

MACALISTER ELLIOTT AND PARTNERS LTD

**SURVEILLANCE VISIT
REPORT FOR THE GERMANY LOWER SAXONY MUSSEL
DREDGE AND MUSSEL CULTURE FISHERY**

**CERTIFICATE CODE: MEP-F-028
FIRST ANNUAL SURVEILLANCE**

Undertaken by:

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1. GENERAL INFORMATION

Fishery Name	Germany Lower Saxony mussel dredge and mussel culture fishery			
Units of Certification	<p>UoC 1. Dredging for mussel seed + bottom culture in the German part of the Wadden Sea around Niedersachsen / Lower Saxony</p> <p>UoC 2. Collection of mussel seed using suspended ropes and nets + bottom culture in the German part of the Wadden Sea around Niedersachsen / Lower Saxony</p> <p>UoC 3. Translocation of mussel seed that has originated from spatfall in the Wadden Sea and has stayed in the Wadden Sea for its whole life span, from an MSC certified fishery + bottom culture</p>			
Species	Blue shell mussel (<i>Mytilus edulis</i>)			
Area	FAO area 27, ICES Area IVb – in the German part of the Wadden Sea around Niedersachsen / Lower Saxony			
Method of capture	Catch and grow, spat collection and on-growing on culture plots			
Client Address	Am Gräberfeld 1 26197 Großenkneten Germany			
Client Contact Name	Manuela Gubernator			
Client Telephone No.:	+49 4431 7398 015			
Client Email	gubernator@muschelfischer.de			
Certificate number	MEP-F-028			
Certificate Issue Date	5 December 2014 (original certificate F-FCI-0035 issued by FCI on 29 October 2013)			
Certificate Expiry Date	28 October 2018			
Audit stage	Year 1	Year 2	Year 3	Year 4
Audit experts	Expert 1 (Team Leader): Jo Gascoigne Expert 2: Chrissie Sieben			
Surveillance Audit Date	28 January 2015			
Conclusion	On the basis of the first surveillance audit the team concludes that the client has made good progress on the conditions and that 4 out of 10 conditions are now closed. The Germany Lower Saxony mussel dredge and mussel culture fishery should retain its MSC certification for another year.			

2. INTRODUCTION

This report outlines the process and outcome of the First Annual Surveillance audit for the MSC certified Germany Lower Saxony mussel dredge and mussel culture fishery.

The fishery is conducted by members of the Niedersächsische Muschelfischer GbR which represents four mussel fishing companies operating 5 vessels. There have been no changes to the list of member vessels since certification. The fishery takes place entirely in Lower Saxony coastal waters between the German-Dutch border (Ems-Estuary) and the border between the German federal states (Länder) of Lower Saxony and Schleswig Holstein (Elbe-Estuary). All known fishing effort falls within the 12 nm-zone and hence in the jurisdiction of Lower Saxony. The area under evaluation is also the territory partly governed by the Ems-Dollart-Treaty.

The mussel fishery has traditionally been based on the fishery of wild mussel seed in the subtidal and in the intertidal (UoC 1) although seed mussel collectors (SMC) consisting of ropes or nets are increasingly being used due to low productivity of wild mussel beds (related to the expansion of the non-native Pacific oyster in the intertidal as well as poor spat fall) (UoC 2). Seed mussels can also be translocated into Lower Saxony from an MSC certified fishery in the Dutch Wadden Sea (UoC 3). Note that seed mussels can also be translocated from Schleswig Holstein, but are in that case not sold as MSC mussels. This translocation is carefully registered. Since 2008, no imports have taken place from outside the Wadden Sea and this currently remains the case (this is further discussed in the Traceability section of this report). Grow-out takes place on subtidal and intertidal mussel plots which are rented by individual fishermen.

Culture mussels are several times fished and relayed on other plots, they are for instance brought to deeper located plots before the winter to protect them against storms and back in spring to the plots with the best growing conditions.

This audit is the first surveillance audit for this fishery since certification which was finalised in October 2013 by the Conformity Assessment Body FCI. The audit was carried out in Hooksiel, Germany on the 28th January 2015 by the surveillance team consisting of Jo Gascoigne (Team Leader) and Chrissie Sieben. The audit participants are listed in Table 1.

Table 1. Audit participants

Name	Company
Jaap Holstein	H&S consultancy (client representative)
Cora Seip	H&S consultancy (client representative)
Manuela Gubernator	Niedersächsische Muschelfischer GbR
David de Leeuw	Niedersächsische Muschelfischer GbR
Karel-Jan Ysseldijk	Niedersächsische Muschelfischer GbR
Jo Gascoigne	MEP
Chrissie Sieben	MEP

Prior to the audit, the fishery held a stakeholder gathering (27th January 2015), which the MEP audit team also attended. Stakeholders were informed of the scheduled site visit, its time and location and the proposed audit team on the 6th January 2015. The audit team was approached by Dr. Hans-Ulrich Rösner of WWF Germany who confirmed that he would attend the stakeholder gathering on the 27th January.

The fishery remains in conformance with the Scope Criteria relating to unilateral exemption and destructive fishing practices (MSC Certification Requirements, Section 27.4.4)

3. PRINCIPLE 1

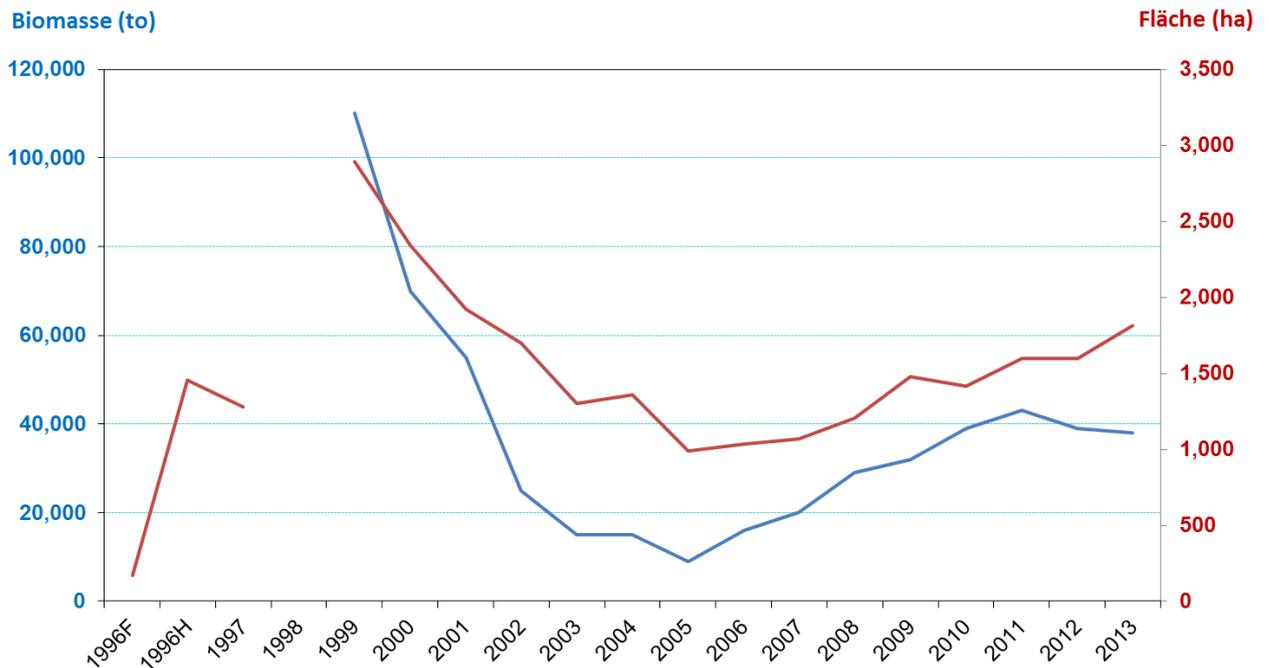
The blue mussel (*Mytilus edulis*) is distributed along the entire geographical range of the Wadden Sea, where for management purposes a number of stocks are identified including the blue mussel stocks of the Netherlands, Lower Saxony, Schleswig-Holstein and Denmark.

The blue mussel fishery in Lower Saxony is managed via the “Blue Mussel Fishery Management Plan for the Wadden Sea National Park of Lower Saxony” (Bewirtschaftungsplan Miesmuschelfischerei im Nationalpark Niedersächsisches Wattenmeer; blue mussel management plan BMMP) which sets out conditions for the issuing of mussel fishing permits (see Section 5 for further details), relating to *inter alia* the minimum required biomass and size of intertidal mussel beds and the closure of stable intertidal mussel beds. Note that no specific management measures apply to subtidal mussel beds as these are thought to be unstable and therefore a temporary occurrence.

Besides the BMMP, mussel culture and fishing is regulated in the Fisheries law (Fischereigesetz). Especially for the culture plots, the 'Küstenfischereiverordnung' includes provisions for closed periods, minimum size, maximum area of culture plots (1300 ha), maximum number of companies (4), etc.

Figure 1 shows the trends in biomass (tonnes) and bed size (hectares) for intertidal mussel beds in Lower Saxony, estimated via aerial photography. Biomass has fluctuated around 40,000 tonnes in the last three years which is well above the 10,000 tonne limit set by the management plan. Overall bed size has also remained above 1,500 hectares in this period, exceeding the 1,000 hectare minimum requirement.

Entwicklung des eulitoralen Miesmuschelbestandes: Biomasse und Fläche



Quelle: Dr. Millat, Nationalparkverwaltung 2014

Figure 1. Trends in biomass (tonnes - in blue) and size (hectares – in red) of intertidal mussel beds in Lower Saxony (as estimated through aerial photography).

To allow the “undisturbed, long-term development of certain mussel beds and sites”, the BMMP sets out the closure of stable mussel beds in the intertidal. Out of 102 beds, 29 are currently closed to the seed mussel fishery. These include 12 beds that are closed under the Lower Saxony National Park Law, another 12 closed under the BMMP and 5 closed voluntarily by the fishery. In practice, however, few if any of these stable beds (‘Standorten’) are fished in a given year, because they have for the most part been colonised by invasive Pacific oyster (*Crassostrea gigas*). Figure 2 shows that the number of Standorten over the last 10 years has remained constant at 102. Even though 1 location was fished in 2009, this has not affected the overall number of stable locations.

