

March 12, 2010

**FORMAL ADJUDICATION:  
MARINE STEWARDSHIP COUNCIL PROPOSED CERTIFICATION OF  
AKER BIOMARINE ANTARCTIC KRILL FISHERY**

**OBJECTORS' SUPPLEMENTARY DOCUMENTATION PURSUANT TO  
MSC OBJECTIONS PROCEDURE SECTION 4.7.4**

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## **I. Introduction**

The Marine Stewardship Council (MSC) has proposed certifying the Aker BioMarine Antarctic krill fishery as “sustainable” according to its standard. Objector, the Antarctic and Southern Ocean Coalition (ASOC), has objected to this decision and hereby submits this document and attachments pursuant to MSC Objections Procedure 4.7.4. This information supplements evidence previously submitted in the Notice of Objection as well as in comments submitted to the Certification Body during the assessment process.

ASOC is raising fundamental substantive, procedural and scoring deficiencies by Moody Marine, the Certification Body. Taken together, these deficiencies provide a compelling basis for the Independent Adjudicator to remand the certification decision.

## **II. Background**

### **A. Antarctic Krill are Critical to the Antarctic Food Web and Their Populations are in Decline**

As the diagram<sup>1</sup> of a somewhat simplified Antarctic food web from Hader et al. (1991) demonstrates, concern over the harvesting fishing of krill was based on its key role in the food web. Krill are the main dietary component for several species of penguins, whales, and seals. Declines in krill populations can therefore be expected to have serious consequences for the ecosystem. Studies have demonstrated that localized declines in krill populations adversely impact krill predators<sup>2 3</sup>, even when these declines are small as related to the overall krill population. The importance of krill in the ecosystem is not exclusive to Antarctica. Other species of krill are similarly important to marine ecosystems worldwide. Krill fishing was recently banned off the West Coast of the United States before any actual fishing had occurred because of concerns about the potential impact of krill fishing on populations of dependent predators.

Effective management of krill is further complicated by the emerging impacts of climate change. Sea ice extent during the Antarctic winter affects krill abundance the following year, presumably because the algae and other microorganisms that grow on the underside of the ice provide rich food sources and habitat protection for krill. Decreases in sea ice extent due to warmer temperatures around the West Antarctic Peninsula have been well-documented and are thought to have contributed to a significant decline in the krill population since the 1970s. Atkinson *et al.* estimate that this decline may be as high as 80% in the southwest Atlantic region of the Southern Ocean.<sup>4</sup> These declines have had significant impacts on the food web. The West Antarctic Peninsula, where the krill fishery occurs, is one of the most rapidly warming areas on the planet. Although there is tremendous uncertainty about the status of the krill population, all available evidence suggests that climate change has caused and will continue to cause declines in krill stocks.

### **B. Management Of Antarctic Krill Is Characterized By A Lack Of Adequate Strategy And Rampant Uncertainty**

The need to manage the Antarctic krill population sustainably was a key motivation behind the development of the Convention on the Conservation of Antarctic Marine Living Resources (“the Convention” and the establishment of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to implement the provisions of the Convention. Specifically, parties to the Convention believed that “pre-emptive management [of krill] could avoid the pattern of overexploitation which had characterised seal, whale and fish exploitation in the Antarctic. There was also major concern that since krill was such a major

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<sup>1</sup> Häder D.-P., Worrest, R.C. & H.D. Kumar H.D. (1991). Aquatic Ecosystems. Chapter 4 In: Environmental Effects Of Ozone Depletion: 1991 Panel Report Pursuant to Article 6 of the Montreal Protocol on Substances that Deplete the Ozone Layer Under the Auspices of the United Nations Environment Programme (UNEP), November 1991.

<sup>2</sup> Reid, K. & Croxall, J.P.(2001). Environmental response of upper trophic-level predators reveals a system change in an Antarctic marine ecosystem. *Proceedings of the Royal Society B* 268: 377-384.

<sup>3</sup> Fraser, W.R. & Hofmann, E.E., (2003). A predator's perspective on causal links between climate change, physical forcing and ecosystem response. *Marine Ecology Progress Series* 265: 1-15.

<sup>4</sup> Atkinson, A., Siegel, V., Pakhomov, E. & Rothery, P. (2004). Long-term decline in krill stock and increase in salps within the Southern Ocean. *Nature* 432: 100-103.

part of the Antarctic food web, harvesting of krill should proceed in such a way so as not to adversely affect the ecosystems dependent on it, and in particular should not hinder the recovery of baleen whales” (Nicol 2001).<sup>5</sup>

However, although CCAMLR decisions are based on science, these are ultimately dependent on consensus by the parties. The Convention embraces the ecosystem-based management approach and the precautionary principle, but the reality is that the implementation of these principles is up to parties. A recent performance review of CCAMLR identified a number of areas where improvement is needed, including management of the krill fisheries. The executive summary of the report noted: “There is need for particular attention to be directed toward the adequacy of monitoring and management of the krill fishery to ensure that its expected development is consistent with Article II, both in relation to the target species and dependent and related species.” In addition, the Performance Review lists all the scientific recommendations pertaining to the krill fishery that were still to be adopted at the time of the report.

The precautionary management of krill is essential to the protection of the Antarctic food web. To achieve this, information both on the status and distribution of krill, and the needs of krill predators is required. Although krill have been extensively studied, there are still key gaps in knowledge of their life history; the exact relationship of sea ice extent to krill recruitment; and the impacts of ice movements and water currents on krill populations. The potentially disastrous consequences of dramatic changes to the krill population indicate that the management of krill fishing should be particularly precautionary, especially taking into account the degree of uncertainty involved. Estimates of krill biomass are uncertain for a variety of reasons, including that the most recent estimate is a decade old. In addition krill are increasingly impacted by climate change as already mentioned. There is also uncertainty about predator population numbers and the amount of krill that they consume. Monitoring of the numerous species dependent on krill occurs as part of the CCAMLR Ecosystem Monitoring Programme (CEMP), but covers a limited number of species and sites, some of which have been discontinued in recent years. Although much uncertainty remains over the impacts of expanded krill fishing on krill, krill predators, and bycatch species, the management strategy does not yet reflect these circumstances.

CCAMLR Conservation Measures are currently insufficient to protect against irreversible impacts to predators as a result of krill fishing. This was acknowledged by CCAMLR at its most recent meeting in 2009. In fact, CCAMLR modeling work indicates that the uncontrolled expansion of the fishery up to the current trigger level is likely to risk depletion of krill-dependent predators.<sup>6</sup> This is because 99% of krill fishing takes place in coastal areas close to land-based predator breeding colonies, in overlap with foraging ranges of krill predators, including recovering baleen whale populations. Thus, the likelihood of localized impact on predators is quite high.

