These vessels also have to comply with marine protected area legislation and rules, such as not fishing in closed areas, for example. Furthermore, they are not allowed to fish near mussel beds, nor would it be in their interest, as it damages the gear. The shrimp fishery does not fish over seagrass beds, as these are either located in too shallow and/or intertidal areas, or within the no-access zone in Danish waters. The location of *Sabellaria* reefs has been mapped and thus the few locations are known. Observer programmes and inspection programmes, as stipulated by EU fisheries regulations, are used to check the location and behaviour of the shrimp fishery, for both MSC shrimp fisheries and non-MSC fisheries. Considering that all shrimp fishers fishing in the Wadden Sea have to comply with EU fisheries rules as well as national and regional protected area management rules, there should be sufficient evidence to meet SG80. However, a recent report by WWF, looking at VMS plots in the German Wadden Sea area, found that although on the whole there is evidence that closed areas are avoided (Kuechly et al. 2016), they non-the-less highlighted the observation that shrimp fishing had been taking place in the Hörnumtief no-take-zone (Schleswig Holstein). The information presented could not differentiate whether it was one fisher only, and it is not clear what enforcement action was taken. A field research experiment conducted by Glorius et al (2015), to assess the effects of shrimp fishing, was affected by fishers fishing through the plots, despite a voluntary agreement not to (Client pers. comm.). This questions the ability of the

	vessels to identify closed areas or research areas temporarily closed to fishing (even if voluntary).
Condition	The Client shall ensure that by the fourth surveillance audit there is some quantitative evidence that the UoA complies with its management requirements and with protection measures afforded to VMEs by other MSC UoAs / non-MSC fisheries, where relevant.
Milestones	**At the first audit:** The client group will provide evidence of working together to to establish harmonised map presentation across all three countries and improve awareness of fishers as to the importance of protected areas including Natura 2000 sites and areas closed to fishing (no take zones). Interim Score: 75 This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. **At the second audit:** The client will provide evidence of the results of working together to implement a harmonised programme to collect and analyse quantitative information of vessel positions and highlight any compliance issues. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 75 **At the third audit:** The client will provide evidence that a harmonised programme of relevant and clear information on vessel positions has been established across all fisheries including compliance checks and, if necessary, follow up action. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 75 **At the fourth audit:** The Client shall provide evidence that there is some quantitative evidence that the UoA complies with its management requirements and with protection measures afforded to VMEs by other MSC UoAs / non-MSC fisheries, where relevant. It is considered that the successful completion of this and previous milestones will result in a rescoring of this PI to at least 80.
Client action plan	As outlined in the Management Plan (section E3), the VMS data of all participating vessels will be monitored each year, and presented in a harmonized format. In order to ensure that protected areas are indeed protected, the Group will provide the participating vessels with data layers of no-take-zones and other closed or restricted areas that can be directly imported into their on-board plotters. Compliance with spatial regulations is inherently the job of the relevant authorities who have implemented the closures. The Group is not able to monitor and take action on individual vessels that may breach these regulations, as it only has legal access to anonymized VMS data. In the unlikely event of systematic non-compliance with closures, the Group can and will however take action at fleet level: information, warning of the consequences for the fleet, peer pressure etc. **Surveillance 1:** Aggregated VMS data across the three countries will be presented to the surveillance team as well as other stakeholders through the NSAC. Data layers for on-board plotters will have been provided to the participating vessels. **Surveillance 2:** Updated VMS data will be presented to the surveillance team as well as other stakeholders through the NSAC, along with analysis of the results. Compliance issues will also be reported. Data layers for on-board plotters will be updated as appropriate. **Surveillance 3 & 4:** Updated VMS data will be presented to the surveillance team as well as other stakeholders through the NSAC, along with analysis of the results. Compliance issues will also be reported. Data layers for on-board plotters

	will be updated as appropriate. As a result, the Group will provide some quantitative evidence that the UoA complies with its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC-fisheries, where relevant. **Intended Outcome** At the 4th surveillance audit the Group will provide some quantitative evidence that the UoA complies with its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC-fisheries, where relevant.
Consultation on condition	N/A

Condition 6

Performance Indicator	2.4.3 Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.
Score	75
Rationale	**2.4.3 (b) SG80 - Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.** Although VMS maps and vessel logs are available for all shrimp fishing vessels to show where they fish and when, the information was not available to the assessment team in a format that allowed cross comparison across all three countries within a particular time period to assess the intensity of the use of the fishing gear over the main habitat areas (for example, some areas are fished more frequently than others).
Condition	The client shall ensure by the fourth surveillance audit that information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.
Milestones	**At the first audit:** The client group will provide evidence of working together to establish harmonised VMS presentation across all three countries and improve information on spatial extent of gear interaction with habitat, and on the intensity per area. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 75 **At the second audit:** The client will provide evidence of the results of working together to implement a harmonised programme to collect and analyse quantitative information of vessel positions and present the initial results showing location and intensity. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 75 **At the third audit:** The client will provide evidence that a harmonised programme of relevant and clear information on vessel positions has been established across all fisheries showing location and fishing intensity and this information has been provided to fishery managers.

	This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 75 **At the fourth audit:** The client will provide evidence that information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. It is considered that the successful completion of this and previous milestones will result in a rescoring of this PI to at least 80.
Client action plan	As outlined in the Management Plan (section E3), the VMS data of all participating vessels will be monitored each year, and presented in a harmonized format. The anonymized and aggregated VMS data allow to assess the location and intensity of use of the fishing gear. **Surveillance 1:** Aggregated VMS data across the three countries will be presented to the surveillance team as well as other stakeholders through the NSAC. Data layers for on-board plotters will have been provided to the participating vessels. **Surveillance 2:** Updated VMS data will be presented to the surveillance team as well as other stakeholders through the NSAC, along with analysis of the results. Compliance issues will also be reported. Data layers for on-board plotters will be updated as appropriate. **Surveillance 3 & 4:** Updated VMS data will be presented to the surveillance team as well as other stakeholders through the NSAC, along with analysis of the results. Compliance issues will also be reported. Data layers for on-board plotters will be updated as appropriate. The Group will provide evidence that information is adequate to allow for identification of the main impacts on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. **Intended Outcome** At the 4th surveillance audit the Group will provide evidence that information is adequate to allow for identification of the main impacts on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.
Consultation on condition	N/A

Condition 7

Performance Indicator	3.2.2 The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.
Score	**70**
Rationale	**SI (a) SG80 - There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.** The national authorities and, in the case of Germany regional authorities too, have policy and fisheries control and enforcement units that have established internal and external decision making processes that result in measures and strategies to support the management of the brown shrimp fishery and deliver the objectives established by their respective fisheries and nature conservation acts, e.g. regular internal and external (between member states) control and

	enforcement meetings to review and re-direct effort as a result of any identified compliance issues (see section 3.7.6). The Brown Shrimp Management Plan identifies a Steering Committee as the main decision-making body. Their decision-making process requires a consensus of the three Committee members (or their deputy). The Steering Committee receives support as necessary from a “Working Group”. The membership of the group is not specified in the Management Plan, this will be established depending on the subject being considered by the Committee (Oberdoerffer, 2016, pers comm, 4 March). Decisions such as the incremental increase in mesh size and the implementation of the harvest control rules will contribute to the overarching objective of the management plan. It is therefore considered that there are decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives so meeting the SG 60. The MSC CR guidance says, “established” decision-making processes should be understood to mean that there is a process that can be immediately triggered for fisheries-related issues, the process has been triggered in the past and has led to decisions about sustainability in the fishery. These processes may or may not be formally documented or codified under an official statute. Using the MSC guidance, it is not possible to say that there are “established” decision-making processes owing to the short period of time within which the Management Plan has been operational. The Management Plan was adopted on 1st December 2015 and came into force on 1st January 2016. The decision making process has not yet been triggered and so for this reason the SG 80 is not met. **SI (d) SG 80 - Information on the fishery’s performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.** Through interview and correspondence during the information gathering phase of this assessment, national authorities considered they responded to information requests on the fishery’s performance and management and provided explanations for any actions, or lack of action, associated with findings and recommendations from research, monitoring, evaluation and review activity. Stakeholders interviewed, in general, considered this to be the case. However, as part of the ENGO consortium submission, the assessment team was provided with correspondence from an industry representative to Dutch regulatory authorities requesting a response to their concerns of breeches to the weekend fishing restrictions. Responses were not apparently forthcoming and, on follow up by the assessment team to see how this issue was dealt with, no response was received by the time of completing this draft report. With respect to the implementation of the management plan, information on the fisheries performance and management action is made available to the harvesters via PO newsletters and their websites. PO representatives are also very active in communicating and corresponding with their members. There is a commitment to their membership to provide explanations for any actions or lack of action associated with findings and relevant recommendations from research, monitoring evaluation and review activity. There is an explicit commitment within the management plan for the Brown Shrimp Cooperative MSC Group to present results of any scientific evaluation and monitoring of progress and changes to the plan to the NSAC, i.e. where

	non-fishing key stakeholder groups are represented, and have already participated in discussions related to the management of this fishery. It is too early into the adoption and implementation of the management plan to have evidence that access to information is available to all stakeholders, so while the fishery meets the SG 60 it does not achieve the SG 80.
Condition	The client shall ensure by the fourth surveillance audit that: 1. There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives. 2. Information on the fishery's performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
Milestones	**SI (a) SG80 - There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.** **At the first audit** the client will provide evidence in the form of a written report and minutes of meetings showing the decision making process and how it relates to measures and strategies to achieve the fishery-specific objectives. For example, the management plan says "…*there will be an annual evaluation by a scientific institute on whether the plan is delivering on its objectives, including (but not necessarily limited to) reaching the target of high long-term sustainable yields, avoiding recruitment overfishing, minimizing unwanted by-catch*", the client is required to show the decision making process resulting from this review and any other key decisions made in the period prior to the first audit. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 70 **At the second audit** the client will provide evidence in the form of a written report and minutes of meetings showing the decision making process and how it relates to measures and strategies to achieve the fishery-specific objectives. This will include the decision making process resulting from the annual review of the management plan, the outcome of the advice received on the effectiveness of mesh size increase that is scheduled in 2018 and any other key decisions made in the period prior to the second audit. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 70 **At the third audit** the client will provide evidence in the form of a written report and minutes of meetings showing the decision making process and how it relates to measures and strategies to achieve the fishery-specific objectives. This will include the decision making process resulting from the annual review of the management plan, and any other key decisions made in the period prior to the third audit. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 70 **At the fourth audit** the client will provide evidence in the form of a written report and minutes of meetings showing the decision making process and how it relates to measures and strategies to achieve the fishery-specific objectives. This will include the decision making process resulting from the annual review of the management plan, and the outcome of the advice received on the

	effectiveness of mesh size increase that is scheduled in 2020 (this is based on the assumption that there will have been a mesh increase in May 2018). It is considered that the successful completion of this and previous milestones will demonstrate that there are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives. This will result in a rescoring of this PI to at least 80. **SI (d) SG80 - Information on the fishery's performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.** **At the first audit** the client will provide documentary evidence that shows: • The number and type of information requests on the fishery's performance and management action that have been made since the certification of the fishery; • The information that was provided in response to these requests; and, • The explanations that were provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. In reviewing this evidence the audit team should take into account reasonable timelines and complexity of request. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. **At the second audit** the client will provide documentary evidence that shows: • The number and type of information requests on the fishery's performance and management action that have been made since the certification of the fishery; • The information that was provided in response to these requests; and, • The explanations that were provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. In reviewing this evidence the audit team should take into account reasonable timelines and complexity of request. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. **At the third audit** the client will provide documentary evidence that shows: • The number and type of information requests on the fishery's performance and management action that have been made since the certification of the fishery; • The information that was provided in response to these requests; and, • The explanations that were provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. In reviewing this evidence the audit team should take into account reasonable timelines and complexity of request. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. **At the fourth audit** the client will provide documentary evidence that shows:

	• The number and type of information requests on the fishery's performance and management action that have been made since the certification of the fishery; • The information that was provided in response to these requests; and, • The explanations that were provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. It is considered that the successful completion of this and previous milestones will demonstrate that the client provides information on the fishery's performance and management action on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. This will result in a rescoring of this PI to at least 80. NB – Four annual milestones have been set. It is considered that this will ensure that requests for information on the performance and management action and explanations provided for any actions or lack of action associated with findings and relevant recommendations is established in the normal working practices associated with the management plan.
Client action plan	The management of the Brown Shrimp fishery implemented by the Group only started in 2016, and it is therefore natural that decision making processes are not long-standing. By agreeing, adopting and enforcing the Management Plan, the Group has however already shown its decision-making ability, and its commitment to uphold the principles of the plan. One of these principles is the transparency and mutual dialogue with other stakeholders, particularly through the NSAC as outlined in the plan (section F). Surveillance 1 - 4: The Group will provide a summary of decisions taken since certification or last audit (including the related minutes of meetings). This includes decisions taken on the basis of the results of the scientific monitoring program and its advice relating to the objective of achieving high long-term sustainable yield. The Group will also provide a summary of the information or other requests received and the responses, including explanations of actions taken (or not). The Group will present stakeholders (in the NSAC) with the scientific monitoring, an overview of sanctions, sievage and LPUE data, as well as a summary of decisions taken, changes to the management plan, etc. **Intended Outcome** At the 4th surveillance audit the client will provide evidence that there are: • Established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives; • The client provides information on the fishery's performance and management action on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
Consultation on condition	N/A

Condition 8

Performance Indicator	3.2.3 Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.

Score	65
Rationale	**SI (a) SG 80 - A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.** A monitoring, control and surveillance (MCS) system has been implemented in the fishery through national administrations and also through the implementation of the tri-lateral management plan. The national administrations include resources and systems to support the MCS of the fishery as set out in section 3.7.6. The national authorities consider the fishery to be a low risk with relatively few and minor instances of non-compliance. Evidence shows non-compliance is dealt with accordingly through official warnings, fines and endorsement of fishing licenses depending on the severity of the offence. Implementation of the management plan requirements is supported by an independent control agency, Landwirtschaftskammer, based in Germany. The agency provides a full time inspector who is responsible for monitoring and reporting on compliance of the plan. An independent consultant based in the Netherlands working 3 days a week supports the inspector. They only monitor the management plan requirements. These relate to: • Hours/days fished; • Beam length; • Weight of fishing gear; • Mesh size; • Use of specified sieve net/sorting grid; • On-shore sieve dimensions; • Quantity of sievage, i.e. the brown shrimp that falls through the shore sieve; • Data collection, including ETP species info. The plan commits to inspection of at least 20% of the vessels working to the plan in each country being inspected annually – using membership figures as of April 2016 that would be at least 6 Danish vessels and 38 vessels in Germany and the Netherlands, respectively. Each member PO is to be inspected at least once a year; and sieving stations at least twice a year. Inspections follow a protocol to ensure standardised and comparable inspections of POs and member fleets. A process for penalising any infringements of the plan requirements are also set out in the management plan along with an Annex that describes the penalties. Inspection reports are provided every 3 months to the Steering Committee. The assessment team observed an inspection of a sieving station and inspection of a vessel during the site visit in Büsum, Germany. The team also received copies of sievage station and vessel inspection reports. Infringements are reported on PO websites. The assessment team were provided with access to a secure section of the CVO website open only to CVO members, which shows infringements of management plan requirements going back to 2013, i.e. prior to implementation of the existing management plan. All the infringements related to vessel sievage values in excess of 15%. Initial infringements result in warning letters sent by the POs. Subsequent infringements result in fines. The website clearly shows fines against particular vessels, including an instance of a repeat infringement and increased fine. It is unclear if the naming and potential shaming of vessels provides an added deterrent.

	A MCS system clearly exists and is implemented within the brown shrimp fishery. Information provided by the national authorities and the tri-lateral management group provides a reasonable expectation that they are effective, thereby meeting the SG 60. Given the relatively short period of time the existing management plan has been in place the assessment team were unable to conclude that an ability to enforce relevant management measures and strategies has been demonstrated. Therefore the SG 80 is not met. **SI (b) SG 80 - Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.** The national authorities impose sanctions on vessels in breech of national and/or EU regulations. Sanctions range from warnings and administrative fines to formal prosecution. Non-compliance may be dealt with through an administrative or judicial system, depending on the severity of the infringement. The member states implement a points system, in accordance with EU Regulation 1224/98, whereby infringements result in fines and points against a license. On reaching a maximum number of points the vessels fishing license is suspended. The suspension of a fishing license is considered to be a very effective deterrent by the authorities. The assessment team did not hear or see evidence that showed inconsistence in the application of national or EU regulations. The national administrators highlighted the low level of non-compliance within the fishery as an indicator that sanctions were effective. With respect to the management plan, an Annex sets out sanctions applied to non-compliance with the requirements of the plan. Failure to meet requirements is reported by independent inspectors to POs. Failure of a PO to act is reported by the independent inspectors to the Steering Committee who then take action against the PO. Access to the CVO website showed that, since implementation of the plan, penalties had been imposed on a number of vessels due to excessive sievage levels. The assessment team concludes that sanctions to deal with non-compliance exist and there is evidence that they are applied, thereby meeting the SG 60. Evidence was not available to demonstrate that sanctions are consistently applied with respect to the implementation of the management plan requirements. Therefore, SG 80 is not met. **SI (c) SG 80 - Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.** National administrations confirmed that the fishery generally complies with EU and national regulations and that this is reflected in the relatively low level limited of action being taken against infringements. With respect to providing information of importance to the management of the fishery, logbooks and landing declarations for vessels over ≥10 m have to be submitted within 48 hours of landing and electronic logbook transmission for vessels ≥12m (Council Regulation 1224/2009) have to be transmitted every 24 hours. Vessels operating under the current management plan have done so since the beginning of 2016, information provided by the independent inspectors indicates

	general compliance with the management plan requirements. Information of importance with respect to the management plan includes recording ETP species interactions. At the time of the site visit no interactions had been reported. The assessment team concludes that fishers are generally compliant with the management system and there is evidence, when required, that fishers provide information of importance to the effective management of the fishery. The SG 60 is therefore met. The SG 80 is not met, as the fishery management plan has not been in place long enough to provide evidence to demonstrate fishers comply with the management plan.
Condition	The client shall ensure by the fourth surveillance audit that: 1. A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. 2. Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence. 3. Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.
Milestones	**SI (a) SG80 - A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.** **SI (b) SG80 - Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.** **SI (c) SG80 - Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.** **At the first audit** the client will provide a written report showing the management measures, strategies and rules that are enforced under the management plan; the number of inspections (vessels, sievage stations, POs); what was inspected; the findings and any follow up action, including any penalties/sanctions that were imposed. The client will also present evidence of appointing an appropriately qualified, independent organisation to review, assess and report on: • the ability of the management plans monitoring, control and surveillance (MCS) system to enforce the management measures, strategies and/or rules; • how sanctions to deal with non-compliance have been applied and whether they provide an effective deterrent; • whether fishers comply with the management system, including, when required, providing information of importance to the effective management of the fishery. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 65 **At the second audit** the client will provide a written report showing the management measures, strategies and rules that are enforced under the management plan; the number of inspections (vessels, sievage stations, POs);

	what was inspected; the findings and any follow up action, including any penalties that were imposed. The client will provide a written report showing the interim results of the independent review and assessment of the MCS mechanisms. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 65 **At the third audit** the client will provide a written report showing the management measures, strategies and rules that are enforced under the management plan; the number of inspections (vessels, sievage stations, POs); what was inspected; the findings and any follow up action, including any penalties that were imposed. The client will provide a written report showing the final results and conclusions of the independent review and assessment of the management plans MCS mechanisms. If any deficiencies or recommendations are highlighted within the report the client will present an action plan to address them. This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 65 **At the fourth audit** the client will provide a written report showing the management measures, strategies and rules that are enforced under the management plan; the number of inspections (vessels, sievage stations, POs); what was inspected; the findings and any follow up action including any penalties that were imposed. If any deficiencies or recommendations were made within the independent review and assessment of the management plans MCS mechanisms the client will present a written report showing how they were addressed. It is considered that the successful completion of this and previous milestones will demonstrate that: • A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. • Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence. • Evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery. This will result in a rescoring of this PI to at least 80.
Client action plan	The Group is convinced that independent enforcement of the Management Plan is necessary to ensure compliance across all 400 vessels. The Management Plan also sets specific targets for the level of controls for each type of inspection (vessel, sieving station, PO). To further strengthen the credibility of the control system, the Group will contract an external independent review. **Surveillance 1:** The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since the start of the Management Plan. The Group will also provide evidence that an appointment has been made with an appropriate external body capable of reviewing the efficacy of the control system in delivering the goals of the Management Plan.

	Surveillance 2: The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since last audit. The Group will provide interim findings of the external review. **Surveillance 3:** The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since last audit. The Group will provide the results of the external review of the control system, as well as an action plan to deal with any deficiencies found. **Surveillance 4:** The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since last audit. The client will report on changes made to the system on the basis of the review and subsequent action plan. Additionally, the Group will include a commitment to external review at least every 4 years in the Management Plan. **Intended Outcome** At the 4th surveillance audit the client will demonstrate that: • A monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. • Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence. • Evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.
Consultation on condition	

Condition 9

Performance Indicator	3.2.4 There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system.
Score	70
Rationale	**SI (b) SG 80 - The fishery-specific management system is subject to regular internal and occasional external review.** National administrations undertake internal reviews of the management of the fishery and regularly correspond and/or meet to review the fishing activity and any associated issues of their respective fleets fishing in their and other member state waters. EU Commission inspectors regularly make short or no-notice visits to audit the implementation of EU regulations by the member states, e.g. engine capacity requirements. As shown in SIa above, the management plan provides a commitment to have external scientific institutions review key aspects of the management plan. Some of these will occur on an annual basis. The decision making body – the Steering Committee – are shown as meeting at least once a year and identified as taking decisions on, "…*matters that follow from*" the management plan. While not explicit in what that means in practical terms it was made clear to the assessment team by members of the Steering Committee that this will include a regular review of all the elements that contribute to the management plan. Given there will be a regular internal review of the management plan it is considered that SG 60 is met. The SG 80 and 100 are not met as it has not been made explicitly clear in the management plan that all its elements will be subject to either occasional or regular external review, e.g. the effectiveness of

	the independent control has not been identified as being subject to an external review.
Condition	The client shall ensure by the fourth surveillance audit that the fishery-specific management system is subject to regular internal and occasional external review.
Milestones	**SI (b) SG80 - The fishery-specific management system is subject to regular internal and occasional external review.** Condition 7 requires the client to have an independent review of the MCS mechanisms that have been implemented under the management plan. In so doing, the client will have initiated an external review that will report by the third audit. In order to meet this condition the client will need to initiate a similar review on an occasional basis. In this instance, the assessment team considers a 4 year review cycle is appropriate for the scale and intensity of the fishery. **At the first audit** the client will present evidence of appointing an appropriately qualified, independent organisation to review, assess and report on MCS mechanisms applied within the management plan (this is the same first audit milestone as Condition 7). This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 70 **At the second audit** the client will provide a written report showing the interim results of the independent review and assessment of the MCS mechanisms (this is the same second audit milestone as Condition 7). This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 70 **At the third audit** the client will provide a written report showing the final results and conclusions of the independent review and assessment of the management plans MCS mechanisms (this is the same third audit milestone as Condition 7). This milestone is an incremental step toward fulfilling the condition. Its successful completion will not result in a change of score to this PI. Interim Score: 70 **At the fourth audit** the client will provide evidence of an explicit commitment within the management plan to undertake an external review of the MCS mechanisms on a 4-year cycle. It is considered that the successful completion of this and previous milestones will demonstrate that the fishery-specific management system is subject to regular internal and occasional external review. This will result in a rescoring of this PI to at least 80.
Client action plan	The Group is convinced that independent enforcement of the Management Plan is necessary to ensure compliance across all 400 vessels. The Management Plan also sets specific targets for the level of controls for each type of inspection (vessel, sieving station, PO). To further strengthen the credibility of the control system, the Group will contract an external independent review. **Surveillance 1:** The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since the start of the Management Plan. The Group will also provide evidence that an appointment has been made with an appropriate external body capable of reviewing the efficacy of the control system in delivering the goals of the Management Plan.

