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Report of the ICES Advisory Committee, 2011

Book 11
Technical Services

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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BOOK 11

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11 TECHNICAL SERVICES

11.1 Introduction to ICES Technical services

There are two categories of advisory services:

- **Advice** which is adopted by ACOM (reported in Books 1-10), and
- **Services** provided by the ACOM chair (with the assistance of the Vice Chairs)[1] and/or the Secretariat under the oversight of ACOM (reported in Book 11).

A Service is the provision of scientific information or a process that produces scientific information that managers and policy makers can use. The service may include recommendations made by individual or groups of scientists, but it does not include a recommendation on behalf of ICES (except to reiterate a recommendation previously agreed by ACOM or former ICES Advisory Committees).

While Services are not ICES approved advice, they share the following characteristics:

- Scientific objectivity and integrity
- Quality assurance including peer review as appropriate
- Transparency

These Services fall into several categories among which three are report in the Advisory Report Series:

1. **Technical Assistance:** This service is the provision of information with minimal interpretation and/or subjectivity. It includes the assembly of existing information, such as previously approved advice. It also includes calculations using known or widely accepted methodologies.

2. **Clarification of Advice:** This service helps users understand ACOM's advice. Clarification is appropriate for technical terms that advice users do not understand, or when there is unintended ambiguity in the advice.

3. **Review Services:** This service is the provision of peer review of scientific activity (including research proposals, survey or sampling designs, or research results). In provision of the service, ICES is responsible for selecting qualified non-vested interest experts to provide reviews, but it does not interpret the reviews or recommend actions that should be taken in response to the reviews. Review Services are provided in the name of the individuals that conduct the reviews. When there are multiple reviewers, a summary of the reviews, factual and without interpretation that goes beyond the views expressed in the reviewers, may be prepared and agreed by all the reviewers or by ICES (ACOM chair or the Secretariat).

Book 11 of the ICES Advisory Report for 2011 documents the Services that ICES has provided in 2011.

[1] It should be understood that reference to the ACOM Chair includes the Vice Chairs as appropriate

11.2 Answers to Requests

11.2.1 EC DG

11.2.1.1 Evaluation of the ICCAT Atlantic-Wide Research Programme for Bluefin Tuna (ICCAT-GBYP)

Prepared by Michael Sissenwine
Consultant, and Visiting Scholar
Woods Hole Oceanographic Institution
29 September 2011

Background

The ICCAT-GBYP is an international research program adopted by the Standing Committee on Research and Statistics (SCRS) and Commission of ICCAT in 2008 after a long developmental process beginning in 2003. The initial focus was on improving understanding of mixing between fish of eastern and western Atlantic origin. However, the current research plan is much broader with the following priority objectives:

1. Improve basic data collection through mining (including information from traps, observers, and VMS), developing methods to estimate sizes of fish caged, elaborating accurate CPUE indices for Mediterranean purse seine fleets, development of fisheries-independent information surveys and implementing a large scale well planned conventional and genetic tagging experiment;
2. Improve understanding of key biological and ecological processes through electronic tagging experiments to determine habitat and migration routes, broad scale biological sampling of live fish to be tagged and dead fish landed (e.g. gonads, liver, otoliths, spines, etc.), histological analyses to determine bluefin tuna reproductive state and potential, and biological and genetics analyses to investigate mixing and population structure; ecological processes, including predator-prey relationships;
3. Improve assessment models and provision of scientific advice on stock status trough improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and developing and use of biologically realistic operating models for more rigorous management option testing.

The ICCAT-GBYP is envisioned as a six year program beginning in 2010 with a total cost of 19 million Euros. Further information about the program is at http://www.iccat.int/GBYP/en .

Request

The European Commission requested the independent scientific advice of ICES in order to assess whether the ICCAT-GBYP programme:

1. is well on track in its implementation compared to the timeline set;
2. has the necessary capacity, both in terms of expertise and activities foreseen, to be successfully carried out;
3. can reasonably be expected to achieve the objectives set for the whole period;
4. significantly contributes to an improved scientific knowledge of the Atlantic bluefin tuna stock which ultimately will offers to managers a better scientific advice upon which taking conservation and management measures.

The response to the request is to be based on an interim report submitted by ICCAT (GBYP Mid Term Scientific and Technical Report for Phase 2 (2011) Activities, August 9, 2011, 53 pages include 6 appendices).

Methodology

ICES arranged for Dr. Michael Sissenwine to prepare a response (this document) to the request. Dr. Sissenwine is a former Director of Research for the US National Marine Fisheries Service, former Chair of the ICES Advisory Committee (ACOM), and past participant in ICCAT SCRS activity specifically dealing with bluefin tuna. He has no current involvement with ICCAT or any of the entities involved in GBYP funded research.
The following sources of information were considered:

1. GYBP Mid Term Scientific and Technical Report for Phase 2 (2011) Activities, August 9, 2011, 53 pages.
2. 2008 Research Proposal. BLUEFIN TUNA RESEARCH PRIORITIES AND POTENTIAL COSTS. Doc. No. STF-207 / 2008
3. 2009 Research Proposal. REPORT OF THE STANDING COMMITTEE ON RESEARCH AND STATISTICS (SCRS) (Madrid, Spain –October 5 to 9, 2009). Section 16.4. Elaboration of a Bluefin Tuna Research Program.
4. GBYP Phase 2- Work Programme. 2.2 DURATION AND SUMMARY TIMETABLE FOR CARRYING OUT THE ACTION / WORK PROGRAMME. 4 pages.
5. REPORT OF THE 2010 BLUEFIN TUNA ASSESSMENT SESSION (Madrid, Spain, 6-10 September 2010). SCRS/2010/018. Collect. Vol. Sci. Pap. ICCAT, 66(2): 505-714 (2011).
6. GBYP website- http://www.iccat.int/GBYP/en

Response

Comparison to GBYP timeline

The timeline for the GBYP (Source 4 above) calls for the following major action categories:

A. Coordination and implementing supporting activities. There are 5 sub-actions.
B. Data mining and data recovery. There are 2 sub-actions.
C. Aerial survey. There are 4 sub-actions.
D. Tagging. There are 5 sub-actions.
E. Biological Sampling. There are 3 sub-actions.
F. Modelling approaches. There are 2 sub-actions.

The following table summarizes the timeline:
z

activities		2010				2011											
id.	type	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
A.1	Coordination																
A.2	Hiring staff				C												
A.3	Steering Committee guidance																
A.4	Secretariat ext. Activities																
B.1.1	Data mining and data recovery					C				(C)							
B.1.2	Data elaboration						C										
B.1.3	Trap workshop/Symposium									WS							
B.2	Aerial survey data elaboration										C						
C.1	Aerial survey Workshop						WS										
C.2	Survey design revision						C										
C.3	Aerial survey training course									T							
C.4.1	Aerial survey								C	(S)	S	S					
C.4.2	Aerial survey monitoring									P							
D.1.1	Conventional & PIT Tagging						C		(TT)	TT	TT	TT		TT	TT	TT	
D.1.2	Tagging operational meeting																
D.2	PIT readers																
D.3	Electronic tagging																
D.4	Conventional tags																
D.5	Tag awareness activities																
E.1	Biological sampling						(C)	C									
E.1.1.	Sampling operational meeting																
E.2	Genetic sampling						(C)	C									
E.2.1.	Sampling operational meeting																
E.3	Analysis									C							
F.1	Modelling workshop							P				WS					
F.2	Modelling trials																
notes: C = Call for tenders; WS = Workshop; T = Training course; S = Surveys; TT = Tagging trials; P = Modelling workshop preparation																	

The GYBP Mid Term Scientific and Technical Report for Phase 2 (Source 1 above) summarizes activities and accomplishments according to the major action categories, although it does not precisely track the timeline at the level of sub-actions. Highlights by action category and a summary are as follows.

Coordination and implementing supporting activities: The GBYP Phase 2 began 22 December 2010 with the signing of the funding agreement with the European Commission. Early in 2011, the GBYP research assistant was hired. A planning meetings involving 44 scientists from 11 countries were convened. ICCAT secretariat staff responsible for GBYP coordination were very active communicating with National scientists via e-mail and occasional site visits. Fifteen contracts were issued for GBYP scientific activities. Written reports were prepared as deliverables.

GBYP activities are continuously monitored and guided by a steering committee made up of the SCRS Chair, Rapporteurs for Eastern and Western Atlantic Bluefin Tuna, the ICCAT Executive Secretary, and an independent scientist (Tom Polacheck of CSIRO, Australia). The independent scientist is an expert on Southern bluefin tuna. He is highly qualified to help steer research on Atlantic bluefin tuna.

Data mining and data recovery: The Secretariat conducted an analysis to identify gaps in data. Three contracts were issued to recover data on trap fisheries. Data resulting from the recovery effort were presented at the Symposium on Trap Fisheries for Bluefin Tuna (Tangiers, 23-25 May 2011). Detailed information on trap fisheries dating back 2600 years was presented at the Symposium in 26 papers. Sixty scientists participated in the symposium.

An additional four contracts for data recovery were issued. These contracts were for recovery of data from a variety of fisheries, including some additional trap fisheries.

The GYBP Mid Term Scientific and Technical Report indicates the main uses of the data will be to improve (a) standardized input to assessments to reduce uncertainty and knowledge about fleet dynamics and (b) in order to develop robust assessments and advice. Data that improves the accuracy and completeness of catch at age data and catch per unit effort data (primary assessment inputs) will fulfil these objectives. However, while extremely long time series data on trap fisheries will provide many fascinating historical insights, it is unclear how valuable this data will be for contemporary stock assessments and fishery management advice. The data will indicate the magnitude of temporal variability (e.g., inter-annual and cyclic), which will be valuable to place the current status of the stocks in context (e.g., were there similar declines in abundance historically when overfishing was unlikely?) and set expectations about rebuilding the eastern stock.

The data mining and data recovery action category also called for aerial survey data elaboration. A contract was issued to the same research team that was funded for aerial survey activity in phase 1. The objective of the contract is to prepare a "minimum aerial survey design." Arrangements were also made to obtain sea surface temperature data to help interpret aerial survey data.

A lot of data mining and data recovery activities was initiated consistent with the GYBP timeline. Only time will tell the value of this activity in terms of improving assessments and advice. Recovery of historic trap fishery data and reporting on trap fisheries at an international symposium was a specific deliverable of the GYBP Phase 2 work plan.

Aerial survey: An aerial survey workshop was conducted 14-16 February 2011 in Madrid with 44 participants. The workshop made many recommendations for aerial survey design and implementation. These recommendations were taken into account in the agreed standards for aerial surveys.

Based on the workshop and other considerations, it was decided to abandon the phase 1 aerial survey design and prepare a new design. To prepare the new design, the Secretariat reviewed VMS data to identify spawning ground fisheries. The location of these fisheries were to be priority areas for aerial surveys. A report on the revised aerial survey design was delivered according to the GBYP timeline.

Three contracts were awarded to conduct aerial surveys during 2011. However, security issues caused by political unrest in North Africa severely curtailed aerial survey activity. There were additional difficulties in obtaining authorization to conduct surveys within the airspace of some countries which further impeded fulfilling the aerial survey plan. In addition, environmental conditions (sea surface temperature and winds) were anomalous. It is unclear how these conditions affected aerial survey results.

A training course for aerial surveys was held 17-18 May 2011. Twenty pilots, scientific spotters and professional spotters attended the workshop.

A workshop to design phase 3 (2012) aerial surveys was conducted 26 June-1 July 2011. It is clear that phase three aerial surveys will face several challenges including budget constraints, problems obtaining access to airspace of member countries, and security issues in the airspace of countries experiencing political unrest. These administrative issues need to be addressed at the 2011 meeting of the Commission.

Tagging: Orders were placed for conventional tags and data recording tags (Passive Integrated Transponders or PIT tags) and related equipment (e.g., PIT tag readers). A meeting was held 18 February 2011 to organize tagging

operations. There were 42 participants. The GBYP tagging design and manual were discussed in detail and refined based on decisions of the meeting. It was decided to limit tagging to juvenile fish in 2012 and to double tag 40% of the fish.

Following the workshop, ICCAT was informed that PIT tagged fish would not be allowed into Japanese markets due to domestic food sanitation regulations. As a result, the order for PIT tags was partially cancelled. Apparently PIT tagging activity was put on hold until this complication can be resolved with the Japanese delegate to ICCAT.

Although electronic tagging with Pop-up Archival Tags (or PATs) was not planned during phase 2 because of budget constraints, arrangements were made for 10 PATs to be deployed on trap caught fish taken near Tangier. Data from six tags has already been recovered (earlier than desirable because the fish had not had time to move very far from the location where they were tagged). The tags from the remaining 4 fish are expected to report after about 250-300 days at large.

A contract for conventional tagging was awarded for the tagging of a total of 10,000 juvenile fish in the Bay of Biscay, Gibraltar area, Western Mediterranean Sea, and Central Mediterranean Sea. An additional 500-700 fish may be tagged opportunistically in recreational fisheries. To accompany conventional tagging, a tag awareness campaign was conducted to encourage tag returns (including rewards).

