Recommended Best Practices for

Regional Fisheries Management Organizations: Technical Study No. 1

Regional Fisheries Management Organizations: Progress in Adopting the Precautionary Approach and Ecosystem-Based Management

Marjorie L. Mooney-Seus and
Andrew A. Rosenberg

CHATHAM HOUSE

Regional Fisheries Management Organizations

Progress in Adopting the Precautionary Approach and Ecosystem-Based Management

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Acronyms

See also page xi for a fuller list of RFMO acronyms.

ACFM	Advisory Committee on Fishery Management (ICES)
ADF&G	Alaska Department of Fish and Game
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black and Mediterranean Seas
AIDCP	Agreement on the International Dolphin Conservation Programme
ASCOBANS	Agreement on Conservation of Small Cetaceans of the Baltic and North Seas
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CEMP	Comprehensive Ecosystem Monitoring Programme (CCAMLR)
CDS	Catch Documentation Scheme
CEY	Constant exploitation yield
CL	Conservation limit
CLA	Catch Limit Algorithm
CPUE	Catch-per-unit effort
DFO	Department of Fisheries and Oceans (Canada)
EBM	Ecosystem-Based Management
EEZ	Exclusive Economic Zone
EMP	Ecosystem Monitoring Programme
ENSO	El Niño Southern Oscillation
ERSWG	Ecologically Related Species Working Group
EU	European Union
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization
FIGIS	FAO Fisheries Global Information System
GEF	Global Environment Facility
HELCOM	Helsinki Commission Baltic Marine Environment Protection Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
IDCP	International Dolphin Conservation Programme
IFQ	Individual fishing quota
IOTC	Indian Ocean Tuna Commission
IPOA	FAO International Plan of Action (i.e. sharks, sea birds, IUU fishing and Capacity Reduction)
IUCN	World Conservation Union
IUU	Illegal, Unreported or Unregulated
LOU	Local operational unit
LRP	Limit reference point
MCS	Monitoring, control and surveillance
MedFiSis	Mediterranean Fishery Statistics and Information Systems
MLS	Minimum landing size
MP	Management Procedure
MPA	Marine Protected Area
MSY	Maximum sustainable yield
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NPOA	National Plan of Action
PA	Precautionary Approach
PAG	Processor Advisory Group
REIO	Regional Economic Integration Organization
RFMO	Regional Fishery Management Organization
RMP	Revised Management Procedure
RPB	Retinol binding protein
SAC	Scientific Advisory Committee
SAP	Strategic Action Programme
SBT	Southern bluefin tuna
SCIC	Standing Committee on Implementation and Compliance
SCRS	Standing Committee on Research and Statistics
SRP	Scientific Research Programme
SSB	Spawning stock biomass
SSRU	Small-scale research unit
TAC	Total allowable catch
TIS	Trade Information Scheme
TOR	Terms of reference
TRP	Target reference point
UNCLOS	UN Conference on the Law of the Sea
UNEP	United Nations Environment Programme
VMS	Vessel-monitoring system
WCP(F)O	Western and Central Pacific Ocean
WG-EMM	Working Group on Ecosystem Monitoring and Management (CCAMLR)
WG-FSA	Working Group on Fish Stock Assessment (CCAMLR)

Executive summary

Regional Fisheries Management Organizations (RFMOs) employ a variety of approaches and methods to manage resources and associated ecosystems under their jurisdiction. Based primarily on a review of annual and technical reports of 13 RFMOs and various publications by the UN Food and Agriculture Organization (FAO), 'best practices' were identified with respect to Ecosystem-Based Management (EBM) and the Precautionary Approach (PA). In addition, information was collected on RFMO target and non-target species, management decision rules and operational benchmarks (where possible), research programmes, and use of scientific advice in decision-making. Through an understanding of best practices employed by various RFMOs, a model for improved high seas governance is derived, which includes measures to promote both EBM and PA.

RFMOs reviewed were chosen because their mandates provide the authority to enact management measures. The following RFMOs were examined: Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR); Commission for the Conservation of Southern Bluefin Tuna (CCSBT); General Fisheries Commission for the Mediterranean (GFCM); Inter-American Tropical Tuna Commission (IATTC); International Baltic Sea Fisheries Commission (IBSFC – now defunct); International Commission for the Conservation of Atlantic Tunas (ICCAT); International Pacific Halibut Commission (IPHC); International Whaling Commission (IWC); Northwest Atlantic Fisheries Organization (NAFO); North Atlantic Salmon Conservation Organization (NASCO); North East Atlantic Fisheries Commission (NEAFC); South East Atlantic Fisheries Organization (SEAFO); and the Convention on the Conservation and Management of Highly Migratory Fish Stocks of the Western and Central Pacific Ocean (WCPFC).

Owing to the decline of many commercially exploited fish stocks, there is a worldwide movement by fisheries managers to embrace EBM and PA and go beyond traditional management approaches (i.e., single-species/stock management plans, which generally assume that the productivity of the stock is a function of its inherent population characteristics). EBM acknowledges that fishing and other activities take place within complex communities of organisms and habitats and that fishing is only one of many human activities which affect these marine environments. EBM considers the cumulative impacts of different sectors on the ecosystem. In the fisheries management context, the main goal of EBM is the sustainability of catches without compromising the inherent structure and functioning of the marine ecosystem. In general, PA is intended to 1) avoid the tendency to address problems only in retrospect, after substantial economic and ecological losses have occurred, by using prudent foresight to guide resource use; 2) promote a more equitable balance between short-term considerations (which often lead to overfishing) and longer-term considerations; and 3) counteract the effects of current high economic discount rates, which provide a strong incentive to overfish, maximizing the discounted net benefits from a stock by *de facto* preferring present consumption over future consumption.[1]

[1] United Nations, 'The Precautionary Approach to Fisheries with Reference to the Straddling Fish Stocks and Highly Migratory Fish Stocks', United Nations General Assembly, UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 14–31 March 1994, A/CONF. 164/INF/8, 26 January 1994, p. 9.

Arguably, single-species management schemes are not the cause of overexploitation of fish stocks. The failure is attributable to a lack of political will by fisheries managers and marine resource users to implement management measures in accordance with scientific advice and effectively enforce and comply with those management measures. Rather than abandoning single-species management, which has in some cases been successful (e.g. US/Canada Pacific halibut), it may be more appropriate to broaden the scope of existing management efforts to manage associated and dependent species.

Another determining factor in the success of fisheries management is the proper identification of conflicts and synergies between conservation outcomes and economic objectives. Inherent in the primary issues which hinder effective fisheries management, such as overfishing, bycatch and discards and Illegal, Unreported and Unregulated (IUU) fishing, is the struggle between short-term socio-economic costs/benefits and long-term conservation costs/benefits. Few of the RFMOs reviewed have well-articulated strategies for identifying and accounting for these socio-economic needs. NASCO and GFCM have defined socio-economic indicators. More typically, RFMOs consider associated costs and ecological benefits when they impose a new management measure or require the use of new fishing technology or methodologies (e.g. the use of pingers on fishing nets or mesh size requirements), and these considerations are implicit in the resulting regulation. Several RFMOs also collect trade data to identify future market opportunities or combat IUU fishing. However, if EBM and PA are to advance, socio-economic considerations must be deliberately stated and appropriately accounted for in management decisions.

How well RFMOs adhere to scientific advice when defining management measures, and how well they comply with those measures once they have been implemented, may provide a good indication of how effectively RFMOs will implement EBM and PA. Only three RFMOs – CCAMLR, IATTC and IPHC – and their respective Contracting Parties appear to comply consistently with both scientific advice and corresponding management measures. While both NASCO and the IWC seem to establish management measures consistent with scientific advice, Contracting Parties have not always complied with these management measures. The WCPFC does appear to be following scientific advice when establishing its management measures, but as it is a new organization, it is too early to tell whether these measures will be enforced effectively and adhered to by Contracting Parties.

In the case of NAFO, NEAFC, ICCAT and CCSBT, scientific advice was inconsistently followed when management measures were defined, and in some cases management measures were not adhered to when they were in place. In the case of GFCM and SEAFO, it is not clear whether scientific advice is being followed when management measures are adopted. SEAFO is a new organization, and GFCM has only recently begun to identify PA management measures for its respective stocks. In the case of the IBSFC, disputes between Contracting Parties over proposed management actions have often resulted in years of unregulated fishing for some stocks, so that it could be argued that the IBSFC has rarely followed scientific advice. Table 1, which summarizes the development of EBM and PA measures within organizations, also highlights how well each organization complies with scientific advice when drawing up management measures, and how well these management measures are complied with once they have been adopted.

Table 1: RFMO management measures

	CCAMLR	CCSBT	GFCM	IATTC	IBSFC	ICCAT	IPHC	IWC	NAFO	NASCO	NEAFC	SEAFO	WCPFC
Overarching objectives													
Decision rules													
Limit reference points													
Target reference points													
Management measures Access control													
Management measures Bycatch reduction													
Management measures Habitat protection													
Interim measures/ Recovery plan													
Capacity reduction scheme													
Evaluation & adjustment													
Voluntary Code of Conduct													
Research programme													
Experimental fisheries													
Monitoring & enforcement Monitors compliance													
Monitoring & enforcement Detection of ancillary impacts													
Monitoring & enforcement Penalties for non-compliance													
Management based on scientific advice	C	I	**	C	R	I	C	C	I	C	I	**	C
Compliance with management measures	C	I	**	C	R	I	C	I	I	I	I	**	**

Key for resource management measures	
	Implemented
	Developing, not applied or applied for some species
	No measures in place or insufficient information to evaluate or not applicable

Key for compliance with scientific advice/management measures	
C	*Consistent* compliance
I	*Inconsistent* compliance
R	*Rare* compliance
**	*Insufficient data for evaluation*

Note: This table merely provides an analysis of whether measures are in place, not how effectively each measure is implemented or enforced. However, each RFMO has been an overall rating based on its use of scientific advice in defining management measures and on the general effectiveness of its management measures (i.e. overall condition of stocks based on Contracting Parites' compliance with management measures).

Of all the RFMOs reviewed, CCAMLR is the most advanced in terms of developing and implementing EBM/PA measures. CCAMLR has not only adopted overarching objectives and decision rules which incorporate PA and EBM for some of its key stocks, but has also adopted precautionary reference points (targets and limits). CCAMLR serves as a model for its efforts to monitor and remediate impacts on associated and dependent species, for example, by establishing total allowable catches (TACs) for bycatch species and tying them to TACs for managed species; closing areas when bycatch targets are reached; and including a set-aside for predators when establishing TACs for target stocks. CCAMLR has a Comprehensive Ecosystem Monitoring Programme (CEMP), which not only monitors the relationship between target and associated and dependent species, but also conducts assessments on predator populations. In addition, CCAMLR applies a number of measures to mitigate seabird bycatch (e.g. setting nets at night; employing tori lines in longline fisheries; moving the start of the fishing season to avoid conflict with birds; and testing a new pumping system in the krill fishery so that the trawl net can remain in the water, thereby reducing bird bycatch). Nevertheless, CCAMLR was viewed as having only partially implemented penalties for non-compliance, because it still is plagued by IUU fishing. Overall, CCAMLR fish stocks are considered to be in good condition, although some are fully exploited and others are being fished without management.

CCSBT is the only organization to pre-specify what should happen when TACs generated by the Management Procedure (MP) are considered to be 'highly risky' or inappropriate, to incorporate regular review and MP revision, and to establish performance measures. The problem is that management advice is not always followed. CCSBT also accounts for both Contracting and Non-Contracting Party fishing effort in its TAC. CCSBT has a fairly comprehensive Trade Information Scheme (TIS), but it has failed to impose any strong penalties on states involved in the sale and distribution of tuna taken in IUU fishing activities. In terms of EBM, CCSBT has instituted educational efforts to improve data collection and reduce seabird and shark bycatch. The organization also compiles and analyses data on species that prey on bluefin tuna. Even though there is a solid scientific foundation, CCSBT efforts to rebuild depleted southern bluefin tuna stocks have been slow, because catches in recent years have remained too high. Australian scientists estimate that the current southern bluefin tuna stock is between 3% and 14% of the 1960 level and between 14% and 59% of the 1980 level.[2]

The GFCM's overarching objective captures the need for taking into account the best scientific evidence that is clearly in keeping with the PA. More than any other RFMO, it has acted to ensure that its Contracting Parties are familiar with and practise the FAO Code of Conduct, which defines key aspects of both PA and EBM. Furthermore, GFCM is using the Code to develop the means for gathering and accounting for socio-economic data in its management approach. GFCM prohibits the use of towed dredges in trawl-net fisheries at depths greater than 1,000 metres, and the use of bottom-trawls and dredges in three areas to protect corals, cold hydrocarbon seeps and seamounts. Generally, catch-per-unit effort (CPUE) is declining in the Mediterranean. The FAO's most recent global assessment identified a number of Mediterranean stocks as overexploited, including bluefin tuna, Atlantic bonito, hake, swordfish, whiting, striped mullet and sea bream.

IATTC has made some progress in implementing the PA and EBM. The IATTC objective encompasses important aspects of both EBM and PA, citing the need to be more cautious when information is uncertain, and the requirement to adopt management measures for associated and dependent species.

[2] http://www.deh.gov.au/biodiversity/threatened/species/southern-bluefin-tuna.html.

While IATTC has an exemplary research programme and has adopted management measures that are consistently complied with by Contracting Parties, the organization still grapples with the problem of IUU fishing, which threatens to undermine its management efforts. Several IATTC stocks are considered fully exploited, and the rebuilding plan for marlin has been only moderately successful. While IATTC has made progress defining precautionary reference points for many of its stocks, the reference points have not yet been fully translated into adaptive management measures for all species. IATTC, unlike most other RFMOs reviewed, has a capacity management scheme in place that actually defines an overall capacity goal for its Convention Area. In addition, IATTC's unique position as Secretariat for the Agreement on the International Dolphin Conservation Programme (AIDCP) has resulted in a much broader ecosystem focus. IATTC has adopted measures to address bycatch of juvenile tuna and associated and dependent species in its regulated tuna fisheries, most notably dolphins and sea turtles. IATTC and ICCAT are the only two RFMOs to impose strict measures to penalize vessels engaged in IUU fishing (e.g. trade sanctions) to promote better compliance with regulations. For the most part, IATTC stocks are considered to be healthy (exceptions include North Pacific albacore, bigeye and south-eastern swordfish), although they are lower than their historical levels.

When the IBSFC was in place, IUU fishing, bycatch and discarding practices were widely recognized as serious problems in the region. In addition, the organization consistently exceeded limits recommended by the International Council for the Exploration of the Sea (ICES) when establishing TACs. Under Baltic 21, IBSFC had promised to advance EBM measures, but those measures were not realized prior to the dissolution of the organization. Even now that the European Union has taken over the primary responsibility for managing Baltic fish stocks, scientific advice is not fully heeded. In 2006 TACs for the severely depressed eastern Baltic cod stock were not reduced to the levels recommended by ICES to rebuild the stock. While Baltic herring and sprat stocks appear healthy, owing in part to favourable environmental conditions, cod and salmon in some areas are seriously overfished.

ICCAT has not made much progress towards developing limit reference points or corresponding management actions. It is also inconsistent when developing management measures to conserve and/or rebuild fish stocks. However, ICCAT, like IATTC, is one of the few RFMOs that use strict enforcement measures (e.g. sanctions) to penalize fishing vessels engaged in activities that undermine stock conservation. ICCAT has adopted some broader EBM measures in recent years. ICCAT is assessing and regulating seabird bycatch and shark finning. The majority of ICCAT-managed stocks are either overfished or fully fished, or their status is unknown.

IPHC, IWC and NASCO are good examples of the effective implementation of the PA under single-species or multi-species management. All have developed limit and/or target reference points. IPHC has successfully restored halibut stocks under a conservative rebuilding programme. The IWC has defined a precautionary management strategy for sustainably fishing whale populations worldwide. This strategy has not been fully implemented for any of the whale stocks, and management is still based on a moratorium. Some whaling has taken place under an objection procedure, or scientific protocol, and remains extremely controversial. NASCO has developed guidelines for implementing the precautionary approach, including river-specific conservation limits. However, the onus remains on Contracting Parties to actually develop corresponding management measures to rebuild depleted salmon populations. In addition, while a moratorium is in effect to help protect salmon on the high seas, IUU fishing continues to impede stock recovery.

With respect to EBM, IPHC and the IWC have taken definitive action to address bycatch of halibut or cetacean species in non-target fisheries. NASCO assesses the risks and the benefits to the Atlantic salmon stocks, including the socio-economic implications of any given project. The IWC's progress in implementing EBM has been limited, with the notable exception of collaborative research with CCAMLR regarding krill/whale relationships and accounting for ship strikes when establishing TACs. However, progress in advancing EBM in these three organizations is likely to be hindered by their limited mandates, which apply either to a single species or to a specific class of marine species. In terms of status of managed stocks, the Pacific halibut stock under IPHC is considered healthy; for the IWC the majority of whale stocks, with the exception of northern right whales, have either recovered or are showing signs of improvement. However, salmon stocks in the North Atlantic Ocean remain in a precarious state.

NAFO scientists have developed a PA framework that includes target and limit reference points, as well as buffer zones to help ensure that precautionary limits are not exceeded. However, this framework has yet to be widely adopted by the Fisheries Commission. The PA has been applied to a few NAFO-managed stocks, most notably yellowtail flounder. NAFO has also adopted a rebuilding plan for Greenland halibut, but this plan has not been adequately enforced. In terms of implementing EBM, NAFO has not made significant progress. For instance, bycatch and discarding remain serious problems for the organization. NAFO has begun to develop research guidelines to identify sensitive deep-sea habitats within the Convention Area (i.e., seamounts). At present, almost half of NAFO-managed stocks remain under moratoriums and are subjected to continued exploitation as a result of IUU fishing. None of these stocks have clear rebuilding plans.

An initial examination of NEAFC reveals that there has been limited progress in adopting PA and EBM measures. ICES scientists have generated precautionary reference points and management recommendations for NEAFC's five primary stocks, but this has not always resulted in corresponding management actions. From an ecosystem perspective, NEAFC has been proactive in protecting deep-sea habitats by prohibiting several gear types from fishing at depths greater than 200 metres and closing five areas to all fishing to protect seamounts. NEAFC has also imposed catch reductions or fishery closures (i.e., basking sharks) to help rebuild depleted shark populations. All but one of NEAFC's primary target stocks are considered fully exploited or harvested at unsustainable or unknown levels.

Both WCPFC and SEAFO include 'precautionary' language in their respective conventions. However, it is too early to tell if these organizations will follow through with the development of precautionary reference points and appropriate management actions for all of their respective stocks. SEAFO's reluctance to follow scientific advice and establish a cap on deep-water fisheries as an interim measure until sufficient scientific data can be collected to clarify further management action is clearly not precautionary, or even in keeping with its own mandate. Nevertheless, SEAFO's requirement that all fishing vessels be equipped with vessel-monitoring systems (VMS) and carry scientific observers, as well as other interim measures to deter IUU fishing (e.g. port inspection scheme, prevention of transhipments at sea for species covered by the SEAFO convention and record-keeping by authorized fishing vessels), are positive steps, provided there is adequate enforcement. SEAFO has laid the foundation for future EBM within its waters, by instituting measures to curtail shark and seabird bycatch and protect deep-sea habitats. In fact, it is only one of two RFMOs (along with NEAFC) to proactively close to fishing an area that is believed to contain sensitive deep-sea

habitat (e.g. seamounts) and implement exploratory measures to study the area and small-scale impacts from fishing activities before permitting full-scale fisheries. WCPFC has been proactive in adopting interim measures to freeze fishing efforts on yellowfin and bigeye tuna. In addition, the fact that the relationship between these two tuna species and associated species is considered at least qualitatively in assessments is both precautionary and helping to promote EBM.

In summary, most RFMOs have taken steps to incorporate PA and EBM objectives in their management practices. Several RFMOs have actually adopted PA measures for some of their managed species. A few organizations stand out as having firmly embraced PA measures, resulting in effective management of some of their fisheries, such as IPHC and NAFO (yellowtail flounder) and the IWC. Most recognize the value of collecting bycatch data and have made progress in adopting various measures to curtail bycatch through gear modifications, imposing minimum size limits and mesh requirements, as well as adopting bycatch targets that can lead to the closure of fishing areas or the relocation of fishing effort. A number of organizations are beginning to collect data on associated and dependent species of target species and investing in the development of broader ecosystem models for defining future catch rates (most notable among these is CCAMLR). There appears to be a strong commitment by these organizations to assess and address IUU fishing, particularly by Non-Contracting Parties (e.g. ICCAT and IATTC). Some RFMOs, such as GFCM and NASCO, have recognized the importance of developing socio-economic indicators and incorporating socio-economic data in their management policies. Some have adopted capacity-reduction schemes (e.g. GFCM, IATTC and CCAMLR). Efforts are under way, stimulated in part by the UN General Assembly mandate, to identify sensitive deep-sea habitats (e.g. seamounts and cold-water corals), but beyond that little is being done to identify and protect other important spawning, nursery or feeding habitats.

What all RFMOs reviewed lack is adequate enforcement and compliance by Contracting Parties with agreed management measures. Furthermore, when catch limits have been established and are exceeded, only a few of these organizations have well-articulated, pre-negotiated management responses (CCAMLR and CCSBT).

Despite the limited application of EBM and PA measures in some areas, it is possible to derive 'best practices' by comparing progress within various RFMOs. Together, these best practices provide a framework for enhanced high seas governance and a model for more effective RFMO management (see Table 2).

EBM/PA parameters	Best practices	RFMOs applying best practices
Overarching objectives	Ecosystem considerations and precautionary principles; promotion and application of best available science.	*CCAMLR, IATTC*
PA decision rules	• Portion of TAC allocated to foodweb considerations. • Rebuilding targets for depleted stocks. • Robust suite of indicators and metrics of ecosystem structure, function, productivity and services at multiple scales. • Control rule includes estimated exploitable biomass thresholds where more conservative harvest rates apply – fishing ceases when limits are reached. • Catch limits account for uncertainty.	CCAMLR, IPHC, IWC

Table 2: Practices of an ideal RFMO

EBM/PA parameters	Best practices	RFMOs applying best practices
Limit reference points	• Minimum/average historical biomass. • MSY a limit for fishing effort, not a target. • Fishing not allowed when stocks below a predetermined proportion of carrying capacity (e.g. IWC 54%).	*CCAMLR*, *IATTC*, IBSFC (cod), *IPHC*, *IWC*, NAFO, NASCO (river specific), NEAFC
Target reference points	• Constant exploitation yield or fishing mortality targets. • SSB rebuilding target (e.g. MSY).	CCAMLR, CCSBT, IPHC, NAFO, NEAFC
Access control	Combination of measures including, but not limited to • Allocation schemes. • Closed areas/season. • Vessel/gear licensing. • Moratoriums, etc.	CCAMLR, CCSBT, GFCM, IATTC, IBSFC, ICCAT, IPHC, IWC, NAFO, NASCO, NEAFC, SEAFO (very limited)
Bycatch reduction	• Bycatch TACs. • Shifting seasons/areas to avoid high incidence of bycaught species. • Minimum size/corresponding to mesh/hook size requirements. • Mesh length requirements. • Innovative methods to reduce entanglement (e.g. night-time fishing, pingers, limits on soak time, use of tori poles). • Safe handling technique training for released species. • Measures to regulate bycatch in recreational and charter boat fisheries.	CCAMLR, GFCM, IATTC, ICCAT, IPHC and IWC (target species specific), NAFO, SEAFO, WCPFO
Habitat protection	• Habitat mapping schemes. • Closed areas for target, associated and dependent species.	*CCAMLR*, CCSBT/EU/HELCOM, GFCM, IATTC,
	• Pollution monitoring. • Restriction on gear type in sensitive habitats.	ICCAT (bluefin tuna), IPHC (target species specific), IWC (small cetaceans), NAFO, NEAFC, SEAFO (seamount bottom-trawling closures), NASCO (guidelines for river restoration)
Interim measures/ recovery plans	• Conservative MP framework. • Rebuilding plans.	*CCSBT*, *IPHC*, *IWC*, IBSFC, ICCAT, NAFO (Greenland halibut RBP not being adhered to), NASCO (limited work being done on high seas), WCPFO
Capacity reduction schemes	• Closed vessel registry. • Fleet segmentation scheme (local operational units). • Quotas for Contracting and Non-Contracting Parties. • IUU control measures.	CCAMLR, GFCM (LOUs), IATTC (closed vessel registry), CCSBT, ICCAT

EBM/PA parameters	Best practices	RFMOs applying best practices
Evaluation	• Flexible management framework, accounts for uncertainty and new information – adaptive. • Pre-specified rules when TAC deemed too risky.	*CCAMLR*, *IPHC*, CCSBT (pre-specified rules), IWC (not used as moratorium in effect), NASCO, NAFO and NEAFC (internal review process), WCPFO
Code of Conduct	• Education effort – disseminate Code of Conduct to Contracting Party fishing vessels. • FAO IPOAs: identification guides, gear/fishing method modifications to protect seabirds, turtles and sharks.	*GFCM*, CCAMLR, CCSBT, IATTC, IBSFC, ICCAT, NAFO, NASCO, SEAFO, WCPFO
Research programme	EMP with data collection protocols, including data on socio-economic considerations, impacts of fishing on sensitive habitats and associated and dependent species, ecological relationships between species/habitat, population assessments for associated and dependent species, and ecosystem models which incorporate cumulative impacts, climate change variables.	*CCAMLR*, *GFCM*, *IATTC*, CCSBT and IPHC (target species specific), IBSFC, ICCAT, NAFO
Experimental fisheries	• Experimental/exploratory fishery monitoring and assessment requirements. • Restrictions on number of new entrants.	*CCAMLR*, SEAFO
Monitors/ improves compliance	• Real-time 100% observer coverage. • VMS. • Catch/trade documentation schemes – exchange of trade data with other RFMOs. • Criteria for cooperating status with small allocation of quota. • Minimum standards for data collection and submission of national reports to RFMO. • Joint inspection schemes (Contracting Parties and independent inspectors).	CCAMLR, CCSBT, ICCAT
Monitors/ improves compliance	• Fund for capacity-building to meet data collection, quality assurance and reporting obligations (particularly for developing countries).	CCAMLR, CCSBT, ICCAT
Penalties for non-compliance	• Black/white lists. • Landings and transhipments from non-complying parties prohibited. • Trade restrictions/sanctions imposed.	IATTC, CCSBT, ICCAT

Note: Italics denote RFMO that are applying all best practices under a given EBM/PA parameter.

Challenges in moving ahead with best practices of EBM/PA management

With EBM, RFMOs are challenged to manage complex marine ecosystems which require an even greater amount of data and information about ecological relationships and the impact of human activities than under single-species management regimes. When applied in conjunction with the PA, prudent foresight needs to be exercised when data and information are lacking. If little is known about the state of a resource or the potential effect of a human activity such as fishing, then the activity should be strictly limited until it is possible to determine whether it is likely to be sustainable. However, external factors such as poverty alleviation, food security, profit motives and lack of political will are likely to hinder progress in achieving effective management of marine resources under these new schemes, just as they hindered management under single-species management approaches.

The age-old social equity debate must still be dealt with – balancing the tradeoffs between short-term economic gains of fishing under the status quo and the costs associated with imposing immediate, stricter management measures which contribute to long-term conservation of fish stocks and future economic benefits. Since humans are components of the ecosystem under EBM, the costs and benefits of new measures must be more fully considered. Short-term costs of imposing management include, among others:

- declining food sources for impoverished nations;
- a reduction in fishing-related jobs;
- impacts on long-standing social communities; and
- investment in EBM measures, such as capacity-reduction schemes and expanded research and monitoring programmes.

These short-term costs must be balanced against the long-term costs of maintaining the status quo, such as:

- declining food sources for impoverished nations;
- forgone profits to future fishermen;
- societal costs of supplying subsidies to the fishing sector, which result in reduced fixed and variable costs or increased revenue but distort trade, undermine competition and often lead to overexploitation and resource declines; and
- greater costs of complex management measures to address overfishing, bycatch and discards, IUU fishing and pollution, which require collaboration with other sectors (e.g. offshore oil and gas operations, mineral extraction, shipping, etc.).

A further challenge to EBM/PA implementation is that for many RFMOs the majority of their regulated fish stocks are either fully fished or overfished. This leaves little room to allocate shares to new members, including developing countries. In addition, some RFMOs have opt-out procedures, whereby Contracting Parties may, without penalty, within a set period of time choose not to abide by agreed fishing regulations, thereby undermining the effectiveness of management efforts. IUU fishing activities also undermine management efforts.

IUU fishing is a large and complex problem, which is unlikely to be solved in the near future. IUU fishing has global effects and will require creative solutions at global, regional and local levels. Solutions identified by RFMOs include trade monitoring and, in artisanal and non-industrially based

fisheries, improving the implementation of co-management. Clearly, there is a need to improve the individual as well as corporate accountability of all parties involved in fishing. In this context, some RFMOs have made progress in developing and circulating both 'positive' and 'negative' vessel lists and imposing sanctions on violating parties as a way to combat IUU fishing in oceanic areas. This approach requires additional information for management to be effective, with consequent increases in costs to obtain high-quality information. Therefore, considerable resources are needed to improve global monitoring and control of IUU fishing, but the benefits could exceed the costs.

As was the case for single-species management under EBM and the PA, a concerted effort to ensure adequate follow-through with enforcement and compliance mechanisms (e.g. comprehensive observer programmes, dockside and on-board monitoring of catch and discards with sufficient deterrents to penalize non-compliance) is imperative. Stakeholder participation, education and adequate information dissemination also are needed to explain fully and enlist support for the development and implementation of EBM and PA measures.

1

Introduction

The intent of this report is to provide a brief summary and review of the various approaches, operational benchmarks (process, methodology or reference points) and best practices exhibited by Regional Fisheries Management Organizations (RFMOs) in addressing the conservation and management of the resources and associated ecosystems under their management. This accepts that RFMOs vary in the extent to which environmental issues are explicitly included as a responsibility in the agreements or conventions that established them.

The report examines the following 13 RFMOs, which have management responsibility for fish stocks:

Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)

Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

General Fisheries Commission for the Mediterranean (GFCM) FAO

Inter-American Tropical Tuna Commission (IATTC)

International Baltic Sea Fisheries Commission (IBSFC)

International Commission for the Conservation of Atlantic Tunas (ICCAT)

International Pacific Halibut Commission (IPHC)

International Whaling Commission (IWC)

North Atlantic Salmon Conservation Organization (NASCO)

North East Atlantic Fisheries Commission (NEAFC)

Northwest Atlantic Fisheries Organization (NAFO

South East Atlantic Fisheries Organization (SEAFO)

The Convention on the Conservation and Management of Highly Migratory

Fish Stocks of the Western and Central Pacific Ocean (WCPFC)

The evaluation of these RFMOs consists of a three-tiered approach: a) review of current RFMO management activities and ecosystem considerations; b) assessment of level of application of Precautionary Approach (PA) by respective RFMOs; and c) classification based on level of compliance with scientific advice.

A. Terms of reference for RFMO review

Terms of reference (TOR) were developed to provide a summary of current and proposed management measures and research for target and non-target species for each RFMO. The five elements of the TOR include:

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and Illegal, Unreported or Unregulated (IUU) activities and decision rules to identify management measures.

2. Application of the Ecosystem-Based Management (EBM) approach (including targets, limits, management measures and decision rules) to:

   2.1 bycatch, incidentally caught and non-target species;

   2.2 species listed by recognized authorities as threatened, endangered or protected;

   2.3 trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem); and

   2.4 habitats.

3. Application of the Precautionary Approach (PA), including highlighting precautionary elements in general or from 1 and 2 above.

4. Data collection and sharing:

   4.1 target species (effort, catch, area, time);

   4.2 bycatch, incidentally caught and non-target species;

   4.3 species listed by recognized authorities as threatened, endangered or protected;

   4.4 trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem);

   4.5 habitats; and

   4.6 non-party and IUU fishing activities, catch and impacts.

5. Content, structure and process of scientific advice.

B. Application of the Precautionary Approach

To assess the extent to which the PA is applied by these RFMOs, a series of international instruments – including the Food and Agriculture (FAO) Technical Guidelines on the Precautionary Approach, provisions of the UN Fish Stocks Agreement (1995), particularly those of Annex II, and the FAO Code of Conduct for Responsible Fishing (1995) and its associated FAO International Plans of Action – provide a coherent framework for evaluation.

According to the FAO Technical Guidelines, precaution is required in all aspects of resource management; for example, in development planning, management, research, technology development and transfer, legal and institutional frameworks, fish capture and processing, fisheries enhancement and aquaculture. Precautionary reference points are a central feature of any precautionary management strategy. Other needs also are important (e.g. access control systems to ensure that fishing capacity is commensurate with resource productivity, evaluation of alternative management systems, improved quality and reliability of input data, improved monitoring and enforcement, design of 'environmentally friendly' fishing gear, and education of fishermen and consumers). Thus the precautionary approach is multi-faceted and broad in scope. This report focused on the following key criteria, derived from the various agreements, as a basis for assessment:

- Limit reference points
- Target reference points
- Improved methodology to evaluate uncertainty and the risk attached to it
- Precautionary harvest control rules and assessment of their robustness

- Rebuilding strategies and plans (and special control rules) for overfished stocks
- Uncertainty about the state of stocks incorporated in management scenarios
- Explicit precautionary objectives by policy-makers as a basis for establishing target reference points
- Precautionary fisheries management plans
- Recovery plans for depleted resources

None of the aforementioned agreements offer detailed advice on how reference points need to be modified to take ecosystem interactions into account. Nonetheless, ecosystem-based reference points are needed to allow for natural mortality to support predator-prey interactions. Only two RFMOs have made significant progress on this front – the CCAMLR and the IATTC, the latter with respect to dolphins. The CCAMLR approach could generally be used as a model for other RFMOs.

C. Adherence to scientific advice

A full analysis of the effectiveness of respective RFMO management efforts, particularly with respect to the application of Ecosystem-Based Management (EBM) and the PA, was beyond the scope of this report, but each RFMO was evaluated on whether it based its management decisions, such as established Total Allowable Catches (TACs), on scientific advice and whether Contracting Parties actually complied with management decisions. RFMOs were categorized as 'consistently', 'inconsistently' or 'rarely' adhering to scientific advice and corresponding management measures.

D. Report structure

For each of the RFMOs reviewed a summary table is provided, which highlights progress in adopting both EBM and PA measures (see Tables 3–15). This is followed by a description of current and/or proposed management measures for target and non-target species of respective RFMOs. While neither the summary tables nor the individual RFMO reviews provide a full analysis of the effectiveness of various RFMO management or conservation schemes, Table 1 provides a synthesis of EBM and PA activities of reviewed RFMOs and/or proposed measures. Also included in this report are highlights of interim management measures imposed prior to the establishment of a new RFMO in the South Pacific and a brief discussion of some of the overarching short-term and long-term socio-economic considerations that are likely to influence RFMO management decisions.

E. Data and information quality

Data used to prepare RFMO summaries were derived primarily from annual and technical reports and from UN/FAO publications. Unless otherwise specified, the summaries reflect current or proposed efforts by various RFMOs to adopt EBM and/or PA measures. The report does not include an evaluation of the effectiveness of established measures.

2

RFMO Profiles

The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)

1. The target and significant retained byproduct species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) was established in 1982 mainly in response to concerns that an increase in krill catches in the Southern Ocean could have a serious effect on populations of krill and other marine life, particularly on birds, seals and fish, which mainly depend on krill for food. The aim of the Convention is 'to conserve marine life of the Southern Ocean excluding seals south of 60°S and whales (which are covered by the Convention for the Conservation of Antarctic Seals and the International Convention for the Regulation of Whaling respectively)'. CCAMLR strives to implement a holistic, or 'ecosystem' approach to the management of marine living resources. This approach views the entire southern Ocean as a suite of interlinked ecological systems and as such distinguishes CCAMLR from other multilateral fisheries conventions. However, this does not exclude harvesting being carried out in a rational manner.[3]

CCAMLR's ecosystem approach not only focuses on regulating fishing for certain species, it also aims to ensure that fishing does not adversely affect other species that are related to, or dependent on, the target species. For example, while krill harvesting is regulated and monitored directly, CCAMLR also endeavours to monitor the potential effect which harvesting may exert on species that either eat krill or in turn are eaten by krill predators. Therefore, CCAMLR seeks to preserve the 'health' of the ecosystem by setting conservative (i.e., precautionary) krill catch limits to take account of the needs of associated species in a manner which preserves the ecological sustainability of all the species concerned.

Harvesting and associated activities are conducted with the following principles in mind:

1. The prevention of a decrease in the size of any harvested population to levels below those which ensure its stable recruitment. For this purpose its size should not be allowed to fall below a level close to that which ensures the greatest net annual increment.
2. The maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources and the restoration of depleted populations to the levels defined in sub-paragraph (a) above.
3. The prevention of change(s) or minimization of the risk of change(s) in the marine ecosystem which are not potentially reversible over two or three decades, taking into account the state of available knowledge of the direct and indirect impact of harvesting, the effect of the introduction

[3] http://www.ccamlr.org/pu/e/gen-intro.htm.

Table 3: EBM and PA management in CCAMLR

Overarching objectives	To prevent a decrease in the population to the point where it affects recruitment; to maintain ecological relationships; to prevent ecosystem changes/minimize risk of change.
Decision rules	Species-specific, based on overarching PA objectives (e.g. *C. gunnari* and three-part decision rule for krill – portion of TAC allocated for predators). Rules are specified as the greatest catch that results in both a median expectation that the stock is > or = to the target level at the end of 20 years or one generation period of the stock (whichever is greater), and there being only a 10% chance or less that stock will become depleted (below the limit reference points over that time).
Limit reference points	Species-specific.
Target reference points	Species-specific.
Management measures Access/effort control	TAC, closed areas/seasons, vessel/gear licensing, moratoriums.
Bycatch reduction	Size limits, gear restrictions/requirements, bycatch and IUU fishing accounted for in TACs. Bycatch TACs tied to target species TACs. Measures in place for non-target fish, seabirds and sharks. Releases alive fish bycatch.
Habitat protection	Closed areas for both target and predators. Restrictions on bottom trawling in some areas. Regulates discharge of pollutants (e.g. plastics). Habitat protection measures for exploratory fisheries.
Interim measures/recovery plan	None apparent.
Capacity reduction scheme	Restricts the number of vessels in new and exploratory fisheries.
Evaluation	Flexible management framework, accounts for uncertainty, adaptive with new information.
Voluntary Code of Conduct	Implemented measures under FAO IPOAs (i.e., seabirds, sharks, IUU fishing and capacity reduction).
Research programme	Observer programme. Fishermen and research surveys to collect data. CEMP: monitors populations/biomass for target and associated/dependent species. Studying application of MPAs. Identification guides for seabirds/sharks. Collaboration with NOAA, GLOBEC and others.
Experimental fisheries	For new fisheries: exploratory/experimental fishery monitoring and assessment requirements.
Monitoring and enforcement	
Monitors compliance	VMS, inspections at sea/port, catch reports, CDS and shares trade/IUU data with other RFMOs.
Detection of ancillary impacts	Monitors predator/prey relationships for krill.
Penalties for non-compliance	Blacklist of IUU vessels and 'flags of non-compliance' – prohibits landings and transhipments.

Note: In Tables 3–5 the phrase 'Inadequate information to assess' means information was not readily available on the RFMO website. A full evaluation would require a review of Contracting Party reports and scientific papers, which was beyond the scope of this review. 'None apparent' means that after careful review of available information it is inferred that no measures/penalties are in place at the RFMO level.

> of alien species, the effects of associated activities on the marine ecosystem, and the effects of environmental changes, with the aim of making possible the sustained conservation of Antarctic marine living resources.[4]

Management strives to follow a 'precautionary' approach. This means that CCAMLR collects the data it can, and then weighs the extent and effect of the uncertainties and gaps in such data before making a management decision. The approach aims to minimize the risk of long-term adverse effects, rather than delaying decisions until all necessary data are available. Specifically, the models used by CCAMLR (e.g. the krill yield model, the general yield model, the foraging fishery model and emerging multi-species models) have all been devised to establish precautionary catch limits, which take into account uncertainties in abundance, biomass and potential yield estimates. For instance, high temporal population fluctuations can be explicitly included in the estimate of harvest rate. The management framework is also flexible and can accommodate adjustment of management objectives and reformulation of the criteria used to ensure that objectives are met. Specifically, CCAMLR's precautionary catch levels for krill, and its willingness to close target fisheries when bycatch levels of non-target species are reached, are clearly precautionary measures.

CCAMLR has studiously avoided the issue of allocation by restricting itself to assigning area-based TACs only – an Olympic fishery. This approach acknowledges the existence of coastal state jurisdiction for some of the sub-Antarctic islands, either overtly for Heard Island (Australia), Kerguelen and Crozet Islands (France), Bouvet (Norway) and Prince Edward and Marion Islands (South Africa), or tacitly for South Georgia (UK). For these resources the rights of coastal states are therefore acknowledged, and there are very few stocks that straddle both Exclusive Economic Zones (EEZs) and high seas waters.

Both krill (*Euphuasia superba*) in the southern Atlantic and toothfish fisheries in the southern Indian Ocean and the Ross Sea take place in high seas waters away from the sub-Antarctic islands. For the krill fishery, there is no effective restriction of effort or allocation among Contracting Parties. Although Contracting Parties are required to notify CCAMLR of their intention in advance, this is only a nominal notification and not an allocation.

Target species

CCAMLR target species include Antarctic krill, Patagonia toothfish, Antarctic toothfish, sub-Antarctic lantern fish, mackerel, icefish, sevenstar flying squid, Antarctic rock cod and crabs.

A number of countries notified CCAMLR of their intention to harvest krill in the 2005–06 fishing season. These included Russia (15,000 tonnes), Japan (25,000 tonnes), the Republic of Korea (25,000 tonnes), Ukraine (30,000 tonnes), the United States (50,000 tonnes) and Norway (100,000 tonnes), giving a total of 245,000 tonnes. The Scientific Council noted that while the Commission has set catch limits for each sub-area in Area 48 in Conservation Measure 51-01, there is no requirement in Conservation Measure 23-03 to report catches at the scale of sub-area, and hence there was no mechanism by which to determine if a catch limit is exceeded.[5]

For the toothfish fishery in the Ross Sea, a rather different scheme is in operation. Because the fishery is classified as an 'exploratory fishery', all vessels and Contracting Parties intending to fish

[4] http://www.ccamlr.org/pu/E/e_pubs/am/p3.htm#2.2_CCAMLRs_Management_.
[5] Ibid., p. 15.

are required to notify CCAMLR of their intention in advance. These intentions are then confirmed in the legally binding CCAMLR Conservation Measures (e.g. CM 41-09 (2005) (see CCAMLR, 2005), which specify fishing opportunities by Contracting Party and the number of vessels each is permitted to use to fish. However, as in the case of krill fishery, this is not a negotiated allocation. It simply reflects applications of intent to fish by Contracting Parties. All vessels report their catch to the Secretariat, and the fishery is closed when the TAC is taken – but at least effort is restricted to those declaring an intention. Declaration itself carries a financial cost, a levy that is non-refundable and helps to finance the cost of administering the scheme.

Other fisheries operate in the Convention Area for finfish (seven exploratory fisheries in 2004–05) and crab and squid (*Martialia hyadesi)*. In total, during the 2004–05 season CCAMLR Contracting Parties actively participated in 13 fisheries in the Convention Area. In addition, four other managed fisheries were conducted in national EEZs within the Convention Area. By 21 September 2005 vessels fishing in fisheries managed under conservation measures in force in 2004–05 had reported a total of 124,535 tonnes of krill, 14,074 tonnes of toothfish *(Dissostichus* spp.) and 1,991 tonnes of icefish (*C. gunnari)*; other species were taken as bycatch (CCAMLR-XXIV/BG/13).[6]

Management measures

Current management measures include, *inter alia*, marking of fishing vessel and gear, licensing and inspection of Contracting Parties, schemes to promote compliance by Contracting and Non-Contracting Party vessels, data reporting, automated satellite-linked vessel-monitoring systems (VMS), port inspections of vessels carrying toothfish, and a toothfish Catch Documentation Scheme (CDS). Moratoriums are also in place for the following species: *Notothenia rossi* (Sub-areas 48.1, 48.2 and 48.3), *Gobionotothen gibberifrons, Chaenocephalus aceratus, Pseudochaenichthys georgianus, Lepidonotothen squamifrons* and *Patagonotothen guntheri* (Sub-area 48.3), *D. eleginoides* at Prince Edward and Marion Islands, *D. eleginoides* (Sub-area 58.7) outside the EEZ, *D. eleginoides* at Crozet Islands (Sub-area 58.6) outside the EEZ, *C. gunnari* at Kerguelen Islands (Division 58.5.1) and finfish species found around the Antarctic Peninsula and South Orkney Islands (Sub-areas 48.1 and 48.2).

Management options are identified from various model outputs. Decision rules, which specify the set of decisions that are made in setting, removing or varying management measures, are under development. To date they have been applied to catches in the krill fishery and the fisheries on Patagonian toothfish.[7]

Krill was initially considered from the single-species perspective, and a model based on a simple approach was developed for fish stocks by John Beddington and Justin Cooke in 1983. Their analyses provides a numerical factor (termed γ) that can be used to multiply a single estimate of biomass obtained from a survey before harvesting begins, to give an estimate of the potential annual sustainable yield. The value of the numerical factor depends on the biological parameters of the stock under consideration. Difficulties became immediately apparent when attempts were made to determine values of some of these parameters for krill, with the result that estimates of the potential annual yield for Sub-area 48.3 ranged widely, from 200,000 tonnes to 13 million tonnes.[8]

[6] CCAMLR, *Report of the Twenty-Fourth Meeting of the Commission*, Hobart, Australia, 24 October–4 November 2005, p. 4.

[7] K.-H. Kock (ed.), *Understanding CCAMLR's Approach to Management*, CCAMLR, 2000, http://www.ccamlr.org/pu/e/e_pubs/am/text.pdf.

[8] Ibid.

Efforts to improve both the model and the estimates of the parameters were accelerated by the Commission's request at its 1990 meeting for the provision of best estimates of precautionary catch limits for krill in the various statistical areas. The krill survey abundance estimates (termed B_0) were multiplied by γ to provide precautionary limits for annual catches. However, the wording of CCAMLR's Article II requires that the needs of krill predators also are given consideration in setting precautionary limits for the fishery. At present, detailed modelling of the impact the fishery might have on such predators has yet to provide reliable quantitative results, so an ad hoc approach is being followed.

The current determination of the potential yield in the krill fisheries is an example of a three-part decision rule employed by CCAMLR:

1. Choose γ1 so that the probability of the spawning biomass dropping below 20% of its pre-exploitation median level over a 20-year harvesting period is 10%;
2. Choose γ2 so that the median escapement in the krill spawning biomass over a 20-year period is 75% of the pre-exploitation median level; and
3. Select the lower of γ1 and γ2 as the level of γ for the calculation of krill yield. As the values of γ1 and γ2 will be different, the third part of the decision rule results in the lower of the two values being applied. A similar decision rule is applied to the fisheries for Patagonian toothfish.

