CCAMLR

Commission for the Conservation of Antarctic Marine Living Resources
Commission pour la conservation de la faune et la flore marines de l'Antarctique
Комиссия по сохранению морских живых ресурсов Антарктики
Comisión para la Conservación de los Recursos Vivos Marinos Antárticos

CCAMLR-XXXIV/BG/26

19 September 2015

Original: English

COMMISSION

Revisiting CCAMLR's Approach to Management – A compendium of papers that explores the implementation of the CAMLR Convention

Submitted by ASOC

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Executive Summary

The adoption of the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and the establishment and workings of its Commission and supporting bodies represents best practice amongst efforts to manage human activities in international spaces. CCAMLR is a key component of the body of instruments developed from the 1959 Antarctic Treaty known as the Antarctic Treaty System.

Since the CAMLR Convention's entry into force in 1982, several papers have reviewed the application and implementation of the Commission's pioneering approach to management. The enclosed compendium contains the full version of a selection of these papers as published in the English language scholarly and scientific literature. The following introductory section includes a summary of what, in ASOC's view, are the key points of each of the papers.

Throughout these papers a number of recurring topics and themes are covered. The purpose of this compendium is to remind CCAMLR Members of the core concepts and practices at the heart of the implementation of the CAMLR Convention as clearly discussed and applied over the past three plus decades.

CCAMLR's primary focus is the conservation of Antarctic marine living resources. Rational use, often interpreted as fishing, is subsequently but explicitly included as part of CCAMLR's conservation mandate. Any harvesting and associated activities in the Convention area must be conducted in accordance with the three principles of conservation included in the Convention's core objective that give rise to CCAMLR's application of ecosystem and precautionary approaches. This structure of the core objective of the Convention makes it clear that conservation is the focus of CCAMLR with fishing accommodated as a secondary activity where consistent with the Convention.

CCAMLR's ecosystem approach endeavours to ensure fishing activity does not negatively impact the wider ecosystem including species and habitats that are related to, or dependent on, the target species, or significant adverse effects on the ecosystems of which they are part, that are not reversible in 20–30 years. Through its application CCAMLR seeks to account for and maintain the delicate and complex relationships between the organisms and physical processes that constitute Antarctic marine ecosystems.

To support an ecosystem approach, CCAMLR has applied the precautionary approach to progress proactive management decisions that aim to minimize the risk of long-term adverse effects based on the best available science whilst accounting for uncertainty. This means that CCAMLR does not wait until it has all the information possible before taking a decision, but acts using the information that is available in a precautionary manner to prevent or minimise negative impacts.

Application of ecosystem and precautionary approaches has included:

- The development and use of modeling supported by decision rules and trigger levels;
- Data collection through a range of sources including fishing activities, scientific observers on fishing vessels and research carried out by CCAMLR Member research and fishing vessels;
- The implementation of the CCAMLR Ecosystem Monitoring Program (CEMP) designed to detect and record significant changes to selected indicator species and distinguish between changes arising directly from fishing from those which occur from broader environmental variability;

- Adoption of measures to nearly eliminate seabird bycatch during fishing operations; and
- Developing mechanisms to identify and protect vulnerable marine ecosystems.

Despite these successes CCAMLR still has significant work to do to achieve full application of the ecosystem approach. Future challenges include:

- Sustainable practices to guide an orderly expansion of the krill fishery;
- Application of measures to adapt to the impacts of human-induced ocean acidification and climate change (including sea-ice changes);
- Implementing a representative system of marine protected areas; and
- Ensuring effective implementation and compliance of conservation measures.

This will require CCAMLR Members to regularly apply the precautionary and ecosystem approaches as embodied in their obligations under the Convention. Further, CCAMLR Members will need to cooperate and collaborate with external bodies due to the global nature of many current and future challenges, particularly climate change.

Additionally, consensus decision- making is both a strength and weakness within CCAMLR with measures aimed to advance fuller implementation of the precautionary and ecosystem approaches often taking a long time to achieve adoption. Success in meeting future challenges will require the continued commitment of CCAMLR Members to cooperate consistent with the principles embedded in the Convention, the Antarctic Treaty, and other Antarctic Treaty System instruments.

ASOC originally compiled this compendium to assist discussions at the recent 2nd CCAMLR Symposium. We note that at last year's meeting CCAMLR agreed to maintain MPA papers in one place on the web site for ongoing reference. ASOC recommends that CCAMLR also place key reference documents and papers on topics of importance relevant to CCAMLR's broader work such as those included in this compendium in one place on the CCAMLR website for ongoing use and easy reference. This will assist in the maintenance of a readily accessible record of CCAMLR's history, progress and discussions across the fuller range of its work and ensure that earlier discussions are always available.