	Surveillance 2: The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since last audit. The Group will provide interim findings of the external review. **Surveillance 3:** The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since last audit. The Group will provide the results of the external review of the control system, as well as an action plan to deal with any deficiencies found. **Surveillance 4:** The Group will provide a summary report of inspections, levels of (non-)compliance and sanctions since last audit. The client will report on changes made to the system on the basis of the review and subsequent action plan. Additionally, the Group will include a commitment to external review at least every 4 years in the Management Plan. **Intended Outcome** At the 4th surveillance audit the client will provide evidence that the fishery specific management system is subject to regular internal and occasional external review.
Consultation on condition	N/A

Appendix 3 The brown shrimp management plan and penalty annex

BROWN SHRIMP MANAGEMENT PLAN

Version 1.0 (adopted 01.12.2015, in force from 01.01.2016) (corrected 11.04.2016)

Text in italics: Explanatory remarks, outlining the intention and background to the regulations
Text in regular font: Binding regulations for the Brown Shrimp Cooperative MSC
Group Text in bold: Binding regulations for each vessel that has joined the
management plan

Definitions

Brown Shrimp:	Shrimp of the species Crangon crangon.
Member:	A person or company that: owns one or more vessels fishing for brown shrimp; is a member of one of the Producer Organizations; and, has been listed by this Producer Organization as member of the Management Plan.
Producer Organization (PO):	A legally registered Producer Organization in the sense of the CMO (EU 104/2000 or 1379/2013) that participates in the Management Plan (directly or indirectly through one of the parties).
Party:	Body representing the members from a particular country in the Steering Committee. A Party may be a producer organization (thus representing the members directly) or formed of a group of producer organizations (thus indirectly representing their members).
The Fishery:	The brown shrimp fishery performed by the members of the Management Plan.
Vessel:	A fishing vessel owned by a member and used for brown shrimp fishing.

A. Management objective

The objective of this management plan is a sustainable North Sea brown shrimp fishery, by means of an ecologically responsible, co-managed fishery, with high long-term sustainable yield of the target species and minimized effects on the marine ecosystem.

B. Management structures and processes

B1. The Steering Committee

A Steering Committee of the Brown Shrimp Cooperative MSC Group shall be responsible for the maintenance, monitoring and control of the management plan on behalf of the members.

The Steering Committee shall consist of one representative (and one deputy) of each party to the management plan:

- CVO (Coöperatieve Visserij Organisatie) for the Netherlands
- MSC-GbR for Germany

- DFPO (Danish Fishermen – Producer Organization) for Denmark

The Steering Committee shall take decisions on matters that follow from this management plan, as well as any changes to the management plan, by consensus of the representatives (or deputy, if the representative is not present) of all three national fleets.

The Steering Committee may elect to invite other participants to its meetings as observers, experts or presenters.

The Steering Committee shall meet in person at least once every year, and may elect to meet as often as necessary.

The Steering Committee shall be aided in its responsibilities by a Working Group, as well as by the active support of each of the PO's that take part in the Brown Shrimp Cooperative MSC Group.

B2. Cost sharing

Common expenses associated with the management plan, as well as with an MSC assessment and surveillance, shall be shared by the parties according to the following key:

CVO: 47 %

MSC-GbR: 42 %

DFPO: 11 %

The key shall be re-evaluated at the conclusion of the MSC-assessment process.

C. Management of the fishery

C1. Participating vessels

Any commercial fishing vessel registered in the EU, fishing for brown shrimp along the Continental North Sea coast (France, Belgium, the Netherlands, Germany, Denmark) can participate in the management plan as long as:

C1.1 The vessel is owned by a member of one of the parties to the plan (either directly, or indirectly through a producer organization).

C1.2 The member and vessel has not been excluded from the plan due to an infringement.

C1.3 The capacity cap in C2 below has not been reached.

C1.4 Vessels in the management plan are not allowed to fish for brown shrimp using trawls emitting electrical pulses.

Fishing with electrical pulses is currently illegal, and only performed on an experimental basis in the North Sea. It is known that pulse fishing has a higher catchability of shrimp and a different profile of *ecosystem effects compared to the existing trawls, but the scientific knowledge is not yet at a point where these differences can be quantified.*

If a member voluntarily elects to remove a vessel from the management plan, this shall have effect for at least 12 months.

C2. General rules for capacity, effort and gears

The general rules for capacity, effort and gear provide a set of limits around the fishery, to avoid unmanaged increases in effort, catchability or ecosystem effects.

The total number of vessels allowed in the management plan, and their combined engine power, shall be limited as follows:

For each participating country, the number of vessels and combined kW shall not be higher than the number of vessels and combined kW officially registered by the authorities of the country on 1 January 2015.

If vessels from a country other than the three founding countries enter the management plan at a later stage, the same rule shall apply for these vessels.

If the number of vessels or combined kW of a particular country reaches the capacity cap, no new vessels /expanding kW shall be allowed unless the Steering Committee decides that this can be allowed on the basis that:

There is scientific advice that shows that an increase in capacity would not move the fishery away from the target of high long-term sustainable yield, or

The Steering Committee has agreed upon other measures that counter-act the effect of an increasing capacity on the long-term yield.

The officially registered number of vessels and kW for each country on 1 January 2015 was:

The Netherlands: 198 vessels, 40410 kW

Germany: 213 vessels, 41198 kW

Denmark: 28 vessels, 5213 kW

C2.1 **No vessel is allowed to fish for brown shrimp for more than 4800 hours at sea (=200 days) per year.**

C2.2 **Vessels are not allowed to have a combined length of the beams of more than 20 m including the shoes (or 18 m excluding the shoes if this is the applicable national regulation)**

C2.3 **Vessels are not allowed to have a combined weight of the gears of more than 4000 kg. The weight is determined as dry weight in air. The gear includes everything**

attached to the beam behind the connection to the wire. The scale shall be attached at the point where the wire is fixed to the gear (Hahnepot). The gear is lifted by the winch until all parts of the gear hangs free in the air.

C2.4 **Trawls used by the participants for brown shrimp fishing may not contain mesh with a smaller opening than 20mm in any part of the gear. The mesh opening shall be measured with the Omega-meter according to the EU regulations. If an outer bag of large-mesh netting is attached around the cod-end, this shall have a circumference at least as large as the cod-end itself.**

C3. Sorting of the catch

The rules on sorting of the catch are intended to minimize the amount and maximize the survival of unwanted bycatch in the fishery (undersized shrimps as well as other marine organisms).

C3.1 **Trawls used by the participants for brown shrimp fishing must contain a sieve net with a maximum opening of 70 mm or a sorting grid with a maximum of 20 mm between the bars and placed in accordance with the national specifications that follow from EU technical rules (850/98 or later versions).**

C3.2 **Catches must be sorted on board using a sorting machine with a bar spacing adjusted to the size of marketable brown shrimp and a constant water flow to ensure high survival of unwanted catches.**

C3.3 **Sieving on land must be conducted on a sieve with at minimum opening of 6.8 mm over a surface of at least one square meter. Shrimps that fall through this sieve are defined as sievage.**

C3.4 **Sievage must be crushed, except if the disposition for non-human consumption can be proven by shipping notes and/or invoices.**

C3.5 **Over a period of two calendar weeks (starting with week 1+2) the average amount of sievage for a vessel may not exceed 15 % of the total landing. Sievage shall be defined as undersized brown shrimp; the total landing as sievage plus marketable brown shrimp. Spoiled brown shrimp and other marine organisms shall not be included in the calculation.**

PO's shall ensure that sievage-data are available for the independent control agencies no later than a week after the end of each two-week period.

C4. High long-term sustainable yield

The Common Fisheries Policy of the European Union aims at fishing stocks at a level that provides the maximum sustainable yield (MSY), or an approximation of this if MSY is not known. MSY is not known for the brown shrimp fishery, but recent scientific results indicate that the effort (since approx. 1995-2000) is above the level that would give the highest long-term sustainable yield. Model results also indicate that one way to achieve high long-term sustainable yields would be to increase the standard mesh-size to 26 mm. This is predicted to increase the stock size by approx. 20% and would contribute to increased egg production (meaning lower risk of recruitment overfishing).

While the model indicates that the long-term result from using a 26 mm mesh would be higher catch-rates for the vessels (because of an increased stock), the model has not been tested in actual management. It is however inevitable that a higher mesh-size leads to short-term losses in catch for the vessels, and this loss will only be reversed through growth in the stock if the model results are correct.

The strategy to achieve high long-term sustainable yield is thus adaptive – it introduces the increase in mesh-size in a stepwise fashion, monitoring the results of each increase to see if the model is validated or contradicted. This stepwise fashion also ensures that the short-term loss of landings is lower and more rapidly compensated.

C4.1 Starting from 1. May 2016, trawls used by the participants for brown shrimp fishing may not contain mesh with a smaller opening than 22 mm in the cod-end. The mesh opening shall be measured with the Omega-meter according to the EU regulations. The cod-end shall be defined as at least the last 150 rows of mesh in the trawl net.

C4.2 Starting from 1. May 2018, the mesh opening described in C4.1 shall be 24 mm. The codend shall be at least 125 rows.

Before 1. January 2018, the Steering Committee shall seek the advice of relevant scientific institutions on whether the results of the monitoring of the shrimp stock indicate that the model is validated and still predicts that a larger mesh size would result in a higher long term yield. If this is not the case, C4.2 shall be re-evaluated based upon the scientific advice.

C4.3 Starting from 1. May 2020, the mesh opening described in C4.1 shall be 26 mm. The codend shall be at least 125 rows.

Before 1. January 2020, the Steering Committee shall seek the advice of relevant scientific institutions on whether the results of the monitoring of the shrimp stock indicate that the model is validated and still predicts that a larger mesh size would result in a higher long-term yield. If this is not the case, C4.3 shall be re-evaluated based upon the scientific advice.

If an increase in average effort of the vessels (hours-at-sea or other applicable metrics) is working against the target of high long-term sustainable yields, measures shall be taken to reduce effort or otherwise counteract the increase.

C5. Avoiding recruitment overfishing

There is no indication that the brown shrimp stock has ever experienced recruitment overfishing nor that it is very likely to occur. However, in accordance with the precautionary principle, it is necessary to reduce fishing when the shrimp stock gets beneath a predetermined precautionary level, indicating a decreased shrimp stock in the North Sea.

As 'Landings per unit of effort' (LPUE) indicate the amount of shrimp caught during a specific time period (kg per hour at sea), LPUE data can be used as an indicator of the status of the shrimp stock in the North Sea[75]*. A high LPUE indicates a high abundance of brown shrimp, and consequently, a low LPUE indicates that the stock has decreased.*

The ICES' Working Group on Crangon (WGCRAN) has concluded that management based on LPUE data and effort reductions currently is the best management practice when it concerns such a short lived species as Crangon crangon[76]*.*

Monthly average LPUE data for all vessels will be gathered (from electronic logbook and auction data) by the Working Group, and compared to the predetermined reference values outlined in table 1 below, after the end of each calendar month.

Table 1: Monthly reference values used for management measures. Reference values represent a percentage (in between brackets) of the average LPUE value per month in 2002 & 2007, representing years where both low and average LPUE values were noted.

Month	Average LPUE per month in 2002	Average LPUE per month in 2007	Average LPUE per month in 2002 & 2007	Ref 1 (70%)	Ref 2 (65%)	Ref 3 (60%)	Ref 4 (55%)	Ref 5 (50%)
January	10,74	36,00	23,37	16,36	15,19	14,02	12,85	11,69
February	13,01	22,40	17,71	12,39	11,51	10,62	9,74	8,85
March	14,18	26,17	20,18	14,12	13,11	12,11	11,10	10,09
April	12,58	27,98	20,28	14,20	13,18	12,17	11,15	10,14
May	13,28	25,29	19,29	13,50	12,54	11,57	10,61	9,64
June	16,01	18,75	17,38	12,17	11,30	10,43	9,56	8,69

[75] Source: Neudecker, Damm, Müller, & Berkenhagen, 2011
[76] Source: ICES Advisory Committee, 2014

July	24,27	24,24	24,26	16,98	15,77	14,55	13,34	12,13
August	37,71	25,91	31,81	22,27	20,68	19,09	17,50	15,91
September	42,81	32,04	37,43	26,20	24,33	22,46	20,58	18,71
October	48,73	27,05	37,89	26,52	24,63	22,73	20,84	18,95
November	37,36	21,92	29,64	20,75	19,27	17,78	16,30	14,82
December	31,75	16,18	23,97	16,78	15,58	14,38	13,18	11,98

If the average LPUE of a calendar month (or as much of the month as is available for calculation –see below) is below reference value 1 for that particular month, fishing in the first two calendar weeks after the calculation has been performed shall be limited for each vessel to the number of hours per week outlined in the Harvest Control Rule in table 2 below.

As long as average LPUE values remain below reference value 1, the monitoring frequency is increased and the average shall be calculated over two weeks (instead of a calendar month).

Table 2: Scenario's and management measures if current LPUE values decrease below predetermined reference values. The harvest control rule is based on the ICES hockey-stick method[77] in five steps of 12 hours for simplicity, and with a lowest level of fishing at 24 hours to ensure continued monitoring of the stock.

Option	Proxy	Management measure
1	LPUE > Ref 1	No particular measure needed since stock is above precautionary limit
2	Ref 1 > LPUE > Ref 2	Precautionary buffer reference value. Vessels may be at sea for a maximum of 72 hours per calendar week, calculated from departure to arrival in the harbor.
3	Ref 2 > LPUE > Ref 3	Vessels may be at sea for a maximum of 60 hours per calendar week, calculated from departure to arrival in the harbor.
4	Ref 3 > LPUE > Ref 4	Vessels may be at sea for a maximum of 48 hours per calendar week, calculated from departure to arrival in the harbor.
5	Ref 4 > LPUE > Ref 5	Vessels may be at sea for a maximum of 36 hours per calendar week, calculated from departure to arrival in the harbor.
6	LPUE < Ref 5	Limit reference value. Vessels may be at sea for a maximum of 24 hours per calendar week, calculated from departure to arrival in the harbor.

Data for a particular month shall be gathered and the LPUE calculated during the first calendar week after the 28th of that month (including as many days as data is available for). Vessels shall be informed of changes to the maximum allowed fishing hours by electronic means at the latest on the Friday of that week, and changes shall enter into force on the following Monday.

[77] Source: ICES, 2015. http://ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/General_context_of_ICES_advice_2015.pdf

C5.1 No vessel is allowed to fish for brown shrimp for more than the maximum number of hours at sea as instructed by the Working Group and/or Steering Committee.

D. Monitoring and research

The monitoring and research requirements are built upon the advice of ICES and national scientists, in order to be able to increase the confidence that the management plan delivers on its objective.

The effort of all vessels shall be monitored by:

Hours-at-sea and kW-hours-at-sea (for comparison with historical data), and

Hours-fishing and kW-hours-fishing (for future reference and refinement of harvest control rules)

A fleet register shall contain basic data on all participating vessels (such as name, number, length, engine power). The register shall be expanded into a fleet inventory, including technical information on vessels that allows monitoring of changes in fishing efficiency. Beam length and gear weight shall be registered before 1 February 2016. Further measures such as deck machinery and sorting devices shall be added gradually.

The Brown Shrimp Cooperative MSC Group will acquire scientific advice from a relevant scientific institution every year to enable an evaluation of whether the management plan is delivering on its objectives, including (but not necessarily limited to):

Reaching the target of high long-term sustainable yields, avoiding recruitment overfishing, minimizing unwanted by-catch.

D1.1 Vessels must participate in any data collection deemed necessary by the Steering Committee for the monitoring of the fishery.

Exceptions to rules in the management plan for a subset of vessels can be granted by the Steering Committee for the purposes of scientific experiments / surveys.

E. Ecosystem impacts

E1. Unwanted catches

The unwanted catches in the brown shrimp fishery consists of three types: undersized brown shrimp (see C3 sorting of the catch), commonly occurring fish and invertebrates; and rare or protected species (see E2 ETP species). The increasing mesh size (See C2.4 and C4) as well as the sieve net (C3.1) and *water-flow in the sorting machines (C3.2) all work to minimize the number (or mortality) of other fish and invertebrates in the catch.*

The Brown Shrimp Cooperative MSC Group will undertake review of alternatives to the existing technical measures (chapter C) which are better at avoiding unwanted catches, and to incorporate these in the plan if they are sufficiently practical, safe and cost-effective. Such reviews shall be done as alternatives become available, and at least every five years.

E2. ETP species

ETP (endangered, threatened and protected) species are by nature rare catches. Since vessels are not required to record catches of less than 50 kg in the EU logbook, it is necessary to have a separate ETP recording system to assess the impact of the brown shrimp fishery on ETP species.

The Brown Shrimp Cooperative MSC Group shall supply each vessel with an ETP registration sheet (on paper or in electronic form) and an identification sheet/wheelhouse guide to help fishermen identify the rare species. The producer organizations or parties shall collate all data from the ETP sheets and a joint report on numbers, trends and geographic spread shall be produced once every year.

E2.1 **Vessels must record all incidental catches of endangered, protected and threatened species in the ETP sheet. Viable specimens must be released as rapidly and gently as possible.**

Each vessel shall have an ETP identification sheet/wheelhouse guide on board to ensure correct identification. ETP sheets shall be sent to the producer organization or party as instructed.

E3. Seabed habitats

The brown shrimp fishery is generally performed on relatively shallow sandy bottom types characterized by very high levels of natural disturbance. Smaller and some larger areas along the entire coast (particularly in the inner parts of the Wadden Sea) have been closed to fishing by the authorities. In addition, the weight limit (C2.3) ensures that the brown shrimp fishery continues to be a fishery with lightweight gear, and avoids penetration below the surface layer of the bottom.

The fishing activity of the members will be monitored (through VMS mapping) every year to monitor the risk of any expansion into sensitive habitats.

E4. Waste and oil

E4.1 **All in-organic waste (including that which is caught in the gear) must be brought to shore, and handed over to the relevant service (Fishing for litter, national harbor recycling initiatives etc.).**

E4.2 **Waste oil or wastewater containing oil must be stored responsibly and brought to shore for proper disposal.**

F. Other stakeholders

Stakeholders with an interest in the management of the brown shrimp fishery include other fishermen and their organizations around the North Sea, as well as NGO's and other public interest organizations. The majority of these are organized in the North Sea Advisory Council (NSAC).

The Brown Shrimp Cooperative MSC Group will at least every year present the NSAC (or a sub-group of this) with the management plan and any changes to it since last year, as well as the results of the scientific evaluation and monitoring of progress. The Brown Shrimp Cooperative MSC Group will encourage advice from the NSAC, and include any changes that the Steering Committee finds would help in fulfilling the objectives of the plan.

G. Independent control

As many of the rules in this management plan go much beyond the legal requirements of the EU and national states, it is necessary to have an independent control of vessels and organizations to ensure compliance across the entire fleet.

The control of the implementation of the management plan shall be performed by one or more independent control agency/ies. If it is performed by more than one agency, the agencies shall cooperate to ensure that the control is performed in the same way everywhere.

At least 20 % of the vessels in each country shall be controlled by the agency each calendar year. Controls must be unannounced and shall be spread out to ensure reasonable geographic coverage.

The producer organizations shall be controlled at least once every calendar year, sieving stations at least twice every year.

All participating parties and producer organizations promise to give strong support to the controlling agency and its work. The producer organizations are responsible for ensuring compliance with the management plan by their members.

G1.1 **Members are obliged to let the independent control agency check their vessel(s). If a member refuses control, the control team will automatically assume that the participant is non-compliant with the rules and regulations of this management plan.**

An inspection protocol shall ensure a standardized and comparable control of producer organizations and vessels. The inspection template shall be based directly upon the rules in the management plan. The filled out inspection reports based on the protocol shall be kept for at least 5 years.

The control agencies report every 3 months to the Steering Committee on the number of inspections and number and type of infringements in each country and producer organization.

H. Penalties

The penalty annex to the management plan sets out the applicable penalties for infringements against any of the rules in the management plan.

H1. Process

The control agency shall take up a written report of each inspection including any infringements. The member shall have the opportunity to include comments on the inspection report before signing it. The control agency electronically sends the report to the PO of which the vessel is a member, as soon as possible.

The PO is responsible for the compliance of its members. In case of an infringement the PO shall send a warning or penalty notice in writing to the member within 14 days of receiving the report.

A warning shall contain at least: the infringement found in the report and management plan rule(s) not followed; notice of the penalty that would apply for a future repeated infringement; and notice of the opportunity of the member to appeal.

A penalty notice shall contain at least: the infringement found in the report and management plan rule(s) not followed; the appropriate penalty as outlined in the penalty annex and date of entry into force; an invoice for any fine and instruction for the member to inform the PO if the penalty is taken in the form of effort reduction instead of a fine; and notice of the opportunity of the member to appeal.

The penalty shall enter into force seven days after the penalty notice has been sent. If the penalty can be taken in the form of an effort reduction, the member shall inform the PO of the intention to do so within this period; otherwise, the fine shall be paid.

Invoices for fines shall be payable 15 days after the date of entry into force. Effort reductions and suspensions shall take effect at midnight on date of entry into force, or the first working day hereafter, if the date of entry into force is not a working day. For effort reductions, this means that from the day of entry into force, and for as long as the length of the reduction, the vessel may not leave port for brown shrimp fishing.

H2. Appeal

If the member wishes to appeal the penalty decision, this must be done within seven days after the penalty notice or warning has been sent. Appeal shall be sent to the PO in writing, and will have suspensive effect on the entry into force of the penalty. The PO shall re-consider the penalty in light of the appeal and any other information it may choose to obtain, and inform the member in writing of its decision to uphold, change or cancel the penalty, and set a new date of entry into force of the penalty (unless cancelled) seven days later.