Situation der Miesmuschel-Standorte

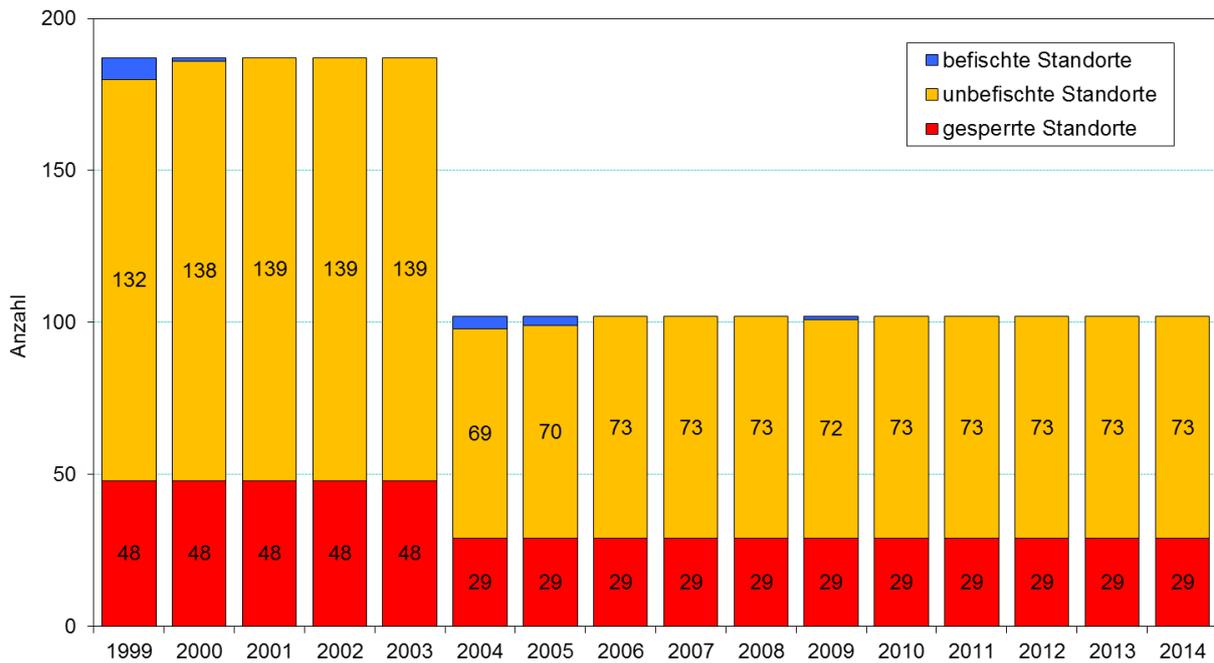
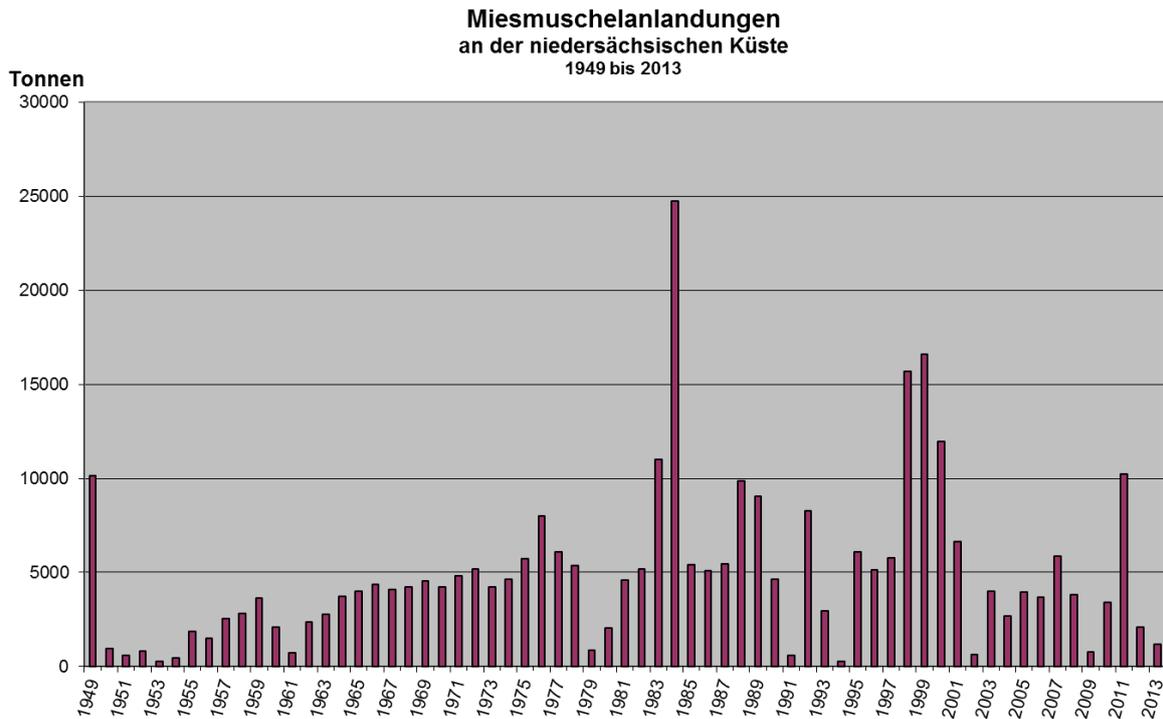


Figure 2. Number of stable intertidal mussel beds or ‘locations’ (Standorte) in Lower Saxony over the last 15 years. Red: closed; orange: open to fishery; blue: fished.

Figure 3 shows the updated historical landings data of adult mussels (fished on subtidal wild mussel beds or culture plots). The bulk of landings stem from culture plots as production from wild beds depends on spat survival which is highly variable and unpredictable. The production of culture plots is also variable and depends on the availability of mussel seed (see Figure 4 below). Although 2014 landings data were not yet available, the landings in 2013 amounted to 1,193 tonnes.



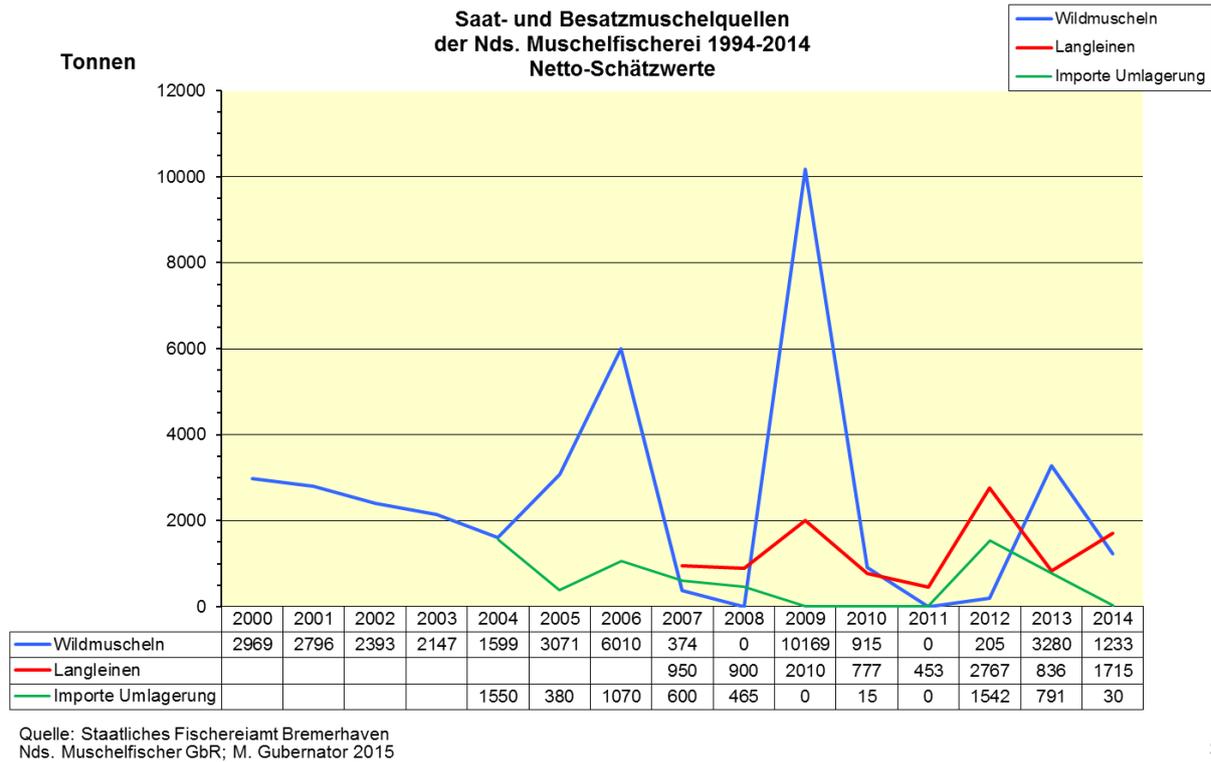
Quelle: Staatliches Fischereiamt Bremerhaven

MIMU1

Figure 3. Historical landings data of adult mussels (from wild beds and culture plots) in Lower Saxony.

Figure 4 shows the updated mussel seed production levels stemming from each of the three UoCs: wild subtidal and intertidal mussel beds (in blue), seed mussel collectors (SMC) or langleinen (in red) and seed imports (in green). As previously stated, most of the wild seed mussel fishery takes place in the subtidal as intertidal beds are increasingly affected by the proliferation of the Pacific oyster, making most of the Standorten unfishable.

Spat fall and survival on wild beds is highly dependent on environmental conditions (weather, predators etc.) and this variability is reflected in the data shown, with recent production levels remaining well below the 2009 peak of 10,000 tonnes. The seed production from SMCs has remained relatively steady, fluctuating around the 2,000 tonnes mark. No mussel imports have taken place from outside the Wadden Sea since 2008 and imports from elsewhere in the Wadden Sea were minimal in 2014 (30 tonnes imported from the Dutch Wadden Sea).



Saat4

Figure 4. Historical mussel seed production levels of each of the three UoCs: wild seed fishery/wildmuscheln (blue), seed mussel collectors/langleinen (red) and imported seed/importe umlagerung (green). Note that ‘imports’ come from other jurisdictions in the Wadden Sea. Note the wild seed fishery production for 2014 should be 866 tonnes which is the net weight.

4. PRINCIPLE 2

The situation in relation to Principle 2 has not changed since the initial assessment – the fishery is very clean, with no discernible impacts on non-target species or ETP species. Several conditions were however raised during the initial assessment in relation to the habitats and ecosystem components and these are further discussed in Section 6.

The team notes that one concern was raised by the MSC in relation to the gear used as part of UoC 1 (mussel dredge + on-growing). The Public Certification Report for this fishery states the following:

Mussels are caught with a mussel dredge. The dredge (Figure 2) consists of a metallic net that is supported by a steel bar frame. The net is usually 1.9 meter wide and a steel bar of approximately 4cm is dredged along the sea bottom. When the net is full it is emptied into the boat hold. The same gear is used for the seed fishery as for the fishery on the mussel plots. (Occasionally a 4 meter trawl net with tickler chains is used.)

Following further investigation, the team confirms that a trawl net is used more often than a mussel dredge in this fishery. A review of the PCR indicates that the relevant Principle 2 components potentially affected by this change (retained species, bycatch and habitat components) were in fact assessed using the Risk-Based Framework in a non-gear specific manner and presenting the worst-case scenario. Any impacts caused by the use of trawl gear would therefore have been considered as part of this scenario. In light of this, MEP proposes

that the name of UoC 1 is therefore changed to ‘wild seed mussel fishery + on-growing’ which represents the situation more accurately.

5. PRINCIPLE 3

The Lower Saxony mussel fishery takes place within the Niedersachsen (Lower Saxony) National Park and as such is subject to the ‘Blue Mussel Fishery Management Plan for the Wadden Sea National Park of Lower Saxony (BMMP)’, issued by the Lower Saxony Ministry of Food, Agriculture, Consumer Protection and Regional Development (MoA) and the Lower Saxony Ministry of Environment and Climate Protection (MoE). The MoA and its subordinate body, the Fisheries Office (Staatliches Fischereiamt Bremerhaven, SFA) are responsible for the implementation and enforcement of the plan.

A management plan was first established for the period 1999 – 2003, followed by a second and third plan for the periods 2004 – 2008 and 2009 – 2013. A fourth management plan for the period 2014 - 2018 has yet to be adopted, reportedly because of insufficient manpower in the MoA to finalise it. The 2014-18 plan was subject to comment by NGOs and other stakeholders in 2014 via the National Park Board (see minutes of meeting 25 June 2014). The fishery therefore remains subject to the 2009 – 2013 plan. The new plan is summarised in the table below, noting any changes from the 2009-2013 plan where applicable:

Component	Measure
Minimum size intertidal mussel beds	<p>When the size of intertidal mussel beds (estimated by aerial survey) is at least 10% below 1.000 ha and 10.000 t biomass (reference values established in 1994), the Fisheries Office will not issue a permit for mussel fisheries on intertidal beds, until the 1994 reference values are reached again.</p> <p>Change from previous plan: Previously the situation had to be below reference values for two years in a row, now action will be possible after one year.</p>
Intertidal mussel beds	To ensure long-term undisturbed development of certain mussel beds, several intertidal areas have been closed for mussel fisheries, both through the National Park Act and voluntarily by mussel fishers (also see Figure 2)
Intertidal seed mussel beds	The seed mussel fishery is allowed in areas where seed mussel settlement is temporary, as long as the condition on the minimum size of intertidal mussel beds is fulfilled.
Subtidal	<p>No measures exist for subtidal beds on the basis that these are not stable and are therefore a temporary occurrence.</p> <p>Change from 2009-13 plan: The new plan states that the Niedersächsische Muschelfischer GbR (the client for this fishery) will however carry out a monitoring programme, to gather information about the distribution and development of stable subtidal mussel beds.</p>

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<p>Monitoring</p>	<p>Change from 2009-13 plan: All Niedersächsische Muschelfischer GbR member vessels will have a black box installed, with which fishing activities can be monitored.</p> <p>The Niedersächsische Muschelfischer GbR will use the data from the black boxes to produce a map of the mussel seed fishing activities. Each year, before 28th February, the PO will make this map available to the Fisheries Office, providing valuable information about fished areas, and the distribution of mussel beds.</p>
<p>Import of mussels from outside the Lower Saxony coastal area</p>	<p>In order to minimise the risk of introducing non-native species, the mussel fishers in Lower Saxony will, as a voluntary precautionary measure for the duration of the management plan, stop the import of mussels from outside the Lower Saxony coastal area (previously from outside the Wadden Sea area), and limit the translocation of mussels. Only mussels naturally occurring between north of 52°54'N, south of 56°N and east from a line between 52°54'N 4°36'E till 56°N 7°30'N can be translocated within the Wadden Sea of Lower Saxony.</p> <p>The Fisheries Department will inform the National Park Service when and if permits will be issued for the translocation of mussels within the Wadden Sea.</p>

It is noted, however, that concerns have been raised by WWF in relation to this draft MP. A statement was filed in July 2014, signed by all five environmental NGOs active in the Wadden Sea of Lower Saxony, in protest that the MP does not conform legally to the protection requirements of the Niedersachsen National Park. It is not possible at this stage to determine to what extent these complaints have been taken into account by the Ministry of Agriculture; however the team will continue to monitor the situation and report on new developments at the next surveillance audit.

