Marine Stewardship Council (MSC) Announcement Comment Draft Report for Client

Jeong Il Corporation Antarctic krill fishery

On Behalf of

Jeong Il Corporation, Seoul

Prepared by

Control Union UK Ltd.

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Contents

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Role	Signature and date
Originator:	HE 30/01/2020
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Glossary

Acronym	Definition
ARK	Association of Responsible Krill
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
CEMP	CCAMLR Ecosystem Monitoring Program
CM	Conservation Measures
CP	Contracting Party
CPUE	Catch Per Unit of Effort
CU UK	Control Union United Kingdom (Formerly CU Pesca)
DWFDA	Distant Water Fisheries Development Act
EEZ	Exclusive Economic Zone
EFMS	Electronic Fisheries Monitoring System
EMM	Ecosystem and Monitoring
ETP	Endangered, Threatened and Protected (species)
F	Fishing Mortality
FCR	(MSC) Fishery Certification Requirements
FMC	Fisheries Monitoring Centre
FPI	Fishery Performance Indicators
GYM	Generalised Yield Model
HCR	Harvest Control Rules
IPI	Inseparable or Practicably Inseparable (catches)
IUU	Illegal, Unreported and Unregulated (fishing)
KOFA	Korea Overseas Fisheries Association
LTL	Lower Trophic Level (Species)
MCS	Monitoring Control and Surveillance
MOF	Ministry of Oceans and Fisheries
MPA	Marine Protected Areas
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
NIFS	National Institute of Fisheries Science
NQFS	National Fisheries products Quality Inspection Service
PA	Precautionary Approach
PCL	Precautionary Catch Level
PI	Performance Indicator
PRI	Point of Recruitment Impairment
RBF	Risk Based Framework

Acronym	Definition
RFMO	Regional Fisheries Management Organisation
SCIC	Standing Committee on Implementation and Compliance
SG	Scoring Guidepost
SISO	Scheme of International Scientific Observation
SSB	Spawner Stock Biomass
SSMU	Small-Scale Management Units
TAC	Total Allowable Catch
TRP	Trigger Reference Point
UoA	Unit of Assessment
UoC	Unit of Certification
VMS	Vessel Monitoring System
WG-EMM	Working Group on Ecosystem Monitoring and Management

1 Executive Summary

This report is the Announcement Comment Draft report for the MSC full assessment of the Jeong Il Corporation Antarctic krill fishery. The CU UK assessment team consists of Henry Ernst (Team Leader), Dr. Julian Addison (Principle 1), Dr Gudrun Gaudian (Principle 2), Dr Sophie des Clers (Principle 3), and Dr Jung-Hee Cho (Principle 3).

CU have submitted a Variation Request (VR) to the MSC with respect to the MSC COVID-19 derogation effective from the 28th September (https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-supporting-documents/msc-covid-19-guidance-for-cabs-september-2020.pdf) to hold the site visit remotely. If it is accepted remote meetings will be held during the week of the 9th November 2020 over the course of the entire week, and potentially the following week, depending on client and stakeholder availability. A wide range of stakeholders have been invited to participate in this assessment. If the VR is not accepted, COVID-19-related travel restrictions and processes upon arrival in Korea will bear great influence on the dates of the site visit, and these will need to be considered at a later date given the evolving nature of the situation (stakeholders will be kept up to date).

The assessment is being undertaken in accordance with the MSC Fisheries Certification Procedure (FCP) v2.1 and the MSC Standard 2.01 using the default assessment tree throughout the assessment.

The fishery under assessment is the Jeong Il Corporation krill (*Euphausia superba*) fishery taking place in Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) Surbareas 48.1 and 48.2. Fishing activities under assessment are carried out by two vessels, the Kwang Ja Ho, and the In Sung Ho, these have been active in the CCAMLR krill fishery since 2006 and 2000 respectively. Both vessels operate a continuous trawling system, where a pump links the codend to the hold so as to not haul the net aboard throughout fishing operations. The trawl is towed at a depth <150 m and fishing gear is equipped with a mammal protection net and escape window. Bycatch is extremely low, with over 99 % of the catch being comprised of krill. The catch is not sorted or separated (though it is sampled by onboard scientific observers) and is destined to be processed into frozen whole round krill and krill meal. The product under assessment is landed in Busan (Korea) and Fukuoka (Japan).

Antarctic krill (*Eurphausia superba*), the target species of the fishery under assessment, is found across the majority of the Southern Ocean, from the Polar Frontal Zone, to the Antarctic Continental shelf. Largescale krill distribution is influenced by hydrography and bathymetry. Their vertical distribution in the water column follows diel vertical migration patterns, ranging from depths of 0 to 600 metres. *E. superba* play a major role in the Antarctic marine ecosystem, acting as a direct energy link between primary production and higher predators. Antarctic krill are therefore considered a Key Low Trophic Level (LTL) species in this assessment. The overarching management body for this fishery is the CCAMLR, which has established a Precautionary Upper catch Limit (PCL) and catch trigger level for this fishery. The management of the krill fishery in Area 48 is based upon the precautionary approach, and the Ecosystem Monitoring programme (CEMP) provides a foundation to regulate the harvest of Antarctic marine living resources in line with the ecosystem approach. The Korean Ministry of Ocean and Fisheries issues licences and is responsible for monitoring Korean vessels to ensure they comply with CCAMLR regulations. The vessels in the UoA are managed under the Distant Water Fisheries Development Act of 2015. The krill fishery is regulated through CCAMLR Conservation Measures, vessels must be licenced to fish krill, and their activities are monitored through a Vessel Monitoring System (VMS). Stock assessment of krill is undertaken by the CCAMLR Scientific Committee and is reviewed annually at meetings of the Working Group on Ecosystem Monitoring and Management. An initial analysis of krill areal density estimated in a 2019 Area 48 survey produced a standard stock

estimate of 62.6 million tonnes with a survey coefficient of variation (CV) of 13 %. There does not appear to be any evidence that krill biomass has declined since the previous fully synoptic survey in 2000. The fishery appears to be operating in a sustainable way, as the annual catches are well below a conservatively set PCL, and there is confidence that current catch levels will not affect total krill biomass adversely even in the event of extraneous ecosystem and climate factors coming into play.

The main source of information on fishing activities (namely catch composition) is observer data, which covers 100 % of the trips. Cruise reports submitted by CCAMLR scientific observers record catch details for all species and provide a summary of the biological data collected. Sampling procedures are standardised across krill fisheries, 25 kg subsamples are taken from each haul, between 1-8 times per day. Between 2016 and 2018, 4,534 fishing trawls were undertaken, 24 % of which were sampled by observers. Combined catch of non-target species makes up 0.009 % of the catch across all observed catches. A potential issue in the Antarctic krill fishery targeting *E. superba* is the potential presence of a similar species *Euphausia crystallorophias* (ice krill) in the catch. Given the difficulties in distinguishing the two krill species, the absence of ice krill in reports does not necessarily mean the absence of ice krill bycatch. A member of the CCAMLR Working Group noted that research surveys in Area 48 did not reveal the presence of ice krill in catches using research gear. A recommendation may be raised after the site visit touching on the provision of scientific observers with the appropriate materials needed to identify ice krill in their routine observations. Midwater trawling for krill is generally considered as low risk to Endangered, Threatened, and Protected (ETP) species. Nevertheless, several technical measures have been put in place to reduce bycatch of seabirds and marine mammals; as a result, ETP species mortality is rare. ETP species mortality mitigation measures include bird bafflers, bird streamers, seabird sprayers, net weighting, warp deflectors, seal exclusion devices, and offal retention for disposal on shore. The fishing practices (pelagic trawl), and fact that gear loss is very rare signify that there is no interaction with the benthos. The region in which the fishery operates is home to many krill predators, the wider ecosystem impacts for the krill fishery have been thoroughly considered in the fishery's management. Seasonal closures, combined with 12 nm no-take zones around South Georgia, Shag Rocks, Clerke Rocks, and the South Sandwich islands are intended to minimise major impacts on krill dependent predators. The on-going monitoring of krill-dependent predators suggests that inter-annual variation in krill abundance associated to physical oceanographical factors has a greater impact on predators than the fishery. Rapid climate change in the region has been well documented, with the most evident sign being ice-shelf collapse. This results in the loss of existing marine habitats and the creation of new ones, with changes to ecological processes and community structure seemingly inevitable. The CCAMLR Working Group on Ecological Monitoring and Management is responsible for krill management. This group meets annually to discuss scientific research outcomes and regulates the harvesting of Antarctic marine living resources in accordance with the "ecosystem approach".

The fishery operates in a well-defined fisheries management framework. Three key jurisdictional levels are involved in the management of this fishery: CCAMLR, the RFMO in charge of resource management; the Republic of Korea, as flag state is responsible for the vessels' compliance with international and national obligations; and any port states where the UoA vessels land or tranship their catch (Japan and Korea). The CCAMLR Commission is the decision-making body. Conservation Measures (CMs) are agreed based on the best available scientific information, with the aim of ensuring the conservation of Antarctic marine ecosystems. CMs are adopted and updated (when necessary) during annual Commission meetings, and a compendium of CMs in force can be found on CCAMLR's official website. Access to the krill fishery is not automatic, and the opportunity to participate in the krill fishery is only open to CCAMLR member vessels. The Republic of Korea was temporarily identified as a potential Illegal, Unreported and Unregulated (IUU) fishing country in September 2019 as the US National Oceanic and Atmospheric Administration (NOAA) deemed that insufficient sanctions were

applied to deter its vessels from engaging in fishing activities that violate conservation and management measures adopted by CCAMLR. In response, the Republic of Korea's Distant Water Fisheries Act was amended to allow administrative sanctions to be applied for the violation of such measures. Consequently, Korea was removed from the list of potential IUU fishing countries, after four months of being put on the list. CCAMLR has a comprehensive Monitoring Control and Surveillance (MCS) system in place, which is upheld and implemented by its members. The MCS system includes vessel and fishing gear markings, vessel licensing, monitoring of vessels movements, vessel monitoring systems, a catch documentation scheme, and monitoring of vessel transhipments (amongst other measures). The CCAMLR System of Inspection relied on each member country designating and training Fisheries inspectors to carry out at sea or on land inspections. At the time of writing, CCAMLR has undertaken two external performance reviews.

At the ACDR stage, further information is needed to finalise scores for Principle 3, concerning the management system of the Republic of Korea as a whole. Further, up to date UoA-specific catch data must be checked with the client. Regarding Principle 1, further information is sought on ways in which krill removals are recorded. Based on the information available to the team, the Jeong Il Corporation Antarctic krill fishery appears to be in conformity with the MSC Standard across all the first two Principles, with both achieving an average score greater than 80. For Principle 3, the overall score is currently 78.3, though this is due to several precautionary scores being awarded due to outstanding information requiring confirmation by the team. As such, three PIs potentially requiring conditions have been identified at this stage. Please note that these conclusions may be subject to change based on evidence acquired during the site visit.

To be completed at Public Certification Report stage

The executive summary shall include:

- Date and location of site visit.
- The main strengths and weaknesses of the client's operation.
- The draft determination / determination reached with supporting justification.

Reference(s): FCP v2.1 Section(s) 7.12, 7.18, 7.21

2 Report Details

2.1 Authorship and Peer Reviewers

Dr Julian Addison – Principle 1 Expert

Dr Julian Addison is an independent fisheries consultant with 30 years' experience of stock assessment and provision of management advice on shellfish fisheries, and a background of scientific research on shellfish biology and population dynamics and inshore fisheries. Until December 2010 he worked at the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) in Lowestoft, England where he was Senior Shellfish Advisor to Government policy makers, working closely with marine managers, legislators and stakeholders, Government Statutory Nature Conservation Organisations and environmental NGOs. He has also worked as a visiting scientist at DFO in Halifax, Nova Scotia and at NMFS in Woods Hole, Massachusetts where he experienced shellfish management approaches in North America. For four years he was a member of the Scientific Committee and the UK delegation to the International Whaling Commission providing scientific advice to the UK Commissioner.

Julian has worked extensively with ICES and most recently was Chair of the Working Group on the Biology and Life History of Crabs, a member of the Working Group on Crangon Fisheries and Life History and a member of the Steering Group on Ecosystems Function. He has extensive experience of the MSC certification process primarily as a P1 team member but also as a P2 team member and team leader. He has undertaken over 30 MSC full assessments of crustacean and mollusc fisheries worldwide which use a wide range of stock assessment methodologies and fishing gears. He has also undertaken MSC pre-assessments in Europe, North America and Australia and over 60 annual surveillance audits and technical reviews. He is a member of the MSC Peer Review College and has carried out peer reviews of MSC assessments worldwide of a wide range of fish and shellfish fisheries.

Julian is a fully trained MSC team member. He is responsible for the assessment of Principle 1.

Dr. Gudrun Gaudian – Principle 2 Expert

Dr Gudrun Gaudian has a BSc in Marine Biology, and a DPhil from University of York (UK) on the topic of "Taxonomy and Ecology of Red Sea Corals. She also completed an LLM Environmental Law and Management. She is an experienced marine ecologist and taxonomist and her work has included coastal marine surveys, EIA's for development and tourism, and research projects in tropical and temperate seas. Since 2011 she has been involved in fisheries certification applying the Marine Stewardship Council standard for sustainable fisheries, concentrating on Principle 2 of the Standard, working on many coastal and marine management issues, such as identifying sustainable coastal development projects, as well as addressing conservation issues, including selection and planning of marine parks and reserves, sustainable utilisation of natural resources and community-based management programmes. Dr. Gaudian meets the requirements in Table PC3 for 'Fishing impacts on aquatic ecosystems'. She has >5 years' experience in research into, policy analysis for, or management of, fisheries impacts on aquatic ecosystems. Gudrun is also fluent in German.

Gudrun is a fully trained MSC team member. She is responsible for the assessment of Principle 2.

Dr Sophie des Clers – Principle 3 Expert

Sophie is an independent scientific expert in fisheries management systems. She is a qualified MSC auditor and a member of the MSC peer review college. She has over 30 years' experience in the formulation, monitoring, and evaluation of fisheries and aquaculture projects to build management

capacity in the public and the private sector. Sophie is trained in databases, applied statistics, population dynamics, economics, law and public policy and has a PhD in Biometrics and a Master's degree in Public Policy. Her past research and consultancy projects have taken her to fishing ports around the UK, EU, Norway, Africa, the North Sea, Mediterranean, Atlantic, Pacific, Indian oceans and the Caribbean. She has been involved in a number of previous MSC assessments and pre-assessments including lobster, cod, haddock, saithe, sole, herring, blue whiting, sardine, whelks (within the EU) and tuna and billfish fisheries.

Sophie is a fully trained MSC team member. She is responsible for the assessment of Principle 3, with a focus on CCAMLR management.

Dr Jung Hee Cho – Principle 3 Expert

Jung-Hee studied for his first degree at the In-Ha University in South Korea, following with a Masters degree at the Nova South Eastern University in the US and a Masters and Ph.D from the University of Rhode Island.

Jung-Hee started his career in 1996 as a Research Assistant at the Department of Environmental and Natural Resource Economics, University of Rhode Island and is now a Senior Research Fellow and Director General of the Fisheries Research Division of the Korea Maritime Institute. His experience includes lecturing at the Konkuk University in Seoul and various government delegations involving the FAO, OECD, FTA and WTO. Jung-Hee is currently the Editor-in-Chief at the KMI International Journal of Maritime Affairs and Fisheries.

He is a fully trained MSC team member and for this project, is responsible for the assessment of Principle 3, with a focus on local Korean management.

Henry Ernst – Team Leader

Henry obtained an MSci in marine biology from the University of Southampton, UK. He has a broad background in marine research including inshore fisheries, functional marine ecology and aquaculture research. Prior to joining CU Pesca (now CU UK) he was engaged in benthic invertebrate identification and biomass work with the National Oceanographic Centre, Southampton, United Kingdom and data compilation for Antarctic fauna with the British Antarctic Survey.

Henry is a fully trained MSC Team Leader. He will be responsible for bringing together the work of the Principle experts and ensuring MSC Processes and Requirements are respected throughout the assessment.

Peer Reviewers:

The MSC Peer Review College compiled a shortlist of potential peer reviewers to undertake the peer review for this fishery. Two peer reviewers were selected from the following list:

Peer reviewer information to be completed at Public Comment Draft Report stage

A summary of their experience and qualifications is available via this link: **Enter link**

The report shall contain:

- Names of team members.
- Specification of which person is the team leader.
- Names of the peer reviewers.

- Statement that peer reviewers can be viewed on the assessment downloads page on the MSC website.

If the Risk-Based Framework (RBF) has been used in assessing the fishery the report shall state which team member(s) has had training in the use of the RBF.

Reference(s): FCP v2.1 Section(s) 7.6, 7.14, Annex PC

2.2 Version details

Table 1. Fisheries programme documents versions

Document	Version number
MSC Fisheries Certification Process	Version 2.1
MSC Fisheries Standard	Version 2.01
MSC General Certification Requirements	Version 2.4.1
MSC Reporting Template	Version 1.1

3 Unit(s) of Assessment and Certification

3.1 Unit(s) of Assessment (UoA)

CU UK confirms that the fishery under assessment is within the scope of the MSC Fisheries Standard (7.4 of the MSC Fisheries Certification Process v2.1):

- The target species is not an amphibian, reptile, bird or mammal;
- The fishery does not use poisons or explosives;
- The fishery is not conducted under a controversial unilateral exemption to an international agreement;
- The client or client group does not include an entity that has been successfully prosecuted for a forced or child labour violation in the last 2 years;
- The fishery has in place a mechanism for resolving disputes, and disputes do not overwhelm the fishery;
- The fishery is not an enhanced fishery as per the MSC FCP 7.4.6; and
- The fishery is not an introduced species-based fishery as per the MSC FCP 7.4.7.

CU UK confirms that the client group has submitted the completed 'Certificate Holder Forced and Child Labour Policies, Practices and Measures Template' prior to the start of this assessment.

The proposed Unit of Assessment (UoA) is given in Table 2.

Table 2. Unit(s) of Assessment (UoA)

Species	Antarctic krill (*Euphausia superba*)
Stock	Subarea 48
Geographical range of fishery	Antarctic waters within sub convention area 48 of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR)*
Harvest method / gear	Stern Trawl
Client group	Jeong Il Corporation, Seoul
Other eligible fishers	None

3.2 Unit(s) of Certification (UoC)

To be drafted at Client and Peer Review Draft Report stage

To be completed at Public Certification Report stage

The report shall include a justification for any changes to the proposed Unit(s) of Certification (UoC).

Reference(s): FCP v2.1 Section 7.5

Table 3. Unit(s) of Certification (UoC)

Species	
Stock	
Geographical range of fishery	
Harvest method / gear	
Client group	
Other eligible fishers	

4 Assessment results overview

4.1 Determination, formal conclusion and agreement

To be drafted at Final Draft Report

To be completed at Public Certification Report

The report shall include a formal statement as to the certification determination recommendation reached by the assessment team on whether the fishery should be certified.

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

Reference(s): FCP v2.1 Section 7.21

4.2 Principle level scores

To be drafted at Client and Peer Review Draft Report

The report shall include scores for each of the three MSC principles in the table below.

Reference(s): FCP v2.1 Section 7.17

Summary of conditions

To be drafted at Client and Peer Review Draft Report

The report shall include a table summarising conditions raised in this assessment. Details of the conditions shall be provided in the appendices. If no conditions are required, the report shall include a statement confirming this.

Reference(s): FCP v2.1 Section 7.18

4.3 Recommendations

To be drafted at Client and Peer Review Draft Report stage

If the CAB or assessment team wishes to include any recommendations to the client or notes for future assessments, these may be included in this section.

5 Traceability and eligibility

5.1 Eligibility date

The report shall include the eligibility date and the justification for selecting this date, including consideration of whether the traceability and segregation systems in the fishery are appropriately implemented.

Reference(s): FCP v2.1 Section 7.8

5.2 Traceability within the fishery

Krill caught by the UoA are hauled aboard the vessels and are poured into a holding tank. From the holding tank the krill are taken by conveyor into the onboard freezing facility. There is no grading of the krill product before it is frozen. The krill is frozen before being placed in JEONG IL marked boxes which are sealed by banding. 100 % of the catch is independently observed with the catch volume reported CCAMLR secretariat and the Korean officials from the vessel. Catch is reported every 5 days along with a monthly summary. The CCAMLR secretariat notifies regularly to all the vessels and contracting parties how many tonnes are caught and when the TAC is reached.

Transhipment is completed at sea and takes place in the fishing area (CCAMLR 48.1 or 48.2 oceanic trench) or at port of the Falkland Islands (Islas Malvinas).

The vessel transhipps the boxed krill to a carrier vessel, the carrier vessel keeps the fish product in a cold storage. The carrier vessel sails to the destination of the product, and offloads. When transhipment is made the UoA vessel receives a Mate's Receipt (MR) from the carrier vessel. The following steps are undertaken:

1. A carrier vessel is booked and transhipment report is produced 72 hours prior to transhipment. This report goes to the CCAMLR secretariat. This contains the following information:
    a. - Vessel Name, Vessel Registration number
    b. - Vessel nationality
    c. - Vessel type, length, total registered tonnage (GRT), storage capacity
    d. - Time of transshipment, location with longitude and latitude
    e. -Product type and quantity of transhipments (including in case of transshipment of foods, fuels, and etc.)
2. Transhipment report is sent to the Korean FMC 24 hours prior to transhipment.
3. Transhipment to the carrier vessel is made and the UoA vessel receives the MR.
4. A transhipment conclusion report is sent to CCAMLR, Korean FMC and Ministry of Fisheries in Korea.
5. The carrier vessel sails to Korea or Japan. The carrier offloads the cargo in the destination.
6. After the offloading is done, the agency reports the exact amount of cargo to the custom, quarantine station.

When the krill is offloaded in Korea, the UoA report to customs with a declaration of import. In accordance with CCAMLR conservation measures, when the transhipment vessel offloads the cargo a port inspection is conducted at random by the National Fishery Products Quality Management Service.

In this case a customs procedure is not required as the catches are caught by Korean vessel and does not constitute an import. In the case of unloading in Japan, the custom procedure is required as it is applicable to the imports.

The first point of sale is at the destination port when the product ownership transfers to an exclusive sale distributer. The product transport and transhipment activities of the fishery are outlined below, by country of destination.

For Korea, Discharging in Busan from Carrier → Cold storage in → Sale (DAEYANG KRILL CO., LTD, SHINSUN SUSAN CO., LTD).

For China, Catching krill in CCAMLR CA → Transshipment → Discharging in Busan from Carrier → Cold storage in→ Export with Reefer Containers (SHANGHAI YIXIN AQUATIC PR).

For Canada, Catching krill in CCAMLR CA → Transshipment → Discharging in Busan from Carrier → Cold storage in → Export with Reefer Containers (KRILL CANADA CORP).

For Japan, Catching krill in CCAMLR CA → Transshipment → Discharging in Fukuoka from Carrier → Cold storage in→ Sale (Umisato Corporation).

For USA, Catching krill in CCAMLR CA → Transshipment → Discharging in Busan from Carrier → Cold storage in → Export with Reefer Containers (GB AQUA INC.).

For Thailand, Catching krill in CCAMLR CA → Transshipment → Discharging in Busan from Carrier → Cold storage in→ Export with Reefer Containers (REEFER TRADING CO., LTD)

To be completed at Public Certification Report stage

The report shall include a description of the tracking, tracing and segregation systems within the fishery and how these systems will allow any products sold as MSC certified to be traced back to the Unit of Certification.

The report shall include an evaluation of the robustness of the management systems related to traceability.

The report shall include any traceability references, including hyperlinks to publicly-available documents.

The report shall include a description of the factors that may lead to risks of non-certified seafood being mixed with certified seafood prior to entering Chain of Custody using the table below. For each risk factor, there shall be a description of whether the risk factor is relevant for the fishery and, if so, a description of the relevant mitigation measures or traceability systems in place.

Reference(s): FCP v2.1 Section 7.9

Table 4. Traceability within the fishery

Factor	Description
Will the fishery use gears that are not part of the Unit of Certification (UoC)?	There is no possibility of using uncertified gear, the vessels do not carry any gear other than that which meets the CCAMLR

Factor	Description
If Yes, please describe: If this may occur on the same trip, on the same vessels, or during the same season; How any risks are mitigated.	requirements. This is verified by 100% observer coverage.
Will vessels in the UoC also fish outside the UoC geographic area? If Yes, please describe: If this may occur on the same trip; How any risks are mitigated.	The vessels (Kwangja-ho and In Sung-ho) do catch horse mackerel and squid outside of CCAMLR Conservation Area (CA), but only Krill is targeted in CCAMLR CA. Therefore, not possible to use the certification for other products.
Do the fishery client members ever handle certified and non-certified products during any of the activities covered by the fishery certificate? This refers to both at-sea activities and on-land activities. Transport Storage Processing Landing Auction If Yes, please describe how any risks are mitigated.	Jeong Il operate only two trawl vessels which are registered to CCAMLR there is no possibility to use other vessels.
Does transhipment occur within the fishery? If Yes, please describe: If transhipment takes place at-sea, in port, or both; If the transhipment vessel may handle product from outside the UoC; How any risks are mitigated.	The boxes produced onboard the vessels are labelled and sealed with banding there is no chances of substitution or addition. Random checks at port confirm weights against CCAMLR records.
Are there any other risks of mixing or substitution between certified and non-certified fish? If Yes, please describe how any risks are mitigated.	Krill is caught in CCAMLR CA only. Fishing seasons and ground are controlled through CCAMLR regulations, and vessel monitoring.

5.3 Eligibility to enter further chains of custody

Antarctic kill (*Euphausia superba*) of the CCAMLR Subarea 48 stock caught in CCAMLR Subareas 48.1 and 48.2 will be eligible to enter further chains of custody upon successful assessment completion after the date of certification. Chain of Custody is required at the point of landing in Korea (Busan) and in Japan (Fukuoka). Only Jeong Il Corporation will be eligible to use the fishery certificate and sell product as MSC certified. As per PA 1.4.1.1 – The MSC ecolabel is only permitted for use on IPI stocks for a maximum of one certification period, see Section 5.4.

To be completed at Public Certification Report stage

The report shall include a determination of whether the seafood product will be eligible to enter certified chains of custody, and whether the seafood product is eligible to be sold as MSC certified or carry the MSC ecolabel.

The report shall include a list of parties, or category of parties, eligible to use the fishery certificate, and sell product as MSC certified.

The report shall include the point of intended change of ownership of product, a list of eligible landing points, and the point from which subsequent Chain of Custody certification is required.

If the CAB makes a negative determination under FCP v2.1 Section 7.9, the CAB shall state that fish and fish products from the fishery are not eligible to be sold as MSC certified or carry the MSC ecolabel. If the client group includes other entities such as agents, unloaders, or other parties involved with landing or sale of certified fish, this needs to be clearly stated in the report including the point from which Chain of Custody is required.

Reference(s): FCP v2.1 Section 7.9

5.4 Eligibility of Inseparable or Practicably Inseparable (IPI) stock(s) to enter further chains of custody

Inseparable or practicably inseparable catches (IPI) stocks are likely in this fishery. They occur at a scale which is small enough that two other certified fisheries on the same stock have submitted variation requests against FCR 7.4.14.2 (and have had them accepted) to allow these small volumes to enter the chain of custody. The assessment team will, as per FCP 7.5.10, upload a MSC IPI Announcement template notifying the stakeholders and the MSC of the identification of IPI stocks (as has been done for the reassessment of the Deris S.A. – Pesca Chile – Antarctic krill fishery https://fisheries.msc.org/en/fisheries/deris-s.a.-pesca-chile-antarctic-krill-fishery/@@view).

The team believe the UoA meets the IPI requirements set out in FCP 7.5.8:

7.5.8.1 a. The non-target catch is practicably indistinguishable during normal fishing operations (i.e. the catch is from a stock of the same species or a closely related species)

Not applicable as the IPI species are fish larvae.

7.5.8.1 b. When distinguishable, it is not commercially feasible to separate due to the practical operation of the fishery that would require significant modification to existing harvesting and processing methods

Both fishing vessels of the UoA operate in the same way, using a stern trawl and a continuous fishing system, which uses a pump connecting the vessel to the codend rather than hauling the net aboard. The continuous pump fishing method transfers the catch to a conveyor system on the vessels where it is moved directly into the hold. All species in the catch are retained, and all are used in the final product (frozen whole round krill and krill meal). Therefore, the ability to separate these out from the krill during fishing operations is not practicable.

7.5.8.1 c. The total combined proportion of catches from the IPI stocks do not exceed 15% by weight of the total combined catches of target and IPI stock(s) for the UoA.

The UoA activities are under 100% observer coverage. The Scientific Observers Manual issued by CCAMLR states that the key tasks of the observers include: (ii) sampling of catches to determine biological characteristics, (iii) recording biological data by species caught, (iv) recording bycatch, their quantity and biological data, (vi) recording the procedure by which declared catch weight is measured

and collecting data relating to the conversion factor between green weight and final product in the event that catch is recorded on the basis of weight of processed product.

The analysis of Observer reports for this fishery between 2016 and 2019 showed that the combined catch of all non-target species amounts to approximated 0.009% of the catch by weight. As such, this fishery is far from exceeding the 15% weight limit set by 7.5.8.1c.

7.5.8.1 d. The IPI stocks are not endangered, threatened or protected (ETP) species.

Based on the Observer data, it appears that ocellated icefish (*Chionodraco rastrospinus*), mackerel icefish (*Champsocephalus gunnari*), and salps (*Salpidae*) make up the majority of the bycatch (see table below).

Species		**kg**	**% of Total**	**Designation**
Euphausia superba	Krill - target	53,060,661.800	99.99%	Target
Chionodraco rastrospinosus	Ocellated icefish	1,099.675	0.002%	Secondary
Champsocephalus gunnari	Mackerel icefish	1,008.388	0.002%	Primary
Salpidae	Salps	969.150	0.002%	Secondary
Chaenodraco wilsoni	Spiny icefish	199.982	0.000%	Secondary
Pseudochaenichthys georgianus	South Georgia icefish	194.160	0.000%	Secondary
Chaenocephalus aceratus	Blackfin icefish	159.802	0.000%	Secondary
Cryodraco antarcticus	Long-fingered icefish	121.388	0.000%	Secondary
Notothenia gibberifrons	Humped rockcod	102.547	0.000%	Secondary
Pleuragramma antarcticum	Antarctic silverfish	81.315	0.000%	Secondary
Electrona carlsbergi	Electron subantarctic lanternfish	78.858	0.000%	Secondary
Semele radiata	bivalve	66.630	0.000%	Secondary
Gymnoscopelus nicholsi	Nichol's lanternfish	65.631	0.000%	Secondary
Pagetopsis macropterus		50.494	0.000%	Secondary
Notolepis coatsi	Antarctic jonasfish	37.935	0.000%	Secondary
Neopagetopsis ionah	Crocodile icefish	29.892	0.000%	Secondary
Geophagus spp		29.204	0.000%	Secondary
Rhopilema spp	Jellyfish spp	19.50	0.000%	Secondary
Nototheniops larseni	Painted rockcod	16.434	0.000%	Secondary
Notothenia coriiceps	Black rockcod	10.155	0.000%	Secondary
Parachaenichthys charcoti	Antarctic dragonfish sp	8.040	0.000%	Secondary
Cyclopteridae	Lumpsucker spp	7.90	0.000%	Secondary
Onykia ingens	Greater hooked squid	7.560	0.000%	Secondary

Species		kg	% of Total	Designation
Psychroteuthis glacialis	Glacial squid	6.951	0.000%	Secondary
Notothenia rossii	Marbles rockcod	5.407	0.000%	Secondary
Trematomus eulepidotus	Blunt scalyhead	4.877	0.000%	Secondary
Lophius americanus	American anglerfish	4.340	0.000%	Secondary
Psilodraco breviceps	Antarctic dragonfish sp	3.050	0.000%	Secondary
Notothenia neglecta	Yellowbelly rockcod	2.10	0.000%	Secondary
Trematomus newnesi	Notothenid sp	1.867	0.000%	Secondary
Onykia knipovitchi	Cephalopod sp	1.580	0.000%	Secondary
Icichthys australis	Southern driftfish	1.290	0.000%	Secondary
Dissostichus mawsoni	Antarctic toothfish	0.970	0.000%	Secondary
Nototheniops nudifrons	Notothenid sp	0.910	0.000%	Secondary
Dunaliella tertiolecta	Algae	0.805	0.000%	Secondary
Trematomus lepidorhinus	Slender scalyhead	0.785	0.000%	Secondary
Pagetopsis maculatus	Channichthid sp	0.63	0.000%	Secondary
Magnisudis prionosa	Southern barracudina	0.52	0.000%	Secondary
Gasterosteus aculeatus	Three-spined stickleback	0.24	0.000%	Secondary
Paraliparis spp	Snailfish sp	0.225	0.000%	Secondary
Paradiplospinus antarcticus	Antarctic escolar	0.2	0.000%	Secondary
Loligo gahi	Cuttlefish	0.165	0.000%	Secondary
Dacodraco hunteri	Crocodile icefish sp	0.14	0.000%	Secondary
Nototheniidae	Notothenid sp	0.05	0.000%	Secondary
Natantia	Decapod sp	0.02	0.000%	Secondary
Alopias superciliosus	Bigeye thresher – dubious identification (far outside the geographical range, to be checked at the site visit)	0.005	0.000%	Secondary
Octopodidae	Octopus	0.005	0.000%	Secondary
Artedidraco mirus	Perciform sp	0.001	0.000%	Secondary

7.5.8.1 e. The IPI stocks are not certified separately

Antarctic krill (*Euphausia superba*) is the only species under assessment in the list above. This stock is currently certified in two other fisheries.

Considering the information presented above, the team believes that the Jeong Il Corporation krill fisheries meets the requirements for FCP v2.1 7.5.8.1 b-e.

Further to this evidence, the rationale for the Variation Request from one of the MSC certified krill fisheries is provided below (Roel et al. 2018):

A small percentage of the catches from the midwater trawl fishery targeting Antarctic krill in CCAMLR subarea 48 is comprised by several fish and non-fish taxa which are caught together with the krill. Due to their small size (modal size class of <10cm, similar to the krill length-frequency distribution), low frequency of occurrence and minimal percentage in volume (between 0.1-0.2%), it is not commercially feasible to separate them from the krill catch. They can only be detected and identified through observer's sampling (within the CCAMLR area there is a Scheme for International Scientific Observation –SISO- which, among other tasks, is commissioned to perform bycatch samplings). Two comprehensive reviews on fish-bycatch occurrence and species composition have been recently performed by two CCAMLR Working Groups: the working group for Ecosystem Monitoring and Management (WG-EMM) and the Working Group on Fish Stock Assessment (WG-FSA).

The report WG-EMM-14/31 and subsequent WG-FSA-16/04 provided an update on the fish by-catch in the krill fishery using data from SISO and from the commercial fleet to examine the frequency of occurrence (FOO), proportion by mass, length-frequency distribution and geographic provenance of the key fish taxa reported. A total of 9,303 hauls collected on 60 cruises involving 18 different vessels over the period 2010- 2014 were analysed to elaborate the report WG-EMM-14/31. While for the most recent WG-FSA-16/04 updated this study using 2014-2016 data on fish by-catch in the krill fishery from commercial catch data (95,513 hauls) and CCAMLR SISO data (11,875 hauls). Both studies show similar results, in terms of species composition and frequencies of occurrence. For instance WG-FSA-16/04 estimated that total annual mass of fish bycatch in a 300,000 tonnes krill fishery would be 370 tonnes (meaning 0.12% of total catch in volume), comprising 50% mackerel icefish (C. gunnari) and 30% the Notothenіid (L. larseni).

To be completed at Public Certification Report stage

Where IPI stocks are present, the report shall include an evaluation of the species, stock, proportion and weight of the catch of IPI stock(s) and their eligibility to enter further chains of custody. The report shall include a justification of how requirements in FCP Annex PA are met for any catches of IPI stock(s).

Reference(s): FCP v2.1 Section 7.5

6 Scoring

6.1 Summary of PI Level Scores

The following scores are preliminary scores derived from the information made available prior to the site visit. In accordance with MSC FCPv2.1 G7.10.2.e, where limited information was available to provide a draft scoring range for a Performance Indicator, a more precautionary score was awarded, in some cases resulting in a score of 60-79. It is expected that, with the provision of information during the site visit, some scores will change.

Table 5. Performance Indicator scores

Princi-ple	Component	Wt	Performance Indicator (PI)		Wt	Score
One	Outcome	0.33	1.1.1	Stock status	0.5	≥80
			1.1.2	Stock rebuilding	0.5	≥80
	Management	0.67	1.2.1	Harvest strategy	0.25	≥80
			1.2.2	Harvest control rules & tools	0.25	≥80
			1.2.3	Information & monitoring	0.25	≥80
			1.2.4	Assessment of stock status	0.25	≥80
Two	Primary species	0.2	2.1.1	Outcome	0.33	≥80
			2.1.2	Management strategy	0.33	≥80
			2.1.3	Information/Monitoring	0.33	≥80
	Secondary species	0.2	2.2.1	Outcome	0.33	≥80
			2.2.2	Management strategy	0.33	≥80
			2.2.3	Information/Monitoring	0.33	≥80
	ETP species	0.2	2.3.1	Outcome	0.33	≥80
			2.3.2	Management strategy	0.33	≥80
			2.3.3	Information strategy	0.33	≥80
	Habitats	0.2	2.4.1	Outcome	0.33	≥80
			2.4.2	Management strategy	0.33	≥80
			2.4.3	Information	0.33	≥80
	Ecosystem	0.2	2.5.1	Outcome	0.33	≥80
			2.5.2	Management	0.33	≥80
			2.5.3	Information	0.33	≥80
Three	Governance and policy	0.5	3.1.1	Legal &/or customary framework	0.33	≥80
			3.1.2	Consultation, roles & responsibilities	0.33	≥80
			3.1.3	Long term objectives	0.33	≥80
		0.5	3.2.1	Fishery specific objectives	0.25	≥80

Princi-ple	Component	Wt	Performance Indicator (PI)		Wt	Score
	Fishery specific management system		3.2.2	Decision making processes	0.25	60-79
			3.2.3	Compliance & enforcement	0.25	60-79
			3.2.4	Monitoring & management performance evaluation	0.25	60-79

6.2 Fishery overview

6.2.1 History of fishery and its management

The commercial fishery for Antarctic krill began in the 1972/73 season and landings increased rapidly in the 1970s peaking with landings of around 530,000 tonnes in 1981/82 before stabilising in the 1980s and early 1990s (Figure 1). These early catches were dominated by former Soviet Bloc countries and when this fleet stopped fishing for economic reasons in 1991/92, annual catches declined to around 80,000 tonnes. However, from the early 2000s, catches began to rise again as vessels from many nations joined the fishery. Vessels from Korea have been fishing for krill in the Antarctic for 28 years with the current two vessels identified in the UoC fishing since 2000 and 2006 respectively. Vessels from Norway currently take the majority (60 %) of the krill catch in Area 48, with vessels from Korea taking an average of around 20 % in recent years, and vessels from China, Chile and Ukraine making up the remainder of the catches. Catches peaked at 316,000 tonnes in the 2014 fishing season and were the largest reported annual krill catch since 1991, when the Soviet bloc fishery ended. Catches declined in 2015 but were stable at around 230,000 tonnes from 2015 to 2017 following the gradual increase in catches observed in recent years (Figure 1). In 2018 catches increased to 312,000 tonnes. In summary recent overall catches in area 48 are significantly below the trigger level of 620,000 and are therefore highly likely to be sustainable.

CCAMLR's formal fishing season has been 1 December to 30 November of the following year (Conservation Measure [CM] 32-01), but historically krill fishing in sub-area 48.3 tends to start later in each season than in sub-areas 48.1 and 48.2. Catch rates are lower during the earlier part of the fishing season when krill aggregations are less, but catches increase as day length peaks during summer. Later in the season in autumn as day length shortens, sea-ice cover spreads north, the southern fishing grounds (e.g. subarea 48.1) become less accessible to the fleet, and total catches generally drop, although this pattern may vary with variations between years in sea-ice cover.

Whilst the overall trigger level for Area 48 has not been exceeded in recent years, as discussed above, an interim distribution of the overall trigger level of 620,000 tonnes across the sub-areas of Area 48 has been agreed under CM51-07 to ensure that there are no local depletions which could impact on predators of krill. Korean vessels currently fish in subareas 48.1, 48.2 and 48.3. Catches in sub-area 48.1 reached their trigger level in 2018 and 2019 and the sub-area was closed on 25 June and 13 July respectively. The trigger levels defined for sub-areas 48.2 and 48.3 were not exceeded in 2018 and 2019. This element of the harvest strategy appears to be working well. Preliminary information for 2019 provided in the draft report of CCAMLR-XXXVIII shows that the fishery had caught 382,000 tonnes of krill by the end of September 2018 (CCAMLR 2019i). For the first time in recent years some small catches of krill were recorded from sub-area 48.4 in 2017 (513 tonnes), 2018 (246 tonnes) and 2019 (12 tonnes).

CCAMLR is currently developing a new approach to krill management entitled Feedback Management System (FBM) (CCAMLR 2017a; Watters et al. 2016) incorporating routine acoustic data collection and intermittent land-based predator studies, and this approach may in future replace the current sub-division of the catch trigger levels set out in CCAMLR CM 51-07.

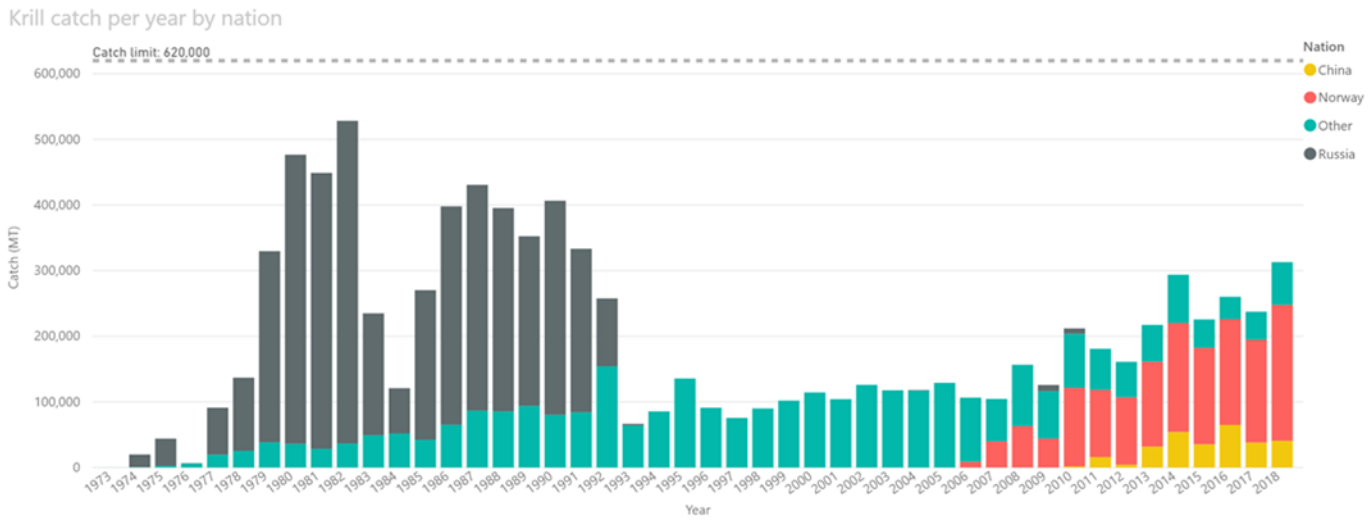

Figure 1. Total annual catches of krill (*Euphausia superba*) in the CCAMLR Area from 1973 to 2018. (Source: CCAMLR)

6.2.2 Gear and operation of the fishery

Fishing vessels:

The two trawler vessels included in the UoA are owned and operated by the JEONG IL Corporation and registered in Busan, the Republic of Korea (CCAMLR vessel registry[1]). Both vessels have similar characteristics (Table 6) and midwater trawl net fishing gear including a marine mammal (sealions) protect net and escape window (Table 7). The two vessels in the fishery operate a continuous fishing system, which uses a pump connecting the vessel to the codend rather than hauling the net aboard. Korea joined CCAMLR as a Contracting Party (CP) in 1985. The vessels in the UoA have been active in CCAMLR's krill fishery for many years (since 2006 for Kwang Ja Ho, and since 2000 for In Sung Ho).

Table 6. Fishing vessel characteristics (CCAMLR active vessel registry)

Vessel name	Kwang Ja Ho	In Sung Ho
CCAMLR Vessel ID	75742	75739
IMO Number	8505977	7042538
Callsign	DTBP9	6LZT
Year built	1985	1970
Crew Count	96	99
Length	93.50 m	88.94 m
Beam	15.60 m	15.00 m
Gross Tonnage	3012.00 t	2999.12 t
Engine Power	3,603.00 kW	2,794.00 kW
Carrying Capacity	1000.00 t	1500.00 t

[1] https://www.ccamlr.org/en/compliance/list-authorised-vessels

Fish Holds Capacity	2844.50 m^3	5324.00 m^3
Fish Holds Count	1	2

Table 7: Fishing gear characteristics (CCAMLR active vessel registry)

Net measurements	Kwan Ja Ho (2 nets)	In Sung Ho (2 nets)
Net-mouth opening height (m)	30	20
Net-mouth opening width (m)	72	57
Total net length (m) including codend, Measured along the centreline of the net	167.6	105.1
Codend-mouth opening height (m)	1.5	2.1
Codend-mouth opening width (m)	3	2.5
Codend length (m)	32	23
Codend mesh size (mm, stretched mesh)	Inner 15 Outer 100	Inner 15 Outer 150

6.2.3 Fishing areas and seasons

Subarea 48.1 - The waters bounded by a line commencing from a point at 70°00'W longitude on the coast of Antarctica at Palmer Land; thence running across the George VI Sound to a point at 70°00'W longitude on the south coast of Alexander Island; thence along the east coast of this island to a point on the northeast coast at 70°00'W longitude; thence due north to 60°00'S latitude; thence due east to 50°00'W longitude; thence due south to 65°00'S latitude; thence due west to a point on the east coast of the Antarctic Peninsula at 65°00'S latitude; thence running in a northeasterly and then southwesterly direction along the coast of the Antarctic Peninsula to the point of departure.