Biological and Genetic Sampling: An operational planning meeting for biological sampling was held 17 February 2011 with 42 scientists. Following the meeting, a contract to prepare a scheme for biological sampling was awarded. The report on the sampling scheme was submitted 14 April fulfilling a GBYP deliverable.

A contract for biological and genetic sampling was issued to a consortium of 13 entities in 7 countries on 14 July. The contract calls for 1950 samples of larvae, juvenile and adult fish, and tissues. A meeting was held with the Regional Observer Program to coordinate biological and genetic sampling.

Modelling approaches: Bluefin assessment modelling needs were considered during a day of the ICCAT workshop on stock assessment methods 27 June- 1 July. Two contracts were awarded for model development. Some additional work on management strategy evaluation was conducted by Secretariat staff.

Summary: It was not feasible to ascertain the effectiveness and adequacy of the scientific work described above, but the available documentation describes many activities that seem appropriate and worthwhile.

The GYBP Mid Term Scientific and Technical Report for Phase 2 (2011) Activities lists 10 deliverables provided during 22 December to 31 July 2011 (Appendix 6). It is ambiguous how these deliverables correspond to the expected Actions called for in the work programme (there is not an exact match), but some products or deliverables seem to be missing. For example, there does not seem to be:

1. A summary report on execution of aerial surveys with problems encountered. However, such information was included in the GYBP Mid Term Scientific and Technical Report for Phase 2 (2001).
2. Final report on the whole year of tagging results. Perhaps this report will be provided later in the year.
3. Interim and final reports on biological and genetic sampling. Perhaps these will be provided later in the year.

In summary, the GBYP is reasonably on track in its implementation compared to the timeline set in the work programme. Some serious problems were encountered during 2011 including administrative and security problems that precluded aerial surveying of some areas and Japanese sanitation regulations that precluded PIT tagging. These problems are not the fault of the GBYP. Nevertheless, they need to be addressed if the GBYP is to fulfil its objectives in the future. There may be some deliverable missing. If so, remedial action should be feasible.

Capacity to successfully carryout the GBYP

Rigorously determining if there is the capacity to successfully carryout the GBYP requires an analysis of the capacities (scientists with various types of expertise; physical assets such as ships, aircraft and instruments) required by the Programme and an inventory of capacities available to ICCAT. However, personal knowledge of the ICCAT scientific community allows a subjective determination.

The ICCAT scientific community includes several hundred scientists from Europe, Asia, North America and South America. Many of these scientists are among the world leaders in modelling, fish genetics, survey and sampling design for fisheries, and other specialties. They are supported by state of the art laboratories and ships, especially in Europe and North America. The scientific activities called for in the GBYP are all activities that have been carried out by the ICCAT scientific community in the past. This community is well qualified to perform the activities called for in the GBYP.

Expectation of achieving GBYP Objectives

The primary objectives of the programme are to improve data collection, understanding of biological and ecological processes and assessments and advice. Presumably, improving advice is the ultimate goal. Undoubtedly, a six year research program costing 19 million Euros will produce such improvements. However, it might be possible to achieve a comparable level of improvement cheaper, or greater improvement for the same cost.

The efficiency of the GBYP (i.e., improvement in advice per unit cost) depends on the relative priority given to each of the programme actions (coordination and implementing supporting activities, data mining and data recovery, aerial survey, tagging, biological sampling, and modelling approaches) and sub-actions, and the effectiveness of their design. I am not aware of an analysis that justifies the priorities in the GBYP. The 2008 Programme Plan gives the priorities (and costs) as follows:

Priority	*Element*	*Year1*	*Year2*	*Year3*	*Year4*	*Year5*	*Year6*	*Total*	*Subtotals*
Highest	**1. Coordination**	210,000	210,000	210,000	210,000	210,000	210,000	1,260,000	
Highest	**2. Conventional tagging**		2,455,000	2,455,000	2,455,000			7,365,000	
Highest	**3. Biological Sampling**		1,450,000	1,450,000	1,450,000			4,350,000	
Highest	**4. Data mining**	200,000	200,000	200,000				600,000	**13,575,000**
High	**5. Modeling**				200,000	200,000	200,000	600,000	
High	**6. Archival tagging**	480,000	480,000	480,000	480,000	480,000		2,400,000	**3,000,000**
Medium	**7. Larval surveys**		650,000	650,000				1,300,000	
Medium	**8. Aerial surveys**		400,000	400,000	400,000			1,200,000	**2,500,000**
								19,075,000	

What is the rationale for these priorities? For example, why is conventional tagging a much higher priority than fishery independent indices of abundance (larval and aerial surveys), especially since conventional tagging is much more expensive (about 40% of the entire cost of the GBYP)? Is conventional tagging aimed at resolving uncertainty in stock structure and/or estimating population size and mortality rates? If the former, are there more cost effective methods such as genetics or otolith micro-constituents? If the later, what is the track record of tagging studies for estimating population size and mortality rates of large oceanic fish stocks?

Another consideration in setting priorities for scientific activities for the GBYP might be the research recommendations of the group conducting bluefin tuna stock assessments as the basis for advice. The 2010 report on bluefin tuna stock assessment session (section 7.1) gives several recommendations that are generally consistent with the GBYP. However, they are not prioritized.

I was not able to review the individual design documents for tagging, biological sampling, and surveys, but the quality of these designs will have a large influence on the efficiency of the GBYP. We understand that the designs reflect workshops with input from a large number of experts from the ICCAT community. Presumably, they are scientifically sound designs. However, it is important that they are statistically rigorous with sampling intensity determined by a desired precision level. For example, will tagging 10,000 fish per year for three years with conventional tags produce the desired (or even a satisfactory) level of precision? In general, the desired precision of all inputs to advice should be based on the sensitivity of assessment model outputs (ultimately advice) to the inputs. This should be an objective of the modelling action of the GBYP.

There are some types of scientific activities not included in the GBYP that have the potential to improve scientific advice. ICCAT may wish to consider the following approaches in the future:

1. Otolith micro-constituent analysis- Studies previously reported to ICCAT have demonstrated the feasibility of using micro-chemical analysis of bluefin tuna otoliths to identify their spawning ground origin. That is, otoliths from the Gulf of Mexico and the Mediterranean Sea have different micro-constituent signatures that allow them to be distinguished with reasonable precision. This method may be an effective and economical alternative to tagging studies or genetic studies. It has the potential of being applied operationally to determine the proportion of fish of Gulf of Mexico and Mediterranean Sea origin in catches on either side of the boundary between eastern and western Atlantic management units.

2. Analysis of close kin relationship of adult and juvenile bluefin tuna.- A genetic analysis analogous to a paternity test between spawners and juvenile fish is performed. Spawners and juveniles are sampled. All

combinations of spawners and juveniles are tested for a paternal match. If the test is positive (i.e., the juvenile is an offspring of the spawner), it is a quasi recovery of a tagged spawner. The number of quasi tag recoveries is a function of the number of adult/juvenile pairs tested and the number of spawners in the population. Preliminary testing of this approach on Southern bluefin tuna indicate it is feasible and cost effective to test enough spawners and juveniles to obtain reasonably precise estimates (e.g., CVs of 12-20%) of stock size. However, application of the method to Atlantic bluefin tuna may be more complicated because there are multiple spawning grounds.

3. Monitoring recreational fisheries- Bluefin tuna are caught recreationally, and recreational fisheries may increase in importance. There is only limited information available on recreational fisheries. It would be useful to design and implement a recreational fishing monitoring program. The US has conducted statistically design recreational sampling surveys for about two decades. Some aspects of the survey design may be transferrable to Europe. ICES has also conducted workshops on monitoring recreational fisheries.

4. Development of a management procedure- A management procedure is a formula for using stock assessment inputs directly to determine a management measure (e.g., annual catch limit). Such procedures are designed to fulfil a desired probabilities of achieving a management objective and avoiding undesirable outcomes. They avoid the need for regular stock assessment updates. They make management more transparent and objective. The Commission for Conservation of Southern Bluefin Tuna recently adopted such an approach.

In addition to these approaches, ICCAT may wish to review the aerial survey methodology used by CSIRO in Australia for Southern bluefin tuna, if it has not already done so. Aerial surveys indices are an important input to Southern bluefin tuna assessments.

Improving scientific knowledge for better advice and management: My sense (based on my past involvement in the development of advice for Atlantic bluefin tuna) is that the most serious weaknesses in advice result from:

1. Inaccurate or incomplete reporting of the amount of catch, particularly for the Eastern Atlantic. It is widely agreed that there has been seriously under-reported perhaps until recently.
2. Inadequate or incomplete sampling of the size composition of the catch, thus limiting the quality of age structured assessments.
3. Lack of fishery independent or fishery dependent (e.g., catch per unit effort) indices of abundance, particularly for the Eastern Atlantic. Such indices are need to "tune" assessments.
4. Lack of annual data on the degree of mixing of fish of Mediterranean Sea and Gulf of Mexico origin in the catch taken from Eastern and Western Atlantic management units or finer subareas (SCRS proposed a 6 box spatial model during the early 2000s).

I think that the degree to which research activities will remedy these weaknesses should be a key consideration in setting priorities.

Concluding Remarks

Atlantic bluefin tuna fisheries are valuable and there is a high degree of public and political concern about their management. There is general agreement that stock assessments are highly uncertain, especially for the Eastern Atlantic management unit. Atlantic wide management is further complicated by an unqualified, but important, degree of mixing between fish of Eastern and Western origin. Therefore a substantial investment in Atlantic bluefin tuna science is needed.

The GBYP was developed over several years by a large group of ICCAT scientists with expertise on Atlantic bluefin tuna and scientific methods proposed in the Programme plan. Undoubtly, any plan that reflects the diverse perspectives of so many scientists on a complex scientific problem can be improved. However, I have not identified any fatal flaws in the Programme.

It should be understood that my evaluation is based on the review of a limited number of documents due to time constraints. Some of the issues raised in my evaluation may be addressed in documents I was unable to review. My evaluation is intended to be constructive and thought provoking. It should not be taken as authoritative or prescriptive. ICCAT scientists are the Atlantic bluefin tuna experts.

11.2.2 HELCOM

11.2.2.1 ICES organised external peer review of the Salar project draft report, December 2010-January 2011

In accordance with an ICES/HELCOM contract, the draft report from the SALAR project is to be reviewed as an external quality control. ICES has been given the task of finding qualified reviewers and organise the review. The reviewers have been asked to undertake a peer, scientific review largely similar to that applied to a scientific paper (see Annex 1).

The reviewers were:

- Peter Hutchingson, a salmon expert from the Atlantic area, employed in North Atlantic Salmon Conservation Organisation (NASCO), but working as an independent expert in this context.
- Bror Jonsson, a salmon expert from Norway, employed in Norwegian Institute for Nature Research (NIVA).

The draft SALAR report was send to the reviewers 13 and 14 December 2010 and their reviews received at ICES at 14 January 2011.

Both reviewers were positive about the report, but have a lot of constructive suggestions in their reviews. One of the reviewers made in addition many editorial suggestions in a Word file of the draft SALAR report. The reviews are given in Annex 2, Annex 3a, and Annex 3b (the Word file with the editorials).

Annex 1 Task of reviewers

SALAR project (SI2.546540).

ICES coordinated scientific review in accordance with ICES/HELCOM contract of 9.6.2010, which states:

> "Arranging and producing an external quality control of the recommended and prioritised actions in the draft project report for the recovery and development of salmon and sea trout populations in rivers flowing to the Baltic Sea. The external quality control shall be made by preferably two experts not earlier involved in the project and on the basis of a draft report. This peer review will serve as scientific advice for the development and finalisation of recommendations and prioritisations in the report..."

The tasks of reviewers are based on a draft report of the SALAR project, to:

> Make a peer scientific review similar to a review of a scientific paper; and specifically review the criteria for prioritising populations/rivers as well as the criteria and definitions for proposing actions (heading 9 of draft report) and the consequent recommendations (heading 10 of draft report) for the development of salmon and sea trout populations in rivers flowing to the Baltic Sea.

The task of the review should be seen in the light of the objectives of the project, which are:

Specific objective(s):
As one of the actions in the HELCOM BSAP adopted in 2007 the Contracting Parties agreed to make a classification and inventory of rivers with historic and existing migratory fish species such as salmon and sea trout no later than 2012. The European Commission is preparing a proposal for a new management plan for Baltic salmon to succeed the IBSFC Salmon Action Plan 1997-2010.
The aim of the Project is to produce an overview and classification of the state of the salmon and sea trout populations in the Baltic rivers, including the status of their habitat. The results of the project shall be used:

- as the major information source by the HELCOM Member States to implement the provisions of the HELCOM Baltic Sea Action Plan related to the conservation of salmon and sea trout populations in the Baltic rivers;
- as the major information basis by the HELCOM Member States, being also EU Member States when nationally implementing the upcoming EU Baltic salmon management plan
- as a basis for prioritization and follow-up of the implementation of measures to conserve salmon and sea trout populations,
- as a basis for ensuring the coordination between HELCOM Member States.

Each reviewer shall report their review separately to ICES by the latest on 20.1.2011.

Annex 2. Review by Bror Jonsson.