Precautionary catch limits for finfish are derived from the general yield model (GYM), which incorporates estimates of either current or pre-exploited biomass together with their estimates of uncertainties. It also takes into account recruitment fluctuations and uncertainty in biological parameters. The GYM enables CCAMLR to predict the effects of different levels of catch, even in the absence of direct estimates of stock abundance. Precautionary catch limits can then be calculated. For some species (e.g. *D. eleginoides* at South Georgia) standardized catch-per-unit effort (CPUE) data are used as a basis for establishing TACs. In addition, the Scientific Committee agreed that the most appropriate approach for generating advice on long-term yield would be the method that uses tagging data (CASAL) employing the low L_{50} projection adjusted by the ratio of the low *M* and base case projections for this species. With respect to L_{50}, this means that for Patagonian toothfish the criterion has been modified to maintain populations at the level likely to give the 'greatest net annual increment', conventionally assumed to be 50% of the unexploited level. In addition, the period of the simulation (20 years in the case of krill) may be modified depending on the generation time of the species being studied.[9]

For toothfish taken off the Heard and McDonald Islands, a vulnerability pattern that combines trawl, longline and pots was calculated for use in the assessments. The GYM, using the updated time series of recruitment estimates and the updated length-at-age vector, was used to estimate the long-term annual yield that would satisfy the CCAMLR decision rules (Annex 5, paragraphs 5.91 to 5.96).

An example of the thought process involved in ensuring that decision rules are adhered to when TACs are established is apparent when examining efforts to establish the catch limit for icefish (*C. gunnari)* at Heard and McDonald Islands in 2005–06. Specifically, the Scientific Committee noted that

[9] G. Parkes, 'Precautionary fisheries management: the CCAMLR approach', *Marine Policy*, No. 24, 2000, pp. 83–91.

1. This catch would primarily be of age-4 fish, which would have been reproductively mature for at least one year;
2. The catch of this cohort in the following year (2006–07) should be zero in order to satisfy the decision rule that the biomass of the stock should be greater than, or equal to, 75% of that which would have been present after two years in the absence of fishing;
3. This strategy would provide for three years of reproduction by this cohort, although the strategy of having the catch concentrated in one year may slightly reduce the capacity for reproduction in the cohort's fifth year; and
4. Although it seems unlikely because of the absence of any indication of a strong 1+ year class in the 2005 survey, should a survey in 2006 show a 2+ cohort entering the fishable population, then it may be difficult to have a fishery in the 2006–07 season that results in a negligible catch of the current dominant cohort, which would be 4+ during that survey.

The Scientific Committee also requested that the Working Group on Fish Stock Assessment (WG-FSA) investigate the ages at which *C. gunnari* is likely to be most successful in reproduction. In doing so, WG-FSA is asked to consider how best to frame decision rules that satisfy the objectives of CCAMLR in terms of reproduction of the stock and the maintenance of predators, especially given the unusual demographic characteristics of this species. The Scientific Committee further requested that the development and evaluation of a Management Procedure (MP) for *C. gunnari* be considered a high priority.

In addition, CCAMLR's recognition that fisheries need to be managed from the time they start is precautionary. In CCAMLR terms, a 'new' fishery is one for a species and/or on a ground that has not previously been fished, or an 'established fishery' where there is an intention to use a new fishing technique. There is a requirement at the 'new' fishery stage to collect information on the target as well as dependent species, and the catch or effort (or both) may be limited. In CCAMLR parlance, a new fishery lasts for one year unless no catch is taken, at which time it retains its classification. In the second year the fishery becomes an 'exploratory' fishery. Both CCAMLR's conservative approach and data collection requirements continue to allow for a full assessment of the fishery and stock(s) to be developed. A data collection plan must be followed and a research and fishery operation plan produced. All such plans are reviewed each year by the Scientific Committee. The crab and squid fisheries around South Georgia are being managed in this way.

CCAMLR has recently introduced a requirement that exploratory toothfish fisheries follow clearly defined experimental fishing plans. This approach strives to maximize the data collection potential of fishing vessels, while ensuring that unacceptable damage is not inflicted on stocks for which key management data are missing. Therefore fishing vessels are required to undertake research on stock distribution and abundance as part of their development of either new or exploratory fisheries. This requirement applies to both toothfish and crabs. There also are catch and time/area restrictions in place on both catch and bycatch for all new and exploratory toothfish fisheries. Similar regulatory criteria are being developed for reopening fisheries that have lapsed or been closed.

IUU fishing

Although fishing by non-parties has decreased in the CCAMLR area recently, it still presents a problem, and the Commission puts considerable effort into deterring such activities. In the 2004–05

season (roughly corresponding to calendar year 2004) the total estimated Illegal, Unreported and Unregulated (IUU) catch in the Convention Area was 2,086 tonnes;[10] it was estimated that about 20% of the total catch of Patagonian and Antarctic toothfish came from IUU fishing. In fact, some of those catches came from vessels flying the flag of CCAMLR members, but the non-member vessels accounted for the vast majority of the catch.[11]

IUU fishing is monitored and accounted for where possible in catch data, such as *D. eleginoides* at South Georgia (Sub-area 48.3), the Kerguelen Islands (Division 58.5.1) and at Heard and McDonald Islands (Division 58.5.2). CCAMLR also has developed an integrated policy of conservation measures. This serves to increase the gathering of essential data and improve compliance with catch limits. Relevant measures include improved data recording procedures, the promotion of closer cooperation between CCAMLR parties and non-parties, the need for flag states to authorize their vessels to fish in the Convention Area, and a process to monitor the international toothfish trade. Specifically, CCAMLR has a species-specific, detailed Catch Documentation Scheme (CDS) to assist with analysis of trade data. This is useful in that gross discrepancies between reported catch and total traded volume can be identified.[12]

The CDS is one of a suite of CCAMLR measures aimed at eliminating IUU fishing in the Convention Area. Other measures include strict vessel licensing requirements, at-sea and port vessel inspections, and the requirement for the continuous monitoring of vessel positions in the Convention Area using automated satellite-linked vessel-monitoring systems (VMS). For a number of fisheries in the Convention Area, Contracting Parties are required to transmit real-time vessel position information to the centralized VMS database located at the CCAMLR headquarters.

CCAMLR reviews annually information on IUU fishing activities in the Convention Area and has established a list of IUU vessels of Contracting and Non-Contracting Parties. Vessels included on the list are presumed to have engaged in IUU activities in the Convention Area, thus undermining the effectiveness of CCAMLR conservation measures in force.

In addition, CCAMLR has introduced the new term 'flags of non-compliance' and requested that both Contracting Parties and Non-Contracting Parties prohibit landings and transhipments of fish and fish products from vessels identified in this category.

One problem in tracking the impact of IUU fishing results from the fact that there are substantial stocks of toothfish outside CCAMLR's jurisdiction. CCAMLR's IUU estimates and the tracking of trade through the CDS have helped to address the problem. The former relies on estimates of the number of vessels fishing in each sub-area within the Convention Area, the estimated number of trips to the area that a vessel would undertake, the length of these trips (in fishing days), and the mean catch rate. The derivation of these parameters has made use of a number of data sources, such as surveillance operations, reports of landings and port visits worldwide, interviews and examination of

[10] CCAMLR, *Report of the Twenty-Fourth Meeting of the Commission*, Hobart, Australia, 24 October-4 November 2005, p. 29.

[11] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*, Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 55.

[12] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, August 2005. Report prepared by a UK consultancy, MRAG, for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 49.

logbooks from apprehended vessels, and information from legal vessels and data (IUU catch rates can usually be assumed to be similar to catch rates of legal vessels, and trip duration can be inferred from hold capacity and catch rates). No attempt has been made to calculate bounds for these estimates.

While the CDS does not provide an estimate of IUU catch, it is thought that almost all toothfish trade is now carried out under the scheme. IUU catch must therefore be traded with false or erroneous documents. For instance, immediately following the introduction of the scheme, toothfish started to be declared as originating from the southern Indian Ocean, just north of the CCAMLR Convention Area, in both FAO and CDS statistics. Over the last three years the catch in these areas has very closely matched the CCAMLR estimates of IUU catch from the Indian Ocean sector of the Convention Area. This suggests that the recent estimates of IUU catch from the Indian Ocean sector made by CCAMLR using the method described above are probably reasonable. Similarly, comparisons of CCAMLR and trade data suggested that CCAMLR estimates of IUU fishing were an accurate reflection of the amount of IUU catch in trade in 1997 and 1998. Unfortunately, there is evidence that around the time of introduction of the CDS (in 1999 and 2000) CCAMLR underestimated the quantity of IUU catch in its waters.[13]

For the 2000–01 season, the Scientific Committee of CCAMLR estimated the total catch of Patagonian toothfish at approximately 56,445 tonnes. Of this amount, 13,725 tonnes were reported as caught by CCAMLR Contracting Parties within the Convention Area on both the high seas and within EEZs combined. Most of the remaining 42,720 tonnes were considered to be catch derived from IUU fishing. This figure includes 25,054 tonnes reportedly 'legally' caught outside the CCAMLR area, the large majority of which were thought to have been taken in IUU fisheries within the CCAMLR area, but intentionally misreported as having been caught outside the CCAMLR area to avoid market restrictions associated with CCAMLR's CDS.[14]

At the annual meeting of CCAMLR in 2002 the Commission concurred, stating that 'CDS reports of catches from outside the Convention Area in Areas 51 and 57 were unlikely to have come from those areas and most likely to have come from within the Indian Ocean sector of the Convention Area'. Furthermore, the Commission felt that the uncertainties associated with assumptions underlying the assessment of IUU fishing levels meant that the estimates of IUU fishing in the CCAMLR area were likely to be 'minimal' (i.e., lower than the actual IUU catch).

Altogether, the high seas catch of Patagonian toothfish for the 2000/01 season, including IUU caught toothfish, may have amounted to somewhere between 40,000 tonnes and 45,000 tonnes or more, although it is difficult to estimate this figure with any real degree of accuracy. Virtually all Patagonian toothfish caught on the high seas are taken in bottom longline fisheries.[15]

Additional efforts are being considered to improve estimates of IUU fishing, including:

(i) that the Secretariat should review its annual estimation and extrapolation of IUU catches after the close of the season (Annex 5, paragraphs 8.1 and 8.2);

[13] Ibid., p. 14.

[14] CCAMLR, *Report of the Twenty-First Meeting of the Scientific Committee*, Hobart, Australia, 21–25 October 2002, SC-CAMLR-XXI, Scientific Committee for the Conservation of Antarctic Marine Living Resources, p. 20 and Annex 5, Tables 3.2 and 3.3.

[15] M. Gianni, *High Seas Bottom Trawl Fisheries and Their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems*. Report prepared for the IUCN, Natural Resources Defense Council, WWF and Conservation International, 2004, p. 47.

(ii) to ask the Standing Committee on Implementation and Compliance (SCIC) to consider the further development of estimation methods for IUU catches;

(iii) to continue work to better understand the effectiveness of different levels of observation in detecting levels of IUU activity (Annex 5, paragraph 8.4); and

(iv) to ask the SCIC to consider undertaking a review of the historical series of IUU catches with respect to the assumptions made by the Working Group on Fish Stock Assessment (WG-FSA) in estimating these catches (Annex 5, paragraph 8.8).

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

Discards in bottom trawls and demersal longline fisheries have been estimated at 7.5% (ranging from 0.5 to 57%) in the Southern Ocean. The overall discard rate in the CCAMLR area is estimated at 12.7%, resulting in about 2,000 tonnes of mostly finfish and invertebrates annually.[16]

CCAMLR measures directly related to bycatch and discards can be grouped into reporting, gear regulations, bycatch limits, area and time restrictions, and mitigation measures (primarily directed at reducing seabird mortalities).

In response to the unintentional overfishing of several non-target fish species in bottom trawl fisheries around South Georgia and the South Orkney Islands in the mid-1980s, CCAMLR now requires that the effects of fishing on non-target species be accounted for in its management practices. In many cases, this has meant that TACs for target species are linked to allowable bycatch. Thus a fishery may be closed when it reaches the TAC level for the bycatch of a particular species, even if the TAC for the target species has not been reached. Bycatch limits, which are based on long-term assessments of biological status,[17] are in place for *Gobionotothen gibberfrons* (1,470 tonnes), *C. aceratus* (2,200 tonnes), *Pseudochaenichthys georgianus*, *Notothenia rossii* and *Lepidonotothen squamifrons* (300 tonnes each) in Sub-area 48.3. For the 2005–06 season bycatch limits were in place for *Channichthys rhinoceratus* (150 tonnes), *Lepidonotothen squamifrons* (80 tonnes), *Macrourus* spp. (360 tonnes), skates and rays (120 tonnes) and other bycatch species (50 tonnes per species). CCAMLR also requires vessels to relocate if bycatch limits per haul are reached (Conservation Measure 33-02, 2005).

CCAMLR has directly prohibited fishing when the risk to bycatch species is thought to be too great, as was the case with the mackerel icefish fishery around the South Orkney Islands. Fishing for this particular species has been confined to the use of midwater trawls only, as the potential for bycatch is lower.

In addition, the Commission agreed to a new move-on rule in exploratory fisheries, which was designed to encourage members and their vessels to improve the selectivity of fishing gear and fishing methods further. This rule requires vessels to monitor the bycatch of *Macrourus* spp. relative to that of *Dissostichus* spp. at ten-day intervals. If the catch of *Macrourus* spp. taken by a single vessel in any two ten-day periods in a single small-scale research unit (SSRU) exceeds 16% by weight of the

[16] FAO, 'The State of World Highly Migratory, Straddling and Other High Seas Fishery Resources and Associated Species', *FAO Fisheries Technical Paper 495*, 2006.

[17] http://www.scar.org/researchgroups/lifescience/ccamlr/hobart04/.

vessel's catch of *Dissostichus* spp. in those periods, then the vessel is required to cease fishing in that SSRU for the remainder of the season.[18]

Other bycatch reduction measures include:

(a) Contracting Parties report annually on both the incidence of marine debris encountered in the Convention Area and the resultant impact, including entanglements on marine mammals and seabirds.

(b) Mesh size requirements are in place for pelagic and bottom trawls fishing for *Notothenia rossii*, *Dissostichus eleginoides* (120 mm) and *Gobionotothen gibberifrons*, *Notothenia kempi* and *Lepidonotothen squamifrons* (80 mm).

2.2 Species listed by recognized authorities as threatened, endangered or protected

CCAMLR has taken steps to reduce incidental mortality of albatrosses and white-chinned petrels in longline fisheries targeting Patagonian toothfish. Vessels deploying longlines in the Convention Area now use various methods to reduce this catch. For example, longlines are set at night, offal is not thrown overboard during setting, and streamer lines (or 'scare devices') are deployed to minimize potentially damaging interactions between foraging seabirds and longlines. Also, the opening of the toothfish season has been moved to a time when fewer birds are likely to be in the Convention Area or proximal to fishing vessels. As one of their designated functions, scientific observers serving on board all Contracting Parties' longline vessels in the Convention Area monitor and record any deaths of seabirds during longlining. A notable success has been the observation that night-time setting alone has reduced albatross deaths by about 80% over the past three years.

Despite these successes, CCAMLR estimated that in 2005 annual mortality amounted to 13,500 seabirds, including about 10,000 albatrosses, mostly of species that breed in the Convention Area.[19] In addition, CCAMLR has made an effort to understand the impact of IUU fishing on bird species. To this end, bootstrapped estimates of 1997 bird-catch rates for Contracting Parties were applied to IUU estimates, suggesting that 176,000 birds (95% confidence interval 143,000–516,000) were killed by IUU operations in the CCAMLR area between 1996 and 2004. However, these estimates are highly dependent on relatively few data from 1997 and do not take account of changes in the population status of the birds themselves, which affect their encounter rate.[20]

To reduce bycatch in the krill fishery, CCAMLR is testing a new fishing system, where krill are continuously pumped aboard from the codend of a pelagic trawl without the need to bring the trawl aboard. This new technique may have considerable potential to impact other elements of the ecosystem either through bycatch, particularly of larval fish, or through incidental mortality of either immature krill or other small pelagic species.[21]

[18] Ibid., p. 43.

[19] CCAMLR, *Report of the Twenty-Fourth Meeting of the Commission*, Hobart, Australia, 24 October–4 November 2005, p. 25.

[20] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005, Report by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 53.

[21] CCAMLR, *Report of the Twenty-Fourth Meeting of the Commission*, Hobart, Australia, 24 October–4 November 2005, p. 15.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

CCAMLR has instituted bycatch limits for several elasmobranch species. Another measure is the release, where possible, of rays from fishing lines by cutting the snoods when the rays are still in the water, unless requested not to do so by the observer during the biological sampling period.[22] In addition, a ban on high seas driftnets in the Convention Area reduces impacts on both target species and non-target marine species which inhabit or frequent these waters.

2.4 Habitats

CCAMLR has restricted bottom trawling for mackerel icefish and other demersel fish in some areas to protect habitat, as well as bottom-dwelling communities.

The Commission has agreed to extend the environmental protection implemented in the fisheries in Sub-areas 88.1 and 88.2 to other fisheries operating south of 60°S. These environmental protection elements regulate the disposal of plastic packaging bands, the dumping or discharge of oil, garbage, food wastes, poultry, sewage, offal or incineration ash, and the translocation of poultry.[23]

At the 2005 annual CCAMLR meeting the Commission requested that the Scientific Committee include in its intercessional programme of work and its agendas for the next years' meetings consideration of ways to achieve broader conservation objectives for the marine environment, including the establishment of marine protected areas as appropriate, addressing the call from the UN to take action on destructive fishing practices, and the link between the CCAMLR Comprehensive Ecosystem Monitoring Programme (CEMP) and the decision-making process.

In at least one case CCAMLR has even gone so far as to apply strict habitat protection measures when allowing exploratory fishing. For instance, for the multi-species trawl fishery for spiny icefish (*Chaenodraco wilsoni)*, striped-eye notothen *(Lepidonotothen kempi)*, blunt scalyhead *(Trematomus eulepidotus)* and Antarctic silverfish (*Pleuragramma antarcticum)* only a single Russian trawl vessel with a 'precautionary quota' of 2,000 tonnes was permitted to fish in the 2003–04 season. In addition, the vessel had to engage in an elaborate research programme to study the effects on the bottom-dwelling community and its habitat. This restricts bottom-trawl fishing for three of the four target species to international waters 280 metres deep or less adjacent to the Antarctic continent south of the western Indian Ocean. For the purpose of the scientific assessment of the fishery, the area is divided into SSRUs. In each SSRU, and in locations where the bottom depth is 280 metres or less, the vessel is required to implement the following measures:

(i) a maximum total of 20 commercial bottom trawls may be conducted in no more than ten locations, but with no more than four bottom trawls in any one location;

(ii) each location must be at least 5 nautical miles distant from any other location;

(iii) at each location trawled, three separate samples will be taken with a beam trawl in the vicinity of the commercial trawl track, to assess the benthos present and compare it with the benthos brought up in the commercial trawl.[24]

[22] Ibid., p. 19.

[23] Ibid., p. 43.

[24] CCAMLR, Limits on the Exploratory Fishery for *Chaenodraco wilsoni*, *Lepidonotothen kempi*, *Trematomus eulepidotus* and *Pleuragramma antarcticum*. Conservation Measure 43-04 (2003) in Statistical Division 58.4.2 in the 2003/04 Season. http://

As a result of CCAMLR's CEMP, study areas are afforded protection from activities other than the proposed study. Detailed management plans are required before approval of additional activities in the study area. CEMP sites exist at Cape Shirreff and Seal Islands.[25]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

CCAMLR has incorporated key aspects of the Precautionary Approach (PA) in its Convention, which it then translates into management strategies, particularly for the management of lower trophic-level species. Specifically, paragraph 3 of Article II identifies objectives of the CCAMLR management strategy, which explicitly includes the idea of biological reference points, the concepts of risk and reversibility of changes over a specific time span, and a requirement to take account of the state of available knowledge in assessing risks and reversibility. Furthermore, it requires that the effects of harvesting on both the population being harvested and on dependent and related populations be taken into account. By any measure, these objectives have strongly precautionary aspects, although the term 'precautionary' is not specifically mentioned.

CCAMLR's approach seeks to determine a long-term annual catch limit that is highly likely to be sustainable, despite uncertainties in stock dynamics and key population parameters. CCAMLR plans to use this approach until long-term feedback Management Procedures are developed. This approach uses simulation to project future stock size using various population and fishery parameters. Given the uncertainties in these parameters, many simulated projections are undertaken. The long-term annual catch limit is set at the catch level that satisfies the decision rule based on the objective. These rules are specified as the greatest catch that results in both a median expectation that the stock is greater than or equal to the target level at the end of 20 years or one generation period for the stock (whichever is greater), and there being only a 10% chance or less that the stock will become depleted (below the limit reference point over that time).[26]

CCAMLR's krill management strategy, which is designed for use with previously unexploited (or very lightly exploited) stocks for which an estimate of pre-exploitation biomass is available, includes both target and limit reference points. Using its three-part decision rule, CCAMLR considers two probabilities and then chooses the more conservative of the two probabilities from which to derive its TAC. The strategy goes even further, because it contains not only an explicit single-species biological reference point (limit), but also an additional ecosystem constraint. In other words, this strategy captures both the now common single-species constraint on the probability of a stock falling below a biological reference point in a given time span, and a further constraint to leave at least some of the prey for other predators. The biological reasoning for this is as follows. A standard single-species production model that completely ignores the interests of the prey, such as the Schaefer model, suggests that the population level at which the maximum sustainable yield (MSY) can be taken is around 50% of the pre-exploitation level, so that the 'optimal' single-species escapement from the fishery would be 50% of B_0. If all the prey were to be reserved for the predators, then the appropriate escapement from the fishery would be 100% of B_0. The figure chosen, 75% of the pre-exploitation level, is halfway between these.

Clearly, the 75% figure chosen is largely arbitrary, and the biological underpinnings are not strong.

www.ccamlr.org/pu/E/pubs/cm/03-04/toc.htm.

[25] See Conservation Measures 91-1 (2004), 91-02 (2004) and 91-03 (2004).

[26] A. Constable, *ICES Journal of Marine Science*, 2006.

As further information is accumulated on the dynamics of both the prey and the predator species, the ecosystem constraint will be refined. However, the principle by which account can be taken explicitly of dependent species seems a very good one and worthy of consideration under the umbrella of a PA for the management of harvested prey species in a marine ecosystem.[27]

Another critical aspect of PA is effective monitoring and data collection. To this end, CCAMLR has established a CEMP that concentrates on key krill predators, to which most Contracting Parties contribute. In this programme selected biological parameters are monitored, using standardized methods at sites around the Antarctic, and a number of species of penguins, flying birds and seals are monitored. Individual Contracting Parties also conduct research programmes aimed at evaluating and improving the utility of the biological parameters being monitored and provide the background information needed to interpret changes in the monitored parameters.

CCAMLR also implements measures to protect endangered, threatened or trophically important species along with their habitats (e.g. a comprehensive monitoring and mitigation programme that encourages innovation to reduce mortality of seabirds in longline fisheries, shark bycatch and population monitoring, TAC establishment efforts, and a ban on high seas driftnetting).

A unique aspect of CCAMLR's management approach is to be proactive in the development of new fisheries through a stringent process of allowing exploratory and experimental fisheries that requires strict data collection and reporting not only on target species, but also on associated and dependent species, and in some cases habitat impacts of fishing activities.

CCAMLR has also embraced many other aspects of the PA:

- ties bycatch TACs to total catch, whereby directed fisheries are shut down even if the TAC for that fishery has not been reached;
- closes areas to protect sensitive habitat;
- imposes marine debris discharge regulations;
- adopts bycatch mitigation measures (e.g. gear modifications, minimum fish size requirements, shifts in fishing activities if bycatch accounts for a certain percentage of the total catch, etc.);
- conducts stock assessments on dependent and associated species.

However, there are some obstacles to the full implementation of the PA by CCAMLR. For example, there are no guidelines to ensure that the resumption of harvests in fisheries previously closed for the purpose of rebuilding depleted stocks does not again result in overfishing. There is also no mechanism to prevent overfishing of stocks for which TACs have not been established. In addition, the Commission is a consensus body, with all members having veto power, which can hinder progress on the adoption of strong conservation measures.[28]

Overall, CCAMLR's ecosystem monitoring and management approach is directly in line with the Annex II Guidelines for the Application of the Precautionary Reference Points in the management of straddling fish stocks and highly migratory fish stocks.

[27] http://www.fao.org/docrep/003/W1238E/W1238E07.htm.

[28] P. Mace and W. Gabriel, *Evolution, Scope and Current Applications of the Precautionary Approach to Fisheries*, Proceedings of the fifth NMFS/NSAW, 1999. NOAA Technical Memorandum NMFS-F/SPO-40, p. 69.

4. Data collection and sharing

To enhance the effectiveness of its management measures, CCAMLR invests heavily in research efforts to expand its knowledge of target species and the effects of IUU fishing, incidental catch of associated and dependent species in target fisheries, and the destruction of habitat from fishing and non-fishing activities.

4.1 Target species (effort, catch, area, time)

CCAMLR enlists the help of national or international independent observers, fishing crews and research vessels to collect catch and bycatch data. Furthermore, each vessel licensed by CCAMLR members to fish in the Convention Area is required to have a vessel monitoring system (VMS) monitored by a flag state. Parties submit VMS data to CCAMLR as they are collected via the flag state, or on a voluntary basis directly to the CCAMLR Secretariat from the vessels engaged in all toothfish fisheries.

CCAMLR also conducts tag-recapture experiments when data are lacking on stock status to enhance catch level recommendations for some target species (e.g. recommended for *D. eleginoides* at Crozet Islands inside the EEZ and *D. eleginoides* at South Sandwich Islands).

4.2 Bycatch, incidentally caught and non-target species

The Commission requires 100% observer coverage in all Convention Area fisheries, except krill. Specifically, catch data reported to CCAMLR for each of the sub-areas or divisions in the Convention Area are now submitted in fine-scale format (1° longitude x 0.5° latitude by ten-day period) or even, in some fisheries, haul-by-haul. Collected data are submitted directly to the CCAMLR database. In addition, scientific observers collect data on fish bycatch and incidental mortality of seabirds and marine mammals in all their managed fisheries. For instance, observers on krill trawls collect data on bycatch of fish larvae and juveniles taken in fine-mesh nets of the krill mid-water trawl fisheries. Initial results suggest that there are large spatial and seasonal differences in the occurrence of juvenile fish in the krill catch, which make it difficult to assess objectively the extent of the problem. CCAMLR members are now intensifying their collection of information, so that CCAMLR will be in a better position to assess more precisely where/when fish are most vulnerable to bycatch by the krill fishery and identify an appropriate course of action.

4.3 Species listed by recognized authorities as threatened, endangered or protected

CCAMLR has published a set of species identification sheets to assist scientific observers in identifying accurately as many species as possible that appear in longline and trawl catches. In addition, a book, *Identification of Seabirds of the Southern Ocean*, was published jointly by Derek Onley and Sandy Bartle for CCAMLR in 1999. In both documents the aim has been to compress as much information as possible into a simple field guide that will allow observers to identify most species quickly.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

CCAMLR's CEMP aims to detect and record significant changes in selected stocks of species that depend on, or are related to, targeted species, in order to distinguish between changes arising directly from harvesting and those which occur naturally as a result of physical or biological variability in the environment.[29] In particular, CCAMLR implements research programmes to study prey species

[29] Ibid., p. 42.

(e.g. krill, Antarctic silverfish (*Pleuragramma antarcticum*)) and early life stages of fish and important predator species. CCAMLR gathers species-specific data (e.g. distribution, size and age, biology, exploitation rates and status) for predators including Antarctic fur seal (*Arctocephalus gazella*), crabeater seal (*Lobodon carcinophagus*), Adélie penguin (*Pygoscelis adeliae*), chinstrap penguin (*P. antarctica*), gentoo penguin (*P. papua*), macaroni penguin (*Eudyptes chrysolophus*), black-browed albatross (*Diomedea melanophrys*), Antarctic petrel (*Thalassoica antarctica*) and Cape petrel (*Daption capense*).[30]

CEMP monitoring sites have been chosen to try to distinguish between broad-scale and local-scale changes and to contrast differences between fished and non-fished areas. Thus the Convention Area is divided into statistical units which are thought to be biologically or environmentally distinct, and therefore to contain relatively discrete stocks of certain species. However, some species straddle the boundaries of these units. This is particularly true for krill, Patagonian toothfish, lanternfish and squid. Therefore, to fully understand the dynamics of these species, data are required from across statistical or biological boundaries, including from areas adjacent to the Convention Area. The biological parameters being measured in CEMP species are broadly similar to those for species targeted by the fishery. However, the types of data vary for the species being monitored as an index of their dependence on the species being targeted by the fishery (e.g. the duration of birds' foraging/feeding trips and the weight of birds arriving to breed give some indication of how effective a population has been in its feeding on krill).

Scientific observers also monitor cetacean predation in *D. eleginoides* longline fisheries off the Prince Edward and Marion Islands, which is reported to be significant, and in *D. eleginoides* at Crozet Islands inside the EEZ, where depredation on toothfish catches by killer whales (*Orcinus orca*) is becoming a major problem for longline fishery and total mortality is believed to double the reported catch level.

In addition, CCAMLR has conducted initial studies to estimate the survival of skates and rays in the catch-release process.[31]

4.5 Habitats

In 2005 the Scientific Committee announced that it had developed a core project to conduct a synoptic survey of krill, pelagic fish and plankton biomass, and biodiversity in the South Atlantic. In addition, the Commission has endorsed the Scientific Committee's proposal (SC-CAMLR-XXIV, paragraphs 13.44 to 13.53) to hold a joint CCAMLR-IWC workshop to review information required for ecosystem models being developed to provide management advice on krill predators in the Antarctic marine ecosystem.[32] CCAMLR is also collaborating with the Southern Ocean GLOBEC (SOWER 2000) and the IWC to study baleen whale habitat and predator/prey interactions.[33]

As part of its obligation as a signatory to CCAMLR, the United States created the National Oceanic and Atmospheric Administration (NOAA) US Antarctic Marine Living Resources (AMLR) research programme to evaluate predator responses to changes in the availability of their food, and how the distribution of finfish and krill (the prey) is affected by both physical and biological aspects of their habitat.

[30] http://www.ccamlr.org/pu/e/e_pubs/am/p9.htm.

[31] http://www.scar.org/researchgroups/lifescience/ccamlr/hobart04/.

[32] CCAMLR, *Report of the Twenty-Fourth Meeting of the Commission*, Hobart, Australia, 24 October–4 November 2005, p. 23.

[33] http://www.iwcoffice.org/meetings/meeting2002.htm.

4.6 Non-party and IUU fishing activities, catch and impacts

Extensive data on trade are collected to better understand and account for impacts of IUU fishing (see discussion of IUU fishing in Section 1).

5. Content, structure and process of scientific advice

The Scientific Committee, composed of scientists from CCAMLR Contracting Parties, reports directly to the Commission. It may seek the advice of other scientists and experts or establish other subsidiary bodies with the approval of the Commission.

The Scientific Committee advises the Commission on harvesting levels and other management measures developed through consultation and the application of advanced scientific techniques. The Committee's specific responsibilities include the following:

- establish criteria and methods to be used as a basis for determining the conservation measures referred to in Article ix of this Convention regularly;
- assess the status and trends of populations of Antarctic marine living resources;
- analyse data concerning the direct and indirect effects of harvesting on the populations of Antarctic marine living resources;
- assess the effects of proposed changes in the methods or levels of harvesting and proposed conservation measures;
- transmit assessments, analyses, reports and recommendations to the Commission as requested, or on its own initiative regarding measures and research to implement the objective of this Convention;
- formulate proposals for the conduct of international and national programmes of research into Antarctic living marine resources.

The Scientific Committee has established two working groups to assist it in formulating scientific advice on key areas of its responsibility: the Working Group on Ecosystem Monitoring and Management (WG-EMM), which is primarily concerned with assessing and developing advice on the krill fishery and analysing data from the CEMP, and the Working Group on Fish Stock Assessment (WG-FSA), which develops management advice on fisheries other than the krill fishery; it also assesses the incidental mortality of seabirds and interactions of longline fisheries with other non-target species, such as cetaceans. These two working groups meet annually and report their findings directly to the Scientific Committee, which may refine them by taking into account additional information available to the Committee. The management advice is then referred to the Commission for consideration.

Adherence to scientific advice: Scientific advice is *consistently* followed in establishing catch limits and *consistently* adhered to once these catch limits have been established.

Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

In May 1993 the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) was created. The Commission's objectives are to ensure, through appropriate management, the conservation and optimum utilization of the global southern bluefin tuna fishery and meet the currently agreed management objective of recovery of the parental biomass to 1980 levels by 2020.

Target species

CCSBT's target species is southern bluefin tuna (SBT). Historically, catches peaked at around 80,000 tonnes in 1961 and subsequently declined to around 40,000 tonnes in the 1980s. In the 1990s catches were around 10,000 tonnes to 13,000 tonnes, and in most recent years, with fishing by Non-Contracting Parties, catches have been around 17,500 tonnes.[34]

Management measures

Initially, southern bluefin tuna were managed by means of quota limits agreed at tripartite meetings between Australia, Japan and New Zealand from 1985 through to the establishment of the CCSBT in 1993. The global quota was reduced several times after the initial level of 38,650 tonnes for the 1984–85 season. In fact, by the 1989–90 season the combined quota for the three countries was 11,750 tonnes. An impasse on a TAC decision in 1996 led to the establishment of national quotas set unilaterally by CCSBT's members. Japan reported its intention to fish beyond its traditional level in an experimental fishery based on the Japanese interpretation of the stock status.[35] By 2000 there was a growing list of Non-Contracting Parties with still no agreement among members on a TAC or national allocations. In 2001 a preliminary TAC was finally set, based on scientific advice, but there was still no agreement on binding national quotas.[36]

Following increases in the membership of the CCSBT (the Republic of Korea and the Fishing Entity of Taiwan joined in 2001 and 2002 respectively), the CCSBT extended the following national catch limits for 2003–04 to 2004–05: Japan 6,065 tonnes, Australia 5,265 tonnes, Republic of Korea 1,140 tonnes, Fishing Entity of Taiwan 1,140 tonnes and New Zealand 420 tonnes (total 14,030 tonnes). An additional catch limit of 900 tonnes was set aside in 2004–05 for cooperating non-contracting parties, of which 50 tonnes were allocated to the Philippines (which had recently been admitted as a cooperating non-contracting party), and 800 tonnes were set aside for Indonesia should it become a cooperating non-contracting party.[37] At its 13th Annual Meeting the CCSBT agreed to a TAC for 2007–09 of 11,810 tonnes, which is a TAC reduction of 3,115 tonnes.

An initial meeting was held in May 2000 in Tokyo, Japan, to steer the Commission's course on a management strategy. The Commission agreed that a procedure should be developed as a set of rules, agreed in advance, to dictate how a TAC for the SBT fishery would be adjusted as data became

[34] http://www.fao.org/docrep/007/y5428e/y5428e07.htm.
[35] CCSBT, Fourth Annual Meeting, Part Two, 1998.
[36] CCSBT, Eighth Annual Meeting, 2001.
[37] Commission for the Conservation of Southern Bluefin Tuna, *Report of the Tenth Meeting of the Scientific Committee*, 9 September 2005, Narita, Japan, http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_SC10.pdf.

Table 4: EBM and PA Management in CCSBT

Overarching objectives	The conservation and optimum utilization of the global southern bluefin tuna fishery and recovery of the parental biomass to 1980 levels by 2020.
Decision rules	Maximizing catches, safeguarding the resource, minimizing inter-annual variation in catch and effort. Under new MP sets quota with awareness that SSB is at historically low level and accounts for fishing effort of both Contracting and Non-Contracting Parties.
Limit reference points	None apparent.
Target reference points	Short-term target: a 50% probability of biomass in 2014 > biomass in 2004.
Management measures	
Access/effort control	TAC and allocation scheme, vessel/gear licensing.
Bycatch reduction	National action to address bycatch – no CCSBT measures. Educational materials for fishermen to identify sharks/seabirds. Collect data on seabirds/use of tori polls in longline fisheries.
Habitat protection	Closed areas for both target species and predators. Restrictions on bottom trawling in some areas. Regulates discharge of pollutants (e.g. plastics). Habitat protection measures for exploratory fisheries. In 2005 Scientific Committee recommended that future decline in spawner biomass below current levels be prevented, at least with a 50% probability. This could only be achieved with a catch reduction of around 5,000 tonnes.
Interim measures/ recovery plan	MP • Immediate reduction in total catches to < 14,925 tonnes to decrease the probability of further stock declines. • Immediate action to restore confidence in estimates of total catch and CPUE series. Monitoring of recruitment and of Indonesian fishery. • An interim MP needs to be adopted within the next 3–5 years, with a full MP thereafter, designed to ensure a high probability of stock rebuilding.
Capacity reduction scheme	Recognizes problem of excess fleet capacity. Sets quotas for Contracting and Non-Contracting Parties.
Evaluation	'Rules' pre-specify what should happen when TAC generated by the MP is considered to be highly risky or highly inappropriate. Regular review and revision of MP and the establishment of performance measures.
Voluntary Code of Conduct	Regional Plans of Action to combat IUU fishing.
Research programme	Aerial surveys. Observer data. Fishermen and research vessel surveys to collect data. Tagging programme. Cooperation with FAO to develop FIGIS. Direct ageing programme.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Monthly catch reporting by Contracting Parties. Observer programme (10% target for coverage). VMS. Resolution on IUU fishing. Centralized database. TIS. Statistical document programme published on website includes trade data. Criteria for cooperating status with small allocation of quota as incentive for participation. Regulates transhipments by large vessels.
Detection of ancillary impacts	Working Group on Ecologically Related Species (ERSWG) monitors and studies bluefin tuna and ecologically related species. Development of data collection protocols for member countries.
Penalties for non-compliance	Trade restriction measures.

available. The Management Procedure (MP) consisted of three components: (1) a list of data as inputs, (2) an algorithm or model to process the data, and (3) rules to translate the algorithm output into a TAC.

CCSBT further refined the operating models for the SBT fishery; identified five fisheries and the data sets required for conditioning of the model; agreed on the principles for selecting candidate Management Procedures; and agreed on the initial identification of objectives and related performance measures (maximizing catches, safeguarding the resource, minimizing inter-annual variation in catch and effort).

The MP was based on fitting a discrete age-disaggregated Fox dynamic production model to past catch and CPUE data from the longline fishery. The basic data requirements for running the management framework included time series of actual catches; CPUE series; and catch at age data obtained from Contracting Party longline fisheries. Since length data were not available (Korea, Philippines, miscellaneous), the Secretariat planned to use Japanese length frequency data as a substitute and its most recent TAC. The procedure would take into account changes in biomass and was meant to provide some stability to the southern bluefin tuna TAC over the longer term. The model would take account of different fishing years of Contracting Parties and make assumptions about the fishing period for Cooperating Non-Parties. One issue still under development was a calculated method of estimating the catch of non-cooperating non-contracting parties. The MP would include 'rules', which would pre-specify what should happen in unlikely, exceptional circumstances, when the application of the TAC generated by the management plan is considered to be highly risky or highly inappropriate. Regular review and revision of the management procedure and the establishment of management procedure performance measures would also be required under this new MP.

However, reviews of SBT farming and market data during 2006 suggested that SBT catches might have been substantially under-reported over the past 10–20 years. As a result, the CCSBT determined that it was not possible to proceed with the current MP and that the procedure needed to be re-evaluated in light of the impact of unreported catches on the estimates of past total catch and CPUE. This process is expected to take five years.[38] Uncertainty was not accounted for in initial trials for the MP. However, it was built into later models.[39] The MP evaluations will provide catch and exploitation rates for each year and fishery. Initial summary statistics will cover average catches over the next five years and the next 20 years.[40]

Up until this point the TAC has been established based on stock status indicators including size distribution and recruitment indices derived from New Zealand and Japanese longline fisheries, aerial spotting survey, commercial spotting indices and fishing mortality rates for age 3 and 4 fish from tagging studies. In 2006 it was accepted for the short term that the Japanese longline CPUE would probably continue to provide the only index of stock abundance for use in a Management Procedure.[41] This is because the stock assessments for SBT by the scientists from the three countries were considered controversial, and some of the processes and discussions were not transparent.

Thus, the 2006 management advice was based on the following considerations.

[38] CCSBT, *Report of the Thirteenth Annual Meeting of the Commission*, 10–13 October 2006, Miyazaki, Japan.
[39] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_9/report_of_mpws1.pdf, p. 10.
[40] Ibid., p. 12.
[41] CCSBT, *Report of the Seventh Meeting of the Stock Assessment Group*, 4–11 September 2006, Tokyo, Japan.

- The discovery of large past catch anomalies led to a reconsideration of the advice provided in 2005. The 2006 management advice is based on results across the range of alternate past-catch scenarios evaluated.
- The scenarios evaluated are reasonably consistent with each other in terms of current stock status, recruitment trends and projected stock biomass under specific constant catch levels. Under the current circumstances they represent the basis for best available scientific advice.
- The scenarios show that, in order to reduce the short-term risk (to 2014) of further declines in stock size, a meaningful reduction in catch below 14,925 tonnes is required, in addition to assurance that all unreported catches are eliminated[42] (recommended 5,000-tonne reduction in 2005).[43]

The CCSBT established a short-term target for SBT, aiming for a 50% probability of the biomass in 2014 being greater than the biomass in 2004. To help ensure a high probability of sustainability and rebuilding of the SBT spawning stock, three steps are required.

- An immediate reduction in total catches to below 14,925 tonnes to decrease the probability of further stock declines.
- Immediate action to restore confidence in estimates of total catch and CPUE series. Monitoring of recruitment and of the Indonesian fishery must continue, and where possible be improved.
- An interim MP needs to be adopted within the next three to five years, with a full MP thereafter designed to ensure a high probability of stock rebuilding.

IUU fishing

In order to combat IUU fishing, CCSBT developed a statement of criteria for the assessment of cooperating status with the Commission. It was agreed that cooperating status would be assessed on the basis of commitment by the party to:

- carry out the objectives of the Commission;
- abide by its conservation measures;
- take appropriate action to ensure that fishing activities do not diminish the effectiveness of the conservation and management measure of the Commission;
- transmit a review of its southern bluefin tuna fishery and all supporting data;
- ensure that states' documents are completed; and
- negotiate with the Commission for other criteria for admission to status of cooperating non-member.

Essentially, CCSBT offered to consider an appropriate southern bluefin tuna allocation for a Non-Contracting Party if all the conditions of cooperating status were met. South Africa was made a secondary offer of 45 tonnes in recognition of the importance of its participation, but its lack of full cooperation with data requests by the CCSBT was noted.[44] In 2005 CCSBT effectively imposed trade restriction measures on Indonesia for refusing to cooperate under conditions of cooperating status.[45]

[42] CCSBT, *Report of the Thirteenth Annual Meeting of the Commission*, 10–13 October 2006, Miyazaki, Japan.
[43] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_ccsbt12.pdf, p. 13.
[44] CCSBT, Twelfth Annual Meeting, 2005.
[45] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_ccsbt12.pdf, p. 28.

In addition, there have been significant efforts made to focus on the tuna market with the implementation in 2000 of the CCSBT Trade Information Scheme (TIS), which documents trade in southern bluefin tuna by Contracting Parties and Non-Contracting Parties.

CCSBT has adopted a resolution to address IUU fishing activity. The preamble makes reference to the need for responsible fishing by Contracting Parties: 'Noting the responsibilities of flag states to ensure that their vessels conduct their activities in a responsible manner.' It also lays out a number of measures and reporting requirements for Contracting Parties' and cooperating non-contracting parties' fishing vessels to comply with the Statistical Document Programme.[46] This resolution provides fishing nations with non-voting membership in the Commission as a means of encouraging compliance with fishery measures to ensure 'sustainability' of the SBT population.[47]

There is no consensus within CCSBT on reporting of bycatches by its members. Thus bycatch is probably not accounted for in stock assessments and TAC establishment. Clearly, though, bycatch and discarding practices are hindering recovery of the SBT stock. For example, Australia reported in 2004 that according to national observers monitoring longline fisheries south of 30° S from May to September, when southern bluefin tuna are most likely to be taken incidentally, 61% of the catch was discarded during observed operations. In contrast, the observed level of discards from logbooks was only 10%. Subsequent management responses by Australia included 100% observer coverage and minimum quota holdings in areas where SBT were most likely to be taken. Japan reported that there was no bycatch in its fisheries. Nonetheless, in the Japanese national report it was noted that there were undisclosed amounts of bycatch of seabirds (unidentified species) and blue, mono and mako sharks in longline fisheries. It also reported that only a small amount of SBT discards occurred, and those discards were damaged by sharks.[48]

While current IUU fishing (levels of unreported catch range between 10% and 30%)[49] is not accounted for in the establishment of TAC, it appears that it will be if the Management Procedure is ultimately adopted. The MP will have the potential to allow for both historical and future levels by fishery, but no attempt was made to agree on values to be used at the present time. The default assumption in the initial trials will be zero.[50]

In addition, the Stock Assessment Group recognized that total catch, including discards and other fishing-related mortality, should be included in the Management Procedure as well.[51]

The overriding current consideration for CCSBT, and one which threatens its future viability and existence, is the need to reach agreement between Contracting Parties on the state of the southern bluefin tuna stock, its predictions for recovery, and the setting of annual catch quotas. In particular,

[46] CCSBT, Resolution on Illegal, Unregulated and Unreported Fishing (IUU) and Establishment of a CCSBT Record of Vessels over 24 Meters Authorized to Fish for Southern Bluefin Tuna, adopted at the Tenth Annual Meeting, 7–10 October 2003, p. 2.

[47] Ibid.

[48] CCSBT, *Report of the Thirteenth Annual Meeting of the Commission*, 10–13 October 2006, Miyazaki, Japan.

[49] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_ccsbt12.pdf, p. 14.

[50] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_9/report_of_mpws1.pdf.

[51] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*, Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 55.

fleet capacity has been raised in discussion within CCSBT, as there are concerns that the resource may not be able to sustain current levels of fishing effort by Contracting and Non-Contracting fleets.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

Bycatch and discard data are collected nationally. Before 2003 the only source of discard information from New Zealand was observer data. Since the introduction of a revised catch and effort form in 2003, there has been a requirement for discarded catch to be reported on catch and effort forms. However, they are unlikely to be completed, in part because of industry confusion regarding reporting obligations. Therefore, while there are some data for 2003–04 on discards from catch and effort forms, these are unlikely to be reliable for estimating actual discards, and New Zealand continues to rely on observer data to estimate historical discarding. Since the 2004–05 fishing season there is now a clear requirement for these specified discards to be reported on catch and effort forms, and these data, in addition to observer estimates, will be reported in future data exchanges. Similarly, Japan and Taiwan report that they plan to include bycatch and discard information in future national reports (source will be 2004 logbooks).