At the request of CCAMLR’s Working Group on Ecosystem Monitoring and Management (WG-EMM), last year a risk assessment was undertaken by Watters *et al.* (2009)<sup>7</sup> applying the FOOSA model. Its goal was to analyze the risks of allowing expansion of the fishery up to the trigger level without catch limit allocations among small-scale management units (SSMUs). This assessment confirmed that the current trigger level is not sufficiently precautionary. It concluded that depletion of krill predator populations are likely to occur as krill catches expand from current levels. Thus, the existing management system (based on the trigger level as an overall krill catch limit until SSMUs are implemented) is not precautionary, and clearly is inconsistent with CCAMLR's fundamental principles. This risk assessment was available at the time of the assessment and should have been taken into account by the Certifier.

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<sup>5</sup> Nicol, Steve. (2001) CCAMLR: the first 20 years. *Australian Antarctic Magazine*. Issue 1. Australian Antarctic Division. <http://www.aad.gov.au/default.asp?casid=2052>

<sup>6</sup> The Commission noted the Scientific Committee’s advice on the need to distribute the trigger level, especially “modeling results indicating that a harvesting level consistent with the current trigger level (620,000 tonnes) was not as cautious as might have been thought at the time this was agreed”. CCAMLR- XXVIII, paragraph 4.20.

<sup>7</sup> WG-EMM-09/12, George M. Watters, Simeon Hill, Jefferson T. Hinke, and Phil Trathan “The Risks of not Deciding to Allocate the Precautionary Krill Catch Limit among SSMUs and Allowing Uncontrolled Expansion of the Krill Fishery up to the Trigger Level” (2009), hereafter quoted in this document as “Waters et al. (2009)”.

As a result of this risk assessment, CCAMLR XXVIII adopted an initial subdivision of the catch limit (“trigger level”) among Subareas. However, this preliminary subdivision, the result of intense negotiations, falls short of providing sufficient protection to krill predators from krill fishing. The initial proposal for subdivision, presented by a fishing nation, Ukraine, was to provide protection to predators by allocating the catch limit between coastal and pelagic zones in Subareas 48.1, 48.2 and 48.3 based on the biomass estimated in those zones during the CCAMLR 2000 Survey. Although this option was considered the most precautionary in allocating the catch limit, pressure from other fishing nations precluded it from being adopted.<sup>8</sup> Instead, CCAMLR XXVIII passed an interim measure that follows the historical distribution of the fishery without regard to the concentration of krill catch in coastal areas. For this reason, it was established that this interim measure will expire in 2011, at which point it is to be revised “with the intent of ensuring the implementation of Article II of the Convention, taking into account the resource requirements of land-based predators.”<sup>9</sup>

## **1. Scientific uncertainties, lack of adequate monitoring, and insufficient observer coverage**

Scientific uncertainties in the krill fishery remain a large obstacle to its proper management. The inability to address information gaps has been a major obstacle to allocation of krill catch limits among SSMUs in Area 48. Furthermore, uncertainties in relation to krill biomass and distribution precluded the adoption of a sufficiently precautionary interim measure to subdivide the trigger limit in 2009.<sup>10</sup> If the data is insufficient for the management body responsible for implementing decisions about the fishery, it should also be insufficient for MSC certification.

Of particular concern are the problems in estimating pre-exploitation biomass ( $B_0$ ) of the krill population. At the WG-EMM meeting (July 2009), members determined that there were errors in the current  $B_0$  estimates in Area 48 and that the level of uncertainty was even more significant than previously thought. Thus, there was agreement that  $B_0$  must be recalculated. In addition, many CCAMLR members acknowledged the compelling need to conduct new surveys as the available data is almost 10 years old.

Most importantly, as highlighted by CCAMLR’s Performance Review Panel, CCAMLR has not yet agreed on a plan to tackle the lack of empirical data on key issues for the management of krill fishing in Area 48. In fact, the Panel concluded that the lack of a “fishery-based research program” is one of the pending issues in relation to CCAMLR’s management of the krill fishery. Thus, a comprehensive research plan for krill needs to be developed by the CCAMLR Scientific Committee. While WG-EMM recognized the importance of developing a research and monitoring plan to reduce scientific uncertainties and to support feedback management unfortunately, this recommendation has not yet been translated into action.<sup>11</sup>

Monitoring of the krill fishery is insufficient, both with respect to krill itself, and the ecosystem as a whole, which includes krill predators and fish larvae. An issue of paramount importance to krill predators and CCAMLR’s management of the fishery is the need to reform the CCAMLR Ecosystem Monitoring Program (CEMP). CCAMLR has already recognized that currently CEMP does not allow distinguishing the impacts of fishing from those associated with environmental change, which was the main objective for its creation. In addition, some CEMP sites have been discontinued and data have decreased consequently. In some cases, information arising from different CEMP sites with similar geographical and oceanographic features, indicate contradictory trends on predator parameters, which are difficult to explain without further investigation.

WG-EMM parties also expressed concern that climate change could potentially induce rapid changes within the ecosystem, impacting the way CEMP indices are being used to detect fisheries impacts. Additionally, climate change can affect predators over a variety of temporal and spatial scales in a direct or indirect way, as well as in their reproductive performance.<sup>12</sup> Until CEMP is significantly reformed, it will be very difficult

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<sup>8</sup> See CCAMLR- XXVIII, paragraphs 4.25 and 4.26.

<sup>9</sup> See Conservation Measure 51-07 (2009), “Interim distribution of the trigger level in the fishery for *Euphausia superba* in Statistical Subareas 48.1, 48.2, 48.3 and 48.4”.

<sup>10</sup> See CCAMLR- XXVIII, paragraph 4.26

<sup>11</sup> SC-CCAMLR-XVIII/3, paragraph 3.149.

<sup>12</sup> SC-CCAMLR-XVIII/3, paragraph 3.110.

to incorporate monitoring data into the formulation of specific conservation measures. This was also acknowledged by CCAMLR's Performance Review panel in its recommendations to the Commission.<sup>13</sup> At its last meeting, WG-EMM recognized that reviewing CEMP has become a priority. Unfortunately, once again no action has been taken so far.