6. CONDITIONS

6.1. CONDITION 1: HABITATS OUTCOME (DREDGE AND ON-GROWING UOC)

Habitats		2.4.1 – Habitats outcome
Condition		<p>Although the impact on mussel beds is restricted by the closure of 29 mussel locations in the management plan the seed fishery in the intertidal could still have an impact on the development of stable mussel beds by removing seed mussels from the mussel locations that are open for the fishery.</p> <p>In the sub-tidal all known concentrations of mussels can be fished under the present management plan. Although it is acknowledged that a large part of the mussels will disappear by natural mortality or other causes it is not certain that this will be always the case. The fishery could prevent the development of stable banks in some areas.</p> <p>The client is advised further develop and implement a comprehensive spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal.</p>
Milestones		<p>Year 1: Provide evidence that discussions on the development of a comprehensive spatial management strategy such that it is highly unlikely that the fishery seriously impacts the development of stable mussel beds in both intertidal and sub-tidal have taken place.</p> <p>Year 2-4: Provide evidence that a comprehensive spatial management strategy is implemented such that it is highly unlikely that the fishery seriously impacts the development of stable mussel beds in both intertidal and sub-tidal.</p>
Client Action Plan		<p>Year 1: Collection of all available data to produce a map of potential locations in the sub littoral for the development of stable mussel beds. Planning of a research program for partly fishing of sub littoral mussel beds.</p> <p>Year 2-4: As soon as a suitable sub littoral mussel beds are available, the NM will start the research project in which some instable mussel beds are partly fished with the aim of understanding the likelihood of development of stable mussel beds. The experiment is coordinated by the NM (Manuela Gubernator) and supervised by H&S Consultancy.</p> <p>Year 4-5: Collection of the necessary information to implement a spatial management strategy with regard to the protection and development of stable mussel beds in the littoral areas. Start with the development of a comprehensive spatial management strategy with the result that it is highly unlikely that the fishery has significant impact on the development of stable mussel beds.</p> <p>Year 5: Complete the implementation of spatial management strategy in the fishery for seed mussels. Finish the map showing the areas with chances for the development of stable mussel beds.</p>
Year 1	Progress on Condition	The blue mussel management plan sets out the closure of stable mussel beds in the intertidal. Out of 102 beds, 29 are currently closed to the seed mussel fishery. Intertidal mussel bed biomass, size and locations are surveyed on an annual basis (through aerial photography and groundtruthing) as shown in Figure 1 and Figure 2. The latter shows that the number of stable locations ('Standorte') over the last 10 years has remained constant at 102. Even though 1 location was fished in 2009, this has not affected the overall number of stable

	<p>locations. None of these locations have been fished in recent years – when fishing does take place in the intertidal, this is on new spat fall in unstable locations, or occasionally at the periphery of the Standorte, subject to permits being issued by the authorities (based on survey results for each of the beds).</p> <p>Research on the impacts of mussel fishing on the development of stable subtidal mussel beds was carried out in the western Wadden Sea from 2006 to 2012 as part of the PRODUS project (Smaal et al., 2013). The study showed that although the mussel seed fishery has significant short-term impacts on the habitat structure, biomass and biodiversity of fished mussel plots, these differences were only detectable after the spring fishery, not the autumn fishery, and were lost after ~2 years. In unstable areas, the absence of fishing did not guarantee the survival of mussel beds: mussel spat beds disappeared at the same rate in both the open and the closed sections. It also appeared that after some years almost no older mussels remained in either open or closed areas. An English summary of the study is provided in Annex 2. These results are particularly relevant to the Germany Lower Saxony mussel fishery which takes place in autumn on unstable mussel beds, and suggest that no impacts on biomass or habitat quality are likely to be detectable as a result of this fishery.</p> <p>Niedersächsische Muschelfischer GbR commissioned the research bureau MarinX (led by Marnix van Stralen) to construct a map of subtidal mussel beds, based on all available information stemming from shrimp fishermen and mussel farmers. The map has been modelled on the stability map for the Dutch Wadden Sea and distinguishes between five levels of stability, ranging from most instable (category 1) to most stable (category 5).</p> <ul style="list-style-type: none"> -Category1: beds will disappear in winter (almost) completely -Category2: beds will disappear in winter for the most part -Category3: disappearance in winter uncertain (due to fluctuations in predator abundance, or accumulation of silt during storms) – requires further surveys. -Category4: beds will remain for the most part -Category5: beds will remain (almost) completely <p>Based on the available data, van Stralen (2015) did not identify any mussel beds with a Category 4 or 5 classification, indicating that subtidal mussel beds in Lower Saxony are for the most part unstable (see stability map in Annex 4) . This could be explained by the morphological and hydrodynamic features that characterise this area of the Wadden Sea (i.e. presence of Eems, Jade and Weser estuaries which dominate the area results in high tidal currents making long-term settlement of mussels difficult). Lower Saxony is in this respect no different from the eastern part of the Dutch Wadden Sea where mussel banks are a sporadic occurrence and no mussel bed has yet been classified as Category 4 or 5. The maps shown in Annex 5 illustrate the fluctuations in water depth (due to sediment erosion/deposition) in some areas of Lower Saxony which supports this hypothesis.</p> <p>The studies cited above demonstrate 1) that mussel fishing as it is currently done by this fishery does not impact on the development of stable mussels beds in the long term; this observation is also supported by the monitoring of stable intertidal mussel beds in Lower Saxony which shows that the number of beds has not declined despite some beds having been fished in previous years (see the trends in intertidal mussel ‘locations’ in Figure 2); and 2) that mussel beds in the subtidal are not stable, and interannual fluctuations in water depth demonstrate</p>
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		<p>the morphologically unstable nature of the subtidal area in Lower Saxony (which also makes mapping of subtidal beds difficult)</p> <p>While the client will continue to monitor trends in intertidal and subtidal mussel beds (in terms of area and biomass) and will continue to contribute annually to the subtidal mussel bed stability map, there are clear indications that this fishery is highly unlikely to prevent the development of stable mussel beds.</p>
	Supporting evidence	<p>PRODUS project (Smaal et al., 2013), see Annex 2</p> <p>Stability map for sublittoral mussel beds in the Wadden Sea of Lower Saxony (van Stralen, 2015) – see Annexes 4 and 5</p>
	Conclusion Year 1 audit	<p>Progress against this condition is on target and this condition will be kept open for review at the next audit.</p>

6.2. CONDITION 2: HABITATS MANAGEMENT (DREDGE AND ON-GROWING)

Habitats		2.4.2 – Habitats management
	Condition	<p>Under the current management plan 29 mussel sites in the intertidal are closed for fishing. In the mussel sites that are open to the fishery a very limited fishery has taken place. Nevertheless the possible impact of the fishery on the development of stable mussel beds in the open parts of the intertidal should be taken into account in the management strategy. Currently all mussels that are located in the sub-tidal can be harvested (with a license). This practice could prevent the development of mussel banks in the sub-tidal in certain areas.</p> <p>For both reasons it cannot be concluded that there is a partial management strategy in place that is expected to achieve the SG 80 outcome level of performance. The client is advised further develop and implement a comprehensive spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal. This strategy could include the development of a map showing chances of development of stable mussel beds.</p>
	Milestones	<p>Year 1: Provide evidence that discussions on the development of a comprehensive spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal have taken place.</p> <p>Year 2-4: Implement a comprehensive spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal.</p> <p>Year 5: Provide evidence that a comprehensive spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal is implemented successfully.</p>
	Client Action Plan	As per condition 1
Year 1	Progress on Condition	As per condition 1
	Supporting evidence	As per condition 1
	Conclusion Year 1 audit	Progress against this condition is on target and this condition will be kept open for review at the next audit.

6.3. CONDITION 3: HABITATS INFORMATION (DREDGE AND ON-GROWING UoC)

Habitats		2.4.3 – Habitats information
Condition		<p>Information on the impact of mussel seed fishery on the development of stable mussel beds in the intertidal does not include a map that shows where the fishery could prevent the development of these beds.</p> <p>Although the locations where mussels are fished in the sub-tidal are known there is no comprehensive information about the distribution and vulnerability of mussel beds in the sub-tidal.</p> <p>The client is advised to liaise with the appropriate stakeholders and research institutes in order to collect the necessary information to inform a management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal. This information gathering should include the development of a map showing chances of development of stable mussel beds.</p>
Milestones		<p>Year 1: Provide written evidence of contacts and correspondence with relevant stakeholders in order to collect the necessary information to implement a spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal.</p> <p>Year 2-4: Collate existing knowledge and if necessary conduct research or monitoring to provide the necessary information to implement a comprehensive spatial management strategy with regard to the protection and development of stable mussel beds in both intertidal and sub-tidal.</p>
Client Action Plan		As per condition 1
Year 1	Progress on Condition	As per condition 1
	Supporting evidence	As per condition 1
	Conclusion Year 1 audit	Progress against this condition is on target and this condition will be kept open for review at the next audit.

6.4. CONDITION 4: HABITATS INFORMATION (ROPE AND ON GROWING UoC)

Habitats		2.4.3 – Habitats information
Condition		<p>Suspended mussel culture like the spat collection on ropes can result in organic enrichment of the seabed through the deposition and accumulation of pseudo-faeces under the structures. The level of impacts is highly dependent however on the scale of production and the hydrographic conditions at the culture site. Currently there is no information on the impact of the mussel spat collection on the local seabed.</p> <p>Client is advised to collate information on the specific features of the sites for suspended mussel culture. This would include measurements of total ‘free’ sulphide (S₂⁻) in surficial (0-2cm) sediments of the seabed under the sites.</p>
Milestones		Year 2-3: The client should provide the team with the results of the measurements of total ‘free’ sulphide (S ₂ ⁻) in surficial (0-2cm) sediments of the seabed under the sites. To allow comparison measurements should also take place on control sites outside of the sites.

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		Year 4-5 No further action required when the measurements show that the sediments under the sites are not impacted significantly and production levels are not increased. In case production levels are increased and/or impacts on sediments are detected the monitoring should be continued.
	Client Action Plan	Year 2-3: The client will provide the team with the results of the measurements of total ‘free‘ sulphide (S ²⁻) in surficial (0-2cm) sediments of the seabed under the sites. To allow comparison measurements will also take place on control sites outside of the sites. Year 4-5: No further action will be required if the measurements show that the sediments under the sites are not impacted significantly and production levels are not increased. In case production levels are increased and/or impacts on sediments are detected the monitoring will be continued.
Year 1	Progress on Condition	During the 1 st year of certification the client has been researching suitable approaches to demonstrate the impact of seed mussel collectors (SMC) on the local seabed. Approaches may include direct measurements in sample locations or a review of SMC installations in areas with similar morphological and hydrodynamic characteristics.
	Supporting evidence	Communications with research institutes as shown during the audit.
	Conclusion Year 1 audit	No milestone was identified for this year; however the client has shown progress towards meeting this condition which is on target.

6.5. CONDITION 5: ECOSYSTEM OUTCOME (TRANSLOCATION AND ON-GROWING UoC)

Ecosystem	2.5.1 – Ecosystem outcome
Condition	To receive an unconditional score of 80 a valid documented risk assessment or equivalent environmental impact assessment has to demonstrate that the translocation activity is highly unlikely to introduce diseases, pests, pathogens or non-native species into the surrounding ecosystem. Such a document has not been presented to the team and therefore the translocation of mussel seed (that has originated from spatfall in the Wadden Sea) from the Wadden Sea outside Lower Saxony to the Lower Saxony Wadden Sea does not meet the SG 80 guideposts. The client is advised to have an appropriate assessment carried out of the risks involved with the imports of mussels from the Wadden Sea outside the Lower Saxony Wadden Sea area.
Milestones	Year 1: The client should present a valid documented risk assessment or appropriate assessment to the team that demonstrates that the translocation activity is highly unlikely to introduce diseases, pests, pathogens or non-native species into the surrounding ecosystem
Client Action Plan	From Year 1: The NM will ask the institute GiMaRIS within 1 year after certification to carry out the appropriate assessment of the risks involved with the translocation of mussels (that have originated from spatfall inside the Wadden Sea) within the Wadden Sea area. The NM will register sufficient information (like origin, quantities, mussel size, way of transport) to adequately inform a risk or impact assessment. The assessment will aim to demonstrate whether the translocation activity is highly unlikely to introduce diseases, pests, pathogens or non-native species into the surrounding ecosystem. The results of this assessment will be used for the implementation of the action plan.

