Advisory Committee on the Marine Environment **ICES CM 2001/ACME:01**
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REPORT OF THE

PLANNING GROUP FOR THE ECOLOGICAL QUALITY OBJECTIVE REQUESTS

ICES Headquarters

23 October 2000

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK–1261 Copenhagen K Denmark

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1 OPENING OF MEETING

The Chair, Prof. H.R. Skjoldal, opened the meeting of the Planning Group for the Ecological Quality Objective Requests (PGEQO) and welcomed the participants. He noted that Ecological Quality Objectives (EcoQOs are an important part of an ecosystem approach to management. This is scientifically challenging, and has political implications. In this work, he felt that ICES should focus on what is possible and what is achievable.

2 ADOPTION OF THE AGENDA

The agenda was adopted as proposed. The agenda is attached as Annex 1 and the list of participants as Annex 2. It was noted that the issue of the Precautionary Approach would be implicitly covered in the work of PGEQO.

The terms of reference for PGEQO are as follows (C.Res. 2000/2ACME01):

A **Planning Group for the Ecological Quality Objective Requests** [PGEQO] (Prof. H.R. Skjoldal (Norway)) will be established and will meet at ICES Headquarters on 23 October 2000 to:

a) develop a framework which would specify the types of information that WGMMPH and WGSE should compile and document as fully as possible to respond to the OSPAR EcoQO requests [OSPAR 2001/2.2. and OSPAR 2001/2.3].

PGEQO will report by 30 November 2000 for the attention of ACME, ACE, and the Marine Habitat and Resource Management Committees.

3 CONSIDERATION OF THE OSPAR REQUESTS FOR EcoQOs FOR MARINE MAMMALS AND SEABIRDS IN THE NORTH SEA

The Chair pointed out that ICES has been requested by OSPAR to prepare Ecological Quality Objectives (EcoQOs) for marine mammals and seabirds in the North Sea. These requests are detailed below:

2.2 Further development of EcoQOs for sea mammals

2.2.1 Provide a synthesis of the status of North Sea populations of sea mammals, including consideration of species that have declined or are threatened from human activities;

2.2.2 Provide a synthesis of the health status of sea mammals in the North Sea in relation to the quality of their habitat;

2.2.3 Taking into account the outcome of the Oslo workshop on Ecosystem approach including the background document prepared for the workshop and the outcome of the Scheveningen workshop on EcoQOs, provide recommendations for appropriate EcoQO indices for sea mammals based on a. and b. and suggestions for appropriate EcoQOs for North Sea mammal populations.

2.2.4 Prepare provisional estimates for the current levels, reference levels and target levels for the EcoQO indices identified.

2.3 Further development of EcoQOs for seabirds

2.3.1 Provide a synthesis of the status of North Sea populations of seabirds, including consideration of species that have declined or are threatened by human activities;

2.3.2 Consider the use of seabirds as indicators for environmental quality and short-term and long-term ecosystem effects;

2.3.3 Taking into account the outcome of the Oslo workshop on ecosystem approach including the background document prepared for the workshop and the outcome of the Scheveningen workshop on EcoQOs, provide recommendations for appropriate EcoQO indices for seabirds based on a. and b. and suggestions for appropriate EcoQOs for North Sea seabird populations;

2.3.4 Prepare provisional estimates for the current levels, reference levels and target levels for the EcoQO indices identified.

The Chair noted that, out of the ten areas for which EcoQOs are intended to be prepared, ICES was requested to carry out the work for marine mammals and seabirds, based on considerations of data availability and the cost estimates associated with the work. EcoQOs will also be developed for benthic communities and fish communities and he felt that WGECO should continue to work on metrics in relation to these communities.

It was questioned whether the term "reference level" is the same as a limit reference value in fisheries. The Chair stated that, for OSPAR, reference levels are the "pristine" condition and "target levels" are the level that society chooses based on available scientific information. This is a departure from the way that such values have been proposed on the fisheries side.

It was pointed out that if "reference levels" are intended to represent "pristine conditions", it is impossible to provide a scientifically defensible response in this regard. There are no meaningful ways to estimate such pristine conditions. For example, the trophic dynamics were completely different when there were still large whales in the North Sea.

It was agreed that there needs to be further dialogue between OSPAR and ICES and a representative segment of the scientific community. The issue of definitions of these terms and the basic view of OSPAR should be discussed with the OSPAR Biodiversity Committee at its meeting in the third week of November 2000.