Oslo, 2011-01-05

To: Henrik Sparholt
From: Bror Jonsson

Review of Baltic salmon and trout review

Thank you for asking me to review the drafted HELCOM SALAR report. I have read the report with interest, and I am happy to see all the good suggestions to improve the situation for Baltic salmon and trout.

General points:

1. The purpose of the report is to give an overview, inventory and classification of anadromous salmonids spawning in rivers flowing into the Baltic Sea. It also includes salmon populations from the Kattegat area in western Sweden, which together with the south Norwegian populations belong to the Atlantic stock complex [King *et al.* (2007) Biodiversity and population structure. In Verspoor E, Stradmeyer L, Nielsen JL (eds) The Atlantic salmon:genetics, conservation and management. Blackwell Publ. Oxford]. The west Swedish stocks face problems, which may be different from those in the Baltic, such as decreasing size of one-sea-winter salmon and mortality due to *Gyrodactylus-salaris*-infections. The latter being a problem in rivers such as the River Ätran [e.g. Johnsen B (2006) *Gyrodactylus salaris*. NOBANIS - Invasive Alien Species Fact Sheet, www.nobanis.org]. This has gained little attention in the present report.

2. When reading the discussion on fisheries regulations, I noticed the suggestion about a maximum catch-size for females. But since age/size at maturity is partly inherited, I do not see why males are omitted from such a measure [e.g. Gjerde B (1984) Response to individual selection for age at sexual maturity in Atlantic salmon. Aquaculture 38:229-240; Gjerde B, Gjedrem T (1984) Estimates of phenotypic and genetic parameters for carcass traits in Atlantic salmon and rainbow trout. Aquaculture 36:97-110; Gjerde B, Simianer H, Refstie T (1994) Estimates of genetic and phenotypic parameters for body weight, growth rate and sexual maturity in Atlantic salmon. Livest Prod Sci 38:133-143]. Fish size is not only a matter about egg production. It also concerns other inherited traits carried by the fish.

3. I notice the focus on habitat restoration, but feel that more could be included on negative impacts of stocking both from a genetic and phenotypic performance points-of-view. For instance, the spawning success of hatchery fish (relative to wild conspecifics) is reduced [Fleming IA, Jonsson B, Gross MR *et al* (1996) Experimental tests of the reproductive impact of farmed on wild Atlantic salmon (*Salmo salar*). J Appl Ecol 33:893-905; Fleming IA, Lamberg A, Jonsson B (1997) Effects of early experience on the reproductive performance of Atlantic salmon. Behav Ecol 8:470-480; Fleming IA, Hindar K, Mjølnerød IB *et al* (2000) Lifetime success and interactions of farmed salmon invading a native population. Proc R Soc Lond B 267:1517-1523], their life-history characters may be changed [McGinnity P, de Eyto E, Cross, TF *et al* (2007) Population specific smolt development, migration and maturity schedules in Atlantic salmon in a natural river environment. Aquaculture 273:257-268], and their mortality most probably is higher [Jonsson N, Jonsson B, Hansen LP (2003) Marine survival and growth of wild and released hatchery reared Atlantic salmon. J Appl Ecol 40:900-911]. They may also have negative production effects on wild fish due to competition [Einum S, Fleming IA (1997) Genetic divergence and interactions in the wild among native, farmed and hybrid Atlantic salmon. J Fish Biol 50:634-651; McGinnity P, Jennings E, de Eyto E *et al* (2009) Impact of naturally spawning captive-bred Atlantic salmon on wild populations: depressed recruitment and increased risk of climate-mediated extinction. Proc R Soc Lond B 276**:**3601-3610].

4. Barriers blocking anadromous fish from reaching the spawning area, such as hydropower facilities in rivers, receive much attention, and one suggestion is to transport the spawners upstream to the spawning grounds. However, little is said about problems post-spawners and offspring may meet on their way downstream passed the same installations. Only in Sweden this problem has received some attention (e.g. in the River Emån where it is a major problem), but I expect that this can be a problem also in some of the other countries.

5. In Denmark, downstream migrating smolts are lost in an artificial lake above a hydropower-plant in the river. I would have liked to know the reason for the losses; is it a migratory problem because the stocked fish are not adapted to migrate through a lake or predation because fish predators, such as pike, pike-perch or burbot, build dense populations in the lake, but not in the rest of the river?

6. There are many rivers and other locations mentioned in the text. It would have been helpful with more maps showing where these locations are situated. I searched in vain for most of them in Fig. 2.1. Moreover, I do not understand what is specific for the rivers indicated on the map relative to the other rivers supporting anadromous salmon and trout in the Baltic region.

7. As a restoration goal, the authors use maximum sustainable yield. However, nothing is presented here about how the population-specific MSYs were estimated. This is a theoretical and usually unknown figure.

8. In general, the report uses few references. This means that the views presented sometimes appear anecdotal instead of a science based conclusion. I understand that references may render the text less reader-friendly, but it would be most helpful for those interested in knowing the quality of the information given.

9. I have a number of specific points (given below), particularly from the first part of the report where I sometimes had problems understanding or accepting views expressed. From page 24 onwards, there is information on the population status in the various countries. To a large extent, this part has character of being the result of consultant work. I have little possibility of judging this information although I see from the enclosed material that sample sizes sometimes are small. I have not corrected language, but see that a copy editor could be of help when finishing the report.

Specific points:

Page 1:

1. I feel that this summary is too short to be very informative. For instance, many of the points discussed such as variation in population characters and effects of climate change, receive no attention in the summary.

2. Instead of giving the main items discussed in the report, more of the views and findings should have been given up front. For instance, what are the needed measures for the restoration of rivers habitats and waters.

3. A number of rivers are in urgent need of habitat improvements. These rivers are listed alphabetically. For most readers it would have been simpler if the rivers were grouped according to country.

4. What is meant by the penultimate sentences in paragraph 3: “Their state should be followed-up on a red list on salmon rivers that are displayed on a GIS-map at the Helcom website.” I search in vain for this on the Helcom page. I received no immediate hit when searching for “red list of salmon rivers”. It would have been better to given the internet address and the proper key-word to the map. The last sentence in the same paragraph gives an X instead of a number. One must remember to change that in the final version of the report.

Page 2:

The introduction states that the report is based on the HELCOM SALAR project. I do not know what that is, and this may be a problem also for other readers. A presentation of the Helsinki-commission and the authority of this report could also be presented on this page. Who are the responsible writers other than “fisheries experts from the various countries”.

Page 3:

In the presentation of the 6 assessment units, the original reference should be given.

Page 4:

The first paragraph gives the general population trends of the various assessment units. However, the basis for the assessment is not shown. Is this the result of assessments in index-rivers or a number of populations in each unit? To what extent is the assessed rivers representative for each unit? If the rivers in Table 2.1 are selected examples illustrating a general trend, this should have been expressed.

Page 5:

There is a contrast between Fig. 2.2 and the text. The report tells that there is an increase from 2007–2009. But for the 3 rivers shown, this trend holds for one of the three only. The two others vary similarly to the other years since 1994, and no density is higher than in one river in 1999. I suspect that the results from Keila River is the basis for the generalization in the text.

Page 6:

First paragraph

I miss number of rivers within each assessment unit. What is the basis for maximum smolt production? Which are the 27 rivers?

Second paragraph

I have difficulty understanding what is meant by "stocks are considered very likely to reach the reference point of 50% or 75% of PSPC in case the probability is more than 90%. How was this probability of 90% estimated. Is it referring to an ICES-report?

Third paragraph

ICES (2010) is not in the reference list, but there is a (2010a) and a (2010b) Which is it?
Erik Degerman (2010) is not in the reference list.

Page 7:

First paragraph.

The first sentence is a contention and should therefore be less bombastic. Again the unreferred ICES (2010) is cited.

Second paragraph, penultimate sentence.

Many other studies have shown the opposite trend: large smolts are good smolts [e.g. Lundqvist *et al*. (1994) Aquaculture 121:245-257; Virtanen *et al*. (1991) Aquaculture 97:231-257; Vehanen *et al*. (1993) Ann Zool Fenn; Antonsson *et al* (2010) Trans Am Fish Soc 139:1688-1698]

Fifth paragraph.

When presenting a Fig. it is better to give the main finding than repeating the figure legend in the text.

Last paragraph.

There is lack of documentation of that "50% as many salmon" ascended rivers in the Gulf of Bothnia in 2010 compared with 2009. There is only the Figure from Umeälven showing an increase.

Page 9:

Fishing of salmon in the Baltic Sea has decreased as a consequence of natural causes. At this point the reader knows that the stock abundance has increased. Hence, many would have expected the opposite trend as natural. Therefore, it would have been better to write something like "due to a growing population of grey seals". This explanation could then be elaborated in the subsequent paragraph

Page 10:

I would have liked that 1000 tonnes were indicated on the Y-axis.

Page 12:

Penultimate paragraph.

1000 sea trout populations of which ca. 500 reproduce in Baltic rivers. Where do the other 500 Baltic populations breed?

Page 13:

Table 2.3. Correct term according to the SI-system is mass. Weight is for everyday use, but not for scientific literature.

Page 14:

Replace fry with alevin [Allan & Ritter (1975) J Cons Int Explor mer 37:293-299]

Page 16:

First paragraph.

It is not correct that Baltic salmon require fresh water and marine habitats to complete their life cycle. There are also non-anadromous populations illustrating that Baltic salmon can carry out their entire life-cycle in freshwater.

Second paragraph.

Egg mortality is often low because the embryos are well protected in the substrate [Elliott (1994) Quantitative ecology and the brown trout. Oxford Series in Ecology and Evolution], but mortality can in some cases be high such as when the oxygen content in the water flowing through the substratum is low. Furthermore, Welcomme likes to see his name spelled with one l. Be aware that this reference is not correct since these are not the authors but the editors of the book.

Third paragraph.

Alevins carry yolk sac not only in the initial stage. You write that a lot of energy is spent on spawning. How much is a lot? Could you be more precise?

Fourth paragraph.

Often adult salmon do not die in the river, but after having returned to sea [Jonsson, B., N. Jonsson & L.P. Hansen (1991) Differences in life history and migratory behaviour between wild and hatchery reared Atlantic salmon in nature. Aquaculture 98:69-78].

In Baltic salmon male parr often migrate to sea subsequent to spawning according to Österdahl (1969) [Österdahl L (1969) The smolt run of a small Swedish river. In: Northcote TG (ed) Salmon and trout in streams. HR MacMillan Lectures in Fisheries, Univ British Columbia, Vancouver]

Page 17:

Second paragraph.

Since the homing mechanism is not fully understood does not mean that it has to be complex. The fish may have a sense we lack, such as magnetoreception [e.g. Lohmann KJ (2010) Magnetic-field perception. Nature 464:1140-1142; Lohmann KJ, Johnsen S (2000) The neurobiology of magnetoreception in vertebrate animals. Trends Neurosci 23:153-159; Lohmann KJ, Lohmann CMF, Putman NF (2007) Magnetic maps in animals: nature's GPS. J Exp Biol 210:3697-3705; Lohmann KJ, Putman NF, Lohmann CMF (2008) Geomagnetic imprinting: A unifying hypothesis of long-distance natal homing in salmon and sea turtles. Proc Natl Acad Sci USA 105:19096-19101]

Fourth paragraph:

Often the eggs are buried deeper than 15-20 cm in the substrate. The nests may be placed in a row, but sometimes they are not (Fleming *et al*. 1996, op cit.).

Fifth paragraph:

Do salmon or sea trout from the same population spawn during 7 consecutive months? Where in the Baltic is that?

Sixth paragraph.

As much as 20% silt and sand can be very harmful. Malcolm *et al*. (2003) [Malcolm IA, Youngson AF, Soulsby C (2003) Survival of salmonid eggs in a degraded gravel-bed stream: effects of groundwater-surfacewater interactions. Riv Res Appl 19:303-316] reported that silt loadings above 0.5% can be detrimental to embryonic survival if the amount of sand exceeds 5%. For sand contents over 10%, Lapointe *et al*. (2004) [Lapointe M, Bergeron N, Berube F *et al* (2004) Interactive effects of substrate sand and silt contents, red-scale hydraulic gradients, and interstitial velocities on egg-to-emergence survival of Atlantic salmon (*Salmo salar*). Can J Fish Aquat Sci 61:2271-2277] found that 1% silt had over three times the effect on survival as a 1% increment in sand.

Page 18:

In sub-chapter 3.5, there should have been a mentioning about early emigration into brackish water in the Baltic Sea. This is probably a specific adaptation due to the low salinity with offspring survival when the salinity is below 4 psu. Landergren's papers are already classic [Landergren P (2001) Survival and growth of sea trout parr in fresh and brackish water. J Fish Biol 58:591-593; Landergren P (2004) Factors affecting early migration of sea trout *Salmo trutta* parr to brackish water. Fish Res 67:283-294; Landergren P, Vallin L (1998) Spawning of sea trout, *Salmo trutta* L., in brackish waters: lost effort or successful strategy? Fish Res 35:229-236; Limburg KE, Landergren P, Westin L *et al* (2001) Flexible modes of anadromy in Baltic sea trout: making the most of marginal spawning streams. J Fish Biol 59:682-695]

Fourth paragraph

Food abundance and fish size are major variables influencing territory size in rivers, but not mentioned here [Grant JWA (1993) Self-thinning in stream-dwelling salmonids. Can Spec Publ Fish Aquat Sci 118:99-102; Grant JWA, Kramer DL (1990) Territory size as a predictor of the upper limit to population density of juvenile salmonids in streams. Can J Fish Aquat Sci 47:1724-1737; Grant JWA, Steingrimsson SO, Keeley ER (1998) Implications of territory size for the measurement and prediction of salmonid abundance in streams. Can J Fish Aquat Sci 55:181-190].