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		The NM will consult the organizations of mussel farmers in Schleswig-Holstein and The Netherlands for setting up a joint project.
Year 1	Progress on Condition	<p>A study was conducted by GIMARES to investigate the risk of introducing non-native species via mussel transport within the Wadden Sea area (Gittenberger, 2015 – see Annex 3 for full report). The study found that many non-native species that were only known in the Dutch part of the Wadden Sea for example, were also found in the German Wadden Sea during recent non-native species inventories. The author concluded that this was to be expected as most marine species have a pelagic life stage and have probably spread with the general south to north sea-current along the western European coast – this suggests that once they are present in the Wadden Sea, non-native species can freely distribute themselves within and between the Dutch and German parts of the Wadden Sea. The study concluded that no indications were found that the transport of mussels within the Wadden Sea will significantly raise the risk that non-native species will increase their distributional range within the Wadden Sea and have a significant impact on the ecosystem.</p> <p>Further inventories are planned in the coming years to reinforce this conclusion and this will involve the inventorisation of non-native species present in mussel production areas in the Lower Saxony part of the Wadden Sea.</p>
	Supporting evidence	Gittenberger, 2015 – see Annex 3 for full report. A presentation of the study’s results was also given by the author at the stakeholder meeting on the 27 th January 2015.
	Conclusion Year 1 audit	The study carried out by GIMARES presents a valid documented risk assessment that demonstrates that the translocation of mussels from outside the Lower Saxony Wadden Sea (but still within the Wadden Sea area) to Lower Saxony is highly unlikely to introduce diseases, pests, pathogens or non-native species into the surrounding ecosystem. This condition can therefore be closed and SG80 is met.

6.6. CONDITION 6: ECOSYSTEM MANAGEMENT (TRANSLOCATION AND ON-GROWING UoC)

Ecosystem		2.5.2 – Ecosystem management
	Condition	<p>To receive an unconditional score of 80 a valid documented risk assessment or equivalent environmental impact assessment has to demonstrate that the translocation activity is highly unlikely to introduce diseases, pests, pathogens or non-native species into the surrounding ecosystem. Such a document has not been presented to the team and therefore the translocation of mussel seed (that has originated from spatfall in the Wadden Sea) from the Wadden Sea outside Lower Saxony to the Lower Saxony Wadden Sea does not meet the SG 80 guideposts.</p> <p>The client is advised to have an appropriate assessment carried out of the risks involved with the imports of mussels from the Wadden Sea outside the Lower Saxony Wadden Sea area.</p>
	Milestones	Year 1: The client should present a risk assessment or appropriate assessment to the team in which the risks connected to the import from mussels from the Wadden Sea outside Lower Saxony are evaluated. The assessment has to demonstrate that the translocation activity is highly unlikely to introduce diseases, pests, pathogens or non-native species into the surrounding ecosystem.
	Client Action Plan	As per condition 5
Year 1	Progress on Condition	See Condition 5
	Supporting evidence	See Condition 5

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	Conclusion Year 1 audit	This condition can be closed and SG80 is met.
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6.7. CONDITION 7: ECOSYSTEM INFORMATION (TRANSLOCATION AND ON-GROWING UoC)

Ecosystem		2.5.3 – Ecosystem information
Condition	<p>To receive an unconditional score of 80 information on the impact of the imports of mussels should be sufficient to adequately inform the risk and impact assessments required in SG80 management level of performance. The team concluded that such information has not been presented to the team and therefore the current level of information is insufficient to assess the risks involved with the practice of translocation of mussels from the Wadden Sea area outside Lower Saxony to the Lower Saxony Wadden Sea.</p> <p>The client is advised to have an appropriate assessment carried out of the risks involved with the imports of mussels from the Wadden Sea outside the Lower Saxony Wadden Sea area.</p>	
Milestones	Year 1: The client should show that sufficient information (origin, quantities, mussel size, way of transport) is available to adequately inform a risk or impact assessment required in the SG 80 management level of performance.	
Client Action Plan	<p>From Year 1: The NM will register sufficient information (like origin, quantities, mussel size, way of transport) to adequately inform a risk or impact assessment. Although outside the scope of certification the translocation from outside the Wadden Sea -if there is- will be based on a risk analysis of the import of mussels from each of the foreign production areas. The NM will discuss this with the colleagues in Schleswig-Holstein and in The Netherlands. Their experience with the shellfish import monitoring protocol will be used in finding together the best method to prevent the introduction of unwanted species.</p> <p>The NM will discuss in the coming months (at latest in 2014) with the 'Fischereiministerium', and the 'Umweltministerium' the future conditions for relaying of imported mussels. The NM will ask the Ministries to involve these conditions in the next Management plan for the next period.</p>	
Year 1	Progress on Condition	As per condition 5
	Supporting evidence	See Condition 5
	Conclusion Year 1 audit	This condition can be closed and SG80 is met.

6.8. CONDITION 8: DECISION-MAKING PROCESSES (ALL UoCs)

Fishery-specific management system	3.2.2 – Decision-making processes
Condition	A number of criteria are defined for decisions in mussel fisheries management which can be seen as provisions for a precautionary approach (e.g. minimum stock sizes, maximum shell length, required documentary proof in case of translocation etc.).

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	<p>The decision-making process is based on inspections of the site, on the results of the monitoring programme and on other sources. In this sense, it can be said that it is based on the best available basis. Nevertheless, information on some important factors are lacking, such as the direct impacts of sub-tidal seed mussel fishery on the potential development of mussel beds. Such information is not generated, but also no specific restrictions are implemented, which would have to be considered as a consequence of the absence of information under a strictly precautionary approach.</p> <p>The client should liaise with relevant stakeholders to support the adoption of the precautionary approach in decision making processes related to the management of the lower Saxony mussel fishery. In particular in aspects related to:</p> <ol style="list-style-type: none"> 1. The potential risk that the fishery may pose on the development of stable mussel beds in the intertidal and sub-tidal zones. 2. The introduction of non-native species into the surrounding ecosystem. 3. Decision making processes related to the installations of ropes
Milestones	<p>Year 1-2: The client should liaise with relevant stakeholders to support the adoption of the precautionary approach in decision making processes related to the management of the lower Saxony mussel fishery. In particular in aspects related to:</p> <ol style="list-style-type: none"> 1. The potential risk that the fishery may pose on the development of stable mussel beds in the intertidal and sub-tidal zones. 2. The introduction of non-native species into the surrounding ecosystem. 3. Decision making processes related to the installations of ropes. <p>Year 3-5: The precautionary approach will be used in the adoption of management measures which will be based on available information.</p>
Client Action Plan	<p>Year 1: The NM will discuss with both ministries how to embody the action plan in the management plan and how to inform the relevant stakeholders in the future. The results will included in the next Management plan.</p> <p>All relevant stakeholders are represented on the National Park Board</p> <p>The Board will be informed about the map with stable and unstable mussel beds and the results of the Dutch research project about the direct impacts of sub-tidal seed mussel fishery on the potential development of mussel beds. (The results of the Dutch research program PRODUS can be used for this). The NM will engage with relevant stakeholders to further develop or support research that will focus on information gaps related to all Unit of Certification.</p> <p>Within the National Park Board the fishery specific management system will be discussed and evaluated based on relevant information.</p> <p>The NM is already using and will use the yearly meeting with relations, stakeholders and press at the start of the season for the presentation of research plans and results and for giving information about mussel farming, especially in Lower Saxony.</p> <p>A number of criteria are already defined for decisions in mussel fisheries management. The aim is to assure that the fishery on mussels will be sustainable. (e.g. minimum stock sizes, minimum shell length, required documentary proof in case of translocation, new installations for ropes, etc.).</p>

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	<p>The decision-making process is based on inspections of the site, on the results of the monitoring program and on other sources</p> <p>Year 2-5: The precautionary approach will be followed by the NM in the adoption of management measures resulting from research outcomes.</p> <p>The own management plan is subject to regular internal and occasional external review. The review system will be implemented by the fifth year of certification.</p> <p>Year 2 and Year 4: the NM will invite the NGO's and will inform them about the mussel fishery, their problems, continuation of the conditions of the MSC certification, etc.</p>
<p>Year 1</p>	<p>Progress on Condition</p> <p>The client should liaise with relevant stakeholders to support the adoption of the precautionary approach in decision making processes related to the management of the lower Saxony mussel fishery. In particular in aspects related to:</p> <p>The following progress has been made by the client in relation to the following aspects:</p> <ol style="list-style-type: none"> 1. <i>The potential risk that the fishery may pose on the development of stable mussel beds in the intertidal and sub-tidal zones.</i> As per condition 1, this issue is being investigated through work on the subtidal stability map by the MarinX institute (van Stralen, 2015) which will be updated on an annual basis. The intertidal monitoring data for this fishery in addition to the findings of the PRODUS project (Smaal et al., 2013) show that this fishery is highly unlikely to prevent the development of stable intertidal mussel beds; nevertheless, annual monitoring will ensure that decision-making processes are based on sound scientific evidence. 2. <i>The introduction of non-native species into the surrounding ecosystem.</i> As per conditions 5 to 7, a risk assessment was recently undertaken by GIMARES (Gittenberger, 2015) which found no indications that the transport of mussels between areas within the Wadden Sea will significantly raise the risk that non-native species will increase their distributional range within the Wadden Sea and have a significant impact on the ecosystem. As a precautionary measure, the NM have also committed to not importing any mussels from outside the Wadden Sea. This measure has been adopted in the draft new blue mussel management plan 2014 – 2018 (see Section 5 for further info). Although this plan has yet to be officially adopted, this demonstrates excellent progress against this particular aspect of the condition. 3. Decision making processes related to the installations of ropes. As per condition 4, suitable approaches to determine the impact of the seed mussel collectors on the local seabed are being investigated. 4. Some of the revisions made to the management plan (2014-18) were made at the request of the client to reflect a more precautionary strategy, including i) no imports from outside Lower Saxony, ii) survey of the subtidal for stable areas to be done, iii) voluntary use of black boxes by the mussel vessels and iv) threshold changed from two years to one year (see above). <p>All of the above was presented to and discussed with the stakeholders listed in Annex 1 at the stakeholder gathering in Hooksiel on the 27th January, and will be presented to the Niedersachsen National Park Board later this year. In 2014 the National Park Board was twice informed and invited for a trap with a mussel vessel; at the start of the season information is given to the press and all guests.</p>

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		The client has demonstrated good progress and a proactive approach towards discussing the above with a wide range of stakeholders. The team considered that progress against this condition is on target.
	Supporting evidence	<p>PRODUS project (Smaal et al., 2013), see Annex 2</p> <p>Stability map for sublittoral musselbeds in the Wadden Sea of Lower Saxony (van Stralen, 2015) – see Annexes 4 and 5</p> <p>Gittenberger, 2015 – see Annex 3 for full report. A presentation of the study’s results was also given by the author at the stakeholder meeting on the 27th January 2015.</p> <p>National Park Board membership list</p>
	Conclusion Year 1 audit	Progress against this condition is on target

6.9. CONDITION 9: RESEARCH PLAN (ALL UOCs)

Fishery-specific management system		3.2.4 – Research plan
Condition		<p>There are information gaps concerning:</p> <ul style="list-style-type: none"> • The immediate impacts of fisheries and sub-tidal stocks. • The seed fishery in the intertidal could still have an impact on the development of stable mussel beds by removing seed mussels from the mussel locations that are open for the fishery (see condition 1). • Impact of mussel ropes and culture plots on the benthos • Risk of introducing non-native species into the surrounding ecosystem when practicing translocation. <p>The fishery should engage with relevant stakeholders to support the development of a research plan that will focus on the information gaps related to the all Unit of Certification to achieve the objectives consistent with MSC’s Principles 1 and 2. This research plan should provide the framework to address condition 1 to 8.</p>
Milestones		Year 1: The fishery should engage with relevant stakeholders to develop a research plan that will focus on the information gaps related to all Unit of Certification to achieve the objectives consistent with MSC’s Principles 1 and 2. In particular the research plan should focus on issues summarised below where information gaps exists.
Client Action Plan		As per condition 8
Year 1	Progress on Condition	The client used the results of the MSC assessment process to inform on important information gaps in the Lower Saxony mussel fishery and established a research plan on this basis. The research plan was presented to stakeholders at the stakeholder gathering on the 27 th January 2015 and to MEP on 9 February 2015.
	Supporting evidence	Research plan – see Annex 6
	Conclusion Year 1 audit	Progress against this condition was ahead of target. Considering the research plan is now in place and has been discussed with stakeholders, the team felt that this condition can be closed. SG80 is now met.