The standards for the new southern bluefin tuna scientific observer programme will include a listing of data collection priorities for non-target catches, but discussion of the actual research priorities is still under way.[52]

2.2 Species listed by recognized authorities as threatened, endangered or protected

Bycatch of seabirds is a considerable problem for the CCSBT longline fisheries, as the area regulated under the CCSBT coincides with the ranges of 14 out of the 16 tracked species of albatross and 70% of the total distribution of breeding albatrosses.[53] The genera mostly taken in these areas are *Diomedea* spp. (albatrosses), some of which are considered vulnerable, threatened or endangered, and *Procellaria* spp. (petrels). As a result, the Commission has a Working Group on Ecologically Related Species (ERSWG), which developed and distributed educational pamphlets on seabirds to SBT fishermen. The pamphlets were produced in four languages (English, Japanese, Korean and Mandarin).

In addition, at its 2006 Annual Meeting there was general agreement on the spirit of the draft to reduce seabird mortality; to develop and implement a National Plan of Action; to collect and provide incidental catch data; to ensure the mandatory use of tori poles in all SBT vessels below 30° S; to encourage the use of a second tori pole or other additional effective measures if required; to undertake research into new mitigation measures; and to develop a practice guide for members' SBT fleets. However, members had differing opinions on whether to specify a target level of reduction of seabird mortality and whether to specify clearly the types of data to be collected and provided.

[52] FAO, *Report of the Twentieth Session of the Coordinating Working Party on Fishery Statistics*, Victoria, Seychelles, 21–24 January 2003; FAO Fisheries Report No.709, FIDI/R709 (En), http://www.fao.org/docrep/006/Y4922E/y4922e08.htm.

[53] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 29.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

In addition, further bycatch mitigation measures, which may expand the scope of non-target species evaluated, are being considered by the ERSWG. Information on bycatch and discards is being collected by observers and analysed by the working group.[54]

The CCSBT distributes educational pamphlets to Contracting Parties to assist fishermen in the proper identification of shark species, which will help to improve the quality of their data and enhance the understanding of bycatch rates on various species.

2.4 Habitats

No specific actions to address habitat were identified.

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

The CCSBT has not formally embraced the PA, either through amendments to its Convention or through binding resolutions. However, the Commission notes that the PA has had a significant influence on its efforts to develop a Management Procedure for southern bluefin tuna. The objective of the MP is to rebuild the spawning stock biomass to the 1980 level by the year 2020. In addition, the fact that the MP pre-specifies actions to be taken in the event that the TAC is exceeded and that there will be ongoing monitoring of fishing activities is clearly one aspect of a PA. Uncertainties in data sets used to assess historic catch rates and inability to reach agreement on stock recovery projections have prevented the implementation of this procedure and resulted in the collapse of the tuna stock.[55] This experience reflects a real challenge in implementing the PA – what to do if data are not lacking, but rather are inaccurate?

CCSBT, based on advice from its Scientific Committee, has moved ahead and adopted an interim measure for 2006 to promote the rebuilding of the stock and to ensure that there is a 50% chance that the spawning stock biomass will be above the 2004 level by 2014.[56] The Scientific Committee also recommended that there be a 5,000-tonne reduction in the TAC. However, it is worth noting that just implementing a 5,000-tonne TAC reduction in 2006 would only rebuild the median biomass to half the 1980 level by 2022. This means that although CCSBT has some rebuilding targets, its corresponding management actions and catch limits will not achieve these targets.

Immediate and substantial cuts in the TAC are required to achieve CCSBT objectives. In addition, CCSBT will have to make considerable strides in overcoming historical problems of IUU fishing in the region. It has employed a number of tactics to understand the actual level of impact from these activities. In fact, the organization's greatest strength may be its research and monitoring programmes and efforts to bring Non-Contracting Parties into compliance with CCSBT regulatory measures. What is lacking is the ability to ensure that its own Contracting Parties adhere to regulations and

[54] CCSBT, Terms of Reference for the Working Group on Ecologically Related Species (ERS), adopted at the Second Annual Meeting, 12–15 September 1995, p. 5.

[55] FAO, Coordinating Working Party on Fishery Statistics, Report of the Eighteenth Session, Luxembourg, 6–9 July 1999.

[56] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*, Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 31.

share collected data with the Secretariat or, more importantly, to get Contracting Parties to adopt regulations in the first place.

Some progress has been made in implementing measures in compliance with the FAO International Plans of Action (IPOAs) for seabirds, sharks and fishing capacity. While the CCSBT has not developed full-scale plans relative to these IPOAs, the Commission has initiated efforts to monitor impacts of its respective fisheries on seabirds and sharks, developed educational material to help fishermen identify sharks when they are taken in fishing gear, and instituted technical measures (e.g. use of tori poles) to mitigate seabird entanglements. This is a good start, but more needs to be done actually to monitor and analyse the state of shark populations and associated fisheries and implement and enforce management actions to reduce shark bycatch. Furthermore, other operational measures as outlined in the IPOA for seabirds (e.g. training on release of live birds, preferential licensing to vessels which use mitigation measures, reducing visibility of the bait, etc.) should be employed to help avoid seabird entanglement. In addition, the most important part of the CCSBT Scientific Research Plan (characterization of the SBT catch) recommends the collection of information on the catch of other tuna and other tuna-like species. However, there has been no progress on agreeing to the provision of bycatch data as part of the regular data submission requirements.[57]

Other aspects of the CCBST management which serve to weaken efforts to implement the PA are further allocations to Contracting Parties under the guise of scientific research (i.e., research mortality allowance).

CCBST has attempted to discourage IUU fishing by enticing Non-Contracting Parties to join its organization through allocation set-asides (e.g. 800 tonnes to Indonesia in 2003). It has also developed criteria for Non-Contracting Party status. These criteria set out conditions for achieving status with an incentive of a small allocation should Non-Contracting Parties meet the conditions. However, this approach to reducing IUU fishing was somewhat weakened by the relaxation of the data requirement for South Africa and the subsequent awarding of a small share of the quota. In addition, despite best attempts to ensure that Indonesia complies with the criteria for Non-Contracting parties, in 2005 sanctions were imposed against it.

Also lacking are further measures to address the overall problem of bycatch or identify and protect critical habitats. For instance, although it is known that purse-seine and longline fisheries in the western and central Pacific take significant numbers of billfish, turtles and small tunas as bycatch, no definitive conservation measures have been enacted by CCSBT to address bycatch of these species within its Convention Area.

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

The CCSBT is implementing a Scientific Research Programme (SRP). The main objective of the SRP is to improve the quality of the data used as input into the stock assessment and to contribute to the development of reliable indices to monitor future trends in stock size. Future trend indicators will be a critical component of a feedback rule to facilitate setting TACs. The implications of possible past overcatches are such that various components of the SRP need to be critically reviewed at the 2007 Scientific Committee meeting. In particular, it is necessary to review catch characterization, CPUE

[57] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_ccsbt12.pdf, p. 29.

modelling, the observer programme and the conventional tagging programme, and links between these SRP components.[58]

Currently, a key part of CCSBT's SRP is its Observer Programme, which is intended to gather representative information and sampling of the entire bluefin tuna fishing fleet. The goal is to have observer coverage of 10% for catch and effort monitoring as a target level. The programme covers the fishing activity of CCSBT Contracting Parties and cooperating non-contracting parties wherever southern bluefin tuna are targeted or are a significant bycatch. Observers are trained based on technical requirements developed by CCSBT and are nationals of either contracting parties or cooperating non-members and, as far as possible, not nationals of the flag state/fishing entity of the receiving carrier vessel.[59] Their responsibilities include tagging fish as practical and appropriate and collecting effort data to aid in the interpretation and standardization of CPUE data (e.g. amount of gear used and gear deployment methods, position of fishing activity and date and time of fishing activity); recording details of the catch (e.g. catch composition – number and length or weight of southern bluefin tuna, other tuna and tuna-like species – and catch retained and discarded); recording length, weight, sex and other biological data for southern bluefin tuna; collecting otoliths of southern bluefin tuna for age determination; monitoring of tag recoveries; gathering environmental data that may influence southern bluefin tuna CPUE (sea surface temperature, wind direction and speed, etc.); and gathering detailed reproductive samples.[60] The costs of implementing this programme are to be financed by the Contracting Parties and cooperating non-contracting parties wishing to engage in transhipment operations.

A statistical document programme has been established, and summaries are now published on the CCSBT website and are updated every six months. The programme was modified to incorporate minimum standards which specify the responsibilities of exporters, importers and the CCSBT Secretariat in relation to the completion of documents and the action required in response to missing or inaccurate information. CCSBT has cooperated with the FAO in the development of the Fishery Resources Monitoring System. It signed the system partnership agreement in late 2003 and submitted a global southern bluefin tuna fact sheet and nominal catch data to the Fishery Resources Monitoring System in late 2004. Most of the nominal catch data are now available from the CCSBT website.[61]

The Secretariat is implementing a tagging programme and maintains a database on tag releases and recoveries. The tagging programme commenced in November 2001 and now has five elements:

- a longline tagging programme in the western Indian Ocean as part of Japanese research cruises;
- a longline tagging programme off the east coast of Australia and in the Indian Ocean involving pop-up tagging of mature SBT by Australia;
- an extensive five-year surface fishery tagging programme off the southern coast of Australia being coordinated by the CCSBT Secretariat;

[58] Ibid.

[59] CCSBT, *Report of the Thirteenth Annual Meeting of the Commission*, 10–13 October 2006, Miyazaki, Japan.

[60] CCSBT, *Report of the SC to CCSBT on the Scientific Research Programme* (adopted at the Seventh Annual Meeting, 18–21 April 2001), 23 March 2001.

[61] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*, Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 44.

- a longline tagging programme in New Zealand associated with the commercial fishery in New Zealand's EEZ; and
- a large-scale spatial dynamics archival tagging programme conducted by Australia across the SBT range.

The three longline tagging projects are now focused on the placement of archival and pop-up tag deployment for biological research, although conventional tagging is also undertaken. The data from the tagging have limited uses for stock assessment activity.

The five-year surface fishery tagging programme entered its last year in 2005–06, and a total 63,740 southern bluefin tuna have so far been tagged in the programme. As of 31 October 2006 over 5,000 tagged southern bluefin tuna had been recovered from this tagging programme. Tagging will continue at a slightly reduced level in 2006–07.

The global spatial dynamics archival tagging programme, which commenced in 2004, involved releasing 500 archival tags over a three year-period. The tags are being deployed across the range of southern bluefin tuna fisheries. The programme is supported and operated by Australia, and other members' fishing activities are being used for tag deployment.

In addition, the CCSBT conducted a Direct Ageing Workshop in June 2002, which produced a manual for age determination of southern bluefin tuna from recovered otoliths. The manual is used as a training resource for member states' scientists.

The CCSBT also began a programme of direct ageing from an otolith recovery programme across the various elements of the fishery in 2003–04.

Furthermore, extensive scientific research is being conducted by the members of the Commission. The focus is on improving the understanding of the unique biology of SBT and reducing uncertainty in stock assessments.

A central database has been established within the Secretariat to hold the core information required for use in assessing the SBT stock. This includes catch and effort data, size composition data, trade information scheme data, and tagging programme data.

A monthly reporting programme for Contracting and Non-Contracting Parties has been adopted, whereby monthly and cumulative catch information is provided.[62]

4.2 Bycatch, incidentally caught and non-target species

No action taken.

4.3 Species listed by recognized authorities as threatened, endangered or protected

The work of the ERSWG includes threatened, endangered or protected species (see discussion in next section).

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

For predator and prey species which may affect the condition of the southern bluefin tuna stock, the ERSWG monitors trends and reviews existing information and relevant research, including but not

[62] http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_ccsbt12.pdf, p. 25.

limited to studies on 1) the population biology of ecologically related species; 2) the identification of factors affecting the population of ecologically related species; and 3) the assessment of the effects of ecologically related species on the condition of the southern bluefin tuna stock.

Data on ecologically related species are collected and held by member states. However, the ERSWG is responsible for ensuring that the collection of data by member states is done in a consistent fashion; it is therefore also responsible for developing data collection protocols consistent with those of the Scientific Committee. Analyses of the data and samples on behalf of the Commission may be conducted by scientists from the Contracting Parties and other relevant experts designated by the ERSWG. Results of analyses which use data and samples collected under these criteria are not published without the consent of the parties that provide the data and samples.

4.5 Habitats

Some data have been obtained from recent archival tag information and analyses in relation to southern bluefin tuna habitat and distribution. Some of these data suggested a correlation between CPUE and environmental conditions, and it was proposed that this be investigated on a wider spatio-temporal scale. However, it was pointed out that similar attempts in the past had not met with much success.[63]

4.6 Non-party and IUU fishing activities, catch and impacts

CCSBT estimates that IUU amounts to about 33% of its reported catches,[64] although this may now have dropped to about 10%, with Taiwan recently gaining membership of the Commission.[65]

In 2007 CCSBT plans to take steps to enhance compliance and improve stock assessments by gathering more complete data on the impact of IUU by refining and implementing three measures:

- a catch documentation scheme;
- a vessel monitoring system for fishing vessels catching southern bluefin tuna and flagged to members and cooperating non-members; and
- regulation of transhipments by large-scale fishing vessels.

The CCSBT implemented a TIS in June 2000 to collect more accurate and comprehensive data on SBT fishing through monitoring trade. The TIS also operates to deter IUU fishing by effectively denying access to markets for SBT.

The core of the TIS is the provision for all members and cooperating non-members of the CCSBT to maintain requirements for all imports of SBT to be accompanied by a completed CCSBT Statistical Document. The document must be endorsed by an authorized competent authority in the exporting country and includes extensive details of the shipment such as name of fishing vessel, gear type, area of catch, dates, etc. Shipments not accompanied by this form must be denied entry by the member country. Completed forms are lodged with the CCSBT Secretariat and are used to maintain a database for monitoring catches and trade. Reconciliation of these forms is conducted against electronic lists

[63] Commission for the Conservation of Southern Bluefin Tuna, *Report of the Tenth Meeting of the Scientific Committee*, 9 September 2005, Narita, Japan.

[64] OECD, *Draft Synthesis Report on IUU Fishing Activities*, AGR/F1(2004)18, 2005.

[65] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 15.

of exports submitted by CCSBT members and cooperating non-members.

The scheme requires the document to include the country of destination and to set minimum standards for completion of TIS documents. The requirement to include the destination country was made in the light of markets for SBT developing outside CCSBT member states. CCSBT is also seeking the cooperation of non-member importing countries with the TIS. The United States has passed domestic legislation to recognize CCSBT documents with effect from 1 July 2005, which brings trade to the United States under the provisions of the CCSBT scheme.

For other Non-Contracting Parties, Japanese import statistics and the CCSBT TIS have been the major source of catch estimates. However, the situation changed with effect from July 2005 as a result of a CCSBT decision that imports of SBT could only be accepted from Contracting Parties and cooperating non-contracting parties. Thus, since July 2005 Japanese import statistics and the TIS have been unable to provide information on the catches of Non-Contracting Parties.[66]

In addition, CCSBT collects data and maintains a list of vessels which are approved to fish for southern bluefin tuna. The list includes vessels from CCSBT Contracting Parties and cooperating non-contracting parties, which are required to refuse the import of southern bluefin tuna caught by vessels not on this list.[67]

5. Content, structure and process of scientific advice

The Scientific Committee was established as an advisory body to the Commission. The main activities of the committee are as follows:

- to assess and analyse the status and trends of the population of southern bluefin tuna;
- to coordinate research and studies of southern bluefin tuna;
- to report to the Commission on its findings or conclusions, including consensus, majority and minority views, the status of southern bluefin tuna stock and, where appropriate, of ecologically related species;
- to make recommendations, as appropriate, to the Commission by consensus on matters concerning the conservation, management and optimum utilization of southern bluefin tuna; and
- to consider any matter referred to it by the Commission.

The CCSBT has a technical sub-committee or working group (called the Stock Assessment Group, or SAG) to conduct the scientific stock assessments and technical evaluation of data from the southern bluefin tuna fishery. The scientific tasks of the SAG are as follows:

- to review any new information on the stock structure and biology of southern bluefin tuna;
- to update the stock assessment, including estimating trends in abundance and current and future stock size;
- to develop and evaluate methods and models for assessing the stock status;
- to provide the technical evaluation of the implications of management measures that have been identified by the Scientific Committee;
- to consider any matter referred to it by the Scientific Committee;

[66] CCSBT, *Report of the Tenth Meeting of the Scientific Committee*, 9 September 2005, Narita, Japan; http://www.ccsbt.org/docs/pdf/meeting_reports/ccsbt_12/report_of_SC10.pdf.

[67] Ibid.

- to identify the research and technical requirements for future stock assessment;
- to produce a report as specified in the agreed Format and Content for the Report from the Stock Assessment Group; and
- to refer matters to the Scientific Committee for consideration.

The CCSBT also has an Advisory Panel to provide external input to its stock assessment and scientific processes. It has appointed independent chairpersons for the SAG and the Scientific Committee.

An External Scientific Advisory Panel was engaged in 2000–01 to design a southern bluefin tuna Scientific Research Programme. The SRP is intended to complement initiatives introduced by CCSBT for improving stock assessments and developing a management strategy/procedure by providing improved data and information inputs for conducting all future stock assessments.

In addition, the ERSWG provides advice and recommendations on southern bluefin tuna fishing and ecological issues and on research priorities to the Commission through the Scientific Committee. ERSWG provides recommendations on data collection programmes and research projects with respect to associated species (fish and non-fish), including 1) recommendations on research priorities and estimated costs of such research; 2) advice on measures to minimize fishery effects on ecologically related species, including but not limited to gear and operational modifications; and 3) advice on other measures which may enhance the conservation and management of ecologically related species.

Adherence to scientific advice: Scientific advice is *inconsistently* followed when establishing catch limits, and catch limits are *inconsistently* adhered to once established.

General Fisheries Commission for the Mediterranean (GFCM)

Table 5: EBM and PA management in GFCM

Overarching objectives	Amended Convention: PA to be applied to conservation and management decisions, taking into account the best scientific evidence available and the need to promote the development and proper utilization of living marine resources.
Decision rules	Under development.
Limit reference points	Considering. No action taken.
Target reference points	Considering. No action taken.
Management measures	
Access/effort control	Under development.
Bycatch reduction	Seasonal closures with respect to FADs usage. Mesh size requirements in codend. Minimum fish size requirements. Exploring use of pingers to reduce marine mammal entanglements. Binding Recommendation prohibiting driftnet fishing with nets more than 2.5 km in length.
Habitat protection	Global Environment Facility Large Marine Ecosystem proposal. Prohibits use of towed dredges in trawl-net fisheries at depths of more than 1,000 m and use of bottom-trawls and dredges in three specific areas to protect corals, cold hydrocarbon seeps and seamounts.
Interim measures/ recovery plan	Under development.
Capacity reduction scheme	Adopting fleet segmentation scheme (LOUs) to better monitor fishing capacity. Database established to list all participating fishing vessels (states' compliance with supplying catch information low). Assessing fishing capacity, pilot studies, workshop on the measurement of fishing capacity.
Evaluation	Inadequate information to assess.
Voluntary Code of Conduct	Disseminated the Code of Conduct and made improvements in the planning process for its implementation. Using Code to upgrade the economic value of aquaculture and to improve and stabilize trade in aquaculture products in the Mediterranean. Implemented measures under FAO IPOAs (i.e., sharks and capacity reduction). Regional workshop/working group to address IUU fishing issue.
Research programme	Contracting Parties collect information on demersal, small and large pelagic fish species (e.g. swordfish, bluefin tuna), socio-economics, sharks, cetaceans, seabirds and turtle-fisheries interactions. Collaboration with ACCOBAMS to collect background data on cetacean–fishery interactions. Studies of ecological relationships, deep-sea species and two areas for potential closure to protect deep-sea habitats.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement	GFCM is collaborating with the ICCAT to register and exchange information on vessels fishing for tuna and tuna-like species in the Convention Area. MCS in the GFCM region is currently carried out primarily on a national basis. Data sharing with CCSBT limited. Implementing MeDFiSiS (i.e., minimum standard for statistics collection).
Monitors/improves compliance	
Detection of ancillary impacts	Conducted some studies on effects of fishing gear on bottom habitats.
Penalties for non-compliance	None apparent.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

On 24 September 1949 the General Fisheries Council for the Mediterranean (GFCM) was established. The purpose of the Council was to promote the development, conservation, rational management and the best utilization of living marine resources of the Mediterranean and the Black Seas. In November 1997 the name of the organization was changed to Commission, membership was opened to regional economic integration organizations, and the mandate was extended to the sustainable development of aquaculture.

GFCM has the following functions and responsibilities:

(a) to keep under review the state of these resources, including their abundance and the level of their exploitation; and

(b) to formulate and recommend appropriate measures for the conservation and rational management of living marine resources (e.g. regulating fishing methods and gear, prescribing minimum sizes for individuals of specified species, establishing open and closed fishing seasons and areas, and regulating the amount of total catch and fishing effort and their allocation among members).[68]

The Commission also recognizes, among other things, the need for reviewing the economic and social aspects of the fishing industry and recommending appropriate measures for its development; implementing training and extension activities in all aspects of fisheries; and undertaking research activities, such as cooperative projects in the areas of fisheries and the protection of living marine resources.

The most recent amendment of the GFCM convention in 1997 added that the PA would be applied 'to conservation and management decisions, taking into account the best scientific evidence available and the need to promote the development and proper utilization of living marine resources'.

It was further agreed that Commission members should report steps taken to implement the Code of Conduct and results achieved.[69]

In 1999 twenty delegates gathered to discuss 1) the dissemination of the Code of Conduct and improvement in the planning process for its implementation; 2) harmonization between aquaculture and environmental conservation; and 3) the use of the Code to upgrade the economic value of aquaculture and to improve and stabilize trade in aquaculture products in the Mediterranean.[70] Since then much of the GFCM focus in applying the Code has remained on aquaculture and enhancing socio-economic opportunities.

Notably, GFCM's Sub-Committee on Economic and Social Sciences is developing socio-economic indicators for fisheries management, including recreational and sport fisheries. To this end, requests have been made to Contracting Parties to collect data on, *inter alia:*

[68] G.L. Lugten, 'A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues', *FAO Fisheries Circular 940*, Food and Agriculture Organization of the United Nations, Rome, 1999, p. 26.

[69] FAO, *Coordinating Working Party on Fishery Statistics. Report of the Eighteenth Session*, Luxembourg, 6–9 July 1999.

[70] FAO, *Report of the Consultation on the Application of Article 9 of the FAO Code of Conduct on Responsible Fisheries in the Mediterranean Region*, Rome, 19–23 July 1999, p. 208.

- relevant exploratory information on recreational and sport fisheries;
- socio-economic data; and
- import and export flows from various trade blocs to promote the analysis of market situations affecting fisheries management.[71]

Most GFCM decisions are taken by a simple majority, with every party having one vote, except in the case of regional economic integration organizations (REIOs) such as the European Union, which are entitled to exercise a number of votes equal to the number of their member states that are entitled to vote at the meeting. REIOs are not entitled to exercise their votes when individual member states exercise their right to vote, and *vice versa*.[72]

Target species

GFCM target species include hake, red mullet, striped mullet, blue and red shrimp, Norway lobster, anchovy, sardine, dolphin, Eastern Atlantic bluefin tuna and swordfish.

Currently, catches in the Mediterranean Sea and Black Sea, grouped together as one statistical reporting area by the FAO, run to around 1.5 million tonnes per year. That is more than double the 700,000 tonnes landed in 1950, but is down from the historical high of 2 million tonnes/year averaged during the 1982–88 period. Generally, CPUE is declining in the Mediterranean. Currently, small, open-water fish (pelagics) make up around half of all Mediterranean catches, with anchovies and sardines being the two most important such species. Bottom-dwelling (demersal) fish such as hake, red mullet and blue whiting account for around 40% of catches. The FAO's most recent global assessment identified a number of Mediterranean stocks as overexploited, including bluefin tuna, Atlantic bonito, hake, swordfish, whiting, striped mullet and sea bream.[73]

A growing concern in the region is related to the capture of juvenile bluefin tuna used as 'seed' in captured-based aquaculture (CBA). Also known as tuna-fattening, CBA is a practice in which tuna are caught in the wild and then penned and fattened using aquaculture techniques prior to harvesting. The FAO estimates that production of bluefin tuna using this method currently amounts to around 25,000 tonnes a year, up from 10,000 tonnes just five years ago. CBA of bluefin tuna is currently concentrated in Croatia, Malta, Spain and Turkey. According to the FAO, the practice poses some serious concerns, as it puts increased pressure on already fragile stocks. At the same time, captures of 'seed stock' may be going unreported, handicapping efforts to assess the stock's status.[74]

Management measures

GFCM is in the process of developing a management programme particularly for demersal trawling fisheries exploiting, *inter alia*, hake (*Merluccius merluccius*), blue and red shrimp (*Aristeus antennatus*), red mullet (*Mullus barbatus*), striped mullet (*Mullus surmuletus*), red shrimp (*Aristaeomorpha foliacea*) and Norway lobster (*Nephrops norvegicus*) in the following geographic sub-areas : Northern and Southern Alboran Sea (GSA 1 and 3), Northern Spain (GSA 6), Balearic Islands (GSA 5), Gulf of Lions (GSA 7), Corsica Island (GSA 8), Ligurian and North Tyrrhenian Sea (GSA 9), South and Central Tyrrhenian Sea (GSA 10), Sardinia (GSA 11), South of Sicily (GSA 16), Northern Adriatic

[71] FAO, General Fisheries Commission for the Mediterranean, *Report of the ninth session of the Scientific Advisory Committee*, Rome, 24–27 October 2006, FAO Fisheries Report No. 814, p. 5.
[72] http://www.oceanlaw.net/orgs/gfcm.htm.
[73] http://www.fao.org/newsroom/en/news/2005/105722/index.html.
[74] Ibid.

Sea (GSA 17), Southern Adriatic Sea (GSA 18), Western Ionian Sea (GSA 19), Eastern Ionian Sea (GSA 20), Aegean Sea (GSA 22), as well as in the adjacent sub-areas, if relevant.

The Commission also plans to develop an effort management scheme for certain small pelagic fisheries in particular pelagic trawling and purse-seines in the pelagic fisheries exploiting, *inter alia*, anchovy (*Engraulis encrasicolus*), sardine (*Sardina pilchardus*) and sprat (*Sprattus sprattus*), in particular in the following geographic sub-areas : Northern and Southern Alboran Sea (GSAs 1 and 3), Northern Spain (GSA 6), Gulf of Lions (GSA 7), Northern Adriatic Sea (GSA 17), South of Sicily (GSA 16) and Aegean Sea (GSA 22), as well as in the adjacent sub-areas, if relevant.[75]

In addition, GFCM has established seasonal closures on fisheries using fish aggregating devices (FADs) in order to protect the dolphin (*Coryphaena hippurus*), in particular small fish.

The GFCM intends to manage its fisheries capacity by implementing the following:

- indicators of sustainability (economic and social indicators, biological reference points, environmental benchmarks);
- a consolidated statistical base;
- geographical management units/sub-areas and operational fisheries units;
- identification of key shared fisheries; and
- fleet segmentation to monitor fishing capacity.[76]

The GFCM has adopted Resolution 95/4, which calls on members to prepare a list of fishing boats operating from ports in the Mediterranean and requests that the Secretariat establish a common data base on existing fleets of fishing vessels operating outside national jurisdiction. Compliance with this Resolution has been low.[77]

In addition, GFCM Contracting Parties were submitting data on fishing vessels over 15 metres fishing in the western Mediterranean (e.g. vessel attributes and types of boat/gear), but are no longer doing so. As a result, GFCM now intends to monitor fleet capacity based on vessel segmentation (i.e., 13 fleet segments mainly based on vessel length) and through LOUs. To this end, it is preparing an inventory of catches of shared stocks generated by geographical areas. Contracting Parties are responsible for adopting management measures to adjust fishing effort for selected demersal species and small pelagics in keeping with the advice of GFCM's Scientific Committee.[78]

GFCM is also considering whether all states whose fishing vessels operate in international waters in the Mediterranean should have to provide information on these vessels. The Commission may also develop a Fishing Monitoring and Control Scheme to address the activities of vessels fishing under flags of convenience in the Mediterranean. Initial steps have been taken to develop such a scheme, with emphasis on flag state responsibility. Furthermore, GFCM is collaborating with ICCAT to register and exchange information on vessels fishing for tuna and tuna-like species in the Convention Area, with respect to both capacity and compliance.[79]

[75] FAO General Fisheries Commission for the Mediterranean, *Report of the Thirtieth Session*, Istanbul, Turkey, 24–27 January 2006, pp. 31–2, 56.

[76] J. Swan, *Implementation of the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing: Relationship to, and Potential Effects on, Fisheries Management in the Mediterranean*, Studies and Reviews No. 76, General Fisheries Commission for the Mediterranean, Food and Agriculture Organization of the United Nations, Rome, 2005, p. 8.

[77] Ibid., p. 8.

[78] Ibid., p. 9.

[79] Ibid., pp. 13–14.

IUU fishing

The EU Fisheries Council has adopted measures to address IUU fishing, and since a number of EU countries also are members of GFCM, this may either serve as a framework for future GFCM action, or at a minimum provide some coherence in efforts to address IUU fishing while GFCM is formulating its own actions.

Still, identifying and quantifying IUU fishing activities in the Mediterranean is a major constraint for GFCM. Although a capture database for the GFCM area is maintained at the FAO, it does not readily reveal IUU fishing information. The data are sourced from ICCAT and FAO member countries, and it is unclear whether these data are verified.[80]

Monitoring, control and surveillance (MCS) in the GFCM region is currently carried out primarily on a national basis. At present GFCM is faced with uneven data submission by members, the need for an integrated database, uncertainties in stock evaluations, inadequate monitoring (of fishing effort as well as fisheries activities), lack of control, and limited surveillance/enforcement and institutional capacity.[81] At this point, it does not appear that GFCM is accounting for the effects of bycatch or IUU fishing effort in its fishery management decisions.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

In 2005 GFCM adopted a resolution requesting its members to adopt management measures aimed at increasing the selectivity of demersal trawl nets, notably through the immediate implementation of a 40-mm mesh size opening for the whole trawl net codend.[82] The Scientific Advisory Committee (SAC) also recommended that the Commission take into account the need to assess, under different scenarios, the possible socio-economic impact that the square mesh might have, especially for coastal fishery activities.[83] The SAC also recognized the need for harmonizing the legal size of small pelagics in line with their size at first sexual maturity.[84]

2.2 Species listed by recognized authorities as threatened, endangered or protected

Among other actions currently being discussed by the SAC and its related sub-committees is the testing of pingers as a deterrent to cetacean entanglement and the exploration of related socio-economic impacts of various conservation measures, such as pinger use, on the fishery sector.[85]

[80] Ibid., p. 20.

[81] Ibid., p. 20.

[82] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments, A/61/154, p. 32.

[83] FAO General Fisheries Commission for the Mediterranean, *Report of the ninth session of the Scientific Advisory Committee, Rome, 24–27 October 2006*, FAO Fisheries Report No. 814, p. 8.

[84] Ibid., p. 2.

[85] Ibid., p. 5.

In 1997 GFCM, under Resolution 97/1, adopted a binding recommendation prohibiting driftnet fishing in the Mediterranean with nets more than 2.5 km in length,[86] which benefits threatened and endangered seabird and marine mammal species.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

In 2006 GFCM announced plans to participate in a Global Environment Facility (GEF) proposal entitled: 'Strategic Partnership for the Mediterranean Large Marine Ecosystem – Regional Component: Implementation of agreed actions for the protection of the environmental resources of the Mediterranean Sea and its coastal areas'. This proposal would help with the implementation of two Strategic Action Programmes (SAPs), namely SAP Med (addressing pollution from land-based activities) and SAP BIO (addressing loss of marine and coastal biodiversity). It was noted that GFCM, together with the FAO and the UN Environment Programme (Specially Protected Areas/Regional Activity Centre – RAC/SPA), would be involved in the components of the programme dealing respectively with the conservation and sustainable use of the biological biodiversity of vulnerable coastal resources and with marine resources of the Mediterranean's large marine ecosystem. The formulation phase was completed, and the project was to be submitted to the GEF Council for its review.[87]

GFCM also collaborates with ICCAT with respect to the management of tuna, particularly in terms of aquaculture projects.

2.4 Habitats

GFCM has called for restrictions on fishing in some areas in order to protect sensitive deep-sea habitats. GFCM has adopted recommendations requiring members to prohibit the use of towed dredges in trawl-net fisheries at depths greater than 1,000 metres and prohibiting the use of bottom-trawls and dredges in three specific areas to protect corals, cold hydrocarbon seeps and seamounts (i.e., *Lophelia* reefs off Capo Santa Maria di Leuca, Nile Delta cold hydrocarbon seeps and Eratosthenes Seamounts).[88]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

In 1997, when GFCM amended the terms of its mandate, it included a reference to the Precautionary Approach.[89] In addition, some of its key long-term objectives now include the need to institute precautionary measures, such as:

[86] S. Tudela, *Ecosystem Effects of Fishing in the Mediterranean: An Analysis of the Major Threats of Fishing Gear and Practices to Biodiversity and Marine Habitats*, General Fisheries Commission for the Mediterranean, Studies and Reviews No. 74, FAO, Rome, 2004, p. 31.

[87] General Fisheries Commission for the Mediterranean, *Report of the ninth session of the Scientific Advisory Committee, Rome, 24–27 October 2006,* FAO Fisheries Report No. 814, p. 3.

[88] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments, A/61/154, p. 33.

[89] Ibid., p. 36.

- for demersal resources, fisheries management by means of effort control, in combination with technical measures such as seasonal or permanent fishery closures;
- management schemes, including the PA, for small pelagic fish stocks;
- a control scheme for fishing vessels using 'flags of convenience';
- statistics collection to be standardized, and the Secretariat to maintain relevant databases of information; and
- development of an integrated systems-based approach to fisheries management.[90]

Other precautionary areas of focus for GFCM included exploring the application of an ecosystem approach to fisheries management, updating the mapping of fish habitat, and improving the exchange of information on the incidental capture of protected species and large migratory sharks.[91] In May 2004, at a its stock assessment sub-committee meeting, GFCM discussed the need for the initial adoption of limit reference points in order to implement management interventions. However, action on the adoption of target reference points was deferred to a later date.[92]

GFCM is in a unique position as a subsidiary body of the FAO. However, this relationship has not proved particularly advantageous in its efforts to advance precautionary measures. In fact, GFCM has not really done much more than just state its intent to implement the PA.

One aspect of the PA on which the GFCM has actually moved forward is dispute settlement. Disputes between parties, if not settled by the Commission, are to be referred to a committee composed of members appointed by each of the parties to the dispute, plus an independent chair to be chosen by the members of the committee. The recommendations of such a committee are not binding, but should become the basis for renewed consideration by the parties. If the dispute remains unsettled, it is referred to the International Court of Justice at The Hague or, in the case of regional economic integration organizations (REIOs), to arbitration, unless the parties to the dispute agree to another method of settlement.[93]

GFMC has made a concerted effort to collaborate with other international bodies, such as ICCAT on the management of shared resources, and GEF on pollution and biodiversity issues in the region. The Commission also appears to be giving a high priority to the development of socio-economic indicators, which is critical in the implementation of ecosystem management efforts, more so than for any other RFMO reviewed for this report. However, it remains to be seen whether either of these activities will result in further precautionary measures being taken by GFMC in the Mediterranean to regulate fish stocks and associated and dependent species.

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

In most countries, statistical information is gathered through a national fisheries data collection

[90] G.L. Lugten, 'A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues', FAO Fisheries Circular No. 940, Food and Agriculture Organization of the United Nations, Rome, April 1999, p. 26.

[91] GFCM, Appendix E: List of Recommendations. Sub-committee on Marine Environment and Ecosystems (SCMEE). Scientific Advisory Committee (SAC). General Fisheries Commission for the Mediterranean (GFCM), Malaga, 10–12 May 2004, p. 19.

[92] GFC-MSAC, A Synthesis of the Workshop on Reference Points held in Rome on 20–21 April 2004; Sub-committee Stock Assessment, Malaga, 10–12 May 2004, Annex 6, p. 51.

[93] http://www.oceanlaw.net/orgs/gfcm.htm.

system, and in some countries this is complemented by research institutes, mainly for gathering data related to stock assessment. For 2006 only a few Contracting Parties provided information on the status of assessed stocks in relation to SAC priority species and on ongoing socio-economic research. Research proposals for SAC consideration were also limited.[94]

Most of the research collected by Contracting Parties for 2005 focused on studies related to the biology and exploitation of the main demersal and small pelagic species, and to a lesser extent on large pelagic species, especially bluefin tuna and swordfish.[95]

GFCM is a member of a joint ad hoc GFCM/ICCAT Working Group, which is involved in conducting studies on large pelagic species.

4.2 Bycatch, incidentally caught and non-target species

In 2006 the SAC endorsed the following suggestions for consideration by the GFCM:

- establishment of a transversal ad hoc working group on the bycatch/incidental catches issue;
- conduct of scientific experiments to assess the impact of different types of pingers on cetacean and fish species; and
- extension of the data collection process on cetaceans to cover other endangered or sensitive species, such as turtles and sharks.[96]

4.3 Species listed by recognized authorities as threatened, endangered or protected

GFCM is collaborating with the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic areas (ACCOBAMS) to collect background data on cetacean/fishery interactions.[97]

In 2006 eight Contracting Parties reported to the GFCM that they were engaged in studies on the marine environment with emphasis on integrated coastal area management, conservation of marine turtles, and the interaction between fishing activities and cetaceans.[98] Contracting Parties also reported that they were involved in numerous studies on the reduced population of monk seals in the Mediterranean resulting from direct mortality as a result of artisanal fishing gear and an increasing scarcity of food resources driven by overfishing.[99]

Other studies by Contracting Parties assess the effects of longline fishing on seabird populations, and the indirect effects of fishing on seabirds related to food availability driven by discards.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

The FAO and Contracting Parties to the GFCM have conducted a number of studies relating to the ecosystem effects of fishing in the Mediterranean. Studies have been conducted on, *inter alia*,

[94] FAO, *Report of the ninth session of the Scientific Advisory Committee, FAO General Fisheries Commission for the Mediterranean, Rome, 24–27 October 2006*, FAO Fisheries Report No. 814, pp. 3–4.
[95] Ibid., p. 4.
[96] Ibid., p. 7.
[97] Ibid., p. 6.
[98] Ibid., p. 4.
[99] S. Tudela, *Ecosystem Effects of Fishing in the Mediterranean: An Analysis of the Major Threats of Fishing Gear and Practices to Biodiversity and Marine Habitats*, General Fisheries Commission for the Mediterranean, Studies and Reviews No. 74, FAO, Rome, 2004, p. 44.

elasmobranch populations; unsustainable catch rates of rays (including the disappearance of certain taxa from commercial catches) and elasmobranches, most notably in pelagic longlining and driftnetting; and the impact of longline fishing on marine turtle populations that are taken as bycatch (particularly on the Loggerhead turtle population).[100]

The GFCM Sub-committee on Marine Environment and Ecosystems is conducting interdisciplinary pilot studies for identifying and applying the principles of the ecosystem approach to the management of shared stocks at the sub-regional level, and testing ecological indicators in relation to the spatio-temporal monitoring of fishing effort.[101]

4.5 Habitats

The SAC has requested that its Sub-Committee on Marine Environment and Ecosystems (SCMEE) collect scientific data and information related to the legal status of establishing two new deep-sea protection zones in the Mediterranean.[102] To this end, the GFCM is conducting studies on species living at depths greater than 1,000 metres and their relationship to three sensitive habitats.

Several studies have looked at the impact of fishing on the seabed mostly as a result of the use of bottom-trawling gear, namely otter trawls, beam trawls and dredges, together with some aggressive practices affecting rocky bottoms, such as dynamite fishing and fishing for coral and date mussels. There have been some documented trawling impacts on seagrass beds by both suspending sediments and directly damaging the vegetal mass, which have the most dramatic consequences on *Posidonia* beds.[103]

4.6 Non-party and IUU fishing activities, catch and impacts

The GFCM is developing a required common minimum standard in fisheries statistics, the MeDFisiS (Mediterranean Fishery Statistics and Information System), to help countries to improve the quality of scientific information collected. It may also help to combat IUU fishing, especially in respect of shared fish stocks or highly migratory fish stocks.[104]

5. Content, structure and process of scientific advice

GFCM is composed of a number of subsidiary bodies, which provide scientific and technical advice on which management decisions are based:

[100] Ibid.

[101] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments, A/61/154, p. 34.

[102] FAO, *Report of the ninth session of the Scientific Advisory Committee*, FAO General Fisheries Commission for the Mediterranean, Rome, 24–27 October 2006, FAO Fisheries Report No. 814, p. 6.

[103] S. Tudela, *Ecosystem Effects of Fishing in the Mediterranean: An Analysis of the Major Threats of Fishing Gear and Practices to Biodiversity and Marine Habitats*, General Fisheries Commission for the Mediterranean, Studies and Reviews No. 74, FAO, Rome, 2004, p. 44.

[104] J. Swan, *Implementation of the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing: Relationship to, and Potential Effects on, Fisheries Management in the Mediterranean*, Studies and Reviews No. 76, General Fisheries Commission for the Mediterranean, Food and Agriculture Organization of the United Nations, Rome, 2005, pp. 12–13.

(a) Committee on Aquaculture: created in 1995, held its first session in 1996;

(b) Scientific Advisory Committee (SAC): established in October 1997; and

(c) Ad-hoc technical panels to advise the SAC in its review of the state of resources and thus in the formulation of management measures for consideration by the Commission.[105]

GFCM is devoting a great deal of effort to establishing regional cooperation among the different research institutions present in the areas covered by AdriaMed and MedSudMed and MedFisis. The Secretariat is especially interested in developing relationships related to the storage and analysis of fisheries data.[106]

The SAC is also exploring the possibility of strengthening collaboration with the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) through the establishment of a Memorandum of Understanding, with the aim of obtaining stock information and scientific advice.[107]

Adherence to scientific advice: Too early to evaluate. Management programme under development. However, several historically important stocks are considered overfished in the region, thus previous management has proven inadequate.

[105] http://www.oceanlaw.net/orgs/gfcm.htm.

[106] FAO, *Report of the ninth session of the Scientific Advisory Committee*, FAO General Fisheries Commission for the Mediterranean, Rome, 24–27 October 2006, FAO Fisheries Report No. 814, p. 3.

[107] Ibid., p. 6.

Inter-American Tropical Tuna Commission (IATTC)

Table 6: EBM and PA management in IATTC

Overarching objectives	To ensure long-term conservation and sustainable use of fish stocks. To be more cautious when information is uncertain, unreliable or inadequate. Absence of adequate scientific information provides no reason for postponing or failing to take conservation and management measures. To adopt measures related to dependent or associated species. To restore abundance of depleted species to MSY level.
Decision rules	Under development.
Limit reference points	Under development. Examining F_{AMSY}, the fishing mortality corresponding to the A_{MSY}, as an LRP, *Smin*, the minimum SSB seen in the model period, as an LRP. Currently, IATTC sees A_{MSY} as a limit reference point.
Target reference points	Under development. Examining S_{AMSY}, the spawning biomass corresponding to the A_{MSY}, as a target reference point.
Management measures Access/effort control	TAC for bigeye. Purse-seine vessel register rather than allocations. Registration rights purchased or transferred. Purse-seine fishery also managed via closures and capacity limits. Closures for longline fisheries. Dolphin-safe tuna certification procedures. Contracting Parties responsible for determining allocations and management for respective vessels.
Bycatch reduction	Area closures to protect juvenile tuna captured with FADs. Secretariat for IDCP (i.e., reduce dolphin mortality in purse-seine fisheries to level approaching zero – mortality cap, real-time observer reporting, dolphin safety gear, training programme for vessel captains and crews). Sea turtle programme – database and release programme/safe handling techniques. Maximum shark fin retention rates/full utilization of retained sharks/release of live sharks.
Habitat protection	Prohibits disposal of salt bags or any other type of plastic trash by vessels at sea.
Interim measures/ recovery plan	Inadequate information to assess.
Capacity reduction scheme	Capacity management scheme: closed regional vessel registry.
Evaluation	Inadequate information to assess.
Voluntary Code of Conduct	Yokohama Declaration of tuna fishermen (2005). Implemented measures under FAO IPOAs (i.e., sharks, IUU fishing and capacity reduction).
Research programme	Experiments planned to reduce mortality of billfishes, sharks, sea turtles and rays. Collect information on seabird interactions and effects on populations. Collaborative research with WWF and US NOAA on sea turtles and predator/prey relationships. Studies primary production in relation to managed fisheries. Shark studies (e.g. habitat, bycatch mitigation, relative abundance, etc.). Habitat studies (e.g. environmental conditions for tuna spawning, etc.)
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Tuna tracking and verification system. Non-contracting cooperating parties required to supply monthly reports if they exceed 500-tonne vessel limit for bigeye tuna. All catches for contracting parties reported by gear type for North Pacific albacore every six months. Requirements for non-contracting party cooperating status. All transhipments of tuna must take place in ports.
Detection of ancillary impacts	Developing model of Eastern Pacific pelagic ecosystem to explore how fishing and climate variation affect animals at middle/upper trophic levels.
Penalties for non-compliance	IUU blacklist. Non-discriminatory trade restrictive measures.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The IATTC, established by international convention in 1949, is responsible for the conservation and management of fisheries for tunas and other species taken by tuna-fishing vessels in the eastern Pacific Ocean. Decisions, resolutions, recommendations and publications of the Commission can only be made by a unanimous vote.

Specifically, the functions of the Commission are, *inter alia*, to gather and interpret information on tuna; to conduct scientific investigation concerning the abundance, biology, biometry and ecology of yellowfin and skipjack tuna in the Convention Area; and to recommend proposals for joint action for conservation.

The IATTC also has significant responsibilities regarding the implementation of the International Dolphin Conservation Programme (IDCP) and provides the Secretariat for that programme. The IDCP was formed through a legally binding multilateral agreement, which entered into force in February 1999.

In 2003 the Antigua Convention was adopted to strengthen the IATTC. The Antigua Convention has a broader mandate: 'To ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention, in accordance with the relevant rules of international law.' It boldly calls for the implementation of the Precautionary Approach and the monitoring of target and dependent and associated species. It also calls on Contracting Parties to be 'more cautious when information is uncertain, unreliable or inadequate; the absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures'.[108]

The Commission is now responsible for adopting 'measures that are based on the best scientific evidence available to ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention and to maintain or restore the populations of harvested species at levels of abundance which can produce the maximum sustainable yield, *inter alia*, through the setting of the total allowable catch of such fish stocks as the Commission may decide and/or the total allowable level of fishing capacity and/or level of fishing effort for the Convention Area as a whole'. The Commission can determine if a fish stock is fully fished or overfished and whether an increase in fishing capacity and/or the level of fishing effort would threaten the conservation of that stock. It also can, among other things, 'adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem and that are affected by fishing for, or dependent on or associated with, the fish stocks covered by this Convention, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened'.