It was noted that there are several types of reference levels. Reference levels based on population values may not be particularly meaningful. But breeding success for seabird species could translate quite well into a type of reference level. However, to try to link any of these values to pristine levels would be impossible.

In terms of the marine mammal request, it will be possible to provide estimates of the current status of the populations and generally an estimate of the health status of marine mammals, but not necessarily in relation to the quality of their habitat. Levels could probably be set for reproductive success, but it would not be wise to set levels for population size, as certain seal populations have been increasing in recent years and it would be politically difficult to set reference levels lower than current levels. However, for certain species it might be necessary to indicate minimum population size. This could also be relevant for some species of seabirds.

It was noted that mortality rate could be a useful criterion, as this can provide good advice to managers.

PGEQO agreed to take note of the terminology and definitions of values used in fisheries management. However, it was pointed out that there is a significant difference between the reproductive processes in fish, with millions of eggs produced but nearly all not surviving, and marine mammals and seabirds with only a few young and a much larger proportion surviving. However, it was noted that chick production tends to be bimodal, with colonies either producing very few chicks or producing many. There can be very large fluctuations in seabird populations.

It was agreed that some definitions need to be made for the terms mentioned in the OSPAR requests. The difficulty of setting reference levels for pristine conditions was noted, but there are a number of other types of reference levels that can be defined, including mortality rates, and breeding success. These definitions need to be prepared before the Biodiversity Committee (BDC) meeting.

It was further pointed out that the precise definition of the boundaries of the North Sea needs to be determined, particularly with regard to the northern areas near Shetland, as they are significantly different from the remainder of the North Sea. The Chair stated that the focus should be on the main part of the North Sea, using the 200 m contour as the limit. It was agreed that the northern boundary should be 62 ˚N, and not include the area west of the Shetlands, as this ecologically has much different conditions.

The request for sea mammals is different from that for seabirds in the second paragraph of these requests, with the sea mammal request covering the health status of the mammals while the seabird request is to consider the use of seabirds as indicators for environmental quality and ecosystem effects. It was questioned whether this indicator issue relates only to the North Sea or is more general in terms of area. This question will be forwarded to the BDC for clarification.

4 PRESENTATION AND REVIEW OF RELEVANT BACKGROUND DOCUMENTS

The Chair briefly summarized a paper he had prepared on the history of the work on ecological quality and ecological quality objectives; this work has been conducted through a series of workshops beginning in 1992. The first workshop was devoted to the development of definitions for relevant terms. In the second workshop, in 1993, consideration was given to the basic ecosystem properties that need to be covered. At the third workshop, in 1995, procedures and models for the derivation of EcoQOs were discussed. Subsequent workshops were held in Oslo in 1998 and Scheveningen in

1999. At this last workshop, ten categories of EcoQOs were identified and the goal was set to develop these EcoQOs for the North Sea.

Noting that the category of "threatened and declining species" can also include some seabird species, it was proposed that all seabird species be covered by ICES when handling the request for seabirds.

A document developed by several Dutch scientists providing a draft work plan for the elaboration of EcoQOs was reviewed. It was pointed out that Appendix 2 of that document showed the scheme and timetable for this work plan. In addition, there was another Dutch paper on the development of indicators for the Dutch North Sea that had originally been provided for the ACME Consultations Meeting in September.

The Chair suggested that these documents be reviewed to provide a background to be taken into consideration in the further development of EcoQOs.

5 PREPARATION OF A FRAMEWORK TO SPECIFY THE TYPES OF INFORMATION THAT WGMMPH AND WGSE SHOULD COMPILE AND DOCUMENT IN ORDER TO RESPOND TO THE ECOQO REQUESTS

The Chair proposed that the possibilities of setting objectives be explored from the standpoint of what is practicable and possible. The Esbjerg Declaration (from the Fourth North Sea Conference) contains a statement of the overall goal of maintaining a healthy, sustainable ecosystem and this would provide the underlying basis for this work.

M. Tasker stated that EcoQOs should be meaningful for the ecosystem, and they should be measurable, quantifiable, and preferably part of existing measurement systems. They should be capable of regulation. They should also be practicable and possible within the context of financial considerations. He felt that these are important elements in the development of a framework for EcoQOs.

