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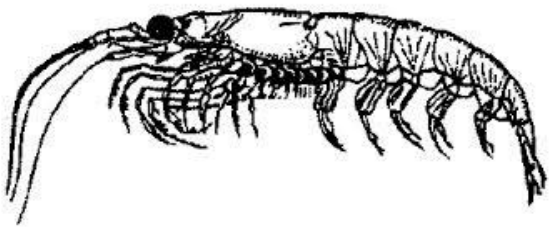
MSC SUSTAINABLE FISHERIES CERTIFICATION

Aker Biomarine Antarctic Krill Fishery



Public Certification Report

January 2015

Prepared For: **Aker BioMarine Antarctic**

Prepared By: **Food Certification International Ltd**

CERTIFIED SUSTAINABLE SEAFOOD MSC www.msc.org

Public Certification Report

November 2014

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Contents

Glossary

ASOC	Antarctic and Southern Ocean Coalition
APA	Antarctic Protected Area
ASPA	Antarctic Specially Protected Area
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CEMP	CCAMLR Ecosystem Monitoring Programme
CITES	Convention on International Trade in Endangered Species
CPUE	Catch per Unit Effort
ETP	Endangered, Threatened, Protected Species
F	Fishing Mortality
FAO	Food and Agriculture Organisation of the United Nations
GSGSSI	Government of South Georgia and South Sandwich Islands
GYM	Generalised Yield Model
IUU	Illegal, Unregulated and Unreported Fishing
IWC	International Whaling Commission
LTL	Low Trophic level
M	Natural Mortality
MRAG	Marine Resource Assessment Group (London)
MSC	Marine Stewardship Council
OCCAM	Ocean Circulation and Climate Advanced Modelling Project
SGSSI	South Georgia and South Sandwich Islands
SMOM	Spatial Multi-Species Operating Model
SSMU	Small-scale Management Unit
TAC	Total Allowable Catch
VME	Vulnerable Marine Ecosystem
VMS	Vessel Monitoring System
WG-EMM	Working Group on Ecosystem Monitoring and Management
WWF	World Wildlife Fund

1. Executive Summary

» This report provides details of the MSC assessment process for the Aker Biomarine Antarctic Krill Fishery for Aker BioMarine Antarctic. The assessment process began in November 2013 and was concluded at a date to be determined.

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

» A rigorous assessment of the wide ranging MSC Principles and Criteria was undertaken by the assessment team and a detailed and fully referenced scoring rationale is provided in the assessment tree provided in **Appendix 1.1** of this report.

» The **Actual Eligibility Date** for this assessment is 15 February 2014

The assessment team for this fishery assessment comprised Dr Geir Hønneland who acted as team leader and primary Principle 3 specialist, Dr Andy Payne who was primarily responsible for evaluation of Principle 1 and Ms. Lucia Revenga Giertych who was primarily responsible for evaluation of Principle 2.

Client strengths

» The client vessels use a trawl system with a fine mesh that prevents anything larger than krill from entering the system, and is monitored by underwater cameras.

» There is 100% observer coverage of the client vessels.

» The client works actively with, and provides financial support to, NGOs and scientific institutes, contributing to knowledge production beyond that provided by CCAMLR and participating states.

Client weaknesses

» No particular weaknesses are identified for the client. The main challenge for the fishery is that no synoptic survey of Antarctic krill has been conducted since 2000.

Determination

On completion of the assessment and scoring process, the assessment team concluded that **the Aker Biomarine Antarctic Krill Fishery be certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.**

Rationale

» There are a number of areas which reflect positively on the fishery:

› The fishery is operating at catch levels well below what would generally be regarded as a precautionary upper level relative to the best estimates available of stock size.

› Bycatch is negligible, and there is virtually no interaction with species other than the target krill or minimal retained species. Direct effects or interactions between the fishery and ETP species are nil. The gear can only impact the habitat in the case of gear loss, which has happened extremely rarely.

› There is a well-established and well-functioning management regime and enforcement system for the fishery, including requirements of 100% observer coverage and catch reports after each haul.

› The fishery is managed within a precautionary and ecosystem approach.

Conditions & Recommendations

» There are no conditions or recommendations for this fishery.

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

FCI Ltd confirm that this fishery is within scope.

2. Authorship and Peer Reviewers

2.1 Assessment Team

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

Assessment team leader: Dr Geir Hønneland

Primarily responsible for assessment under Principle 3

Geir Hønneland is Research Director of the Fridtjof Nansen Institute and adjunct professor at the University of Tromsø, Norway. He holds a PhD in political science from the University of Oslo, speaks Russian fluently and has followed the developments of Russian fishery politics and the Barents Sea fisheries management for more than two decades. Among his books are *Implementing International Environmental Agreements in Russia* (Manchester University Press, 2003) (including fisheries agreements), *Russian Fisheries Management: The Precautionary Approach in Theory and Practice* (Martinus Nijhoff, 2004), and *Making Fishery Agreements Work: Post-Agreement Bargaining in the Barents Sea* (Edward Elgar, 2012). He has also published a number of articles about Russian fisheries management, and the Barents Sea fisheries management more widely, in peer reviewed journals.

Geir also has a wide range of evaluation experience, e.g. for the FAO relating to the FAO Code of Conduct for Responsible Fisheries. Further, he has produced a country study of Russian fisheries management for the OECD and several consultancies about Russian fisheries management. He was member of the team that performed the first MSC assessment of a Russian Barents Sea fishery in 2010.

Geir is based near Oslo in Norway. A more comprehensive presentation can be found at the FNi´s website: http://www.fni.no/cv/cv-geh.html

Expert team member: Dr Andrew I. L. Payne

Primarily responsible for assessment under Principle 1

Dr Payne is an honours graduate of the University of London and completed post-graduate degrees at the Universities of Stellenbosch and Port Elizabeth in South Africa. He worked in Namibia for five years, South Africa for 25 years (eventually leaving in 2000 as Director of the Sea Fisheries Research Institute), and retired in 2013 from the Centre for Environment, Fisheries and Aquaculture Science (Cefas), UK, where he was initially Science Area Head for Fisheries and then "roving" international fisheries consultant in which role he managed a large commercial contract evaluating sites for future nuclear power stations to be built in the UK, and the Fisheries Science Partnership, an initiative bringing scientists and fishers together in a common aim to produce information of use to those charged with managing Europe's fish stocks. Most of his research was conducted in South Africa, and he has published widely in the scientific literature, mainly about fisheries management and demersal fish in particular. He was an active player in the Benguela Ecology Programme, was involved in drafting South Africa's first democratic fisheries policy (which later became enshrined as the Marine Living Resources Act), and was a leading player in the establishment of the Benguela Current Large Marine Ecosystem project and the Benguela Environment, Fisheries, Interaction, and Training (BENEFIT) project, the latter two concentrating on three countries, Angola, Namibia and South Africa. From 2003 to 2011, he was Editor-in-Chief (and from 2000 to 2003 editor) of the ICES Journal of Marine Science, was the founding editor/editor-in-chief (and now international panel member) of the (South) African Journal of Marine Science, and is Series editor of the Springer book series Humanity and the Sea. He has also conducted peer expert review of fisheries in Argentina, South Africa and the USA, and was involved in the EU's TACIS project on Sustainable Management of Caspian Fisheries, among other EU projects. He has conducted several accreditation reviews for the Marine Stewardship Council, the full ones being the first certification exercise for Antarctic krill and another for Russian pollock, has acted as expert reviewer for reports on US Limited Entry Groundfish Trawl fishery recertification and the South Georgia longline fishery for Patagonian toothfish, and has twice acted as condition-meeting evaluator for the SA deep-sea trawl fishery for hake.

Expert team member: Ms Lucia Revenga Giertych

Primarily responsible for assessment under Principle 2

Lucia Revenga is a marine scientist, specialising in Fisheries Biology. She holds a degree in Marine Sciences and in Environmental Sciences both from Cadiz University (Spain).

Between 2005 and 2010 she worked with TRAGSA for the Spanish General Marine Secretariat, the Spanish Institute of Oceanography and the Canary Islands Marine Sciences Institute, conducting research and writing reports concerning the biology and stock status of different species, studying and analysing the catch composition and population of the stocks, the species biology (sex and maturity), as well as reporting all the information concerning retained species. She has worked with different species (bluefin tuna, skipjack tuna, albacore, mackerel, sardine, eel, scarlet shrimps, prawns, Norway lobsters, sole, halibut, hake, seabreams,…), on board fishing vessels with different fishing gears (bottom trawlers, tuna traps and artisanal fleet) in Atlantic waters (NAFO area, Moroccan and Spanish waters). She has worked closely with different stakeholders, including fishermen, shipowners, institutional partners and the scientific community. She has also taken part in oceanographic surveys focused on the search for vulnerable marine ecosystems, sampling benthic habitats of deep-water canyons.

Since 2011 she has worked for IFAPA (Institute for Research and Training in Fisheries) as a fisheries biology teacher for fishermen. She has also conducted research on local fishery activities and tries to increase community awareness of the conservation of coastal ecosystems and to encourage sustainable fishing practices.

Previously she worked as a teacher and technician of environmental issues related to the ISO-14000 and ISO-9000 norms.

2.1.1 Peer Reviewers

The peer reviewers used for this report were Dr Graham M. Pilling and Dr Denzil G. M. Miller. A summary CV for each is available in the **Assessment downloads** section of the fishery's entry on the MSC website. Justification for choosing these peer reviewers:

Graham Pilling:

Worked on South Georgia and South Sandwich Islands fisheries; was a member of the original MSC assessment team for the Aker BioMarine krill certification; has worked in Antarctic marine ecosystem on fisheries. He as more than 19 years international experience in fisheries science, stock assessment and management advice, is currently involved in the provision of policy advice on the stock assessment of target species, implications of bycatch and ecosystem interactions for fisheries managers, has been involved in numerous MSC certification audit teams as P1 and/or P2 specialist – so is familiar with MSC methodology and criteria.

Denzil Miller:

Extensive experience of Antarctic krill biology and ecology as well as management issues, as evidenced by extensive list of publications; he was Convener of the CCAMLR Krill Working Group from 1987 to 1994, and has led 15 research cruises to the Sub-Antarctic and Antarctic. He served as Chair of the CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources) Scientific Committee (SC-CAMLR) from 1996 to 2000 and was CCAMLR Executive Secretary from 2002 to 2010.

2.1.2 RBF Training

RBF was not used for this fishery assessment.

3. Description of the Fishery

3.1 Unit(s) of Certification and scope of certification sought

Food Certification International Ltd confirm that the fishery is within scope of the MSC certification sought for the assessment as defined.

Prior to providing a description of the fishery it is important to be clear about the precise extent of potential certification. The MSC Guidelines to Certifiers specify that the unit of certification is **"The fishery or fish stock (biologically distinct unit) combined with the fishing method / gear and practice (= vessel(s) and / or individuals pursuing the fish of that stock)"**.

This clear definition is useful for both clients and assessors to categorically state what was included in the assessment, and what was not. This is also crucial for any repeat assessment visits, or if any additional vessels are wishing to join the certificate at a later date. The unit of certification for the fishery under consideration is as set out below.

The fishery assessed for MSC certification is defined as:

Species:	Antarctic Krill (*Euphausia superba)*
Stock:	Antarctic krill in Area 48
Geographical area:	Area 48, Antarctic Sea
Harvest method:	Pelagic trawl using own patented Eco-Harvesting system
Client Group:	All Aker BioMarine Antarctic vessels targeting Antarctic Krill in the Antarctic Sea area covered in Area 48, using Pelagic trawl using their own patented Eco-Harvesting system.

Please note that although the Unit of Certification details the full extent of what is being assessed, it is the full and complete Public Certification Report that precisely defines the exact nature of certification for this fishery.

This Unit of Certification was used as it is compliant with client wishes for assessment coverage and in full conformity with MSC criteria for setting the Unit of Certification.

3.2 Overview of the fishery

3.2.1 Aker BioMarine Antarctic

Fishery Ownership

Aker BioMarine is a Norwegian integrated biotech company providing biomarine ingredients through an optimized value chain, from raw materials to customer. It owns two vessels involved in the krill fishery and a transport vessel that carries the krill to the company's own storage facility in Uruguay.

History of the Fishery

Aker BioMarine began krill test fishing in 2003. The following year they began to harvest krill for use as a feed ingredient and in 2008 started to produce oil for human consumption. The company currently operates two fishing vessels, the *Saga Sea*, which has been operating since 2005/06 and the *Antarctic Sea*, which commenced operating in 2012. Norwegian notifications for the two vessels are similar at 65,000 t annually, but this catch level is not reached at the moment. See Section 3.3.3 for further information.

Organisational Structure

The fishery is managed by CCAMLR, the Norwegian Directorate of Fisheries and the Government of South Georgia and South Sandwich Islands. See Sections 3.5.1 and 3.5.4 for further information.

Area under Evaluation

Southern Ocean, CCAMLR Area 48

3.2.2 Species and Fishing Practice

Species type/s

There is one target species for the fishery under certification. As indicated initially, this report does not intend to provide a scientifically comprehensive description of the species. Interested readers should refer to sources that have been useful in compiling the following summary description of the species. See Section 7 for a list of references.

Management History

CCAMLR was established in 1982 with the objective *inter alia* of conserving Antarctic marine life. Based on the best available scientific information, the Commission agrees a set of conservation measures that determine the use of marine living resources in the Antarctic. The fishery under certification is managed by CCAMLR, in interaction with the Norwegian Ministry/Directorate of Fisheries and the Government of South Georgia and the South Sandwich Islands (GSGSSI). CCAMLR coordinates scientific research and observer programmes, establishes a total allowable catch (TAC) and distributes quotas between subareas. The Norwegian Ministry/Directorate of Fisheries issues fishery permits and performs quota control of the client vessels. CSGSSI issues permits for the vessels in the SGSSI Maritime Zone. See Sections 3.5.1 for further information.

Fishing Practices

Krill are harvested using a continuous midwater/pelagic trawl system that was developed specifically by Aker BioMarine for its own two vessels (Table 1). The system contains a fine mesh that prevents anything larger than krill from entering the system, and it is monitored by underwater cameras. See Sections 3.3.3 and 3.4.3 for further information.

Table 1: List of member vessels

Name	Vessel Reg. No.
Antarctic Sea	LAWR
Saga Sea	LNSK

Source: client

An up-to-date vessel list can be obtained by contacting FCI using the following details:

MSC Fisheries Department

Contact Email: fisheries@foodcertint.com

Contact Tel: +44(0)1463 223 039 (FCI main number)

Historical Fishing Levels

Exploratory fishing for krill began in the early 1960s. Catch levels were initially low and the build-up of catches was slow. It was not until the 1973/74 season that the fishery assumed commercial significance.

Soon, it focused on three main fishing grounds: to the east of South Georgia, around the South Orkney Islands, and north of the South Shetland Islands. The annual catch peaked in 1981/82 at well over 500 000 tonnes, 93% of which was taken by the Soviet Union. In subsequent years, catches stabilized at around 300 000-400 000 t. They then dropped to approximately 100 000 t per year when the Russians stopped krill fishing as a result of the economic problems following the dissolution of the Soviet Union. It is only recently that catches have again approached 200 000 t. Russia and the Ukraine later resumed krill fishing. Other participating nations include Korea, Japan, Poland and Chile, but only Poland and Japan have maintained a consistent presence. Norway, the US and China are among countries that have made small but inconsistent catches over the years, but show increasing interest in the fishery. See Section 3.3.3 for further details.

3.2.3 Administrative Framework

User Rights (Legal and Customary Framework)

The fishery is managed mainly by CCAMLR, interacting with the Norwegian Ministry/Directorate of Fisheries and the Government of South Georgia and the South Sandwich Islands (GSGSSI). CCAMLR coordinates scientific research and observer programmes, establishes TAC and distributes quotas between subareas. The Norwegian Ministry/Directorate of Fisheries issues fishery permits and performs quota control of the client vessels. CSGSSI issues permits for the vessels in the SGSSI Maritime Zone. See Section 3.5.1 for further information.

Legal / Administrative Status

National and international legal documents refer to and are in compliance with relevant international agreements, such as the 1982 Law of the Sea Convention and the 1995 Fish Stocks Agreement. Norwegian and South Georgia fishery authorities liaise closely with CCAMLR. See Section 3.5.1 for detail.

Involvement of Other Entities

The Antarctic and Southern Ocean Coalition (ASOC) had been actively involved in marine management in the Antarctic since the establishment of CCAMLR and was given observer status in 1991. ASOC is also a key partner to the Antarctic Krill Conservation Project. At a national level in Norway, WWF is actively consulted on krill issues by Norwegian fisheries management authorities. A formal partnership between the client and WWF-Norway has existed since 2006. Scientists from the Institute of Marine Research conduct research on board client vessels. See Section 3.5.2 for further information.

3.3 Principle One: Target Species Background

Principle 1 of the Marine Stewardship Council standard states that:

A fishery must be conducted in a manner that does not lead to overfishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

Principle 1 covers all fishing activity on the entire target species stock - not just the fishery undergoing certification. However, the fishery under certification would be expected to meet all management requirements, such as providing appropriate data and complying with controls, therefore demonstrably not adding to problems even if the problems will not cause the certification to fail.

3.3.1 Krill biology, life history, ecology and population dynamics

Introduction

The krill *Euphausia superba*, the target UoC species, is a key member of the Southern Ocean (Antarctic) ecosystem, providing a vital energy link between primary production and higher predators (baleen whales, seals, fish, birds and cephalopods). Few organisms in the region do not depend on or are impacted by krill, thought by some to have the largest biomass of any species on Earth. As much as 152–313 million tonnes of krill are thought to be consumed by its various predators each year (Miller and Hampton 1989). Krill are circumpolar and in the austral summer at least bounded on the north by the Antarctic polar front and seemingly by pack ice in the south, although it is not known accurately how far under the pack ice the krill distribution extends, rendering any survey estimates of biomass tenuous.

Being primarily herbivorous, especially between austral spring and autumn when there are extensive phytoplankton blooms in the Southern Ocean, krill feed mainly on phytoplankton, but can take advantage of other food resources to survive when such food is scarce, e.g. in winter when they have been recorded foraging on ice-algae. Krill actively search for food aggregations and feed rapidly to exploit locally good food concentrations.

There have been many studies on krill over the past century, covering all aspects from spatial distribution through life history, biology and ecology, but this section synthesizes current knowledge as a backdrop to subsequent discussion of stock status and fisheries. Key information in this respect is contained in the Discovery Reports of the 1930s, various sightings and commercial activities (generally on other stocks and species) throughout the 20th century, FIBEX acoustic study reports and the results of several other surveys, most of them other than the Discovery cruises having been relatively recent. Summary literature consulted to compile this summary includes the works of McWhinnie *et al*. (1976), Miller and Hampton (1989), Everson (2000), Miller (2003) and Nicol (2006), although specific aspects relating to certain life history characteristics are outlined in a wealth of other literature, some referenced as appropriate in the text that follows.

Distribution

The circumpolar spatial distribution of the species is underpinned by the main currents, of which the Antarctic Circumpolar Current (see Miller and Hampton, 1989) is probably the most influential. Notwithstanding, concentrations appear to be densest in Convention Area 48, and it is there where the current and most historical fisheries on krill have focused their attention, with just small catches being made in other areas. Indeed various survey results have indicated krill density in the western Atlantic sector of the Southern Ocean, which apparently contains about half of the whole Southern Ocean krill stocks and as a consequence of the geography there extends substantially farther north than elsewhere (Atkinson *et al.* 2004), some 2.5 times that in the Indian Ocean sector, and other indicators have demonstrated that krill abundance is somewhat less again in the Pacific Ocean sector.

Bottom topography (specifically shallow continental shelves and areas around islands) and key hydrographic features seemingly govern the spatial distribution of krill, ensuring the enhanced biomass of the species around the Antarctic Peninsula in Area 48. It is current-induced circulations, especially those associated with the Antarctic Circumpolar Current, that seed the circumpolar distribution of krill, notably from known spawning and nursery areas of the species around the Antarctic Peninsula, and it is variations in the strength of those flows that contribute to the variability in krill recruitment and biomass on a seasonal and annual basis (see Sushin and Shulgovsky 1999, Meredith *et al*. 2008). The

latter reference also shows how krill distribution and biomass fluctuations *per se* influence the distribution and sizes of other species and stocks that depend heavily on krill. On a smaller scale too, the distributions of the commercial krill aggregations in Area 48 are influenced strongly by the variations in these flows, including counter- or compensatory flows that carry krill to areas not so influenced by the main flow patterns. There are, however, hotspots of krill abundance, and Atkinson *et al*. (2008) state that retention of the stock in habitats that are sufficiently productive to support such a large, though fluctuating, biomass is key to the success of the species in the Southern Ocean.

Krill are generally categorized as being relatively passive components of ocean systems and currents, but there is good evidence too that adult krill are efficient swimmers that can sustain their motion against currents for long periods. Therefore, overall krill distribution is likely influenced by adults being able to remain in favourable (i.e. productive) habitats for long periods (Miller and Hampton 1989). The scientific literature and evidence based on commercial-size aggregations is not definitive in terms of whether krill follow repetitive diurnal migrations; some stocks seem to do so, whereas others may not. What is not questioned, however, is that krill are often distributed in layers and patches ranging from a few square metres across, through shoals, schools, swarms and even up to superswarms covering >100 km^2, and it is this aspect of their behaviour that renders them appropriate for commercial harvesting. Solitary or dispersed groups of krill are often found during research surveys, generally in a seasonally repetitive pattern, but such animals are not sought by the fishery. The commercially targeted krill are those in dense aggregations, generally around islands, over shallow shelves or associated with areas where water masses mix, and their swarming and schooling behaviour has been explained as an adaptive strategy to avoid selective predators such as fish and seabirds, as well as to increase efficiency in finding and utilizing their own food. Aggregations of krill may last a matter of hours, days or weeks, and their components vary considerably in shape, size and state of sexual maturity.

For any stock with a distribution as extensive as that of krill, there must be a good possibility that different stocks exist, but to date for krill, formal stock separation by any means, including genetics (Siegel 2000), has not been proven robustly.

Krill growth

Several techniques have been used to estimate krill age and longevity, but research is ongoing and the outputs still require verification (the reliable age determination of crustaceans in general is still work in progress). Krill apparently attain a maximum length of >60 mm and an age of >5 years. Modal progression in length-frequency data (de la Mare 1994a, 1994b) and laboratory experimentation have been used to determine the growth rate of krill, and it is clear that growth is highly seasonal and almost certainly depends on food availability. For instance, around the Antarctic Peninsula, the main fishing area, the peak season for krill growth is the austral summer (January/February), and it is at that time of year too that somatic fat reserves are accumulated and fishing targeting the valuable Omega 3 somatic oil in krill starts. The fat content of krill, and hence the oil yield, drops again as the ice advances north as autumn changes into winter, and is very low from May/June on.

During winter of course, food availability in the form of the plankton production on which krill depend is much less, so it has been assumed that little feeding takes place and that body size might then shrink, although a reduced metabolic rate then would be likely too. Laboratory experimentation has revealed krill surviving for 200 days or more without food but with some body shrinkage. Krill in the wild in winter have, however, been observed feeding on ice-algae as well as on other zooplankton components of the water column.

Reproductive biology and life history

Gravid females are usually found over the continental slope, less developed ones over the inner shelf or closer to the ice-edge, and spawning females mainly in open water. Spawning apparently lasts from late November to late March, but the onset of krill spawning varies spatially and between years. The extent of winter sea-ice and the duration of ice cover together seem to influence the onset of each spawning season, with overall less spawning success immediately following mild winters.

Several studies have shown that spawning biomass is a reasonable indicator of egg production, which itself is a major factor governing regional recruitment. Egg production is a product of female abundance, the percentage of females reproducing in a season, the number of spawning episodes (krill are batch-

spawners) and the number of eggs released per spawning episode, with each female producing 6000–10 000 eggs per episode. Not all females reproduce every year, the proportion of subadult and adult females reproducing within a season apparently varying from <20% to virtually 100%.

The number of batches of eggs released per season depends on interbrood period, which itself varies with location and year from a minimum of 6 to a maximum of 50 d in midsummer, almost certainly depending on food availability and environmental conditions. The number of spawning episodes per season has been demonstrated to range from 3 to 9 and the number of eggs released per episode is likely related to the mean body size of krill in the spawning aggregation, although that relationship is still tenuous.

Female krill generally spawn from an age of about 2 years near the sea surface and the eggs sink to hatch at depth, probably between 800 and 2500 m deep. The larvae then develop through various stages as they ascend in the water column. Feeding commences after 21–30 d at depths of 30–100 m at the fourth development stage, but the total development time from egg to final larva takes about 130 d. Male krill seem to mature at 3 years of age. Although krill can live for several years, the biomass of krill aged 5+ years is relatively small, apparently <1% of the total stock surveyed, meaning that older krill do not contribute substantially to overall population structure.

Population dynamics

Realistic estimates of the rate of natural mortality (M) for krill lie in the range 0.66–1.35 year^{-1}. Based on the method of Hoenig (1984), longevity of between 7 and 5 years would be consistent with natural mortality rates of between 0.62 and 0.87 year^{-1}, respectively.

Estimates of recruitment and recruitment indices are currently derived from survey data, and although no stock–recruitment relationship has been demonstrated for krill in the Antarctic Peninsula region to date, year classes have clearly been stronger in some years than others. One likely factor explaining variability in krill recruitment is the extent of sea-ice, Loeb *et al*. (1997) showing for instance that salps compete with krill for phytoplankton food when sea-ice extent is low. In any event, geographic variation in krill recruitment is huge, likely necessitating separate geographic estimation of recruitment levels. In some years, for instance, likely stimulated by geographic variation in sea-ice extent associated with local levels of productivity, recruitment in the dominant Atlantic Ocean sector has been excellent, whereas that in the Indian Ocean sector has been poor.

3.3.2 Krill stock status

As with all evaluations of stock health for species and stocks seeking MSC accreditation, rigorous numerical assessments of stock health through formal stock assessments (based on catch rates and/or survey data) and fishing and biomass levels against reference points have to be made in order to evaluate whether the fishery is operating sustainably. Crucial here is the emphasis in the evaluation on total stock rather than on the UoC fishery area alone, but for Antarctic krill with its massive estimated total biomass and circumpolar distribution centred on Area 48, the evaluations have tended over the years to concentrate on that area alone. The first certification of the Aker Biomarine fishery went into great detail on stock assessment, reference points and fishing levels against total stock size, and it is clear from the literature that not much has changed since that first evaluation. Unfortunately, no further fully synoptic survey of even Area 48 has been attempted, although individual countries, including Norway and Aker Biomarine itself, have been making serious attempts to collect representative annual survey data from specific areas (generally following a carefully selected fixed grid) and over time, and hopefully will ultimately coordinate their findings in an attempt to bring new, updated knowledge of total and area stock size to the consideration table.

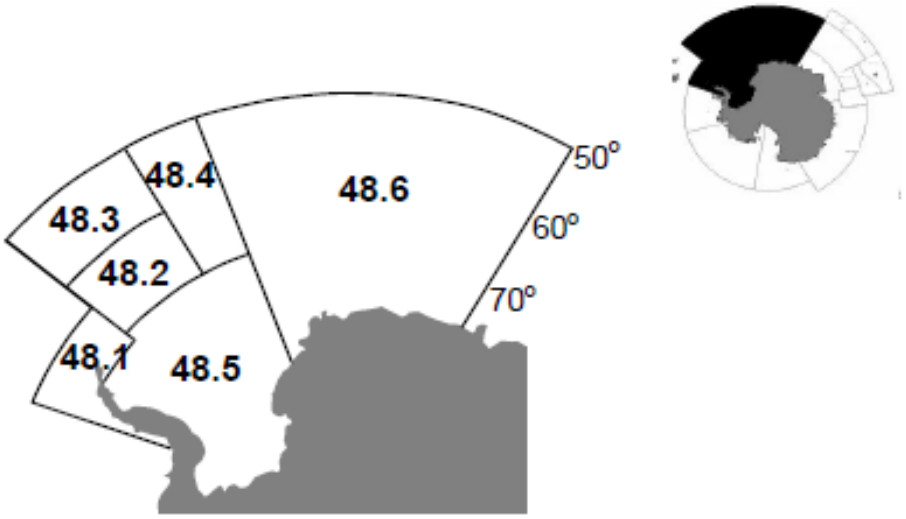
Succinctly, however, there is no annual or updated stock assessment of krill available, just new assessments of old data sometimes with fresh assumptions or different interpretations of parameters, supported by research findings that appear in the literature annually. As will be shown below, though, the fishery is operating at catch levels well below what would generally be regarded as a precautionary upper level relative to the best estimates available of stock size (i.e. a precautionary catch limit or PCL), although those estimates themselves vary extensively depending on the assumptions being made and the values for key parameters used. Of note here is the recent evaluation by Kinzey *et al*. (2013) that shows that because of the uncertainty inherent in an assessment based on supplying the Generalized

Yield Model (GYM) with a value of M of 0.8 and recruitment variability generated using a Beta distribution for proportional recruitment of krill, caution will have to be taken if management in future allows the trigger level to rise up towards the PCL level. For the purposes of this evaluation, however, it is deemed sufficient to present an updated summary of standard stock evaluation outputs, many based on knowledge tabled five years (when this fishery was first certified) or even more years ago. The key issue here is considered to be the likely effect of fishing levels on stock size(s) over time, and, as is shown in Section 3.5. below, the management rigour and controls applying to the stock are such that scientific confidence is good that current catch levels will not affect the total krill biomass adversely even if extraneous ecosystem and oceanographic/climate come into play.

Introduction

Area 48 is here considered to be a single management unit even if recruitment is shared with other areas (Pacific, Area 88; Indian, Area 58). Given the very limited and certainly inconsistent rates of exploitation of krill elsewhere than Area 48, managing Area 48 as a single separate stock is deemed to be appropriately precautionary. Making this assumption does not, though, preclude the future possibility of managing some small areas as self-recruiting single stocks if it is found that seasonal immigration from other areas is not essential in maintaining those small stocks. Miller (2003) and others have identified a few possible candidates for "separate self-sustaining small krill stock" status, generally based on survey and catch data aggregations, but to date no substantive proof has been forthcoming. The management areas currently in place (Subareas 48.1–48.6; Fig. 1) are based on CCAMLR's own precautionary management regime for krill, given that is unlikely that krill, or krill products, move extensively between smaller areas and following understanding of the oceanography of the Convention Area.

Figure 1: The location of subareas in Area 48 (South Atlantic) and (inset) the whole CAMLR Convention Area



Source WG-EMM-13/37 Rev. 1.

There has been concern, however, about localized depletion and ensuring that commercial catches leave adequate biomass to support local predator populations. This has led to an overall TAC, and trigger levels of catch (see below) for Area 48 divided among the smaller-scale subareas to ensure control over depletion in each subarea. CCAMLR does provide reasonably accurate catch data since 1980 on defined small-scale management units (SSMUs; see the extensive Table 4 of the document cited in the legend above) within the focal fishing areas of 48.1–48.3, but TAC and trigger level management of such SSMUs is still not carried out.

Stock assessment

As stated above, no formal (annual or less regular) assessment of krill is made. Catch reporting is good, but comprehensive age data and regular, verifiable survey data are lacking; those are the two data sources generally used to underpin the stock assessments of most fish stocks internationally. Reliable age data for invertebrates generally are scarce (although length data are available and have been used – see below), and a fully synoptic survey of the whole UoC fishing area is likely to be prohibitively expensive given its extent and geographic location. The CCAMLR scientific community therefore uses a different process to determine stock health. It sets a precautionary catch limit based on the potential yield of the stock as determined from the synoptic survey carried out in 2000, and it then requires that strong and effective monitoring systems be in place. CCAMLR set the initial limit to yield on the basis of estimated potential yield, and the software used to estimate that value, a Generalized Yield Model (see Constable and de la Mare, 1996), uses standard population model equations, but allows the population dynamics to represent particular stocks by setting appropriate parameter values for growth, natural mortality and recruitment.

Miller (2003) provides the life history information and parameterisation used in the GYM for krill, with growth and mortality estimates being drawn from length frequency data (de la Mare 1994a; 1994b). The GYM accounts for expected population production and random effects around it through variable recruitment, and the projection is used to calculate the appropriate TAC as a proportion of unexploited biomass (B_0) based on the harvest control rule. Unexploited biomass is estimated from surveys.

Integrated assessments, lessening the reliance on expensive synoptic surveys, and management strategy evaluation to test quota allocations have both been mooted as a means of improving the scientific evaluation supporting management, but remain a future hope rather than something that can be used immediately to improve stock assessment.

Biomass and abundance

CCAMLR's multi-ship acoustic survey of krill in Area 48 in 2000, for which the rationale and protocols are described in CCAMLR Science, Vol. 8 of 2001, is still the only fully synoptic survey available for krill biomass in Area 48 and provides the initial biomass estimate for the harvest control rule. Lacking a swimbladder, krill biomass is difficult to estimate acoustically, but novel methodology for the time was used to yield an initial estimate of krill standing stock (B_0) of 44.29 million tonnes. That value was used as a proxy for krill pre-exploitation biomass in the GYM, estimating krill sustainable yield based on the decision rule.

Subsequently, different models and target strengths have been applied to the same survey data, and a wide range of estimates of B_0 has been produced, from as little as 37.29 million tonnes (Demer *et al*. 2007) to as high as 207.98 million tonnes (Heywood *et al*., 2006), with several other estimates in between. Clearly, the level of uncertainty in all these estimates is great, but for the potential yield parameter used in management, a low estimate is still used.

Biomass varies seasonally as well as annually and this fact probably explains the year-on-year variation in survey estimates of biomass determined from surveys undertaken at different times of the year. To date, however, commercial catch per unit effort (cpue) data, annual or seasonal, have not provided a good index of abundance for comparative purposes given that fishing vessels tend to seek and target aggregations of a size depending on national targets for product.

Monitoring

Total catch of live weight is generally estimated from processed product, which is weighed. Inconsistencies in the conversion factors being applied between and even within nations (for example, see Table 5 of WG-EMM-13/37 Rev. 1) and a lack of information on discard practices have led to some concern that the quantity of krill being removed from the system is not documented sufficiently accurately. This concern gives rise to regular queries, for example, about catch estimates and ecosystem effects of the krill fishery. Observer coverage in the krill fishery is relatively good (though not in all cases nationally independent), however, and in the UoC fishery, it is 100% (and carried out by non-Norwegians), so the team is confident that krill fishing is being well monitored generally. Although Leape *et al*. (2009) have formally questioned the validity of the conversion factors being applied in the

UoC fishery, catches, even if they were to be subject to raising by as much as four times, are still very low relative to the precautionary annual catch (trigger) level set.

Other concerns raised about the effect of krill fishing have highlighted the selectivity of different gears, the bycatch of fish larvae, seabird warp strikes and incidental seal mortality as areas of concern. Also, the incidental mortality of krill from trawling (krill that pass through the net but may be damaged and die) has not been estimated.

Conservation measures for data reporting in the krill fishery do not require collection of biological information (sex and size information), but the UoC fishery does allow such data to be collected and analysed, and actively supports and sponsors such research effort. The Scientific Committee and WG-EMM have over the years commented extensively on the implications of new technologies in the krill fishery. In particular, concerns have been expressed that the continuous fishing system of the UoC fishery may be capturing different components of the krill population than other fishing methods and may have a greater ecosystem impact than conventional trawls would. Ongoing monitoring, preferably independently of fishing nation, and verification are therefore crucial to effective management of the resource.

The CCAMLR database now holds scientific observer data from a large number of trips/deployments for each fishing season, and can easily be perused. Bycatch in the krill fishery generally is low, and virtually nil in the UoC fishery, and the fishery anyway has in place effective bycatch mitigation measures. Specifically in the UoC fishery, which has a mesh excluder screen at the opening of the net and is rarely brought to the surface, contact with larger mammals and birds is low, and seal and seabird bycatch is negligible.

Harvest strategy

Article II of the CAMLR Convention lays the foundation for an "ecosystem approach" to management, requiring that harvested populations be monitored and assessed, that significant ecological interactions between harvested and other species be defined and quantified, and that levels of depletion be estimated in order to monitor their recovery, if necessary.

Management has to take account of krill‘s low and pivotal position in the Antarctic trophic structure, so sustainable exploitation needs to take account of the species’ interactions with other species (Miller 2003).

WG-EMM's terms of reference have been prioritized and cover requirements to provide scientific advice and to account for major uncertainties. Emphasis is given to ecosystem assessment and status, but although CCAMLR‘s role has been focused on conservation, the Commission has also been tasked with allowing development of fisheries within the Convention area. Therefore, although adequate protection needs to be afforded to krill-dependent predators at critical times and in specific areas, such protection should not exert unnecessary, or unreasonable, restrictions on the fishery (SC-CAMLR 1993).