Target species

IATTC target species include yellowfin, bigeye, albacore, skipjack, bonito, Pacific bluefin tuna, sailfish, and billfishes including marlin and swordfish.

Historically, the most important IATTC fisheries are for the scombrids (family *Scombridae*), which include tunas, bonitos, seerfishes and mackerels. The principal species of tuna caught are yellowfin,

[108] http://www.iattc.org/PDFFiles2/Antigua_Convention_Jun_2003.pdf.

skipjack, bigeye and albacore, with lesser catches of Pacific bluefin, black skipjack, and frigate and bullet tunas and other scombrids such as bonitos and wahoo.[109]

The total catch (by purse-seine and pole and line) in 2005 was 596,372 tonnes and was comprised of the following species: yellowfin tuna (273,525 tonnes), skipjack tuna (267,041 tonnes), bigeye (49,471 tonnes), Pacific bluefin tuna (4,545 tonnes), bonitos (241 tonnes), black skipjack (1,183 tonnes) and others, which includes mackerel, sharks, other tunas and miscellaneous fishes (366 tonnes). The total catch of bigeye by longline was 37,917 tonnes in 2005. The albacore catch is not included in the total catch by IATTC and was taken primarily by the United States. The total albacore catch taken in 2005 was 18,578 tonnes.

With respect to bycatch, the biggest problem for IATTC has been the bycatch and discarding of undersized tuna. In 2003 more than 20,000 tonnes of tuna were discarded.[110] According to IATTC, in 2005 bycatch and discards of billfish species (7,077 tonnes) and elasmobranch species (6,769 tonnes) accounted for the highest level of bycatch and discards in all the western Central Pacific tuna fisheries. Species most frequently caught include swordfish and blue marlin, which amounted to 2,370 tonnes and 2,320 tonnes, respectively, in 2005. The bycatch of these species is not tied to TACs for regulated species.

Management measures

Most decisions of the Commission made prior to the adoption of the Antigua Convention were resolutions on dolphin conservation and research, fish aggregating devices, compliance, regional vessel register, fleet capacity, at-sea reporting for bigeye tuna and yellowfin tuna, bycatch, finance, fishing by Non-Contracting Party vessels, dolphin-safe tuna certification procedures and a revised Tuna Tracking and Verification System.[111]

The IATTC manages tuna and tuna-like species through a combination of measures based on gear type. IATTC limits fishing in the Convention Area to vessels on its purse-seine register, rather than by allocations.[112] Purse-seine activity is managed by closure periods and carrying capacity of each Contracting Party's fleet (i.e., yellowfin, bigeye and skipjack tuna). As of 2007, area closures were in place for all longline fisheries. In addition, a TAC of 57,244 tonnes per year (2004–07) was established for bigeye longline fisheries, to be shared by China, Japan, Korea and Chinese Taipei. Other IATTC Contracting Parties, cooperating non-parties, fishing entities or REIOs were required to ensure that their total annual longline catch of bigeye tuna in the eastern Pacific Ocean during 2007 does not exceed 500 tonnes or their respective 2001 catch levels, whichever is higher. Furthermore, countries exceeding this catch are required to provide monthly catch reports for this species to the IATTC Director.

Contracting Parties have agreed to take the necessary measures to ensure that the level of fishing effort by their vessels is not increased. All catches of North Pacific albacore tuna are reported by gear type to the IATTC every six months.[113]

[109] Inter-American Tropical Tuna Commission, Fishery Status Report–Informe de la Situación de la Pesquería No. 4. Tunas and Billfishes in the Eastern Pacific Ocean in 2005, La Jolla, California.

[110] K. Malsch and C. Muffett, *The Eastern Pacific Ocean and the IATTC. A Status Report and Recommendations for Action*, Defenders of Wildlife, February 2005.

[111] J. Swan, 'Decision-Making in Regional Fishery Bodies or Arrangements: The Evolving Role of RFBs and International Agreement on Decision-Making Processes', Swansea Oceans Environment Inc., *FAO Fisheries Circular 995*, 2004, p. 65.

[112] Ibid., p. 65.

[113] IATTC Resolution C-05-02 on Northern Albacore Tuna.

A capacity management scheme is in place for Contracting Parties. A target overall capacity goal was set at a level of 135,000 tonnes (equivalent to 158,000 m^3 of carrying capacity), and the regional register was used to determine the capacity of each member. The agreement also set developmental limits on Costa Rica, El Salvador, Nicaragua, Peru and Guatemala.[114] Another interesting aspect of this plan is that new vessels are only permitted to be added to the vessel registry if a vessel of equal or greater capacity is removed. However, the measure is slightly weakened because IATTC does make exceptions. Currently the Capacity Reduction Plan is still in draft form. It has not yet been adopted, and it lacks adequate mechanisms for implementation and enforcement.

In 2004 IATTC set the requirements for attaining cooperating status with the Commission. Prospective cooperating parties had to meet criteria established in three areas.

- *Information*: Parties must provide full data on historical catch in IATTC area, annual catch and size distribution; and communicate current fishing presence and research programmes in the area.
- *Compliance*: Parties must respect all conservation measures of the IATTC-AIDCP, capacity limits in place for tuna vessels, measures taken to ensure compliance, observers, inspections at sea and VMS; and provide an appropriate response to alleged violations of IATTC.
- *Participation*: Parties must participate at plenary and scientific meetings as observers; confirm a commitment to the Commission's conservation and management measures; and inform the Commission of measures taken to ensure compliance.[115]

Also in 2004 IATTC tightened the criteria for cooperating parties, adding that when considering an application for cooperating status, the IATTC would consider the compliance of the party to fisheries commissions in other parts of the world.[116]

IUU fishing

According to IATTC, almost all of the catch by Non-Contracting Parties was fished by cooperating non-contracting parties or fishing entities and Colombia.[117] The Commission has created a Permanent Working Group on Fishing by non-parties to address IUU fishing.

IATTC also recognizes the link between IUU fishing and overcapacity. To this end, IATTC has established a fleet capacity-limitation programme, including, among other things, a regional vessel register and measures to discourage landings of fish caught by IUU fishing.[118] With respect to the latter, new purse-seine vessels are prohibited from registering unless a vessel of equal or greater capacity is removed. Some specific exceptions are, however, included in the programme for named parties. IATTC is close to adopting a regional management plan addressing fishing vessel capacity.[119]

[114] IATTC Resolution C-02-03 on Capacity of the Tuna Fleet Operating in the Eastern Pacific Ocean.

[115] IATTC Resolution C-04-02 on Criteria for Attaining the Status of Cooperating Status.

[116] IATTC Resolution C-04-01.

[117] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF, 210/2006/1, p. 55.

[118] J. Swan, 'Decision-Making in Regional Fishery Bodies or Arrangements: The Evolving Role of RFBs and International Agreement on Decision-Making Processes', Swansea Oceans Environment Inc., FAO Fisheries Circular 995, 2004.

[119] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement:*

This capacity-reduction programme requires that Contracting Parties and all participants in these fisheries should limit the total fleet capacity to the present level and to reduce it, as appropriate, in accordance with an agreed programme. After any targets for the fleet capacity have been achieved, Contracting Parties and all participants in these fisheries should exercise caution to avoid growth in fleet capacity.

The immediate objective is to be achieved through a series of actions related to two main strategies:

(a) update a comprehensive regional assessment of fishing capacity and improve the capability for monitoring fishing capacity; and

(b) consider a reduction schedule to manage fishing capacity effectively.[120]

In addition, Contracting Parties which import products of species managed by IATTC must submit annual reports on import and landing data. Furthermore, the Commission, through the Permanent Working Group on Compliance or the Joint Working Group on Fishing by Non-Contracting Parties, as appropriate, should identify each year Contracting and Non-Contracting Parties which have undermined the effectiveness of conservation and management measures under the IATTC Convention, and provide them with an opportunity to explain why they did so. A decision is then made by the Commission whether to revoke permission for the Contracting Party to fish in the convention area, allow it to continue to fish, or adopt non-discriminatory trade restrictive measures. The effectiveness of this resolution is to be evaluated in 2008.

In 2005 IATTC established an IUU vessel list based on information collected by Contracting Parties and from any other relevant sources. However, it does not appear that IUU fishing catches are accounted for in the establishment of TACs, even though it is known that organized tuna laundering operations have been conducted, and a significant amount of catches by IUU tuna longline fishing vessels have been transhipped under the names of duly licensed fishing vessels within the Convention Area.

In 2007 IATTC adopted a resolution which required that except under the special conditions, all transhipment operations of tuna and tuna-like species in the IATTC Convention Area must take place in port.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

To protect juvenile bigeye caught in association with FADs, area closures were initially adopted to limit the total catch and to increase yield per recruit by reducing the take of very small fish. However, area closures were subsequently abandoned, and scientists then recommended to set a vessel maximum limit of catching bigeye for seiners. The limit was to have been based on the fact that only about 15 seiners contributed almost all the juvenile catch of bigeye. However, this proposal was rejected in 2005 and 2006; hence no management plan is in place, except measures for juvenile yellowfin tuna, which help to some extent to protect small bigeye, as they are frequently caught together.

Report of the Secretary-General. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 34.

[120] IATTC, Plan for Regional Management of Fishing Capacity, 73rd Meeting, Lanzarote, Spain, 20–24 June 2005.

Furthermore, in 2004 IATTC adopted a comprehensive resolution (C-04-05 (REV 2) on bycatch designed to reduce the bycatch of juvenile tunas and non-target species, including dolphins, turtles, seabirds and sharks, and the release of unharmed non-target species.[121]

IATTC Resolution C-04-05 instructs the Director to seek funds for the reduction of incidental mortality of juvenile tuna, for developing techniques and equipment to facilitate the release of billfishes, sharks and rays from the deck or the net, and to carry out experiments to estimate the survival rates of released billfishes, sharks and rays. In addition, IATTC has adopted a resolution on the live release of sharks, rays, billfishes, dorado and other non-target species.

As a result of the AIDCP, IATTC must develop and implement a number of measures to improve the protection of the ecosystem and tuna, including, *inter alia*:

- develop and implement a programme for assessing, monitoring and minimizing bycatch of juvenile tuna and non-target species in the Agreement Area;
- to the maximum extent practicable, develop and require the use of selective, environmentally safe and cost-effective fishing gear and techniques;
- require that Contracting Party vessels operating in the Agreement Area release alive incidentally caught sea turtles and other threatened or endangered species, to the maximum extent practicable; and
- initiate investigations to assess whether the fishing capacity of vessels fishing in the Agreement Area poses a threat to the sustainability of tuna stocks and other living marine resources associated with the fishery and, if so, examine possible measures and recommend their adoption whenever appropriate.

The agreement also requires that Contracting Parties develop national laws to complement these efforts.

2.2 Species listed by recognized authorities as threatened, endangered or protected

Contracting Parties are required to collect, and provide to the Commission, information on interactions with seabirds. In turn, IATTC scientists will assess the overall impact of these incidental catches on seabird populations. For instance, a population model for black-footed albatross is being developed to assess whether past and present levels of bycatch are likely to affect the population level of this species significantly, and to generate a protected species model that can be applied to multiple species and used to provide management advice. In addition, IATTC purse-seine observer data are being used to plot seabird distributions.

With respect to dolphin/fisheries interactions, IATTC, through the AIDCP, coordinates the following programme objectives:

- reduce incidental dolphin mortalities in the tuna purse-seine fishery to levels approaching zero, through the setting of annual limits;
- seek ecologically sound means of capturing large yellowfin tunas not in association with dolphins; and

[121] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 38.

- take into consideration the interrelationship among species in the ecosystem, with special emphasis on, *inter alia*, avoiding, reducing and minimizing bycatch and discards of juvenile tunas and non-target species.

Furthermore, in 2005 IATTC imposed a 5,000-tonne mortality cap for dolphins in the tuna purse-seine fishery in 2005. This cap is adjusted annually and represents 0.1% of the Minimum Estimated Abundance N_{min}. Furthermore, under the AIDCP, in the event that annual mortality of 0.1% of N_{min} is exceeded for either eastern spinner or north-eastern spotted dolphin stocks, the Contracting Parties are required to conduct a scientific review and assessment and consider further recommendations.

The Agreement also requires IATTC to establish a system, based on real-time observer reporting, to ensure effective implementation and compliance with the per-stock, per-year dolphin mortality cap and an equitable system for the assignment of dolphin mortality limits to individual vessels. Other aspects of the Agreement include:

- incentive programmes for vessel captains to reduce mortality;
- the required use of dolphin safety gear and equipment (e.g. purse-seines must be equipped with a dolphin safety panel);
- technical training and certification for fishing captains and crews on gear and its use and on the techniques for the rescue and safety of dolphins; and
- the development of a tracking and verification system of tuna harvested with and without mortality or serious injury of dolphins. If the mortality in any given year rises above the levels which an independent International Review Panel considers to be significant, the Panel can recommend that the Parties hold a meeting to review and identify the causes of mortality and formulate options to address such causes.

In addition, a database has been compiled to monitor sea turtle sightings, captures and mortalities reported by observers. IATTC is also developing a three-year programme to address the mitigation of sea turtle bycatch, biological research on sea turtles, the improvement of fishing gears, industry education, and other techniques to improve sea turtle conservation. Additional initiatives include:

- provisions regarding the release and handling of sea turtles captured in purse-seines;
- the prohibition of vessels to dispose of plastic containers and other debris at sea; and
- instructions to the Director to study and formulate recommendations regarding the design of FADs, particularly the use of netting attached underwater to FADs.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

The IATTC staff has developed a model of the Eastern Pacific pelagic ecosystem to explore how fishing and climate variation might affect the animals at middle and upper trophic levels. The ecosystem model has 38 components, including the principal exploited species (e.g. tunas), functional groups (e.g. sharks and flying fishes), and sensitive species (e.g. sea turtles). The model was also used to evaluate the relative contributions of fishing and the environment in shaping ecosystem structure in the tropical pelagic Eastern Pacific Ocean. This was done by using the model to predict which components of the ecosystem might be susceptible to top-down effects of fishing, given the apparent importance of environmental variability in structuring the ecosystem. In general, animals with relatively low turnover rates were influenced more by fishing than by the environment.[122]

[122] Ibid.

In 2005 IATTC adopted a resolution on sharks which required, *inter alia*,

- national Plans of Action are adopted by Contracting Parties;
- preliminary advice on the stock status of key shark species is provided and a research plan for a comprehensive assessment of these stocks proposed;
- fishermen utilize fully any retained catches of sharks;
- vessels are permitted to have on board fins equal to no more than 5% of the weight of sharks on board; adequate certification, monitoring or other appropriate measures are to be implemented to ensure compliance; and
- vessels are encouraged to release live sharks, especially juveniles, to the extent practicable, which are caught incidentally and are not used for food and/or subsistence.

2.4 Habitats

IATTC addressed the issue of lost or abandoned fishing gear and related marine debris in its resolution C-04-05 on bycatches, by prohibiting vessels from disposing of salt bags or any other type of plastic trash at sea.[123]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

Under the Antigua Convention and the AIDCP, IATTC is required to apply the Precautionary Approach, as described in the relevant provisions of the Code of Conduct for Responsible Fisheries and the UN Fish Stocks Agreement, which state that where the status of target and non-target species is of concern, such stocks and species shall be subject to enhanced monitoring in order to review the status and efficacy of conservation and management measures. The PA is applied by IATTC in the annual determination of its fisheries conservation measures as well as other measures, such as capacity controls and bycatch restrictions.

Specifically, since the 1980s IATTC has taken into account scientific advice, including precaution in the absence of information. A working group on reference points has been established to suggest precautionary limits and targets.[124] While IATTC has not yet adopted any target or limit reference points for the stocks it manages, it is considering the following:

- S_{AMSY}, the spawning biomass corresponding to the A_{MSY},[125] as a target reference point;
- F_{AMSY}, the fishing mortality corresponding to the A_{MSY}, as a limit reference point;
- S_{min}, the minimum spawning biomass seen in the model period, as a limit reference point. The S_{min} reference point is based on the observation that the population has recovered from this population size in the past (e.g. the levels estimated in 1983); and
- maintaining tuna stocks at levels corresponding to the A_{MSY} is the management objective specified by the IATTC Convention. If catches for target species reach the yield limit, management measures are imposed.[126]

[123] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 40.

[124] Ibid., p. 31.

[125] Average maximum sustainable yield.

[126] http://www.iattc.org/PDFFiles2/SAR6-YFT-ENG.pdf, p. 18.

In addition, the amended Agreement on the AIDCP does much more than just promote the protection of dolphins in tuna fisheries. It is a broad sweeping agreement with implications for both the PA and EBM.

AIDCP (2005) seeks to ensure the long-term sustainability of marine-related species as well as take into consideration the ecological relationships among species. To this end, Contracting Parties are to adopt measures to ensure the conservation of ecosystems as well as tuna stocks and other stocks of living marine resources associated with the tuna purse-seine fishery in the Agreement Area, based on the best scientific evidence available, and apply the PA consistent with the relevant provisions of the FAO Code of Conduct for Responsible Fisheries and the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks. Such measures are to be designed to maintain or restore the biomass of harvested stocks at or above levels capable of producing maximum sustainable yield, and with the goal of maintaining or restoring the biomass of associated stocks at or above levels capable of producing MSY.[127]

Other areas where IATTC has made progress in more broadly implementing the PA is through its efforts to reduce capacity in the fishery, combat IUU fishing through a well-articulated cooperating non-contracting party scheme, and the implementation of a comprehensive research programme which, as specified under Annex II of the UN Fish Stocks Agreement, assesses target and associated dependent species.

Furthermore, IATTC is unique among RFMOs in that it does not allow Contracting Party objections (or opt-out provisions if they choose not to comply with conservation and management measures) and requires unanimous agreement among all members for its decisions, thereby preventing the occurrence of objections.[128] Thus IATTC is in a better position to be precautionary than most RFMOs with an objections procedure, because IATTC can more readily implement pre-agreed management actions to be taken when precautionary reference points are approached.

4. Data collection and sharing

IATTC data are derived from various sources, including vessel logbooks, observer data, unloading records provided by canners and other processors, export and import records, estimates derived from the species and size composition sampling programme, reports from governments and other entities, and published reports.

4.1 Target species (effort, catch, area, time)

Through its tuna-billfish programme, IATTC studies the biology of the tunas and related species of the eastern Pacific Ocean with a view to determining the effects that fishing and natural factors have on their abundance; recommends appropriate conservation measures so that the stocks of fish can be maintained at levels which afford maximum sustainable catches; and collects information on compliance with Commission resolutions.

4.2 Bycatch, incidentally caught and non-target species

Data on the bycatches of large purse-seine vessels are being collected by IATTC through its Contracting Parties. IATTC scientists also collect data on the spatial distributions of the bycatches

[127] Inter-American Tropical Tuna Commission, Agreement on the International Dolphin Conservation Programme (amended), 2005.

[128] J. Swan, 'Decision-Making in Regional Fishery Bodies or Arrangements: The Evolving Role of RFBs and International Agreement on Decision-Making Processes', Swansea Oceans Environment Inc., FAO Fisheries Circular 995, 2004.

and the bycatch/catch ratios for analyses of policy options to reduce bycatch, as well as information to evaluate measures to reduce the bycatches, such as closures or effort limits.[129] Estimating the total bycatch of a species of fish is difficult, for various reasons. Some fish are discarded at sea, and the data for some gear types are often incomplete. Data for fish discarded at sea by Class-6 purse-seine vessels have been collected by observers since 1993. This information allows for a better estimation of the total amounts of fish caught by the purse-seine fleet.[130]

IATTC has a tuna/dolphin research programme which is designed to:

- monitor the abundance of dolphins and their mortality incidental to purse-seine fishing in the eastern Pacific Ocean;
- study the causes of mortality of dolphins during fishing operations and promote the use of fishing techniques and equipment which minimize these mortalities; and
- study the effects of different modes of fishing on the various fish and other animals of the pelagic ecosystem.

In compliance with AIDCP, IATTC is to conduct research to improve gear, equipment and fishing techniques, including those used in the fishery for tunas associated with dolphins.

4.3 Species listed by recognized authorities as threatened, endangered or protected

IATTC began a programme, supported by the World Wildlife Fund and the US government, to mitigate the incidental capture of sea turtles; to reduce the mortality of sea turtles as a result of the coastal longline fisheries of North, Central and South America; and to compare the catch rates of tunas, billfishes and dorado using circle and J-hooks of two sizes. Improved procedures and instruments to release hooked and entangled sea turtles have also been shared with longline fleets in the region. Observers have recorded data on almost 400 fishing trips of vessels which tested the different hooks. The programme is actively running in Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Panama and Peru, with plans to implement the programme in Nicaragua in 2006. Some activities are also being carried out in Mexico. The programme in Ecuador is being carried out in partnership with the government and the Overseas Fishery Cooperation Foundation of Japan, while those in other countries are currently funded by US agencies.

Initial results show that in the fisheries which target tunas, billfishes and sharks there was a significant reduction in the hooking rates of sea turtles with circle hooks, and fewer hooks lodged in the oesophagus or other areas damaging to turtles. Catch rates of the target species are in general similar to the catch rates with J-hooks. An experiment was also carried out in the dorado fishery using smaller circle hooks. There were reductions in turtle hooking rates, but the reductions were not as great as for the fisheries which target tunas, billfishes and sharks. In addition, workshops and presentations were conducted by IATTC staff members and others in all the countries participating in the programme.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

The IATTC Convention states that the Commission is to conduct 'investigations concerning the abundance, biology, biometry and ecology of yellowfin (*Neothunnus*) and skipjack (*Kaisuwonus)* tuna in the waters of the eastern Pacific Ocean fished by the nationals of the High Contracting Parties, and

[129] Ibid.
[130] IATTC, Fishery Status Report No. 4, La Jolla, California, 2006, p. 7.

the kinds of fishes commonly used as bait in the tuna fisheries, especially the anchovetta, and of other kinds of fish taken by tuna fishing vessels; and the effects of natural factors and human activities on the abundance of the populations of fishes supporting all these fisheries'.

To this end, IATTC conducts ongoing research on the connection between the El Niño Southern Oscillation (ENSO) phenomenon and the rate of primary production, phytoplankton biomass, and phytoplankton species composition.

IATTC has conducted a joint project with the National Marine Fisheries Service (NMFS), which included studies of the food habits of co-occurring yellowfin, skipjack and bigeye tuna, dolphins, pelagic sharks, billfishes, dorado, wahoo, rainbow runner and others.[131]

IATTC has also requested that its Contracting Parties gather relevant information on sharks in fisheries under its management, including:

- research to identify ways to make fishing gear more selective;
- research to identify shark nursery areas; and
- annual data on catches, effort by gear type, landing and trade of sharks by species, where possible in accordance with IATTC reporting procedures, including available historical data. Contracting Parties shall send to the IATTC Secretariat by 1 May at the latest a comprehensive annual report of the implementation of this Resolution during the previous year.

In addition, the Commission shall consider appropriate assistance to developing Contracting Parties for the collection of data on shark catches.[132]

IATTC scientists also have conducted preliminary estimates of relative abundance for species such as silky shark (*Carcharhinus falciformis*), which is the most commonly caught species of shark in the purse-seine fishery for tunas in the eastern Pacific Ocean.[133]

4.5 Habitats

Tunas and billfishes are pelagic during all stages of their lives, and the physical factors that affect the tropical and subtropical Pacific Ocean can have important effects on their distribution and abundance. Environmental conditions are thought to cause considerable variability in the recruitment of tunas and billfishes. Thus, ICCAT conducts ongoing research into oceanographic conditions that are believed to influence recruitment in the eastern Pacific Ocean, and stock assessments often include assumption of this relationship. To this end, IATTC reports monthly average meteorological and oceanographic data on a quarterly basis for the eastern Pacific Ocean, including a summary of current ENSO conditions.[134]

IATTC has also made assessments of habitat preferences and the effect of environmental changes.[135]

[131] IATTC, *Annual Report of the Inter-American Tropical Tuna Commission 2004*, La Jolla, California, 2006, p. 20.

[132] IATTC, Resolution C-05-03 on the Conservation of Sharks Caught in Association with Fisheries in the Eastern Pacific Ocean.

[133] IATTC, *Annual Report of the Inter-American Tropical Tuna Commission 2004*, La Jolla, California, 2006, p. 20.

[134] Inter-American Tropical Tuna Commission, Fishery Status Report No. 4, *Tunas and Billfishes in the Eastern Pacific Ocean in 2005*, La Jolla, California, 2006.

[135] Ibid.

4.6 Non-party and IUU fishing activities, catch and impacts

One of the main responsibilities of the working group on fishing by non-parties is to assess the extent and impact of IUU fishing in the area of the Agreement.[136]

5. Content, structure and process of scientific advice

The Commission has a staff of scientists, who work with national scientists to:

- collect and analyse information relating to current and past conditions and trends of the populations of fishes covered by this Convention;
- study and appraise information concerning methods and procedures for maintaining and increasing the populations of fishes covered by the Convention;
- recommend from time to time, on the basis of scientific investigations, proposals for joint action by the High Contracting Parties designed to keep the populations of fishes covered by this Convention at those levels of abundance which will permit the maximum sustained catch; and
- collect statistics and reports concerning catches and the operations of fishing boats, and other information concerning the fishing for fishes covered by this Convention, from vessels or persons engaged in these fisheries.

The work of the staff in carrying out the Commission's functions and duties is divided into two programmes: the Tuna-Billfish Programme and the Tuna-Dolphin Programme. The responsibilities of these respective programmes are outlined in IATTC Section 4.1 and IATTC Section 4.2. IATTC also has working groups on bycatch and capacity reduction.

Adherence to scientific advice: Scientific advice is *consistently* followed in establishing catch limits, and catch limits are *consistently* adhered to once established. However, it could be argued that catch limits might be 'inconsistently' complied with as a result of overages from regulatory discards of undersized tuna.

[136] J. Swan, 'Decision-Making in Regional Fishery Bodies or Arrangements: The Evolving Role of RFBs and International Agreement on Decision-Making Processes', Swansea Oceans Environment Inc., FAO Fisheries Circular 995, 2004, p. 66.

International Baltic Sea Fisheries Commission (IBSFC)

Table 7: EBM and PA management in IBSFC

Overarching objectives	Former IBSFC objective: 'To preserve and increase the living resources of the Baltic Sea and the Belts ... and to obtain the optimum yield.' Under Baltic 21, IBSFC pledged, among other things, 'to maintain biologically viable fish stocks ... appropriate selective fishing techniques'. EU objective: 'To ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions... apply the Precautionary Approach ...'
Decision rules	Inadequate information to assess.
Limit reference points	Minimum SSB defined by ICES for cod stocks. No LRP established as yet by EU.
Target reference points	Target fishing mortality rates advised by ICES for cod stocks (0.3 for eastern stock/0.3-0.6 for western stock). No TRP established as yet by EU.
Management measures Access control	TACs. Closed fishing seasons. Minimum fish and mesh sizes. Under EU closed areas to protect juveniles.
Bycatch reduction	Limits on soak time for fixed gear and gear configurations. EU 'discard ban trials'. ASCOBANS recovery plan for harbour porpoise. HELCOM conservation plan for harbour porpoise and seals.
Habitat protection	HELCOM is addressing pollution in Baltic, among other things. EU considering closed areas for harbour porpoise.
Interim measures/ recovery plan	Salmon action plan (long-term management plan). Cod recovery plan. EU quota reductions for salmon and cod. ICES recommended zero TAC for eastern Baltic cod to promote rebuilding in 2007.
Capacity reduction scheme	Inadequate information to assess.
Evaluation	Inadequate information to assess.
Voluntary Code of Conduct	Pledged to comply with the Code.
Research programme	Baltic Sea Research Programme. EU framework for data collection. ICES biological sampling and multi-species assessments. ICES also implementing BECAUSE and PROTECT. EU research programmes to study incidental capture of harbour porpoise. CHARM and HELCOM/ICES habitat mapping project.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	National authorization of vessels allowed to fish cod in the Convention Area, monthly catch reporting, landing reports and joint inspection schemes.
Detection of ancillary impacts	IBSFC ecosystem approach to marine conservation must take into account not only bycatch, but also functional role of porpoises in Baltic ecosystem.
Penalties for non-compliance	None apparent.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The International Baltic Sea Fishery Commission (IBSFC) was established in 1974. The main objective of the Commission was 'to preserve and increase the living resources of the Baltic Sea and the Belts and to obtain the optimum yield, in particular, to expand and coordinate studies towards these ends and to put into effect organizational and technical projects on conservation and growth of the living resources on a just and equitable basis as well as take other steps towards rational and effective exploitation of the living resources'.[137]

The IBSFC ceased to exist on 1 January 2006. The Baltic Sea fisheries are now managed jointly by Russia and the European Union.[138]

The loss of the organization may not have a significant impact on high seas fisheries management in the region, since all of the former IBSFC Convention Area lies within waters under national jurisdictions. In addition, with accession to the EU of most of the Baltic nations, the bilateral arrangement has substantial authority. The IBSCF's main issues were focused on transboundary issues (as opposed, for example, to straddling stocks issues). Management of certain coastal species, inland water species and aquaculture was always the responsibility of the relevant coastal states.[139] In addition, throughout its 30-year history, IBSFC was not particularly successful at achieving its mandate. This is in part attributable to its objection procedure and exemptions such as those for Contracting Parties which fish 'solely for the purpose of scientific investigations' and do not sell their catch.

Target species

IBSFC target species included cod, herring, sprat and salmon. Until 2006 these four species were the only species regulated by quotas within IBSFC. Other commercially exploited species, mainly in the coastal areas, were eel, sea trout, flat fish (e.g. flounder), pike, pike perch, perch and white fish. Some of these species are often exploited to the same or even higher extent in recreational fisheries.[140]

Management measures

The primary conservation tool used by IBSFC was the setting of annual TACs for its four main species. When TACs were first established by IBSFC in the mid-1970s, the coastal states had access to all fishing grounds of the Baltic Sea. With the establishment of national fishery zones covering the whole Baltic Sea, the allocations were made under new legal conditions. Several considerations played a role in determining the specific allocations (historical catches, aerial distribution of fish stocks, fishing dependent areas, etc.). For the last few years, the allocations for the Contracting Parties have been based on fixed percentages for the target species by countries.[141] With respect to TAC adoption, the decision-making scheme for IBSFC consisted of consensus by the Contracting Parties, and when this was not possible, decisions and recommendations of the Commission were taken by a two-thirds majority of votes, where each party had one vote. These decisions then entered into force subject to

[137] http://www.fao.org/DOCREP/006/Y5357E/y5357e08.htm.

[138] http://www.baltic21.org/attachments/baltic_21_report_1_2006__triennial_report_2003_2005.pdf.

[139] International Baltic Sea Fishery Commission, *Sector Report on Fisheries – Contribution to Baltic 21. Agenda 21 for the Baltic Sea Region*, Baltic 21 Series No 4/98, 2006, p. 3.

[140] Ibid.

[141] http://www.fao.org/docrep/006/y4652e/y4652e0a.htm.

an objection procedure.[142] Throughout the organization's history there were often disputes where no decisions were made in any given years on TACS (e.g. cod 1982–88; it took 17 years before a TAC could be agreed to for Baltic salmon). However, for less valuable species such as sprat and herring TACs have been consistently set since 1977.[143]

In addition, IBSFC introduced a number of technical conservation measures, such as closed fishing seasons and minimum fish and mesh sizes. Recent major initiatives included IBSFC's Action Programme for Sustainable Development, which it developed as a member of the Baltic 21 Steering Committee. The Programme included 1) a Baltic Cod Strategy Plan; 2) a Salmon Action Plan 1997–2010, and 3) a Long-term Strategy for Pelagic Species.[144]

The salmon TAC in the Main Basin and the Gulf of Bothnia was set at the level of 460,000 fish. As IBSFC data are no longer accessible via the Internet, it is unclear exactly what measures were implemented under the Salmon Action Plan other than the quota. According to IBSFC, the Salmon Action Plan was instrumental in stock improvement in this region. Correspondingly, IBSFC maintained that the low state of the Gulf of Finland wild salmon was caused by factors outside the fishery and could not be improved by fishery management measures. In addition, it appears that little progress was made on other initiatives before the organization's dissolution.

The TAC for herring was set for the first time according to four management areas agreed on by the Commission in 2003: Northern Area 64,000 tonnes; Central Area 130,000 tonnes; Gulf of Riga 38,000 tonnes; and the Western Area 46,000 tonnes.

The sprat TAC was increased to 550,000 tonnes (2004: 420,000 tonnes) because of the strong stock abundance.

The International Council for the Exploration of the Sea (ICES) provided IBSFC with scientific advice. The scientific information and advice provided by ICES included the research of various oceanographic, environmental and fisheries working groups. According to ICES, during the last decade IBSFC frequently set TACs beyond scientific recommendations. As a result, the majority of the most commercially important fish stocks in the Baltic Sea are now classified as outside safe biological limits (i.e., the result of unsustainable fisheries).[145]

IBSFC maintained that the 2005 TACs were based on scientific advice from ICES. However, no agreement was reached by the Contracting Parties on the 2005 TAC for the eastern cod stock.[146] A significant problem with respect to cod is the historical high level of unreported catch. At the time of its dissolution the Commission was focusing on the implementation of its cod recovery plan.

With the regime shift in the Baltic, the EU will have primary responsibility for managing fish stocks, as Russian catches of various stocks reportedly only represent about 8% of the total catches for the area.

The objective under the new EU Common Fisheries Policy is more precautionary than the objective of the former IBSFC: 'To ensure exploitation of living aquatic resources that provides sustainable

[142] http://www.oceanlaw.net/orgs/ibsfc.htm.
[143] http://www.fao.org/docrep/006/y4652e/y4652e0a.htm.
[144] Ibid.
[145] J. Thulin and A. Andrushaitis, 'The Baltic Sea: Its Past, Present and Future', in *Proceedings of the Religion, Science and the Environment Symposium V on the Baltic Sea*, 2003.
[146] http://www.helcom.fi/press_office/news_baltic/en_GB/balticnews14092004/.

economic, environmental and social conditions. For this purpose, the Community shall apply the Precautionary Approach in taking measures designed to protect and conserve living aquatic resources, to provide for their sustainable exploitation and to minimize the impact of fishing activities on marine ecosystems. It shall aim at a progressive implementation of an ecosystem-based approach to fisheries management. It shall aim to contribute to efficient fishing activities within an economically viable and competitive fisheries and aquaculture industry, providing a fair standard of living for those who depend on fishing activities and taking into account the interests of consumers.'

The EU has made some moderate progress in advancing fisheries management in the Baltic since the break-up of the IBSFC. For salmon the authorized catch was reduced by 5%.[147]

An agreement was also reached by 25 member states in October 2006 to reduce Baltic Sea cod quotas and days at sea in 2007. Under the scheme cod catches in the eastern Baltic will be reduced by 10% to 40,805 tonnes in 2007, and by 6% in the western Baltic to 26,696 tonnes. These reductions are subject to the establishment of a recovery plan for the intensively fished cod by 30 June 2007. However, if an agreement is not reached by that date, the reductions on both stocks will automatically shift to 15%. Despite this progress, the EU plan is still not in keeping with ICES scientific advice, which called for a 30% reduction in cod catches in the eastern Baltic to allow the stock to increase in size, and thus become less dependent on constant and strong recruitment rates.[148]

IUU fishing

Since 1994 IBSFC had taken steps to limit the effects of IUU fishing. Measures included national authorization of vessels allowed to fish cod in the Convention Area, monthly catch reporting, landing reports where landings are made in ports of other Contracting Parties and, since 2001, joint inspection schemes.[149] However, it does not appear that either bycatch or IUU fishing were accounted for in IBSFC TACs for managed stocks.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

IBSFC was a member of the steering committee and chair of the fisheries sector for Baltic 21. This is a collaborative effort which, among other things, is intended to ensure that biological and ecosystem diversity and productivity are restored and maintained. Its members include governments of EU member states, non-governmental and inter-governmental organizations such as the Helsinki Commission – Baltic Marine Environment Protection Commission (HELCOM), the Nordic Council of Ministers and the international development banks. The emphasis of Baltic 21 is on regional cooperation on the environment and its bearing on economic and social aspects of sustainable development. The work focuses on seven sectors of crucial economic and environmental importance in the region. The EU and Russia now plan to share former IBSFC responsibilities.

2.1 Bycatch, incidentally caught and non-target species

According to IBSFC, since 1996 some 5,000 tonnes of fish have been discarded each year in the western Baltic. The ICES estimate is somewhat higher (15,000 tonnes) as a result of unregulated fishing. In the same period, the percentage discarded by weight was slightly greater than 10%, while

[147] http://www.eubusiness.com/Fisheries/061025120256.7h4snc96.
[148] ICES, *Advice on Eastern Baltic Cod*, 2006, chapter 8.4.1, subdivisions 22–24.
[149] http://www.fao.org/docrep/006/y4652e/y4652e0a.htm.

the percentage discarded by number fluctuated between 20% and 32%.[150] In order to address bycatch in fixed-gear fisheries in the Baltic, IBSFC, and hence the EU, agreed to limit soak time and physical dimensions of fixed gear.[151]

The overall mean discard rate per year in numbers (1996–2003) for cod was approximately 900,000 fish for gillnet fisheries and 14.2 million fish in trawl fisheries. The total discard for 2003 was 11.7 million fish, approximately 5.5 million more fish than the previous year.[152] In 2001 IBSFC revised its technical regulations. However, managers refused to follow the recommendations of 'a one-net rule', or harmonization of selectivity and minimum landing size (MLS) rules. A minimum landing size of 35 cm was in place, and the mesh size of the two types of codend nets used was increased. The length distribution of annual landed trawl catch remained unchanged, despite the increase in minimum mesh size, until the MLS was increased in January 2003 to 38 cm. However, because no change in the selectivity of the widely used traditional diamond mesh codend was made, all fish between 35 cm and 38 cm were now undersized and consequently discarded. Thus it was the MLS and not the mesh size that determined which part of the catch was landed, indicating that the objective of increased selectivity had failed. Swedish fisheries observers on board estimated that in January 2003 on average 34% of trawl catches consisted of undersized cod. In April 2003 this waste of resources resulted in a closure of the trawl fishery in EU waters.[153]

The EU continues to employ a variety of methods to reduce bycatch of target species, including required fishing gear modifications, minimum fish size and mesh size regulations, bycatch limits, and regulations obliging fishermen to use bycatch reduction devices for certain cod fisheries in the Baltic Sea. It also is exploring the use of discard ban trials, in which representative samples of fishing vessels would be encouraged by economic incentives to retain their entire catch.[154] The preparation of production plans by producer organizations as provided under the Common Fisheries Policy is also being considered as an indirect entry point for discard management.[155]

2.2 Species listed by recognized authorities as threatened, endangered or protected

The Agreement on Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), which came into force in 1994, was developed to address bycatch, habitat deterioration and anthropogenic disturbance.[156] Through ASCOBANS, a Recovery Plan for Harbour Porpoise was developed. ASCOBANS had begun to collaborate with IBSFC and other organizations operating within the region to promote better conservation of harbour porpoises. IBSFC's 'ecosystem approach' to marine conservation implicitly required that not only porpoise bycatch be taken into account in its fisheries management efforts, but also the functional role of porpoises in the Baltic ecosystem.

Even though IBSFC is now defunct, the responsibility for the implementation of management measures remains with the EU member states (several of which are also members of ASCOBANS), and Russia.[157]

[150] http://eur-lex.europa.eu/LexUriServ/site/en/com/2002/com2002_0656en01.pdf, p. 17.
[151] Ibid., p. 12.
[152] A. Rosenberg and C. Morgensen, *A Template for Recovery of Cod in the Western and Eastern Baltic*, Report prepared for WWF, 2005, p. 4.
[153] http://www.fao.org/docrep/008/y5936e/y5936e0b.htm.
[154] http://www.ejfoundation.org/page175.html.
[155] http://www.fao.org/docrep/008/y5936e/y5936e0b.htm.
[156] http://www.cetaceanbycatch.org/europe_policies.cfm.
[157] ASCOBAN, *Recovery Plan for Baltic Harbour Porpoises (Jastarnia Plan)*, Bonn, July 2002, p. 6.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

HELCOM plans to develop a conservation plan for seals and harbour porpoises in the region, which will not only include possible target and limit reference points for species, but also identify gaps in the monitoring of populations and bycatches.

2.4 Habitats

Habitat management existed largely outside the jurisdiction of IBSFC and remains the responsibility of HELCOM, which continues to operate in the region.[158]

The EU is considering the designation of special conservation areas for harbour porpoises and other species in the region.

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

Although IBSFC had pledged to comply with the objectives of the Code of Conduct for Responsible Fisheries and adopt specific target reference points and limit reference points as provided by ICES, no meaningful progress was made prior to the dissolution of the Commission.

Had IBSFC's Action Programme for Sustainable Development been implemented, IBSFC might have become more precautionary or ecosystem-oriented in its approach to the management of Baltic fish stocks. Its goals included the development of economically and socially sustainable, environmentally safe and responsible fisheries by:

- maintaining biologically viable fish stocks, the marine and aquatic environment and associated biodiversity;
- within these limits establishing maximum fishing possibilities and appropriate selective fishing techniques for harvesting stocks; and
- distributing the direct and indirect benefits of open sea and coastal fishery resources between local communities in an equitable manner.[159]

An example of IBSFC use of scientific advice in establishing management measures is best observed with respect to cod. In 2004 IBSFC agreed to establish precautionary TACs for the eastern and western Baltic cod stocks to prevent further overfishing and help rebuild the spawning stock biomass for these stocks. IBSFC had also planned to implement a comprehensive enforcement and monitoring programme, as well as measures to reduce juvenile cod discard mortality.[160]

To prompt recovery, ICES provided advice to reduce fishing mortality below a rate of 1.0 as an immediate short-term goal. ICES also advised that landings should be less than 24,700 tonnes in 2005, yet the quota proposed by the Commission was 24,700 tonnes for the western stock and 31,120 tonnes for the eastern stock – clearly not in line with ICES scientific advice.[161] The IBSFC website is

[158] International Baltic Sea Fishery Commission, *Sector Report on Fisheries – Contribution to Baltic 21, Agenda 21 for the Baltic Sea Region*, Baltic 21 Series No 4/98, 2006, p. 3.

[159] G.L. Lugten, *A Review of Measures Taken by Regional Marine Fishery Bodies to Address Contemporary Fishery Issues*, FAO Fisheries Circular 940, Food and Agriculture Organization of the United Nations, Rome, 1999, p. 36.

[160] Advisory Committee on Fishery Management, *Report of the Study Group for Long-Term Advice*, ICES, Copenhagen, 23–27 February 2004, ICES CM 2004/ACFM:16, p. 7.

[161] A. Rosenberg and C. Morgensen, *A Template for Recovery of Cod in the Western and Eastern Baltic*, Report prepared for WWF, 2005, p. 1.

no longer accessible and thus access to historical documents pertaining to Commission management decisions and actions actually implemented are not available. However, given the organization's inability to establish TACs in line with scientific advice in the past, it is unlikely that the IBSFC would have been able to implement the Precautionary Approach for these two stocks effectively.

Recent scientific advice from the ICES indicates that the two cod stocks are still suffering from unsustainable exploitation levels. With respect to the eastern stock, ICES recommended that no catch should be taken in 2007, and that a recovery plan should be developed and implemented. ICES also recommended a substantial reduction in the fishing on the western stock to keep the SSB above precautionary levels. In the absence of a management plan, ICES determined precautionary minimum SSBs for both stocks and target fishing mortality rates as limit measures to prevent continued declines in the stocks.[162]

According to the EU, implementing the reduction required to rebuild the eastern stock within one year would remove the economic basis for the fishing sector and would undermine the management system. Rather than adopting strict precautionary measures as proposed by ICES, the EU plans to take a long-term approach of gradually reducing fishing effort. The EU plan also includes other measures for comprehensive monitoring and regulating directed cod catches as well as bycatch (e.g. gear restrictions).[163] The EU has not adopted target or limit reference points for rebuilding cod stocks. It has adopted target benchmarks for inspection and monitoring (e.g. as a general rule, the level of inspection in ports is to cover 20% by weight of cod landings covering all places of landing, and the level of inspection of marketing shall be 5% of the quantities of cod offered for sale at auction).

A further hindrance to effective PA and EBM in the Baltic relates to bycatch reduction measures. While steps were taken to address bycatch and discards in the Baltic, efforts have not always been successful. Numerous studies by the EU and ICES have not adequately quantified total discards for all species in the EU, partly because of weak discard sampling and observer coverage. In addition, bycatch and discard reduction have typically relied heavily on technical measures, which have proved ineffective because they have not been adequately enforced.

4. Data collection and sharing

The Baltic Sea Research Programme (BRSP) 2003–08 is a project jointly implemented by HELCOM, ICES and IBSFC along with the nine riparian Baltic countries supported by GEF and by Norway and the United States. Goals of the BSRP are to:

- develop and apply an ecosystem-based management strategy for the Baltic Sea Large Marine Ecosystem (LME);
- facilitate the strengthening of regional institutions through capacity-building efforts;
- assess and evaluate the socio-economic effects of the ecosystem-based management for farming, fishing and coastal communities; and
- inform and engage stakeholders, the public and decision-makers on the project approach and objectives.[164]

[162] http://www.fishsec.org/article.asp?CategoryID=1andContextID=41.
[163] http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0485en01.pdf.
[164] http://www.ices.dk/projects/balticsea/CD/OVERALL/Thulin_BSRP_Russia%20St.P-05.pdf.

4.1 Target species (effort, catch, area, time)

At the beginning of 2002 the EU established a new framework for the collection and management of data needed to evaluate fishery resources and the fishing industry. All but Russian waters will be sampled. The assessment of Baltic fish stocks is dependent on national sampling schemes.[165]

ICES makes routine estimates of the herring, sprat, salmon and cod in the Baltic Sea. These estimates are incorporated into the data used in routine stock assessments and are updated each year.