Subarea 48.2 - The waters bounded by a line running from a point at 64°00'S latitude and 50°00'W longitude; thence due north to a point at 57°00'S latitude and 50°00'W longitude; thence due east to 30°00'W longitude; thence due south to 64°00'S latitude; thence due west to the point of departure.

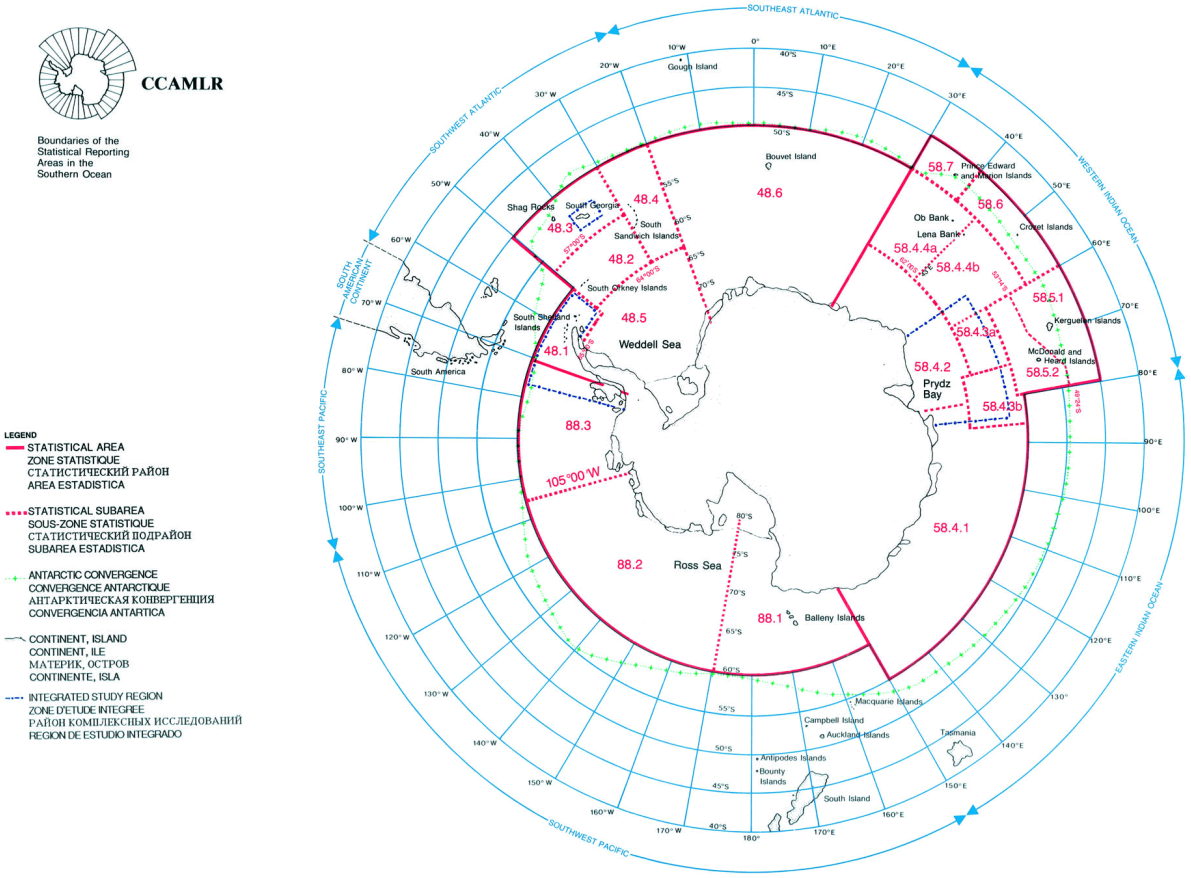

Figure 2: The fishery takes place in the Southwest Atlantic CCAMLR Statistical Area 48. Source CCAMLR.

6.2.4 Catch profiles and data availability

To be collected by the team leading up to- and during the site visit.

The report shall include any relevant catch profiles showing Unit of Assessment (UoA) catch over time.

6.3 Principle 1

6.3.1 Biology and ecology

Krill are small crustaceans of the order *Euphausiacea* and the Antarctic krill (*Euphausia superba*) is distributed widely across the 36 million km^2 of the Southern Ocean extending from the high Antarctic continental shelf to the Antarctic Polar Front Zone (Everson 2000). With its widespread distribution, swarming behaviour and much of its distribution covered by sea ice, there are significant logistical problems in estimating krill abundance. The highest density concentrations of krill are found in CCAMLR Area 48, and consequently the krill fisheries have been focussed on this area. On a broad scale, krill distribution is influenced by hydrography and bathymetry. Krill are found in depths of up to 600 m or more and exhibit diurnal vertical migrations from deeper waters in the day to shallower waters at night. Krill are also found generally in deeper waters in the winter than the summer. Through diel vertical migration and swarming, krill may be retained in the deep troughs and canyons where phytoplankton biomass is concentrated (Siegel & Watkins 2016). Swarming may also be a response to predation. There is some evidence that krill are active swimmers that can maintain their position within favourable habitats (Miller & Hampton 1989).

As noted above, *E. superba* are widespread across the Southern Ocean and so there may be multiple stocks across that area. However, there is no evidence of genetic differences between krill in different regions of the Southern Ocean, and so it seems reasonable to assume that there is a single stock across Area 48. For management purposes CCAMLR has defined sub-areas of Area 48 based on knowledge of oceanography in the area and on the assumption that krill are unlikely to move between these smaller sub-areas (

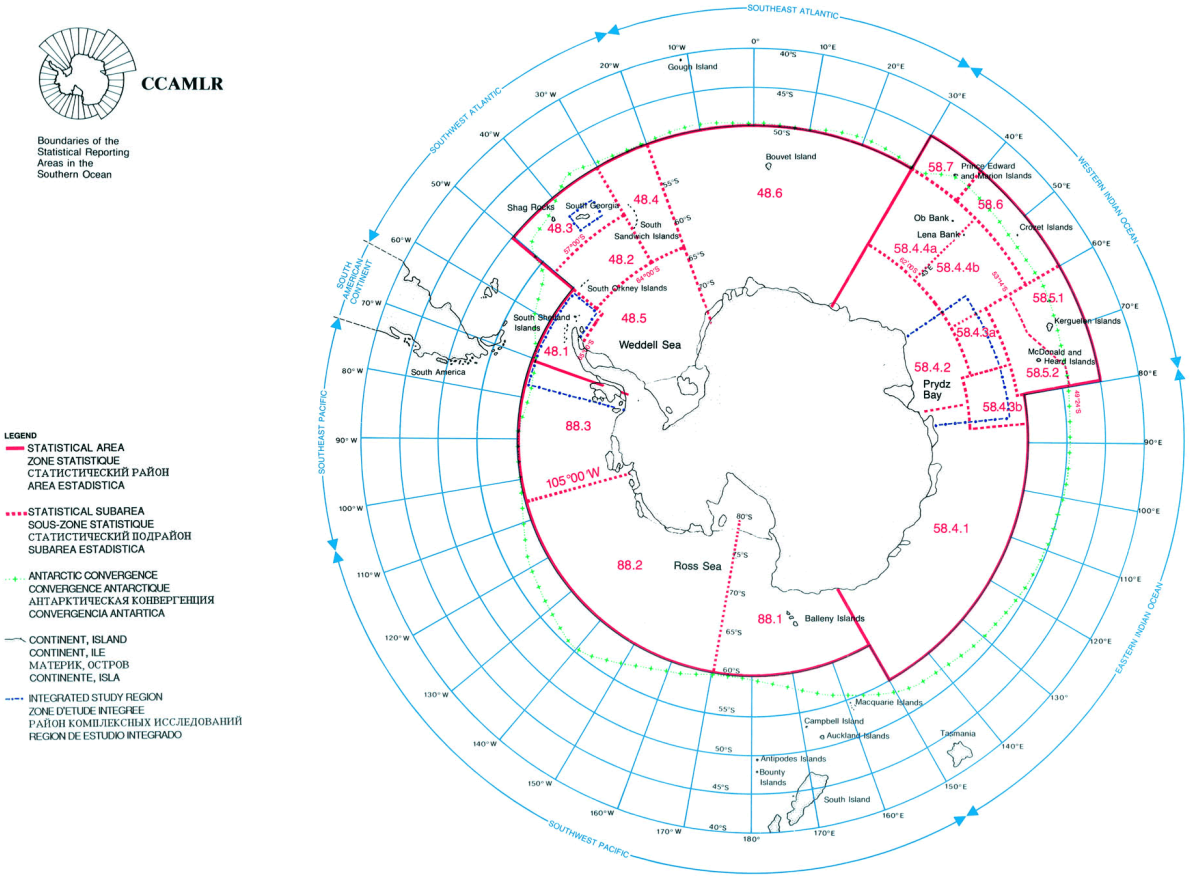

Figure 2: The fishery takes place in the Southwest Atlantic CCAMLR Statistical Area 48. Source CCAMLR.).

As with all crustacean species, the lack of hard parts precludes routine ageing of krill, and therefore good information is not available on growth rates and longevity. Best estimates are that krill reach a maximum length of more than 60 mm at an age of 5 or more years, but the proportion of krill over 5 years in the population is considered to be very low. Female krill spawn from 2 years of age near the surface and then the eggs sink into deeper water where they hatch. After hatching, the larvae rise in the water column whilst they continue development. Male krill mature at age 3 years. Spawning of mature krill takes place primarily from late November to late March but may vary temporally and spatially. Krill are batch spawners with 3 to 9 batches per year dependent on food availability and environmental conditions, with batches of eggs ranging from 6,000 to 10,000 eggs. However not all females spawn every year.

In their first winter, krill will feed on algae on the underside of the sea ice cover, which provides a nursery ground for the larval krill. Adult krill will also feed on the ice algae in the spring when other food sources are scarce, but then the phytoplankton bloom that occurs when the sea ice retreats enhances krill growth and maturation prior to reproduction. Recruitment of krill is therefore strongly influenced by the timing of these phases in the life history during the calendar year. However, the report of a recent meeting of CCAMLR's Working Group on Ecosystem Monitoring and Management (WG-EMM-18) describes research which challenges the traditional paradigm that krill recruitment is enhanced by prolonged sea-ice conditions (CCAMLR 2018j). As krill may be dependent on sea ice, any long-term changes in temperature due to climate change could impact on krill population dynamics. In addition, krill eggs will be sensitive to any future ocean acidification through increased levels of CO2.

Reviews of the biology and life history of krill can be found in Miller (2003), Everson (2000), Nicol (2009) and Ikeda (1985).

6.3.2 Feeding, predators and the role of *Euphausia superba* in the ecosystem

Krill graze on phytoplankton and are therefore important processors of primary production. Protozoans and small copepods are ingested simultaneously and represent an important food resource year-round (Schmidt & Atkinson 2016). Predators of krill include baleen whales, seals, fish species, a wide range of species of penguins, squid and seabirds such as albatross. Whilst individual seals and penguins may consume large amounts of krill, the overall predation of fish species on krill is greater than that of penguins, whales and seals combined (Hill et al. 2007). There have been some observed declines in penguin populations, but there is currently no evidence linking these declines to the fishery for krill.

Krill therefore play a key role within the Antarctic ecosystem, and previous MSC certification assessment reports have considered whether *E. superba* can therefore be considered as a key Low Trophic Level (LTL) species as defined by MSC Fisheries Standard v2.01. *E. superba* plays a central role in the ecosystem and acts as a direct energy link between primary production and higher predators such as baleen whales, seals, fish, birds and cephalopods by feeding on phytoplankton and to a lesser extent also zooplankton, converting them into a form suitable as an energy source for those predators for whom krill make up a large part of the diet. A simplified food web of the Southern Ocean (Figure 3) shows that linkages across trophic levels are centred around krill (Everson 2000).

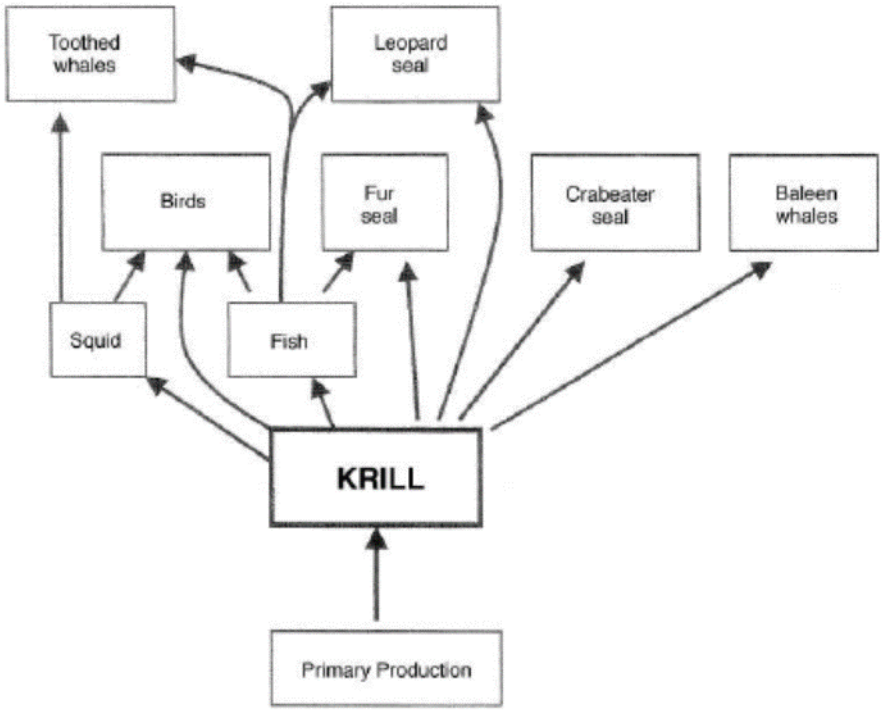

Figure 3. A simplified representation of the Southern Ocean food web. (Source: Everson (2000)**).**

Antarctic krill are one of the species listed in Box SA1 of MSC Fisheries Standard v2.01, and therefore krill could be considered as a key LTL stock if it meets two of the following criteria as set out in SA2.2.9ai-iii:

i) A large portion of the trophic connections in the ecosystem involves this stock, leading to significant predator dependency;

ii) A large volume of the energy passing between lower and higher trophic levels passes through this stock;

iii) There are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels, such that a high proportion of the total energy passing between lower and higher trophic levels passes through this stock (i.e. the ecosystem is 'wasp-waisted')

All the evidence on Southern Ocean food webs points to krill meeting criteria (i) and (ii) above, and therefore the assessment team concluded that *Euphausia superba* should be considered as a key LTL species in this fishery assessment. The same conclusion was also reached in the certification report of the Deris S.A. krill fishery (Roel et al. 2018) and during the reassessment of the Aker Biomarine Antarctic krill fishery (Hønneland et al. 2019) which assessed the Chilean and Norwegian fleets respectively fishing *E. superba* in the same geographical area in the Southern Ocean.

6.3.3 Harvest strategy and regulations

The overarching body for management and development of the harvest strategy for the krill fishery in the Antarctic is the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), which establishes a Precautionary Upper Catch Limit (PCL) and a catch trigger level for the krill fishery. CCAMLR distributes quotas across subareas of Area 48, and coordinates both research and observer programmes. Management of the krill fishery by CCAMLR is based upon the precautionary approach

and the Ecosystem Monitoring Program (CEMP) provides a basis for regulating harvesting of Antarctic marine living resources in accordance with the ecosystem approach. As noted above, krill is a key species within the Antarctic marine ecosystem and therefore krill fishing needs to be managed by CCAMLR to ensure there are no detrimental effects on predator species.

The Korean Ministry of Ocean and Fisheries is responsible for issuing licenses and for surveillance and monitoring of the Korean fishing companies to ensure that their national vessels comply with CCAMLR regulations including monitoring of quotas. Korean vessels that engage in fishing are managed under the Distant Water Fisheries Development Act 2015 (DWFDA). Article 1 states that the DWFDA "*is to advance the sustainable development of the distant water fisheries industry and contribute to the growth of the national economy through the rational preservation, management, exploitation and utilization of maritime living resources and the promotion of international cooperation.*" Krill may be landed in countries other than Korea, and therefore other Port States will play a role in the monitoring of landings. In addition, all krill producing fishing companies are members of the Association of Responsible Krill harvesting companies (ARK) whose objective is the maintenance of a sustainable harvest of Antarctic krill in an ecosystem context.

A key element of the harvest strategy is the setting of precautionary catch limits based upon recruitment and biomass escapement reference points, which are designed to ensure that any impact on any land-based predators is minimised.

The krill fishery is regulated through CCAMLR Conservation Measures. Vessels must be licensed to fish for krill and their fishing activity is monitored through a Vessel Monitoring System (VMS). Within the UoC, there are currently only two vessels licensed to fish for krill - FV Insung-Ho and FV Kwangja-Ho. There are no regulations such as days-at-sea that limit the overall fishing effort of the two licensed vessels.

There are a series of Marine Protected Areas (MPAs) within Area 48 where krill fishing is not permitted. There are no seasonal restrictions in the fishery with a season considered to run from 1 December to 30 November in the following calendar year.

CCAMLR regulates the rigging of the gear through various conservation measures (CMs). The fishery uses a mid-water trawl in depths between 200 m and 600 m and trawl cod end mesh size (15 mm inner, 100 mm outer) is regulated under CCAMLR CM22-01-04. Marine mammal exclusion devices, which consist of a ramp that lets krill through but pushes seals to an escape hole in the roof of the net, are mandatory within the fishery. CCAMLR CM25-03 (2016) requires that the fishery shall operate in such a way as to minimise the incidental mortality of seabirds and marine mammals.

A Precautionary Catch Level (PCL) of 5.61 million tonnes is set for Area 48, which is approximately 9 % of the estimated biomass in 2000 and is therefore considered to be highly precautionary. However, the PCL is not formally implemented in practice, and instead a much more precautionary overall TAC (described as a trigger level for the krill fishery) is set at 620,000 tonnes for CCAMLR subareas 48.1, 48.2, 48.3, 48.4. The quota is open to all vessels and not sub-divided by nations, and there are no individual vessel quotas. The current trigger level of 620,000 tonnes is set out under CCAMLR CM 51-01 (2010), and is equivalent to 11 % of the PCL, and consequently only 1% of the estimated biomass in 2000.

Historically there was no sub-division of this quota across the four sub-areas, but concerns over the potential impact of high removals of krill within a small geographical area, in particular to ensure that land-based predator populations would not be inadvertently and disproportionately affected by fishing activity, resulted in the implementation of CCAMLR CM 51-07 (2016) which provides an interim

distribution of the trigger level in the fishery as set out in Table 8 below. These catch limits are set for the 2018/19 season.

Table 8. Trigger levels for krill catches for each of the sub-areas in Area 48. (Note that the total percentage distribution sums to over 100 %, so CCAMLR still monitors catches to ensure that the overall trigger level of 620,000 tonnes for Area 48 is not exceeded.)

Area	Maximum percentage of total catch from area	Maximum catch based on trigger level of 620,000 tonnes
48.1	25%	155,000 tonnes
48.2	45%	279,000 tonnes
48.3	45%	279,000 tonnes
48.4	15%	93,000 tonnes

There are no regulations governing the levels of bycatch species.

The work of CCAMLR has undergone two performance reviews in 2008 and 2016, from which a number of recommendations resulted. These include improved management of the spatial management of catches in Area 48 and developing harvest strategies which take into account ecosystem changes.

6.3.4 Data/Monitoring/Enforcement

CCAMLR carries out fisheries monitoring, scientific observer and ecosystem monitoring programmes and has implemented a series of Conservation Measures (CMs) in relation to the krill stocks in Area 48. Fishing activity of Korean vessels is monitored through the on-board Vessel Monitoring System (VMS) which is polled every hour. In addition, there is a CCAMLR requirement to notify the commission when a vessel enters or leaves a subarea of Area 48. As with all national fleets, full details of the vessel and fishing gear characteristics of the two Korean vessels are maintained through CCAMLR's active vessel registry.

All vessels must complete logbooks detailing catch and effort and this information must be transmitted to CCAMLR secretariat and to the Korean authorities. The CCAMLR requirement is that catch returns must be made on a monthly basis. However, once the overall catch limits reach 80 % of the trigger level within sub-areas, then catch returns must be made every 5 days. In sub-area 48.1 trigger levels have been reached in recent years, and so for season 2018/19, catch returns must be made every 5 days from the start of the season. The Korean Fisheries Monitoring Center requires that Korean vessels report their catches of krill and bycatch species electronically every 24 hours. Catches are not graded. CCAMLR monitors total uptake of catches in relation to the overall TAC for the area (and for the thresholds determined for each sub-area) and regularly notifies all contracting parties of uptake of overall TAC.

Fishing operations of the Korean vessels are monitored by the Korean Fisheries Monitoring Center (FMC). Krill catches are transhipped to a 'carrier' vessel which then sails to either Korea or Japan to land the catch. The fishing vessel is then issued with a Mate's Report (MR) from the transhipment

vessel. The whole transhipment and landing processes are reported to CCAMLR and the Korean authorities (FMC and Ministry of Fisheries). Landings of krill in Korea are randomly monitored by the National Fishery Products Quality Management Service (NFQS), who cross-check landings with reported catches. If there is more than a 10 % weight discrepancy by inspector sampling at offloading, or if there is no sampling, then observer data are used to clarify any discrepancy. Observer data are routinely cross-checked for validation with submitted vessel catch data.

All krill fishing trips will have an observer on board the vessel, and where possible, a scientific observer will also be present to record all catches and discards. Observers will report any violations/infringements to both Korean authorities and CCAMLR. The CCAMLR Scheme of International Scientific Observation (SISO) requires that no less than 75 % of vessels should be covered by observers during the 2018/19 and 2019/20 fishing seasons. The observer programme provides data on length composition, sex and maturity stage, fish by-catch and the collection of acoustic data for krill. Observers also collect information on wind, sea and air temperatures during fishing operations.

Estimates of stock biomass of krill are made through fishery-independent surveys. Biomass of krill is estimated using hydroacoustic surveys which calibrate the signals from echo-sounders with targeted trawl catch information. Major fully synoptic surveys of Area 48 were undertaken in 2000 and 2019, and between these two major surveys there have been smaller-scale surveys carried out regularly under national programmes by, for example, Norway and Korea. There is therefore substantial biological information on krill populations that has been built up over many years of surveys. For the Korean fleet, scientific research is undertaken on annual research cruises. Korea has been conducting standardised acoustic transects in Bransfield Strait, using the standard CCAMLR protocols, and will be repeating these in future years, including monthly sampling to examine the dynamics of krill. FV Kwangja-Ho undertook a research cruise in February 2019.

CCAMLR also conducts stock surveys of krill predators and maintains a network of stations through the CCAMLR Ecosystem Monitoring Program (CEMP) where information has been collected since 1989 on other components of the Antarctic ecosystem to monitor change.

6.3.5 Stock assessment of krill

Stock assessment of krill in Area 48 is undertaken by the CCAMLR Scientific Committee and reviewed at annual meetings of the Working Group on Ecosystem Monitoring and Management (WG-EMM). CCAMLR considers that managing Area 48 as a single stock is appropriate. Whilst recruitment may be distributed across Areas 48, 58 and 88, there has been virtually no fishing in the other two areas in recent years, so Area 48 can be considered as a single management unit. Area 48 is divided into a number of small-scale management units (SSMUs) based upon the distribution of krill, the fishery and krill predators.

Previously the estimated biomass of krill in Area 48 has been based upon a fully synoptic survey of the whole fishing area carried out in 2000. The objective of the survey was to provide a pre-exploitation biomass estimate of krill (B_0) to be used in the krill population model to estimate a sustainable yield from the stock. Full details of the survey methodology can be found in Trathan et al. (2001). This estimate has been improved over recent years following improvements in analysis of acoustic data, particularly target strength estimates. CCAMLR undertakes an annual review of stock status which evaluates the 2000 survey results in conjunction with smaller scale surveys that are undertaken from time to time by various nations. In 2010 the CCAMLR Scientific Committee concluded that the best estimate of pre-exploitation biomass was 60.3 million tonnes with a survey coefficient of variation (CV) of 12.8 %. This estimate of biomass is used to determine a sustainable yield from the fishery, but

it is recognised that the harvest strategy is therefore based upon an estimate of abundance from almost 20 years ago.

Until 2018/19, no such synoptic survey had been conducted since 2000, but there were biomass indices available that were estimated from local monitoring surveys in individual sub-areas of Area 48 carried out previously by the United States and Norway, and more recently by Korea and China (Table 9; (Skaret et al. 2015; Fielding et al. 2014; Kinzey et al. 2015). Whilst the relationship between these local estimates of biomass and the biomass across the whole of Area 48 is not clear, and therefore these biomass estimates cannot be used in assessment models, these surveys provided no evidence that the stock had declined since the major survey in 2000 (Hill et al. 2016). In addition, a recent re-analysis of abundance data for krill on KRILLBASE, a circumpolar database of Antarctic krill and salp numerical densities (Atkinson et al. 2017), showed no evidence for a decline in krill density from 1976 to 2016 (Cox et al. 2018). The re-analysis showed that after accounting for sampling heterogeneity and habitat variables, average krill density appears to have been stable but with considerable inter-annual variability. Catch per unit effort data are not considered reliable indicators of krill abundance (Butterworth 1988) and recent comparison of Fishery Performance Indicators (FPI) based on catch and effort data have not shown conclusively that success of the fishery is directly related to krill abundance.

The 2019 large-scale survey was undertaken by 6 vessels surveying transects corresponding to those used in the CCAMLR 2000 survey in the period 13-18 December 2018 and 16 January to 2 March 2019, while those corresponding to the regular US surveys around South Shetland Island (AMLR surveys) were run in the period 5-10 February and 8-15 March 2019 (Macaulay et al. 2019). The survey methodology used was similar to that used in the CCAMLR 2000 survey with acoustic surveys used to estimate mean krill target strength which is then calibrated with krill length distributions observed from trawl samples. Acoustic backscatter at 120 kHz was attributed to krill swarms, and then backscatter from krill were delineated using the 'swarms' method (Cox et al. 2016) and integrated to produce distribution maps of krill areal density and survey standing stock estimates. Full details of the survey methodology and results can be found in Macaulay et al. (2019).

An initial analysis of krill areal density estimated in the 2019 survey for the CCAMLR 2000 strata was 35.2 g m^{-2}, producing a standing stock estimate of 72 million tonnes with a sampling CV of 13 % (Macaulay et al. 2019). However the survey data were reanalysed at a meeting of the Acoustic Survey and Analysis Methods sub-group of CCAMLR's Scientific Committee in August 2019 (SG-ASAM-2019). The initial analysis made several processing decisions and assumptions that were discussed and revised during SG-ASAM-2019. Some processing errors were also discovered. Implementing these revisions and correcting errors produced a new krill biomass estimate from the 2019 Area 48 Survey of 62.6 million tonnes with a coefficient of variation (CV) of 13% (CCAMLR 2019j). The full Scientific Committee of CCAMLR endorsed this revised estimate of krill biomass. This standing stock estimate is slightly higher than the estimate of pre-exploitation biomass of 60.3 million tonnes (CV of 12.8 %) from the CCAMLR 2000 survey. Whilst these biomass estimates are sensitive to the choice of length distributions used to convert acoustic backscatter into krill density estimates (Macaulay et al. 2019), there does not appear to be any evidence that krill biomass has declined since the previous fully synoptic survey in 2000, and therefore the management strategy including the setting of trigger catch levels can still be considered to be precautionary.

Table 9. Krill biomass indices from local biomass surveys (tonnes km^{-2}). (Source: (Hill et al. 2016)**)**

Year	Subarea		
	48.1 (Kinzey et al., 2015)	48.2 Skaret et al., 2015)*	48.3 (Fielding et al., 2014)
1996	35.5		
1997	46.5		31.7
1998	20.7		38.9
1999	7.8		9.7
2000	23.6		2.7
2001	4.1		36.7
2002	2.2		137.0
2003	16.6		84.6
2004	3.7		26.1
2005	5.9		89.4
2006	9.7		119.1
2007	32.4		61.1
2008	16.8		
2009	16.1		28.8
2010	13.3		15.1
2011	13.2	212.8	59.0
2012		94.8	90.1
2013			61.8
2014		301.4	31.1

The approach used by CCAMLR is to estimate a sustainable yield using a Generalised Yield Model (GYM) (Constable & Mare 2003). A simple population model, which includes random variability in recruitment, is used within a simulation framework to project forward the krill population with varying values for growth, mortality and abundance drawn at random from plausible statistical distributions, and therefore to allow the effects of different catch levels to be simulated. This approach takes into account natural variability in the population and uncertainty in the parameter estimates to be incorporated in the projection model. The simulation model calculates a distribution of possible population sizes both in the absence of fishing and at various fishing mortalities.

These distributions are used to determine the proportion ɣ (gamma) of an estimate of the unexploited biomass B_0 estimated from the hydroacoustic survey in 2000 (Constable et al. 2000) that would support a sustainable harvest. CCAMLR sets a PCL for krill using a set of "decision rules" to determine the proportion of the stock that can be fished. The catch limit is estimated using the GYM projecting the pre-exploitation population forward with different yield levels (ɣ) based on the following rules:

1. Choose a yield level, ɣ 1, so that the probability of the spawning biomass dropping below 20% of its median pre-exploitation level over a 20-year harvesting period is 10 %.

2. Choose a yield level, ɣ 2, so that the median escapement at the end of a 20-year period is 75% of the median pre-exploitation level.

3. Select the lower of ɣ 1 and ɣ 2 as the yield level.

The catch limit is the value of gamma selected by rule 3.

Rule 1 is equivalent to a limit reference point with an overfishing threshold of 20% of B_0, and Rule 2 is a target reference point for stock biomass based upon an escapement criterion.

Using this approach, a PCL was determined based upon an unexploited biomass (B_0) of 60.3 million tonnes and a CV of 12.8% and a gamma value of 0.093. Such a PCL equates to an annual catch of 5.61 million tonnes. Whilst this PCL is a highly precautionary harvest rate, there may be negative ecosystem impacts if such a harvest is taken in a spatially restricted area, rather than distributed across the whole krill stock. CCAMLR therefore introduced a much more precautionary catch trigger level of 620,000 tonnes. This catch trigger level is based upon the total of the maximum catches recorded in each of the sub-areas of Area 48 over the history of the fishery, although it should be emphasised that the overall catch from Area 48 has never exceeded 620,000 tonnes.

The annual PCL of 5.61 million tonnes has remained constant since 2010. However, such a large figure for extraction overall (the PCL), or even the much more precautionary catch trigger level of 620,000 tonnes carries with it a risk that the fishery could be spatially restricted, resulting in localised, potentially negative, ecosystem impacts, and so the overall catch trigger level has been disaggregated across the four sub-areas of Area 48 (Table 8). It is not envisioned that the overall catch trigger level will be revised until the 2019 full synoptic survey has been analysed.

Clearly this approach to determining the PCL takes into account uncertainty due to parameter estimation and different modelling approaches have been evaluated. Whilst there are also uncertainties in relation to the development of the fishery, estimates of stock biomass and the impact of the fishery on the ecosystem, the PCL is set at a precautionary level of 9.3%, and the catch trigger levels are set at a more precautionary level. The catch trigger level combined with conservative estimates of sub-area biomass derived from localised sub-area surveys allows a calculation of an upper limit to exploitation rates: taking of the full catch trigger levels would be equivalent to an average exploitation rate of 6%, whereas evaluation of actual recorded catches in relation to localised survey estimates suggests that exploitation rates in the fishery have averaged around 1% across all areas since 1996 (Hill et al. 2016).

Previously there were clearly some concerns that the stock assessment was based upon a synoptic survey carried out in 2000, and that significant changes in krill biomass and krill predator biomass may have taken place since then, and indeed environmental conditions may have changed since the last survey. However, the harvest strategy is highly precautionary, so the fishery was still unlikely to have any impact on the stock. Until 2019, the synoptic survey had not been repeated since 2000 primarily due to the cost of such a large-scale survey, but there are now new estimates of krill biomass from the 2019 survey which used the same survey strata as the CCAMLR 2000 survey and the AMLR strata. As noted above, the estimate of krill biomass from the 2019 synoptic survey did not suggest that there had been any significant decline in krill biomass since the 2000 survey and therefore the previous concerns about using survey data that was nearly 20 years old have been allayed.

In summary the fishery appears to be operating sustainably because annual catches are well below a very conservatively set PCL, and overall there is confidence that current catch levels will not affect the total krill biomass adversely even if extraneous ecosystem and oceanographic/climate factors come into play.

The assessment team notes that CCAMLR Conservation Measure (CM) 51-07, which sets the trigger levels for the various sub-areas of Area 48 (see Table 9 above), is due to expire after the 2020/2021 season, and that an alternative approach (using for example risk assessment, spatial management methods or a Feedback Management System) must be implemented no later than during the 2019 meeting. The Commission and Scientific Committee of CCAMLR met in October 2019. The Scientific Committee's Working Group on Ecosystem Monitoring and Management (WG-EMM) concluded that the most appropriate approach to management of the krill fishery would be to take a sub-area based-approach, nested within an overall large-scale approach, for Subareas 48.1 to 48.4 based on sub-area-

scale stock assessment models and biomass estimates from regular surveys within sub-areas, to determine precautionary catch limits. The spatial distribution and scaling of the catch limits would then be based on the risk assessment framework (CCAMLR 2019l). WG-EMM concluded that this will require the development of:

(i) an implementation of the GYM and the krill decision rules that is appropriate for estimating area and sub-area catch limits
(ii) methods to estimate area and sub-area biomass or density based on available surveys
(iii) data layers and implementation of the risk assessment framework to evaluate catch distribution options at the area, sub-area and fishing ground scales
(iv) a management strategy evaluation.

On the basis of the work of WG-EMM, the Scientific Committee proposed a work plan toward a preferred management strategy for the krill fishery by 2021. This strategy consists of three components:

(i) a stock assessment to estimate precautionary harvest rates
(ii) updated biomass estimates, initially at the subarea scale, but potentially at multiple scales
(iii) a risk assessment to inform the spatial allocation of catch.

The Commission endorsed the Scientific Committee's proposal, although it was recognised that development of these three elements of the strategy before the expiration of CM51-07 at the end of the 2010/21 season would be a significant challenge.

In the interim, the setting of the trigger levels for the various sub-areas of Area 48 as prescribed under CM51-07 would remain in force for the 2019/20 season.

6.3.6 Total Allowable Catch (TAC) and Catch Data

The TAC and catch data for UoA 1 are shown below.

Table 12. TAC and Catch Data

TAC*	Year	2018/19	Amount	Subarea 48.1 – 155,000 tonnes Subarea 48.2 – 279,000 tonnes Subarea 48.3 – 279,000 tonnes
UoA share of TAC*	Year	2018/19	Amount	Subarea 48.1 – 155,000 tonnes Subarea 48.2 – 279,000 tonnes Subarea 48.3 – 279,000 tonnes
UoA share of total TAC*	Year	2018/19	Amount	Subarea 48.1 – 155,000 tonnes Subarea 48.2 – 279,000 tonnes Subarea 48.3 – 279,000 tonnes
Total green weight catch by UoA	Year (most recent)	2018**	Amount	Subarea 48.1 – 14,664.123 tonnes Subarea 48.2 – 0 tonnes Subarea 48.3 – 0 tonnes

	Year (second most recent)	2017	Amount	Subarea 48.1 – 16,308.560 tonnes Subarea 48.2 – 0 tonnes Subarea 48.3 – 0 tonnes

*The TAC for the krill fishery is based on an Olympic system with no allocation of the overall TAC to individual nation's fleets.

** 2018 figures were only up until the end of September, further detail on these figures will be sought leading up to and during the site visit.

6.3.7 Principle 1 Performance Indicator scores and rationales

Scoring table 1. PI 1.1.1A – Stock status

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Stock status relative to recruitment impairment			
	Guide post	It is **likely** that the stock is above the point where serious ecosystem impacts could occur.	It is **highly likely** that the stock is above the point where serious ecosystem impacts could occur.	There is a **high degree of certainty** that the stock is above the point where serious ecosystem impacts could occur.
	Met?	Yes	Yes	Yes

Rationale

The krill fishery is managed by setting catch limits based upon a Generalised Yield Model, and the estimate of sustainable yield (Precautionary Catch Level) is chosen so that the probability of the spawning biomass dropping below 20 % of its median pre-exploitation level (B_0) over a 20-year harvesting period is 10 %. The 20 % B_0 level is considered a limit reference point below which krill recruitment would be impaired and given the key role that krill plays in the Antarctic ecosystem, any such recruitment failure in krill would undoubtedly result in serious ecosystem impacts. The limit reference point set for krill is therefore in line with SA2.2.12a which considers that for key LTL species the point where serious ecosystem impacts could occur shall not be less than 20% of the spawning stock level that would be expected in the absence of fishing. A highly precautionary catch trigger level has been set at 11 % of the PCL, and the catch trigger level has been disaggregated across sub-areas of Area 48 to minimise any adverse effects on land-based predators of krill. The overall catch trigger level has never been exceeded for Area 48, and the fishery is closed if the sub-area catch triggers are approached. It is highly likely (≥80th percentile) therefore that the stock is above the point where serious ecosystem impacts could arise and the SG60 and SG80 are met.

Analysis of small-scale surveys between 2000 and 2016 provide no evidence of a decline in the krill stock, a re-analysis of abundance data for krill on KRILLBASE, a circumpolar database of Antarctic krill and salp numerical densities, showed no evidence for a decline in krill density from 1976 to 2016, and the 2019 large-scale survey provided an estimate of krill biomass above the pre-exploitation level (B_0) estimated from the 2000 synoptic survey. There is a high degree of certainty therefore that the krill stock is above the point where serious ecosystem impacts could occur. The SG100 is met.

b	Stock status in relation to achievement of Maximum Sustainable Yield (MSY)

	Guide post	The stock is at or fluctuating around a level consistent with ecosystem needs.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with ecosystem needs or has been above this level over recent years.
	Met?	Yes	Yes

Rationale

The krill fishery is managed to ensure that exploitation levels are set at levels that do not have any deleterious impacts on krill predators. A target level for the krill stock has been set at 75% of the median pre-exploitation biomass (B_0), i.e. at a level significantly higher than is required if only the target species is being considered and one that is consistent with the MSC expectations for key LTL species PI SA2.2.13a. Recent studies that evaluated the impact of the krill fishery on predators (Watters et al. 2013; Plaganyi & Butterworth 2012; Smith et al. 2011) indicate that such a target would satisfy ecosystem needs. The GYM predicts that if catches are kept below the Precautionary Catch Limit (PCL) of 5.61 million tonnes, then the stock will fluctuate about the reference target level with high probability. SG 80 is met.

In practice, the catch limit has been set at a highly precautionary level of 620,000 tonnes, and this level has not been exceeded in any year throughout the history of the fishery. In addition, in response to concerns that high removals of krill concentrated within a small geographical area could inadvertently and disproportionately impact land-based predator populations, CCAMLR CM 51-07 stipulates that the overall catch limit in Area 48 must be distributed across the various sub-areas of the fishery. These disaggregated catch limits remain in place for the 2019/20 season.

Analysis of small-scale surveys between 2000 and 2016 provide no evidence of a decline in the krill stock, a re-analysis of abundance data for krill on KRILLBASE, a circumpolar database of Antarctic krill and salp numerical densities, showed no evidence for a decline in krill density from 1976 to 2016, and the 2019 large-scale survey provided an estimate of krill biomass above the estimate of the pre-exploitation level (B_0) estimated from the 2000 synoptic survey. There is strong evidence therefore that the current stock is well above the target level and so there is a high degree of certainty that the stock has been fluctuating around a level consistent with ecosystem needs or has been above this level over recent years (in line with SA2.2.14a). The SG100 is met.

References:

(Constable & Mare 2003; Hill et al. 2016; Atkinson et al. 2017; CCAMLR 2019j; Cox et al. 2018; Macaulay et al. 2019; Plaganyi & Butterworth 2012; Smith et al. 2011; Watters et al. 2016)

Stock status relative to reference points

Type of reference point	Value of reference point	Current stock status relative to reference point

Reference point used in scoring stock relative to PRI (SIa)	≤10 % probability of the spawning biomass dropping below 20 % of its median pre-exploitation level (B_0) of 60.3 million tonnes	12.06 million tonnes	2019 estimate of stock biomass is 62.6 million tonnes Current stock status = 62.6 / 20%B_0 = 5.19
Reference point used in scoring stock relative to MSY (SIb)	Median escapement at the end of a 20-year exploitation period is 75 % of B_0 (60.3 million tonnes)	45.23 million tonnes	2019 estimate of stock biomass is 62.6 million tonnes Current stock status = 62.6 / 75%B_0 = 1.38

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 2. PI 1.1.2 – Stock rebuilding

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	Rebuilding timeframes			
	Guide post	A rebuilding timeframe is specified for the stock that is the **shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA

Rationale

There is no evidence that the stock is depleted and therefore this Performance Indicator is not scored.

b	Rebuilding evaluation			
	Guide post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is **evidence** that the rebuilding strategies are rebuilding stocks**, or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the **specified timeframe**.	There is **strong evidence** that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the **specified timeframe**.
	Met?	NA	NA	NA

Rationale

There is no evidence that the stock is depleted and therefore this Performance Indicator is not scored.

References

NA

Draft scoring range	NA
Information gap indicator	NA

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 3. PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Harvest strategy design			
	Guide post	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Yes	Yes	Yes

Rationale

The harvest strategy is underpinned by CCAMLR management regulations which are based upon the precautionary approach and the Ecosystem Monitoring Program (CEMP) which provides a basis for regulating harvesting of Antarctic marine living resources in accordance with the ecosystem approach. The harvest strategy consists of licensing of all vessels, precautionary catch limits, gear regulations including trawl mesh size and incorporation of marine mammal exclusion devices, monitoring of catches and fishing activity through logbooks, VMS and an observer scheme, and there is a rigorous monitoring and enforcement scheme in place. A key element of the harvest strategy is the setting of precautionary catch limits based upon recruitment and biomass escapement reference points and a well-defined harvest control rule. The harvest strategy is designed to minimise the impact on both krill and its predators through disaggregating catch trigger levels across sub-areas. The harvest strategy is therefore responsive to the state of the stock and, for a key LTL species, is designed to ensure that the stock is (a) above the point where serious ecosystem impacts could occur and (b) around a level consistent with ecosystem needs. SG60, 80 and 100 are met.

b	Harvest strategy evaluation			
	Guide post	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.

	Met?	Yes	Yes	No

Rationale

A harvest strategy consisting of highly precautionary catch limits, clearly defined reference points and a harvest control rule is likely to work based on prior experience in other fisheries. The fishery appears to be operating sustainably because annual catches are well below a very conservatively set precautionary catch limit (PCL), and overall there is confidence that current catch levels of approximately 0.5% of the stock biomass will not affect the total krill biomass adversely even if extraneous ecosystem and oceanographic/climate come into play. The SG60 is met.

There is no evidence of catch levels exceeding the catch trigger levels and sub-areas of Area 48 have been closed in recent years when the catch trigger levels have been approached as required under CCAMLR CM50-17 providing evidence of an effective HS. The most recent full survey of krill distribution provides evidence that krill biomass has not declined since the previous large-scale survey in 2000, and a reanalysis of abundance data for krill on KRILLBASE, a circumpolar database of Antarctic krill and salp numerical densities, showed no evidence for a decline in krill density from 1976 to 2016. There is evidence that the harvest strategy is achieving its objective and the SG80 is met.

Whilst the effects of different catch levels have been simulated using the GYM, the performance of the harvest strategy has not been fully evaluated through, for example, a Management Strategy Evaluation (MSE). SG100 is not met.

c	Harvest strategy monitoring	
	Guide post	Monitoring is in place that is expected to determine whether the harvest strategy is working.
	Met?	Yes

Rationale

Fishing activity of the two Korean vessels is monitored through the on-board Vessel Monitoring System (VMS) which is polled every hour. All Korean vessels must complete logbooks detailing catch and effort and this information must be transmitted regularly to CCAMLR secretariat. The Korean Fisheries Monitoring Center requires that Korean vessels report their catches of krill and bycatch species electronically every 24 hours. All krill fishing trips must have an observer on board the vessel, and where possible, a scientific observer will also be present to record all catches and discards, and there is a rigorous monitoring and enforcement scheme in place (further discussed in Section 6.4.2). CCAMLR monitors total uptake of catches in relation to the overall TAC for the area (and for the thresholds determined for each sub-area) and regularly notifies all contracting parties of uptake of overall TAC. Estimates of stock biomass of krill are made through fishery-independent surveys and the Ecosystem Monitoring Programme (CEMP) monitors the potential impact of the krill fisheries on the ecosystem components. All these elements of the monitoring programme provide information on whether the harvest strategy is working. The SG60 is met.

d	Harvest strategy review

	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Yes

Rationale

CCAMLR is the overarching body for management and development of the harvest strategy for the krill fishery, and the work of CCAMLR has undergone two performance reviews in 2008 and 2016 (CCAMLR 2017e; CCAMLR 2008a), from which a number of recommendations resulted. These include improved management of the spatial management of catches in Area 48 and developing harvest strategies which take into account ecosystem changes. In addition, the Working Group on Ecosystem Monitoring and Management (WG-EMM) meets annually to review all elements of the management of the krill fishery based on up-to-date data and research. For example, catch limits are reviewed regularly, stock assessment methodologies are fine-tuned, sub-area-based catch triggers have been introduced recently, and stock survey methodologies have been fully reviewed prior to the 2019 synoptic survey. CCAMLR is currently developing a Feedback Management System (FBM) incorporating routine acoustic data collection and intermittent land-based predator studies, and this approach may in future replace the current approach where catch trigger levels are disaggregated by sub-areas. SG 100 is met.

e	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NA	NA	NA

Rationale

Shark species are not targeted in this fishery so this scoring issue is not applicable.

f	Review of alternative measures			
	Guide post	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.