With regard to marine mammals, A. Bjørge pointed out that there will be very different levels of availability of data for the different species in the North Sea. For the two seal species, there will be good data on populations and their trends. For harbour porpoises, there will be one estimate available, and for bottlenose dolphins there is some information available. However, for other cetacean species, very little reliable information is available. He stated that he would like to have information on the trends in these populations using models similar to those used in the Baltic Sea. Information on reproduction will be available for pinnipeds, but not for cetaceans. For the objectives, target levels of populations should not be considered. Instead, indicators of physiological health, reproductive rates, and removals (hunting and by-catch) should be provided.

J. Rice questioned whether the models to be used for retrospective marine mammal estimates will be adequately tested by experts before advice is made on the basis of these models. He proposed that ACFM and ACME locate some experts to test out these models intersessionally so that a review can be conducted before the results of model application are finally reviewed by WGMMPH.

A. Bjørge stated that there are two main types of models that could be used and the models would probably not cause problems, but rather the assumptions used in the model application and the data included would have a greater potential to cause controversy.

In terms of marine mammals, it was noted that the following indices are relevant: population size, reproductive rate, mortality rate, individual health, and geographical distribution of a species or population. In terms of populations, it was agreed that limit levels should not be stated, but that minimum population sizes could be established. However, the basis for setting this minimum level needs to be reviewed by other experts, as there are many factors that could potentially be included in determining the minimum population size that could be sustained over long periods. It is an important question to determine how many of these factors need to be considered to be confident that the population will be viable in the long term. Relevant factors include the effects of pathogens (that also depends on the health status of the population), by-catch and other human-induced sources of mortality, etc.

The species to be covered include two species of seals and three species of cetaceans; there are also a range of other species of cetaceans that can be considered peripherally. The issue of contaminants can be very important in this work owing to the immunosuppressive properties of many organic contaminants and the probable parallels in effects between pinnipeds and cetaceans, given the similar prey of these species. In this context, it was proposed that objectives be set directly for body burdens of certain contaminants, without needing to relate them to mortality rates. A. Bjørge stated

that it is not always possible to measure contaminant levels in marine mammals, but that relevant biomarkers can be identified that can be measured in more easily obtained samples, e.g., blood.

The situation with regard to seabirds was noted and it was pointed out that it is generally much easier to determine the various parameters in seabirds, such as population sizes, breeding success, and contaminant levels, than in marine mammals. In terms of the types of seabirds to include in this work, M. Tasker stated that he would try to include shore birds, but that for them in particular there can be a question of where they are obtaining their contaminant levels, which may have nothing to do with the North Sea. He felt that it will be possible to prepare EcoQOs for seabirds, but that they will open up for discussion from a number of sides. WGSE has not normally considered shore birds, but he will attempt to obtain experts on these types of birds.

Dr Bjørge queried how he should handle the development of new ideas within his group and still retain comparability with the work on seabirds. It was proposed that the Working Groups follow the work plan prepared by PGEQO. This plan should serve as guidance for the groups, but should not inhibit the development of new ideas.

Common aspects for seabirds and marine mammals are population size, mortality rates, reproductive success, geographical distribution, and individual health status.

PGEQO agreed on the following list of topics on which information and data should be collected for the development of EcoQOs:

1) Abundance/distribution/trends/viability/risk assessment;
2) Mortality/anthropogenic removals (hunting and by-catches);
3) Reproduction/reproduction rates/pup:adult ratio;
4) Individual health/pollutant concentrations in tissue/immunosuppression/biomarkers/gross pathology;
5) Trophic interactions/diet/consumption rates/prey populations;
6) Monitoring/precision/frequency/coverage/practicality/costs.

It was agreed that information on planning for the meetings of the working groups contributing to this work should be provided by e-mail to the other members of PGEQO.

A. Bjørge pointed out that it will be more difficult to link marine mammals to the ecosystem than seabirds. These links will need to be determined via studies of trophic interactions; this will include links to contaminants and to the fish prey of mammals. The links to prey have not been clearly determined, but after discussion it was agreed that this should be considered to the extent possible, as the prey of seabirds will be an important part of the development work for seabird EcoQOs. Although these issues are not specified in the request for EcoQOs, they are important to the work.

The Chair stated, however, that any relations to human activities should be mentioned wherever possible so that steps can be taken in regard to management actions.

It was noted that the question of relationships between fish stocks and marine mammals will ultimately be raised, although it has not been considered here in the request.

When objectives have been set, then considerations can be given to the management implications.