Within this second period, the member has the opportunity to appeal to the Steering Committee in writing, with suspensive effect. The Steering Committee shall consider the appeal and inform the member of its decision to uphold, change or cancel the penalty. The decision of the Steering Committee is final, and shall be informed to the member and PO in writing including a new date of entry into force of the penalty (unless the penalty is cancelled).

H3. Rules for POs and sieving stations

In the event of an infringement against the regulations of the management plan by a PO or sieving station, the control agency immediately informs the relevant party and the Steering Committee. The Steering Committee is responsible for ensuring that the appropriate penalty from the penalty regulation is applied.

PO's shall transfer the value of any fines paid by its members to the party of which it is a participant.

Penalty annex to the Brown Shrimp Management Plan

Management Plan Article	Number of infringements and applicable penalty					Remarks
	1	2	3	4	5	
C2.1 & C5.1 200 days & HCR	€ 100/hour or 2 hours/hour	€ 200/hour or 4 hours/hour	**Exclusion**			The penalty is calculated according to the number of hours at sea over and above the allowed number of hours.
C2.2 & C2.3 beam width & gear weight	**Warning***	**Exclusion**				At the first warning, the member shall be given 14 days to change the gear, after which a second control shall be performed.
C2.4, C3.1, C4.1, C4.2 & C4.3 mesh size & sieve net		€ 1000 or 48 hours	**Exclusion**			
C3.3 & C3.4 sieving stations	**Warning**	**Exclusion**				In this case exclusion means that the sieving station will be excluded from MSC approved landing sites.
C3.5 sievage	**Warning**	€ 250 or 12 hours	€ 500 or 24 hours	€ 1000 or 48 hours	**Exclusion**	The member will only get a penalty if he has more than one landing within the two week period
D1.1 & E2.1 Data collection and ETP species	**Warning**	**Exclusion**				The member will be contacted (via text message or similar) as a reminder before an official written warning or exclusion is given.
G1.1 Refused control	€ 1000 or 48 hours	**Exclusion**				No warning is given.

* This warning is applicable for all MP articles mentioned in the column before: i.e. C2.2, C2.3, C2.4, C3.1, C4.1, C4.2 and C4.3. If a vessel has already been warned once for infringement of any of these articles, a subsequent infringement of any of these articles shall count as a second infringement.

A warning, penalty or exclusion is given to a particular member, for a particular vessel. If a member owns more than one vessel, it only applies to the vessel where the infringement has been found. If the vessel is sold (minimum half the ownership) to another fisherman or company, previous infringements shall not count against the number of infringements for that vessel.

Exclusion: An exclusion from the management plan (and list of MSC-certified vessels if a certificate is obtained) is valid for at least 12 months. Re-inclusion after this period is only possible when the independent control has checked the vessel again and has found no infringements.

Sunset clause: When the date of entry into force of a previous warning or penalty notice is more than 2 years past, this infringement no longer counts against the number of infringements for that vessel.

Appendix 4 Client review of alternative measures to reduce unwanted catch

Review of alternative measures to reduce unwanted catch.

All measures that have been adopted in the Brown Shrimp Management Plan are the result of comprehensive literature research, intensive discussions and carefully weighing up of the alternatives. The following Management Plan topics are related to reducing/avoiding unwanted catch, or increasing the survivability of discarded catch:

C1.4 Vessels in the management plan are not allowed to fish for brown shrimp using **trawls emitting electrical pulses**.

C3.1 Trawls used by the participants for brown shrimp fishing must contain a **sieve net** with a maximum opening of 70 mm or a **sorting grid** with a maximum of 20 mm between the bars and placed in accordance with the national specifications that follow from EU technical rules (850/98 or later versions).

C3.2 Catches must be sorted on board using a **sorting machine** with a bar spacing adjusted to the size of marketable brown shrimp and a **constant water flow** to ensure high survival ofunwanted catches.

C3.5 Over a period of two calendar weeks (starting with week 1+2) the average amount of **sievage for a vessel may not exceed 15 %** of the total landing. Sievage shall be defined as undersized brown shrimp; the total landing as sievage plus marketable brown shrimp. Spoiled brown shrimp and other marine organisms shall not be included in the calculation.

C4.1 Starting from 1. May 2016, trawls used by the participants for brown shrimp fishing may not contain **mesh with a smaller opening than 22 mm** in the cod-end. The mesh opening shall be measured with the Omega-meter according to the EU regulations. The cod-end shall be defined as at least the last 150 rows of mesh in the trawl net.

C4.2 Starting from 1. May 2018, the mesh opening described in C4.1 shall be **24 mm**. The cod-end shall be at least 125 rows.

C4.3 Starting from 1. May 2020, the mesh opening described in C4.1 shall be **26 mm**. The cod-end shall be at least 125 rows.

E1. Unwanted catches

The Brown Shrimp Cooperative MSC Group will undertake review of alternatives to the existing technical measures (chapter C) which are better at avoiding unwanted catches, and to incorporate these in the plan if they are sufficiently practical, safe and cost-effective. Such reviews shall be done as alternatives become available, and at least every five years.

Pulse beam trawl

The use of pulse beam trawls represents a promising alternative to traditional beam trawls used today for brown shrimp fishery. Scientific investigations could demonstrate positive effects with respect to bycatch reduction (Polet 2003, Kratzer 2012). To promote further research activities the Brown Shrimp Cooperative MSC Group was actively involved in planning and execution of several research projects concerning pulse beam trawling. One of those was a German research project under the leadership of the Thünen-Institutes in Hamburg and Rostock (Stepputtis et al. 2014). A pulse beam trawl was tested from 2012 - 2013 by using a commercial shrimp vessel provided by the producer's organization of the German shrimp fishers. Furthermore, tests have been performed in The Netherlands with a commercial fishing vessels using the pulse trawl as fishing method (Verschueren et al. 2014). In Belgium ILVO has performed several tests on the effects of pulses on different life stages of several species of fish and invertebrates to define appropriate pulse variables (Soetaert et al. 2014; Desender et al. 2016).

Although the results obtained (Kratzer 2012; Stepputtis et al. 2014) show a significant reduction in fish bycatch the decision for the Brown Shrimp Management Plan was to exclude vessels equipped with pulse beam trawls from the MSC certification process for three reasons:
- There are still unanswered questions left concerning environmental effects of electric pulses to the environment (Soetaert et al. 2014).
- Research results show a higher catchability of shrimp in pulse trawls. Allowing pulse trawls would thus lead to a higher fishing mortality from the same effort – which would directly counteract the Management Plan measures to achieve high long term sustainable yield.
- The use of electricity for fishing purposes is still forbidden by EU regulations, and current pulse fishing is based on derogations.

The Brown Shrimp Cooperative MSC Group is pursuing the further research on the effects of pulse beam trawling for shrimp fishing and is in close contact with scientists and legislative administration.

Sieve net / sorting grid

The preceding literature research for the use of sieve nets with a certain mesh size is documented in a short note (Vorberg 2015), which served as a basis for discussions initially led by the Project Management Group and used finally for the decision in the Steering Committee of the Brown Shrimp Cooperative MSC Group (SC-meeting_20150921). Up to date the sieve net / sorting grid are the best known measures to avoid the bycatch fraction >10 cm. While a 70 mm mesh opening revealed as the best alternative (see literature cited in Vorberg 2015), the choice between sieve net or sorting grid was left to the fishermen in accordance to their individual preferences. Scientifically proven differences between these two devices do not exist.

The "letterbox" (Steenbergen et al. 2011) as alternative to the sieve net was considered but rejected, because there are no decisive advantages. Moreover the sieve net or sorting grid is obligatory for the shrimp fishery and was already built into most of the present nets before the Management Plan.

Sorting machine and sievage rule

The sorting machine is adjusted to ensure that marketable shimp are retained, and undersized shrimp (and other small marine organisms) are sorted out (Boddeke 1992). By using a constant water flow, the survivability of the discard fraction is maximised.

Because sorting can never be knife-edged (retaining 100% marketable, discarding 100% undersized), the Steering Committee chose to set a limit of 15 % landed (i.e. boiled) undersized shrimp, to make sure that there was no incentive to adjust the sorting machine too far towards retention. This results-based measure was considered more effective than any 'micro-management' of the construction and use of the sorting machine which would inevitably be highly detailed and very difficult to enforce.

Mesh size

The Brown Shrimp Cooperative MSC Group promoted gear technology research in order to improve the net selectivity for shrimp fishing by optimizing mesh size and net material. Under the leadership of the Thünen-Institute in Hamburg an interdisciplinary research project (CRANNET) took place from 2013 - 2015 in Germany (Schultz et al. 2015). The German shrimp fishery provided yarn material and net makers and tested new cod-ends under commercial conditions. It could be shown that 26 mm mesh size is the most appropriate alternative with respect to a high long-term sustainable yield in the shrimp fishery. Concurrently, this increase in mesh size will reduce the catch of undersized shrimps as well as of small fish. Instead of starting immediately with 26 mm mesh size the Management Plan provides an alternative procedure by implementing a stepwise increase of the mesh size, starting with 22 mm in 2016. When scientific research indicate that the expected effect has been achieved (as predicted by the CRANNET model) then in 2018 the mesh size will be increased to 24 mm. If the expected trend of the CRANNET report continues in 2020 the mesh size will be increased towards 26 mm (SC-Meeting_20151104). This adaptive, stepwise implementation ensures that the applicability of the CRANNET model results is tested before full implementation.

Since basic assumptions of the project results are model-based the Brown Shrimp Cooperative MSC Group has initiated a research project to verify the CRANNET results and concluded a six-years-contract with the University of Hamburg (Universität Hamburg 2016) to investigate the effects of increasing mesh sizes on catch results of marketable shrimps, brown shrimp population dynamic and bycatch reduction effects. The project started on 01.07.2016 and is organized and closely monitored by the MSC Project Group.

Review of unwanted catches

In effect the process of creating the management plan consists of one long review of alternative rules/measures – summarised and formally documented in this paper and the attached Steering Committee meeting minutes. As stipulated in the plan, review of measures will take place regularly as new technologies, ideas, issues and problems occur – but also formally at the latest in 2021

Table 1 demonstrates the reviewing of measures and alternatives that has taken place in the Steering Committee meetings of the Brown Shrimp Cooperative MSC Group:

Measure	Proposal	Alternative	Decision	Reference
Pulse trawling	Not allowed	Allowed	Not allowed	SC-Meeting_20150921, p. 8, 28; Stepputtis et al. (2014); Soetaert et al. (2014)
Sorting of the catch	Sieve net with max. 70 mm	Sieve net with 60 or 80 mm	Sieve net with max. 70 mm	SC-Meeting_20150921, p. 8, 28; Vorberg (2015)
Sorting of the catch	Sieve net	Sorting grid or letterbox	Sieve net or sorting grid	SC-Meeting_20150921, p. 8, 28; Vorberg (2015); Steenbergen et al. (2014)
Mesh size increase	26 mm diamond mesh	24 mm T45; 26 mm T90	26 mm diamond mesh	SC-Meeting_20150921, p. 18-20, 28; Schulz et al. (2015)
Mesh size	22 mm for entire trawl	22 mm only in the cod-end	22 mm in the cod-end	SC-Meeting_20151104, p. 10
Mesh size increase	Stepwise approach up to 26 mm	26 mm from the beginning	Stepwise approach	SC-Meeting_20151104, p. 4
Mesh size increase	Scientific examination of measures	Relying on model results	Research order to Universität Hamburg	SC-Meeting_20160411, p. 9; Uni Hamburg (2016)

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SC-meeting_20151104: Minutes of Steering Committee meeting on 04.11.2015 in Oldenburg

SC-Meeting_20160411: Minutes of Steering Committee meeting on 11.04.2016 in Oldenburg

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Appendix 5 Peer Review Reports

Peer Reviewer 1

Summary of Peer Reviewer Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No** **Yes**	**CAB Response**
Justification: Rationales clearly support scores for all SIs, hence each PI, and the recommendation to certify the fishery is sound.		No response required.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe? [Reference: FCR 7.11.1 and sub-clauses]	**Yes/No** **Yes**	**CAB Response**
Justification: The milestones very clearly indicate what is required to achieve SG 80 in the case of each SI in question. Condition 1 – yes. Condition 2 – yes. Condition 3 – yes. Condition 4 – yes, but note comment for 2.3.3 below. Condition 5 – yes. Condition 6 – yes. Condition 7 – yes. Condition 8 – yes. Condition 9 – yes.		No response required

If included:

Do you think the client action plan is sufficient to close the conditions raised? [Reference FCR 7.11.2-7.11.3 and sub-clauses]	**Yes/No** **Yes**	**CAB Response**
Justification: The CAP indicates a clear understanding of what is required for each SI. Much of what is required is well in hand and at this point there appears to be no major hurdle to closing all conditions over the 4-year timeframe. Condition 1 – yes. Condition 2 – yes. Condition 3 – yes. Condition 4 – yes. Condition 5 – yes. Condition 6 – yes. Condition 7 – yes.		No response required

Condition 8 – yes. Condition 9 – yes.	

Table 1 For reports using one of the default assessment trees:

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.1.1	Yes	Yes	N for SIb SG 80 – no condition raised but 1.1.2 scored.	I don't disagree with the 100 score for SIa, however, SG100 would normally be based on a more quantitative rationale, i.e. 95% CIs from an analytical assessment. This probably should be acknowledged but, more important, a statement saying that the evidence is "interpreted" as supporting such a high level of confidence should be included in the rationale. In SIb, as important as the F estimates are to the overall stock assessment, I'd be inclined to not refer to them as "reference points" to avoid confusion with the LPUE reference points which trigger the HCRs. F_{msy} proxies, as I first noticed in 1.2.3 scoring rationales, should be used instead of "reference points" throughout.	Score for SIa. The peer reviewer's comment is accepted, and the rationale has been modified accordingly. SIb. The comment is noted, and the rationale has been revised to ensure that Fmsy proxies are not cconfused with the LPUE reference points.
1.1.2	Yes	Yes	NA	No further comment.	
1.1.3	.NA			No 1.1.3 PI in FCR v2.0.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.1	Yes	Yes	Yes	SIa rationale states there is no minimum landing size in the fishery, however, reference is made to minimum commercial size in the SIb rationale and on p.82, where the on board sorting procedure is described, reference is made to minimum landing size. Clarification is in order.	There is no minimum landing szie in the Crangon fishery. The erroneous reference to a minimium landing szie on page 82 has been deleted.
1.2.2	Yes	Yes	NA	Please refer to general comments at end of template.	See response to general comments.
1.2.3	Yes	Yes	NA	No further comment.	
1.2.4	Yes	Yes	NA	No further comment.	
2.1.1	Yes	Yes	NA	No further comment.	
2.1.2	Yes	Yes	NA	No further comment.	
2.1.3	Yes	Yes	Yes	No further comment.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
2.2.1	Yes	Yes	NA	For SIb, even though SG100 cannot be met, there should be some brief summary of information, perhaps only for a few of the most frequently encountered species, along with general commentary, such as that included in the paragraph near the top of p. 79, and reference to relevant sections.	Additional text has been provided and references made to the relevant section in the report.
2.2.2	Yes	Yes	NA	In SIa it is stated that only brown shrimp is retained, however,Table 5 (p.73-74) shows that Baltic prawn is also retained in the Danish fishery, although everything else is discarded. Tables for the other two countries only show bycatch incidence. Any other exceptions to the overall rule??	Noted and text edited accordingly. No other exceptions to the rule were noted, as the information is presented differently between Denmark and Germany and the Netherlands – whereby the latter two appear to follow a similar recording protocol. This was noted as part of condition setting.
2.2.3	Yes	Yes	Yes	No further comment.	
2.3.1	Yes	Yes	NA	No further comment.	
2.3.2	Yes	Yes	NA	No further comment.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.3.3	Yes	Yes	Yes	In Appendix 2, the milestones section of Condition 4 refers only to bycatch (no specific reference to ETP species), wheras ETP species are highlighted in the CAP section.	Noted and section edited accordingly to provide more targeted detail.
2.4.1	Yes	Yes	NA	No further comment.	
2.4.2	Yes	Yes	Yes	No further comment.	
2.4.3	Yes	Yes	Yes	No further comment.	
2.5.1	Yes	Yes	NA	No further comment.	
2.5.2	Yes	Yes	NA	No further comment.	
2.5.3	Yes	Yes	NA	No further comment.	
3.1.1	Yes	Yes	NA	No further comment.	
3.1.2	Yes	Yes	NA	No further comment.	
3.1.3	Yes	Yes	NA	No further comment.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.1.4	NA			No 3.1.4 PI in FCR v2.0.	
3.2.1	Yes	Yes	NA	There must be some degree of "measurability" more or less built into the MP, allowing some scope for a partial score >80????	The MSC requirements state, "The team shall interpret 'measurable' at SG100 to mean that in addition to setting fishery-specific objectives that make broad statements objectives are operationally defined in such a way that the performance against the objective can be measured" An example of an explicit measurable objective is also provided in the guidance, i.e. "the impact on dependent predators will be reduced by x% over y years". The assessment team considers that the objectives are broad in their language and not well enough defined to provide "measurability".
3.2.2	Yes	Yes	Yes	No further comment.	
3.2.3	Yes	Yes	Yes	No further comment.	
3.2.4	Yes	Yes	Yes	No further comment.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.5	NA			No 3.2.5 PI in FCR v2.0.	

Optional: General Comments on the Peer Review Draft Report (including comments on the adequacy of the background information if necessary) can be added below and on additional pages

Given how difficult logbook data can be to work with, I was dubious initially about the use of LPUE as a basis for reference points and HCRs. Commercial catch rates are often considered unreliable as an indicator of stock status, even after rigorous standardization. Details in the P1 background section, however, provide a fair degree of reassurance that it is appropriate in this instance. There is a clear recognition that LPUE standardization is a work in progress and that reference points and HCRs will be subject to modification as needed. Work described appears not to have included any consideration of gear configuration – beam length/weight (height?) – or tow speed/duration in the standardization. These, among other things, I would guess could vary considerably.

Also, fishermen have an innate propensity to make adjustments to stabilize/slow declining catch rates and are quite adept at doing so, even under normal circumstances. Knowing their logbook data could be used to restrict their fishing effort places them in an untenable position. This is recognized in the reference (p. 36/37) to monitoring to detect systematic changes in fishing behavior that might bias estimates of LPUE – one thing not mentioned in ongoing monitoring that should be included is rigorous comparison of observed and unobserved trips. It is also recognized in the team's recommendation #3 (p. 122) for development of a fishery-independent survey approach to monitoring LPUE. Using FCR v1.3, a condition would likely have been raised regarding the limited standardization of LPUE to date. In this particular case, audit teams and especially the re-assessment team should ensure thorough standardization has been done and reference points/HCRs for the fishery adjusted accordingly.

Assessment team response. We note the comments of the reviewer concerning standardisation of LPUE data and the likely need for reference points and HCRs to be adjusted accordingly and to be reviewed carefully at future surveillance audits. The Clients will be continually reviewing the reference points and HCRs in the light of experience and new information, and will be updating their fleet inventory annually in order to check for any systematic changes in fishing behaviour that might bias LPUE estimates. In line with the reviewer's comments, the assessment team also made recommendations that a full inventory of all vessels is maintained and updated on an annual basis to identify any systematic changes in fishing vessels or gear or fishing behaviour (the latter now added to take into account the reviewer's comment), that a fishery-independent survey approach to monitoring monthly LPUE patterns is developed (to permit rigorous comparison between observed and unobserved fishing trips) and that standardised LPUE data are collected across all national fleets. We note the comment that fishermen may be put in a difficult situation where their log book data will be used to determine whether fishing effort needs to be reduced within season. Whilst it may be possible for fishermen to “adjust” their log book data accordingly, evidence from 2016 when fishing effort was reduced due to a decline in monthly LPUE suggest that fishermen in the shrimp fishery accept this management approach, probably because their experience shows that short term reductions in fishing effort usually lead to higher catch rates later in the season.

Throughout the body of the report, Appendix 1 (Scoring Tables and Rationales) and Appendix 2 (Conditions), I flagged quite a few places requiring minor editing. A number of comments/questions are flagged in the body of the report as well – some of these were clarified/answered further on. However, as a matter of course, there should be a little more detail or reference to where clarification is provide where the point in question is initially raised.

Assessment team response. We thank the peer reviewer for his detailed review of the text of the report. Where flagged in the text, the appropriate revisions have been made.

Scoring rationales provide solid support for all scoring issues and, hence, each PI. The assessment team’s conclusion that the fishery is recommended for certification is sound. The recommendation is provided in the Executive Summary but not yet written up in Section 6.5.

Assessment team response. The recommendation for certification should only be included in section 6.5 of the report at later stages of the certification process than the Peer Review Draft Report.

Peer Reviewer 2

Summary of Peer Reviewer Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes**	**CAB Response**
Justification: Principle 1. I agree with the CAB arguments for not classifying this *Crangon* stock as LTL species. For the assessment and evaluation of current stock status the CAB refers to ICES. A key problem with such a short lived species is a rapidly changing/varying stock status. For management stock status is evaluated in relation to LPUE based reference values on a monthly basis, i.e. almost 'real-time' monitoring. The stock dynamics of this short-lived species is heavily influenced by high mortality rates, where the fishing mortality component seemingly has been dominating in recent years. Based on the available information I fully agree with conclusion reached by the CAB. Principle 2. The CAB has elucidated all the important 'ecosytem' problems connected to this fishery in the Wadden Sea. With the information available, also the sometimes insufficient conformity of the data, I agree with the CAB conclusions and in general with their scoring. . Concerning Principle 3. The EU regulations common to Denmark, Germany and Netherlands together with the various national regulations contribute to the complexity of the management of this UoA. In my opinion the CAB has covered all the relevant aspects and made the right conclusions and scoring.		No response required.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe? [Reference: FCR 7.11.1 and sub-clauses]	**(Yes)**	**CAB Response**
Justification: The conditions set by the CAB are all appropriate and some of them would be fulfilled without problems, e.g. condition 1 (increase of mesh size). Whereas others mainly those connected to Principle 2, for instance conditions 3, 4 (harmonizing quantitative by-catch data) even when fulfilled may not improve the data sufficiently to the expected SG80. The Principle 3 conditions (7-9) should give no problems.		The comments in relation to conditions 3 and 4 are noted. Careful review of progress against these conditions will need to be made at annual surveillance audits to ensure that the conditions can be closed within the certification period.

If included:

Do you think the client action plan is sufficient to close the conditions raised? [Reference FCR 7.11.2-7.11.3 and sub-clauses]	**Yes**	**CAB Response**

Justification: As said above, I would think that by some of the Principle 2 conditions, the outcome of the action plans might not fully fulfill the expectations.	The comments in relation to conditions 3 and 4 are noted. Careful review of progress against these conditions will need to be made at annual surveillance audits to ensure that the conditions can be closed within the certification period.