6.10. CONDITION 10: REVIEW OF THE FISHERY-SPECIFIC MANAGEMENT SYSTEM (ALL UOCs)

Fishery-specific management system		3.2.5 – Review of the fishery-specific management system
Condition		<p>The review is undertaken by the fisheries and the environmental administration, i.e. the two parties responsible for the management system. During the first phase of the Management Plan (1999-2003), there was an advisory council to the research project accompanying the Management Plan, which critically reviewed the plan and its results. This practice, however, which could be regarded as an external review, was discontinued under subsequent plans, as it was felt that a suitable solution had been reached.</p> <p>A system of more regular and formalized internal reviews and of regular or occasional external evaluations of the management system should be introduced</p>
Milestones		<p>Year 1: The fishery should engage with relevant stakeholders to demand a system of more regular and formalized internal reviews and of regular or occasional external evaluations of the management system should be introduced.</p> <p>Year 2-5: A system of more regular and formalized internal reviews and of regular or occasional external evaluations of the management system is to be introduced in the next review of the management plan.</p>
Client Action Plan		As per condition 8
Year 1	Progress on Condition	In relation to the management plan, the MoA provide internal review (final review currently underway) while external review is provided by the National Park Board, on which all key stakeholders are represented. Minutes of the meeting of the National Park Board (25 June 2014) show that the board was consulted about the management plan and stakeholders requested to provide comments.
	Supporting evidence	Minutes of National Park Board meeting, 25 June 2014 National Park Board membership list
	Conclusion Year 1 audit	Progress against this condition is on target

7. RESPONSE TO MSC TO

On 13/3/15, MEP received some Technical Oversight comments from MSC on this report, in relation to the proposed UoC change discussed under Section 4. A response to the TO comments is provided in the following section.

In relation to the use of trawls as well as dredges by the fishery, MSC made the following points:

- *The RBF was also used to assess P11.1.1, but the susceptibility (selectivity in particular) against the trawl net was not considered at that time (PCR, PSA, page 175, “The mussel dredge is design to capture mussel seed and it is highly selective”).*

- *The RBF was not used to assess PI 2.3.1 (PCR, page 81) and rationale in the scoring guideposts was partially based on the type of fishing method (mussel dredge), not considering trawl net: “Direct effects of this fishery on ETP species are considered highly unlikely as a consequence of fishing method and low fishing speed.”*

Although there is no practical difference in the impacts of a mussel dredge and a beam trawl on either the target species (mussels) or the likely effect of ETP species, the MSC requires that these PIs are rescored for the beam trawl, which is done in the following sections. We also provide some further information on the trawl and its use, for information.

7.1. THE USE OF BEAM TRAWLS IN THIS FISHERY

Firstly, it is useful to point out some basics about fishing for seed mussels, which is not like fishing for infaunal or semi-infaunal bivalves such as scallops or clams. Mussels may sometimes be found partially buried in the sediment, but this is not the moment when they are fished. When mussels feed they take in quantities of suspended sediment from the water column alongside organic matter, and expel this sediment packaged in the form of faeces or pseudofaeces to the seabed. Generally, in soft sediment areas (depending on the amount of scouring of the bottom by waves and/or tidal currents) this ‘mussel mud’ accumulates under the mussel bed, and creates a low friction layer which makes it easy to remove mussels from the seabed without the need to dig into the sediment. The mussel mud may be very soft and organic-rich, or may be more compacted and clayey, depending on the amount of erosion, density of mussels, rate of feeding and amount of suspended sediment. Under a dense mussel bed, mud may accumulate to the depth of several tens of centimetres over the course of a season.

The fishery may use either dredges (Figure 5) or beam trawls (Figure 6) to fish seed mussels. The choice between the two gear types depends on two things: i) the amount and density of the mussel mud and ii) the strength of the mussel shells. A trawl will be preferred where mud is deep and soft, because a dredge picks up too much sediment, making cleaning and sorting more laborious, while a trawl scoops the mussels off the top while leaving the sediment layer more intact. A trawl will also be preferred if the mussel shells are weak (which can happen when small mussels grow very fast in the sub-tidal) because it is less likely to break shells and therefore damage the catch.



Figure 5. Mussel dredges.



Figure 6. Mussel beam trawl. The tickler chains are visible. The coloured material is to protect the net from damage from the bottom and to reduce friction over the bottom.

7.2. RE-SCORING PI 1.1.1 USING THE PSA FOR BEAM TRAWL

In relation to the PSA used to score 1.1.1, MSC highlight ‘selectivity’ (a component of ‘susceptibility’) which they argue may be different for beam trawls and dredges. The rationale for scoring for susceptibility (score given – 2 = medium) from the PSA in the PCR (assuming the use of dredge only) is given below:

The mussel dredge is designed to capture mussel seed and it is highly selective. However mussels are relayed in culture plots and are caught when they reach 4.5 cm at about 2 years of age. Mussels generally produce gametes and are ready to spawn by the time they are 1 year old (between 2 and 3 cm) (Newell, 1989; Tyler-Walters, H., 2002). Therefore spawning is likely to occur before being caught and landed from the culture plots at least once. A risk score of 2 is given.

We consider these points in turn in relation to the beam trawl:

- *‘The mussel dredge is designed to capture mussel seed and it is highly selective’* – so is the mussel trawl. In Figure 6, for example, the modifications made to a mussel trawl compared to a ‘standard’ beam trawl (e.g. used to target flatfish) are very clear. Furthermore, the strong selectivity of both gears relates to a large extent to the area in which they are used. Seed mussel beds are discrete and distinct areas, where mussels dominate the benthic macrofauna to the exclusion of most other species, so demersal fishing in these areas is by definition very selective for mussels.
- *‘mussels are relayed in culture plots and caught when they reach 4.5cm at about 2 years of age’* – there is no difference in the relaying and re-harvesting process for mussels caught by dredge vs. trawl.
- *‘mussels generally produce gametes and are ready to spawn by the time they are 1 year old ... spawning is likely to occur before being caught and landed from the culture plots at least once’* – there is no difference in mussel biology between those caught by dredge vs. trawl.

On this basis, it is reasonable to assume that the score for dredge and trawl for selectivity would be the same. Therefore, no change to the scoring of PI 1.1.1 is required.

7.3. RE-SCORING PI 2.3.1 FOR BEAM TRAWL

In the PCR, this PI scored 80. The rationale for the scoring issues at SG80 are set out below for the original assessment (dredge) and considered below in relation to beam trawls. On this basis, we conclude that the use of dredges vs beam trawls makes no difference to the scoring of PI 2.3.1 at the SG80 level – i.e. all scoring issues are still met. We also considered SG100 – the original assessment team considered that there was not enough information on populations of ETP species to score any of the scoring issues at SG100 as met. This likewise is not affected by the type of gear used for harvesting seed mussels. There is, therefore, no change to the scoring of PI 2.3.1.

SG80 scoring issue a) *The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species*

Rationale: *ETP species that are present in the Lower Saxony Wadden Sea include, seals, harbor porpoise and birds species. There are no direct interactions between mussel dredging and seals, harbor porpoises and birds however. The risk that they will be caught during fishing operations can be considered negligible due to the small net opening and low fishing speed.*

Comment for trawl: As can be seen from a comparison of Figure 5 and Figure 6, the beam trawls are more or less the same size as the mussel dredges. Fishing speed is the same for both types of gear.

The only impacts on ETP species could derive from disturbance during fishing operations and through the impact on food supply. Disturbance of birds and seals is not considered an issue in this fishery. Fishing operations are carried out during short fishing period in a specified fishing area regulated in the fishing license. Eider ducks feeding on wild mussel banks might be disturbed but it is highly unlikely that this would have negative effects on the eider duck population. Oystercatchers are not disturbed since fishing is carried out in the subtidal or with high tide on the intertidal. Oystercatchers are not present on the flats at that moment.

The time period and duration of fishing operations is the same whether trawl or dredge are used. Possible disturbance rates of eider duck would be the same. The location of fishing in relation to oystercatchers is the same.

Concerning the effects of mussel fishing on the food supply of eider ducks an important factor in the evaluation of impacts are that eider ducks are diving birds and also feed on the culture plots. Thus when seed mussels are fished and relocated to culture plots, they can still be a food source for these birds and it is commonly known that eider ducks do feed on the culture plots. The fishery (in the wild) for consumption mussels will remove the mussels from the system. However also this activity is restricted by the rule that these mussels should have a minimal size of 5cm and that this fishery is only allowed in the sub-tidal. In general most mussels in the intertidal do not reach this size since they will either be fished and trans located or perish before they reach this size. Therefore the wild fishery for consumption mussels is quite a rare event and does not have a significant impact on the average total mussel stock present in the system. (However under PI 2.4.3 a condition is attached to the question whether sub-tidal mussel beds could develop in certain areas when left unfished.)

The location of culture plots and the type and density of mussels relaid on them are the same whether the mussels have been fished with dredge or trawl. Therefore, bird feeding on the culture plots is not changed. Rates of wild fishing for consumption sized mussels are not related to the type of gear.

It has been considered by the team that intertidal mussel beds have been largely replaced by reefs of the invasive species pacific oyster. On these oyster reefs mussels are still present between the oysters. Oystercatchers still feed on these mussels and it has also been concluded that they have developed techniques to open smaller oysters (Markert, in press.). The oyster beds thus form an important new food source for this species. Eider ducks on the other hand cannot feed on oysters and the structure of the oyster beds prevents them from feeding effectively on the mussels attached to the oysters.

Oystercatchers feed mainly on shellfish, blue mussels and cockles have always been their most important food items. Thus during low tide the majority of birds are located on blue mussel

beds and on sand flats with cockles and to a lesser degree in areas with Mya and Scrobicularia. Oystercatchers are known to be very territorial which restrict the density of birds when feeding. This means that not the total biomass of mussels that is present is important but merely the areas where the birds can feed such as cockle beds or mussel beds.

The population of oystercatcher has increased up to the 1990s but has shown a decrease since in the Dutch, and Schleswig Holstein Wadden Sea areas. It is assumed that the decrease was induced by low shellfish stocks in the early 1990's and the reduction in the area of intertidal mussel beds. In Niedersachsen the breeding population is considered stable (JMBB, 2010). The number of staging birds however has decreased considerably in the last 20 years (JMBA 2011). Concerning the impact of the fishery on oystercatchers the team has considered that nowadays large parts of the intertidal cannot be fished because of the presence of oysters and oyster reefs and that the fishery will be closed when the total area of intertidal mussel beds falls below 1000 hectares. Considering this and the fact that oystercatchers can also feed on oyster beds that cannot be fished by the fishermen the team has judged that it is highly likely that the effects of the fishery are within limits of national and international requirements for protection of ETP species.

The type of gear used to fish seed mussels has no impact on eiderduck and oystercatcher feeding ecology or long-term population dynamics. The regulations in relation to closures and areas of intertidal mussel bed are not related to the type of gear used.

SG80 scoring issue b): *Direct effects are highly unlikely to create unacceptable impacts to (on) ETP species*

Direct effects of this fishery on ETP species are considered highly unlikely as a consequence of fishing method and fishing speed. ETP species that are present in the Lower Saxony Wadden Sea include, seals, harbor porpoise and birds species. There are no direct interactions between mussel dredging and seals, harbor porpoises and birds however. The risk that they will be caught during fishing operations can be considered negligible due to the small net opening and low fishing speed

Fishing speed, net opening and gear footprint are the same whether a dredge or a trawl is used.

SG80 scoring issue c): *Indirect effects have been considered and are thought unlikely to lead to unacceptable impacts*

The indirect effects of the fishery have been considered by considering the impact of the fishery in the intertidal on the food supply of oystercatchers. This indirect impact is limited through restrictions on the fishery in the intertidal as described above. From data on fishing activities in recent years it is also clear that fishing activity in the intertidal has been low. Most mussel seed was harvested in the sub-tidal area. The team therefore considers it unlikely that the fishery has created unacceptable impacts

Restrictions in the intertidal and the ratio of harvesting between the intertidal and the subtidal is not affected by the use of dredge vs. trawl.

8. TRACKING AND TRACING OF FISH PRODUCTS

Although in the Public Certification Report for this fishery it was specified that MSC Chain of Custody (CoC) should commence at the vessel level due to an identified risk of mixing MSC with non-MSC mussels, a statement was issued by the fishery's previous CAB FCI on the 29th July 2014, retracting this requirement. The statement can be found here: http://www.msc.org/track-a-fishery/fisheries-in-the-program/certified/north-east-atlantic/germany-lower-saxony-mussel-dredge-and-mussel-culture/assessment-downloads-1/20140729_CoC_Requirement_Change_MUS328.pdf. The traceability and separation of MSC and non-MSC products in this fishery is now ensured through the following measures adopted by the client:

1. For the duration of the 2014 – 2018 blue mussel management plan, no imports will be taking place from outside the Wadden Sea. This measure has been adopted in the draft management plan (see Section 5);
2. All Lower Saxony vessels are equipped with a black box which monitors all fishing activities;
3. The history of mussels from the moment of fishing seed mussels to the unloading for sales can be controlled without gaps in addition to the actual log books from the Fisheries Office;
4. In the case that non MSC certified mussels are translocated to Lower Saxony, a written request has to be made by the farmer to the Fisheries Office, detailing the period, the quantity, the origin and the plot where the mussels will be relayed. The future of these mussels can then be followed with the black box system on board the vessels;
5. Although wild adult mussels can in theory be fished from subtidal beds (note that this is not common practise due to the instability of the beds), any wild mussels would have to be relayed onto culture plots to adhere to sanitary requirements.