4.2 Bycatch, incidentally caught and non-target species

ICES monitors cod bycatch in the eastern and western Baltic Sea. These estimates are incorporated into the data used in routine stock assessments and are updated each year.[166]

4.3 Species listed by recognized authorities as threatened, endangered or protected

The EU has recently established directives to, *inter alia*, conduct research programmes to assess the incidental capture and killing of harbour porpoises, among other species.[167]

HELCOM has requested that ICES evaluate biannually seal and harbour porpoise populations in the Baltic, including size and structure, distribution, migration pattern, reproductive capacity, effects of contaminants on the health status, and fishing-related mortality by sub-region (bycatch, intentional killing). In the northern Baltic there is renewed interest in seal hunting. Currently there is a ban on the hunting of grey seals (*Halichoerus grypus*), ringed seals (*Phoca hispida bothnica*) and harbour seals (*Phoca vitulina*). In order to safeguard the survival of these species, the ban is to be maintained until a natural health condition and a normal reproductive rate can be shown scientifically.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

ICES has been conducting Baltic multi-species assessments for about 20 years to better understand the dynamics and interactions among the three dominant species in the open sea, namely cod, herring, and sprat.[168]

Currently ICES is implementing two efforts to further ecosystem and precautionary management efforts in the Baltic region. BECAUSE[169] (2004–07, 'Critical interactions between species and their implications for a precautionary fisheries management in a variable environment – a modelling approach') and PROTECT (2005–08, 'MPAs as a tool for ecosystem conservation and fisheries management') will play an important cooperative role in the future multi-species work. BECAUSE covers the development of stochastic multi-species models which include critical interspecies interactions such as marine mammals and seabirds. These critical biological interactions, which have a significant relevance for fisheries management and ecosystem functioning, examine relationships among top predators such as marine mammals and commercial species (e.g. seals/salmon interactions) as well as relationships among commercial species (e.g. cod/cod, cod/herring,

[165] ICES, *Report of the Study Group on Multispecies Assessment in the Baltic* (SGMAB), 13–17 June 2005, Riga, Latvia, ICES CM 2005/H: 06, p. 5.

[166] http://eur-lex.europa.eu/LexUriServ/site/en/com/2002/com2002_0656en01.pdf, p. 5.

[167] ASCOBANS, *Recovery Plan for Baltic Harbour Porpoises (Jastarnia Plan)*, Bonn, July 2002, p. 16.

[168] ICES, *Report of the Study Group on Multispecies Assessment in the Baltic* (SGMAB), 13–17 June 2005, Riga, Latvia, ICES CM 2005/H: 06, p. 3.

[169] http://www1.uni-hamburg.de/BECAUSE/content/case_study_2.html.

cod/sprat and sprat/cod). In the new multi-species model (SMS model) it is possible to estimate parameters and their variances, but more work is needed on model formulation and the use of the full data set. The PROTECT programme, which began in early 2005, concentrates on developing a suite of implementation, monitoring and assessment tools in order to manage fisheries' impacts on cod and clupeids stocks and the structure of upper trophic levels in the ecosystem.

4.5 Habitats

The EU implemented the CHARM project on the 'Characterization of the Baltic Sea ecosystem dynamics and function of coastal types', in connection with its EU Water Framework Directive.

In 2005 HELCOM submitted a request to ICES to conduct a marine habitat classification and mapping project for the Baltic and produce a draft marine bioregional map of the Baltic Sea.

4.6 Non-party and IUU fishing activities, catch and impacts

ICES estimated that in 2005 the amount of illegally caught cod (15,000 tonnes) was 38% above the official landings.[170]

IBSFC also adopted a system for quota transfers to better monitor IUU catches.[171]

5. Content, structure and process of scientific advice

The Commission's Standing Committee on Regulatory Measures analysed the scientific advice provided by the Advisory Committee on Fishery Management (ACFM) of ICES and prepared proposals for regulatory measures to be adopted by the Commission. The Commission also had a number of ad hoc working groups to discuss particular problems.[172]

Under the new management regime, ICES will continue to provide scientific advice. The EU through its Common Fisheries Policy and Russia will then develop and implement management recommendations.

Adherence to scientific advice: Under the IBSFC regime, Contracting Parties *rarely* followed scientific advice in establishing catch limits.

[170] http://oceans.greenpeace.org/raw/content/en/documents-reports/cod-fishery-baltic-sea.pdf.
[171] http://www.fao.org/docrep/006/y4652e/y4652e0a.htm.
[172] http://www.oceanlaw.net/orgs/ibsfc.htm.

International Commission for the Conservation of Atlantic Tunas (ICCAT)

Table 8: EBM and PA management in ICCAT

Overarching objectives	To maintain the populations of tuna and tuna-like species found in the Atlantic at levels which permit the maximum sustainable catch for food and other purposes.
Decision rules	Inadequate information to assess.
Limit reference points	None apparent.
Target reference points	F_{MSY} target.
Management measures Access control	Catch limits. Effort restrictions. Minimum size limits. Time and area closures.
Bycatch reduction	Collects catch (bycatch) data of sharks, a resolution on shark and shark fisheries, and encourages implementation of NPOAs-sharks. Ban on use of high seas driftnets and shark finning. Live release of billfish and juvenile bluefin tuna. Encourages use of circle hooks to reduce sea turtle mortalities.
Habitat protection	Targeting bluefin tuna in Gulf of Mexico spawning ground prohibited.
Interim measures/ recovery plan	Rebuilding plan for blue and white marlin.
Capacity reduction scheme	Resolution to endorse the IPOA-capacity. Instituted Capacity Reduction Programme.
Evaluation	Inadequate information to assess.
Voluntary Code of Conduct	Yokohama Declaration of tuna fishermen (2005). Implemented measures under FAO IPOAs (i.e., seabirds, sharks, IUU fishing and capacity reduction).
Research programme	Comprehensive studies on target species. Genetic studies. Surveys, assesses and analyses shark populations. Collects information on incidental catches of seabirds. Collaborates with FAO and other RFMOs on data exchange. Japanese Data Improvement Project. Monitors interactions between fisheries and seabirds and turtles. Bluefin tuna tagging programme.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Regional Plan of Action to combat IUU fishing. Improving data on small-scale fisheries and bycatch and establishing a special fund for capacity-building to meet data collection, quality assurance and reporting obligations. Initiating protocols to ensure information (data) quality control. VMS on large-scale vessels. Certificates of origin. Compliance Committee.
Detection of ancillary impacts	Studies include research on abundance, biometry and the ecology of the fishes, the oceanography of their environment, as well as the effects of natural and human factors on their abundance. Formed new committee on ecosystem monitoring.
Penalties for non-compliance	Warnings. Sanctions as a last resort.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The International Commission for the Conservation of Atlantic Tunas (ICCAT) was established in 1969. The main objective of the Convention is to maintain the populations of tuna and tuna-like species found in the Atlantic at levels which permit the maximum sustainable catch for food and other purposes. The Commission's functions include, *inter alia*: (i) to study the populations of tuna and tuna-like fishes, (ii) to collect and analyse statistical information relating to the current conditions and trends of the tuna fishery resources of the Convention Area, and (iii) recommend studies and investigations to the Contracting Parties.

To carry out its objectives, the Commission is responsible for the study of tunas and tuna-like fishes and other species of fishes exploited in tuna fishing in the Convention Area. Such studies include research on abundance, biometry and the ecology of the fishes, the oceanography of their environment, and the effects of natural and human factors on their abundance. The Commission's work also involves the collection and analysis of statistical information relative to current conditions and trends of the tuna fishery resources in the Convention Area.

The Commission has no regulatory powers, but makes regulatory recommendations to be implemented by Contracting Parties. According to ICCAT Rules of Procedure, decisions of the Commission are taken by a majority of the members. Two-thirds of the Contracting Parties constitutes a quorum. Votes may be taken by show of hands, roll call or secret ballots, and in cases of necessity between meetings by mail or other means. Voting rights may be suspended if the member is in arrears in an amount that equals or exceeds the contributions due for the previous two years.

Interestingly, when management recommendations are made, they are applied to the entire Convention Area, irrespective of national jurisdictions. In other words, a Contracting Party's quota can be taken either in its own EEZ or the high seas, unless there are some special conditions attached.

Target species

ICCAT target species include about 30 species, among them commercially important species, such as Atlantic bluefin tuna, yellowfin tuna, albacore and bigeye tuna, skipjack tuna, swordfish, billfishes such as blue and white marlins, and sailfish, the Spanish mackerel family, such as spotted Spanish mackerel, king mackerel, as well as small tunas, such as black skipjack, frigate tuna and Atlantic bonito.[173]

Preliminary estimates – not all countries had reported their catches at the time of the Standing Committee on Research and Statistics (SCRS) review – for 2005 reported catches for the primary species taken by ICCAT Contracting Parties as follows: 108,143 tonnes yellowfin tuna, 59,818 tonnes bigeye tuna, 166,261 tonnes skipjack tuna, 59,992 tonnes albacore tuna (slightly up from last year), 22,596 tonnes bluefin tuna (much lower than the previous year), 2,897 tonnes blue marlin, 475 tonnes white marlin, 1,692 tonnes sailfish (no regulations in place), 24,830 tonnes swordfish and 12,471 tonnes swordfish in the Mediterranean. In addition, small tunas (no regulations in place) and several shark species (e.g. blue, mako, oceanic white tip and thresher) were also taken in various fisheries.[174]

[173] G.L. Lugten, *A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues*, FAO Fisheries Circular No. 940, Food and Agriculture Organization of the United Nations, Rome, April 1999, p. 54.

[174] ICCAT, *Report of the Standing Committee on Research and Statistics* (SCRS), Madrid, Spain, 2–6 October 2006, PLE-014/2006.

Not all Contracting Parties consistently report their catch estimates, and when they do, discrepancies sometimes exist between data collected by respective Contracting Parties and those collected by the SCRS. For example, discrepancies exist between the catch statistics reported to ICCAT by Contracting Parties and Non-Contracting Parties, entities or fishing entities, and the import data compiled from the Bluefin Tuna Statistical Documents.[175]

Management measures

Over the years the Commission has recommended various management measures based on scientific findings. These measures include catch limits (on bluefin tuna, albacore, bigeye tuna, swordfish, and billfishes); effort restriction (yellowfin and bigeye tunas); minimum size (swordfish and yellowfin, bigeye and bluefin tunas); time/area closure (bluefin, yellowfin and bigeye tunas); and rebuilding plans (white and blue marlin).[176] The implementation of the recommendations is the responsibility of national governments.

The first comprehensive bigeye tuna allocation agreement occurred in 2004, when allocations and vessel limits were made to China, the EU, Ghana, Japan, Panama and Chinese Taipei. The allocations of quota appear to be relative to recent previous catches without being restrictive.[177]

To date, ICCAT has been using an Olympic-style quota management for the South Atlantic albacore stock, with no specific allocations made to the parties. Since 2000 the parties have made agreements to notify each other of catch and to take measures when 80% of the overall quota was reached. ICCAT made a commitment to develop a sharing scheme in 2006.

For North Atlantic albacore, ICCAT prepared its first allocation scheme in 2002, which recognized existing parties in the fishery and set aside a portion of the TAC for other Contracting Parties to fish in a small competitive pool.[178] The agreement was extended in 2003 for the period 2004–06 and included a provision to carry over 50% of unused allocation from one year to the next.[179]

ICCAT has adopted a number of resolutions over the past several years for more readily complying with the UN Fish Stocks Agreement, the FAO Compliance Agreement on the FAO Code of Conduct and the FAO International Plans of Action, such as the Resolution Regarding the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1995), the Resolution on Large-Scale Pelagic Driftnets (1997), the Resolution for Integrated Monitoring Measures (2000), the Resolution on the Development and Procedures for Data Submission (2002), the Resolution on Atlantic Sharks (2002), etc.[180]

Recognizing that the majority of the bluefin tuna being taken in the Mediterranean were juveniles, ICCAT boldly recommended in 2003–04 that Contracting Parties, cooperating non-contracting parties, entities or fishing entities should develop, within the scope of their respective jurisdictions, specific plans directed at reducing their catches of juvenile bluefin tuna in their Mediterranean fisheries, with the objective of reaching at least the tolerance levels indicated in the current ICCAT recommendations for the protection of juvenile bluefin tuna, which would lead to a reduction of at

[175] http://www.iccat.es/Documents/Recs/compendiopdf-e/1997-03-e.pdf.
[176] http://www.nmfs.noaa.gov/docs/ICCAT_Conclusion.pdf.
[177] ICCAT, Task one data search 1999–2002.
[178] ICCAT 2002–05.
[179] ICCAT Recommendation 2003–06.
[180] ICCAT, Integrated Monitoring Measures, 2003, pp. 65, 69, 75, 181, 196, 197.

least 60% in the number of fish caught below 6.4 kg in the Mediterranean. Such plans, and the results obtained, were then to be presented to the Commission.

IUU fishing

One area where ICCAT has made progress in more recent years is in addressing illegal and unreported fishing activities. It has imposed stronger penalties and sanctions against member states in order to encourage greater flag state compliance and to reduce illegal fishing activity.[181] ICCAT members also agreed to implement a requirement to have vessel monitoring systems on board large-scale longline vessels to keep better track of fishing vessels within the Convention Area.[182]

Specifically, ICCAT found that as soon as imports from certain countries were prohibited in order to address IUU fishing, the vessels flying the flags of those countries changed their registration and flag. ICCAT warned the country in which the vessels were newly registered, and as a result most of these vessels again changed flags. Moreover, in 1998 and 1999 some Contracting Parties were themselves involved in IUU fishing operations.[183]

To improve compliance, the Commission has adopted action plans for bluefin and swordfish, which consist of step-by-step actions to enforce the regulations on non-collaborating countries (e.g. flags of convenience). All the bluefin tuna imported to the Contracting Parties must have a government certificate of origin. Together with other actions taken by the Commission (e.g. sighting reports of fishing vessels of non-compliance and prohibition of transhipment at sea), the Commission identifies countries undermining the effect of the regulatory measures and warns them that if they do not rectify the illegal operations, the Commission will recommend that other Contracting Parties impose multilateral, non-prejudiced trade measures.[184] In addition, a Compliance Committee has been mandated to review the status of the Contracting Parties' compliance with the regulatory measures, to consider any infractions and to seek effective ways to enforce regulations.

ICCAT has taken punitive action against Contracting Parties which violate regulations. For instance, in 2005 action was taken against Chinese Taipei for overfishing and laundering of catch. Chinese Taipei was penalized through fleet-size reductions; quota reductions; tighter reporting requirements; increased observer coverage; scrapping of vessels; and threats of trade action if such practices continued.[185] A similar step was taken against Singapore,[186] which in spite of being the world's largest importer and re-exporter of swordfish, refused to adopt ICCAT's swordfish trade tracking scheme. This constituted the first steps by ICCAT to severely penalize a cooperating non-contracting party for non-compliance.

In order to better track and prevent IUU fishing activity ICCAT requires, among other things, that all commercial fishing vessels over 24-metre length keep a bound or electronic logbook recording the information required in the *ICCAT Field Manual for Statistics and Sampling*.[187] In 2005 ICCAT

[181] ICCAT, Third Informational Consultations of the States Parties to the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 8–9 July 2004, ICSP3/UNFSA/REP/INF.1, August 2004, p. 9.

[182] http://www.nmfs.noaa.gov/docs/ICCAT_Conclusion.pdf.

[183] http://www.fao.org/docrep/005/Y3274E/y3274e08.htm.

[184] Ibid., p. 55.

[185] ICCAT 2005–02.

[186] http://www.nmfs.noaa.gov/docs/ICCAT_Conclusion.pdf.

[187] http://www.iccat.es/Documents/Recs/compendiopdf-e/2003-13-e.pdf.

began efforts to develop a capacity reduction programme, beginning with the collection of data from Contracting Parties on, *inter alia*, permits and existing limits on fishing, as well actions to prevent IUU fishing.[188]

ICCAT has identified the prohibition of at-sea transhipments as a possible key to prevent further IUU activities. Some Contracting Parties are known to import bluefin tuna without the accompanying statistical document, and this is undermining the effectiveness of the ICCAT monitoring system.[189]

Despite best efforts to curtail IUU fishing, it does not appear that ICCAT has a firm handle on the actual level of IUU fishing, particularly in the Mediterranean, and catches occurring in the Convention Area. Therefore, TACs for managed stocks do not adequately reflect these impacts.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

ICCAT has minimum size limits and time and area closures for several tuna species and swordfish, as well as measures to encourage the release of live discards of billfish and bluefin tuna (+A/CONF.210/2006/1, paragraph 182).[190]

2.2 Species listed by recognized authorities as threatened, endangered or protected

ICCAT has adopted a resolution to implement the FAO International Plan of Action on Seabirds and to improve the safe release of sea turtles caught in fishing operations.[191] Some members of ICCAT include turtle interactions in their observer programmes, and it has been reported that loggerhead catch can be reduced by 92% using circle hooks (ICCAT Biennial Report 2002–03, Madrid, Spain, 2004).[192]

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

In 2004 ICCAT adopted, by consensus, the first international ban on shark finning.[193] Under ICCAT Resolution 05/05, 'Contracting Parties shall require their vessels to not have on board fins that total more than 5% of the weight of sharks on board, up to the first point of landing. Contracting Parties that currently do not require fins and carcasses to be offloaded together at the point of first landing shall take the necessary measures to ensure compliance with the 5% ratio through certification.' The

[188] http://www.iccat.es/Documents/BienRep/REP_EN_04-05_I_1.pdf.

[189] http://www.fao.org/docrep/005/Y3274E/y3274e08.htm.

[190] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005, Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 35.

[191] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instrument, A/61/154, p. 32.

[192] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005, Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 35.

[193] http://www.hsus.org/wildlife/wildlife_news/international_measures_to_protect_sharks_not_enough.html.

practicalities of supervising this process will be a considerable challenge owing to the storage process (i.e., fins are normally dried offshore, then frozen in large sacks, which may be difficult to detect/easy to conceal during the landing process) unless provision for adequate monitoring is in place.[194]

Furthermore, in its implementation of the IPOA for sharks, ICCAT has adopted resolutions on Atlantic sharks and on shark fishery. These resolutions called for the ICCAT Scientific Committee to conduct assessments of Atlantic shortfin mako and blue sharks in 2004. They also requested all Contracting Parties, cooperating non-contracting parties and others to submit appropriate data and to fully implement a national plan of action in accordance with the FAO IPOA for the conservation and management of sharks, and to minimize waste and discards of shark catches, including the retention of sharks from which fins are removed.

2.4 Habitats

Time/area closures are in place in the Gulf of Guinea to regulate bigeye tuna surface fisheries. However, as they are not permanent and do nothing to restrict bottom fisheries, they have negligible habitat protection benefits.

Targeting bluefin tuna in the Gulf of Mexico spawning grounds is prohibited. This has indirect habitat benefits. However, to date ICCAT has enacted no specific measures strictly for habitat protection.

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

In 1997 ICCAT established an Ad Hoc Working Group on the Precautionary Approach to develop a discussion document of what PA means in the context of ICCAT stocks, including: (i) likely criteria (benchmarks); (ii) ecological, environmental and distribution aspects; (iii) the role of uncertainty; (iv) how precautionary information should be communicated to the Commission in the future; and (v) other issues as appropriate. However, the Precautionary Approach is not yet formally embedded in ICCAT's management measures.

The Working Group classified ICCAT stocks in the following manner: of the 17 stocks managed by ICCAT none were considered information-rich, eight were considered information-moderate, and the remainder were considered information-poor. In 1999 a series of computer simulations investigated the extent of uncertainties associated with unreliable catch data. The Working Group identified environmental variability as another source of uncertainty.[195]

Although ICCAT has made some progress on adopting precautionary measures, such as the implementation of rebuilding plans for blue and white marlin, these efforts still fall short. For instance, there is conflicting evidence among abundance indices used to assess blue and white marlin. Some indices suggest that neither stock is actually recovering under the current rebuilding plans. However, the SCRS did not recognize this discrepancy, because the management advice it gave to the Commission in 2006 does not include a conservative (precautionary) option for rebuilding blue and white marlin stocks.

[194] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DFID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 18.

[195] Coordinating Working Party on Fishery Statistics, *Report of the Eighteenth Session*, Luxembourg, 6–9 July 1999. Food and Agriculture Organization of the United Nations, Rome, 1999, Meeting Documents.

For other overfished stocks, ICCAT management efforts appear to be inadequate. In 2005 ICCAT failed to reduce quotas for overfished eastern Atlantic bluefin tuna or to protect juvenile swordfish by limiting quota increases in the Mediterranean.[196]

In addition, there are currently no management measures in place for skipjack tuna, sailfish and small tunas, as data are lacking. ICCAT has relinquished its management authority, stating that 'management of these stocks is best handled at the regional level'. For skipjack fisheries this is particularly troublesome, as these constitute growing tuna fisheries with bycatch of juvenile yellowfin and bigeye tuna, whose populations are declining and are possibly at or below MSY.

With respect to sharks, although data collection efforts are improving and there are more data available on which the SCRS was able to make assumptions about stock conditions for blue and mako sharks, the Committee still maintained that data were insufficient to complete stock assessments or generate management recommendations. If ICCAT is to make greater progress towards achieving the objectives under the FAO IPOA for sharks, it needs to invest more resources to examine 1) past and present trends for effort (i.e., directed and non-directed fisheries) in all types of fisheries; 2) the physical and economic yield; and 3) the status of shark stocks. Furthermore, ICCAT should provide incentives for fishermen to explore technological solutions to reduce shark bycatch in non-targeted fisheries and to determine adequate harvest removal rates to prevent overfishing of targeted species.

Although ICCAT has stated that it supports the FAO IPOA for seabirds, to date it has not increased monitoring efforts or instituted any specific measures to reduce seabird mortalities in longline fisheries.

The fact that ICCAT has not adopted provisional reference points in cases where data are lacking (e.g. targeted shark fisheries, skipjack and small tuna fisheries), and the fact that the Ad Hoc Precautionary Approach Working Group has not met since 1999 because it is awaiting better scientific data, suggests that ICCAT is using insufficient information as a justification for not moving ahead with PA implementation for managed stocks, rather than accounting for uncertainty in its management decisions.[197]

A major obstacle which prevents ICCAT from fully complying with the Precautionary Approach is that the ICCAT Convention specifies F_{MSY} as a reference target, while the Precautionary Approach refers to F_{MSY} as a reference limit.[198]

4. Data collection and sharing

ICCAT conducts a range of studies of some 30 species of tunas and tuna-like species found throughout the Atlantic Ocean. Such studies include research on biometry, ecology and oceanography, with a principal focus on the effects of fishing on stock abundance. The Commission also undertakes work in the compilation of data in the Convention Area for other fish species that are caught as bycatch during tuna fishing, such as sharks (draft UN paper).

[196] http://www.publicaffairs.noaa.gov/releases2002/nov02/noaa02148.html.

[197] MRAG Americas, *Evaluation of Northwest Atlantic Fisheries Organization's (NAFO) Implementation of the Precautionary Approach*. Report Prepared by MRAG Americas on behalf of World Wildlife Fund, UK, 5 April 2005, p.18.

[198] L.J. Richards, J.T. Schnute, R. Haigh and C. Sinclair, *Science Strategic Project on the Precautionary Approach in Canada*. Proceedings of the Second Workshop, 1–5 November 1999, Pacific Biological Station, Nanaimo, BC, Fisheries and Oceans Canada, Science Branch, Pacific Region, Canada Stock Assessment Proceedings Series 99/41, 2000, p. 8.

A total of ten organizations, including CCAMLR, IATTC, ICCAT, NAFO and ICES, are collaborating through information-sharing in programmes such as the FAO Fishery Resources Monitoring System. A website provides a comprehensive, one-stop source of information on world fishery resources. The site includes data on catches, fishing fleet activities, stock levels and management practices.[199]

ICCAT is also working with Japan, through the Japanese Data Improvement Project, to improve data collection from developing-nation members. This project is focused on African and Central and South American states.[200]

4.1 Target species (effort, catch, area, time)

Since 1992 Contracting Parties are required to identify the source of all imported bluefin tuna through the use of the Bluefin Tuna Statistical Document.

Contracting Parties and Non-Contracting Parties, entities or fishing entities are also required to identify landings and transhipment data from foreign vessels and transmit such data to the Secretariat.[201] In addition, Contracting Parties are now required to carry standardized logbooks to record catch and effort data.

4.2 Bycatch, incidentally caught and non-target species

Contracting parties are obligated to collect data on bycatch of target and non-target species.

4.3 Species listed by recognized authorities as threatened, endangered or protected

ICCAT has adopted resolutions calling for the monitoring of interactions between ICCAT fisheries and seabirds and sea turtles.[202] Contracting Parties, cooperating non-contracting parties, entities or fishing entities are encouraged, not required, to collect all available information on incidental catches of seabird and sea turtle species in all fisheries in the Convention Area.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

In 2005 the ICCAT Standing Committee on Research and Statistics created a Sub-committee on Ecosystems for the purpose of integrating ecosystem-related monitoring and research activities that are required by the SCRS to fulfil its advisory role to the Commission. In so doing, the Sub-committee will serve as the scientific cornerstone in support of an ecosystem approach to fisheries in ICCAT.[203]

[199] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-Genera*l, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments. A/61/154, p. 34.

[200] Ibid.

[201] http://www.iccat.es/Documents/Recs/compendiopdf-e/1997-03-e.pdf.

[202] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments. A/61/154, p. 30.

[203] Ibid.

Under its shark resolution, Contracting Parties, cooperating non-contracting parties, entities or fishing entities are encouraged to collect all available information on incidental catches of shark species in all fisheries in the Convention Area.

4.5 Habitats

In 2005 scientists reported the results of an ongoing bluefin tuna tagging programme. To date, 800 electronic tags have been deployed in the Atlantic Ocean. The recapture of 25% of the first 279 archival tagged bluefin tuna (1996–99) and the successful downloading of data from 210 pop-up satellite tags are providing new insights into the seasonal movements, habitat utilization, breeding behaviours and population structure of western and eastern tagged bluefin tuna. In addition, the data are revealing migration corridors, hot spots and physical oceanographic patterns that are important for understanding how northern bluefin tunas use the open ocean environment. A number of other studies are ongoing to assess bluefin tuna and swordfish migration patterns.[204] At the Fourth International Billfish Symposium participants also discussed several studies of billfish habitat use and spatial distribution.[205]

4.6 Non-party and IUU fishing activities, catch and impacts

ICCAT is monitoring the international trade in bluefin tuna and swordfish, as its IUU problems stem primarily from unreported fishing by otherwise legitimate vessels.[206] Since the introduction of the bluefin tuna document system in the ICCAT regulatory area, IUU fishing of this species has dropped to relatively low levels of about 1% of the reported catch. These estimates were made using reconciliation of trade statistics and the document system statistics. However, there continue to be other reports that there is considerable IUU activity in the Mediterranean, with more than 50% of the catch being unreported. The IUU catch of bigeye tuna has also dropped since the introduction of the document scheme, although it is still estimated at about 5% of reported catches. If the same is assumed for yellowfin tuna, catches of these tunas being taken by IUU vessels in the Atlantic can be estimated at between 5,000 tonnes and 10,000 tonnes. There are currently no estimates for IUU fishing for skipjack tuna in the Atlantic.[207]

5. Content, structure and process of scientific advice

The Commission is the main decision-making body and is composed of all members. The Commission is responsible for the study of the populations of tuna and tuna-like fishes and such other species of fishes exploited in tuna fishing in the Convention areas not managed by other international fishery organizations. The Convention describes what the research may include and where information and technical services can be sourced. The Commission has the following responsibilities:

- collecting and analysing statistical information relating to the current conditions and trends of the tuna fishery resources of the Convention Area;
- studying and appraising information concerning measures and methods to ensure the maintenance of the populations of tuna and tuna-like fishes in the Convention Area at levels

[204] http://www.iccat.es/Documents/BienRep/REP_EN_04-05_I_1.pdf, pp. 104–106.

[205] http://www.iccat.es/Documents/BienRep/REP_EN_04-05_II_1.pdf, p. 28.

[206] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 50.

[207] Ibid., p. 14.

which will permit the maximum sustainable catch and which will ensure the effective exploitation of these fishes in a manner consistent with this catch;

- recommending studies and investigations to the Contracting Parties; and
- publishing and otherwise disseminating reports of its findings and statistical, biological and other scientific information relative to the tuna fisheries of the Convention Area.

In addition, there are four Panels, dealing with tropical tunas, northern temperate tunas, southern temperate tunas, and swordfish and billfishes and small tunas, respectively. These Panels review research results and draft management measures. The SCRS coordinates and executes all matters related to monitoring and assessment and oversees the following sub-committees:

(1) Species Groups, which assess individual stocks and provides advice to the panels;

(2) Sub-committee on Statistics, which handles quality control and policy for fishery statistics; and

(3) Sub-committee on Ecosystems, which deals with a wide range of issues, including EBM and oceanographic conditions as they relate to tuna biology and fisheries.

There also are miscellaneous SCRS groups:

- Enhanced Billfish Research Programme: A programme funded by the Commission to obtain more complete, detailed catch and effort statistics for billfishes, to carry out an expanded tagging programme and to carry out studies on age and growth.
- Bluefin Year Programme: The programme, funded by the Commission, has multiple objectives ranging from the improvement of fishery statistics to research on biology, population structure and environmental relationships.
- Stock Assessment Methods Working Group: Evaluates assessment methods of the Ad Hoc Working Group on Tagging Information Channels and makes use of the experience of the scientists, so that it is available for new tagging activities.

The Commission is empowered, on the basis of scientific evidence, to recommend management measures and resolutions aimed at carrying out its objective of maintaining the populations of tuna and tuna-like fishes at levels which will permit maximum sustainable catch. Normally, recommendations and resolutions are drafted by the subsidiary bodies, such as the four species-group Panels or the Compliance Committee, and are presented to the Commission for adoption. Recommendations enter into force subject to an objection procedure.[208]

Adherence to scientific advice: Scientific advice is *inconsistently* followed in establishing catch limits, and catch limits are *inconsistently* adhered to once established.

[208] http://www.fao.org/DOCREP/006/Y5357E/y5357e08.htm.

International Pacific Halibut Commission (IPHC)

Table 9: EBM and PA management in IPHC

Overarching objectives	Developing the stocks of halibut of the northern Pacific Ocean and Bering Sea to levels which will permit the optimum yield from that fishery. The goal of the IPHC halibut harvest policy is to achieve a high level of yield, while at all times maintaining a healthy female spawning biomass.
Decision rules	Applies a constant exploitation rate (formerly 30–35%, presently 20–25%) to the estimated exploitable biomass in each regulatory area. Determines 'threshold' when more conservative harvest rates are applied. All fishing ceases when LRP is reached.
Limit reference points	Minimum historical observed biomass.
Target reference points	CEY.
Management measures Access/effort control	Quotas by the IPHC and by United States and Canada through licensing, vessel clearance schemes, IFQs, community development quotas, derby fishery (i.e., Washington and Oregon) and sport fishery minimum size, bag/possession limits, catch and release programmes, depth restrictions, fishing periods, seasons.
Bycatch reduction	Bycatch quotas. Pacific halibut quota in each regulatory area is reduced by the amount of adult Pacific halibut bycatch mortality in that area, and the target exploitation rate is adjusted downward (slightly) to offset the bycatch mortality of juveniles. No retention of Pacific halibut in non-target fisheries. Observers monitor condition of bycatch. Exploring measures to regulate bycatch in recreational and charter boat fisheries. Use of tori poles to minimize seabird bycatch.
Habitat protection	Closed areas.
Interim measures/ recovery plan	Stock decline in 1970s resulted in recovery plan, including limited harvesting during rebuilding at 75% of surplus production. Fishing allowed only by licensed vessels, and bycatch prohibited in other fisheries.
Capacity reduction scheme	Inadequate information to assess.
Evaluation	Ongoing evaluation of harvest policy. Assesses females and males separately to ensure females are not subjected to overfishing.
Voluntary Code of Conduct	Inadequate information to assess.
Research programme	Fisheries Oceanography Programme: studies effects of oceanographic/ meteorological forcing factors on halibut dynamics. Stock assessment surveys. Systematic set-line surveys. Tagging programme. Collects length-frequency data from sport fisheries. Studies on bycatch of halibut in Alaska groundfish trawl fisheries. Collaborative efforts to collect habitat information. Studies on halibut nursery and feeding grounds.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Logbook reporting. Weight of all commercial landings recorded. Port samplers.
Detection of ancillary impacts	Ongoing studies to assess ecological footprint of halibut fisheries.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The International Pacific Halibut Commission (IPHC) was established in 1923, as a result of an agreement between the United States and Canada. Its mandate is research on and management of the stocks of Pacific halibut (*Hippoglossus stenolepis*) within the Convention waters of both nations. The agreement was modified by protocol in 1979 and provides 'for the purpose of developing the stocks of halibut of the Northern Pacific Ocean and Bering Sea to levels which will permit the optimum yield from that fishery'.[209]

The Commission encourages public participation in the management of the resource and regularly seeks advice from the Conference Board,[210] the Processor Advisory Group (PAG),[211] and various state and federal agencies.

Target species

The IPHC target species is the Pacific halibut. Pacific halibut are harvested by hook fisheries operating on vessels ranging in size from a small single-person skiff with a few hundred pounds of annual quota to traditional wooden 65-foot longline schooners dating back to the 1920s, all the way to 15-foot multi-purpose steel vessels that fish halibut, sablefish, tender salmon, herring and more. Over 63% of the Alaska quota is owned by Alaskans, with the next-largest number of individual fishing quota (IFQ) owners being based in Washington. It is also in Alaska that the majority of the coast-wide quota pounds are owned and landed, representing nearly 54% of the halibut fishery quota by weight.[212] Derby fishery survives only in Washington and Oregon.[213] In 2003 the commercial fishery landed 73.141 million pounds (33,176 tonnes) with an ex-vessel value of over US$200 million. When extrapolated to a retail value, the fishery increases to over US$400 million in direct product value.[214] In 2005 the removals for commercial catch, sport catch, personal use (subsistence), and wastage were 71.8 million, 9.9 million, 1.5 million and 2.2 million pounds respectively.[215]

In addition, for both the United States and Canada the sport fishery represents a significant portion of the West Coast marine sport fisheries effort. Landings in the sport fishery are divided fairly equally between individuals and charter operations, with significant charter operations occurring in the central Gulf of Alaska and northern British Columbia. In 2003 and 2004 the fishery landed over 9 million pounds coast-wide. Economic value assessments estimate the sport fishery value in this fishery at over US$50 million, with the volume of participation second only to the sport salmon

[209] L. Lugten, *A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues*, FAO Fisheries Circular No. 940, Food and Agriculture Organization of the United Nations, Rome, April 1999, p. 68.

[210] A panel representing Canadian and American commercial and sport halibut fishermen. Created in 1931 by the Commission; the Board gives the IPHC the fishermen's perspective on Commission proposals presented at Annual Meetings. Members are designated by union and vessel owner organizations from both nations.

[211] The Processor Advisory Group (PAG), formed in 1996, represents halibut processors. Like the Conference Board, the PAG gives its opinion on Commission proposals and offers recommendations at IPHC Annual Meetings.

[212] Distribution of the 2003 commercial halibut ownership (net weight pounds) by nation/state: Alaska 38.9 million pounds, Washington 14 million pounds, Canada 12.5 million pounds, California/Oregon 4.2 million pounds, and other US 2.2 million pounds.

[213] W. Clark and S. Hare, *Assessment and Management of Pacific Halibut: Data, Methods, and Policy*, 2006, http://www.iphc.washington.edu/halcom/research/sa/papers/sr83.pdf, p. 4.

[214] http://www.iphc.washington.edu/halcom/pubs/pamphlet/4IPHCUserPage.pdf, p. 1.

[215] H. Gilroy, *The Pacific Halibut Fishery 2005*, 2006 IPHC Annual Meeting handout, p. 5.

fishery. There are significant economic benefits derived from this fishery; for instance, Alaska has recognized that the fishing industry is one of the top three employers in the entire state.[216]

In 2005 bycatch mortality in the fishery totalled 12 million (net) pounds, a decrease from 2004 and the lowest seen since 1987,[217] about evenly divided between fish larger and smaller than the commercial minimum size limit (81 cm). Observer data are used to estimate direct mortality rates (DMRs) in fisheries in two major areas. The National Marine Fisheries Service (NMFS) manages the groundfish fisheries off Alaska according to a schedule of DMRs. In Area 2B, observers monitoring the Canadian trawl fishery examine each halibut to determine survival. For Area 2A, the domestic groundfish trawl and shrimp trawls are assumed to have a 50% mortality rate, whereas the unobserved hook-and-line fishery for sablefish is assigned an assumed DMR of 25%. The midwater fishery for whiting is assumed to have a 75% rate, based on the large catches of whiting typical of this type of fishery.[218] In 2004, for the sport fishery fish below the 81 cm commercial size limit made up about 30% of the sport catch in number, but only about 10% in weight.[219]

Management measures

The Commission passes regulations, including fishing quotas, every year at its annual meeting. The only two member parties, the United States and Canada, are required by the Convention to mirror these regulations in their domestic regulations. In this sense, there is absolute compliance with Commission decisions, and the reporting of implementation is not an issue. The Commission recommended to the governments of Canada and the US catch limits for 2006 totalling 69,860,000 pounds, a 5.37% decrease from the 2005 catch limit of 73,819,000 pounds.[220] Pacific halibut are regulated by the US and Canada in domestic waters by, *inter alia*, catch limits (e.g. shared-sharing plans, individual fishing quotas, community development quotas, sport fishery possession/bag limits); North Pacific Fishery Management Council guideline harvest level (GHL) for sport fishermen; individual vessel quota; licensing and vessel clearance schemes; logbook requirements; depth restrictions; fishing periods/seasons; and size limits.

The goal of the IPHC halibut harvest policy is to achieve a high level of yield while at all times maintaining a healthy female spawning biomass (all subsequent references to spawning biomass imply female spawning biomass). The IPHC harvest strategy for the directed Pacific halibut fishery has been to apply a constant exploitation rate (formerly 30–35%, presently 20–25%) to the estimated exploitable biomass in each regulatory area.[221] IPHC sets annual catch limits by regulatory area for the directed halibut fisheries in the north-east Pacific Ocean. Abundance in each area is estimated by fitting an age- and sex-structured population model to commercial and survey data. Specifically, each year the staff estimates abundance in each regulatory area by fitting a population model to commercial and survey data going back to 1974. A biological target level for total removals in each area is calculated by applying a carefully chosen target harvest rate to the estimate of exploitable biomass. This biological target level is called the constant exploitation yield (CEY). Part of the total

[216] http://www.iphc.washington.edu/halcom/pubs/pamphlet/4IPHCUserPage.pdf, p. 2.

[217] IPHC, *Report of Assessment and Research Activities 2005*, 2006, p. 153.

[218] Ibid., p.154.

[219] G. Williams, *Revised Estimates of the Personal Use Harvest, including New Estimates for the Subsistence Fishery off Alaska*, IPHC Report of Assessment and Research Activities, 2004: 55-60.

[220] http://www.iphc.washington.edu/halcom/newsrel/2006/nr20060120.htm.

[221] W. Clarke and S. Hare, *Accounting for Bycatch in Management of the Pacific Halibut Fishery* (in preparation), p. 10. http://www.iphc.washington.edu/halcom/research/sa/papers/sr83.pdf.

yield is set aside to provide for miscellaneous removals (e.g. bycatch in other fisheries, sport and subsistence catches in Alaska, and wastage in the halibut fishery owing to, *inter alia*, lost gear).[222, 223] Specifically, the Pacific halibut quota in each regulatory area is reduced by the amount of *adult* Pacific halibut bycatch mortality in that area, and the target exploitation rate is adjusted downward (slightly) to offset the bycatch mortality of juveniles.[224]

The remainder is available for directed fisheries subject to allocation, which are the commercial longline fisheries in all areas and the sport fisheries in Areas 2A and 2B. This amount is called the 'fishery CEY'. Staff catch limit recommendations may be lower or higher than the calculated fishery CEY, depending on the Director's assessment of the uncertainties and risks involved in each regulatory area. The Commissioners make the final decision at the annual meeting in January, after considering the recommendations of the staff, the industry and the two governments' scientific advisers.[225]

A Constant Harvest Rate (CHR) policy has a number of attractive features. The CEY rises and falls smoothly with the biomass; catches are automatically scaled down at lower biomasses and increased during periods of high biomass levels. Yields near the theoretical maximum sustainable yield can be taken across a broad range of harvest rates. In a number of simulation studies, a CHR policy has been shown to be quite robust to climate-induced variability in productivity of the stock.[226] A CHR policy has also been well received by the industry – it is relatively simple to understand, and the halibut fishery has enjoyed a sustained period of high yields.[227]

The annual stock assessment uses data from commercial landing reports, commercial logbooks, port sampling of commercial landings, IPHC setline surveys, and fishery agencies in both countries that report estimates of bycatch, sport catch and subsistence catch.[228]

Over the past few years there have been several advances in the understanding of halibut population dynamics. Several substantive changes have also occurred in the stock assessment model used to estimate population. Among the most important changes since the last published analysis of the harvest policy in 1997 are a lower natural mortality rate, independent accounting of sexes, quantification of ageing error, length-specific selectivity, and new views about factors affecting growth and recruitment. A constant harvest rate policy has served the halibut population well, but needs to be re-examined in the light of these changes.

IUU fishing

IPHC, in a brief comment on 22 July 1999 to the FAO, stated that it does not view IUU fishing as a significant issue for Pacific halibut. In large measure this stems from the relatively near-shore distribution of halibut, making unobserved activities by third parties less likely, and the individual quota (IQ) management framework for halibut. The IQ framework provides incentives for quota harvesters to report IUU fishing, because it has a direct negative impact on their quota shares. This

[222] Ibid.
[223] Ibid., p. 3.
[224] Ibid., p. 1.
[225] Ibid., p. 3.
[226] C. J. Walters and A. Parma, 'Fixed Exploitation Rate Strategies for Coping with the Effect of Climate Change', *Canadian Journal of Fisheries and Aquatic Sciences*, 2001, 53: 148–158; and R. Hilborn and C. Walters, *Quantitative Fisheries Stock Assessment: Choice, Dynamics, and Uncertainty*, Chapman and Hall, New York, 1992.
[227] W. Clark and S. Hare, *Assessment and Management of Pacific Halibut: Data, Methods, and Policy*, http://www.iphc.washington.edu/halcom/research/sa/papers/sr83.pdf, 2006, p. 30.
[228] Ibid., p. 4.

framework thereby creates a very large monitoring community, and for that reason commends itself as one component of plans for dealing with IUU fishing in other jurisdictions. The two contracting parties also maintain active enforcement programmes for halibut.[229]

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

Both the US and Canada have adopted a number of management measures over the years to limit the bycatch of Pacific halibut in other groundfish fisheries. At present the total annual bycatch mortality in Alaska is capped at 7,000 tonnes. This total is distributed as bycatch quotas among a number of fisheries and management areas, which are closed when the bycatch quota is reached. (In some years the bycatch quotas have been inadvertently exceeded, but not by much.) Canada first imposed similar (in fact stricter) controls in 1996, which had the effect of reducing annual halibut bycatch in British Columbia from its previous average of about 1,000 tonnes to only 200 tonnes. There are as yet no halibut bycatch control measures in the groundfish fisheries off Washington and Oregon.[230]

IPHC is engaged in several efforts to reduce the amount of halibut bycatch in North Pacific fisheries. Halibut taken as bycatch in other groundfish fisheries must be returned to the sea, and a proportion of them die in the process. Both Canada and the US place observers aboard fishing vessels to estimate the amount and length composition of the halibut bycatch, and to assess the condition of halibut before being discarded. These condition factors are used to predict mortality. The bycatch estimates available for the assessment are therefore estimates of bycatch mortality in number by length; no age data are collected.[231]

In addition, IPHC is promoting measures to address charter boat and recreation bycatch. In 2005 it reported that halibut bycatch mortality in non-target fisheries was slightly reduced and was at its lowest level since 1987.[232] This may be due, at least in part, to careful release requirements, whereby all halibut that are caught and not retained shall be immediately released outboard of the roller and returned to the sea with a minimum of injury by (a) hook straightening; (b) cutting the gangion near the hook; or (c) carefully removing the hook by twisting it from the halibut with a gaff.[233]

2.2 Species listed by recognized authorities as threatened, endangered or protected

In Alaska and British Columbia regulations are in place requiring vessels to tow bird avoidance devices to minimize seabird bycatch.[234]

[229] http://www.fao.org/docrep/005/Y3274E/y3274e08.htm.

[230] W. Clarke and S. Hare, *Accounting for Bycatch in Management of the Pacific Halibut Fishery*, draft, p. 2.

[231] W. Clark and S. Hare, *Assessment and Management of Pacific Halibut: Data, Methods, and Policy*, 2006, p. 5. http://www.iphc.washington.edu/halcom/research/sa/papers/sr83.pdf.

[232] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments. A/61/154, p. 32.

[233] http://www.iphc.washington.edu/halcom/pubs/regs/2006iphcregs.pdf.

[234] H. Gilroy, *The Pacific Halibut Fishery, 2005*. 2006 IPHC Annual Meeting handout, p. 12.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

While it does not appear that IPHC itself is directly adopting ecosystem management measures, work is being undertaken by both Contracting Parties to further the ecosystem approach. For instance, in British Columbia the Canadian Department of Fisheries and Oceans (DFO) is working with industry stakeholder groups to develop a pilot project for the groundfish fisheries that meets conservation needs, including addressing rockfish conservation concerns, and to improve catch monitoring. In 2006 a pilot integrated management programme for all groundfish fisheries was implemented. The pilot scheme has the following components: individual quotas for all groundfish fisheries; transferability among licences; 100% at-sea monitoring and dockside monitoring; and individual vessel accountability for all catch, both landed and discarded.[235]

2.4 Habitats

An area closure to halibut fishing in the Bering Sea and along the northern coasts of the Alaska Peninsula and Unimak Island to the point of origin at Cape Sarichef Light indirectly provides protection to habitat.

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

IPHC has consistently set conservative quotas and given preference to maintaining a large spawning biomass over maximizing productivity. As a result, the stock is providing higher than average yields.[236] In the 1970s the stock declined. Caddy and Agnew (2003) suggest that environmental conditions were the main factor in decline and recovery. Nevertheless, the IPHC adopted recovery measures (i.e., limited harvesting during rebuilding at 75% of surplus production, fishing allowed only by licensed vessels, and bycatch prohibited in other fisheries). Stock recovered in the 1980s.[237]

Three of IPHC's current primary considerations which have relevance to the Precautionary Approach include 1) the control of bycatch mortality of halibut in non-target fisheries; 2) determination of the effects of oceanographic/meteorological forcing factors on halibut dynamics; and 3) constant evaluation of harvest policy.[238]

The IPHC has incorporated two key Precautionary Approach concepts into its management decisions, namely 'threshold' and 'limits'. For the purposes of the IPHC's Pacific halibut harvest policy, threshold can be defined as a level at which more conservative harvest rates begin to apply, and limit as a biomass level at which all fishing on the stock ceases.

Specifically, the IPHC's framework for determining yield recommendations adheres to the provisions of the PA in that a target harvest rate (used to compute the constant exploitation yield) is established, which results in adequate long-term yields across a wide range of population dynamic models consistent with historical experience.

[235] Ibid., p. 11.

[236] P. Mace and W. Gabriel, *Evolution, Scope and Current Applications of the Precautionary Approach to Fisheries*. Proceedings of the fifth NMFS NSAW, NOAA Technical Memorandum, NMFS-F/SPO-40, 1999, p. 70.

[237] J.F. Caddy and D. Agnew – see http://www.ices.dk/products/CMdocs/2003/U/U0803.pdf, p. 4.