J. Rice stated that WGECO will look at the EcoQOs from a very different scale than the individual species population levels that WGSE and WGMMPH will cover. WGECO will review community metrices and ecosystem reference points from a broad perspective. These community metrices will, however, need to meet the same standards as for the other EcoQOs.

M. Tasker stated that he would explore with WGSE whether any community metric could be established for seabirds.

It was noted that SGEAM will review the topic of EcoQOs from a more holistic perspective. It was, however, questioned what SGEAM could do in terms of adding to the EcoQOs for marine mammals and seabirds. Concerning the dates of the SGEAM meeting, it was proposed that the SGEAM meeting be held so that it overlaps somewhat with the meeting of WGECO. This would be useful also to determine the differences between the two groups.

It was noted that ACFM will meet this week and can contribute to the definitions of terms to be used in relation to fisheries ecosystem issues.

The attendance of the appropriate experts at the meetings of WGSE and WGMMPH was discussed. It was pointed out that a list of required participants had been prepared by the Chair of WGSE. This list had originally been included in the justifications for the WGSE meeting resolution, but the names had been deleted by the Consultative Committee.

6 INTERSESSIONAL WORK REQUIRED TO FINALIZE THE FRAMEWORK

J. Rice offered to develop a list of definitions of terms with regard to fisheries terminology. This list will be reviewed by ACFM. This list will need to be expanded to include other terms used in broader contexts at a later stage. The list is attached as Annex 3.

It was agreed that the PGEQO website should be the medium to provide information to the group as a whole and that, as this work is being done in an advisory context, this site should be password protected, separately from the ACME website.

7 ANY OTHER BUSINESS

There was no other business.

8 CLOSING OF MEETING

The Chair thanked the participants and closed the meeting at 16.30 hours on 23 October.

ANNEX 1: AGENDA

23 October 2000
ICES Headquarters, Hjort Room
09.30 hrs – 16.00 hrs

1) Opening of the meeting.

2) Adoption of the agenda.

3) Consideration of the OSPAR requests for EcoQOs for marine mammals and seabirds in the North Sea.

4) Presentation and review of relevant background documents (by H.R. Skjoldal and other participants, as appropriate).

5) Preparation of a framework to specify the types of information that WGMMPH and WGSE should compile and document in order to respond to the EcoQO requests.

6) Intersessional work required to finalize the framework.

7) Any other business.

8) Closing of the meeting.

ANNEX 2: LIST OF MEMBERS

Name	Address	Telephone no.	Fax no.	E-mail
Arne Bjørge *WGMMHA Chair*	Institute of Marine Research P.O. Box 1870 Nordnes N-5817 Bergen Norway	+ 47 5523 8608	+ 47 5523 8617	arne.bjorge@imr.no
Lars Føyn *SGEAM Chair*	Institute of Marine Research P.O. Box 1870 Nordnes N-5817 Bergen Norway	+47 5523 8500 Direct +47 5523 8501	+47 5523 8584	lars@imr.no
Tore Jakobsen *ACFM Chair*	Institute of Marine Research P.O. Box 1870 Nordnes N-5817 Bergen Norway	+47 552 38636	+47552 38687	torej@imr.no
Astrid Jarre *MHC Chair*	Danish Institute for Fisheries Research North Sea Centre P.O. Box 101 DK-9850 Hirthshals Denmark	+45 3396 3235	+45 3396 3260	torej@imr.no
Hans Lassen *Fisheries Adviser*	ICES Palægade 2–4 DK-1261 Copenhagen K Denmark	+45 3315 4225	+45 3393 4215	hans@ices.dk
Janet Pawlak *Environment Adviser*	ICES Palægade 2–4 DK-1261 Copenhagen K Denmark	+45 3315 4225	+45 3393 4215	janet@ices.dk
Jake Rice *WGECO Chair*	Canadian Stock Assessment Secretariat Department of Fisheries and Oceans 200 Kent Stree, Station 12036 Ottawa, ONT K1A OE6 Canada	+1 613 990 0288	+1 613 954 0807	ricej@dfo-mpo.gc.ca
Hein Rune Skjoldal *Chair* ACME *Chair*	Institute of Marine Research P.O. Box 1870 Nordnes N-5817 Bergen Norway	+47 5523 8500	+47 5523 8584	hein.rune.skjoldal@imr.no
Robert Stephenson *RMC Chair*	DFO Biological Station St. Andrews NB Canada EOG 2XO	+1 506 529 3108	+1 506 529 5862	stephensonr@mar.dfo-mpo.gc.ca
Mark Tasker *WGSE Chair*	Joint Nature Conservation Committee, Dunnet House 7 Thistle Place, Aberdeen AB10 1UZ, Scotland	+44 1224 655701	+44 1224 621488	tasker_m@jncc.gov.uk and mltasker@aol.com