A review of sales documentation satisfied the team that no mussels had been sold as MSC prior to this change coming into effect. **Should there be a change in the measures listed above, the client should inform MEP immediately.**

9. CONCLUSION AND CERTIFICATION RECOMMENDATION

Re-scoring of performance indicators at the first surveillance is summarized in the table below.

On the basis of the first surveillance audit the team concludes that the client has made good progress on the conditions and that 4 out of 10 conditions are now closed.

On the basis of the above, the Germany Lower Saxony mussel dredge and mussel culture fishery **should** retain its MSC certification for another year.

	Component	Performance Indicator		Initial assessment			Year 1		
				UoC1	UoC2	UoC3	UoC1	UoC2	UoC3
Principle 1	Outcome	1.1.1	Stock status	91.4	91.4	N/a	91.4	91.4	N/a
		1.1.2	Reference points	80.0	80.0	N/a	80.0	80.0	N/a
		1.1.3	Stock rebuilding	N/a	N/a	N/a	N/a	N/a	N/a
	Management	1.2.1	Harvest Strategy	85.0	85.0	N/a	85.0	85.0	N/a
		1.2.2	Harvest control rules and tools	90.0	90.0	N/a	90.0	90.0	N/a
		1.2.3	Information and monitoring	80.0	80.0	N/a	80.0	80.0	N/a
1.2.4		Assessment of stock status	80.0	80.0	N/a	80.0	80.0	N/a	
Principle 2	Retained species	2.1.1	Outcome	100.0	100.0	100.0	100.0	100.0	100.0
		2.1.2	Management	100.0	100.0	100.0	100.0	100.0	100.0
		2.1.3	Information	80.0	80.0	80.0	80.0	80.0	80.0
	Bycatch species	2.2.1	Outcome	100.0	100.0	100.0	100.0	100.0	100.0
		2.2.2	Management	80.0	80.0	80.0	80.0	80.0	80.0
		2.2.3	Information	80.0	80.0	80.0	80.0	80.0	80.0
	ETP species	2.3.1	Outcome	80.0	95.0	95.0	80.0	95.0	95.0
		2.3.2	Management	80.0	80.0	80.0	80.0	80.0	80.0
		2.3.3	Information	80.0	80.0	80.0	80.0	80.0	80.0
	Habitats	2.4.1	Outcome	60.0	80.0	80.0	60.0	80.0	80.0
		2.4.2	Management	60.0	80.0	80.0	60.0	80.0	80.0
		2.4.3	Information	75.0	75.0	80.0	75.0	75.0	80.0
	Ecosystem	2.5.1	Outcome	80.0	80.0	60.0	80.0	80.0	80.0
		2.5.2	Management	80.0	80.0	60.0	80.0	80.0	80.0
		2.5.3	Information	80.0	80.0	75.0	80.0	80.0	80.0
Principle 3	Governance and Policy	3.1.1	Legal and customary framework	100.0	100.0	100.0	100.0	100.0	100.0
		3.1.2	Consultation, roles and responsibilities	85.0	85.0	85.0	85.0	85.0	85.0
		3.1.3	Long term objectives	90.0	90.0	90.0	90.0	90.0	90.0
		3.1.4	Incentives for sustainability	80.0	80.0	80.0	80.0	80.0	80.0
	Fishery-specific management system	3.2.1	Fishery specific objectives	80.0	80.0	80.0	80.0	80.0	80.0
		3.2.2	Decision making processes	75.0	75.0	75.0	75.0	75.0	75.0
		3.2.3	Compliance and enforcement	100.0	100.0	100.0	100.0	100.0	100.0
		3.2.4	Research plan	70.0	70.0	70.0	80.0	80.0	80.0
		3.2.5	Management performance evaluation	70.0	70.0	70.0	70.0	70.0	70.0

10. SURVEILLANCE SCORE

In accordance with the MSC Certification Requirements, the frequency of future surveillance visits was calculated for this fishery. The overall surveillance score is calculated by adding the scores from Table 2 and matching those with the Surveillance Level in Table 3.

This fishery's score was calculated at 8, which implies a normal surveillance level with annual on-site surveillance audits.

Table 2. Criteria to determine Surveillance Score

Criteria	Surveillance Score	This Fishery
1. Default Assessment Tree used?		
Yes	0	2
No	2	
2. Number of conditions		
Zero conditions	0	2
Between 1 – 5 conditions	1	
More than 5	2	
3. Principle level Scores		
≥85	0	2
≤85	2	
4. Conditions on outcome PIs?		
Yes	2	2
No	0	
Total Score		<u>8</u>

Table 3. Surveillance level

Surveillance score (from Table C3)	Surveillance level		Years after certification or recertification			
			Year 1	Year 2	Year 3	Year 4
2 or more	Normal Surveillance		On-site surveillance audit	On-site surveillance audit	On-site surveillance audit	On-site surveillance audit & recertification site visit
1	Remote Surveillance	Option 1	Off-site surveillance audit	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit & recertification site visit
		Option 2	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit	
0	Reduced Surveillance		Review of new information	On-site surveillance audit	Review of new information	On-site surveillance audit & recertification site visit

11. REFERENCES

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ANNEX 1. STAKEHOLDER MEETING ATTENDANCE RECORD

Note: table lists all stakeholders invited to the meeting by the Niedersächsische Muschelfischer GbR

Name	Surname	Organisation	Present?
Michel	Hilscher	-	yes
Manfred	Vollmer	CWSS	yes
Arjan	Gittenberger	GIMARES	yes
Cora	Seip	H&S Consultancy	yes
Jaap	Holstein	H&S Consultancy	yes
Phillip	Oberdorffer	Landwirtschaftskammer	yes
Hilke	Looden	Landwirtschaftskammer Niedersachsen	yes
Jo	Gascoigne	MEP	yes
Chrissie	Sieben	MEP	yes
Karel-Jan	van IJsseldijk	Mussel farmer	yes
Wolfgang	Christoffers	Mussel farmer	yes
André	de Leeuw	Mussel farmer	yes
David	de Leeuw	Mussel farmer	yes
Gerald	Millat	Nationalparkverwaltung	yes
Manuela	Gubernator	NM	yes
Thorsten	Brandt	Staatliches Fischereiamt	yes
Hermann	Verheij	Waddenvereniging NL	yes
Hans-Ulrich	Rösner	WWF, Wattenmeerbüro	yes
Sandra	Schöttner	Greenpeace	no
Thilo	Maack	Greenpeace	no
Heike	Vesper	WWF, Leiterin Meeresschutz, Hamburg	no
Viola	Liebich	WWF, Wattenmeerbüro	no
Jorg	Schmiedel	BUND	no
Kim	Detloff	NABU	no
	Rainer	Borcherding	no
Lutz	Wessendorf	BLE	no
Volkert	de Jong	CWSS	no
Olaf	Prawitt	Landwirtschaftsministerium	no
Minister	Wenzel	Umweltministerium	no
Hubertus	Hebbelmann	Umweltministerium	no
Peter	Südbeck	Nationalparkverwaltung	no
Lothar	Fischer	Deutscher Fischerei Verband	no
Peter	Breckling	Deutscher Fischerei Verband	no
Dirk	Sander	Landesfischereiverband Weser-Ems	no
Thomas	Neudecker	Von Thünen Institut	no
Kai-Arne	Schmidt	Erzeugergemeinschaft Kutterfischer	no
Paula	Huissen	PO Mosselen	no
Peter	Ewaldsen	Schleswig-holsteinische Muschelzüchter	no

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Achim	Wehrmann	Forschungsinstitut Senkenberg	no
Edda	Bartelt	Veterinäramt	no
Katrin	Sassen	Veterinäramt	no
Wilfried	Rodiek	Wasser- und Schifffahrtsamt	no
Kai-Uwe	Bielefeld	Beirat Nationalpark Niedersachsen	no
Martin	Dehrendorf	Beirat Nationalpark Niedersachsen	no
Jens	Graul	Beirat Nationalpark Niedersachsen	no
Hans	Janssen	Beirat Nationalpark Niedersachsen	no
Dietmar	Patron	Beirat Nationalpark Niedersachsen	no
Harm-Uwe	Weber	Beirat Nationalpark Niedersachsen	no
Barbara	Schlag	Beirat Nationalpark Niedersachsen	no
Rolf	Blumenberg	Beirat Nationalpark Niedersachsen	no
Jürgen	Buss	Beirat Nationalpark Niedersachsen	no
Frank	Ulrichs	Beirat Nationalpark Niedersachsen	no
Kristin	Mahlitz	Beirat Nationalpark Niedersachsen	no
Holger	Wesemüller	Beirat Nationalpark Niedersachsen	no
Alfred	Schumm	Beirat Nationalpark Niedersachsen	no
Jörn	Wrede	Beirat Nationalpark Niedersachsen	no
Hans-Joachim	Ropers	Beirat Nationalpark Niedersachsen	no
Joachim	Peters	Beirat Nationalpark Niedersachsen	no
Jörg	Orlemann	Beirat Nationalpark Niedersachsen	no
Erich	Hinrichs	Beirat Nationalpark Niedersachsen	no
Dirk	Tramsen	Beirat Nationalpark Niedersachsen	no
Leenert	Cornelius	Beirat Nationalpark Niedersachsen	no
Hermann	Möhlmann	Beirat Nationalpark Niedersachsen	no
Holger	Kohls	Beirat Nationalpark Niedersachsen	no
Martin	Salverius	Beirat Nationalpark Niedersachsen	no
Holger	Freund	Beirat Nationalpark Niedersachsen	no
Michael	Kleyer	Beirat Nationalpark Niedersachsen	no
Eva	Hacker	Beirat Nationalpark Niedersachsen	no
Eick	von Ruschkowski	Beirat Nationalpark Niedersachsen	no
Martin	Waldhausen	Beirat Nationalpark Niedersachsen	no
Stefanie	Hedtkamp	Beirat Nationalpark Niedersachsen	no
Beatrice	Claus	Beirat Nationalpark Niedersachsen	no
Maike	Bielfeldt	Beirat Nationalpark Niedersachsen	no
Peter	Doescher	Beirat Nationalpark Niedersachsen	no
Wilke	Siebels	Beirat Nationalpark Niedersachsen	no

ANNEX 2. PRODUS REPORT SUMMARY

From: Smaal A.C., Craeymeersch J., Drent, J., Jansen, J.M., Glorius, S. and van Stralen, M.R. 2013. Effecten van mosselzaadvisserij op sublitorale natuurwaarden in de westelijke Waddenzee. Samenvattend eindrapport. Produs Rapport C006/13 PR1, IMARES - Institute for Marine Resources & Ecosystem Studies. Available online at: <http://www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2013/05/14/effecten-van-mosselzaadvisserij-op-sublitorale-natuurwaarden-in-de-westelijke-waddenzee.html>

Background

The mussel farming industry in the Netherlands is based on bottom culture. These bottom cultures exist primarily in the mussel plots of the western Wadden Sea and the Oosterschelde estuary, in areas constantly under water during both high and low tides (sublittoral). The culture of mussels begins with young mussels (mussel spat), which are traditionally fished and collected from natural mussel spat beds in the Wadden Sea. Not only does this fishing of mussel spat require a permit based on national fisheries laws in the Netherlands, but as the Wadden Sea is a protected natural area a permit is also required for fishing in the area under the Nature Protection laws.

The granting of the permit under the Nature Protection laws requires proof that the fisheries have no adverse effects on designated conservation objectives for the habitat type in which fishing takes place. This report describes the effects of mussel fishery on the natural values below low tide. Research was carried out in the period 2006 - 2012 and was commissioned by the Ministry of Economic Affairs and the Producer Organisation of Dutch mussel culture.

Research Approach

At the start of the study in 2006, the conservation objectives had not been established. Therefore, a literature study was carried out to better understand what the natural values of the sublittoral western Wadden Sea are. On this basis, a number of variables were identified in which the PRODUS research would focus on. This included the development and buildup of the mussel stocks, the composition and nature of the benthos, fish populations, soil properties and the spatial structure of the mussel habitat (the environment in which the mussel bed is located). The effects of mussel fishery were determined by 40 research sites on eight hectares set in areas where new mussel spat beds are formed.

Each location was divided into two equal 4ha sections, one section was closed to fishing for mussels, while the adjacent section was open to fishing. These study sites could not all be established at the same time because there needed to be enough new spat in each area, which depends on natural spat fall, and this varies from year to year. In 2006 the sampling started in 10 sites, then the number of sites increased each year from 2010 to eventually include 40 sites. Due to various reasons 3 plots were omitted from the analyses.