Given the dynamics of the stock and its concentrations, krill stock boundaries are not delineated other than into Subareas (as stated above), but CCAMLR strategy is to manage fishery expansion in accord with its own management objectives (WG-EMM-08/46). Its primary controls remain catch limits and it does not set MSY as a target, because sustainable harvesting levels would almost certainly be well below a single-species krill MSY. The precautionary limits are therefore set commensurate with information available on stock dynamics.

In setting a krill precautionary catch limit, CCAMLR has used a potential yield estimate. Although that estimate does not take account of the potential effects of harvesting krill on the species’ dependent predators, the decision rule does. In addition, CCAMLR monitors krill predator populations, makes catch reports and supports periodic, fisheries-independent surveys of local biomass. Monitoring includes a long time-series of krill density and recruitment indices, although whether these will be sufficient to detect the impacts of fishing in a timely manner has not been tested.

The krill fishery overlaps with areas where foraging, land-based predators, particularly penguins, capture krill to feed their young during the rearing phase. Using a modelling approach and robust assumptions, Mangel and Switzer (1998) suggested that the required level of krill forage by penguin offspring, and adult foraging behaviour and relative local reproductive success could be inversely correlated with the fraction of the total krill biomass caught by the fishery. Notwithstanding, every effort

is being made to correlate data on potential krill fishery/predator (not just penguins) overlap with a view to identifying areas and times of likely most significant common use, with a view ultimately to developing spatial catch quotas for krill.

Conservation measure CM 51-01 (2010) requires that although the total combined catch of krill In Subareas 48.1–48.4 (little fishing is undertake currently in 48.5 or 48.6) be limited to 5.61 million tonnes in any fishing season, "until the Commission has defined an allocation of this total catch limit between smaller management units, …, the total combined catch in [the same areas] shall be further limited to 620 000 tonnes in any fishing season." That value is the so-called trigger level applied currently. Predator stocks are further protected from the fishery by Conservation measure CM 51-07 (2011) which requires that the same krill catch be distributed in such a way as not to be inadvertently or disproportionately affected by [krill] fishing activity. The measure goes on to recognize that large catches up to the trigger level from areas smaller than the subareas (i.e. SSMUs) be avoided, and that the distribution of the trigger level needs to provide for flexibility in the location of fishing in order to (i) allow for interannual variation in the distribution of krill aggregations, and (ii) alleviate the potential for adverse impacts of the fishery in coastal areas on land-based predators. Thence, no more than 25% of the trigger level catch (i.e. 155 000 t) can be taken from Subarea 48.1 annually, 45% (i.e. 279 000 t) from each of 48.2 and 48.3, and 15% (i.e. 93 000 t) from 48.4. Those percentages clearly add up to >100%, though it would be unlikely for more than one to be reached at a time. The aim of the measures (and strategy) is clear, however, to protect local availability of food to predators.

We note that catches have remained well below the overall trigger level, but that individual subarea triggers have been reached occasionally recently and fishing in some areas stopped, so the strategy does seem to be working effectively.

Additional provisions within the various measures in effect for the krill fishery deal with (monthly) data-reporting procedures, including ongoing requests to provide haul-by-haul data from the fishery and to carry scientific observers on krill vessels.

Harvest control rule

The harvest control rule for krill in Area 48 is a precautionary catch limit that has the objective of constraining exploitation to a safe level. The limit is based on krill potential yield estimated using the GYM, so is a proportion of pre-exploitation biomass (B_0). Estimates of krill recruitment variability, growth and natural mortality were used in a stochastic simulation to determine the likely effects of various levels of harvesting on the population. The GYM is used to estimate the probability density of possible krill population sizes at various levels of fishing mortality (F), including in the absence of fishing, by running the simulation many times with different random input values for recruitment. Outcomes from the simulations are used in the decision rule.

The two rules used in the approach are the recruitment criterion, that the probability of the spawning biomass falling below 20% of median pre-exploitation spawning biomass after 20 years should not exceed 10%, and the predator criterion, that the median spawning biomass should not fall below 75% of pre-exploitation spawning biomass after 20 years. The recruitment criterion therefore effectively includes a limit reference point of a general recruitment-overfishing threshold, and the predator criterion a target reference point for spawning biomass; together they address Convention Article II objectives 3a and 3b. The 20-year period specified relates to Convention Article 3c and allows integration of expanding exploitation levels with sustainability and precaution, so is good practice; it certainly allows for several generations of the stock (see below). Taking these two criteria into consideration in the model, the lowest value is accepted as the catch limit, and that value is reviewed annually and, of course, as stated in the subsection above, is well above the trigger level currently set for catches.

Having a precautionary catch trigger level (overall and for the subareas) in place prevents the decision rule having any practical effect on management and catches until true SSMUs are developed and applied. The overall value of 620 000 t is 50% above the historical maximum annual catch in Area 48 (400 835 t in 1986/87; WG-EMM-13/37 Rev. 1), but is nevertheless considered to be an arbitrary choice, less than that of alternative proposals made when it was originally established. The structuring of SSMU quotas is still deemed by the Commission to be necessary to render the management procedure fully consistent with ecosystem requirements (Article II of the Convention), but although in 2000 the Commission estimated development would take 5–10 years, practical issues of reporting, observer coverage, etc., still need to be dealt with before such a system becomes feasible. Ongoing modelling, including ecosystem-type modelling, is and has been used to examine possible

principles for subdividing the precautionary catch limit among SSMUs (i.e. smaller than the subareas), e.g. based on spatial distribution of historical catches, predator demand, krill biomass, krill biomass minus predator demand, krill availability indices that can be updated on a regular basis, and fishing strategies that rotate catches within and between the smaller areas.

Ultimately, various scenarios will likely be applied to the ecosystem models to evaluate their performance in allocating quota among SSMUs, and performance measures are being derived to cover the status of krill, predator populations and the fishery over relevant time- scales. This effort is deemed crucial to improving the management system covering the krill fishery as a whole, but with current total catches so low relative to potential yield, there is still some management resistance to implementing further controls on the fishery at this stage.

Uncertainty and the precautionary approach

The current assessment process is inclusive of parameter (fishery and ecosystem) uncertainty, and structural (model) uncertainty to the extent that several models are being developed, but the robustness of the decision rule to broader uncertainties has not been explored. For instance, the extent to which long-term changes to parameters, particularly those caused by changes in krill/predator distribution and particularly climate and the environment, would be incorporated into the harvest strategy is not clear. Another uncertainty not currently incorporated in the assessment and decision rules is implementation uncertainty, caused, for instance, by inaccurate reporting of catches, for instance. Of course, that uncertainty could be minimised by putting appropriate management measures in place or explicitly representing the uncertainty in the models.

There are naturally uncertainties associated with the fishery (see Leape *et al*. 2009, Johnston *et al*. 2009), so the question does arise whether the catch limit is sufficiently precautionary to preclude there being a high risk of unacceptable damage to the ecosystem. The trigger level catch, which is anyway arbitrary and above the historical maximum catch, is justified as precautionary primarily on the basis of the potential yield estimate.

The current average annual catch in Area 48, which is now rising slowly as new vessels begin to operate in the fishery, is still <30% of the trigger level catch (although it did slightly exceed 30% in 2009/10 and 2012/13), and that itself is just 11% of the potential yield (catch limit) estimated currently. Clearly, though, whether or not the trigger level is precautionary in terms of stock dynamics depends on the yield estimated from the GYM, which has its own uncertainties (Kinzey *et al*. 2013).

The harvest control rule used to calculate the potential yield is probabilistic, but it does not take account of all possible uncertainties. It does take account of recruitment variability through a Beta distribution for proportional recruitment of krill, but seasonal changes in stock size, natural fluctuations in krill abundance and long-term changes in productivity (e.g. caused by climate change) are not accounted for. Reference points and risk parameters are generic despite the considerable research activity undertaken on the species. For instance, the predator criterion refers to the simulation median after 20 years and is set half-way between $SSB_{50\%}$, which is a B_{MSY} proxy, and unexploited stock size; it is conservative relative to a single-species criterion and does reserve additional biomass for predators. The recruitment criterion refers to 10% of simulations after 20 years falling below 20% of the spawning stock, but again, there is no real justification for 10%, 20% or the 20 years used in the rule. The last value is, though, some three times the longevity and eight times the generation time. The decision rule will decrease the exploitation rate the longer this interval is, so considering the natural mortality of the species, 20 years would appear to be suitably precautionary. Also, if such a TAC were to be applied, the criteria in place mean that the reference points will likely be approached over that 20-year period, which should allow plenty of time to monitor the performance of the rule.

Current levels of exploitation are precautionary, but the range of values calculated and documented in the literature for B_0 do raise concern. All are based, as stated above, on the level of unexploited biomass calculated from a single synoptic survey carried out in 2000, and there is no seeming likelihood of this survey being conducted again soon, although some national efforts are being made to resurvey certain sectors regularly in a rigorous manner, including in the area covered by the UoC fishery. Differences in the various estimates generally exceed sampling standard errors and confidence ranges, suggesting that overall uncertainty is likely being underestimated, but at least the latest CCAMLR-approved estimate of unexploited biomass is taken from near the lowest of the range of values. Confidence is engendered in the management control system, however, when considering that the overall trigger level and individual subarea trigger levels are still well below the precautionary catch limit based on the GYM.

Elsewhere, mention is made of uncertainties and concerns related to the use of varying conversion factors for krill, from processed to live weight, and to the potential for discards not to be taken into account. These issues are almost certainly not relevant in terms of the UoC fishery, and despite total annual catches following a rising trend, it would seem highly unlikely given the current controls and conservation measures in place that catches will exceed the trigger levels in the short term. In the medium and longer term, however, if catches continue to rise, these issues are going to have to be addressed.

The monitoring system instituted by CCAMLR is probably adequate to detect any problems that may arise in the fishery overall, and in the UoC fishery, the observer, reporting and data-collection systems in place are as good as or better than those in place for many certified fisheries around the world. Hence, it is unlikely that the uncertainties within the total krill fishery, and the UoC fishery in particular, are so serious as to mitigate against recertification.

3.3.3 The fishery

History

Miller (2003) outlines the history of the development of the krill fishery. It started on a small scale in the 1960s, but it was not until the early 1970s that catches started to rise. Most commercial catches are made in the top 200 m of the water column, generally where the water temperature gradient is steep, the majority of catches about 50 m deep (Naganobu *et al*. 2008). According to the latter author too, commercial operations in Area 48, the main commercial area, have tended to focus on oceanic fronts.

From the early 1970s, total krill catches (not just in Area 48, though that area dominated the catches) rose steadily, from 19 785 t in 1973/74 to 528 201 t in 1981/82 and taken mainly by the former Soviet Union, but they then quickly collapsed, possibly because of marketing and processing problems likely associated with the discovery of high levels of fluoride in the exoskeleton of krill. When these technical problems were resolved with the introduction of new methods of processing and especially peeling, catches rose again, to attain a regular annual yield throughout the late 1980s of 300 000–400 000 t. However, with the break-up of the Soviet Union in the early 1990s, catches declined again, and it is only very recently that they have even approached a total value of 200 000 t again. Over the years, participating nations other than Russia and the Ukraine (both parts of the former Soviet Union), which dominated the developing krill fishery, have included Korea (initially in Area 58, but more recently focused in Area 48), Japan Poland and Chile, but other than Poland and Japan, they have not all maintained a consistent presence. Also, Norway in particular, the US and China, plus a few other countries that make small but inconsistent catches have shown or are showing interest in the fishery. Norway in particular has developed a successful new operating technique (continuous pumping; see below) and good markets for the products, so Norwegian catches now constitute the main commercial take of krill.

Miller (2003) considers the potential for krill harvesting outside the CCAMLR Convention Area to be minimal and indeed few catches have been made or recorded to the north. CCAMLR Subareas 48.1. 48.2 and 48.3 dominate the catch history, especially recently, and catches in other areas (e.g. Areas 58 and 88) have historically been small. Catches have always been concentrated on shelf-breaks, e.g. north and west of the South Shetland Islands, in a broader area north of the South Orkneys, and around South Georgia. Fishing patterns are linked to the distribution of sea-ice, operations generally commencing as the ice edge retreats south in spring and diminishing as the ice edge spreads north at the onset of winter. South Georgia waters (Subarea 48.3), however, remain virtually ice-free in winter, so krill fishing there is possible virtually year-round, although that area is subject to its own rigorous management regime on top of the CCAMLR system. For more than a decade (since 2001), the formal fishing (reporting) season of CCAMLR has been 1 December of one year to 30 November of the next (Conservation Measure [CM] 32-01), but historically, krill fishing in 48.3 tends to start later in each season, in winter as 48.1 and 48.2 are covered by the expanding ice field.

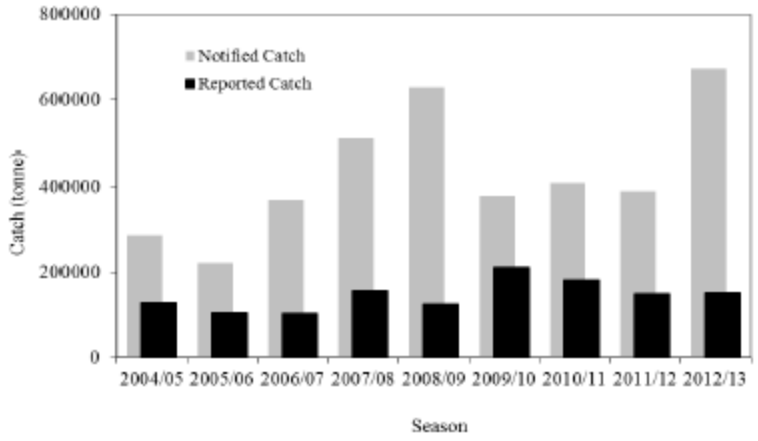
As stated above, market limitations are seemingly the major constraint on the fishery developing even further (Nicol and Foster 2003, Nicol *et al*. 2011; and see below), but there is still interest in the fishery in many CCAMLR member countries, with ongoing and sometimes collaborative international research and surveys being undertaken. Different fishing techniques are currently practiced by the fleet, but all

involve some form of midwater trawling (using pelagic trawls or trawls with a beam) on layers or aggregations of krill.

Notifications and catch reporting

To improve management and control, and for any country to be able to participate in the krill fishery, CCAMLR requires annual (in advance of each season) notifications of vessels and their potential catches, gear and fishing area (Conservation measure CM 21-03). However, to date and notwithstanding CCAMLR's attempts to bring the notification system to an acceptable and realistic standard, it has not been operating as effectively as wished. Annual notifications of potential fishing activity have thus far nearly always well exceeded not only the realized catches (with Area 48 dominating notifications; see Fig. 2), but also the catch levels (so-called trigger levels) at which subareas or even whole areas would have to be closed to protect the stocks (see previous subsection). New CCAMLR rules on notifications, and suggested greater cost to prospective participants, are hoped to solve the current rather loose notification system and support better management rigour in the krill fishery overall. However, the situation for 2013/14, the season during which this report is being produced, was that six countries (Chile, China, Korea, Norway, Poland and Ukraine) proposed fishing for krill in Area 48 (48.1–48.4, although Korea notified no proposed fishing in 48.4), amounting to a possible maximum catch of 545 000 t). Clearly, the system is not yet being used as effectively as it should in terms of alerting management to likely annual catches.

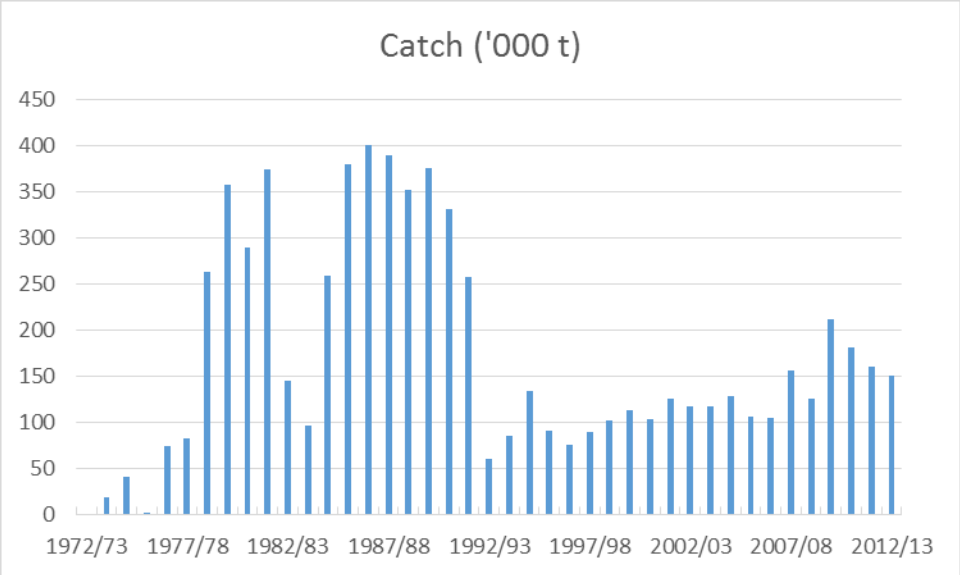
Figure 2: Notified and reported catches of krill in Area 48, 2004/05–2012/13 (note that the catch shown for 2012/13 is incomplete, only up to end May.



Source WG-EMM-13/37 Rev. 1.

Total annual catches of krill from the Convention Area are now on an upward trajectory again (Fig. 3), but although catches and notification levels are starting to converge and in all areas catches are well below peak historical values, there is still a need for participating member countries to become more realistic and less frivolous in their advance notifications of annual fishing activities. Virtually all catch reporting is swift and accurate, so there is confidence that management is maintaining control of catching activities, especially in the preferred Area 48, but a realistic notification system would render a good management system much better. So far, an individual subarea was closed in terms of its own trigger level having been reached only in 2009/10 and 2012/13. Such an ability to close a subarea quickly is reflective of a good reporting and management control system, lending confidence to belief that the system of managing krill catches is working effectively.

Figure 3: Annual Antarctic krill catches 1972/73–2012/13 in Area 48 The annual catch exceeded 200 000 t from 1978/79 to 1981/82, from 1984/85 to 1991/92, and more recently only in 2009/10. It peaked in 1986/87 at just over 400 000 t. The total Antarctic catch of krill peaked in 1981/82 at 528 201 t. Note that the 2012/13 catch only reflects the harvest up to May 2013



Source WG-EMM-13/37 Rev. 1.

Gear and product

Vessels tend to operate near known geographic features or in waters associated with specific hydrographic properties (e.g. fronts) and use echo sounders to locate the krill aggregations, including to determine their shape and orientation; searching speed is generally ~10 knots. They then set their gear to haul through the aggregation (at ~2 knots), but over time take cognizance of krill quality (oil content, etc.) to maximize product value. In the continuous fishing system of the UoC fishery, care is also taken when deciding on fishing depth not to block the net by making very large catches.

Krill aggregations tend to be smaller and catch rates lower during the earlier part of the fishing season, but they pick up as day length peaks during summer. As the season progresses into autumn and 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 drop. However, variations between years in sea-ice cover render this pattern inconsistent between years. Fishing is around the clock if weather conditions, krill availability and ice cover allow, but later in each fishing season, night-time fishing tends to stop (except when vessels use the continuous fishing system) as the krill aggregations migrate diurnally and disperse.

Miller (2003) notes that most (>95%) krill swarms are <1 t, making fishing them subeconomic, but there seem nevertheless to be sufficient large aggregations in the focus Subareas 48.1, 48.2 and 48.3 to support the current level of fishing activity there. Fine-mesh pelagic trawls are deployed by the fleet and they are either brought aboard the vessels after each tow, brought to the side of the vessel and then pumped out, or fished continuously for up to four weeks with the krill being pumped continuously from the codend (the UoC fishery). The last system is successful not only because it minimizes damage to the net caused by hauling and shooting it continuously, which would also waste valuable potential fishing time, but also because interactions between the net and surface predators of krill (especially seals and birds) are mitigated. Various net configurations are used by the fleets operating in the CCAMLR Convention Area currently, likely having some influence on gear selectivity (Krag *et al*. 2013), and such information is generally recorded by observers and submitted to the Commission, although observer coverage throughout the fleet is not yet complete.

The main limitations on catching are almost certainly processing capacity and attendant quality issues. Large catches may result in poorer quality (or crushed) material being brought aboard, and krill product quality is enhanced too if it is processed within a couple of hours of coming aboard. Therefore, in vessels

not operating the continuous pumping system, hauls tend to be short, e.g. 30 minutes, depending on aggregation density.

Currently, the main products by mass are boiled-and-frozen krill (for human consumption), fresh frozen krill (used for bait and as food in aquaculture, and as seasoning for human consumption) and meal. Production of Omega 3 oil and other organic (mainly lipid) products is not large in terms of mass, but it is valuable in certain still-developing markets. Fresh frozen krill are best processed within 2–3 h of capture, although peeled and boiled-and-frozen krill can be stored at low temperature for 3–4 h before final processing.

Krill actively feeding on phytoplankton tend to be avoided by the fleet if the final product is for human consumption because not only is such product considered less desirable by end-consumers, but processing time has to be shorter to preclude quality concerns. As processing technologies have improved, there has been increased demand for peeled krill for meal production and for whole animals for bait or biochemical processing (Everson 2000). Meal production is also increasing year on year and the aquaculture market for whole krill is expanding. In fisheries targeting krill for human consumption and bait, the bycatch tends to be largely discarded, but it is retained and used in the meal fishery.

Three size classes of krill tend to be categorized throughout the fishery other than that part targeting meal production: LL (>45 mm), L (35-45 mm), and M (<35 mm). The largest size class is easier to peel automatically and the two larger classes are preferred for both human consumption and as bait.

The Unit of Certification (UoC) fishery

Aker BioMarine currently operate two catcher/processor vessels, the *Saga Sea*, which has been operating since the 2005/06 season and the *Antarctic Sea*, which commenced operations in 2012. Both spend most of the year at the fishing grounds. Although the latter vessel is slightly bigger, they use the same gear configuration (for continuous trawling) and there are differences in processing capacity between the two, with the *Saga Sea* currently processing some 25% more than the *Antarctic Sea*. Norwegian notifications (see above) for the two vessels are similar at 65 000 t annually, but annual catches by each do not reach this level at the moment, although they are anticipated to get closer to it over time. *Saga Sea* processed catch volume exceeds that of the *Antarctic Sea*, but the differential is likely to diminish with time and experience. The net they are fishing is more than 200 m long, with the first panel of 50 m having meshes of 400 mm, the second panel of ~85 m having meshes of 200 mm, the next two panels of 29 m each having meshes of 22 mm, and the shorter codend (20 m) also having meshes of 22 m. Net circumference at the opening is 80 m and when operating effectively, the mouth is about 20 m in vertical and horizontal spread.

3.4 Principle Two: Ecosystem Background

Principle 2 of the Marine Stewardship Council standard states that:

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent ecologically related species) on which the fishery depends.

The following section of the report highlights some of the key characteristics of the fishery under assessment with regard to its wider impact on the ecosystem.

3.4.1 Retained catch

CCAMLR Conservation Measure 51-06 (2012), which covers general measures for scientific observation in fisheries for *Euphausia superba*, reaffirms the need for adequate monitoring and management of the krill fishery and recommends observer coverage 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.

Cruise reports submitted by CCAMLR scientific observers record catch details for all species and 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.

Sampling methodology is established in Part II, section 11 of the Manual. The observer is requested to select a haul or a two-hour period of continuous fishing, and to ensure that all large fish are removed from the conveyor during this haul/time-period and are retained for subsequent weighing and identification. At the same time, the observer is instructed to take a 25 kg sample, to remove all fish and to record the total mass of each fish species. Then he/she has to take a 10 kg subsample from the remaining krill sample and to sort carefully through this, again removing any fish and recording the total mass of each fish species. Following that, the requirement is to take two 1-kg subsamples from the remaining krill sample and to sort through each of these, again removing and recording the total mass of any remaining fish species (paying particular attention to larval fish). When accurate taxonomic identification of material is impossible, samples are photographed and kept for later study.

Following AKER BioMarine's first MSC certification, and in order to meet the second condition that arose then, information from observers' reports for the period 2007–2011 was submitted to MRAG for analysis of larval fish bycatch. The MRAG report is comprehensive and available, but some of the most pertinent information is repeated here for ease of access by the reader. The results of the analysis show that myctophid (lanternfish) and channichthyid (icefish) species dominated the bycatch, but with occasional small quantities of nototheniids present too. A list of the species caught is given in Table 2.

The MRAG report also summarizes bycatch rates of the different species into species groups (Table 3), where ICE refers to all icefish species group, LAN to myctophids (lanterfish) and NOT to the notothenid species group. FIN refers to all other finfish species. Table 3 is therefore a summary version of Table 2.

Figures 12, 13 and 14 of MRAG (2012) show standardized counts of icefish, lanternfish and notothenid individuals per tonne sampled. Together, the three groups account for ~1000 individuals per sampled tonne. As a precautionary proxy, one could consider that each larva weighs about 2 g, which would yield a final weight of 2 kg of retained larvae per tonne sampled. In other words, 0.2% of the catch composition can be considered as retained species other than krill. The gear and the fishing strategy can be considered as highly selective. However, because this small weight represents a large number of individuals, continued monitoring of fish larvae is necessary in future.

Table 2: Unstandardized total numbers of fish larvae in the *Saga Sea* catch by species code and species name, 2007–2011.

Code	Species name	English name	Area 48.1	Area 48.2	Area 48.3	Total
ANI	*Champsocephalus gunnari*	Mackerel icefish	3	2	367	**372**
ANS	*Pleuragramma antarcticum*	Antarctic silverfish	5	20	0	**25**
ART	*Artedidraco spp*	-	1	0	0	**1**
BTI	*Bathydraconidae*	Bathydraconidae	0	2	0	**2**
ELN	*Electrona antarctica*	-	0	6	0	**6**
FIC	*Cryodraco antarcticus*	Long-fingered Icefish	9	1	0	**10**
ICX	*Channichthyidae*	Icefish spp	24	150	22	**196**
JIC	*Neopagetopsis ionah*	Crocodile icefishes	3	20	0	**23**
KRA	*Krefftichthys anderssoni*	Lanternfish spp.	0	**4**	16	**20**
LXX	*Myctophidae*	Lanternfish	10	337	213	**560**
MIC	*Chionodraco myersi*	Myers' icefish	2	1	0	**3**
MOY	*Muraenolepis microps*	Smalleye moray cod	0	9	26	**35**
MRL	*Muraenolepis spp*	Moray cods	0	0	2	**2**
NOC	*Notothenia coriiceps*	Black rockcod	0	5	0	**5**
NOG	*Notothenia gibberifrons*	Humped rockcod	1	**44**	1	**46**
NOL	*Nototheniops larseni*	Painted rockcod	1	5	14	**20**
NOT	*Patagonotothen brevicauda*	Patagonian rockcod	0	19	0	**19**
NOX	*Nototheniidae*	Rockcods	3	12	23	**38**
NTO	*Notolepis coatsi*	Antarctic jonasfish	0	38	0	**38**
PGE	*Parachaenichthys georgianu*	Bathydraconidae	0	3	0	**3**
PRE	*Protomyctophum tenisoni*	-	0	5	0	**5**
RTX	*Macrouridae*	Grenadiers, rattails ne	1	0	0	**1**
SGI	*Pseudochaenichthys georgia*	South Georgia icefish	9	15	0	**24**
SSI	*Chaenocephalus aceratus*	Blackfin icefish	22	3	0	**25**
TIC	*Chionodraco hamatus*	-	6	0	0	**6**
TOA	*Dissostichus mawsoni*	Antarctic toothfish	1	5	0	**6**
TOT	*Dissostichus spp*	Toothfish spp	0	0	2	**2**
TRT	*Trematomus spp*	Trematomus spp	3	0	0	**3**
WIC	*Chaenodraco wilsoni*	Spiny icefish	17	2	0	**19**
YDB	*Cryodraco spp*	-	48	11	0	**59**
TOTALS			**169**	**719**	**686**	**1 574**

Source: Analysis of larval bycatch report, MRAG 2012

Table 4 lists the species groups, subarea and season-specific bycatch rates of fish larvae (number of individuals per tonne of krill caught), and Table 5 is precautionary total larval fish bycatch estimates (numbers and tonnes) by subarea, species group and season for a normal ice year and a low ice year. The MRAG report (MRAG 2012) assumes that the bycatches of channichthyiids and notothenioids were exclusively *Champsocephalus gunnari* and *Notothenia rossii*, respectively, the species of greatest

concern in the analysis. It is also of note that very few of the icefish larvae recorded in Subarea 48.1 and 48.2 were actually *C. gunnari*, the main species of concern in the area.

Table 3: Total numbers of fish larvae in the *Saga Sea* catch composition by species group, 2007–2011.

Code	English name	Area 48.1	Area 48.2	Area 48.3	Total
FIN	Finfish group	2	47	28	77
ICE	Icefish group	143	210	389	742
LAN	Lanternfish group	10	352	229	591
NOT	Notothenid group	14	110	40	164
Totals		169	719	686	1 574

Source: Analysis of larval bycatch report, MRAG 2012

Table 4: Species group, subarea and season-specific bycatch rates of fish larvae (number of individuals per tonne of krill caught).

Area	Species code	Number of individuals per tonne of krill caught.	
		Summer	Winter
48.1	ICE	6 272	6 272
48.2	ICE	3 850	804
48.3	ICE	0	5 026
48.1	LAN	0	0
48.2	LAN	3 444	3 444
48.3	LAN	0	5 048
48.1	NOT	838	838
48.2	NOT	1 224	1 224
48.3	NOT	0	370

Source: Analysis of larval bycatch report, MRAG 2012

The MRAG report concludes that it is highly unlikely that the rates of larval fish bycatch of the *Saga Sea* pose any threat to lanternfish, icefish or nototheniid stocks in Area 48. It is also deemed unlikely that the addition of the *Antarctic Sea* to the UoC fishery would result in significant risk to these stocks.

Table 5: Precautionary total larval bycatch estimates (numbers and tonnes) by subarea, species group and season for a normal ice year and a low ice year.

Scenario	Area	Species code	Summer (number)	Winter (number)	Total (number)	Total (tonnes)
Normal ice year	48.1	ICE	18 816	6 272	25 088	0.132
	48.2	ICE	88 549	24 913	113 462	0.596
	48.3	ICE	0	175 911	175 911	0.925
	48.1	LAN	0	0	0	0
	48.2	LAN	79 222	106 777	185 999	1.019
	48.3	LAN	0	176 677	176 677	0.968
	48.1	NOT	2 514	838	3 352	0.008
	48.2	NOT	28 154	37 946	66 100	0.160
	48.3	NOT	0	12 936	12 936	0.031
Low ice year	48.1	ICE	31 360	344 956	376 316	1.978
	48.2	ICE	111 648	4 018	115 667	0.608
	48.3	ICE	0	45 234	45 234	0.238
	48.1	LAN	0	0	0	0
	48.2	LAN	99 888	17 222	117 110	0.641
	48.3	LAN	0	45 431	45 431	0.249
	48.1	NOT	4 189	46 084	50 273	0.122
	48.2	NOT	35 498	6 120	41 618	0.101
	48.3	NOT	0	3 326	3 326	0.008

Source: Analysis of larval bycatch report, MRAG 2012

3.4.2 Bycatch

According to CCAMLR scientific observer reports from the UoC fishery, all species recorded in the catch composition are used in the intended products, mainly fishmeal and krill oil. 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; all species in the catch are retained. Therefore, all the species in the catch are considered as target and retained species.

Interactions with other bycatch species such as birds, penguins or marine mammals (those not considered to be ETP species) are recorded by scientific observers on board the vessels. The observation methodology in terms of the interactions between seabirds and marine mammals and fishing operations is provided in Part II, section 12 of the CCAMLR Scientific Observer Manual, and the periods and durations of the observations are detailed. Table 6 summarizes records of the species reported (i.e. seen) by the observers on board. Levels of interactions of these species with the vessel or the fishing gear are listed in Tables 7 and 8.

Table 6: A summary of species reported seen by observers in all MRAG observer reports for the years 2012, 2013 and January–June 2014. Quantities are given when detailed in the reports. (X: presence; 0: absence). (IUCN status: DD, data-deficient; LC, least concern; NT, near threatened; T, threatened; VU, vulnerable; EN, endangered)

Year			2012	2013	2013	January – June 2014	January – June 2014
Vessel			*Saga Sea*	*Saga Sea*	*Antarctic Sea*	*Saga Sea*	*Antarctic Sea*
FAO code	IUCN status	Species					
CAA	LC	South polar skua	X	0	0	0	0
CAM	LC	South polar skua	X	0	X	0	0
CAQ	LC	Sub-Antarctic skua	X	X	X	X	0
DAC	LC	Cape petrel	X	X	X	X	X
DIC	EN	Grey-headed albatross	X	X	X	X	0
DIM	EN	Black-browed albatross	X	X	X	X	X
DIX	VU	Wandering albatross	X	X	0	X	0
FGQ	LC	Black-bellied storm petrel	0	X	0	X	0
FUG	LC	Southern fulmar	X	X	X	X	X
HBE	LC	Blue petrel	0	X	0	0	0
ISQ		Antarctic shag	X	X	0	X	0
KIW	DD	Killer whale	33	X	>15	3	0
LDO	LC	Kelp gull	X	X	X	X	X
LRD	LC	Kelp gull	X	0	0	0	0
MAI	LC	Southern giant petrel	0	0	X	X	X
MBX	LC	Giant petrel	X	X	X	X	X
OCO	LC	Wilson's storm petrel	X	X	0	X	X
PAD	LC	Antarctic prion	X	X	0	X	0
PAN	LC	Snow petrel	X	X	X	X	X
PFG	NT	Sooty shearwater	0	0	0	X	0
PHE	NT	Light-mantled sooty albatross	X	X	X	0	0
PHU	EN	Sooty albatross	0	0	0	X	0
PRO	VU	White-chinned petrel	X	X	X	0	0
PUG	LC	Greater shearwater	0	0	X	0	0
PWP	LC	Snow petrel	0	X	0	X	0
PWX		Prions, nei	X	0	0	0	0
PYD	LC	Adelie penguin	X	X	0	X	X
PYN	LC	Chinstrap penguin	X	X	X	X	X
PYP	NT	Gentoo penguin	X	40	X	1110	X
SKZ	LC	Skuas	X	0	0	0	0
SVI	LC	Antarctic tern	X	X	X	X	X
SVZ	LC	Arctic tern	0	0	X	0	0
SWS		Paleface sheathbills	0	0	0	X	0
SWS	LC	Snowy sheathbill petrel	0	X	0	X	0
SXX	LC	Weddel seal	0	2	2	0	0
SXX	LC	Crabeater seal	0	>32	>100	55	X
TAA	LC	Antarctic petrel	X	X	X	X	X

Source: MRAG observer reports for the years 2012, 2013 and 2014 (the latter, to June)

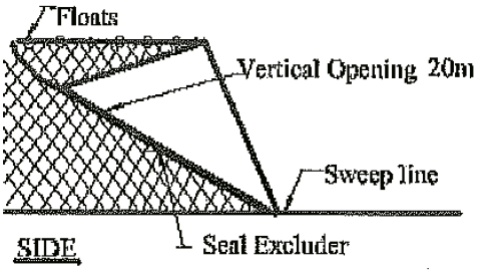
The fishing strategy in the UoC fishery, with long hauls of 20 or 25 days (proxy), slow towing speed (2 knots), quick sinking of the net on deployment, and the rigging of the trawl warps, which enter the water close to the stern of the vessel in order to reduce the potential for birds to strike the warps during fishing

operations, all contribute to the low number of interactions recorded by observers during fishing operations.

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.

A Marine Mammal Exclusion Device (Fig. 4) is present in each of the nets to prevent marine mammal entanglements, particularly by seals. There are eight escape holes (1 m diameter each) cut out at the top of the net panel to facilitate marine mammal escape. The net opening is covered by a fine-mesh excluder that actively excludes marine mammals and penguins from the net and hence becoming trapped.

Figure 4: Marine mammal exclusion device in the UoC fishery



Source: AKER BioMarine

Table 7: Summary of warp strikes reported in observer reports for the years 2012, 2013 and January–June 2014. All of the species listed were released alive with no apparent injury or escaped unharmed.

		Snow petrel	Southern fulmar	Cape petrel	Wilson's storm petrel	Kelp gull	Chinstrap penguin	
Year	Vessel	PAN / PWP	FUG	DAC	OCO	LRD / LDO	PYN	TOTAL
2012	*Saga Sea*	4	4	5	5	1	0	**19**
2013	*Saga Sea*	0	15	5	0	0	0	**20**
2013	*Antarctic Sea*	0	0	5	0	0	0	**5**
2014 (January-June)	*Saga Sea*	0	1	7	0	0	0	**8**
2014 (January-June)	*Antarctic Sea*	0	0	0	0	0	1	**1**

Source: MRAG observer reports for years 2012, 2013 and January–June 2014

Table 8: Summary of bycatch fatalities as reported in observer reports for the years 2012, 2013 and January–June 2014.