	Met?	NA	NA	NA

Rationale

All krill caught in the trawl are processed on board, and therefore there is no unwanted catch as per definition in SA3.1.6 and SA3.5.3. This scoring issue is not relevant.

References

(CCAMLR 2018j; Constable & Mare 2003; Hill et al. 2016; CCAMLR 2017e; Atkinson et al. 2017; CCAMLR 2017a; CCAMLR 2019j; Cox et al. 2018; Macaulay et al. 2019)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 4. PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Yes	Yes	Yes

Rationale

A Generalised Linear Model (GYM) was used to calculate a distribution of possible population sizes both in the absence of fishing and at various fishing mortalities. These distributions are used to determine the proportion ɣ (gamma) of an estimate of the unexploited biomass B_0 that would support a sustainable harvest. CCAMLR sets a PCL for krill using a set of "decision rules" to determine the proportion of the stock that can be fished. The catch limit is estimated using the GYM projecting the pre-exploitation population forward with different yield levels (ɣ) based on the following rules:

1. Choose a yield level, ɣ 1, so that the probability of the spawning biomass dropping below 20% of its median pre-exploitation level over a 20-year harvesting period is 10 %.

2. Choose a yield level, ɣ 2, so that the median escapement at the end of a 20-year period is 70% of the median pre-exploitation level.

3. Select the lower of ɣ 1 and ɣ 2 as the yield level.

The catch limit is the value of gamma selected by rule 3.

Rule 1 is equivalent to a limit reference point with an overfishing threshold of 20% of B_0, and Rule 2 is a target reference point for stock biomass based upon an escapement criterion.

Using this approach, a PCL was determined based upon an unexploited biomass (B_0) of 60.3 million tonnes and a CV of 12.8% and a gamma value of 0.093. Such a PCL equates to an annual catch of 5.61 million tonnes. Whilst this PCL is a highly precautionary harvest rate, there may be negative ecosystem impacts if such a harvest is taken in a spatially restricted area, rather than distributed across the whole krill stock. CCAMLR therefore introduced a much more precautionary catch trigger level of 620,000 tonnes. This catch trigger level is based upon the total of the maximum catches recorded in each of the sub-areas of Area 48 over the history of the fishery, although it should be emphasised that the overall catch from Area 48 has never exceeded 620,000 tonnes. This more precautionary catch trigger level of 620,000 tonnes still carries with it a risk that the fishery could be spatially restricted, resulting in localised, potentially negative, ecosystem impacts, and so the overall catch trigger level has been disaggregated across the four sub-areas of Area 48 (see Table 10). Whilst these sub-area trigger catches sum to more than 620 000 tonnes, there is evidence that fishing has been suspended if the sub-area trigger level is approached, and management experience has shown clearly that stopping fishing in one sub-area virtually stops fishing anywhere in the management area, so the overall trigger level has yet to be reached.

This harvest control rule is clearly understood and well-defined and results in the exploitation rate being maintained at a level which ensures that the point of recruitment impairment (PRI) is not approached. SG60 is met. The overall catch trigger level is 11 % of the PCL, which was calculated to ensure that the stock remains above the target reference point of 75% of B_0. In practice this means that the exploitation rate cannot approach either the target or limit reference point, and therefore the HCR ensures that the exploitation rate is expected to keep the stock fluctuating around a level consistent with ecosystem needs (SG80 is met) and indeed above a level consistent with ecosystem needs (SG100 is met).

b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Yes	No

Rationale

The development of the HCRs took into account parameter uncertainty in both the fishery and the ecosystem as well as model uncertainty as different population models were evaluated. The overall catch trigger permitted in the fishery is only 11% of the PCL estimated from the assessment model which is a highly precautionary PCL designed to keep the stock above 75 % of B_0. The HCRs are based upon a precautionary estimate of B_0. Uncertainty related to the potential impact on land-based predator populations of high removals of krill concentrated within a small geographical area have been taken into account by disaggregating the overall catch trigger level across the four sub-areas of Area 48. The HCRs are therefore likely to be robust to the main uncertainties. SG80 is met.

Whilst the HCRs take into account the ecological role of krill as important prey items of a range of predators, there are uncertainties relating to the potential effect of climate change on krill, increases in predators such as baleen whales and oceanographic patterns which do not appear to have been taken into account. SG100 is not met.

c	HCRs evaluation			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Yes	Yes	No

Rationale

There is good evidence that the harvest tools (robust recording of catches, observer trips, precautionary catch trigger levels, sub-area closures) are effective in achieving exploitation levels required under the HCRs. In recent years catches have not exceeded even the highly precautionary overall catch trigger of 620,000 tonnes, let alone the PCL of 5.61 million tonnes, and there is evidence in recent years that sub-areas of Area 48 have been closed when catch levels have approached the disaggregated sub-area catch triggers set out in CCAMLR CM 51-07. The large-scale survey undertaken in 2019 provided evidence that the krill stock has not been diminished by fishing and therefore the HCRs appear to be working. The SG60 and SG80 are met.

There are some concerns relating to inconsistency in the way that krill removals are recorded. Uncertainties in recording of green weight need to be resolved. SG100 is not met.

References

(CCAMLR 2018j; Constable & Mare 2003; CCAMLR 2019j; CCAMLR 2019l; CCAMLR 2019i; Cox et al. 2018; Macaulay et al. 2019); (CCAMLR 2016e)

Draft scoring range	≥80
Information gap indicator	More information sought on the ways in which krill removals are recorded

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 5. PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Yes	Yes	Yes

Rationale

Information is available on stock abundance and stock structure from krill biomass surveys including a full large-scale stock survey of Area 48 undertaken in 2019. These surveys include hydroacoustic surveys which calibrate the signals from echo-sounders with targeted trawl catch information on length distributions. Regular stock surveys of individual sub-areas of Area 48 have provided detailed information on stock structure and stock productivity. The stock surveys also collect a wide range of environmental information through for example the use of CTDs. The observer programme provides data on length composition, sex and maturity stage and fish by-catch. Observers also collect information on wind, sea and air temperatures during fishing operations. There is excellent information on fleet composition collated under CCAMLR's active vessel registry. UoA removals are rigorously recorded through electronic logbooks. The SG60 and SG80 are met.

In addition to information on krill abundance and distribution, regular surveys of krill predators are undertaken, and the CCAMLR Ecosystem Monitoring Program (CEMP) provides information to monitor ecosystem change. The information available is comprehensive and includes some environmental information (wind, sea and air temperatures) that may not be directly related to the harvest strategy. SG100 is met.

b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and **at least one indicator** is available and	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control**	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty,

		monitored with sufficient frequency to support the harvest control rule.	**rule**, and **one or more indicators** are available and monitored with sufficient frequency to support the harvest control rule.	and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Yes	Yes	No

Rationale

Stock abundance has been monitored through two large-scale stock surveys in 2000 and 2019, and in sub-areas of Area 48 through regular stock surveys in the period between the full stock surveys. Abundance data for krill is also available on KRILLBASE, a circumpolar database of Antarctic krill and salp numerical densities, and a recent re-analysis of this time series of krill abundance data provided evidence that average krill density appears to have been stable but with considerable inter-annual variability. CCAMLR monitors total uptake of catches in relation to the overall catch trigger limit for the area (and for the triggers determined for each sub-area) and regularly notifies all contracting parties of uptake of overall catch quota which allows closure of sub-areas if the recorded catches approach the trigger levels. UoA removals are rigorously monitored through logbooks, landings records and an observer programme. Stock abundance and UoA removals are monitored at a level consistent with the harvest control rule, and although the full stock surveys are not undertaken regularly, they are sufficiently frequent to support the highly precautionary harvest control rule. SG80 is met.

Whilst there is a good understanding of the inherent uncertainties in the data and the robustness of assessment and management to that uncertainty, the large-scale stock surveys are not conducted every year, or indeed every few years, and therefore SG100 is not met.

c	Comprehensiveness of information		
	Guide post		There is good information on all other fishery removals from the stock.
	Met?		Yes

Rationale

There is good information on all removals from the stock by vessels outside the UoA. Whilst there is no strong evidence relating to stock structure of krill, almost all the catch is taken from the area targeted by the UoC, and there is little or no krill caught in adjacent areas that might hold part of the same stock, and none from outside the CCAMLR area. There is no evidence of IUU fishing on the stock. All fishery removals are well documented by CCAMLR from both within and outside Area 48 and there is no incentive in the UoC fishery or outside the UoC to misreport catches. SG80 is met.

References

(CCAMLR 2018j; Atkinson et al. 2017; Cox et al. 2018; Macaulay et al. 2019)

CCAMLR Ecosystem Monitoring Program (CEMP)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 6. PI 1.2.4 – Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Yes	No

A key component of the assessment is a krill stock survey which estimates stock biomass with acoustic surveys that estimate mean krill target strength which is then calibrated with krill length distributions observed from trawl samples. Acoustic backscatter at 120 kHz is attributed to krill swarms, and then backscatter from krill are delineated using the 'swarms' method and integrated to produce distribution maps of krill areal density and survey standing stock estimates. Full large-scale stock surveys have been undertaken in 2000 and 2019. In intervening years smaller-scale stock surveys have been undertaken, and although statistical analysis of these biomass indices provided no evidence that the stock had declined since the major survey in 2000, the biomass estimates have shown such high variability that it is very difficult to separate systematic changes in biomass from natural variability. Trends in abundance can also be identified through analysis of data on KRILLBASE, a circumpolar database of Antarctic krill and salp numerical densities.

A GYM is used to estimate a sustainable yield. The model simulates a distribution of possible population sizes both in the absence of fishing and at various fishing mortalities, and these distributions are used to determine the proportion ɣ (gamma) of the unexploited biomass B_0 estimated from the hydroacoustic survey in 2000 that would support a sustainable harvest. A Precautionary Catch Level (PCL) is estimated using the GYM projecting the pre-exploitation population forward with different yield levels (ɣ) based on generic reference points appropriate to krill stock dynamics. The assessment has defined a limit reference point at 20% of its median pre-exploitation level in line with MSC Fisheries Standard v2.01, SA2.2.12a which considers that for key LTL species the point where serious ecosystem impacts could occur shall not be less than 20% of the spawning stock level that would be expected in the absence of fishing, and the target level has been set at 75% of the median pre-exploitation biomass, i.e. at a level significantly higher than is required if only the target species is being considered and a level in line with MSC Fisheries Standard v2.01, SA2.2.13a. Recent studies that evaluated the impact of the krill fishery on predators (Smith *et al*. 2011, Plaganyi and Butterworth 2012, Watters *et al*. 2013) indicate that such a target would satisfy ecosystem needs. Krill is a key LTL within the Antarctic ecosystem, and therefore the assessment must take into account the potential impact of krill fishery removals on the ecosystem, particularly on land-based predators. Catch trigger levels set under the PCL (5.61 million tonnes) may cause negative ecosystem impacts and so the PCL has been replaced with a highly precautionary catch trigger level of 620,000 tonnes (11% of the PCL). In addition, the overall catch trigger level is disaggregated across the sub-areas of Area 48 (as set out in Table 9) to ensure that high krill removals cannot be concentrated in one sub-area and cause adverse ecosystem impacts.

Estimating stock biomass with acoustic surveys calibrated with length distributions observed from trawl samples is an appropriate assessment methodology for krill stocks. The large-scale krill stock surveys in 2000 and 2019 and the use of the GYM provide an assessment of stock status against reference points set at appropriate levels for key

LTL species. The reference points and harvest control rules were based upon the estimate of stock biomass from the 2000 large-scale survey, and the results from the 2019 survey demonstrated that there had been no decline in krill stock biomass and therefore confirmed that the reference points and HCRs were still appropriate. On the basis that there had been a very recent full stock survey, the assessment team concluded that the assessment is appropriate for the stock and for the harvest control rule and the SG80 is currently met. However only two large-scale stock surveys have been undertaken in the last 20 years, and more regular surveys will be required for such a key LTL species particularly in the light of likely ecosystem changes caused by climate change. The assessment team notes that the high costs of conducting large-scale stock surveys may preclude further such surveys in the near future, and therefore alternative approaches may be required to ensure that the stock assessment approach remains appropriate to the stock throughout the recertification cycle. At the 2019 meeting, WG-EMM determined that future management should be based on sub-area-scale stock assessment models and biomass estimates from regular surveys within sub-areas, to determine precautionary catch limits. WG-EMM concluded that this will require the development of:

(i) an implementation of the GYM and the krill decision rules that is appropriate for estimating area and sub-area catch limits

(ii) methods to estimate area and sub-area biomass or density based on available surveys

(iii) data layers and implementation of the risk assessment framework to evaluate catch distribution options at the area, sub-area and fishing ground scales

(iv) a management strategy evaluation.

In the likely absence of more regular large-scale stock surveys, and the need (as stated by WG-EMM) for sub-area-scale stock assessment models and biomass estimates from regular surveys within sub-areas in order to determine precautionary catch limits, the assessment team concluded that the assessment does not fully take into account krill's role within the ecosystem as a key LTL species and therefore SG100 is not met.

The assessment team therefore recommends that, within the period of certification, regular sub-area stock surveys are continued, robust estimates of biomass in sub-areas are established, and stock assessment models are developed at a sub-area scale in order to determine appropriate precautionary catch limits which will take into account the potential fine-scale impact of the krill fishery on land-based predators, and to provide sufficiently regular estimates of krill stock biomass in order to assess whether krill stocks have been impacted by ecosystem changes caused by climate change.

b	Assessment approach		
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.
	Met?	Yes	Yes

Rationale

The assessment estimates stock status relative to two generic reference points, a limit reference point with an overfishing threshold of 20 % of unexploited biomass (B_0), and a target or escapement target reference point of 75% of B_0. The target reference point is set at a level significantly higher than is required if only the target species is being

considered, and based on studies to evaluate the impact of the krill fishery on predators, the target reference point is determined to be appropriate to satisfy ecosystem needs. The reference points are therefore appropriate to a key LTL species. SG60 is met.

The reference points were estimated based on the results of the CCAMLR-2000 krill stock survey of Area 48 which provided data to estimate krill biomass in Subareas 48.1–48.4. Following an updated full stock survey in 2019, reference points may be adjusted in the future. SG80 is met.

c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Yes	Yes	Yes

Rationale

Precautionary catch limits (PCLs) for krill considers uncertainty due to parameter estimation and different modelling approaches have been evaluated. The PCL for krill is calculated probabilistically using Monte Carlo integration. The model incorporates natural variability in recruitment and uncertainty in growth, natural mortality and abundance. The simulation model is used to calculate a distribution of possible population sizes both in the absence of fishing and at various fishing mortalities. Whilst there are also uncertainties in relation to the development of the fishery, estimates of stock biomass and the impact of the fishery on the ecosystem, the lowest of several candidate values for unexploited biomass (B_0) is used to determine the catch limit, and the PCL is set at a precautionary level of 9.3% of the estimate of unexploited biomass (B_0), and the catch trigger levels are set at an even more precautionary level. The assessment has therefore identified the major sources of uncertainty (SG60 is met), considering uncertainty (SG80 is met) and is evaluating stock status relative to reference points in a probabilistic way (SG100 is met).

d	Evaluation of assessment		
	Guide post		The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?		No

Rationale

The stock assessment was based on the CCAMLR-2000 large-scale survey of Area 48 and since 2000 information from regular surveys in sub-areas of Area 48 has been used to evaluate and fully test the assessment through, for example, improvements in assessing target strength in acoustic assessments, and the assessment has been shown to be robust. During the development of the GYM, other assessment models were evaluated, and at present CCAMLR WG-EMM are developing an integrated stock assessment model intended to make use of multiple data sources and to provide an alternative to stock surveys as a means of assessing krill stock status. However, these alternative approaches have not yet been rigorously explored. SG100 is not met.

e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Yes	Yes

Rationale

The methodology and results from the CCAMLR-2000 survey and the GYM have been published in the peer-reviewed literature, and survey results and assessments are peer reviewed within the CCAMLR Working Group system. The survey methodology for the 2019 full-scale stock survey was rigorously peer-reviewed within CCAMLR Working Groups. The assessment of stock status is therefore subject to peer review, and so SG80 is met. Whilst most of the annual review of stock assessment is through the CCAMLR WG system, these meetings are attended by highly competent stock assessment scientists from several countries and therefore constitute a form of external peer review. In conjunction with occasional external peer reviews of specific elements of the stock assessment process, and the publishing of the 2000 survey methodology and GYM in the peer-reviewed literature, it can be concluded that the assessment has been internally and externally peer-reviewed. SG100 is met.

References

(CCAMLR 2018j; Constable & Mare 2003; Atkinson et al. 2017; CCAMLR 2019j; CCAMLR 2019l; CCAMLR 2019i; Cox et al. 2016; Cox et al. 2018); (Kinzey et al. 2015; Macaulay et al. 2019; Plaganyi & Butterworth 2012; Smith et al. 2011; Watters et al. 2016) (Atkinson et al., 2019)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

6.4 Principle 2

6.4.1 Designation of species under Principle 2

Primary species (MSC Component 2.1) are defined as follows:

- Species in the catch that are not covered under P1;
- Species that are within scope of the MSC program, i.e. no amphibians, reptiles, birds or mammals;
- Species where management tools and measures are in place, intended to achieve stock management objectives reflected in either limit (LRP) or target reference points (TRP). Primary species can therefore also be referred to as 'managed species'.

Secondary species (MSC Component 2.2) are defined as follows:

- Species in the catch that are not covered under P1;
- Species that are not managed in accordance with limit or target reference points, i.e. do not meet the primary species criteria;
- Species that are out of scope of the programme, but where the definition of ETP species is not applicable (see below)

ETP (Endangered, Threatened or Protected) species (MSC Component 2.3) are assigned as follows:

- Species that are recognised by national ETP legislation
- Species listed in binding international agreements (e.g. CITES, Convention on Migratory Species (CMS), ACAP, etc.)
- Species classified as 'out-of scope' (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CE).

Both primary and secondary species are defined as '**main'** if they meet the following criteria:

- The catch comprises 5% or more by weight of the total catch of all species by the UoC;
- The species is classified as 'Less resilient' and comprises 2% or more by weight of the total catch of all species by the UoC. Less resilient is defined here as having low to medium productivity, or species for which resilience has been lowered due to anthropogenic or natural changes to its life-history
- The species is out of scope but is not considered an ETP species (secondary species only)
- Exceptions to the rule may apply in the case of exceptionally large catches of bycatch species

6.4.2 Primary and Secondary species

6.4.2.1 Observer reports

The CCAMLR Scheme of International Scientific Observation was adopted in 1992 under Article XXIV of the Convention. It is one of the most important sources of scientific information that is essential for

assessing the impact of fishing on the ecosystem, including the status of target populations, as well as those of related and dependent species. The scheme also plays a crucial role in developing approaches to reducing the impact of fishing on the ecosystem by collecting data on the effectiveness of mitigation measures. All vessels fishing in CCAMLR fisheries are required to carry an observer for some or all of their fishing operations. In fisheries for icefish and toothfish there is a requirement for 100% coverage by an international (i.e. not from the same flag state as the vessel) observer, while in the krill fishery there is a target coverage of at least 75% during 2018/19 and 2019/20 fishing seasons; and 100% coverage in subsequent fishing seasons (CM 51-06 2019), using either international or national observers. Observers record information on the gear configuration (including measures to reduce incidental mortality of seabirds and marine mammals), fishing operations (including catch composition), biological measurements of target and by-catch species, details of fish tagging and tag-recaptures, vessel sightings and data on indicators of vulnerable marine ecosystems

CCAMLR Conservation Measure 51-06 (2016), which covers general measures for scientific observation in fisheries for *Euphausia superba*, states the need for adequate monitoring and management of the krill fishery and recommends 100% observer coverage from the 2019-2020 fishing season and the use of the Scientific Observers Manual, according to the CCAMLR Scheme of International Scientific Observation. The observer's tasks are listed in Annex I of the Manual, and include, among others:

- sampling of catches to determine biological characteristics,
- recording biological data by species caught,
- recording bycatches, their quantity and other biological data,
- recording entanglement and incidental mortality of birds and mammals,
- recording the procedure by which declared catch weight is measured.

According to the different CCAMLR scientific observer reports from the UoA, all species recorded in the catch composition are used in the intended products, mainly fishmeal and krill oil. There are no discards as the continuous pumping system transfers the catch to a conveyor belt on board the vessel (s), which moves the catch into the hold. There is no size sorting of the krill caught and all species in the catch are retained. These retained species are primarily pelagic larval stages of fish and non-fish organisms. Cruise reports submitted by CCAMLR scientific observers record catch details for all species and provides a summary of the biological data collected. Comprehensive information on the length, weight, sex and maturity of the individuals sampled is recorded in the observer's electronic logbook.

The catch composition data presented in this report is based on Observer data collected between 2016 to 2019 krill fishing seasons. A total of 4534 fishing trawls were undertaken (both vessels) between 2016 and 2018, out of which a total of 1077 were sampled. Although observer reports are available for both vessels for 2019, the number of fishing trawls and number of samples was not recorded in the report. Sampling is a standardised process across the krill fisheries, whereby 25kg sub-samples are taken from each haul, up to 1-8 times a day. These subsamples are analysed in detail as to species composition and krill sizes.

Table 10. Catch composition aggregated for both vessels and all samples (2016-2019)

Species		kg	% of Total	Designation
Euphausia superba	Krill - target	53,060,661.800	99.99%	Target
Chionodraco rastrospinosus	Ocellated icefish	1,099.675	0.002%	Secondary
Champsocephalus gunnari	Mackerel icefish	1,008.388	0.002%	Primary
Salpidae	Salps	969.150	0.002%	Secondary

Chaenodraco wilsoni	Spiny icefish	199.982	0.000%	Secondary
Pseudochaenichthys georgianus	South Georgia icefish	194.160	0.000%	Secondary
Chaenocephalus aceratus	Blackfin icefish	159.802	0.000%	Secondary
Cryodraco antarcticus	Long-fingered icefish	121.388	0.000%	Secondary
Notothenia gibberifrons	Humped rockcod	102.547	0.000%	Secondary
Pleuragramma antarcticum	Antarctic silverfish	81.315	0.000%	Secondary
Electrona carlsbergi	Electron subantarctic lanternfish	78.858	0.000%	Secondary
Semele radiata	bivalve	66.630	0.000%	Secondary
Gymnoscopelus nicholsi	Nichol's lanternfish	65.631	0.000%	Secondary
Pagetopsis macropterus		50.494	0.000%	Secondary
Notolepis coatsi	Antarctic jonasfish	37.935	0.000%	Secondary
Neopagetopsis ionah	Crocodile icefish	29.892	0.000%	Secondary
Geophagus spp		29.204	0.000%	Secondary
Rhopilema spp	Jellyfish spp	19.50	0.000%	Secondary
Nototheniops larseni	Painted rockcod	16.434	0.000%	Secondary
Notothenia coriiceps	Black rockcod	10.155	0.000%	Secondary
Parachaenichthys charcoti	Antarctic dragonfish sp	8.040	0.000%	Secondary
Cyclopteridae	Lumpsucker spp	7.90	0.000%	Secondary
Onykia ingens	Greater hooked squid	7.560	0.000%	Secondary
Psychroteuthis glacialis	Glacial squid	6.951	0.000%	Secondary
Notothenia rossii	Marbles rockcod	5.407	0.000%	Secondary
Trematomus eulepidotus	Blunt scalyhead	4.877	0.000%	Secondary
Lophius americanus	American anglerfish	4.340	0.000%	Secondary
Psilodraco breviceps	Antarctic dragonfish sp	3.050	0.000%	Secondary
Notothenia neglecta	Yellowbelly rockcod	2.10	0.000%	Secondary
Trematomus newnesi	Notothenid sp	1.867	0.000%	Secondary
Onykia knipovitchi	Cephalopod sp	1.580	0.000%	Secondary
Icichthys australis	Southern driftfish	1.290	0.000%	Secondary
Dissostichus mawsoni	Antarctic toothfish	0.970	0.000%	Secondary
Nototheniops nudifrons	Notothenid sp	0.910	0.000%	Secondary
Dunaliella tertiolecta	Algae	0.805	0.000%	Secondary
Trematomus lepidorhinus	Slender scalyhead	0.785	0.000%	Secondary

Pagetopsis maculatus	Channichthid sp	0.63	0.000%	Secondary
Magnisudis prionosa	Southern barracudina	0.52	0.000%	Secondary
Gasterosteus aculeatus	Three-spined stickleback	0.24	0.000%	Secondary
Paraliparis spp	Snailfish sp	0.225	0.000%	Secondary
Paradiplospinus antarcticus	Antarctic escolar	0.2	0.000%	Secondary
Loligo gahi	Cuttlefish	0.165	0.000%	Secondary
Dacodraco hunteri	Crocodile icefish sp	0.14	0.000%	Secondary
Nototheniidae	Notothenid sp	0.05	0.000%	Secondary
Natantia	Decapod sp	0.02	0.000%	Secondary
Alopias superciliosus	Bigeye thresher – dubious identification	0.005	0.000%	Secondary
Octopodidae	Octopus	0.005	0.000%	Secondary
Artedidraco mirus	Perciform sp	0.001	0.000%	Secondary

Table 10 gives an indication of the diversity of species caught, showing 46 species/ species groups recorded (excluding the target species). The catch is dominated by krill. Two species, Ocellated icefish and Mackerel icefish, are the only ones which have been caught in large enough quantity to show up as 0.002% of the total catch. Salps were also caught in 0.002% of the total catch. The combined catch of all non-target species barely amounted to 0.009% of the total catch across all observed catches. According to the Observer reports, the fish species taken predominantly corresponded to larval stages.

According to CCAMLR there are currently active fisheries for four species: the fisheries in the Convention Area currently target Patagonian toothfish (*Dissostichus eleginoides*), Antarctic toothfish (*Dissostichus mawsoni*), mackerel icefish (*Champsocephalus gunnari*) and Antarctic krill (*Euphausia superba*). These fisheries are managed using the ecosystem-based and precautionary approach, and management objectives which balance 'conservation' and 'rational use' of living resources and maintain existing ecological relationships. The fisheries operate in a regulatory framework which recognises five types of fisheries that reflect the stage of development and the level of information available to make management decisions.

Catch limits in each fishery are agreed using decision rules that ensure the long-term sustainability of the fishery. These limits and the other operational aspects defined in the conservation measures determine when, where and how fisheries are conducted in order to manage the potential impacts on the ecosystem. These regulations are usually specific to a fishing season, and currently apply to toothfish, icefish and krill fisheries. Other fisheries have operated at various times in the past and are no longer active.

Based on the catch composition table, one of these currently commercial species showing up in the catch statistic (besides the target species) is mackerel icefish (*Champsocephalus gunnari*) at 0.002%. Recent (2018) survey biomass estimates from CCAMLR indicate that *C. gunnari* in Subarea 48.3 is well above average and the second highest since 2000 (CCAMLR Krill Fishery report 2018). However, biomass estimates for *C. gunnari* within Subarea 48.1, where the client fishery operates, do not appear to be available. Based on the information available, *C.gunnari* is designated a Primary minor species.

The only toothfish species noted in the catch composition is the Antarctic toothfish (*Dissostichus mawsoni*) at small quantities (less than 1kg). Unlike Patagonia toothfish (*Dissostichus eleginoides*), which has an established fishery in a number of regions in the Antarctic, including area 48.3 (these fisheries are licenced and managed through CCAMLR, with catch limits, stock assessment (see CCAMLR (2018i)) and appropriate conservation measures (CM 41-02), there is no established fishery for Antarctic toothfish (*Dissostichus mawsoni)* in area 48.1 and 48.2 and therefore this species is not managed in this area, no stock assessments are available (the Antarctic toothfish fishery currently occurs in 88.3 with exploratory fisheries in 88.2 and 88.1). *D.mawsoni* is designated a Secondary minor species.

The low percentage of non-target species in the catch composition compares with other observed krill fisheries and dedicated bycatch studies in krill fisheries. CCMALR's report WG-EMM-14/31 gathered bycatch information from the commercial fisheries (95,513 hauls) and SISO (Scheme of International Scientific Observation) data (11,875 hauls) (CCAMLR 2017d; CCAMLR 2018i). The analysis showed a consistent overlap of the bycaught taxa reported in both data sources. The two most frequently reported species in both sources were painted rockcod (*Lepidonotothen larseni*) and spiny icefish (*Chaenodraco wilsoni*). *L. larseni* is listed under the scientific name *Notothenio*ps *larseni* (CCAMLR code NOL) at CCAMLR's official bycatch species code list. In terms of total estimated catch, the highest estimated volume amongst bycaught species corresponded to mackerel icefish, *Champsocephalus gunnari* (coded as ANI), followed by *N. larseni*. This partly tallies with the fishery under assessment, although *N.larseni* is by comparison recorded less frequently.

The data assessed by WG-EMM-14/31 showed that "*The estimated total annual mass of fish by-catch in a 300,000 tonnes krill fishery would be 370 tonnes* [=0.12%]*, comprising 40% mackerel icefish (Champsocephalus gunnari) and 30 % L. larseni*" (CCAMLR 2017d). A detailed analysis of observer data for the Aker Biomarine certified krill fishery yielded an estimate of 2kg of fish larvae per tonne of krill taken (i.e. 0.2%) (Hønneland et al. 2015). If raised to the hypothetical total catch of 300,000 t, this would represent 600 t of larval fish taken.

The CCAMLR's bycatch review further notes that "*The length-frequency distribution of all taxa for which >100 fish were measured had modal size class of <10 cm. The fish species taken as bycatch in the krill fishery are the same species (and size classes) as those reported in the diet of 'krill-dependent' predators*". It also noted that the quality of the reported bycatch data has been increasing, as has the amount of bycatch species reported (CCAMLR 2018i).

Amongst the taxa most frequently recorded as bycatch in the fisheries for Antarctic krill, the group of the *Notothenids* stands out for several reasons. These fish have some adaptations that allow them to thrive in such cold habitat, such as antifreeze proteins in their blood and ample fat to insulate them against heat loss and to offset their lack of a swim bladder. *Notothenids* are extraordinarily diverse regarding their body size, morphology and habitat ranges (Calì et al. 2017). The family encompasses 12 genera and about 50 species. They share a common benthic ancestor, from which the family experienced an evolutionary radiation that allowed notothenid species to colonize cryopelagic, pelagic, semi-pelagic and epibenthic habitats (Calì et al. 2017). The genus *Notothenia* includes five species, three of which (*N. rossii, N. coriiceps* and *N. cyanobrancha*) are typical of Antarctic waters.

N. rossii (marbled rockcod) was fished to depletion during the early stages of Antarctic commercial fisheries in the late 1960s and 1970s. The fishery was finally closed in 1985. However, even after more than 30 years since the closure, the stock has either failed to recover, or is just barely starting to slowly recover (Arriagada & Neira 2014; Marschoff et al. 2012). *N. rossii* is considered to have a high vulnerability to fishing mortality (Fishbase 2019) due to traits such as late sexual maturity and slow growth (Calì et al. 2017).

On the other hand, its congeneric species *N. coriiceps*, Black rockcod was never commercially exploited. Its range appears to encompass higher latitudes than that of *N. rossii* (Calì et al. 2017) and is considered to be one of the dominant fish in nearshore waters of the Scotia Sea (Marschoff et al. 2012). A third *notothenid* of interest is Painted Notie, *Nototheniops larseni*. It is mentioned as frequently caught by the Antarctic krill fishery but there is no stock assessment (MBA 2017).

Beyond *notothenids*, there are also a number of other finfish bycaught across commercial krill fisheries:

- Antarctic Jonasfish, *Notolepis coatsi*, for which there is no current stock assessment. There is anecdotal evidence that Antarctic jonasfish is caught in 5%-10 % of krill tows (MBA 2017).
- Blackfin Icefish, *Chaenocephalus aceratus* is in similar situation of data deficiency. Whilst the current stock status is unknown, there are signs of a decreasing biomass trend (MBA 2017).
- Spiny Icefish, *Chaenodraco wilsoni*, constitutes a special case because it was targeted by a commercial fishery in the 1970s and 1980s (Mesa et al. 2009). It has widespread distribution on the Antarctic continental shelf at depths from 200m to 800m; however, its stock status is not regularly assessed and hence it is currently unknown (Mesa et al. 2009; MBA 2017).
- Lanternfishes, family *Myctophidae.* Lanternfishes constitute one of the dominant mesopelagic fishes (MBA 2017). Given their abundance and the low percentage in which they appear in the bycatch, they are unlikely to constitute a concern in the fishery.

Following on from the catch composition data presented in Table 10, there are no Secondary main species, all Secondary species listed are minor.

6.4.2.2 Potential IPI issues

IPI – other krill species in catch.

An emerging issue with the Antarctic krill fishery targeting *E. suberba* is the more than likely presence of a similar species, *E. crystallorophias* (ice krill), undetected in the catch. Ice krill might constitute an IPI stock in the UoC and indeed across all Antarctic krill fisheries.

The issue was considered in a document published by ASOC in 2017 (ASOC 2017). During the Third International Krill Symposium in June 2017, representatives of the krill fishing industry indicated that they do not report bycatch of ice krill (*E. crystallorophias*) that might be caught during their operations. While other species of Southern Ocean krill are easily distinguishable from Antarctic krill, *E. superba* and *E. crystallorophias* are almost impossible to differentiate without the aid of a microscope. Since krill fishing operations concentrate in shallow coastal areas, which overlap with the preferred habitat of *E. crystallorophias*, there is concern that *E. crystallorophias* is being caught and landed as *E. superba*.

Uncertainty in which species are being fished undermines science-based fisheries management of Antarctic krill. Thus far in its management of the fishery, CCAMLR has assumed that only *E. superba* is being fished, not a mix of *Euphausiid* species. Therefore, ASOC recommended (ASOC 2017) for CCAMLR to develop requirements for evaluation of representative samples of the krill catch to assess the level of *E. crystallorophias* in the catch. Also, historical samples should be examined to gain new understanding on this particular issue.

More recently, CCAMLR's Working Group on Ecosystem Monitoring and Management (WG-EMM) stated the following (CCAMLR WG-EMM 2018):

- "2.15 WG-EMM-18/05 analysed publicly available aggregated decadal-scale krill catch data to evaluate the likelihood that ice krill (*Euphausia crystallorophias*) will have been included in the reported Antarctic krill catch. The Antarctic krill fishery operates in geographic areas that overlap with the known range of ice krill, potentially occupying similar depths in the water column. The authors of the paper concluded that as both species are morphologically similar, the possibility of ice krill being caught as by-catch, and the failure to detect it, cannot be dismissed and that the likelihood of ice krill by-catch is effectively 100%.
- 2.16 The Working Group noted that some krill fishery operations occur in areas where datasets from scientific net hauls indicate the likelihood of co-existence of these two species. The Working Group further noted that the absence of ice krill reports does not necessarily indicate an absence of ice krill by-catch and underlined the importance of providing scientific observers with the appropriate materials needed to identify ice krill in their routine observations".

The CCAMLR Working Group noted that the absence of ice krill in bycatch could be because the fishery is targeting Antarctic krill and avoiding catch of ice krill due to its smaller size and one member of the working group suggested that research surveys in Area 48 did not reveal the presence of ice krill in catches using research gear. This circumstantial evidence alone may be insufficient to address the MSC requirements on IPI stocks. In response to the evidence in WG-EMM-18/05 (CCAMLR WG EMM 2018). The Working Group requested that Members compile relevant survey and catch data in order to provide advice in the future on bycatch in terms of finfish and invertebrates in the krill fishery.

The client reports that the National Institute of Fisheries Science in Korea currently have no accurate data on ice krill contributions, but they expect that as a result of the Working Group report catch data from CCAMLR vessels will be reviewed and countermeasures will be discussed in future Scientific Committees or Working Group. The client, Jeong Il Corporation, will comply with all conservation measures enacted by CCAMLR in this regard.

The issue of Ice krill was raised by CCAMLR in 2018 (CCAMLR WG EMM 2018) and neither of the MSC certified fisheries for krill have yet to incorporate this new information into their assessment audits, but reviews of their 2019 surveillance audits are warranted in this regard. Currently (Dec 2019) it looks unlikely that ice krill ought to be considered an IPI species in the UoC.

6.4.2.3 Out of scope species

Out of scope species include amphibians, reptiles, birds and mammals which are not listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CE). All such out of scope species are considered as Secondary main species.

Observer reports must record any interaction of seabirds and marine mammals with the fishery. Two such records were made: 2018 – one *Bubulcus ibis* (cattle egret) was found dead. 2019 – one Antarctic fur seal was found in the net and immediately released alive and unharmed – the fur seal is considered under ETP.

Observer reports record such krill fishery interactions, which are then all compiled annually in CCAMLR Fishery reports. In 2018 there were two seabird mortalities reported from the whole of the krill fishery, one snow petrel (*Pagodroma nivea*) in Subarea 48.1 and one cape petrel (*Daption capense*) in Subarea 48.2. There were also 19 reported mortalities of Antarctic fur seal (*Arctocephalus gazella*) in the fishery in Subarea 48.3, of which 18 were reported from the same vessel.

The CCAMLR krill fishery report (CCAMLR 2017d) reported 2 seabird mortalities (unspecified species, one in subarea 48.1 and one in subarea 48.2) for the whole fleet in 2017 and 9 seabird (unspecified) mortalities in 2016, one in Subarea 48.2 and eight in Subarea 48.1.

The global population of snow petrels exceeds 4 million individuals, and in the absence of evidence for any declines or substantial threats the population is considered stable (Birdlife_International 2019c) Species factsheet: *Pagodroma nivea*). As for the cape petrel, its population exceeds 2 million individuals and is also expected to be stable in the absence of any evidence to the contrary (Birdlife_International 2019b) Species factsheet: *Daption capense).* Both species are listed as Least Concern by IUCN.

The cattle egret (*Bubulcus ibis*) is not listed in CITES; it is listed as LC in the IUCN Red List; it is listed as LC by Birdlife International (Birdlife_International 2019a). The cattle egret is therefore considered as a Secondary main species.

6.4.2.4 Mitigation measures

Mitigation measures which apply to out-of-scope species (birds and marine mammals in this case) are described in Section 6.4.3.2 (ETP Section)

6.4.3 ETP species

The two main groups of ETP species which might be directly affected by the Antarctic krill fishery are krill predators such as seabirds and marine mammals (especially pinnipeds). These, and other ETP species (e.g. whales), might also be indirectly impacted through the fishery's removal of krill. This aspect will be considered under the ecosystem component.

The marine resources managed by CCAMLR specifically exclude whales and seals, which are the subject of other conventions – namely the International Convention for the Regulation of Whaling and the Convention for the Conservation of Antarctic Seals. In 1994 the International Whaling Commission (IWC) adopted a whale sanctuary covering the waters of the Southern Ocean around Antarctica (the geographical area included in the UoA falls within this sanctuary). Commercial whaling on any whale species is prohibited within this sanctuary.

The following table lists a number of ETP species which occur in the area of the fishery under assessment.

Table 11. List of ETP species which occur in the area of the UoA.

Species	Cites App 1	IUCN	CMS/ ACAP	CC of Antarctic Seals
Arctocephalus gazelle (Antarctic fur seal)				X
Mirounga leonine (Southern elephant seal)				X
Lobodon carcinophagus (Crabeater seal)				X
Leptonychotes weddellii (Weddel seal)				*X*
Balaenoptera borealis (Sei whale)	X			

Species	Cites App 1	IUCN	CMS/ ACAP	CC of Antarctic Seals
Balaenoptera bonaerensis (Antarctic minke whale)	X			
Balaenoptera musculus (Blue whale)	X			
Physeter microcephalus (Sperm whale)	X			
*Balaenoptera physalus (*Fin whale)				
Spheniscus humboldti (Humboldt penguin)	X	VU		
Thalassarche chrysostoma (Grey headed albatross)		EN	X	
Diomedea exulans (Wandering albatross)		VU	X	
Thalassarche melanophris (Black browed albatross)			X	
Phoebetria palpebrata (Light-Mantled Sooty Albatross)			X	
Phoebetria fusca (Sooty Albatross)		EN	X	
Macronectes giganteus (Southern giant petrel)			X	
Macronectes halli (Northern giant petrel)			X	
Procellaria cinereal (Grey Petrel)			X	
Procellaria aequinoctialis (White-chinned Petrel)		VU	X	

Midwater trawling for krill is generally considered a low risk of ETP bycatch (MBA 2017), although some interactions have been recorded, as can be seen in the Observer reports and Krill fishery reports. A number of technical measures have been put in place over the years to reduce the bycatch of seabirds and marine mammals, and as a result ETP mortality events are relatively rare. The total estimated mortalities in this krill fishery are low. The 2018 meeting report of the Working Group on Fish Stock Assessment (CCAMLR 2018k) stated: "*The 11 krill vessels operating in Subareas 48.1, 48.2 and 48.3 reported one seabird mortality and 19 marine mammal mortalities*." (…) "*The 19 Antarctic fur seals (Arctocephalus gazella) caught in 2018 represent a sudden increase* (…) *However, as 18 of the 19 mortalities were reported from one vessel, this indicates that this is likely to be a vessel-specific, rather than a fishery-wide issue* (…)."

The Antarctic fur seal (*Arctocephalus gazella*) is protected under the Convention for the Conservation of Antarctic Seals (which came into force in 1978). This Convention is part of the Antarctic Treaty system, whereby the CAMLR Convention applies to all Antarctic populations of finfish, molluscs, crustacean and sea birds found south of the Antarctic Convergence (the Convention Area).

The breeding range of the Antarctic fur seal, also formerly known as the Kerguelen fur seal, is restricted mainly to seasonally ice-free islands south of, or close to, the Antarctic Polar Front with over 95% of the species breeding on South Georgia. Other breeding sites, many fuelled by migrants from South Georgia, are established at South Orkney, South Shetland, South Sandwich, Bouvetiya, Heard, Marion, Macquarie, McDonald, Crozet, Prince Edward and Kerguelen Islands. The total population size was estimated as 1.5 million in 1990 but it is thought that the population may have since increased to over 4 million. Wandering seals have been found as far north as Brazil and the Juan Fernandez Islands (SCS 2011).

Antarctic fur seals were almost made extinct by commercial sealing for their fur in the 18th and 19th centuries, perhaps only a few hundred of the seals remaining, and small-scale hunting continued until 1907. The species is now protected by the Convention for the Conservation of Antarctic Seals (CCAS), the Antarctic Treaty and the legislation of various countries within its range. In addition, the Antarctic fur seal is listed as an Appendix II species under CITES. Since protection, the population has been growing steadily, particularly at South Georgia since the 1950s, and population growth is now about 10% per annum (SCS 2011).

6.4.3.1 Observer programme on ETPs

As part of the records in the Observer reports, a list of seabird species which have been seen during the trip is presented. This is in addition to specific information to be given on any seabird/ fishing operation interactions.

There were no seal mortalities reported between 2008 and 2014, however, there were three mortalities of Antarctic fur seals in 2015 and 2016, none in 2017 and 19 in 2018 (CCAMLR krill fishery report 2018).

The 2019 Observer report for the fishery under assessment recorded one fur seal as being caught in the trawl net and immediately released unharmed and without injuries.

6.4.3.2 Mitigation measures

CCAMLR Conservation Measure 25-03 covers the issue of minimizing incidental mortality of seabirds and marine mammals in the course of trawling in the Convention Area, and it requires the fisheries to develop gear configurations that reduce the chance of birds or marine mammals encountering the net. The following figures demonstrate mitigation measures, designed to reduce seabird and mammal bycatch.

Seabirds:

Fishing operations and seabird foraging zones can overlap. Seabirds are attracted to fishing boats as they recognise them as a source of food. Feeding from behind the boat puts the seabird in danger of being injured or killed by fishing gear like trawl nets and warp cables. Their wings can become tangled on the warp wires or in the net and they can be dragged under water, possibly leading to drowning. The following devices are deployed by the fishery under assessment to reduce seabird interaction (as recorded in the Observer reports):

Bird streamers: The streamer line was used during the setting and hauling of the net, with two streamer lines used at any one time. A 200mm diameter plastic buoy attached to the end of the streamer line to keep the line taught.

Figure 4. Streamer Line deployed (Observer report 2016)

Two streamer lines are deployed per vessel, and a buoy is attached to the end of the line to keep it taught.

Net Weighting: The net weights used are 1,100kg of steel chain in each net wing, for the quick sinking of the net and holding it taught and in position when trawling.

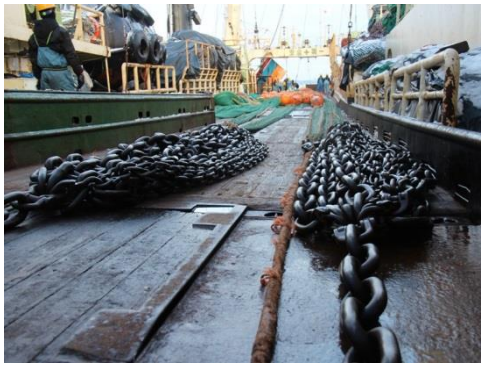

Figure 5. Net weights (Source: Kwang Ja Ho Cruise report 2018)

The Observer Reports for 2016 and 2017 also list the regular deployment of acoustic bird scarers. These devices were listed as “not used” in the 2018 and 2019 Observer reports.

There are a number of other mitigation measures to discourage seabird interaction with the fishery, but these are not necessarily deployed by the fishery under assessment (ie not mentioned as such in the Observer reports).

Bird bafflers: A bird baffler is a curtain like device which has been designed to deter seabirds from foraging in between the stern of the vessel and where the warps enter the water.

Figure 6. Bird baffler in situ (Source: https://www.afma.gov.au/environment-and-research/reducing-bycatch/bycatch-reduction-devices/bird-baffler)

Bird bafflers contain two booms, one on the port and one on the starboard stern quarters which extend perpendicular to the sides of the vessel, past where the trawl wire enters the water. The booms have droppers hanging down to the water line which act as a curtain, and tori lines extending from the booms. The baffler is designed to prevent seabirds from accessing the front and sides of the warp wire whilst trawl gear is being towed as these are the areas where seabird interactions are most likely to occur.