Page 19:

Second paragraph.

Juveniles sometimes remain more than 4 years in fresh water [e.g. Metcalfe NB, Thorpe JE (1990) Determinants of geographical variation in the age of seaward migrating salmon, *Salmo salar*. J Anim Ecol 59:135-149; Jonsson B & L'Abée-Lund JH (1993) Latitudinal clines in life history variables of anadromous brown trout in Europe. J. Fish Biol. 43 (supplement A.): 1-16]. Four years can be mean not maximum smolt age in northern rivers.

The thyroid hormones and the insulin-like growth factor-I are also important hormones influencing the smolting process (McCormick *et al*. 2002). For instance, the thyroid hormones have a direct role in the silvering of the smolts [Hutchison MJ, Iwata M (1998) Effect of thyroxine on the decrease of aggressive behaviour of four salmonids during the parr-smolt transformation. Aquaculture 168:169-175]

Third paragraph.

Smolt run: Do you mean time or speed of migration? If time, temperature is generally most important (Jonsson and Jonsson 2009, referred in the text).

Page 21:

Second paragraph.

It looks naive to write that it is not completely understood how different climatic and environmental factors affect fish. What is completely understood in biology?

What is meant by that some changes at individual, population and ecosystem levels have already been observed. State *what* is observed and cite for instance Pörtner HO, Peck MA (2010) Climate change effects on fishes and fisheries: towards a cause-and-effect understanding. J Fish Biol 77:1745-1779. I guess this is the paper you are thinking of since you specify the three levels?

Third paragraph.

Although studies from the Baltic are lacking, the principles observed in other parts of the species range should still hold.

Sixth paragraph.

Expand your thinking about length of the growing season and smolt age. You should look up recent papers on the subject [e.g. Elliott JM, Hurley MA (1998) An individual-based model for predicting the emergence period of sea trout fry in a Lake District stream. J Fish Biol 53:414-433; Jonsson N, Jonsson B, Hansen LP (2005) Does climate during embryonic development influences parr growth and age of seaward migration in Atlantic salmon (*Salmo salar*) smolts? Can J Fish Aquat Sci 62:2502-2508]

Page 24:

Last paragraph:

What is some instances?

Page 25:

Second paragraph:

Some were found the river Dudka. Are these some the one individual mentioned in the next sentence, ore were there more?

Fourth paragraph:

How were anadromous and non-anadromous fish distinguished?

Page 26:

Here and later, few references to original literature. Since so many specific results are given, there should be observations, experiments and experience behind.

Penultimate paragraph:

What do you mean by older fry? Is it alevins or parr?

Page 27:

Seventh paragraph:

Why not write Gudenå?

Ninth paragraph:

It looks strange that Danish *populations* increase in *population* size. This paragraph definitely needs a reference.

Page 29:

Salmonid, are you referring to salmon or trout. Both are salmonids.

Page 31:

Third paragraph:

Is M74 still a problem here?

Fourth paragraph:

Why should stocking of hatchery fish increase wild production. There are enough examples of the opposite: [See e.g. Jonsson B & Jonsson N (2009) Restoration and enhancement of salmonid populations and habitats with special reference to Atlantic salmon. – Pp 497-535 in Haro, A. J., T. S. Avery, K. L. Beal, J. E. Cooper, R. A. Cunjak, M. J. Dadswell, R. J. Klauda, C. M. Moffitt, R. A. Rulifson, and K. L. Smith, eds. *Challenges for Diadromous Fishes in a Dynamic Global Environment*. American Fisheries Society Symposium 69. Bethesda, Maryland; and references therein].

Page 32:

Fourth paragraph.

I do not understand what is meant by period of years.
Page 39:

First paragraph:

Is this about the Baltic region. This looks more like the Atlantic West-coast region.

Fifth parahraph.

You may not put too much emphasis on this paragraph since this is Atlantic salmon probably mainly feeding in the Norwegian Sea of the North Atlantic.

Page 49:

But clipping of the adipose may influence the performance of the fish, particularly in males [Järvi T (1990) The effect of male dominance, secondary sexual characteristics and female mate choice on the mating success of Atlantic salmon *Salmo salar*. Ethology 84:123-132; Petersson E, Järvi T, Olsén H *et al*. (1999) Male-male competition and female choice in brown trout. Anim Behav 57:777-783]

Page 55-60

Many mistakes (inconsequences) in the reference list

Annex 3a . Review by Peter Hutchinson

Review of Draft SALAR Report

Basis for the review:

In accordance with an ICES/HELCOM contract, the draft report from the project is to be reviewed as an external quality control and the reviewers have been asked to undertake a peer, scientific review similar to that applied to a scientific paper focusing on sections 9 and 10 of the draft report which deal with the criteria for prioritising salmonid rivers for restoration and recommended actions for achieving this. It should be noted that the focus of the report for review purposes is concerned with management priorities and actions rather than scientific issues. Nonetheless, the review has been conducted to the standards applied to manuscripts submitted to international fisheries journals.

Overall assessment:

The stated aim of the SALAR Project is to produce an overview and classification of the state of the salmon and sea trout populations in Baltic rivers, including the status of their habitats. It is clear that historically extensive damage to salmonid habitat has occurred in Baltic rivers, particularly through the construction of dams for hydropower and irrigation. The information presented indicates that the production of wild salmon smolts has increased markedly over the last fifteen years but that very significant challenges remain not least those associated with degraded or lost habitat, a marked decline in post-smolt mortality in recent years and climate change. The management target in the HELCOM Baltic Salmon Action Plan is that salmon and sea trout populations should attain 80% of their PSPC (50% for 'weak stocks'). Stock rebuilding initiatives will be required in many rivers and the challenges are great as, for example, around half of the salmon rivers are currently below 50% of their PSPC despite the significant measures already taken.

It is clear that an enormous amount of information has been collated through this project and a valuable approach to classifying populations that still retain wild salmon and sea trout populations has been developed so as to prioritise stock rebuilding initiatives. The approach based on an objective measure (attainment of PSPC) with the listing framed around the HELCOM BSAP attainment objectives and with priority given to remaining original wild stocks seems sound. Recommendations on the nature of the actions that might be taken to conserve and rebuild the stocks have also been developed. The approach is valuable in highlighting the status of the stocks and should assist in consultations with stakeholders and in informing the public to the situation facing the resource. Consideration might be given to assigning descriptors to the three categories defined using the traffic light system and given that some of the red list rivers appear to be in a tenuous state, while others are close to attaining 50% PSPC, a fourth category might serve to highlight the very severe plight of some rivers and the measures needed at such low stock levels. There might also have been a clearer explanation of how rivers were selected from the red list as candidates for the development of salmon restoration and development plans e.g. was it on the basis of quality of monitoring facilities in the systems, quality of habitat, existing listing under EU legislation etc. Ideally, restoration plans would be developed as a matter of priority for all rivers on the red list, even if different timescales are needed for implementation of the measures they contain. It would also have been useful to have some modelled trajectories for stock rebuilding under different scenarios. Finally, mechanisms for exchange of information on progress towards the achievement of the goals and to facilitate collaborative learning on approaches to rebuilding would be valuable. Overall, while salmonid classification systems are to some extent arbitrary the approach proposed is considered to be a valuable development in conserving and rebuilding the Baltic's valuable wild salmon and sea trout resource.

General comments:

It is clear that an enormous amount of valuable information on the Baltic salmon and sea trout populations and their habitats has been compiled through the SALAR project, in accordance with the project's objectives of classifying and developing an inventory of rivers with historic and current migratory fish populations. This information should assist in assessing progress towards the international goals, provide a valuable tool for raising public awareness of the status of these populations, the threats to them and the measures being taken to protect and restore them, and highlight data deficiencies and, consequently, uncertainty in the assessments.

The draft report would benefit from some re-drafting since it is overly long and repetitive in places. The substance of the report is contained in the last 12 of 60 pages excluding annexes. Sections 2, parts of 7 and 8 all describe the status of the stocks and could be combined. Similarly, sections 3, parts of 7 and 9.2 deal with habitat issues. It would assist the reader if the report was re-structured as follows: Introduction; Life-cycle and habitat requirements (including the information on habitat status in the country reports in section 7 (or these might be annexed), 4 and 9.2); Status of stocks (combining sections 2, aspects of the country reports in section 7 (or these might be annexed) and 8); Management (including section 2.1.2, the management aspects of the country reports in section 7 (or these might be annexed),

information on stocking (section 2.3), and the categories detailed in section 5); Defining Criteria for prioritising stocks; Recommendations for actions; and Implementation of actions.

The draft report provided did not contain a Glossary and would benefit from further editing and suggestions in this regard are made in the attached Word version of the report (an earlier version than the pdf sent for review was provided).

Specific comments:

Section 1: Introduction

The Introduction to the draft report briefly summarises the overall ecological state of the Baltic rivers and their fish populations indicating that anthropogenic factors have played a significant role in the decline of salmonid stocks. It also describes the basis for collating the information in the report, its scope and the recommendations proposed. Given that the river classification system described in section 5 is based on the extent of natural and reared populations in the rivers, it would have been useful to provide more context in the Introduction in terms of the history and scale of the stocking programmes in the Baltic and to set out the management context by referring to the objectives of the IBSFC Salmon Action Plan (achievement of 50% of the PSPC) and the HELCOM Baltic Salmon Action Plan (80% or 50% of the PSPC). While these are referred to later in the report (section 9), they could usefully have been described in the Introduction.

Section 2: Salmon and Sea trout population trends

This section provides valuable information drawn mainly from ICES reports. It refers to a number of indicators of abundance that are used including post-smolt survival, adult counts, estimates of juvenile abundance and smolt numbers. It indicates that smolt counts are available in 27 rivers but given that the approach to prioritising rivers is based on attainment of the PSPC it would have been valuable to describe how the PSPCs are set, how smolt counts are made in these 27 rivers and estimated in the other rivers, particularly in those where data is limited.

It would have been useful to have a more detailed overview of the remaining fisheries including the gear used and effort data etc. and perhaps further discussion of the reported expansion of the marine long-line fishery.

The report would benefit from combining the various sections that refer to stock status (see general comments above). Section 8 provided a valuable overview. It is important that a clear message is given early in the report to highlight the severity of the situation facing those charged with restoring Baltic salmon and sea trout stocks and, therefore, the need for urgent rebuilding initiatives but at the moment it is not until section 8 that a clear picture emerges that although significant reductions in exploitation have occurred declining post-smolt survival and other factors mean that 45% of salmon rivers are achieving less than 50% of the PSPC and adult salmon returns declined in both 2009 and 2010 from a peak in 2008. Thus, the challenges in preventing local extinctions and in rebuilding stocks are considerable and additional actions focused on the wild stocks will be required.

Section 3: Habitat and water requirements

This section describes in general the life-cycle and habitat requirements of Baltic salmon and sea trout. It would benefit from further re-drafting so that it describes the phases of the life-cycle, their habitat requirements and activities that may affect this habitat. For example, the section dealing with smolting and the smolt run does not describe the habitat requirements e.g. a downstream migration corridor free from physical, chemical and biological barriers, although section 9.2 provides useful information on habitat requirements which could be included. This section might also include the summary information on the state of habitat in each country (section 7). Information in.

Section 4: The influence of climate change on populations of Baltic salmon and sea trout

This section, while not a comprehensive review of the potential effects of climate change on salmon and sea trout, is useful in raising the uncertainty posed for stock rebuilding. For example, reference is made to higher run-off benefitting sea trout access to spawning grounds. However, there could also be negative impacts e.g. increased redd washout. Similarly, the report indicates that growing seasons could be extended resulting in earlier smolt migration. There could, however, be adverse consequences from this if there is a mismatch of smolt sea entry and availability of marine prey resources as hypothesised for Atlantic salmon. There should be a clear message that climate change poses considerable potential challenges for stock rebuilding and that a holistic approach to rebuilding will be needed with measures in both freshwater and marine environments, although it is recognised that marine aspects are beyond the scope of the SALAR project.

Section 5: Classification of salmon and sea trout populations

This section is very brief and describes the eight categories used to distinguish salmon and sea trout populations on the basis of their status and origin. It fails to make maximum use of the listing of rivers by category (where these can be assigned) in Annex 1 for salmon and Annex 2 for sea trout, and it would have been valuable to present this information summarised by country and for the Baltic as a whole in tabular format and graphically. It is suggested that this section be incorporated into the section dealing with Stock status (see General comments above). Annexes 1 and 2 would be enhanced if they also included in the % PSPC attainment and the MSY listing category assigned to wild original stocks. It is clear that more comprehensive data are available for salmon than for sea trout populations. For example, Annex 2 shows that no categories have been assigned to Danish sea trout populations but Annex 3 includes 55 Danish rivers with red listed sea trout populations. Some explanation is needed as to how these rivers were included on the red list in the absence of any category being assigned to them.