Year	Vessel	Southern fulmar	Cape petrel	Snowy egret	Wilson's storm petrel	TOTAL
2012	*Saga Sea*	3	2	0	0	**5**
2013	*Saga Sea*	0	2	0	0	**2**
2013	*Antarctic Sea*	0	0	1	0	**1**
2014 (January-June)	*Saga Sea*	0	0	0	1	**1**
2014 (January-June)	*Antarctic Sea*	0	1	0	0	**1**

Source: MRAG observer reports for years 2012, 2013 and January–June 2014

As stated above, direct interactions have been reported to be minimal. Indirect effects of the fishery on predators such as crabeater seals, Adélie, chinstrap, gentoo and macaroni penguins have been studied by mapping selected krill predator summer foraging ranges and overlaying it on known fishing activity areas of AKER Biomarine's *Saga Sea* for the period 2007–2011 (Nicoll and Douglas 2012).

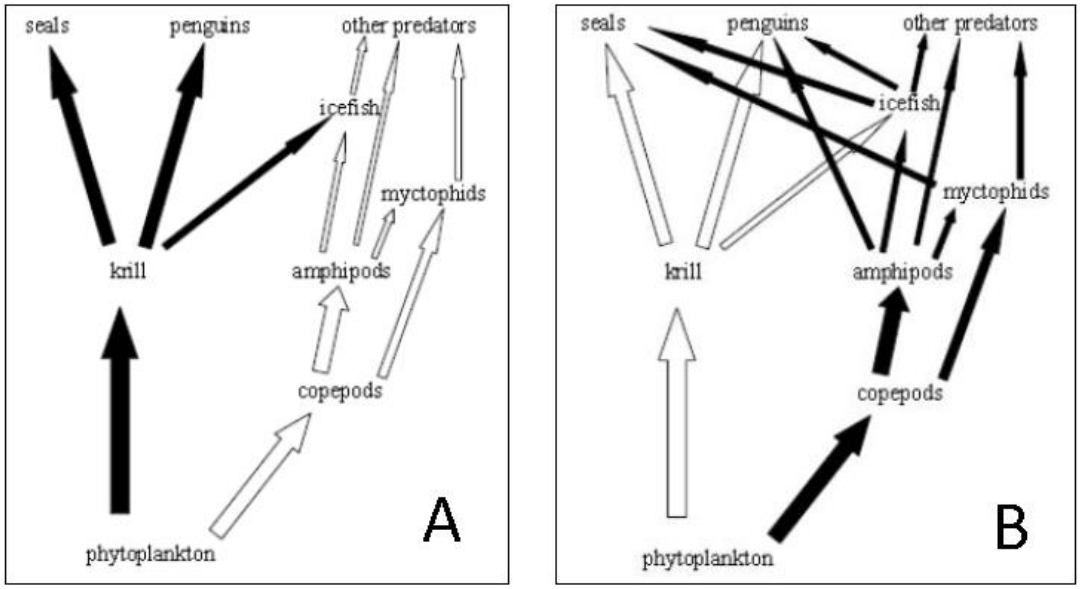
Species such as the macaroni penguin overlap with summer krill-fishing operations around the Antarctic Peninsula, but there is much less overlap elsewhere. Crabeater seals appear to have a moderate to high degree of overlap between year-round krill-fishing operations and their projected foraging distribution. Adélie penguin summer foraging activity shows an overall low level of overlap with fishing activity throughout the year. For chinstrap and gentoo penguins, there is a low overall level of overlap between their foraging distribution and the fishing activities.

Fraser and Hofmann (2003) reported that during the breeding season, Adélie penguin foraging trip duration varied in a non-linear manner, but in accordance with sea-ice extent and changes in krill abundance. Years with the lowest sea-ice extent were associated with the longest foraging trip durations and the lowest measures of krill abundance. Years with intermediate or extensive sea-ice cover were associated with shorter foraging trip durations and greater krill abundance. These relationships are particularly evident during the breeding season.

According to Murphy *et al.* (2007), some species also look for alternative breeding options in years when krill are scarcer (Fig. 5).

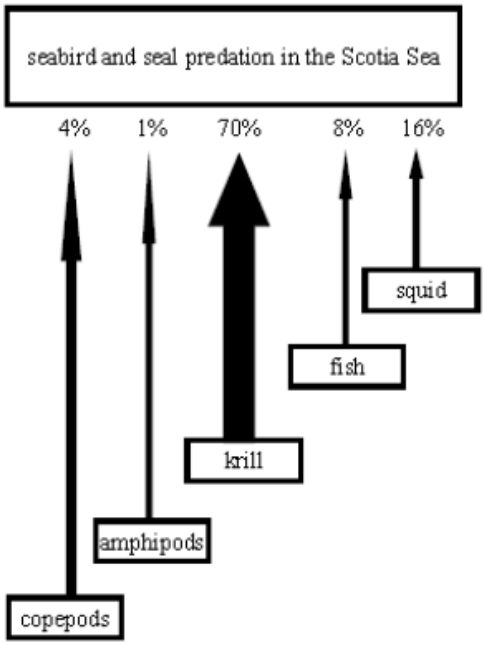
Seabird and seal predation in the Scotia Sea, and their dependence on krill abundance, were also studied by Murphy *et al.* (2007) – see Fig. 6. As the estimates provided are based mainly on summer studies, however, they are likely to overestimate the importance of krill in the diet.

Figure 5: Schematic illustration of alternative pathways in part of the Scotia Sea foodweb, showing shifts between (A) years when krill are abundant throughout the Scotia Sea, and (B) years when krill are scarce. Major pathways are shown as black arrows.



Source: Murphy et al. (2007).

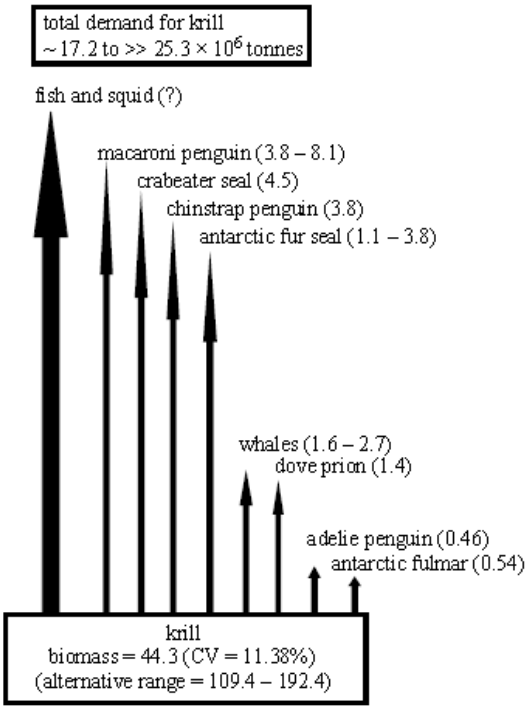
Figure 6: Proportional consumption of different groups of prey by the major predators in the Scotia Sea.



Source: Murphy *et al*. (2007).

Removals by the fishery have been estimated to be orders of magnitude below both the demand by predators and the biomass available to both predators and the fishery. Hewitt *et al.* (2004) estimated the annual consumption of krill in Area 48 for different predators to be 15 223 000 t. Murphy *et al.* (2007) also estimated the annual consumption of krill (in 10^6 t per year) by the main krill predators in the Scotia Sea foodweb (Fig. 7). However, those estimates are based mainly on summer studies that are likely to overestimate the importance of krill in the diet.

Figure 7: Estimates of annual consumption of krill (10^6 t) by the main krill predators in the Scotia Sea foodweb.



Source: Murphy *et al*. (2007).

3.4.3 ETP Species

According to MSC guidelines, ETP species under consideration should be based on the listing by CITES. The South Georgia and South Sandwich Islands have identified the following CITES species in their waters:

- *Arctocephalus gazelle* (Antarctic fur seal)
- *Australophocoena dioptrica* (spectacled porpoise)
- *Balaenoptera bonaerensis* (Antarctic minke whale)
- *Balaenoptera borealis* (sei whale)
- *Balaenoptera musculus* (blue whale)
- *Balaenoptera physalis* (fin whale)
- *Cephalorhynchus commersonii* (piebald dolphin)
- *Eubalaena australis* (southern right whale)
- *Hyperodon planifrons* (southern bottlenose whale)
- *Megaptera novaeangliae* ((humpback whale)
- *Mirounga leonine* (elephant seal)
- *Phocoena dioptrica* (spectacled porpoise)
- *Physeter macrocephalus* (sperm whale)

Interactions with ETP species are recorded by scientific observers on board the fishing vessels. Tables 9 and 10 list the species seen by observers during the fishing trips for the years 2012, 2013 and January–June 2014.

Table 9: ETP species seen and their FAO code

Species	FAO code
Fin whale	FIN
Humpback whale	HUW
Southern right whale	EUA
Minke whale	MIW
Southern bottlenose whale	SRW
Antarctic fur seal	SEA
Southern elephant seal	SES

Source: MRAG observer reports for years 2012, 2013 and January–June 2014

Table 10: Number of individuals of the different ETP species seen by observers. The observers report that most of these species did not interact at all with the vessel or the fishing gear.

Year	Vessel	FIN	HUW	EUA	MIW	SRW	SEA	SES	Unknown whale
2012	*Saga Sea*	> 340	>785	>29	0	0	>5431	0	>40
2013	*Saga Sea*	>22	>1043	>52	3	2	>7156	0	>178
2013	*Antarctic Sea*	>87	>530	141	2	0	>10000	0	>25
2014 (January-June)	*Saga Sea*	>394	>390	>112	0	0	>1175	Abundant	>219
2014 (January-June)	*Antarctic Sea*	Abundant	Abundant	Abundant	0	0	Abundant	0	Abundant

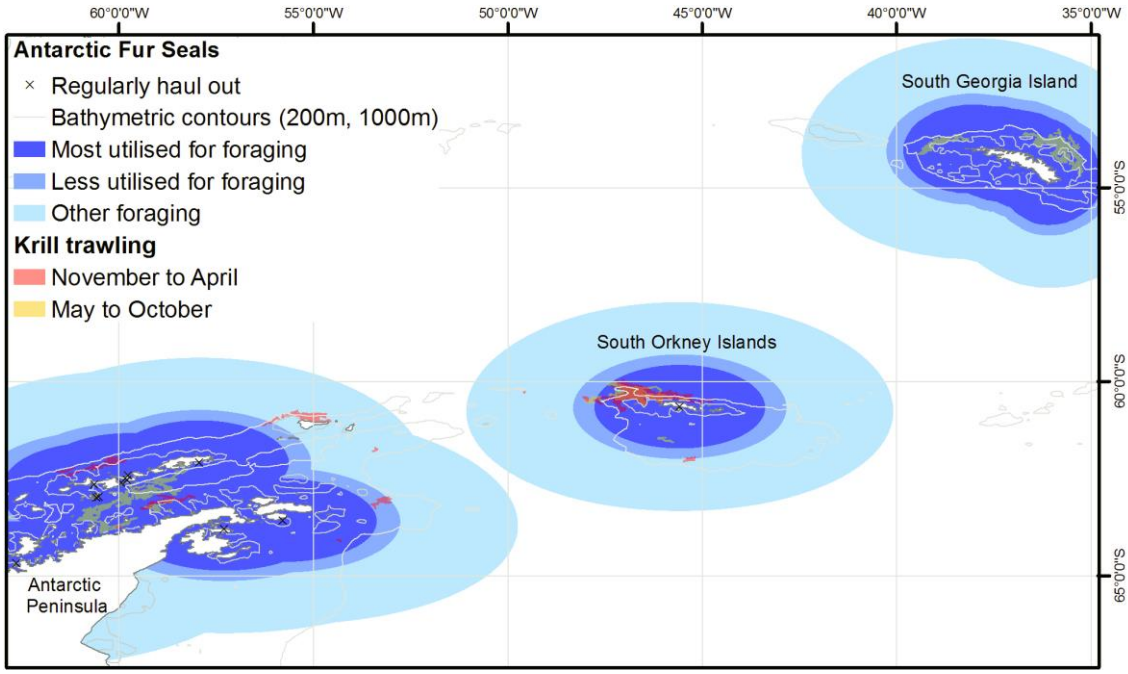
Source: MRAG observer reports for years 2012, 2013 and January–June 2014

As mentioned above, 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 chance of birds or marine mammals encountering the net, such as the Marine Mammal Exclusion Device shown in Figure 4.

On 4 August 2013, an Antarctic fur seal became entangled in the fishing gear of the *Antarctic Sea* and was killed. This is the only ETP species entanglement reported by observers in the last 2½ years, although Antarctic fur seals normally swim, play or feed close to the net during hauling.

Indirect effects of the fishery on predators such as Antarctic fur seals have also 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 of Aker Biomarine's *Saga Sea* for the period 2007–2011 (Nicoll and Douglas 2012). For the Antarctic fur seal (a CITES-listed species), the analysis showed a high degree of overlap of year-round fishing operations and the summer foraging ranges of the species (Fig. 8).

Figure 8: *Saga Sea* summer and non-summer fishing effort, 2007–2011, and summer foraging ranges of Antarctic fur seals.



Source: Mapping selected krill predator summer foraging ranges with fishing activity of AKER BioMarine's *Saga Sea* 2007-2011.

As mentioned above (Fig. 5), some species also look for alternative breeding options in years when krill are scarce.

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 November to 31 March along with minimum (700 m) and maximum (2500 m) depths at which trawling can take place.

The International Whaling Commission (IWC) also actively analyses information for the area and held a workshop with CCAMLR to review the input of data for Antarctic marine ecosystem models.

As the fishing vessels operate in pelagic waters with a pelagic net, no interactions with cnidarians or hydrozoans at the seabed, or with the seabed itself, are expected.

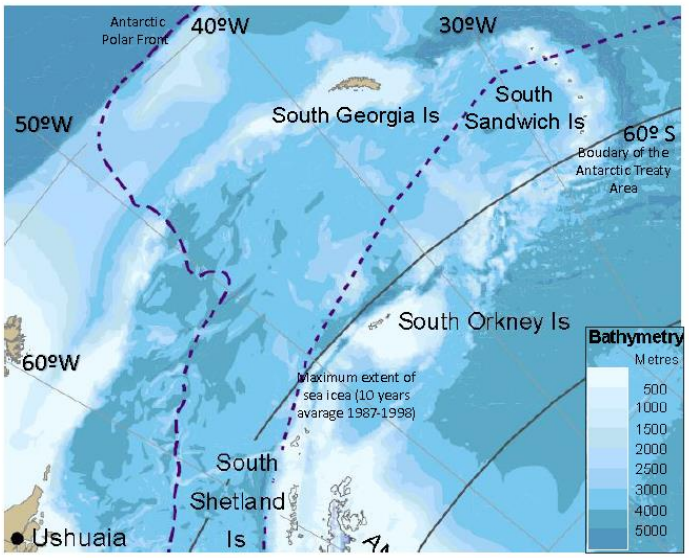
3.4.4 Habitats

As stated above, the UoC fishery is pelagic, towing at depths <150 m, a situation that means that gear would rarely impact the seafloor or its benthic habitats. Such interaction is anyway actively avoided because it would damage the net to the extent that repairs on board would probably be impossible. The only possible interaction of the net with the seafloor, therefore, would be loss of the net, which happens rarely and is always reported on formal observer reports if it transpires. According to MRAG Scientific Observer reports for the years 2012, 2013 and 2014 (up to June), no gear was lost in those years during fishing activities. Occasionally, though, a float or a small section of rope would be lost during shooting or hauling the nets.

The bathymetric map below (Fig. 9), produced by the Australian Antarctic Data Centre in 2007, is downloadable from the Antarctic Treaty webpage. For information about data sources used in the map (Fig. 9), the reader is referred to:

http://aadc-maps.aad.gov.au/aadc/mapcat/display_map.cfm?map_id=13438

Figure 9: Bathymetry of the Southwest Atlantic.



Source: http://www.ats.aq/e/info.htm

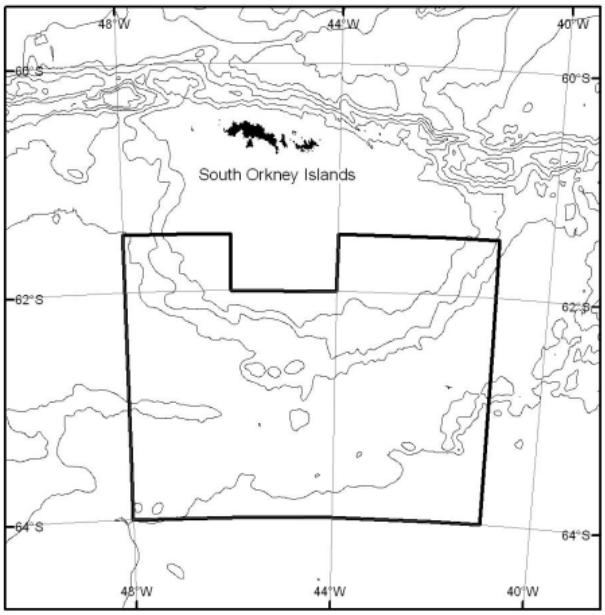
In 2009, a Marine Protected Area in Subarea 48.2, to protect the South Orkney Islands southern shelf, was established by CCAMLR Conservation Measure 91-03. Marine Protected Areas (MPAs) are recognized as one of the most effective means of achieving ecosystem-level conservation, protecting marine biodiversity, and mitigating key threats and pressures on marine environments and the resources they contain. They help to achieve conservation and fisheries management objectives, as well as providing a foundation for ecosystem-based management (Toropova *et al*. 2010).

The CCAMLR Marine Protected Area is bounded by a line starting at 61°30'S 41°W, thence due west to 44°W longitude, due south to 62°S, due west to 46°W, due north to 61°30'S, due west to 48°W, due south to 64°S, due east to 41ºW, and finally due north back to the starting point. The Measure prohibits all types of fishing activities within the defined area, with the exception of scientific fishing research activities agreed by the Commission for monitoring or other purposes.

Conservation Measure 91-04 provides a General framework for the establishment of CCAMLR Marine Protected Areas and 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.

Fig. 10 shows this Marine Protected Area as a heavy black line, with depth contours at intervals of 1000 m.

Figure 10: CCAMLR Marine Protected Are for the protection of the South Orkney Islands.



Source: CCAMLR Conservation Measure 91-03

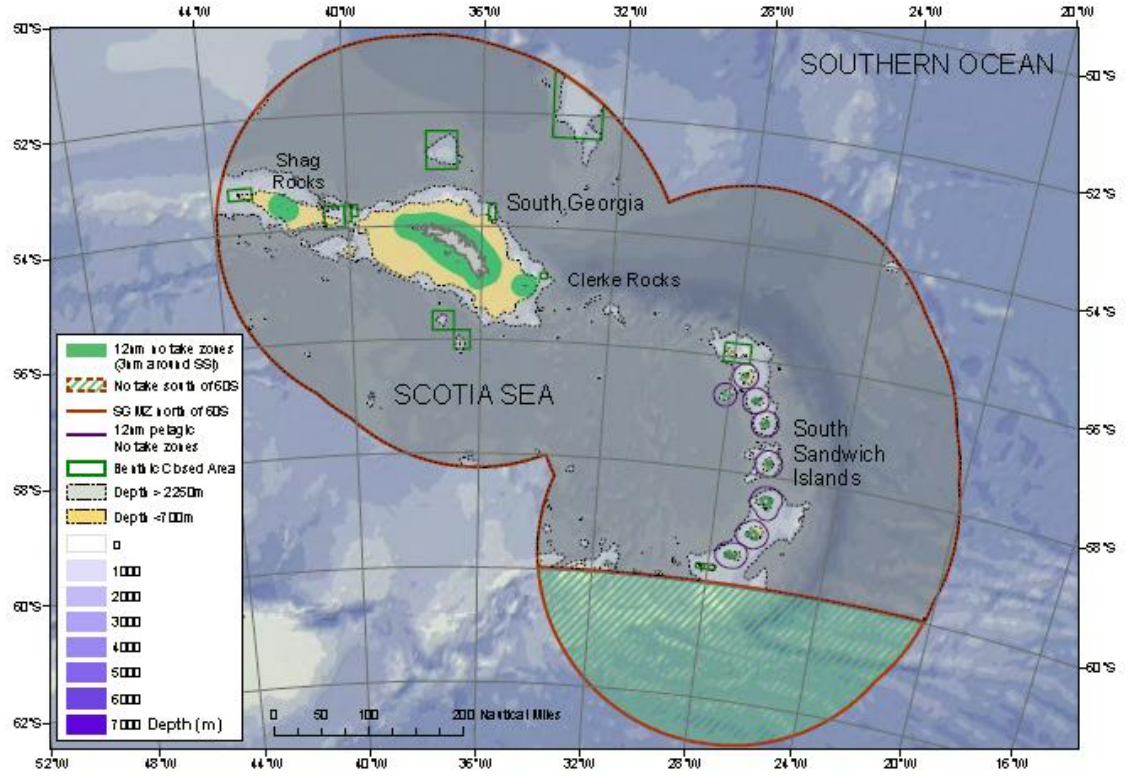
Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Areas (ASMAs) are designated under the Antarctic Treaty as areas of special scientific or biological significance. They are areas designated under CCAMLR Conservation Measure 91-02 (2012) on the Protection of the values of Antarctic 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: http://www.ats.aq/devPH/apa/ep_protected.aspx?lang=e

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).

South Georgia and the South Sandwich Islands are home to a tremendous abundance and diversity of birds, marine flora and fauna and marine-dependent predators, and are a hotspot of benthic biodiversity. In 2012 the South Georgia and South Sandwich Islands declared a Marine Protected Area (Fig. 11) with spatial and temporal limits on the fisheries in their waters.

Figure 11: Chart illustrating the location of the South Georgia and South Sandwich Islands Marine Protected Area and the additional No-take Zones. The section of the Maritime Zone south of 60ºS is not part of this MPA, but no fishing is licensed there.



Source: SGSSI Marine Protected Area Management Plan

Limitations on the South Georgia and South Sandwich Islands include:

- seasonal closure (1 November to 31 March) of the Antarctic krill fishery;
- ban on bottom fishing deeper than 2250 m;
- a 12 nautical mile No-take Zone around the island of South Georgia and around Clerke Rocks, Shag Rocks and Black Rock;
- A 3 nautical mile No-take Zone around each of the South Sandwich Islands and a 12 nautical mile area around each of the islands closed to pelagic fishing;
- Bottom trawling is prohibited in the Marine Protected Area and bottom fishing with other gears is only allowed between the depths of 700 and 2,250 m.

In addition there also are Benthic Closed Areas:

- West Shag
- West Gully
- The Northern benthic closed area
- The Eastern benthic closed area
- Southern Seamounts
- North Georgia Rise
- North East Georgia Rise
- Protector Shoals
- Kemp Seamount and Calderas

Regardless of the habitat description under this section, it needs to be remembered that, as stated above, the krill fishery operates with pelagic gear that should not come into contact with the seabed.

3.4.5 Ecosystem

CCAMLR's Ecosystem Monitoring Programme (CEMP) was established in 1989 to monitor the effects of fishing on both harvested species (target species) and dependent species (predators), so as to assist CCAMLR with its task of regulating the commercial harvesting of Antarctic marine living resources in accordance with the ecosystem approach embodied in Article II (www.ccamlr.org).

The two aims of CEMP are:

1. to detect and record significant changes in critical components of the marine ecosystem within the Convention Area, to serve as a basis for the conservation of Antarctic marine living resources;
2. to distinguish between changes attributable to harvesting of commercial species and changes attributable to environmental variability, both physical and biological.

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. 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.

CCAMLR has adopted a feedback approach to krill fisheries management, such that management measures need to be adjusted continuously to relevant information -- as it becomes available -- on the interactions between krill fishing and krill predators. Therefore, it was expected that such a monitoring programme would enable CCAMLR to adjust management measures in response to new information, but that the CEMP assessment of the impacts of krill fishing on dependent species still remained to be integrated into long-term management procedures. Hence, because there is no direct link between the monitoring programme and a specific management objective, CEMP is not generally considered to be truly effective.

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 60°S are within ASPAs or ASMAs.

The Working Group (WG) on Ecosystem Monitoring and Management (WG-EMM) first met in 1995 after the amalgamation of the WG on krill (WG Krill) and the WG on the CCAMLR Ecosystem Monitoring Programme (WG-CEMP). WG-EMM is responsible for the design and coordination of the monitoring programme and the analysis and interpretation of the data arising from it. The programme's biggest component is the monitoring of dependent species (predators), but in order to distinguish between changes attributable to harvesting and those attributable to environmental variability, the programme also monitors harvested species, harvesting strategies and environmental parameters, and requires analysis of these data at an annual ecosystem assessment.

According to CCAMLR, the WG-EMM shall:

- assess the status of krill;
- assess the status and trends of dependent and related populations, including identification of the information required to evaluate predator/prey/fisheries interactions and their relationship to environmental features;
- assess the environmental features and trends that may influence abundance and distribution of harvested, dependent, related and/or depleted populations;
- identify, recommend and coordinate the research necessary to obtain information on predator/prey/fisheries interactions, particularly where it involves harvested, dependent, related and/or depleted populations;
- liaise with WG-FSA on matters related to stock assessment;
- develop further, coordinate the implementation of, and ensure continuity in CEMP;

- taking into account the assessments and research carried out, the WG shall develop management advice on the status of Antarctic marine ecosystems and for managing krill fisheries in full accord with CCAMLR Convention Article II.
- provide advice on aspects of spatial protection, including marine protected areas and vulnerable marine ecosystems.

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.

WG-EMM has acknowledged difficulties in differentiating the effects of fishing from those of climate change, and has reported that:

- at current harvesting levels, it is unlikely that the existing design of CEMP, with the data available to it, would be sufficient to distinguish between ecosystem changes attributable to harvesting of commercial species and changes attributable to environmental variability, whether physical or biological;
- with the existing design of CEMP, it may never be possible to distinguish between these different and potentially confounding causal factors, so recommends that the Scientific Committee seek advice from the Commission on the extent to which further work should be directed towards this topic;
- without a real ability to separate the confounding effects of harvesting and environmental variation and in the context of uncertainty, the Scientific Committee should seek advice from the Commission about the policy of how management should proceed when a significant change is detected, but no single causal factor can be attributed;
- one possible method that may assist in the separation of confounding effects of harvesting and environmental variation would be the establishment of an experimental fishing regime whereby fishing would be concentrated in local areas in conjunction with an appropriate predator monitoring programme.

In order to understand and interpret natural ecosystem variability and how large-scale physical processes influence small-scale ecology in the Antarctic, long-term data series of krill predators are necessary (Reid and Croxall 2001). According to Hewitt and Low (2000), an extensive and well-designed monitoring programme, covering both fishing and non-fishing areas, will be key to the timely detection of local or regional adverse effects on krill or krill predators from a long-term krill decline that may be magnified by the krill fishery.

Scientists agree that there is a need for more protected areas in the region:

- in areas with high species biodiversity, particularly for those predators that feed on krill, in order to improve the knowledge of how the ecosystem operates in the absence of fishing; it could be that the combination of bathymetry, oceanography and the movements of krill could explain the biodiversity in the area;
- as reference areas (with no fishing), in order to evaluate the impacts of climate change without the impact of fishing.

As was acknowledged by CCAMLR's WG-EMM at its 2009 meeting, climate change may induce rapid changes within the ecosystem, impacting the way indices generated by CEMP are being used to detect fisheries impacts, because the life history and demography of Antarctic krill are intimately tied to seasonal sea-ice conditions, climate and the physical forcing of ocean currents. Key spawning, recruitment and nursery areas of krill are located around the western Antarctic Peninsula (Constable *et al*. 2003). The climate there is warming rapidly, so the extent and duration of winter sea ice is dropping (Parkinson 2012). Constable *et al*. (2003) also show that diminished sea-ice cover over the past 20 years might result in greater recruitment variability and lower overall abundance of krill in the Southwest Atlantic, whereas recruitment may have been more stable and less variable previously. Changes in krill abundance will surely be having an impact on krill-dependent predators.

As reported by Smith *et al*. (2011), fishing low trophic level (LTL) species, even at conventional levels associated with maximum sustainable yield (MSY), can have a great impact on other parts of the

ecosystem, particularly when they constitute a high proportion of the biomass in the ecosystem or are highly connected in the foodweb.

There is a global need to develop strategic frameworks for assessing uncertainty in ecosystem dynamics models. Such models have already been used within CCAMLR to evaluate options for managing the Antarctic krill fishery in the Scotia Sea and southern Drake Passage (Hill and Mathews 2013). However, the use of models to evaluate catch allocation options illustrates the tension between the ideal of well-constrained models and the reality of ecosystem-based management problems in which data are sparse, structure complex and uncertainty rife (Hill *et al*. 2007; Plagányi 2007).

There is tension between the parameter stability benefits of well-constrained models and the use of model conditioning to identify plausible alternative hypotheses in data-poor situations (Hill and Mathews 2013).

The Southern Ocean is a major component within the global ocean and climate system and potentially the location where the most rapid climate change is most likely to happen, particularly in high latitude polar regions. In such regions, even small temperature changes can potentially lead to major environmental perturbations, and failure of Antarctic krill recruitment would inevitably foreshadow recruitment failures in a range of higher trophic-level marine predators (Trathan *et al.* 2007).

The main physical and biological processes important in determining the dynamics of the Scotia Sea ecosystem have been studied by Murphy *et al*. (2007). Fig. 12 shows the spatial and temporal scales for these processes.

One of the major nursery grounds for Antarctic krill lies to the north of the Antarctic Peninsula (Siegel 1988; Brinton 1991; Spiridonov 1995; Siegel *et al.* 2002), close to the area of recent rapid regional warming (King 1994). Ocean currents are thought to carry krill from this area to other areas of the Southwest Atlantic (Hofmann *et al*. 1998; Murphy *et al*. 1998, Thorpe *et al*. 2004). Consequently, changes in the environment close to the nursery grounds have the potential to have far-reaching impacts on both local and more-distant marine communities (Trathan *et al*. 2007). Ecosystem studies in the Southwest Atlantic have pointed to strong relationships between temperature and the abundance of Antarctic krill (Trathan *et al*. 2003), so climate warming needs to be taken into account in CCAMLR fisheries management strategy, as suggested by the CCAMLR Scientific Committee (SC-CAMLR-XXXII, pp. 63-65).

Temporal patterns in krill recruitment suggest that there is a direct causal relationship between variability in sea-ice cover, krill recruitment, prey availability and predator foraging ecology, and that large-scale forcing associated with climate variability may be governing ecological interactions between ice, krill and their predators in the western Antarctic Peninsula and Scotia Sea regions (Fraser and Hofmann 2003).

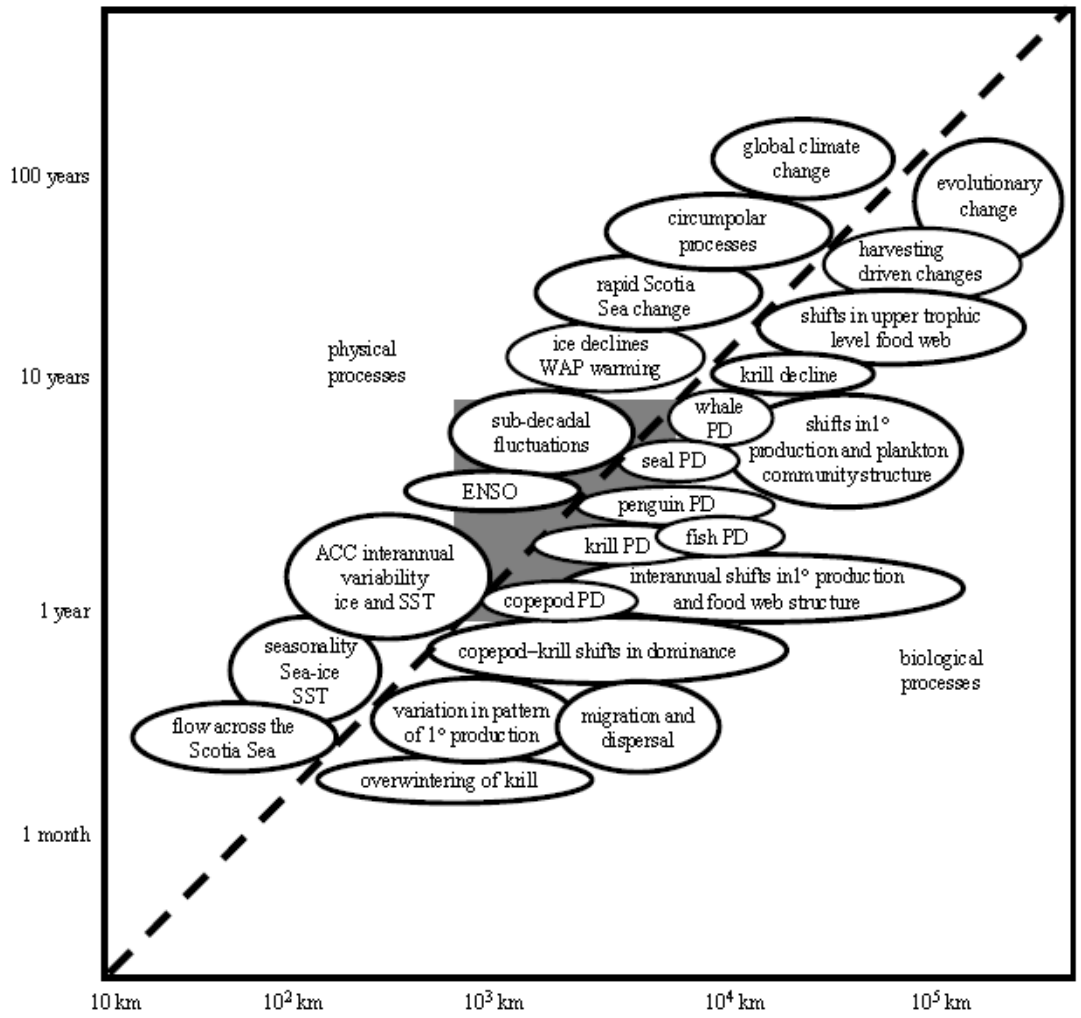
Recent rapid climate change is now well documented in the Antarctic, particularly close to the Antarctic Peninsula. One of the most evident signs of climate change has been ice-shelf collapse; overall, 87% of the Peninsula's glaciers have retreated in recent decades. Further ice-shelf collapse will lead 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 and Grant 2013).

Changes in the physical properties of the marine system are especially important for CCAMLR and include, *inter alia*, changes in ocean temperature (Gille 2002) and ocean acidification (Bednarek *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 and Vaughan, 2010; Cook *et al.* 2005; Gutt *et al*. 2010, 2013; Rignot *et al*. 2013).

Habitats previously covered under ice shelves present outstanding opportunities to undertake science related to habitat colonization. Studying them when they become available would provide valuable scientific insights into how communities develop over time-scales ranging from years to decades. Habitats under ice shelves have been closed to both terrestrial and pelagic community interactions over recent geological time-scales. If exposed, they would offer a range of opportunistic study sites, often with contrasting ecological scenarios. Long-term reference areas would facilitate scientific study of the effects of such changes, primarily in the absence of any effects caused by other human activities (Trathan and Grant 2013).

Fig. 13 depicts 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).

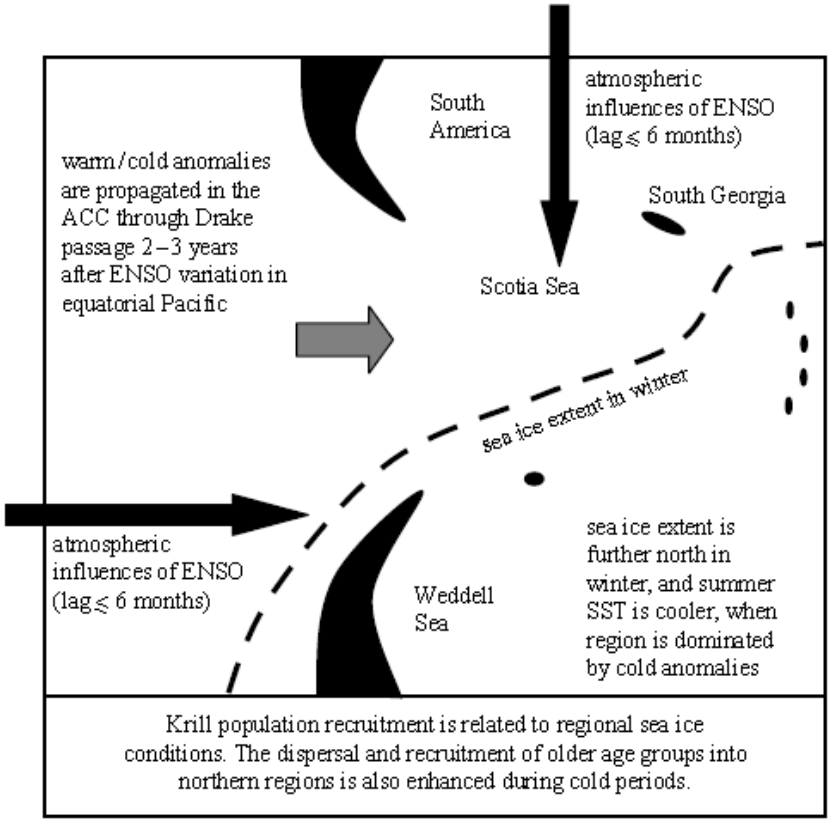
Figure 12: Schematic of the temporal and spatial scales of the main physical and biological processes important in determining the dynamics of the Scotia Sea ecosystem. The 1:1 relationship is based on the scale of physical mixing in the oceans. Note that the physical and biological processes are illustrated 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.