Seabird sprayers: Seabird sprayers are an industry designed device that use seawater delivered at high pressure to deter seabirds from the area of water around the warps.

Figure 7. Seabird sprayers in situ (Source: https://www.afma.gov.au/environment-and-research/reducing-bycatch/bycatch-reduction-devices/seabird-sprayer)

Warp deflector: A warp deflector is a plastic “pinkie” buoy attached to fishing boats to prevent seabirds from being injured by coming into contact with the trawl warp wires.

Figure 8. Warp deflector in situ (Source: https://www.afma.gov.au/environment-and-research/reducing-bycatch/bycatch-reduction-devices/warp-deflectors)

Marine mammals

Seal excluder device: Seal Excluder Devices (SEDs) are designed to help seals swim out of a fishing net if they are accidentally caught. The SED has a metal grid which blocks access to the codend, whilst still allowing fish to pass through the bars. The metal grid angled towards the codend, which guides animals out of the escape hole. SEDs also allow larger animals such as sharks and rays to escape the net safely.

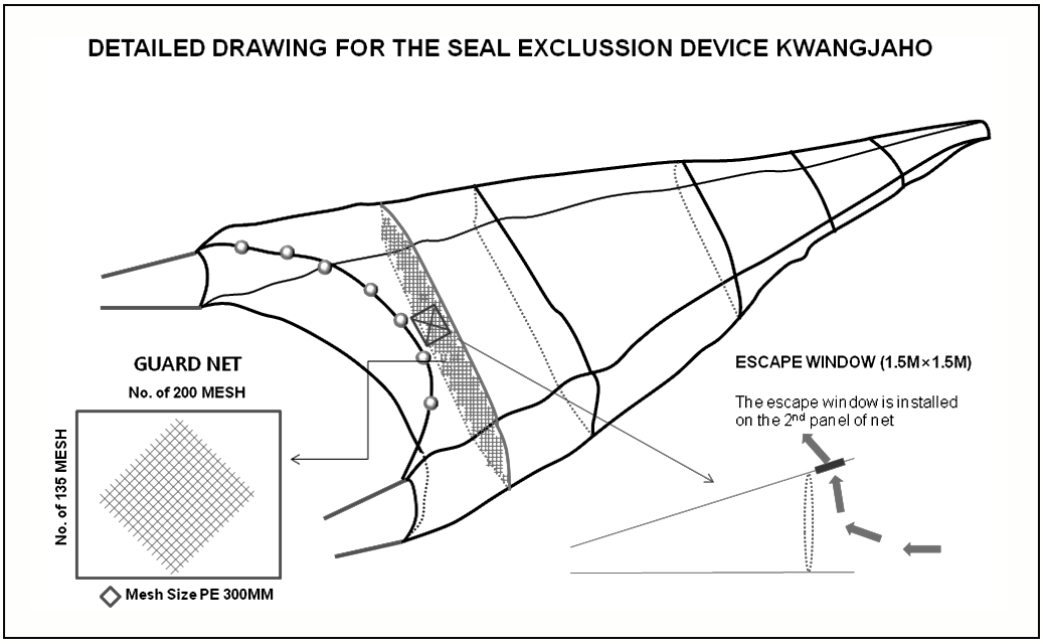

Figure 9. Detailed drawing of the seal exclusion device in use in the fishery (Source: Observer report 2017 Kwang Ja Ho)

Figure 10. Seal excluder device (Source: https://www.afma.gov.au/environment-and-research/reducing-bycatch/bycatch-reduction-devices/seal-excluder-devices)

Offal management: Offal is managed on board, as recorded in the Observer reports (2014-2018), whereby 'most or all' of the offal is retained for disposal onshore.

Midwater trawling for krill is generally deemed to be a low concern for its risk of ETP bycatch (MBA 2017). This is not to say that bycatch of ETP species is totally absent, but rather that ETP mortality events are rare, and the total estimated mortalities are very low. When compared to the abundance of the species, it becomes clear that detrimental impacts of the UoC upon ETP species are negligible. Hence, the CCAMLR Krill Report (CCAMLR 2018i) stated the following: "In 2018, there were two seabird mortalities reported from the krill fishery, one snow petrel (*Pagodroma nivea*) in Subarea 48.1 and one cape petrel (*Daption capense*) in Subarea 48.2. There were also 19 reported mortalities of Antarctic fur seal (*Arctocephalus gazella*) in the fishery in Subarea 48.3, of which 18 were reported from the same vessel." (which likely indicates that this is a vessel-specific, rather than a fishery-wide issue).

The population of Antarctic fur seals is currently estimated at some 700,000-1,000,000 mature individuals, with 95% of the population concentrated on South Georgia (Hofmeyr 2016). The 19 mortalities registered in 2018 can be deemed as exceptional; in contrast, there were three reported mortalities of Antarctic fur seal *A. gazella* in the fishery in both 2016, and 2015 (CCAMLR 2016a). CCAMLR reports that there were no fur seal mortalities between 2008 and 2014 (CCAMLR 2017b), although this seems not to be totally correct (Roel et al. 2018); however, it is clear that the total mortality of fur seal in krill fisheries is too low to constitute a significant impact.

The report further states that "*In terms of bird interactions, CCAMLR Conservation Measure 25-03 covers the issue of minimizing the incidental mortality of seabirds and marine mammals in the course of trawling in the Convention Area and requires the fisheries to develop gear configurations that reduce the chance of birds or marine mammals encountering the net, such as Marine Mammal Exclusion Devices. The observation methodology for interactions of seabirds and marine mammals with fishing operations is established in Part II, section 12 of the CCAMLR Scientific Observer Manual, where periods and duration of these observations are detailed*."

The way krill fishing is conducted, the risk of lethal interactions with seabird species is considerably reduced. "*The fishing strategy, with a slow towing speed (<2 knots), quick sinking of the net on deployment, and the layout of the trawl warps, which enter the water very close to the stern of the vessel and reduce the potential for birds to strike them during fishing operations, all contribute to the sparseness of interactions recorded by observers during fishing operations.*" (Hønneland et al. 2015)

The one seabird mortality recorded in 2018 compares to nine seabird mortalities in 2016 and two in 2017 (CCAMLR 2017b).

6.4.4 Habitats

6.4.4.1 Commonly encountered habitat and broad ecoregions

The krill fishery is a pelagic trawl fishery, where towing depth is <150m. The fishery uses a pelagic net, which has no interactions with the benthos. Any interaction of the net with the benthos is actively avoided because it would damage the net to the extent that repairs on board would probably be impossible. Pelagic trawl gear is not designed for benthic contact, it would not be robust enough to survive the drag damage. The only potential interaction of the net with the seafloor would be accidental loss of the net, which happens rarely and has to be reported on the formal observer reports if and when it happens, giving exact relevant details. According to CCAMLR krill fisheries report for 2018 and UoA Observer reports from 2016-2019 there has been no trawl gear loss during fishing activities.

The following maps and sections indicate where the fishery operates (Figure 11) in relation to underlying bathymetry (Figure 12) and habitats and marine protected areas.

Figure 11. The UoA operates in 48.1 and 48.2. (Client information, see observer reports)

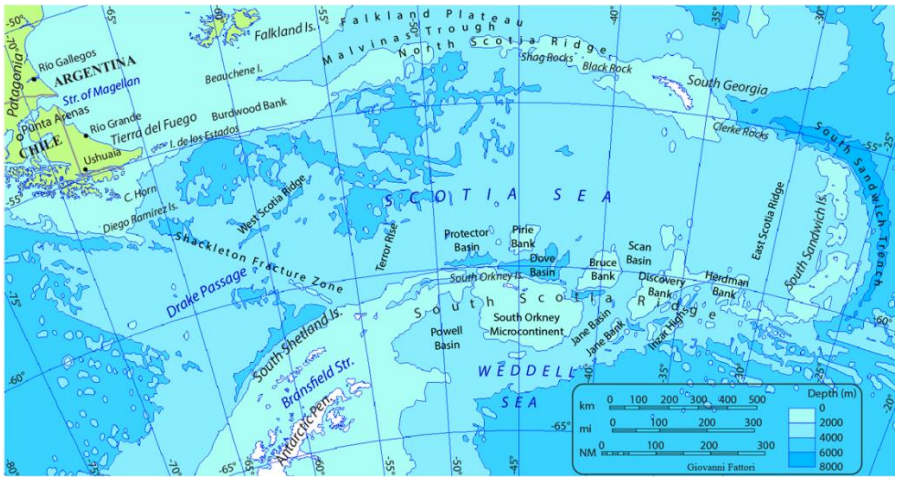

Figure 12. Bathymetry of Scotia Sea and South Scotia Arc region (Source https://en.wikipedia.org/wiki/Scotia_Sea#/media/File:Scotia-sea.png)

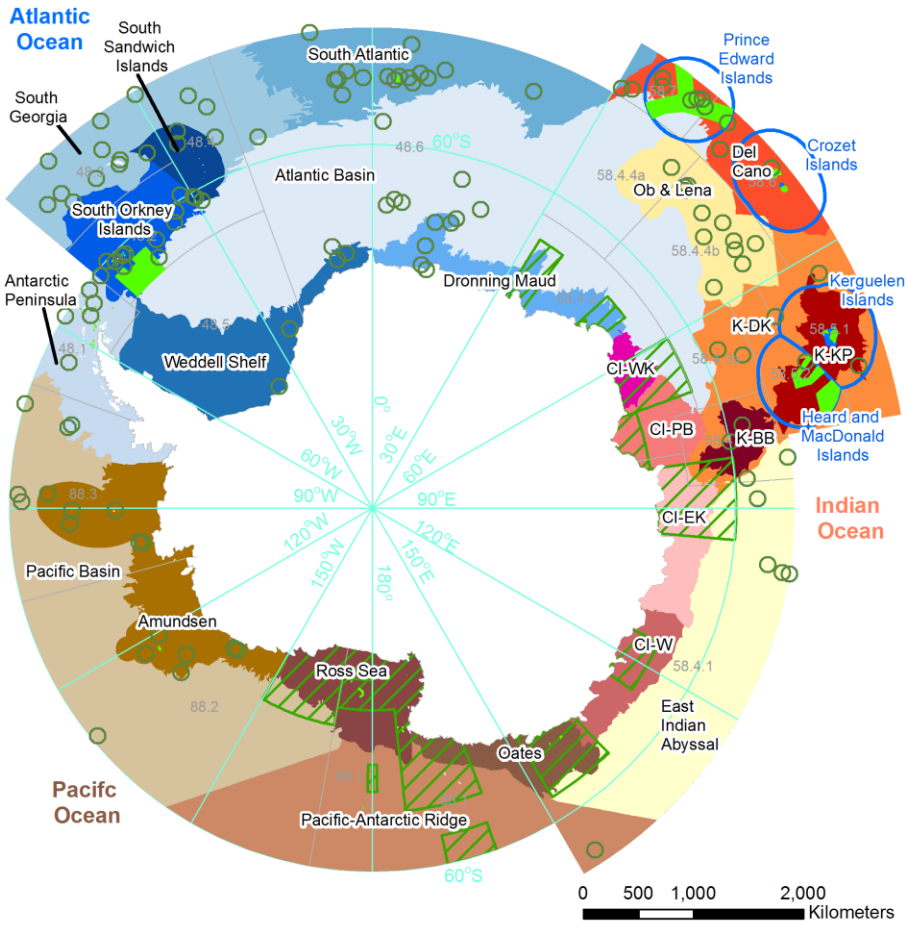

Figure 13. Benthic ecoregions around Antarctica (Source: Douglass et al 2014)

Figure 13 shows the benthic ecoregions, restricted environments and marine protected areas identified within the Southern Ocean. An environmental type is a unique combination of an ecoregion, bathome and geomorphic feature. According to Douglas et al. (2014), Figure 13 also shows existing marine protected areas and regions where planning processes are underway to propose future representation. Where large gaps in existing and proposed representation were found, the locations of geographically restricted environmental types were identified. These restricted environments (eg seamounts) indicate areas of potential future marine protected area selection since there are limited spatial options for protecting the biodiversity for which these environments are a surrogate. The benthic ecoregions relevant to this fishery assessment are:

The Antarctic Peninsula - The shallow, productive shelf of the west Antarctic Peninsula with a low duration of sea ice cover and warm seabeds relative to other Antarctic shelf areas. The island ecosystems of the South Shetland Islands. 13 endemic molluscs; greater than 10% of gastropods endemic.

Atlantic Basin: The very deep and very cold rugose ocean floor and abyssal plain of the South Atlantic Ocean Basin and Weddell Sea.

6.4.4.2 Vulnerable Marine Ecosystem - VMEs

Please note (https://mscportal.force.com/interpret/s/global-search/VME): It is not the responsibility of an assessment team to identify habitats as VME within the fished area. Instead, VMEs need to be identified by a local, regional, national, or international management authority/governance body; the history of fishing and when the VME was identified is critical to establishing what the 'unimpacted level' is; if a VME was already impacted by any fishery/UoA prior to its identification as a VME, and fishing impacts occurred prior to 2006, then the 'unimpacted level' is considered to be the status at the point of designation

VMEs are identified in the Southern Ocean and compiled in the 'CCAMLR VME Registry', which records the location and taxa of Vulnerable Marine Ecosystems (VMEs) and associated areas in the Convention Area. These areas will have been notified under CM 22-06 and CM 22-07 (https://www.ccamlr.org/en/document/data/ccamlr-vme-registry). Access to this registry is open to the public. Figure 14 and Figure 15 shows the location of areas holding VME. There are no registered vulnerable marine ecosystems (VMEs) or VME Risk Areas in Subarea 48.3 (in CCAMLR Fishery report 2018: *Dissostichus eleginoides* South Georgia, Subarea 48.3).

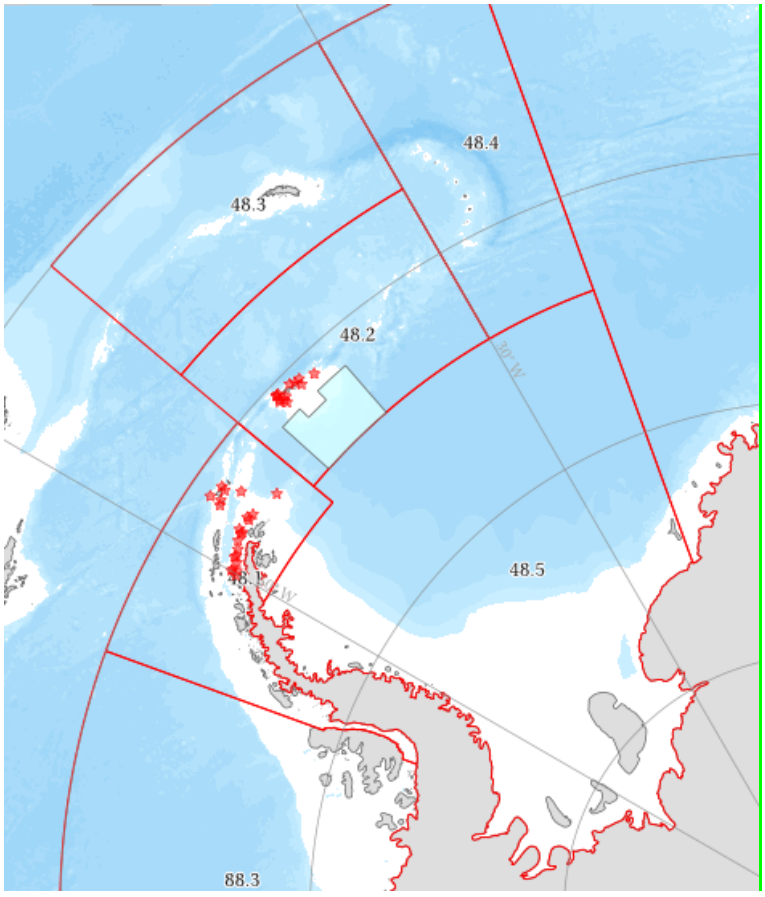

Figure 14. Location of VME present (red dots) in the UoA fishing area (48.1 and 48.2) grounds. The light blue block is the South Orkney southern shelf marine protected area – CM91-03. Source: https://gis.ccamlr.org/

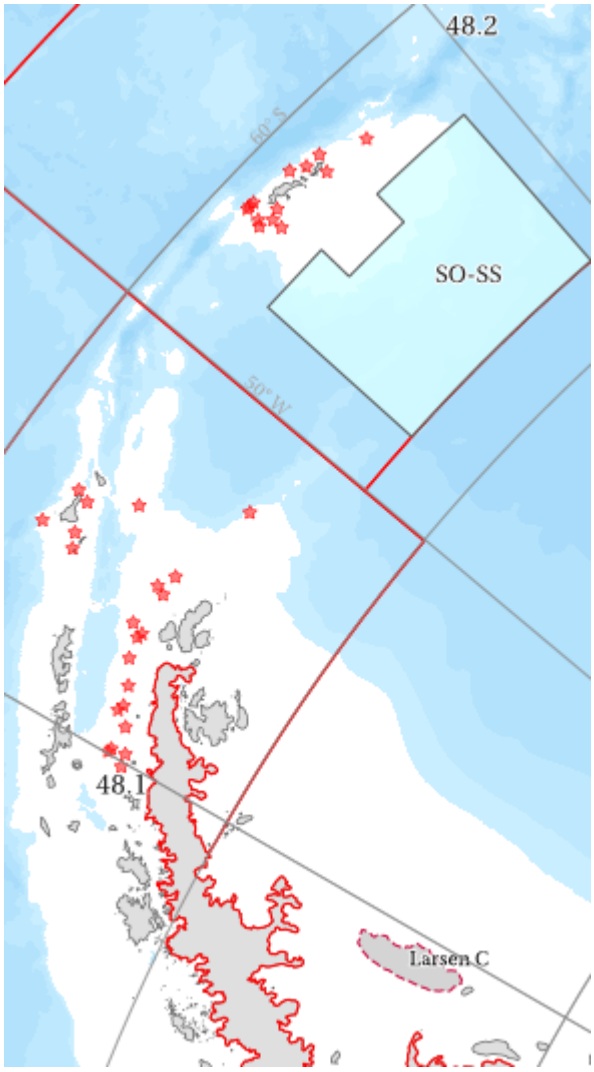

Figure 15. VMEs (enlarged map) to show location more clearly, also showing SO-SS MPA. (Source: https://gis.ccamlr.org/)

The VMEs indicated in Figure 15 are based on benthic species such as aggregations of seapens for example (https://www.ccamlr.org/en/wg-emm-18/36). The VMEs as identified in the map above are closer to shore and in shallower water. Other VME areas are for example based in aggregations of coral species as observed using submarine surveys in Gerlach Strait and Antarctic Sound (Area 48.1; https://www.ccamlr.org/en/wg-emm-18/35). The procedures to be followed by vessels to monitor and report encounters with potential VMEs during the course of bottom fishing are described in CM 22-07. These require fishing vessels to collect and report all catches of a suite of "VME-indicator taxa" that are described in CCAMLR's VME Taxa Classification Guide. This obviously does not apply to the krill fishery under assessment, as it is a pelagic fishery.

6.4.4.3 Marine Protected Areas MPA

CCAMLR defines an MPA as follows: "it is a marine area that provides protection for all or part of the natural resources it contains. Within an MPA certain activities are limited, or entirely prohibited, to meet specific conservation, habitat protection, ecosystem monitoring or fisheries management objectives. MPAs do not necessarily exclude fishing, research or other human activities; in fact, many MPAs are multi-purpose areas. MPAs in which no fishing is allowed are often referred to as 'no-take

areas'. Other uses may still be permitted. Areas closed to fishing (or in which fishing activities are restricted) can be used by scientists to compare to areas that are open to fishing to research the relative impacts of fishing and other changes, such as those arising from climate change. This can help scientists understand the range of variables affecting the overall status and health of marine ecosystems including the effects of climate change. CCAMLR has agreed to develop a representative system of MPAs based on the best available science and has also agreed a framework that describes the objectives and requirements for establishing MPAs" (https://www.ccamlr.org/en/science/marine-protected-areas-mpas).

CCAMLR has set out to establish a representative series of MPAs within its area (CCAMLR 2011b) and currently has enacted the following four CMs within group 91, protected areas, for that purpose:

1. CM91-01. Provides for the protection of CCAMLR Ecosystem Monitoring Programme (CEMP) sites.

2. CM91-02. Provides for protection of the values of Antarctic Specially Managed and Protected Areas (ASMA and ASPA, respectively).

3. CM91-03 (2009). Provides for protection of part of the South Orkney Islands southern shelf. The 'Protection of the South Orkney Islands southern shelf' has its origins within CCAMLR and has primary aims that include the conservation of biodiversity. That aim is extended to set the area aside as a scientific reference area with representative examples of pelagic and benthic bioregions and also to conserve important predator foraging areas. The SO-SS site is located within 48.2. see also Figure 15 for location of the site.

4. CM91-04. General framework for the establishment of CCAMLR Marine-Protected Areas; it states that the Commission will, on the basis of the advice of the Scientific Committee, adopt a research and monitoring plan for an MPA. Every five years, Members conducting activities according or related to the research and monitoring plan, will compile a report on those activities, including any preliminary results for review by the Scientific Committee.

Conservation Measure 91-05 (2016) establishes the Ross Sea region Marine Protected Area, the world's largest marine protected area, covering 1.55 million square kilometres, of which 1.12 million square kilometres are fully protected. This MPA is located in CCAMLR subarea 88.1 and does not overlap with the UoA.

The South Orkney Island southern shelf (SO-SS – see location in Figure 15) was the first CCAMLR MPA (CCAMLR 2009), established in 2009, where amongst other management measures the following applies: *All types of fishing activities are prohibited within the defined area, with the exception of scientific fishing research activities agreed by the Commission for monitoring or other purposes on advice from the Scientific Committee and in accordance with Conservation Measure 24-01.*

The South Georgia and South Sandwich Islands Maritime Zone (north of 60°S) (Figure 16) was designated as a sustainable use Marine Protected Area (MPA) in 2012, with additional spatial and seasonal closures added in 2013. The MPA includes a prohibition on bottom trawling throughout, and a range of spatial and temporal closures (Falkland_Islands 2012b). The MZ, which was declared by Proclamation in 1994, includes a significant area south of 60° South. This area is a de-facto no-take zone and commercial fishing licences are not issued for this area. Four main fisheries operate in the SGSSI Maritime Zone:

(i) the longline fishery for Patagonian toothfish around South Georgia (CCAMLR Statistical Subarea 48.3);

(ii) the longline fishery for Patagonian and Antarctic toothfish around the South Sandwich Islands (CCAMLR Statistical Subarea 48.4);

(iii) the pelagic trawl fishery for Antarctic krill in the SGSSI Maritime Zone (CCAMLR Statistical Subareas 48.3 & 48.4); this includes a seasonal closure of the fishery for Antarctic krill (from November 1st until March 31st) to avoid competition with krill eating predators (particularly penguins & fur seals) during the season breeding, as well as a 12nm pelagic no-take zones around each of the South Sandwich Islands, protecting 18,042 km², including important feeding areas of chinstrap and Adelie penguins;

(iv) the pelagic trawl fishery for mackerel icefish (CCAMLR Statistical Subarea 48.3);

(v) a ban on all bottom fishing deeper than 2250m, which covers 920,000 km² (an area similar to the size of Spain), to protect deep-water habitats (Falkland_Islands 2012a).

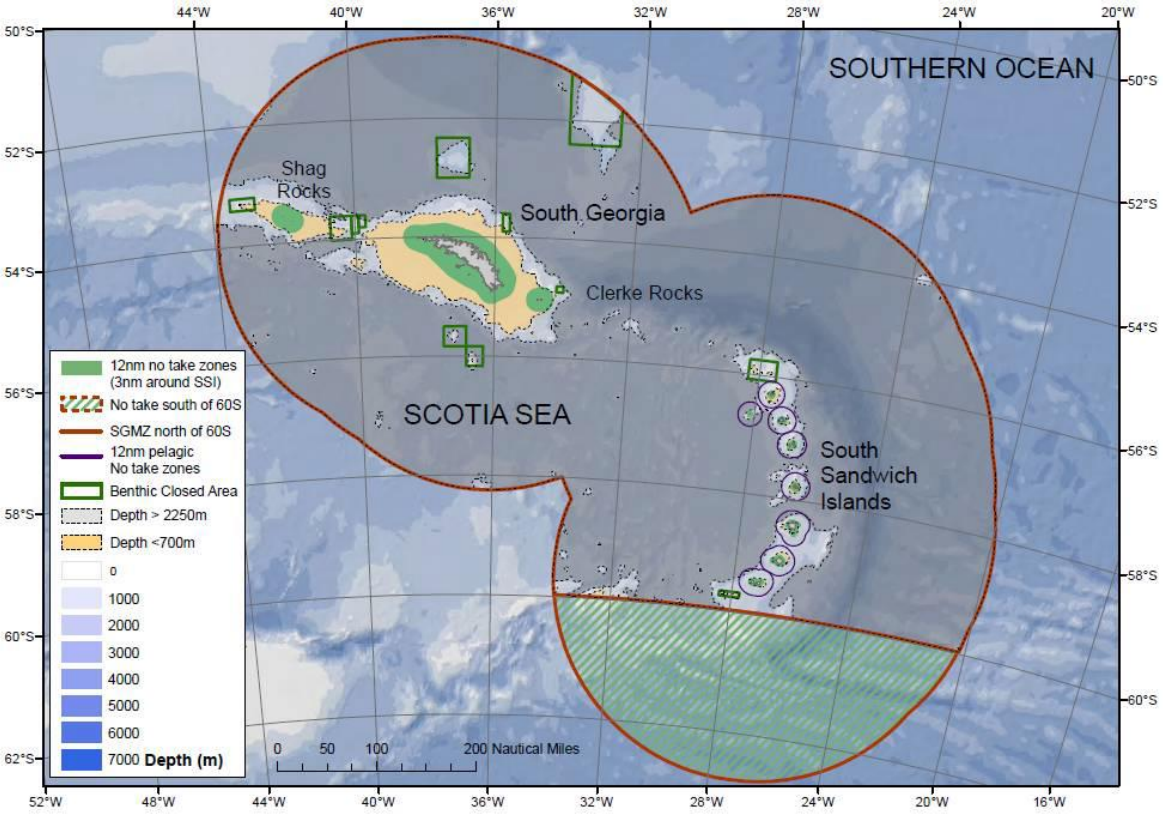

Figure 16. South Georgia and South Sandwich Islands Maritime Zone (MZ), showing the closed areas. The MPA is the area north of 60 S. (Source: www.gov.gs)

1. The green areas are the No-Take zones around South Georgia, Shag Rocks, Clerke Rocks and each of the South Sandwich Islands.
2. The pale orange area indicates depths less than 700 m in which bottom fishing is prohibited.
3. The dark shaded area includes depths greater than 2250 m in which bottom fishing is prohibited.
4. The narrow band between the pale orange area and the shaded area includes the depths between 700 and 2250 in which bottom fishing is permitted.
5. The boxes with a green border are the additional benthic closed areas in which bottom fishing is also prohibited.
6. The blue-bordered areas around the South Sandwich Islands are the pelagic closed areas.
7. The area south of 60°S, with green stripes, that falls within the SGSSI Maritime Zone whilst not formally part of the MPA is already a no-take zone as no fishing licences are issued for this area.

Other protected areas are Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Areas (ASMAs), which are designated under the Antarctic Treaty as areas of special scientific

or biological significance. They are areas designated under CCAMLR Conservation Measure 91-02 (2012) on the Protection of the values of Antarctic Specially Managed and Protected Areas. The Secretariat of the Antarctic Treaty manages a database on the locations of ASPAs and ASMAs and holds information on their management plans and purposes for designation. The management plans for all these areas can be found on the Antarctic Protected Areas (APA) database on the Antarctic Treaty Secretariat (ATS) website (https://www.ats.aq/devph/en/apa-database - accessed on 5/12/2019). The following list contains those ASPAs and ASMAs containing marine areas within Area 48:

- ASPA 144, Chile Bay, Greenwich Island, South Shetland Islands (Subarea 48.1)
- ASPA 145, Port Foster, Deception Island, South Shetland Islands (Subarea 48.1)
- ASPA 146, South Bay, Doumer Island, Palmer Archipelago (Subarea 48.1)
- ASPA 152, Western Bransfield Strait, South Shetland Islands (Subarea 48.1)
- ASPA 153, Eastern Dallmann Bay, Palmer Archipelago (Subarea 48.1)
- ASPA 149, Cape Shirreff, South Shetland Islands (Subarea 48.1)
- ASPA 151, Lions Rump, South Shetland Islands (Subarea 48.1)
- ASMA 1, Admiralty Bay, South Shetland Islands (Subarea 48.1)
- ASMA 3, Deception Island, South Shetland Islands (Subarea 48.1)
- ASMA 7, Southwest Anvers Island, Palmer Archipelago (Subarea 48.1).

Figure 17. Antarctic Specially Protected Areas (ASPA) Location (Source: https://gis.ccamlr.org/)

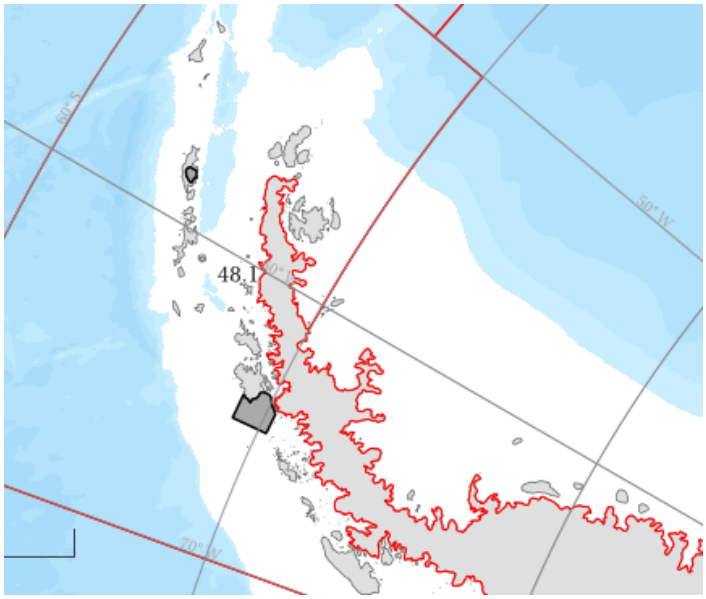

Figure 18. Antarctic Specially Managed Areas (Source: https://gis.ccamlr.org/)

In addition, there is one area for special scientific study, Larsen C.

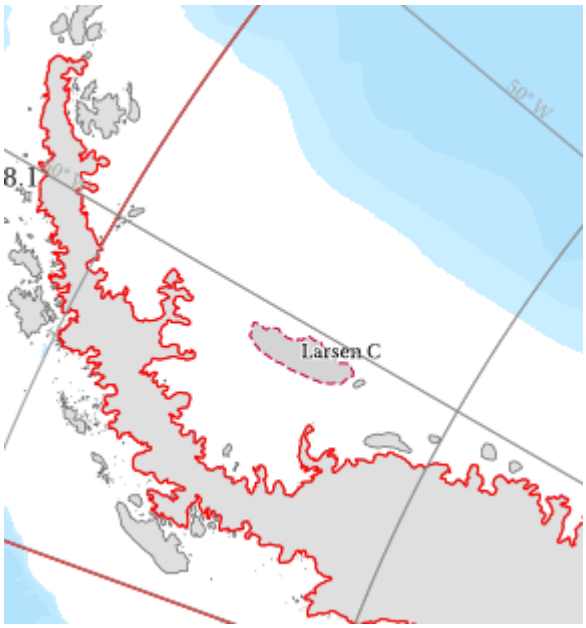

Figure 19. Special Scientific Study area, Larsen C. (Source: https://gis.ccamlr.org/)

6.4.5 Ecosystem

6.4.5.1 The Scotia Sea and Antarctic Peninsula ecosystems

The ecosystem under consideration is The Scotia Sea, the boundary between the South Atlantic Ocean and the Southern Ocean. The Drake Passage constitutes its western limit, whilst on the north, east and south it is encompassed by the Scotia Arc; the emerged areas of the Arc form a number of subantarctic islands and archipelagos, such as South Georgia, the South Sandwich and South Orkney. Scotia Sea's total area is about 900,000 km^2. The Antarctic Circumpolar Current (ACC) flows around Antarctica, fully circumnavigating it in approximately six years (Roel et al. 2018).

The Antarctic Peninsula is the northernmost tip of the Antarctic continent. Its coasts (especially the western side) are free of permanent ice and have comparatively the mildest climate in Antarctica. The archipelago of the South Shetland is split from the mainland by the Bransfield Strait, which is currently a key area of krill abundance and thus it is also an area where most krill fishing effort has been concentrated in recent years.

All across the Scotia Sea islands and the fringes of the Antarctic Peninsula (especially its western coast), there is also an abundance of krill-dependent predators, such as seals and seabirds. There are six seal species native to Antarctica: crabeater seal (*Lobodon carcinophagus*), Ross seal (*Omimatophoca rossii*), leopard seal (*Hydrurga leptonyx*), Weddell seal (*Leptonychotes weddellii*), southern elephant seal (*Mirounga leonina*), and southern fur seal (A*rctocephalus gazella*) (Roel et al. 2018).

More than thirty flying seabird species are found in Antarctica; many of them have breeding colonies in Marieland and/or in the subantarctic islands. Some of these species are: southern fulmar (*Fulmaras glacialoides*), southern giant fulmar (*Macronectes giganteus*), cape pigeon (*Daption capense*), snow petrel (*Pagodroma nivea*), Wilson's storm petrel (*Oceanites oceanicus*), blue-eyed shag (*Phalacrocorax atriceps*), American sheathbill (*Chionis alba*), south polar skua (*Catharacta maccormick*i), brown skua (*Catharacta lonnbergi*), southern black-backed gull (*Larus dominicanus*), and Antarctic tern (*Sterna vittata*).There are also six species of penguin native to the Antarctic region: Adélie penguin (*Pygoscelis adeliae*), chinstrap penguin (*P. antarctica*), gentoo penguin (*P. papua*), emperor penguin (*Aptenodytes forsteri*), king penguin (*A. patagonicus*), rockhopper penguin (*Eudyptes crestatus*), and macaroni penguin (*E. chrysolophus*) (Roel et al. 2018).

The following graphic (Figure 20) shows the main physical processes generating variation in the Scotia Sea ecosystem. These processes also influence krill recruitment trends and dispersal across the region, generating observed correlations of changes in krill density and biomass and higher trophic level predator foraging and breeding performance with sea ice and larger indices of oceanic and climatic variation (Murphy et al. 2007).

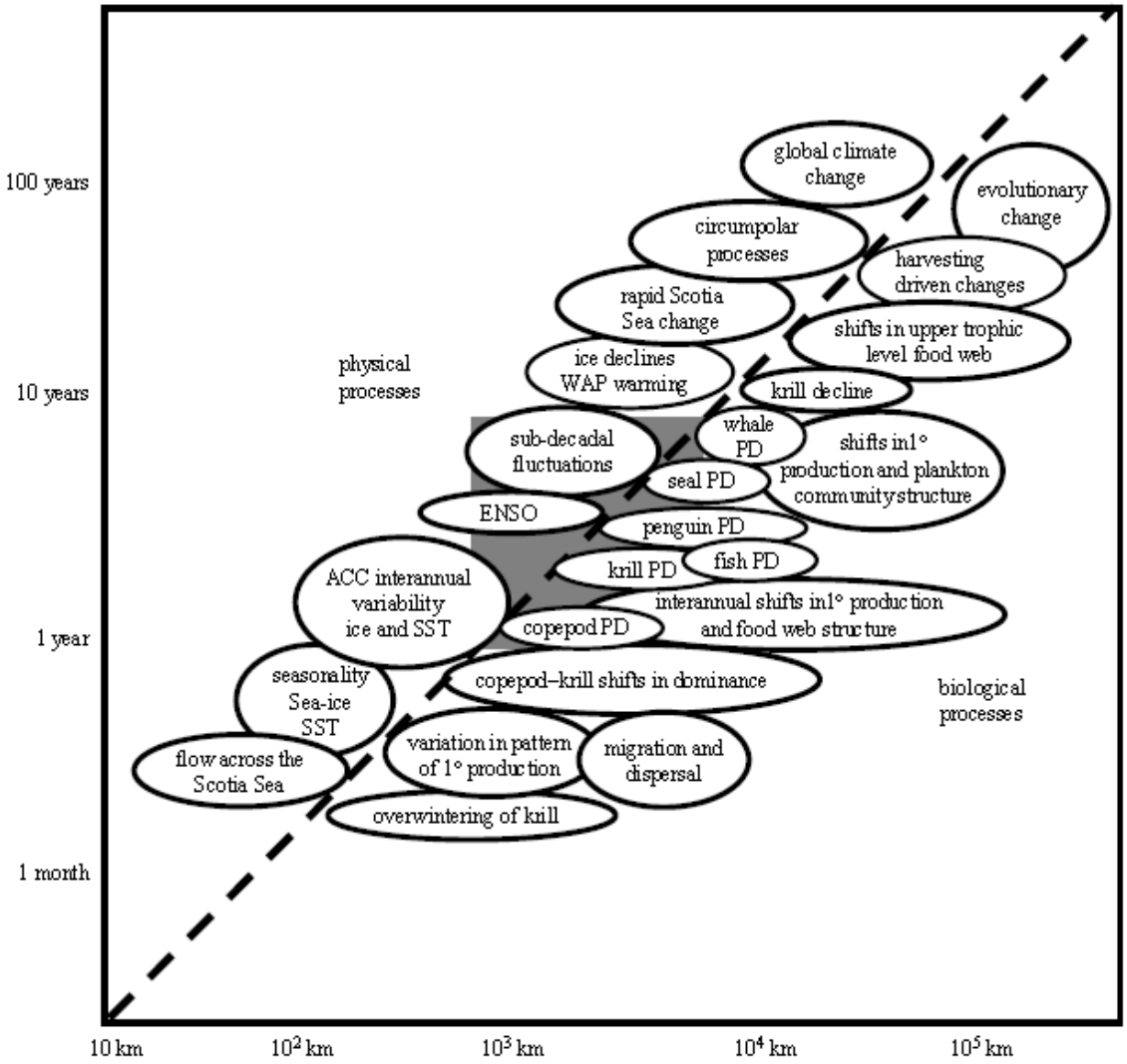

Figure 20. Schematic of the temporal and spatial scales of the main physical and biological processes important in determining the dynamics of the Scotia Sea ecosystem. Source: Murphy et al. (2007)

In Figure 20 the 1:1 relationship is based on the scale of physical mixing in the oceans. Note that the physical and biological processes are illustrated offset above and below this line, respectively, for clarity. The shaded grey block illustrates the natural spatial and temporal scale of Scotia Sea processes. Acronyms used include PD, Population Dynamics, SST, sea surface temperature and ENSO, *El Niño* Southern Oscillation.

The food web of the Scotia Sea is highly heterogeneous, widely distributed but dynamically connected through ocean circulation. The ecosystem is dominated by the flows of the major current systems (the Antarctic Circumpolar Current and the Warm Swallow Current) and by its seasonality, manifested by the advance of sea ice across the region during winter. This unique environment is high in both nutrients and chlorophyll-a. The role of krill in the ecosystem is crucial, because the resource provides the major link between LTL production and consumption by higher trophic level predators across the Scotia Sea (Murphy et al. 2007). Different ecosystem models show that changes in primary production and detritus are responsible for most of the declines within the model, implying that this is a bottom-up ecosystem (Hoover et al. 2012).

6.4.5.2 Krill in the foodweb

There is a high diversity of marine life in the Antarctic region and the Southern Ocean. Light and nutrients are concentrated in the upper layer (top 300m) of the water column; it is here where most of the biological processes occur. The prevailing winds also contribute to mix this upper layer, hence called the mixed layer. In the summer months winds are weaker, which combined with the melted sea ice produce stratification, and the mixed layer is thus reduced, sometimes to just the top 50 meters. This epipelagic zone is where krill concentrates to feed on phytoplankton, and it is here also that the midwater trawling targets the feeding krill schools (Constable & Doust 2009).

Antarctic krill (*Euphausia superba*) is a key species in the Southern Ocean ecosystem, linking primary production to abundant vertebrate predators in short and highly efficient food chains (Murphy et al., 2007). Krill are principally herbivorous and grow to a maximum size of 60 mm and an age of 5 years. Antarctic krill has a circumpolar distribution but is particularly abundant in the SW Atlantic sector. It is primarily a species of the seasonal sea ice zone and South Georgia is close to the northern limit of their distribution. Krill are dependent on sea ice, with juveniles thought to feed under the ice during the winter. Krill are advected to the South Georgia and South Sandwich Islands region from the seas around the Antarctic Peninsula, and at South Georgia the population is dominated by adult stages, with early larvae rarely seen. Krill forms dense swarms, which are targeted by both the fishery and predators.

South Georgia is home to many land-based krill-dependent predators, including Antarctic fur seals, macaroni and gentoo penguins and many flying seabirds. The South Georgia MZ is also an important foraging area for baleen whales, which also feed on krill.

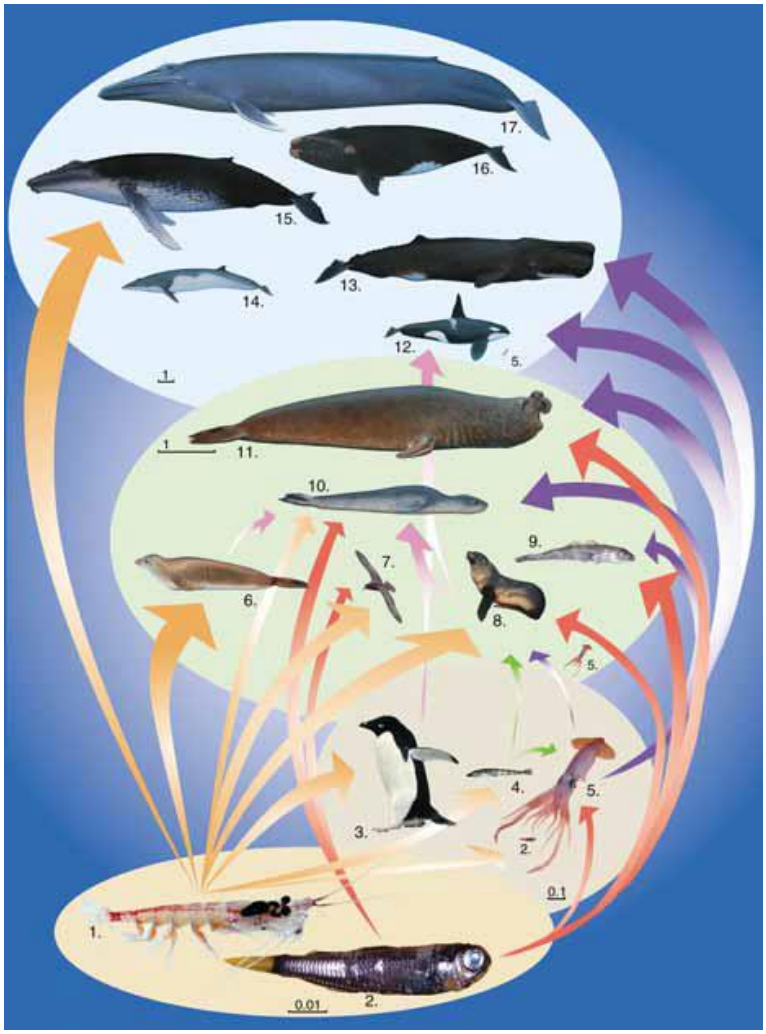

Figure 21. A generalised Southern Ocean foodweb from the krill level upwards (Source: Constable et al 2009)

When modelling the ecosystem (eg Figure 21) four main size groups of animals (each in a coloured ellipse) are suggested (Figure 21; (Constable & Doust 2009). Each animal is shown to scale within each ellipse. Scale bars are present in each ellipse along with a measurement in metres showing how big the bar would be in its natural size. Squid and lantern fish are used for comparing scales between ellipses. Lower orange ellipse: (1) Antarctic krill, (2) lantern fish. Lower middle red ellipse: (2) lantern fish at new scale, (3) Adelie penguin, (4) mackerel icefish, (5) squid. Upper middle green ellipse: (5) squid at new scale, (6) crabeater seal, (7) white-chinned petrel, (8) Antarctic fur seal, (9) Patagonian toothfish, (10) leopard seal, (11) southern elephant seal. Top blue ellipse: (5) squid at new scale, (12) orca (13) sperm whale, (14) minke whale, (15) humpback whale, (16) southern right whale, (17) blue whale.

The food web of the Scotia Sea is highly heterogeneous, widely distributed but dynamically connected through ocean circulation. The ecosystem is dominated by the flows of the major current systems (the Antarctic Circumpolar Current and the Warm Swallow Current) and by its seasonality, manifested by the advance of sea ice across the region during winter. This unique environment is high in both nutrients and chlorophyll-a. The role of krill in the ecosystem is crucial, because the resource provides the major link between LTL production and consumption by higher trophic level predators across the Scotia Sea (Murphy et al. 2007). Different ecosystem models show that changes in primary production and detritus are responsible for most of the declines within the model, implying that this is a bottom-up ecosystem (Hoover et al. 2012).

Several studies address the issue of impact of the krill fishery on dependent predators (Hinke et al. 2017; Plaganyi & Butterworth 2012; Descamps et al. 2016) and how to address the impact on those species in the krill fishery management system (Watters et al. 2013; Hill et al. 2016; Watters et al. 2016). The main threat from the krill fishery comes from the potential for resource competition with krill-eating predators, including with marine mammals and seabirds. The potential for competition is most likely to occur when land-based predators are constrained to feed within a limited distance of their breeding site and when they must also provision their offspring as well as feed themselves (Trathan et al. 2015). Should the krill fishery become aggregated close to these breeding sites, the potential for resource competition may be very significant (Cury et al. 2011). Figure 22 shows the kind of foraging ranges of various species concerned.