Section 6: EU and Russian Federation legislation

This section refers to EU legislation such as the Water Framework Directive, Marine Strategy Framework Directive and Habitats Directive. However, the draft report makes no assessment of the possible opportunities these Directives offer for the rebuilding of Baltic salmon and sea trout stocks. With regard to the Habitats Directive, the draft report does not indicate if any of the Baltic salmon and sea trout rivers have been designated as Natura 2000 sites on the basis of their salmon and sea trout stocks and whether this was a factor in selecting the rivers for development of management plans described in section 10.

Section 7: Overview of salmon and sea trout populations and rivers by country

This section provides a very useful overview of habitat issues in each country, the status of stocks and the national legislation in place. The information is provided according to an agreed format although the scope of the information provided varies, presumably because it was drafted nationally. It is rather long and might be better annexed if the draft report remains in its current format or alternatively it could be assigned to the sections suggested in the General comments section.

Section 8: Synthesis on the state of salmon and sea trout populations

This section provides a very useful and succinct overview of the status of the stocks that might have been given greater prominence in the report.

Section 9: Defining criteria for prioritising populations

The classification system adopted assigns rivers to one of eight categories and those rivers with the original population are prioritised for restoration over introduced populations. From a conservation perspective this is a rational approach although some stakeholders might take a different view. Red lists of 22 salmon and 251 sea trout populations have been developed on the basis that they are achieving < 50% of their PSPC so a quantitative approach is being used unlike some similar listings used for Atlantic salmon populations. All classification systems such as this have limitations and to some extent the categories are arbitrary, but in this case the three lists proposed align with the HELCOM BSAP which is a logical approach. However, a population in the yellow list but in long-term decline may be more in need of intervention than a red list population which is increasing in abundance, so it will be important that long-term trends are also taken into account in addition to attainment of the PSPC.

The red list populations represent a wide range of stock status from < 1% to close to 50%. The report recognises (section 10) that more stringent measures may be needed for stocks achieving < 20% of their PSPC and consideration should perhaps, therefore, be given to a fourth category with stringent recommendations for management actions so as to highlight the precarious state of this group of rivers.

These are relatively minor concerns and the listing should be an extremely valuable tool in increasing public awareness of the situation facing wild salmon and sea trout populations and the measures being taken to conserve them and in discussions with stakeholders.

One challenge in this approach is that there is limited data for sea trout populations and there is, therefore, greater uncertainty about the status of these stocks. In this situation, application of a Precautionary Approach would require additional caution and steps taken to address data deficiencies.

The graphical displays of the state of salmon populations by MSY list category over time and by region are helpful and it would have been useful to have similar displays for sea trout. It would also have been useful to have some modelled trajectories for stock rebuilding under different scenarios.

In addition to the red list populations the draft report suggests re-establishing wild populations held in hatcheries in their original river and that rivers with large potential also be targeted for restoration. However, the draft report also notes that where this approach was attempted under the IBSFC SAP it met with limited success. A clear explanation of why this approach is favoured rather than focusing on rivers that still have their original wild stocks should be provided.

There could have been additional information provided on how material for stocking might be obtained from rivers with very low wild fish abundance. In France, for example, stocking programmes are required to use only fish returning to the river but numbers are extremely low as in some Baltic rivers. In such situations, should captive breeding be considered, on-growing of parr etc?

Specific comments relating to actions relating to by-catch, illegal harvests and catch and release are included in the corrected Word version of the document attached. It is important to stress that the focus on the red list rivers does not diminish the need to maintain and enhance measures on all other rivers.

Reference is made to establishing targets for tributaries. This presumably allows for diversity considerations to be taken into account, which is important, but it is far from clear how these would be applied and inform management which is based on attainment of PSPC. Some clarification would be helpful.

The report might highlight that the actions taken to restore habitat and improve access should also have benefits for other species e.g. eels.

The actions relating to fisheries management apply only to exploitation in rivers but it will be important that a holistic approach is applied so that strict measures introduced in fresh water are not undermined at sea and *vice versa*.

Section 10: Recommendations

This section provides the lists of original salmon populations in the three MSY categories. It would have been helpful to include in for each river the country, the category as given in Annexes 1 and 2, a summary of the threats to each population, any designation e.g. under the Habitats Directive and an indication of options available for monitoring the attainment of the PSPC. There was one river included on the red list that appeared to be a category 7 in terms of its origin (i.e. reared) so some explanation may be required. The others appeared to be mainly category 1, 3 or 4.

The draft report proposes that ten original and six potential populations/rivers are selected for a HELCOM salmon river restoration and development project and that restoration and development plans be developed urgently for these rivers. It is not clear how these populations/rivers in the red list were selected and they cover a wide range of % PSPC attainment but some explanation would be useful. However, it should be a priority to establish rebuilding plans for all listed rivers even if the timescale in which measures can be introduced may vary. It is not clear what is proposed for the other rivers but it would be valuable to introduce some form of reporting process to allow progress to be assessed in implementing the measures consistent with the actions proposed and to facilitate an exchange of information on approaches to stock rebuilding. Evaluation of the effectiveness of measures taken to rebuild stocks should form part of the rebuilding programme.

Annexes

See comments under Section 5 above.

Annex 3b. Review by Peter Hutchinson – Word file with editorial suggestions.

Available in the ICES Secretariat as a separate file.

11.2.3 OSPAR

11.2.3.1 Review of Draft OSPAR ICG-COBAM Advice Manual on Biodiversity

V. Guida • A.-S. Heiskanen • E. Kenchington • M. Sköld • M. Vecchione

Introduction

The Marine Strategy Framework Directive (MSFD; 2008/56/EC) calls upon EU Member States (MS) to develop criteria and methodological standards to allow consistency in approach in evaluating the extent to which Good Environmental Status (GES) is being achieved. MS are required to provide indicators of GES to the European Commission by July 2012, using the guidance provided in the Commission Decision document (2010/477/EU). A number of reports have been published relating to the descriptors of GES, including eight reports facilitated by the JRC and ICES and two (Contaminants in fish and other seafood and Marine litter) facilitated by DG SANCO and IFREMER respectively. OSPAR is coordinating the MSFD implementation process for the OSPAR Maritime Area and established an Intersessional Correspondence Group on Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM). This group organised an expert workshop 23–24 November 2010 in Utrecht, Netherlands (BDC 11/4/2-E) to consider the definition of GES for the biodiversity descriptors, and to recommend appropriate indicators, targets and assessment tools. A product of this workshop is an Advice Manual aimed at national experts and policy makers who will be directly involved in this work at MS and Regional Sea levels.

Of the 11 Descriptors of GES, the Advice Manual deals with 4:

D1. Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

D2. Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.

D4. All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

D6. Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.

OSPAR has requested ICES to peer review a draft Advice Manual made available in April 2011. The objective of this peer review is to provide expert comments for consideration in revisions to the Advice Manual prior to publication.

The complete terms of reference for the request from OSPAR is found in Annex A. This document records the reviews of 5 independent scientists whose work was overseen by one of them. This does not constitute ICES advice but rather the consensus view of those independent scientists.

General Comments on the Advice Manual

The Manual is an important step toward advice on the assessment and monitoring of marine biodiversity and OSPAR should be congratulated for taking the lead on this difficult subject. However, the review group found that this draft is too general to provide sufficient guidance for the development of actions. The Manual provides introductive approaches but doesn't follow up with details and clarifying examples. With some further work it could be much more informative and clear. There are few if any incorrect or indefensible statements within the manual. Rather, it simply stops short of what is needed for useful advice. For example, Section 7, Approaches to setting targets for pressures, is all true. However, it does not provide advice on how to determine important pressures for individual species, how to set targets for those pressures, or how to achieve those targets once they have been set. The suggestion to map distribution and intensity of pressures is useful guidance but not typical of this document.

The Advice Manual clearly is based on the report of the workshop, but in translating the workshop recommendations into an Advice Manual, important points seem to have been lost. For example, paragraph 4 of the Fish and Cephalopods working group Appendix of the workshop report provides very important input from the group discussions for which we could find no reflection in the Advice Manual.

Overall, the discussion of potential methods for determination of baselines, targets, indicators, etc. seems adequate but insufficient for advice on biodiversity. There is a general need for advice about selection of the species for which proposed methods are to be applied. Are all species to be assessed or a subset? If a subset, how will the species be selected? If different methods are to be used for different species, how are those subsets of species to be selected? Will deterioration in the status of a single species trigger widespread corrective action? If not, what is the trigger?

Broad coordination of selections and methods is necessary for broadly distributed species. Although such coordination is mentioned several times, no advice is provided about how to achieve it. For example we envision a scenario where one Contracting Party (CP) chooses to assess population distribution, etc. for one suite of fish species and a neighbouring CP chooses another suite of species and then being unable to put together anything meaningful. Further, if the monitoring methods are not harmonised it is not explained how to ensure that the GES assessment results would be comparable between CPs.

Lastly, the advice manual includes descriptors 1, 2, 4 and 6, however, the report does not really treat descriptor 4 on food webs. The understanding of this descriptor and the developed indicator for the Proportion of Large Fish has been proposed by the ICES/JRC TG 4 and has been developed over several years (see ICES, 2010, 2011)-WGECO reports 2010, 2011). The advice manual could be developed accordingly.

ToR 1: Are there other options for setting baselines and setting targets for GES?

i) Whether the methodologies outlined for setting baselines and setting targets for GES cover all options available to CPs (Chapters 3 and 4)

The report covers in general the potential ways to set baselines for GES, however, it would benefit from real examples on indicators that indicate difficulties as well as solutions, including references. One example of modelling to predict pristine conditions is the use of macroecological theory (Jennings and Blanchard, 2004). There are also a large number of experiences in setting the reference conditions under the Water Framework Directive (WFD) (2000/60/EC) that could be better explored here, or relevant examples could be chosen to help the MS in evaluating the tools for background/ reference conditions setting. For instance, concerning the setting of the historical/ past baseline (Method A), a further paleo-ecological method (combining experimental and modelling approach) for estimation of reference conditions that has been proposed to be applied in coastal water for the WFD purposes (e.g., Andersen *et al*., 2004; Clarke *et al.,* 2006) although it would be limited to coastal / estuarine pelagic waters only.

Under the base line setting Method A (iii) it is mentioned that ecosystem reconstruction modelling work is being developed "within academia, such as at British Columbia, Dalhousie and Chicago Universities", but not providing any reference where these approaches could be checked. Statistical and hind-casting methodologies can be also used for A (iii).

Three methodologies for setting targets are presented in Chapter 3.12. These cover the different approaches for target setting. There is no guidance on what criteria could be used to set the actual targets (particularly what are the principles on how the targets are set as absolute values or as deviation from baseline). However, such criteria would be dependent on the habitats/ species where those are applied, and more guidance is provided in Chapters 5 and 6. Also baseline setting and target setting are linked so that if the baseline setting C (current state) is used, Target setting method 1: Directional or trend-based targets, would be most feasible, showing only the direction of change.

(Chapter 4.1., p. 21–22, first paragr.): It would be useful to compare the assessment scales of habitats with the WFD type-approach that requires type-specific reference conditions for water body types, as all CP's have carried out characterization of their coastal waters based on the hydro-morphological features and criteria. This approach should enable comparison of similar water body types (including their habitats) within the CP as well as between the CPs that share similar water body types.

One of the key issues in identifying GES targets for different descriptors is how to define sustainable use, i.e., to what degree human activity causing perturbation(s) is acceptable. In Section 3 of the TG6 report (Rice *et al.,* 2010) this is discussed and the manual would benefit from taking this into account. In short, the TG6 concluded "Sustainability is achieved when the pressures associated with all those uses cumulatively do not hinder the ecosystem components to retain their natural diversity, productivity and dynamic ecological processes. Perturbations due to use must be small enough that recovery is rapid and secure if a use ceases." The methodologies for identifying aspects of recoverability are well developed within fish population dynamics (precautionary levels for spawning stock biomass, fishing mortality etc). However, data to produce similar relationships are scarce for other components of the ecosystem such as benthic invertebrates, and for others, such as habitats, mechanisms for recoverability are less understood. The manual does not point out how to overcome this problem but see TG 6 discussion (3.1).

ToR 2: Are the proposed methods scientifically robust?

ii) Feedback on the relative value of these methods in terms of scientific robustness, practicality and transparency

All methods are valid but will depend on the indicator and quality of data that are used, again well chosen examples would be informative. The least appropriate method is method C, to use the current baseline, since this method introduces a significant risk that a baseline will be outside GES.

The review group cautioned advocating the use of population models to set baselines (e.g., "carrying capacity") and feels that they should be approached carefully because of the assumptions required. Such methods may be useful for examining some questions about species for which most biological and other environmental interactions are well

known. However, such species with relatively complete knowledge bases comprise a small percentage of the biodiversity in the ecosystem(s).

Specific Comments Related to Pelagic Habitats:

Base line setting: all methods would require operational definition of the pelagic habitat types which is not available currently.