Source: Murphy *et al.* (2007)

The foodweb 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).

Figure 13: Schematic of the main physical processes generating variation in the Scotia Sea ecosystem. ENSO, *El Niño* Southern Oscillation; ACC, Antarctic Circumpolar Current.



Source: Murphy *et al*. (2007)

Krill attract large quantities of top predators (Howard *et al*. 2004) and are considered to be a keystone species (Moline *et al*. 2000), linking most pathways in the food chain from primary producers to top predators. In addition, krill around the Antarctic Peninsula are believed to be the main source of krill populations around the Scotia Sea (Atkinson *et al*. 2004), suggesting that krill are important not only in the immediate area where te population is deemed to be large, but also to surrounding areas, and to predators there (Hofmann *et al*. 1998; Brierley *et al.* 1999; Atkinson *et al*. 2004). Hence, changes to the krill population around the Antarctic Peninsula will affect predators locally and across the Scotia Sea (Hoover *et al.* 2012).

Because of its importance in the Southern Ocean, the krill resource has been subject to many studies and models that try to provide a greater understanding of its role in the ecosystem, but the models may be difficult to apply to real life. Models that incorporate interspecific interaction typically have more parameters than single-species models. However, increasing complexity leads too to accumulation of uncertainties and increased difficulty in interpreting results (Fulton *et al.* 2003; Raick *et al.* 2006; Plagányi 2007; Hill *et al.* 2007).

Atkinson *et al.* (2012) described different methods for sampling krill, such as:

- with nets (for historical time-series, demographic information and live krill);
- acoustics (distribution, time-series, biomass and swarm-scale information);
- the fishery (sustained sampling in one place and wide area and time coverage);
- via predators (long time-series, demographic indices).

Different broad categories of model representing Antarctic krill, their data sources and limitations were reviewed by Atkinson *et al.* (2012). The categories include:

- models exploring specific aspects of krill biology such as life cycle, energetics or behaviour (Hofmann and 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 *et al*. 1979; Murphy 1995);
- 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 and 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, 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 and Antezana 2008); the model shows that phytoplankton, zooplankton and krill account for most of the mass flow, and describes the foodweb 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 (Plagányi and 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).

In terms of other environmental issues that may arise while fishing takes place, CCAMLR established Conservation Measure 26-01 (2009) 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.

3.5 Principle Three: Management System Background

Principle 3 of the Marine Stewardship Council standard states that:

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

In the following section of the report a brief description is made of the key characteristics of the management system in place to ensure the sustainable exploitation of the fishery under assessment.

3.5.1 Jurisdiction and management system

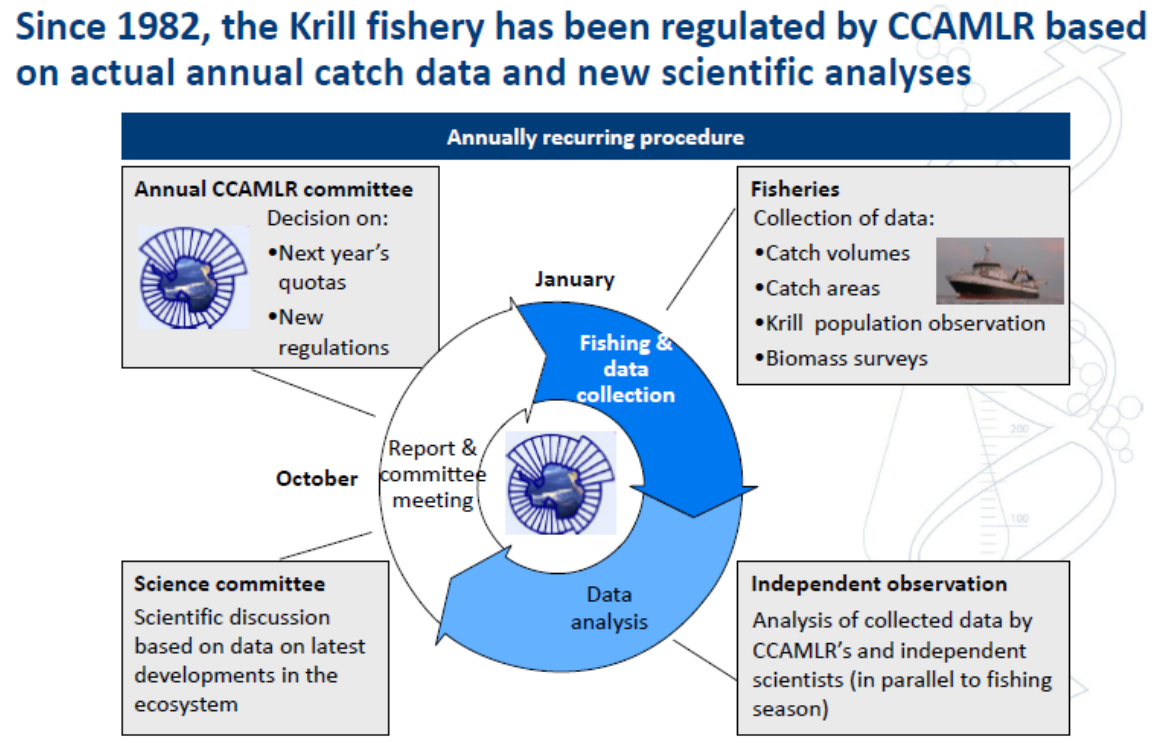
The fishery is managed mainly by CCAMLR, in interaction with the Norwegian Ministry/Directorate of Fisheries and the Government of South Georgia and the South Sandwich Islands (GSGSSI). CCAMLR coordinates scientific research and observer programmes, establishes TAC and distributes quotas between subareas. The Norwegian Ministry/Directorate of Fisheries issues fishery permits and performs quota control of the client vessels. CSGSSI issues permits for the vessels in the SGSSI Maritime Zone.

CCAMLR was established in 1982 with the objective *inter alia* of conserving Antarctic marine life. Based on the best available scientific information, the Commission agrees a set of conservation measures that determine the use of marine living resources in the Antarctic. The key institutional components of CCMLAR are the CAMLR Convention (with supportive regulations), the decision-making Commission, the Scientific Committee and the Secretariat located in Hobart, Tasmania. The Commission determines the regulatory framework applied to the management of each fishery in the Convention Area, including catch limits and seasonal or area closures and measures aimed at minimizing potential impacts of fishing activities on non-target species and the ecosystem. The Standing Committee on Implementation and Compliance, subordinate to the Commission, provides it with information, advice, recommendations on fishery monitoring and compliance. The Scientific Committee provides the Commission with the best available scientific information on harvesting levels and other management issues. In turn, the Commission is obliged 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 programmes of CCAMLR members. In addition CCAMLR has established a number of programmes to collect the data required for the effective management of the Southern Ocean, including fisheries monitoring, scientific observers on fishing vessels and ecosystem monitoring (see Fig. 14).

Norway has a well-established system for fisheries management, which has evolved over more than a century and is now codified in its 2008 Marine Resources Act. The Act provides for a formal system of cooperation between regulatory bodies of governance, such as the Ministry of Fisheries and Coastal Affairs, the Directorate of Fisheries and the Coast Guard, and further for cooperation between management authorities and scientific research institutes, primarily the Institute of Marine Research. The 2008 Integrated Management Plan for the Norwegian Sea provides for cooperation between different sector authorities, such as the Ministry of Fisheries and Coastal Affairs and the Ministry of Environment.

GSGSSI is based in Government House in the Falkland Islands and has a Director of Fisheries among its staff. It is mainly involved in the licensing of vessels that fish in the South Georgia Maritime Zone, catch monitoring at King Edward Point in South Georgia and at sea-surveillance in the Maritime Zone. A Marine Protected Area was introduced in 2012 and reinforced in May 2013, including a no-fish zone within 12 nautical miles of the coast.

Figure 14: The management system for Antarctic krill.



Source: The client

3.5.2 Interest groups and consultation processes

The Antarctic and Southern Ocean Coalition (ASOC) had been actively involved in marine management in the Antarctic since the establishment of CCAMLR and was given observer status in 1991. ASOC is also a key partner to the Antarctic Krill Conservation Project, which is an international effort managed by the Pew Foundation to secure from CCAMLR an ecosystem-based fisheries management programme for krill that is highly precautionary, scientifically based and protects the unique environment of the southern polar region.

At national level in Norway, WWF is actively consulted on krill issues by Norwegian fisheries management authorities. For instance, the Ministry of Foreign Affairs invites stakeholders, including WWF, to meetings before CCAMLR meetings in order to discuss relevant issues, including for the management of krill. WWF has been invited to become part of the Norwegian delegation to CCAMLR, but has chosen to remain an independent actor.

A formal partnership between the client and WWF-Norway has existed since 2006 with the common goal of sustainable management of fish and krill, and combating illegal harvesting. A new three-year agreement was signed in 2012.

The joint activities of Aker BioMarine and WWF-Norway include promoting environmental labelling and ensuring traceability throughout the fisheries value chain, from harvesting through to products purchased by consumers. WWF-Norway will play a key role too of bringing critical external stakeholder input into the management process for the fishery under assessment.

3.5.3 Objectives and regulation measures

All CCAMLR fisheries are managed within a precautionary and ecosystem approach, as defined by the FAO in its Code of Conduct for Responsible Fisheries, and are consistent with MSC Principles and Criteria. At national level in Norway, the 2008 Marine Resources Act, which covers all living marine resources, requires that Norwegian fisheries management be guided by the precautionary approach and by an ecosystem approach that takes into account habitats and biodiversity.

The three main objectives of the CCAMLR management system are (Article 2 of the Convention): 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 minimization 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.

The aims of these three objectives mirror and preceded the establishment of the aims of MSC Principles 1 and 2. CCAMLR‘s more specific, short- and long-term strategy for achieving these objectives is reflected in Conservation Measure 51-01 (2010) A precautionary krill catch limit of 5.61 million tonnes is set for Area 48, based on the potential yield estimate. This is well above the current catch and will allow for expansion. However, a "catch trigger" (620 000 t) is set not to be exceeded until a procedure for division of the overall catch limit into smaller management units has been established, based on advice from the Scientific Committee. The objective of this division is to avoid possible unacceptable concentration of catch within the foraging areas of vulnerable predators. Although the trigger level is close to the highest global annual catch to date, it is significantly more than the largest annual catch to date in Area 48.

In general, CCAMLR has well-established decision-making processes. They allow for stakeholder input and clear scientific analysis of the data available within the Working Groups and Scientific Committee, and they result in conservation measures and fisheries strategies designed to achieve their short- and long-term fishery-specific objectives.

3.5.4 Monitoring, control and surveillance

CCAMLR provides a clear and comprehensive monitoring system and control framework for Antarctic fisheries. Surveillance of CCAMLR fisheries is undertaken by Member States and incorporates the CCAMLR observer scheme. For the client fishery, enforcement is mainly taken care of by the Norwegian Directorate of Fisheries, which has demonstrated a consistent ability to enforce relevant regulations. Vessels are licensed on an annual basis and report catches from each haul through their electronic logbooks; for client vessels that implies at two-hour intervals. In order to receive a license for the Antarctic krill fishery, Norwegian vessels are obliged to have an observer on board at all times. When entering the South Georgia Maritime Zone, vessels need to apply for a licence and pay a fee. All vessels are inspected by the South Georgia administration at King Edward Point before they are allowed to start fishing. They have to report catches on a daily basis and are also inspected by a patrol vessel during fishing operation.

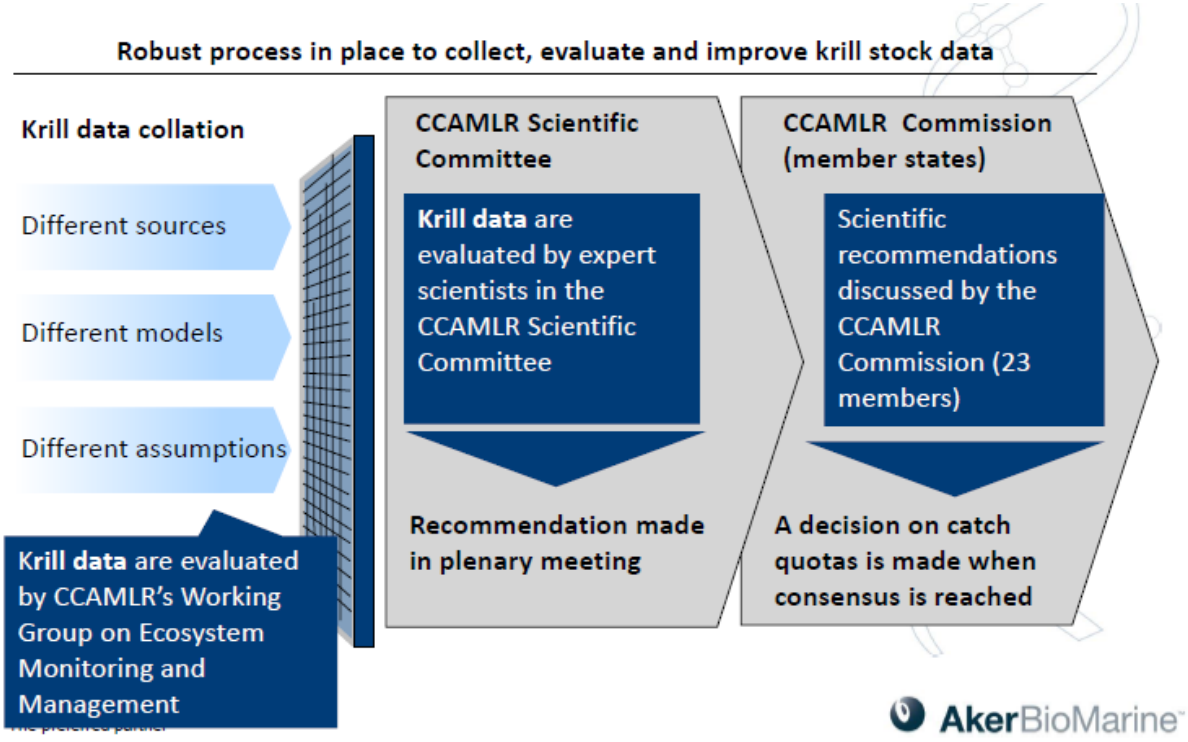
3.5.5 Research plan and reviews

A comprehensive research plan by CCAMLR exists for krill fisheries, focusing on the monitoring of krill catches, scientific observation and environment monitoring (Fig. 15). The CCAMLR Ecosystem Monitoring Programme provides cross-cutting data on environment and predator abundance to link into fisheries data and targets research at an ecosystem approach to management of the krill fishery. An additional research programme for the client group vessels has been developed between Aker BioMarine and British Antarctic Survey and utilising CCAMLR Scientific Observers supplied by MRAG. Data requirements above and beyond the standard set of CCAMLR observer data have been defined and implemented.

CCAMLR conducts ongoing internal reviews of its processes and the performance of its Member States to meet the fishery-specific management requirements outlined. These requirements are reviewed annually (to fit in with the annual fisheries cycle) by the appropriate CCAMLR Working Groups (e.g. seabird mortality will be analysed by the Working Group on Incidental Mortality of Associated Fauna). CCAMLR was subject to a comprehensive external performance review during 2008, but such external review is not regular. The review was carried out by a panel appointed by the Commission composed of nine persons (see http://www.ccamlr.org/pu/E/revpanrep.htm).

The purpose of the performance review was to evaluate the Commission's performance against comprehensive criteria and specifically against the objectives and principles set out in Article II of the Convention. The review states that the stock status and trends are broadly consistent with Article II of the Convention and international best practice. With particular reference to krill fisheries, it identified the need for ongoing research into predator–prey linkages in ecosystem modelling and adequate monitoring and management within krill fisheries.

Figure 15: The management plan for Antarctic krill.



Source: The client

4. Evaluation Procedure

4.1 Harmonised Fishery Assessment

At the time of writing, no other MSC assessments have been completed that overlap with this assessment.

4.1.1 Harmonisation Details

Harmonisation meeting/s

No harmonisation is carried out for this fishery.

4.2 Previous assessments

Summary of previous assessments of the client operation, conclusions reached and past compliance with specified conditions:

- MSC Assessment
- http://www.msc.org/track-a-fishery/fisheries-in-the-program/certified/southern-ocean/aker-biomarine-antarctic-krill/assessment-downloads

Assessment conclusion: Certified

Compliance with conditions: All conditions are closed.

4.3 Assessment Methodologies

This fishery was assessed using version 1.3 of the MSC Certification Requirements and version 1.3 of the MSC Full Assessment Reporting Template.

4.3.1 Assessment Tree

The Default Assessment tree was used for this assessment.

4.4 Evaluation Processes and Techniques

4.4.1 Site Visits

During the week commencing 20 January 2014, three members of the assessment team, supported by an FCI staff member, undertook a site visit to Oslo and Bergen. This enabled a scheduled programme of consultations to take place with key stakeholders in the fishery – including skippers, scientists, fishery protection officers, NGOs, fishery managers and technical support staff. Prior notification of this site visit was issued on the MSC website and in Fiskaren – Norwegian Fishing News in order that all relevant stakeholders were aware of the opportunity to meet with the assessment team.

Itinerary of field activities

Day 1 - Date - Location

» On day 1, the assessment team met with three stakeholders in Oslo to discuss the fishery under assessment and provide an opportunity for interested parties to submit comments, additional information or ask questions of the assessment team.

Day 2 - Date - Location

» On day 2, the assessment team met with two stakeholders in Bergen.

Day 3 - Date - Location

» On day 3, the assessment team met with two stakeholders in Oslo.

In addition, several stakeholders were consulted by skype and telephone. See next section.

4.4.2 Consultations

Stakeholder issues

Written and verbal representations were provided to the assessment team expressing a range of views, opinions and concerns. The team is of the view that matters raised have been adequately debated and addressed as a part of the scoring process for this fishery, and that none of the issues raised, therefore, require separate attention beyond that represented in this report.

Interview Programme

Following the collation of general information on the fishery, a number of meetings with key stakeholders were scheduled by the team to fill in information gaps and to explore and discuss areas of concern.

Meetings were held as follows (Table 11):

Table 11: Interview Programme

Name	Position	Organisation
Elisabeth Røkke		Client
Sigve Nordrum		Client
Odd Gunnar Skagestad		Norwegian Ministry of Foreign Affairs
Mette Strengehagen		Norwegian Ministry of Foreign Affairs
Karoline Andaur		WWF Norway
Fredrik Myhre		WWF Norway
Modulf Overvik		Norwegian Directorate of Fisheries
Olav Rude Godø		Institute of Marine Research
Svein Iversen		Institute of Marine Research
Georg Skaret		Institute of Marine Research
Truls Gulowsen		Greenpeace
Kit Kovacs (skype)		Norwegian Polar Institute
Robert Scott (skype)		Cefas
Chris Darby		Cefas
James Clark (skype)		MRAG
Jonathan Watkins (skype)		British Antarctic Survey
Phil Trathan (skype)		British Antarctic Survey
Martin Collins (telephone)		South Georgia fisheries administration

Source: FCI assessment team

Important Points Raised during Stakeholder Meetings

A common theme in the interviews with the client, the Norwegian Ministry of Foreign Affairs, WWF, the Norwegian Directorate of Fisheries and the Institute of Marine Research was the tight integration and well-functioning cooperation between the client, management authorities, scientists and NGOs. For example, the client is engaged in formalized partnership with both WWF and the Institute of Marine Research. All these organizations also participate in CCAMLR. A main concern with scientists, NGOs and managers alike was that no fully synoptic survey has been conducted since 2000. Greenpeace

also expressed concern that the MSC system is not sufficiently robust to assess the sustainability of the system, and are of the opinion that certification should not be awarded.

4.4.3 Evaluation Techniques

Public Consultation

A total of 35 stakeholder individuals and organizations having relevant interest in the assessment were identified and consulted during the assessment. The interest of others not appearing on this list was solicited through postings on the MSC website and by advertising in Fiskaren. These were felt to be the most appropriate media for making these public announcements as Fiskaren has significant readership / uptake in the primary stakeholder locations for this fishery and the processes used on the MSC website for tracking and announcing the various stages of the assessment as it progresses - from Full Announcement through to Certification - form an ideal tool through which to channel stakeholder interest and keep them abreast of the important stages of the assessment as a whole.

Initial approaches were made by email and followed up by telephone. Issues raised during correspondence were investigated during research and information-gathering activities, and during interviews.

Most stakeholders contacted during this exercise either indicated that they had no particular cause for concern with regard to its assessment to the MSC standard, or that they had no direct interest in this fishery assessment.

Process

The MSC is dedicated to promoting “well-managed” and “sustainable” fisheries, and the MSC initiative focuses on identifying such fisheries through means of independent third-party assessments and certification. Once certified, fisheries are awarded the opportunity to utilize an MSC-promoted eco-label to gain economic advantages in the marketplace. Through certification and eco-labelling, the MSC works to promote and encourage better management of world fisheries, many of which have been suggested to suffer from poor management.

The MSC Principles and Criteria for Sustainable Fisheries form the standard against which the fishery is assessed and are organised in terms of three principles:

» **MSC Principle 1** - Resource Sustainability
» **MSC Principle 2** - Ecosystem Sustainability
» **MSC Principle 3** - Management Systems

A fuller description of the MSC Principles and Criteria and a graphical representation of the assessment tree is presented as **Appendix 1a** to this report.

The MSC Principles and Criteria provide the overall requirements necessary for certification of a sustainably managed fishery. To facilitate assessment of any given fishery against this standard, these Criteria are further split into Sub-criteria, which represent separate areas of important information (e.g. Sub-criterion 1.1.1. requires a sufficient level of information on the target species and stock, 1.1.2 requires information on the effects of the fishery on the stock and so on). These Sub-criteria therefore provide a detailed checklist of factors necessary to meet the MSC Criteria in the same way as the Criteria provide the factors necessary to meet each Principle.

Below each Sub-criterion, individual ‘Performance Indicators’ (PIs) are identified. It is at this level that the performance of the fishery is measured. Altogether, assessment of this fishery against the MSC standard is achieved through measurement of 31 Performance Indicators. The Principles and their supporting Criteria, Sub-criteria and Performance Indicators that have been used by the assessment team to assess this fishery are incorporated into the scoring sheets (**Appendix 1.1**).

Scoring of the attributes of this fishery against the MSC Principles and Criteria involves the following process:

» Decision to use the MSC Default Assessment Tree contained within the MSC Certification Requirements (Annex CB)

» Description of the justification as to why a particular score has been given to each sub-criterion

» Allocation of a score (out of 100) to each Performance Indicator

In order to make the assessment process as clear and transparent as possible, the Scoring Guideposts are presented in the scoring table and describe the level of performance necessary to achieve **100** (represents the level of performance for a Performance Indicator that would be expected in a theoretically 'perfect' fishery), **80** (defines the unconditional pass mark for a Performance Indicator for that type of fishery), and **60** (defines the minimum, conditional pass mark for each Performance Indicator for that type of fishery). The Assessment Tree and Scoring Guideposts for the Aker Biomarine Antarctic Krill Fishery are shown as **Appendix 1.1** to this report.

Scoring outcomes

There are two, coupled, scoring requirements that constitute the Marine Stewardship Council's minimum threshold for a sustainable fishery:

» The fishery must obtain a score of 80 or more for each of the MSC's three Principles, based on the weighted average score for all Criteria and Sub-criteria under each Principle.

» The fishery must obtain a score of 60 or more for each Performance Indicator.

A score below 80 at the Principle level or 60 for any individual Performance Indicator would represent a level of performance that causes the fishery to automatically fail the assessment. A score of 80 or above for all three Principles results in a pass.

Prior to scoring the fishery, the team determined and documented which component P2 species would be assessed (see **Section 3.4**).

5. Traceability

5.1 Eligibility Date

The **Actual Eligibility Date** for this fishery is 15 February 2014. This means that any fish caught by the certified fleet following that date will be eligible to enter the chain of custody as certified product if and when certification is ultimately granted. The rationale for this date is that it meets with the client's wishes, for commercial reasons, for the date to be set at the earliest point at which the Certification Requirements allow.

The measures taken by the client to account for risks within the traceability of the fishery – and therefore generating confidence in the use of this date for target eligibility – are detailed in the rest of this section.

5.2 Traceability within the Fishery

Traceability up to the point of first landing has been scrutinized as part of this assessment and the positive results reflect that the systems in place are deemed adequate to ensure fish is caught in a legal manner and is accurately recorded. The report and assessment trees describe these systems in more detail, but briefly traceability can be verified by:

» VMS/electronic logbook reporting to enforcement bodies after every haul

» 100% observer coverage

» no possibilities for mixture of certified with non-certified catch; only krill delivered to client's own transport vessel; only client vessel catch delivered to the client's own production facility

» labelling of catch with an identification key which is traceable all the way to the end user.

5.2.1 Description of Tracking, Tracing and Segregation Systems within the Fishery and Management systems in place relating to Traceability

The *Antarctic Sea* and the *Saga Sea* are 100% krill vessels only participating in the Antarctic krill fishery in CCAMLR Area 48, including South Georgia. All catches are reported continuously during the fishing operations to the Norwegian authorities and CCAMLR. Norwegian-licensed vessels are obliged to report catches from each haul through their electronic logbooks; for client vessels this implies reporting with two-hour intervals. In the hypothetical cases where the signal from the vessel is temporarily lost, the information can subsequently be recovered because all data are stored automatically on board. Aker BioMarine also adheres fully to the principle of allowing non-national observers on its vessel at all times, which is required by Norwegian law for all Norwegian-licensed vessels. Catch reporting includes information about the quantity of catch, location, time and vessel license number.

All catch is transshipped to the client's own transport vessels and subsequently delivered to the client's own warehouse facility in Uruguay. Products from there are transported directly to processing plants in Spain and the US to be further processed into human Omega 3 products, or to the end customer (meal-to-feed customers). Products from Uruguay are transported to Norwegian customers using conventional shipping lines. At the end of the krill season the *Saga Sea* will land its last trip in Uruguay.

5.2.2 Evaluation of the Risk of Vessels Fishing Outside of UoC

Only client vessels deliver krill to the client's own transport ship, Furthermore, only these ships deliver krill to the client's storage facility in Uruguay, so there is no risk of catch from units outside the UoC being sold as certified.

5.2.3 Risk of Substitution of Mixing Certified / Non-Certified Catch prior to point of landing

There is no risk of substitution of certified and non-certified catch prior to the point of landing, because the vessels only fish for krill, and only the vessels covered by this certification deliver catches to the client's transport ship.

5.2.4 At-Sea Processing

The krill catch is processed on board to a krill meal or a frozen krill paste. It is bagged in sacks which clearly state that they contain krill from the vessels *Antarctic Sea* or *Saga Sea* and also display the license numbers of the vessel. All krill products are marketed as 100% krill product and no other products are produced by the vessels, with all products being labelled accordingly. All products from the fishery are labelled with an identification key which is traceable all the way to the end-user. This identification key includes the catch coordinates of the krill, vessel license number, catch date and production date.

5.2.5 Transshipment

An Aker BioMarine owned and controlled tramper vessel transloads the krill products from the *Antarctic Sea* and the *Saga Sea* (no other vessels) and transports the products from the fishing grounds to Aker BioMarine‘s facility in Uruguay. Occasionally, when production exceeds its own freighter’s capacity, a second freighter has been chartered to assist in transshipping product to shore, but only Aker BioMarine product is carried on those few occasions.

5.2.6 Robustness of management systems relating to traceability

Catch reports to the Norwegian enforcement bodies after each haul and 100% observer coverage ensure a high level of robustness of the management system relating to traceability; see Section 5.2.1 above.

5.3 Eligibility to Enter Further Chains of Custody

Only krill caught in the manner defined in the Unit of Certification (**Section 3.1**) under restrictions detailed throughout the body of the final Public Certification Report for this fishery shall be eligible to enter the Chain of Custody. Chain of Custody should commence following the first point of landing, at which point the product shall be eligible to carry the MSC logo (under restrictions imposed by the MSC Chain of Custody standard). There are no restrictions on the fully certified product entering further chains of custody. Aker BioMarine Antarctic does not require its own chain of custody certificate.

5.3.1 Eligible points of landing

The client’s own transport vessel transloads the krill from the *Antarctic Sea* and the *Saga Sea* and transports the products from the fishing grounds to Aker BioMarine‘s facility in Nueva Palmira close to Montevideo, Uruguay.

5.3.2 Parties eligible to use the fishery certificate

Only Aker BioMarine vessels operating in the manner described in this report are eligible to use the fishery certificate.

6. Evaluation Results

6.1 Principle Level Scores

Table 12: Final Principle Scores

Principle	Score
Principle 1 – Target Species	90
Principle 2 - Ecosystem	93
Principle 3 – Management System	93.1

Source: FCI assessment team

6.2 Summary of Scores

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Score
One	1	Outcome	0,5	1.1.1	Stock status	100
				1.1.2	Reference points	90
				1.1.3	Stock rebuilding	n/a
		Management	0,5	1.2.1	Harvest strategy	95
				1.2.2	Harvest control rules & tools	80
				1.2.3	Information & monitoring	80
				1.2.4	Assessment of stock status	85
Two	1	Retained species	0,2	2.1.1	Outcome	80
				2.1.2	Management	80
				2.1.3	Information	90
		Bycatch species	0,2	2.2.1	Outcome	100
				2.2.2	Management	100
				2.2.3	Information	100
		ETP species	0,2	2.3.1	Outcome	95
				2.3.2	Management	100
				2.3.3	Information	95
		Habitats	0,2	2.4.1	Outcome	100
				2.4.2	Management	100
				2.4.3	Information	85
		Ecosystem	0,2	2.5.1	Outcome	100
				2.5.2	Management	80
				2.5.3	Information	90
Three	1	Governance and policy	0,5	3.1.1	Legal & customary framework	90
				3.1.2	Consultation, roles & responsibilities	95
				3.1.3	Long term objectives	100
				3.1.4	Incentives for sustainable fishing	80
		Fishery specific management system	0,5	3.2.1	Fishery specific objectives	90
				3.2.2	Decision making processes	95
				3.2.3	Compliance & enforcement	100
				3.2.4	Research plan	100
				3.2.5	Management performance evaluation	90

6.3 Summary of Conditions

There are no conditions for this fishery.

6.3.1 Recommendations

There are no recommendations for this fishery.

6.4 Determination, Formal Conclusion and Agreement

The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any MSC Criteria.

It is therefore determined that the **Aker Biomarine Antarctic Krill Fishery should be certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries**.

The decision to uphold the determination was confirmed by FCI's decision making entity following a recommendation by the assessment team, and review by stakeholders and peer reviewers.

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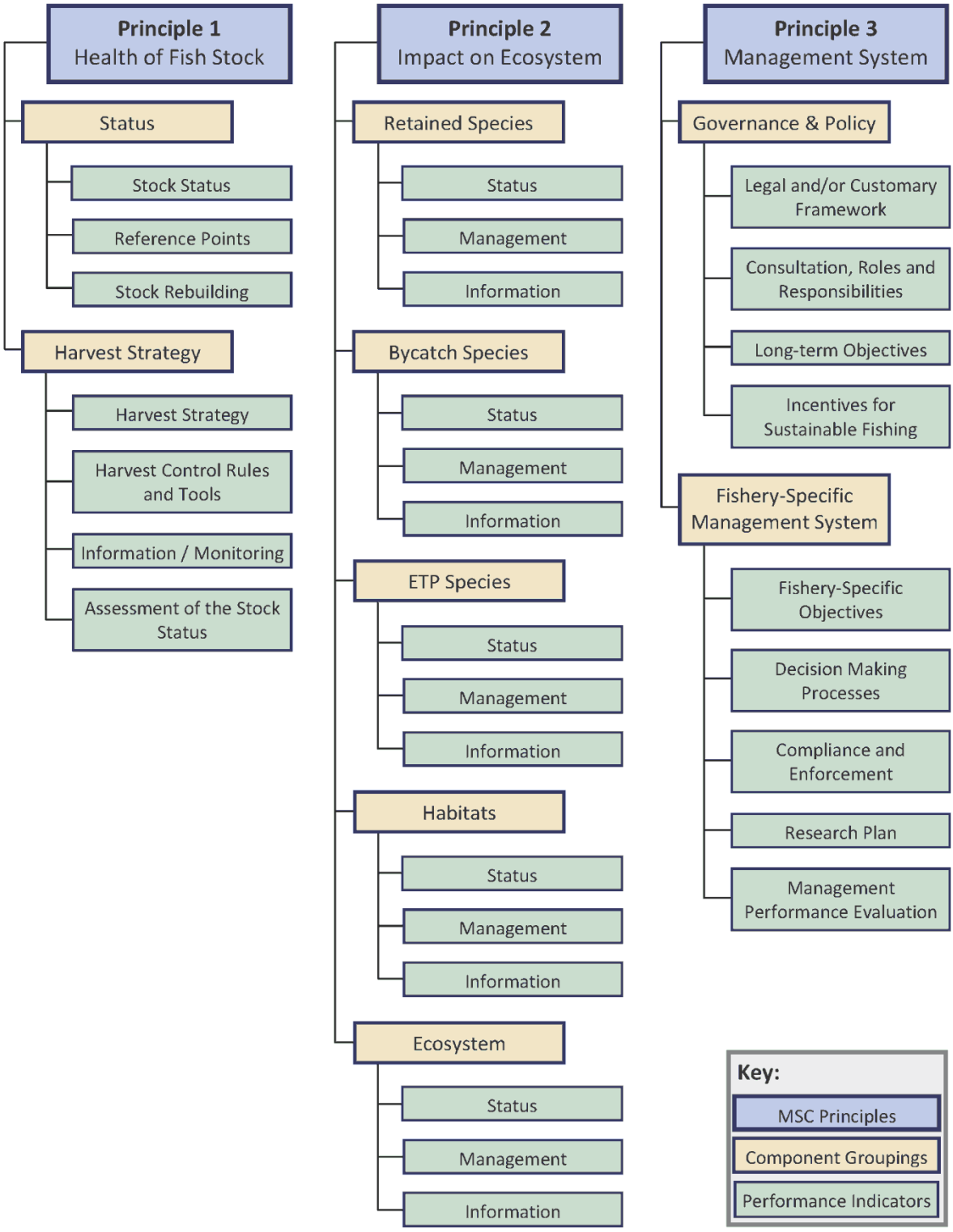
Appendix 1. Scoring & Rationale

Appendix 1a – MSC Principles & Criteria

Fig. A1 – Graphic of MSC Principles and Criteria



Below is a much-simplified summary of the MSC Principles and Criteria, to be used for over-view purposes only. For a fuller description, including scoring guideposts under each Performance Indicator, reference should be made to the full assessment tree, complete with scores and justification, contained in **Appendix 1.1** of this report. Alternately a fuller description of the MSC Principles and Criteria can be obtained from the MSC website (www.msc.org).

Principle 1

A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

Intent:

The intent of this Principle is to ensure that the productive capacities of resources are maintained at high levels and are not sacrificed in favour of short-term interests. Thus, exploited populations would be maintained at high levels of abundance designed to retain their productivity, provide margins of safety for error and uncertainty, and restore and retain their capacities for yields over the long term.

Status

» The stock is at a level that maintains high productivity and has a low probability of recruitment overfishing.

» Limit and target reference points are appropriate for the stock (or some measure or surrogate with similar intent or outcome).

» Where the stock is depleted, there is evidence of stock rebuilding and rebuilding strategies are in place with reasonable expectation that they will succeed.

Harvest strategy / management

» There is a robust and precautionary harvest strategy in place, which is responsive to the state of the stock and is designed to achieve stock management objectives.

» There are well defined and effective harvest control rules in place that endeavour to maintain stocks at target levels.

» Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.

» The stock assessment is appropriate for the stock and for the harvest control rule, takes into account uncertainty, and is evaluating stock status relative to reference points.

Principle 2

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends

Intent:

The intent of this Principle is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

Retained species / Bycatch / ETP species

» Main species are highly likely to be within biologically based limits or if outside the limits there is a full strategy of demonstrably effective management measures.