[238] H. Gilroy, *The Pacific Halibut Fishery 2005*, 2006 IPHC Annual Meeting handout, p. 69.

In addition, the Commission has used the minimum observed historical biomass as a limit reference point, even though historical estimates show no evidence of a decrease in recruitment when that level was attained (twice) in the past. In other words, the minimum historical biomass is not equated with an overfishing threshold. The theory behind identifying a minimum observed historical biomass as a limit reference point is simple: if a stock has been monitored long enough to observe a descent to and recovery from a low point, then that low point may be a 'safe' minimum limit. In the IPHC harvest policy, the target harvest rate is linearly scaled downward once spawning biomass reaches the threshold.[239]

Furthermore, the IPHC considers first and foremost the impact of the harvest policy on spawning biomass. The approach taken is one of avoidance of dropping below the minimum observed historical level. This is different from the philosophy where harvest control rules are based on a more theoretical construct: spawning biomass per recruit. Within the three areas being analysed, halibut populations rebounded from the minimum spawning biomasses of the early 1970s to the high levels observed for the past 15–20 years. Therefore, IPHC scientists maintain that it is possible to have some confidence in stock dynamics at those spawning biomass levels, but not at lower levels. Thus, there is no compelling reason to allow spawning biomass to drop below the minimum limit.[240]

In 1997 a peer review of Pacific halibut stock assessment recommended that IPHC develop precautionary reference points for various fisheries, which may include re-examination of appropriate measures of reproductive output, including effects of changes in sex ratios.[241] This advice was heeded by IPHC, and in 2003 the first separate assessment of male and female components of the stock was conducted to ensure that mortality on the females was not excessive. This was done in view of the lower growth rates of halibut in recent years and the different growth rates between the sexes. Commission staff will continue to investigate a new harvest policy, which may result in greater stability in the yield from the fishery and insulate the process of setting catch limits from technological changes in the assessment. This policy utilizes caps on harvest rate and total catch as well as threshold and limit reference points on the biomass.[242]

IPHC has initiated a Fisheries Oceanography Programme, which addresses (in part) the specifications of the Precautionary Approach that concern the dynamics of associated resources. Knowledge of ecosystem-wide dynamics could be a key component of understanding and predicting halibut dynamics, and in producing realistic simulations to evaluate a target reference point. Lastly, while IPHC has not adopted precautionary measures directly in response to the FAO IPOAs for sharks, seabirds and capacity reduction, its two Contracting Parties have.

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

Current projects include standardized stock assessment fishing surveys from northern California to the end of the Aleutian Islands, as well as field sampling in major fishing ports to collect scientific information from the halibut fleet. In conjunction with these ongoing programmes, IPHC conducts

[239] W. Clark and S. Hare, *Accounting for Bycatch in Management of the Pacific Halibut Fishery*, draft.

[240] W. Clark and S. Hare, *Assessment and Management of Pacific Halibut: Data, Methods, and Policy*, 2006, p. 3. http://www.iphc.washington.edu/halcom/research/sa/papers/sr83.pdf.

[241] Anon, *Scientific Peer Review of Pacific Halibut Stock Assessment*, Group comprised of J. Horwood (chair), V. Restrepo and S. J. Smith, 29 September–2 October 1997, p. 7. www.iphc.washington.edu/halcom/research/sa/papers/peerreview.html.

[242] Halibut Commission Complete 2004 Annual Meeting, IPHC press release, 26 January 2004, Seattle, Washington, p. 1.

numerous biological and scientific experiments to further the understanding of and information about Pacific halibut.[243]

The weight of every commercial landing is recorded on a sales report (fish ticket), a copy of which is sent to IPHC. The total catch in weight in every regulatory area in every year is known from this reporting system. The weight reported is net weight, meaning headed and gutted weight, which is about 75% of round weight.[244]

The Commission established a network of port samplers throughout Alaska and British Columbia in the 1930s to obtain logbook information from harvesters and biological samples of the catch from every regulatory area. This contact network has been a cornerstone of the cooperative relationship of IPHC and the halibut industry. For as many trips as possible, port samplers record the areas fished, amount of gear set and hauled, and catch by copying the skipper's logbook or interviewing the skipper. These records are combined with fish ticket data to calculate the CPUE in each area. Port samplers also obtain a carefully chosen random sample of (presently) about 1,500 fish from each regulatory area, from which the length and age composition of the commercial landings can be estimated. Between 1963 and 1990, in order to save money, the lengths of fish in the sample were not actually measured, but predicted from a regression of body length on otolith size, which complicates the assessment in some ways. Since 1991 samplers have measured the lengths.[245]

Except for a hiatus in the years 1987–92, IPHC has conducted systematic setline surveys since 1977, with both the frequency and coverage of surveys increasing over the years. Before 1996 no surveys were done in Areas 3B and 4. Since 1997 most areas have been surveyed nearly every year. All halibut in the catch are measured, and a random sample (of target size 2,000 per area) is collected for age, sex and maturity determination.[246]

Most recently, IPHC has implemented an extensive Passive Integrated Transponder (PIT) tagging effort, where over 65,000 halibut were marked throughout the range of their distribution, from California to the Aleutian Islands.[247] The goals of this tagging project are 1) to provide a direct estimate of abundance that is independent of the current stock assessment model; 2) to provide exploitation rates in areas where no analytic assessment exists; and 3) to provide estimates of the movement rates among management areas. The goal of the scan sampling programme is to scan 25% of all halibut landed from each regulatory area in the commercial fishery. Area 2A is the only regulatory area where scanning is also done on sport catch, because a large portion of the 2A halibut quota is allocated to the sport fishery.[248]

Furthermore, length frequency data are available for most but not all jurisdictions where sport fisheries take place; age samples are only available from Alaska.[249]

4.2 Bycatch, incidentally caught and non-target species

Concern over the large amount of juvenile halibut bycatch in the Alaskan groundfish trawl fishery, which Canadians believe might otherwise migrate to Canada and recruit to the fishable stock, has

[243] http://www.iphc.washington.edu/halcom/about.htm.
[244] W. Clark and S. Hare, *Assessment and Management of Pacific Halibut: Data, Methods, and Policy*, 2006, p. 31.
[245] Ibid., p. 5.
[246] Ibid., p. 5.
[247] http://www.iphc.washington.edu/halcom/pubs/pamphlet/2IPHCSciencePage.pdf.
[248] http://www.iphc.washington.edu/halcom/scanners.htm.
[249] W. Clark and S. Hare, *Assessment and Management of Pacific Halibut: Data, Methods, and Policy*, 2006, p. 5.

stimulated further research to try to understand area-specific impacts of the bycatch on various-size fish in different parts of Alaska. Simulation studies using a range of assumptions indicate that the impact falls mostly, but not entirely, in the area where the bycatch is taken. At present there is a two-part process for dealing with bycatch in calculating fishery CEY. The bycatch of fish above the commercial minimum size limit (81 cm), which have presumably completed their juvenile migration, is deducted from the total CEY in the regulatory area where they are caught. The coast-wide recruitment loss resulting from sub-legal bycatch – estimated to be about 10% – is included in the simulations that are conducted to choose a target harvest rate. It therefore depresses the target harvest rate slightly in all areas, but the choice of an optimum harvest rate is not at all sensitive to this factor. This method of accounting for juvenile bycatch therefore reduces the uncertainty about unequal and unknown area-specific impacts of juvenile bycatch.[250]

4.3 Species listed by recognized authorities as threatened, endangered or protected

In 2002 IPHC, in collaboration with Washington Sea Grant, developed a sampling protocol for research surveys to count seabirds in the vicinity of the survey vessel after hauling. Sampling after the haul addresses the question of where and when certain seabird species occur. IPHC developed and is maintaining a database with the seabird information. The database includes data from surveys by IPHC, the Alaska Department of Fish and Game (ADF&G) and the NMFS. Ultimately, these data might be used to identify appropriate seabird deterrent requirements in certain geographical locations, especially for the halibut fleet.[251]

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

Both the US and Canada are collecting ecosystem data to manage halibut and multi-species fisheries more effectively.

4.5 Habitats

In 2000 IPHC purchased a water column profiler to record measurements of conductivity, temperature and depth at various stations in the IPHC setline surveys. The idea was to gain a better understanding of halibut habitat and to contribute to the larger oceanographic picture that multiple agencies were working to build.[252]

Although IPHC does not have regulatory authority over all types of marine fishing effort, the Commission has worked cooperatively with the US National Marine Fisheries Service (NMFS) and the Canadian DFO in their initiatives to protect sensitive habitats. IPHC has provided data on research and commercial fishing effort distribution with respect to identifying habitat and developing closed areas to protect vulnerable marine ecosystems, with particular attention to deep-water corals and sponges in the northeast Pacific Ocean.[253]

The Commission maintains an active research programme designed to evaluate the ecological footprint of halibut fishing. At this time, the Commission has not moved to exclude any fishing effort by bottom longlines, other than in cooperation with the NMFS and DFO concerning deep-water

[250] Ibid., p. 4.

[251] H. Gilroy, *The Pacific Halibut Fishery 2005*, 2006 IPHC Annual Meeting handout, p. 12.

[252] Ibid., p.110.

[253] IPHC, Response to UNDALOS with respect to giving effect to paragraphs 66 to 69 of UNGA resolution 59/25 concerning the impacts of fishing on vulnerable marine ecosystems, according to General Assembly resolution 60/31, 2006.

coral and sponge protection areas. The Commission plans to expand its research programme to incorporate detailed observations of commercial fishing gear.

IPHC plans a four-part research programme in the Bering Sea, which will involve satellite tagging to address the lack of detailed knowledge about the timing of spawning migrations of halibut within its regulatory area.[254]

Over the years, IPHC has also conducted numerous studies to identify halibut nursery and spawning areas and summer feeding grounds.

4.6 Non-party and IUU fishing activities, catch and impacts

Not applicable.

5. Content, structure and process of scientific advice

IPHC meets annually to conduct the business of the Commission. At this annual meeting the budgets, research plans, biomass estimates, catch recommendations and regulatory proposals are discussed, approved and then forwarded to the respective governments for implementation. There are three Boards which assist with Commission fishery management decisions: the Research Board (RAB), the Conference Board, and the Processor Advisory Group (PAG). In addition, sea, port and scan samplers help collect the data on which management decisions are based.

The RAB was formed in 1999. It consists of both fishermen and processors, who offer suggestions to the Director and staff on where Commission research should focus. The RAB reports directly to the IHPC Director. The Conference Board is a panel representing Canadian and American commercial and sport halibut fishermen. Created in 1931 by the Commission, the Board gives IPHC the fishermen's perspective on Commission proposals presented at annual meetings. Members are designated by union and vessel owner organizations from both nations. The PAG represents halibut processors. Like the Conference Board, PAG gives its opinion regarding Commission proposals and offers recommendations at IPHC annual meetings. The group was formed in 1996.

Port samplers serve as the Commission's liaison with the public.[255] In addition, IPHC hires seasonal employees as scan samplers for Alaska, while British Columbia ports are sampled under a contract with Archipelago Marine Research (AMR). In Area 2A the commercial landings are scanned by IPHC staff, tribal biologists and contract employees. The 2A sport catch is scanned by biologists from the Washington and Oregon Departments of Fish and Wildlife.[256]

In addition, for the management of the halibut fishery, sea samplers are key players who collect data, which are independent of commercial catch records. IPHC's quantitative scientists use these independent data in concert with data collected from commercial halibut fishing logs to determine total allowable catch for the upcoming season.

[254] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments. A/61/154, p. 35.

[255] http://www.iphc.washington.edu/halcom/port.htm.

[256] http://www.iphc.washington.edu/halcom/scanners.htm.

The roughly 25 sea samplers hired each year work aboard a fleet of 12 to 15 IPHC charter commercial longline vessels and conduct the standardized setline stock assessment survey, which ranges from the southern Oregon border north through British Columbia to the Bering Sea, and west to Attu Island in the Aleutian Islands.

The sea samplers' primary directive is to collect CPUE data; however, because the chartered vessels present a rare and valuable scientific research platform, samplers are also involved in mark and recapture experiments, sea bird studies, genetic sampling, oceanographic sampling, and much more. The IPHC collaborates with other agencies to take full advantage of the research opportunities made possible by the fleet of research vessels.[257]

Adherence to scientific advice: Scientific advice is *consistently* followed in establishing catch limits, and catch limits are *consistently* adhered to once established.

[257] http://www.iphc.washington.edu/halcom/seasams1.htm

International Whaling Commission (IWC)

Table 10: EBM and PA management in IWC

Overarching objectives	To provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry.
Decision rules	Maintain stability of catches.
Limit reference points	MSY when fisheries were in operation. When fishing resumes, catches should not be allowed on stocks below 54% of the estimated carrying capacity.
Target reference points	Plans to have TRPs under RMP.
Management measures Access/effort control	Commercial Fishery Moratorium. Whale sanctuaries. When catch allocation for aboriginal fisheries are determined, the impact of ship strikes is factored into the calculations. Limits on numbers and size of whales taken. Open and closed seasons and areas. Prohibits capture of suckling calves and female whales accompanied by calves. Norway fishing in national waters. Small allocations made for 'research purposes'.
Bycatch reduction	TACs include ship strikes. Centralized international database on ship strikes. Studies bycatch of small cetaceans. Collaborates with FAO SOWER and GLOBEC programmes.
Habitat protection	Inadequate information to assess.
Interim measures/ recovery plan	RMP (yet to be implemented). Conservative TACs set based on robustness trials. CLA accounts for uncertainty used to determine TAC. Catch limits established for five years.
Capacity reduction scheme	Moratorium in place.
Evaluation	RMP has a feedback procedure.
Voluntary Code of Conduct	Not applicable. Moratorium in place.
Research programme	Comprehensive assessment of whale populations. Biological studies. Studies humaneness of the killing operations. Ecosystem studies and modelling. Studies impact of whale watching on whales. POLLUTION 2000+. Collaborative studies with CCAMLR (i.e., on whales and krill abundance) and ACCOBAMS.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Catch reports. DNA tracking of origin of whale meat. Proposed measures: DNA registers and market sampling procedures.
Detection of ancillary impacts	Inadequate information to assess.
Penalties for non-compliance	If whaling resumes, proposed ban on import of whale meat from Non-Contracting Parties.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The International Whaling Commission (IWC) was established on 2 December 1946. IWC's area of competence is all waters in which whaling is prosecuted. Its mandate is 'to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry'.

The main duty of the IWC is to keep under review and revise as necessary the measures laid down in the Schedule to the Convention, which governs the conduct of whaling throughout the world. These measures provide, among other things, for the complete protection of certain species; designate specified areas as whale sanctuaries; set limits on the numbers and size of whales which may be taken; prescribe open and closed seasons and areas for whaling; and prohibit the capture of suckling calves and female whales accompanied by calves. The compilation of catch reports and other statistical and biological records is also required.

In addition, the Commission encourages, coordinates and funds whale research, publishes the results of scientific research and promotes studies into related matters, such as the humaneness of the killing operations.[258]

Target species

There are many stocks or populations of the 13 species of 'great whales'. A worldwide moratorium on commercial whaling is in place. However, several artisanal and small-scale fisheries still operate for scientific research. Many species have been depleted by over-exploitation, some seriously, both in recent times and in earlier centuries. Fortunately, several of these are showing signs of increase since their protection.

Management measures

Before its decision in 1982 to declare a moratorium on commercial whaling, the catch limits set by the IWC were based on stock assessments developed by its Scientific Committee, which were very similar in nature to standard fishery assessments at the time. In essence, for each stock all the available data were used to obtain best estimates of current and historical stock sizes and of the productivity of the stock. Catch limits were then set with the aim of keeping the stock at or above the level at which the MSY could be taken, or moving it towards that level. One of the major reasons for deciding to impose the moratorium was the difficulty experienced by the Scientific Committee in reaching consensus on the status of stocks, given the prevailing uncertainties regarding the data and their interpretation.

A Revised Management Procedure (RMP) was developed, which the Commission accepted and endorsed in 1994 but has yet to implement. This balances the somewhat conflicting requirements to ensure that the risk to individual stocks is not seriously increased, while allowing the highest continuing yield.[259] It provides for a highly conservative method of calculating a TAC based on robustness trials. The method is more conservative for stocks the status of which is unknown or which have not been assessed in recent years.[260]

[258] http://www.iwcoffice.org/commission/iwcmain.htm#history.

[259] Ibid.

[260] L.J. Richards, J. T. Schnute, R. Haigh and C. Sinclair, *Science Strategic Project on the Precautionary Approach in Canada*. Proceedings of the Second Workshop. 1–5 November 1999, Pacific Biological Station, Nanaimo, BC, Fisheries and Oceans Canada, Science Branch, Pacific Region, Canada Stock Assessment Proceedings Series 99/41, 2000, p. 9.

Catch rates are determined via the Catch Limit Algorithm (CLA). This specifies the way in which catch limits are calculated from the required information. Very simply, the CLA recognizes that initially the 'true' situation of the stock is poorly known (i.e., there is a wide range of possible values for the level of depletion of the stock and its productivity). Similarly it recognizes two kinds of uncertainty in the estimate of current population size: that the methodology used to estimate abundance, although it produces a 'best' estimate, can actually only give a range within which the population size probably lies; and second, that the estimate may be biased.

The CLA is a 'feedback' procedure – as more information accumulates from sighting surveys (and catches if taken), estimates of necessary parameters are refined. In this way the procedure constantly monitors itself. Catch limits are set for periods of five years. This is one of the ways in which the objective of stability of catches is met. Catches are also phased out if new sighting estimates are not obtained at the requisite intervals. As more information accumulates from new surveys, the CLA improves its estimates of parameter values. This in turn will narrow the range of possible catch limits.

The CLA was initially tested on the assumption that it is applied to known biological stocks. At present, this has only been carried out for minke whales in the North Atlantic and the Southern Hemisphere. Without such 'implementation trials', catch limits will be zero under the RMP. Even with such trials, it is clear that for many species, such as blue whales in the Southern Hemisphere, it will be a long time before catches would be allowed under the RMP. The CLA, together with the rules about, among other things, details of stock boundaries, allocation of catches to small areas, what to do if many more of one or other sex are caught, and when complete reviews of all available information should be carried out, form the RMP.

The IWC recognized that should an RMP be implemented in the future, it should also include measures with respect to the humaneness of killing techniques and adequate enforcement and monitoring schemes.[261]

Currently the moratorium is undermined by the 'objection procedure', whereby Contracting Parties can object to the management scheme and then proceed with fishing on whales. Since the moratorium was passed in 1985, a total of 18,518 whales have been taken by countries which have issued such an objection. Since 1993 the only country to exercise this right has been Norway.[262] However, in 2004, when Norway objected to the IWC management plans and exercised its right to set national catch limits for its coastal whaling operations for minke whales, the Commission passed a resolution calling on Norway to halt all whaling activities under its jurisdiction. In 2005 Norway took an estimated 639 minke whales, reportedly in national waters.

In addition, small allocations are made to Contracting Parties for 'research purposes'. Since the moratorium was implemented Japan, Iceland, the Republic of Korea and Norway have been issued scientific research allocations. Some 10,432 whales have been taken over this time period.[263] In 2004 Japan's request to take 50 whales was rejected by the IWC.

Furthermore, the pause in commercial whaling does not affect aboriginal subsistence whaling, which is permitted from Denmark (Greenland, fin and minke whales), the Russian Federation (Siberia, grey whales), St Vincent and the Grenadines (humpback whales), and the United States (Alaska, bowhead

[261] Ibid.
[262] http://www.iwcoffice.org/_documents/table_objection.htm.
[263] http://www.iwcoffice.org/_documents/table_permit.htm.

and occasionally off Washington, grey whales). At the 2002 meeting the Committee completed its work with respect to the Bering-Chukch-Beaufort Seas stock of bowhead whales. It was agreed that a total of up to 280 bowhead whales could be landed in the period 2003–07, with no more than 67 whales struck in any year (and up to 15 unused strikes may be carried over each year). There is a proviso that this be reviewed in the light of the Scientific Committee's work at the 2004 meeting and beyond. Aboriginal fisheries are subject to size, species and season limits in various areas.

In addition, TACs, including shipstrikes, were established for aboriginal fisheries for 2003–07 in the eastern North Pacific (620 grey whales), in the waters around Greenland (19 fin, 187 minke), and St Vincent and the Grenadines (no more than 20 humpbacks). Further conditions for the latter included that the meat and products of such whales should be used exclusively for local consumption, and that the quota should only be operative after the Commission received advice from the Scientific Committee that the take of four humpback whales for each season was unlikely to endanger the stock.

IUU fishing

The IWC is concerned about reflagged, unauthorized or illegal whaling and has taken action to monitor IUU fishing and catches. However, since there are no authorized directed commercial fisheries for whales in international waters, data collected are not incorporated into established TACs.

Since directed commercial fisheries for whales are prohibited on the high seas, bycatch data are lacking. However, given that the harvesting methods currently employed in aboriginal and other IUU fisheries are generally targeted (e.g. use of high-powered harpoons), bycatch and discards are expected to be negligible.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

There is no target species bycatch in directed aboriginal fisheries. Although beyond the scope of this report, it may also be worthwhile to examine the domestic policy of Norway, where harvesting of whales is taking place, to see if some extrapolations can be made.

The Committee agreed to hold a session in Anchorage, Alaska, to discuss the potential value to the Committee of information from the handling and release of cetaceans entangled in fishing nets and marine debris.[264]

2.2 Species listed by recognized authorities as threatened, endangered or protected

The Ship Strikes Working Group has proposed the development of a centralized international database on ship strikes.[265] This is particularly relevant to species such as the endangered North Atlantic right whale.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

With respect to ecosystem modelling, plans have been put in place 1) for a joint workshop with CCAMLR (some time in 2008) to review information required for ecosystem models for krill

[264] http://www.iwcoffice.org/_documents/meetings/ChairSummaryReportIWC58.pdf, p. 6.
[265] Ibid., p. 7.

predators in the Antarctic marine ecosystem; and 2) to participate in an FAO Expert consultation on modelling ecosystem interactions for informing an ecosystem approach to fisheries (tentatively scheduled for the second quarter of 2007).[266]

2.4 Habitats

There are currently three sanctuaries where whaling is prohibited. However, none of these sanctuaries appears to be permanent, and they are subject to ongoing review and assessment to determine if closures are to remain in effect (e.g. Antarctic whaling grounds, Indian Ocean sanctuary and the Southern Ocean sanctuary). Proposals submitted for two other sanctuaries in the South Atlantic and South Pacific failed to receive the necessary three-quarters majority vote in order to be designated.[267]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

Although a Precautionary Approach was not explicitly considered in developing the IWC's management measures under the RMP, the procedure is both precautionary by design and in performance. After the IWC's management objectives had been identified and quantified, simulation trials of the management procedures were conducted. The performance of the procedures in meeting management objectives was evaluated statistically. All elements of the management strategy were tested simultaneously, and robustness was examined at a much wider range of uncertainties than is normally considered.[268] The RMP takes a realistic view of the uncertainties inherent in current and likely future data and in baleen whale dynamics.

The results of the simulation trials showed clear interactions between the precision and quantity of data and the degree of conservatism needed to meet the objectives. A valuable aspect of the best-performing procedure was that it incorporated a mechanism for automatically adjusting the catch limit in line with the apparent precision of the assessment. This is not a new suggestion, but the important role it played in ensuring good performance suggests that this may be a design feature that should be included among the characteristics of a precautionary management strategy.

The equivalent of the stock assessment method used in the best-performing management strategy involved fitting a simplified production model by Bayes-like techniques. By itself, this carries no particular connotations for other fisheries, since whales have rather different dynamics to fish, but in this case it was found that increasing the apparent realism of the underlying dynamics of the model would not necessarily improve the performance. So there is application to fisheries for which data availability is comparably lower, since it provides an example where robust precautionary management can be achieved without having to rely on the data-hungry types of stock assessment typically used for temperate western industrialized fisheries.[269]

The RMP also contains target and limit reference points, namely that catches should not be allowed on stocks below 54% of the estimated carrying capacity, and that there should be stable catch limits with the highest possible continuing yield being obtained from the stock.[270] A stock assessed to be below 54% of its carrying capacity should have a zero catch limit. Acceptable risk is then judged

[266] Ibid., p. 6.

[267] http://www.iwcoffice.org/conservation/sanctuaries.htm.

[268] P. Mace and W. Gabriel, *Evolution, Scope and Current Applications of the Precautionary Approach to Fisheries*. Proceedings of the fifth NMFS NSAW. NOAA Technical Memorandum NMFS-F/SPO-40, 1999, p. 70.

[269] http://www.fao.org/docrep/003/W1238E/W1238E07.htm.

[270] http://www.iwcoffice.org/conservation/rmp.htm.

in terms of the likelihood of inadvertently setting non-zero catch limits when the stock is actually below the protection level, but is assessed to be above it. For a Revised Management Procedure to be acceptable, it must be able to meet the above objectives, regardless of existing and continuing uncertainties in the data, stock structure and dynamics of whale populations.

Currently, the IWC applies the Precautionary Approach to regulated aboriginal subsistence whaling. As a precautionary measure when establishing TACs, the IWC Scientific Committee determines a Strike Limit Algorithm (SLA), where the TAC includes an allotted catch as well as set number of vessel strikes.

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

As a result of the IWC moratorium, there currently are no official data on catch and effort data on the high seas. However, the IWC Scientific Committee has embarked on a major review of the status of whale stocks. This comprehensive assessment includes examination of current stock size, recent population trends, carrying capacity and productivity. To date the Committee has completed or is still undertaking such in-depth analyses of:

- Antarctic minke whales – Southern Hemisphere;
- Common minke whales – North Atlantic; western North Pacific;
- Fin whales – North Atlantic;
- Humpback whales – Southern Hemisphere and North Atlantic;
- Bryde's whales – western North Pacific; and
- Bowhead whales – Bering-Chukchi-Beaufort Seas.

The Scientific Committee has also developed guidelines and rules for the conduct of sighting surveys and how the data are to be analysed if the resultant estimates are of sufficient quality to be used in the CLA. Similar guidelines and rules have been developed with respect to data requirements, quality and analysis.

In addition, in order to determine the TAC for aboriginal fisheries off Greenland for minke and fin whales, the Scientific Committee has developed a research programme dealing with stock identity.

The Scientific Committee has been addressing ways to estimate numbers of whales removed by indirect means, including bycatch in fishing gear and ship strikes. The Committee has reviewed progress towards estimating bycatch using 1) fisheries data (including cooperative work with FAO) and observer programmes; and 2) genetic data from market sampling. The Committee is also looking at cetacean mortality through ship strikes. It also reviewed and endorsed the recommendations of a joint ACCOBAMS/Pelagos Sanctuary workshop on large whale ship strikes in the Mediterranean, including the need for liaison between the IWC and ACCOBAMS, and the report from the IWC Ship Strikes Working Group.[271]

4.2 Bycatch, incidentally caught and non-target species

Not applicable. When whaling occurs it is a targeted (e.g. harpoon) fishery. Other marine species are typically not taken.

[271] http://www.iwcoffice.org/_documents/meetings/ChairSummaryReportIWC58.pdf.

4.3 Species listed by recognized authorities as threatened, endangered or protected

IWC conducts studies on the estimation of bycatch and other human-induced mortality on cetaceans (including some 26 species of small cetaceans) for use in the Revised Management Procedure.[272]

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

Collaborative studies are ongoing with CCAMLR to assess the relationship between whales and krill abundance in the Antarctic.

The Scientific Committee has examined a number of issues related to whale watching, including possible impacts of whale watching (including 'swim-with' programmes) on cetaceans and the identification of data sources from whale-watching programmes. With respect to possible impacts, the Committee agreed that there is new compelling evidence that the fitness of individual small cetaceans repeatedly exposed to whale-watching vessel traffic can be compromised, and that this can affect population levels. It recommended that similar studies be undertaken on large whales. The Committee is considering taking a holistic approach to impact assessment of whale watching to separate impacts attributed to whale watching from other human-induced and ecological effects. A workshop is planned to develop a world-wide research plan.

4.5 Habitats

The IWC's SOWER programme studies the effects of environmental changes on cetaceans. SOWER 2000 examines the influence of temporal and spatial variability in the physical and biological Antarctic environment on the distribution, abundance and migration of whales. The programme is carried out in cooperation with other major research programmes, including those of CCAMLR and Southern Ocean GLOBEC.

Another IWC initiative, POLLUTION 2000+, has two aims: 1) to determine whether predictive and quantitative relationships exist between biomarkers, i.e., exposure to and/or effect of polychlorinated biphenyls (PCBs) and PCB levels in certain tissues; and 2) to validate/calibrate sampling and analytical techniques.[273]

The Committee has endorsed plans for major new cetacean surveys in the Mediterranean Sea (under the auspices of ACCOBAMS) and the North Atlantic (a new survey in the NASS7 series) and agreed that it should cooperate with these initiatives.[274]

4.6 Non-Contracting Party and IUU fishing activities, catch and impacts

In an effort to better understand the impact of IUU fishing activities and catch rates, IWC scientists are currently using DNA tracking to investigate the origins of whale meat on sale in certain markets.[275] In addition, if the proposed RMP is ever implemented, there would be further catch verification to combat IUU whaling and/or unreported bycatches. These include:

- national diagnostic DNA registers and market sampling to agreed standards (with outside review) and a procedure to allow checking of samples against the registers;

[272] Ibid., p. 8.
[273] http://www.iwcoffice.org/conservation/environment.htm.
[274] http://www.iwcoffice.org/_documents/meetings/ChairSummaryReportIWC58.pdf, p. 7.
[275] Ibid.

- a resolution urging countries to institute national legislation prohibiting the import of whale products from non-IWC countries as well as from IWC countries that are non-whaling; and
- documentation up to the port of entry if the import is from an IWC member.[276]

5. Content, structure and process of scientific advice

The Scientific Committee comprises up to 200 of the world's leading whale biologists. Many are nominated by member governments. In addition, in recent years the Committee has invited other scientists to supplement its expertise in various areas. The size of the Committee, as well as the subject matter it addresses, has increased considerably over time. In 1954 it comprised 11 scientists from seven member nations. At its annual meeting in Berlin in 2003 it comprised over 170 participants. The Committee meets two weeks immediately before the main Commission meeting and may also hold special meetings during the year to consider particular subjects. The Scientific Committee's report provides an annual review of the major issues affecting cetacean conservation. It is published each year as a supplement to the *Journal of Cetacean Research and Management*.

The subject matter considered by the Committee is largely determined by the scientific needs of the Commission. These are expressed in broad terms in the Convention text and are to:

- encourage, recommend, or, if necessary, organize studies and investigations relating to whales and whaling;
- collect and analyse statistical information concerning the current condition and trend of the whale stocks and the effects of whaling activities thereon; and
- study, appraise and disseminate information concerning methods of maintaining and increasing the populations of whale stocks.

The Scientific Committee has established a number of sub-committees and working groups to discuss the major topics currently on its agenda, including:

- the Revised Management Procedure;
- aboriginal subsistence whaling management procedures;
- bycatch;
- assessments of nominated species/stocks;
- stock definition;
- environmental concerns;
- whale watching;
- sanctuaries;
- special permits; and
- small cetaceans.

The information and advice provided by the Scientific Committee on the status of the whale stocks form the basis on which the Commission develops the regulations for the control of whaling. These are contained in the Schedule and require a three-quarters majority of the commissioners voting. Any changes become effective 90 days later unless a member state has lodged an objection, in which case

[276] http://www.iwcoffice.org/conservation/rms.htm#working.

the new regulation is not binding on that country. This procedure may be used when a government considers that its national interests or sovereignty are unduly affected.

The regulations adopted by the Commission are implemented through the national legislation of the member states, which appoint inspectors to oversee their whaling operations and may also receive international observers appointed by the IWC.[277]

Adherence to scientific advice. Scientific advice is *consistently* followed in establishing catch limits, but catch limits are *inconsistently* adhered to once established.

[277] http://www.iwcoffice.org/commission/iwcmain.htm#history.

Northwest Atlantic Fisheries Organization (NAFO)

Table 11: EBM and PA management in NAFO

Overarching objectives	To contribute to the optimum utilization, rational management and conservation of the fishery resources of the Convention Area.
Decision rules	PA Working Group has recommended managing within safe biological limits. Scientific Council has defined buffers (F_{buf}, a fishing mortality rate below F_{lim} that acts as a buffer to ensure that there is a high probability that F_{lim} is not reached, and B_{buf} is a level of spawning stock biomass above B_{lim} that acts as a buffer to ensure there is a high probability that B_{lim} is not reached). On average F_{buf} should not be exceeded. The more uncertain the estimate of F_{lim}, the lower the value of F_{buf} and the > the distance between F_{lim} and F_{buf}.
Limit reference points	B_{lim} for some stocks; $F_{lim} = F_{MSY}$.
Target reference points	F_{target} is a fishing mortality level based on management objectives and is defined below or equal to F_{buf} (e.g. 2/3 fishing mortality for yellowtail flounder). B_{tr} as the target total biomass recovery level that would produce MSY.
Management measures Access control	Vessel register, authorization to fish, gear marking, TAC, effort control, season restrictions (e.g. shrimp fisheries), mesh size requirements (e.g. skate, shrimp), minimum size limits (e.g. yellowtail flounder), use of sorting grates and depth requirements (e.g. shrimp fisheries). Shared stock with NEAFC, requires that Secretary to be notified when accumulated reported catches reach 50%, after which time notification is weekly (e.g. Sub-area 2 and Div. 1F +3K Redfish stock).
Bycatch reduction	Mesh size requirements. Sorting grate with minimum bar placement requirements. Gear requirements. Move on requirements if certain percentage of bycatch taken in a given area. Regulations on finning and shark live release.
Habitat protection	Ban on bottom trawling around seamounts.
Interim measures/ recovery plan	Rebuilding plan for Greenland halibut. PA only applied to three stocks (3NO cod, under moratorium, 3LNO yellowtail flounder and 3LNO shrimp).
Capacity reduction scheme	Verbal commitment.
Evaluation	Bi-annual and annual stock assessments.
Voluntary Code of Conduct	Implemented measures under FAO IPOAs (i.e., sharks and capacity reduction).
Research programme	Research vessel (acoustic and net surveys). Fishing vessels now collecting data on seamounts along with species-specific data. NAFO also has a new sea turtle data collection programme and shark monitoring programme. Conducts symposiums on ecosystem management topics. Collaborates with other RFMOs to share data, particularly NEAFC.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	At-sea and port inspections. Developing new Objections Procedure. Observer Programme with standardized observer reports and electronic submission.
Detection of ancillary impacts	Canadian scientists collect data on plankton communities. Ecosystem studies conducted by sub-committees.
Penalties for non-compliance	Sanctions and strengthened follow-up by Contracting Parties. Blacklist.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The Northwest Atlantic Fisheries Organization (NAFO) was established by the Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries, which was signed on 24 October 1978 in Ottawa and came into force on 1 January 1979. NAFO's area of competence is the north-west Atlantic Ocean. Its mission is '… to contribute to the optimum utilization, rational management and conservation of the fishery resources of the Convention Area'.

Target species

NAFO target species include cod, Greenland halibut, redfish, skate, American plaice, yellowtail flounder, white hake, witch flounder, capelin, squid and shrimp. The NAFO fishery targets approximately 25 commercial species, of which 11 species are managed by the RFMO. For these 11 species, NAFO manages 19 target stocks, nine of which are under moratorium (i.e., cod (*Gadus morhua*) in Divisions (Div.) 3L, 3M and 3NO; 3LN redfish (*Sebastes spp.*); 3L and 3NO American plaice (*Hippoglossoides platessoides*); 2J, 3K and 3L and 3NO witch flounder (*Glyptocephalus cynoglossus*), and 3NO capelin (*Mallotus villosus*).[278]

In 2003 catch estimates for the NAFO Convention Area (FAO statistical area 21) amounted to just under 2.3 million tonnes. Of this total, over 2.1 million tonnes were taken by coastal states in their Exclusive Economic Zones (under national jurisdiction), and approximately 182,000 tonnes, i.e., about 8% of the total catches, in the NAFO Regulatory Area.[279]

Management measures

NAFO manages its fisheries primarily via the establishment of TACs. Currently seven stocks, i.e., 3LN and 3O redfish fisheries, white hake (*Urophycis tenuis*), 3LNO yellowtail flounder (*Limanda ferruginea*), 3LNO Thorny skate (*Amblyraja radiata*) – actually a mixed skate fishery, Sub-area 3 and 4 Squid (*Illex illecebrosus*) and 3LMNO Greenland halibut (*Reinhardtius hippoglossoides*), are operating under TAC management schemes, and one fishery, i.e., 3M Shrimp (*Pandalus borealis*), is being managed via effort control.[280]

NAFO also has area and season restrictions (e.g. shrimp fisheries), mesh size requirements (e.g. groundfish, skate, shrimp), minimum size limits (e.g. yellowtail flounder), and the use of sorting grates and depth requirements (e.g. shrimp fisheries). In addition, for one fishery, because it is a shared stock with NEAFC, NAFO requires that vessels notify the Secretary when accumulated reported catches reach 50%, after which time notification is weekly (e.g. Sub-area 2 and Div. 1F +3K redfish stock).

A rebuilding plan is in place for only one NAFO-managed species, the Greenland halibut in Div. 3LMNO, which is under a 15-year rebuilding plan. The objective of this programme is to attain a level of exploitable biomass of fish aged 5+ of 140,000 tonnes on average, allowing a stable yield over the long term in the Greenland halibut fishery. Additional measures are in place for vessels 24

[278] A. Rosenberg, M. Mooney-Seus and C. Ninnes, *Bycatch on the High Seas: A Review of the Northwest Atlantic Fisheries Organization*. Report prepared for World Wildlife Fund Canada by MRAG Americas, Inc., 2005.

[279] Ibid.

[280] http://www.nafo.int/fisheries/frames/fishery.html.

metres in length or greater, including that vessels may only land their catch in specific ports and are subject to port inspections. The catches in 2004 and 2005 were 25,500 tonnes and 23,000 tonnes, which exceeded the rebuilding plan TACs by 27% and 22%, respectively.[281]

Generally, estimates of biomass, abundance, SSB, recruitment and size are based on survey results (e.g. national spring and autumn bottom trawl surveys using Campelen and Engel gear), and B_{lim} are established for stocks where possible (e.g. 3M cod, 3NO cod, 3LN redfish, 3LNO American plaice, 3LNO yellowtail flounder and 3M shrimp). CPUE data from commercial fishery data also are used to help assess stock status (e.g. 3M shrimp).

In some cases where sufficient data are available, analytical assessments are conducted and used to derive TACs or effort allocation schemes. For yellowtail flounder an analytical assessment using a stock production model was presented to estimate stock status in 2006, and the Scientific Council established 2/3 F_{MSY} as a fishing mortality target. In the case of 2J, 3K and 3L witch flounder, in the absence of an analytical assessment, B_{lim} was calculated as 15% of the highest observed biomass estimate. However, the Scientific Council recognized that B_{lim} may be underestimated using this method, because the highest observed biomass estimates are in the early part of the time series, when the survey did not cover the entire stock area. For at least one stock, 3NO witch flounder survey mean weights (kg) per tow in the Canadian spring survey series were used as an index for abundance and biomass from which TACs were derived.

IUU fishing

Bycatch and IUU fishing, particularly bycatch and IUU fishing misreported by Contracting Parties, are significant problems for NAFO. With respect to bycatch, the redfish population on the Flemish Cap remains at a low level relative to historical biomass. An estimated 22.1 million redfish were taken as bycatch in the northern prawn trawl fishery in the area during the 2001–02 fishing season.[282] In 2001–03 the redfish bycatch in numbers from the Flemish Cap shrimp fishery was 78% of the total catch numbers and 44% in 2004.[283, 284] In addition, NAFO states that in 2004 and 2005 between six and eight Non-Contracting Party vessels were sighted fishing in the regulatory area, mainly targeting redfish.[285]

IUU fishing is a problem for all species covered by moratoriums. For instance, historically, American plaice in Div. 3LNO comprised the largest flatfish fishery in the Northwest Atlantic. Currently, this species is taken in substantial numbers by offshore otter trawlers, despite the moratorium. In 2004 the reported catch was 6,200 tonnes. In addition, 2J, 3K and 3L witch flounder is now only a bycatch of other fisheries. The catches during 1995–2003 were estimated at between 300 tonnes and 1,400 tonnes, including unreported catches. The 2004 catch was about 830 tonnes. The 2003 catch of 3NO

[281] http://www.nafo.int/science/frames/science.html.

[282] NAFO, *Redfish (Sebastes spp.) in Division 3M*, Northwest Atlantic Fisheries Organization, Report of the Scientific Council Meeting, 5–19 June 2003, SC 6-19, Part D., p. 167.

[283] http://www.nafo.int/science/frames/science.html.

[284] A.M. Rosenberg, M. Mooney-Seus and C. Ninnes, *Bycatch on the High Seas: A Review of the Northwest Atlantic Fisheries Organization*. Report prepared for World Wildlife Fund Canada by MRAG Americas, Inc., 2005, pp. 62-4.

[285] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 55.

witch flounder, also a moratorium species, was estimated at between 844 tonnes and 2,239 tonnes. Catches in the most recent two years (2004–05) were 630 tonnes and 260 tonnes respectively.[286]

Even when data are reported, they contain discrepancies. For instance, the NAFO database, UN FAO Fishstat Plus – NAFO capture 1960–2002, lists that catch of northern prawns by distant water nations in 2001 was 39,460 tonnes in NAFO Area 3, the international waters of the Grand Banks and the Flemish Cap. However, two papers presented at the meeting of the Scientific Committee of NAFO in September 2003 put the catch at about 20,000 tonnes higher than the reported catch. The papers list estimates of catches of prawns for nine countries in either NAFO Area 3L (the nose of the Banks) or 3M, the Flemish Cap, for which there are no catches reported on the UN FAO Fishstat Plus – NAFO capture 1960–2002 database. In addition, there are significant discrepancies between the Spanish catch as recorded by NAFO and the catch reported by the UN FAO. The NAFO database lists the Spanish catch of Greenland halibut in 2001 as 9,141 tonnes, whereas the UN FAO database, the UN FAO Fishstat Plus Capture Production 1950–2001, lists the 2001 Spanish catch at 11,571 tonnes. Likewise, NAFO lists the Spanish catch in 2001 of roundnose and roughhead grenadiers combined at 6,229 tonnes, whereas NAFO lists the same catch at 3,595 tonnes.[287]

NAFO's opt-out provision, whereby countries can choose not to adhere to a NAFO regulation if they notify the Secretariat within 60 days after a regulation has been adopted, contributes to the problem of unregulated fishing. For instance, in the northern prawn fishery two countries, Estonia and Denmark/Faroe Islands, which took approximately 40% of the catch in 2001, were apparently operating outside the regulations established by NAFO in 2002. Both countries took a reservation on the management measure for this fishery adopted by NAFO, which is essentially an effort restriction that limits the number of days vessels from each country are permitted to trawl for prawns on the Flemish Cap. In response, Canada closed its ports to vessels from both countries in 2002. However, it is important to note that NAFO is not unique in having such a provision, as several of the RFMOs reviewed for this report have objection procedures and corresponding opt-out provisions. NAFO is developing a new objection procedure to place an extra burden on individual parties that do not want to implement Commission decisions. The planned provisions foresee a mechanism for impartial review panels and dispute settlement procedures.[288]

NAFO monitors closely bycatch and IUU fishing, particularly for its moratorium stocks, and this is reflected in the scientific advice that is presented to the Commission. Furthermore, NAFO has adopted a number of measures to strengthen the follow-up of infringements and to ensure the application of sanctions against vessels committing serious infringements. Other important provisions restrict port access for vessels that engage in IUU fishing. These measures go hand in hand with a new blacklist for IUU vessels that NAFO is now publishing on its website.[289]

In other cases, where the Commission establishes TACs or permits fishing effort at levels beyond scientific recommendations (e.g. skates, 3M shrimp) or establishes TACs in compliance with scientific advice but the stocks are still overfished (e.g. Greenland halibut), NAFO is clearly not taking account of IUU fishing and bycatch removals in its TAC and corresponding allocations.

[286] http://www.nafo.int/science/frames/science.html.

[287] M. Gianni, *High Seas Bottom Trawl Fisheries and their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems*. Report prepared for IUCN/the World Conservation Union, Natural Resources Defense Council, WWF International and Conservation International, 2004.

[288] http://www.nafo.int/about/frames/activities.html.

[289] Ibid.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

Until now, NAFO has generally managed stocks on an annual stock-by-stock and single-species basis. The development by NAFO of an ecosystem-based approach is being discussed, and NAFO scientists are tasked to look into areas of marine biological and ecological significance. In addition, fishing vessels will collect, on a voluntary basis, data on seamounts in the NAFO area.[290] NAFO has started a reform process to include, *inter alia*, an ecosystem approach, and to strengthen its monitoring and control mechanisms.[291]

2.1 Bycatch, incidentally caught and non-target species

NAFO has in place a number of regulations to diminish bycatch, including gear (e.g. a sorting grate with minimum bar requirements was recommended for the shrimp fishery in some specific areas), fish size requirements (e.g. Atlantic cod, American plaice, yellowtail flounder and Greenland halibut), area and time restrictions, and bycatch requirements obliging fishing vessels to stop fishing and move location when a certain proportion of bycatch species has been reached. Discards have to be recorded in the logbook and are reported by observers.[292]

Specifically, Contracting Party vessels are required to limit their bycatch to a maximum of 500 kg or 10%, whichever is the greater, for species for which they have not been allotted a quota for that division. In cases where a ban on fishing is in force or an 'others' quota has been fully utilized, bycatches of the species concerned may not exceed 1,250 kg or 5%, whichever is greater. If the percentages of bycatches are exceeded in any one haul, the vessel must immediately move a minimum of 5 nautical miles from any position of the previous haul. If any future haul exceeds these bycatch limits, the vessel has to move again a minimum of five nautical miles and cannot return to the area for at least 48 hours.

2.2 Species listed by recognized authorities as threatened, endangered or protected

NAFO has adopted a resolution that will contribute to the protection of sea turtles and expand knowledge of these animals in the Northwest Atlantic. Measures in this regard will include reducing the bycatch of sea turtles in fishing operations, extensive scientific data collection programmes, and the sharing of data with other international organizations.[293]

[290] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 37.

[291] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments. A/61/154, p. 36.

[292] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 38.

[293] http://www.nafo.int/about/frames/activities.html.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

NAFO has adopted a number of measures to reduce shark bycatch, including a requirement that Contracting Parties encourage the release of live sharks, especially juveniles, to the extent possible when they are caught as bycatch and are not used as food and/or subsistence fisheries. In order to reduce finning, NAFO does not allow vessels to have on board shark fins totalling more than 5% of the weight of sharks on board, up to the first point of landing. In addition, Contracting Parties are required to ensure that fishing vessels utilize their entire catches of sharks. Full utilization is defined as retention by the fishing vessel of all parts of the shark with the exception of head, guts and skins, to the point of first landing. Furthermore, Contracting Parties that do not require fins and carcasses to be offloaded together at the point of first landing are required to take the necessary measures to ensure compliance with the 5% ratio through certification, monitoring by an observer, or other appropriate measures. The ratio of fin-to-body weight of sharks is being reviewed by the Scientific Council. Finally, fishing vessels are prohibited from retaining on board, transhipping or landing any fins harvested in contravention of these provisions.