The benthos and fish in the sections were sampled using a dredge which would collect material larger than 5 mm over a surface area of 30 m² per pull. Two pulls were taken in each 4ha section. A box core was also used to sample the smaller benthos and sediment. The top 5 cm of sediment was sampled and organisms greater than 1 mm were sieved out. Box cores sampled an area of 0.06 m² per box and 12-20 samples were taken per 4ha section.

Mussels are generally fished twice a year; in the autumn on the newly formed spat beds, particularly in beds that are relatively unstable and therefore have a greater chance of disappearing in winter; and a second time following the spring, in the remaining beds in the more stable areas. In the study, the effects of the autumn and the spring fishery were analyzed separately. The fishing effort was determined based on data on ship movements, registered by an on-board black box. This data showed that most open sections were intensively fished, unless there was a paucity of mussels.

Parallel to the research in open and closed sections, a Wadden Sea wide survey was conducted in 2008 in which the benthic composition in the sublittoral areas of Wadden Sea was determined. In the period 2008 - 2010 there was also a comparison of the benthic composition and environmental characteristics of wild mussel beds and mussel plots. Furthermore, in 2009 and 2010 some of the larger mussel beds were permanently closed to fishing, and a study was conducted to investigate what the consequences for the mussel beds were. The results of the survey, the comparison of wild beds and plots as well as open and closed sections, and developments in the closed mussel beds are included in this PRODUS report.

Interim evaluation

In response to a statement by the State Council in 2008, declaring that the permit for mussel fishery in 2006 was not validly issued, an interim evaluation of the PRODUS study was conducted in 2008. The State Court was concerned that because the PRODUS investigation had not yet been completed, it could not be demonstrated that there would be no significant effects of mussel fishery on nature in the Wadden Sea. They consequently, urgently posed the question of whether the study could be accelerated while also producing sufficiently useful results. The evaluation concluded that an accelerated completion was not possible as a result of a trailing spat fall. In addition, they suggested that more attention was needed for abiotic factors and the question was raised whether a closed area of 4ha was not too small. Furthermore, the evaluation asked for a more reliable estimate of biodiversity. This resulted in an interim adjustment of the research plan and an extension of the study period by two years.

Developing mussel stock

The study showed, as expected, that immediately after the spring fishing fewer mussels remained on the open sections compared with the closed sections. The differences between open and closed sections reduced over time, but after some years differences were still detectable. After the autumn fishery, no significant differences were found between open and closed sections. In these unstable areas, mussel spat beds disappeared at the same rate in both the open and the closed sections. It also appeared that after some years almost no older mussels remained. Of two larger wild beds that were closed for fishery in 2009 and 2010, one survived and one disappeared.

At three out of 37 locations considerable mussel biomass survived for a number of years, one of them in unstable areas and 2 in relatively stable areas. Total biomass of two closed plots turned out to be higher than open plots

An important research question was to what extent the fishing of mussels affected the subsequent spat fall. In this regard, the analysis distinguishes between a large spat fall which occurs on average every two years, and a limited spat fall with a density of less than 100 spat per m² which occurs every year. It appeared that large spat falls were not positively correlated with densities of mussels already present and are potentially larger in areas without mussels.

However, spat falls in low densities occur primarily in amid mussels already present. In addition, no difference is observed between open and closed sections.

The relationship between mussel presence and biodiversity

There was a positive relationship between biodiversity and the presence of mussels. Locations where mussels are present are "hot spots" for biodiversity in the western Wadden Sea. There are significantly more benthic species found in locations with mussels. The Wadden Sea wide survey found that samples in which mussels were found had two times higher species richness and biomass than samples without mussels.

The comparison of wild mussel beds with plots show that more species (102) were found in the plots than in wild beds (84). Total abundance of soft substrate species was higher on the wild beds than on the plots.

The occurrence of characteristic species for the sublittoral habitat type also differed. On the plots the typical species including mussels, crabs and sea stars were more numerous than on the wild banks. The soft-shell clam, *Mya arenaria*, and the Baltic clam, *Macoma balthica*, were more frequently found on wild beds than on plots. The plots were generally located in areas with a higher salinity than the beds. So there are similarities between wild beds and plots but also important differences. After correction of the salinity differences, by comparing culture plots in the vicinity of wild beds, it shows that species numbers were higher on wild beds. It is concluded that culture plots and wild beds show differences but are both a suitable habitat for a species rich benthic community.

Effects of the mussel spat fishery on natural values

The effects of mussel fishery are analyzed on the basis of a comparison between the 4ha sections that were either open or closed to fishing. To determine whether the surface area was not too small, an investigation of edge effects was conducted. There was no evidence to suggest that the sections were too small.

The dredge samples showed that the larger benthic species richness is higher in places where more mussels are present. Directly after fisheries species richness, abundance and density of characteristic species such as shore crab, and sea anemone were lower on fished plots. Later on the differences disappeared. For smaller benthic samples taken with the box core, there was a significantly higher species richness and total abundance per species observed in the open versus closed sections immediately after the spring fishery. There was a significant effect on species diversity 1-1.5 years after fishing: it was higher in the open plots. For autumn fishery these differences were no observed.

There were both positive and negative associations of fish species with mussel beds found. Species that were positively associated include rock gunnel, black goby, ocean pout, greater and lesser pipefish, Montagu's sea snail, father lashers and five bearded rockling. Species that were negatively associated include plaice, small sand eel, flounder and sole. In locations where fishing led to a decrease in mussel densities there was a corresponding response in associated fish. However, only the decrease of positively associated species immediately after fishing was significant.

With regard to the grain-size fraction of the sediment and sludge it was determined that there was a large variation among the locations and a development over time. The only significant

difference between open and closed sections was found for the sludge fraction <63 µ immediately after fishing.

The habitat structure was mapped with a side scan sonar and a spatial auto-correlation program. There was a positive relation between the parameter Morans I with mussel biomass. Directly after spring fishery there was a significant decrease in structure in fished plots. After 1 and 2 years the difference was not detectable anymore.

Conclusions

Mussel seed fishery has short term impacts on natural values of wild beds. The difference between open and closed plots does not sustain. For the longer term it shows that on a few locations older mussel stocks were still there, with higher biomass in closed plots. It was also shown that mussel beds are "hot spots" for biodiversity in the western Dutch Wadden Sea. Species richness in mussel plots was at least similar to wild beds. This shows that translocation of mussels has no negative impact on biodiversity. In how far biodiversity on wild beds would increase over time in the absence of fishery remains to be seen. It is noticed that culture plots are located in areas close to the North Sea in higher salinity regions. This is positive for biodiversity and stimulates the biodiversity of culture plots.

On the beds, where fishing takes place in the autumn, mussels decline not only from the open sections but also the closed sections. This is related to the decision to fish in the relatively unstable beds in the autumn, where the probability of survival for the mussels is lower. Fishery in the spring, in the relatively stable areas leads to significantly lower mussel numbers in the open sections compared to the closed sections. Although the numbers of mussels in both sections decrease, the difference is only visible for a few years. As development of older beds seems to be a rare event, no answer could be given on where and when this might happen. We observed longer term survival on 3 out of 37 locations.

Fishery also has an impact on the benthic community. Species number and densities of larger benthic organisms such as crabs and anemones, are lower after fishery in open plots. Also for the infaunal benthic species, such as the worms, lower species numbers and densities were observed after fishery in the open plots. The response of the fish to mussel fishery varies by species. Positively associated fish species declined directly after fishery in open plots. On the short term, impact of fishery on benthos and fish was significant, for the subsequent sampling periods no clear differences between open and closed plots have been detected.

The effects of mussel fishery on the benthic community vary between spring and autumn fishery. After the autumn fishery no differences for most variables, including mussel biomass, between open and closed plots were found. After the spring fishery, impacts were detected, and remained visible for 2 years after fishery. After this period, differences faded out, as mussels also disappeared from closed plots. Fishery impacts were visible, particularly from spring fishery, for the short term. For the long term no conclusions can be drawn as the research period was 6 years. It is therefore recommended to monitor developments of beds that are permanently closed in the actual policy framework.

The Natura 2000 goals are focused on the presence of mussel beds in various stages of development. From our study it is concluded that the closure of an area to fishing does not determine whether mussel beds will develop. A better survival was observed on closed plots after spring fishery, that can be considered as an indication for better development of beds

without fishery. Also other factors, such as predation by starfish, play a role in the development of mussel beds. The outcomes of the study can be used for further development of nature conservation and sustainable mussel culture objectives.

ANNEX 3. RISK ANALYSIS OF MUSSEL TRANSPORTS WITHIN THE WADDEN SEA

Risk analysis of mussel transports within the Wadden Sea

Issued by: Niedersächsische Muschelfischer GbR



A. Gittenberger

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Introduction

This risk analysis focuses on the probability that the transport of mussels within the Wadden Sea raises the risk that non-native species have a significant impact on the ecosystem. To do this the risk assessment protocol for shellfish transports of the Dutch government is used. Hereby the probability is assessed that:

- [1] non-native species are introduced with shellfish transports into an area where they didn't occur yet,
- [2] non-native species are able to settle within an area where they didn't occur yet because of shellfish transports,
- [3] non-native species are able to expand their populations within the Wadden Sea because of shellfish transports, and finally
- [4] non-native species have a significant impact on the ecosystem because of shellfish transports.

To study these aspects we focused on the natural distribution capacities of non-native species within the Wadden Sea, and the habitats where most non-native species are found, i.e. the non-native species hotspots in the Wadden Sea. In addition the importance of a species specific risk assessment is described for species that are present areas where from mussels are transported, but are not present areas in the Wadden Sea where they are imported.

Natural distribution capacities of non-natives within the Wadden Sea

Most marine species have a pelagic life-stage during which they distribute themselves with the sea currents. Depending on the strength of the currents and the duration of this pelagic life-stage they can distribute themselves over large distances. They can also use the sea-currents for their distribution by hitchhiking on drifting algal assemblages, wood or other floating objects. The thongweed *Himantalia elongata* for example commonly washes ashore in the Wadden Sea. As this species does not occur in The Netherlands and Belgium, these individuals most likely origin from the French and British coasts and have drifted along the south-north current up to the Wadden Sea. This is also confirmed by the large variety of organisms, which are often still alive, that are found on these thongweeds. Among these species there are other algal species but also animals like barnacles, crabs, snails and hydroids that are known to occur in France and Britain. For most of these species the Wadden Sea waters are probably too cold. They therefore don't settle there and do not pose a threat.

In fact, by using the general south-north current along the western European coast (Turrell et al., 1992), most species that are present in the Dutch Wadden Sea will be able to distribute themselves by natural means via the Niedersachsen and Schleswig-Holstein Wadden Sea to the Danish Wadden Sea, assuming that the local habitat there is suitable for their settlement. This may happen directly by larvae drifting along in the sea-currents for 2 to 4 weeks, or indirectly by settling on hard substrates like embankments, buoys and structures in harbours that can function as stepping stones on their way north. An example of such a species is the Japanese oyster *Crassostrea gigas*, which was able to distribute itself throughout the Wadden Sea up north along the Danish coast into various Norwegian and Swedish fjords. This has most likely happened by drifting along with the sea-currents (Wrange et al., 2010) as in most of

the Norwegian and Swedish fjords where the Japanese oyster is found, there is little to no boat traffic and no shellfish aquaculture activities. Also the population genetics of the oyster populations within the Wadden Sea supports this.

Although most non-native species live on hard substrates and have an extended pelagic stage during which they can distribute themselves over the whole Wadden Sea, some non-native species do not. Those species usually do not have a significant impact on the ecosystems however and are therefore not considered “invasive” species because of their relatively weak distribution capacities. For such non-species that cannot easily distribute themselves over the Wadden Sea with the sea-currents, shellfish transports may significantly increase the chance that they are introduced into areas where they did not occur yet.

Non-native species in shellfish production areas

From four species inventories focusing on non-native species in the Wadden Sea between 2009 and 2013 (Gittenberger et al. 2010, 2012, 2013), it was concluded that by far most non-native species (> 95 %), can be found in harbours and then especially on the floating docks (Gittenberger et al., 2010). In comparison, within areas with shellfish, only about 45% of the non-native species were found, and most of those species are only found on oyster reefs. Of the species that do occur in between mussels in mussel production areas most only occur in between and on mussels that are at least two to three years old, while only a selection of those species is found to occur in between or on mussel seed and one year old mussels, i.e. about half the number of species that is found on older mussels (Gittenberger et al., 2011). Mussels that are transported within the Wadden Sea usually concern the younger age classes.

Although the diversity of non-native species on mussels that are being transported may be relatively low, there still exists a risk that they are introduced into new areas by these transports. One therefore needs to monitor which species are present in between mussels, for example with a Shellfish Associated Species Inventory. This methodology, used throughout northwestern Europe, was specifically designed to get an accurate overview of the species that are present among the shellfish within a shellfish production area (Gittenberger, 2010). The list of species that is found to occur among the mussels in the export area has to be compared with the list of species known for the import area to assess whether or not a risk exists that non-native species may be introduced with the transports.