» There is a strategy in place for managing these species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.

» Information is sufficient to quantitatively estimate outcome status and support a full strategy to manage main retained / bycatch and ETP species.

Habitat & Ecosystem

» The fishery does not cause serious or irreversible harm to habitat or ecosystem structure and function, considered on a regional or bioregional basis.

» There is a strategy and measures in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.

» The nature, distribution and vulnerability of all main habitat types and ecosystem functions in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery and there is reliable information on the spatial extent, timing and location of use of the fishing gear.

Principle 3

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Intent:

The intent of this principle is to ensure that there is an institutional and operational framework for implementing Principles 1 and 2, appropriate to the size and scale of the fishery.

Governance and policy

» The management system exists within an appropriate and effective legal and/or customary framework that is capable of delivering sustainable fisheries and observes the legal & customary rights of people and incorporates an appropriate dispute resolution framework.

» Functions, roles and responsibilities of organisations and individuals involved in the management process are explicitly defined and well understood. The management system includes consultation processes.

» The management policy has clear long-term objectives, incorporates the precautionary approach and does not operate with subsidies that contribute to unsustainable fishing.

Fishery specific management system

» Short and long term objectives are explicit within the fishery's management system.

» Decision-making processes respond to relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner.

» A monitoring, control and surveillance system has been implemented. Sanctions to deal with non-compliance exist and there is no evidence of systematic non- compliance.

» A research plan provides the management system with reliable and timely information and results are disseminated to all interested parties in a timely fashion.

Appendix 1.1 Performance Indicator Scores and Rationale

Evaluation Table for PI 1.1.1

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	**Guidepost**	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
	Met?	Yes	Yes	Yes
	Justification	Annual catches of krill, though slowly rising year on year, are well below the trigger levels set overall and generally too by subarea. The overall trigger level itself is currently only 11% of the estimated catch limit overall, and that catch limit is estimated using a precautionary recruitment criterion that renders a high degree of certainty that recruitment of krill is not being impaired		
b	**Guidepost**		The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
	Met?		Yes	Yes
	Justification	Catches, which were higher historically, are well below levels that might impact both target and limit reference points, if known accurately, though the form of the assessment is such that such points are not currently evaluated directly. Uncertainties do exist and there is no annual assessment of the stock, but management and controls on catch are rigorous, with reporting systems sufficiently robust to detect potential concerns long before they become problematic		
References		WG-EMM 2011, 2012, and 2013, various reports, Constable and de la Mare (1996), WG-EMM-13/37 Rev. 1 (2013)		

Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Target reference point	Percentage of B_0 after 20 years	75%	Biomass is in the range 37–208 million tonnes, well above 75%B_0
Limit reference point	Probability of biomass being less than a set percentage of B_0 after 20 years	20%	Current evaluated range as above, so there is extremely low probability of stock being at that percentage of B_0

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

Evaluation Table for PI 1.1.2

PI 1.1.2		Limit and target reference points are appropriate for the stock		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	Yes	Yes	
	Justification	Target and limit reference points are defined as part of the harvest control rule and not determined directly. However, the fishery is currently managed through implementation of a catch trigger level, well below the precautionary catch limit (PCL) currently estimated from the GYM, which acts as an effective risk-limit reference point. Values of F and B consistent with this trigger level in the fishery have been compared with the harvest control rule and shown to be well below (F) and above (B) both target and limit reference points.		
b	**Guidepost**		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		Yes	Yes
	Justification	The determination of reference points relative to the 620 000 t trigger level (Peatman *et al*. 2011; F = 0.0159, 95% CIs 0.00750–0.0357); current SSB = 97.7% SSB_0; 80% CIs 71.6–135%), a level which is much higher than recent catches, reveals full consideration of precautionary issues, despite the recent comments by Kinzey *et al*. 2013 about the uncertainty associated with the basic parameters for M and recruitment variability applied in the GYM. Note that the limit reference point currently defined indirectly as part of the harvest control rule, which allows a much larger catch than currently taken and would be far higher than the trigger level, is already calculated as being at a level commensurate with there being a very low risk of reproductive capacity of the stock being impaired in any way.		
c	**Guidepost**		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		Yes	
	Justification	The target reference point is set at a precautionary level such that the stock is being maintained at a level consistent with a proxy B_{MSY}. However, as krill constitute a massive forage and foraging resource and hence are a crucial part of the ecosystem, an overarching concern for management is to support its ecological role, with substantial biomass being reserved specifically for predation. Currently, subdivision of the stock and quotas into SSMUs to reflect this crucial ecological role of krill has not been achieved, and seemingly we are far from that situation even though smaller area trigger levels have been established. Hence, SG100 is not yet met		

PI 1.1.2		Limit and target reference points are appropriate for the stock		
d	Guidepost		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
	Met?		Yes	
	Justification	Krill is a low trophic level species, and as stated in text, the target reference point does take into account its ecological role through the predator criterion used in the model and process. In this perspective, the reference point protecting spawning biomass has to maintain it at a level of at least 75% of B_0, although that percentage is not based on krill biology and is always subject to updating as more information might become available through research and ecosystem modelling		
References		Miller (2003), Peatman *et al*. (2011), Kinzey *et al*. (2013), WG-EMM 2011, 2012, and 2013, various reports		
OVERALL PERFORMANCE INDICATOR SCORE:				90
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.1.3

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?	(Y/N)		(Y/N)
	Justification	The stock is clearly not depleted, so no scoring is applicable here		
b	**Guidepost**	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted 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 depleted stock.
	Met?	(Y/N)	(Y/N)	(Y/N)
	Justification	With a non-depleted stock, no rebuilding is necessary, but CCAMLR anyway has predefined rules for ensuring stock rebuilding should that situation eventuate. Hence, in the unlikely event that depletion is proven in the future, a rigorous rebuilding plan would be developed and implemented		
c	**Guidepost**	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
	Met?	(Y/N)	(Y/N)	
	Justification	As above, any future rebuilding plan would stipulate the time-frame in terms of CCAMLR rules		
References		WG-EMM 2011, 2012, and 2013, various reports		

PI 1.1.3	**Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe**
OVERALL PERFORMANCE INDICATOR SCORE:	**n/a**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 1.2.1

PI 1.2.1		**There is a robust and precautionary harvest strategy in place**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	Yes	Yes	Yes
	Justification	The stock is currently only lightly exploited, so the harvesting strategy remains incompletely tested against even a doubling of the exploitation rate, which the trigger level would allow but is considered to be unlikely under the present conditions of interest in the fishery. It is highly unlikely that the stock would be placed at risk under current levels of exploitation, although the harvest has been increasing slowly over recent years. The target reference point built into the harvest strategy is aimed at ensuring that sufficient stock is available for predators, so that the role of krill in the ecosystem is preserved. Careful monitoring of predators and the focal distribution of the fishery does reveal limited overlap, although the extent of overlap does vary seasonally. Research into this issue is continuing. The current trigger level of 620 000 t, which has been in place for several years, is only 11% of the precautionary catch limit based on the General Yield Model, which is based on recruitment and predator criteria within a harvest control rule. The trigger level is an arbitrary one and the lowest of several proposals made originally, but still some 50% more than the historical annual harvest by the fishery (during the 1980s). The PCL is reviewed annually and set at the lowest of recruitment- and predator-targeted outcomes of the model, with currently the predator level yielding the lowest value. However, no catch limit will be instituted, even if desired and potential catches rise drastically, until formal smaller management areas (small-scale management units, SSMUs) have been established, so allowing for greater protection of the predators of krill competing for the resource with the fishery. Research into how such SSMUs may be constructed is comprehensive, but no attempt has been made recently to institute them, likely because the catch remains so low and the fact that other management issues currently assume greater importance overall. However, the precautionary trigger level catch is subdivided into percentage (and tonnage) trigger levels for subareas of Area 48, so management of krill exploitation is moving towards smaller area management, by default. The trigger levels for smaller subareas have been reached twice in recent years and the fishery in those areas closed for the season. This has arisen generally because the annual geographic distribution of krill fishing operations is variable by season, depending generally on climate conditions and sea-ice extent. The response to the closure (which in both cases was well into the season) was gratifyingly immediate.		
b	**Guidepost**	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	

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
	Justification	As stated above, the harvest strategy has not been fully tested, but there is plenty of evidence that it is achieving all its objectives. There is a comprehensive observer/monitoring programme in place (independent observer monitoring on board the krill fishing vessels plus CEMP monitoring of predator populations), and there is no evidence, factual or anecdotal, that krill biomass or predator populations are being impacted negatively at the current level of exploitation. There is also no indication of market demand for krill product increasing much beyond current levels, and with no unaccounted for fishing activity taking place, it is deemed unlikely that the current strategy will not continue to achieve its objectives. Catch rates are not used to model fishery performance, and several fishery-independent surveys of parts of the focus fishing area are starting to yield results that in due course will be considered in tandem to replace the findings of the single synoptic survey or Area 48 carried out in 2000. The lack of a follow-up synoptic survey is regrettable, but cost mitigates against it. Clearly, a regular, fully synoptic survey would be preferable in terms of delivering proof of efficacy of the current harvesting strategy, which is using the 2000 findings as the basis for the management advice and catch limits. However, in its absence and given the lack of factual indications that both krill stock and predator populations dependent upon it are being impacted negatively at the much lower level of catches beneath the conservative overall trigger level, there is sufficient evidence that the current strategy is achieving its objectives		
c	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Yes		
	Justification	Monitoring of the krill and predator stocks is adequate for management. Observer coverage is not 100% (though it is in the UoC fishery) and it is categorized generally as independent (definitely so in the UoC fishery). CEMP monitoring is impressive, and regular annual effort is deployed in all of the target fishing areas to show that commercial catches of krill are not negatively impacting the predator populations, i.e. that annual variations in predator populations cannot be attributed solely to the effect of the commercial fishery for krill. Hence, it is clear that the monitoring currently in place is sufficient to show that the harvest strategy is working effectively		
d	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Yes
	Justification	Not only is the harvest strategy periodically reviewed, but it is also improved as monitoring and research information becomes available and as the Commission requires. Various meetings of WGEMM and CCAMLR are well minuted, and any issues are discussed in establishing whether the harvest strategy is working effectively or what needs to be improved. Catch limits and trigger level, and more importantly trigger levels for the subareas within Area 48, are reviewed annually. Although annual catches are rising generally, and information from notifications suggests that they will continue to rise in future, they are still well below the annual trigger level overall, and to date of writing, only two subarea (trigger level) closures have resulted, both well into the season. According to Watters *et al*. (2009), the overall management objectives may not be achieved if annual catches are made at the trigger level before smaller-area quotas are put in place, but the establishment of the subarea trigger levels (and their implementation twice in closing subareas to harvesting) has ensured that such a situation is unlikely to arise. Management in support of the harvest strategy is therefore clearly working and will likely preclude the warning of Watters *et al.* (2009) that management objectives might be compromised. However, that situation will need to be reviewed regularly.		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
e	Guidepost	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not a relevant issue		
References		Watters *et al*. (2009), WG-EMM 2011, 2012, and 2013, various reports		
OVERALL PERFORMANCE INDICATOR SCORE:				95
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.2

PI 1.2.2		**There are well defined and effective harvest control rules in place**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
	Met?	Yes	Yes	
	Justification	All evidence is that the current level of exploitation is ultra-precautionary. The fact that catches are kept within an overall trigger level that is only 11% of the catch limit means that the exploitation rate will not approach either target or limit reference points, at least for the foreseeable future and definitely not until the necessary quotas for SSMUs are decided. The harvest control rule is well defined and is fully consistent with the declared harvesting strategy for krill. The CCAMLR objective is to allow development of the fishery for krill up to that allowed by the harvest control rule, but the trigger level currently in place constrains catches so that none of the reference points are approached.		
b	**Guidepost**		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		Yes	
	Justification	Main uncertainties in system understanding are taken into consideration in the harvest control rule, shown by the relatively low level of catch allowed against the trigger level relative to the catch limit based on the model. However, uncertainties associated with, for instance, variations attributable to climate change and associated oceanographic dynamics are not explicitly covered in the selection. Uncertainty in recruitment and biomass levels is catered for as the harvest control rule itself is probabilistic and the lowest estimate of B_0 is always taken. This generates confidence that the precautionary level of total catch allowed is appropriate.		
c	**Guidepost**	There is some evidence that tools used to implement harvest control rules 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 harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met?	Yes	Yes	

PI 1.2.2		There are well defined and effective harvest control rules in place
	Justification	Much of the evidence is based on a highly effective and impressively accurate observer coverage of the fishery. The bases for the model underlying management are up-to-date life history parameters, but biomass results based on a synoptic survey completed 14 years ago. That biomass is taken as B_0, although there was fishing subsequent to that time, is a slight concern, though, even though catch levels since have seemingly been very low relative to total biomass. The decision rule uses a proxy for biomass at MSY, with an arbitrary adjustment to allow for the biomass necessary to support predator populations. Reported catches (in some cases based on widely varying conversion factors from processed to green weight) are the main method of controlling the catch against targeted maximum levels of exploitation, and they are generally well monitored and managed. Despite the concerns about the accuracy of the reports, however, given the currently relatively low levels of catch, the tools is use are probably adequate in keeping exploitation levels under control.
References		WG-EMM 2011, 2012, and 2013, various reports, Demer *et al*. (2007), Heywood *et al*. 2006)
OVERALL PERFORMANCE INDICATOR SCORE:		**80**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 1.2.3

PI 1.2.3		**Relevant information is collected to support the harvest strategy**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery 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	
	Justification	Information on the fleets active in the fishery is excellent, through the notification system, which has been proven actually to overpredict the catch that might be taken. An excellent reporting system provides the final accurate data on fleet distribution at any single time. The synoptic survey of 2000 (the results of which underpin the harvest strategy) and various other individual surveys conducted before and since provide the majority of the baseline data on stock structure and abundance, but more information on the spatial distribution of biomass is essential for SSMU management to be instituted in future. Productivity is assessed through the results of the annual reviews of stock health at CCAMLR, when the harvest strategy and catch limits are reviewed, and the catch composition (of krill and any other species taken, which comprise little) is determined from the observer/monitoring system. Fishery-independent surveys are the source of the environmental data made available, but the quantity of such data cannot be described as comprehensive.		
b	**Guidepost**	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Yes	Yes	
	Justification	Stock abundance is monitored through regular review of catch and effort information and (newly) available scientific evidence provided by the scientific corps of CCAMLR. Catch monitoring in the krill fishery is excellent, with reports deposited by the observers at worst monthly, and given current markets, there is no incentive to misreport. There is no discarding in the UoC fishery, but some may take place in other fisheries for krill, particularly where the size of the animals (mainly for the purposes of human consumption) is important. Conversion factors in such fisheries are not consistent, but with the current low level of exploitation, that situation is unlikely to cause problems. The harvest control rule for krill fishing in place depends on reasonable knowledge of krill life history, and although there has been improvement in the knowledge base over time, some elements, such as age and early life history, remain insufficiently known to preclude this item being scored above SG80		
c	**Guidepost**		There is good information on all other fishery removals from the stock.	

PI 1.2.3		Relevant information is collected to support the harvest strategy		
	Met?		Yes	
	Justification	Virtually the whole catch is taken from the target area specified for the UoC fishery, with very little or no krill annually being caught in adjacent areas that might hold a small part of the same stock, and none from outside the CCAMLR area, so all extractions are well documented given the level of CCAMLR monitoring in place. Fishing for krill is also virtually clean, with few other fish taken (see P2 scoring on the small take of other items by the fishery). It is notable too that, in this fishery, there is no incentive to misreport.		
References		WG-EMM 2011, 2012, and 2013, various reports, Demer *et al*. (2007), Heywood *et al*. 2006), WG-EMM-13/37 Rev. 1 (2013)		
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.4

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		Yes	
	Justification	The krill is not subject to an annual stock assessment of the nature generally applied in fisheries, as much because of the very small catches relative to the survey-determined stock size as to the general lack of appropriate data to support su8ch an assessment. However, the approach of using a generalized yield model and predator and recruitment criteria is appropriate in terms of determining an upper catch limit for the stock, but again it has to be stressed that the trigger level set for the fishery (i.e. the absolute maximum that may be taken) is just 11% of that level, so is ultra-precautionary in terms of the harvest control rule in place. It is merely the lack of baseline information on stock biology and distribution that mitigates against scoring more than 80 for this guidepost		
b	**Guidepost**	The assessment estimates stock status relative to reference points.		
	Met?	Yes		
	Justification	Target and limit reference points are taken into consideration in the GYM approach and harvest control rule, although catch maxima are well below the suggested levels allowed through the inclusion in management of a trigger level of catch. Stock status is reviewed regularly through this approach		
c	**Guidepost**	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	
	Justification	Uncertainty is taken into account through the GYM being stochastic and applying a probabilistic decision rule. Although some structural uncertainties are not taken into account in the assessment, which is based predominantly on dated survey data, the precautionary nature of management, through the lowest of several candidate values for B_0 being used to determine the catch limit and an even more restrictive trigger level being set, clearly support the view that uncertainty is effectively covered by the system now in place.		
d	**Guidepost**			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Yes

PI 1.2.4		**There is an adequate assessment of the stock status**		
	Justification	The assessment is reviewed regularly at CCAMLR and new data, where available, are employed to ensure that it is as robust as it can possibly be given the difficulty of obtaining fresh data at any time in such a distant area of the globe. Alternative hypotheses for stock status have been and are being explored through various different models and parameter choices (e.g. for target strength in the acoustic assessment), but at present, virtually the most conservative estimate of B_0 is still used in priming the harvest rule and ensuring sustainability of the total fishery. Again, though, it has to be stressed that trigger level catches remain well below assessment-derived catch limits		
e	**Guidepost**		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		Yes	
	Justification	Although a limited amount of external peer review of the assessment has been undertaken by interested parties, most of the (thorough) annual review is through the CCAMLR WG system		
References		WG-EMM-2011, 2012, 2013, various reports, de la Mare (1994a, 1994b), Jolly and Hampton (1990), Constable and de la Mare (1996)		
OVERALL PERFORMANCE INDICATOR SCORE:				**85**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.1.1

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Main retained species are likely to be within biologically based limits (if not, go to scoring issue c below).	Main retained species are highly likely to be within biologically based limits (if not, go to scoring issue c below).	There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.
	Met?	N/A	N/A	No
	Justification	The larval fish bycatch report compiled by MRAG (2012) for the Aker BioMarine krill fishery identifies myctophids (lanternfish, LAN) and channichthyids (icefish, ICE) species as dominating the retained species in the catch, with lower levels of Nototheniidae (Notothenid, NOT) species. The only species to achieve SG100 is *Champsocephalus gunnari* in Subarea 48.3. Notothenid species suffered from overexploitation in the 1970s and do not reach SG60. They are evaluated under SGc. Lanternfish and icefish species attain SG80.		
b	**Guidepost**			Target reference points are defined for retained species.
	Met?			No
	Justification	Reference points are defined only for *Champsocephalus gunnari* (icefish).		
c	**Guidepost**	If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	Yes	Yes	

PI 2.1.1		**The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species**		
	Justification	The precautionary trigger level for the krill fishery (which is currently just 11% of the estimated catch limit overall), the partition of the TAC among smaller subareas to ensure control over depletion in those areas, along with the exclusion net of fine mesh and the monitoring of catch composition through 100% observer coverage in this UoC are expected to result in the fishery not unduly influencing the status or hindering the recovery of such species. According to CCAMLR Scientific Observer reports and MRAG's (2012) Larval fish bycatch report, the total larval fish retention on board makes up less than 0.5% of the total catch. Although some of the species taken as larval bycatch may be outside biologically based limits (e.g. *Notothenios rosii*), this partial strategy is sufficient to prevent any hindrance to species recovery. Besides, directed fishing for this specie is forbidden in the area. The work carried out by MRAG looked at the biomass estimates for these species in the different subareas and concluded that there is no significant risk to any of their populations within Area 48. MRAG also evaluated the additional risk posed by the *Antarctic Sea* entering the fishery at the time of this recertification evaluation. They conclude that, even assuming that both vessels would operate to their maximum possible annual capacity, there would not be a significant threat to any of the fish populations taken as larvae by the UoC fishery. Lanternfish and icefish species both attain SG80.		
d	**Guidepost**	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		
	Met?	Yes		
	Justification	The status of all species is known. There is also a partial strategy in place that would avoid any hindrance to the recovery of species such as *Notothenios rosii.*		
References		» CCAMLR Scientific Observer Cruise Reports for 2012 and 2013. » MRAG, 2012. Analysis of larval bycatch on the Saga Sea during continuous trawling for krill in CCAMLR Areas 48 between December 2007 and September 2011.		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.1.2

PI 2.1.2		**There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
	Met?	Yes	Yes	
	Justification	The precautionary trigger level for the krill fishery (which is currently only 11% of the estimated catch limit overall), the establishment of subareas with associated quotas (which area expected to be converted into smaller scale management units, SSMUs, but are not yet specifically defined as such), along with the exclusion net of fine mesh at the codend and the monitoring of the catch composition through 100% observer coverage are considered as a partial strategy that is expected to ensure that the fishery would not hinder any recovery of these species.		
b	**Guidepost**	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 partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Yes	Yes	
	Justification	The risk assessment carried out by MRAG (using information directly about the fishery and the species involved) in the larval fish bycatch report provides confidence objectively that this partial strategy will work.		
c	**Guidepost**		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Yes	
	Justification	The CCAMLR scientific observer programme and Aker BioMarine's 100% observer coverage, along with the fact that all CCAMLR regulations are met for this fishery, provide evidence for the successful implementation of this partial strategy.		

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
d	Guidepost			There is some evidence that the strategy is achieving its overall objective.
	Met?			No
	Justification	As there is no specific strategy for the management of larval retained species, this SG cannot be met. Although a good management strategy would imply the unharmed release of all individuals entering the net, it is notable that the larval proportion in the total catch is <0.5%.		
e	Guidepost	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not a relevant issue in this fishery		
References		» CCAMLR Conservation Measure 51-01 (2010) regarding Precautionary catch limitations on *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-01.pdf » CCAMLR Conservation Measure 51-07 (2011). Interim distribution of the trigger level in the fishery for *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-07.pdf » MRAG, 2012. Analysis of larval bycatch on the *Saga Sea* during continuous trawling for krill in CCAMLR Areas 48 between December 2007 and September 2011.		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.1.3

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
	Met?	Yes	Yes	
	Justification	Accurate information on catch composition is available through the manifold observer reports. However, is difficult to state the consequences for the status of all species, because their distribution is not always well understood and is also subject to other ecosystem factors.		
b	**Guidepost**	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
	Met?	Yes	Yes	
	Justification	Fish larval bycatch work carried out by MRAG in 2012 looked at biomass estimates for these species in the different subareas with respect to biologically based limits. Data on catch composition is collected on an ongoing basis through CCAMLR scientific observer reports.		
c	**Guidepost**	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Yes	Yes	Yes
	Justification	Information on catch is reported to CCAMLR on a continuous basis. 100% international observer coverage ensures sampling and recording of information on catch composition according to the CCAMLR Scientific observers manual. There is also access to the catch composition of other vessels not part of the UoC fishery (but only with 50% observer coverage). This comprehensive information base is sufficient to support and evaluate a strategy for managing retained species.		
d	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator score or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
	Met?		Yes	Yes

PI 2.1.3		**Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species**
	Justification	Aker Biomarine's 100% observer coverage is adequate to assess ongoing mortalities to all retained species. Difficulties in taxonomically identifying some individuals is solved by photographing or conserving them for later study at South Georgia or in the UK.
References		» CCAMLR Scientific Observer Manual. http://www.ccamlr.org/en/system/files/obsman.pdf » www.ccamlr.org » MRAG, 2012. Analysis of larval bycatch on the *Saga Sea* during continuous trawling for krill in CCAMLR Areas 48 between December 2007 and September 2011. MRAG, London. 36 pp.
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.2.1

PI 2.2.1		The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Main bycatch species are likely to be within biologically based limits (if not, go to scoring issue b below).	Main bycatch species are highly likely to be within biologically based limits (if not, go to scoring issue b below).	There is a high degree of certainty that bycatch species are within biologically based limits.
	Met?	Yes	Yes	Yes
	Justification	Given the harvesting strategy used by Aker BioMarine with its continuous pumping system, no species in the catch composition can be considered as bycatch. The whole harvest is kept onboard and considered as krill (other than very small proportions of other species considered under the retained species PI). The catch is not sorted on board, and the total catch is retained. There are no size limitations operating in the fishery (e.g. minimum landing size) which could lead to discarding. Birds, seals and whales that are not included in the CITES list should also be considered under this PI. Any interactions with such species are recorded in the comprehensive scientific observer reports. Table 8 in section 3.4.2 lists the fatalities of bycatch species after entanglement with the nets, and reveals a maximum of 5 birds per year killed for both vessels operating in the UoC fishery. All of them were species of least concern according to the IUCN red list. Therefore, bycatch or incidental mortality can be considered to be minimal.		
b	**Guidepost**	If main bycatch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	If main bycatch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	Yes	Yes	
	Justification	As mentioned above, there are no bycatch species in the catch composition to consider here. For other incidental catches, there are mitigation measures in the design of the net, such as a marine mammal exclusion device and a 22 mm mesh excluder net at the codend to avoid taking any bycatch. Harvesting strategy, with the net being set generally once every 20 or 25 d (proxy) also limits any interactions with birds or other predators, most of which would be attracted to the fishing operation at shooting and hauling times. The establishment of trigger levels for smaller subareas and regions also mitigates any depletion of species that might become bycatch.		
c	**Guidepost**	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.		
	Met?	Yes		

PI 2.2.1		**The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups**
	Justification	As bycatch is negligible, there is no risk of this fishery hindering the recovery of bycatch species, if depleted.
References		» AKER BioMarine notification to CCAMLR to enter the fishery » CCAMLR Scientific Observer Cruise Reports for 2012 and 2013.
OVERALL PERFORMANCE INDICATOR SCORE:		**100**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.2.2

PI 2.2.2		There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place, if necessary, that are expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing and minimizing bycatch.
	Met?	Yes	Yes	Yes
	Justification	This strategy consists of: » 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 » Retention on board of all material captured » 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. » 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.		
b	**Guidepost**	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 partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Yes	Yes	Yes
	Justification	The CCAMLR international observer programme, with 100% observer coverage in this UoC, records any interactions of the fishery with different species. CCAMLR Scientific Observer Cruise Reports from previous years show minimum interaction with any potential bycatch species. The use of underwater cameras during the deployment of the gear is a useful tool that allows the observer to see underwater interactions of the gear.		
c	**Guidepost**		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Yes	Yes

PI 2.2.2		**There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations**		
	Justification	The krill fishery in the Southern Ocean has been managed by CCAMLR since 1982. Subarea quotas were allocated in 2011 (Conservation Measure 51-07) to prevent localized overexploitation by the fishery. Subarea 48.1 was closed in October 2010 and June 2013 for the balance of those two fishing seasons, when the cumulative catch there reached the trigger level for the subarea (155 000 t currently). Other than that, the Aker BioMarine Antarctic krill fishery has implemented several improvements in its own gear since its first MSC certification, in an attempt to meet even more rigorous standards of fishery and ecosystem sustainability. It can therefore be concluded that the strategy for managing bycatch is implemented successfully. Evidence of this implementation can be found in the exhaustive observer reports.		
d	**Guidepost**			There is some evidence that the strategy is achieving its overall objective.
	Met?			Yes
	Justification	CCAMLR Scientific Observer Cruise Reports reveal little interaction with species other than the target krill or minimal retained species. Table 8 shows that a maximum of 5 birds were killed per year recently by both vessels as a consequence of entanglements with the fishing gear.		
References		» AKER BioMarine notification to CCAMLR to enter the fishery » CCAMLR Conservation Measure 51-07 (2011). Interim distribution of the trigger level in the fishery for *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-07.pdf » CCAMLR Scientific Observer Cruise Reports for 2012 and 2013. » CCAMLR Secretariat. Krill fishery report: 2013 update. WG-EMM-13/37 Rev. 1 http://www.ccamlr.org/en/wg-emm-13/37-rev-1		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.2.3

PI 2.2.3		Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Qualitative information is available on the amount of main bycatch species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery.	Accurate and verifiable information is available on the catch of all bycatch species and the consequences for the status of affected populations.
	Met?	Yes	Yes	Yes
	Justification	The fishery falls completely under CCAMLR international observer programme. The well-constructed CCAMLR scientific observer manual provides guidelines for scientific observers in terms of sampling processes, data collection and the observations to be made on board. Both the manual and the reports are available on the CCAMLR website. Seabird abundance around the vessels can reach up to >500 when fishing is good. There are sporadic interactions between seabirds and the fishing gear during shooting and hauling (once each every 20–25 d) when the net is at the surface. The 5 seabird casualties recorded per year (in the past 2½ years) are categorised as species of least concern according to the IUCN red list, implying little consequence for the affected populations. The observers record any bycatch entanglement and fatality, as well as identifying and counting other species of special interest around the vessel. The quick sinking of the net on deployment prevents interactions with the fishing gear, so other bird mitigation devices or acoustic scarers (e.g. tori lines) are not considered to be needed.		
b	**Guidepost**	Information is adequate to broadly understand outcome status with respect to biologically based limits	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.
	Met?	Yes	Yes	Yes
	Justification	As the bycatch is negligible, it is expected that biologically based limits for such species will not be affected by the fishery. However, any incidental bycatch would be recorded in CCAMLR Scientific Observer Cruise Reports. Underwater cameras also contribute to the gathering of this information.		
c	**Guidepost**	Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a strategy to manage bycatch species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Yes	Yes	Yes
	Justification	Information gathered by observers is sufficient to evaluate the efficiency of the strategy mentioned in 2.2.2.a		

PI 2.2.3		**Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch**		
d	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
	Met?		Yes	Yes
	Justification	Both the *Saga Sea* and the *Antarctic Sea* have 100% international observer coverage, under the formal CCAMLR scientific observer programme. This observer programme started in 2006 and will continue in future, so it should be sufficient to assess ongoing mortalities to all bycatch species, which are anyway negligible at the moment. The observers record not only bycatch fatalities, but also entanglements that result in the unharmed release (or self-escapement) of the animal and estimation of different populations of sea birds and marine mammals seen from the vessel.		
References		» CCAMLR Scientific Observer Manual. http://www.ccamlr.org/en/system/files/obsman.pdf » CCAMLR Scientific Observer Cruise Reports for 2012 and 2013.		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.3.1

PI 2.3.1		The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
	Met?	Yes	Yes	Yes
	Justification	Both UoC vessels include a Sea Lion Escape Device (SLED) to prevent marine mammal entanglements, particularly those of seals. However, an Antarctic fur seal was caught by its jaw in August 2013 and became inextricably entangled in the main net of the *Antarctic Sea*, resulting in the animal's death. This has seemingly been the only entanglement of ETP species with the net in the past 2½ years on both Aker BioMarine vessels. Observer reports for previous years have not been revised. Marine mammal and bird observations and interactions are recorded in CCAMLR Scientific Observer Reports in accord with the CCAMLR Observers Manual. Identification guides are available for all observers on the bridge of the vessels.		
b	**Guidepost**	Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.
	Met?	Yes	Yes	Yes
	Justification	ETP species such as Antarctic fur seals, which are extremely abundant in some areas, feed next to the vessel during hauling. However, hauling takes place generally only once every 20–25 d (proxy), so interactions are expected to be minimal. More than 10 000 Antarctic fur seals were counted cumulatively by the observers next to the *Antarctic Sea* in 2013. Only one of those was reported to have been killed, on 4 August 2013, which yields a very low probability of entanglement. Besides the direct detrimental effect on the animal, the team considers that this low probability (0.01%) provides a high degree of confidence that such effects are not significant in terms of the overall population. No other detrimental effect on ETP species was recorded by observers in the years 2012, 2013 and 2014 (January–June for the latter).		
c	**Guidepost**		Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
	Met?		Yes	Yes

PI 2.3.1		**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**
	Justification	Direct effects or interactions between the fishery and ETP species are minimal. For indirect effects, the mapping of selected krill predator summer foraging ranges with fishing activity of Aker BioMarine's *Saga Sea* during the period 2007–2011 reveals a high degree of overlap of summer foraging ranges of Antarctic fur seals and year-round fishing operations. This information needs to be collected on a continuous basis in future. At the current harvesting rate of krill, there would be no significant indirect impacts on this specie. If the catch rate were to increase, however, some species could be affected, especially those that are constrained in their foraging ambit (seals and also penguins, which are not under the CITES agreement). Therefore, harvesting should only take place where these species feed when there are adequate management provisions based on robust ecological knowledge, or where there is a high level of precautionary protection (Phil Trathan, pers. comm.). According to Hewitt *et al*. (2004), the estimated annual consumption of krill in Area 48 shows that fur seals would eat 706.7 thousand tonnes per year, whales 2360 thousand tonnes, fish 2963.9 thousand tonnes and penguins up to 9192.1 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.
References		» CCAMLR Scientific Observer Manual. http://www.ccamlr.org/en/system/files/obsman.pdf » CCAMLR Scientific Observer Cruise Reports for 2012 and 2013. » Convention on International Trade in Endangered Species of Wild Fauna and Flora list. http://www.cites.org/eng/disc/species.php » Hewitt et al. 2004. Options for allocating the precautionary catch limit of krill among small scale management units in the Scotia Sea. *CCAMLR Science, Vol.* 11 (2004): 81–97. http://www.ccamlr.org/en/system/files/science_journal_papers/05hewitt-etal.pdf » Nicoll, R., and Douglass, L. 2012. Project report: Mapping krill trawling and predator distribution.
OVERALL PERFORMANCE INDICATOR SCORE:		**95**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.3.2

PI 2.3.2		**The fishery has in place precautionary management strategies designed to:** • **Meet national and international requirements;** • **Ensure the fishery does not pose a risk of serious harm to ETP species;** • **Ensure the fishery does not hinder recovery of ETP species; and** • **Minimise mortality of ETP species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place that minimise 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 fishery'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 fishery'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
	Justification	All krill vessels operating in Area 48 have to apply CCAMLR Conservation Measures 26-01, 51-01 and 25-03 to minimize incidental mortalities of marine mammals and seabirds. The same strategies are used in the avoidance of bycatch and consist of: » 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 » Retention on board of all material captured » 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. » 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.		
b	**Guidepost**	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 strategy will work, based on information directly about the fishery and/or the species involved.	The 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
	Justification	CCAMLR scientific observer reports have not recorded any significant or fatal interactions on ETP species in the fishing operation of the UoC fishery. Marine mammals and birds in the vicinity of the operation are counted and their presence documented formally by the observer.		
c	**Guidepost**		There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Yes	Yes

PI 2.3.2		**The fishery has in place precautionary management strategies designed to:** • **Meet national and international requirements;** • **Ensure the fishery does not pose a risk of serious harm to ETP species;** • **Ensure the fishery does not hinder recovery of ETP species; and** • **Minimise mortality of ETP species.**		
	Justification	Clear evidence of the strategy being implemented can be found in CCAMLR Scientific Observer Reports, CCAMLR Annual Observer Reports and Annual Fishery Reports.		
d	**Guidepost**			There is evidence that the strategy is achieving its objective.
	Met?			Yes
	Justification	The strategy is considered to be achieving its objective because there are no significant interactions recorded on the manifold observer reports perused.		
References		» CCAMLR Annual Fishery Reports » CCAMLR Annual Observer reports » CCAMLR Conservation Measure 25-03 (2011) on the minimization of incidental mortalities of seabirds and marine mammals in the course of trawl fishing in the Convention Area. http://www.ccamlr.org/en/measure-25-03-2011 » CCAMLR Conservation Measure 26-01 (2009) on general environmental protection during fishing. http://www.ccamlr.org/en/measure-26-01-2009 » CCAMLR Conservation Measure 51-01 (2010) regarding Precautionary catch limitations on Euphausia superba in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-01.pdf » CCAMLR Scientific Observer Manual. http://www.ccamlr.org/en/system/files/obsman.pdf » CCAMLR Scientific Observer Cruise Reports for 2012, 2013 and 2014.		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.3.3

PI 2.3.3		**Relevant information is collected to support the management of fishery 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	**Guidepost**	Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
	Met?	Yes	Yes	
	Justification	ETP species in the area are those included in the CITES list (see Section 3.4 of this report, covering ecosystem background). Onboard observers record interactions, impacts, injuries or mortalities of all the species listed. 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 (Trathan *et al.* 2011, 2012), but the effects in the area on the recovery of populations of whales and fur seals are still poorly described (Christensen 2006, Nicol *et al*. 2008, IWC 2010). The 2013 South Georgia and the South Sandwich Islands Marine Protected Area Management Plan (Appendix 9) describes the ETP species present in that region.		
b	**Guidepost**	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
	Met?	Yes	Yes	Yes
	Justification	The presence, abundance, interactions with and injuries to ETP species such as marine mammals and seabirds is recorded on CCAMLR Scientific Observer Reports, which are produced and available on board the UoC vessels during all fishing operations. The overlap between some of the predators' summer foraging ranges and the krill fishery has recently (in 2012) been mapped. Such records and studies should provide accurate information on the magnitude of all impacts and the consequences for the status in the region of ETP species.		
c	**Guidepost**	Information is adequate to support measures to manage the impacts on ETP species.	Information is sufficient to measure trends and support a full 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
	Justification	The CCAMLR observer programme provides sufficient data to support this form of strategy and to evaluate its effectiveness. Injuries to or mortalities of ETP species is minimal so the strategy is working. CCAMLR and the International Whaling Commission have worked together through, for instance, a formal "CCAMLR-IWC Workshop to review input data for Antarctic marine ecosystem models", establishing steering committees from both organizations.		