2.4 Habitats

NAFO has requested its Scientific Council to provide advice on the development of criteria for determining areas of marine biological and ecological significance and the identification of these areas in the regulatory area.[294] In 2006 NAFO Contracting Parties decided to impose a ban on bottom trawling on seamounts in the Northwest Atlantic.[295]

In 2005 NAFO amended Article 21 of its Conservation and Enforcement Measures to provide for the collection of biological data on seamounts in its Regulatory Area and began to apply the Precautionary Approach.[296]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

In 1997 NAFO established a Precautionary Approach Working Group, comprising participants from the Fisheries Commission and the Scientific Council. Through this working group NAFO developed a provisional framework for implementing the PA with particular attention to Annex II of the UN Agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. Specific reference was made to the Annex II requirements that management actions result in only a low probability of a stock falling outside safe biological limits, and that management actions be taken to facilitate recovery to within safe biological limits.

[294] UN Secretary-General, *The impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*, 14 July 2006, advance, unedited text. 61st session, Item 69 (b) of the preliminary list, Oceans and the law of the sea A/61/_.

[295] http://www.nafo.int/about/frames/activities.html.

[296] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, 2006. Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 36.

NAFO has also undertaken stock assessments using three types of data (NAFO SCS Doc. 99/4): 1) stocks for which data are good, with both fishery and survey data being available for a currently open fishery; 2) stocks for which data are relatively good, but recent data availability is restricted owing to closed fishery; and 3) stocks for which data are poor.

To date, NAFO's Fisheries Commission has not formally adopted the PA framework and has voiced a number of concerns, which are preventing its implementation. At its 2003 NAFO Scientific Council Workshop on the Precautionary Approach to Fisheries Management (St John's, March/April 2003, NAFO SCS Doc. 03/05) steps were taken to begin to develop a more flexible PA framework within NAFO. In June 2003 a proposal elaborating on this framework was presented by scientists from Canada, the United States and France. A study group on the estimation of limit reference points (LRPs) was established to, *inter alia*,

- review the properties of alternative LRPs, including the ability to quantify risk and determine strengths and weaknesses of various alternatives;
- provide guidance regarding the most appropriate approaches for stocks ranging from data-rich to data-poor and for a range of life history strategies; and
- provide example applications to Sub-area 2 + Division 3KLMNO Greenland halibut, Div. 3LNO yellowtail flounder and Div. 3LNO thorny skate based on existing and recent biological fisheries and survey data, recent stock assessments and management measures. Other examples may also be explored.[297]

The NAFO PA framework includes a set of management strategies and courses of action, as well as reference definitions which recognize the agreed roles and responsibilities of the Scientific Council and the Fisheries Commission. The framework includes five zones for assessing the status of a stock and defines proposed management strategies and courses of action within each zone. There are five zones.

(1) A Safe Zone, where the stock is perceived to be fairly healthy (has a very low probability of falling below B_{lim}, which is a biomass level where the stock productivity is likely to be seriously impaired), fishing mortality is set from a range of F values that have a low probability of exceeding F_{lim} (a fishing mortality rate that should have a low probability of being exceeded and is not greater than F_{MSY}), and target reference points are selected and set by managers based on criteria of their choosing (e.g. stable TACs, socio-economic considerations).

(2) An Overfishing Zone, where F must be reduced below F_{buf}, which is a fishing mortality rate below F_{lim} that is required in the absence of analyses of the probability that current or projected fishing mortality exceeds F_{lim}. In the absence of such analyses, F_{buf} should be specified by managers and should satisfy the requirement that there is a low probability that any fishing mortality rate estimated to be below F_{buf} will actually be above F_{lim}. The more uncertain the stock assessment, the greater the buffer zone should be. In all cases, a buffer is required to signify the need for more restrictive measures.

(3) A Cautionary F Zone, where the closer stock biomass (B) is to B_{lim}, the lower F should be below F_{buf} to ensure that there is a very low probability that biomass will decline below B_{lim} within the foreseeable future (e.g. could be 5–10 years, but actual time frame should be defined by managers).

[297] NAFO, Appendix 1: Agenda, NAFO LRP Study Group, 15–20 April 2004; IFREMER, Lorient, France, p. 70.

(4) A Danger Zone, in which case F must be reduced below F_{buf}. The closer the stock biomass (B) is to B_{lim}, the lower F should be below F_{buf} to ensure that there is a very low probability that biomass will decline below B_{lim} within the foreseeable future.

(5) A Collapse Zone whereby F should be set as close to zero as possible.[298]

In addition, for depleted stocks B_{tr} is defined as the target total stock biomass recovery level that would produce maximum sustainable yield.

Currently, NAFO is applying the Precautionary Approach to three of its managed species. For 3LNO Shrimp PA reference points were established by the Scientific Council, whereby 15% of the maximum female biomass index is considered a limit reference point for biomass (B_{lim}) for northern shrimp in Div. 3LNO. It is not possible to calculate a limit reference point for fishing mortality. Currently, the biomass is estimated to be well above B_{lim}. For 3LNO yellowtail flounder, by definition in the Scientific Council PA framework, the limit reference point for fishing mortality (F_{lim}) should be no higher than F_{MSY}. The Scientific Council recommends that B_{lim} be set at 30% B_{MSY}, following the recommendation of the Limit Reference Point Study Group in April 2004. Currently, the biomass is estimated to be above B_{lim} and F below F_{lim}, so the stock is in the safe zone as defined in the NAFO PA framework. F_{MSY} was estimated to be 0.22. Projections were made to estimate catch for each year from 2007 to 2016 at a range of fishing mortalities. The results at 2/3 F_{MSY} suggest that the projected catch would remain constant at 15,600 tonnes to the year 2016. At 0.75 F_{MSY} and 0.85 F_{MSY}, catch and biomass are projected to decrease slightly over the ten years. At 2/3 F_{MSY}, the estimated probability of biomass falling below B_{MSY} decreases over the ten years. At 0.75 F_{MSY} the probability of biomass falling below B_{MSY} remains stable, and at $F = 0.85\ F_{MSY}$ the probability increases. The probabilities were low under all projected levels of fishing mortality. It was not possible at the time to quantify the risk of stock size being below B_{lim} (30% B_{MSY}), but these probabilities are likely to be very low under all three projected levels of F. Age-based reference points are not available for this stock at this time. The Scientific Council noted that considerable progress has been made on ageing of yellowtail in recent years and recommends that priority be given to restore the Council's ability to do age-structured analyses on this stock.

In addition, the Scientific Council recommended that it review in detail the biological reference points for 3NO cod in the context of the PA framework when the SSB has reached half the current estimate of B_{lim}. Deterministic projections were conducted to examine stock biomass over the next five years. Projections were limited to five years, as extended projections are increasingly driven by recruitment assumptions. Spawner biomass was projected assuming F = 0, and under recently observed fishing mortality (F = 0.50). If there are no removals, spawner biomass is projected to decline by 11% by 2010. This projection is more pessimistic than the projection provided in 2003, because subsequent high catches have reduced the population and recent low recruitment rate. If the stock continues to be fished at current rates, spawner biomass will decrease by 76% to about 1,300 tonnes by 2010.

Yellowtail flounder (3LNO) does constitute a success for NAFO, as management measures are being established within safe biological limits for the stock. However, IUU fishing and bycatch in other fisheries is not accounted for in the TAC. In the case of 3NO cod, precautionary catch limits are currently a moot point, unless the stock can be rebuilt. To aid recovery, NAFO must enforce its own measures, whereby vessels are forced to relocate their fishing effort if bycatches of cod reach 1,250

[298] MRAG Americas, *Evaluation of Northwest Atlantic Fisheries Organization's (NAFO) Implementation of the Precautionary Approach*. Report prepared by MRAG Americas on behalf of the World Wildlife Fund, UK, 5 April 2005, p. 13.

kg or 5%. In addition, NAFO should require the use of sorting grates similar to those used in the Canadian yellowtail flounder fishery to reduce bycatch in other NAFO fisheries where the incidence of cod bycatch is high. Management strategies (e.g. a rebuilding plan) must be implemented effectively to restore the cod stock. Such a strategy would account not only for the resilience of the stock to recover, but also for direct and indirect sources of mortality as well as uncertainty. As previously stated, NAFO has implemented a recovery plan for one of its stocks (i.e., Greenland halibut), and while the target and limit reference points established may be sufficient to rebuild the stock, the TACs are consistently overfished.

With respect to NAFO's actions to address impacts on other associated species, NAFO has implemented monitoring programmes (e.g. sharks). However, TACs recently established for skate fisheries are not precautionary, as they have been set beyond scientific advice.

In summary, NAFO's efforts to define precautionary reference points and management targets are undermined by IUU fishing by Non-Contracting Parties and misreporting or lack of reporting by Contracting Parties. This is compounded by NAFO's opt-out provision, which leads to further unregulated fishing by Contracting Parties.

4. Data collection and sharing

NAFO collects data via Contracting Parties, including catch and effort data, VMS and reports from port inspections, at-sea inspections and an observer programme. Since 1998 all vessels fishing in the NAFO area must carry observers, mainly for monitoring and compliance purposes, but some of the data they collect also are used by the Scientific Committee of NAFO.[299]

In addition, NAFO and NEAFC have developed a format and protocols for the electronic exchange of fisheries monitoring, inspection and surveillance information (the North Atlantic Format), which has now also been adopted by CCAMLR and SEAFO. A working group consisting of members of the FAO Coordinating Working Party on Fishery Statistics and coordinated by NAFO is proposing amendments to the Format to ensure its usefulness in assessment and scientific research (see A/CONF.210/2006/1, paragraph 214).[300]

4.1 Target species (effort, catch, area, time)

NAFO research is generally implemented by Contracting Parties through observer programmes and fishery-dependent and independent research surveys (acoustic and net surveys) to collect data on target species; fisheries catch and effort data; harvested species abundance; and biological, ecological and environmental data.

[299] UN Secretary-General, *Report submitted in accordance with paragraph 17 of General Assembly resolution 59/25, to assist the Review Conference to implement its mandate under paragraph 2, article 36 of the United Nations Fish Stocks Agreement: Report of the Secretary-General*. Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22–26 May 2006, A/CONF.210/2006/1, p. 44.

[300] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the UN Secretary-General*, 61st session, item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments. A/61/154, p. 35.

4.2 Bycatch, incidentally caught and non-target species

National observers on board Contracting Party fishing vessels monitor all bycatch and discards and provide their reports to the NAFO Secretariat.[301]

4.3 Species listed by recognized authorities as threatened, endangered or protected

In 2006 NAFO announced plans to begin collecting data on sea turtle entanglements in the Regulatory Area.

In addition, NAFO has a Memorandum of Understanding with the ICES. Cooperation with ICES is reflected in a joint shrimp stock assessment and the shared Working Groups on harp and hooded seals and on reproductive potential.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

NAFO has conducted a number of symposiums over the years to explore, *inter alia*, what influences living marine resources in the Northwest Atlantic, the role of marine mammals in the ecosystem, the Flemish Cap ecosystem, and the sustainability of elasmobranch fisheries.

Historically, the spawning biomass of capelin (*Mallotus villosus*) was determined through the use of hydroacoustics. Currently, the only indicator of stock dynamics available is capelin biomass indices obtained during Canadian stratified, random bottom-trawl surveys. However, it is not clear how precise the capelin indices from these bottom-trawl surveys reflect the real stock distribution and stock status.

Contracting Parties also are required, where possible, to undertake research to identify ways to make fishing gear more selective; and when possible to conduct research to identify shark nursery areas.

4.5 Habitats

In 2005 NAFO amended Article 21 of the NAFO Conservation and Enforcement Measures (CEM) to provide for the collection of biological data of seamounts in the NAFO Regulatory Area.

The Scientific Council has been asked by the Commission to assess corals in the NAFO Convention Area to help guide decisions on future protection.[302]

4.6 Non-party and IUU fishing activities, catch and impacts

Since 2004 NAFO has published an annual compliance report, which includes information about violations and impacted fish stocks. NAFO also publishes a 'blacklist' of fishing vessels that have engaged in IUU fishing activities on its website and also provides websites for other RFMO blacklists.

NAFO has developed a port inspection scheme, which requires verification of species and quantities caught, cross-checking with the quantities recorded in logbooks, catch reports and inspection reports, as well as verification of mesh size of nets on board and size of fish retained on board.[303] In its first compliance report in 2004 NAFO identified a number of quality and consistency problems with VMS, observer reports and port inspection reports.[304]

[301] G.L. Lugten, *A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues*, FAO Fisheries Circular No. 940, Food and Agriculture Organization of the United Nations, Rome, 1999, p. 57.

[302] http://www.nafo.int/about/frames/activities.html.

[303] See UN General Assembly Document A/CONF.210/2006/1, paragraph 280.

[304] NAFO, Report of the twenty-seventh annual meeting, September 2005. Annual compliance review (NAFO/FC doc.05/6).

A total of ten organizations, including CCAMLR, IATTC, ICCAT, NAFO and ICES, are collaborating by sharing information in programmes such as the FAO Fishery Resources Monitoring System. A website provides a comprehensive, one-stop source of information on world fishery resources. The system includes data on catches, fishing fleet activities, stock levels and management practices.[305]

5. Content, structure and process of scientific advice

Scientific advice for stock management is provided by the Scientific Council at the request of the Fisheries Commission for specific fish stocks within the NAFO Regulatory Area, or by coastal states which need information on stocks within their EEZs or on stocks that are straddling two jurisdictional areas. The Scientific Council can also conduct stock assessments on its own accord and present the results to the Fisheries Commission. A large part of the annual scientific advice elaborated within NAFO is supplied in June (shrimp stocks are assessed later in the year). Designated experts take the lead role in coordinating the assessment. Assessments can also be done in September. The November meeting assesses the Northern shrimp stocks. Details of all matters addressed by the Scientific Council are published in NAFO Scientific Council Reports. The scientific advice is presented to the Fisheries Commission, which then develops NAFO management measures. These are reported in the Conservation and Enforcement Measures.

The scientific advice is generated through a joint effort by NAFO members and makes use of different data sampling programmes carried out by Contracting Parties, as well as of available statistics on the resources and their environment. Formulation of the scientific advice takes place at Scientific Council plenary sessions, based on the work performed in its four Standing Committees. These are: STACFIS (Standing Committee on Fisheries Science), which carries out fish stock assessment; STACREC (Standing Committee on Research Coordination), which keeps track of and coordinates the various national research activities; STACPUB (Standing Committee on Publications), which is responsible for Scientific Council publications, and STACFEN (Standing Committee on Fisheries Environment), which provides information on the environment.

The Scientific Council also compiles and maintains statistics and records and publishes information pertaining to the fisheries, including environmental and ecological factors affecting the fisheries.

Adherence to scientific advice: Scientific advice is *inconsistently* followed in establishing catch limits, and catch limits are *inconsistently* adhered to once established.

[305] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, 14 July 2006, A/61/154.

North Atlantic Salmon Conservation Organization (NASCO)

Table 12: EBM and PA management in NASCO

Overarching objectives	To contribute through consultation and cooperation to the conservation, restoration, enhancement and rational management of salmon stocks subject to the Convention, and taking into account the best scientific evidence available to it.
Decision rules	Guidelines prepared. Developed for each river.
Limit reference points	River-specific CLs developed by ICES for North Atlantic salmon stock complexes as the level of stock (number of spawners) that will achieve long-term average MSY. Takes into account the best scientific information and socio-economic factors.
Target reference points	None apparent.
Management measures Access control	Moratorium on high seas fisheries.
Bycatch reduction	Onus placed on Contracting Parties to implement measures.
Habitat protection	Developed guidelines for salmon river restoration with NOAA. First step was to quantify existing and degraded habitat.
Interim measures/ recovery plan	Integrated Fishery Management Plans and guidelines for stock-rebuilding programmes (including, as appropriate, habitat improvements, stock enhancement and fishery management actions) to be developed for stocks that are below conservation limits. Contracting Parties required to develop comprehensive habitat restoration programmes. Considers socio-economic factors.
Capacity reduction scheme	Moratorium on high seas fisheries.
Evaluation	Contracting Parties to report annually to NASCO on extent of implementation of Decision Structure. Internal review process of organization effectiveness.
Voluntary Code of Conduct	Implemented measures under FAO IPOA (i.e., IUU fishing).
Research programme	Plans to study bycatch of post-smolts at sea. Plans to conduct studies on predator-related mortality and the impact of acid rain on Atlantic salmon.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Minimum standards for collection of catch data to help differentiate between wild fish and farmed fish. Coordinated surveillance with Contracting Parties. Research cruises to study impact of salmon mortality on high seas.
Detection of ancillary impacts	Studies impacts of global warming, pollution and habitat damage on salmon stocks and on introductions, transfers and impacts of transgenic fish.
Penalties for non-compliance	Onus placed on Contracting Parties to implement measures. Protocol for states not party to convention, calling for each party to the Protocol to prohibit fishing for salmon beyond areas of fisheries jurisdiction.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The North Atlantic Salmon Conservation Organization (NASCO) is an international organization established under the Convention for the Conservation of Salmon in the North Atlantic Ocean, which entered into force on 1 October 1983. NASCO's area of competence is defined in Article 1(1) of the Convention and applies to salmon stocks which migrate beyond the areas of fisheries jurisdiction of coastal states of the Atlantic Ocean north of 36° N latitude throughout their migratory range. The objective of NASCO as outlined in Article 3(2) of the Convention is 'to contribute through consultation and cooperation to the conservation, restoration, enhancement and rational management of salmon stocks subject to the Convention, and taking into account the best scientific evidence available to it'.[306]

Target species

NASCO's target species is North Atlantic salmon north of 36° N latitude. At present, fishing of salmon is prohibited beyond the areas of the fisheries jurisdiction of coastal states. Within the areas of fisheries jurisdiction of coastal states, fishing of salmon is prohibited beyond 12 nautical miles from the baselines from which the breadth of the territorial sea is measured, except in the following areas: (a) in the West Greenland Commission area, up to 40 nautical miles from the baselines; and (b) in the North-East Atlantic Commission area, within the area of fisheries jurisdiction of the Faroe Islands.[307]

Management measures

To maximize the number of salmon returning to spawn in their home rivers, NASCO agreed at its June 2006 meeting that the Faroe Islands mixed-stock fishery should continue to be managed in a precautionary manner and in accordance with scientific advice. For the last few years there has been no fishery off the Faroe Islands. NASCO also agreed to continue measures to limit the West Greenland mixed-stock salmon fishery to internal consumption, which is estimated at about 20 tonnes. The waters around these two countries are where Atlantic salmon from all other NASCO members gather to feed and grow. These agreements were particularly significant in 2006, as they represent a move to longer-term and more stable regulatory schemes in light of the continued poor status of the resource.[308]

NASCO has adopted the following measures in order to achieve its objective:

- Precautionary Approach in overarching goals and objectives;
- measures (and their effective implementation) to minimize the impacts of aquaculture and of introductions and transfers; to this end it has developed minimum standards for the collection of catch data which include, *inter alia*, differentiating, wherever possible, between wild fish and fish that have escaped from fish farms;
- measures to reduce the level of unreported catches; and
- assessing the bycatch of salmon in pelagic fisheries.

[306] G.L. Lugten, *A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues*, FAO Fisheries Circular No. 940, Food and Agriculture Organization of the United Nations, Rome, April 1999, p. 64.
[307] http://www.nasco.int/pdf/nasco_convention.pdf.
[308] http://www.nasco.int/pdf/nasco_pressrelease2006.pdf.

Other steps identified by NASCO to further its effort to institute 'rational management' include:

- increased cooperation between the Parties on freshwater issues such as pollution and habitat damage, which cause great losses of salmon;
- adoption of actual Precautionary Approach measures to safeguard wild salmon stocks;
- enhanced organization working methods, including its relations with non-governmental and inter-government organizations;
- adoption of measures to address global warming and its possible impact on salmon distribution; and
- defining NASCO's role in educating the young on salmon conservation and management issues.[309]

NASCO established a Working Group to advise, *inter alia*, on the application of the Precautionary Approach in its respective salmon fisheries; the formulation of management advice and associated scientific research; and the introductions, transfers and impacts of transgenic fish. The Group's work subsequently led to the development of NASCO's Agreement on the Adoption of a Precautionary Approach (CNL (98) 46), which identified a new direction for NASCO's salmon management and its Contracting Parties, namely 'to promote the diversity and abundance of salmon stocks'. Specifically, this Agreement recognizes the importance of maintaining all salmon stocks in the Convention Area above their conservation limit through the use of management targets, which are defined as 'the spawning stock level that produces MSY, taking into account the best scientific information and socio-economic factors'. In addition, the PA is an integrated approach that requires, *inter alia*, that the stock-rebuilding programme (including, as appropriate, habitat improvements, stock enhancement and fishery management actions) be developed for stocks that are below conservation limits.[310]

The following components required for an integrated fishery management process for salmon have also been identified:

(a) that stocks be maintained above the conservation limits by the use of management targets;

(b) that conservation limits and management targets be set for each river and combined as appropriate for the management of different stock groupings defined by managers;

(c) the prior identification of undesirable outcomes, including the failure to achieve conservation limits (biological factors) and instability in the catches (socio-economic factors);

(d) that account be taken at each stage of the risks of not achieving the fisheries management objectives by considering uncertainty in the current state of the stocks, in biological reference points, and in fishery management capabilities;

(e) the formulation of pre-agreed management actions in the form of procedures to be applied over a range of stock conditions;

(f) assessment of the effectiveness of management actions in all salmon fisheries; and

(g) stock rebuilding programmes (including, as appropriate, habitat improvement, stock enhancement and fishery management actions) to be developed for stocks that are below their conservation limits.[311]

[309] Ibid., pp. 64–6.
[310] http://www.ices.dk/reports/ACFM/2005/WGNAS/wgnas05sec1.pdf, p. 10.
[311] NASCO, 2004, www.nasco. int/pdf/nasco_res_adoptpre.pdf.

NASCO is in the process of implementing a PA Action Plan. The plan identifies action items in a number of areas, including management of North Atlantic salmon fisheries, socio-economic issues, unreported catches, scientific advice and research requirements, stock rebuilding programmes and habitat issues.[312]

IUU fishing

NASCO has long recognized the problem of IUU fishing. In a July 1999 report to the FAO it stated that 'in the light of continuing concern about unreported catches of salmon, it will continue to review its management control and reporting systems, the estimates of unreported catch and their reliability, and the measures taken to further minimize the level of unreported catches'.[313] To help minimize the impact of IUU fishing, the Council of NASCO adopted a Protocol for States not Party to the Convention for the Conservation of Salmon in the North Atlantic Ocean, calling for each Party to the Protocol to prohibit fishing for salmon beyond areas of fisheries jurisdiction. The organization has also promoted the exchange of information and coordinated surveillance activities.[314]

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

NASCO is exploring the possible bycatch of salmon post-smolts at sea in fisheries for pelagic fisheries. It is seeking funding to study the overlap between salmon at sea and these fisheries and encouraging pilot studies on technical adjustments to the deployment of gear in pelagic fisheries to minimize bycatch of salmon. It has asked ICES to continue to provide information on salmon bycatch.

NASCO has also encouraged its Contracting Parties to conduct studies to assess non-catch fishing mortality in both salmon-directed and non-directed gears, in particular unreported catches, and to adopt measures to reduce the level of non-catch fishing mortality, in particular unreported catches.[315]

2.2 Species listed by recognized authorities as threatened, endangered or protected

Not applicable. Fishing moratorium in place.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

Not applicable. Fishing moratorium in place.

2.4 Habitats

NASCO and its Contracting Parties, led by the United States, are in the process of establishing inventories of salmon rivers. In addition, NASCO has developed guidelines for habitat restoration under its Plan of Action for the application of the PA to the protection and restoration of Atlantic

[312] L.J. Richards, J. T. Schnute, R. Haigh and C. Sinclair, *Science Strategic Project on the Precautionary Approach in Canada*. Proceedings of the Second Workshop, 1–5 November 1999, Pacific Biological Station, Nanaimo, BC, Fisheries and Oceans Canada, Science Branch, Pacific Region, Canada Stock Assessment Proceedings Series 99/41, 2000, p. 8.

[313] http://www.fao.org/docrep/005/Y3274E/y3274e08.htm.

[314] Committee on Fisheries, *Progress in the Implementation of the Code of Conduct for Responsible Fisheries and Related International Plans of Action*, Twenty-Fifth Session, Rome, Italy, 24–28 February 2003. COFI/2003/3 Rev. 1, p. 25.

[315] http://www.nasco.int/pdf/nasco_res_minstdcatstat.pdf.

salmon habitat. One of the first steps under the Plan of Action was to quantify existing habitat and, if possible, the extent of lost and degraded habitat.[316]

Under this plan, Contracting Parties to NASCO and their relevant jurisdictions are requested to establish comprehensive salmon habitat protection and restoration plans that aim to:

- identify potential risks to the productive capacity and develop procedures for implementation, in a timely fashion, of corrective measures;
- place the burden of proof on proponents of an activity which may have an impact on habitat;
- balance the risks and the benefits to the Atlantic salmon stocks with the socio-economic implications of any given project;
- maintain biodiversity; and
- take into account other biological factors affecting the productive capacity of Atlantic salmon populations, including predator/prey interactions.

In developing and implementing these inventories and plans, NASCO, its Contracting Parties and their relevant jurisdictions should seek to:

- protect the current productive capacity of the existing physical habitat of Atlantic salmon; and
- restore, in designated areas, the productive capacity of Atlantic salmon habitat which has been adversely impacted.[317]

Contracting Parties must report their progress on the implementation of habitat plans within their respective jurisdictions. The Council of NASCO will then review the overall effectiveness of these efforts.

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

A key aspect of the Precautionary Approach is the ability to be adaptive in management, something that NASCO has recognized since at least 1995–97, when it cited its 'continued efforts to broaden its competence to address new measures as they arise' in an internal management report. Referring to its database on salmon rivers, the Commission further noted: 'About 13% (approximately 240 rivers) of the 1,900 salmon rivers in the North Atlantic area are considered threatened with loss and 6.5% (120 rivers) have been lost to salmon production. Thus the challenge facing NASCO and its Contracting Parties is to rebuild the stocks which are threatened and to restore those which have been lost.'

Since that time NASCO has made a concerted effort to shift its management focus to the development of precautionary management measures. It has developed preliminary guidelines on the use of stock rebuilding programmes, which it plans to refine annually, based on feedback from Contracting Parties. In addition, a framework which could be used to assess the social and economic values of wild salmon stocks in the application of the PA was developed during a Technical Workshop in 2003.

[316] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, 14 July 2006, A/61/154, p. 33.

[317] http://www.nasco.int/pdf/nasco_res_habitatpoa.pdf, p. 2.

The NASCO Precautionary Approach Decision Structure proposes the use of reference points, such as conservation limits (i.e., the number of spawning salmon below which the stock would decline markedly) and management targets, or other indicators of stock status, to trigger management actions to address any failure in abundance or diversity.

Specifically, ICES has defined Conservation Limits (CLs) for North Atlantic salmon stock complexes as the level of stock (number of spawners) that will achieve long-term average MSY, as derived from the adult-to-adult stock and recruitment relationship. Therefore, the CL is a limit reference point (S_{lim}), which should be avoided with high probability. Management advice for Atlantic salmon is referenced to the S_{lim} conservation limit, therefore stocks assessed here are reported as being outside precautionary limits when the confidence limits of the most recent stock estimate include S_{lim}. Management targets have not yet been defined for North Atlantic salmon stocks. When these have been defined, they will play an important role in ICES advice.[318]

It is intended that the Decision Structure be widely applied by managers with stakeholders on salmon rivers. In applying the Decision Structure, management decisions are to be taken in accordance with an assessment of risk, such that, in the face of uncertainty, there is a low risk to abundance and diversity of the stock(s). The probability of achieving the management goals should be high. The results of using the Decision Structure are to be monitored and evaluated to ensure that the actions taken in managing salmon fisheries are consistent with the Precautionary Approach. The Contracting Parties have agreed to report annually to NASCO on their experiences in applying the Decision Structure and on the extent of its implementation.

NASCO is also developing guidelines for incorporating social and economic factors into management decisions under the PA. In addition, a small working group was established and led by the United States to develop a bio-economic modelling approach integrating social and economic factors into salmon management. Having developed agreements on the application of the PA 'to conserve reproductive capacity of the resource and avoid irreversible change' in a number of areas, the next steps for the Council will entail moving ahead with the implementation by Contracting Parties.[319, 320]

In another important step, in 2006 NASCO continued to make progress on implementing recommendations from its two-year internal review process. The process has now resulted in substantial changes to the way NASCO does business. In particular, NASCO has adopted procedures to make sharing and assessing information from its members more efficient and effective.[321]

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

NASCO has established minimum standards for collecting catch statistics to improve the quality of data collected.[322]

[318] http://www.ices.dk/reports/ACFM/2005/WGNAS/wgnas05sec1.pdf, p. 10.

[319] http://www.nasco.int/pdf/nasco_res_habitatpoa.pdf, p. 2.

[320] NASCO, *Proceedings of NASCO's Twenty-First Annual Meeting*, 2004, pp. 5–9.

[321] http://www.nasco.int/pdf/nasco_pressrelease2006.pdf.

[322] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of

NASCO plans to implement intensive research cruises (SALSEA) in 2007 and 2008 to examine salmon mortality on the high seas, which will be conducted by ICES. SALSEA is a major public/private partnership, and NASCO's accredited non-governmental organizations are playing a key role.[323]

4.2 Bycatch, incidentally caught and non-target species

A likely problem in IUU high-seas fisheries, but no details are available on affected species and the extent of impacts in the Atlantic.

4.3 Species listed by recognized authorities as threatened, endangered or protected

A likely problem in IUU high seas fisheries, but no details are available on affected species and the extent of impacts in the Atlantic.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

NASCO plans to conduct studies on predator-related mortality and the impact of acid rain on Atlantic salmon.[324]

4.5 Habitats

Under its Habitat Plan, NASCO, its Contracting Parties and their relevant jurisdictions are to:

- establish inventories of rivers for the protection and restoration of salmon habitat (see Annex 2);
- regularly report on, and update, these inventories;
- identify and designate priority/key habitats for improvement; and
- share and exchange information on habitat issues and best management practice.[325]

4.6 Non-party and IUU fishing activities, catch and impacts

Contracting Parties are to use all means and influences available to encourage France, in respect of St Pierre and Miquelon, to cooperate with NASCO and its members in instituting a scientific sampling programme for the fishery in St Pierre and Miquelon beginning in 2003. This programme will gather information on the origin and biological characteristics of catch estimates, catch data, licensing and other management measures, reporting mechanisms, unreported catch, disease status of salmon harvested, and the proportion of escapees from salmon aquaculture operations. France, in respect of St Pierre and Miquelon, was invited to attend future annual meetings of NASCO in order to enhance cooperation and information exchange.[326]

10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 35.

[323] http://www.nasco.int/pdf/nasco_pressrelease2006.pdf.

[324] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 35.

[325] http://www.nasco.int/pdf/nasco_res_habitatpoa.pdf, p. 2.

[326] http://www.nasco.int/pdf/nasco_res_piemiq02.pdf.

5. Content, structure and process of scientific advice

Along with its role of providing management recommendations to Contracting Parties for salmon found in waters beyond their national jurisdictions, the NASCO Council has a number of responsibilities related to scientific research and advice. These include:

(a) to provide a forum for the study, analysis and exchange of information among the Parties on matters concerning the salmon stocks subject to this Convention, and on the achievement of the objective of the Convention;

(b) to provide a forum for consultation and cooperation on matters concerning the salmon stocks in the North Atlantic Ocean beyond Commission areas;

(c) to facilitate the coordination of the activities of the Commissions and initiatives of Contracting Parties under Article 2, paragraph 3;

(d) to establish working arrangements with ICES and other appropriate fisheries and scientific organizations; and

(e) to make recommendations to the Parties, ICES or other appropriate fisheries and scientific organizations concerning the undertaking of scientific research.[327]

In the formulation of management advice and associated scientific research, ICES or other scientific advisers are requested, *inter alia*, to:

(a) provide stock conservation limits and management targets for all river stocks;

(b) advise on the risks of not achieving the objectives of NASCO or its Contracting Parties by considering uncertainty in the current state of the stocks, in biological reference points related to specific management objectives and in fishery management capabilities;

(c) provide catch options or alternative management advice, with associated risk assessments for the fisheries regulated by NASCO and homewater fisheries for all salmon stocks;

(d) advise, in the light of current conditions in the freshwater and marine environment, on stock rebuilding programmes including, where appropriate, habitat improvement, stock enhancement, disease prevention and fishery management actions;

(e) identify the monitoring and data collection required to better achieve the objectives of NASCO and its Contracting Parties; and

(f) advise on the impacts on salmon stocks of existing and new fisheries for other species, and of salmon fisheries on non-target species.[328]

Adherence to scientific advice: Scientific advice is *consistently* followed in establishing catch limits, but catch limits are *inconsistently* adhered to once established. A moratorium is in place on the high seas, and there are no directed salmon fisheries in coastal North Atlantic waters with the exception of a small fishery off Greenland. However, IUU fishing and habitat loss (historical damming of rivers and existing pollution and development) hinder salmon recovery.

[327] http://www.nasco.int/.
[328] http://www.nasco.int/pdf/nasco_res_adoptprec.pdf.

North East Atlantic Fisheries Commission (NEAFC)

Table 13: EBM and PA management in NEAFC

Overarching objectives	'To promote the conservation and optimum utilization of the fishery resources of the North-East Atlantic.' Subsequent amendment: 'To take due account of the impact of fisheries on other species and marine ecosystems.'
Decision rules	Species-specific. Includes targets, limits and buffers (i.e., B_{pa}, $B_{lim,}$ F_{pa} and F_{lim}).
Limit reference points	Species-specific. In general, where data are sufficient to assess, ICES recommends SSB should not fall below a certain level (B_{lim}).
Target reference points	Species-specific (e.g. for Norwegian spring spawning herring fishing mortality rate < 0.125 for appropriate age groups as defined by ICES).
Management measures Access control	TACs, vessel and gear markings, minimum fish-size limits, gear restrictions, closed areas to certain gear types (area west of Rockall), and mesh sizes for capelin and blue whiting. A cap on fishing effort by trawl fisheries for some deep-sea species was enacted in the NEAFC Regulatory Area. At-sea and port inspections. 30% reduction in effort of deep-sea fishing compared with previous years for the relevant species. Zero TAC for basking shark fishery in 2006.
Bycatch reduction	Cooperating non-contracting parties required to supply bycatch estimates in their target fisheries.
Habitat protection	Five areas closed to protect deep-water habitat, subject to ICES review.
Interim measures/ recovery plan	Temporarily prohibited use of gillnets, entangling nets and trammel nets in the Regulatory Area at depths of more than 200 metres until regulatory measures for this gear type can be developed.
Capacity reduction scheme	Inadequate information to assess.
Evaluation	Internal review to assess consistency. ICES evaluates effectiveness of management.
Voluntary Code of Conduct	Inadequate information to assess.
Research programme	ICES conducts photographic and acoustic surveys on Lophelia reefs and assesses the effectiveness of closed areas and the biological data of target species. Contracting Parties supply data on species-specific shark bycatch and are to develop sampling plans for deep-water species.
Experimental fisheries	Inadequate information to assess.
Monitoring and enforcement Monitors/improves compliance	Provisional monthly catch reports. Control and Enforcement Scheme: inspector and observer reports. Scheme of Joint International Inspection and Surveillance. Data on IUU fishing collected by Contracting Parties. Satellite imagery and VMS.
Detection of ancillary impacts	Collects biological information on associated species (e.g. porbeagle and spurdog).
Penalties for non-compliance	Non-Contracting Party Compliance Scheme (A-lists and B-lists).

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The North East Atlantic Fisheries Commission (NEAFC) was established in 1963. In its current form NEAFC was established in 1980 by the Convention on Future Multilateral Cooperation in North East Atlantic Fisheries. This accommodated the extension of the EEZs in the North Atlantic in the late 1970s and the incorporation of the EU (then the EEC) into NEAFC. The Convention Area covers all waters of the Northeast Atlantic Ocean, including the 200-mile zones.

NEAFC's mission, according to the Convention, is 'to promote the conservation and optimum utilization of the fishery resources of the North-East Atlantic area within a framework appropriate to the regime of extended coastal state jurisdiction over fisheries, and accordingly to encourage international co-operation'.[329]

Each Contracting Party, including the EU, has one vote in the Commission, and decisions of the Commission are normally taken by a simple majority. In some situations a two-thirds majority of vote is required. Decisions enter into force subject to an objection procedure.[330] The Commission's recommendations are weakened by this procedure, which allows a Contracting Party to decide not to comply with binding regulations if it notifies the Secretariat of its intention within 60 days of the regulation's adoption.[331]

The responsibility for enforcing management measures adopted under NEAFC rests with the Contracting Parties. However, in 1999 a Scheme of Joint International Inspection and Surveillance was adopted, which closely followed the models provided by the UN Fish Stocks Agreement and NAFO.[332]

Target species

NEAFC target species include redfish, blue whiting, mackerel, Atlanto-Scandian herring, Rockall haddock, blue ling, black scabbardfish and orange roughy. The Commission covers all fishery resources of the Northeast Atlantic, except marine mammals, sedentary species and, insofar as they are dealt with by other international agreements, highly migratory species and anadromous stocks.[333]

The size of the catch in 2004, the last year for which full catch data are available, was about 4 million tonnes in the Convention Area, of which one million tonnes was taken in the Regulatory Area (RA).[334] Catches for the four main fisheries regulated in the NEAFC RA amounted to approximately 3.3 million tonnes, which broken down amounts to 59,278 tonnes of redfish, with the majority being taken inside the RA, 1,253,537 tonnes of herring, three-quarters of which were taken inside the RA, 1,972,633 tonnes of blue whiting, half of which was taken inside the EEZs of Contracting Parties, 356,500 tonnes of mackerel, the majority of which was taken inside EEZs, 7,689 tonnes of haddock, most of which was taken inside the RA. All but one (Norwegian spring-spawning herring) of these

[329] G.L. Lugten, *A Review of Measures Taken by Regional Fishery Bodies to Address Contemporary Fishery Issues*, FAO Fisheries Circular No. 940, Food and Agriculture Organization of the United Nations, Rome, 1999, pp. 49–66, 97.

[330] Ibid.

[331] Ibid.

[332] Ibid.

[333] http://www.oceanlaw.net/orgs/neafc.htm.

[334] NEAFC, *Performance Review Panel Report of the North East Atlantic Fisheries Commission*, Volume I: *Main Report*, Agenda item 16 – for information, AM 2006/31, 2006, p. vii.

stocks are being fully harvested or harvested at unknown or unsustainable levels. NEAFC assumes that bycatch in these respective fisheries is minimal.[335]

Management measures

In the past, NEAFC recommended a ban on salmon fishing on the high seas (1969) and a temporary ban on industrial fishing for herring in the North Sea (1975).[336] At present, NEAFC has in place 'precautionary' TACs for five main stocks based on scientific advice from ICES. These stocks include redfish, blue whiting, Norwegian spring-spawning herring, mackerel and Rockall haddock.

Other management measures enacted by NEAFC include minimum fish-size limits, gear restrictions, closed areas to certain gear types (area west of Rockall), and mesh sizes for capelin and blue whiting.

In 2003 NEAFC expanded its list of managed species to include deep-water species. Until then deep-water species such as roundnose grenadier, orange roughy, blue ling and deep-sea sharks had been referred to as 'non-regulated species', even though some of these species, such as roundnose grenadier, had been fished in the international waters of the Northeast Atlantic for over 30 years. A cap on fishing effort by trawl fisheries for some deep-sea species was enacted in the NEAFC Regulatory Area. However, no specific regulations are presently in place for the deep-water gillnet fishery.[337]

Contracting Parties agreed that effort would be calculated as 'aggregate power, aggregate tonnage, fishing days at sea or number of vessels which participated'.[338] Given the historical high levels of catch of deep-water species in mixed fisheries, particularly roundnose grenadier, there are concerns that this regulation will not go far enough to prevent over-harvesting of deep-water resources.[339]

In fact, NEAFC's Working Group on the Appraisal of Regulatory Measures for Deep-Sea Species (2002) reported trends in landings and CPUE for most deep-water fisheries, which indicated that fishing pressure was far beyond sustainability.[340] In 2006 adjustments were made to NEAFC regulations stating that 'effort put into fishing for deep-sea species in 2006 is not to exceed 70% of the highest level in previous years for the relevant species using the same reference period and method of calculation as used in 2005, where these have been established'. In addition, Contracting Parties had to notify NEAFC before the end of March 2006 of measures that apply to deep-sea species in waters

[335] http://www.neafc.org/reports/annual-meeting/docs/am2006_papers/2006-31_review-vol_1.pdf, p. 33.

[336] North East Atlantic Fisheries Commission: History of the Organization, http://www.neafc.org/about/about_history.htm.

[337] N.R. Hareide, G. Garnes, D. Rihan, M. Mulligan, P. Tyndall, M. Clark, P. Connolly, R. Misund, P. McMullen, D. Furevik, O. Børre Humborstad, K. Høydal, T. Blasdale, *A Preliminary Investigation on Shelf Edge and Deep-water Fixed Net Fisheries to the West and North of Great Britain, Ireland, around Rockall and Hatton Bank*, Irish Fisheries Board, Fiskeridirektoratet, NEAFC, Seafish Fisheries Development Centre, Joint Nature Conservation Committee, Marine Institute, Foras na Mara, 2002, p. 26.

[338] The list of species for which the recommendation applies is roundnose grenadier, black scabbardfish, orange roughy, blue ling, ling, red sea bream, forkbeards, Greenland halibut, greater silver smelt, alfonsinos, tusk and the following deep-water shark species: Iceland catshark, gulper shark, leafscale gulper shark, black dogfish, Portuguese dogfish, kitefin shark, birdbeak dogfish, greater lanternshark, velvet belly, blackmouth dogfish and mouse catshark. Recommendation V from the 22nd Annual Meeting: NEAFC Recommendation for Ad Hoc and Temporary Conservation and Management Measures for Deep-Sea Species in the NEAFC Regulatory Area in 2004, http://www.neafc.org/measures/deep_sea_2004.htm.

[339] M. Gianni, *High Seas Bottom Trawl Fisheries and Their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems* Report prepared for IUCN/the World Conservation Union Natural Resources Defense Council, WWF International and Conservation International, 2005, pp. 61–4.

[340] NEAFC, *Meeting of the NEAFC Working Group on the Appraisal of Regulatory Measures for Deep-Sea Species*. North East Atlantic Fisheries Commission Deep-Sea Working Group, 11–13 June 2002. Final Report, Annex 4, Summary of Expert Presentations. Reports, Meeting on Deep-Sea Species, 11–13 June 2002, Bergen, http://www.neafc.org.

under national jurisdiction. Such measures are not to undermine those established for the Regulatory Area.[341]

IUU fishing

IUU fishing is reportedly a problem for NEAFC. There are serious inconsistencies in the deep-sea fisheries catch data (e.g. redfish and roundnose grenadier) as reported by NEAFC, ICES and the FAO for the NEAFC Regulatory Area and surrounding waters in the Northeast Atlantic region. The discrepancies in the published catch data for bottom-trawl fisheries on the high seas of the Northeast Atlantic are in some cases quite large.[342]

IUU fishing and reporting inconsistencies are most apparent for redfish, for which three species are found in the RA (*S. marinus, S. mentella* and *S. viviparous*). There is currently limited information on the distribution and status of redfish stocks in the Northeast Atlantic, which aggregate in both deep-water and on the edge of the continental shelf. However, in 2004 a provisional total catch of 137,000 tonnes was reported for redfish. The EC Joint Research Centre, using satellite imagery vessel detection system (VDS), which it compared with VMS position reports, indicated that not all fishing vessels could be accounted for. The discrepancy between the two sources of information indicates that the unreported effort might be significant and could be more than 25% higher than that reported to NEAFC. During 2002 and 2003 six Lithuanian vessels were reported to have fished within the NEAFC Regulated Area. Approximately 15,000 tonnes of redfish were taken as IUU, ten times above their quota.[343]

A Non-Contracting Party Scheme was introduced by NEAFC in 1999 to deter IUU fishing by non-members. Vessels are observed and inspected by NEAFC inspectors, and those without the correct licences are added to NEAFC's 'A-list'. Inquiries are made into the reasons why these vessels were fishing without permission and, if there is no satisfactory explanation, the vessel is transferred permanently to NEAFC's 'B-list', which is discussed at regular meetings of NEAFC's Permanent Committee of Control and Enforcement. Vessels can only be removed from the B-list by a decision of the Commission at its Annual Meeting. Letters drawing attention to these sightings also are sent to the Ministry of Foreign Affairs of the country under whose flag the vessel is registered. In addition, this list is circulated to other RFMOs. Infringements by Contracting Party vessels are reported by the inspection party to the vessel's flag state, which is obliged to report to NEAFC's Committee on Control and Enforcement on how it has dealt with the infringement.[344]

NEAFC's blacklist has had some positive effects in that one Non-Contracting Party, with a history of flag-of-convenience IUU vessels in the Northeast Atlantic, applied for cooperative non-contracting party status, which means that it will have the same obligations as Contracting Parties. Another has de-flagged and de-listed a large part of the IUU vessels on the NEAFC blacklist.[345] However, it does

[341] NEAFC, NEAFC Deep-Sea Technical Working Group, 27–28 April 2005, p. 8.

[342] M. Gianni, *High Seas Bottom Trawl Fisheries and Their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems*. Report prepared for IUCN/the World Conservation Union Natural Resources Defense Council, WWF International and Conservation International, 2005, pp. 61–4.

[343] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 21.

[344] http://www.neafc.org/measures/index.html.

[345] NEAFC, Response to request for information from UN. Letter dated 1 December 2005, signed by the Under-Secretary-General for Legal Affairs, Nicolas Michel. Agenda item 13 – for information, AM/2006/15, p. 2.

not appear that IUU fishing is adequately accounted for in stock assessments or the establishment of TACs.

NEAFC's Contracting Party Scheme also incorporates rules regarding authorization to fish, vessel and gear-marking requirements, catch-reporting requirements, guidelines for pilot projects, details about the inspection and surveillance process, and procedures for handling infringements. If a serious infringement occurs, NEAFC inspectors notify the contracting party, which in turn must conduct an inspection on the vessel within 72 hours. If justification for the violation is not provided, a port inspection may ensue. Contracting Parties are also required to follow up to ensure that the violation has been addressed.