One of the most important deficiencies of CCAMLR's management of the krill fishery is related to the scientific observer program. The krill fishery is the only fishery under CCAMLR management to which the CCAMLR Scheme of International Scientific Observation is not a requirement. As of November 2009, before Moody Marine finalized its assessment, there was no compulsory observer coverage in the krill fishery at all. In November 2009, a Conservation Measure was adopted by CCAMLR requiring 30% of national or international observers.<sup>14</sup> However, this coverage falls very short of being systematic and does not provide the level of observer data needed for management. Because scientific observation programs are a key component of ecosystem-based management of the fishery, CCAMLR urgently needs to adopt a conservation measure that ensures systematic coverage of international scientific observers on board krill vessels, in accordance with the CCAMLR Scheme of International Scientific Observation. The adoption of such a system represents a minimum standard for the largest fishery in the CCAMLR Area, targeting the core of the Antarctic food web, and particularly in view of the large degree of scientific uncertainty. Until such systematic coverage is in place, monitoring of this fishery will remain highly inadequate.

## **2. Uncertainties about krill mortality as a result of fishing**

An additional cause of concern for management of the krill fishery is that fishing States report catch data derived from product information, without indicating the product-specific conversion factors used, causing significant uncertainty in krill catch data. This not only affects assessments of krill stocks, but also the estimations of the impact of krill removals on predators. Moreover, it raises important enforcement issues. Already in 2008 CCAMLR XXVII recognized the importance of consistent "green weight" reporting. But so far no specific action has been taken to resolve this issue.

The issue of krill escapement mortality from krill nets raises further concerns about CCAMLR's capacity to effectively measure krill removals during fishing operations. Krill trawl net escapement mortality represents an important source of uncertainty, which further undermines CCAMLR's capacity to determine the full impacts of fishing operations on the ecosystem.<sup>15</sup> At the last WG-EMM meeting, it was indicated that mortality of krill could be between 10 and 50% higher than that reported being caught. Furthermore, given the discrepancy between the estimates of mortality of escaped krill, together with the lack of data on the rates at which krill escape from nets in different fishing gears, WG-EMM recommended a concerted effort to estimate escape mortality in the krill fishery, including through the evaluation of existing results and the continued development of existing models.<sup>16</sup> Further, the Working Group recommended that the Scientific Committee ask Members fishing for krill to actively investigate the effect of different fishing gears on krill escapement mortality,<sup>17</sup> and the Scientific Committee echoed these concerns by WG-EMM at its 2009 meeting.<sup>18</sup> This information was available at the time when Moody Marine finalized its assessment.

## **3. Risks to depleted fish populations from bycatch of fish larvae**

The by-catch of fish larvae is another important concern in the Antarctic krill fishery. At the 2008 CCAMLR meeting the Scientific Committee noted that there is still uncertainty over the level of by-catch of juvenile and larval fish in the krill catch over all seasons and areas in which the krill fishery operates, and from different fishing gears and fishing strategies. The uncertainty about the actual krill catch derived from the

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<sup>13</sup> See CCAMLR Performance Review Panel, (2009) CCAMLR Performance Review Panel Report.

<sup>14</sup> See CM 51-06 (2009).

<sup>15</sup> Krill escapement mortality occurs when krill gets squeezed through the nets while fishing, an unknown percentage of which gets killed or seriously injured, without being counted as caught. Many different factors such as krill density, type of gear, speed of trawling, and mesh size (both cod end and side panels - a range of different mesh sizes are used in both cod ends and side panels) could affect unseen mortality.

<sup>16</sup> SC-CCAMLR-XVIII/3, paragraph 3.5.

<sup>17</sup> SC-CCAMLR-XVIII/3, paragraph 3.7.

<sup>18</sup> See SC-CCAMLR XVIII, paragraph 4.13.

different conversion factors used in krill catch reporting adds even greater uncertainty to the extrapolated level of juvenile fish by-catch in the krill fishery.

As early as 2006 WG-EMM noted that the occurrence of fish larvae by-catch observed in the krill fishery was higher than the previous general understanding of by-catch in this fishery. The Working Group agreed that such results underscore the importance and need to increase observer coverage, and establish acceptable levels of by-catch in the krill fishery.

#### **4. Inadequacies Identified by the CCAMLR Performance Review**

ASOC's notice of objection included detailed references to the different findings of CCAMLR's Performance Review Panel in relation to the management of krill fishing, when commenting on relevant Performance Indicators (PIs). Moody Marine's assessment (and its response to ASOC) ignores these findings, which were agreed by a group of key international experts on CCAMLR and Southern Ocean issues. We are, therefore, compelled to restate some of these points here below. Particularly, the report of the Panel makes a very clear explanation of the lack of adoption by CCAMLR of key recommendations of the Scientific Committee on various issues in relation to the krill fishery:

*“Recommendations for improved biological research and fishery operations in the krill fisheries have been made for many years without adoption and implementation, or with very limited adoption and implementation. This is despite the operation and development of the krill fishery, and its potential effects on dependent species, being one of the main motivations for the establishment of CCAMLR, and that the krill fishery is in most respects a new or exploratory fishery. Specific improvements that are implemented for other CCAMLR fisheries, that have been formally recommended for the krill fishery, but that have not been adopted and implemented in the krill fishery include: mandatory sampling, reporting and verification by CCAMLR scientific observers; VMS reporting, access and use; 5-day catch and effort reporting, and monthly fine scale catch and effort reporting; spatial restrictions, including SSMUs for catch limits; target species move-on rules; by-catch limits and move-on rules; gear and mesh size restrictions; fishery-based research program. Formal recommendations on some of these issues (e.g. scientific observers) go back to at least the year 2000 but without adoption.”*

As indicated in ASOC's notice of objection, many of these issues remained unresolved at the time of the assessment, and only very limited progress has been made since then on issues such as spatial distribution of the trigger level, or mandatory observer coverage, as explained above.

Below is a summary of the most relevant recommendations of the Performance Review Panel in relation to the krill fishery, with reference to specific sections of the report. These recommendations provide an overview of the main pressing issues that remain unresolved with regards to the krill fishery. ASOC finds it unfortunate that Moody Marine did not build on these findings in order to examine these issues in their full depth.