PI 2.3.3	**Relevant information is collected to support the management of fishery 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.**
References	» CCAMLR-IWC Joint Workshop to Review Input Data for Antarctic Marine Ecosystem Models report. *J. Cetacean Res. Manage. 11 (suppl.2),* 2010. http://iwc.int/cache/downloads/i5flpo5e6coog0c04g40scg0/SC-61-Rep2-JCRM11(2).pdf » Christenesen L.B. (2006) Marine mammal populations; reconstructing historical abundances at the global scale. *Fish Cent Res Rep* 14:1-161. » Government of South Georgia and the South Sandwich Islands. 2013. The South Georgia and South Sandwich Islands Marine Protected Area management plan. http://www.sgisland.gs/download/MPA/MPA%20Management%20Plan%20v2.0.pdf » Krafft, B.A., Skaret, G., Krag, L.A., Trathan, P.,Ying, Y. Studies of Antarctic krill, krill predators and trawl gear at South Orkney Islands, 2013. *Institute of Marine Research Report, N*r 8- 2013. » Lynch, H.J., Naveen, R., Trathan, P., Fagan, W.F. Spatially integrated assessment reveals widespread changes in penguin populations on the Antarctic Peninsula. *Ecology*, 93(6), 2012, pp. 1367–1377. » Nicoll, R., Douglass, L. 2012. Project report: Mapping krill trawling and predator distribution » Nicol S, Worby A, Leaper R (2008) Changes in the Antarctic sea ice ecosystem: potential effects on krill and baleen whales. *Mar Freshw res* 59:361-382. » Trathan P.N., Fretwell P.T., Stonehouse B. 2011 First recorded loss of an emperor penguin colony in the recent period of Antarctic regional warming: implications for other colonies. *PLos ONE* 6:e14738. » Trathan P.N., Ratcliff N., Masden E.A. 2012 Ecological drivers of change at South Georgia: the krill surplus, or climate variability. *Ecography* 35:983-993.
OVERALL PERFORMANCE INDICATOR SCORE:	**95**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 2.4.1

PI 2.4.1		**The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
	Met?	Yes	Yes	Yes
	Justification	Owing to the pelagic nature of the trawling operations there is no interaction with the seafloor, so there is little potential for damaging the benthic ecosystem. Reports submitted by scientific observers from January 2012 to June 2013 do not record any gear loss during those years, other than some floats occasionally recorded as lost during manoeuvre along with small sections of rope (~1 m long). Before 2012, just one set of gear was recorded as lost in the UoC fishery. On that occasion, no attempt was made to recover the gear, so there might have been some impact on the seabed in the immediate vicinity of the gear-loss site, but not elsewhere. There are some marine protected areas in Area 48, but VMS reveals that the UoC fishery does not enter them during its normal operations.		
References		» CCAMLR Scientific Observer Cruise Reports for 2012, 2013 and 2014.		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.4.2

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	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 the fishery on habitat types.
	Met?	Yes	Yes	Yes
	Justification	As stated above, the gear can only impact the habitat in the case of gear loss. CCAMLR Conservation Measures 21-03 and 51-01 restrict the type of fishing gear to be used to pelagic gear only. This is generally operated works 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. In 2009 CCAMLR designated the South Orkney Islands southern shelf as its first Marine Protected Area. The Antarctic Treaty System has different 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, coast-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, established in 2012, 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. At-sea inspections are carried out under the auspices of CCAMLR and also by South Georgia Fisheries Patrol Vessels.		
b	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
	Met?	Yes	Yes	Yes
	Justification	The establishment and location of marine protected areas have taken into account scientific opinion on the crucial areas associated with breeding seabird colonies. 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. The virtually no interaction of the gear with the seabed also contributes to the efficiency of this strategy.		

PI 2.4.2		**There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types**		
c	**Guidepost**		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Yes	Yes
	Justification	Most of the marine protected areas are of recent creation, which gives an idea of the involvement of CCAMLR and the South Georgia and South Sandwich Islands 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.		
d	**Guidepost**			There is some evidence that the strategy is achieving its objective.
	Met?			Yes
	Justification	VMS (vessel monitoring system) data and manifold observer scientific reports show how localized the fishery is, seeking out the few very 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.		
References		» CCAMLR Conservation Measure 21-03 (2013). Notifications of intent to participate in a fishery for *Euphausia superba*. http://www.ccamlr.org/en/measure-21-03-2013 » CCAMLR Conservation Measure 51-01 (2010) regarding Precautionary catch limitations on *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-01.pdf » CCAMLR Scientific Observer Cruise Reports for 2012 and 2013. » IUCN. Antarctic Treaty Consultative Meeting XXXV. Hobart 2012. (IP34) Using ASMAs and ASPAs when necessary to complement CCAMLR MPAs http://www.ats.aq/index_e.htm » Government of South Georgia and the South Sandwich Islands. 2013. The South Georgia and South Sandwich Islands Marine Protected Area management plan. http://www.sgisland.gs/download/MPA/MPA%20Management%20Plan%20v2.0.pdf		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.4.3

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There is basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
	Met?	Yes	Yes	
	Justification	The distribution of terrestrial vulnerable habitat types in the area is very well known. Increased seafloor mapping would improve the knowledge of the UoC krill fishery habitats, with information on vulnerable benthic marine ecosystems still scarce. The South Georgia and South Sandwich Island Government manages nine benthic closed areas located within their territorial waters. However, it is stressed again that the krill fishery is conducted with pelagic gear only and that there is no interaction with the seafloor. For the pelagic ecosystem, a number of oceanographic models have been developed, including the Ocean circulation and climate advanced modelling project (OCCAM; Rintoul *et al.* 2001). Development work in this respect is still being undertaken, and in 2007, the CCAMLR Bio-regionalization Workshop served notice that it wished to include the Ross Sea area in a network of marine protected areas.		
b	**Guidepost**	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.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
	Met?	Yes	Yes	Yes
	Justification	Gear operated in the pelagic zone of the sea does not interact with the seafloor (the net is not constructed anyway to withstand contact with the seabed). However, international 100% observer coverage would record any such interaction which would happen only in the case of gear loss.		
c	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Changes in habitat distributions over time are measured.
	Met?		Yes	

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types
	Justification	Changes in terrestrial habitats are measured, but not marine benthic habitats water where the fishery takes place. However, again it needs to be stressed that there is no interaction of the gear with seafloor habitats. In terms of the pelagic ecosystem in the area, this is monitored by CCAMLR through research surveys using remote sensing, localized sensor arrays, argo floats and other sensors. The findings are incorporated within ecosystem and current models (OCCAM).
References		» GEBCO General Bathymetric Chart of the Oceans. http://www.gebco.net/about_us/news_and_events/arctic_antarctic_mapping_meeting.html » IBCSO International Bathymetric Chart of the Southern Ocean. http://www.ibcso.org/ » http://www.ibcso.org/documents/IBCSO_AGU2012_ePoster.pdf » Arndt, J.E., H. W. Schenke, M. Jakobsson, F. Nitsche, G. Buys, B. Goleby, M. Rebesco, F. Bohoyo, J.K. Hong, J. Black, R. Greku, G. Udintsev, F. Barrios, W. Reynoso-Peralta, T. Morishita, R. Wigley, "The International Bathymetric Chart of the Southern Ocean (IBCSO) Version 1.0 - A new bathymetric compilation covering circum-Antarctic waters", Geophysical Research Letters, doi: 10.1002/grl.50413 http://hs.pangaea.de/Maps/bathy/IBCSO_v1/IBCSO_v1_digital_chart_pdfA.pdf » Ainley, D.G., Ballard, G., Weller, J. 2010. CCAMLR WG-EMM-10/11. Ross Sea Biodiversity, Part I: validation of the 2007 CCAMLR Bio-regionalization Workshop results towards including the Ross Sea in a representative network of marine protected areas in the Southern Ocean. http://www.ccamlr.org/en/wg-emm-10/11 » Government of South Georgia and the South Sandwich Islands. 2013. The South Georgia and South Sandwich Islands Marine Protected Area management plan. http://www.sgisland.gs/download/MPA/MPA%20Management%20Plan%20v2.0.pdf » Rintoul, S.R., Hughes, C. and Olbers, D. 2001 Ocean circulation and climate. Chapter 4.6 The Antarctic Circumpolar Current System. *Academic Press* ISBN 0-12-641351-7 » Thorpea,S.E., Heywooda, K., Brandonb, M.A., Stevens, D.P. Journal of Marine Systems 37 (2002) 87 – 105. Variability of the southern Antarctic Circumpolar Current front north of South Georgia. https://ueaeprints.uea.ac.uk/15924/1/DS_30.pdf » Trathan, P.N., Grant, S.M., Siegel, V., Kock K-H. CCAMLR Science, Vol. 20 (2013): pp 139–151. Precautionary spatial protection to facilitate the scientific study of habitats and communities under ice shelves in the context of recent, rapid, regional climate change. http://www.ccamlr.org/en/system/files/science_journal_papers/Trathan%20et%20al_0.pdf

OVERALL PERFORMANCE INDICATOR SCORE:	**85**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 2.5.1

PI 2.5.1		**The fishery 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	**Guidepost**	The fishery 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 fishery 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 fishery 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
	Justification	The current CCAMLR *Euphausia superba* TAC for Area 48 is 5.61 million tonnes, with an established precautionary trigger level of 620 000 t. The lower (trigger) limit is intended, *inter alia*, to ensure that in terms of CCAMLR primary objectives, the impact of the fishery on krill-dependent predators is minimized. Most of the krill catch in Area 48 is made in Subareas 48.1, 48.2 and 48.3 (see Section 3.3. above), and in 2009 CCAMLR introduced trigger level limits for each subarea. Those subarea trigger levels are calculated using the GYM. According to Peatman *et al*. (2011), the probability of stock depletion increases substantially with increased recruitment variability, although in absolute terms it remains negligible. Kinzey *et al*. (2013) note that the proportional recruitment option in the GYM does not appear to be able to model recruitment consistently, and that the precautionary catch limit meeting of CCAMLR criteria relies on the maintenance of a natural mortality of no more than 0.8. If the trigger level is reached in any of the subareas or the total area, the fishery is obliged to either halt operations there or to move elsewhere to a position where notification of fishing activity has already been given. Krill tend to be in layers and patches ranging from a few square metres across, through shoals, schools, swarms and up to superswarms covering more than 100 km^2, which makes the catch very homogeneous. The whole catch of the UoC fishery is considered to be krill because there is no sorting or discarding. Removals by the krill fishery have been estimated to be orders of magnitude below the demand from predators and the biomass available to both predators and the fishery (Nicoll and Douglass 2012) The annual predator demand for krill in Area 48 was estimated by Hewitt *et al.* (2004) as orders of magnitude higher than the current fishery take. Moreover, according to Murphy *et al*. (2007), some species also seek alternative breeding options in years when krill are relatively scarce. International observers record any sighting of ETP species as well as interactions with birds and marine mammals. The records show very little bycatch fatality, a maximum of 5 birds per year for both vessels. Fishing vessels are normally accompanied by >100 birds, and this number increases to >500 birds at the time of hauling. Observer reports do list the entanglement and death of a single Antarctic fur seal in a 2½-year period. There is also thorough sampling of the catch composition that shows that larvae retained are relatively few (<0.5%), and that all are identified and recorded. For all the reasons given above, the team and virtually of the consultees consider that at the current harvesting rate it is highly unlikely that the fishery would cause serious or irreversible harm to the key elements of ecosystem structure and function. Any substantial future increases in krill harvests in Area 48 beyond the trigger level, however, will require verification that krill recruitment variability, natural mortality and other parameters specified by Kinzey *et al*. (2013) in the scenarios used to test management criteria, adequately represent the range of plausible values encompassing krill population biology. Observer reports, along with papers by the aforementioned authors, can be considered as evidence here.		
References		» CCAMLR Conservation Measure 51-01 (2010). Precautionary catch limitations on Euphausia superba in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-01.pdf		

PI 2.5.1	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function
	» CCAMLR Conservation Measure 51-07 (2011). Interim distribution of the trigger level in the fishery for Euphausia superba in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-07.pdf » CCAMLR Scientific Observers Manual (2011). http://www.ccamlr.org/en/system/files/obsman.pdf » Government of South Georgia and the South Sandwich Islands. 2013. The South Georgia and South Sandwich Islands Marine Protected Area management plan. http://www.sgisland.gs/download/MPA/MPA%20Management%20Plan%20v2.0.pdf » Hewitt et al. 2004. CCAMLR Science, Vol. 11 (2004): 81–97. Options for allocating the precautionary catch limit of krill among small scale management units in the Scotia Sea (p. 88, Table 2). http://www.ccamlr.org/en/system/files/science_journal_papers/05hewitt-etal.pdf » Kinzey, D., Watters, G. and Reiss, C.S. (2013). Effects of recruitment variability and natural mortality on generalised yield model projections and the CCAMLR decision rules for Antarctic Krill. http://www.ccamlr.org/en/system/files/science_journal_papers/Kinzey%20et%20al.pdf » Murphy, E. J., Watkins, J. L., Trathan, P. N., Reid, K.,, Meredith, M. P., Thorpe, S. E., Johnston, N. M., Clarke, A., Tarling, G. A., Collins, M. A., Forcada, J., Shreeve, R. S., Atkinson, A., Korb, R., Whitehouse, M. J., Ward, P., Rodhouse, P. G., Enderlein, P., Hirst, A. G., Martin, A. R., Hill, S. L., Staniland, I. J., Ponmd, D. W., Briggs, D. R., Cunningham, N. J., and Fleming, A. H. 2007. Spatial and temporal operation of the Scotia Sea ecosystem: a review of large-scale links in a krill centred food web. *Philosophical Transactions of the Royal Society of London B. Biological Sciences* 362. Doi: 10.1098/rstb.2006.1957. » Nicoll, R., Douglass, L. 2012. Project report: Mapping krill trawling and predator distribution. » http://www.ccamlr.org/en/publications/science_journal/ccamlr-science-volume-20 » Peatman, T., Clarke, J. M., and Agnew, D. J. 2011. Estimation of management reference points consistent with the catch trigger level for the Antarctic krill fishery in Area 48. WG-EMM-11-17. CCAMLR, Hobart. https://www.ccamlr.org/es/node/65473
OVERALL PERFORMANCE INDICATOR SCORE:	**100**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 2.5.2

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan, in place.
	Met?	Yes	Yes	
	Justification	The trigger levels associated with the Area 48 subareas, established through to CCAMLR Conservation Measure 51-07, are considered to be a partial strategy that prevents the fishery from causing serious harm to the ecosystem. It is obligatory for the fishery to move to another area if the trigger level is reached. 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.		
b	**Guidepost**	The measures take into account potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	The strategy, which consists of a plan, contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
	Met?	Yes	Yes	
	Justification	The establishment of an interim distribution of the trigger level in the different subareas has been an improvement in the management of the fishery since the previous UoC certification assessment. However, Small Scale Management Units (SSMU) are not totally implemented yet (see Section 3.3 above). Data collected through the CCAMLR Ecosystem Monitoring Programme 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.		
c	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.
	Met?	Yes	Yes	

PI 2.5.2		**There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function**		
	Justification	Measures such as the establishment of subareas and their rigorously enforced precautionary trigger levels in CCAMLR Area 48, established under Conservation Measure 51-07 (2011), ensure that the fishery does not cause irreversible harm to the fishery. The measure recognizes that catches up to the trigger levels in areas smaller than the whole of Area 48 are the maximum that should be made at the current state of knowledge. The reporting of catch and effort data on a haul-by-haul basis, required in all CCAMLR fisheries, facilitates monitoring of cumulative catch in each subarea. Data gathered through this monitoring are used to monitor fishery activity, quantifying catches of target and bycatch species, incidental catches and any removal of vulnerable marine ecosystem (VME) indicator species, estimate fishery and biological parameters and contribute to assessment of fish stocks.		
d	**Guidepost**		There is some evidence that the measures comprising the partial strategy are being implemented successfully.	There is evidence that the measures are being implemented successfully.
	Met?		Yes	
	Justification	Subarea 48.1 has been closed twice to the fishery well into each season, in October 2010 and in June 2013, as its precautionary trigger level was reached. The team considers that this provides evidence of the successful implementation of management controls over the ecosystem.		
References		» CCAMLR Conservation Measure 51-07 (2011). Interim distribution of the trigger level in the fishery for *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4. http://www.ccamlr.org/sites/drupal.ccamlr.org/files//51-07.pdf » http://www.ccamlr.org/en/wg-emm-13/37-rev-1 » https://www.ccamlr.org/en/wg-emm-11/5 » http://www.ccamlr.org/en/fisheries/fishery-monitoring		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.5.3

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Information is adequate to identify the key elements of the ecosystem (e.g., trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	Yes	Yes	
	Justification	Despite the inhospitable nature of the Southern Ocean, its ecosystem has been studied fairly well over many years through different research programmes and the development of appropriate models. The CCAMLR Working Group on Ecosystem Monitoring and Management (WG-EMM), considering data generated through the monitoring of CEMP areas and information collated in scientific observer reports, monitors the effect the fishery may be having on the ecosystem. Different institutions such as the International Whaling Commission, 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 and other institutions and NGOs provide even more knowledge of the region's ecosystem. Several models covering krill, the Southern Ocean or small area foodweb, the Antarctic ecosystem and Antarctic physical characteristics have been developed.		
b	**Guidepost**	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information and some have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
	Met?	Yes	Yes	
	Justification	CCAMLR reviews and analyses data from CEMP and identifies trends in the monitored parameters by species and site. Recent reports on the fisheries overlap with the marine foraging areas of land-based predators, as well as studies on larval bycatch composition have been produced. However, there is still need for more knowledge on the predatory requirements of pelagic predators such as the baleen whales. Some authors are of the opinion that functional relationships between the fishery and elements of the ecosystem are not yet sufficiently well understood (e.g. Kawaguchi *et al.* 2006). In 2007 the CCAMLR WG-EMM noted that the results of a comprehensive review of the structure and operation of the Scotia Sea ecosystem indicated that a combination of historical exploitation and the effects of climate change could lead to significant and rapid changes over the next two or three decades. Climate change brings changes to the Southern Ocean's temperature, acidity and sea ice coverage, with consequences on krill populations that are not yet well understood. A WG-EMM report notes that at current harvesting levels, it is unlikely that the existing design of CEMP, with the data available to it, would be sufficient to distinguish between ecosystem changes attributable to harvesting of commercial species and changes attributable to environmental variability, whether physical or biological (Appendix D, paragraph 87; WG-EMM Report 2003, pp. 143–145). There is need, therefore, for more information on the impacts of climate change on krill recruitment and survival. Krill management needs to incorporate a feedback tool to be sufficiently adaptive and flexible to respond in a timely manner to ecosystem change.		

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
c	Guidepost		The main functions of the Components (i.e., target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species are identified and the main functions of these Components in the ecosystem are understood.
	Met?		Yes	Yes
	Justification	CCAMLR scientific observer reports identify and record interactions with target, retained, bycatch and ETP species. Special attention is paid in management to studying retained species and especially krill predators. The main functions of these components in the ecosystem have been studied through a range of models, which include those exploring specific aspects of krill biology (Hofmann and Hùsrevõglu 2003; Murphy *et al.* 2004), multispecies population models (May *et al*. 1979; Murphy, 1995), single species population projection models to quantify regional catch limits (Constable *et al.* 2000), spatial single species models (e.g. Marin and Delgado 2001), mass-balance regional foodweb models such as EwE (Cornejo-Donoso and Antezana 2008), a spatial multispecies operating model (SMOM) of krill–predator fishery dynamics (Plagányi and 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).		
d	Guidepost		Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
	Met?		Yes	Yes
	Justification	Information derived from observer 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. These provide sufficient information to parameterize the ecosystem models described above and have been used to examine the main consequences for the ecosystem as a result of fishing at different levels.		
e	Guidepost		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
	Met?		Yes	
	Justification	Data are collected by different groups and institutions, and can be obtained *inter alia* from logbooks, VMS track records, observer reports and CEMP programme. In the team's opinion, it should be sufficient to detect increases in risk levels to both target stock and the ecosystem in which it is found. However, the team considers that there is need for more protected areas where more information could be gathered to support developing strategies. Such protected areas could serve as reference areas where fishing cannot take place, to investigate the impacts of climate change without the impacts of fishing. Some areas where species biodiversity is great could also be protected to study how the ecosystems there operate in the absence of fishing, and to study how oceanographic dynamics, bathymetry and krill movements combine to explain the biodiversity of the areas.		

PI 2.5.3	There is adequate knowledge of the impacts of the fishery on the ecosystem
References	» www.ccamlr.org » CCAMLR Scientific Observer Cruise Reports for 2012 and 2013. » CCAMLR WG-EMM 2003 report CEMP Review (pages 143 to 148) http://www.ccamlr.org/es/system/files/s-sc-xxii-a4.pdf » CCAMLR WG-EMM 2007 Report. http://www.ccamlr.org/es/system/files/s-sc-xxvi-a4.pdf » http://www.ccamlr.org/en/science/ccamlr-ecosystem-monitoring-program-cemp » http://www.ccamlr.org/en/science/working-group-ecosystem-monitoring-and-management-wg-emm » Constable A.J., de la Mare, W.K., Agnew, D.J., Everson, I. and Miller, D. 2000 Managing fisheries to conserve the Antarctic marine ecosystem: practical implementation of the Convention on the Conservation of Antarctic Marine Living Resources. *Ices J. Mar. Sci.* 57, 778-791. (doi:10.1006/jmsc.2000.0725) » Cornejo-Donoso, J., Antezana, T., Preliminary trophic model of the Antarctic Peninsula Ecosystem (Sub-area CCAMLR 48.1) (EwE model) *Ecological Modelling* 218 (2008) 1–17. http://www.ecopath.org/node/195 » Hofmann, E.E and Hùsrevõglu, Y. S. 2003. A circumpolar modeling study of habitat control of Antarctic krill (*Euphausia superba)* reproductive success*. Deep Sea Res. Part II Topical Stud. Oceanogr*. 50, 3121-3142. doi:10.1016/j.dsr2.2003.07.012 » Marín, V. H. and Delgado, L.E. 2001 A spatially explicit model of the Antarctic krill fishery off the south Shetland Islands. *Ecological* Applications 11(4): 1235-1248. » May, R.M. 1979. Ecological interactions in the Southern Ocean. *Nature* 277, 86-89. (doi:10.1038/277086a0) » Murphy, E.J. 1995 Spatial structure of the Southern Ocean ecosystem predator-prey linkages in the Southern Ocean food-webs*. J. Anim. Ecol*. 64, 333-347. (doi:10.2307/5895) » Murphy, E. J., Thorpe, S.E. Watkins, J.L., and Hewitt, R. 2004. Modeling the krill transport pathways in the Scotia Sea: Spatial and environmental connections generating the seasonal distribution of krill. *Deep Sea Res. Part II Topical Stud. Oceanogr*. 51, 1435-1456. (doi:10.1016/j.dsr2.2004.06.019) » Plagányi, E.E. and. Butterworth, D.S. 2012. The Scotia Sea krill fishery and its possible impacts on dependent predators: modeling localized depletion of prey*. Ecological Applications* 22:748–761. http://www.esajournals.org/doi/abs/10.1890/11-0441.1 » Rintoul, S.R., Hughes, C. and Olbers, D. 2001 Ocean circulation and climate. Chapter 4.6 The Antarctic Circumpolar Current System. *Academic Press* ISBN 0-12-641351-7
OVERALL PERFORMANCE INDICATOR SCORE:	**90**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 3.1.1

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	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

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
	Justification	The fishery is managed mainly by CCAMLR, in interaction with the Norwegian Ministry/Directorate of Fisheries and the Government of South Georgia and the South Sandwich Islands (GSGSSI). CCAMLR coordinates scientific research and observer programmes, establishes TAC and distributes quotas between subareas. The Norwegian Ministry/Directorate of Fisheries issues fishery permits and performs quota control of the client vessels. CSGSSI issues permits for the vessels in the SGSSI Maritime Zone. CCAMLR determines the regulatory framework applied to the management of each fishery in the Convention Area, including catch limits and seasonal or area closures and measures aimed at minimizing potential impacts of fishing activities on non-target species and the ecosystem. The Standing Committee on Implementation and Compliance, subordinate to the Commission, provides it with information, advice, recommendations on fishery monitoring and compliance. The Scientific Committee provides the Commission with the best available scientific information on harvesting levels and other management issues. In turn, the Commission is obliged 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 programmes of CCAMLR members. In addition CCAMLR has established a number of programmes to collect the data required for the effective management of the Southern Ocean, including fisheries monitoring, scientific observers on fishing vessels and ecosystem monitoring. Norway has a well-established system for fisheries management, which has evolved over more than a century and is now codified in the 2008 Marine Resources Act. The Act provides for a formal system of cooperation between regulatory bodies of governance, such as the Ministry of Fisheries and Coastal Affairs, the Directorate of Fisheries and the Coast Guard, and further for cooperation between management authorities and scientific research institutes, primarily the Institute of Marine Research. The 2008 Integrated Management Plan for the Norwegian Sea provides for cooperation between different sector authorities, such as the Ministry of Fisheries and Coastal Affairs and the Ministry of Environment. GSGSSI is involved in the licensing of vessels that fish in the South Georgia Maritime Zone, catch monitoring at King Edward Point in South Georgia and at-sea surveillance in the Maritime Zone. A Marine Protected Area was introduced in 2012 and reinforced in May 2013, including a no-fish zone within 12 nautical miles of the coast. The national and international legal documents refer to and are in compliance with relevant international agreements, such as the 1982 Law of the Sea Convention and the 1995 Fish Stocks Agreement. Norwegian and South Georgia fishery authorities liaise closely with CCAMLR. The system is considered to be effective insofar as it constitutes a coherent set of rule-making practices at national and international level.

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**		
b	**Guidepost**	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 fishery.	The management system incorporates or 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	
	Justification	Any issues of contention among the CCAMLR member states can be raised and discussed at the meetings of the Commission and subordinate bodies. These processes are transparent and subject to scrutiny by all member states. The system is considered to be effective insofar as no major disputes have emerged, although the assessment team has not been provided with evidence that this has been tested and proven to be the case. At the national level in Norway, there is an effective, transparent dispute-resolution system in place, with fishermen able to take their case to court if they do not accept the rationale behind an infringement accusation by enforcement authorities, or the fees levied against them. Verdicts at the lower court levels can be appealed to higher levels. There are instances from recent years that management authorities have lost cases against fishermen and accepted the verdict, which is a clear demonstration that the system works.		
d	**Guidepost**	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	Yes
	Justification	Within the fishery there are no indigenous people dependent upon fishing in waters managed by CCAMLR, and no indigenous inhabitants of SGSSI. According to MSC Review and Report on Compliance with the Scheme Requirements (see Appendix 3.1), this scoring issue still needs to be scored and might meet the SG100 level. The team interprets this to the effect that a SG100 score can be achieved if the fishery has no negative impact on people dependent on fishing for food or livelihood. This is the case in the present fishery.		
References		» CCAMLR Annual Fishery Reports » CCAMLR website » Convention on the Conservation of Antarctic Marine Living Resources, 1982 » Government of South Georgia and the South Sandwich Islands. 2013. The South Georgia and South Sandwich Islands Marine Protected Area management plan. http://www.sgisland.gs/download/MPA/MPA%20Management%20Plan%20v2.0.pdf		

PI 3.1.1	**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**	
	» Interviews with representatives of GSGSSI, the Norwegian Ministry of Foreign Affairs and the Norwegian Directorate of Fisheries » Norwegian Ministry of Fisheries. 2008. Act of 6 June 2008 no. 37 relating to the Management of Wild Living Marine Resources (the Marine Resources Act). » Norwegian Ministry of Fisheries. 2012. Fiskeriavtalane Noreg har inngått med andre land for 2013 og fisket etter avtalane i 2011 og 2012 (The Fishery Agreements Norway had Concluded with Other Countries for 2013 and Fishery according to the Agreements in 2011 and 2012), *Meld. St. 40 (2012-2013)* (White Paper No. 40 2012-2013).	
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 3.1.2

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	**Guidepost**	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	Yes
	Justification	Overall management lines and the responsibilities of different management bodies are clear. The main responsibility for developing and promulgating the management plan for the fishery within Area 48 lies with CCAMLR, within the framework of the Antarctic Treaty. Article XVII of the Convention details the role of the Executive Secretary of CCAMLR and any other staff that they may need to appoint. Scientists appointed by CCAMLR members meet annually in Working Groups to undertake stock assessments and prepare scientific advice for the Commission. This scientific advice is reviewed annually by the CCAMLR Scientific Committee, which provides management advice to the Commission. Management policies and procedures are implemented through Conservation Measures and Resolutions. The CAMLR Convention sets out the terms under which observers can attend and participate in its statutory meetings. Within the CCAMLR Secretariat, the roles for the management of the different aspects of the fishery (compliance, data, observers, etc.) are well defined and operate in a clear and efficient manner. At national level in Norway, the roles, functions and responsibilities of the various actors, including management authorities, the Institute of Marine Research, NGOs and fishermen's organizations are clearly defined in long-standing practice and are now codified in the Marine Resources Act. Within the SGSSI Maritime Zone, the only relevant actor is GSGSSI, which is responsible for licensing and enforcement. Their role is clearly defined and well understood by participants in the fishery.		
b	**Guidepost**	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 demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
	Met?	Yes	Yes	

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**		
	Justification	As follows from 3.1.1 above, overall management responsibility for Antarctic krill rests with CCAMLR. Member States must comply with all regulations and requirements set (as Conservation Measures) and subsequently license their own flagged vessels. All decisions on Conservation Measures and other resolutions are made by consensus. The NGO Antarctic and Southern Ocean Coalition (ASOC) had been actively involved in marine management in the Antarctic since the establishment of CCAMLR and was given observer status in 1991. ASOC is also a key partner to the Antarctic Krill Conservation Project, which is an international effort managed by the Pew Foundation, to secure from CCAMLR an ecosystem-based fisheries management programme for krill which is highly precautionary, scientifically based and protects the unique environment of the southern polar region. The management system demonstrates consideration of the information, but the assessment team has not been provided with documentation that consistently explains how the information is or is not used.		
c	**Guidepost**		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	Yes
	Justification	The process followed includes an open forum for dialogue, and encourages transparency wherever possible. As follows from 3.1.2 a) above, ASOC has observer status in CCAMLR and is also a key partner to the Antarctic Krill Conservation Project. At national level in Norway, WWF is actively consulted on krill issues by Norwegian fisheries management authorities. For instance, the Ministry of Foreign Affairs invites stakeholders, including WWF, to meetings before CCAMLR meetings in order to discuss relevant issues, including for the management of krill. WWF has been invited to become part of the Norwegian delegation to CCAMLR, but has chosen to remain an independent actor. A formal partnership between the client and WWF-Norway has existed since 2006 with the common goal of sustainable management of fish and krill, and combating illegal harvesting. A new three-year agreement was signed in 2012. The joint activities of Aker BioMarine and WWF-Norway include promoting environmental labelling and ensuring traceability throughout the fisheries value chain, from harvesting through to products purchased by consumers. WWF-Norway will play a key role too of bringing critical external stakeholder input into the management process for the fishery under assessment.		
References		» ASOC website » CCAMLR website » Convention on the Conservation of Antarctic Marine Living Resources, 1982 » Interviews with representatives of the Institute of Marine Research, the Norwegian Ministry of Foreign Affairs, the Norwegian Directorate of Fisheries and WWF » Norwegian Ministry of Fisheries. 2008. Act of 6 June 2008 no. 37 relating to the Management of Wild Living Marine Resources (the Marine Resources Act) » Norwegian Ministry of Fisheries. 2012. Fiskeriavtalane Noreg har inngått med andre land for 2013 og fisket etter avtalane i 2011 og 2012 (The Fishery Agreements Norway had Concluded with Other Countries for 2013 and Fishery according to the Agreements in 2011 and 2012), *Meld. St. 40 (2012-2013)* (White Paper No. 40 2012-2013)		
OVERALL PERFORMANCE INDICATOR SCORE:				**95**

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**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 3.1.3

PI 3.1.3		**The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Long-term objectives to guide decision-making, consistent with the MSC Principles and Criteria and the precautionary approach, are implicit within management policy	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach are explicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.
	Met?	Yes	Yes	Yes
	Justification	All CCAMLR fisheries are managed within a precautionary and ecosystem approach, as defined by the FAO in its Code of Conduct for Responsible Fisheries, and are consistent with MSC Principles and Criteria. At national level in Norway, the 2008 Marine Resources Act, which covers all living marine resources, requires that Norwegian fisheries management be guided by the precautionary approach and by an ecosystem approach that takes into account habitats and biodiversity. The SGSSI Marine Protected Area management plan is designed to ensure the protection and conservation of the region's marine life, whilst allowing sustainable and carefully regulated fisheries, which is considered to be consistent with MSC Principles and Criteria.		
References		» Convention on the Conservation of Antarctic Marine Living Resources, 1982 » FAO Code of Conduct for Responsible Fisheries, 1995 » Government of South Georgia and the South Sandwich Islands. 2013. The South Georgia and South Sandwich Islands Marine Protected Area management plan. http://www.sgisland.gs/download/MPA/MPA%20Management%20Plan%20v2.0.pdf » Norwegian Ministry of Fisheries. 2012. Act of 6 June 2008 no. 37 relating to the Management of Wild Living Marine Resources (the Marine Resources Act)		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.1.4

PI 3.1.4		**The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure they do not contribute to unsustainable fishing practices.
	Met?	Yes	Yes	
	Justification	There is clear evidence that the management system in place is seeking to ensure that negative incentives do not arise. The client receives no national subsidy, and the CCAMLR system has no capacity to provide subsidies of any sort. Costs related to the operation and management of the Commission are fully recovered from member states through their membership fees. Nor does the GSGSSI provide subsidies of any sort, recovering their fisheries management operational costs from licensed vessels through the charging of license fees. There is an implicit incentive to meet national (Norway), CCAMLR and GSGSSI requirements in terms of licensing, observer requirements and data reporting, to ensure that Norwegian fishing operations are well placed to ensure future licensing in the fishery. Although the management system seeks to ensure that perverse incentives do not arise, the assessment team has not been provided with documentation proving that incentives are explicitly considered in a regular review of management policy.		
References		» Interviews with representatives of GSGSSI, the Institute of Marine Research and the Norwegian Directorate of Fisheries and WWF		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.1

PI 3.2.1		**The fishery 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	**Guidepost**	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's 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's 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's management system.
	Met?	Yes	Yes	Partly
	Justification	The three main objectives of the CCAMLR management system are (Article 2 of the Convention): 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 minimization 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. The aims of these three objectives mirror and preceded the establishment of the aims of MSC Principles 1 and 2. CCAMLR's more specific, short- and long-term strategy for achieving these objectives is reflected in Conservation Measure 51-01 (2010). A precautionary krill catch limit of 5.61 million tonnes is set for Area 48, based on the potential yield estimate. This is well above the current catch and will allow for expansion. However, a "catch trigger" (620 000 t) is set not to be exceeded until a procedure for division of the overall catch limit into smaller management units has been established, based on advice from the Scientific Committee. The objective of this division is to avoid possible unacceptable concentration of catch within the foraging areas of vulnerable predators. Although the trigger level is close to the highest global annual catch to date, it is significantly more than the largest annual catch to date in Area 48. Hence, well defined and measurable long- and short-term objectives are in place for the fishery, demonstrably consistent with achieving the outcomes of P1. These are explicit insofar as they are well-established, understood and applied by users within the fishery and considered durable and unambiguous (cf. CR CB4.1.3). However, they are less well defined and measurable for P2.		
References		» CCAMLR website » Convention on the Conservation of Antarctic Marine Living Resources, 1982 » Interviews with representatives of the Norwegian Ministry of Foreign Affairs and the Norwegian Directorate of Fisheries » Norwegian Ministry of Fisheries. 2008. Act of 6 June 2008 no. 37 relating to the Management of Wild Living Marine Resources (the Marine Resources Act) » Norwegian Ministry of Fisheries. 2012. Fiskeriavtalane Noreg har inngått med andre land for 2013 og fisket etter avtalane i 2011 og 2012 (The Fishery Agreements Norway had Concluded with Other Countries for 2013 and Fishery according to the Agreements in 2011 and 2012), *Meld. St. 40 (2012-2013)* (White Paper No. 40 2012-2013)		
OVERALL PERFORMANCE INDICATOR SCORE:				**90**

PI 3.2.1	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 3.2.2

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 under assessment.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	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	
	Justification	CCAMLR has well established decision-making processes. They allow for stakeholder input and clear scientific analysis of the data available within the Working Groups and Scientific Committee, and they result in conservation measures and fisheries strategies designed to achieve their short- and long-term fishery-specific objectives.		
b	**Guidepost**	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	
	Justification	Generally, fisheries-specific issues identified in relevant research are included in transparent decision-making processes within the Working Groups and the Scientific Committee, as appropriate. Where and when necessary, modifications are made by these and by the Norwegian Directorate of Fisheries and GSGSSI to the monitoring and evaluation of the fisheries (through modifications to the complex data-recording systems and observer logbooks). A clear example of the well-functioning responsiveness of the management system is its ability to halt the fishery within a subarea once the subarea's proportion of the "trigger level" has been caught. There is no clear evidence, however, that *all* issues identified in relevant research, monitoring, evaluation and consultation are responded to in the appropriate way.		
c	**Guidepost**		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		Y	
	Justification	CCAMLR decision-making is based on the precautionary approach (see 3.1.3) and the best available information by national experts working closely together in Working Groups, the Scientific Committee and the Commission.		