Method A (un-impacted state/negligible impacts): All pelagic habitats are impacted to some extent, particularly with respect to the large species/ functional groups. This approach may thus not be feasible for pelagic habitats, although it would be most scientifically robust and transparent. As suggested above, paleo-ecological methods (in some coastal/ estuarine habitats) and modelling may be available to evaluate the historical un-impacted state with respect of eutrophication pressure (nutrient status as a proxy). However, in the case on dynamic food web models/ ecosystem models, the models are not yet adequate to address biodiversity issues. Also lack of data for validation of models would make the modelling approach unfeasible and very uncertain. However, expert judgement could be used, but this will have the problem of being very subjective.

Method B (past state): would be appropriate if sufficient long data series would be available. Therefore this method is probably not practical for many pelagic habitats. However, coastal and estuarine pelagic habitats may be an exception, as long term data series for those are available to many CPs.

Method C (current state): As stated in the guidance, this approach is problematic due to shifting a baseline.

ToR 3: Advantages and disadvantages of the proposed methods

iii) Experience in applying these methods in setting environmental targets – and their respective advantages/disadvantages

ICES has been involved in two larger projects related to the Common Fisheries Policy (CFP) and the Habitats Directive (HD) (92/43/EEC), i.e., the EMPAS (Pedersen *et al.,* 2008) and the FIMPAS projects. In both of these projects effects of fisheries have been evaluated in relation to conservation objectives under the HD, i.e., favourable conservation status. In practice, favourable conservation status has proved to be a challenge for scientists to interpret consistently and apply objectively (ICES, 2007a, 2007b; STECF, 2006). An important aspect of this problem is the setting of the baseline at the date of the inception of the HD (i.e., using Method C) since status, whether favourable or not according to the directive, needs to be evaluated from past and present perturbations as well as state of the indicators used. The consequence of this challenge to scientists in interpreting the conservation objectives is obviously the ability for delivering advice on management measures to achieve the objectives.

Experience with Pelagic Habitats

Target setting

Method 1: Directional or trend-based targets: if Method C is the only possible way of setting a baseline, this is the only feasible target setting methodology. However, this is the weakest target setting approach for operational policy implementation, and thus can only be used as supporting evidence that the direction of development is right with respect to the measures applied for protection of pelagic habitats.

Method 2: Target set as an absolute value: pelagic habitats are very fluctuating in space and time. It would probably be very difficult to set some absolute value for anything else than pressure targets (e.g., an example of a practical approach in setting of absolute values for pressure targets is the Baltic Sea Action Plan, where target values for land based nutrient loading have been set by modelling and using transparency as a proxy of ecosystem response on nutrient loading).

Method 3: Target set as a deviation from baseline: this could be feasible for some coastal and estuarine pelagic habitats, if Method A has been applied for baseline setting. A practical example is the ecological quality status assessment for WFD, where the target setting for chlorophyll *a* (as proxy for phytoplankton biomass) has been assessed as deviation from reference conditions. However, this applies only for eutrophication pressure and may not be feasible for other pressures impacting pelagic habitats (fishing, harmful substances).

Tor 4: Comments on the approach for the referenced Species and Habitats

iv) The applicability of the baseline setting and target setting methodologies to the species and habitats referred to in the Advice Manual (Chapters 6 and 7) (i.e. based on the conclusions of the Utrecht GES workshop)

Seabed Habitats

The advice on setting baseline for seabed habitats is technically sound (Section 5.1.2). The Advice Manual refers directly to the methods set forth in Section 3 in detail, including reiteration of and elaboration on their strengths and weaknesses in making recommendations. Listed methods are prioritized according to their merits in various situations.

The advice on setting targets for benthic habitats is less developed (Section 5.1.3). It is stated that "The way in which the targets are set for benthic habitats, in terms of the actual deviation from reference conditions, can be underpinned by science or set purely on the basis of policy aspirations." This appears contradictory to the definition of GES. According to the directive, targets shall relate to sustainable use (see discussion on understanding GES above in i) and that should be underpinned by science preferably by empirical or experimental data, and/or expert judgment. However, the progress towards the identified targets is based on policy aspirations.

The Section ends with a recommendation that targets should be set as consistently and uniformly as possible across the NE Atlantic region. The review group suggests that this should be clarified better. Targets may well be different in different regions depending on the state of the ecosystem in relation to historical perturbations. In practice this means variable targets at least if the relationship with the baselines are evaluated in terms of deviations.

Water column habitats

This section is particularly vague and needs a lot more work. Although it is far too general to provide advice on assessment and monitoring of pelagic biodiversity (presumably zooplankton, phytoplankton, and microbes), it includes a few valuable recommendations about how to progress towards that goal. These include further defining pelagic habitats and determining what is good *vs* not-good. It is important to note that historically emphasized biomass measures, like chlorophyll *a* or zooplankton displacement volume, and productivity measures, such as carbon fixation, are NOT indicators of biodiversity.

With regard to the scarce information for the pelagic habitat we cannot find it justified to state that Method B would be preferred in relation to Methods A and C. The text seems to have focussed mainly on the lower end of the food web which is the most dynamic and difficult component to monitor in the pelagic ecosystem. Little attention seems to have been paid to higher trophic levels such as fish and seabirds that are part of the pelagic ecosystem or benefit from lower trophic levels. This section should be developed further and would benefit from being integrated with the results from the ICES/JRC TG 4 report on food webs.

Marine mammals- general

Top predators may, through top-down effects, have important consequences for other species in the ecosystem, e.g., recoverability for depleted fish stocks (Bundy, 2001). These ecological interactions are poorly understood. However, these research needs should be emphasized since targets for marine mammals may influence the possibilities to reach targets for depleted fish stocks.

Marine mammals- Cetaceans

It is more difficult to map this section onto the Terms of Reference. Other than a caveat about "Seals only", it is not clear what methods would be applied to what species. If all methods are to be applied to all species, then Table 6.1 seems a reasonable starting point for cetaceans. However, details about how to assess population size, demography, and distribution are lacking.

Marine mammals- Seals

Many seals forage across vast marine areas and breed in well-known locations often on isolated beaches. This latter characteristic makes them relatively easy to monitor. Section 6.2 focuses on two OSPAR EcoQOs related to seals: monitoring estimated population sizes for harbour seals and determining the relative breeding success (recorded as pup production) for grey seals at selected breeding sites. Another related indicator is the number of breeding cows (e.g., Southern Elephant Seals at Macquarie Island http://www.environment.gov.au/soe/2006/publications/drs/indicator/472/index.html).

ICES has previously provided an evaluation of the status of grey seals, harbour seals and harbour porpoise in relation to the Ecological Quality Objectives being applied by OSPAR in the North Sea (OSPAR, Ostend 25 – 29 June 2007, Annex 24):

a. *Harbour seal population size: Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea. These sub-units are: Shetland; Orkney; North and East Scotland; South-East Scotland; the Greater Wash/Scroby Sands; the Netherlands Delta area; the Wadden Sea; Heligoland; Limfjord; the Kattegat, the Skagerrak and the Oslofjord; the west coast of Norway south of 62°N.*

b. *Grey seal pup production: Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years), and in breeding sites, within any of nine sub-units of the North Sea. These sub-units are: Orkney; Fast Castle/Isle of May; the Farne Islands; Donna Nook; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Heligoland; Kjørholmane (Rogaland).*

This advice is much more specific and useful than anything in the draft Advice Manual. It was noted that the workshop participants viewed the 10% decline in grey seals to be simply a threshold which would trigger further research and dismissed it as unsuitable as a GES target. However, this seems too draconian, especially as the Advice Manual is not internally consistent in this regard (e.g., see Section 6.4 Population size). The ICES WGMME has pointed out that for long-lived marine mammals such as seals (and also cetaceans), the time series may not reflect more than one or two generations. Grey seals for example have a life expectancy of about 35 years which would mean that the 10% decline could be within natural mortality bounds. Hence overly interpreting trends from such data is not recommended. However a 10% decline would be in the range of natural mortality and so deviance from that could relate to anthropogenic factors. *If combined with condition indices this target might be much more meaningful.* A New Zealand Department of Conservation programme has been monitoring three fur seal rookeries on the West Coast of the South Island since 1990. Parameters that have been monitored are: pup success and weight gains, and age at first breeding.

The reviewers felt that pressure indicators should also be used to monitor this ecosystem component. The number of marine mammals caught by species, by fisheries, by area by year is one such pressure indicator (Froude, 1998).

Reptiles

This is a difficult situation because of the lack of marine reptiles (turtles) nesting in the North Sea vicinity. It is quite clear from the OBIS SWOT program that this is true. Also lacking are any estuarine reptiles (e.g., *Malaclemys terrapin* of North America) that interact with marine systems. The Advice Manual claims that "… it is probably unrealistic to attempt to collect abundance data that could be used to provide indicators of population distribution/size or condition under Descriptors 1 and 4." It also indicates that the kind of carrying capacity models used for marine mammals would be extremely hard to construct due to the lack of data. The seeming uncertainty ("…probably unrealistic…") is not helpful in a manual such as this. It sounds as the authors are unsure about whether such data really does exist. Parenthetically, marine turtle data in the northeastern U.S., where they are also uncommon, come from a combination of commercial fisheries bycatch records and data from marine mammal surveys.

As a consequence of the lack of data one suggestion is to use an alternative method to achieving GES: setting a pressure-target to reduce or eliminate the impact of predominant pressures, for example, from fisheries by-catch. On the presupposition that there really is a lack of data, of which we are not convinced, a recommendation is being made to employ a method not really specified in Section 3 and for which little detail is offered. What the authors suggests may indeed be the best advice; as written the argument is not compelling and needs to be re-written with a better sense of how rare data actually are and a better vision of how the alternative analysis might be done.

Birds

As for other ecosystem components, Section 6.4 does not provide guidance on the selection of species (see General Comments above). The functional group approach under investigation by OSPAR appears promising; however, there can be widely divergent population dynamics within functional groups and so this approach is not recommended for species. New Zealand identified two sea bird indicators (Estimated population size for selected species of seabirds and Relative breeding success for selected species of seabirds in selected breeding sites) but recommended that they not be developed further: "It is recommended that these indicators not be developed further. This is because individual seabird populations behave differently and so it is not possible to define a suite of representative species." (NZ Ministry for the Environment, 1998, An Analysis of Potential Indicators for Marine Biodiversity). However, grouping of species according to ecological guilds may be useful indicators of change in particular aspects of the marine environment (Parsons *et al.*, 2008), and so be useful indicators of habitat change, particularly if all members of a particular guild respond in a similar direction.

The reviewers felt that population condition may be a more direct indicator of ecosystem health especially if linked to a change in population numbers. Such sublethal responses can be used to track ecosystem health, as well as the health of bird populations. Mallory *et al.* (2010) advocate this approach which may lead to the use of baseline physiological and chemical target levels for seabirds, against which we can detect future changes in aquatic ecosystems.

Fish and Cephalopods

The statements in this section are very vague. This group should be divided into pelagic and demersal components because of their very different interactions with the benthic and pelagic habitats considered elsewhere. This category could be expanded to include all Nekton, which would include shrimps and other large non-air-breathing swimmers.

This section is written as a brief outline rather than a text, and it does not address the subject on a descriptor-by-descriptor basis, as do other chapters, and lacks detail and explanation of choices. It also lacks any mention of issues of scale. The table, which is organized according to descriptors, contains a lot of blanks and question marks and not much explanation. Fish and cephalopod species are among those for which the most data on population and ecological parameters is known, yet the authors seem to give them short shrift. The scope and depth of the science in this section is inadequate. More depth is needed in addition to reorganization of the section. Why are some methods preferred in some cases and others in other cases? Why are there question marks in the tables? Why is the issue of pressure indica-

tors being side-stepped altogether? This section requires a thorough re-writing in order to provide a credible advice document.

Another issue is the limited nature of this section. Why are invertebrates other than cephalopods not included here or in a separate section? At least decapod crustacean and bivalve species ought to be included somewhere because of their ecological and commercial importance. Further, the group is divided into "well sampled" and "not often sampled (because of low abundance or unsuitability of sampling methods)". What about species that are not often sampled because they are not of commercial interest (i.e., they are collected by fishing/sampling methods but ignored because they are not target species)? Target setting states that for well-sampled species all methods are possible. Will different methods be used for different species? Will these vary by country?

With respect to Fish and Cephalopods it is unlikely that all species will be assessed with identical methods. Therefore species will have to be agreed upon by the various member nations in order for there to be consistency in application. As mentioned above, there is no guidance on how this will be accomplished to maximize comparability.

ToR 5: Are issues of scale addressed?

v) Whether the Advice Manual adequately addresses issues of scale in the context of target setting for species and habitats, in case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards

The issue of scales is discussed in Chapter 4 on a general level, however, the advice manual could be developed more with regard to the problems of scales. The issue of scale is best understood with practical examples. Such concrete examples or case descriptions, addressing assessment scales needed for various types of habitats or species (if mobile or sessile, and depending on their distribution range) would be needed to take this forward.