Under 3.1.2 - trends in the status of marine living resources under the purview of CCAMLR:

*“Design and agree a strategy for krill fishery development (e.g. timing, spatial scale and location, catch limits) and fishery monitoring that explicitly (i) ensures that adequate information is available to support orderly development of the fishery while addressing Article II, and (ii) allows separation of the effects of fishing from climate change and natural variability. Further, and in an integrated manner, the monitoring of key dependent predators should be explicitly designed to (i) aid separation of the effects of fishing from climate change and natural variability, and (ii) explicitly link to the ongoing management decisions for krill fishery development. Consideration should be given to the use of indicators of predator status in the strategy for krill fishery development”.*

Under 3.1.3 - status of species that belong to the same ecosystems as, or are associated with or dependent upon, targeted Antarctic marine living resources:

*“Options should be examined to develop and implement a more comprehensive and consistent monitoring program for non-retained by-catch species (i.e. fish, elasmobranches and invertebrates that are directly or indirectly affected by fishing but that are not commercially retained). This should aim to allow for the effective monitoring of the status of these species or*

*groups, and the status should be centrally compiled and available for CCAMLR decision-making. Monitoring may be differentially targeted on species/areas of perceived highest risk, but it should endeavor to provide wide ecosystem coverage and relate to management actions that CCAMLR could take. The monitoring program should consider the need to differentiate the effects of fishing from the effects of other human activities and from natural variability. Consideration should be given to mechanisms that can ensure an ongoing monitoring program to meet CCAMLR's requirements, including mechanisms that reduce the reliance and focus on funding and interests of individual Members. As appropriate, this monitoring program should be collaborative with other elements of the ATS and with the activities of those States that have national jurisdiction within parts of the Convention Area".*

*"Further examine, develop and agree methods to link monitoring information from dependent species to fishery management decision procedures, especially the procedures for determining the location and size of the krill catch. Ensure that these procedures have a high probability of satisfying the requirements of Article II".*

Under 3.2 - Ecosystem Approach:

*"An explicit and active process should be developed to anticipate threats from fishing and environmental change, and to develop appropriate approaches through research, monitoring and/or precautionary CMs to address them before they become manifest".*

Under 3.3.4 - extent to which CCAMLR is addressing any gaps in the collection and sharing of data as required:

*"Monitoring and reporting of the krill fishery should be made consistent with the requirements of other CCAMLR fisheries".*

Under 3.5.3 - extent to which CCAMLR is applying uniform principles and procedures to all species in the Antarctic ecosystem:

*"The RP strongly supported the views expressed in paragraphs 3.3 to 3.17 of the 2007 Scientific Committee report (SC-CAMLR-XXVI) regarding the collection of data from the krill fishery, and recommended that at least the requirements of the new and exploratory fisheries be applied to the krill fishery. The procedures for new and exploratory fisheries should be applied to all new and exploratory fisheries, including the developing krill fishery".*

Under 4.3.1 - extent to which CCAMLR has adopted integrated MCS measures:

*"There should be consistency in management and enforcement measures (including in the operation of the C-VMS) for finfish and other fisheries (including krill)".*

### **III. Interests of Objector and Deficiencies in the Record**

The Objector is a non-profit coalition of environmental organizations concerned with the preservation of Antarctica and the Southern Ocean. As the only environmental NGO observer in the Antarctic Treaty System (ATS), ASOC provides the primary voice for conservation at ATS governance meetings. At CCAMLR meetings, ASOC presents policy papers and encourages the adoption of measures designed to further the implementation of the Convention conservation principles. ASOC also provides information to the public about Antarctic environmental issues, including the management of Southern Ocean fisheries. In partnership with the Pew Charitable Trusts, we participate in the Antarctic Krill Conservation Project (AKCP).

ASOC has no financial interest in the certification of this fishery. ASOC's main objective is to ensure that the ecosystems and resources of the Southern Ocean are managed and exploited in a precautionary manner. The rapid warming of some regions of Antarctica, including those where the krill fishery currently takes place, has put enormous strains on these ecosystems. By advocating for strong ecosystem-based management, ASOC seeks to protect ecosystems in the Southern Ocean from the unwise management practices that have led to fisheries collapse and to ecosystem destruction around the world. ASOC believes it important to ensure that the public receives accurate information about the sustainability of Southern Ocean fisheries, and that MSC certifications are awarded only to fisheries that truly meet MSC criteria.

In relation to deficiencies detected in the record, ASOC requested that the Adjudicator ensures that all documents that should be part of the official record but were not publicly available, pursuant to Section 4.7.5(a), be made available, including specific examples of oral, written and documentary evidence used by Moody Marine in scoring PIs. The documents that ASOC obtained as a result of this request are handwritten, unreadable, and incomplete notes which cannot be analyzed in any meaningful way. The outcomes of the meetings to which the notes refer might have been used in the assessment, but it is impossible for ASOC or anyone else to verify how the content of these notes were used in the scoring. The minimum requirement for these types of documents should be a typewritten account of the meetings held, by which any reader can get a sense of the discussions. Handwritten notes should not suffice as a legitimate part of the written record, particularly when they are cited in the scoring of numerous PIs. The omission of a formal written record of these interviews and meetings, upon which part of the assessment and the scoring were based, compromises the transparency of the certification process.

## **IV. Argument**

### **Introduction**

ASOC has objected to the certification under provisions (a) and (b) of section 4.8.2 of the MSC Objections Procedure, which state that:

*“The Independent Adjudicator shall remand the Determination to the certification body if he or she determines that:*

*(a) there was a serious procedural or other irregularity in the fishery assessment process that made a material difference to the fairness of the assessment; or*

*(b) the score given by the certification body in relation to one or more performance indicators cannot be justified, and the effect of the score in relation to one or more of the particular performance indicators in question was material to the outcome of the Determination, because:*

*(i) the certification body made a mistake as to a material fact; or*

*(ii) the certification body failed to consider material information put forward in the assessment process by the fishery or a stakeholder; or*

*(iii) the scoring decision was arbitrary or unreasonable in the sense that no reasonable certification body could have reached such a decision on the evidence available to it;”*

The lack of consideration given to the comments of stakeholders and the peer reviewer by Moody Marine resulted in the inclusion of serious factual errors in the scoring and the assessment that were never fully addressed or corrected by the certification body. The inclusion of these errors made a material difference to the fairness of the assessment because they concerned the operation of CCAMLR, the composition of research programs, and the state of information on the fishery. Moreover, the scores given on numerous performance indicators cannot be justified by available evidence, and the decisions to award passing scores were therefore arbitrary or unreasonable. The fishery should have failed on these PIs and thus not been recommended for certification. For both of these reasons, the certification decision should be remanded.