To get an accurate and complete view of the non-native species that are already present, it is best to do an assessment of the species in the harbours in the import area as previous studies show that most non-native species will have settled there. If no harbour is close by, a species inventory on an oyster reefs would probably provide the best overview of non-native species settled in the area.

For a good and reliable risk assessment of the transport of mussels throughout the Wadden Sea it is essential to have accurate lists of species that are present in the various regions of the Wadden Sea. Until recently such species lists were apparently not available. Therefore some parties mistakenly concluded that various non-native species in the Wadden Sea were only locally distributed and that one could manage their spread by stopping all mussel transports. Most of the non-native species turned out to be widely distributed in the Wadden Sea however. They were probably missed in previous years because the ongoing monitoring programs did not focus on finding non-native species. As a result of four species inventories in the Wadden Sea since 2009 that did specifically focus on finding non-native species, more than 20 non-native species

new to the Dutch Wadden Sea were discovered and more than 30 species new to the Schleswig-Holstein Wadden Sea were recorded of which about 14 species appear to be new to Germany. Most of these species have probably been overlooked in the past because the habitats in which they settled were never or rarely monitored and/or the taxonomical expertise available was insufficient, e.g. for the algal species.

Conclusions

The high number of species that was found to be new to the Wadden Sea during the recent non-native species inventories can for the most part be explained by the fact that the ongoing monitoring programs in the region did not focus on species that are found on hard substrates like rocks and floating docks. In addition, some taxa, like the macro-algae, appear to be understudied in the region. To effectively assess and manage the risk of non-native species being transported within the Wadden Sea, one should know which native and non-native species are already there. Many non-native species that were only known from the Dutch part of the Wadden Sea for example, were also found to occur the German Wadden Sea during the recent non-native species inventories. As most marine species have a pelagic life stage, it is to be expected that species that occur in the Dutch part of the Wadden Sea also occur in German part. They have probably spread with the general south to north sea-current along the western European coast as is also confirmed by the distribution patterns of these species, which indicate that they can freely distribute themselves within and between the Dutch and German parts of the Wadden Sea. The most important stepping stones in their distribution are probably the harbours, which were found to be main hotspots of non-native species in the Wadden Sea. In comparison the diversity of non-native species found on mussel beds is

relatively low. More in general during the recent non-native species inventories, no indications were found that the transport of mussels within the Wadden Sea will significantly raise the risk that non-native species will increase their distributional range within the Wadden Sea and have a significant impact on the ecosystem.

Schlussfolgerungen

Die hohe Anzahl der als neu fürs Wattenmeer ermittelten Arten, dürfte damit zusammenhängen, dass im Rahmen der vorhergehenden Geländearbeit die festen Substrate vernachlässigt worden sind. Dazu kommt, dass die Arten von einigen Gruppen, wie die Macro-Algen, bis jetzt nur sehr unvollständig aufgesammelt und identifiziert worden sind. Ohne Kenntnis der bereits im Wattenmeer vorhandenen Arten, lässt sich der Einfluss von Invasivarten nicht ermitteln. So ergibt sich zum Beispiel, dass viele nicht-heimischen Arten die bis jetzt nur aus den Niederlanden bekannt waren, auch im deutschen Wattenmeer vorkomen. Das ist an sich auch ganz logisch in Anbetracht der Meeresströmungen. Mit der Süd-Nord Strömung, können die meisten Arten sich im larvalen Stadium durch das ganze Wattenmeer ausbreiten. Im Rahmen der Bestandaufnahmen wurden keinerlei Anzeichen für das Vorkommen irgendwelcher Barrieren für die natürliche Verbreitung von Arten zwischen den Teilgebieten des Wattenmeeres festgestellt. Die Häfen erwiesen sich im ganzen Wattenmeer als ‚Hotspots‘ für das Vorkommen von nicht-heimischen Arten, wohingegen die Gebiete mit Muscheln relativ arm an nicht-heimischen Arten waren. Im Rahmen der Bestandaufnahmen im niederländischen und im deutschen Teil des Wattenmeeres wurden keinerlei Anzeigen dafür gefunden, dass die Muscheltransporte innerhalb des Wattenmeeres einen wesentlichen Einfluss auf die Verbreitung der nicht-heimischen Arten hatten.

Planned species inventories

As explained above, it is unlikely that mussel transports in and from the Niedersachsen area throughout the Wadden Sea will have a significant negative impact on the ecosystem because of non-native species that were aided in their distribution by these transports. Taking into account the precautionary principle however, the risk of transporting mussels will be assessed in the coming years by monitoring the mussel production areas from which the transports may take place, and by assessing for each non-native species found the risk of it being transported together with the mussels. More specific the research plans for the coming years include:

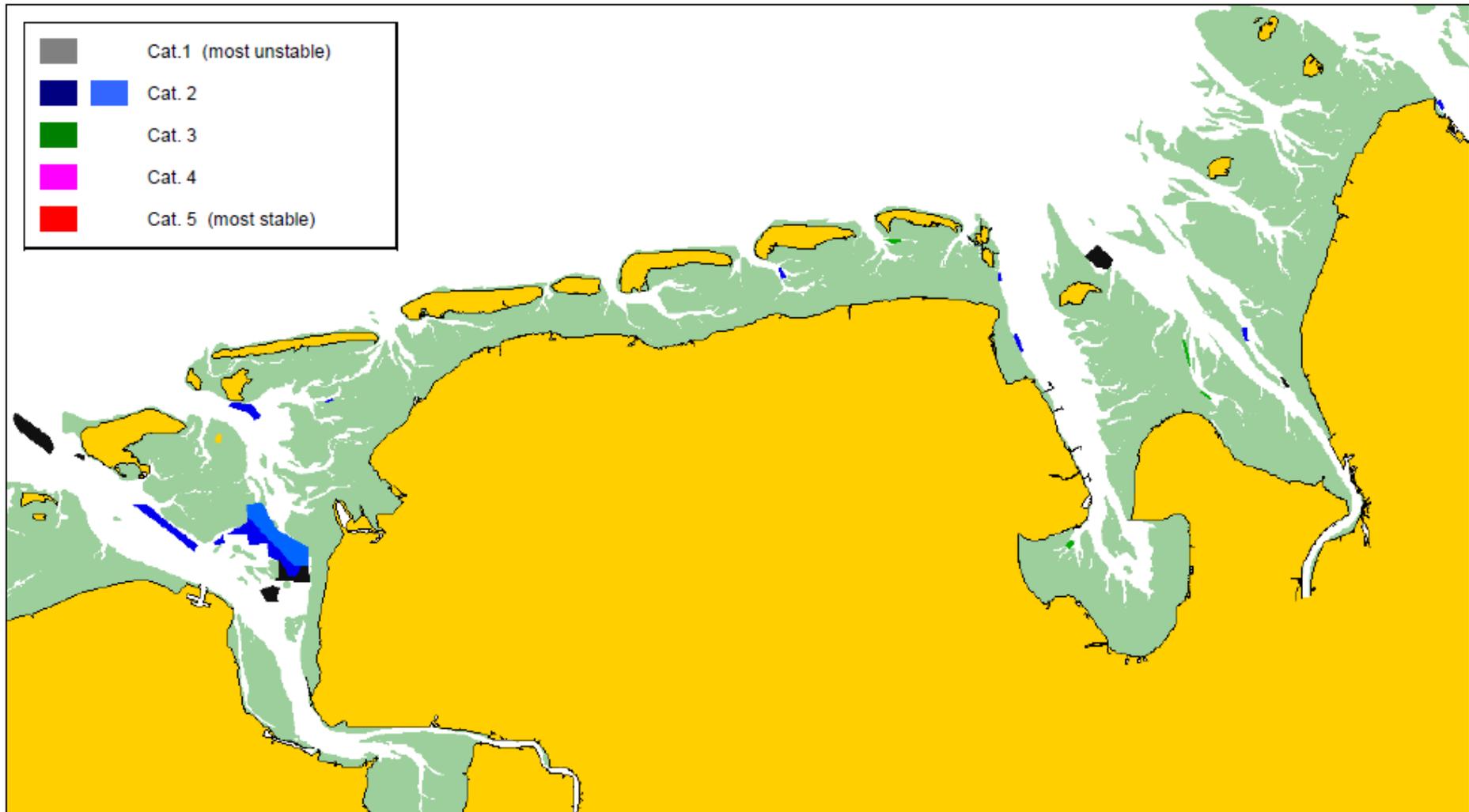
1. Species inventories focusing on all non-native species that are present on and in between the mussels in the mussel production areas in the Niedersachsen Wadden Sea. These inventories will be done following a species inventory methodology, i.e. the Shellfish Associated Species Inventory (SASI), which is also used since 2010 for mussel transports to and within the Netherlands to assess the risk of non-native species.
2. For each of the species recorded, it will be assessed whether it is likely that they will settle, expand their population and impact the ecosystem in the potential import region because of shellfish transports within the Wadden Sea.
3. To effectively assess the risk of non-native species being imported in certain regions within the Wadden Sea, one should know which non-native species are already there. Therefore the non-native species diversity will also be assessed in potential import areas both in and just outside of the mussel production areas, with a focus on known non-native species hotspots like harbours and oyster reefs.

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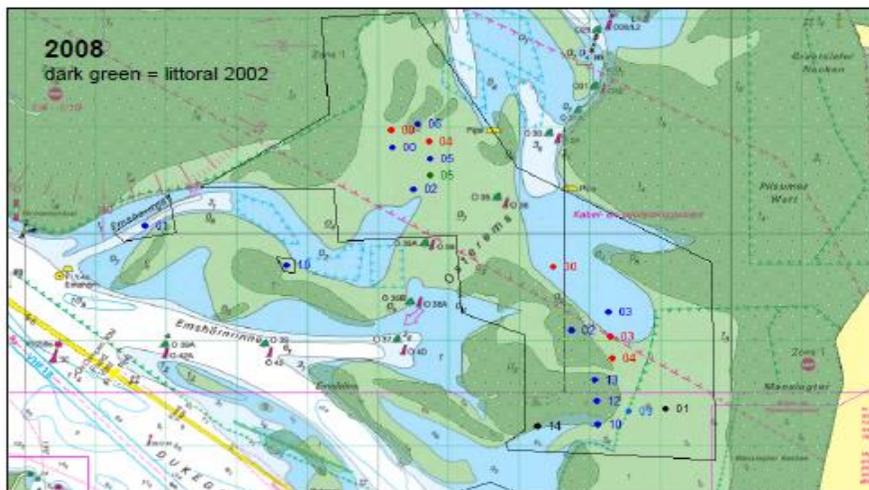
ANNEX 4. STABILITY MAP OF SUBTIDAL MUSSEL BEDS IN LOWER SAXONY

Stability map for sub tidal mussel beds in the Wadden Sea in Lower Saxony – Complete area, version 20 January 2015. The eastern part of the area Ranzel Süd – Manslagter Nacken, which in the early 2000ths probably was classified as category 3, but for the present situation as cat. 2, is colored light blue. Category 4 and 5, as mapped in the Dutch part of the Wadden Sea, are not found in Lower Saxony. Note, the background of the map originates from 2002 and with respect to water depths out dated (van Stralen, 2015).



ANNEX 5. CHANGES IN WATER DEPTH IN THE AREA RANZEL SÜD – MANSLAGTER NACKEN

Changes in water depth in the area Ranzel Süd – Manslagter Nacken, based on sea maps over the period 1998 – 2014. On the map for 2008 as overlaid the littoral areas as present in 2002 is given, together with the outer limits of the accumulated fishing areas as licensed since 2000 (van Stralen, 2015).



ANNEX 6. LOWER SAXONY MUSSEL FISHERY RESEARCH PLAN

Research topics	Action	2014 1. Jahr	2015 2. Jahr	2016 3. Jahr	2017 4. Jahr	2018 5. Jahr
Littoral	Monitoring: National Park authorities	✖	✖	✖	✖	✖
	Comparison fished / non fished areas					
Subtidal	Map stable / unstable	✖	✖ (check)			
	Project fishing unstable bed	✖ (planning)	✖	✖	✖	✖
	Management strategy		✖		✖	✖
	Map stability / management		✖		✖	✖
MZI	MZI Wangerreede Report	✖				
	Deposita Wangerreede	✖ (planning)	✖	✖	(✖) prob. measures	(✖) prob. measures
Import	Import outside the Waddensea	✖				
Translocation	Translocation Ministries MU/ML Management plan	✖				
	GIMARIS Risk analysis	✖				
	GIMARIS Species inventories	✖	✖			
	Management strategy			✖	✖	✖
NGO's	Seasonal opening	✖	✖	✖	✖	✖
	National Park Board	✖		✖		✖
	Homepage	✖			✖	
	Stakeholder		✖		✖	
Dokumentation	Black Boxes maps	I Q 2014 ✖	✖	✖	✖	✖