Table 1 For reports using one of the default assessment trees:

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
Example:1.1.2	[redacted]	[redacted]	[redacted]	[redacted]	
1.1.1	yes	yes	N/A		
1.1.2	yes	yes	N/A		
1.1.3	yes	yes	N/A		
1.2.1	yes	yes	Yes		
1.2.2	yes	yes	N/A		
1.2.3	yes	yes	N/A		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.4	yes	yes	N/A		
2.1.1	yes	yes	N/A		
2.1.2	yes	yes	N/A		
2.1.3	yes	yes	Yes		
2.2.1	yes	yes	N/A		
2.2.2	yes	yes	N/A		
2.2.3	yes	yes	(no)	Even with 'harmonised' by-catch data the fractions of several of the ETP species will be small and the reliability of subsequent time series as stockindicators uncertain.	Noted. Although 2.2.3 deals with secondar species, the issue is the same for ETF species. By harmonising the protocol acros all fisheries, including timing of sampling i order to reduce variance due to seasonality, i may be possible to improve the informatio content of the observer data across all thre fisheries.
2.3.1	yes	yes	N/A		
2.3.2	yes	yes	N/A		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
2.3.3	yes	yes	(no)	Even with 'harmonised' by-catch data the fractions of several of the ETP species will be small and the reliability of subsequent time series as stockindicators uncertain.	Noted. By harmonising the protocol across al fisheries, including timing of sampling in orde to reduce variance due to seasonality, it may be possible to improve the information conten of the observer data across all three fisheries such as noting trends to inform strategy.
2.4.1	yes	yes	N/A		
2.4.2	yes	yes	yes		
2.4.3	yes	yes	yes		
2.5.1	yes	yes	N/A		
2.5.2	yes	yes	N/A		
2.5.3	yes	yes	N/A		
3.1.1	yes	yes	N/A		
3.1.2	yes	yes	N/A		
3.1.3	yes	yes	N/A		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.1	Yes	Yes	N/A		
3.2.2	Yes	Yes	Yes		
3.2.3	Yes	Yes	Yes		
3.2.4	Yes	Yes	Yes		

Optional: General Comments on the Peer Review Draft Report (including comments on the adequacy of the background information if necessary) can be added below and on additional pages

General Comments.

In general a very good and well written report covering all important and relevant information on this *Crangon* UoA .

However, it is strange that the CAB team has not had any contact with Danish Scientists (DTU-Aqua). Even if there at present are no scientists directly involved in *Crangon* reseach, DTU-Aqua supervises data collection from the fishery carried out in Danish waters. Also a longer time series for the landings would have been available.

Assessment team response. The assessment team and the Danish Client were informed by DTU Aqua that there was currently no scientist working on Crangon within the organisation and that it would therefore not be worthwhile arranging a visit to the institute during the site visit. The assessment team noted that until his recent retirement, Per Sand Kristensen was a regular contributor to the ICES Working Group (WG), and that the current ICES WG reflected up-to-date reliable landings data from the Danish fleet. Figure 4 (source ICES WG) shows Danish landings from the 1970s, but Figure 5 (source ICES WG) shows landings only from 1987. The assessment team noted the opinion of the ICES WG (ICES, 2015) that landings data across the various national fleets prior to 1994 are not considered complete and reliable and therefore the assessment team did not consider that it was worthwhile searching for additional data that were considered unreliable by the ICES Working Group.

1.
Historical data and management:

In the description of the development of the *Crangon* fisheries and management (pp. 18-21), a mention of the Danish fishery is missing. For the graph in Fig. 5 Danish landings data for the period prior to around 1987 should also be available.

Assessment team response. A mention of the Danish fishery has now been added to page 18 in section 3.4. There may be some Danish landings data available prior to around 1987 that could be included in Figure 5. However the assessment team noted the opinion of the ICES Working Group (ICES, 2015) that landings data across the various national fleets prior to 1994 are not considered complete and reliable and therefore the assessment team did not consider that it was worthwhile searching for additional data that were considered unreliable by the ICES Working Group.

For historical 'completeness' the first ICES WG on *Crangon* should perhaps be mentioned :

Report of the Working Group on crangonid shrimps. ICES C.M.1979/K:7, 31p.

Here data on by-catch are presented as well as a model for assessment (Belgian data).

Assessment team response. A reference to the first ICES WG has been added to the text.

2.
Sect. 3.4
Overview : In Denmark this species is also known as 'Sandrejer'.

Assessment team response. The additional Danish name has been added to the text.

Sect. 3.5.3
Discard monitoring: Denmark also takes part in the Discard sampling.

Assessment team response. A comment to that effect has been added to the text.

In Section 3.7.4 (Principle 3) there is a 'difficult' Danish name, which is consistently spelled wrongly:

‘Danish Agrifish Agency’ should in Danish be: Natur**Erhverv**styrelsen

Assessment team response. The misspellings have been corrected.

Appendix 6 Stakeholder submissions

Section 4.4.1 of the main report describes the various meetings with stakeholders that took place during the site visit. The primary purpose of these meetings was to obtain all information that might be relevant to the assessment of the brown shrimp fishery against the MSC Certification Requirements. During the site visit, the assessment team held meetings with Dutch and German NGOs in Utrecht and Buesum respectively. At these meetings the stakeholders made formal presentations of information and evidence in relation to the assessment of the fishery. Detailed discussions between the assessment team and the stakeholders followed these presentations. In addition to these meetings and presentations, the NGO stakeholders joined together to produce a written submission containing the information and evidence that was presented to the assessment team during the site visit. This written submission is reproduced below.

Comments from Consortium of NGOs

To: Acoura Marine
Findhorn House
Dochfour Business Centre
Dochfour
Inverness, IV3 8GY

(via email)

Date: 11 April 2016

SUBJECT: Site Visit Comments for the MSC certification of the North Sea Brown Shrimp Fishery

Dear Billy Hynes,

On behalf of the consortium of Non-Government Organizations (NGOs) recently formed to provide joint stakeholder input on the MSC certification of the North Sea Brown Shrimp fishery, as representatives of the following organizations; the World Wide Fund For Nature, the North Sea Foundation, the Marine Conservation Society, the Dutch Elasmobranch Society, ClientEarth, the Nature and Biodiversity Conservation Union (NABU), and the Royal Society for the Protection of Birds, we would like to submit these written comments as a follow up to our presentations at the site visits in the Netherlands and Germany regarding the MSC certification of the North Sea Brown Shrimp fishery.

Thank you for the opportunity to provide a stakeholder submission for the MSC assessment of the North Sea Brown Shrimp fishery. While the consortium of NGOs contributing to this submission supports the efforts of DFPO, GbR and CVO to seek MSC certification for the fishery, our review of the available literature and the management plan recently adopted by the sector has identified serious issues which must be addressed for the fishery to meet the minimum requirements under the MSC Fishery Certification Requirements (FCR) version 2.0. We present our concerns on the following pages. The issues that we raise are fundamental and must be addressed in order for the fishery to meet the MSC's global environmental standard for sustainable fisheries.

We hereby request that the CAB carefully review these comments during the scoring of the fishery against the MSC certification requirements and preparation of the Public Comment Draft Report for the North Sea Brown Shrimp fishery.

Best regards,

Floris van Hest
North Sea Foundation

Bruce Robson
on behalf of WWF-NL

Dr. Wilfred Alblas
Natuurmonumenten

Carrie Hume
Marine Conservation
Society

Dr. Kim Cornelius Detloff
NABU

Rainer Borcherding
Schutzstation Wattenmeer

Arjan Berkhuysen
Waddenvereniging

Dr. Hans-Ulrich Rösner
WWF Germany

cc: Hans Nieuwenhuis, MSC
Vivien Kudelka, MSC
Camiel Derichs, MSC

NGO Consortium Stakeholder Submission
Full MSC Assessment of the
North Sea Brown Shrimp Fishery

11 April 2016

Contributing Organizations:

North Sea Foundation
World Wide Fund for Nature (WWF-NL, WWF-DE, WWF-DK)
Natuurmonumenten
Waddenvereniging
Schutzstation Wattenmeer
Marine Conservation Society
Nature and Biodiversity Conservation Union (NABU)

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SUMMARY

The NGO Consortium agrees with the recent characterization by ICES that the voluntary management plan implemented by the sector represents a "good start" towards sustainable management of the North Sea brown shrimp (***Crangon crangon***) fishery. We support the efforts of the Danish Fishermen Producer Organization (DFPO), MSC-GbR (for the German fishery) and Coöperatieve Visserij Organisatie (CVO, for the Dutch fishery) to seek MSC certification for this fishery in principle. However, our review of the available literature and the current voluntary management plan has identified serious issues that must be addressed for the fishery to meet the minimum thresholds under the MSC Fishery Certification Requirements (FCR) v2.0. Based on a wide range of available scientific information, the NGO consortium has identified a number of issues that remain unaddressed despite clear advice from ICES and national scientific institutes on improvements that are necessary for effective and sustainable management of the fishery. We also raise concerns about a number of ambiguities, errors and omissions in the voluntary management plan, that must be critically addressed by the fishery and the assessment team before the fishery can be certified as sustainable and well-managed under the MSC certification requirements. The major issues that must be addressed to move towards a sustainable and well-managed brown shrimp fishery under the MSC principles and criteria can be summarized as follows:

- Measuring and monitoring fishing effort
- Design, implementation and validation of a precautionary harvest strategy
- Monitoring and mitigating mortality of important by-catch species
- Monitoring and controlling fishing in MPAs and particularly in VME habitats
- Poor compliance with existing regulations and management measures
- Transparency in monitoring and enforcing existing regulations

We provide detailed documentation of these issues relative to specific MSC performance indicators in the following sections. Of greatest concern under Principle One is the fact that the fishery as currently conducted does not demonstrate a viable means to measure, monitor and control fishing effort, especially related to preventing undetected increases in effort due to changes in technology (e.g. realized engine power, deck machinery, mesh size used, sorting devices, etc.) or re-entry into the fishery of inactive licenses. Without the means to detect and manage 'effort creep' the sustainability of the target stock can not be guaranteed. Under Principle Two, if it cannot be demonstrated that a) the fishery respects closed areas designed to protect VME habitats and research areas necessary to evaluate habitat recovery and b) that the fishery implements precautionary measures to protect these habitat (e.g. scientifically-based move-on rules) the fishery cannot be certified under the MSC requirements. Under Principle Three it must also be clearly demonstrated that the fishery complies with existing national and international laws and binding agreements (e.g. Natura-2000 and the Guiding Principles of the Wadden Sea Trilateral Agreement).

ICES (2014) provided a six-step 'roadmap' for the implementation of the HCR and expressed the opinion that the first three steps could be implemented within a year if sufficient funding is available. Although the steps identified in the roadmap were not specifically linked to the MSC process, the NGO Consortium considers that these steps provided the outline of a viable Fisheries Improvement Project (FIP) for a sustainable fishery. However it is clear that not all of the initial steps to implement the HCR have been met at this point in time. Furthermore, the ICES roadmap pertained specifically to elements considered under Principle One of the MSC fisheries certification requirements. Although ICES considered that implementation of a management system that effectively reduced effort would concurrently reduce the impact on the benthic community, on by-catch species and on species relying on brown shrimp as prey, it is clear that additional improvements are necessary to meet the requirements of MSC Principles Two and Three.

In summary, based on our analysis of the status and management of the fishery relative to the MSC certification requirements, we do not find that the North Sea brown shrimp fishery can meet the minimum requirements for MSC certification without significant improvements that go beyond the current voluntary management plan and are designed and implemented to address these deficiencies. Without these improvements we consider that the fishery should embark upon a rigorous FIP until the minimum sustainability requirements of the MSC Fisheries Standard are met. We believe that these improvements are critical to ensure that an MSC certification of this fishery is credible in the eyes of stakeholders, retailers and consumers. As a broadly based coalition of engaged stakeholders, the NGO Consortium has provided a wide range of inputs to develop a coherent management plan for the Brown shrimp fishery. This includes the WWF advice to inform a long term management of the shrimp fishery and the recent Brown Shrimp Focus Group of the NSAC meeting. In this capacity we hope that these comments will encourage the fishery to seriously consider making strong improvements to the management plan in order to meet standards for sustainable fishing.

PRINCIPLE 1: Sustainable fish stocks

- **PI 1.1.1 Stock status**

The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing

Under scoring Issue (SI) (a), MSC PI 1.1.1 assesses the status of the target stock relative to the likelihood that the stock is above the point of recruitment impairment (PRI) and under SI (b) the status of the stock in relation to achievement of the maximum sustainable yield (MSY). In relation to scoring issue (b) we also note that the Common Fisheries Policy of the European Union aims at maintaining stocks ABOVE a level that provides the maximum sustainable yield (MSY).[1]

It is widely agreed that the life cycle of brown shrimp does not allow for a normal age-based stock assessment due to the lack of a clear age structure and nearly continuous reproduction (ICES 2015). Accordingly, under SA 2.2.3 the MSC allows for the use of proxy measures when information is not available on the status of the stock relative to PRI or MSY levels and SA 2.2.4 allows for recent trends in the fishing mortality rate as a means or scoring stock status. The MSC Certification Requirements and Guidance v2.0 focus specifically on avoiding recruitment overfishing and do not define or address the concept of growth overfishing. The MSC guidance (GSA2.2.2) does however, provide the following definition of overfishing as “fishing mortality higher than F_{MSY}, the fishing mortality level that results, in the long term in the stock being at maximum sustainable yield.”

Temming and Hufnagl (2014) and ICES (2015) provide an analytical definition of growth overfishing in relation to fishing mortality where F should not be increased beyond F_{max} to avoid growth overfishing and $F_{0.1}$ indicates a level of exploitation, where any further increase would only result in minimal further increase in the Y/R, while at higher F levels, the mean spawning stock per recruit (SSB/R) would decrease substantially.

Recent ICES reports recommend the use of landings per unit effort (LPUE) as a measure of fishing mortality in order to assess the status of the brown shrimp stock (ICES 2013, 2014a, 2014b and 2015). ICES (2015) summarized current monitoring indicators standardized across nations with modeling efforts and information on the shrimp predator stocks. The analysis indicates that the population is currently growth overfished and that fishing pressure F is about 4 times higher than natural mortality M. Effort constantly increased during recent decades and in 2013 and 2014 the highest effort (in horse-power days at sea) was reported. F is currently at a level of about 4.5 per year while F_{max} and $F_{0.1}$ were calculated to be about 2 and 1.5, respectively. Steenbergen et al. (2015b) reached a similar conclusion from HCR simulations – that the current exploitation of brown shrimp in the North Sea occurs at an

[1] See Article 2(2) of Regulation (EU) No 1380/2013

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intensity that clearly leads to growth overfishing and that a reduction in fishing mortality will lead not only to an increased efficiency (higher LPUE) but also to higher overall catches, despite a lower effort. ICES (2014) reports that: "Appropriate management would be needed to effectively limit the fishing effort, as reaching the maximum sustainable yield does not seem possible unless effort is reduced from the current level."(...) In addition: "A reduced effort will lessen the environmental impact of the brown shrimp fishery on non-target species and the benthic community of the seafloor."

Based on our review of the available scientific evidence the NGO Consortium concludes that it is clear that the UoA does not meet SI(b) with F at a level exceeding F_{MSY} for well over a decade. Indeed the fishery is at risk of not meeting SI(a) at the SG80 level as well if increasing levels of fishing mortality impact the spawning biomass resulting in impaired recruitment. At minimum fishing effort needs to be reduced to a level that the stock achieves the appropriate target (below F_{MSY}) and remain below this level.

- **PI 1.1.2 Stock rebuilding**

Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe

The assessment team is required to score PI 1.1.2 when the Stock Status PI 1.1.1 does not achieve an 80 score. Due to the life cycle of brown shrimp it is very likely that the stock can quickly be rebuilt within the timeframe required under SI(a) in the event that effort is effectively reduced under the condition required for PI 1.1.1. Simulation modeling (Temming and Hufnagl 2013, ICES 2015, and Steenbergen et al. 2015b) also indicates that the stock will likely be rebuilt within the specified timeframe as required under SI(b). Thus we consider that pending appropriate action under PI 1.1.1 the requirements for PI 1.1.2 could be met at the SG80 scoring guidepost.

- **PI 1.2.1 Harvest strategy**

There is a robust and precautionary harvest strategy in place

The brown shrimp fishery is currently not regulated with quotas and the fishing effort is only limited based on the number of permits. However, there is broad consensus that management of the fishery is needed to achieve long-term sustainability (e.g. ICES 2014, 2015). Because the brown shrimp fishery lacks a legally mandated management structure under the EU or any of the national governments it is clearly difficult, if not impossible for the fishery to meet the minimum MSC certification requirements. In response to this need the client fishery has voluntarily implemented a management plan that describes a harvest strategy consisting of five principal components or management measures that together constitute the overall harvest strategy:

C1 - Requirements for participating vessels
C2 - General rules for capacity, effort and gears
C3 - Rules for sorting of the catch

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C4 - An 'adaptive' plan for incremental increases in the standard cod-end mesh size
C5 - Implementation of an HCR based on LPUE

The sector management plan also includes a 'Penalty Annex' that specifies actions to be taken in the event that fishers do not comply with the requirements of the management plan.

Taken together, the elements of the harvest strategy clearly show the intention to achieve high long-term yields for the fishery; however, it is not yet clear that the individual elements of the strategy will work together to achieve a sustainable shrimp population that is consistently above SSB_{MSY}. The assessment team should clarify how the LPUE reference points identified in Table 1 of the sector management plan relate to stock health and how these and the HCR are expected to achieve the management goals that have been defined for the target species (i.e. preventing growth overfishing and ensuring high long term yields). The management plan that defines the harvest strategy should discuss how the HCR and associated reference points are expected to perform under variable environmental conditions, for example in the case that gadoid/predator species 'recover' leading to an increase in natural mortality. How is predation currently accounted for in the plan? And are these reference points and HCRs appropriate, when considering interactions with predator species?

Step 2 of the ICES roadmap (ICES Advice 2014), ICES states that appropriate reference points and HCRs should be established on the basis of the identified management goals. These management targets include but are not limited to the objective of 'high shrimp yield'. These targets may equally involve ecosystem objectives, such as bycatch reduction, low net environmental impact, etc. An ecosystem based HCR has the ability to control environmental impacts beyond fishery impacts on the target species. The HCR, as applied in the plan, seems a very narrow interpretation of the ICES advice, as it only focuses on the target species (and on avoiding recruitment overfishing).

Regarding SI (b), the harvest strategy is new and it is not yet clear that it will achieve its objectives. There is an implied risk in using LPUE indicators. An increase in LPUE is indicative of abundance trends, but an increase can also be the result of greater efficiency. How is technological creep in fishing effort accounted for in the harvest strategy and how will the strategy address this risk? How will the fishery either control or prevent entry into the fishery of vessels currently operating outside of the fishery and the UoA? The current management plan does not contain an explicit provision that allows for a reduction of the capacity cap over time which is an integral long-term component of reaching the management objectives of PI 1.1.1. How will it be ensured that the number of vessels removed from the fleet will actually lead to a sustainable reduction in overall fishing capacity and effort? Rather the current management strategy seems to create an opening for a capacity increase. Given these issues and considering the current level of fishing capacity, we question whether the capacity constraints being proposed in the plan can be realistically enforced, and whether the current management framework will lead to an environmentally and economically sustainable fishery that meets the MSC requirements.

The scientific rationale behind the current management strategy is not explained or well documented in the current management plan. Few references are made to scientific studies and literature to explain why and to what effect management measures have been selected. This calls into question the robustness of the plan and its effectiveness, for example how are the selected measures expected to lead to the desired outcomes? How do they relate to the objectives defined? We recommend that this operational management plan be complemented by a more elaborate long-term management plan in which the decisions in the plan are contextualised and underpinned by science.

Under SI (f) of PI 1.2.1 (and SI (e) of PI's 2.1.2, 2.2.2, and 2.3.2) the new MSC standard requires a review of alternative measures to reduce unwanted catch. These reviews are critical to the management of the Brown Shrimp fishery and should be required to quantify the effectiveness of the various management measures on (mortality) of unwanted catch of undersized shrimp (PI 1.2.1), bycatch (PIs 2.1.2, 2.2.2) and ETP species (PI 2.3.2), including the effect of increased mesh size, sieve net, sorting grids, and water-flow in the sorting machine. The CAB should evaluate whether these measures are sufficient to meet MSC certification requirements and achieve the management goals that have been identified in relation to minimizing unwanted catch. We address specific issues related to unwanted catch of bycatch species under Principle Two below, however we consider that the general concerns regarding minimization of unwanted catch discussed below apply to all of the appropriate PIs.

As an active stakeholder in this assessment, the NGO Consortium would like to participate in or contribute to forthcoming reviews of alternative measures to reduce unwanted catch. If these reviews have already been conducted the NGO Consortium would like to request a copy of the review a soon as possible. The NGO Consortium also requests that the CAB fully document the rationale used to determine whether alternative measures to reduce unwanted catch are cost-prohibitive or impractical to implement. In making decisions whether to implement alternative, 'more effective' measures', the review should specify what is meant by 'cost-effective' or 'cost-prohibitive' and address the issue of determining when environmental benefits outweigh associated costs of adaptation, given that there will always be trade-offs between these objectives. The reviews should discuss whether other operational management measures, such as Real Time Closures (RTCs) have been evaluated and should be integrated into the reduction strategy. Currently, only technical or gear modification measures are discussed.

With regard to the regulation specified under management plan section C2: the plan would benefit from a clarification for the selected limits (e.g. hours at sea, beam length, gear weight, mesh size). To what effect and to what end are these measures being introduced? How are these limits expected to translate into measureable effects? And, to what extent can these limits be considered restrictive and demonstrate progress in terms of achieving management goals? This needs to be substantiated and quantified within the plan with appropriate scientific data.

Based our assessment and the lack of evidence that the harvest strategy is yet to achieve the objectives required under the stock status PI (1.1.1), the NGO Consortium expects significant improvements to the harvest strategy in order to meet minimal requirements for PI 1.2.1.

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- **PI 1.2.2 Harvest control rules and tools**

There are well defined and effective harvest control rules (HCRs) in place

In the opinion of the NGO Consortium, further scientific evaluation and validation of the current management strategy by ICES and the respective national scientific institutes should be required. It is not clear from available information to what extent the HCR and associated reference points have been evaluated and validated by ICES as precautionary and in line with the objectives specified in Article 2.2 of the Common Fisheries Policy (CFP). The European Union aims at maintaining stocks above a level that provides the maximum sustainable yield. The NGO Consortium is concerned that the sector has implemented an HCR and associated management tools that are less precautionary than what was recommended in the ICES roadmap and the scientific studies that formed the foundation for its development. ICES states that a 30% effort reduction will help achieve precautionary management: in low recruitment year the total egg production can be raised to that of an average year. That means sustained catch in poor recruitment years and thus a reduction of risk for the shrimp fishery.