### **A. The certification body committed procedural errors that made a material difference to the fairness of the assessment**

#### **1. Failure to consult stakeholders**

Moody Marine did not consult a wide range of stakeholders, especially experts on relevant issues, which would likely have prevented it from making some of the errors enumerated in this submission. Moody Marine asserted that “the assessment team has met with representatives of the Norwegian delegation to CCAMLR and with scientists active in the CCAMLR process”, considering that these meetings provided “more than sufficient information for us to make an evaluation of the fishery against the MSC standard”. Yet according to the official record, the CCAMLR representatives that were consulted all were members of the Norwegian delegation, with only one of them being a scientist. Furthermore, this Norwegian scientist consulted has attended only one meeting of the Working Group of Ecosystem Monitoring and Management (WG-EMM) - the expert group on krill - in the last 6 years.

CCAMLR scientists working on krill modeling and krill predator monitoring in Area 48, where krill fishing takes place, were not consulted either. The omission of these scientists, who are arguably the best informed about the krill fishery and the Antarctic, is a glaring oversight. We note that UK CCAMLR scientists working on krill modeling and predator monitoring are based at the British Antarctic Survey and their offices are not far from those of the Certification Body, making this omission even more puzzling.

It is unacceptable that Moody Marine did not consult with any representatives from other CCAMLR Members, particularly those CCAMLR scientists currently active in the WG-EMM process who would have been able to provide complementary or different perspectives of the issues at stake.

## **2. Failure to give adequate consideration to the peer reviewers and stakeholders**

Moody Marine failed to give full consideration to the comments of Peer Reviewer Dr. Steve Nicol, and did not address many of the issues and concerns he raised. Only in a few instances did Moody Marine make minor score revisions, even when Dr. Nicol suggested that the fishery had failed to meet the minimum SG for some PIs. Dr. Nicol is not only one of the world's leading experts on krill biology, but also participates very intensively in CCAMLR working groups and discussions such as EMM, which allowed him to provide an accurate, up-to-date overview of the challenges faced in managing Antarctic krill fisheries. His comments provided an opportunity for the assessment team to investigate these issues in a more thorough way. While Moody Marine acknowledged some of these concerns, it avoided making any significant changes to its assessment. For example, in a discussion of PI 2.5.2, Nicol notes that "it is not possible to make this statement" about a specific sentence in the scoring commentary. Moody Marine admits that the reviewer has a point and reduces the score, but the erroneous text in the scoring comments remains. Other stakeholders, such as a group of international independent scientists, also raised concerns over the dismissal of Dr. Nicol's comments, but these too were ignored by Moody Marine. According to the FCM Section 3.7.6 "upon receipt of the peer reviewers' written comments the Assessment Team shall explicitly address the issues raised and incorporate any appropriate changes into the Public Comment Draft Report and, if appropriate, into any special conditions contained therein." .

Stakeholder comments were also addressed in a superficial manner. In response to ASOC's request that Moody Marine "review the report taking account of all the stakeholder comments and revise the report as appropriate", Moody Marine stated that "this has been done and stakeholder comments reviewed in the Final Report", adding that "We have reviewed and fully considered the concerns raised by stakeholders". This was not the case, however, as the numerous errors in characterizing the fishery and CCAMLR management were not corrected or revised, nor was additional information provided to support their interpretations.

*We would suggest that the Independent Adjudicator read all stakeholders' previous submissions and compare them with Moody Marine's final report assessment to reach an independent conclusion.*

## **3. Failure to consider Watters *et al.* (2009) study**

Moody Marine argued that information cited by ASOC in the objection is outside the scope of the assessment. In particular, Moody Marine decided that the study conducted by Watters *et al* (2009) was produced after the final report was completed, but this is incorrect: The findings of Watters *et al* (2009) were highlighted by the AKCP in comments on Moody Marine's draft report, which are included in the record.<sup>19</sup> Specifically, reference to this paper was made by the AKCP in relation to PIs 1.2.1, 1.2.2, 2.5.2 and 2.5.3. Moody Marine simply chose not to respond to it, but they had ample opportunity to become familiar with this important document, which is being provided to the Independent Adjudicator and should be a part of the formal record.

## **4. Problems with citations and footnotes**

ASOC raised concerns about the format for citations in the scoring justifications. Moody Marine listed references in a group at the end of each scoring rationale, rather than using footnotes or providing in-text citations. Moody Marine maintained that "the aim of the assessment report is not to provide a seminal 'scientific' review paper on the fishery, but to provide the information necessary for a reader to understand the rationale behind the determination reached." ASOC understands the nature of this document as opposed to a peer-reviewed paper. However, there is a minimum logical standard in any technical document such as

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<sup>19</sup> See Leape *et al.* (2009). Comments of the Pew Environment Group's Antarctic Krill Conservation Project on Public Comment Draft Report for Antarctic Krill Pelagic Trawl Fishery.

this assessment that should allow a reader to be able to corroborate the information provided and to evaluate the correctness of the interpretation made of the source. That is not the case here.

Moody Marine claimed in its response to the ASOC Objection that its references are consistent with Fisheries Certification Methodology (FCM) v6, Appendix 1, Section 3.2. However, Section 3.2 concerns what information should be covered in discussions of fishery management, and not procedures for citing references. It remains unclear whether Moody Marine is justified by any provisions of the FCM in using this irregular citation style, as Objectors were not able to find any procedures for references in the FCM. What is clear is that the format used by Moody Marine makes it impossible for even a well-informed reader to determine the basis for its scores. The FCM requires a transparent process and Moody Marine's format for citations makes their rationale significantly less transparent to stakeholders and the public.

## **B. The certification body cannot justify its scores on multiple performance indicators and these PIs are material to the outcome of the assessment**

ASOC provided eleven examples of incorrect statements that were used to justify high scores, which reveal the assessment team's general misunderstanding of the current state of data and management of the fishery.<sup>20</sup> Some of these incorrect statements were also pointed out in other stakeholders' comments, and importantly by Dr. Nicol, one of the peer reviewers of the assessment. Moody Marine has not provided any substantive arguments supporting their interpretations of these facts.

Moody Marine awarded overly generous scores on numerous performance indicators, which are not justified by available evidence or by its scoring commentaries. Several of these PIs do not meet the criteria for scoring guidepost 60, which indicates that the fishery should not have been recommended for certification.

As explained earlier in this document and in our Notice of Objection, management of Antarctic krill is plagued by substantial uncertainties and a lack of adequate strategy. These problems have been identified by CCAMLR itself, the scientific community, and the peer reviewers in the certification process.