ASOC hopes that this compendium may be a useful contribution to such a compilation and a useful resource for CCAMLR delegates at the current and future CCAMLR meetings, supporting valuable discussions to help CCAMLR meet its objectives and continue its leading role in the conservation of marine living resources through the application of the precautionary and ecosystem approaches.

Compendium Papers

1. DJ Agnew, *Review —The CCAMLR Ecosystem Monitoring Programme.* Antarctic Science. 9 (3), 235-242 (1997)
2. *Understanding CCAMLR's Approach to Management.* edited by Karl-Hermann Kock. Published by the CCAMLR Secretariat (2000)
3. AJ Constable, WK de la Mare, DJ Agnew, I Everson & DGM Miller, *Managing fisheries to conserve the Antarctic marine ecosystem: practical implementation of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).* ICES Journal of Marine Science. 57, 778–791 (2000) doi:10.1006/jmsc.2000.0725
4. CCAMLR's Management of the Antarctic, CCAMLR 2001 ISBN 0-947300-06-6
5. JP Croxall & S Nicol, *Management of Southern Ocean fisheries: global forces and future sustainability*. Antarctic Science. 16 (04), 569 – 584 (2004)
6. KH Kock, K Reid, JP Croxall & S Nicol, *Fisheries in the Southern Ocean: An ecosystem approach*. Philosophical Transaction of the Royal Society. 362, 2333-2349 (2007)
7. K Reid, *Monitoring and management in the Antarctic - making the link between science and policy.* Antarctic Science. 19 (2), 267–270 (2007)

8. PN Trathan & D Agnew, *Climate change and the Antarctic marine ecosystem: an essay on management implications*. Antarctic Science. 22 (04), 387 – 398 (2010)
9. A Constable, *Lessons from CCAMLR on the implementation of the ecosystem approach to managing fisheries.* Fish and Fisheries. 12, 138–151 (2011) DOI: 10.1111/j.1467-2979.2011.00410.x
10. DGM Miller & NM Slicer, *CCAMLR and Antarctic Conservation: The Leader to Follow*. In: *Governance for Fisheries and Marine Conservation*, SM Garcia, J Rice & AT Charles (eds). New York: Wiley. 253-270 (2014)
11. S Hanchet, K Sainsbury, D Butterworth, C Darby, V Bizikov, O Rune Godø, T Ichii, KH Kock, L López Abellán & M Vacchi, *CCAMLR's precautionary approach to management focusing on Ross Sea toothfish fishery*. Antarctic Science. FirstView, 1-8 (2015)

1. **DJ Agnew, *Review —The CCAMLR Ecosystem Monitoring Programme.* Antarctic Science. 9 (3), 235-242 (1997)**

Key points:

- In order to meet its objectives, in particular the application of the ecosystem approach, CCAMLR established the CCAMLR Ecosystem Monitoring Programme (CEMP)
- The central aim of CEMP is the detection of changes in environmental indicators of ecosystem performance and the interpretation as to whether these changes are due to natural events or the harvesting of marine living resources
- The core of CEMP is the acquisition, centralised storage and analysis of standardised monitoring data combined with a strong emphasis on empirical and modelling based research to provide a sound scientific background against which to test the effects of management options on components of the Antarctic ecosystem
- The development of procedures for translating monitoring results into management advice is a critical part of the programme
- CCAMLR applies the ecosystem approach through a range of conservation measures such as catch limits calculated for krill incorporating allowances for predator demands however direct operational application of CEMP monitoring to fisheries management has yet to be achieved

2. ***Understanding CCAMLR's Approach to Management.* edited by Karl-Hermann Kock. Published by the CCAMLR Secretariat (2000)**

Key points:

- Recognising the complexity of marine ecosystems and uncertainty associated with managing activities in the region, CCAMLR's approach to management sought to ensure past human impacts on Antarctic ecosystem did not occur again
- CCAMLR's objective as stated in Article II of the CAMLR Convention embodies the precautionary approach that accounts for uncertainty when making management decisions to ensure there is a low risk of long term negative impacts. Article II also embodies the ecosystem approach that seeks to avoid impacts to dependent and related species
- The precautionary and ecosystem approaches are applied through:
  - Data collection, monitoring and scientific research efforts
  - Scientific modeling complemented by decision rules and target reference points Protective measures for non-target species and habitats
  - A rigorous approach to managing new and exploratory fisheries including precautionary catch limits that aim to ensure that the effect of fishing on prey abundance is limited to a level that is unlikely to have an impact on predators
- At the time of writing the authors acknowledged that CCAMLR's leading work on the implementation of precautionary and ecosystem approaches to management was at an early stage in its development