Specifically, we are concerned with the following elements that comprise the overall HCR.

LPUE reference points

Under SI (a) the UoA is required to have well defined HCRs in place that ensure that the exploitation rate is reduced as the PRI is approached and are expected to keep the stock fluctuating around a target level consistent with (or above) MSY. Accordingly, the assessment team should verify that the 70% trigger value established in the voluntary management plan and adopted by the UoA (Section C5) is indeed precautionary and consistent with maintaining the stock at a level where $B>B_{MSY}$ as required by the CFP, or at minimum consistent with MSY as required by the MSC SG80 scoring guidepost for PI 1.1.1. Two of the recent analytical evaluations of potential HCRs (Temming et al. 2013, Steenbergen et al. 2015) that formed the foundation for the current HCR both used an initial trigger value of 75% of the mean LPUE for a range of recent years. Temming et al. (2013) estimate that if a 75% trigger would have been applied in the past decade, effort reductions would have been triggered in spring 2002, autumn 2003, autumn 2007 and spring 2008 as well as in summer 2012. However, the first trigger reference point in the HCR established by the sector management plan is set at a lower level of 70%. It is logical to assume that fewer effort reductions in response to decreasing LPUE may be triggered at the 70% threshold. No scientific rationale is provided in the management plan for deviating from the 75% trigger that was extensively evaluated in previous simulation testing (Temming et al. 2013, Steenbergen et al. 2015). We have found no documentation of simulation testing of the 70% trigger value in the scientific literature for the fishery. The assessment team should evaluate the rationale for this change and whether the 70% trigger value constitutes a precautionary HCR that can be "expected to keep the stock fluctuating around a target level consistent with (or above) MSY" as required at the SG80 scoring guidepost for PI 1.2.2 (a). As a part of this evaluation the team should bear in mind that MSC critical guidance (GSA 2.5) states that HCRs should be regarded as 'well-defined' at the SG80 scoring guidepost "when they exist in some written form that has been agreed by the management agency, ideally with stakeholders, and clearly state what actions will be taken at what specific trigger reference point levels." In this regard the assessment team should provide documentation, at minimum, that the current reference points have been agreed upon by the relevant management authorities. This documentation is not currently

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provided in the sector management plan. In sum, the LPUE reference values are inconsistent with ICES advice (2014), but the departure from this advice is not substantiated nor underpinned by science.

Controlling Fishing Effort

Regarding scoring issue (b), it is questionable whether the HCR as currently implemented is robust to the main uncertainties present in the brown shrimp fishery. Foremost among these concerns is to constrain fishing effort at a level at or below F_{MSY} as required by the MSC at SG60 or SG80. As noted above, the CFP Article 2(2) requires that exploitation levels maintains the population above SSB_{MSY}. The clear scientific consensus is that additional measures are required to manage fishing mortality. Thus it is highly likely that long term fishing effort will need to be reduced substantially from current levels, and therefore it is absolutely necessary to have an accurate metric to measure effort. ICES (2014) identifies a standardization of the reported effort to kilowatt hours (kWh), ideally only for actual fishing time, as a high priority. However, although the current management plan mandates the collection of data based on kWh for research purposes, the measure of effort used in the HCR is kilograms per ***hour*** at sea. The CAB should clearly identify what metric should be used for effort (i.e. what is the unit of effort), and discuss the appropriateness of this indicator under the current management strategy. Moreover, it is not clear at what spatial-temporal scale this will be determined and whether data collected to potentially refine the HCR will define effort measured by kWh based on realized engine power or legislated engine power/engine capacity. It is well known that in practice, engine power can exceed the legislated (300hp) engine power limit (e.g. up to 400hp). This noncompliance has implications for the suitability of the chosen metric for the unit of effort.

It is also unclear how access to the brown shrimp fishery is going to be controlled under the current management strategy or how the proposed 'capacity cap' can be effectively implemented and managed and how 'dormant or less intensively used licenses' will be considered. The ICES Advice (ICES 2014) states that a number of flatfish beam trawlers and multi-rig lobster fishers own permits for shrimp fishing which are not fully used or are only partly used; these vessels can switch at any time into this fishery (if engine power is less than 221 kW). Hence, the current regulation does not even limit the total capacity of the fleet to the status quo, as there is inactive capacity that can be reactivated at any time.

In summary, the current HCR is based on effort, but it's unclear what unit of effort will be used and how this will be reliably monitored. First, if engine power is used in combination with hours to approximate effort, it is clear to us that legislated engine power is an unsuitable proxy (due to non-compliance). Engine power should preferably be monitored real-time (through a 'black box' system). Experiments show that this is technically feasible. Second, if fishing mortality is controlled by adjusting effort, how can this be done when there is currently clearly NO control over the effort on the water (due to sleeping licenses, noncompliance AND effort creep)?

Incremental increases in the standard cod-end mesh size

Section C4 in the management plan states that the mesh size increases recommended by the CRANNET project will be implemented gradually in a "stepwise fashion" in order to minimize short-term loss of landings, and that full implementation will be made using an "adaptive approach" depending on

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scientific validation of the results. The NGO Consortium questions whether the CRANNET model can be reliably 'validated' with the planned (2mm) mesh increases as set forth in the plan to be implemented at two- year intervals. Examination of the selection parameters and associated confidence intervals in Table 1 of the CRANNET final report (Schultz et al. 2015) suggests that it may be difficult to reach reliable conclusions about model validity based on a 2 mm initial size increase (i.e. from 20mm to 22mm). This is further questioned by the recent results of Slijkerman et al. (2016) in an experimental study of catch rates between cod-ends with different mesh sizes. The results showed that although fewer juvenile shrimp were caught in a cod-end with 22mm mesh size than a cod-end with 20mm mesh size, the results were not significantly different. In contrast, the comparison between the 20mm and 24mm mesh cod-ends showed a statistically significant difference in the catch of undersized shrimp.

Because the implementation of an increased standard mesh size in the brown shrimp fishery is an important technical component of the sector management strategy to address by-catch of juvenile brown shrimp, the assessment team should carefully examine this issue and consult with the relevant scientific institutes that conducted the CRANNET and Slijkerman et al. (2016) studies. It is important to address how the risk embedded in this approach will be managed relative to the risk that further increases in mesh size will be opposed by the sector if it does not deliver measurable results. In addition, the CAB should clarify why the proposed increase in mesh size will only be implemented in the cod-end.

In summary, the NGO Consortium questions whether the specified adaptive approach to implementing an increase in standard mesh size is valid and in line with the best available scientific advice (e.g. Schultz et al. 2015, Slijkerman et al. 2016). The assessment team should carefully evaluate whether an immediate change to one of the cod-end configurations recommended by the CRANNET study is required sooner to minimize the by-catch of undersized brown shrimp consistent with the need to reduce and eliminate growth overfishing of the *C. crangon* stock. The team should also ensure that when increased mesh size requirements are implemented, the fishery needs to monitor the impact on catches of all species, not just shrimp.

Spatial distribution of effort

Effort also needs to be limited spatially to protect nursery and spawning grounds, areas of high seabird concentrations and for example parts of the coastal seabed that reach deeper and can be considered less dynamic. As per ICES Advice (2014) a spatial effort analysis needs to be considered. This analysis can inform the harvest strategy so as to limit effort distribution spatially in the more sensitive areas. ICES also states: "(...) these values (trigger lpue and effort reduction) need to be permanently evaluated and adjusted (e.g. on an annual basis through ICES), taking stock development, habitat and fleet characteristics into account (both in terms of knowledge gained and changes observed)." A limit and control of the spatial distribution of the effort to protect vulnerable species and habitats is currently missing from the harvest strategy.

Based on the information summarized above, the NGO Consortium cannot conclude that the HCRs and associated tools implemented in the voluntary sector management plan attain minimum requirements of PI 1.2.2.

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- **PI 1.2.3 Information and monitoring**

Relevant information is collected to support the harvest strategy

At the SG80 the scoring guidepost requires that sufficient relevant information must be available to support the harvest strategy. ICES 2014 defines a fleet inventory as one of the key factors necessary to monitor effort creep in the brown shrimp fishery. This should include detailed characteristics of the majority of the fleet including information on boat type, boat length, engine power, deck machinery, mesh size used, and sorting devices. Although the sector management plan states that the initial fleet register will be expanded into a fleet inventory, few details are included regarding the information that will be collected. The assessment team should verify that the client fishery collects all relevant information necessary to monitor effort creep. Ultimately one of the most important pieces of information that should be collected is realized engine power. Measuring used effort real-time is technically possible and has been tested recently in the Netherlands in experiments with a 'black box' system designed to detect fishing activity, fishing location and engine power (ship propulsion power). However, there is currently resistance on the part of some members of the fleet towards including engine power in the 'black box' design (Keus 2015). The black box system has been shown to be a better method for collecting more detailed data to accurately monitor actual fishing location and activity, as well as used engine power than other methods currently available.

The fact that there are no provisions in place to measure the spatial and temporal distribution of actual fishing effort and to prevent technological 'effort creep', have been identified as major shortcomings in the management of the brown shrimp fishery. The team must require that these issues are addressed in their assessment of the fishery.

Another area where information to support the harvest strategy can be improved is better monitoring of sieving operations both on board vessels and on land at the auctions where the final sieving operations are conducted. Accurate measures of the discard fraction of undersized shrimp in the fishery are a critical factor in efforts to eliminate growth overfishing.

Finally, similar to the P2 information PIs discussed below, increased levels of observer coverage deployed in a random and unbiased manner will provide independent confirmation of a subsample of the fleet to verify the accuracy of other critical elements of the harvest strategy. Observers are also able to conduct special studies to evaluate alternative measures that may increase the survival of discarded shrimp or by-catch species such as underwater release of discards that could further support the harvest strategy and improve the sustainability of the fishery.

Based on these unmet or unverified information needs to support the harvest strategy, especially as pertains to the measurement of fishing effort and location, the NGO Consortium is concerned that the minimum score is not justified for this PI. The fishery first needs to implement scientifically based methods uniformly across nations to accurately track fishing location and measure fishing effort (including realized engine power) if the fishery is certified. Fully documented fishery, on-board observer programmes and other tools could be considered.

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- **PI 1.2.4 Assessment of stock status**

There is an adequate assessment of the stock status

Although an analytical aged based stock assessment is not possible for the *C. crangon* stock, a wide range of information is gathered to assess the status of the stock through collaboration with ICES and relevant scientific institutes. In particular, new stock assessment methodologies are being devised and reviewed, such as the swept area estimate by Tulp et al. (submitted). Although we have raised questions above regarding the level at which precautionary reference points are currently set (see PI 1.2.2) we do not question the concept of setting LPUE reference points and see this as an improvement in the management of the fishery. However, we have raised what we believe are legitimate issues with whether the assessment takes uncertainty into account under SI (c). In particular, the lack of adequate controls of effort among the fleet and pace at which mesh size adjustments are being made. Both of these measures are critical contributors to uncertainty in the harvest control rule and stock assessment process. Another issue with the LPUE indicators is the lack of a precautionary buffer. It is well established that an increase in natural (i.e.predation) mortality due to an increase in the numbers of larger cod or whiting in the coastal zone could have a negative impact on the brown shrimp stock leading to further overfishing. Regarding PI (e), although ICES recommended regular testing and review of the stock status, we have yet to see a specific commitment to peer review in the management structure for the fishery. Although a level of peer review is indicated by the annual reviews by the ICES Crangon working group and associated publications, we believe a specific protocol in this regard would be beneficial in regards to transparency and stakeholder confidence in the management system. For example, we are concerned that the change from a 75% lpue trigger value to the current 70% threshold has not been subject to adequate peer review.

Based on these concerns we would like to see more documentation on and improvement in above issues for the fishery to meet standards under PI 1.2.4.

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PRINCIPLE 2: Minimizing Environmental Impact

Primary and Secondary species classification
The MSC certification requirements direct the assessment team to classify non-target species as primary species where management tools and measures are in place that are intended to achieve stock management objectives reflected in either limit or target reference points (SA3.1.3.3). Under EU Council Regulation 2016/72 the following species are managed with an analytical TAC; plaice (***Pleuronectes platessa)***, herring (***Clupea harengus)***, whiting (***Merlangius merlangus)***, European sprat (***Sprattus sprattus)***, common sole (***Solea solea)***, Atlantic mackerel (***Scomber scombrus)*** and cod (***Gadus morhua)***. Sand eels (***Ammodytes spp.)*** are also managed based on an analytical TAC under EU regulations which is set to zero. Under the MSC certification requirements these species should therefore be considered as primary species under the MSC Principle 2 performance indicators. However, we also note that cod also qualifies as an ETP species (see below). Three other species documented in the by-catch analysis conducted by Steenbergen et al. (2015), (juvenile) dab ***(Limanda limanda),*** flounder ***(Platichthys flesus) and*** lemon sole ***(Microstomus kitt)*** are managed under a precautionary TAC and could be considered as secondary species based on GSA3.1.1-3.1.4. However, we note that these species, in particular dab and flounder which are managed under a combined TAC, are frequently caught in the brown shrimp fishery and we strongly urge the assessment team to act in a precautionary manner and classify these species as primary species due to limited by-catch sampling on which these determinations are being made.

Main and Minor species classification
Although by-catch species comprise a large proportion of the total catch in the brown shrimp fishery, current discard sampling efforts are minimal. They do not provide an accurate representation of the total by-catch volume and may underestimate the importance of some species in the composition of the catch. Steenbergen et al. (2015) provide an overview of observer sampling in the Dutch and German fleets from 2009-2012, during which observers sampled less than 0.1% of the total days at sea during all years. Due to the low sampling effort and large variation between sampled hauls Steenbergen et al. (2015) determined that discard data were not suitable for extrapolation to the total catch of the brown shrimp fleet for the two countries. By-catch data were therefore summarized using two metrics; a) the number of hauls in which they were present, and b) the mean number caught per hour (with standard deviation). Because the MSC assessment tree uses a threshold of >5% of the total weight of the catch of all species to determine whether a primary or secondary species should be considered as a main species (>2% for less resilient species), it is uncertain how the assessment team will determine this threshold for unwanted catch in the UoA under assessment. We strongly urge the assessment team to resolve this issue using a precautionary approach given the high by-catch volume of unwanted species in the brown shrimp fishery and the potential impact to important nursery areas for many species occurring in the Wadden Sea and North Sea Coastal Zone.

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- **PI 2.1.1 Primary species outcome**

The UoA aims to maintain primary species above the point where recruitment would be impaired (PRI) and does not hinder recovery of primary species if they are below the PRI

As stated above, a lack of adequate data on by-catch composition precludes a complete and accurate assessment of the status of main primary by-catch species relative to the PRI. While the PRI may be known for some main primary species, the inability to estimate the proportion of the species in the total catch severely constrains an assessment of the true impact of the fishery on these species. Based on the available sampling data for the fishery, by-catch composition was similar between the Dutch and German fleets. Gobies (*Pomatoschistus sp.*) were the most abundant fish species in the catch, occurring in over 90% of the hauls for both fleets. In descending order, plaice, herring, whiting, dab and sole had the highest recorded catches among the commercially managed species (Steenbergen et al. 2015). Cod also ranked highly among the catch of the German fleet, occurring in 31% of the hauls, but was only observed in 4% of the hauls for the Dutch fleet. Another by-catch study conducted by Glorius et al. (2015) found plaice in 97% of all trips conducted by a sample of Dutch vessels. Glorius et al. (2015) used the catch data for plaice to estimate the effect of the Dutch shrimp fishery by-catch on the spawning stock biomass (SSB) of plaice. The results indicated that the Dutch shrimp fishery alone could reduce the plaice SSB by 14-20% if total by-catch mortality is assumed, or 12-17% if mortality is estimated at 80%. Although plaice stocks are currently at high levels, recruitment is variable and the impact of such high levels of juvenile by-catch will be problematic if the stock declines from current levels. This may also be the case for other key by-catch species in this fishery, especially stocks that are (currently) less abundant than plaice (e.g. cod). The study on plaice certainly raises questions regarding the sustainability of by-catch mortality in this fishery: when raised to the fleet level and when considering the impact of this mortality at the population level, seemingly 'small' by-catches can become significant.

We also stress that, at the SG80 threshold, the MSC requires that cumulative impacts are considered for species below the PRI for all MSC UoAs that consider a species as 'main'. In the case of cod, a species currently managed under a recovery plan, it is very difficult to determine whether the impact of juvenile bycatch in the brown shrimp fishery can be accurately assessed in relation to other MSC certified UoAs which consider cod as a main species. In the absence of adequate information to determine whether impacts to primary and secondary species will impact their status relative to the PRI or biologically based limits, the CAB should explicitly address how and which indicators of population health will be monitored. This should allow evaluation of the performance of the management strategy and also their status relative to Descriptor 3 of the EU's Marine Strategy Framework Directive (Good Environmental Status).

In summary, we question whether the available information can be used as evidence of a demonstrably effective strategy in place between all MSC UoAs which categorise a bycatch species as main. This is especially important in the event that a primary main species is close to or approaching the PRI and MSC UoAs are required to ensure that they collectively do not hinder recovery and rebuilding.

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- **PI 2.1.2 Primary species management strategy**

There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species; and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch

EU Council Regulation No 850/98 requires all vessels operating in the European brown shrimp fisheries to use selective gear in order to reduce discarding. All shrimp vessels in the Netherlands and Germany were required to use sieve nets beginning in 2002 with temporary exemptions granted during the spring and summer when nets can become clogged with organic matter. After 2013 exemptions are no longer permitted in the Netherlands, however German vessels can still be granted an exemption between 1 May and 30 September. During this period a sorting grid (or letterbox) can be used to comply with EU discard reduction requirements. Sieve nets are effective in reducing the catch of fish and other organisms >10 cm, however large numbers of juvenile fish <10 cm are retained in the catch (ICES 2015). This is important to consider when assessing the impact of the fishery on nursery areas. Most of these species are subsequently removed during the first on-deck sieving process and discarded. Steenbergen et al. (2015) summarized literature on survival rates for discarded species, reporting that mortality was highly variable (ranging from 5% to 100%) depending on the species, size and catch processing conditions. Catch handling can be especially important for species with a high potential for post-discard survival, such as elasmobranchs. Critical MSC guidance at GSA3.4.3 states that assessment teams should interpret very low post capture mortality as no less than a 90% survival rate. This should be proven by scientific evidence, e.g. via independent observer coverage, fully documented fishery, tagging studies or similar methods.

The NGO Consortium believes that the management strategy for primary, secondary and ETP species should specify how appropriate catch handling will be ensured and how this ties in with the goal of mortality reduction. How to deal with an expected increased predation of cod on shrimp with recovery of cod (and of other predatory fish) is not addressed in the management plan. Under the new MSC certification requirements the UoA is required to conduct a review of alternative measures to minimise unwanted catch. The sector management plan specifies that this will be done at least every 5 years, which qualifies as a regular review and meets the SG80 scoring guidepost. However we wish to reiterate our request that the CAB fully document the rationale used to determine whether alternative measures to reduce unwanted catch are deemed cost-prohibitive or impractical to implement. To improve discard survival, we recommend evaluation of additional measures under SI (e) that require discards to be released under water to reduce post-release avian predation mortality. The PCDR should also explicitly address how management will respond to seasonal and temporal by-catch patterns (e.g. higher rates of juvenile fish and ETP species). Catches of juvenile flatfish show a strong seasonal pattern, indicating that real-time closures (RTCs) can play an important role in addressing the by-catch problem. The CAB should also explicitly address how spatial patterns in the stock will be monitored and how this information will be used to reduce by-catch. Another critical component of this evaluation is an assessment of how the proposed increases in the minimum mesh size used by the fishery will influence the bycatch rates of species that constitute unwanted catch in the brown shrimp fishery.

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Based on the available scientific information we believe that the UoA has a partial strategy in place under PI 2.1.2. The management plan should clearly outline how tools for avoidance, increased selectivity and increased survival of aforementioned species will be applied. Improvements are required to ensure that additional alternative measures to minimize unwanted catch are implemented (e.) where necessary to reduce current levels of by-catch for juvenile fish and other species.

- **PI 2.1.3 Primary Species Information/Monitoring**

Information on the nature and amount of primary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species

The assessment team should specify in the PCDR how monitoring and data-collection will be performed and how data-quality will be ensured. The current management plan refers to 'fully documented fisheries' however it is unclear what will be the degree of implementation and how the output will be checked. Does this refer to an expanded observer programme that -in addition to CCTV - includes personnel onboard monitoring and if so, what observer coverage levels will be implemented and how will observer coverage be allocated spatially and temporally in a random and unbiased manner across vessel types? As described above, while there is some quantitative information available on the by-catch of unwanted species in the brown shrimp fishery, the extremely limited sampling data does not appear to be adequate to assess the impact of the UoA on the main primary species with respect to status as required under SI (a) for PI 2.1.3. Steenbergen et al. (2015) concluded that the available data was not adequate to extrapolate up to an estimate of the total catch weight for by-catch species. Another issue raised by Steenbergen et al. (2015) that contributes to the risk of biased data and unrepresentative data (unrepresentative of the whole fisheries during the years studies), is the ad-hoc non random deployment of observers in both countries and the lack of requirements to take observers on board. Steenbergen et al. (2015) provided the following initial recommendations to improve the monitoring programs for both the Dutch and German fleets:

1. We need to find profound methodologies to raise shrimp discard data to fleet level, for example by increasing the sampling coverage and/or by the introduction of a statistically sound sampling scheme.
2. Protocols on board need to be optimized. There is a need for a better estimation of different catch fractions.
3. Harmonized Dutch and German sampling programs and methods.

Based on the lack of adequate data to assess the impact of the UoA on main primary species, the NGO Consortium is very concerned that the minimum criteria are not met for PI 2.1.3. We believe that a protocol addressing aforementioned issues is required and should be based on the recommendations for improvement of the sampling programs as specified by Steenbergen et al. (2015).

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ETP Species Classification

The assessment team is required to determine which species should be considered as Endangered, Threatened or Protected (ETP) species among the species that occur as unwanted catch or interact indirectly with the North Sea brown shrimp fishery. The members of the NGO Consortium have conducted an analysis of the relevant binding national and international agreements and legislation concerning ETP species relevant to this fishery. We provide a detailed table listing ETP species and the relevant legislation in Appendix I. The list includes species listed under the OSPAR list and the Birds and Habitats Directives (Natura-2000 species) in addition to other binding national or international agreements and legislation. In summary, we conclude that at least the following species should be considered by the assessment team as species that have either been documented in by-catch sampling or that commonly occur within the distribution of the fishery and may have a higher likelihood of being adversely impacted and therefore should be monitored in the brown shrimp fishery: all elasmobranch species, European sturgeon (***Acipenser sturio***), seahorses (***Hippocampus spp***.), Salmon (***Salmo salar***), houting (***Coregonus oxyrinchus),*** River lamprey (***Lampetra fluviatilis***), Sea lamprey (***Petromyzon marinus***), Allis shad (***Alosa alosa***), Twaite shad (***Alosa fallax***) and living ***Sabellaria spinulosa*** and ***Zostera marina***. As mentioned above, we also recommend that as a listed species under OSPAR Cod (***Gadus morhua***) be included as an ETP species for the purpose of this assessment.