ANNEX 3: PRECAUTIONARY TERMINOLOGY IN ICES

Reference points—specific values of measurable properties of systems (biological, social, or economic) used as benchmarks for management and scientific advice. They function in management systems as guides to decisions or actions that will either maintain the probability of violating a reference point below a pre-identified risk tolerance, or keep the probability of achieving a reference point above a pre-identified risk tolerance.

Limit reference point (biological) **—**The value of a property of a resource that, if violated, is taken as *prima facie* evidence of a conservation concern. By "conservation concern", we mean that there is unacceptable risk of serious or irreversible harm to the resource. Beyond the limit reference point, the stock has entered a state where there is evidence that

- productivity is seriously compromised, or
- exploitation is not sustainable or
- stock dynamics are unknown.

Management should maintain stocks inside limit reference points with high probability.

Limit Reference Points are based on the biology of the stock/species/ecosystem, independent of social and economic considerations. Hence ICES has argued that they should be identified by technical experts, and has selected limit reference points for stocks on which it provides scientific advice.

The limit reference points most commonly used in fisheries advice are in terms of spawning biomass**—B lim**.**—**and exploitation rate (usually fishing mortality**—F lim**.).

- Where SSB and recruitment data are available, and demonstrate some dependency of recruitment on SSB, the **B lim**. should be the greater of the SSB where the probability of strong recruitment begins to decline rapidly or the SSB where the probability of poor recruitment begins to increase rapidly. This is justified because either the loss of ability to produce strong year classes or an increased propensity to recruitment failure constitutes serious harm to the stock.
- Where SSB and recruitment data are not available, or are available but do not demonstrate some dependency of recruitment on SSB over the range of observed SSBs, **B lim**. should be the lowest biomass from which the stock has been observed to increase (usually, but not necessarily, following a planned reduction in exploitation).
- Where a stock or species is known to play an important role as a forage species for other predators, **B lim**. should explicitly include a reasonable allowance for consumption by predators. This is sometimes adequately captured by the value of natural mortality used when estimating SSB, but in some cases it needs to be explicitly presented as a biomass to be accounted for in the assessment. Which approach is best in specific applications will depend on details of the analytical assessment and the dynamics of the feeding relationships.
- **F lim**. is the lowest fishing mortality at which the stock is expected to decline with high probability under "normal" productivity conditions. It has been estimated in many ways, depending on the nature of the data available and productivity dynamics of the stock. All methods have in common that they identify fishing mortalities that, if maintained, would cause the stock to decline in the medium to long term (even when incoming above-average recruitment may allow the stock to remain the same or even increase in the immediate future), although medium- to long-term projections are not a preferred method for estimating **F lim**.

The reasoning applied by ACFM in estimating limit reference points in no way restricts selection to only SSB and fishing mortality. Other biological properties of stocks or ecosystems for which there is evidence that either productivity is diminished with high probability or sustainability is unlikely to be achieved with high probability, could be used as additional limit reference points.

ICES has yet to explore other potential reference points in depth. However, for certain types of stocks and fisheries, such as those in deep-sea regions, data are not available to estimate biomass and fishing mortality with sufficient accuracy and precision to be used as reference points. In such cases, biological properties of survey and commercial catches, such as age or size composition or maximum ages or lengths, are being investigated as sources of potential reference points. In cases of even greater ignorance of the biology of the species and the dynamics of the fishery, it may be necessary to base limit reference points on properties such as CPUE. However, as the biological basis for specific target reference points becomes more tenuous, the confidence that they ensure conservation of the resource is also weakened, and achieving a desired degree of risk aversion will require more restrictive limit reference values. More work is expected on these alternative limit reference points in coming years.