The TG6 report concludes that pressures operate at different but always patchy scales and that monitoring of the seafloor as well is patchy. This is challenging for assessing the environmental status of that descriptor in particular. TG6 propose a way to address this challenge by using a spatial risk analysis (see Chapter 3.2 in Rice et al., 2010).

ToR 6: Comments on the target setting approach for pressures

vi) Whether the target setting approach outlined for pressures is clear, transparent and scientifically robust. In case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards.

This issue is discussed in Chapter 7 only on a very general level. This would also benefit by the presentation of a few concrete examples focusing on the most common pressures such as eutrophication, fisheries, construction of installations such as wind energy parks in marine areas, etc. Many pressures, including harvesting, degradations of spawning habitats, etc. are well-known for many of fish species in particular. There is a wealth of literature on pressure indicators from which to draw on.

References Cited

Andersen, J. H., Conley, D. J. and Hedal, S. 2004. Palaeoecology, reference conditions and classification of ecological status: the EU Water Framework Directive in practice. Marine Pollution Bulletin, 49: 283–290.

Bundy, A. 2001. Fishing on ecosystems: the interplay of fishing and predation in Newfoundland–Labrador. Canadian Journal of Fisheries and Aquatic Sciences, 58: 1153–1167.

Clarke, A. L., Weckström, K., Conley, D.J., Anderson, N.J., Adser, F., Andrén, E., de Jonge, V.N., Ellegaard, M., Juggins, S., Kauppila, P., Korhola, A., Reuss, N., Telford, R.J., and Vaalgamaa, S. 2006. Long-term trends in eutrophication and nutrients in the coastal zone. Limnology and Oceanography, 51: 385–397.

Froude,V.A. 1998. The New Zealand environmental performance indicators programme: an analysis of potential indicators of marine biodiversity. EPIP Technical Paper No.43. Ministry for the Environment: Wellington.

ICES. 2007a. An integrated framework for ecosystem advice in European Seas. ICES Advice 2007, Book 1: 52–77.

ICES. 2007b. Report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO), 11–18 April 2007. ICES CM 2007/ACE: 04. 163 pp.

ICES. 2010. Report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO), 7–14 April 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:23. 225 pp.

ICES. 2011. *Draft* Report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO),13–20 April 2011, Copenhagen, Denmark. ICES CM 2011/ACOM:24.

Jennings, S. and Blanchard, J.L. 2004. Fish abundance with no fishing: predictions based on macroecological theory. Journal of Animal Ecology, 73:632–642.

Mallory, M.L., Robinson, S.A., Hebert C.E. and Forbes, M.R. Seabirds as indicators of aquatic ecosystem conditions: a case for gathering multiple proxies of seabird health. Marine Pollution Bulletin, 60: 7–12.

Parsons, M., Mitchell, I., Butler, A., Ratcliffe, N., Frederiksen, M., Foster, S., and Reid, J. B. 2008. Seabirds as indicators of the marine environment. ICES Journal of Marine Science, 65: 1520–1526.

Rice, J., Arvanitidis, C., Borja, A., Frid, C., Hiddink, J., Krause, J., Lorance, P., Ragnarsson, S. A., Sköld, M., and Trabucco, B. 2010. Marine Strategy Framework Directive. Task Group 6 Report. Seafloor integrity. JRC/ICES.

STECF. 2006. Report of the STECF-SGRN-06–01: Data Collection Regulation Review. Brussels, 19–23 June 2006. Commission Staff Working Paper. 88 pp.

Annex A. Terms of Reference for the ICES COBAM Review Group

The purpose of this ICG-COBAM Advice Manual is to provide practical advice to OSPAR Contracting Parties on the methodologies to be applied for determining good environmental status and the setting of environmental targets for Marine Strategy Framework Directive descriptors on biodiversity. The current version is a first draft that will undergo further editing to improve the presentation of the advice and to shorten the main text by moving supporting information to Annexes.

ICES is therefore invited to primarily focus on the contents of the document. OSPAR is now seeking advice from ICES on:

i) Whether the methodologies outlined for setting baselines and setting targets for GES cover all options available to CPs (Chapters 3 and 4)
ii) Feedback on the relative value of these methods in terms of scientific robustness, practicality and transparency
iii) Experience in applying these methods in setting environmental targets – and their respective advantages/disadvantages
iv) The applicability of the baseline setting and target setting methodologies to the species and habitats referred to in the Advice Manual (Chapters 6 and 7) (i.e. based on the conclusions of the Utrecht GES workshop)
v) Whether the Advice Manual adequately addresses issues of scale in the context of target setting for species and habitats, in case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards;
vi) Whether the target setting approach outlined for pressures is clear, transparent and scientifically robust. In case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards.

11.2.4 UK

11.2.4.1 ICES organised external peer review of documentation associated with the UK-Dogger Bank Special Area of Conservation

The Department for Environment,, Food and Rural Affairs, UK, has requested ICES to review documentation used in the selection process for Special Area of Conservation on the UK sector of the Dogger Bank.

The documents are:

The SAC selection assessment document:
http://www.jncc.gov.uk/PDF/DoggerBank_SACSAD_v6_0.pdf;

The draft conservation objectives:
http://www.jncc.gov.uk/pdf/DoggerBank_DraftCOsAndAdviceOnOperations_5.0.pdf;

and the Impact Assessment:
http://www.jncc.gov.uk/pdf/DoggerBankSAC_ConsultationIA160810.pdf.

ICES has asked two independent reviewers to review the documents.

The reviewers were:

- Dr. Jan Helge Fosså, Institute for Marine Research, Norway
- Dr. Jake Rice, Ecosystem Sciences – Department of Fisheries and Oceans Canada

Both reviewers taking slightly different approaches agree that the UK data are comprehensive and conform to 'best scientific practise' and they do not point to particular data deficiencies. The UK data therefore seem to suffice for the data analysis that is required by the EC guidelines for fisheries measures in Natura 2000 sites.

Also, the conclusion on the conservation objectives (status of the habitats) is supported.
The two reviews are enclosed.

Annex 1

Review of documentation associated with UK – Dogger Bank Natura2000 site impact assessment.
Jan Helge Fosså, Institute of Marine Research, Norway

I have read or looked at the following documents found at the share point:

- *Dogger Bank SAC Final IA*
- *Dogger Bank SAC Final IA Annexes*
- *Fisheries measures for marine Natura 2000 sites*

In addition I downloaded:

- *Draft Conservation Objectives and Advice on Opeations (Dogger Bank) (JNCC)*
- *Understanding the marine environment - seabed habitat investigations of the Dogger Bank offshore draft SAC (JNCC report No 429)*[1]

From my point of view the last document is very important and I don't know why this was not placed on the sharepoint or provided by whoever sent the documents to ICES. The deadline for this review has been very short and it is important to get an overview of relevant documents as soon as possible.

I was asked to "take a look at the UK situation" and interpret that you (ICES) want to have a view on:

1. are the data and their interpretation scientifically sound
2. will the proposed fisheries measures deliver on the conservation objectives

The Impact Assessment of Dogger Bank SAC is interesting reading. It is the first time i read such an assessment that goes into many of the possible consequences of a designation of a SAC. I think the report presents much good thinking and reasoning. However, I am a marine biologist with general knowledge and some expertise on benthic habitats. I am not a fish biologist, fisheries biologist, fisheries analyst or an economist. Most of the material in the IA with annexes are therefore outside my competence. I will not comment on that stuff. Regarding information on the benthic communities and general ecological aspects of the Dogger Bank the IA-document is too general and presents little scientific information.

Below you find my comments, mostly based upon the information presented in JNCC report No. 429.

Justification of the SAC boundary

In summary, the Dogger Bank is a morphologically distinguishable seabed feature with slopes in excess of 0.1 degrees separating the sandbank from the ambient seafloor. At its summits it rises to water depths of less than 20 m. The morphology of the Dogger Bank is largely controlled by the extent of the Dogger Bank Formation, which forms its core. The formation is not found anywhere else in the North Sea.

Slope analyses were used to obtain a natural boundary with some exceptions referring to important sandeel nursery habitats. Detailed documentation is presented in JNCC 429 in the main text and Appendix I.

The scientific justification of boundaries is convincing.

Justification of the protection values

Here I mostly refer to JNCC 429. The Dogger Bank has been identified as a special ecological region in the central North Sea due to a variety of factors including its hydrographic regime, sediment composition, phytoplankton production regime and faunal community characteristics.

High levels of phytoplankton production on the Dogger Bank have been found to occur all year round, an a significant amount settles out onto the seafloor surface. This, in turn, appears to have a direct effect on the macrofaunal

[1] Diesing, M., Ware, S., Foster-Smith, R., Stewart, H., Long, D., Vanstaen, K., Forster, R. And Morando, A. 2009. Understanding the marine environment – seabed habitat investigations of the Dogger Bank offshore draft SAC. Joint Nature Conservation Committee, Peterborough. JNCC Report No. 429, 89 pp., 5 Appendices.

communities in that they exhibit little seasonality.

Macrofaunal communities are characterized by a higher abundance, higher species number and higher biomass in comparison with samples collected on more southerly sandbanks. Recent studies suggest that the spatial distributions of macrofaunal communities present on the bank are the result of a number of factors but are principally controlled by the availability, quantity and quality of food in the benthic boundary layer and this in turn is largely controlled by frontal systems such as the Flamborough/Frisian frontal system.

In this respect the Dogger Bank represents a sub-type of sandbank that is not found elsewhere and will therefore constitute a meaningful part of a representative network of SACs in the North Sea. I think this is well documented with among other things updated and very good information on seabed sediment information on maps and a fair ecosystem overview.

In the JNCC 429 a combination of new methods has been used to document sediment types and associated faunal communities (sidescan sonar, multibeam echosounder, video data collection 15 tows pluss still photos every 30 sec. Beam trawl for larger epifauna for collection of voucher samples. Grab with video. Combined video tow, stills and grab samples, satellite data on chlorophyll).

It is always possible to take more samples and more replicates, but I think that the documentation is good enough for the purpose: to obtain information, or update information, on the primary conservation targets: the benthic communities and of course the ecological function that the communities and the ecosystem represent. I do not evaluate the sandeels.

The scientific knowledge of the protection values is sufficient and is justified through citations of scientific literature and new data.

Documentation of impact

A weak point of the assessment is the documentation of, or the lack of, impact from human activities such as fishing. This is a crucial point because it is the reason for the designation of the SAC.

Demersal fishing is identified as threat number one (Table 2.1 in IA) and impact from fisheries is discussed on page 73-74 in JNCC 429 and some evidence of trawl marks are found in Figure 5.2.

It is referred only to one work that has studied possible impact from fishing on the Dogger Bank: "Whilst the Dogger Bank has historically been subjected to relatively intensive fishing effort, Frid et al (2000)[2] reported no significant impacts on benthic communities that could be attributed to fishing were apparent in this area between the early 1920s and late 1980s. However, it is hypothesized that fishing induced changes in benthic communities may have already occurred on the Dogger Bank prior to the 1920s (Frid *et al*, 2000)".

In addition there are references to the scientific literature describing different impacts from bottom trawling on the seabed and its associated fauna in other parts of the North Sea and elsewhere. However, few if any of the cited works do show clear effects that can be attributed to fishing activities. Also, it is difficult to extrapolate from these studies to other areas such as the Dogger Bank.

There is only indirect evidence and hypotheses about effects from bottom trawling on the benthic habitat and the associated fauna and ecological function of the Dogger Bank.

Effects of fisheries measures on the conservation objectives

There are no very specific fisheries measures presented, only as far as I can see three general options;

- do nothing
- minimum management scenario
- maximum management scenario

[2] Frid, C.L.J., Harwood, K.G., Hall, S.J. and Hall, J.A. 2000. Long-term changes in the benthic communities on North Sea fishing grounds. ICES Journal of Marine Science, 57: 1303-1309.

To be short. Because of lack of evidence of impacts from bottom trawling on the benthos on the Dogger Bank, something like the minimum scenario can be a good way forward. It ensures that representative parts of the Dogger Bank are secured against possible future deterioration by bottom trawling, and it enables monitoring and description of a possible restoration of the closed areas. It is imperative that a monitoring program is designed to detect possible changes due to closing when compared with unclosed areas.

I don't consider effects for sandeel or other fish

Jan Helge Fosså
Bergen, 5 May 2011

Annex 2

Review of documentation associated with UK – Dogger Bank Natura2000 site impact assessment.
Dr. Jake Rice, Ecosystem Sciences – Department of Fisheries and Oceans Canada

The primary documents which formed the basis for this review include:

- Dogger Bank SAC Final 1A – 18 Feb
- Dogger Bank SAC Final 1A –Annex - 18 Feb
- Offshore Special Area of Conservation: Dogger Bank – Draft Conservation Objectives and Advice on Operations
- EC Communication: Fishery Measures for Marine Natura2000 sites
- EC Final Report: Regional Social and Economic Impacts of Change in Fishery-dependent communities

In my review I also made use of the knowledge and experience gained through association with the German EMPAS project, which also considered fisheries issues associated with Natura2000 sites in the German EEZ (including some sites near the site being considered in this case). I am aware of a similar project in the Dutch EEZ, but I have not seen final reports of that project and do not consider its findings in this review.