The six Birds Directive species; the Common Scoter (***Melanitta nigra), the*** Greater Scaup ***(Aythya marila),*** the Common Eider (***Somateria mollissima***), the Common Shelduck (***Tadorna tadorna***), the Black-throated Diver (***Gavia arctica)*** and the Red-throated Diver (***Gavia stellata***), should be considered by the assessment team relative to potential indirect effects due to disturbance by vessel traffic. For the same reason the Habitats Directive species Harbour Seal (***Phoca vitulina)*** and the Grey Seal ***(Halichoerus grypus)*** should be considered.

Consideration of Typical Species in Natura-2000 Habitat Type H1110

In addition to the above mentioned species, our research into species protected under binding national legislation identified that species listed as 'Typical Species' of Natura-2000 Habitat Type H1110A and B are, according to the Dutch High Court, an "integral part of the conservation status of the Habitat Directive". The Habitats Directive is 100% legally binding to the Dutch State and therefore Typical Species are recognised by national legislation as 'protected'. This status has been confirmed by consultation with the Dutch Rijkswaterstaat. Hence, Typical Species should be considered as ETPs. The species that are considered as typical for H1110A and H1110B are listed in the tables below taken from the H1110 Habitat Type Profile document (2014). This includes species, such as ***Mytilus edulis*** (mussels), that are typical to hard substrates such as mussel reefs (which in turn are typical to this habitat type). We recommend that the CAB consider these species as ETP species based on Dutch national law (which is based on European law, which means it needs to be applied also outside Dutch waters), or if the CAB questions this determination that the assessment team requests a clarification from the MSC Standards Director regarding this issue. In German waters the reef habitat type (1170) should also be considered by the assessment team.

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Table 1. *Typical species for Habitat Type H1110A: Permanently inundated shallow sandbanks (Wadden Sea)*

Dutch name	***Scientific name***	**Species group**
Zandzager	*Nephtys hombergii*	Bristle worms
Groene zeeduizendpoot	*Alitta virens*	Bristle worms
	Spio martinensis	Bristle worms
Schelpkokerworm	*Lanice conchilega*	Bristle worms
Harnasmannetje	*Agonus cataphractus*	Fish
Vijfdradige meun	*Ciliata mustela*	Fish
Haring	*Clupea harengus*	Fish
Schar	*Limanda limanda*	Fish
Slakdolf	*Liparis liparis*	Fish
Gewone zeedonderpad	*Myoxocephalus scorpius*	Fish
Botervis	*Pholis gunnellus*	Fish
Bot	*Platichthys flesus*	Fish
Schol	*Pleuronectes platessa*	Fish
Puitaal	*Zoarces viviparus*	Fish
Wulk	*Buccinum undatum*	Molluscs
Nonnetje	*Macoma balthica*	Molluscs
Strandgaper	*Mya arenaria*	Molluscs
Mossel	*Mytilus edulis*	Molluscs
Kokkel	*Cerastoderma edule*	Molluscs

Table 2. *Typical species for Habitat Type H1110B Permanently inundated sandbanks (North Sea coastal zone)*

Dutch name	***Scientific name***	**Species group**
Schelpkokerworm	*Lanice conchilega*	Bristle worms
Zandkokerworm	*Spiophanes bombyx*	Bristle worms
	Nephtys cirrosa	Bristle worms
	Nephtys hombergii	Bristle worms
	Magelona papillicornis	Bristle worms
Kniksprietkreeftje	*Bathyporeia elegans*	Crustaceans
Gewone zwemkrab	*Liocarcinus holsatus*	Crustaceans
Bulldozerkreeftje	*Urothoe poseidonis*	Crustaceans
Gewone heremietkreeft	*Pagurus bernhardus*	Crustaceans
	Pontocrates altamarinus	Crustaceans
Hartegel	*Echinocardium cordatum*	Echinoderms

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Gewone slangster	*Ophiura ophiura*	Echinoderms
Dwergtong	*Buglossidium luteum*	Fish

- **PI 2.3.1 ETP Species outcome**

The UoA meets national and international requirements for protection of ETP species/ The UoA does not hinder recovery of ETP species

The MSC certification requires that the fishery must have in place precautionary management strategies designed to: a) meet national and international requirements; b) ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; c) ensure the fishery does not hinder recovery of ETP species; and d) minimise mortality of ETP species. The MSC guidance (GCAB3.2) states that "irreversible harm from fishing includes very slowly reversible harm that is effectively irreversible on timescales of natural ecological processes (e.g. natural perturbation, recovery and generation times in the absence of fishing, normally one or two decades but may be shorter or longer depending on the species and ecosystem concerned)."

The fish species listed above which the NGO Consortium has determined must be assessed under the ETP Outcome Performance Indicators are all caught by the fishery in varying amounts. Glorius et al. (2015) conducted a by-catch survey specifically directed at quantifying the risk to juvenile age classes of three Habitats Directive species during 2012-14; twaite shad, river lamprey and sea lamprey. The study was conducted using a reference fleet of 24 vessels and observers from the Ministry of Economic Affairs and IMARES sampled 827 hauls. They distinguished between three sampling areas; the Wadden Sea, the Delta and the North Sea Coastal zone and beyond. The average weight of the catch was 38.9% landed shrimp, 48.7% discard shrimp (including shells and other waste), and 12.3% fish and benthos. Of the Natura-2000 species targeted, only river lamprey and twaite shad were caught. Sea lamprey was not caught. Twaite shad were caught in 27% of the hauls, especially in the 1st and 4th quarter in all areas. River lamprey occurred in 14% of the hauls, especially in the 3rd quarter in the North Sea coastal zone. There was no significant difference in catches between samples collected by fishermen and samples collected by observers. Glorius et al. (2015) concluded that population level effects of by-catch numbers for Natura-2000 target species cannot be properly assessed because there is no population estimate available for these species. The by-catch of twaite shad were primarily juveniles and the post-capture survival of twaite shad was estimated to be zero. The size of the twaite shad bycatch in the Dutch fishery was estimated at 100,000 per year in each of the three Natura-2000 areas and the size of the river lamprey catch was estimated at 10.000 individuals per year in each of the three Natura-2000 sites except the Delta. According to Glorius et al. 2015 the current river lamprey spawning population in the Netherlands is estimated to be at least 100.000 individuals. To what extent the additional by-catch mortality is limiting river lamprey and twaite shad populations that make use of these Natura-2000 sites could not be determined due to a lack of knowledge about which populations use the Dutch coastal areas for rearing and what the size and dynamics of these populations are. The conservation status of twaite shad and river lamprey as well as sea lamprey are assessed as "matig ongunstig" (moderately unfavourable) according to the Natura-2000 management plan for the ***Noordzeekustzone*** (Natura-2000 site code: NL9802001). For all three species an improvement goal applies.

In another recent bycatch assessment, Steenbergen et al. (2015) sampled by-catch species from 167 hauls each on Dutch and German vessels from 2009-2012. Cod was caught in 7 hauls by Dutch vessels occurring at 0.5 individuals/hour trawled and 31 hauls by German vessels occurring at 10 individuals/hour. River lamprey and Twaite shad were both caught by Dutch vessels at a rate of 0.2 individuals/hour in 4 and 2 hauls respectively. Sea Lamprey was caught in one haul, also at a rate of 0.2 individuals/hour. On German vessels River lamprey and Twaite shad were caught at a rate of 1.6 and 0.7 individuals/hour in 10 and 6 hauls respectively. Allis shad also occurred in one haul.

Based on the available information, the NGO Consortium considers that of the species with recent catch records, cod and twaite shad may be caught at levels that could present a potential risk to the recovery of the species. Cod is considered under SI (a) because an EU quota is set for this species. TACs vary between the three countries at approximately 3000-5000 tons. Twaite Shad, as well as the other species do not have limits set, and are therefore considered under SI (b). There is no population assessment for twaite shad, so it is very difficult to determine the true risk level. We are also concerned that the current sampling effort is not sufficient to determine whether the fishery may be hindering the recovery of depleted elasmobranch species. However, work by the Dutch Elasmobranch Society suggests that the sieve net could be an effective deterrence device. This should be established through rigorous by-catch sampling, across all regions.

The Common Scoter, Greater Scaup, Common Eider, Common Shelduck, Black-throated Diver and Red-throated Diver as well as the Harbour Seal and Grey Seal should be considered by the assessment team relative to potential indirect effects due to disturbance by vessel traffic. There are conservation goals for these species for many of the Natura-2000 sites in the area concerned. Studies such as from Garthe et al.(2015) demonstrate the impact of ship traffic disturbance on these bird species. Although the main distribution of Black-throated Divers and Red-throated Divers is in the Economic Exclusive Zone (EEZ)[2] and the coastal North Sea, they are also present in the Wadden Sea during winter months and do show disturbance effects and displacement in a distance of 2-4 km to ships (Garthe et al 2015). Germany has a special responsibility for both of these species. Common Eider and Common Shelduck are especially vulnerable during their moulting period when they cannot fly. At this time they concentrate in those parts of the Wadden Sea where they can both forage and where the level of disturbance is small. The disturbance problem may be especially important for shelducks, as almost the entire population from Northwestern Europe gather during their moult in parts of the Schleswig-Holstein Wadden Sea (e.g. Kempf 2014) and have proved to be extremely sensitive to disturbance. Recently a part of the population has also begun to moult in the Dutch Wadden Sea (Kleefstra et al 2011). Eider ducks, which are distributed over more areas in the Wadden Sea, have recently shown a decrease (see e.g. www.waddensea-infogate.org/Migratory%20Birds/Migratory_birds.html) is is necessary to discuss to what extent this could be attributed to disturbance by vessels.

[2] The EEZ is beyond the 12nm and lies outside the territorial sea

Due to the low level of by-catch sampling, the available information does not provide a high level of certainty that ETP species are either within limits or that the UoA is not hindering recovery and a condition may be required to improve ETP species monitoring and protection. Based on the information summarized above, a clear plan for avoidance, increased selectivity and increased survival needs to be an integral part of the management plan to meet requirements of PI 2.3.1.

- **PI 2.3.2 ETP Species management strategy**

The UoA has in place precautionary management strategies designed to: a) meet national and international requirements; and b) ensure the UoA does not hinder recovery of ETP species. Also, the UoA regularly reviews and implements measures, as appropriate, to minimize the mortality of ETP species.

The management strategy in place for the fishery that is applicable to SI (a) or SI (b) depends on the species and whether there are limits set for that species. It consists of a by-catch mitigation measure (the use of a sieve net or grid) and a crew based monitoring programme to report on catches of ETP species occurrence and identification. Reports are collated each year by the PO and a basic analysis is done with the data. As stated above for PI 2.1.3, independent confirmation of ETP identifications by trained observers is minimal at present, so emphasis must be placed on crew education. The PO must provide a list of ETPs that need to be monitored in this fishery. This should also include species on the OSPAR list. We suggest including at least the species listed above as ETP species to be monitored and *Sabellaria spinulosa* reefs and *Zostera marina* beds that are designated under OSPAR. The PO representative or written protocol that is distributed should discuss how reliable data collection and monitoring of ETP catches can be ensured. To assist fishers to identify and classify ETPs, and to ensure correct classification, we propose using visual documentation, which could be further reinforced by remote camera monitoring, and implementing a training programme. Experiments with such visual documentation strategies are already being explored in other fisheries. This is especially (but not only) relevant for shark and ray species, where classification is notoriously difficult for some species and has led to a lot of problems with data validity. Secondly, the assessment team should evaluate how fishers are going to be incentivised to document ETP catches. It seems that this will be a time-consuming (and potentially costly) activity, if only a part of the fleet would participate in such a programme. Incentives will be an important part of any effective fishery-dependant monitoring programme. Catch handling can be especially important for species with a high potential for post-discard survival, such as elasmobranchs. The protocol should specify how appropriate catch handling will be ensured and how this ties in with the goal of mortality reduction. In general the protocol should also discuss indirect fishery impacts. This is particularly relevant considering that *C. crangon* is very important both as prey and as predator in the ecosystem.

Under SI(d) it is uncertain whether the measures are being implemented successfully until the fishery reports back with monitoring results. This is because the strategy is new and fishers have not had time to report back. This should be a transparent process and as a stakeholder the NGO Consortium is very interested in the results.

SI(e) addressed the review of alternative measures to minimise mortality of ETP species. As with our full comments under PI 1.2.1 above, we think that this review should be a transparent process and the results open to stakeholder review. Currently, the sieve net appears to reduce by-catch of larger ETP species, however it is difficult to unequivocally establish this without independent verification.

The NGO consortium recommends that the CAB give careful consideration to recent agreements under the Common Fishery Policy under PI 2.3.2. The Regulation on Technical Measures[3] obliges member states to ensure that bycatches of marine species listed under Directives 92/43/EEC and 2009/147/EC and other sensitive species that result from fishing are minimised and where possible eliminated such that they do not represent a threat to the conservation status of these species. Furthermore to ensure that the environmental impacts of fishing on marine habitats are minimised and where possible eliminated such that they do not represent a threat to the conservation status of those habitats. And to contribute to having in place fisheries management measures for the purposes of complying with the obligations under Directives 92/43/EEC, 2009/147/EC, 2008/56/EC and 2000/60/EC. Article 1, of this legislation explains what actions need to be taken, in particular "On the basis of the best available scientific advice a Member State may put in place for vessels flying its flag, mitigation measures or restrictions on the use of certain gears pursuant to the procedure laid down in Article 19 of Regulation (EU) No 1380/2013. Such measures shall minimise and where possible eliminate the catches of the species referred to in paragraph 1 and shall be compatible with the objectives set out in Article 2 of Regulation (EU) 1380/2013 and be at least as stringent as technical measures applicable under Union law."

Due to the low level of by-catch sampling the available information does not provide a high level of certainty that the management strategy for ETP species does not allow the fishery to hinder the recovery of by-catch species. Again, a clear plan for avoidance, increased selectivity and increased survival needs to be integral part of the management plan to meet requirements of PI 2.3.2.

- **PI 2.3.3 ETP Species information/monitoring**

Relevant information is collected to support the management of UoA impacts on ETP species, including: a) information for the development of the management strategy; b) information to assess the effectiveness of the management strategy; and c) information to determine the outcome status of ETP species

Under the current management framework, the information and monitoring system for ETP species relies almost entirely on the crew to collect information and document ETP species catch. Under SI (a) this will primarily provide mostly qualitative and some quantitative, but unverifiable data. Without additional independent observer coverage, or at minimum an improved deployment framework to randomize and/or stratify observer coverage as discussed above. Under scoring issue (b), because the

[3] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2016:134:FIN

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programme is new, it is difficult to determine whether it will provide adequate and reliable information to measure trends for an important PI such as ETP species.

We recommend that the CAB give careful consideration to these issues when scoring ETP species Information.

Assessing Impacts to Habitats
Under the new MSC certification requirements for the habitats performance indicators, a fundamental component is the classification of habitats into the categories of commonly encountered habitats, vulnerable marine ecosystems (VMEs), and minor habitats (SA3.13.3). The definition of VME habitats is taken from paragraph 42 subparagraphs (i)-(v) of the FAO Guidelines International guidelines for the management of deep-sea fisheries in the high seas, however the MSC also applies this definition to shallow, inshore habitats pointing out that in these areas the definition of a VME may "include other species groups and communities (e.g., seagrass beds, complex kelp-dominated habitats, biogenic reefs)" (GSA3.13.3.2).

The Wadden Sea and large parts of the Dutch, German and Danish coast have been designated as Natura-2000 sites under the Birds and Habitats Directives. For each of these sites a number of Habitat Types have been designated. The Habitat Type that is relevant to the shrimp fishery is 'permanently inundated shallow sandbanks' (EU Code for Habitat Type: H1110)[4]. H1110 occurs throughout the entire Dutch, German and Danish coast and throughout large extents of the Wadden Sea, and has an important nursery and feeding function. Biogenic, habitat forming structures such as *Lanice conchilega* beds, mussel and oyster reefs, and other shellfish beds (*Spisula, Cerastoderma edule* and *Macoma baltica*) are considered an integral part of this shallow coastal habitat type, providing shelter and food for many associate fish and bird species. The sections below discuss H1110 in relation to Natura-2000 sites in more detail.

The boundary of the Natura-2000 area generally coincides with the boundaries of three designated marine National Parks in Germany and one in Denmark. The OSPAR commission also lists a number of sensitive habitat types located within the distribution of the brown shrimp fishery, including:

- Intertidal *Mytilus edulis* beds on mixed and sandy sediments
- Intertidal mudflats
- *Ostrea edulis* beds
- *Sabellaria spinulosa* reefs
- *Zostera* beds

In 2009 the UNESCO World Heritage Committee (WHC) adopted the statement on the "outstanding universal value" of the Wadden Sea in June 2009 and inscribed the Dutch-German Wadden Sea on the World Heritage List (WHC, 2009, Decision 33 COM 8B.4); the nomination dossier can be accessed at

[4] Official name: Sandbanks which are slightly covered by seawater all the time

www.waddensea-secretariat.org/management/whs/whs.html). In 2014 the Danish Wadden Sea was added to the World Heritage site which since then belongs to and is the responsibility of all three Wadden Sea countries. Based on the unique ecological values for which these areas were designated, the Wadden Sea Area clearly meets the FAO criteria for a VME in accordance with clearly defined national and international standards. Additional details relevant to the classification of VME habitats are provided below.

In 2015, all national RAMSAR sites located in the Dutch, German and Danish Wadden Sea were combined into one Transboundary RAMSAR Site (http://www.waddensea-secretariat.org/news-and-service/news/16-08-02creation-of-transboundary-ramsar-site-wadden-sea).

Habitat H1110 & Natura-2000 areas in Dutch waters

The main habitat type that occurs along the Dutch coast between the Lowest Astronomical Tide (LAT) and the -20m depth line (NAP) is H1110. This habitat type also occurs throughout the Dutch Wadden Sea. A description of this habitat type is given in the Profile Document (2014)[5]. The main shrimp fishery takes place within the 20m depth line and hence coincides with this habitat type. The intertidal zone is classified as H1140A, but officially shrimp fishers are not permitted to fish in the intertidal in the Netherlands (not the case in Germany) .

Subtypes of habitat type H1110 (that are relevant for the shrimp fishery) are:

- **H1110A**: Wadden Sea (tidal area). Area Dutch EEZ ~130 000 ha
- **H1110B**: North Sea coastal zone. Area Dutch EEZ ~590 000 ha

Interestingly, the Netherlands has explicitly chosen not to classify biogenic structures as 'reefs' (H1170), according to the EU classification (note: Germany has decided differently and classified some reefs, but due to limited knowledge this classification is not complete, it also does not include e.g. ***Lanice conchilega*** beds). Rather, such biogenic structures are recognised as integral part of habitat type H1110 (and H1140). Taking this approach, biogenic structures such as ***Lanice conchilega*** beds, mussel and oyster reefs, and other shellfish beds (***Spisula, Cerastoderma edule and Macoma baltica***), are considered as a feature of H1110 and an integral part of the structure and functioning of this habitat type. Hence, biogenic habitats such as those mentioned above are protected as features of H1110 in the Natura-2000 sites. These hard substrates provide habitat for other species (associated species) and/or provide an important feeding function for a diversity of species, including birds feed on these shellfish or the associated species. As filter feeders, these shellfish beds also perform an important role in the nutrient cycle.

The quality of H1110A and B is assessed as: ***matig ongunstig*** (moderately unfavourable). The status of the habitat is determined based on: Typical Species (see species table for habitat types H1110 A and B included in the section above regarding ETP species classification), the structure and function (described

[5] http://www.synbiosys.alterra.nl/Natura-2000/documenten/profielen/habitattypen/Profiel_habitattype_1110_2014.pdf

in the profile document under 'other biotic characteristics' and 'abiotic characteristics') and the pressures. For both habitat types an improvement goal applies. A brief quality description of the status of these subtypes follows (taken from the Profile Document, 2014):

> **H1110A** - *The number of typical species is stable, but there are shifts in abundancies of some species (Buccinum undatum, Malcoma balthica, Zoarces viviparous). Abiotic characteristics: In this habitat type there is more than natural dynamics: bottom disrupting activities add to the dynamics in H1110A, especially in those areas that are by nature less dynamic. This is considered to contribute to the observed shifts in biodiversity observed in this area, from relatively short-lives species to long-lived species. Community structure: The biomass of relatively short-lived species has increased. This shift is considered to be the result of regular unnatural disturbance of the sediment. This unnatural disturbance is caused by bottom disrupting activities (that includes the shrimp fishery). Nursery function: This habitat type supports an important nursery function. The relatively shallow waters and food abundance, provide ideal conditions for young fish. However, total biomass of fish in the Wadden Sea has declined significantly since the reference period (1960-90) and this is likely to be due to changing biotic conditions in the Wadden Sea (including sea temperature) and fishery impacts (inside and outside the habitat type). Mussel reefs in various stages of development: Mussel reefs in various stages of development are typical for this subtype (H1110A) and have an important ecological function within this habitat type. Old mussel reefs are the least common. Old mussel reefs have disappeared or are declining. Due to their ecological value an increase of old mussel reefs is pursued.*

> **H1110B –** *As for type A the number of Typical species (see tables above) seems to be stable (relative to the reference period 1960-90). There are however shifts in abundancies of certain species, with declines observed for Spisula subtrancata and Buccinum undatum. Abiotic characteristics: In this habitat type there is more than natural dynamics: bottom disrupting activities add to the dynamics in H1110A, especially in those areas that are by nature less dynamic. This is considered to contribute to the observed shifts in biodiversity observed in this area, from relatively short-lives species to long-lived species. Community structure: The biomass of relatively short-lived species has increased. This shift is considered to be the result of regular unnatural disturbance of the sediment. This unnatural disturbance is caused by bottom disrupting activities (that includes the shrimp fishery). Nursery function: This habitat type supports an important nursery function. The relatively shallow waters and food abundance, provide ideal conditions for young fish. However, total biomass of has declined significantly since the reference period (1960-90) and this is likely to be due to changing biotic conditions (including increasing sea temperature) and fishery impacts (inside and outside the habitat type). Apart from this by-catch and discards of young fish are likely to be impacting the nursery function of this habitat type. Food function of shellfish beds: The biomass and abundance of the typical species Spisula subtruncata has declined significantly since 2001. In contrast, ensis abundance has increased since the turn of the century.*

In the Netherlands, H1110B has been identified as Habitat Type for the following Natura-2000 sites: ***Noordzeekustzone***[6], ***Vlakte van de Raan***[7], ***Voordelta***[8], ***Westerschelde&Saeftinghe*** (site code:

[6]Standard data form (map included): http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=NL9802001
[7]Standard data form (map included): http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=NL2008003
[8]Standard data form (map included): http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=NL4000017

NL9803061)[9]. H110A has been identified as Habitat Type for the Natura-2000 site ***Waddenzee***[10]. Natura-2000 sites are marine protected sites that have been designated under the EU Birds and Habitats Directives. For these Natura-2000 sites we have included a table directly below identifying the management goals and closed area (% closed for shrimp fishery as of today) in these sites. Further information can be found in the Standard Data Form for these sites (see footnotes). The Designation Decrees have been hyperlinked in the table below. The management objective of Noordzeekustzone and Vlakte van de Raan is to improve the quality of H1110B. At a national level this habitat type is in ***moderately unfavourable condition*** (mentioned above). Note that, together, these sites represent ~50% of the total area of habitat type H1110B. However, the majority of these areas remain open to the shrimp fishery. Management plans are developed for each of these sites and the fishery management regime in these plans is established within the VIBEG agreement (Noordzeekustzone) and VISWAD agreement (Waddenzee).