### **1. A score of 95 for PI 1.2.1 cannot be justified because there is no evidence that the harvest strategy is effective**

A score of 95 is completely unsupported by the available evidence. Even a score of 60 for this PI would be questionable. Performance Indicator 1.2.1 assesses the harvest strategy for the fishery and the status of evaluation and monitoring of the effectiveness of the strategy. The Certification Body awarded a score of 95 based on its determination that "there is clear evidence of ongoing development of the strategy and interim controls on fishing that are precautionary and appropriate for the current level of development." In fact, there is no evidence that the harvest strategy is achieving its objectives, which is reflected even in Moody Marine's own scoring comments. To meet SG 80, it is required that "evidence exists that it [the harvest strategy] is achieving its objectives." SG 60 requires "Monitoring is in place that is expected to determine whether the harvest strategy is working." The scoring comments appear to indicate that by this standard, SG 60 is not met, noting that "[m]onitoring of the stock, based on biomass surveys, has been patchy since the last synoptic survey [in 2000] so the state of the stock is **surmised based on the low levels of catch relative to the potential yield**" (emphasis ours). If the monitoring is "patchy" and the state of the stock is merely "surmised", it does not appear that there is any evidence of monitoring that contributes to an understanding of whether the harvest strategy is working.

Furthermore, Moody Marine notes that the strategy "remains untested" yet SG 80 indicates a harvest strategy that "may not have been fully tested." The Certifier appears to believe that because the current catches are below the interim trigger level, which is considered by Moody Marine a precautionary level, that the harvest strategy is precautionary. However, the scoring guideposts all suggest that ongoing testing or monitoring is necessary to achieve the minimum score for this PI. Although the proposed vessel to be certified provides full observer coverage, other vessels in the fishery do not, and thus the majority of catches go unmonitored.

As previously noted, krill populations are being affected by climate change and thus without further evidence it cannot be stated that current catch limits remain precautionary, particularly when the biomass estimate is a decade old. Dr. Nicol's comments reiterate this point, stating: "I am unaware that any evidence that exists that the strategy is effective other than the absence of an obvious stock collapse." Moody responded that "the

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<sup>20</sup> These can be found on page 6 of the Notice of Objection.

level of monitoring here is assessed in the context of the decision rule.” It is unclear why this assessment is considered appropriate given that the scoring guideposts are clear in requiring evidence, not merely an educated guess. The fishery therefore does not appear to even meet the requirements for SG 60, much less those for SG 80, which also requires that the strategy is “responsive to the state of the stock.”

Although Moody Marine notes that annual CCAMLR meetings discuss the harvest strategy and alleges that they respond to issues as they arise, it is not demonstrated how this could be achieved in the absence of current information about the stock. Therefore the fishery does not meet the minimum scoring requirement for this PI and should have failed.

Additional discussion of errors made in the scoring of this PI can be found in ASOC’s Objection. The harvest strategy is a key part of krill fisheries management, and failure on this PI constitutes sufficient reason to deny MSC certification.

## **2. A score of 65 for PI 2.1.1 cannot be justified because the impacts of the fishery on retained non-target species is unknown**

Performance Indicator 2.1.1 assesses the impacts of the fishery on retained, or bycatch, species and whether the fishery may “hinder recovery of depleted retained species.” Moody Marine awarded the fishery a relatively low score of 65 for this PI and generated a condition that a risk assessment be conducted within two years to determine the level of the fishery’s impact on the larvae of *Champsocephalus gunnari* and *Notothenia rossii*, both of which have been subject to overfishing. Moody Marine has based its score on its belief that the total amount of krill harvested is too low to have any harmful impact on retained species. There is, however, no evidence to support that assumption.

Two of the species retained as bycatch by the krill fishery have both been subjected to high fishing pressure in the past. *C. gunnari* (mackerel icefish) has recovered somewhat, but information suggests that the population is still in decline and catch limits are much smaller than they were previously.<sup>21</sup> On the other hand, fishing for *N. rossii* (Antarctic rockcod) is currently prohibited. Other icefish larvae are present in the catch in smaller numbers. At the CCAMLR 2008 meeting, the Scientific Committee stated that “there is still uncertainty over the level of bycatch of juvenile and larval fish in the krill catch over all seasons and areas in which the krill fishery operates, and from different fishing gears”, and that “the collection of information on fish by-catch should remain a priority task for observers.”<sup>22</sup>

If the level of bycatch remains uncertain, the impact of bycatch cannot be determined. Requirements for SG 60 are that “retained species are likely to be within biologically based limits or if 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 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.”

In the case of Antarctic rockcod and other icefish, Moody Marine admits that “catch rates **appear** low” (emphasis ours), but does not present any evidence that enough is known about the level of bycatch to determine if it is hindering recovery of these species. There are no specific measures to address bycatch in the krill fishery, although Moody Marine seems to consider the trigger catch limit for krill to be sufficient based on its estimation of the maximum larval bycatch per tonne. However, the trigger level cannot be considered sufficient given that there is so much uncertainty over the level of bycatch. As noted in the scoring commentary, “Rockcod appear to remain at low populations levels” and since fishing for rockcod is prohibited, the impact of bycatch could indeed be hindering recovery. However there are no measures or practices in place to ensure that bycatch is not slowing recovery.

In choosing to consider the catch size for krill as the primary justification for this PI, Moody Marine has ignored the requirements of the PI. As noted in the Objection, Peer Reviewer Nicol noted that it was “difficult” to see how the fishery met SG 60. There is clearly no evidence to support even the low score of 65. Additional discussion of the reasons this PI does not meet the requirements for SG 60 can be found in ASOC’s Objection.

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<sup>21</sup> Kock, K. H. 2000. “A Brief Description of the Main Species Exploited in the Southern Ocean.” Appendix 1 to Understanding CCAMLR’s Approach to Management, 32.

<sup>22</sup> SC-CAMLR (2008) Report of the XXVII Meeting. Item 4, Harvested species, paragraphs 4.19 and 4.20.

### **3. A score of 60 for PI 2.1.2 cannot be justified because there is no strategy in place to manage retained species**

Performance Indicator 2.1.2 determines whether “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.”<sup>23</sup> To meet the minimum SG 60 for this PI, it is required that “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” and that “the measures are considered likely to work, based on plausible argument (e.g., general experience, theory, or comparison with similar fisheries/species).” Moody Marine notes that it scored this PI based on the trigger level of 620,000 tonnes, and that it considers this a “measure” that maintains bycatch species.