As I was drafting this review, I received a copy of the review completed by Jan-Helge Fosså. His treatment of ecological aspects of the site is thorough and professional, and I concur with his treatment of those issues. I will not repeat them in my review. However, I will offer my conclusions regarding the suitability of the proposed site relative to the relevant criterion for inclusion in the national network of areas protected under the Habitats Directive, and the appropriateness of the objectives being set for the proposed area, relative to the provisions of the Directive. The bulk of this review will concern itself with the impact assessment, however, particularly with regard to potential impacts of fisheries, were they to be allowed inside the proposed area, and the justification for the mitigation measures that are being proposed.

<u>The site selection</u>

Based on the information in the first three documents listed above I conclude that the case is very sound that the area being proposed does indeed meet the criterion for "sandbanks that are slightly covered by water at all times" (or some such wording). The substrate is not completely homogeneous, with some areas of muddy-sand and some areas of coarser grain-sizes up to pebbles. However, all qualify as "sandy sediment" and area appropriate for consideration. Not the entire range of sandy sediments in the larger areas of the UK EEZ is included in the proposed protected area; rather a subset of the area of sandy substrate defined by approximately the 40 m depth contour is proposed for inclusion. This approach is consistent with the provision of the criterion regarding "slightly covered by water". There is no purely science basis for deciding what depth is consistent with "slightly" but the use of the 40 m depth contour as a guide to positioning a smooth boundary is consistent with practice elsewhere.

Also with regard to selection of the site, other sandbanks always (or usually) covered by shallow water can be found in UK waters, However this is the only one that is large, offshore, and meets the criterion. Therefore there are no opportunities to consider alternative sites for inclusion in the UK network of protected areas to fulfil the requirements of the Habitats Directive.

Also based on the information in those documents I conclude that the coverage of the area within the proposed boundaries by a relatively homogeneous substrate type considered to meet the criteria for inclusion in Annex 1 has implications for the risk and impact assessments and management. In the EMPAS case, many of the proposed areas were mosaics of areas which met criteria (especially for "reef") and areas which did not. In the EMPAS case the operational need for smooth boundaries of the protected areas meant that any reasonable configuration would include a mixture of habitats requiring protection and habitats where sustainable impacts would not be inconsistent with the Habitats Directive. Much effort in EMPAS was expended seeking options to allow activities that might impact the seafloor in those portions of the proposed MPAs that did not have the specific habitat features required to be protected under the Habitats Directive. In the case of Dogger Bank, based on the available information on substrate types and depth, the science information suggests there is little opportunity for such arrangements. Activities considered to be inconsistent with restoring or maintaining favourable conservation of sandbanks in the Dogger Bank area would be inconsistent with that overarching requirement throughout the proposed protected area.

On the conservation and management objectives

The Habitats Directive requires that areas identified for protection be returned to or maintained in "favourable conservation status"; a state characterized by three features:

i. its natural range and area it covers within that range are stable or increasing;
ii. the specific structure and functions, which are necessary for its long-term maintenance, exist and are likely to continue to exist for the foreseeable future; and
iii. the conservation status of its typical species is favourable.

Under that guidance conservation objectives have been proposed for the area:

> "Subject to natural change, restore the *sandbanks which are slightly covered by seawater all the time* to favourable condition, such that the:
>
> • The natural environmental quality is maintained
> • The natural environmental processes are maintained
> • The extent, physical structure, diversity, community structure and typical species representative of *sandbanks which are slightly covered by seawater all the time* in the southern North Sea are restored."

In the context of other ICES advice on ecosystem objectives, these would not yet be considered "operational" objectives, a point acknowledged in document 3, where the objectives are proposed and justified. However, I conclude based on wide experience with these types of issues in ICES and other advisory settings that these high level objectives provide adequate initial guidance to evaluate if classes of activities could pose major threats to achieving favourable conservation status, and to selecting classes of management and mitigation measures needed to address impacts that may be inconsistent with the objectives. I also note that the definitions proposed for technical terms included in the higher level conservation objectives are generally consist with past ICES advice on these issues.

In several ICES WG Reports (particularly but not exclusively from WGECO), scientific information and sometimes advice has been provided on the potential impacts of the activities of various industry sectors in marine habitats, communities, and populations. Based on that information it is likely that the third bulleted objective, particularly the parts on "diversity, community structure and typical species representative of sandbanks", will be of greatest concern relative to most industry sectors, including fishing.

Evaluation of threats posed by various types of fishing, and management and mitigation measures proposed to address the potential threats.

Evaluation of the threats posed by various types of fishing requires both knowledge of how the fishing practices of each fishing fleet may affect the biotic community and habitat features characteristic of the habitat type being protected, and the expected pattern and intensity (frequency) of use of the various gear types. In this section I will first present my conclusions about the soundness and adequacy of the information provided on potential impacts of each fishing fleet (gear sector) on the species and habitat features, then my conclusions on the soundness and adequacy of the information provided on the pattern and intensity of use of each gear, and finally my conclusions on the degree to which any proposed fisheries measures are justified by the information either provided in the documents or known to exist from past ICES advice and reports.

Information on potential impacts of various gear sectors: The reports contained very little information about the expected impacts caused by the different gear sectors. In the only table specifically about threats (2.1) fishing is listed a source of increased selective biological removals and a cause of physical disturbance or abrasion. Both pressures are considered Moderate sensitivity, High exposure and High Vulnerability. The high threat posed by biological removals is attributed to "demersal fishing" and the high threat posed by physical disturbance is attributed to "mobile benthic fishing". The rationale for these assessments is provided in the Draft Conservation Objectives document, where mobile demersal fishing is identified as the only high risk activity ongoing in the proposed MPA. . However that document provides only sketchy rationale for the evaluations of the sensitivity and exposure and provides no breakdown of risk by gear sector, with very few citations.

ICES, particularly WGECO, has evaluated the impacts of some mobile bottom contacting gears on seafloor features and benthic communities. The conclusions are broadly consistent with the evaluation in Draft Conservation Objectives document, but makes a number of more nuanced distinctions about conditions that affect the severity of impact of such gears. ICES has advised in the past that impacts of mobile bottom-contacting gears on unstructured habitat types in high energy environments is unlikely to be nearly as large as impacts of the same gears in structurally complex, fragile,

hard bottoms or in areas of very low natural disturbance. Consequently, I consider the evidence that there is a high threat of serious damage to the generally sandy substrates to be weak. Information is not presented on the natural mixing of surface sediments by tides, currents, and storms, but it is at least plausible that the natural disturbance regime is high enough that the added impact of mobile fishing gear does not actually pose a threat to the objectives of maintaining natural environmental quality and processes.

Investigating this issue further may not be warranted, however. Even if the threat posed to physical structure is over-estimated, the threat posed by these fisheries to the objective of restoring (and when restored, maintaining) diversity, community structure and typical species is expected require significant management intervention. Fisheries are selective in themselves for target species, such that their prosecution is highly likely to alter community structure and diversity. Moreover, even if the disturbance of seabed sandy sediments by mobile bottom-contacting gears is not greatly different from the disturbance of these sediments by natural processes, the fishing gears will increase mortality to many epibenthos and burrowing benthic species, again potentially altering community structure and diversity. Now the Habitats Directive only seems to require that communities and populations all be in "favourable" status (defined circularly at least in these reports) and not explicitly that they be in unimpacted states. Hence some degree of fishing impact may be consistent with the Directive and the Conservation Objectives of this initiative. However, the sustainability of fishing impacts on the most vulnerable species needs to be established, as does the stability of biodiversity and community structure in the face of all fishing-induced mortality (retained or not). As I understand the Habitats Directive, the burden of proof lies with those who wish to continue a pressure posing a potentially high threat, to provide evidence of the sustainability of the impacts. Even if it can be established that some fishing could occur while posing no more than negligible risk of failing to achieve the conservation objectives, the natural, intensity and spatial distribution of effort and mortality (mortality of target species, bycatch species, and benthos killed by not retained in the gear) would have to managed and monitored carefully.

Information on patterns and intensity of activity of various gear sectors: The UK data on overall catch, effort and value data are presented first for individual ICES rectangles. Catch and value data are disaggregated by species, and effort data by gear sector when appropriate. Three consecutive recent years of data are presented.

Data at this scale are of at best moderate use in evaluating the scale of fisheries in the proposed protected area, because the boundaries proposed for the area do not follow the boundaries of the ICES rectangles. However, VMS data were used to estimate effort by vessel and gear type on much finer spatial scales of 0.05 decimal degrees. The procedures used to estimate fishing effort from VMS data are described briefing in the Annex, and reference to a more comprehensive technical explanation of the methods is provided. The methods have become well established in the fisheries community and I am satisfied that the described methods for obtaining file-scale effort data from VMS meet all disciplinary norms for sound practice. Although VME data are only available for vessels greater than 15 meters, .the document reports that there are no landings from the area reported by vessels less than 15 meters. I know of no contradictory information to contest that statement, so I am satisfied that the fine-scale effort data are sound. Even at 0.05 degree spatial units, these individual units are not fully impacted by every individual trawl that passes through the square. However all management decisions are going to be applied on scales larger rather than smaller than those 0,05 degree VMS units of resolution. Hence the small amount of "smearing" of very fine scale patterns of fishery impacts at the scale of the individual squares does not weaken the basis for science advice.

Going from the fine scale effort data to matching-scale catch data becomes more uncertain. Information from vessel landings records and logbooks was allocated trip by trip (and sometimes, if possible, even tow by tow) to each small square. These data sources are uncertain to begin with, although a number of EC and national initiatives are reported to be greatly increasing the reliability of logbook and catch reporting. Even if they are imperfect they are the best data available, and have been accepted as part of the basis for fisheries advice for many years. There is further uncertainty because allocating logbook and catch reporting data to the small squares was done assuming there was a direct proportionality between effort and catch on the scale of each record. This assumption may increase the variance in estimates slightly, but I do not expect it to be a source of bias. It is also an assumption underlying a large number of widely undertaken fisheries computations, and is no way a unique feature of this report.

The very large majority of fishing effort and catch data used in the report are from UK vessels or from foreign vessels fishing in UK waters and landing in UK ports. The SAC Final 1A reports catches at the ICES rectangle scale from fisheries by vessels registered to other EU States and Norway (Table 2.4). However the table is not clear if all those catches (and the catches in table 2.5) are included in the data used in the report, and does not break down those catches to portions of the rectangles inside the proposed MPA and outside its proposed boundaries. I also could not find an explicit statement whether the amount of fishing in the proposed protected area by non-UK vessels that do not land in UK ports was large or small compared to effort by UK vessels or foreign vessels landing in UK ports. The report only says any such catches are not captured in the data that are analyzed. The report is structured as if such non-UK fishing is not large in the proposed MPA, consistent with the final two figures of Dutch effort in Annex II and the text associated with table 2.9 and the narrative reports from Denmark and Norway. If there is substantial non-UK fishing in the area then the current risk assessment information is a minimum scenario, and the actual potential threat (and

corresponding need for management measures to achieve the conservation objectives) is actually larger than discussed in the report.
Support for proposed fisheries management measures: The Report 1A is vague with regard to management measures for fisheries that may be called for:

> "The UK will consider, in collaboration with the Dutch and German authorities, applying to the EC for controls to close parts or all of the Dogger Bank (across UK, Dutch and German SACs) to some forms of fishing if justified to achieve the conservation objectives in order to reduce the impacts of fishing on benthic communities and target and non-target fish and shellfish species. Experimental closures may be considered, to inform future management measures based on their relative success."

It is certainly fully justified to say that the UK government will *consider* seeking measures to close parts or all of the proposed SAC to "some forms" of fishing, and to plan to work in cooperation with actions by German and Denmark in their corresponding SACs. The Report is careful to qualify the "will consider" to be explicit that the relevant consideration is "if justified to achieve the conservation objectives. At least some experimental closures of selected subareas of the SAC will be necessary if only to evaluate if fishing is jeopardizing achievement of the conservation objectives as stated in the quoted text.

Overall, the case has not been made and supported with sound and well documented science - at least not with information available to this review - that a closure of *all* the SACs to all forms of fishing, or even to all mobile bottom-contacting gears, will be necessary to achieve the conceptual conservation objectives presented at the beginning of the Report. Nor is it possible to conclude from the information available that some level and forms of fishing definitely *will* be possible within the SACs.

In the short term the uncertainty about the nature and extent of management measures needed for the Dogger Bank SAC can be reduced if conservation objectives with greater specificity (i.e. more "operational") can be developed and justified relative to the requirements for compliance with the provisions of the Habitats Directive.. There is no question that fishing will cause *some* change to biodiversity and community structure, if only some change in the relative abundance of species. And there is no question that fishing with mobile bottom contacting gears will cause some at least transient changes in the sediment distribution. However "some change" does not mean failure to maintain (or restore) "natural environmental quality and processes, diversity and community structure". Objectives which make clear the degree of change consistent with the necessary outcomes under the Directive will be invaluable in providing a basis for selecting necessary (or alternative) management options. Lessons learned from monitoring experimental closures about how much different types of fishing actually change the quite distinct habitats and community properties of the Dogger Bank SAC as well.