3. **AJ Constable, WK de la Mare, DJ Agnew, I Everson & DGM Miller, *Managing fisheries to conserve the Antarctic marine ecosystem: practical implementation of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).* ICES Journal of Marine Science. 57, 778–791 (2000) doi:10.1006/jmsc.2000.0725**

Key points:

- Human activity in the Southern Ocean related to the exploitation of marine living resources has historically followed a pattern of over-harvesting followed by collapse
- To address past over-harvesting the CCAMLR experience provides two important lessons:
  1) Conservation objectives can only be achieved by implementing management

measures, even when very little is known;
2) Methods were found for achieving scientific consensus despite the uncertainties surrounding estimates of parameters and the behaviour of the system.

- Implementation of important conservation measures to progress ecosystem and precautionary management approaches has often met resistance within the CCAMLR Commission from its earliest days. Progress on measures have often lagged behind the advice of the CCAMLR Scientific Committee by one to two years
- The Commission has agreed that reactive management – the practice of taking management action when the need for it has become apparent – is not a viable long-term strategy for the krill fishery, thus favouring a precautionary approach to management
- The precautionary and ecosystem approaches were furthered by the adoption of decision rules that specified the objectives of CCAMLR in scientifically interpretable and measurable terms
- The development of any fishery should not occur at a rate faster than the Commission is able to evaluate its potential consequences and whether the objectives in Article II would be met
- Monitoring independent of, and as part of, fishing operations as well as of environmental parameters is crucial to the proper application of ecosystem and precautionary approaches
- Effective monitoring must:
  - identify any effects from fishing in sufficient time for management decisions to be made before impacts are irreversible;
  - identify environmental changes that may require changes to management; and
  - be able to differentiate between fishery impacts, environmental impacts or other types of human impacts.
- While the precautionary approach is now entrenched within CCAMLR, essential work is still required to develop management procedures, inclusive of monitoring, that avoid localized effects on the ecosystem, provide effective feedbacks on the effects of fishing and are robust in the face of unknown and uncertain changes to Antarctic ecosystems

4. CCAMLR's Management of the Antarctic, CCAMLR 2001 ISBN 0-947300-06-6

Key points:

- CCAMLR has been recognised as a pioneer in the development of the 'ecosystem approach' to the management of marine living resources
- CCAMLR strives to follow a 'precautionary' approach', collecting the data it can, then weighing up the extent and effect of uncertainties and gaps in such data before making a management decision
- This approach attempts to balance not having all the information desired to develop a sustainable and scientifically defensible management regime prior to the commencement of a fishery. It takes a conservative approach to setting limits, requiring data collection on target and dependent species and clearly defined experimental fishing plans
- CCAMLR also follows an 'ecosystem approach' that strives to take into account all the delicate and complex relationships between the organisms and physical processes that constitute Antarctic marine ecosystems, aiming to ensure that fishing does not adversely impact other species that are related to, or dependent on, the target species
- With science underpinning the application of precautionary and ecosystem approaches, the CCAMLR Scientific Committee and its working groups use data collected by:
  - Members fishing activity including catch and effort data and biological information;
  - Scientific observers on Members' vessels (who collect data on the fishing operations, the catch and biological information, report on compliance and advise operators and owners);
  - Scientific surveys carried out by Members' research and fishing vessels
  - Monitoring selected species that depend on, or are related to, commercial target species and fisheries through the CCAMLR Ecosystem Monitoring Program (CEMP)
- CCAMLR uses data collected to develop management advice through analysis and models
- CCAMLR scientists have taken a global lead developing models that incorporate some of the key effects of uncertainty into their analyses and into the subsequent management advice
- CCAMLR uses decision rules associated with models and analyses to facilitate decision making

5. **JP Croxall & S Nicol, *Management of Southern Ocean fisheries: global forces and future sustainability*. Antarctic Science. 16 (04), 569 – 584 (2004)**

Key points:

- The CAMLR Convention was visionary, foreshadowing by at least a decade the wider adoption of the precautionary and ecosystem-based approaches to management of marine systems
- Nevertheless, initially CCAMLR's management was reactive. The application of these principles began slowly with the institution of ecosystem monitoring and groundwork to develop precautionary models to support management
- Precaution is incorporated into management through models with decision rules and accounting for information such as natural mortality of target species including as food for predators, the requirements of predators of target species, biology of species, estimations of inter-annual variability in recruitment, updating of models as new information becomes available and accounting for uncertainty from several sources
- Efforts to apply precautionary and ecosystem approaches were also supported by extensive monitoring through the CCAMLR Ecosystem Monitoring Programme (CEMP) aimed at detecting and recording changes in the ecosystem and distinguishing between changes due to fisheries and those resulting from physical and biological environmental variability
- CCAMLR has had success applying conservative yield models for toothfish and krill stocks and in establishing strict rules for undertaking new and exploratory fisheries
- Despite these efforts CCAMLR still has significant progress to make to implement a full ecosystem approach
- To further progress the precautionary and ecosystem approaches CCAMLR will need to account for:
    - Technological and scientific changes that can result in changes to demand for Antarctic marine living resources;
    - Industry, economic and market forces;
    - Inadequate management in areas adjacent to the CCAMLR area;
    - Political decisions; and
    - Most importantly for global and regional environmental changes

6. **KH Kock, K Reid, JP Croxall & S Nicol, *Fisheries in the Southern Ocean: An ecosystem approach*. Philosophical Transactions of the Royal Society. 362, 2333-2349 (2007)**

Key points:

- The objective of the CAMLR Convention requires the application of an ecosystem approach to the management of Antarctic marine living resources (Article II, 3)
- CCAMLR's efforts to apply an ecosystem approach have extended to the application of a precautionary approach to management
- To assist the Commission in meeting its objectives, as set out in Article II, 3, the Scientific Committee established the CCAMLR Ecosystem Monitoring Programme to detect possible effects of krill fishing on the performance of top-level predators, such as albatrosses, penguins, petrels and fur seals
- While CCAMLR has demonstrated clear leadership in the application of ecosystem and precautionary approaches amongst international organisations, there is still significant progress that could be made
- The adoption of marine protected areas and the ability to assess ecosystem dynamics across large scales in the absence and presence of fishing offer opportunities to better understand the impacts of fishing and natural variability

7. **K Reid, *Monitoring and management in the Antarctic - making the link between science and policy.* Antarctic Science. 19 (2), 267–270 (2007)**

Key points:

- Managing human impacts in the Antarctic requires an effective monitoring system to provide information about the process being managed and effectiveness of management actions.
- A number of monitoring programmes have been established in both terrestrial and marine systems to measure impacts that arise as a result of fishing, tourism and research. However, most of this monitoring is surveillance monitoring, which is not linked to a specific management objective, and does not produce quantitative metrics that can be assessed and compared to agreed targets.
- Defining quantitative measures, with agreed trigger levels for the Antarctic, where the aim is to minimise human impacts, is a complex process.
- Although potential analogues for target setting exist in other parts of the world these are generally insufficiently precautionary to be applied in the Antarctic.
- Measures and agreed trigger levels based on quantifiable management objectives need to be appropriately precautionary to ensure application of an ecosystem approach (as embodied in Article II, 3 of the CCAMLR Convention)

8. **PN Trathan & D Agnew, *Climate change and the Antarctic marine ecosystem: an essay on management implications.* Antarctic Science. 22 (04), 387 – 398 (2010)**

Key points:

- Climate change is one of the most important threats to Antarctic marine ecosystems
- CCAMLR's responsibilities extend beyond the management of harvesting, encompassing ecosystem and species conservation and related issues
- Application of CCAMLR's conservative and precautionary ecological management framework can and should prevent the exacerbation of climate change impacts from harvesting
- Ecosystem and fisheries management in the Antarctic must be fully integrated with an understanding of the ecological consequences of climate change
- CCAMLR also applies a precautionary approach that takes into account the state of currently available knowledge, yet accounts for uncertainty in facilitating management decisions that aim to prevent changes or minimize the risk of changes to the marine ecosystem
- CCAMLR will need to re-examine its approach to precaution to account for the potential of major ''natural'' climate induced changes combining with the effects of harvesting that would prevent CCAMLR from achieving its objectives
- To progress precautionary and ecosystem approaches in the context of climate change CCAMLR will need to consider use of Marine Protected Area (MPA) networks, additional climate focused monitoring, data collection and research including changes to the CCAMLR Ecosystem Monitoring Program (CEMP), changes to stock assessment processes, additional restrictions on fishery development and activities (e.g. transhipment), and increased action against IUU vessels
- Risk assessments using current knowledge are now feasible and should be pursued to determine relative risks (uncertainties), impacts and timescales, of various processes consequent on climate change

9. **A Constable, *Lessons from CCAMLR on the implementation of the ecosystem approach to managing fisheries.* Fish and Fisheries. 12, 138–151 (2011) DOI: 10.1111/j.1467-2979.2011.00410.x**