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 under assessment.		
d	**Guidepost**	Some information on fishery performance and management action is generally available on request to stakeholders.	Information on fishery performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders provides comprehensive information on fishery performance and management actions and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	Yes	Yes	Yes
	Justification	Formal reporting to all interested stakeholders, primarily through CCAMLR reports and website, describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. The whole CCAMLR process is based on dialogue, stakeholder involvement and formal reporting. The same is true for the Norwegian fisheries management system, which in addition to written reports and websites extensively uses informal as well as formal meetings open to all interested stakeholders to describe how available information is responded to. The role of GSGSSI is the management of the fisheries in question is more limited, but they also publish information about licensing and enforcement matters on their website and in written reports.		
e	**Guidepost**	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	Yes
	Justification	The management system works proactively – within CCAMLR and its Working Groups – to settle any disagreement outside the legal system. There are no signs that the management system does not rapidly implement judicial decisions arising from legal challenges, neither from Norway nor SGSSI. As mentioned in 3.1.1 b), there are instances in Norway that management authorities have lost cases against fishermen and accepted the verdict, which is a clear demonstration that the system works. However, there are no instances of court cases in the fishery-specific management system.		
References		» ASOC website » CCAMLR Annual Fishery Reports » CCAMLR website » Convention on the Conservation of Antarctic Marine Living Resources, 1982 » Interviews with representatives of GSGSSI, the Institute of Marine Research, the Norwegian Directorate of Fisheries and WWF		
OVERALL PERFORMANCE INDICATOR SCORE:				**95**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.3

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery under assessment 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 under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	Yes	Yes	Yes
	Justification	CCAMLR provides a clear and comprehensive monitoring system and control framework for Antarctic fisheries. Surveillance of CCAMLR fisheries is undertaken by Member States and incorporates the CCAMLR observer scheme. For the client fishery, enforcement is mainly taken care of by the Norwegian Directorate of Fisheries, which has demonstrated a consistent ability to enforce relevant regulations. Vessels are licensed on an annual basis and report catches from each haul through their electronic logbooks, for client vessels at two-hour intervals. In order to receive a license for the Antarctic krill fishery, Norwegian vessels are obliged to have an observer on board at all times. When entering the South Georgia Maritime Zone, vessels need to apply for a licence and pay a fee. All vessels are inspected by the South Georgia administration at King Edward Point before they are allowed to start fishing. They have to report catches on a daily basis and are also inspected by a patrol vessel during fishing operations.		
b	**Guidepost**	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	Yes
	Justification	The implementation of sanctions to deal with non-compliance is an issue for Member States, either through flag state control (here: Norway), or, in the case of South Georgia through GSGSSI, coastal state jurisdiction over the Maritime Zone. The Norwegian enforcement agencies use a graded sanctioning system, with sanctions ranging from oral warnings, written warnings and administrative fines to formal prosecution. If the fishers do not accept the fines issued by the enforcement or prosecution authority, the case goes to court. The system has demonstrated a consistent ability over time to provide effective deterrence. There are no instances of infringements by the client vessels. Sanctions within the South Georgia Maritime Zone are applied at a level appropriate for deterring IUU fishing. No instances of non-compliance by the client vessels exist there either. Moreover, Norwegian interest in the future of the Antarctic krill fishery ensures that, as for all other Norwegian fisheries interests, all regulations on the fishery now, and almost certainly all that may be applied in future, are closely monitored and adhered to.		

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with		
c	Guidepost	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	Yes
	Justification	Fishers seeking certification comply with the management system, providing information on the fishery prior to (Notification of Intent) and during fishing (C1, observer data catch reports), at the levels defined by CCAMLR, the Norwegian Directorate of Fisheries and GSGSSI to provide effective management of the fishery.		
d	Guidepost		There is no evidence of systematic non-compliance.	
	Met?		Yes	
	Justification	There is no evidence of systematic, indeed any, non-compliance. The Norwegian enforcement system is generally considered to work effectively, which strengthens the argument that the lack of systematic non-compliance is merely the result of fault in detection.		
References		» Convention on the Conservation of Antarctic Marine Living Resources, 1982 » Hønneland, G. 2012. *Making Fishery Agreements Work*, Edward Elgar, Cheltenham » Interviews with representatives of GSGSSI and the Norwegian Directorate of Fisheries » Norwegian Directorate of Fisheries. 2013. Melding fra fiskeridirektøren J-236-2013 (Fisheries Directorate Regulation J-236-2013) » Norwegian Ministry of Fisheries. 2008. Act of 6 June 2008 no. 37 relating to the Management of Wild Living Marine Resources (the Marine Resources Act) » Norwegian Ministry of Fisheries. 2012. Fiskeriavtalane Noreg har inngått med andre land for 2013 og fisket etter avtalane i 2011 og 2012 (The Fishery Agreements Norway had Concluded with Other Countries for 2013 and Fishery according to the Agreements in 2011 and 2012), *Meld. St. 40 (2012-2013)* (White Paper No. 40 2012-2013)		

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

Evaluation Table for PI 3.2.4

PI 3.2.4		**The fishery has a research plan that addresses the information needs of management**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
	Met?	Yes	Yes	Yes
	Justification	A comprehensive research plan by CCAMLR exists for krill fisheries, focusing on the monitoring of krill catches, scientific observation and environment monitoring. The CCAMLR Ecosystem Monitoring Programme (CEMP) provides cross-cutting data on environment and predator abundance to link into fisheries data and targets research at an ecosystem approach to management of the krill fishery. An additional research programme for the client group vessels has been developed between Aker BioMarine and British Antarctic Survey and utilising CCAMLR Scientific Observers supplied by MRAG. Data requirements above and beyond the standard set of CCAMLR observer data have been defined and implemented.		
b	**Guidepost**	Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion.	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.
	Met?	Yes	Yes	Yes
	Justification	The research plan and its results are disseminated to all interested parties in a timely fashion and are widely and publicly available on CCAMLR's website.		
References		» CCAMLR Annual Fishery Reports » CCAMLR website » Convention on the Conservation of Antarctic Marine Living Resources, 1982 » Interviews with representatives of the British Antarctic Survey, the Institute of Marine Research, MRAG and the Norwegian Directorate of Fisheries		
OVERALL PERFORMANCE INDICATOR SCORE:				**100**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.5

PI 3.2.5		**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	**Guidepost**	The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system	The fishery has in place mechanisms to evaluate all parts of the management system.
	Met?	Yes	Yes	Yes
	Justification	CCAMLR conducts ongoing internal reviews of its processes and the performance of its Member States to meet the fishery-specific management requirements outlined. These requirements are reviewed annually (to fit in with the annual fisheries cycle) by the appropriate CCAMLR Working Groups (e.g. seabird mortality will be analysed by the Working Group on Incidental Mortality of Associated Fauna).		
b	**Guidepost**	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	Yes	
	Justification	CCAMLR was subject to a comprehensive external performance review during 2008, but such external review is not regular. The review was carried out by a panel appointed by the Commission composed of nine persons (see http://www.ccamlr.org/pu/E/revpanrep.htm. The purpose of the performance review was to evaluate the Commission's performance against comprehensive criteria and specifically against the objectives and principles set out in Article II of the Convention. The review states that the stock status and trends are broadly consistent with Article II of the Convention and international best practice. With particular reference to krill fisheries, it identified the need for ongoing research into predator–prey linkages in ecosystem modelling and adequate monitoring and management within krill fisheries.		
References		» CCAMLR website » Interviews with representatives of the Norwegian Ministry of Foreign Affairs, the Institute of Marine Research, the Norwegian Directorate of Fisheries and WWF		
OVERALL PERFORMANCE INDICATOR SCORE:				**90**
CONDITION NUMBER (if relevant):				

Appendix 1.2 Conditions

There are no conditions for this fishery.

Appendix 2. Peer Review Reports

Peer Reviewer 1

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No** Yes	**Certification Body Response**
Justification: The assessment team's report thoroughly reviews and considers all information required for an informed assessment of the Aker Biomarine Antarctic Krill Fishery in conformity with MSC principles and criteria for sustainable fishing. Conclusions derived from the team's assessment are clearly articulated, supported and justifiable. They are also comprehensive, logical and presented in support of certifying the Fishery.		No comment required

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No** N/A	**Certification Body Response**
Justification: While there are no conditions specifically raised by the assessment team, the continued and potential impact of a fourteen-year lack of a synoptic survey on the krill target stock concerned poses a challenge for the fishery's ongoing management. From a management perspective, the report alludes to the lack of small-scale apportionment, and setting, of precautionary catch limits to mitigate catch over-concentration. An indication by the client as to the decision-making criteria (e.g. in terms of catch rate or actual catches) attached to limiting fishing in such circumstances would be beneficial in terms of balancing the 'conservation' and 'rational exploitation' principles of CAMLR Convention Article II in the context of client expectations.		No comment required in terms of the question posed, because there are no conditions. However, in terms of the query about the client's decision-making criteria applied to determining fishing area, from the discussions had in Norway between the client and the certification team, it is almost certain that the decision reached on where to fish is based on a combination of catch rate (too great a rate will preclude optimal processing), catch volume (too small a catch will not be economic) and the closeness of the total catch to the smaller area maximum.

If included:

Do you think the client action plan is sufficient to close the conditions raised?	**Yes/No** N/A	***Certification Body Response***
Justification: The client is exerting all efforts (e.g. supporting relevant research) to address the challenge outlined above. However, CCAMLR and its Members still have a strong, important, directive and important responsibility to face in facilitating execution of a new krill synoptic survey of Area 48.		Good point, but already well-covered in text and scoring motivation.

General Comments on the Assessment Report (optional)

The report is clear and a pleasure to read. It is well written, thorough and easy to understand. The report's scoring, conclusions and assessments are justifiable and meet all MSC requirements.

Performance Indicator Review

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.1	Yes	Yes	N/A	The stock is highly productive with low probability of recruitment overfishing. Subject to CCAMLR decision rules, the allocated scores are acceptable on a stock status basis. While annual stock assessments are absent (see comments on the Area 48 synoptic survey absence), the management system's precautionary elements are sufficiently robust to respond timeously to likely future impacts on the fishery's target and limit reference points.	No comment or change to text content required
1.1.2	Yes	Yes	N/A	The catch trigger level is well below the F, and above the B, target/limit reference points. The reference points are sufficiently precautionary to allow for larger catches without risking the stock's future reproductive capacity. The target reference points account for krill's key ecological role.	No comment or change to text content required
1.1.3	Yes	Yes	N/A	No stock re-building is necessary, CCAMLR rules should be applied if rebuilding is required.	No comment or change to text content required
1.2.1	Yes	Yes	N/A	A lack of small-scale management areas to account for predator-fishery overlap, and other issues, may not be critical at this stage if catches remain low compared to the overall stock yield and *pro-forma* percentage subareal apportionment of trigger catch	These are valid and valuable comments, but it is not the certification team's mandate to recommend action to CCAMLR in terms of future specific research needs, only to report on the current situation in terms of overall management and the available knowledge. The issue of smaller subarea trigger levels is, however, annually reviewed at the

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				levels remains in place. However, increased and spatially-localised large catches may change this picture, even though the current management strategy appears to meet its objectives. More information is required to examine functional relationships between fishery and krill predators at various scales, as well as in the context of formally using CEMP-derived data to improve discrimination between annual predator variability and fishing effects on the Area 48 krill stock. CCAMLR should should be encouraged to assess the efficacy of subarea trigger levels in ameliorating the need for smaller than subareal catch quotas. Equally, the client should be encouraged to share decision-making criteria (e.g. catch rate or actual catches) attached to limiting fishing in such circumstances (see comment on 'conditions' above).	Commission scientific body in light of all, and especially new, knowledge and the team is comfortable that information on functional relationships between the fishery and krill predators is high on the current agenda. Likewise, the suggestion that the client share its decision-making criteria on where to fish is already being heeded by the client and such information is being shared through the various industry and Commission bodies available. No change is therefore needed to text.
1.2.2	Yes	Yes	N/A	While contributory precautionary elements of the harvest control rules are generally implicit, they are clearly bounded and address CCAMLR objectives. The consequent precautionary nature of attached control decision rules means that catch level(s) fall appropriately (i.e. conservatively) within the lower bounds of associated B_0 estimates. Despite prevailing concerns about the ongoing lack of synoptically-determined Area 48 biomass, and adequacy of catch controls/monitoring, low precautionary catch levels from the GYM relative to potential	Fair comment, though it would probably be more the case if the trigger levels were being approached regularly, rather than just occasionally. To date, small subareas have been closed only on two occasions (see text) and, despite the possibility of annual catches rising annually as the active fleet grows, the precautionary element of the management system currently in place is adequate for the current system and fishery. Therefore, at this point in time, no further comment or text change is necessary, but it will be imperative that the annual surveillance audit watch the growth trajectory of the fishery closely and report and recommend accordingly if it is felt that the ultra-precautionary element of management is being undermined through the sheer volume of future annual

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				biomass levels underscore the conclusion that CCAMLR management is up to the task of maintaining reasonable, sustainable, and sufficiently precautionary, exploitation levels for the time being. However, the situation may change if catches rapidly approach, or exceed, trigger levels in the foreseeable future (Nicol *et al*. 2011).	catches.
1.2.3	Yes	Yes	N/A	While fishery-independent data may be lacking, fleet information is largely good. Observer, and other, monitoring activity is important in providng key data for CCAMLR's assessment of the Area 48 krill stock. Fishery data reporting is generally good, but basic knowledge of some key krill demographic parameters (e.g. age, early life -history, reproductive success) remains limited. With the fishery's cover, and limited bycatch, total krill removals are well documented, probably as well as accurate. Misreporting incentives seem low. Assessment of stock status is likely to be further improved when CCAMLR finally, and fully, institutes 100% observer coverage in line with Aker Biomarine's current practices.	No comment or change to text content required, other than that the UoC fishery itself does have 100% independent observer coverage already. Other harvesters of the resource are not as well-covered, of course, meaning that the overall assessment will definitely be improved as the observer output of other fisheries for krill deliver credible data, as the reviewer intimates. However, another fully synoptic fishery-independent survey of the stock would likely improve the assessment even more, as stated in text!
1.2.4	Yes	Yes	N/A	The GYM approach, with attached predator and recruitment criteria, provides adequate precaution for managing the stock,despite ongoing lack of fishery-independent survey data to assess stock biomass. However, and in this regard, the current situation probably	That there is some uncertainty, specifically in the assessment and ecosystem processes is not queried, that is normal for fisheries work. By international standards, the level of peer-review applied to the annual assessment is high. That it could be improved further perhaps by instituting more fully-independent (of CCAMLR) processes is already mentioned in

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				downgrades the value of stock assessments relative to prevailing reference points. While most uncertainty may be effectively addressed by the GYM and attached decision-rule process, the role of uncertainty (e.g. both ecosystem and assessment uncertainty) generally remains an area of concern to be expressly addressed. Therefore, the CCAMLR stock assessment and precautionary catch determination process is generally adequate, but additional peer review is encouraged to improve assessments, including allowing for fishery input, as as was originally the case in the GYM's development during the late 1980s.	text, and the belief is that at the current ultra-precautionary level of harvest rules is, as the reviewer says, adequate. The team does, however, acknowledge in text already that broadening the review base would generate even greater confidence in the assessment and management system. Therefore, for now, no extra comment or text change is required.
2.1.1	Yes	Yes	N/A	The review's, and other independent, assessments conclude there are no significant risks of serious/irreversible, harm being imparted to fishery-retained species. Uncertainty is nonetheless attached to the absence of suitable information/practices to ensure reversal of depleted retained species status. However, considerations such as precautionary trigger levels, partitioning of allowable catch between smaller than fishery subareas and net mitigation devices do much to mitigate such uncertainities. This justiifes, the review team's overall evaluation (80) of the fishery's potential to induce serious, or irreversible, harm to retained depleted species.	As mentioned, there is still some uncertainty relating to the status of the population of some retained species. However, the low proportion of those species in the catch of the UoC fishery supports the scoring given. No comment or change to text content required

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2.1.2	Yes	Yes	N/A	Full-fishery, deployment of Aker Biomarine and CCAMLR observers potentially offers, currently partial for CCAMLR, a strategy to reduce the potential for fishery-damage on retained species. However, the situation remains unclear until CCAMLR mandates 100% observer coverage in the fishery. In this respect, it should be noted that the client's actions to date go beyond CCAMLR requirements.	No comment or change to text content required
2.1.3	Yes	Yes	Yes	Observer-derived catch composition data appear accurate, but do not relate to all potentially caught-species other than krill (the target species). Current observer-provided information is likely to contribute to assessing the status of fishery-retained species. It is also useful in terms of potentially contributing to strategies for managing retained species. The client's efforts, particularly 100% observer coverage, again serve to provide useful information for assessing retained species mortality as does it sponsorship of taxonomic identification. The question of net extrusion of both target (krill), and potentially retained, species has not been specifically investigated for the Norwegian krill fishing system. On-going monitoring of retained species is mandated.	All species taken (catch composition) are now listed in Table 2. Monitoring will continue in the area on the same basis. No change in the scoring is required.
2.2.1	Yes	Yes	N/A	The deployement of net exclusion measures, full catch retention, potential bycatch interaction reduction and fishery practices all	Information has been added in Section 3.4.2 regarding interactions with birds and other non-ETP species. Thereare very few fatalities of birds in the UoC fishery (5 birds per year

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				serve to reduce the risk of fishery bycatch. Small area trigger levels spread the potential of fishery bycatch becoming overly-concentrated in subareas and regions, and mitigates potential fishery induced bycatch impacts significantly depleting species. With neglible bycatch, the fishery is unlikely to impact depleted bycatch species recovery to any significant extent, so justifying the review score (100).	for both vessels), so further changes in scoring to this PI are not considered necessary.
2.2.2	Yes	Yes	N/A	The bycatch mitigations strategies identified by the review team are comprehensive and consistent with a cohesive bycatch management and mitigation strategy. Similarly, observer-derived information and underwater photography indicate minimal interactions between the fishery and potential bycatch species. The client has implemented several gear changes and CCAMLR osbervers report minimal fishery interactions other than with the target (krill) and small numbers of retained species. These observations indicate that t a bycatch management strategy is being successfully implemented and is currently achieving its objectives,	No comment or change to text content required
2.2.3	Yes	Yes	N/A	The client's 100% observer deployment consistent with the CCAMLR Scheme, and minimal reported bychatch since 2006, mean that assessment of the risks posed by fishery bycatch and the effectiveness of the bycatch	Information has been added on observer records on birds and marine mammals, but no change to the scoring is required.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				management strategy are sufficient to assess ongoing bycatch mortailty.	
2.3.1	Yes	Yes	N/A	The deployment of seal escape devices, scientific observers operating in accordance with CCAMLR requirements and gear deployment strategies all serve to mitigate potentially-harmfull interactions between the fishery and ETP species.Such interactions are nil. In terms of potentially indirect impacts, fishery removals are currently several orders below krill predator demands, and available krill biomass for krill, predators and the fishery. However, in the absence of small-scale management units with attached krill precautionary catch levels, an unquantifiable risk persists in terms of over-concentrating fishing within krill predator foraging areas, or at specific times, leading to localised krill depletion(s). Such depletions may consequently prejudice predators with limited foraging ranges.	The risk of significant indirect effects such as overlapping with foraging areas has already been considered under PI 2.3.1.c, so no changes in the scoring are required. Comments on bird interactions have been transferred to the Bycatch section, not being considered ETP species because they are not subject to the CITES agreement.
2.3.2	Yes	Yes	N/A	CCAMLR CMs 26-01, 51-01 and 25-03, and other bycatch-avoidance mitigation measures all serve a purpose in managing ETP species bycatch. These strategies appear to be implemented successfully, as supported by a number of relevant CCAMLR publications.	No comment or change to text content required

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.3.3	Yes	Yes	N/A	Various documents support the review's score (100) for this indicator. Nevertheless, knowledge remains limited on potential effects of the fishery on functional relationship between krill and other species, particulary for other than land-based predators. Recent, and contemproary, information on krill predator foraging ranges and krill fishery grounds are important to improving knowledge of such functional relationships. Equally, the on-going deployment of scientific observers and joint CCAMLR-IWC intiatives offer much in terms of providing input to further develop feasible Antarctic ecosystem models, including those addressing the fishery.	Following PR2 comments, the scoring of this PI has dropped from 100 to 95, because there is no real evidence of the importance of the effects of the krill fishery on whales and other ETP species.
2.4.1	Yes	Yes	N/A	Fishery habitat degradation is unlikely since it the fishery is pelagic in nature. Equally, gear losses are likely to be minimal.	No comment or change to text content required.
2.4.2	Yes	Yes	N/A	CCAMLR's CMs, pioneering South Orkney's MPA, on-going CEMP, scientific observer scheme implementation, vulnerable marine ecosystem assessment/protection and lack of fishery interactions with the seabed provide a context for favourable minimisation of irreversible habitat impacts. Additional, and indepedent, fishing vessel licensing requirements enhance the positive effects of this context. Effective CCAMLR induced monitoring, control and surveillance (MCS) activities are also likely to be of benefit.	No comment or change to text content required.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.4.3	Yes	Yes	N/A	Various CCAMLR bioregionalisation initiatives are likely to become relevant for the fishery with time. Area 48 as a whole is the focus of much research into the region's ecological and physical environments. This research is regularly reported to CCAMLR and informs SC-CCAMLR's scientific advice. It is reasonable to assume that any significant, and future, enhancement of current knowledge will flow through to the the fishery's management in due course.	No comment or change to text content required.
2.5.1	Yes	Yes	N/A	The balance of available information tends to concur with the review team's conclusion that - "it is highly unlikely that the fishery would cause serious or irreversible harm to the ecosystem". However, this could change with the fishery's rapid expansion, the cpnsequences of a continued absence of an updated B_0 estimate and any persistent manifestation of climate impact(s) on the resource.	Some information has been added to support the scoring, but there is no change over what was supplied to the peer reviewers. The assessment of this UoC refers to the present fishery, with the actual harvesting rates.
2.5.2	Yes	Yes	N/A	While trigger levels have improved the fishery's management, non-implementation of SSMUs remains an issue for all the reasons stated above. Similarly, ongoing, non-use of CEMP data in CM development remains a concern and there is some way to go before the benefits of even rudimentary use of such data is determined. Nonethless, closure of Subarea 48.1 in 2013 holds promise for future implementation of	Following PR2 comments, scoring on PI 2.5.2 has dropped from 90 to 80, because the measures in place refer to a partial strategy.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				management controls on the fishery with attached implications for ecosystem health monitoring/preservation and application of precautionary management principles.	
2.5.3	Yes	Yes	N/A	A considerable body of information is available on the Area 48 krill-based ecosystem and fishery. However, there are also considerable uncertainties, notably concerning potential climate effects, krill-predator-fishery functional relationships and factors impacting krill demography. The limited utility of CEMP to distinguish between ecosystem effects caused by harvesting and natural variability remains a concern. While current CCAMLR management practices appear sufficiently precautionary at what is probably a relative low level of fishing, there is room for improvement. The use of reference areas, 'experimental' fishing and feedback management practices offer ways forward to improve knowledge and develop approaches for combating uncertainty and promoting fishery feedback management. The client is encouraged to become further involved in such initiiatives and to build on its efforts to sponsor relevant research. In this respect, the role of ARK (Association of Responsible Krill harvesting companies) should be noted along with the client's, and others, involvement therein.	Uncertainties mentioned by PR1 have already been considered by the team under SGb and SGc.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
3.1.1	Yes	Yes	N/A	Both national and international governance of the fishery are substantially consistent with MSC principles. However, lack of a tried CCAMLR dispute resolution mecahnism does hold some import for effectively resolving differences of opinion concerning the fishery's management, especially in terms of potential measures that take into account indirect ecosystem effects in a proactive and feedback-driven approach,	No comment or change to text content required.
3.1.2	Yes	Yes	N/A	The lines of mangement responsibilities are clear, although how information is consistently used in decision-making is hard to understand at times. Operational processes are also clear and it is notable that the client promotes environmental labelling and tries to ensure traceability through the fishery's value chain. The client's involvement with various non-governmental institutions is also notable.	No comment or change to text content required.
3.1.3	Yes	Yes	N/A	Both CCAMLR and Norwegian management policies are consistent with MSC principles and criteria, as well as the precautionary approach (particularly as outlined in CAMLR Convention Article II).	No comment or change to text content required.
3.1.4	Yes	Yes	N/A	The supporting information available to the assessment appears to support the view that perverse incentives for the fishery do not arise. However, whether such incentives	No comment or change to text content required.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				have been afforded explicit consideration is not clear, but the overall performance score (80) seems justifiable.	
3.2.1	Yes	Yes	N/A	The review team notes that, for P1, well-defined and measurable objectives are in place for the fishery, in both the long- and short-term. These objectives are clear and well-understood by the affected parties. They also appear durable and unambiguous. The situation is less clear for P2.	No comment or change to text content required.
3.2.2	Yes	Yes	N/A	CCAMLR's well-developed decision-making process is based on consensus derived through dialogue, stakeholder involvement, formal reporting and scientific input. In the latter regard, it is unclear whether all relevant research and scientific advice is responded to appropriately as other (e.g. political) considerations may be taken into account. Efforts are made to avoid sceintific/legal confrontations and no dispute resolution has ever been formally instituted. Every effort is made to reflect divergent views in CCAMLR's formal meeting records. These records are publicly available.	No comment or change to text content required.
3.2.3	Yes	Yes	N/A	CCAMLR's MCS framework is comprehensive, although sanction implementations for non-compliance is an issue for some CCAMLR Member States. In terms of this application compliance-	No comment or change to text content required.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				enforcement by both the GSGSSI and Norwegian Directorate of Fisheries are closely applied.	
3.2.4	Yes	Yes	N/A	A fishery research plan has been developed and widely disseminated for the fishery in question. The client has defined and implemented its own research programme using international scientific observers. Its data requirements exceed those of the CCAMLR Observer Scheme.	No comment or change to text content required.
3.2.5	Yes	Yes	N/A	Annual review of relevant CCAMLR activties and practices are undertaken at Commission and SC-CAMLR meetings, as well as those of the attached Standing Committees and Working Gropus respectively. An external CCAMLR performance review in 2008 identified various matters for the Commission and SC-CAMLR to further address. Some of these matters are still outstanding, while the Commission is considering undertaking another review at this time.	No comment or change to text content required.

Any Other Comments

Comments	Certification Body Response
The acronym 'MRAG' is not included in the report's acronym list. The full listing for Nicol *et al.* (2011) is: Nicol, S., Foster, J., & Kawaguchi, S. 2011. The fishery for Antarctic krill—recent developments. *Fish and Fisheries,* 13: 30–40.	Both omissions have now been rectified, and the reference has been consulted and used extensively in substantive and scoring rationale text.

Peer Reviewer 2

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No** **Partially**	**Certification Body Response**
Justification: The peer review team has reached an appropriate conclusion. However, there are areas within the assessment report where the information presented is relatively limited or unclear and requires the reader to make assumptions or refer to other documents. This is particularly the case for P2, and comments related to this are raised in both the general comments section and against specific PIs below.		Adjustments have been made where appropriate to substantive text and/or scoring rationale.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No** **Yes**	**Certification Body Response**
Justification: No conditions are raised and this appears appropriate based upon the information provided.		No comment or text change required

If included:

Do you think the client action plan is sufficient to close the conditions raised?	**Yes/No** **N/A**	**Certification Body Response**
Justification: No conditions are raised for this fishery.		No comment or text change required

General Comments on the Assessment Report (optional) - *Certification Body (CB) comments provided after each paragraph*

This is a re-assessment of a fishery that has progressed through addressing the first assessment certification conditions, along with the continued development of regional science and management.

The key areas of potential concern are:

» the lack of a recent survey of krill biomass. Current management is still being based on the results of the last survey performed in 2000. Given that krill are thought to live for around 5 years, a number of generations have passed since that survey, and combined with the comments made within the report on climate change and sea-ice influences on recruitment,

this would raise some concern. However, as noted in the report, the very low level of catch taken by the fishery, well below the trigger level, along with available scientific analysis (e.g. I found the Peatman *et al*. 2011 reference, which translates those levels into estimates of the likely impact on the stock through reference points, particularly useful; the estimates of F and SSB reference points for the krill stock in Area 48 consistent with the catch trigger level (higher than recent catch levels) are 0.0159 (95 % CIs: 0.00750 – 0.0357) and 97.7 % SSB_0 (80 % CIs: 71.6 – 135 %) respectively). This reduces concern over the historical nature of the survey. However, a recent paper by Kinzey *et al*. 2013 (http://www.ccamlr.org/en/system/files/science_journal_papers/Kinzey%20et%20al.pdf) does note the impact of uncertainties in krill biology/population dynamics on the potential consequences of the trigger catch level, and should be considered within the audit (in particular within Principle 1, Harvest Strategy). *CB comment: A useful reference is provided and some careful adjustments to the substantive text and scoring rationales have been made. The Peatman et al. paper works in one direction, perhaps reducing concern about the absence of a fishery-independent fully synoptic survey for 14 years, but the Kinzey et al. paper shows that because of the uncertainty associated with the currently estimated precautionary catch limit (based on a value of natural mortality, M, of 0.8, and with recruitment variability generated using a Beta distribution for proportional recruitment of krill), extra caution needs to be taken if the total catches start to reach smaller area trigger levels regularly, and very much so if management in future allows the catch to rise (even slowly) towards the PCL.*

» that although the development of Small Scale Management Units for krill has been discussed for a number of years, there appears from the report to be little action in this management direction. However, the use of 'smaller' scale units (sub-units of Area 48) and the low level of total catch which has not reached the trigger level that might drive management action, is acknowledged. The fact that fishing in one region (at least) has reached that 'sub-unit' limit is noted, however. A time-series table of catch levels by sub-area, relative to catch limits, would be useful. *CB comment: The comment of the reviewer is reasonable. However, provision of such a complicated table (the questions immediately arise, for what period and for the subareas or smaller areas within subareas 48.1-48.3?) might confuse the reader if placed within the report, given that only two subarea closures have been required over the recent past. Such a table is available in the most recent update to the fishery (WG-EMM 13/37 Rev. 1), however, and reference is already made to that complicated table, providing the necessary clarification.*

Despite these two areas, and as already noted, the team appears to have reached an appropriate conclusion on the fishery.

A key area of additional information/clarification needed for the reader currently limited within the report is the rate and overall level of interactions with non-target species (Principle 2). I note below that the observations made by the team within the scoring table are based on information that is not summarised for the reader, and leaves them without the information to judge the justifications for the scores given. This should not be an onerous job, and may be supported by summaries of information or tables/figures within existing reports. I would like to see:

» for Principle 2, Retained species: A summary in the main text of observed interaction rates and overall estimated catch levels of key fish larvae, along with a summary of the analysis performed within the MRAG report that indicates that the current catch levels will not be a significant threat to the fish populations. *CB comment: Adjustments have been made where appropriate to the substantive text. Tables 2–5 list the interactions and their form with retained species.*

» for Principle 2, Bycatch and ETP species: observed interaction rates with key bycatch and ETP species (birds, mammals), including further information on the interaction rate of e.g. the species listed in Table 2; these are described as the most common ETP species seen by observers, but there is no further information on the type of interaction or the level - if any - of mortality that occurs within the UoC. How 'common' is that interaction? Part of the issue may be the definition of 'interaction' used, which is not specified. Interaction could be a mortality (e.g. warp strike, net entanglement), a survived encounter, or a 'sighting'? In turn, in different

places within the text the level of interaction is described as 'nil' or as 'a low number' (which is not nil, but what is it?). The scores given are likely reasonable, but the inconsistencies in the text raised uncertainty within this reader. Supporting statements therefore need to be clearer and consistent and with the information requested above, the document would provide the evidence that supports any scoring table statements. *CB comment: Adjustments have been made where appropriate to the substantive text. Tables 6–10 list interactions, their form and their frequency with bycatch and ETP species. Most of the interactions refer to just sightings, but that information is specified now in the main text.*

Performance Indicator Review

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.1	Yes	Yes	NA	While CCAMLR may not relate the stock biomass directly to TRP/LRP levels, it would be useful to clarify the potential consequences of catches at the trigger level in b), using e.g. Peatman et al. 2011 (97.7% of SSB_0, for example), rather than rely only on the 14-year old biomass estimates.	Adjustments have been made to substantive and scoring text that covers this point, plus the uncertainties associated with the current GYM. A consequences table would, in the oppinion of the certification team, not add to overall understanding of the current situation, given that the catches are still so low relative to trigger levels.
1.1.2	Yes	Yes	NA	Check the overall score given, given three elements score SG80 and one element scores SG100	The score of 90 is correct according to guidance.
1.1.3	NA	NA	NA	As noted, the stock is not considered to be depleted so this PI is not scored.	No comment or text changes necessary
1.2.1	Yes	Yes	NA	Under a) and d), further details on the mentioned closure of sub-areas would be welcomed. This issue is only briefly discussed within the main text (section 3.3.2, 'harvest strategy') with no details of e.g. when, where or how early in the season the limit was reached. I also note that in the text of PI1.2.1d, the closure is said to have occured twice, but in PI2.5.2d a mention of only subarea 48.1 being closed in June 2013 is mentioned. Under c), I would suggest that without a survey of biomass, monitoring of the krill stock cannot be said to be 'comprehensive'	Additional clarification wording has been made to the scoring rationale, as suggested, and the error in PI 2.5.2d (where it refers to a siunmgle closure) has been rectified; there have been two subarea closures since original certification. The word "comprehensive" has been removed – it is subjective anyway.