Precautionary reference points—Limit reference points are provided as point estimates to be avoided with high probability. However, there is uncertainty in the data, model formulations, and model parameters used to estimate both current stock status and the limit reference points. The total uncertainty is often large. Hence, each limit reference point has a corresponding precautionary reference point (**B pa, F pa**), which takes account of this uncertainty. Again, the methods for calculating the precautionary reference points vary depending on the type of information available and the known sources of uncertainty. Although the relationships between the quantified uncertainties and the distance between the precautionary and the limit reference points are explicit in all cases, the nature of the uncertainty in estimates of current population parameters and in the limit reference points to which they are contrasted is not always equally explicit. In all cases, however, the intention is that if there is a high probability of complying with the precautionary reference point (SSB being above **B pa**, or fishing mortality being below **F pa**) then we are confident that the limit reference points will not be violated. **ICES advice is framed in terms of complying with precautionary reference points, not avoiding limit reference points.**

The selection of precautionary reference points requires determining the degree of tolerance with regard to placing limit reference points at risk. Although there are scientific aspects of risk management, **society has a role in the selection of risk tolerances, and hence managers have a role in final choices of precautionary reference points**. Where managers have not given explicit direction on their risk tolerances for violation of limit reference points, ACFM has usually used a 5 % tolerance for positioning precautionary reference points relative to limit reference points.

Target Reference Points—properties of stocks / species / ecosystems which are considered to be "desirable" from the combined perspective of biological, social, and economic considerations. Because they do include biological considerations, target reference points must in all cases be at least as "safe" (biomasses at least as high, fishing mortalities at least as low) as precautionary reference points selected on exclusively biological considerations. Technical experts, managers, decision-makers, and stakeholders all have roles in the selection of target reference points.

Where **target reference points** are identified, management should be designed to achieve them, although it is not yet resolved whether they should be achieved with high probability or in a risk-neutral context. Correspondingly, scientific advice should be framed in terms of probability of achieving targets, when they have been identified. Nonetheless, advice should also provide clear warnings when the probability of compliance with **precautionary** (or in the extreme case, limit) **reference points** exceeds the risk tolerance, regardless of the likelihood of achieving targets. This is an important factor, because if **target reference points** are set at or very close to **precautionary reference points** and management is risk neutral with regard to achieving targets, then 50 % of the time the stock will violate the **precautionary reference point**. This provides a clear incentive to either have **target reference points** at much safer values than **precautionary reference points**, or else for management to be highly risk averse with regard to not achieving targets.

Target reference points have been set for only a few stocks for which ICES provides advice, including Baltic cod, sprat, and salmon, Icelandic cod, and Barents Sea cod and capelin. In addition, some management bodies have formal agreements among states, from which functional targets can be extracted. ICES expects more target reference points to be set in coming years.

Management Objectives—Statements of what is intended to be achieved in the management of a stock/species/fishery /ecosystem. Objectives may be biological, social, economic, or combinations of those considerations, and may be **conceptual** or **operational**. Where there are multiple management objectives, processes must be in place to ensure that they are mutually compatible, or they are impossible to use as an effective guide to management. These function as the benchmarks against which successful management is evaluated.

Conceptual objectives are non-technical statements of common goals, for example, "ensure fleet viability" or "conserve the stock". Conceptual objectives are valuable in building consensus among all parties (technical experts, managers, decision-makers, resource users, environmentalists, communities). However, they are not effective guides to management decision-making and scientific advice unless translated into **operational objectives**, which are empirical statements about measurable properties of stocks/species/ecosystems.

Where empirical, operational objectives have been set, it generally should be possible to identify directly corresponding reference points which managers and scientific advisors can use in developing management plans intended to achieve the management objectives. Single operational objectives may require multiple reference points, however. For example, a management objective of rebuilding a stock to a specified biomass over a specified time interval while allowing certain catches may imply separate reference points for biological, social, and economic factors.

Ecological Quality Objectives are a class of management objectives developed in the specific context of ecosystem management. As with other management objectives, they exist at both conceptual and operational scales. Their special property is that they are identified as sets of objectives to cover a wide spectrum of ecosystem properties, both structural and functional. They are chosen with the intention that if the suite of Ecological Quality Objectives is achieved, the ecosystem as a whole can be considered conserved. As such, they are predominantly biological rather than social and economic. The social / economic objectives, which are identified as Ecological Quality Objectives, are likely to include non-consumptive uses and values.

Reference Level is used within the context of Ecological Quality Objectives to refer to the pristine condition for an ecosystem property. In cases where the reference level refers to a property associated with anthropogenic activity, such as a contaminant level, managers may use the reference level as a reference point. For many properties of biological populations, however, such as abundance or biomass, technical experts do not use reference levels as biological reference points.