Site name and code	**Management objective** (regarding habitat type H1110)	**No takes for shrimp fishery**
Noordzeekustzone NL9802001 Management plan: https://www.noordzeeloket.nl/images/2015-02-16_Ontwerp%20beheerplan%20Noordzeekustzone%20Natura%202000_v8_4113.pdf	Maintain the amount (hectares) and improve quality of H1110B See management plan for a complete overview of management objectives. These include objectives for 'Habitat Species' and 'Birds Directive Species', that are covered under the plan.	Yes, total coverage 25% (under current VIBEG agreement). The VIBEG agreement is currently under revision. VIBEG agreement: http://www.waddenvereniging.nl/wv/images/PDF/ons_werk_2013/VIBEG-accoord.pdf
Vlakte van de Raan NL2008003 Management plan: https://www.noordzeeloket.nl/images/Ontwerpbeheerplan%20%20januari%202015%20Natura%202000%20Vlakte%20van%20de%20Raan_4110.pdf	Maintain the amount (hectares) and improve quality of H1110B See management plan for a complete overview of management objectives. These include objectives for 'Habitat Species' and 'Birds Directive Species', that are covered under the plan.	See management plan
Voordelta NL4000017 Management plan: http://www.platformparticipatie.nl/Images/Natura%202000%20Ontwerpbeheerplan%20Voordelta	Maintain the amount and the quality of H1110B See management plan for a complete overview of management objectives. These include objectives for 'Habitat Species' and 'Birds Directive Species',	See management plan

[9]Standard data form (map included): http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=NL9803061
[10]Standard data form (map included): http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=NL1000001

%202015-2021_tcm318-360896.pdf	that are covered under the plan.	
Waddenzee NL1000001 Management plan: http://www.waddenzee.nl/fileadmin/content/Bestuur/pdf/Natura-2000/n200_dec_2015/TERINZAGE2_Beheerplan_WADDENZEE_RHDHV_06112015.pdf	Maintain the amount (hectares) and improve quality of H1110B See management plan for a complete overview of management objectives. These include objectives for 'Habitat Species' and 'Birds Directive Species', that are covered under the plan.	Yes, 6,5% (under the VISWAD agreement) VISWAD Agreement: http://www.rijkewaddenzee.nl/assets/pdf/dossiers/natuur-en-landschap/transitie-garnalenvisserij-natuurambitie-rijke-waddenzee.pdf There are also other areas that are closed to shrimp fishers, but have been closed for other nature protection goals: These include areas with seagrass experiments (reintroductions), Mussel beds, the boundaries of the national parks, reference areas near Rottums.

Additional information regarding habitat classification and protection in the entire Wadden Sea, with particular reference to Germany and Denmark

The Guiding Principle of the trilateral Wadden Sea policy is "*to achieve, as far as possible, a natural and sustainable ecosystem in which natural processes proceed in an undisturbed way.*" This principle was identified for the first time by Denmark, Germany and The Netherlands (the Trilateral Cooperation for the Protection of the Wadden Sea) at the Trilateral Wadden Sea Conference in Esbjerg in 1991. This fundamental decision for the future of the protection of the Wadden Sea has been reaffirmed several times since then. Also very important is the dossier for the nomination of the Dutch-German Wadden Sea as a World Heritage Site to the UNESCO World Heritage Committee (which later was extended also to the Danish Wadden Sea).[11]

For Germany, the Bundesnaturschutzgesetz (BNatSchG) is the Federal Law for Nature Conservation in Germany.[12] Article 24 is about National Parks, which is the legal protection framework for the Wadden Sea within Germany. All three German states bordering the Wadden Sea (Schleswig-Holstein, Hamburg and Niedersachsen) have their parts of the Wadden Sea legally designated as National Parks. According to Article 24 of the BNatSchG, National Parks must „*sich in einem überwiegenden Teil ihres Gebiets in einem vom Menschen nicht oder wenig beeinflussten Zustand befinden oder geeignet sind, sich in einen Zustand zu entwickeln oder in einen Zustand entwickelt zu werden, der einen möglichst ungestörten Ablauf der Naturvorgänge in ihrer natürlichen Dynamik gewährleistet.*" and „*haben zum Ziel, in einem überwiegenden Teil ihres Gebiets den möglichst ungestörten Ablauf der Naturvorgänge in ihrer natürlichen Dynamik zu gewährleisten.*". That means, that at least (i.e. as a minimum proportion which

[11] http://www.waddensea-secretariat.org/management/whs/whs.html
[12] https://de.wikipedia.org/wiki/Bundesnaturschutzgesetz

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could also be higher) 50 % of a National Park must be managed in a way that the natural processes would not be altered by human use or that it must be developed into such a situation.

Until now, for the German Wadden Sea both the Guiding Principle for the entire Wadden Sea (see above) and the conditions for a National Park according to the Federal Law for Nature Conservation (see above) have not been put into practise for the underwater ecosystem. Actually, given that the proper management unit for the underwater part of the Wadden Sea in an ecological sense would be a tidal basin (i.e. the spatial unit in the Wadden Sea within which most movements of organisms between high and low tide may occur), then all tidal basins in Germany are fished (except a very tiny one). Currently even the only part of a tidal basin in Schleswig-Holstein which has been legally designated as a no-take-area is illegally being fished (http://www.wwf.de/2016/maerz/krabbenfischerei-in-der-schutzzone/ where the WWF report „***Where the brown shrimp fishery operates – Spatial distribution and temporal development in the use of the Wadden Sea and the adjacent North Sea by the German brown shrimp fishery, 2007-2013***" (Kuechly et al 2016) can be downloaded; concerning the illegal fishing see map on page 37, concerning the proportional use of the National Parks by the fishery see mainly table 11 on page 52).

In Germany, for the underwater ecosystem of the Dutch Wadden Sea the Guiding Principle has so far not been implemented. However, for the Danish Wadden Sea this is different: Since 1993 the brown shrimp fishery there is regulated by the "shrimp-line", which contributes considerably to the implementation of the Guiding Principle in Denmark. The line connects the southern tip of Fanø, passes just North of Mandø, follows the Eastern coast of Rømø, and goes straight south to the German border. All brown shrimp fishing is prohibited east of this line.

At the Trilateral Wadden Sea Conference in Tønder 2014 also a „Framework for Sustainable Fisheries" was decided upon.[13] This is a valid agreement (though not a law, i.e. it is not legally binding for the countries) for the Wadden Sea cooperation area, where a considerable part of the German-Dutch-Danish shrimp fishery takes place. The text on closed areas indicates an important intention: „*Closed areas are a management option for sustainable fisheries in the Wadden Sea Conservation Area, in particular to allow natural processes to proceed in an undisturbed way, to achieve the conservation objectives and biodiversity and in cases where there is insufficient knowledge about impacts. Sufficiently large closed areas can also serve as reference and recovery areas. The designation of such areas is in the responsibility of the national state, taking into account the relevant EU regulations.*"

- **PI 2.4.1 Habitats outcome**

The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.

[13] http://www.waddensea-secretariat.org/sites/default/files/Meeting_Documents/Conference2014/council_declaration_final_5_feb_2014_incl._annexes_.pdf

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Under each scoring issue of PI 2.4.1 the MSC requires the team to assess whether the UoA is unlikely (at SG60) to reduce structure and function of encountered habitat types to a point where there would be serious or irreversible harm. The SG80 and SG100 scoring guideposts differ only in the probability with which this determination can be made (e.g. highly unlikely at SG80, etc.) In Table SA8 the MSC defines serious or irreversible harm to "structure or function" to mean changes caused by the UoA that fundamentally alter the capacity of the habitat to maintain its structure and function. This is defined as a reduction in habitat structure, biological diversity, abundance and function such that the habitat would be unable to recover to at least 80% of its unimpacted structure, biological diversity and function within 5-20 years, if fishing were to cease entirely. This process is repeated for each habitat type that occurs in the managed area; commonly encountered, VME and minor habitats.

To determine the amount of each habitat type to assess against the 80% impact threshold we must first know the extent of the managed area. However, it is uncertain how the managed area should be determined under SA3.13.5 for the brown shrimp UoA. Without a formal management or governance body for the fishery and no defined spatial extent for the area managed by the fishery in the current voluntary management plan, it would seem that the managed area must be the actual area in which the fishery occurs. The NGO consortium strongly recommends that the team define the managed area for the brown shrimp UoA as the average long-term footprint of the fishery based on VMS data collected over the last decade that is available in recently published studies (e.g. Kuechly et al. 2016 or Glorius et al. 2015).

Once the managed area for the fishery is defined it must then be determined whether the UoA encounters VME habitats. This is not problematic for the brown shrimp fishery. Two recent reports have used VMS data to assess the distribution of fishing within areas that are clearly defined as VME habitats. Glorius et al. (2015) determined that the majority (70%) of the total effort by the Dutch shrimp fleet occurred within Natura-2000 sites during 2012-2013. The recent study by Kuechly et al. (2016) reported remarkably similar results for the German fleet; a total of 69.1% of the German brown shrimp fishery took place within the Wadden Sea National Parks which include the vast majority of the internal waters of the Wadden Sea and parts of the territorial waters – an area roughly contiguous with the Natura-2000 area. Only 25.8 % of the German brown shrimp fishery actually takes place within the tidal basins of the German Wadden Sea (the tidal basins would be the equivalent to those Danish parts of the Wadden Sea which are fully closed for the shrimp fishery there). In addition, a small proportion in Germany takes place also in offshore Natura-2000 sites. Turenhout et al. (2015) concluded that between 2012-2014 on average 23% of the shrimp catches of the Dutch fleet came from the Wadden Sea. Based on the available scientific data it is clear that the UoA frequently encounters VME habitats in the Wadden Sea and areas of the North Sea coastal zone. In fact it is clear that the majority of the fishery takes place within VME habitats.

The remaining steps required under PI 2.4.1 are to determine the recoverability of the VME habitats and whether the areas encountered are able to recover to 80% of their unimpacted state within 5-20 years. There are serious concerns regarding the impact of the fishery on (the recovery of/settlement of) certain habitat forming species and biogenic habitat structure, particularly in the Wadden Sea ecosystem.

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Fishery impacts on benthic habitats come in various forms including alteration of physical structure, sediment suspension, changes in chemistry, changes to the benthic community, and ecosystem changes (Johnson et al. 2002). Doeksen (2006) provides a literature review and overview of chronic changes in benthic community structure in areas of prolonged commercial trawling over the last century, concluding that: "Although comparative studies of historical benthic surveys have pointed out some obvious changes that may indicate that shrimp beam trawling may have had an impact on benthic communities, no long-term impact studies have been conducted for the commercial shrimp trawl fishery in the North Sea to verify any such suspicions." Although some studies suggest that the effects of trawling on the seabed are short lived on sandy and sandy-mud habitats (e.g. Kaiser et al. 2006), few studies have assessed long-term recovery from repetitive trawling on the scale that occurs in the North Sea brown shrimp fishery. In fact, it is hard to find an area of seafloor that hasn't been disturbed by the shrimp fishery in the last 20 years. We note that in shallow sandy sediment habitats typical to these coastal waters, biogenic structures such as mussel beds, European oyster beds (after reintroduction) and *Sabellaria* reefs would naturally occur in the absence of intensive trawling disturbance. We also note that mussel beds in all stages of development are protected as integral part (and feature of) Habitat type H1110A. It is ironic that the experimental design of two recent studies designed to assess the impacts and recoverability of VME habitats in the coastal zone were ruined due to unauthorized trawling in control areas. Future studies of recoverability should incorporate closed areas at a scale that is appropriate for the highly dynamic nature of this habitat (i.e. the pristine area must have the room to be dynamic and still tell us something about the fishing effects).

Background information provided by the OSPAR Commission (Benson et al. 2013) and interviews with fishermen (H-U Rösner pers. comm) indicate that fishing has contributed to serious damage to *Sabellaria* reefs in the Wadden Sea over accumulated decades of fishing. This is caused both through active destruction and/or through repeated fishing with the bobbin rope and runners (cumulative effect). This has likely caused changes in the structure and community of the seabed. While this does not preclude other factors unrelated to fishing that may also influence *Sabellaria* (e.g. eutrophication), it is likely that *Sabellaria* could be restored in areas of the Wadden Sea in the absence of fishing. The OSPAR Commission states that "The greatest sensitivity is still believed to be physical damage, recognising that there can be a high recoverability rate where conditions are suitable (Benson et al. 2013). However, abandoned and older living *Sabellaria* tubes, which could stimulate a settlement of the larvae of these animals, do not currently appear to be available on a widespread basis. Initial colonization requires a strong tidal flow through undisturbed channels and it is currently unlikely that *Sabellaria* is will be able to form robust reefs in the Wadden Sea due to the large-scale and recurring impact of the shrimp fishery.

At present it is difficult to evaluate the impact the shrimp fishery may have both on seagrass (*Zostera*) and on mussel (*Mytilus edulis*) beds. While subtidal seagrass in the Wadden Sea had disappeared already during the last century (probably for other reasons than shrimp fishery), there is still intertidal seagrass in parts of the area. For Germany it has been shown (Kuechly et al 2016) that the shrimp fishery avoids the intertidal and therefore does not overlap extensively with seagrass beds. However, it needs to be considered to what extent the shrimp fishery would actually prevent the recovery and recolonization of subtidal seagrass beds in the Wadden Sea. For mussel beds the present situation is that natural subtidal mussel beds occur only very rarely. While it is mainly the mussel fishery which may be the reason for this it cannot be ruled out that the shrimp fishery also contributed to the disappearance of such beds and make the recovery of them more difficult.

Any recovery of biogenic reefs and other important habitats (including oyster banks, mussel beds and zostera beds) is impaired by (cumulative) trawling impacts. The management plan needs to incorporate provisions on the spatial distribution of effort and how care is taken for the protection of existing as well as (future) recovery of habitats. Although not specifically required under the MSC principles and criteria, to be truly precautionary the fishery and the CAB Coastal zone should also take into consideration cumulative impacts to habitats given the global significance of the Wadden Sea. This area is subject to a myriad of human activity and disturbance (Sand extraction, wind energy, fishery, shipping etc.) which act in conjunction with the fishery to impact sensitive habitats.

In conclusion, the NGO Consortium does not believe that the UoA meets the requirements for PI 2.4.1 given the vast scale and repetitive nature of trawling in VME habitats evidenced in this fishery. A plan to reduce fishing effort in VME habitats encountered by the brown shrimp fishery needs to be incorporated into the brown shrimp fishery long term management plan.

- **PI 2.4.2 Habitats management strategy**

There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.

Under scoring issue (a) of PI 2.4.2 the new MSC standard clearly requires that a UoA that encounters VMEs shall have in place “measures” to protect VME habitats. At both SG60 and SG80 these must include *at least* requirements to comply with management measures to protect VMEs (e.g., designation of closed areas) and implementation by the UoA of precautionary measures to avoid encounters with VMEs (SA3.14.2.3). The scoring guideposts differ only in that at SG60 precautionary measures must be “based on commonly accepted move-on rules” whereas at SG80 avoidance measures are required to be scientifically based gear- and habitat specific move-on rules or local area closures. The sector management plan for the fishery acknowledges that protected areas along the entire coast have been closed to fishing (however, except for Denmark these are just very small ones), however there is currently no specific requirement in the management plan that vessels comply with even these closed areas, nor are precautionary measures such as move-on rules in place. Were scientifically based move-on rules to be implemented in the brown shrimp fishery they may provide a valuable tool to locate and protect *Sabellaria* reefs and other biogenic habitat forming species.

Regarding to the requirement to comply with management measures to protect VMEs such as designation of closed areas, it is unfortunate that some members of the fleet seem to display what can be characterized as a ‘culture of non-compliance’ in regard to fishing in closed areas. Occurrences similar to the lack of respect for research closures mentioned previously that ruined the experimental research programmes of Glorius et al. (2015) and Schellekens et al. (2014) have recently been documented. During the 1980s and 1990s four reference areas were established for research and

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monitoring under the trilateral Wadden Sea agreement; two in Germany and one each in the Netherlands and Denmark (for the latter it is the entire inner Wadden Sea which is closed, see above). In contrast to the research closures in the recent Dutch studies, these areas are legally designated no take zones. The recent study by Kuechly et al. (2016) also documents that from 2007-2013, the areas within Germany were repeatedly fished by vessels from the German fleet. Figure 10 in Kuechly et al. (2016) shows that the fishing activity documented on the basis of VMS in the Hörnumtief no-take-zone appears no different than for the surrounding areas. It is also apparent from the VMS mapping in Glorius et al. (2015) that fishing occurs in the closures implemented under the VIBEG agreement (also see Keus 2015 for a summary of the status of the VIBEG negotiations).

Based on this information, it appears that the UoA is at risk of not meeting the minimum requirements for SI (a), which in the case of this PI could result in the failure of the fishery. At minimum, if the fishery is determined to meet the minimum requirements, a condition should be set requiring the management plan to implement measures for the immediate cessation of fishing in closed areas and the implementation of a scientifically based move-on rule to protect sensitive habitats. The NGO consortium also suggests that a plan be developed and implemented for step-wise improvements of the gear and its impact on the habitat.

- **PI 2.4.3 Habitats information**

Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.

Under SI(b) at SG80 the assessment team needs to clarify how the gear weight regulation in the management limit was set, and support this with scientific data. In sampling programmes in both the Netherlands and Germany (Schellekens et al. 2014, Glorius et al. 2015, Steenbergen et al. 2015), have documented the catch of shellfish that live in the seabed suggesting that the gear may penetrate the seabed, contrary to the opinion expressed in the brown shrimp management plan. We believe that it is important to also give detailed consideration to not only the weight of the gear but also to the design. Alternative measures such as a reduction in the number of bobbins, a straight bobbin rope or lifting the net of the seafloor should also be considered as alternative measures to reduce habitat impacts.

It is also uncertain whether identification of the impacts on all main habitats is adequately known. As soon as it can be assured that scientific reference and control areas can be established, the experimental designs of the Schellekens et al. 2014 and Glorius et al. 2015 studies should be re-implemented in order to determine the extent of impacts of the fishery on all main habitats and provide information on potential recovery rates for seafloor habitats impacted by beam trawls with the configuration used in the brown shrimp fishery.

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Under SI(c) adequate information must continue to be collected to detect any increase in risk to the main habitats. SA3.15.6 requires that all UoAs which are encountering VME habitats must at least include:

A. A spatial plan including maps of effort distribution and specific position information relating to the UoA's footprint.
B. Position of closed areas to protect VMEs.
C. Position of closed areas that were established by the UoA, other MSC UoAs, and non-MSC fisheries fishing in the area as a precautionary measure, subject to the provisions of SA3.14.3.2.
D. Catch and catch rates of VME-indicator organisms and information to support the scientific definition of precautionary trigger levels, where these are used.

The current regulations are not rigorous enough if they allow vessels fishing under an MSC certificate with a size below 15 or 12 meters to fish without VMS monitoring, even if they are not legally required to send VMS-data or do not send it during shorter trips . As an interim measure while VMS is implemented on all vessels in the UoA all non-VMS vessels must be documented in the fleet inventory.

The NGO Consortium realizes that smaller vessels in the brown shrimp fishery are not required to have VMS. However, the scoring of PI 2.4.3 SI (b) is clear for vessels encountering VME habitats; therefore the UoA does not meet the minimum MSC requirements until all vessels, including smaller vessels are equipped with VMS (or ideally a black box system) and use this for all fishing activity. Maps should be also regularly produced for the management of the fishery. VMS intervals should to be shortened to 10 minutes in line with the draft fisheries measures in Natura-2000 sites of the German EEZ which recently have been suggested by the federal government. The NGO Consortium recommends that maps showing the location of all closed areas and the fishing locations of all vessels be added to the monthly reports posted on the UoA website(s) with the Sievage and LPUE reports. It is also very important that the fishery provides adequate transparency in regards to who will analyze the monitoring information.

- **PI 2.5.2 Ecosystem management strategy**

There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function

When discussing an ecosystem management strategy in the context of the brown shrimp management plan it is important to acknowledge that the current plan represents a scaled-back version of most of the management research from which it was drawn. The plan has yet to implement many of the basic recommendations of the ICES roadmap. In an ecosystem management context the plan is best characterized as a partial strategy under PI(a) which takes into account some of the information and we must wait to see if it can be expected to restrain the impacts of the UoA on the ecosystem. The assessment team should carefully evaluate whether there is any evidence or documentation that the precautionary approach is being applied in the Brown Shrimp fishery. The impacts of long term intensive

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trawling at this extensive scale have not been adequately researched, yet fishing continues throughout the vast majority of coastal zone and the Dutch and German parts of the Wadden Sea. Given the lack of knowledge regarding these impacts, we do not consider this to be in line with an ecosystem-based management approach or the precautionary principle as mandated by the MSC requirements. This is very relevant considering the role that *C. crangon* plays as forage species in this coastal ecosystem. Currently there is not adequate information provided in the fishery management plan detailing how dependent species and fishery interactions (through competition) will be monitored and accounted for in management? It is unknown whether the exploitation rates and HCR are appropriate indicators, especially considering the role of shrimp in the ecosystem. The management plan should explicitly address how and which indicators of population health will be monitored (e.g. large Shrimp Index (LSI), spatia distribution etc.) This should allow evaluation of the plans performance, also vis-à-vis Descriptor 3 of the Marine Strategy Framework Directive (Good Environmental Status). Appropriate ecosystem-based management should consider scenarios where gadoid stocks recover and also consider the potential effects of climate variability and long-term change on predator-prey relationships. It is also important to note that the shrimp fishery is obligated to do an impact assessment according to Natura-2000 regulations. It is too early to tell if the measures/partial strategy are being implemented successfully.