The krill fishery in South Georgia waters is well managed and regulated with far greater protection for krill-dependent predators than in Subareas 48.1 or 48.2 (see (RSPB 2017)) . The prohibition of fishing within 12nm of South Georgia and each of the South Sandwich Islands for example, coupled with the seasonal closure of the krill fishery (November 1st to March 31st) should avoid any such competition (Trathan et al. 2015). The 12nm No-take zone around South Georgia protects predators such as gentoo penguins, which are present all year round, but forage locally. The seasonal closure should protect predators such as macaroni & chinstrap penguins that forage further from the land but are not in South Georgia waters in the winter. Ratcliffe et al. (2015) looked at the spatial overlap between macaroni penguins and the krill fishery during the winter and concluded that competition between the krill fishery and macaroni penguins is low.

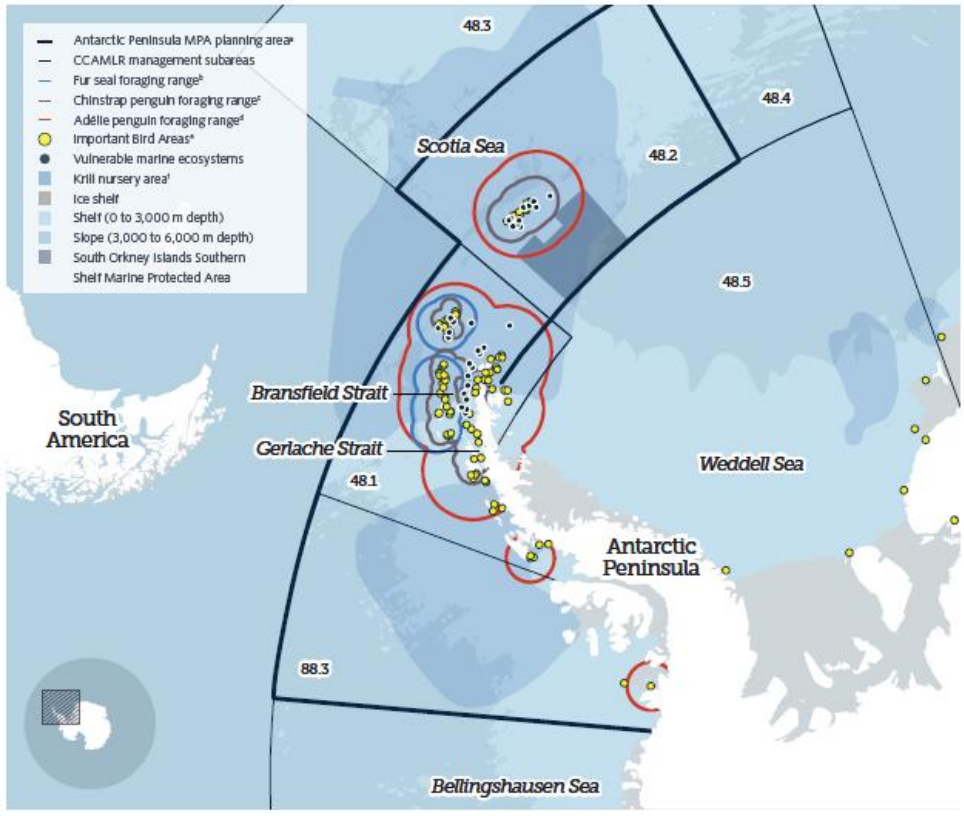

Figure 22. Western Antarctic Peninsula and South Scotia Arc region showing the foraging ranges of several species. (Source: http://www.pewtrusts.org/~/media/assets/2017/10/protection-for-the-antarctic-peninsula-region.pdf)

One important question for the krill fishery is the retention time and replacement time of krill in the fishing grounds. If retention time is short and replacement is rapid, the fishery should not present a significant threat to the krill-dependent predators. The seasonal closure, coupled with the 12 nm mile

No-take zones around South Georgia, Shag Rocks, Clerke Rocks and each of the South Sandwich Islands should minimise any impact on dependent predators (see (Trathan et al. 2014), providing that the krill is quickly replenished. The on-going monitoring of krill-dependent predators suggests that inter-annual variation in krill abundance, associated with physical oceanographic factors, has a greater impact on predators than the fishery.

Historically, the densest concentrations of krill have been found in CCAMLR Area 48, thus explaining why the main commercial krill fisheries are located there. Krill density in other CCAMLR areas such as the Indian ocean and the Pacific ocean sectors are deemed to be much lower (Roel et al. 2018). One concern with the krill fishery in Area 48 is the lack of a recent assessment of krill biomass (Hill et al. 2016) but, whilst the fishery remains well below the catch limit, this is not a major concern.

The seabird mortality associated with the fishery appears low as can be seen from the Observer reports as well as the annual CCAMLR Krill fishery reports providing an overall analysis of that year's krill fishing season.

The importance of krill in the diet of Antarctic fur seals at South Georgia could result in the species being affected by an increased krill fishery in the Southern Ocean as well as by increased competition for krill with other marine mammal species that are now recovering from previous exploitation. The entanglement of Antarctic fur seals in man-made debris, particularly around the neck, is a problem as it can cause death by drowning or starvation. A 1988-1989 study at Bird Island, South Georgia, found 208 sightings of entanglement, the main culprits being polypropylene straps, nylon string and fishing net, indicating a figure of 5,000-10,000 fur seals entangled for the entire South Georgia population. The debris is most likely to come from marine traffic in the Southern Ocean (SCS 2011).

6.4.5.3 Monitoring and precautionary management

When the CCAMLR Convention came into force it established the Scientific Committee (SC-CCAMLR) and all Members of the Commission are also Members of the Scientific Committee. The Scientific Committee provides the best available scientific information on harvesting levels and other management issues to the Commission. In turn, the Commission is obligated by the Convention to take full account of the recommendations and advice of the Scientific Committee in making its decisions. The Scientific Committee takes into account the outcomes of research from national programs of CCAMLR Members.

The Scientific Committee works through a number of working groups, with the one responsible for krill being WG-EMM, Working Group on Ecological Monitoring and Management. The terms of reference for this WG are specific and deal with krill at its heart (https://www.ccamlr.org/en/science/scientific-committee):

(i) Assess status of krill;

(ii) Assess status and trends of dependent and related populations including identification of information required to evaluate predator/prey/fisheries interactions and their relationships to environmental features;

(iii) Assess environmental features and trends which may influence abundance and distribution of harvested, dependent, related and/or depleted populations;

(iv) identify, recommend and coordinate research necessary to obtain information on predator/ prey/fisheries interactions, particularly those involving harvested, dependent, related and/or depleted populations;

(v) Liaise with WG-FSA on stock assessment related matters;

(vi) Develop further, coordinate the implementation of, and ensure continuity in CEMP;

(vii) Taking into account assessments and research carried out under terms of reference (i) to (v) above, develop management advice on status of Antarctic marine ecosystems and for management of krill fisheries in full accordance with Convention Article II.

(viii) Provide advice on aspects of spatial protection, including marine protected areas and vulnerable marine ecosystems.

The WG-EMM meets annually.

The scientific research outcomes from WG-EMM feed into the broader CCAMLR Ecosystem Monitoring Programme (CEMP), which was established to detect changes in the krill-based ecosystem and to provide a basis for regulating the harvesting of Antarctic living marine resources in accordance with the 'ecosystem approach'. Recognition of the central role of krill in the ecosystem is at the core of the approach taken by CCAMLR in the management of the krill fishery. The program's remit is to:

- detect and record significant changes in critical components of the ecosystem, to serve as a basis for the conservation of Antarctic marine living resources
- distinguish between changes due to the harvesting of commercial species and changes due to environmental variability, both physical and biological.

In practice, CEMP's major function (via the contributing research from WG-EMM) is to monitor the key life-history parameters of selected dependent species to detect changes in the abundance of harvested species. So-called "dependent species" are marine predators for which species targeted by commercial fisheries are a major component of their diet. "Krill-dependent species" of interest to CEMP include land-based species such as seals, penguins, petrels and albatrosses, a decision consistent with the existing overlap between krill fishing areas and the foraging ranges of these predators. However, the potential impact of fishing on pelagic predators such as whales is not yet measured. CEMP-based estimates of predator-prey interaction strength are deemed highly uncertain at this stage, and therefore this information has primarily been used as context to inform management decisions. Predator reference points have yet to be defined (MBA 2017). The reports of the annual meetings of WG-EMM as published on the CCAMLR website provide detailed information of the kind of research and analysis conducted in the preceding year, and how this is taken forward in the management and monitoring of the ecosystem. (eg. WG-EMM 2019 https://www.ccamlr.org/en/wg-emm-2019). It is clear from the detailed research conducted on a wide range of Antarctic ecology that the knowledge base continues to increase, and time series on data sets is beginning to become increasingly more powerful in modelling and empirical studies.

In order to facilitate data analysis and comparison between predator monitoring studies in the context of CEMP, the Scientific Committee developed a set of CCAMLR Ecosystem Monitoring Programme Standard Methods for monitoring predator parameters that include details of how the data should be collected, the formats for submission of the data to the CCAMLR Secretariat and procedures for data analysis.

CCAMLR members take part in CEMP voluntarily, so contributions to data gathering depend on national research programmes and priorities. In terms of environmental protection of CEMP sites, there is no direct mechanism to protect them, but 7 of the 13 currently active CEMP monitoring sites south of 60oS are within ASPAs or ASMAs.

In addition, CCAMLR has not only established a number of programs to collect the data required for the effective management of the Southern Ocean such as fisheries monitoring, scientific observers on fishing vessels and ecosystem monitoring, but also the marine debris programme. The CCAMLR was established in 1989 to monitor debris levels in the Convention Area, with specific regard to fishing debris items. Members annually submit data using a standardised form and instructions covering marine debris from beach surveys, debris associated with seabird colonies, entanglements of marine mammals, and hydrocarbon soiling of mammals and seabirds. The CCAMLR Marine Debris Database

contains data from 15 sites, predominantly in the Antarctic Peninsula and on Sub-Antarctic islands. In addition to the Marine Debris program, CCAMLR has implemented measures to monitor and reduce the amount of debris entering the marine system and to mitigate its impact in the Convention Area. Specific measures have been implemented to address the risk associated with entanglement of marine mammals in plastic packaging bands (used to secure bait boxes) and the injury to seabirds caused by the discharge of hooks in offal.

CCAMLR has also developed a number of initiatives to educate fishers and fishing vessel operators about the potential impact of marine debris on seabirds and marine mammals. Since 1989, fishing and fisheries research vessels operating in CCAMLR waters have been required to display a marine debris poster, Overboard is not Forgotten , which outlines procedures for the handling, storing and discarding of different types of refuse. This poster, highlighting the dangers posed to marine mammals by plastic debris, has been produced in multiple languages. CCAMLR established Conservation Measure 26-01 (2018) in terms of General environmental protection during fishing. The measure regulates the disposal of plastic packaging bands, food waste, sewage, incineration output, and prohibits the dumping or discharging of garbage and oil or fuel products or oily residues into the sea. How well this Conservation Measure is met is also being reported by scientific observers.

Regarding krill catch specifically in the area for the fishery under assessment, and as was discussed under Principle 1, it is deemed that the krill catch limit over CCAMLR Area 48 is precautionary. There are some concerns regarding the potential impacts of the krill fishery at the local scale however. CCAMLR set a trigger level limit of 620,000 t over the entire Area 48. This trigger limit is further subdivided into regional trigger limits per Subareas: each fishing season catches cannot exceed 25 % of the trigger level (155,000 tonnes) in Subarea 48.1 and 45 % (279,000 tonnes) in Subareas 48.2 and 48.3 (CCAMLR 2017c). In addition, in 2003, CCAMLR agreed to the definition of a suite of small-scale management units (SSMUs) in Area 48 that are based on the distribution of krill, krill-predators and the fishery. However, to date there has been no agreement on the allocation of catches at this scale (CCAMLR 2017c). This has prompted concerns that there is a risk of localized predator depletion (MBA 2017). There is an ongoing debate within CCAMLR as to whether the current approach, and specifically the present level of spatial resolution of the management units, is indeed sufficiently precautionary (MBA 2017).

The trigger sub-limit for Subarea 48.1 has been reached repeatedly in recent years; each time it happened, the fishery within Subarea 48.1 was closed, as required by Conservation Measure 51-07. Thus, there is evidence that the overall mechanisms to minimise impact on predators does work. However, most of the catch within Subarea 48.1 stemmed from the Bransfield Strait. This high concentration of fishing effort in a relatively small area suggests that further trigger limits might need to be implemented at a local scale (MBA 2017).

Another main area of concern is the combination of the effects of climate change and the expansion of the krill fishery (MBA 2017). Indeed the Antarctic Peninsula is one of the fastest warming areas at a global scale: along the Western Antarctic Peninsula (WAP), the mean annual air temperature has increased as much as 3.4 °C and the mid-winter temperature has increased 6.0 °C over the past 50 yr (Bockheim et al. 2013). This warming will undoubtedly have effects at different levels and spatial scales, ranging from a reduction of the ice cover to changes in the water mixing and primary productivity. The outcome of these changes upon the predator populations, when combined with a fishing effort similar or higher than current and as spatially concentrated as it is now, constitutes a main concern over the long-term sustainability of the krill fishery. The WG-EMM at their 2019 meeting agreed that the climate change associated risks to krill and the ecosystem it supports emphasise the need for precautionary management of the krill fishery (CCAMLR 2019m).

Recent rapid climate change is now well documented in the Antarctic, particularly close to the Antarctic Peninsula. One of the most evident signs of climate change has been ice-shelf collapse; overall, 87% of the Peninsula's glaciers have retreated in recent decades. Further ice-shelf collapse will lead to the loss of existing marine habitats and to the creation of new ones, with consequent changes in both ecological processes and in community structure, with changes from a unique ice-shelf-covered ecosystem to a typical Antarctic shelf ecosystem, and high primary production during a short summer. This process is likely to be among the largest ecosystem changes on the planet (Trathan & Grant 2013).

Changes in the physical properties of the marine system are especially important for CCAMLR and include, *inter alia*, changes in ocean temperature (Guille 2002) and ocean acidification (Bednarsek et al. 2012), reductions in the extent and timing of seasonal sea-ice (Stammerjohn et al. 2008) and the retreat and collapse of ice shelves, glaciers and ice tongues (Cook et al. 2005; Cook & Vaughan 2010; Gutt et al. 2010).

6.4.5.4 Ecosystem Models

Different broad categories of model representing Antarctic krill, their data sources and limitations were reviewed by Atkinson et al. (2012). The main groups of sampling krill described included: with nets (for historical time series, demographic information and live krill), acoustics (distribution, time series, biomass and swarm-scale information), the krill fishery (sustained sampling in one place and wide area and time coverage) and via predators (long time series, demographic indices). Observations that krill occupy the under-ice layer, the 0–10 m layer, the deeper water column and the benthos have fundamental implications, both for assessing biomass and for modelling the food web. Temporally, the intense (order of magnitude) interannual variability in krill population size within the southwest (SW) Atlantic sector is a major scale of variability, driven by sea-ice and climate effects on recruitment. This variability masks top–down predation controls that may operate over multi-decadal scales. Growth in spring, summer and autumn is now fairly well quantified. The main predator groups of krill are known, although the extent of predation is more variable and not linear. Krill feed across three trophic levels and can control food populations through locally high grazing impact and nutrient regeneration. They also have fundamental regional differences in overwintering strategies, on-shelf/off-shelf distributions, relationships with sea-ice and diet. Whether this reflects 'subpopulations' with regionally specific life cycles is still unclear, which therefore makes scaling-up food-web models difficult across regions difficult (Atkinson et al. 2012).

The model categories described by Atkinson et al. (2012) include:

- models exploring specific aspects of krill biology such as life cycle, energetics or behaviour (Hofmann & Hùsrevõglu 2003; Murphy et al. 2004);

- multispecies population models, simulating either historical changes in the abundance of krill and its predators or the effects of harvesting on interacting species (May 1979; Murphy et al. 1998);

- single species population projection models, for instance to quantify regional catch limits (Constable et al. 2000);

- spatial single species models, such as that of Marin & Delgado (2001), which showed that some 80% of the krill catch was taken from within penguin foraging areas near the Antarctic Peninsula, suggesting that fisheries are in direct spatial competition with predators (Hewitt et al. 2002; Hewitt et al. 2004);

- mass-balance regional foodweb models incorporating krill, such as the preliminary Ecopath with Ecosim (EwE) model of the Antarctic Peninsula ecosystem, Subarea 48.1 (Cornejo-Donoso & Antezana 2008); the model shows that phytoplankton, zooplankton and krill account for most of the mass flow,

and describes the food web as dominated by the phytoplankton-krill-top predators chain, complemented with alternative food pathways (e.g. through *Electrona antarctica*);

- a spatial multispecies operating model (SMOM) of krill–predator fishery dynamics, which has been used to evaluate proposed management measures for the krill fishery in the Scotia and Bellingshausen Seas (Plaganyi & Butterworth 2012); the model describes the underlying population dynamics, is used in simulations to compare different management options for adjusting fishing activities (e.g. different spatial distribution of catches), and allows the discrimination of the ecosystem impacts of different spatial fishing allocations;

- models of krill transport at the maximum advection rate indicated by the Ocean Circulation and Climate Advanced Modelling Project (OCCAM), with the aim of evaluating the large-scale ocean circulation and interpreting data coming from the World Ocean Circulation Experiment (WOCE; (Rintoul et al. 2001)).

6.4.6 Cumulative impacts

The MSC introduced requirements for cumulative impact assessments in Principle 2 with the release of the Fisheries Certification Requirements v2.0. These requirements are to ensure that MSC certified fisheries will no longer cumulatively be at risk of generating negative impacts on Principle 2 species (and habitat).

For primary species, cumulative impacts assess whether the collective impact of overlapping MSC fisheries are hindering the recovery of 'main' primary species that are below a point of recruitment impairment (PRI); i.e. ensuring that the combined impact of MSC fisheries are not harming the recovery of the stock;

For secondary species, the same intent applies when a species is below a biologically based limit, but only in cases where two or more MSC fisheries have 'main' catches that are 'considerable', defined as a species being 10 per cent or more of the total catch;

For ETP species, the combined impacts of MSC fisheries on all ETP species needs to be evaluated, but only in cases where either national and/or international requirements set catch limits for ETP species and only for those fisheries subject to the same national legislation or within the area of the same binding agreement';

For habitats, in contrast, cumulative impacts are evaluated in the management PI (PI 2.4.2). The requirements here aim to ensure that vulnerable marine ecosystems (VMEs) are managed cumulatively to ensure serious and irreversible harm does not occur.

Apart from Krill, there are currently no other directed fisheries in areas 48.1 48.2 (CCAMLR CM 32-02 2017). No finfish are targeted in this area (

Table 12).

Prohibition of Directed Fishing

Area \ Taxon	*Chaenocephalus aceratus*	*Dissostichus eleginoides*	*Dissostichus* spp.	*Electrona carlsbergi*	*Gobionotothen gibberifrons*	*Lepidonotothen squamifrons*	*Notothenia rossii*	*Patagonotothen guntheri*	*Pseudochaenichthys georgianus*	All other species of finfish
Subarea 48.1	1,2	1,2	1,2	1,2	1,2	1,2	1,2,4	1,2	1,2	1,2
Subarea 48.2	1,2	1,2	1,2	1,2	1,2	1,2	1,2,4	1,2	1,2	1,2
Subarea 48.3	3			1,2	3	3	4	3	3	

Table 12. Extract from CCAMLR CM 32-02 2017

Table 13. Cumulative impact considerations

Outcome Performance Indicator	Element	Cumulative impact?	Rationale
2.1.1 Primary species (main)	NA	NA	No Primary main species in this UoA
2.2.1 Secondary species (main)	NA	NA	None caught in this UoA
2.3.1 ETP outcome	NA	NA	None caught in this UoA
2.4.2 VME management	NA	NA	A mid-water pelagic fishery

6.4.7 Scoring elements

Table 14. Principle 2 scoring elements

Component	Scoring elements	Designation	Data-deficient
Principle 1	Krill *Euphasia superba*	Target	No
Primary	Ocellated icefish *Chionodraco rastrospinosus*	Minor IPI	No
Primary	Icefish species *Champsocephalus gunnari*	Minor IPI	No
Secondary	*Bubulcus ibis* (cattle egret)	Main Unidentified mortality	
Secondary	*Daption capense* (cape petrel)*		
Secondary	*Pagodroma nivea* (snow petrel)*		
ETP	*Arctocephalus gazelle* (Antarctic fur seal)	Released live	No

Habitat	Common	NA	
	VME	NA	
	Minor habitat	NA	

* it must be noted that these species were not recorded I the Observer reports for this fishery under assessment, but were recorded in the CCAMLR kirll fishery report (2018) as a whole

6.4.8 Principle 2 Performance Indicator scores and rationales

Scoring table 7. PI 2.1.1 – Primary species outcome

PI 2.1.1		The UoA aims to maintain primary species above the point where recruitment would be impaired (PRI) and does not hinder recovery of primary species if they are below the PRI		
Scoring Issue		SG 60	SG 80	SG 100
a	Main primary species stock status			
	Guide post	Main primary species are **likely** to be above the PRI. OR If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding.	Main primary species are **highly likely** to be above the PRI. OR If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY.
	Met?	NA	NA	NA

Rationale

There are no main primary species in this fishery – according to MSC interpretation 24.02.2017 ID 2845 "If the fishery has no main species, scoring issue (a) is not applicable. In scoring issue (b) each species will score either 80 or 100 depending on whether the SG100 is met or not.

b	Minor primary species stock status		
	Guide post		Minor primary species are highly likely to be above the PRI. OR

		If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species.
	Met?	Yes

Rationale

This is a reduction fishery all minor primary and secondary species are accounted for as IPI species, as they are not separated at any point from the targeted krill.
Based on the Observer reports, the bycatch has identified one Primary minor species, mackerel icefish (*Champsocephalus gunnari)* at 0.002% (1,008 kg). This species is commercially targeted. Recent (2018) survey biomass estimates from CCAMLR indicate that *C. gunnari* in Subarea 48.3 is well above average and the second highest since 2000 (CCAMLR Fishery report 2018 for *C.gunnari* 48.3). CCAMLR provides scientific advice and management measures for Icefish (CCAMLR 2019 CM 42-01, https://www.ccamlr.org/sites/default/files/42-01_51.pdf). Although biomass estimates for *C. gunnari* within Subarea 48.1, where the client fishery operates, are not currently available, the areas 48.1 and 48.2 are not currently exploited for mackerel icefish. As the stock has recovered in 48.3 from previous exploitation levels, it can therefore be assumed, that since it is not exploited at all in 48.1/2 that the stock levels have recovered there too from historic exploitation levels. Based on the stock assessment for 48.3, the mackerel icefish in 48.1/2 is highly likely to be above PRI. Given the amount of mackerel icefish catch taken by the UoA and the existence of directed fisheries for these species, the team considers that the low catch taken by the UoA serves as evidence that the UoA is not hindering the recovery of *C. gunnari*. SG100 is met.

References

(CCAMLR 2018a; CCAMLR 2018h)

https://www.ccamlr.org/en/system/files/01%20ANI483%202018.pdf

https://www.ccamlr.org/sites/default/files/42-01_51.pdf

CCAMLR scientific observer reports from 2016-2019

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 8. PI 2.1.2 – Primary species management strategy

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to be above the PRI.	There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the PRI.	There is a **strategy** in place for the UoA for managing main and minor primary species.
	Met?	Yes	Yes	Yes

Rationale

There are no Primary main species recorded in the Observer reports, therefore SG60 and SG80 are automatically met.

There is currently no active fishery, and has not been for years, for mackerel icefish in 48.1 and 48.2. The management strategy which applies to mackerel icefish is 48.3 would be applicable here too, as it would be under the management regime of CCAMLR (mackerel icefish in 48.3 is a MSC certified fishery - https://fisheries.msc.org/en/fisheries/south-georgia-icefish-pelagic-trawl/@@view for relevant stock and management details).

There is a strategy in place for the UoA for managing mackerel icefish, the fishing strategy allows for a selective catch of the targeted krill, which limits the catch of the mackerel icefish species to low levels (<0.002% based on observer data). This is verified by on-board observer reports. Given this high level of selectivity, the team considers that the fishing strategy is adequate for managing main and minor primary species. SG100 is met.

b	Management strategy evaluation			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Yes	Yes	Yes

Rationale

The type of fishing gear used and being a pelagic and highly targeted fishery, as well as comprehensive observer coverage providing detailed bycatch information and monitoring of relevant krill conservation measures (gear design, area limits, bycatch limits) as stipulated by CCAMLR (https://www.ccamlr.org/en/conservation-and-management/browse-conservation-measures) SG60 and SG80 are met.

Testing can include the use of experience from analogous fisheries, empirical testing (for example practical experience of performance or evidence of past performance) and simulation testing (for instance using computer-intensive modelling such as Management Strategy Evaluation). In the case of this fishery, there are several years of comprehensive Observer data providing detailed evidence of past performance, and the fishery under assessment is similarly executed and observed as other krill fisheries in Sector 48.1 and 48.2. SG100 is met.

c	Management strategy implementation			
	Guide post		There is **some evidence** that the measures/partial strategy is being implemented successfully.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a).
	Met?		Yes	Yes

Rationale

CCAMLR observer reports for this fishery, dating back to 2016 for the vessels under assessment, provide clear information on the location and execution of the fishery as well as detailed bycatch reporting. Furthermore, the observer coverage is 100%, the observer takes photographs of the mitigation measures and gear configurations, and verifies location as stipulated by CCAMLR Conservation Measures and these are part of the report. The bycatch data show that non-target species bycatch is consistently very low, amounting to 0.006% of the total catch. This provides clear evidence that the strategy is implemented successfully and achieving its overall objective. SG80 and SG100 are met.

d	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NA	NA	NA

Rationale

No sharks are caught in this fishery. There are no observations to suggest so.

e	Review of alternative measures			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	NA	NA	NA

Rationale

MSC's definition of 'unwanted catch' is as follows (SA3.1.6): the part of the catch that a fisher did not intend to catch but could not avoid, and did not want or chose not to use.

There are no 'main' species identified in the observer data and given the low level of non-targeted species in the catch (<0.01% of catch by weight), the team considers that there is no unwanted catch of primary species. Therefore, this SI is not applicable.

References

CCAMLR observer reports for this fishery;

(CCAMLR 2018a; CCAMLR 2018h); (CCAMLR 2019g; CCAMLR 2018g)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 9. PI 2.1.3 – Primary species information

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impact on main primary species			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species.	Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status.
	Met?	NA	NA	NA

Rationale

There are no Primary main species in the bycatch. This SI is not scored.

b	Information adequacy for assessment of impact on minor primary species		
	Guide post		Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?		No

Rationale

Based on detailed observer records, there is quantitative information on the amount of primary species caught by the UoA. No targeted fishing of mackerel icefish and Antarctic toothfish occurs in 48.1 and 48.2. There are up-to-date stock assessments on mackerel icefish *Champsocephalus gunnar*i in area 48.3, and one can extrapolate

from these the status of *Champsocephalus gunnar*i in area 48.1 and 48.2 as those areas do not have a targeted fishery. The quantitative information is not adequate to estimate the impact of the UoA on mackerel icefish with respect to status. SG100 is not met.

c	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage **main** primary species.	Information is adequate to support a **partial strategy** to manage **main** primary species.	Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the strategy is achieving its objective.
	Met?	Yes	Yes	Yes

Rationale

There are no main primary species, SG 60 and SG80 are met by default.

As regards all primary species, there is detailed information on the quantity taken by the UoA for both species concerned. The status of *C gunnari* is known by extension of updated stock assessments in 48.3 and no targeted fishery in 48.1 and 48.2. The 100% observer coverage ensures that the Conservation Measures stipulated by CCAMLR are complied with (eg gear design, deployment, fishing location, catch analysis). VMS further verifies the location of the fishery. It is therefore considered, that in this highly targeted fishery the information is adequate to support a strategy to manage all primary species and to evaluate with a high degree of certainty that the strategy is achieving its objective. SG100 is met.

References

CCAMLR observer reports for this fishery;

(CCAMLR 2018a; CCAMLR 2018h); (CCAMLR 2019g; CCAMLR 2018g)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 10. PI 2.2.1 – Secondary species outcome

PI 2.2.1		The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit		
Scoring Issue		SG 60	SG 80	SG 100
a	Main secondary species stock status			
	Guide post	Main secondary species are **likely** to be above biologically based limits. OR If below biologically based limits, there are **measures** in place expected to ensure that the UoA does not hinder recovery and rebuilding.	Main secondary species are **highly likely** to be above biologically based limits. OR If below biologically based limits, there is either **evidence of recovery or a demonstrably effective partial strategy** in place such that the UoA does not hinder recovery and rebuilding. AND Where catches of a main secondary species outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main secondary species are above biologically based limits.
	Met?	Yes	Yes	Yes

Rationale

Based on the Observer reports available for this UoA (table Table 10 and section 6.4.2.1), there were no Secondary main species recorded in the bycatch of this krill fishery. Out-of-scope species such as seabirds would be regarded as Secondary main species (MSC CR v2.0 SA3.7.1.2).

In 2018 one dead cattle egret (*Bubulcus ibis*) was recovered around the ship's forecastle – it was retained as a sample and sent to the Korean National Institute for Science. The cattle egret's death is not directly related to the act of fishing, but more likely to be an indirect effect of fishing (collision with the forecastle?) and therefore considered elsewhere in the scoring of this fishery. The cattle egret is therefore not considered an out-of-scope (and therefore Secondary main) species.

On a krill fishery wide basis in the area under assessment both snow petrel and cape petrel were recorded in the CCAMLR 2018 krill fishery report (and which therefore are regarded as Secondary main species under MSC CR). Specifically, in 2018, there were two seabird mortalities reported from the krill fishery (all fleet of 11 vessels), one snow petrel (*Pagodroma nivea*) in Subarea 48.1 and one cape petrel (*Daption capense*) in Subarea 48.2. The 2017 CCAMLR krill fishery report recorded two seabird mortalities (unspecified species, one in subarea 48.1 and one in subarea 48.2) for the whole fleet in 2017 and nine seabird (unspecified) mortalities in 2016, one in Subarea 48.2 and eight in Subarea 48.1. It has to be noted that snow petrel and cape petrel were not recorded in the Observer reports of the fishery under assessment.

According to information from Birdlife International, the population of snow petrels in Antarctica exceeds 4 million individuals, and the population is stable (BirdLife International (2019) Species factsheet: *Pagodroma nivea*.). As for the cape petrel, its population exceeds 2 million individuals, and is also expected to be stable (BirdLife International (2019) Species factsheet: *Daption capense).* Both species are listed as Least Concern by IUCN.

Based on this information on the species, there is a high degree of certainty that main secondary species (of two species of seabirds, caught in the wider krill fishery in the area) are above biological based limits. SG60, SG80 and SG100 are met.

b	Minor secondary species stock status	
	Guide post	Minor secondary species are highly likely to be above biologically based limits. OR If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species
	Met?	No

Rationale

Minor species relevant to this PI are listed in Table 10.

Since this is a reduction fishery all minor primary and secondary species account as IPI species, as they are not separated at any point from the targeted krill. Given the low amount of fish bycatch taken by the UoA (considered here as Secondary minor species), totalling about 0.007% of the total catch, it may be reasonable to consider that the UoA does not hinder the recovery and rebuilding of these species. However, no evidence could be found of biological based limits for these species. SG100 is not met.

References

CCAMLR observer reports for this fishery, from 2016-2019.
(CCAMLR 2017b; Birdlife_International 2019a; Birdlife_International 2019c; Birdlife_International 2019b; CCAMLR 2018b)
(https://www.ccamlr.org/en/document/publications/krill-fishery-report-2018)
(https://www.ccamlr.org/en/system/files/00%20KRI48%202017.pdf)
(http://datazone.birdlife.org/species/factsheet/snow-petrel-pagodroma-nivea/details)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 11. PI 2.2.2 – Secondary species management strategy

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **strategy** in place for the UoA for managing main and minor secondary species.
	Met?	Yes	Yes	Yes

Rationale

There are no Secondary main in-scope identified in Table 10 so these elements achieve SG60 and SG80 by default.

All krill vessels operating in Area 48 have to apply CCAMLR Conservation Measures 26-01 (2018), 51-01(2010) and 25-03 (2018) to minimize incidental mortalities of out of score species such as seabirds, namely the snow petrel (*Pagodroma nivea*) and cape petrel (*Daption capense*) (considered Secondary main unless otherwise allocated to ETP).

All krill vessels operating in Area 48 have to comply with a raft of management measures as stipulated by CCAMLR (eg location of fishery, exclusion of certain areas, gear design and configuration, catch and bycatch recording, observer coverage (see https://www.ccamlr.org/en/conservation-and-management/browse-conservation-measures). These measures amount to a strategy as designed by CCAMLR to manage krill fisheries in the area.

This raft of measures includes for example:
- The mandatory use of a marine mammal exclusion device
- Fine-mesh exclusion net at the codend
- Long hauls of 20 or 25 days (proxy)
- A slow towing speed (2 knots) that allows animals to avoid the net
- Square mesh and T90 mesh orientation to reduce the bycatch of juvenile fish and small fish
- Retention on board of all material captured

- The quick sinking of the net on deployment (to further reduce attention from seabrids)
- Spatial and seasonal limitations around South Georgia and the South Sandwich Islands, to reduce interaction with foraging species based on the shores during breeding season.
- The trawl warps enter the water very close to the stern of the vessel, reducing the potential for seabirds to strike them during fishing operations

The grouping of these measures and their periodic review (through the CCAMLR resources management process) are considered to make up a strategy for the UoA to manage main and minor secondary species. SG60 and SG80 are therefore exceeded, and SG100 is met.

b	Management strategy evaluation			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.
	Met?	Yes	Yes	Yes

Rationale

CCAMLR scientific observer reports for the UoA have not recorded any fatal interaction with Secondary main species between 2016-2019. The broader, krill fishery fleet wide information provided in the CCAMLR 2018 and 2017 krill fishery reports showed that interactions by the UoA with seabird species could occur but are also rare (see PI 2.2.1). The list of measures mentioned in SIa are all considered likely to work, as regards seabirds they restrict and discourage access to the net and limit the time of the hauling of the net (when interactions could be most expected). SG60 is met.
The low level of interactions and the high surveillance of these interactions (given the 100 % observer coverage – whereby the implementation of measures is observed and recorded as such in the relevant reports) give some objective basis for confidence that the strategy will work. SG80 is met.

Testing can include the use of experience from analogous fisheries, empirical testing (for example practical experience of performance or evidence of past performance) and simulation testing (for instance using computer-intensive modelling such as Management Strategy Evaluation). In the case of this fishery, there are several years of comprehensive Observer data providing detailed evidence of past performance, and the fishery under assessment is similarly executed and observed as other krill fisheries in Sector 48.1 and 48.2. The low level of interactions (as recorded in CCAMLR observer reports and summarised in the CCAMLR 2018 / 2017 krill fishery reports), the safe biological status of the affected main species (snow petrel and cape petrel) and the low proportion of Secondary minor finfish species in the catch all support high confidence that the strategy is working effectively. SG100 is met.

c	Management strategy implementation			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented

				successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Yes	Yes

Rationale

CCAMLR observer reports for this fishery, dating back to 2016 for the vessels under assessment, provide clear information on the location and execution of the fishery as well as detailed bycatch reporting. The bycatch data show that non-target species bycatch is consistently very low, amounting to 0.006 % of the total catch. Furthermore, the observer coverage is 100%, the observer takes photographs of the mitigation measures and gear configurations, and these are part of the report. The layout of the observer report template prompts observers to highlight when measures are or aren't used. This provides clear evidence that the strategy is implemented successfully and achieving its overall objective. SG80 and SG100 are met.

d	Shark finning			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NA	NA	NA

Rationale

No sharks are caught in this fishery according to the observer reports. GSA3.8 on Secondary species management strategy states that MSC Guidance for Primary species management strategy applies (GSA3.5). GSA 3.5.1 states that scoring issue (d) is only scored where the primary (in this case secondary) species is a shark. This is not the case here. As such, this SI is not applicable.

E	Review of alternative measures to minimise mortality of unwanted catch			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and they are implemented, as appropriate.
	Met?	Yes	Yes	Yes

Rationale

CCAMLR holds annual meetings amongst its members in which updates are shared on the different fisheries operating in the Southern Ocean. CCAMLR's WG FSA (Working Group on Fish Stock Assessment) and WG EMM (Working Group on Ecosystem Monitoring and Management) meet regularly and annually. The most recent meeting was held in France in July 2019. The WG-EMM discusses, amongst other issues, the effectiveness of implemented measures to avoid mortality of unwanted catch and reviews the effectiveness and usefulness of the data collected. Given the frequency of these meetings, the requirements at SG60, SG80 and SG100 are met.

References

https://www.ccamlr.org/en/conservation-and-management/browse-conservation-measures
https://www.ccamlr.org/en/meetings-and-publications/meetings-publications.
CCAMLR observer reports for the UoA
(CCAMLR 2017b; CCAMLR 2019l; CCAMLR 2020; CCAMLR 2018i); (CCAMLR 2018f; CCAMLR 2010; CCAMLR 2018d)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 12. PI 2.2.3 – Secondary species information

PI 2.2.3		Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts on main secondary species			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status. OR If RBF is used to score PI 2.2.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status. OR If RBF is used to score PI 2.2.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status.
	Met?	NA	NA	NA

Rationale

There are no Secondary main species recorded in the Observer reports for this UoA. The exact cause of death of the cattle egret (the only "main" secondary specimen noted in the observer reports) on the forecastle of the vessel is not known. This will be further investigated at the site visit. The SIa is not scored.

b	Information adequacy for assessment of impacts on minor secondary species		
	Guide post		Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.
	Met?		No

Rationale

Although there is good quantitative information on all those Secondary minor species bycaught in this fishery, based on good observer coverage and extensive sampling of hauls, there is no information on the status of Secondary minor species. SG100 is not met.

c	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage **main** secondary species.	Information is adequate to support a **partial strategy** to manage **main** secondary species.	Information is adequate to support a **strategy** to manage **all** secondary species, and evaluate with a **high degree of certainty** whether the strategy is **achieving its objective**.
	Met?	Yes	Yes	Yes

Rationale

Detailed information on bycatch is reported to CCAMLR on a continuous basis, the 100% international observer coverage ensures detailed sampling and recording of information on catch composition according to the CCAMLR Scientific observer's manual. The collection and analysis of such detailed bycatch data in the krill fishery has been in place for some years, so that the data can be analysed meaningfully for trends and responded to accordingly. This means that the information is adequate to support a strategy to manage all Secondary species and to evaluate its effectiveness. SG60, SG80 are exceeded and SG100 are met.

References

(CCAMLR 2020)
CCAMLR 2018 to 2016 observer reports for the UoA.

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 13. PI 2.3.1 – ETP species outcome

PI 2.3.1		The UoA meets national and international requirements for the protection of ETP species The UoA does not hinder recovery of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	Effects of the UoA on population/stock within national or international limits, where applicable			
	Guide post	Where national and/or international requirements set limits for ETP species, the **effects of the UoA** on the population/ stock are known and **likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population /stock are known and **highly likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty that the combined effects of the MSC UoAs** are within these limits.
	Met?	NA	NA	NA

The CCAMLR Schedule of Conservation Measures currently in force were adopted by the Commission at a recent meeting of the parties (Nov 2019 – Schedule of Conservation Measures in force 2019/20; https://www.ccamlr.org/en/system/files/e-schedule2019-20_1.pdf). The schedule outlines, amongst other measures, the requirements to prevent and minimise incidental mortalities of seabirds and marine mammals. These measures do not set limits for ETP species, the raft of measures across all areas within the Convention Area are designed to prevent incidental mortalities. This SI is not applicable.

b	Direct effects			
	Guide post	Known direct effects of the UoA are likely to not **hinder recovery** of ETP species.	Direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	Yes	Yes	Yes

Rationale

Marine mammal and seabird observations and interactions are recorded in a standardised format as part of the CCAMLR Scientific Observer Reports in accord with the CCAMLR Observers Manual. Identification guides are available for all observers on each of the fishing vessels. Any interactions are summarised annually in the Krill fishery reports compiled by CCAMLR.

The CCAMLR krill fishery 2018 report (covering all vessels participating in the year's krill fishery) provides information on recent interactions with marine mammals and seabirds. In 2018, there were two seabird mortalities reported from the krill fishery, one snow petrel (*Pagodroma nivea*) in Subarea 48.1 and one cape petrel (*Daption capense*) in Subarea 48.2. These two seabird species are not ETPs, however, but they are mentioned here to indicate that all seabird interactions are recorded by the observers

The use of seal exclusion devices (SED) became mandatory in the krill fishery in 2010 (CCAMLR 2010), prior to that date no seal interactions with the fisheries were recorded. There were no seal mortalities reported in the CCAMLR krill fishery between 2008 and 2014. There were three mortalities of Antarctic fur seals in 2015 and 2016, none in 2017. There were also 19 reported mortalities of Antarctic fur seal (*Arctocephalus gazella*) in the krill fishery in Subarea 48.3, of which 18 were reported from the same vessel (not a UoA vessel). As reported in CCAMLR observer reports for the UoA, none of these mortalities took place in the UoA vessels.

The 2018 Observer report for the UoA recorded one dead cattle egret being found on the forecastle, the bird was retained for further examination to establish the cause of death. The 2019 Observer report recorded one fur seal being caught in the net and released alive and uninjured.

Given the low level of interactions, known direct effects of the UoA are likely to not hinder the recovery of ETP species. SG60 is met.

CCAMLR Conservation Measure 25-03 covers the subject of minimizing the incidental mortality of seabirds and marine mammals in the course of trawling in the Convention Area and requires the fisheries to develop gear configurations that reduce the risk of seabirds or marine mammals encountering the net, such as the Seal Exclusion Device (SED), as well as a raft of other measures as outlined in the ETP background section of this report (6.4.3). The implementation of these measures is rigorously checked by the Observers. SG80 is met.

Considering the interaction with Antarctic fur seals, these are currently classified as LC on the IUCN Redlist (accessed 1st Dec 2019). The most recent assessment of the Antarctic fur seal population was published in 2016 (see IUCN Redlist species detail http://www.iucnredlist.org/details/2058/0). According to this assessment the greatest threat to this species is considered to be the impact of climate change on its physical environment and populations of its prey. The impacts of other threats, such as entanglement in anthropogenic have also been recorded. The impact of incipient fishing industries on prey populations remain low, possibly as a result of the conservative management of these fisheries. The 100% comprehensive scientific observer coverage showing no fatal interactions by the UoA with fur seals, as well as other marine mammals and seabirds, provide a high degree of certainty that there are no significant detrimental effects of the UoA on the population status of ETP species. SG100 is met.

c	Indirect effects			
	Guide post		Indirect effects have been considered for the UoA and are thought to be **highly likely** to not create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species.
	Met?		Yes	Yes

Rationale

Indirect effects of the fishery on predators such as Antarctic fur seals have been studied along with effects on other species such as crabeater seals, Adélie, chinstrap, gentoo and macaroni penguins, by mapping selected krill predator summer foraging ranges and overlaying it on known fishing activity areas (Hinke et al 2017). The results showed that direct overlap of krill-dependent predators (including Antarctic fur seals) with the krill fishery on small spatiotemporal scales is relatively common throughout the Antarctic Peninsula region.

In order to protect predators and their foraging areas, the South Georgia and South Sandwich Islands have established a no-take zone around the islands, consisting of a seasonal closure for the krill fishery from 1 October to 30 April along with minimum (700 m) and maximum (2500 m) depths at which trawling can take place. In order to limit the indirect effects that harvesting for krill may have on penguin colonies, the Association of responsible krill harvesting companies (ARK http://www.ark-krill.org/) and its members (including Jeong Il Corporation) have committed themselves, as from January 2019, to voluntary restrictions in the Antarctic Peninsula covering about 74000 km^2 around penguin colonies, to ensure the long-term viability of krill stocks and that the krill fishing industry does not compete with penguin colonies during their breeding season (see: http://www.ark-krill.org/index.cfm/7/News). With this commitment, ARK companies pledge to keep fishing effort up to 40 kilometres away from the coast from October to March, depending on the conservation needs of colonies of Adélie, chinstrap and gentoo penguins while breeding around the Antarctic Peninsula, off South Shetland and in Gerlache strait. The commitment will see the seasonal closure gradually implemented into a permanent closure from 2020.

According to Hewitt *et al*. (2004) , the estimated annual consumption of krill in Area 48.1/.2/.3 shows that fur seals would consume 706.7 thousand tonnes per year, whales 2360 thousand tonnes, fish 2,963.9 thousand tonnes and penguins up to 9,192.1 thousand tonnes. These estimates add up to 15,223 thousand tonnes of krill potentially consumed annually by the different predators.

Removals by the fishery have been estimated to be several orders of magnitude less than both the demand from predators and the biomass available for both predators and the fishery.

Given the level of consumption of krill by ETP species, the catch taken by the krill fishery (subject to annual review of catch limits and to partial closures of the fishery) and the establishment of no-take zone around foraging areas, the team considers that there is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species. SG80 and SG100 are met.

References

(Hinke et al. 2017; CCAMLR 2018b; Hewitt et al. 2004; CCAMLR 2019n); (CCAMLR 2018e)

IUCN Redlist for fur seal http://www.iucnredlist.org/details/2058/0

www.ark-krill.org

Draft scoring range	≥80
Information gap indicator	More information sought / Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 14. PI 2.3.2 – ETP species management strategy

PI 2.3.2		The UoA has in place precautionary management strategies designed to: meet national and international requirements; ensure the UoA does not hinder recovery of ETP species. Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place (national and international requirements)			
	Guide post	There are **measures** in place that minimise the UoA-related mortality of ETP species, and are expected to be **highly likely to achieve** national and international requirements for the protection of ETP species.	There is a **strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be **highly likely to achieve** national and international requirements for the protection of ETP species.	There is a **comprehensive strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to **achieve above** national and international requirements for the protection of ETP species.
	Met?	Yes	Yes	Yes

Rationale

MSC CRv2.1 SA3.11.2.1 Where there are requirements for protection and rebuilding provided through national ETP legislation or international agreements, the team shall score scoring issue (a)).