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				(but no change to the score is needed).	
1.2.2	Yes	Yes	NA	The observer coverage could be noted as one of the pieces of available evidence under c)	Added as suggested
1.2.3	Yes	Yes	NA	I agree with the scoring. However, some mention of how the 'stock abundance... [is] regularly monitored...' consistent with the needs of the harvest control rule under b) would be welcomed.	Additonal wording is provided in the scoring rationale to meet this excellent suggestion
1.2.4	Yes	No	NA	Further justification of the SG100 scoring of d) is needed (either here or in the main text) on the alternative hypotheses and assessment' that have been 'rigorously explored', particularly given the main text indicates that (section 3.3.2 'stock assessment') while e.g. 'MSE has been considered, it has not yet been performed', and that 'the robustness of the decision rule to broader uncertainties has not been explored'. On the basis of the information presented so far, the SG100 level does not appear to be met.	The question posed for consideration here relates to adequacy of the assessment in terms of current knowledge rather than its excellence judged against stock assessment of fisheries internationally, and there can be either a score of 100 or no score given, in which case this PI would be unscorable. The team agrees that other methodology has been and is regularly being considered at CCAMLR, stated by several of its respondents and clear from the literature, but it believes that the current assessment methodology and application is adequate for purpose as the scoring rationale says. Hence, no addional comment is made at this point in time; the score of 100 is, we believe, fair.
2.1.1	Yes	Partial	NA	The authors have defined the larval fish catch as 'main', despite representing 0.2% of the catch composition. This is prudent given the concern over the larval catch. As noted in the main comments above, there	Information has been added in section 3.4.1. The categories Icefish and lanternfish, as well as nototheniids, refer to two or more species of those family groups found in the catch. In order to facilitate use of that information, MRAG (2012) grouped them as such. Information on all the species found

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				is no information provided within the report (particularly in the main section) that details the species caught (beyond lanternfish and icefish. A table of this would be welcome, along with the rate of species captures and estimated total catches rather than percentages) and an evaluation of the biological limits of those stocks (particularly given that *N. rossii* is apparently considered to be outside biologically-based limits). This would provide the reader with some of the logic behind the conclusion within the MRAG report. The text for a) should be clarified to detail which species are being considered here, and which are considered under c). This would be aided by the summary of stock status requested. The actualy partial strategy should be stated under c) (the operational strategy that leads to a relatively low bycatch of *N rossii* indicated by the MRAG report not to pose a threat to the stocks in Area 48?). For d), clarify for which species is this being scored - are there species for which the status is poorly known?	in the catch is now listed in Table 2. No change in the scoring is required.
2.1.2	Yes	Yes	NA		No comment or text changes necessary.
2.1.3	Yes	Yes	NA		No comment or text changes necessary.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.1	Yes	Partial	NA	Similar to the comments against 2.1.1, there is insufficient information within the report to judge the scoring here. Within section 3.4.2 of the main report there are no details on the level (or lack of) interactions with non-CITES birds, seals etc, estimates of population numbers that allow some idea of the potential importance of interaction rates to be gained (this comment also applies to 2.3), nor the approaches used to minimise this (if needed) beyond the observation in 2.2.1a that incidental mortalities/interactions with birds are 'minimal'. What is the level of interaction over a season, for example? Is the bird interaction noted 'within a two month period' the bird discussed under PI2.3?	Adjustments have been made where appropriate to substantive text. Tables 6–10 show interactions, their form and their frequency with bycatch and ETP species. Most of the interactions refer to just sightings, but that information is specified now in the main text. No changes in the scoring are required.
2.2.2	Yes	Partial	NA	For c), there is little discussion of the evidence that the strategy detailed in a) is being implemented successfully. This would surely include the records of the observers, rather than CCAMLR management of the krill quotas and gear improvements (which may be part of the strategy, rather than the evidence?). Under d) it is stated that there is NO bycatch noted, and 'virtually' no interaction with non-target species. Some clarity would be welcome to judge the SG100 score given.	The comments are noted and information has been added on SGc and SGd. No changes in the scoring are necessary, however.
2.2.3	Yes	Partial	NA	If interactions are indeed zero, rather than negligible, the information provided is justified. However, for b) and potentially for c)	Information on the type of interaction and size of populations has been added in SGa and in section 3.4.2. No changes are

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				also, if interactions do occur, some description on the information base for the size of the population of concern (or information to allow some risk-based judgement of the interaction rate against the species biology) is needed to estimate the outcome status against biologically-based limits for a SG100 score.	required to the scoring, however.
2.3.1	Yes	No	NA	While the text for a) describes mitigation and monitoring approaches, it does not detail whether there is a high degree of certainty that the effects of the fishery are within national/international requirements (i.e. to minimise incidental mortality and reduce interactions for CCAMLR - are similar requirements detailed for Norway or SGSSI?). For b), please specify that interaction in this sense does not lead to mortality. In turn, I assume the low level of interations (and known population abundance?) provides the high degree of confidence that there are no significant detrimental direct effects of the fishery on the species concerned, but please explicitly state the justification for the SG100 scoring level (and see earlier comments on the provision of information on interaction levels/rates and population levels where needed). For c), the team state that direct effects or interactions between the fishery and ETP species are nil, but in sections above have	The number, frequency and nature of the interactions are now fully described. Birds are now considered under the bycatch section. Scoring remains at 95.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				mentioned bird interactions. Please clarify.	
2.3.2	Yes	Yes	NA	I note that the SGSSI time closure for fishing is also a direct result of local understanding of the ecosystem and would further support the score.	Noted with thanks. No changes in the scoring are required.
2.3.3	Yes	Partial	NA	For a), it is noted that 'the effects in the area on the recovery of populations of whales and fur seals are still poorly described'. Does this then allow for the 'high degree of certainty' required for the SG100 level? Further information is required to justify the score given.	SGa is now corrected to a score of 80. Therefore, this PI drops its score from 100 to 95.
2.4.1	Yes	Yes	NA		No comment or text changes necessary
2.4.2	Yes	Yes	NA	For a), I assume that observers would note interactions of the gear with the sea bed? If so, can it be stated that no interactions with the bottom have been recorded (rather than 'be expected')? Also in a), what is the relevance of discussing the SGSSI MPA for the UoC? For c), the information from VMS and observers would also provide evidence?	The sentence has been modified. Information on gear losses for the period 2012-2014 has been thoroughly revised and added to the section, along with comments on the VMS recording process.
2.4.3	Yes	Yes	NA		No comment or text changes required

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.1	Yes	No	NA	The current supporting text suggests a score of SG80 is warranted (e.g. 'the team and virtually [all] of the consultees consider that at the current harvesting rate it is highly unlikely...'), but where is the evidence required to support SG100? e.g. the results of ecosystem models examining this issue, along with e.g. studies of local depletion effects at the sub-Area level for limit levels of fishing (noting that those levels have been reached on occasion)?	As PI 2.5.1 refers to serious or irreversible harm to the key elements of ecosystem structure and function,and not to the effects on the target species, the team considers that the low rate of injuries to these species recorded by observers, along with comprehensive observations on retained, bycatch and ETP species made by the observers, and the content of the mentioned papers on the adaptability of predator to krill-scarce situations support an SG score of 100. Therefore, no change has been made to the scoring.
2.5.2	Yes	No	NA	I note that 'measures' under SG100 of c) is related to the presence of a strategy (which contains measures) under SG100 of b). Given that a strategy has not been considered to be in place by the team, there needs to be justification of the approach in place being considered to be 'measures'. Also for c), if SG100 is still considered justified, please clarify and described the basis of the SG100 score which indicates that the trigger levels for Area 48 (and sub-areas) are likely to work. Prior experience, plausible argument or information directly from the fishery? Currently the information presented appears consistent with SG80 only.	The PI score drops to 80, because the mentioned measures refer to a partial strategy. Information on a second cloasure has been added in 2.5.2.d
2.5.3	Yes	No	NA	While I agree with the score for a), the current text does not describe whether the information is adequate to broadly	For a), more information on the different ecosystem models can be found in Section 3.4.5. For e), clarification has been

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				understand the key elements of the ecosystem, although this might be assumed by the reader from the last short paragraph of a). Further description is required of that work to support the scoring. Again, while I agree with the score for b), the current text paints quite a negative picture which does not detail the evidence that the main impacts of the fishery on these key ecosytem elements can be inferred from existing information, and that some have been investigated in detail. Part of this is addressed by the first paragraph of the text in element e). The second paragraph for e) appears to provide a call for protected areas, which is irrelevant to the SG80 text. Also, the final paragraph which addresses SG80 needs to be clarified to provide the information the team feels allows any change in risk to be identified (i.e. the continued collection of data through logbooks, observers and the CEMP programme, for example).	provided. The score remains at 90.
3.1.1	Yes	Yes	NA	Under b) please clarify - if relevant - how the GSGSSI system feeds into the management system.	As explained under a), the formal role of GSGSSI is licensing and enforcement in the SGSSI Maritime Zone. No comment or change to text content required.
3.1.2	Yes	Yes	NA	Under a), please clarify - if relevant - the function, role and responsibility of the GSGSSI system.	Information about the role of GSGSSI is added to the text.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
3.1.3	Yes	Yes	NA	Again, please clarify - if relevant - how long-term objectives guide decision making within the SGSSI component of the fishery (e.g. through alignment with CCAMLR)?	Information is added about the objectives of the SGSSI Maritime Protected Area management plan. See CB4.4.2 about how MSC defines the precautionary approach.
3.1.4	Yes	Yes	NA		No comment or change to text content required.
3.2.1	Yes	Yes	NA		No comment or change to text content required.
3.2.2	Yes	Partial	NA	For b), please clarify how the decision-making processes in Norway and SGSSI also respond on the basis of CCAMLR decisions (as per the main text). For d), please provide further evidence/description of the formal reporting (e.g. CCAMLR website, etc) and how this is also done within Norway and SGSSI. For e), have issues arisen in Norway or SGSSI as part of the Management system that are relevant here?	For b), the Norwegian Directorate of Fisheries and GSGSSI respond primarily through their licensing and enforcement activities, based on the needs defined by CCAMLR. This is now reflected in the text. For d), information is added about the reporting practices of the Norwegian Directorate of Fisheries and GSGSSI. For e), no such issues have arisen. This is now reflected in the text. The score remains at 95.
3.2.3	Yes	Yes	NA		No comment or change to text content required.
3.2.4	Yes	Yes	NA		No comment or change to text content required.
3.2.5	Yes	Yes	NA		No comment or change to text content required.

Any Other Comments

Comments	Certification Body Response
N/A	

Appendix 3. Stakeholder submissions

a. Written submissions from stakeholders received during consultation opportunities on the announcement of full assessment, proposed assessment team membership, proposed peer reviewers, proposal on the use or modification of the default assessment tree and use of the RBF.

None

b. All written and a detailed summary of verbal submissions received during site visits pertaining to issues of concern material to the outcome of the assessment[3] regarding the specific assessment.

None

c. Explicit responses from the assessment team to submissions described in **a.** and **b.** above.

None

Appendix 3.1 Amendments made to the PCDR following stakeholder consultation

Sent: Tue 29/08/2014 10.00
To: Carol Leiper
From: Stephanie Good, MSC

Subject: MSC Technical Oversight: Aker Biomarine Antarctic krill PCDR

Dear Carol,

Please find attached MSC's Technical Oversight comments for the PCDR for the Aker Biomarine Antarctic krill fishery. If you have any queries please don't hesitate to contact me.

Best regards,

Stephanie

Ref.	Type of Finding	Page	Requirement	Reference	Details	PI
1	Major	118, 131	CR-27.10.6.1 v.1.3	Rationale shall be presented to support the team's conclusion	PI 3.1.1., Scoring issue (d). The assessment team have indicated 'n/a' in scoring table for all three SG levels. However, this scoring issue still needs to be scored. If there are no people dependent on fishing for food or livelihood in this fishery, it could be that it meets the SG100 level (it would be a similar case to scoring PI 2.1.1 (Retained outcome) at 100 when there are no retained species, for example). PI 3.2.3, scoring issue (d). The rationale should be strengthened by providing an indication that the system works beyond just that there are no non-compliances (these could be through fault in detection rather than that there are none). For example, information on how the management systems in	3.1.1, 3.2.3

Ref.	Type of Finding	Page	Requirement	Reference	Details	PI
					place detect non-compliances for other fisheries could be used. See Guidance GCB4.9.2 for further explanation.	
	FCI Response. In terms of PI 3.1.1, scoring issue (d): Within the fishery there are no indigenous people dependent upon fishing in waters managed by CCAMLR, and no indigenous inhabitants of SGSSI. According to the MSC Review and Report on Compliance with the Scheme Requirements (see Appendix 3.1), this scoring issue still needs to be scored and might meet the SG100 level. The team interprets this to the effect that a SG100 score can be achieved if the fishery has no negative impact on people dependent on fishing for food or livelihood. This is the case in the present fishery. This does not influence the overall scoring for this PI. In terms of PI 3.2.3, The Norwegian enforcement system is generally considered to work effectively (see new reference to this PI), which strengthens the argument that the lack of systematic non-compliance is merely the result of fault in detection.					
2	Guidance	66-134	*N/A v.n/a	(blank)	Throughout Appendix 1.1, the row in the scoring tables for 'met' should be completed for each SG level to make it clear to people reading the report that all relevant SG levels have been assessed and are either met or not.	
	FCI Response. This has been changed.					
3	Minor	6, 52	CR-27.6.1.2 v.1.3	Any date prior to the certification of the fishery up to a maximum of six months prior to the publication of the most recent Public Comment Draft Report. This date should be linked to: a. The beginning of the fishery management year in which the Public Comment Draft Report is published; or, b. The start of the fishing season in which the Public Comment Draft Report is published; or, c. Any other logical date with regard to the applicant fishery.	Target eligibility date is listed as 31st January 2014, but PCDR release date was 14th August 2014. This is beyond the 6-month maximum permitted in the certification requirements.	
	FCI Response. This was purely an error and has now been corrected.					
4	Minor	52	CR-27.12.1.2 v.1.3	27.12.1 The CAB shall determine if the systems of tracking and tracing in the fishery are sufficient to make sure all fish and fish products identified and sold as certified by the fishery originate from the certified fishery. The CAB shall consider the following points and their associated risk for the integrity of certified products: 27.12.1.2 The possibility of vessels fishing outside of the unit of certification.	The justification for 5.2.2 is not entirely satisfactory, as it does not really answer the clause intent. Instead, the response provided for 5.2.2. Evaluation of the Risk of Vessels Fishing Outside of UoC is further evidence of conformity against 5.2.3. Risk of Substitution of Mixing Certified/Non-Certified Catch prior to point of landing.	
	FCI Response. This has now been amended. Only these ships deliver krill to the client's storage facility in Uruguay					
5	Major	77-78	CR-27.10.6 v.1.3	To contribute to the scoring of any PI, the team shall verify that each scoring issue is fully and unambiguously met.	PI 1.2.3: It is not clear from the scoring rationale that Scoring Issue (a), SG80 is fully and unambiguously met. Text from the Introduction states that "there are no reliable or comprehensive age data, and regular, verifiable survey data are lacking, rendering reliable	1.2.3

Ref.	Type of Finding	Page	Requirement	Reference	Details	PI
					stock assessment impossible." Scoring issue (c) also requires further consideration. The rationale in that scoring issue states that "Fishing for krill is virtually clean, with few other fish taken" and then refers to no misreporting. Neither address the requirements in the scoring issue. As a scoring issue in P1, this issue is interested in removals of fishing vessels outside of the UoC that fish the same stock and whether there is good information on those removals. See Guidance GCB2.7.2 for more information.	
	FCI Response. Fair point. Scoring issue (a) has been adjusted by clarifying the substantive text rather than the scoring, so that there are no ambiguities between the two sets of text, and (c) has been addressed by adding wording and re-ordering it, to the scoring issue so that the reasoning behind the conclusion that this MSC requirement is fully met is clearer. No scoring change eventuates.					
6	Minor	52-53	CR-27.12.2.1.b v.1.3	27.12.2 If the CAB determines the systems are sufficient, fish and fish products from the fishery may enter into further certified chains of custody and be eligible to carry the MSC ecolabel. The CAB shall determine:27.12.2.1 The scope of the fishery certificate, including the parties and categories of parties eligible to use the certificate and the point(s) at which chain of custody is needed. b. Chain of custody certification may be required at an earlier stage than change of ownership if the team determined that the systems within the fishery are not sufficient to make sure all fish and fish products identified as such by the fishery originate from the certified fishery.	As the report states that “traceability up to the point of first landing has been scrutinized”, the Aker Biomarine Uruguayan processing facility is unaccounted for. There seems to be, therefore, a gap in this supply chain’s CoC because Aker Biomarine’s CoC is a single-site certificate covering only the head office in Norway (MSC-C-52985). The report further states, "Aker BioMarine Antarctic does not require its own chain of custody certificate." It is unclear which parties are within this company; does it refer to just the two vessels? Or does it also indicate that the processing facility is included in the fishery certificate, which is currently not possible with traceability having been checked only to first landing.	
	FCI Response. The client’s facility in Uruguay is a warehouse, not a processing facility. Contract Manufacturing Organisations (CMOs) either hold their own MSC CoC certificate or contracts in place which cover MSC Certification Requirements Part B V1.4 Annex BD4 Requirements for Use of Subcontractors.					

Sent: Tue 12/09/2014 10.00
To: FCI Fisheries
From: Karoline Andaur, WWF

Subject: Comment to Public Comment Draft Report - Aker Biomarine Antarctic Krill - WWF

ATT: FCI Fisheries Department

Please find attached (as below) WWF comments to the Aker BioMarine Antarctic Krill Fishery Public Comment Draft Report for MSC re-assessment.

Kind regards,
Karoline Andaur
Head of the Marine Programme
WWF-Norway

WWF comments on the Aker BioMarine Antarctic Krill Fishery Public Comment Draft Report for MSC re-assessment

Dear FCI Fisheries Department,

WWF actively engages as a stakeholder in a number of Marine Stewardship Council (MSC) fishery assessments in order to improve fisheries sustainability. With this letter, we wish to provide comments on your public comment draft report (PCDR) for the re-assessment of the Aker BioMarine Antarctic Krill Fishery against the MSC Standard. We have organized our comments according to six main areas of concern. Where possible, we relate our comments to relevant performance indicators. In each case, we try to provide objective evidence in support of our contentions. For some indicators, WWF does not believe that the scoring rationale which is provided is adequate to support some of the scores given. In other instances, we question whether the assessment team has considered and included all available information.

1. Outdated Stock Assessment

WWF feels that a major shortcoming of this MSC fishery assessment arises from the fact that management of the Antarctic krill fishery is currently based on a sorely out-of-date stock assessment. The most recent synoptic survey of krill biomass in the fishery area was performed in 2000 (Hewitt et al. 2002). Although the Commission for the Conservation of Antarctic Marine Living Resource (CCAMLR) has updated these acoustic datasets with new interpretations of parameters, there has not been a comprehensive survey of krill biomass in Area 48 for almost 15 years.

The assessment team has acknowledged the situation (p. 20 in the PCDR): *"Current levels of exploitation are precautionary, but the range of values calculated and documented in the literature for B_0 do raise concern. All are based, as stated above, on the level of unexploited biomass calculated from a single synoptic survey carried out in 2000, and there is no seeming likelihood of this survey being conducted again soon, although some national efforts are being made to resurvey certain sectors regularly in a rigorous manner, including in the area covered by the UoC fishery. Differences in the various estimates generally exceed sampling standard errors and confidence ranges, suggesting that overall uncertainty is likely being underestimated, but at least the latest CCAMLR-approved estimate of unexploited biomass is taken from near the lowest of the range of values*."

WWF does not dispute the fact that current harvest levels are relatively low and that trigger values are set at precautionary levels. However CCAMLR's continued reliance on an outdated stock assessment has implications for fishery performance against PI 1.2.4 (Assessment of Stock Status). At the SG80 level, scoring issue (*a)* asks whether the assessment is appropriate for the stock and for the harvest control rule. Krill abundance is known to be highly variable in time and space, and such volatility might be expected to bring about wide swings in abundance over longer time-frames. In fact some authors argue that krill has undergone a sustained decline in abundance over the longer term (Atkinson *et al*. 2004). Our point is that the certainty associated with any particular stock abundance estimate should decrease with time and these uncertainties are propagated forward into the harvest control rule. In WWF's opinion, using severely outdated stock assessment information is not appropriate for any significant fishery (including krill) and it is not appropriate for implementing the krill harvest control rule.

In the scoring rationale for PI 1.2.4(a), the assessment team acknowledges that krill is not subject to an annual stock assessment "…*of the nature generally applied in fisheries, as much because of the very small catches relative to the survey-determined stock size as to the general lack of appropriate data to support such an assessment.*" We accept that the harvest control rule is "ultra-precautionary", but we still have some problems seeing how the rationale justifies meeting the SG80 level for scoring issue (a) regarding the appropriateness of the krill stock assessment when this essential fishery parameter is so badly out of date.

FCI response. This an extremely valid concern: the team is well aware of the limited confidence that a severely outdated assessment places on the management of any fishery. However, it needs to be stated that to conduct another synoptic survey such as that of 2000 would require a massive commitment (time, infrastructure, staff, costs) by all member countries, especially those currently prosecuting krill fisheries. Indeed, given its geographic isolation from mainstream international fishing activity, it is remarkable indeed that such a fully synoptic survey of a fishery was ever achieved at all. CCAMLR is, of course, wrestling with many priorities for management and control, and is generally doing pretty well by international standards. However, by handing over to the member countries the responsibility for updating the survey dataset on krill, the organization has at least ensured that quality fresh data will be collected by those member countries currently active and wishing to remain active in the fishery. Norway in particular has been very proactive in such research surveying and Aker Biomarine vessels (the UoC fishery) have played a leading role in the activity.

It also needs to be said that the way the harvest control rule and the contributing algorithms have been developed around this (dated) synoptic survey and the subsequent results meets the most rigorous international scientific standards. In other words, accepting that survey data are likely always going to be dated (although the first recertification contained a note that such a synoptic survey was planned for the future – that suggestion has not been realized), several assessment scientists, some of whom were consulted during the period of this recertification, unanimously felt that despite the lack of a "formal" updated assessment for the krill stocks, scientific advice currently was as good as possible and even better than for some stocks currently MSC-certified. Add to that the current ultra-precaution relating to trigger catch levels, the likelihood of damage to the stock at present levels of exploitation, and perhaps even higher levels, is considered to be very slight (not all scientists agree with Atkinson and his colleagues that the stock is declining rapidly and perhaps terminally).

The stakeholder believes that an outdated stock assessment precludes the scoring of PI 1.2.4(a) at the suggested level of 80 (appropriate for the stock and the harvest control rule). The certification team does not agree that the mere outdated nature of a survey dataset (if indeed that was all that was being used to underpin management) is the single most important criterion in determining appropriateness for use. The science and technicalities of the krill stock assessment in the target area are being updated and improved all the time, and management advice is no longer based only upon the results of that survey in 2000, as the background to the report clearly states. Hence, the score of 80 is retained and the overall score goes unchanged.

2. Limited Knowledge about the Stock Structure of Antarctic Krill

The PCDR presents a good review of our knowledge about the stock structure of Antarctic krill. For a species with such an extensive distribution, it seems reasonable to suspect that different stocks might exist. Nonetheless, there has been no convincing evidence put forward to date – including genetic studies (Siegel 2000) - which supports the idea of separating Antarctic krill into distinct sub-populations or stocks.

Krill are not passive components of ocean systems and there is good evidence that adult krill are efficient swimmers capable of sustained motion against currents. Therefore, overall krill distribution is likely influenced by adults being able to remain in favourable (i.e. productive) habitats for long periods (Miller and Hampton 1989). This could of course impact how and when krill should be harvested. Clearly more research is needed. A better understanding of stock structure could form the theoretical basis of a small scale management unit (SSMU) approach. CCAMLR has made little progress with krill SSMUs to date.

Performance indicator 1.2.3 is designed to evaluate whether relevant information is collected to support the harvest strategy. The first scoring issue of PI 1.2.3 at the SG80 level asks whether "…sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy." The assessment team contends that there is baseline data on stock structure but that "… more information on the spatial distribution of biomass is essential for

SSMU management to be instituted in future." If SSMU management cannot be implemented without more detailed information about stock structure, then how can the existing information be deemed "sufficient" to support the harvest strategy (i.e. equivalent to the SG80 level for scoring issue *a*)? WWF questions whether the scoring rationale justifies the assignment of this score.

Note: WWF does support the establishment of interim catch limits on an areal basis and believes that it must remain in place until CCAMLR has adopted an adaptive feedback management system that not only divides the catch limit into SSMUs, but is flexible enough to respond to ongoing monitoring.

FCI response. We thank the stakeholder for raising this issue. However, the first scoring issue of PI 1.2.3 is not based solely on knowledge of stock structure (stock productivity and fleet structure knowledge are better known), though as the commentary above states, proven knowledge of stock structure remains elusive. The results of genetic analysis are also rarely taken as evidence of stock differences anyway. The contention is that until better proof of stock structure is available, there will be serious questions asked about the appropriateness and efficacy of the small-scale management areas established for the fishery and therefore whether existing information on stock structure can support the overall harvest strategy. The team's belief is that it can, simply because the current harvesting strategy is ultra-conservative and based on several smaller management units, maximal exploitation of each of which will trigger fishery closure.

In an ideal world, fine-scale knowledge of stock structure would be available, but there are many fisheries around the world (but few prosecuted as conservatively as Antarctic krill) that are carried out (and certified) on less knowledge of stock structure than is this fishery. Indeed, many have stock assessments based on now-known flawed understanding of stock structure. Succinctly, it is the ultra-conservatism of small-scale management through the established CCAMLR Conservations Measures in this case that justifies the score of 80 against this PI.

3. Comprehensive Information about Fishery Removals

Some concerns have been raised that krill catch statistics do not accurately reflect total fishing mortality arising from fishing operations (Nicol *et al*. 2011). There is a general lack of information on discard practices (for vessels outside the UoC) which has led to concern that the quantity of krill actually being removed from the system has been underreported. This suspicion gives rise to regular queries, for example, about catch estimates and ecosystem effects of the krill fishery. Observer coverage in the krill fishery is relatively good though not in all cases, depending on nation of vessel origin. Aker BioMarine vessels undergo 100% observer coverage which is carried out by non-Norwegian observers so WWF is confident that the UoC krill fishery is being well monitored. However we do not have the same level of confidence in observational data for other vessels (outside the UoC) fishing for krill in Area 48.

Little is known about the mortality of krill which survive interactions with fishing trawls (e.g. krill that pass through the mesh of trawl nets but may be damaged and die). There have been reports that such escapement mortality can be substantial (Nicol *et al*. 2011) but this has never been adequately quantified – at least to our knowledge. Further, Aker BioMarine has introduced a new continuous flow trawl system called "Eco-Harvesting" technology. Recently the size selectivity of this trawl system has been studied (Krafft *et al*. 2013), but krill escapement mortality from the gear type remains unknown.

In performance Indicator 1.2.3, the third scoring issue is about "comprehensiveness of information". At the SG80 level, the scoring issue asks whether "there is good information on all other fishery removals from the stock." The assessment team concludes that the krill fishery meets the SG80 level. However their scoring rationale only describes how the fishery has low levels of bycatch (quite irrelevant to the issue) and how the underreporting of catches is rare. Their scoring rationale gives no indication that the team has considered escapement mortality as a source of fishery removals. MSC Guidance (GCB2.7.1) says that teams should consider incidental and unreported mortalities to be categories of fishery removals.

Given that there is a high degree of uncertainty about the magnitude of escapement mortality, WWF questions whether the assessment team has considered all relevant available information. We feel that the score assigned to PI 1.2.3(c) is not fully justified.

FCI response. This stakeholder raises two reasonable issues here under the related heading "other mortality".

The first of these, unaccounted for catches of krill (e.g. discards) by non-observed vessels as a consequence of such vessels not achieving the 100% coverage that the UoC fishery does, could be an

issue, but the report goes into a lot of detail in concluding that unaccounted for catches of krill in the target fishing area and adjacent areas are insignificant compared with declared catches (the CCAMLR catch reporting system is one of the best international ones in existence).

The second, escapement mortality, is always a difficult one to quantify technically, but the gear in use (a continuous midwater trawl) is designed specifically to collect everything that enters the net and to bring it on board. Hence, other than krill being damaged (and presumably suffering mortality) by the gear as it travels through the water, there is unlikely to be any significant further source of mortality outside of the declared catches. Krill tend to swarm at the required density for optimal fishing in schools of similar individual size and age, and the meshes of the net are designed to capture all the targeted animals, releasing few through the meshes.

Together, therefore, although the team certainly agrees with the stakeholder that other possible forms of mortality of the target species (krill) exist, it contends that it has considered the other forms of mortality in evaluating whether the information on total fishery removals is accurate. Therefore, the score is maintained as is.

4. Indirect Impacts on Predators

Throughout the first MSC assessment of Antarctic krill, stakeholders were very concerned about the magnitude and extent of direct interactions between fishery and non-target species (e.g. bycatch of larval fish, seabird warp strikes, and incidental seal mortality). Subsequent studies have provided a better context to evaluate these direct impacts. For example, the fishery client has supported a research programme to investigate if and how the krill fishery impacts land-based predators such as seabirds and seals (Nicoll and Douglass 2012). Even though this investigation showed no negative effects for the predatory species, there is still insufficient knowledge about possible long-term indirect impacts of the krill fisheries.

It is possible that krill fishing can have significant localized impact on predator populations, as there is a close relationship between krill and baleen whale distributions, and the current fisheries are operating close to shore where land-based predators forage. Reduced abundance of krill in these local areas may pose significant risks to spatially constrained krill dependent predators, such as seals and penguins over time.

WWF believes that it is essential that the Aker BioMarine krill fishery continue their contribution with information related to how the fishing effort is distributed according to the proposed SSMUs and in relation to predator distribution, to be able to conclude on potential localized impacts of the krill fishery over time.

WWF also believes that for the fishery to be certified it must be able to demonstrate that there is no significant localized impact on predator populations, and ensure that the fishing effort is well dispersed to avoid conflict and competition with krill predators at a local scale over time. More detailed knowledge is needed to understand the spatial relationship between krill biomass and predator populations, and how krill harvesting effects predator populations.

FCI response. Indirect impacts of the krill fishery have been scored under PI 2.3.1(c). Although there may well be need for better knowledge on possible long-term indirect impacts, these have been considered while scoring the fishery and are considered unlikely to create unacceptable impacts (SG80). According to both Hewitt *et al.* (2004) and Murphy *et al*. (2007), removals of krill biomass by the fishery in Area 48 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. Moreover, some species also look for alternative breeding options in years when krill are scarcer (Murphy *et al.* 2007). The absence of a high degree of confidence on the likelihood of there being significant detrimental effects of the fishery on predators (such as possible long-term indirect impacts) prevents the fishery from achieving SG100 at this PI. As regards pelagic predators such as baleen whales, the team agrees with WWF on the need of more knowledge on their predatory requirements, as recognized in PI 2.5.3(b).

CCAMLR Conservation Measure 51-07 (2011), aims to distribute krill catch in Statistical Area 48 in such a way that predator populations, particularly land-based ones, would not be inadvertently and disproportionately affected by fishing activity. The measure goes on to recognize that large catches up to the trigger level from areas smaller than the subareas (i.e. SSMUs) should be avoided, and that the distribution of the trigger level needs to provide for flexibility in the location of fishing in order to

(i) allow for interannual variation in the distribution of krill aggregations, and

(ii) alleviate the potential for adverse impacts of the fishery in coastal areas on land-based predators.

Therefore, no more than 25% of the trigger level catch (i.e. 155 000 t) can be taken from Subarea 48.1 annually, 45% (i.e. 279 000 t) from each of 48.2 and 48.3, and 15% (i.e. 93 000 t) from 48.4. Those percentages clearly add up to >100%, though it would be unlikely for more than one to be reached at a time.

The aim of the measures (and strategy) is clear, however, to protect the local availability of food for predators. We note that catches have remained well below the overall trigger level, but that Subarea 48.1 has been closed twice to the fishery well into each season, in October 2010 and in June 2013, as its precautionary trigger level was reached, which proves that this strategy is implemented effectively and robustly.

The Antarctic krill fishery is required to report to CCAMLR on the catch distribution by small scale management unit (SSMU). As regards the relation between the fishing effort and predator distribution, these have already been studied by Nicoll and Douglass (2012), but the client is aware that information on the degree of overlap between the krill fishery and predator foraging areas needs to be collected on a continuous basis in future.

The team agrees with WWF on the importance of avoiding direct and indirect impacts on predators along with the dispersion of the fishing effort, and knows the importance of gathering information to gain a better understanding of the Antarctic ecosystem. However, at the current harvesting rate of krill, it is considered that there would be no significant indirect impacts on this species. It is recognized that if the catch rate were to increase, some species could be affected, especially those that constrained in their foraging ambit. Therefore, it is proposed that harvesting should only take place where these species feed when there are adequate management provisions based on robust ecological knowledge, or where there is a high level of precautionary protection (Phil Trathan, pers. comm.).

5. Responsiveness of Management to Impacts from Climate Change

The assessment team provides a good overview of the evidence for climate-related changes in the Antarctic and Southern Ocean. The PCDR identifies how these changes have the potential to impact upon krill and dependent predator populations. The team observes that the changeover in ecological processes and in community structure, going from an ice-shelf-covered ecosystem to a typical Antarctic shelf ecosystem with high primary production during a short summer is likely to be among the largest annual ecosystem changes on the planet (Trathan and Grant 2013).

WWF believes that krill management needs to be adaptive and flexible in order to allow rapid adjustments as new information on the impacts of climate change becomes available. Failure to do so could mean that current management may prove to be inadequate as changes in seasonality, food availability, and migration result in changes in krill stocks that could not been foreseen under non-climate change scenarios. The fishery must have in place the mechanisms to cope and respond to these matters in a timely manner, and we are concerned that this is not currently the case.

FCI response. The team agrees with WWF on the need for adaptive and flexible management of the krill fishery, and agrees that there is not yet a management feedback policy in place to regulate the ecosystem impacts of fishing activities, notwithstanding the continued collection of data through the CCAMLR Ecosystem Monitoring Programme. However, this has already been considered under PI 2.5.2(b).

PI 2.5.3(b) also supports the need for more information on the impacts of climate change on krill recruitment and survival, and that krill management needs to incorporate a feedback tool to be sufficiently adaptive and flexible to respond in a timely manner to ecosystem change.

6. Anticipated Expansion of Antarctic Krill Fishery

Interest in the Antarctic krill fishery has grown substantially in recent years due in part to advances in harvesting and processing technology as well increased market demand for krill-based products in the aquaculture and pharmaceutical sectors (Nicol *et al.* 2011). Although there has been an increase in krill fishery notifications, the actual number of vessels that fish and the quantity of krill caught remain stable. However, there is reason to expect that the Antarctic krill fishery will expand over the next decade. All the issues that we identify above will be exacerbated by rapid growth in the krill fishery. In addition, WWF is concerned that an abrupt expansion of the krill fishery would overwhelm existing management

arrangements. It is unclear, for example, whether CCAMLR is capable of upscaling the necessary investment in science and monitoring of impacts on predator populations required for continued precautionary management of the fishery.

WWF believes that rapid expansion poses a huge challenge for the current and future sustainability of the krill fishery. In the first MSC assessment of Aker BioMarine Antarctic krill (Medley *et al*. 2011), the assessment team imposed a voluntary condition of certification (Condition 4) which stated: "*If the fishery expands beyond current catch trigger levels (620 000 mt), then SSMUs, as defined by CCAMLR, must be introduced within two years of expansion beyond the trigger levels or (in the absence of other relevant and compelling information) the certification will be voluntarily withdrawn.*" WWF requests that the assessment team consider imposing a comparable condition as a failsafe against a rapid unchecked expansion of the krill fishery.

FCI response. The team shares WWF's concerns about the consequences of a substantial expansion in the Antarctic krill fishery. However, according to MSC methodology, fisheries have to be evaluated as at the time of assessment, not in light of possible future developments. Any major changes during the certification period will be addressed during the annual surveillance audits.

Concluding Remarks

WWF applauds the efforts taken by Aker BioMarine to adopt sustainable fishing practices. In particular, we want to highlight the cooperation and support that Aker has provided during their first certification to investigate key environmental issues with the krill fishery such as bycatch of larval fish (MRAG 2012) and fishery interactions with land-based seabirds and marine mammals (Nicoll and Douglass 2012). We look forward to Aker BioMarine's continued cooperation in monitoring potential indirect impacts of the krill fishery on dependent predators in Area 48.

WWF's primary concerns about the PCDR relate to the severely outdated stock assessment information and the need to manage both localized krill depletion and the impacts of an expanding krill fishery.

WWF advocates for 100% observer coverage of the krill fishery. We feel these data are necessary to monitor, evaluate and mitigate the impacts of krill fishing on the Antarctic ecosystem. We note that Aker BioMarine has been exemplary in this regard, allowing for 100% observer coverage during the five year period of their first MSC certificate. WWF believes that it is the responsibility of all participants in the krill fishery to contribute to research in the region by enabling researchers to work on board fishing vessels, by allowing independent scientific observers on board and by contributing to monitoring costs through a dedicated CEMP Fund.

WWF believes this could be an important condition to set for all vessels applying for MSC certification in the krill fisheries. We note that Aker BioMarine has provided researchers with access to two vessels for a period each year to do studies on krill, marine mammals, and seabirds. We hope this collaborative spirit continues into the future.

Kind regards,

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Appendix 4. Surveillance Frequency

Table A4: Fishery Surveillance Plan

Criteria	Surveillance Score	This fishery
1. Default Assessment Tree used		
Yes	0	0
No	2	
2. Number of conditions		
Zero conditions	0	0
Between 1-5 conditions	1	
More than 5	2	
3. Principle level scores		
greater than or equal to 85	0	0
less than 85	2	
4. Conditions on outcome PIs?		
Yes	2	0
No	0	
	TOTAL	**0**

Score from CR Table C3	Surveillance Category	Year 1	Year 2	Year 3	Year 4
0	Reduced Surveillance	Review of new information	On-site surveillance audit	Review of new information	On-site surveillance audit & recertification site visit

Source: FCI assessment team

Appendix 4.1 Rationale for determining surveillance score

The fishery meets the score for Reduced Surveillance, as the Default Assessment Tree is used, there are no conditions, and all principle level scores are above 85.

Appendix 5. Client Agreement

FCI confirm that the client has reviewed the Public Certification Report and is in full agreement with the terms of certification detailed therein.