- **PI 2.5.3 Ecosystem information**

There is adequate knowledge of the impacts of the UoA on the ecosystem

In general there is both a lack of data available and a lack of knowledge regarding ecosystem impacts of the brown shrimp fishery in the North Sea and Wadden Sea as well as impacts on non-target species and habitats. At present there is no clear information to determine what measures and/or gear modifications are necessary to reduce by-catch in the fishery. Recent research has provided some promising results (e.g. combining fleet size reduction, sieve nets, pulse trawl gear and avoidance of areas with high by-catch proportions), however there is a clear lack of research on the influence the shrimp fishery may have on the sea bottom (in the short-term as well as long-term). Research is also needed on the species composition of the catch in areas where the fishery takes place (including the protected areas). This means, for a MSC certified fishery there must be more research both on fishing gear and on the influence the fishery has on the ecosystem and its components. We recommend that the long-term management approach should contain a detailed ecosystem research plan to collect the necessary data and fill knowledge gaps It should also include a communication strategy to ensure all fishermen fully support and participate in data collection and ensuing research. For example fishermen trawled through closed areas set up for research on shrimp fishery effects on the seabed, which has resulted in a limited body of knowledge on the short and long-term benthic impacts of the fishery that makes it difficult to draw conclusions on these issues. Research is needed to better understand the relationship between the fishery and the recovery of both natural ecosystem function and biogenic structures in areas that have been repeatedly trawled for multiple decades. Any fisheries management plan must include effects on biodiversity, species, habitats and ecological processes. For example, if the abundance of key species is reduced as a result of by-catch, major and unpredictable changes may occur

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in food chains. This impact is similar whether the removal results from targeted catch or by-catch. One aspect of this issue is the removal of shrimp predators by trawling (such as whiting and cod) that can result in profound changes in the food chain, such as increased abundance of prey, including squid and shrimp. So far there is not an adequate independent observer program. More and better monitoring is needed and the relevant data must be made publicly available to ensure transparency of the fishery.

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PRINCIPLE 3: Effective Management

- **PI 3.1.1 Legal and/or customary framework**

Under SI(a) The current management plan for the UoA needs to be consistent with the EU Common Fisheries Policy (CFP), the EU Birds and Habitats Directives (Natura-2000) and the Marine Strategy Framework Directive (MSFD) and needs to reflect the objectives set out in EU and national policies and be compliant with overarching national, EU and international law. This includes regulations with respect to Multi Annual Plans (Article 9 and 10 of the CFP), and also with requirements regarding stock status relative to MSY (Article 2.2). The plan should openly discuss the implications of the CFP landings obligation and formulate a proactive plan for how it will comply with the landings obligation in regards to management of discards. Considering that the fishery operates in sites that are designated as marine protected areas under EU and national law (including Natura-2000), the advisory board formed under the sector management plan must openly discuss how compliance with these regulations and policies will be ensured within the current management plan and what it will do to ensure management goals with respect to nature and habitat protection are met.

The current management plan implements a system of self-regulation and is effectively voluntary: it is not embedded in either national law in each of the three UoA countries or EU law. It applies to fishers that are members of a PO and have been listed by their PO as a 'member of the plan'. In case of noncompliance with the plan, membership to the plan can be withdrawn (see plan regulation C1.2). Hence there are fishers operating outside of the plan, which includes Belgian fishers and pulse fishers (see plan regulation C1.4), and in Germany also fishers with traditional gear. There is an implied risk in this operational strategy. The management plan does not acknowledge and openly address this risk. Nor does it discuss how this risk will be managed. It is unclear what this means for effective stock management (control on F) and the appropriateness of the HCR and reference points in the plan. It is also unclear what this means for the plan's ability to achieve management objectives. The plan should openly acknowledge and discuss this risk.

Germany recently published draft regulations for fishery measures in four Natura-2000 sites[14] in the Exclusive Economic Zone (EEZ, beyond 12 nm) of the German North Sea. These areas were designated in 2004 to protect marine mammals and threatened birds as well as sandbanks and reefs. According to a study by Kuechly et al. (2016), about 5.6% of the German shrimp fishing effort takes place in the EEZ of the German North Sea[15]. The fishery sector has objected to these draft regulations and announced the

[14] http://www.bfn.de/22827+M5054de7a952.html
[15] Within the Natura-2000 sites in the EEZ less than 3% of the total German shrimp fishing effort takes place, and from this 3% only a part would be affected by the proposal of the government. However, also an unknown proportion of the Dutch and the

desire to increase fishing efforts in EEZ Natura-2000 sites due to the loss of fishing grounds in other parts of the North Sea by offshore wind projects and other anthropogenic uses. The NGO consortium calls the UoA to act in line with Natura-2000 goals and not accept any increases in fishing effort in marine protected areas. Instead, a long-term strategy should be developed decreasing fishing effort and impact, particularly in national parks, resulting in fishery no-take-zones of more than 50% of the combined area of the MPAs overall.

At present we do not believe that it can be demonstrated that there is an effective legal system in place that can deliver the management outcomes required under Principle 1 and 2, and do so in a transparent manner. Therefore we are concerned that the requirements for this PI are not met.

Fishery specific management system

- **PI 3.2.2 Decision-making processes**

The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives and has an appropriate approach to actual disputes in the fishery.

Under SI (b) we recommend that violations of fishing regulations and enforcement actions are transparent and available to the public. In addition, as recommended under PI 3.4.3, the NGO Consortium recommends that maps showing the location of all closed areas and the fishing locations of all vessels be added to the monthly reports posted on the UoA website with the sievage and LPUE reports. These reports should all be made publically available.

At present it is not apparent that the decision-making processes for the fishery effectively use the precautionary approach and do so in a transparent and open manner.

- **PI 3.2.3 Compliance and enforcement**

Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.

The UoA should incorporate a full monitoring, control and enforcement component into the existing sector management plan that also details how the strategies and actions required under the MSC certificate are expected to ensure compliance with the various regulations (including those specified in national law, such as the 300 hp limit). The brown shrimp fishery has a significant history of noncompliance and this is a major concern, especially for the fishery to meet the minimum sustainability threshold under the MSC principles and criteria for sustainable and well managed fisheries. This is also important to ensure a level playing field within the sector, and to ensure that compliance is rewarded. The current 'Independent Control' section of the management plan has elements of what is needed,

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Danish shrimp fishery operates in these areas. There is currently no such draft regulations for fisheries for the MPAs that lie in the German territorial sea (0-12 nm) or the internal waters.

however the 20% enforcement/control per year level sounds inadequate. This would mean that a vessel would be subject to a control only once during the life of the certificate. This clearly does not seem adequate given some of the issues of noncompliance facing the fishery.

The revised management plan should envision the mandatory use of a black-box that can monitor activity (fishing-non-fishing), fishing location and engine power in real time - for monitoring & research purposes as well as for control & enforcement purposes. Self-regulation only works when rules and penalties are clear and uniformly applied and enforced, across the entire (international) fleet. In the plan the POs are responsible for compliance of their members, but it is uncertain what level of control is exercised by the MSC client fishery organizations (e.g. CVO, DFPO and MSC-GbR) or other umbrella organisations. The revised management plan needs to specify how uniform application of the regulations will be ensured, across all POs.

Based on the requirements under PI 2.4.3, a requirement for all vessels to be equipped with VMS should also be added to the Penalty Annex that accompanies the management plan. This requirement for a UoA encountering VME habitats is unambiguous in the MSC certification requirements and as such must be addressed in the sector's Penalty Annex.

Scoring issue (b) regarding sanctions should be scored by the team at 60 or 70 if records of sanctions for non-compliance with closures and/or engine power requirements cannot be found. These are two of the major non-compliance issues in this fishery and must be addressed under an MSC certificate.

Scoring issue (d) requires at SG80 that there is no evidence of systemic non-compliance. The information presented above under PI 2.4.2 SI(a) clearly documents that there is a problem of systemic non-compliance with fishing in closed areas in this fishery. This evidence is clear and is substantiated by VMS monitoring information. There is also a problem of systemic non-compliance with the 300hp engine capacity requirement, however this is harder to document.

The NGO Consortium has also received documentation that members of the Dutch fishing fleet are not in compliance with the weekend closure regulation[16] designed to reduce fishing effort. Regarding non-compliance with these regulations, we have received a copy of a letter sent by the Garnalenvissersbond, a Dutch shrimp PO, to the Nederlandse Voedsel- en Warenautoriteit (NVWA, the Dutch control agency), complaining about the lack of enforcement action on behalf of the NVWA after multiple attempts by the Garnalenvissersbond to report evidence of noncompliance with the weekend closure by a shrimp fisher. A copy of this letter is included in the supplemental information submitted with our comments. The letter includes a concluding statement saying that (translated from Dutch) "A growing number of fishers are violating the weekend fishing closure. The support by shrimp fishers for this measure is declining

[16] The shrimp fishery in the Dutch waters above the 52°00'00" N Latitude and in the Ems area is closed from Friday 12:00 until Monday 8:00. Fishing is allowed from Monday 8:00 until Friday 12:00. The maximum fishing time is 100 hours. This is the so called *weekendverbod* (Weekend closure). The shrimp fishery in Dutch waters below the 52°00'00" NL, is closed from Friday 4:00 until Monday 0:00. Fishing is permitted from Monday 0:00 until Friday 4:00. The maximum fishing time is 100 hours. The shrimp fishery in German waters, east of the 7°35'00" EL and North of the 54°00'00" NL is permitted during 200 hours (9 days) per 14 days. This period starts at the beginning of every uneven week.

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rapidly. The motivation for a black box has plummeted to zero, the NVWA is considered as an organisation/institution that operates 'arbitrarily'." We believe that this information demonstrates that both compliance AND enforcement action is poor in this fishery and requires strong remedial action by both the fishery and management authorities before the fishery can meet the MSC certification requirements.

Based on the information presented above we strongly question whether the fishery meets the minimum requirements under PI 3.2.3. Adequate enforcement effort and/or capacity appears to be lacking on the part of government authorities charged with this responsibility. It remains to be seen whether the control and enforcement measures in the sector management plan are adequate to address these issues, however it seems unlikely given the current provisions in the plan. In sum, The demonstrated pattern of non-compliance within the fishery on multiple regulatory issues needs to be addressed both by the fishery and the NVWA and equivalent agencies in Germany and Denmark.

- **3.2.4 Monitoring and management performance evaluation**

There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives / There is effective and timely review of the fishery-specific management system.

Objectives in the management plan for the fishery need to be in line with EU and national legislation, such as the CFP and MSFD (i.e. Good Environmental Status) as well as the protection goals of the protected areas in which the fishery operates. This is currently not the case. For example the CFP Article 2.2. Objective states that: "*The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species* ***above*** *levels which can produce the maximum sustainable yield.*" This is binding law within EU member states and hence any serious management plan for a fishery operating within this jurisdiction needs to make reference to these overarching goals (and needs to contribute to achieving these goals). The management plan for the fishery should also make clear that environmental impact assessments are required to be undertaken in all countries where the fishery takes place within protected areas.

The current management plan also needs to incorporate an adaptive component, guided by evaluation of the results of management actions in conjunction with stakeholder consultation. For example how are measures such the LPUE based HCR, effort reduction, habitat protections, fleet characteristics, stock development, etc. evaluated in an integrated manner and how does this lead to adaptation when needed?

The current fishery management plan does not provide adequate provisions for monitoring the fishery-specific management system against its objectives and a mechanism for review. Documentation should be required by the CAB to meet the MSC requirements regarding this PI.

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The assessment team reviewed the information thoroughly and the points raised in the oral presentations and written submission are addressed in the report. The client was also provided with the submission and gave additional information to address many of the concerns. Other areas of concern raised in the submission have been addressed in the raising of conditions. Without addressing every point raised, some examples of where the NGO presentations and submission have been influential are the concern about dormant licenses being reactivated and consequently contributing to an increase in fishing effort (PI 1.2.1), evidence that shrimp fishing had been occurring in some closed areas (PI 2.4.2) and mechanisms for review of the fishery management plan (PI 3.2.5).

In addition, the assessment team received a letter from a stakeholder in June 2016 expressing some concerns about the certification process. The nature of those concerns and the assessment team's responses are outlined below.

Letter received from Johan Rispens, Dutch fishermen, on 16 June 2016.

Mr Rispens' letter is attached below – the original letter was in Dutch and the translation below was provided by the Dutch member of the Client Group, Paulien Prent. Text in italics is explanatory material written by the Client to provide clarification on the nature of Mr Rispens' concerns.

"Dear members of the assessment team,

This letter is sent to you by a shrimp fisherman that has been fishing for shrimp since 1986. From 1988 onwards he owns his own vessel (with 188 hp *= 140 kW, and a GK licence*) and fishes on the Wadden Sea and the North Sea (*i.e. the coastal zone*).

Everybody knows by now, that for years the shrimp fishery (*i.e. he is talking about the Dutch fishery in this letter*) has been engaged in the certification process of it's so beloved product. Whether the certificate is awarded still remains the question, after all this is in your hands. It is the fishermen's job to get a good score (*i.e. to be compliant to the rules and regulations of the management plan*). I have my doubts about this and I would be horrified if the shrimp fishery is not going to be certified. This would most certainly mean that the NGO's will be even more inclined to fire up on issues dealt with in this fishery.

The reason why I am troubled, is this:
Firstly, fishing on brown shrimp with 300 hp (*i.e. 221 kW*) is allowed within the 12 nm. Unfortunately we (*i.e. the coastal fishermen*) have been striving for 30 years to remove those fishermen (*i.e. 300 hp*) from these waters. However, these guys have such a good lobby that this issues is not addressed. Even our own board members, the ministry and the inspection authority on shipping know that this problem exists. The coastal fishermen have been combining forces with NGO's. The magic word in these discussions was the 'Black box'. However, they have found a solution for this (*I don't know who 'they' are [suspect the ministry], and I am not sure what he means with this last sentence*). The 'Black box' system is allegedly not fraud proof and above all, it is expensive: one says that the costs would mount from € 9.000,- to € 12.000,-. These are costs that frighten small scale fishermen.

Secondly, the fishery has been frugal all year; prices of € 10 – € 12/kg confirm this. For fishermen this is nice, but on the long term it isn't good for the market even though this used to happen often, when (*large numbers of*) predators such as cod, whiting, dab etc. were present.

The number of juvenile fish is pretty good (*i.e. increasing*), however a big fleet is fishing in European waters. This continues in Holland for 5 days and 24 hours per day, also in the Wadden Sea which of all areas is a World Heritage site. In German and Danish waters one fishes 7 days per week. Dutch are mostly present there in the winter months. These people fish by using shifts (*i.e. crew is changed over the weekend*) and thus increasing the impact. While there is a regulation (*i.e. the Sylt regulation*), which states that a fishermen can fish for brown shrimp in the Sylt for 9 days out of 14 days, no control or enforcement takes place. This is an eyesore for most small scale fishermen.

Because the fishery was so frugal the LPUE reference values were breached and our Associations told us that we could only be on sea for a maximum of 72 hours to fish on shrimp. I think this is a good thing because the Dutch have had a TAC fishery of 1500kg per week in the past. However, the Competition Authorities (*i.e. the ACM*) concluded that this was a form of cartel and forbade it (*and gave some heavy fines*).

I think you have to know though, that this rule was beneficial to nature. Shrimps were growing very well and the fleet was in the harbour at Wednesdays, leaving no fisherman to impact the sea after that Wednesday (*i.e. no shrimp fisherman*). Fishermen experienced that discards were growing fast and were sorted out of the catch through the sievenet within a shorter period of time (*i.e. sorting period*) than was usual.

MSC (*he means the TAC system here, since we haven't had an MSC label for shrimp in the past*) is also socially present; fishermen were home more often, fuel consumption was decreased (*present fuel consumption is decreased if compared to that period since a lot of improvements and innovations have been applied now*), employment possibilities increased in these weak coastal regions, and youngsters were more willing to work in the fishery again.

Now (*i.e. in 2016*) we have had a two week period of effort restrictions (*i.e. a max of 72 hours on sea*), and to our dismay on Thursday the 9th of June we were told that the effort restrictions were no longer necessary. We could most definitely see on the following Monday that the fishery (*i.e. the catchability*) was slightly increased. However, with the big fleet fishing (*I think he means the big vessels here*) on shrimp again this advantage didn't last long. This fact resulted in most vessels (*I think he means small scale fishermen here*) landing way to little shrimp on Wednesday, I myself had an LPUE that day of 7,5 kg/h.

I wish the effort restrictions would have lasted all summer. I think this is ecologically, socially and economically (saving costs) much better. In the autumn, when juvenile fish are bigger and is sorted out under water, when shrimps are big, then one can fish for longer periods of time again (*I think he means without effort restrictions here*). In spring, when there are a lot of roe shrimps, one fishes for 7 days: 'People, calm fishing in this period is prudent. Give the females time to spawn.'

I turn to you in the hope that you will lead people in the EU to take sensible steps. Furthermore, I have no comments on the MSC plan (*i.e. the management plan*). But I am of the opinion that control and enforcement should be better.

Additionally, I would like to take the opportunity to point out that we are anxious of the pulse fishery. We think that this form of electric fishing brings harm to our fishery. Unfortunately, scientists are not able to answer our questions. Since this fishery is praised so much, I would like to ask you to be critical before an MSC certificate is awarded to this type of fishery.

Kind regards,

Johan Rispens (ZK 18)"

Assessment team response. Mr Rispens raises a number of issues. Firstly, he is concerned that some large fishing vessels are fishing within the 12 nm. The assessment team has considered all aspects of control and enforcement under Principle 3 within its report, and notes that the introduction of the black box system in the Netherlands fishery should aid the enforcement of closed areas. Secondly, Mr Rispens is concerned about the high level of fishing effort within the fishery and contends that effort restrictions implemented as part of the harvest control rules in summer 2016 were an appropriate measure. The assessment team recommended that the overall fishing effort in the fishery should be limited and also noted Mr Rispens' view (and that of many other stakeholders) of the beneficial nature of effort restrictions implemented as part of the harvest control rules. Thirdly, Mr Rispens considers that control and enforcement should be improved, and in its report the assessment team raised some conditions in relation to enforcement. Finally Mr Rispens expressed concern about the use of pulse fishing, and the assessment team confirms that pulse fishing does not constitute part of the UoC.

(REQUIRED FOR FR AND PCR)

1. The report shall include all written submissions made by stakeholders about the public comment draft report in full, together with the explicit responses of the team to points raised in comments on the public comment draft report that identify:

a. Specifically what (if any) changes to scoring, rationales, or conditions have been made.
b. A substantiated justification for not making changes where stakeholders suggest changes but the team makes no change.

(Reference: FCR 7.15.5-7.15.6)

Appendix 7 List of Authorised Ports of Landing

Denmark
Thyboron, Thorsminde, Hvide Sande, Esbjerg and Havneby on Rømø

German Ports
Accumersiel, Bensersiel, Brake, Bremen, Bremerhaven, Cuxhaven, Ditzum, Dorum, Fedderwardersiel, Greetsiel, Harlesiel, Hooksiel, Neuharlingersiel, Norddeich, Spieka-Neufeld, Varel, Wilhelmshaven (Nassau-Hafen), Wremen, Hamburg, Friedrichskoog, Büsum, Husum, Hafen am Eidersperrwerk, Schlüttsiel, Dagebüll, Hörnum, Burgstaaken, Eckernförde, Heiligenhafen, Heikendorf, Kappelin, Laboe, Maasholm, Niendorf, Stein-Wendtorf ,Travemünde, Wismar, Rostock (nur Frostfisch), Barhöft, Sassnitz, Mukran, Freest

Dutch Ports
Amsterdam (Ransdorp), Bergen Op Zoom, Broek in Waterland, Bunschoten, De Marne (Lauwersoog), De Marne (Zoutkamp), Delfzijl (Termunten), Den Helder, Diemen, Dongeradeel (Westdongeradeel), Drimmelen (Hoge en Lage Zwaluwe), Edam (Volendam), Eemsmond (Usquert), Enkhuizen, Genemuiden, Goedereede, Goedereede (Ouddorp), Goedereede (Stellendam), Goes, Harderwijk, Harlingen, Hemelumer Oldeferd, Hindeloopen, Hontenisse, Hoorn, Katwijk, Klundert, Lemsterland (Lemmer), Medemblik, Middelburg (Arnemuiden), Nieuw-Beijerland, Noord-Beveland (Kortgene), Oostdongeradeel, Reiderland (Finsterwolde), Reimerswaal (Yerseke), Schouwen-Duiveland (Bruinisse), Schouwen-Duiveland (Midden-Schouwen), Schouwen-Duiveland (Westerschouwen), Schouwen-Duiveland (Zierikzee), 'S-Gravenhage (Scheveningen), Sloten (fr.), Sluis (Breskens-Oostburg), Staveren, Terneuzen, Terschelling, Texel, Tholen, Urk, Velsen (Ijmuiden), Vlaardingen, Vlieland, Vlissingen, Waterland (Monnickendam), Wieringen, Workum, Wunseradiel (Wonseradeel), Zeevang (Oosthuizen)

Appendix 8 Surveillance Frequency

1. The report shall include a rationale for any reduction from the default surveillance level following FCR 7.23.4 in Table 4.1.
2. The report shall include a rationale for any deviations from carrying out the surveillance audit before or after the anniversary date of certification in Table 4.2
3. The report shall include a completed fishery surveillance program in Table 4.3.

Table 4.1 : Surveillance level rationale

Year	Surveillance activity	Number of auditors	Rationale
e.g.3	*e.g.On-site audit*	*e.g. 1 auditor on-site with remote support from 1 auditor*	*e.g. From client action plan it can be deduced that information needed to verify progress towards conditions 1.2.1, 2.2.3 and 3.2.3 can be provided remotely in year 3. Considering that milestones indicate that most conditions will be closed out in year 3, the CAB proposes to have an on-site audit with 1 auditor on-site with remote support – this is to ensure that all information is collected and because the information can be provided remotely.*

Table 4.2: Timing of surveillance audit

Year	Anniversary date of certificate	Proposed date of surveillance audit	Rationale
e.g. 1	*e.g. May 2014*	*e.g. July 2014*	*e.g. Scientific advice to be released in June 2014, proposal to postpone audit to include findings of scientific advice*

Table 4.3: Fishery Surveillance Program

Surveillance Level	Year 1	Year 2	Year 3	Year 4
e.g. Level 5	*e.g. On-site surveillance audit*	*e.g. On-site surveillance audit*	*e.g. On-site surveillance audit*	*e.g. On-site surveillance audit & re-certification site visit*

Appendix 9 Objections Process

(REQUIRED FOR THE PCR IN ASSESSMENTS WHERE AN OBJECTION WAS RAISED AND ACCEPTED BY AN INDEPENDENT ADJUDICATOR)

The report shall include all written decisions arising from an objection. *(Reference: FCR 7.19.1)*