Article II of CCAMLR clearly states the objective of this Convention as being the conservation of Antarctic marine living resources, whereby 'conservation' includes rational use. Harvesting has to be conducted with certain principles of conservation: (a) prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment. For this purpose its size should not be allowed to fall below a level close to that which ensures the greatest net annual increment; (b) maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources and the restoration of depleted populations to the levels defined in sub-paragraph (a) above; and (c) prevention of changes or minimisation of the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades, taking into account the state of available knowledge of the direct and indirect impact of harvesting, the effect of the introduction of alien species, the effects of associated activities on the marine ecosystem and of the effects of environmental changes, with the aim of making possible the sustained conservation of Antarctic marine living resources.

CCAMLR requirements for the protection of ETP species are specified in Conservation Measure 25-03 (2019) - Minimisation of the incidental mortality of seabirds and marine mammals in the course of trawl fishing in the Convention Area, which sets out a raft of measures on fishing vessels to minimise such bycatch mortalities. Vessels in the UoA comply with this requirement, as recorded in CCAMLR observer reports. In addition, Conservation Measures 26-01 2019 (on general environmental protection) addresses the disposal of plastic (not at sea!), prohibition of discharge (including oil, garbage, organic waste, offal etc), live birds including poultry must not be brought into the Convention area, and any bycatch with a high chance of survival has to be released immediately (after certain recordings have been taken). Conservation Measures 51-01 (2010) addresses the precautionary catch limits in the krill fishery in Statistical Subareas 48.1, 48.2, 48.3 and 48.4; and Conservation Measure 51-06 (2019) is a General measure for scientific observation in fisheries for *Euphausia superba* and includes.

In practice the measures outlined in CM 25-03 (2019) include:

- Long hauls of 20 or 25 days (proxy)

- A slow towing speed (2 knots) that allows animals to avoid the net

- Retention on board of all material captured (apart from those species which have high survivability and are released as quickly as possible)

- The trawl warps enter the water very close to the stern of the vessel, reducing the potential for birds to strike them during fishing operations.

- Streamer lines

- The quick sinking of the net on deployment (so that bird scaring lines, so-called tori lines, are not required)

- Spatial and seasonal limitations around South Georgia and the South Sandwich Islands.

- Voluntary spatial and seasonal limitations around the Antarctic Peninsula as proposed by ARK.

These measures are configured on the vessels, in conjunction with CM 25-03, 26-01 and 51-01, 51-06 2019 to form a comprehensive strategy for managing the UoA's impact on ETP species. SG60, SG80 and SG100 are met.

b	Management strategy in place (alternative)			
	Guide post	There are **measures** in place that are expected to ensure the UoA does not hinder the recovery of ETP species.	There is a **strategy** in place that is expected to ensure the UoA does not hinder the recovery of ETP species.	There is a **comprehensive strategy** in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species.
	Met?	NA	NA	NA

Rationale

This SI was not scored following MSC CR v2.0 SA3.11.2

c	Management strategy evaluation

	Guide post	The measures are **considered likely** to work, based on **plausible argument** (e.g., general experience, theory or comparison with similar fisheries/species).	There is an **objective basis for confidence** that the measures/strategy will work, based on **information** directly about the fishery and/or the species involved.	The strategy/comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a **quantitative analysis** supports **high confidence** that the strategy will work.
	Met?	Yes	Yes	Yes

Rationale

Fisheries managed by CCAMLR are subject to a proven regulatory framework which includes access control, high frequency of reporting obligations (100% observer coverage), scientific monitoring of both target species catch and bycatch, mandatory marine mammal exclusion devices, as well as measures aimed specifically at targeting minimizing interaction with and mortality of seabirds and marine mammals (see previous SI for more details on management measures in place). SG60 is met.

The CCAMLR Scheme of International Scientific Observation was adopted in 1992 under Article XXIV of the Convention. It is one of the most important sources of scientific information that is essential for assessing the impact of fishing on the ecosystem, including the status of target populations, as well as those of related and dependent species. The scheme also plays a crucial role in developing approaches to reducing the impact of fishing on the ecosystem by collecting data on the effectiveness of mitigation measures. All vessels fishing in CCAMLR fisheries are required to carry an observer for some or all of their fishing operations. In fisheries for icefish and toothfish there is a requirement for 100% coverage by an international (i.e. not from the same flag state as the vessel) observer, while in the krill fishery there is a target coverage of at least 75% during 2018/19 and 2019/20 fishing seasons; and 100% coverage in subsequent fishing seasons (CM 51-06 2019). Observers record information on the gear configuration (including measures to reduce incidental mortality of seabirds and marine mammals), fishing operations (including catch composition), biological measurements of target and by-catch species, details of fish tagging and tag-recaptures, vessel sightings and data on indicators of vulnerable marine ecosystems. All of these data are submitted by observers to the CCAMLR Secretariat on standardised logbook forms designed for longline, trawl (finfish and krill) and pot (crabs and finfish) fisheries.

The fishery under assessment has 100% observer coverage. Observer reports from both vessels covering 2016-2019 have been made available to the assessment team. The observer reports specific for this UoA recorded one interaction with an Antarctic fur seal which was immediately released alive and uninjured, and one dead cattle egret which was found lying on the forecastle (it was retained for further examination).

There is an objective basis for confidence that the strategy will work. SG80 is met.

The CCAMLR 2018 krill fishery report stated that the entanglement and mortality of Antarctic fur seals was significantly reduced over time after the introduction of improved reporting and the implementation of marine mammal exclusion devices (SED) since 2003. The SED technology and configuration has been improved over that time, and CM 25-03 shows that these and related measures have now become mandatory. Over that time period the numbers of fur seals caught has reduced significantly, from 292 in 2004 to single figures in recent years. Although in 2018 there were also 19 reported mortalities of Antarctic fur seal (*Arctocephalus gazella*) in the fishery in Subarea 48.3, of which 18 were reported from the same vessel – not the UoA (CCAMLR 2018i). The same report also noted two seabird mortalities reported from the krill fishery, one snow petrel (*Pagodroma nivea*) in Subarea 48.1 and one cape petrel (*Daption capense*) in Subarea 48.2.

As regards the UoA, marine mammals and birds in the vicinity of the operation are counted and their presence documented formally by the observer. CCAMLR scientific observer reports have not recorded any significant or fatal interactions on ETP species in the fishing operation of the UoA. Given that this strategy is implemented since 2008

and that observer records show no interactions, the team concludes that there is a quantitative analysis supporting with high confidence that the strategy will work (and is already working). SG100 are met.

d	Management strategy implementation			
	Guide post		There is some **evidence** that the measures/strategy is being implemented successfully.	There is **clear evidence** that the strategy/comprehensive strategy is being implemented successfully and is **achieving its objective as set out in scoring issue (a) or (b).**
	Met?		Yes	Yes

Rationale

There is clear evidence that the strategy is being implemented successfully and achieving its objective. The observer coverage is 100%, the observer takes photographs of the mitigation measures and gear configurations, and these are part of the report. The observer reports available to the assessment team cover 2016-2019 for both vessels, and none show fur seal mortalities (one fur seal was caught alive and immediately released unharmed), and one cattle egret (not an ETP) found dead on the forecastle of the ship (retained for further examination). SG100 is met.

e	Review of alternative measures to minimize mortality of ETP species			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.
	Met?	Yes	Yes	No

Rationale

The effectiveness of the measures to minimize UoA-related mortality ETP species is periodically reviewed by CCAMLR, through the annual meetings of the Working Group on Fish Stock Assessment (WG FSA) and on Ecosystem Monitoring and Management (WG EMM), and reports are published accordingly. SG60 and SG80 are met. With the introduction of 100% observer coverage by the 2020/2021 fishing season, any issues with the exclusion devices and mitigation measures will be detected and acted on in a more timely manner (compared to the years it took to install the now mandatory conservation measures to reduce seabird and marine mammals bycatch). In order to meet

SG100, it has to be shown that there is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and that these are implemented, if appropriate. This cannot be said to be the case for this fishery. SG100 is not met.

References

CCAMLR https://www.ccamlr.org/en/organisation/camlr-convention-text#II
(CCAMLR 2017b; CCAMLR 2018e; CCAMLR 2018i; CCAMLR 2010; CCAMLR 2019h; CCAMLR 2019f)
Observer reports

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 15. PI 2.3.3 – ETP species information

PI 2.3.3		Relevant information is collected to support the management of UoA impacts on ETP species, including: Information for the development of the management strategy; Information to assess the effectiveness of the management strategy; and Information to determine the outcome status of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts			
	Guide post	Qualitative information is **adequate to estimate** the UoA related mortality on ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species.	Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.	Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species.
	Met?	Yes	Yes	No

Rationale

The overlap between some of the predators' summer foraging ranges and the krill fishery has been studied. E.g. (Hinke et al. 2017) and continues to be studied (see WG-EMM 2019/23). Fishing restrictions (currently voluntary but with a view to make these mandatory see www.ARK-krill.org) have been established in foraging areas of the Antarctic Peninsula and of the South Georgia and South Sandwich Islands. Changes in the relationship between predators and krill in terms of, for instance, penguin densities, species composition and diet changes in certain areas have been documented (Nicol 2009; CCAMLR 2019l; Watters et al. 2016; Hewitt et al. 2004; Trathan et al. 2011; Trathan et al. 2012).

Although there is 100% observer coverage on both vessels of the fishery under assessment, and with reports available to the assessment team from 2016-2019, provided detailed quantitative information to assess with an adequate degree of certainty the magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status of ETP species, a high degree of certainty would demand continuous observer coverage of the fishing operation – ie 2 observers taking it in turns SG100 is not met.

b	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage the impacts on ETP species.	Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species.	Information is adequate to support a **comprehensive strategy** to manage impacts, minimize mortality and injury of ETP species, and evaluate with a **high degree of certainty** whether a strategy is achieving its objectives.
	Met?	Yes	Yes	Yes

Rationale

The detailed information on ETP interactions available from the Observer reports is adequate to measure trends and support a strategy to manage impacts on ETP species. This is made possible by the high level of observer coverage in the krill fishing fleet. Together with the information recorded across the whole krill fishery fleet operating in the area, using all the same measures and protocols, and this data being collated by CCAMLR as part of the annual reporting process on these fisheries (CCAMLR krill fishery reports 2018, 2017), it can said that information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives. This work is also supported by the Working Group on Ecosystem Monitoring and Management (WG-EMM), which has as one of its remit to "Assess status and trends of [krill] dependent and related populations including identification of information required to evaluate predator/prey/fisheries interactions and their relationships to environmental features". Relevant studies include for instance WG-EMM 2019/23, WG-EMM 2019/26 and 2019/27. SG60, SG80, and SG100 are met.

References

UoA Observer reports 2016-2019

(CCAMLR 2017b; Hinke et al. 2017; Nicol 2009; CCAMLR 2018b; Warwick-Evans et al. 2019; Humphries et al. 2019); (Trathan et al. 2011; Trathan et al. 2012)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	

Condition number (if relevant)	

Scoring table 16. PI 2.4.1 – Habitats outcome

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates		
Scoring Issue		SG 60	SG 80	SG 100
a	Commonly encountered habitat status			
	Guide post	The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Yes	Yes	Yes

Rationale

This is a pelagic trawl fishery. The commonly encountered habitat is therefore the upper water column, the habitat of the target species. The fishing gear does not come into contact with the benthos – it would severely damage the gear if it did. VMS tracks confirm where the fishery operates. It can therefore be stated that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitat, the open water pelagic habitat, to a point where there would be serious or irreversible harm. SG100 is met.

b	VME habitat status			
	Guide post	The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.
	Met?	Yes	Yes	Yes

Rationale

This is a pelagic fishery. It does not come into contact with the benthos and therefore any possible VMEs. Furthermore, fishing with bottom gear is highly managed and restricted following CM 22-06 (2019) Bottom Fishing in the Convention Area, applying to areas south of 60°. The UoA therefore does not have any interaction with VME benthic habitats. A map of VME locations in the area where the fishery operates is provided in Section 6.4.4. Due to the fishing practices, area of activity, and 100% observer coverage, SG60 and SG80 are exceeded and SG100 is met.

c	Minor habitat status	
	Guide post	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.
	Met?	Yes

Rationale

Minor habitats are defined by MSC as those which do not fall within the classification of Commonly Encountered Habitats or VME (SA3.13.3). Taking into consideration information presented in SI(a) and SI(b), for the purpose of this assessment all benthic habitats excluding seamounts, hydrothermal vents, cold water corals and sponge fields (as defined as VMEs in CM22-06 2019) are be considered as Minor habitats. The midwater trawl used in the krill fishery is designed to operate in the water column without any contact with the sea bottom, and the loss of gear is a very rare event, confirmed by the Observer reports (2016-2019) showing zero entry for this (ie. The observer has to record such interaction, and the relevant box was filled as “0”). SG100 is met.

References

(CCAMLR 2019d)

Observer reports 2016-2019

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	

Condition number (if relevant)	

Scoring table 17. PI 2.4.2 – Habitats management strategy

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats.
	Met?	Yes	Yes	Yes

Rationale

This is a pelagic mid-water trawl fishery for krill, there is no impact of the fisheries on benthic habitat. As to managing the impact of all MSC UoAs/ non-MSC fisheries on habitats in general, there is a strategy in place, designed and implemented through CCAMLR.

CCAMLR Conservation Measures 21-03 and CM 51-01 restrict the type of fishing gear to be used to pelagic gear only, as well as tightly regulate bottom gear fishing (CM22-06 2019). This is generally operated at depths of about 150 m (proxy), over much deeper water. No interactions with the bottom have been recorded by international observers during their 100% coverage of the fishery (Observer reports from 2016-2019).

CCAMLR Conservation Measures 91-01 (2004), 91-02 (2012), 91-03 (2009), 91-04 (2011) and 91-05 (2016) describe the protected areas in Antarctic waters. In 2009 CCAMLR designated the South Orkney Islands southern shelf (SO-SS) as its first Marine Protected Area, located in subarea 48.2. Latest (2016) designated MPA is the Ross Sea region Marine Protected Area, the world's largest marine protected area, located in CCAMLR subarea 88.1 (the fishery under assessment does not fish there). The 'CCAMLR VME Registry' records the locations and taxa of Vulnerable Marine Ecosystems (VMEs) and associated areas in the Convention Area which have been notified under CM 22-06 and CM 22-07.

The Antarctic Treaty System has several means of spatially managing and protecting the marine environment. Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Area (ASMAs) under Annex V of the Protocol on Environmental Protection may be used as tools for spatial management and essential recognition of outstanding values in the Southern Ocean. The implementation of marine spatial protection and management measures through the Antarctic Treaty Consultative Meeting (ATCM) is currently primarily small-scale, coastal based. Marine spatial protection and management measures will contribute towards effective, representative and coherent spatial protection of marine biodiversity within the Antarctic Treaty Area.

The South Georgia and South Sandwich Islands Marine Protected Area (SGSSI MPA), established in 2012, and reviewed in 2018, establishes a no-take zone around the islands and a seasonal closure of the fishery for Antarctic krill from 1 November to 31 March, to avoid competition with krill-eating predators (particularly penguins and fur seals) during their breeding seasons, a minimum 700 m depth for trawling and (although it is not relevant for the UoC fishery) a ban on all bottom fishing deeper than 2250 m, to protect deep-water habitats, and additional closed areas to protect sensitive benthic fauna and provide refugia for Patagonian toothfish.

Fishing is also restricted around the CCAMLR Ecosystem Monitoring Programme (CEMP) management sites.

CCAMLR Conservation measures apply to all fisheries in the Southern Ocean, regardless of being MSC certified. At-sea inspections are carried out under the auspices of CCAMLR and also by South Georgia Fisheries Patrol Vessels.

Given the different management measures afforded to the protection of marine ecosystems, including benthic habitats, the team considers that there is a strategy in place for managing the impact of all fisheries on habitats. SG60, SG80 and SG100 are met.

b	Management strategy evaluation			
	Guide post	The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved.
	Met?	Yes	Yes	Yes

Rationale

The establishment and location of marine protected areas have taken into account scientific opinion on the crucial areas associated with breeding seabird colonies. The area covered by MPAs has increased in the past years with the creation of the Ross Sea Region MPA. The CEMP (CCAMLR Ecosystem Monitoring Programme), the international scientific observer coverage and the rigorous enforcement in the area by patrol vessels lends confidence to the efficiency of the strategy in mitigating against habitat harm. This is a mid-water pelagic fishery, the habitat involved is the habitat for krill – pelagic. Based on Observer reports, no interaction of the gear with the seabed has been recorded – this has to be recorded as per reporting template. SG60, SG80 and SG100 are met.

c	Management strategy implementation			
	Guide post		There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully.	There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?		Yes	Yes

Rationale

VMS (vessel monitoring system) information and detailed observer scientific reports show that this is a localized fishery, seeking out large aggregations of krill. Operating pelagic gear precludes any interactions with the seafloor and sampling of all retained species is carried out in a rigorous manner according to formal CCAMLR observer protocols, which would allow the observation of benthic organisms in the catch, if any.

CCAMLR, as part of its remit, is directly involved in the creation and management of MPAs, in protecting these habitats and ecosystems. Regulations covering these areas and patrol inspections contribute to the successful enforcement of the strategy, along with VMS tracks and observer coverage. Annual CCAMLR review of the performance of the krill fishery (eg Krill fishery report 2018) in the Southern Ocean (and other CCAMLR fisheries) identifying constrains of the fishery and possible infractions serve as a clear quantitative evidence that the strategy is implemented successfully and achieving its objective. SG80 and SG100 are met.

d	Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs			
	Guide post	There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs.	There **is some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	Yes	Yes	Yes

Rationale

All Southern Ocean fisheries have to comply with CCAMLR requirements afforded to the protection of VMEs, whether MSC or non-MSC. There is clear quantitative evidence of the UoA compliance with management requirements and protection measures for VMEs in the form of VMS records, compliance inspection reports, and detailed observer reports. SG60, SG80 and SG100 are met.

References

(CCAMLR 2018b; CCAMLR 2010; CCAMLR 2019d; CCAMLR 2016b; CCAMLR 2012; CCAMLR 2009; CCAMLR 2011a; CCAMLR 2016f; CCAMLR 2008c; CCAMLR 2013) (CCAMLR 2010; CCAMLR 2019d; CCAMLR 2016b; CCAMLR 2004; CCAMLR 2012; CCAMLR 2009; CCAMLR 2011a; CCAMLR 2016f; CCAMLR 2013)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 18. PI 2.4.3 – Habitats information

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	The types and distribution of the main habitats are **broadly understood**. OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the types and distribution of the main habitats.	The nature, distribution and **vulnerability** of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA. OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.	The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.
	Met?	Yes	Yes	No

Rationale

Although seabed mapping for the area in which the fishery operates is incomplete at a scale that is relevant to managing impacts of some fisheries, such as demersal trawls, this is of little consequence to this assessment, as the fishery under assessment occurs in mid-water and does not directly come in contact with and thus impact on the benthic habitat.

There have been a number of studies and surveys which enable a broad understanding of the types and distribution of the main habitats in the marine Antarctic (Douglass et 2014; Reid 2011; and updates on ongoing research and surveys are published at the CAMLR Science Committee meetings (https://www.ccamlr.org/en/meetings/27, accessed 18th Feb 2020). SG60 is met.

Mapping of the seabed and vulnerable seabed habitats is an ongoing process and CCAMLR requires Observers to record benthic organisms (in the relevant fisheries; CM 22-07 2013 Collection and Reporting of VME-Indicator Data and to contribute to the VME Registry). Given the pelagic nature of the krill fishing gear operating in the UoA, the benthic main habitats are therefore not vulnerable to UoA, and the nature and distribution of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA. SG80 is met.

At this stage the distribution of all habitats is not known over their range. CCAMLR itself acknowledges that: "*Compared to many global ocean areas where bottom fishing occurs, the Southern Ocean is characterised by extremely limited data on both the prevailing bottom topography and associated benthic marine ecosystems. This is exemplified by the proportion of new species discovered by recent focused research efforts to study the marine benthic fauna of the region. Furthermore, in the Antarctic, where growth rates of benthic taxa are typically slower than in more temperate regions, the impacts of fishing gear on vulnerable taxa may be magnified because of the much longer time taken to recover*." (CCAMLR https://www.ccamlr.org/en/compliance/vulnerable-marine-ecosystems-vmes, accessed 1st Dec 2019). While the team considers that information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat, at present there is room for improvement in the knowledge of the distribution of all habitats including VMEs. SG100 is not met

b	Information adequacy for assessment of impacts			
	Guide post	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear. OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.	Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.	The physical impacts of the gear on all habitats have been quantified fully.
	Met?	Yes	Yes	Yes

Rationale

This is a pelagic fishery. The fishing gear does not impact or make contact with the seabed. There are no physical impacts. There are no known impacts of the fishing gear on the pelagic habitat; the only possible physical impact of the gear on benthic habitat would be through net entanglement if the gear was to make contact with the seafloor. The nets would snap and break easily, and since nets are expensive, any contact with the seafloor is strenuously avoided. There are no records of gear losses in the fishery by the certified fleet, it is a requirement to record gear loss in the Observer report (Observer coverage is 100%). SG60, SG80 and SG100 is met.

c	Monitoring		
	Guide post	Adequate information continues to be collected to detect any increase in risk to the main habitats.	Changes in all habitat distributions over time are measured.
	Met?	Yes	No

Rationale

This is a pelagic fishery. There are no known impacts of this pelagic fishery on the main benthic habitat, there is therefore no risk of this fishery to the main habitats.

There is ongoing research and mapping mapping of benthic habitats (CM 22-07 2013; annual CCAMLR Science Committee meetings and reports - https://www.ccamlr.org/en/meetings/27), so SG80 is met. However, the information available to date is too limited to be able to assess changes in all habitat distribution over time. SG100 is not met

References

(CCAMLR 2018b; CCAMLR 2010; CCAMLR 2019d; CCAMLR 2016b; CCAMLR 2004; CCAMLR 2012; CCAMLR 2009; CCAMLR 2011a; CCAMLR 2016f; CCAMLR 2008c) (CCAMLR 2013)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 19. PI 2.5.1 – Ecosystem outcome

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Ecosystem status			
	Guide post	The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Yes	Yes	Yes

Rationale

The krill fishery under assessment is highly selective (targeting dense aggregations of krill using mid-water pelagic trawl gear), has very little or no interaction with ETP species (as can be seen from Observer reports from 2016-2019), and has no impact upon benthic habitats. There is a low amount of bycatch of non-target species, including larval fish, but it represents a low total amount (as estimated by CCAMLR, a krill catch of 300,000 t would include a catch of about 370 t fish bycatch (CCAMLR 2017d)).

Thus the only main way in which the fishery may have an impact on the ecosystem is through the removal of the krill biomass itself. Krill is a key species and has a central role in the Antarctic food webs. In the Southern Ocean, the Antarctic krill, *Euphausia superba*, makes up an estimated biomass of around 379 000 000 tonnes (Atkinson et al 2009). Of this, over half is eaten by whales, seals, penguins, squid and fish each year, and is replaced through reproduction and subsequent growth of the krill population. Sustainability of the krill fishery is dependent on the size of the catch relative to the population. CCAMLR's approach to managing the krill fishery is to minimise the impact on the ecosystem rather than trying to maximise the size of the fishery. The total allowable catch for the southwest Atlantic is currently about 5.6 million tonnes annually (https://www.ccamlr.org/en/fisheries/krill-fisheries-and-sustainability). CCAMLR regulates the catch within a 620 000 tonne 'trigger' level which is distributed across four regions in the southwest Atlantic. This 'trigger' level represents approximately 1% of the estimated 60 million tonnes of the unexploited biomass, or virgin size, of the krill population in this region. This trigger limit was further split into sub-limits for each of the Subareas 48.1 to 48.4 (the calculations behind the trigger level are described in the 2018 Krill fishery report https://www.ccamlr.org/en/system/files/00%20KRI48%202018.pdf). In recent years some sub-limits have been reached, especially in Subarea 48.1, and in each case the fishery was closed within the pertinent Subareas. The interim total trigger catch of 620,000 t has not been officially reached. The actual annual catch is around 0.3% of the unexploited biomass of krill. The geographic focus of the krill fishery since 2010 has been area 48 (CCAMLR 2018i).

CCAMLR has agreed that any expansion in the krill fishery should not happen unless the scientific data indicate that it will continue to be sustainable.

At current catch levels the UoA is highly unlikely to disrupt the key elements underlying the ecosystem structure and function to a point where there would be serious or irreversible harm. SG60 and SG80 is met.

The evidence available are extensive Observer reports for this fishery under assessment, which together with the Observer reports from the other krill fisheries in the area are analysed annually and published in the CCAMLR krill report (2018). The catch information and ecological surveys feed into the population models of krill, and the TAC is precautionary and reviewed and updated annually. Cautious extrapolation from these local monitoring programs provides conservative estimates of the regional biomass in recent years. This suggests that fishing at the trigger level would be equivalent to a long-term exploitation rate (annual catch divided by biomass) of <7%, which is below the 9.3% level considered appropriate to maintain the krill stock and support krill predators (Hill et al. 2016). SG100 is met.

References

(Trathan & Hill 2016; Atkinson et al. 2009; CCAMLR 2018b; CCAMLR 2011b; Hewitt et al. 2004; Kinzey et al. 2013; Nicol et al. 2011; Peatman et al. 2011; CCAMLR 2016e; CCAMLR 2010)
Observer reports

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 20. PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary which take into account the **potential impacts** of the UoA on key elements of the ecosystem.	There is a **partial strategy** in place, if necessary, which takes into account **available information and is expected to restrain impacts** of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place.
	Met?	Yes	Yes	Yes

Rationale

Fisheries operating within the Convention Area are subject to a raft of regulations and conservation measures concerning the management of the krill fishery as part of the ecosystem. The overall remit of krill management within CCAMLR starts from a position of recognising the importance of krill within the ecosystem, and therefore krill harvesting is being managed in a very precautionary manner (CCAMLR website accessed 2019 - https://www.ccamlr.org/en/fisheries/krill-fisheries-and-sustainability). Apart from krill, there are currently no other targeted fisheries in areas 48.1 48.2 (CCAMLR CM 32-02 2017). No finfish are targeted in this area.

The conservation measures and regulations designed to sustainably manage fishing as well as krill fishing include the following:

several regulations directed to the management of the ecosystem:

- A set of Conservation Measures that allow control of the fleet accessing the fishery, including licensing and inspection obligations (CM 10-02, CM 10-03), VMS (CM 10-04), technical characteristics of the fishing gear (CM 10-01, 22-01, 22-02) and, in the case of the krill fishery, a notification of intent to participate (CM21-03),

- Enforcement of collection and reporting of catches (CM23-01, CM 23-02, CM 23-03, CM 23-06), including haul by haul data to complete CCAMLR fine scale catch and effort data form (Form C1).

- Scheme of International Scientific Observation (SISO) targeting, in the case of the krill fishery a 100% on-board observer's coverage for the 2019/2020 fishing season (CM 51-06). The UoA has had 100% for several years so far. Observer duties are: (i) to identify and sample bycatches (i) to record incidental mortality of birds and mammals and warp strikes; (ii) to inspect whether environmental requirements included in CM 26-01 (see below) are being accomplished and report non-compliances.

- CM 51-01 (2010) included the mandatory use of marine mammal exclusion devices on trawls in the krill fishery, and it also establishes a trigger limit of 620,000 tonnes for catches in Subareas 48.1, 48.2, 48.3 and 48.4.

- CM 51-07 (2016) establishes an interim distribution of the trigger level determined in CM 51-01 between the different subareas. The purpose of the trigger levels being set at such precautionary levels is, *inter alia*, for sufficient krill resource to be preserved for predators within the ecosystem to be able to exist, as well as to underpin any recovery from depressed levels. In 2018 this trigger level was reached on the 25th June in subarea 48.1, resulting in the closure of subarea 48.1

- CM 25-03 establishes a set of measures to all trawl fisheries in order to minimize incidental mortality of seabirds and marine mammals.

- CM 22-05, 22-06 and 22-07 aims to protect benthic habitats, in particular VMEs.

- CM 26-01 establishes a set of measures to protect the marine environment.

Other components of the strategy to manage ecosystem impacts include:

- CCAMLR Ecosystem Monitoring Program (CEMP), is focused on the monitoring of predators to detect changes in their populations and distinguish between changes attributable to fisheries and environmental variation. The Working Group on Environmental Monitoring and Management (WG-EMM) updates and reviews information on the krill fishery (including bycatches and incidental mortality), MPAs (monitoring on the existing ones and progress on the proposed ones), and CEMP data. This information is compiled in several documents (e.g. the annual krill fishery report, the WG-EMM annual meeting report). CCAMLR envisions to achieve a feedback management for the krill fishery which integrates information from CEMP, but to date such data is not yet being used to develop Conservation Measures, so there is no management feedback policy in place to regulate the ecosystem impacts of fishing activities.

- Creation of CCAMLR MPAs, specifically the South Orkney Islands Southern Shelf MPA (created in 2009) and the Ross Sea MPA (created in 2017), in addition to benthic area closures. Out of CCAMLR management, the South Georgia and South Sandwich Islands Government established a Marine Protected Area in 2012. Also, the Association of Responsible Krill Harvesting Companies (ARK), to which the UoA belongs, have agreed to voluntary no-go areas around seabird and marine mammal breeding sites in order to prevent krill depletion within foraging ranges.

In summary, it can be stated that there is a strategy in place which contains a raft of measures to address all main impacts of the UoA on the ecosystem, and these measures are in place, as it is one of the conditions for a fishery to operate in the Convention area – to abide by these measures. SG100 is met

b	Management strategy evaluation			
	Guide post	The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar UoAs/ ecosystems).	There is **some objective basis for confidence** that the measures/ partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved.	**Testing** supports **high confidence** that the partial strategy/ strategy will work, based on information directly about the UoA and/or ecosystem involved.
	Met?	Yes	Yes	Yes

Rationale

The strategy is designed to keep impact of krill fish on the Antarctic ecosystem to a minimum, and the driver of this is to keep within a certain krill catch level – which is achieved (CCAMLR krill report 2018).

The CCAMLR Conservation Measures as implemented cover the different issues related to the protection of the ecosystem and its elements, including bycatch, ETPs, habitat protections, foodweb considerations of krill, compliance and regular collection and analysis of detailed data to inform fisheries management decisions, including target catch and bycatch species. The establishment of subarea trigger levels in area 48 ensures that the fishery does not cause irreversible harm to the local predator populations. All CCAMLR fisheries have to report catch and effort data of krill on a haul-by-haul basis, which facilitates monitoring of cumulative catch in each subarea. Given the level of monitoring in the fishery the measures are considered likely to work. SG60 is met.

Moreover, CCAMLR Scientific Committee and WGs meet annually to review the performance of the different fisheries and suggest modifications to fishing practices when unacceptable impacts are detected. This periodic review gives an objective basis for confidence that the strategy will work. SG80 is met.

100% observer coverage and their reports show that the UoA has very limited impact on primary, secondary, and ETP species, nor on benthic habitats. Recently published research showed that the estimated biomass of krill is higher than expected (Macaulay et al. 2019). This serves as testing (as a form of feedback mechanism showing that the conservation measures in place are working), which supports with a high degree of confidence that the strategy is working ensuring that the UoA does not pose a risk of serious harm to ecosystem structure and function. SG100 is met.

c	Management strategy implementation			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Yes	No

Rationale

CCAMLR krill fishery reports show that krill catches have remained below the trigger level. Bycatch levels are low, and Observer reports show that the relevant Conservation measures are implemented on board the vessels. Subarea catch limits have been reached recently, whereby Subarea 48.1 was closed on the 25th June 2018, in accordance with Conservation Measure 51-07, when the catch limit was reached. The same applies to previous fishing years. This indicates, for example, that CM-07 is being implemented rigorously. International 100% observer coverage show limited impacts of other ecosystem elements such as primary, secondary and ETP species, as well as habitats. Such interactions have to be recorded as per reporting template and Conservation measures. The team considers that there is evidence that the strategy is being implemented successfully. SG80 is met.

CCAMLR has acknowledged the need to adopt feedback management procedures for the krill fishery, by which management measures are continuously adjusted to relevant information -as it becomes available- on the interactions between krill, fisheries, krill predators, and the environment. It is also acknowledged that management at a small scale is needed to account for predator-prey relationships. The current management system based on annual krill catch limits for the krill fishery in the South Atlantic is therefore considered by CCAMLR as an interim solution until mechanisms are in place that allow for these feedback management procedures to be developed and

implemented. Furthermore, these annual catch limits are complemented by the establishment of a trigger level of 620,000 tonnes in the South Atlantic aimed at ensuring that fishing effort does not greatly exceed historical catches until an adequate, small-scale management regime is in place. Establishing such a small-scale, feedback management regime for the South Atlantic is a complex task. Many scientific uncertainties remain, and monitoring of land-breeding predators is still insufficient to establish a full feedback management regime across the whole area where the fishery operates (ASOC 2007).

It appears that this Feedback Management Strategy is still a goal to achieve. Further steps towards developing the implementation of an ecosystem-based management strategy for the krill fishery are still under discussion, and neither the ambitious feedback management including SSMUs (Watters et al. 2013; Hewitt et al. 2004; Hill et al. 2019) nor the development of the risk-based system based on overlapping indices (Hinke et al. 2017; Warwick-Evans et al. 2019) have been implemented yet. This work is ongoing, as can be seen from the submissions at the recent (2019) WG-EMM meeting. SG100 is not met.

References

(Macaulay et al. 2019; Warwick-Evans et al. 2019; Hill et al. 2019; ASOC 2007)

(CCAMLR 2016e; CCAMLR 2010; CCAMLR 2018d; CCAMLR 2019h; CCAMLR 2019f; CCAMLR 2019d; CCAMLR 2008c; CCAMLR 2013; CCAMLR 2019b; CCAMLR 2018c; CCAMLR 2014; CCAMLR 1986; CCAMLR 1984; CCAMLR 2019c; CCAMLR 2019e; CCAMLR 2016c; CCAMLR 2016d)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 21. PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	Information is adequate to **identify** the key elements of the ecosystem.	Information is adequate to **broadly understand** the key elements of the ecosystem.	
	Met?	Yes	Yes	

Rationale

There is adequate information to broadly understand the key elements of the ecosystem. CCAMLR's WG-EMM publishes research on the various components of Antarctic ecology. Monitoring at CEMP (CCAMLR Ecosystem Monitoring Program)-sites provides valuable information on the distribution, forage behaviour, population trends and response to environmental parameters of krill dependant predators, such as marine mammals and seabirds. CEMP also monitors environmental parameters, such as hydrographic and sea-ice cover information. The CCAMLR Working Group on Ecosystem Monitoring and Management (WG-EMM), assesses data generated through the monitoring of CEMP areas and information gathered in scientific observer reports, and monitors the effect the krill fishery may be having on the ecosystem. Several ecosystem models have been developed covering krill and associated food webs in the Southern Ocean.

A number of institutions such as the International Whaling Commission, the Southern Ocean Observing System (SOOS), the British Antarctic Survey, the Norwegian Institute of Marine Research, the US Antarctic Marine Living Resources Program, the South Georgia and South Sandwich Islands government, Australia's Integrated Marine Observing System (IMOS) and other institutions and NGOs further add to the knowledge-base of the region's ecosystem. SG80 is met.

b	Investigation of UoA impacts			
	Guide post	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**.	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**.
	Met?	Yes	Yes	No

Rationale

Detailed information on the krill fishery collected by on board, international observers (100% cover) is used in the assessment of the impact of the UoA on krill stock and krill-dependent species. This is an ongoing, annual update.

CEMP's major function is to monitor the key life-history parameters of selected dependent species to detect changes in the abundance of harvested species which would be caused by changes in krill availability. CCAMLR Ecosystem Monitoring Program was implemented in 1990. Consequently, the CEMP database forms an extensive archive with which to study ecosystem interactions and trends (Everson 2000). SG60 and SG80 is met

The main interactions between the krill fishery and a number of ecosystem elements (such as seabirds, pinnipeds, and cetaceans) has been and continues to be relatively well studied. There are several other groups of krill predators, such as finfish, cephalopods and carnivorous zooplankton, whose trophic dependence on krill remains poorly studied (Trathan et al. 2015). SG 100 is not met.

c	Understanding of component functions			
	Guide post		The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**.	The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood.**
	Met?		Yes	Yes

Rationale

CCAMLR scientific observer reports identify and record interactions with P1, primary, secondary, ETP species and habitats, allowing for the identification of the UoA impacts on these components of the ecosystem. The main functions of these components in the ecosystem are identified and understood.

Special attention is paid in management to studying bycatch species and especially krill predators. The main functions of these components in the ecosystem have been studied through a range of models, as reviewed by Atkinson et al. (2012). The suite of models include those exploring specific aspects of krill biology (Hofmann & Hùsrevõglu 2003; Murphy et al. 2004), multispecies population models (May 1979; Murphy et al. 1998), single species population projection models to quantify regional catch limits (Constable et al. 2000), spatial single species models (Marin & Delgado 2001), mass-balance regional food web models such as EwE (Cornejo-Donoso & Antezana 2008), a spatial multispecies operating model (SMOM) of krill–predator fishery dynamics (Plaganyi & Butterworth 2012), and models of krill transport at the maximum advection rate indicated by the Ocean Circulation and Climate Advanced Modelling Project, OCCAM (Rintoul et al. 2001). SG80 and SG100 are met.

d	Information relevance			
	Guide		Adequate information is available on the impacts of the UoA on these components to	Adequate information is available on the impacts of the UoA on the components **and elements** to

	post	allow some of the main consequences for the ecosystem to be inferred.	allow the main consequences for the ecosystem to be inferred.
	Met?	Yes	No

Rationale

The data recorded by the SISO observers provides detailed information on the impact of the krill fishery on the affected different components (fish bycatch, seabirds, marine mammals) to species level. This information is recorded following standardized protocols and compiled and analysed by the WG-EMM. Information derived from SISO reports, CEMP research output, WG-EMM reports and ecosystem studies is available on the CCAMLR website (http://www.ccamlr.org/en/) and through the websites of many other organizations and institutes conducting research in the Antarctic. These provide sufficient information to parameterize the ecosystem models described above. This information is considered adequate to assess the impacts that the UoA has on the components of the ecosystem to allow some of the main consequences for the ecosystem to be inferred. SG80 is met.

The number of different species encountered in the bycatch, Secondary species, is diverse and covers a range of finfish species, generally juveniles, as well as cephalopods and molluscs (larval). Although the numbers/ amounts caught are small, little is known about the populations of many of those species. Therefore, it cannot be said that information available on the impacts of the UoA on elements is adequate. SG100 is not met.

e	Monitoring		
	Guide post	Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?	Yes	No

Rationale

Data is collected on a continuous basis by different groups and institutions, and can be obtained *inter alia* from logbooks, VMS track records, 100% observer coverage in the UoA and CEMP programme. Besides, there is an update (2019) on the krill biomass estimation thanks to ARKs effort. The data collected is adequate to detect increases in risk levels to both target stock and the associated ecosystem.

A feasibility program was initiated based on CCAMLR instructions, highlighting the potential to support the development of FBM by collecting information from dedicated acoustic transects. The potential of this technology has also been highlighted by WG-EMM and SG-ASAM during recent years. The fleets capacity and competence in demonstrating satisfactory performance quality has been acknowledged by the SG-ASAM 2019 (SC-CCAMLR 2019). Such research demonstrates that CCAMLR continues to strive to improve on the data base informing krill management decisions. SG80 is met

There is concern regarding the vulnerability of the Southern Ocean to the changing global climate. Resulting changes in water temperature, ocean acidity, currents and ice cover will affect resident seabird and marine mammal populations through changes in prey availability patterns. Research continues to build robust data time series on the krill and krill dependant predators' response to the changing climate, as well as 'normal' ecosystem fluctuations. The changing climate has added layers of complexity to managing ecosystem impacts, therefore it cannot be said that I currently information is adequate to support the development of strategies to manage ecosystem impacts. SG100 is not met.

References

Observer reports;

(Atkinson et al. 2012; Plaganyi & Butterworth 2012; Cornejo-Donoso & Antezana 2008; Hofmann & Hùsrevõglu 2003; May 1979; Murphy et al. 1998; Murphy et al. 2004; Rintoul et al. 2001)

CCAMLR website: http://www.ccamlr.org/en/

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

6.5 Principle 3

The two vessels in the UoA fish exclusively in international waters inside CCAMLR subareas 48.1 and 48.2 (see section 6.2). There are no coastal states involved. Three jurisdictional levels are key in the management of the fishery: i) CCAMLR is the RFMO in charge of resource management, ii) the Republic of Korea as Flag State is responsible for the vessels' compliance with all international and national obligations , and iii) any port states where the vessel may tranship or land its catch bound by the Port State Measures Agreement (PSMA) implementation.

6.5.1 Legal and customary framework

The fishery resource is managed through the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the regional fisheries management organisation (RFMO) set up under the Antarctic Treaty[2]. The CCAMLR Convention is legally binding for its 26 member countries. It came into force on 7 April 1982, with a further 10 countries having acceded since[3]. Countries parties to the Antarctic Treaty and to the CCAMLR include all those with vessels presently fishing for krill: Chile, China, the Republic of Korea (or Korea), Norway and Ukraine[4].

6.5.1.1 CCAMLR (RFMO)

The Commission is the decision-making body. Based on the best available scientific information, it agrees conservation measures (CM) that determine the use of marine living resources to ensure the conservation of the Antarctic marine ecosystems. The Commission doesn't prevent fishing, provided it is carried out in a sustainable way. CCAMLR's management objectives are set out in Article II of the Convention and bring together the precautionary and ecosystem approaches[5]. The central objective of the Convention is conservation whilst allowing rational use, and it requires that the effects of fishing on the ecosystem are taken into account and minimised.

The CCAMLR subsidiary bodies are as follows:

- Scientific Committee (SC): meets annually prior to the Commission meeting. In order to address the wide range of science areas that might impact on the decisions of the Commission, the Scientific Committee has established a number of working groups that meet during the year and assist in formulating scientific advice on key areas. Presently, the SC has four working groups and one specialist subgroup meet once during the year or at the SC's request, to assist formulating scientific advice based on the best available scientific information:
    - Working Group on Ecosystem Monitoring and Management (WG-EMM)
    - Working Group on Fish Stock Assessment (WG-FSA)
    - Working Group on Statistics, Assessments and Modelling (WG-SAM)
    - Working Group on Incidental Mortality Associated with Fishing (WG-IMAF)
    - Subgroup on Acoustics, Survey and Analysis Methods (SG-ASAM)
- Standing Committee on Implementation and Compliance (SCIC)
- Standing Committee on Administration and Finance (SCAF)

[2] https://www.ccamlr.org/en/organisation/about-ccamlr
[3] https://www.ccamlr.org/en/organisation/status-list-contracting-parties
[4] https://www.ccamlr.org/en/compliance/authorised-vessels-0
[5] Convention : https://www.ccamlr.org/en/system/files/e-pt1_3.pdf

- a Secretariat based in Hobart, Tasmania, that supports the work of the Commission.

Annually, CCAMLR publishes a Commission Report, a Scientific Committee Report, a Statistical Bulletin and Fishery Reports[6]. It also published an international peer-reviewed scientific journal – CCAMLR Science – between 1994 and 2016.

CCAMLR adopts and updates Conservation measures (CM) during its annual Commission meetings. Members are notified of new or amended conservation measures in early November, following the Commission's annual meeting, and these are usually implemented on 1 December to align with the start of the fishing season. Conservation measures become binding, according to Article IX.6 of the Convention, around early May of the following year (180 days after the first notification). A compendium of CMs in force by CCAMLR fishing season is available from its website[7].

Several categories of CCAMLR CMs apply to the fishery. Generic CMs relate to vessel licensing conditions and reporting obligations, as well as general provisions for fisheries management and ecosystem protection. There are also three CM specific to the krill fishery in Area 48 (Table 15), in particular one to set an overall combined catch limit for Area 48 and proportions for each subarea (CM 51-01), and another that sets out trigger levels (CM 51-07).

CMs may be updated annually. CCAMLR relies on a fully developed fisheries Monitoring, Control and Surveillance (MCS see section 6.5.7) system to support the implementation of its Conservation Measures and to reduce risks that harvesting activities may pose to the sustainability of target species, of species taken incidentally as bycatch and of the marine ecosystem. Specifically, for the krill fisheries, vessels report when the catch in subareas 48.2, 48.3, 48.4 approaches 80 % of the trigger levels set in CMs 51-01 and 51-07, the Secretariat informs Fishery Update Contacts, and vessels active in each fishery must report catch and effort every 5 days for the rest of the season (instead of every month). For the 2018/19 fishing season the Secretariat requested that the 5-day catch-and-effort reporting system be implemented by Members voluntarily from the start of the season in Subarea 48.1. This has been carried over for the 2019/20 season.

As per the Antarctic Treaty, there are no coastal states in the CCAMLR Area, although some unresolved territorial sovereignty claims on the Antarctic continent remain, from seven states (Australia, Argentina, Chile, France, New Zealand, Norway and the United Kingdom), and two "semi-claimants" (Russia and the United States) who reserve a basis of claim without presently asserting claims. Notwithstanding the apparent non-recognition of their claims by the other 186 UN Member States, all seven claimants see themselves as coastal states and there may be challenges ahead (Ferrada 2018; Smith et al. 2015).