Key points:

- CCAMLR is widely recognized as a leading international organization in developing best practice in the ecosystem approach to managing fisheries

- CCAMLR is demonstrating that
    i. Ecosystem-based fisheries management does not need to be complex; and
    ii. Methods can be developed to decide on spatial management strategies for fisheries so that predators of target species are not disproportionately affected.
- CCAMLR has instituted management for target species, but not yet fully operationalized effective management for species dependent on target species or the wider ecosystem
- The application of the precautionary approach to account for uncertainty is now well established in CCAMLR with lower catches allowed when there is less certainty about population and food web dynamics and catches only increasing with improved information
- Efforts to reduce uncertainty through greater investments in monitoring may or may not be cost effective in terms of opportunities for higher catches. More precautionary catch limits with lower monitoring investment may be more desirable than the requirement to invest more in monitoring to obtain higher catch limits
- The costs of reducing uncertainty should be shared not only amongst CCAMLR Members but also with fishers
- CCAMLR must continue to make decisions based on the best available science, and not waiting for the best scientific (irrefutable) evidence possible before taking action, but seeking and applying new information as it becomes available

10. DGM Miller & NM Slicer, *CCAMLR and Antarctic Conservation: The Leader to Follow*. In: *Governance for Fisheries and Marine Conservation*, SM Garcia, J Rice & AT Charles (eds). New York: Wiley. 253-270 (2014)

Key points:

- CCAMLR was the first international agreement to explicitly and distinctly account for specific 'principles of conservation' whilst managing marine living resources
- CCAMLR is seen as delivering ecosystem and precautionary approaches essential for strong fisheries and ecosystems outcomes.
- CCAMLR aims to ensure that fishing for a specific target species does not compromise other species or harm the environment. This is distinguished from more traditional fisheries management practices based on maximum sustainable yield principles and single stock management
- Due to the explicit links and relationship between the CAMLR Convention and the Antarctic Treaty all Convention Contracting Parties are bound to further the Treaty's objectives regarding 'preservation and conservation of living resources' in the Treaty Area.
- CCAMLR pursues four key actions to address Article II conservation principles:
    (1) Determining the management status for relevant species and/or ecosystem qualities;
    (2) Assessing ecosystem status in terms of perceived 'health';
    (3) Implementing harvest controls to address differences between the assessed status of exploited stocks and agreed conservation objectives; and
    (4) Striving to reach scientific consensus on advice to the Commission
- CCAMLR further addresses conservation principles through 'operationalized' essential management requirements including:
    (1) Minimizing the risk(s) of irreversible ecosystem change(s);
    (2) Monitoring harvest controls to ensure sustainable exploitation;
    (3) Minimizing potential direct or indirect fishing impacts on dependent and related species;

and
(4) Refining assessments to account for uncertainties in available information and/or concerning stock status including potential responses of non-harvested species and ecosystem function(s).

- CCAMLR's management approach seeks to directly integrate science into management decisions in order to:
  (1) apply correct/timely decisions consistent with Article II conservation principles;
  (2) carry out sufficient monitoring to ensure that dependent predators are not affected by fishing;
  (3) allow sufficient time to detect/rectify ecosystem changes from fishing within two to three decades; and
  (4) refine precautionary assessment of harvested stock yield to revise key demographic parameter estimates

11. S Hanchet, K Sainsbury, D Butterworth, C Darby, V Bizikov, O Rune Godø, T Ichii, KH Kock, L López Abellán & M Vacchi, *CCAMLR's precautionary approach to management focusing on Ross Sea toothfish fishery*. Antarctic Science. FirstView, 1-8 (2015) DOI: http://dx.doi.org/10.1017/S095410201400087X

Key points:

- The application of the precautionary and ecosystem approaches in the context of the Ross Sea toothfish fishery includes:
  - Use of decision rules and limit reference points in assessment and setting catch limits, accounting for ecosystem impacts - in particular the needs of predators, uncertainty, biology and ecosystem status of target species;
  - Various "move on" rules with respect to seabird and fish bycatch as well as vulnerable marine ecosystems;
  - Technical innovations to reduce or eliminate ecosystem impacts;
  - Ongoing monitoring and data collection on target species and the broader ecosystem;
  - Spatial and temporal closures
- Recognising that scientists and managers can never have complete scientific knowledge or certainty CCAMLR accounts for uncertainty through a precautionary decision rule framework which is updated and modified as new information becomes available allowing the fishery to further develop
- CCAMLR's management also allows for adaptive feedback to account for new information and adjust management to ensure the objectives of the Convention are achieved
- Further work is required to more fully implement the ecosystem approach