However as noted by peer reviewer Steve Nicol, “the current catch level cannot be viewed as a measure that maintains retained species at a high level. As the catch is allowed to rise to 620,000 tonnes and can be locally concentrated it could significantly affect retained species. (...)Consequently it is difficult to see how a minimum score can be given on this criterion until further study has been completed.” Moody responded that SG 80 requires an “objective basis” and therefore the fishery meets the criteria for SG 60, but even this is questionable.

Moody has no “general experience, theory, or comparison with similar fisheries/species” on which to base its argument that the trigger catch level constitutes a measure that is likely to work. Furthermore, with the low observer coverage throughout the fishery it is unclear how sufficient information will be collected on retained species to determine if they are being harmed by current levels of fishing. Moody Marine's institution of a Condition to address the issue of impact on retained species does not override the fact that it does not have any objective basis for determining that the current level of bycatch is not detrimental.

Since the scoring comments acknowledge that there is “no objective basis” for determining that the fishery meets SG 60, the fishery should have failed to achieve the minimum score for this PI until further evidence is obtained. Additional discussion of the reasons this PI does not meet SG 60 can be found in ASOC's Objection.

### **4. A score of 80 cannot be justified for PI 2.5.2 because there is no evidence to suggest the plan is likely to work**

Performance Indicator 2.5.2 determines whether “there are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.”<sup>24</sup> This PI is especially critical to score appropriately given the importance of krill in the Antarctic food web. However, Moody Marine has presented no evidence that there are in fact measures in place, or that these measures are successful or likely to work.

To achieve a score of 80, there must be “a partial strategy in place, if necessary that takes into account available information and is expected to restrain impacts of the fishery on the ecosystem...The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems)...There is some evidence that the measures comprising the partial strategy are being implemented successfully.”

Again, Moody Marine relied on the trigger level as a strategy sufficient to ensure the fishery complies with Principle 2, although peer reviewer Dr. Nicol noted that “there is still a considerable risk” to the ecosystem from catches up to the trigger level. Modeling results from Watters *et al.* (2009) further support the possibility that the current trigger level does not provide sufficient protection for krill predators.

Furthermore, as noted by Dr. Nicol, ecosystem monitoring of the fishery was not done in the 1980s, when catches were somewhat higher but did not exceed the current trigger level, and therefore it cannot be concluded that there was no impact on the ecosystem. Since only simulations on the current impacts of fishing are available at present, it is logical to infer that the fishery does not meet the standards for SG 60, which require “general experience, theory, or comparison with similar fisheries/ecosystems.”

Moody Marine acknowledged that “it cannot be said that the functional relationships between the fishery and the components and elements of the ecosystem are well understood,” so it is difficult to understand how even the existing partial strategy based on the trigger limit can be considered likely to work. The modeling that

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<sup>23</sup> Discussion of the scoring for this PI starts at page 78 of the Final Report.

<sup>24</sup> Discussion for the scoring of this PI begins on page 100 of the Final Report.

Moody Marine cites in support of its scoring may qualify as “theory”, but as there remains significant uncertainty about the interactions between krill and krill predators, those results do not appear to be sufficient to constitute a plausible argument that existing measures -or a strategy- are *likely* to work.

A score of 80 for this PI is not justified; a score of 60 or below would be more appropriate. Additional discussion of the reasons this PI does not meet SG 80 can be found in ASOC’s Objection.

**5. A score of 85 cannot be justified for PI 2.5.3 because of substantial inadequacies in the ecosystem monitoring program**

Performance Indicator 2.5.3 addresses the state of knowledge about ecosystem impacts by the fishery. As the fishery lacks systematic observer coverage, and the CCAMLR Ecosystem Monitoring Program (CEMP) is acknowledged to have many shortcomings, it is difficult to see how Moody Marine considers knowledge about the fishery to be “adequate.”

To achieve a score of SG 80, information on ecosystem impacts should be “adequate to broadly understand the functions of the key elements of the ecosystem (...) Sufficient data continue to be collected to detect any increase in risk level.”

As described in detail in the Objection, there are numerous problems with the CEMP, including that the data being collected currently cannot distinguish between the impacts of fishing and environmental change; no procedures have been developed to take environmental changes and harvesting effects into account when developing conservation measures; finally, the number of sites is small and, as noted by Dr. Nicol, “not strategically located.” Dr. Nicol also noted that “WG-EMM has on numerous occasions pointed out the inadequacy of this sort of data collection,” indicating that even CCAMLR does not regard its own program as adequate.

Moody Marine acknowledged these problems and revised the score down to 85, but did not acknowledge these problems in its scoring commentary or explain how the data is “sufficient” nor is the problem of low observer coverage addressed.

Current information does not meet the requirements for SG 60, which is that “main impacts of the fishery on these key ecosystem elements can be inferred from existing information.” Information from CEMP cannot even differentiate between fishing and environmental impacts. A score of 60 or below is therefore more appropriate, and a score of 85 is completely unsupported by the evidence. Additional discussion of the reasons this PI does not meet SG 60 can be found in ASOC’s Objection.

**6. A score of 90 cannot be justified for PI 3.2.2 because the CCAMLR peer review report identified numerous problems with CCAMLR's decision-making on krill**

Performance Indicator 3.2.2 addresses whether “the fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives.”<sup>25</sup> SG 60 for this PI requires that “there are informal decision-making processes that result in measures and strategies to achieve the fishery-specific objectives (...) 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.”

The Performance Review report outlines why this standard is not met by the krill fishery at present, noting that “Recommendations for improved biological research and fishery operations in the krill fisheries have been made for many years without adoption and implementation, or with very limited adoption and implementation. This is despite the operation and development of the krill fishery, and its potential effects on dependent species, being one of the main motivations for the establishment of CCAMLR, and that the krill fishery is in most respects a new or exploratory fishery (our emphasis).”

Peer Reviewer Dr. Nicol also noted problems for this PI, to which the Certification Body responded that CCAMLR is performing well by comparison with other management bodies. However, this PI is supposed to evaluate the appropriateness of the management system in the context of this fishery and its specific challenges. The issue of systematic observer coverage on krill vessels is a very serious one, representing the minimum scientific requirement necessary to gather information to establish an adequate management regime, yet decisions on this issue have been stalled for nearly a decade by a small minority of fishing nations. It is surprising that Moody Marine, which does cite the Performance Review in a subsequent PI, did

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<sup>25</sup> Discussion for the scoring of this PI begins on page 113 of the Final Report.

not mention the Panel's conclusions in the commentary on this PI, as they are directly relevant to the issue. This is a serious omission, particularly since the PI is in part concerned with “effective” decision-making.