[6] See https://www.ccamlr.org/en/meetings-and-publications/publications
[7] https://www.ccamlr.org/en/publications/past-conservation-measures

Table 15: CCAMLR Conservation Measures specific to the krill (*E. superba*) fishery in Area 48 for 2019/20

Title	Conservation Measures	Areas
Vessel and fishing gear markings Licensing and inspection obligations Port inspections of vessels carrying Antarctic marine living resources Automated satellite-linked VMS IUU vessels lists Notification of transhipments within the Convention area CCAMLR Compliance evaluation procedure	10-01 10-02 10-03 10-04 10-06 and 10-07 10-09 10-10	All
Notification of intent to participate in a krill fishery (by 1st June), to be considered annually by the Commission, with details of proposed subareas, expected catch, fishing technique, gear configuration etc.	21-03	All
Five-day catch and effort reporting system Five-day (from 2019/20)data reporting system for krill fisheries with provision for small-scale management units (SSMU)	23-01 23-06	All
Catches taken for research purposes are part of catch limits	24-01	All
Bird and marine mammals incidental mortality in the course of trawl fishing minimisation measures	25-03 (and 51-01)	All
Environmental protection during fishing operations	26-01	All
General measure for the closure of all fisheries	31-02	All
The fishing season for all Convention Area species is 1 December to 30 November	32-01	All
Limitation of the by-catch of *Gobionotothen gibberifrons, Chaenocephalus aceratus, Pseudochaenichthys georgianus, Notothenia rossii and Lepidonotothen squamifrons*	33-01	Subarea 48.3 only
Precautionary catch limitations on *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4	51-01	Subarea 48.1, Subarea 48.2, Subarea 48.3, Subarea 48.4
Scientific Observation in krill fisheries	51-06	All
Interim distribution of the trigger level in the fishery for *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4 (to end 2020/21)	51-07	Subarea 48.1, Subarea 48.2, Subarea 48.3, Subarea 48.4
CCAMLR Ecosystem Monitoring Program (CEMP) Protection of the values of Antarctic Specially Managed and Protected Areas (Antarctic Specially Protected Area (ASPA) or an Antarctic Specially Managed Area (ASMA))	91-01 91-02	General

Presently, all CCAMLR waters are therefore “High Seas” and there are no automatic fishing rights. However, the opportunity to participate in the krill fishery is only open to CCAMLR member vessels that are duly licensed (CM 10-02), not listed in the IUU Fishing vessel lists (CM 10-06 and CM 10-07), and after prior notification (CM 21-03, Table 15). Fishing is not permitted unless members reach an agreement to fish. Importantly, access is not automatic. CCAMLR fishing members must notify their intent to fish every year at the annual CCAMLR meeting, and the Commission must then approve their notification via consensus. In addition, all directed fishing is governed by conservation measures

adopted by the Commission, so there are no unregulated fisheries. Licenses to fish in the CCAMLR Area are delivered by the Contracting Party (CP), who must be "satisfied of the vessel's ability to exercise its responsibilities under the Convention and its conservation measures" (CM 10-02).

The text of the Convention includes a special article (applicable to all fisheries) to deal with disputes (art. XXV), which privileges mechanisms such as negotiation, mediation and conciliation – among other- to reach agreement between the parties in case of legal conflicts. The annual meetings of the Commission, preceded by the SC and SCIC meetings, which in turn take place after the working groups meeting provide a mechanism that prevents conflicts or legal disputes, since all parties have had in advance the chances to reach technical and political agreements.

A number of important new issues have emerged in recent years for the consideration of the Scientific Committee, including MPA designation in the Convention Area and feedback management for the krill fishery. In order to cope with the increasing workload, an informal executive group comprised of Scientific Committee Chairs and working group conveners and facilitated by the Science Manager at the Secretariat was established to work during the Scientific Committee annual meeting, as well as inter-sessionally, to coordinate and streamline the work of working groups and the Scientific Committee.

6.5.1.2 Republic of Korea (Flag State)

The Republic of Korea has an extensive Distant Water fleet of fishing vessels, in numerous fisheries around the world[8]. The vessels that engage in fishing are managed by the Ministry of Oceans and Fisheries (MOF) as per the Distant Water Fisheries Development Act (DWFDA). Article 1 of the DWDFA states that the purpose of the Act is to "*advance the sustainable development of the distant water fisheries industry and contribute to the growth of the national economy through the rational preservation, management, exploitation and utilization of maritime living resources and the promotion of international cooperation*." (Korea 2015). DWFDA Article 13 (Rules for Distant Water Fishery Operators to Observe) sets out that distant-water fishing vessels "*shall conscientiously conduct fishing operations within the permitted scope of operations and shall comply with resolutions made by international fisheries organizations for the conservation and management of resources and international standards regarding fisheries in high seas*" (Korea 2015).

Specifically, Article 13 sets out that no distant water fisheries business shall engage in any of the following activities:

"1. Conducting fishing operations without any valid licence, authorization or permit, or registration issued by the state of flag or the relevant coastal state;

2. Failing to maintain such the amount of catch and detailed records thereof (including the data transmitted from fishing vessels monitoring system) as demanded by an international fisheries organization, or of falsely reporting such allowable amount of catch;

3. Conducting fisheries operations in any marine preserve established by an international fisheries organization or any coastal state, conducting fisheries operations during a prohibitive period of fisheries, or conducting fisheries operations without being allocated a catch quota or in excess of the catch quota;

[8] See http://www.kosfa.org/english/e_fish/e_fish1.asp

4. Directly conducting fisheries operations for any resources, the fisheries operations of which are tentatively or permanently prohibited;

5. Fishing with prohibited or unauthorized fishing gear;

6. Forging or concealing a fishing vessel's unique marking/identifier and registered matters;

7. Concealing, damaging, or removing any evidence related to inspections onboard a vessel;

8. Fisheries in violation of conservation and management measures of an RFMO in the areas under the purview of such RFMO;

9. Transhipping fish or a joint fishing operation, with a vessel listed by any international fisheries organization engaged in illegal, unreported, or unregulated fishing or assisting such vessel;

10. Interrupting the duty performance of an observer, such as the movement, embarking, disembarking and inspection;

11. Interrupting the embarking, disembarking, ship inspection, and communications of an inspector of the Port State or on board or violate any measure following an inspection by the Port State;

12. Failing to install a fishing vessel monitoring system or intentionally not operating the installed fishing vessel monitoring system."

6.5.2 Port States

There are no (designated) fisheries landing ports in the CCAMLR Convention area, but provisions are made to allow transhipments in the Area, provided a notification is received and permission is granted (CM 10-09). In addition, CCAMLR monitors the vessels' entry-exit declarations, and it is the duty of the Flag State to ensure that all catch is declared as it is caught, as it is transhipped and eventually as it is landed.

Depending on the final product destination (Korea, China, Canada, USA, Thailand), the krill sale process may differ slightly. In all cases the Krill products caught in the CCAMLR Convention Area (CA) are transhipped (see section 5) at sea. The products are then landed in Busan for the domestic market or export or exported directly in the case of Japan.

6.5.2.1 Republic of Korea (Flag State)

The Republic of Korea acceded to the FAO Port State Measures in 2016 and all key provisions are included in its legislation. Any IUU fishing conducted in waters outside Korea's jurisdiction (EEZs and high seas) by Korean distant water fisheries operators who are authorized by the Korean government would be subject to prosecution and subsequent sanctions in accordance with the Distant Water Fisheries Development Act (DWFDA), which also applies to those who support IUU activities by transporting, processing, distributing and selling the illegal catches. Landing of catches from illegal vessels is not allowed and catches would be confiscated. In recent years, Korea has developed close collaborations with other Port States and international organisations combatting fisheries-related crime such as Interpol.

In October 2018, the Republic of Korea signed a partnership agreement with the European Union in line with the objectives of the EU's Ocean Governance strategy[9], in order to:

- exchange information about suspected IUU-activities;
- enhance global traceability of fishery products threatened by IUU fishing, through a risk-based, electronic catch documentation and certification system;
- join forces in supporting developing states in the fight against IUU fishing and the promotion of sustainable fishing through education and training;
- strengthen cooperation in international fora, including regional fisheries management organisations.

In order to ensure that its Distant Water fleet is compliant wherever it fishes and lands, catch certificates are checked at all ports of landing[10].

6.5.3 Consultation, roles and responsibilities

6.5.3.1 CCAMLR

CCAMLR Contracting Parties (CP) are States or regional economic integration organisations, such as the European Union, which have committed to the Convention through ratification, acceptance, approval or accession. Members include those CPs that participated in the first meeting at which the Convention was adopted in 1980, as well as States that have subsequently acceded to the Convention and been accepted as Members by the Commission. The Convention is open for accession by any State interested in research or harvesting activities to which the Convention applies. Acceding States do not take part in the decision-making process of the Commission nor contribute to the budget. Consultation processes in place at CCAMLR are well-defined, open and seen to take place at annual meetings, with a diverse and active participation from industry and environmental NGOs encouraged by CCAMLR and by the national delegations including by Korea. The information, analyses and comments from stakeholders with Observer status are presented in the Commission's annual reports (see CCAMLR, 2019).

Research and information contributed by the numerous international environmental and industry NGOs who have CCAMLR Observer Status and submit reports to the Commission[11] to inform WG and Commission deliberations. A list of observers who have contributed topics relating to the Krill fisheries at CCAMLR annual Commission meetings in 2018 and 2019 are listed in Table 16.

Table 16. International and Korean organisations represented at 2018 CCAMLR Commission meeting.

Organisation represented at 2018 CCAMLR Commission meeting or on Korea's Delegation
MOF – Ministry of Oceans and Fisheries – Distant Water Fisheries Division (Korea)
FMC – Fisheries Monitoring Centre (Korea)
NFS – National Fisheries Product Quality Services (Korea)
Research (Korea): NIFS – National Institute of Fisheries Science, KOPRI - Korea Polar Research Institute, Research Institute of Oceanography, Seoul National University, Korea Fisheries Observer Association

[9] https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/join-2016-49_en.pdf
[10] See FMC presentation https://www.wcpfc.int/system/files/Presentation_Korea%20ERandEMWG2%20Agenda%202.2.pdf
[11] See https://www.ccamlr.org/en/ccamlr-xxxvii

Environment NGOs: Citizens' Institute for Environmental Studies, WWF Korea, ACAP, ASOC, Oceanites
Industry: KOFA - Korea Overseas Fisheries Association, ARK - Association of Responsible Krill harvesting companies, Krill Fishing Companies - Jeong Il Corporation, Dongwon Industries

6.5.3.2 Republic of Korea (Flag State)

At Korean level, the relationship between government, vessel owners and crew has been strengthened by the DWFDA amendments of 2015, which provide information and training to the industry actors while relying on their collaboration to improve compliance with RFMO CMs and contribute information and research. Stakeholder engagement is detailed in the Republic of Korea DWFDA, including training and scientific collaboration with industry and public interest groups. The active industry participation through the ARK (see section 6.5.3.4 below) is praised and facilitated by CCAMLR. The roles and means of all partners in the fisheries national management system for DWF have been clarified and improved, including the fisheries research and monitoring capacity of the national fisheries (NIF) and polar research (KOPRI) institutes.

Korea established a Deliberative Committee for Development of the Distant Water Fisheries Industry (the "Deliberative Committee") under the jurisdiction of the Ministry of Oceans and Fisheries to deliberate on matters concerning the development of the distant water fisheries industry (Amended DWFDA Act No. 11690, Mar. 23, 2013 and art.4 DWFD Act 2015) including:

- The formulation of comprehensive plans to develop the distant water fisheries industry;
- The balanced development of the distant water fisheries industry;
- Decisions on permitted quotas for distant water fisheries;
- Matters necessary for the structural improvement of distant water fisheries, strengthening the competitiveness of distant water fisheries, and establishing foundations for the development of the distant water fisheries industry;
- Matters concerning administrative and financial assistance for the development of the distant water fisheries industry.

The Deliberative Committee includes 20 members nominated by the government, including scientists and members of the civil society.

6.5.3.3 Korean Fishing Industry representation

The Korea Overseas Fisheries Association (KOFA[12]) created in 2008 (DWFDA art. 28) represents the fishing companies involved in all DW fisheries and some 200 Korean flagged DWF vessels. It cooperates with MOF and is authorised to act as a go-between to inform the industry of RFMO CM updates. KOFA operates the Overseas Fisheries Information System and regularly cross-checks MOF e-reporting data submissions with submissions directly from vessel owners/ operators. KOFA also compiles production statistics.

[12] http://www.kosfa.org/english/e_info/e_info1.asp

6.5.3.4 ARK

ARK, the Association of Responsible Krill harvesting companies, was founded in 2010, to "facilitate an industry contribution to an ecologically sustainable krill harvest[13]". ARK has Observer status at CCAMLR and the Jeong Il company owner of the vessels in the UoA is one of its seven fishing company members (Norway 2, Korea 2, P.R. China 2 and Chile 1). The ARK openly commits to develop sustainably to ensure long term viability of the krill stocks and dependent predator. It provides representation and research sponsorship. In particular, ARK members have agreed to:

i) Undertake annual transects in Subareas 48.1 and 48.2 to collect raw acoustic data which may be used to provide qualitative and quantifiable information on the distribution and relative abundance of Antarctic krill.

ii) Participate in a multinational large-scale krill synoptic survey in Area 48 in 2019 being proposed by Norway. This survey is intended to update the CCAMLR-2000 survey data which is used to estimate sustainable yield.

ARK has also committed, at a roundtable meeting in Cambridge (UK) on 5 July 2018, to voluntary restricted zones covering about 74 000 km^2 around the Antarctic Peninsula (subarea 48.1). The initiative aims to limit krill harvesting around penguin colonies from 1 January 2019 to ensure that the krill fishing industry does not compete with penguin colonies during their breeding season. ARK companies pledge to keep fishing effort up to 40 kilometres away from the coast from October to March, depending on the conservation needs of colonies of Adélie, chinstrap and gentoo penguins while breeding around the Antarctic Peninsula, off South Shetland and in Gerlache strait[14]. The commitment will see the seasonal closure gradually implemented into a permanent closure from 2020, of which size and limits are to be decided after an independent review of the implementation, of scientific data collected and the potential impact on the commercial fishery.

6.5.4 Long-term objectives

6.5.4.1 CCAMLR

All CCAMLR fisheries are managed using a precautionary and ecosystem approach, as defined by the FAO in its Code of Conduct for Responsible Fisheries. Long-term objectives are defined and required in Article 2 of the Convention as a) prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment; b) maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources; and c) prevention of changes or minimization of the risk of changes in the marine ecosystem.

CCAMLR's management of the krill fishery follows the principles set out in Article II of the Convention on the Conservation of Antarctic Marine Living Resources (www.ccamlr.org/node/74528). Long-term objectives for fished stocks (including krill) and the wider ecosystem, including predators that feed on fished stock are as follows: "Fished stocks must be maintained at or above the level 'which ensures the greatest net annual increment', meaning that fishing should not reduce the ability of each stock to replace itself. The 'ecological relationships between harvested, dependent and related populations' must be maintained and 'the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades must be minimised".

[13] http://www.ark-krill.org

[14] See Map of Voluntary Restriction Zones http://files.zetta.no/www-ark-krill-org/_upl/ark_vrz_map_rev.jpg

(Hill et al. 2016) concluded that CCAMLR's management of the krill fisheries is precautionary at the regional scale, with subarea catch limits set to help prevent excessive concentration of catch at the subarea scale. The study recommended that finer-scale management might be necessary to manage the risk of adverse impacts which might occur as a result of concentrated fishing in sensitive areas or climate change, and that frequent assessment of the krill stock would enhance CCAMLR's ability to manage these risks. This appears to be addressed in recent years, through voluntary and permanent area closures, and the ARK's sponsorship of a research survey to inform a new stock assessment modelling exercise.

6.5.4.2 Republic of Korea (Flag State)

The Republic of Korea is committed to the implementation of international agreements and to the sustainable use of fishery resources (Korea 2015), its long-term management policy objectives coincide with those of the CCAMLR.

Beyond CCAMLR regulations, the Korean government establishes a Distant Water Fisheries Development Plan every five years (as per Article 4 of the Distant Water Fisheries Development Act).

The 3rd "comprehensive plan for development of distant water fisheries industry" was established in December 2018. This plan includes the following agenda;

1. Changes in the environment of marine resources in international waters;
2. Objectives and strategies of national of distant water fisheries industry and implementation plans by phase;
3. Matters concerning a planned survey of marine resources in international waters;
4. Matters concerning strengthening the competitiveness of distant water fisheries industry , and the advancement of and assistance to distant water fisheries industry;
5. Matters concerning the fostering of professional personnel related to distant water fisheries industry and the development of relevant technologies;
6. Matters concerning international cooperation with coastal states, international fisheries organizations, etc.;
7. Other matters necessary for the efficient promotion of distant water fisheries industry.

The main policy agenda of the newly adopted Plan is categorized into five areas, which are 1) enhancing fishing vessels' safety, 2) pioneering fishing grounds, 3) improving crewmen's welfare, 4) reorganizing the industrial structure, and 5) promoting international cooperation. To explain its core contents, Korean government introduces funds for replacing aging deep-sea fishing boats, which is worth up to 170 billion won. Secondly, privately led fisheries agreements will be turned public. Thirdly, the government will invest in improving working conditions on deep sea fishing vessels. Fourthly, government will support industrial diversification in order to improve its global competitiveness. Lastly, Korean government will play an active role in the international community as a global rule-maker. Under this plan, government mainly plans to revamp safety guidelines and the welfare system for deep-sea crew members, and transform Korea's fishing industry to remain globally competitive (government news Agency, see the following article http://www.korea.kr/news/policyBriefingView.do?newsId=156312163&pageIndex=1&srchType=&startDate=2008-02-29&endDate=2019-01-07&srchWord=).

6.5.5 Fishery specific objectives

CCAMLR, the fishery manager, sets short-term sustainability objectives for the krill resources and the ecosystem. The status of krill fisheries is reviewed annually by CCAMLR's Working Group on Ecosystem Monitoring and Management (WG-EMM) and by the Scientific Committee, which meet annually and bring together government and university researchers from numerous countries (CP and NCP) involved in CCAMLR fisheries and ecosystem research (CCAMLR 2019i). Since 2010 CCAMLR has set a Precautionary catch limitations on *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4 at the overall trigger level of 620 000 tonnes agreed by the Scientific Committee (CM 51-01), with an interim distribution of the trigger level in the fishery for *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4 of 25%, 45%, 45% and 15% respectively agreed from 2016 (CM 51-07).

The ecological importance of krill as a key Low trophic level (LTL) species in the Antarctic marine ecosystem is recognised, and the need to manage krill stocks in such a way as to minimise potential ecological risks to both krill (Principle 1), its predators and ecosystem (Principle 2) is reiterated in each Ecosystem and Monitoring (EMM) annual WG report.

6.5.6 Decision-making processes

6.5.6.1 CCAMLR

CCAMLR has well established decision-making processes based on the precautionary approach and the best available information, on dialogue, stakeholder involvement, detailed reporting and consensus. CCAMLR pioneered the ecosystem approach to resource management and is seen as an example of best practice in managing marine resources in international waters. CCAMLR's consensus-based decision-making process has been a central element in shaping outcomes while facing challenges that arise in the balance between 'fishing' and 'conservation' interests, for example in the current debates over climate change and marine protected areas in the Southern Ocean. CCAMLR has been given as an example of best practice in managing marine resources in international waters (Nilsson et al. 2016).

Fisheries-specific issues identified in relevant research are taken into account by the Working Groups and the Scientific Committee. Some issued identified in research, such as the need to operate subarea "trigger" levels are not yet resolved, but the ARK supported area closures and recent scientific data collection attest of close collaboration between key stakeholders.

6.5.6.2 Republic of Korea (Flag State)

Within the Ministry of Oceans and Fisheries (MOF), there are 2 main offices for fisheries with particular relevance to this assessment: Marine Policy and Fisheries Policy. Within the Marine Policy office operate the Marine Industry, Marine Environment, the Overseas Fisheries and International Bureaus. The most important "sub-office" to this assessment is the Overseas Fisheries office, which includes a Distant-Water Fisheries (Resources) Division. This is the Division that is in charge of compliance with the CCAMLR CMs. For example, while there are no licence caps for Korean vessels, government legislation under the DWFDA (2019) calls for adhering to and not exceeding any capacity limits which might be set by any RFMO. Any new licence request is through the MOF to the existing stakeholders for discussions on whether the new entrant might have a negative impact to the industry and the MOF-allocated equitable quota to existing individual vessels (the quotas are in line with RFMO quota).

The Republic of Korea includes public interest representatives on its delegation to CCAMLR meetings. It has strengthened the capacity of government agencies (including legal obligations and the court

process) and understanding of fishing companies and vessel crew through training to provide in-depth information of compliance requirements and developed collaborative research to improve management outcomes.

The Republic of Korea has demonstrated an effective and committed collaboration with CCAMLR since the review of its DWFDA in 2015 and subsequent strengthening of its MCS system (see next section).

All illegal, unreported, unregulated (IUU) fishing activities in accordance with Paragraph 3 of IPOA-IUU shall be regulated based on Distant Water Fisheries Development Act. Vessel information such as location are reported through vessel's VMS (Vessel Monitoring System), based on which monitoring of any IUU fishing activities can be conducted. The National Fishery Products Quality Management Service is in charge of issuing catch certificate, share VMS records with FMC to verify potential involvement in IUU fishing when issuing catch certificate. In addition, designation and special management of high risk vessels such as previously penalized for being involved in IUU fishing vessels charged with potential IUU fishing, etc., and constant monitoring of vessels operating in waters with high risk of IUU fishing (Korea 2016a).

6.5.7 Compliance and enforcement

6.5.7.1 CCAMLR

CCAMLR's Convention (Art. XXI) put the responsibility on each Contracting Party to take appropriate measures within its competence to ensure compliance with its provisions and with conservation measures to which the Party is bound in accordance with Article IX. It also binds each CP to transmit to the Commission information on measures taken to ensure compliance, including the imposition of sanctions for any violation.

CCAMLR has a comprehensive MCS system in place, which is implemented by its members, including by onboard observers and captains of vessels active in all CCAMLR fisheries who report any concern. CCAMLR conservation measures include several monitoring and compliance systems and tools as follows:

- Vessel and fishing gear markings (Conservation Measure 10-01)
- Vessel licensing (Conservation Measure 10-02) [15]
- Monitoring of vessel movements (Conservation Measure 10-04)
- Vessel Monitoring System (Conservation Measure 10-04)
- Catch Documentation Scheme (Conservation Measure 10-05)
- Contracting Party IUU Vessel List (Conservation Measure 10-06)
- Non-Contracting Party IUU Vessel List (Conservation Measure 10-07)
- Obligations in respect of the control of nationals from CCAMLR Member countries (Conservation Measure 10-08)
- Monitoring of vessel transhipments (Conservation Measure 10-09)
- System of Inspection.

[15] https://www.ccamlr.org/en/compliance/authorised-vessels-0

The CCAMLR System of Inspection[16] relies on each member country designating and training Fisheries Inspectors to carry out inspections, at sea or on land. Inspection reports are copied to CCAMLR Executive Secretary to be forwarded to the other members. The System of Inspection also requires that the Flag State inform the Secretariat of the laying of charges or the initiation of proceedings relating to a prosecution, and at least once a year, report to the Commission, in writing, about the results of prosecutions and sanctions imposed (art. XII), and that sanctions applied in respect to infringements of CCAMLR provisions shall be sufficiently severe as to effectively ensure compliance with CCAMLR conservation measures and to discourage infringements and shall seek to deprive offenders of any economic benefit accruing from their illegal activities (art. XIII). Finally, the Flag State must ensure that "any of its vessels which have been found to have contravened a CCAMLR conservation measure do not carry out fishing operations within the Convention Area until they have complied with the sanctions imposed" (art.XIV).

The Standing Committee on Implementation and Compliance (SCIC) meets annually to review the operation of conservation measures and compliance systems and advise the Commission on their refinement and implementation.

CCAMLR implements measures to support the conservation and management of Antarctic living marine resources by reducing the risk harvesting activities may have on the sustainability of target species, on species taken incidentally as by-catch and on the marine ecosystem. CCAMLR seeks to achieve optimal levels of compliance with conservation measures and has been pioneering in its endeavours to achieve this.

[16] CCAMLR Basic Documents Part 9. https://www.ccamlr.org/en/system/files/e-pt9_2.pdf

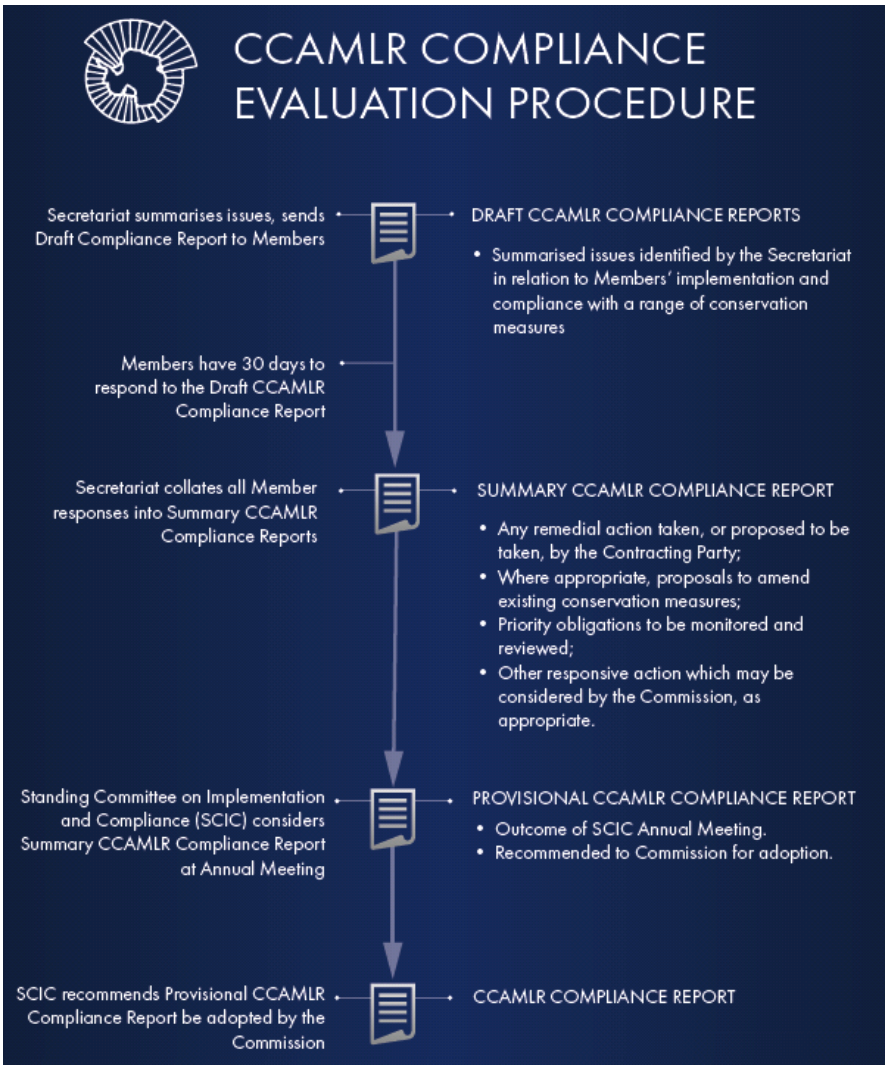

Figure 23. CCAMLR Compliance Evaluation procedure

CCAMLR has recently adopted a conservation measure to support the implementation of a Compliance Evaluation Procedure (CCEP CM 10-10) for all Members. The CCEP[17] is an annual process with a number of key steps to evaluate Contracting Party implementation of, and compliance with, conservation measures in a responsible, open, transparent and non-discriminatory manner (see Figure 23. CCAMLR Compliance Evaluation procedure Figure 23). It uses information provided to the Secretariat, as required under the CAMLR Convention, conservation measures and other rules and procedures such as the CCAMLR Scheme of International Scientific Observation (SISO) and the System of Inspection.

CCAMLR's Standing Committee on Implementation and Compliance (SCIC) is the entity responsible for providing information, advice and recommendations on fishery monitoring and compliance. The

[17] https://www.ccamlr.org/en/compliance/compliance-evaluation-procedure

system is comprehensive and relies on the support of Contracting and non-contracting parties MCS competent authorities as well as vessel captains and opinions and information provided by NGOs.

The current MCS system has been commended by the 2017 2nd Performance review as "an impressive array of monitoring, control and surveillance (MCS) measures and cooperative mechanisms to monitor compliance and detect non-compliance and IUU fishing activities", and "discussions in the Standing Committee on Implementation and Compliance (SCIC) are robust with respect to cases of non-compliance and sharing of information regarding IUU vessel activities and sightings, enforcement patrols, international cooperation, satellite imagery projects, progress in prosecutions and imposition of domestic legal remedies", with notable progress since the 1st Performance Review (CCAMLR 2017e).

Some aspects are flagged for improvement, such as CCAMLR's capacity to monitor transhipment (SCIC 2019 report ASOC point #144, (CCAMLR 2019k)).

6.5.7.2 Republic of Korea (Flag State)

The Korean Fisheries Monitoring Center (FMC) was established in 2014 under the Ministry of Oceans and Fisheries. It is responsible for: (1) conducting real-time monitoring and releasing of IUU alerts; (2) preventing illegal fish from entering the marked by controlling transhipments and landings; (3) cooperating with the international community to strengthen Monitoring, Control and Surveillance (MCS) capabilities for the eradication of IUU fishing; (4) ensuring proper functioning of VMS onboard and maintaining vessel track data for all Korean fishing vessels worldwide; (5) operating the Fisheries Monitoring System (FMS), E-reporting System (daily basis for catch/bycatch/ETP interaction) and the Korean Fisheries Information Management System on a constant basis. Vessel positional data from VMS units are polled hourly and supervised by 11 staff with six inspectors working 365 days per year; (6) verifying catch data; (7) sharing data for stock assessments.

The FMC is in charge of monitoring the activity of approximately 260 Korean distant-water fishing vessels. Their comprehensive database includes fishing authorisation, catch data, licences, IUU lists, transhipment/landing authorisation and data, and quota exhaustions. All these elements are incorporated into the FMS so that monitoring agents can conduct data analyses and risk assessments. Once the data have been submitted, (three-day margin for paper submissions) a three day period opens to validate the data input or submit changes (through an official request to NIFS to change the data) if there is more than a 10% discrepancy per species (EU and Korean tolerance limit) by an inspector sampling at offloading, or if there is no sampling, then observer data are used to clarify any discrepancy.

Korea had a systemic problem of IUU fishing activities until 2013 (see section 6.5.7), which was addressed in a comprehensive manner in 2014 through:

- The publication of Korea's IUU-National Plan Of Action (NPOA) (FAO 2014) [18];
- The amendment of its Distant Water Fisheries Development Act of 2007 in 2014 and in 2015 (DWFDA No. 13001, Jan. 6, 2015)[19]; and
- a fully functional Fisheries Monitoring Centre (FMC). The information flow through the FMC is illustrated in Figure 24.

[18] From http://www.fao.org/fishery/docs/DOCUMENT/IPOAS/national/KoreaRep/NPOA_IUU_Korea_Republic.pdf
[19] English translation from http://extwprlegs1.fao.org/docs/pdf/kor160014.pdf

In December 2017, two South Korean deep-sea fishing vessels conducted fishing operations in the Antarctic even after a closure notice. Later, the judicial authorities of South Korea inflicted little punishment on the vessels. Then, the U.S. National Oceanic and Atmospheric Administration (NOAA) made the preliminary decision to identify South Korea as "failing to apply sufficient sanctions to deter its vessels from engaging in fishing activities that violate conservation and management measures adopted by" the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR). Following the process, the U.S. government put South Korea on the list of potential IUU countries in September 2019.

The matter was discussed as part of the environmental chapter of the Korean-USA trade agreement (KORUS). In November 2019, the US Trade Representative applauded the significant efforts Korea has made to strengthen its regime to deter and penalize IUU fishing[20]: “We commend Korea for acting expeditiously to strengthen its regime to combat illegal fishing, which disadvantages law-abiding fishermen everywhere,” said U.S. Trade Representative Robert Lighthizer.

The recently adopted amendments to Korea’s Distant Water Fisheries Development Act now enable the Minister of Oceans and Fisheries to administer administrative sanctions for violations of conservation and management measures of regional fisheries management organizations, including CCAMLR. Consequently, the U.S. government removed South Korea from its list of potential IUU fishing countries in four months, by the end of 2019.

The reformed institutional structure of the Ministry of Oceans and Fisheries (MOF) Distant Fisheries Division also shows close collaboration between central and provincial government partners (MOF), the National Institute of Fisheries Science (NIFS) and MCS agencies and RFMOs as partners of the Competent Authority (NFQS, the FMC Electronic Fisheries Monitoring System (EFMS) and enforcement agencies), linking the issuing of catch certificates for compliant fishing activities to maritime control of vessel certificates and licences, and to hygiene and food safety certification issued by the National Fisheries products Quality Inspection Service (NFQS). The Korean administrative competent authorities, scientists and NGOs active contributions to CCAMLR’s fisheries management are evidenced in CCAMLR’s Commission and other reports (see for example (CCAMLR 2019i)).

[20] https://ustr.gov/about-us/policy-offices/press-office/press-releases/2019/november/ustr-welcomes-passage-amendments

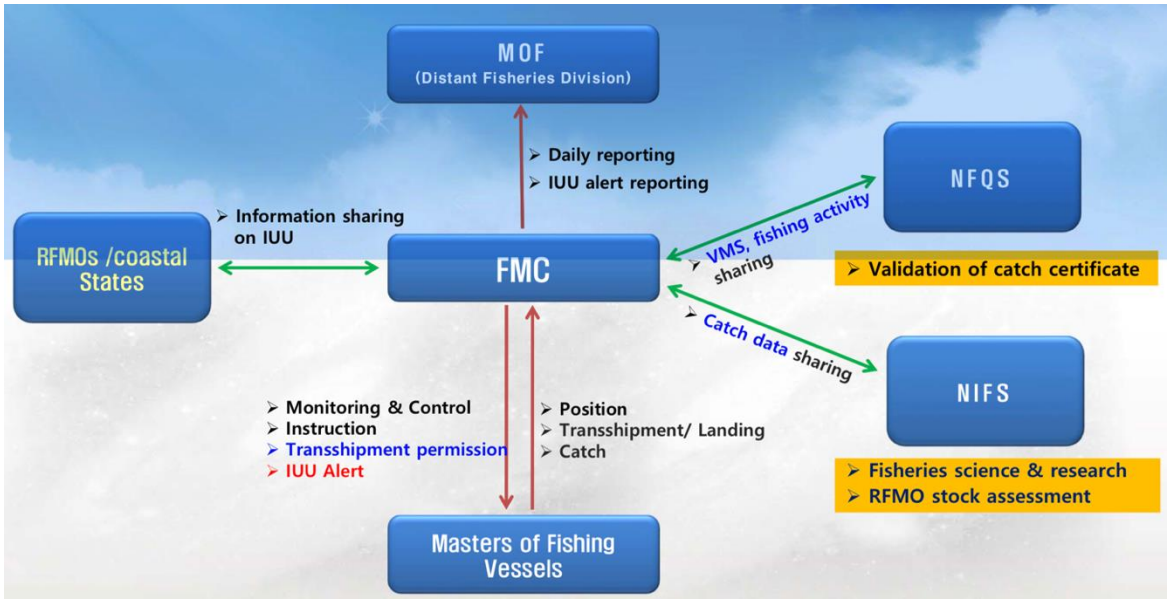

Figure 24. The Republic of Korea IUU Response System (MOF)

The amended Act ((Korea 2014b) and Enforcement decree of the DWFD Act amended Presidential Decree No. 27285, jun. 28, 2016 (Korea 2016b)[21]) give clear regulatory powers and strengthened the national MCS system and government services capacity and the cooperation with coastal states and RFMOs. In the Korean system (Flag State), the loss of fishing vessel licence and fishing rights is linked to compliance with RFMOs CMs.

Following procedures by both the USA and the EU to designate Korea as an IUU fishing nation in 2013, the Republic of Korea reformed and strengthened its MCS system in 2014 and 2015 (see section 6.5.1.2). However, US National Oceanic and Atmospheric Administration (NOAA) made a preliminary decision to designate Korea as an IUU fishing nation in September 2019, finding fault with two Korean fishing boats that had failed to comply with regulations while fishing in the CCAMLR area in 2017. The request came after the release of The U.S. National Marine Fisheries Service (NMFS) biennial report to Congress identifying IUU fishing (NOAA 2019). The NMFS found that South Korea was “failing to apply sufficient sanctions to deter its vessels from engaging in fishing activities that violate conservation and management measures”.

Korea’s Ministry of Oceans and Fisheries said the move will have no immediate impact on domestic fishery as the designation does not automatically entail trade embargoes or restrictions. But punitive actions may follow if the U.S. finds Korea’s efforts to rectify its practices inadequate during the two-year consultation period.

The infractions concerned two longlining vessels targeting toothfish that had set lines in locations within 24 hour of a fishery closure (CCAMLR CM 31-02). Details are given in the most recent SCIC report (CCAMLR 2019k). Notably, that “members also noted that, despite that its domestic law provides for severe criminal penalties, there seemed to be significant gaps with respect to administrative and other civil tools to address violations, including mechanisms to deprive violators of the economic benefit of their infringements.” Consequently “SCIC requested Korea report back on the progress and outcome of the pending prosecution and efforts to review and strengthen its internal

[21] https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=47560&type=part&key=28

legal framework in terms of administrative actions to ensure that it can impose sanctions of sufficient severity to serve as an effective deterrent to IUU fishing in all cases."

Noting that this was the third time this decade that Korea has been listed by a major economy as a nation associated with IUU fishing, the Environmental Justice Foundation (EJF) found, in December 2019[22] that "the Korean government reacted quickly by addressing flaws in the Distant Water Fisheries Development Act that had made it difficult to sanction illegal vessels. The government is now able to take action quickly and effectively when they find a vessel has fished illegally." The EJF and Korean NGOs (the Citizens' Institute for Environmental Studies and the Korean Federation for Environmental Movement) praised the amendment, which was informed by the recommendations of the NGOs. However, they also called for the government to ensure greater transparency in fisheries governance. The publication of key information on vessels, such as license lists, is considered to be a first step, along with full disclosure of any sanctions issued.

The Distant Water Fisheries Development Act has been amended to strengthen transparency and safety management of a distant water fisheries business and to combat illegal fishing (illegal, unreported, and unregulated fishing). In the amendment, the activities related to serious violations in overseas' waters were subdivided (Article 13 para 2) and the legal basis for the imposition of penalties for those who did not obtain a permit distant water fisheries, etc was newly established (Article 31-2). In addition, it stipulated that the operation of the fisheries monitoring system for enhancing the transparency of fishing vessels (Article 19-2). The amendment was promulgated on Nov. 26, 2019, and is scheduled to take effect Nov. 27, 2020 (Korea 2019).

6.5.8 Monitoring and Management performance evaluation

6.5.8.1 CCAMLR

CCAMLR activities and practices regarding the management of the krill and other main fisheries are reviewed annually by the Commission and SC, as well as by its Standing Committees and Working Groups (such as EMM). In an exemplary fashion, Conservation Measures include a provision for their effectiveness to be reviewed on an annual basis.

Compliance is evaluated by the Standing Committee on Implementation and Compliance (SCIC) annually. It provides an example of internal evaluation of the Commission and its Members' effectiveness. There is also open scientific discussion and peer review of the stock and ecosystem assessment and methods used to provide scientific management advice. Finally, the active collaboration of industry and environmental NGO stakeholders in all CCAMLR work provides for regular reviews.

To date, CCAMLR has undertaken two external performance reviews (PR1 in 2007 and PR2 in 2016), which being only two may not yet qualify as regular.

Regarding the krill fisheries, PR2 noted the following needs (CCAMLR 2017e):

- improved clarity in the management of the krill fishery in its early phases through notifications and the spatial management of the trigger level in Area 48 and CCAMLR established fisheries conservation measures;

[22] https://ejfoundation.org/news-media/korea

- implementation of an ecosystem approach to fisheries derived from Article II of the Convention, including measuring by-catch in the krill fisheries;

and the need for further strengthening of the Scientific Committee to deal with new research issues and coordination. In particular regarding Principle 2:

- relationship between krill and whales;
- Harvest strategies based on decision rules that allow for changes to the ecosystem other than due to natural variability;
- Detection movement of the system from one stable state, say one based on krill, to another stable state, say one based on fish or salps (planktonic tunicates).

Following the first PR, CCAMLR published a record of its follow up activities[23] on its website. The most recent review (PR2) does not have a similarly visible follow up. However, recommendations are examined by all concerned and progress are reported on in the Commission report (CCAMLR 2019i).

6.5.8.2 Republic of Korea (Flag State)

The Republic of Korea has a number of evaluation mechanisms in place, in particular for the implementation of its IUU-IPOA and DWFDA (details to be obtained at site visit).

A Deliberative Committee for the Development of the Distant Water Fisheries Industry (hereinafter referred to as the "Deliberative Committee") shall be established under the jurisdiction of the Ministry of Oceans and Fisheries (Korea 2015). The Deliberative Committee will deliberate on the following matters concerning the development of the distant water fisheries industry:

1. The formulation of comprehensive plans to develop the distant water fisheries industry;
2. The balanced development of the distant water fisheries industry;
3. Decisions on permitted quotas for distant water fisheries;
4. Matters necessary for the structural improvement of distant water fisheries, strengthening the competitiveness of distant water fisheries, and establishing foundations for the development of the distant water fisheries industry;
5. Matters concerning administrative and financial assistance for the development of the distant water fisheries industry;
6. The formulation of policies to eradicate illegal, unreported, or unregulated fishing; and implementing such policies;
7. Special management of high-risk vessels;
8. The promotion of international fisheries cooperative projects;
9. The facilitation of the dissemination of new technology and technique on the distant water fisheries industry;

[23] https://www.ccamlr.org/en/organisation/performance-review-activities

10. Other important matters tabled by the Minister of Oceans and Fisheries for deliberation with regard to the development of the distant water fisheries industry.

The Deliberative Committee shall be comprised of no more than 20 members, including one Chairperson. Committee members shall be appointed or commissioned by the Minister of Oceans and Fisheries from among the following persons:

1. Public officials at Director General-level or with an equivalent position in a relevant central administrative agency;

2. Persons with abundant knowledge about and experience in the distant water fisheries industry;

3. Persons recommended by the competent Standing Committee of the National Assembly. A majority of the current committee members shall be appointed from among non-public official members, term of office of which shall be two years; renewable for only one further term.

Once the Committee is established and running, it is expected that its meeting minutes will contribute to the DW fisheries management evaluation system (to be confirmed at site visit).

Finally, the worldwide scrutiny of its DW fishing vessels including at CCAMLR, the USA and EU also provides the opportunity for regular internal and external reviews.

6.5.9 Principle 3 Performance Indicator scores and rationales

Scoring table 22. PI 3.1.1 – Legal and/or customary framework

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: Is capable of delivering sustainability in the UoA(s); Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and Incorporates an appropriate dispute resolution framework		
Scoring Issue		SG 60	SG 80	SG 100
a	Compatibility of laws or standards with effective management			
	Guide post	There is an effective national legal system **and a framework for cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and **organised and effective cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and **binding procedures governing cooperation with other parties** which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	Yes	Yes	Yes

Rationale

CCAMLR

Two jurisdictions are directly involved in the management of the fishery. CCAMLR is the RFMO in charge of ecosystem and fisheries resource management (MSC Principles 1 and 2) and the Republic of Korea is the Flag State responsible for its vessel's activities and compliance with the management regime and international obligations. They combine to make up a legal system effective for several decades. The CCAMLR Convention provides a framework for effective cooperation between and with other parties and its Conservation Measures are binding, the Republic of Korea has been a Contracting Party (CP) since 1985. SG60, SG80 and SG100 are met.

Republic of Korea

The Republic of Korea is a signatory to UNCLOS II as of January 29th 1996, and UNFSA as of February 1st 2008. As a CCAMLR CP, the Republic of Korea is bound to the Conservation Measures set out by CCAMLR. Korea also has national fisheries laws which are binding legal instruments consistent with the principle sand provisions of UNCLOS, UNFSA, and the Ecosystem Approach of the UN Convention of Biological Diversity (CBD). Coastal and offshore fisheries are managed under the Fisheries Act and the Fishery Resources Management Act, whereas the fishery under assessment is managed by the Distant Water Fisheries Development Act. The Fisheries Act covers all Korean fisheries, and deals with fishing permit and license issuing of distant water fisheries. Both Korea and Japan are parties of the Agreement on Port State Measures. As such, there is an

effective national legal system and organized and effective cooperation between parties involved in the management of fisheries, and SG80 is met (SG 60 is met and exceeded, because there is more than just a framework in place). The Republic of Korea is a CCAMLR CP and as such is bound to abide by the Conservation measures of this RFMO. Further, the Distant Water Fisheries Development Act explicitly states that Korean fisheries operators must abide by the management measures of regional management bodies in which they operate (Korea 2015) SG100 is met.

b	Resolution of disputes			
	Guide post	The management system incorporates or is subject by law to a **mechanism** for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes which is **considered to be effective** in dealing with most issues and that is appropriate to the context of the UoA.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes that is appropriate to the context of the fishery and has been **tested and proven to be effective.**
	Met?	Yes	Yes	No

Rationale

CCAMLR

Both CCAMLR and Korea have dispute resolution mechanisms. For CCAMLR, Art. XXV of the Convention (CCAMLR 1980) explicitly considers mechanisms for the resolution of disputes or conflicts which may arise within the fishery, including external arbitration. The mechanisms are considered to be effective, because conflicts do not arise, SG60 and SG80 are met for CCAMLR. However, CCAMLR's 1st Performance Review recommended that, in order to be fully effective, *"the binding procedures for dispute settlement set out in Part XV of UNCLOS could be considered by CPs*" (CCAMLR 2008a). Although this recommendation has not been followed by apparent action by the Commission, the matter was not identified as important by the 2nd Performance Review (CCAMLR 2017e). On the basis that it hasn't been tested, SG100 is not met.

Republic of Korea

For the Republic of Korea, the Distant Water Fisheries Act Article 32 (hearings) states: When the Minister of Oceans and Fisheries (MOF) intends to cancel or suspend a permit for fisheries under Article 11, he/she shall hold a hearing thereon (Korea 2019). More broadly, Korea does have a Dispute Settlement mechanism which is based on the model of the World Trade Organisation (WTO) Dispute Settlement Understanding, but its procedures are much faster. The first step of the procedure is the consultation between the parties, with a view to reaching a solution. If the parties do not find an agreement, the dispute is referred to an arbitration panel. The panel is composed of three experts that are chosen by the parties or selected by lot from a list agreed in advance. The panel receives submissions from the parties and will hold a hearing that will be open to the public. Interested persons or companies will be allowed to inform the panel of their views by sending *amicus curiae* (friends of the court) submissions, SG60 is met.