Given the numerous problems noted above that were identified with CCAMLR’s management of krill in the CCAMLR Performance Review, the high score of 90 is completely unjustified. Even a score of 60 would not be supported by the evidence. Additional discussion of the reasons this PI does not meet SG 60 can be found in ASOC’s Objection.

#### **7. A score of 100 cannot be justified for PI 3.2.4 because there is no fishery-specific research plan**

Performance Indicator 3.2.4 determines the status of the research plan for the fishery and whether it “addresses the information needs of management.” A score of 100, which according to the MSC Fisheries Certification Methodology “defines the upper boundary of the scoring and represents the level of performance on an individual performance indicator that would be expected in a theoretically ‘perfect’ fishery,” is clearly not supported by the evidence. Importantly, the CCAMLR Performance Review notes: “Specific improvements that are implemented for other CCAMLR fisheries, that have been formally recommended for the krill fishery, but that have not been adopted and implemented in the krill fishery include...[a] fishery-based research program (our emphasis).” Though Moody Marine posits that the CEMP and the observer coverage on the client fishery’s vessels constitute a research plan, the Performance Review report clearly finds otherwise. Research may be performed, but it does not constitute a comprehensive plan, and is certainly not “coherent and strategic” as required by SG 100.

It is puzzling that Moody Marine believes there is a plan that includes scientific observation when proposals for comprehensive observer coverage have been repeatedly blocked. It is completely incorrect then to assert that there is any “comprehensive research plan” and, in light of the Performance Review report, it is clear that at best a case could be made for SG 60, but not SG 100. The aforementioned problems with the harvest strategy and CEMP make it unlikely that the fishery could even achieve “objectives consistent with MSC’s Principles 1 and 2.”

As noted by ASOC in its notice of objection, CEMP is a monitoring program aimed at detecting changes in the ecosystem, and it is not a research plan for krill. CEMP in itself it does not provide the baseline data needed to manage the krill fishery in accordance with P1, P2, and P3. Furthermore, Moody Marine made an additional error in stating: “[That] the research plan does not meet everyone’s wishes is an issue addressed under P1 and P2 – where it is determined whether sufficient information is available to manage the fishery”. It is clear that what is required is the existence of a plan aimed at providing information relevant to P1 and P2. Providing the type of information required under this PI is not the goal of CEMP. CEMP was designed to monitor the effects of the krill fishery on krill predators as opposed to those produced by environmental changes. The non-existence of a research plan as required by this PI becomes clear by reading CCAMLR relevant documentation for recent years.<sup>26</sup>

A score of 100 is completely unjustifiable. At best, the PI could be scored at SG 60, which requires only that “Research is undertaken, as required, to achieve the objectives consistent with MSC’s Principles 1 and 2...Research results are available to interested parties.” Additional discussion of the reasons this PI does not meet SG 60 can be found in ASOC’s Objection.

## **V. Conclusions**

Krill is a critical component of the Antarctic food web and many species are dependent on it. All available information on the krill fishery suggests that current management does not meet the standards established by the MSC. A certification by the MSC is supposed to represent best industry practice in a sustainable fishery. This test is not met here.

The MSC has proposed certifying a fishery that is currently lacking the information necessary to determine if fishing will impact a vital component of the Antarctic ecosystem. There are numerous uncertainties

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<sup>26</sup> For example, the need for a comprehensive research plan was the focus of the paper by the delegation of the Ukraine CCAMLR-XXVII/43, “Current uncertainties in scientific data for risk assessments in the allocation of krill catch limits among SSMUs in Area 48”.

concerning the stock's current status, the impacts of fishing on the stock and bycatch, and the impacts of fishing on predators.

In addition to many procedural problems, Moody Marine does not have evidence to support passing scores for numerous performance indicators.

The Independent Adjudicator should remand this proposed certification, and require the Certification Body to fully consider the information presented here in order to correct its procedural and scoring errors.

## VI. Table of Attachments

Attachment	Title
1	SC-CAMLR. 2009. <i>SC-CAMLR XXVIII Report</i> .
2	CCAMLR. 2009. <i>CCAMLR XXVIII Report</i> .
3	CCAMLR Conservation Measure 51-07, 2009.
4	George M. Watters et al. 2009. Working Group on Ecosystem Monitoring and Management, <i>The Risks of Not Deciding to Allocate the Precautionary Krill Catch Limit among SSMUs and Allowing Uncontrolled Expansion of the Krill Fishery up to the Trigger Level</i> , WG-EMM 09/12.
5	CCAMLR Conservation Measure 51-06, 2009
6	Atkinson, A., Siegel, V., Pakhomov, E. & Rothery, P. 2004. Long-term decline in krill stock and increase in salps within the Southern Ocean. <i>Nature</i> 432: 100-103.
7	Nicol, Steve. 2001 CCAMLR: the first 20 years. <i>Australian Antarctic Magazine</i> . Issue 1. Australian Antarctic Division. <a href="http://www.aad.gov.au/default.asp?casid=2052">http://www.aad.gov.au/default.asp?casid=2052</a>
8	Reid, K. & Croxall, J.P. 2001. Environmental response of upper trophic-level predators reveals a system change in an Antarctic marine ecosystem. <i>Proceedings of the Royal Society B</i> 268: 377-384.
9	Fraser, W.R. & Hofmann, E.E. 2003. A predator's perspective on causal links between climate change, physical forcing and ecosystem response. <i>Marine Ecology Progress Series</i> 265: 1-15.
10	Häder D.-P., Worrest, R.C. & H.D. Kumar H.D. 1991. Aquatic Ecosystems. Chapter 4 In: <i>Environmental Effects Of Ozone Depletion: 1991 Panel Report Pursuant to Article 6 of the Montreal Protocol on Substances that Deplete the Ozone Layer Under the Auspices of the United Nations Environment Programme (UNEP)</i> ,
11	Gerald Leape et al. 2009. Comments of the Pew Environment Group's Antarctic Krill Conservation Project on Public Comment Draft Report for Antarctic Krill Pelagic Trawl Fishery.
12	K.H. Kock, <i>A Brief Description of the Main Species Exploited in the Southern Ocean</i> , <a href="http://www.ccamlr.org/pu/E/e_pubs/am/p7.htm">http://www.ccamlr.org/pu/E/e_pubs/am/p7.htm</a> .
13	SC-CAMLR. 2008. Report of the XXVII Meeting. Item 4, Harvested species, paragraphs 4.19 and 4.20.
14	CCAMLR Performance Review Panel. 2008. <i>Report of the CCAMLR Performance Review Panel</i> .