In addition to the amended Arbitration Act 2016, which is to ensure the appropriate, impartial and prompt settlement of disputes in private laws by arbitration, there are also two other types of Alternative Dispute Resolution Systems that are mostly used in Korea: arbitration and mediation in the form of court-annexed or statutory conciliation. The conciliation system can be classified as either a judicial conciliation, such as those court-annexed conciliation procedures under the CCA or non-judicial conciliation such as statutory conciliation administered by governmental agencies.

These transparent mechanisms under the various Acts for the resolution of legal disputes in Korea are considered effective in dealing with disputes, SG 80 is met. There is no evidence they have been tested for this or for comparable DW fisheries so the national Korean system does not meet SG 100.

c	Respect for rights			
	Guide post	The management system has a mechanism to **generally respect** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to **observe** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to **formally commit** to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
	Met?	Yes	Yes	No

Rationale

CCAMLR

There are no coastal states fishers in the CCAMLR area. The opportunity to participate in the krill fishery is currently open to vessels duly licensed (CM 10-02) by a Commission member flag state, not listed in the IUU Fishing vessel lists (CM 10-06 and CM 10-07) after prior notification (CM 21-03), and only if all members agree (CCAMLR 2019n)). With these criteria in place, rights established by historical participation have been respected. Licenses to fish in the CCAMLR Area are delivered by the Contracting Party (CP), who must be "satisfied of the vessel's ability to exercise its responsibilities under the Convention and its conservation measures" (CM 10-02). CCAMLR CMs are binding and consistent with the objectives of MSC Principles 1 and 2 (see Background sections 6.2.1 and 6.2.2). For the CCAMLR management system, SG60, SG80 and SG100 are met.

Republic of Korea

In the National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) fishing, Korea explicitly recognises the importance of fisheries resources for food security in small-island developing States and makes provisions to assist these States through "*transferring its knowledge and technologies for fisheries conservation and management*" while implementing the NPOA-IUU (Korea 2014a). Even though the statement on small-island developing states does not apply in this fishery, it demonstrates that the management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood such that SG 80 is met, but given there is no formal commitment, SG 100 is not.

References

(CCAMLR 2017e; CCAMLR 2019i; CCAMLR 1980; CCAMLR 2008a; CCAMLR 2019n; Ferrada 2018; Korea 2014b; Korea 2016b; Sykora-Bodie & Morrison 2019) (Korea 2014a; Korea 2019)
http://www.fao.org/fileadmin/user_upload/legal/docs/037s-e.pdf

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 23. PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2		The management system has effective consultation processes that are open to interested and affected parties The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties		
Scoring Issue		SG 60	SG 80	SG 100
a	Roles and responsibilities			
	Guide post	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **generally understood**.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for key areas** of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for all areas** of responsibility and interaction.
	Met?	Yes	Yes	No

Rationale

CCAMLR

CCAMLR structure and conditions of participation are clearly defined in the Convention. CP functions, roles and responsibilities within the Commission, the Scientific Committee, the Standing Committee on Implementation and Compliance (SCIC) and other subsidiary bodies are well understood for all areas of responsibility and interactions,

as evidenced in publicly available meeting reports on its website. In support of the Convention, the Commission has adopted a Strategic Plan for the CCAMLR Secretariat for the period 2019–2022, which describes the core services provided to Members and other stakeholders. Functions, roles and responsibilities are clearly defined in the WG meetings' agenda (see for example WG-EMM, which refers to the Scientific Committee and the Commission report), SG60 and SG80 are met. Areas of responsibilities and interactions include the criteria and methods to be used in Conservation Measures, regular assessment of status and trends of Antarctic living resources, data collection and data analyses and the formulation of proposals for the conduct of international and national programs of research (Convention Article XV, (CCAMLR 1980). Fishing companies are also organised into the Association of Responsible Krill harvesting companies (ARK), striving to become an information hub and provide links with CCAMLR and the scientific community, to promote research for the sustainable harvest of Antarctic krill in an ecosystem context and work with national CCAMLR delegations. Thus, functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction: SG100 is met.

Republic of Korea

Organisations and individuals directly involved in the Korean DWF management process and their roles are explicitly defined and well understood for all areas. Other interested parties such as NGOs and industry have been identified as demonstrated by engagement with MOF in Korea on a range of management-related issue. The MOF is the main department responsible for managing all fisheries and marine issues. MOF is comprised of three offices (i) Planning and Coordination Office; (ii) Oceans Policy Office and (iii) Coastal Fisheries Policy Office. The most important office for distant water fisheries is the Oceans Policy Office. Under this Office are three sub-offices with a General Director appointed to manage separate Divisions. Relevant Divisions for the distant water fisheries include the International Cooperation Division and Distant Water Fisheries Division. The Distant Water Fisheries Division administers the distant water fisheries, while the International Cooperation Division works on international relations and negotiations at RFMOs. The MOF also works closely with the National Institute of Fisheries Science (NIFS), which provides fisheries science and technology expertise. The MOF also works closely with the recently established (May 2014) Fisheries Monitoring Centre (FMC), whose responsibility is inter alia to monitor in real time (through vessel monitoring systems (VMS)) and control all distant water fishing vessels and the Korea Maritime Institute (KMI), which specialises in maritime and fishery policy. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction: SG 60 and SG80 are met. According to WWF-Korea (2017) there are over 35 organisations that are relevant to domestic and distant water fisheries, seafood trade, ports etc. The Korean Fishery Association (KFA) and Korea Overseas Fisheries Association (KOFA - established under Article 28 of the DWFDA) are the most relevant associations to this unit of assessment. KFA is the largest corporation and plays a key role in facilitating discussion between central government and fishery stakeholders for the coastal and offshore fisheries sectors, while the KOFA supports the distant water fishing industry, including inter alia providing statistics on fishing activities, analysis and research of foreign markets etc. (WWF 2017). It also plays a key role in non-governmental cooperation with foreign countries (WWF 2017). Thus, based on the document review of the ACDR, it seems that functions, roles and responsibilities are not only "*generally understood*" or "*explicitly defined and well understood in key areas*", they are explicitly defined and well understood for all areas of responsibility and interaction. The team will look to confirm this during the site visit. For now, the Republic of Korea will receive a provisional precautionary score of 80 for this PI as more certainty is sought by the team before scoring SG100.

b	Consultation processes			
	Guide post	The management system includes consultation processes that **obtain relevant information** from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge.	The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system

			The management system demonstrates consideration of the information obtained.	demonstrates consideration of the information and **explains how it is used or not used.**
	Met?	Yes	Yes	No

Rationale

CCAMLR

Consultation processes take place through the participation to working groups and other work either as members of CP delegations or through the international Observer status. Consultation processes are open and consultees' contribution are evident from annual meeting reports, with a diverse and active participation encouraged by the national delegations, including scientists and experts from Korea. CCAMLR CP and vessel captains are closely involved in the collection of data, in research and welcome on-board Observers, SG60 and SG80 are met. The information, analyses and comments from stakeholders with Observer status are presented in the Commission's annual reports (see (CCAMLR 2019i)). All decisions on Conservation Measures and other resolutions are made by consensus with detailed accounts of the information used (or not used) are also given in the Commission's annual reports (see (CCAMLR 2019i)), SG100 is met.

Republic of Korea

It is a requirement under the DWFDA that stakeholder information sessions be scheduled whenever any RFMO CM is created or amended, thus potentially requiring the DWFDA to be amended. At these sessions, discussions and explanations of potential consequences are presented to stakeholders and input is sought which can then be taken into consideration when deciding whether the new or amended CM can be implemented effectively in the Korean context. Therefore, a consultation process is set to obtain relevant information from the main affected parties, and SG60 is met. Furthermore, various outreach activities are conducted to engage stakeholders and the general public on matters such as IUU fishing and provide an opportunity for information and local knowledge to be incorporated into decision-making. Under Article 5 of the DWFDA, a "Deliberative Committee for Development of the Distant Water Fisheries Industry" is established under the jurisdiction of the MOF to consult on matters such as:

a. The formulation of comprehensive plans to develop the distant water fisheries industry;
b. The balanced development of the distant water fisheries industry;
c. Decisions on permitted quotas for distant water fisheries;
d. Matters necessary for the structural improvement of distant water fisheries, strengthening the competitiveness of distant water fisheries, and establishing foundations for the development of the distant water fisheries industry;
e. Matters concerning administrative and financial assistance for the development of the distant water fisheries industry; and
f. Other important matters tabled by the Minister of Oceans and Fisheries for deliberation with regard to the development of the distant water fisheries industry.

This committee (not to exceed 20 persons) includes government officials, persons with "knowledge about and experience in the distant water fisheries industry" and those recommended by the competent Standing Committee of the National Assembly. This suggest that there are processes in place to obtain relevant information from stakeholders, including local knowledge and that this allows for consideration of the information obtained such that SG80 is met. SG100 is not met because the team could not find any evidence to demonstrate that the management system explains how it uses (or doesn't use) the information provided by stakeholders.

c	Participation		
	Guide post	The consultation process **provides opportunity** for all interested and affected parties to be involved.	The consultation process provides **opportunity and encouragement** for all interested and affected parties to be involved, and **facilitates** their effective engagement.
	Met?	Yes	No

Rationale

CCAMLR

Management of the Antarctic krill fishery is the responsibility of CCAMLR, while the management of fishing activities lies with the Korea as a CP.

CCAMLR was set up within the framework of the Antarctic Treaty. The Convention (art. XVII) set out the role of the Executive Secretary and Secretariat in detail. The latest CCAMLR Secretariat Strategic Plan 2019–2022 sets out specifically to consult widely with Members and other stakeholders and foster engagement by Contracting Parties in the work of CCAMLR (CCAMLR 2019a). Opportunities and encouragement are provided annually for CCAMLR members (CP and NCP) to delegate scientists to take part in Working Groups that prepare scientific advice for the Scientific Committee to review and present to the Commission. Consultation processes in place at CCAMLR are well defined and consultation are open and seen to take place at annual meetings, with a diverse and active participation encouraged by the national delegations. The information submitted by stakeholders with Observer status are presented in the Commission's annual reports and their use (or not) is discussed. For CCAMLR, SG80 and SG100 are met.

Republic of Korea

The Korean government (MOF and through KOFA) usually provides the opportunity for representatives from industry and NGOs to attend relevant international negotiations and RFMO meetings as part of the Korean delegation so that their interests can be incorporated into decision-making and so they are aware of the reasoning behind eventual management and policy decisions (refer also to NPOA-IUU, 2014). Furthermore, various outreach activities are conducted to engage stakeholders and the general public on matters such as IUU fishing and provide an opportunity for feedback. When the Korean government implements new policy, this is published for general comment. As previously highlighted under 3.1.2(b) a "Deliberative Committee for Development of the Distant Water Fisheries Industry" is established under the DWFDA, which includes representatives with "knowledge about and experience in the distant water fisheries industry" and provides opportunity for interested parties to be involved in the decision-making process. Based on this SG 80 is met. SG 100 is not met because the team does not have sufficient evidence to assert that the consultation process provides opportunity and encouragement for all interested and affected partied to be involved and facilitates their engagement.

References
(CCAMLR 2019i; CCAMLR 1980; CCAMLR 2019a) (WWF 2017; Korea 2014a)

Draft scoring range	≥80

Information gap indicator	Information sufficient to score PI for CCAMLR – more information needed on stakeholder engagement processes for Korea

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 24. PI 3.1.3 – Long term objectives

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Fisheries Standard, and incorporates the precautionary approach		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	Long-term objectives to guide decision-making, consistent with the MSC Fisheries Standard and the precautionary approach, are **implicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Fisheries Standard and the precautionary approach are **explicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Fisheries Standard and the precautionary approach, are explicit within and **required by** management policy.
	Met?	Yes	Yes	No

Rationale

CCAMLR

All CCAMLR fisheries are managed using a precautionary and ecosystem approach, as defined by the FAO in its Code of Conduct for Responsible Fisheries. Long-term objectives are defined and required in Article 2 of the Convention as a) prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment; b) maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources; and c) prevention of changes or minimization of the risk of changes in the marine ecosystem, SG60 is met. For the krill fishery, management follows the principles set out in Article II of the Convention (CCAMLR 1980) www.ccamlr.org/node/74528), SG80 is met. These objectives are required by CCAMLR and reiterated in every annual Commission report (CCAMLR 2019i), SG100 is met.

Republic of Korea

Under Article 1 of the DWFDA, the principal objective is to "*advance the sustainable development of the distant water fisheries industry and contribute to the growth of national economy, through the rational preservation, management, exploitation, and utilisation of maritime living resources, and the promotion of international cooperation*" (Korea 2019). In the formulation of plans for the distant water fisheries specifically, it is an explicit requirement under Article 4 of the DWFDA that the Minister of Oceans and Fisheries include "*matters concerning the rational preservation and management and exploration and exploitation of marine living resources*" where rational preservation and management means "*measures to preserve or manage one or more species of marine and fisheries resources as adopted and applied in accordance with international law*". This is more than implicit, and so SG60 is met. Given Korea is a signatory to UNCLOS and UNFSA, this would therefore include reference to ecosystem-based management

and the precautionary approach, which is consistent with the MSC fisheries standard. Indeed, after signing UNCLOS and the UNFSA, the Ministry of Maritime Affairs and Fisheries (MOMAF) in 2006 (as presented in (Zhang et al. 2009) presented a five-year vision for Korean fisheries development with four major goals that included:

(i) rebuilding fishery resources based on an ecosystem approach;
(ii) modifying the structure of fishery production;
(iii) preventing harmful and illegal fishing activities; and
(iv) improving marine environmental quality.

These objectives are consistent with the requirements of the Conservation and Management of Marine Ecosystems Act (coming into effect in 2007, as amended 2017), which specifies that governments must take into account the following measures (which are aligned with MSC P1 and P2) to conserve or manage marine ecosystems under Article 4 (Obligations of State):
1. Formulation and implementation of measures to conserve or manage marine ecosystems, in an effort to prevent inordinate damage to marine ecosystems caused by activities or projects (hereinafter referred to as "development activities, etc.") affecting marine ecosystems, including the development or use of the sea, and to promote the sustainable use of marine ecosystems;
2. Promotion of policies which encourage nationals to take an active part in the conservation or management of marine ecosystems, and the creation of conditions therefore;
3. Investigation, research and technology development concerning the conservation and management of marine ecosystems, and the fosterage of specialised human resources;
4. Formulation and implementation of measures to restore or recover damaged marine ecosystems;
5. Raising public awareness on the importance of marine ecosystems, through education and public relations concerning marine ecosystems; and
6. Promotion of international cooperation concerning the conservation of marine environments.

And even before the 2006 vision statement, MOMAF in 2005 (in (Lee 2011), provided a study on the promotion of a mid and long-term fish stock rebuilding plan. Based on this evidence SG80 is met as there are clear explicit objectives incorporating the precautionary approach and ecosystem approach. Though the long term objectives are explicitly stated within the management policy, the team will look to the interviews with stakeholders during the site visit to determine if and how these objectives are required by the management framework. SG100 not met.

References

(CCAMLR 2019i; CCAMLR 1980; Korea 2014b; Korea 2016b) (Korea 2019; Zhang et al. 2009; Lee 2011)

http://www.korea.kr/news/policyBriefingView.do?newsId=156312163&pageIndex=1&srchType=&startDate=2008-02-29&endDate=2019-01-07&srchWord=

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 25. PI 3.2.1 – Fishery-specific objectives

PI 3.2.1		The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	**Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system.	**Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.	**Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.
	Met?	Yes	Yes	Partial

Rationale

CCAMLR

CCAMLR, the fishery manager, sets short-term sustainability objectives for the krill resources and the ecosystem. CCAMLR's short- and long-term objectives for the Krill fishery are set out in the Conservation Measures (CM 51-01 and 51-07) that define a precautionary krill catch limits and trigger levels for Area 48 (Principle 1). A "trigger" catch limit not to be exceeded until a procedure for division of the overall catch limit into small-scale management units (SSMU) has been established to avoid possible unacceptable concentration of catch within the foraging areas of vulnerable predators (Principle 2), SG60 and SG80 are met. For Principle 1, the objectives are quantitative and therefore well-defined, explicit, understood as they are applied by users within the fishery, SG100 is met.

Regarding Principle 2, the recent commitment to voluntary area closures in subarea 48.1 by the ARK addresses CCAMLR's explicit objectives to minimise the fishery's impacts on penguin colonies during the breeding season. However, the WG-EMM is still developing data layers to input into the krill fishery risk assessment (CCAMLR 2019l). Thus, short-term objectives are not yet well-defined and measurable to achieve outcomes expressed by Principle 2. SG100 is only partially met. The scores also apply to Korea who, as a CP, contributes to the formulation of CCAMLR's binding CMs.

References

(CCAMLR 2019l) (Korea 2015)

Draft scoring range	≥80
Information gap indicator	Information sufficient to score PI

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 26. PI 3.2.2 – Decision-making processes

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery		
Scoring Issue		SG 60	SG 80	SG 100
a	Decision-making processes			
	Guide post	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	Yes	Yes	

Rationale

CCAMLR

CCAMLR's consensus-based decision-making process has been a central element in shaping outcomes while facing challenges that arise in the balance between 'fishing' and 'conservation' interests, for example in the current debates over climate change and marine protected areas in the Southern Ocean, SG60 is met. CCAMLR's established decision-making processes have been given as an example of best practice in managing marine resources in international waters (Nilsson et al. 2016), SG80 is also met.

Republic of Korea

Korea participates in these international negotiations and at CCAMLR, stakeholder information sessions are automatically scheduled whenever any RFMO CM is developed or modified requiring the DWFDA to be amended. SG 60 is met. Discussion and stakeholder input are sought and taken into consideration before a decision is made as to whether the new or amended CM can be implemented in the Korean context. This system of decision-making allows Korean delegation representatives (including industry) at the RFMO meeting and then relevant stakeholders in the Korean national system to be fully informed of the issues under consideration and ensure that decision-making results in measures and strategies to achieve the fishery-specific objectives. Thus, Korean (MOF) processes respond to important issues and allow consultation and participation and these also have established, effective decision-making processes identified in their distant water management plans. These tend to respond to issues identified in relevant research, monitoring, evaluation and consultations. All management measures apply equally inside foreign EEZ as well as on the high seas. The CCAMLR scores also apply to Korea who, as a CP, contributes to the formulation of CCAMLR's binding CMs. From the above, SG 80 is met.

b	Responsiveness of decision-making processes			
	Guide post	Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Yes	Yes	No

Rationale

CCAMLR

Fisheries-specific issues identified in relevant research are taken into account by CCAMLR's Working Groups and Scientific Committee. A decision-making management loop ensures that serious and important issues are identified through monitoring, research and consultations. SG60 and SG80 are met. However, the complexity of rapid environmental and climate change present new challenges and not all issues find quick responses (see section 6.2.3 and (CCAMLR 2019l). For example, the need to operate subarea "trigger" levels are not yet resolved, even though the ARK supported area closures and scientific data collection attest of close collaboration between key stakeholders, SG100 is not met.

Republic of Korea

The Republic of Korea has repeatedly responded to serious issues identified in relevant research, monitoring, evaluation and consultation. For example, Korea was "yellow carded", as a potentially non-cooperating country in the fight against IUU fishing by the EU in November 2013 (http://europa.eu/rapid/press-release_IP-13-1162_en.htm) due to deficiencies in fisheries monitoring, control and surveillance (MCS). In response, Korea revised the DWFDA in 2013 and 2014 to strengthen MCS for this sector (e.g. strengthening controls on nationals, greater monitoring of fishing activities and high-risk vessels, port-State controls, VMS e-logbook requirements etc.) and respective sanctions (criminal prosecution and higher financial fines). Korea also created a new FMC, with real-time reporting on the fleet, 100% VMS and detailed and complete operational data provided to RFMOs and developed a NPOA on IUU fishing. This series of reforms of the legal system and establishment of FMC led to the European Commission lifting its "yellow card" warning to Korea in April 2015 (see: http://europa.eu/rapid/press-release_IP-15-4806_en.htm). This suggests that Korea responds to serious issues identified in relevant research monitoring, evaluation and consultation such that SG 60 is met. Another more recent example is the response to being identified by NOAA for IUU activities in the 2019 Improving International Fisheries Management Report to Congress (NOAA 2019)). This prompted a further amendment of the DWFDA to increase sanctions for infractions, therefore, SG 80 is also met by Korean management. The Korean management system fails to meet SG 100 because there is not enough evidence to demonstrate that all identified issues are responded to.

c	Use of precautionary approach

	Guide post	Decision-making processes use the precautionary approach and are based on best available information.
	Met?	Yes

Rationale

CCAMLR

The precautionary approach is required by CCAMLR's Convention. Krill-specific CMs on catch limitation and trigger levels are based on a precautionary approach for the krill resource and its predators. The fishery harvest in Area 48 has been capped at 620 000 tonnes per year, a catch limit or trigger level chosen to be extremely low when compared to an estimated initial virgin biomass. An interim distribution of trigger levels in Subareas 48.1 to 48.4 (CM 51-07) has been set up until the 2020/2021 to reinforce precaution, which the Commission may prolong until further progress is made with the fishery risk assessment (CCAMLR 2019l).

Krill is a keystone component of the Antarctic ecosystem (see LTL species in background section 6.3.2) and its harvest is based on the collection of the best possible scientific information, on the stock and other ecosystem components. SG80 is met.

Republic of Korea

It is an explicit requirement under Article 4 of the DWFDA that the Minister of Oceans and Fisheries, when drawing up a management plan, that it include "*matters concerning the rational preservation, management, exploration and exploitation of marine living resources*", where "*measures to preserve or manage one or more species of marine and fisheries resources as adopted and applied in accordance with international law*"(Korea 2019). Given Korea is a signatory to UNCLOS and UNFSA, this would therefore include reference to ecosystem-based management and the precautionary approach. However, WWF (2017) does note that *implementation* of the precautionary approach and ecosystem-based management with current legislation is still needed. For decision making at the national level, it appears that within the Conservation and Management of Marine Ecosystems Act (as amended 2017) the MOF, seeks the best available information in the decision-making process, through extensive consultations with a wide-ranging constituency.
Further, as a CP to CCAMLR, the Republic of Korea contributes to the formulation of binding CMs which are set using the precautionary approach and are based on the best available information as explained above. SG 80 is met.

d	Accountability and transparency of management system and decision-making process			
	Guide post	Some information on the fishery's performance and management action is generally available on request to stakeholders.	**Information on the fishery's performance and management action is available on request,** and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from	Formal reporting to all interested stakeholders **provides comprehensive information on the fishery's performance and management actions** and describes how the management system responded to findings and relevant

			research, monitoring, evaluation and review activity.	recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	Yes	No	No

Rationale

CCAMLR

CCAMLR provides extensive information on the fishery's performance and management actions, which are publicly available and promptly updated after meetings, SG60 is met. Each specific report, starting with the Commission (CCAMLR 2019i) and the Scientific Committee (SCIC) reports provide details of findings obtained from scientific data collection, on board observations, analyses and research, of recommendations and actions taken or not taken. The same applies to CCAMLR's performance reviews (CCAMLR 2008b; CCAMLR 2017e), SG 80 is met. Stakeholders, either from the national CP and NCP delegations or Observers, are an integral part of the management system. They contribute to all CCAMLR's reports in a transparent process, for the CCAMLR decision-making process, SG 100 is met.

Republic of Korea

The Republic of Korea has provided some information and explanations for actions or lack of action taken at the national level. For example, the justifications for the amendments to the DWFDA, establishment of the Fisheries Monitoring Center (FMC) and NPOA-IUU development is clear (i.e. in response to European Commission "yellow card"). So it can be said that some information on the fishery's performance and management action is generally available on request to stakeholders. SG 60 is met. With that exception however, information on the rationale behind most other decision-making at the national level is not transparent, at least on the MOF website or in various reports or minutes from stakeholders' meetings. Within the political structure itself, perhaps it is simply a matter of "need-to-know" as determined by whatever the highest authority deems necessary to divulge. Information on the fishery's performance and management action is more available on specific request through MOF and/or their associated agencies. Until this is confirmed to be the case through interviews at the site visit, the score of 80 will not be awarded on a precautionary basis.

e	Approach to disputes			
	Guide post	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	Yes	Yes	No

Rationale

CCAMLR

The Convention foresees the possibility of disputes (art. XXV), to be minimised through mechanisms such as negotiation, mediation and conciliation and reach agreement between parties in case of legal conflicts. Annual SC, SCIC and Commission meetings all provide opportunities for open discussions and proactively avoid the possibility of conflicts or legal disputes, since all parties have had in advance the chances to reach technical and political agreements. There is a general respect and compliance of the management system implemented by CCAMLR in regard to the krill fishery (see also PI 3.2.3). No IUU fishing has been recorded in this fishery in recent times and no legal disputes are pending. For CCAMLR, SG60, SG80 and SG 100 are met.

Republic of Korea

As outlined in greater detail in 3.1.1 (b) there are mechanisms in place in Korea to resolve disputes. There is no evidence that Korea is disrespectful or in defiance of national laws or legally binding agreements at the national level. SG60 is met. For example, the rapidly implemented changes to the DWFDA in response to being classified as a potential IUU nation by NOAA resulted in Korea being removed from that list within four months. SG80 is met/ There is evidence MOF attempts to proactively avoid legal disputes, by inviting industry to attend RFMO meetings as part of the Korean delegation to ensure their interests are incorporated into decision-making. Industry certainly was made aware of the reasoning behind current agreed current CMs and especially the National Plan of Action-IUU in 2014 (Korea 2014a). And when new CMs are agreed upon at RFMOs, the Korean government will hold stakeholder consultations to explain what the new measure is and what it means for the fishery as the DWFDA requires compliance with all RFMOs binding management measures and requirements. Furthermore, various outreach activities are conducted to engage stakeholders and the general public on matters such as IUU fishing and provide an opportunity for feedback and avoid the potential for future disputes. The above evidence suggests the management system has mechanisms in place to comply in a timely fashion with judicial decisions arising from legal challenges and works proactively to avoid legal disputes. However, pending concrete evidence of these processes, SG100 is not met. The team will investigate this further at the site visit.

References

(CCAMLR 2008b; CCAMLR 2017e; CCAMLR 2019l; CCAMLR 2019i; Nilsson et al. 2016) (WWF 2017; Korea 2014a)

Draft scoring range	60-79
Information gap indicator	Further Korea-specific information is required to finalise the scores

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 27. PI 3.2.3 – Compliance and enforcement

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with		
Scoring Issue		SG 60	SG 80	SG 100
a	MCS implementation			
	Guide post	Monitoring, control and surveillance **mechanisms** exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance **system** has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A **comprehensive** monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	Yes	Yes	No

Rationale

CCAMLR

CCAMLR's Convention (Art. XXI) put the responsibility on each Contracting Party to take appropriate measures within its competence to ensure compliance with its provisions and with conservation measures. CCAMLR has a comprehensive MCS system set out in several CMs (see Background section 6.5.7.1). It is implemented by its members, including by onboard observers and captains of vessels active in all CCAMLR fisheries who report any concern, SG60 and SG80 are met. The CCAMLR System of Inspection (CCAMLR 2019l) relies on each member country designating and training Fisheries Inspectors to carry out inspections, at sea or on land. Inspection reports are copied to CCAMLR Executive Secretary to be forwarded to the other members. Any concerns are reported and discussed during annual SCIC meetings (CCAMLR 2019k). There have been no instances of non-compliance in the krill fisheries in recent years. The MCS system is comprehensive and adapted to the risks of IUU catches in the fishery, SG100 is met.

Republic of Korea

Korean fishing vessels engaged in distant water fishing in CCAMLR areas 48.1 and 48.2 are managed by the DWFDA. Under DWFDA Article 13, distant water fishing vessels must comply with resolutions made by RFMOs (CCAMLR for this UoA), which apply equally inside EEZs (not relevant to this UoA) and in the high seas (relevant to this UoA). If violation of these rules occurs then under Article 13, Part 9, the Minister of Oceans and Fisheries can immediately suspend fishing operations of the vessel, entry into designated ports or prohibit discharge and trans-shipment of catch. To ensure compliance, vessels must have a functional VMS prior to departing from port (Article 15) and must obtain a permit in advance to trans ship (Article 16). Vessels suspected of IUU fishing can be denied port entry or prohibited from departing or restricted from unloading

etc. and/or use of port services (Article 14). Penalties for non-compliance (fines and imprisonment) are listed in Article 33 (these have been amended in 2019 in response to being put on the IUU fishing nation list by NOAA). Korean fishing vessels are monitored in real-time by the FMC, which has a state-of-the-art monitoring system generating real time reporting on the fleet (Korea 2016a). The FMC ensures proper functioning of VMS and operates the fisheries monitoring system (FMS), e-reporting system (daily basis for catch/bycatch and protected species interactions) and the Korean fisheries information management system (FIMS) on a 24/7 basis. This allows detailed and operational fishery data to be sent to RFMOs and for FMC to also monitor the fleet in real-time to ensure it is complying with regulations, such as not fishing in protected areas. Korea also has a scientific observer programme on distant water fishing vessels, which is administered by the National Institute of Fisheries Science (NIFS), and Observer coverage on the UoA fleet is 100 % at the time of writing. The tasks required of the observers are describes in section 6.4.2.1. Given the mandatory 100% observer coverage, there is a high degree of confidence that fishing operators comply with the national and international management frameworks in place. As such, a monitoring, control and surveillance system has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules and SG60 and SG80 are met. Without any concrete evidence from the Republic of Korea authorities, the team cannot award SG100. This is to be revisited at the site visit.

b	Sanctions			
	Guide post	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, **are consistently applied** and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and **demonstrably** provide effective deterrence.
	Met?	Yes	Yes	No

Rationale

CCAMLR

Instances of non-compliance (in the fisheries where they exist) are discussed openly at CCAMLR and remedied by the Flag State authorities, including through the courts if necessary, and there is evidence that they are applied. SG 60 is met. Sanctions are thought to provide effective deterrence to the extent that there are no instances of non-compliance in the Krill fishery, SG 80 is met.

Republic of Korea

In September 2019 the USA made a preliminary decision to designate Korea as an IUU fishing nation "for failing to apply sufficient sanctions to deter its vessels from engaging in fishing activities that violate conservation and management measures adopted by an international fishery management organization" (NOAA 2019). The fishing activities in questions took place in CCAMLR waters in 2017, in a toothfish fishery. The matters are described in detail in the national report as part of the SCIC annual reports, and in 2019 the SCIC recognised that no further action was required to address the cases involving the Hong Jin No.701 and Southern Ocean (CCAMLR 2019k). However, SCIC noted that Korea had taken swift action by issuing a new Ministerial Directive implementing CM 10-05 (CCAMLR 2019k) and that the recently adopted amendments to Korea's Distant Water Fisheries Development Act now enable the Minister of Oceans and Fisheries to administer administrative sanctions for violations of conservation and management measures of regional fisheries management organizations, including CCAMLR. The U.S. government removed South Korea from its list of potential illegal, unreported and unregulated (IUU) fishing countries after four months. SG80 is met. There have been no instances of non-compliance is this fishery (SIa), but the Korean strengthened regime of sanctions for DW vessels is very recent (2019), therefore SG100 is not met.

c	Compliance			
	Guide post	Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	**Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
	Met?	Yes	Yes	No

Rationale

Fishers in the krill fishery are generally though to comply with CCAMLR's MCS system requirement, SG60 is met. Evidence provided in the SCIC annual report shows that fishers comply with the management system by providing information before (i.e. notification of intent to fish) and during operations (catch and effort data; VMS data, on-board observers data) and comply other conservation measures, in particular those regarding the environmental protection during fishing and to minimise ecosystem impacts. This is reinforced by the UoA fishing company membership of the Association of Responsible Krill Harvesting Companies (ARK), which comes with its commitments to comply with all CCAMLR's CM's. Evidence of compliance is available from the SCIC compilation for each CM and by country (CP and NCP), SG80 is met. Further evidence will be sought from the Korean authorities and the CCAMLR Secretariat during the site visit to determine if SG100 is met.

d	Systematic non-compliance		
	Guide post		There is no evidence of systematic non-compliance.
	Met?		No

Rationale

CCAMLR has a comprehensive MCS system, which is also heavily reliant on the Members cooperation, including Observers and vessel captains in all CCAMLR fisheries who report any concern. The MCS system has been demonstrably effective for this fishery. SG80 is met for CCAMLR. The Republic of Korea has completely reformed and strengthened its MCS system in 2014, 2015, and 2019 which is now recognised as highly performant and effective. However, before SG80 can be met, inspection reports must be reviewed, and compliance must be discussed with the competent authorities. SG80 is not met.

References

(CCAMLR 2019k; Korea 2014a; NOAA 2019; CCAMLR 2019g) (Korea 2016a)

Draft scoring range	60-79
Information gap indicator	More information sought on compliance of the UoA fishery – information sought from CCAMLR and the Republic of Korea

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	
Condition number (if relevant)	

Scoring table 28. PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4		There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives There is effective and timely review of the fishery-specific management system		
Scoring Issue		SG 60	SG 80	SG 100
a	Evaluation coverage			
	Guide post	There are mechanisms in place to evaluate **some** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **key** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **all** parts of the fishery-specific management system.
	Met?	Yes	No	No

Rationale

CCAMLR

CCAMLR activities and practices are reviewed annually during the Commission and SC meetings as well as during Standing Committees and Working Groups (such as EMM) meetings. The compliance evaluation procedure of the Standing Committee on Implementation and Compliance (SCIC) conducted annually provides an example internal evaluation of the Commission and Members effectiveness. There is also open scientific discussion and peer review of the stock and ecosystem assessment and methods behind scientific management advice, SG60 and SG80 are met. Finally, the CCAMLR Secretariat Strategic Plan (CCAMLR 2019a) also provides a means for Members to periodically assess the Secretariat's performance. For CCAMLR, all parts of the fishery-specific management system are under scrutiny and SG100 is met.

Republic of Korea

There are mechanisms in place to evaluate key parts of the fishery-specific management system. For example, national legislation for distant water fisheries was reviewed and revised following the issuing of a "yellow card" to Korea by the EU under its IUU Regulation and being put on the NOAA potential IUU fishing nation's list, SG60 is met. An internal audit (performance review) of all MOF operations also occurs (Article 16-2 of DWFDA, (Korea 2015)) according to Korean legislation, though the team must verify if this indeed takes place. As highlighted in 3.1.2, when new CMs are agreed upon at RFMOs, the Korean government will hold stakeholder consultations to explain what the new measure is and what it means for the fishery as the DWFDA requires compliance with all RFMO CMs. This allows opportunities to review and evaluate the CMs with relevant stakeholders before changes are made to the DWFDA. Further details are needed on these consultations, the team must determine whether they can be considered to be an evaluation of the management system. On this basis SG 80 is not met. In the absence of evidence that all parts of the fishery specific management system are evaluated, SG 100 cannot be awarded.

b	Internal and/or external review			
	Guide post	The fishery-specific management system is subject to **occasional internal** review.	The fishery-specific management system is subject to **regular internal** and **occasional external review**.	The fishery-specific management system is subject to **regular internal and external review**.
	Met?	Yes	No	No

Rationale

CCAMLR

CCAMLR has multiple mechanisms to provide regular annual internal reviews, of the Commission CMs, the SC recommendations and SCIC compliance reports. Scientific data collection and analyses are reviewed internally and externally on a regular basis through peer reviewed publications. SG60 and SG80 are met. As a whole, CCAMLR has had two external reviews (CCAMLR 2017e; CCAMLR 2008a) of its performance as an RFMO, which cannot yet qualify as regular, SG100 is not met.

Republic of Korea

Article 16-2 of the DWFDA states: The Minister of Oceans and Fisheries shall conduct a performance review on the operation of the distant water fisheries industry including, inter alia, illegal, unreported, and unregulated fishing". As highlighted in 3.1.2, when new CMs are agreed upon at RFMOs, the Korean government will hold stakeholder consultations to explain what the new measure is and what it means for the fishery as the DWFDA requires compliance with all RFMO CMMs. This allows opportunities to review and evaluate the CMs with relevant stakeholders before changes are made to the DWFDA. SG60 is met. Korea has also been externally reviewed by the EU to ensure their management system meets EU IUU Regulations, which has led to new legislation developed and the FMC established. For the time being, the team requires evidence of these reviews. Until such evidence is presented to the team, SG80 and SG100 are not met.

References
(CCAMLR 2017e; CCAMLR 2008a; CCAMLR 2019a) (Korea 2015)

Draft scoring range	60-79
Information gap indicator	More information sought on the regularity of performance reviews on the operation of distant water fisheries / Information sufficient to score PI for CCAMLR

Overall Performance Indicator scores added from Client and Peer Review Draft Report

Overall Performance Indicator score	

Condition number (if relevant)	

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8 Appendices

Appendix 1 Assessment information

Appendix 1.1 Small-scale fisheries

Unit of Assessment (UoA)	Percentage of vessels with length <15m	Percentage of fishing activity completed within 12 nautical miles of shore
UoA1	0%	0%

Appendix 2 Evaluation processes and techniques

Appendix 2.1 Site visits

The report shall include:

- An itinerary of site visit activities with dates.
- A description of site visit activities, including any locations that were inspected.
- Names of individuals contacted.

Reference(s): FCP v2.1 Section 7.16

Pending the MSC's response to a VR submitted on 09/09/2020 a site visit will be held during the week of the 9th November 2020. If the VR is accepted, the meetings be remote, and will take place over the course of the entire week, and potentially the following week, depending on client and stakeholder availability. A wide range of stakeholders have been invited to participate in this assessment. If the VR is not accepted, covid-related travel restrictions and processes upon arrival in Korea will bear great influence on the dates of the site visit, and these will need to be considered at a later date given the evolving nature of the situation (stakeholders will be kept up to date).

Table 17. List of attendees at the on-site meetings.

Name	Position	Type of consultation

Appendix 2.2 Stakeholder participation

The report shall include:

- Details of people interviewed: local residents, representatives of stakeholder organisations including contacts with any regional MSC representatives.
- A description of stakeholder engagement strategy and opportunities available.

Reference(s): FCP v2.1 Section 7.16

Appendix 2.3 Evaluation techniques

The report shall include:

- Justification for how public announcements were developed.

- Methodology used, including sample-based means of acquiring a working knowledge of the management operation and sea base.
- Details of the scoring process e.g. group consensus process.
- The decision rule for reaching the final recommendation e.g. aggregate principle-level scores above 80.

If the RBF was used for this assessment, the report shall include:

- The justification for using the RBF, which can be copied from previous RBF announcements, and stakeholder comments on its use.
- The RBF stakeholder consultation strategy to ensure effective participation from a range of stakeholders including any participatory tools used.
- A summary of the information obtained from the stakeholder meetings including the range of opinions.
- The full list of activities and components that have been discussed or evaluated in the assessment, regardless of the final risk-based outcome.

The stakeholder input should be reported in the stakeholder input appendix and incorporated in the rationales directly in the scoring tables.

Reference(s): FCP v2.1 Section 7.16, FCP v2.1 Annex PF Section PF2.1

Appendix 3 Peer review reports

To be drafted at Public Comment Draft Report

The report shall include unattributed reports of the Peer Reviewers in full using the relevant templates. The report shall include explicit responses of the team that include:

- Identification of specifically what (if any) changes to scoring, rationales, or conditions have been made; and,
- A substantiated justification for not making changes where peer reviewers suggest changes, but the team disagrees.

Reference(s): FCP v2.1 Section 7.14

Appendix 4 Stakeholder input

To be drafted at Client and Peer Review Draft Report

To be completed at Public Certification Report

The CAB shall use the stakeholder input template to include all written stakeholder input during the stakeholder input opportunities and provide a summary of verbal stakeholder input received during the site visit. Using the stakeholder input template, the team shall respond to all written stakeholder input identifying what changes to scoring, rationales and conditions have been made in response, where the changes have been made, and assigning a 'CAB response code'. The team may respond to the verbal summary.

Reference(s): FCP v2.1 Section 7.15

Appendix 5 Conditions

To be drafted from Client and Peer Review Draft Report

The report shall document all conditions in separate tables. The CAB shall include rationale for exceptional circumstances in the summary of conditions in the Client and Peer Review Draft Report and all subsequent reports.

For reassessments, the CAB shall note:

- If and how any of the new conditions relate to previous conditions raised in the previous assessment or surveillance audits.
- If and why any conditions that were raised and then closed in the previous assessment are being raised again in the reassessment.
- If any conditions are carried over from a previous assessment, including an explanation of:
  - Which conditions are still open and being carried over.
  - Why those conditions are still open and being carried over.
  - Progress made in the previous assessment against these conditions.
  - Why recertification is being recommended despite outstanding conditions from the previous assessment.
- If any previous conditions were closed after the 4th Surveillance Audit and reassessment site visit (i.e. in Year 5), including the rationale for re-scoring and closing out of the condition.

Reference(s): FCP v2.1 Section 7.18

Table 18. Condition 1

Performance Indicator	
Score	State score for Performance Indicator
Justification	Cross reference to page number containing scoring template table or copy justification text here. If condition relates to a previous condition or one raised and closed in the previous assessment include information required here
Condition	State condition
Milestones	State milestones and resulting scores where applicable
Consultation on condition	Include details of any verification required to meet requirements in FCP v2.1 7.19.8

Appendix 6 Client Action Plan

To be added from Public Comment Draft Report

The report shall include the Client Action Plan from the fishery client to address conditions.

Reference(s): FCP v2.1 Section 7.19

Appendix 7 Surveillance

To be drafted from Client and Peer Review Draft Report

The report shall include the program for surveillance, timing of surveillance audits and a supporting rationale.

Reference(s): FCP v2.1 Section 7.28

Table 19. Fishery surveillance programme

Surveillance level	Year 1	Year 2	Year 3	Year 4
e.g. Level 5	e.g. On-site surveillance audit	e.g. On-site surveillance audit	e.g. On-site surveillance audit	e.g. On-site surveillance audit & re-certification site visit

Table 20. Timing of surveillance audit

Year	Anniversary date of certificate	Proposed date of surveillance audit	Rationale
e.g. 1	e.g. May 2018	e.g. July 2018	e.g. Scientific advice to be released in June 2018, proposal to postpone audit to include findings of scientific advice

Table 21. Surveillance level rationale

Year	Surveillance activity	Number of auditors	Rationale
e.g.3	e.g. On-site audit	e.g. 1 auditor on-site with remote support from 1 auditor	e.g. From client action plan it can be deduced that information needed to verify progress towards conditions 1.2.1, 2.2.3 and 3.2.3 can be provided remotely in year 3. Considering that milestones indicate that most conditions will be closed out in year 3, the CAB proposes to have an on-site audit with 1 auditor on-site with remote support – this is to ensure that all information is collected and because the information can be provided remotely.

Appendix 9 Harmonised fishery assessments

To be completed at Public Certification Report stage

Harmonisation is required in cases where assessments overlap, or new assessments overlap with pre-existing fisheries.

If relevant, in accordance with FCP v2.1 Annex PB requirements, the report shall describe processes, activities and specific outcomes of efforts to harmonise fishery assessments. The report shall identify the fisheries and Performance Indicators subject to harmonisation.

Reference(s): FCP v2.1 Annex PB

Table 22. Overlapping fisheries

Fishery name	Certification status and date	Performance Indicators to harmonise
Aker Biomarine Antarctic Krill	Certified (Re-assessment final report published on 31/08/2020)	Principle 1: All PIs Principle 2: None Principle 3: All PIs (CCALMR components)
Deris S.A. – Pesca Chile – Antarctic Krill fishery	Certified (initial assessment PCR published on 06/09/2018)	Principle 1: All PIs Principle 2: None Principle 3: All PIs (CCALMR components)

Table 23. Overlapping fisheries

Supporting information	
P1: The target stock is the same, as such, every Principle 1 PI should be harmonised. P2: The fishery under assessment partially overlaps with the fishing area of the two certified krill fisheries. Bycatch relative abundance and profiles are fishery specific, and given the slight differences in areas fished (the fishery under assessment does not operate in Area 48.3) ETP legislation is not the same. P3: The same CCAMLR regulations apply to all three fisheries, but national management systems differ (Chilean, Norwegian, and Korean)	
Was either FCP v2.1 Annex PB1.3.3.4 or PB1.3.4.5 applied when harmonising?	No
Date of harmonisation meeting	Email exchange between CABs throughout 2020
If applicable, describe the meeting outcome	
N/a	

Table 24. Scoring differences

Performance Indicators (PIs)	Aker Biomarine Antarctic Krill	Deris S.A. – Pesca Chile – Antarctic krill fishery	Jeong Il Corp. Antarctic krill fishery
PI 1.1.1	90	90	90
PI 1.2.1	95	95	95

PI 1.2.2	85	85	85
PI 1.2.3	90	90	90
PI 1.2.4	85	95	85

Table 25. Rationale for scoring differences

If applicable, explain and justify any difference in scoring and rationale for the relevant Performance Indicators (FCP v2.1 Annex PB1.3.6)
The CU Pesca fishery has been fully P1 harmonised with the Akre Biomarine Fishery, because the Principle 1 expert is the same across both fisheries. Indeed, the team leader for this assessment chose to hold back the publication of the ACDR until the Peer review comments we fully resolved in the Aker Biomarine fishery to ensure full harmonisation at the ACDR publication stage. For a rationale on the scoring differences between the aforementioned fisheries and the Deris S.A. fishery, please consult Hønneland et al. (2020): https://fisheries.msc.org/en/fisheries/aker-biomarine-antarctic-krill/@@assessments
If exceptional circumstances apply, outline the situation and whether there is agreement between or among teams on this determination
N/a

Appendix 10 Objection Procedure

To be added at Public Certification Report stage

The report shall include all written decisions arising from a 'Notice of Objection', if received and accepted by the Independent Adjudicator.

Reference(s): FCP v2.1 Annex PD