NEAFC was one of the first RFMOs to conduct an internal performance review to assess its consistency with the Convention on Future Multilateral Co-operation in the North East Atlantic Fisheries (the Convention), the UN Agreement for the implementation of the Provisions of the UN Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFA), and other relevant international instruments. The review panel consisted of six individuals, three from outside the organization.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

NEAFC has updated its Convention with respect to biodiversity and ecosystem and precautionary approaches. The amendments are 'to take due account of the impact of fisheries on other species and marine ecosystems'. NEAFC has also requested ICES to provide advice in a fisheries and ecosystem context, in particular by including mixed fisheries considerations in management advice; the impact of environmental changes on fisheries; the impacts of fisheries on the ecosystem; and precautionary reference points for stocks.[346]

2.1 Bycatch, incidentally caught and non-target species

Although the NEAFC Convention does not specifically refer to the need to minimize bycatch and discards, it does call for 'taking into account the impact of fisheries on other species and marine ecosystems, and in doing so adopt, where necessary, conservation and management measures that address the need to minimize harmful impacts on living marine resources and marine ecosystems'.[347]

In 2005 NEAFC temporarily prohibited the use of gillnets, entangling nets and trammel nets in the NEAFC RA at depths greater than 200 metres until regulatory measures for these gear types could be developed.[348]

[346] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 30.

[347] http://www.neafc.org/reports/annual-meeting/docs/am2006_papers/2006-31_review-vol_1.pdf p. 23.

[348] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the

In its rules for obtaining cooperating non-contracting party status, parties are required to supply bycatch estimates in their target fisheries.[349]

2.2 Species listed by recognized authorities as threatened, endangered or protected

In 2006 ICES advised a zero TAC for the entire distribution area for basking shark. However, NEAFC maintained that there was no information from fishery-independent sources on stock levels, and no CPUE data were used as a basis for this advice. As a result, NEAFC recommended an interim measure, to the effect that no directed fishery for basking shark should be undertaken in the Convention Area in 2006. In addition, Contracting Parties were urged to make available to ICES all data on basking shark, including fisheries data, so that it could conduct a full evaluation of the state of the stock.[350]

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

ICES has advised NEAFC that many deep-sea species (i.e., sharks) within its RA may well be harvested unsustainably. Current regulations call for a 30% reduction in effort of deep-sea fishing in relation to previous years for the relevant species.[351]

2.4 Habitats

In 2001 NEAFC closed an area on the western slope of the Rockall plateau to bottom-trawling in order to protect juvenile haddock. In November 2004 NEAFC adopted a recommendation for the precautionary, interim closures of five areas (the Hekate, Faraday, Altair and Antialtair seamounts, and an area of the South Reykjanes ridge) to apply to all fishing gear from 2005–07, pending scientific advice from ICES. In 2005, in response to requests from NEAFC and the Commission for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), ICES provided advice on seamounts, the distribution of cold-water corals and other vulnerable deep-water habitats. NEAFC concluded that current information was insufficient to support scientifically based closures.[352] However, the closures are to remain in effect until 2008.[353]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

NEAFC, with the help of ICES, has developed precautionary reference points for its primary stocks. However, it has not always been consistent in adopting conservative management measures to prevent stock declines. Furthermore, it does not appear to account for the impact of regulatory discards and

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1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 32.

[349] http://www.neafc.org/reports/annual-meeting/docs/am2006_papers/2006-31_review-vol_1.pdf.

[350] http://www.neafc.org/measures/basking_shark_2006.htm.

[351] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 31.

[352] Ibid., p. 34.

[353] http://www.neafc.org/measures/deep-water_05_06.htm.

misreporting when establishing its management measures. What follows is a summary of the most recent measures adopted for four of its stocks.

ICES developed precautionary biological reference points for the blue whiting stock (e.g. B_{pa}, B_{lim}, F_{pa} and F_{lim}). The advice was intended to provide guidance to managers so that the spawning stock biomass did not fall below a certain level, B_{lim}, where the recruitment is thought to be impaired or the dynamics of the stock are unknown. It included implicit assumptions on the levels of probability and risk in the biological dimension. However, NEAFC established a TAC beyond scientific advice. As a result, the fishing mortality rate was above agreed targets and reached the limit reference point. ICES evaluated NEAFC's management plans for this stock and concluded that they were not precautionary. NEAFC maintained that the rationale for not following the advice was due to the uncertainty, possible bias and estimates of the reference points. Most notably, the reference points for this stock had been decided on in 1997–98 and did therefore not reflect the current stock and recruitment situation.

No target reference points were established for Rockall haddock. ICES reported that the stock had reached full reproductive capacity, although SSB was reported to be above B_{pa} in 2005. There are reports of high grading and misreporting occurring in the region. In 2001 a zone around Rockall bank was closed to protect juvenile fish. The most recent assessment of stock shows an upturn in SSB. It is not known how much of the improvement in stock condition is a result of the closure.

For mackerel, although ICES considered the NEAFC management plan to be consistent with the Precautionary Approach, it cited some shortcomings in the plan, namely that it did not specify measures that would apply under poor stock conditions, which preclude further evaluation. Furthermore, the management plan assumes that catch information is unbiased, so that absolute estimates of SSB can be produced. According to ICES, this condition has not been met for a number of years.

Unlike the other three stocks, in the case of Norwegian spring-spawning herring, ICES deems NEAFC's management strategy to have been consistent with the Precautionary Approach.

The EU, Faroe Islands, Iceland, Norway and Russia agreed on a long-term management plan, which consisted of four key elements.

1. Every effort shall be made to maintain a level of SSB greater than the critical level (B_{lim}) of 2,500,000 tonnes.
2. For the year 2001 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.
3. Should the SSB fall below a reference point of 5,000,000 tonnes (B_{pa}), a prescribed fishing mortality rate shall be adopted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5,000,000 tonnes. The basis for such an adoption should be at least a linear reduction in the fishing mortality rate from 0.125 at B_{pa} (5,000,000 tonnes) to 0.05 at B_{lim} (2,500,000 tonnes).
4. The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.

There are currently no specific management objectives for salmon. However, ICES has supplied NEAFC with scientific advice, namely that ICES requires that the lower bound of the 95% confidence interval of the current estimate of spawners is above the CL for the stock to be considered at full reproductive capacity.

- When the lower bound of the confidence limit is below the CL, but the mid-point is above, then ICES considers the stock to be at risk of suffering reduced reproductive capacity.
- When the mid-point is below the CL, ICES considers the stock to suffer reduced reproductive capacity. It should be noted that this is equivalent to the ICES precautionary target reference points (S_{pa}). Therefore, stocks are regarded by ICES as being at full reproductive capacity only if they are above the precautionary reference point (S_{pa}). This approach parallels the use of precautionary reference points used for the provision of catch advice for other fish stocks in the ICES area.[354]

NEAFC has adopted a number of other measures to curtail bycatch in target fisheries and reduce mortality on shark species (e.g. basking shark, deep sea sharks). It closes areas to protect habitat for target species (e.g. Rockall haddock) and collects information on other shark species (e.g. porbeagle and spurdog). However, it has not instituted a large-scale effort to address seabird entanglement or capacity reduction in NEAFC fisheries.

NEAFC has long-term plans to continue to evaluate the structure and function of the Commission with regard to the UN Conference on the Law of the Sea (UNCLOS) and the development of relevant international law, in particular the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks and the FAO Code of Conduct for Responsible Fisheries.

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

NEAFC compiles provisional weekly and monthly data on catches of regulated and some non-regulated species from Contracting Parties' statistical offices. Catches are reported split between the Regulatory Area and waters under national jurisdictions. Moreover, the NEAFC Scheme of Control and Enforcement sets out requirements for vessel notification and authorization along with specifications on logbook preparation. Vessel data are reported to the Fishing Monitoring Centres of Contracting Parties and then automatically forwarded to the central NEAFC database. The data in the VMS database are made available to the scientific community under the confidentiality rules established by NEAFC. In addition, NEAFC compiles inspector and observation reports from surveillance agencies and port controls.[355]

ICES also collects data on deep-water redfish (*Sebastes mentella*) in the Irminger Sea, including information of stock identity and quantitative information to allow spatial and temporal limitations in catches and other measures.[356]

4.2 Bycatch, incidentally caught and non-target species

ICES is providing data on the spatial and temporal extent of all current deep-water fisheries in the Northeast Atlantic and developing and applying suitable criteria for differentiating fisheries into

[354] http://www.ices.dk/reports/ACFM/2005/WGNAS/wgnas05sec1.pdf, p. 10.

[355] NEAFC, CWP and FIRMS meetings in 2006 at ICCAT headquarters in Madrid. Note prepared by the NEAFC Secretariat. Agenda item 13 – for information, AM2006/17, p. 3.

[356] http://www.ices.dk/advice/request/requesttable.asp.

possible management types (e.g. directed deep-water fisheries and bycatch fisheries).[357] Contracting Parties are to provide scientific information to ICES every six months (e.g. type of fishing activity, economic zone, depth of fishing, landings and discards) in logbooks and/or reports presented by observers.[358] In addition, Contracting Parties are to develop sampling plans for deep-sea species (including discards where necessary), and communicate them via NEAFC to ICES. ICES shall be asked to review the sampling plans and provide feedback to the Contracting Parties via NEAFC.

In addition, the NEAFC Working Group on Deep Sea Species recommended that the Advisory Group on Data Communication establish data exchange protocols for data collection requirements specified in Annex B.[359]

4.3 Species listed by recognized authorities as threatened, endangered or protected

ICES has made the following recommendations to NEAFC with respect to basking sharks (IUCN Red List status: VU A1ad + 2d).[360]

- Recent catch and effort data in the fishery should be provided. At present, the information is only available from Portugal and Norway.
- Bycatch should be recorded and accidental collisions recorded and reported to ICES.
- Biological sampling of dead bycatch and stranded basking sharks should be initiated.
- Novel means to obtain fisheries-independent information should be explored, including observations at oil platforms, observations from whale and dolphin watching programmes, and cetacean abundance surveys in the northern seas.
- Electronic tagging studies should be conducted to better understand stock structure.
- Historical catch data (i.e., in liver weight) should be converted to total weight.

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

ICES is developing a sampling scheme for pelagic sharks (e.g. porbeagle, basking and spurdog),[361] and a list of information that should be obtained from the fisheries on pelagic sharks to allow for an improvement of assessments and advice.[362] Contracting Parties are to supply more complete catch information (e.g. discards, sex composition, length, weight, etc.). ICES suggested that as these fish are caught across a wide area of the northern Atlantic and are often implicated in tuna longlining, in particular, it would be advantageous if NEAFC, ICES and ICCAT all had compatible approaches to data collection.

4.5 Habitats

Studies by ICES of the effects of bottom trawling around *Lophelia* reefs include photographic and acoustic surveys showing trawl marks at depths between 200 metres and 1,400 metres all along the Northeast Atlantic shelf break area from Ireland, Scotland and Norway.[363]

[357] Ibid.
[358] http://www.neafc.org/measures/recs-2006/rec-10-2006.htm.
[359] NEAFC, Deep-Sea Technical Working Group, 27–28 April 2005, p. 8.
[360] http://www.elasmo-research.org/education/shark_profiles/cetorhinus.htm.
[361] NEAFC, Request to ICES for Scientific Advice for 2006. Agenda Item 7, 2006, AM 2005/51..
[362] http://www.ices.dk/advice/request/requesttable.asp.
[363] M. Gianni, *High Seas Bottom Trawl Fisheries and Their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems*. Report prepared for IUCN/the World Conservation Union Natural Resources Defense Council, WWF International and Conservation International, 2005, p. 15.

Along with evaluating the effectiveness of three existing closures to protect vulnerable deep-sea habitats and their proximity to fisheries, ICES is to conduct further research to identify the distribution of vulnerable habitats in the NEAFC Convention Area and fisheries activities in such habitats and in their vicinity.[364]

4.6 Non-party and IUU fishing activities, catch and impacts

Data on IUU fishing are collected by NEAFC Contracting Parties and ICES.

5. Content, structure and process of scientific advice

There is no internal scientific body, since scientific advice is provided by ICES through a Memorandum of Understanding (MOU). ICES agrees to provide NEAFC with

- annual 'standard advice' (i.e., recurring advice) on the state and management of the main commercial stocks listed in Annex 1, according to the form established in Annex II; and
- 'non-recurring advice' as may be agreed between NEAFC and ICES, including advice concerning the state of the marine environment or ecosystem approaches to management of human activities that have an impact on the marine environment, especially fisheries.

The information on which the advice is based (*inter alia*, study group or working group reports) is made available to NEAFC, following the full ICES review process. Any other relevant reports published by ICES will be made available to NEAFC. The advice and scientific information from ICES is presented by the Chairman of the Advisory Committee on Fishery Management (ACFM) or the designee at NEAFC's Annual Meeting. The scientific information and advice is sent to NEAFC and must be presented to NEAFC by a chairman of an ICES advisory committee or designee. An ICES professional adviser is also invited to the meetings. In the event that scientific work necessary for ICES to fulfil its obligations under this agreement is not completed, ICES must inform NEAFC of the nature, detail and consequences of such shortfalls.[365]

Adherence to scientific advice: Scientific advice is *inconsistently* followed in establishing catch limits, and catch limits are *inconsistently* adhered to once established.

[364] http://www.ices.dk/advice/request/requesttable.asp.
[365] http://www.ices.dk/advice/Request/NEAFC/NEAFC%20MoU.pdf.

South East Atlantic Fisheries Organization (SEAFO)

Table 14: EBM and PA management in SEAFO

Overarching objectives	Provides for a management regime ensuring long-term conservation and sustainable use of fish resources on the high seas off the Southeast Atlantic Ocean.
Decision rules	None apparent.
Limit reference points	None apparent.
Target reference points	None apparent.
M*anagement measures* Access control	Vessel registration and licensing scheme. Vessel and gear marking. Entry and exit reports. Prohibition on transhipments at sea.
Bycatch reduction	Mitigation measures in place to reduce seabird mortalities in longline fisheries. Full utilization of sharks.
Habitat protection	Closed areas to protect seamounts.
Interim measures/ recovery plan	Proposed freeze on fishing effort. No recovery plan identified as yet.
Capacity reduction scheme	None apparent.
Evaluation	None apparent.
Voluntary Code of Conduct	Instituted actions in compliance with FAO IPOAs for sharks and seabirds.
Research programme	Non-binding resolution requiring Contracting Parties to supply data on sea turtle bycatch.
Experimental fisheries	Permitting small-scale exploratory fisheries in closed areas with strict scientific protocol.
Monitoring and enforcement Monitors/improves compliance	VMS, scientific observers, port inspection scheme, list of authorized vessels and logbooks.
Detection of ancillary impacts	Working Group formed to assess wider ecosystem impacts of fishing.
Penalties for non-compliance	Blacklist.

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

Along with the Western and Central Pacific Convention and the Galapagos Agreement, the South East Atlantic Fisheries Organization (SEAFO) Convention is one of the first international fisheries agreements establishing a regional organization to manage and conserve straddling fish stocks, following the adoption of the UN Straddling Fish Stocks and Highly Migratory Fish Stocks Agreement (UNSFA) in 1995. However, since the

UNSFA was not in force when the SEAFO agreement entered into force in 13 April 2003, Contracting Parties do not view it as imposing binding obligations on them.[366]

The objective of the Convention provides for a management regime ensuring the long-term conservation and sustainable use of fish resources on the high seas of the south-east Atlantic Ocean.[367]

SEAFO's management regime is designed to be science-based, to take into consideration an ecosystem approach, and to apply the Precautionary Approach in the absence of reliable information.[368] SEAFO is the only RFMO with all members (Angola, Namibia, Norway and the EU) parties to the Fish Stocks Agreement.[369]

The conservation objectives of SEAFO will be achieved by exercising a degree of control over high seas fishing through:

- cooperative management and conservation measures based on the best scientific evidence available;
- application of the Precautionary Approach in line with the Code of Conduct for Responsible Fisheries;
- management of stocks on the basis of precautionary reference points adopted or established by the Commission;
- accounting for the impact of fishing operations on ecologically related species such as seabirds, marine mammals and marine turtles;
- ensuring that management measures do not result in harmful impacts on living marine resources as a whole; and
- protecting biodiversity in the marine environment.[370]

The convention is to implement a scheme of compliance, enforcement, inspection and observation in the region, incorporating:

- a joint international inspection scheme with procedures for boarding and inspection on a reciprocal basis;
- a scheme of port inspection;
- a scheme of scientific observation, to be implemented by each participating party; and
- a satellite surveillance system.[371]

366 http://www.seafo.org/welcome.htm.

367 SEAFO, 2004, www.mfmr.gov.na/seafo/seafo.htm.

368 UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 31.

369 United Nations, *Oceans and the law of the sea: Report of the Secretary-General*. Fifty-ninth session, Item 50 (a) of the provisional agenda, Oceans and the law of the sea. AddendumA/59/62/Add.1, 2004, p. 78.

370 Anon, 2004, www.oceanlaw.net/texts/westpac.htm.

371 SEAFO, South East Atlantic Fisheries Organization First Session, 9–13 March 2004, Swakopmund, Namibia. Report of the Meeting, p. 65.

At its inaugural meeting in 2004, basic rules for the functioning of the organization and its subsidiary bodies were adopted. Meeting members agreed on regulations regarding the financing of the organization, its rules of procedure and staffing arrangements. In particular, it was decided that a permanent Secretariat would be in place by the end of 2004, based in Walvis Bay, Namibia. It also adopted guidelines and priorities for the work of the Scientific Committee, which was to hold its first meeting in 2005.[372]

Target species

SEAFO's mandate covers discrete high-seas stocks, including, *inter alia*, fish, molluscs, crustaceans and other sedentary species within the Convention Area that are not covered by other regional fisheries organizations. Specifically, these include several deep-water and other species for which very little scientific data and catch data are currently available, including alfonsino (*Beryx splendens*), horse mackerel (*Trachurus capensis*), chub mackerel (*Scomber japonicus*), orange roughy (*Hoplosthetus atlanticus*), skates (various family *Rajidae*), armourhead (*Pseudopentaceros richardsoni*), cardinal fishes, deep-sea crab (*Chaceon maritae*), squids/octopus, Patagonia toothfish (*Dissostichus eleginoides*), deep-water hake (*Merluccius paradoxus*), wreckfish (*Polyprion americanus*) and oreodories.

The convention specifically excludes the highly migratory species listed in Annex I of the UN Convention of the Law of the Sea (UNCLOS).

Management measures

In 2005 the Scientific Committee advised that a freeze on current fishing effort in the SEAFO area should be imposed. Lengthy discussions took place during the Annual Meeting in order to explore how such a general recommendation could be implemented in practice. The Commission maintained that since only one party had conducted fisheries in 2004, the freezing of current fishing effort could discriminate against other parties that might want to deploy vessels in the area. Bearing in mind that the full provisions of the transitional arrangements had not yet been implemented, including notification of vessels intending to fish in the area, the Commission considered that the issue be deferred to the 2006 Annual Meeting, when it was expected that the extent of fishing in the SEAFO area might have become more transparent.

In 2006 the Scientific Committee reported that 'due to the lack of sufficient data for stock assessments, it is not possible to give specific management advice for any of the species harvested in the SEAFO area'. As an interim precautionary measure for existing fisheries, it recommended that the fishing pressure be reduced considerably and should only be allowed to expand again if reliable assessments indicated that increased harvests were sustainable. When new fisheries develop or existing fisheries expand into new areas, relevant indicators of the status of the stocks and fishing pressure should be established on the basis of small exploratory fisheries. In addition, these fisheries should only be allowed to expand very slowly if reliable assessments indicated that increased harvests were sustainable. Also, precautionary catch limits or effort limitations should be introduced.[373] A decision on this recommendation was to be made during the 2006 Annual Meeting, but the proceedings report is not yet available.

According to the Scientific Committee, so far only data on the Namibian orange roughy provide enough information to allow any analysis of trends. These data are solely based on limited CPUE

[372] Ibid.

[373] http://www.seafo.org/Scientific%20Committee/reports/SC%20Report%202006%20Eng.pdf.

data, which show that at present the CPUE seems to have stabilized at a low level. The Committee has stressed that caution should be exercised when examining these trends.[374]

As of April 2006, all vessels fishing for species that were not subject to the management and conservation regimes of other competent regional fisheries organizations operating in the SEAFO Convention Area were required to have a satellite-based VMS and be equipped with an autonomous system. The system must be able automatically to transmit a message to the land-based Fisheries Monitoring Centre (FMC) of its flag state, allowing for the continuous tracking of the position of the fishing vessel by the flag state.[375] All fishing vessels were also required to carry scientific observers.

An interim port inspection scheme was implemented, which required the collection of information on vessel registration and licensing as well as landings information. However, there is no mention in the Conservation Measure of what actually happens to the inspection report after it is signed by the vessel captain. In other words, it is not clear that the reports are sent to SEAFO, or whether SEAFO does anything with the reports.

In 2006 a Conservation Measure was adopted prohibiting Contracting Party vessels from making transhipments at sea in the Convention Area when fishing for species covered by the SEAFO Convention.[376]

IUU fishing

Another interim measure deals with the maintenance of a record of fishing vessels authorized to fish for species covered by the Convention. For the purpose of this measure, fishing vessels not entered into the record are deemed not to be authorized to fish for, retain on board, tranship or land species covered by the Convention, and are therefore considered to be conducting IUU fishing. To this end, Contracting Parties are required to submit by 2007 and thereafter annually a list of vessels authorized to fish under their flag.[377]

Contracting Parties are subject to extensive reporting requirements, which include information pertaining to VMS usage, vessel documentation, vessel and gear-marking requirements, entry and exit reports, information on fishing and research activities by means of logbooks, management and enforcement actions, and the sighting of Non-Contracting Parties in the Convention Area.[378]

SEAFO is also creating a blacklist, which will include fishing vessels that engage, *inter alia*, in the following activities:

- harvesting species covered by the SEAFO Convention in the Convention Area when they are not on the SEAFO record of authorized vessels;
- harvesting species covered by the SEAFO Convention when their flag state has no quota (or has exceeded its quotas), or if their flag state has no catch limit or effort allocation established by SEAFO Conservation Measures;
- failing to record or report their catches made in the Convention Area, or making false reports;
- taking or landing undersized fish in contravention of SEAFO Conservation Measures;

[374] Ibid., p. 6.

[375] SEAFO, Conservation Measure 01/05 to monitor the Fisheries in the SEAFO Convention Area, 2005.

[376] SEAFO, Conservation Measure 03/06: On an Interim Prohibition of Transshipments-at-Sea in the SEAFO Convention Area and to Regulate Transshipments in Port, 2006.

[377] SEAFO, Conservation Measure 07/06: Relating to Interim Measures to Amend the Interim Arrangement of the SEAFO Convention, 2006.

[378] Ibid.

- fishing during closures in contravention of SEAFO Conservation Measures;
- using prohibited fishing gear in contravention of SEAFO Conservation Measures;
- transhipping with, participating in joint fishing operations with, supporting or resupplying vessels included in the IUU vessel list;
- without nationality, harvesting species covered by the SEAFO Convention in the Convention Area;
- engaging in fishing activities contrary to any other SEAFO Conservation Measures; and
- fishing under the control of the owner of any vessel on the SEAFO IUU vessel list.

Contracting Parties are required every year, and at least 120 days before the Annual Meeting of the Commission, to transmit to the Executive Secretary a list of vessels presumed to be carrying out IUU activities in the Convention Area during the current and previous year, accompanied by evidence that supports the presumption of this IUU activity. The Executive Secretary then draws up a draft list for review by Contracting and Non-Contracting Parties, which is distributed at least 90 days before the Annual Meeting. If no evidence is presented to the contrary, vessel operators are notified of their inclusion in the list and related consequences.

SEAFO is a relatively new organization, and the assessment and impact of bycatch and IUU fishing is not yet fully reflected in management decisions.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

No measures specified as yet.

2.2 Species listed by recognized authorities as threatened, endangered or protected

Contracting Parties are required to implement mitigation measures, the effectiveness of which will be evaluated by the Commission at the 2009 Annual Meeting.

- All longline vessels fishing south of 30° S latitude are required to carry and use bird-scaring lines (tori poles). Where practical, vessels are encouraged to use a second tori pole and bird-scaring line at times of high bird abundance or activity and are required to have a back-up tori line, which is ready for immediate use if needed.
- When setting nets at night only minimal ship lights necessary for safety are to be used.
- Soak time is to be decreased.
- Offal discharge requirements are in place.
- Gear modifications must be made (e.g. weighting or decreasing the buoyancy of the net so that it sinks faster, or placing coloured streamer or other devices over particular areas of the net where the mesh sizes create a particular danger to birds).
- Every effort is to be made to ensure that birds captured alive during fishing operations are released alive, and that whenever possible hooks are removed without jeopardizing the life of the bird concerned.[379]

[379] SEAFO, Conservation Measure 05/06: On Reducing Incidental Bycatch of Seabirds in the SEAFO Convention Area, 2006.

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

SEAFO has adopted a number of measures to reduce shark bycatch.

- Contracting Parties are required to take the necessary measures to ensure that their fishermen utilize their entire catches of sharks fully. Full utilization is defined as retention by the fishing vessel of all parts of the shark, with the exception of heads, guts and skins, to the point of first landing.
- Contracting Parties are required to ensure that their vessels do not have on board fins that total more than 5% of the weight of sharks on board, up to the first point of landing. Contracting Parties which currently do not require fins and carcasses to be offloaded together at the point of first landing are required to take the necessary measures to ensure compliance with the 5% ratio through certification, monitoring by an observer, or other appropriate measures.
- The ratio of fin to body weight of sharks shall be reviewed by the Scientific Committee, which will report back to the Commission in 2008 for review, if necessary.
- Fishing vessels are prohibited from retaining on board, transhipping or landing any fins harvested in contravention of this Conservation Measure.
- In fisheries that are not directed at sharks, Contracting Parties are required to encourage, to the extent possible, the release of live sharks, especially juveniles, that are caught incidentally and are not used for food and/or subsistence.[380]

2.4 Habitats

In response to a UN General Assembly request for a progress report on actions taken to address the impact of fishing on sensitive deep-sea habitats (e.g. seamounts, hydrothermal vents, deepwater corals, etc.), SEAFO has restricted fishing for species covered by the SEAFO Convention from 1 January 2007 to 31 December 2010 on Dampier Seamount, Molloy Seamount, Schmidt-Ott Seamount and Erica Seamount, Africana Seamount, Panzarini Seamount, Vema Seamount, Wust Seamount, and Discovery, Junoy and Shannon seamounts until the necessary scientific information is collected to permit an assessment of the areas concerned.[381]

Based on input from the Scientific Committee, at its 2007 Annual Meeting the Commission plans to consider limited access to seamount areas. Access would be restricted, allowing only for an exploratory fishery in an area not exceeding 20% of the fishable area of each seamount from 1 January 2008. The Scientific Committee will base future recommendations on existing survey and commercial data from these seamount areas. In addition, the Scientific Committee is to provide a scientific protocol for data collection in the experimental fishery.[382]

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

SEAFO is in the early stages of developing a management strategy and is unencumbered by years of convention. It therefore has a genuine opportunity to implement meaningful precautionary

[380] SEAFO, Conservation Measure 04/06: On the Conservation of Sharks Caught in Association with Fisheries Managed by SEAFO, 2006.

[381] SEAFO, Conservation Measure 06/06: On the Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area, 2006.

[382] Ibid.

management measures. However, the reluctance of the organization to institute provisional reference points in line with those for similar or better-known stocks, or to establish interim measures (e.g. an interim cap on deep-water fisheries) until adequate information about the status of resources can be collected, is clearly not in keeping with the Precautionary Approach.

SEAFO has laid the groundwork for complying with the guidelines for data collection and management established by the FAO IPOA for sharks and seabirds.

SEAFO's efforts to advance a standardized methodology for observer programmes are laudable. What is needed is a comprehensive data collection programme, with adequate funding and political support from Angola, Namibia, the EU, Norway and others fishing in the region. The programme should include target stocks and associated and dependent stocks and focus on reproductive capacity, stock resilience and the characteristics of fisheries exploiting these stocks.

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

As a relatively new organization, SEAFO has recently established a Scientific Committee to assist with the collection of future scientific data within its regulatory area. SEAFO has begun to collect data on catch and fishing effort, as well as scientific data to support stock assessment. It has also recognized the need to collect information on vulnerable ecosystems. To assist with this effort, the Scientific Committee is developing a standardized Observer Programme.[383]

4.2 Bycatch, incidentally caught and non-target species

No research plans have been specified as yet.

4.3 Species listed by recognized authorities as threatened, endangered or protected

Contracting Parties are required to collect and provide all available information to the Secretariat on interactions with seabirds, including incidental catches by their respective fishing vessels, and fishing for species covered by the SEAFO Convention.[384]

Beginning in 2008, Contracting Parties are to provide the Secretariat with detailed data on sea turtle/fishery interaction (e.g. species identification, fate and condition at release, relevant biological information and gear configuration) and any sea turtle-specific training provided to these observers, including data collected by their respective national observer programmes, in fisheries managed by SEAFO in the Convention Area. This information will then be compiled by the Secretariat and reported to the Scientific Committee and to the Commission.[385]

In addition, Contracting Parties must annually report data for catches of sharks, in accordance with SEAFO data reporting procedures, including available historical data. Each Contracting Party, where

[383] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, p. 35.

[384] SEAFO, Conservation Measure 05/06: On Reducing Incidental Bycatch of Seabirds in the SEAFO Convention Area, 2006.

[385] SEAFO, Resolution 01/06: To Reduce Sea Turtle Mortality in SEAFO Fishing Operations, 2006.

possible, is required to undertake research to identify ways to make fishing gear more selective (such as avoiding the use of wire traces). Contracting Parties should also engage in research to identify shark nursery grounds.[386]

The Commission hopes to cooperate with other regional, sub-regional and global organizations to share data on sea turtle bycatch and to develop and apply compatible bycatch reduction measures as appropriate.[387]

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

No studies identified in the immediate future.

4.5 Habitats

SEAFO has established a working group to investigate, review, assess and evaluate, among other things, the wider ecosystem impacts of fisheries activities, such as fishing gear impacts on seabed and benthic ecosystems. The working group presented its preliminary findings in February 2007.[388]

In addition, experimental fishing permits are expected to be granted in 2008 for access to closed areas to protect deep-sea habitats. If hard corals are encountered, the fishing vessel is required to contact the Executive Secretary immediately, who will then close the area temporarily until a full evaluation can be made.

4.6 Non-party and IUU fishing activities, catch and impacts

There are no plans to address IUU activities at the present time.

5. Content, structure and process of scientific advice

Scientific advice is produced by the Scientific Committee, which presents advice annually to the Commission. The Commission, in turn, decides on what management actions are to be taken.

The priority areas for the Scientific Committee are to:

- advise and facilitate the establishment of an appropriate data handling system; implement resource stock assessments on key stocks (orange roughy, alfonsino, sharks, swordfish, armourhead, deep sea red crab, Patagonian toothfish);
- prepare results and make comprehensive recommendations on the resources;
- address and make recommendations on the impacts of fishing activities on the ecosystem;
- advise on the undertaking of fisheries and oceanographic surveys; and
- advise on appropriate management actions to ensure the sustainability of fisheries and the conservation of the ecosystem.

386 SEAFO, Conservation Measure 04/06: On the Conservation of Sharks Caught in Association with Fisheries Managed by SEAFO, 2006.

387 SEAFO, Resolution 01/06: To Reduce Sea Turtle Mortality in SEAFO Fishing Operations, 2006.

388 UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regard the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, 2006, p. 34.

Adherence to scientific advice: It is too early to tell if scientific advice is followed, but in 2005 the Commission did not act on scientific advice to freeze fishing effort in the area, as only one fishing nation was fishing, and it viewed this as discriminatory.

Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC)

Table 15: EBM and PA management in WCPFC

Overarching objectives	To ensure through effective management, the long-term conservation and sustainable use of the highly migratory fish stocks of the Western and Central Pacific Ocean in accordance with the 1982 Convention and Agreement and to promote optimum utilization of the stocks.
Decision rules	Responsibility for implementing PA management lies with each Contracting Party, not the RFMO.
Limit reference points	MSY.
Target reference points	None apparent.
Management measures Access control	None apparent.
Bycatch reduction	Management plans to reduce bycatch for tuna fisheries using FADs to be developed.
Habitat protection	None apparent.
Interim measures/recovery plan	Capped fishing effort for bigeye, yellowfin and albacore tuna.
Capacity reduction scheme	None apparent.
Evaluation	Scientific Committee recommended reduced fishing mortality on bigeye and yellowfin tuna (10% and 30% respectively). As meeting of Commission has yet to occur, it is unclear if advice will be heeded, and further management action will be taken.
Voluntary Code of Conduct	Yokohama Declaration of tuna fishermen (2005).
Research programme	Planned tagging programme. Contracting Parties to collect information on seabird mortality in longlines and shark and sea turtle bycatch. Commission plans to collect biological data for billfish species.
Experimental fisheries	Testing deep-setting longline techniques to validate the method and to see if the technique is useful for deep daytime swordfish fishing to reduce bycatch.
Monitoring and enforcement Monitors/improves compliance	Observer programme in development. National reports to the Commission. Plans to create centralized database for catch data. Special arrangements for participation by fishing entities and by territories situated within the Convention Area.
Detection of ancillary impacts	None apparent.
Penalties for non-compliance	Trade restriction measures (as a last-resort measure).

1. The target and significant retained by-product species, including targets, limits, management measures (e.g. effort, catch, area, time), incorporation of non-party and IUU activities, decision rules to identify management measures

The Convention on the Conservation and Management of Highly Migratory Fish Stocks of the Western and Central Pacific Ocean (WCPFC) was established after the UN Fish Stocks Agreement. The WCPFC agreement came into force on 19 June 2004. As a result the Precautionary Approach and ecosystem management principles are actually reflected in the Convention text, which includes socio-economic considerations, the need to avoid adverse impacts on the marine environment and preserve biodiversity, and the need to maintain the integrity of marine ecosystems and minimize the risk of long-term or irreversible effects of fishing operations.

The objective of the WCPFC Convention is 'to ensure through effective management, the long-term conservation and sustainable use of the highly migratory fish stocks of the Western and Central Pacific Ocean in accordance with the 1982 [UN Fish Stocks Agreement] Convention and the Agreement and to promote optimum utilization of the stocks'. However, this is further qualified as follows: 'Measures are based on the best scientific evidence available and are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield ... and taking into account fishing patterns, the interdependence of stocks and any generally recommended international minimum standards, whether sub-regional, regional or global.'

As a general rule, decisions on questions of substance are made by a three-fourths majority of those present, so long as the majority includes a three-fourths majority from the South Pacific Forum Fisheries Agency and a three-fourths majority of non-members of the South Pacific Forum Fisheries Agency. In addition, under no circumstances can a management proposal be defeated by two or fewer votes in either agency.[389]

The Convention also contains special arrangements for participation by fishing entities and by territories situated within the Convention Area. In addition, WCPFC's management decisions result either in non-binding Resolutions (recommendations) or in binding Conservation and Management Measures (requirements).

Target species

WCPFC target species include skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), albacore tuna (*Thunnus alalunga*) and bigeye tuna (*Thunnus obesus*). The Convention applies to all species of highly migratory fish stocks within the Convention Area, with the exception of sauries.[390] Fisheries are diverse, ranging from small-scale artisanal operations in the coastal waters of Pacific states to large-scale, industrial purse-seine, pole-and-line and longline operations in both the EEZs of Pacific states and on the high seas.[391]

The provisional total tuna catch for 2005 from the Western and Central Pacific Ocean (WCPO) was 2,145,367 tonnes (77% of the total Pacific tuna catch),[392] comprising skipjack (1,443,127 tonnes; 67%), yellowfin (423,468 tonnes; 20%), bigeye (163,419 tonnes; 8%) and albacore (115,353 tonnes; 5%). This was a record tuna catch recorded for the WCPO – an increase of 5% on the catch reported in 2004.

[389] http://www.wcpfc.int/pdf/Rules_of_Procedure.pdf.
[390] http://www.wcpfc.int/.
[391] http://www.wcpfc.int/sc2/pdf/SC2_GN_WP1.pdf.
[392] Ibid., p. 4.

Management measures

At present management consists of a cap on fishing for bigeye, yellowtail and North Pacific and South Pacific albacore tuna stocks. These caps were set in response to scientific advice that the stocks were being overfished. The Scientific Committee determined that 2005 catch levels appeared to be sustainable, so no measures were adopted for skipjack tuna.

For North Pacific albacore, which are believed to be fully exploited or may be experiencing fishing mortality above levels that are sustainable in the long term,[393] the WCPFC further required Contracting Parties to report all catches to the WCPFC every six months, except for small coastal fisheries, which shall be reported on an annual basis. Such data are to be reported to the Commission as soon as possible, and no later than one year after the end of the period covered.[394]

In 2006 the Scientific Committee recommended a further reduction in fishing mortality of bigeye and yellowfin of 25% and 10%, respectively, from the average levels for 2001–04.[395] It remains to be seen whether a further reduction in fishing effort will be required by the Commission.

In 2006 the Scientific Committee provided advice for two other species: swordfish and striped marlin in the Southwest Pacific. For swordfish, total and spawning biomass are believed to be above B_{MSY}, and fishing mortality is probably below F_{MSY}. Thus the Committee recommended that there be no increases in fishing mortality on this stock. For striped marlin, current fishing mortality may approximate or be exceeding F_{MSY} and current spawning biomass may approximate or be below B_{MSY}. The Committee recommended that there should be no increase in fishing mortality, particularly in the area encompassing the Coral Sea and the Tasman Sea.

In developing criteria for the allocation of the total allowable catch or the total level of fishing effort, the Commission takes into account, *inter alia*:

(a) the status of the stocks and the existing level of fishing effort in the fishery;

(b) the respective interests, past and present fishing patterns, and fishing practices of participants in the fishery and the extent of the catch being utilized for domestic consumption;

(c) the historical catch in an area;

(d) the needs of small island developing states, and territories and possessions, in the Convention Area whose economies, food supplies and livelihoods are overwhelmingly dependent on the exploitation of marine living resources;

(e) the respective contributions of participants to the conservation and management of the stocks, including the provision by them of accurate data and their contribution to the conduct of scientific research in the Convention Area;

(f) the record of compliance by the participants with conservation and management measures;

(g) the needs of coastal communities which are dependent mainly on fishing for the stocks;

(h) the special circumstances of a state which is surrounded by the exclusive economic zones of other states and has a limited exclusive economic zone of its own;

[393] Scientific evidence on North Pacific albacore from the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean.

[394] Conservation and Management Measure for North Pacific Albacore, Conservation and Management Measure-2005-03.

[395] http://www.wcpfc.int/wcpfc3/pdf/WCPFC3-2006-10-AnnualReport_2_.pdf.

(i) the geographical situation of a small island developing state which is made up of non-contiguous groups of islands having a distinct economic and cultural identity of their own, but which are separated by areas of high seas; and

(j) the fishing interests and aspirations of coastal states, particularly small island developing states, and territories and possessions, in whose areas of national jurisdiction the stocks also occur.

In 2007 the Secretariat has prepared a draft Strategic Plan. The Plan draws on the provisions of international arrangements, such as the UN Fish Stocks Agreement and the FAO Compliance Agreement. It has been drafted in an effort to identify the principal activities and tasks of the Commission between 2007 and 2011, to provide transparency in relation to the work of the Commission and to provide a basis against which to monitor and periodically report on the effectiveness and performance of the Commission.[396]

IUU fishing

In 2005 the Scientific Committee reported that the level of IUU fishing in the WCPO was a significant factor in preventing accurate estimates of catch and effort levels for regional tuna fisheries, and for providing the spur to develop appropriate advice in respect of conservation and management measures.[397]

Uncertainty in catch estimates stems at least in part from inadequate observer and port sampling coverage. For instance, in 2003 coverage by port sampling data was only 5.1%, and for observer data it was 4.8% (the latter increased slightly in 2004 to 5.8%).[398] Furthermore, there are discrepancies in catch levels among various sampling schemes. This is reflected in two studies concerning the species composition of the catch taken by purse-seiners. A two-variable model, with school association and year, was used to determine factors for adjusting catch estimates for the misidentification of bigeye as yellowfin based on observer data. A comparison of the species composition of catches by purse-seiners determined from observer data and other types of data was also conducted. The proportion of skipjack in purse-seine catches determined from observer data was found to be 55.4%. This value was inconsistent with the proportions of skipjack determined from logsheet data, records of unloadings, port-sampling data and final outturn reports, which ranged from 72% to 78%. Comparisons of the observer data with the port sampling data indicated that there were higher quantities of (>80 cm) yellowfin and bigeye in the observer samples than in the port samples. The cause of the discrepancy, and whether it is related to observer data or the other types of data, is not known. Further work should identify the cause of the problem, and unbiased sampling protocols should be developed with reference to sampling schemes used by other RFMOs.[399]

In 2006 the Commission adopted a non-binding resolution, requesting that Contracting Parties take action to reduce capacity in the purse-seine fishery by 2007. However, it qualified this recommendation by imposing two conditions:

(1) that such efforts should not adversely affect coastal processing and transhipment facilities and associated vessels of developing island coastal states and territories, and should not affect investment that has occurred legally in Forum Fisheries Agency (FFA) member countries; and

[396] http://www.wcpfc.int/wcpfc3/pdf/WCPFC3-2006-10-AnnualReport_2_.pdf, p. 7.
[397] http://www.wcpfc.int/wcpfc2/pdf/WCPFC2_Records_Summary.pdf, p. 3.
[398] http://www.wcpfc.int/sc1/pdf/sc1_final_report.pdf, p. 28.
[399] Ibid., p. 29.

(2) that the resolution applies only to capacity increases in the period 1999 to 2005.[400]

The Technical and Compliance Committee (2006) agreed on three priorities for monitoring, control and surveillance:

(1) a Vessel Monitoring System;

(2) a Regional Observer Programme; and

(3) high seas boarding and inspection procedures.[401] The Secretariat has hired independent contractors to provide guidance in the development of these schemes.

2. Application of the ecosystem approach (including targets, limits, management measures and decision rules)

2.1 Bycatch, incidentally caught and non-target species

Beginning in 2006, the Scientific Committee and the Technical and Compliance Committee began exploring and evaluating mitigation measures for juvenile bigeye and yellowfin taken around FADs, in cooperation with other RFMOs.[402]

The purse-seine fishery has a significant level of bycatch of both bigeye and yellowtail tuna juveniles, which was capped at current effort levels and had restrictions placed on the use of FADs in 2005.[403] Furthermore, in order to achieve the overall reduction in catch and effort required for bigeye and yellowfin tuna, the development of a system of temporary purse-seine closures similar to those in effect in the IATTC Convention Area is being considered.

The Commission further implemented a binding resolution on purse-seine fisheries, requiring that Contracting Parties develop management plans for the use of FADs (anchored and drifting) within waters under national jurisdiction, which are to be submitted to the Commission. However, any developing skipjack purse-seine fisheries between 20° N and 20° S, which that can provide verifiable evidence of minimal yellowfin and bigeye bycatch with 100% observer coverage and a legitimate development plan, are exempted. Any such plan is required to restrict the use of FADs and implement other management measures necessary to minimize impacts on bigeye and yellowfin. These measures must be supported by adequate monitoring, control and surveillance to ensure their effective implementation. Existing plans are to be submitted to the Commission before government approval, so that the Commission can comment on the plan before its approval.[404]

[400] http://www.wcpfc.int/.

[401] http://www.wcpfc.int/wcpfc3/pdf/WCPFC3-2006-10-AnnualReport_2_.pdf, p. 4.

[402] Conservation and Management Measures for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean, Conservation and Management Measure-2005-01.

[403] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regard the impacts of fishing on vulnerable marine ecosystems.: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/61/154, 2006, p. 31.

[404] Conservation and Management Measures for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean, Conservation and Management Measure-2005-01.

2.2 Species listed by recognized authorities as threatened, endangered or protected

WCPFC has adopted non-binding resolutions on the incidental catch of seabirds, non-target fish species, and on the mitigation of the impact of fishing for highly migratory fish species on sea turtles.[405]

The Commission also agreed that the Scientific Committee, in consultation with the Technical and Compliance Committee, is to investigate seabird mitigation measures applied and tested by other RFMOs, particularly those of the CCAMLR; investigate the utility of implementing compatible measures; and recommend specific seabird mitigation measures for consideration at the third regular session of the Commission.[406]

2.3 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

Since quantitative impacts on the fishery and the tuna stocks are highly uncertain, the WCPFC is exploring the use of a spatial ecosystem and population dynamics model (SEAPODYM), driven by physical and 'simplified' food web interactions as a basis for future assessments.[407]

2.4 Habitats

No action taken as yet directly related to habitat protection at the WCPFC level.

3. Application of the Precautionary Approach, including highlighting precautionary elements in general or from 1 and 2 above

WCPFC, being a new organization established after the enactment of the UN Fish Stocks Agreement, is well positioned to establish management measures that are both precautionary and ecosystem-oriented in nature. It seems to recognize this responsibility in its overall objective, which cites the need to comply with recommended international minimum standards and acknowledges the interdependence of stocks.

In defining management targets and limits, the Commission uses $F_{current}$ and $B_{current}$ referring to the average fishing mortality and biomass over the period 2001–03 respectively, 2003 being the final year for which complete fishery data are available. Sustainable catch levels for bigeye, yellowfin and South Pacific albacore are estimated under two assumptions concerning recruitment. First, the MSY estimates reflect recruitment at long-term average levels. Second, the maximum yield estimates are based on recent (1994–2003) average recruitment. F_{MSY} was chosen as an indicator of sustainable effort – clearly not very precautionary.[408]

Annex II of the UN Fish Stocks Agreement states that 'management strategies shall seek to maintain or restore populations of harvested stocks, and where necessary associated or dependent stocks'. WCPFC scientists account for potential impacts on other catch components qualitatively in their stock assessments. The Scientific Committee has noted that for at least two gear types, longline and purse-seine setting on floating objects (FADs and logs), there is a potential for considerable impacts on non-target species, even

[405] Resolution on the Incidental Catch of Seabirds, Resolution 2005-01.
[406] http://www.wcpfc.int/wcpfc2/pdf/WCPFC2_Records_Summary.pdf, p. 6.
[407] http://www.wcpfc.int/sc1/pdf/sc1_final_report.pdf.
[408] Ibid., p. 35.

if the target stock is not being adversely affected.[409] Annual assessments further include a report on the economic condition of tuna fisheries as a measure of the health of resource.

WCPFC has taken steps to reduce bycatch, but for the most part they are non-binding or simply monitoring efforts, with the exception of its requirement on Contracting Parties to develop management plans related to fishing for tunas with FADs.

The Commission has been proactive in response to scientific advice, adopting interim measures (e.g. effort caps) when overfishing was reported to be occurring in yellowfin and bigeye tuna fisheries. However, like most RFMOs, the question remains as to how effectively these measures are enforced and complied with by the Contracting Parties. In addition, while freezing effort is a good starting point, to be precautionary and to prevent the stock from being overfished, effective monitoring and reporting must occur to ensure that Contracting Party vessels are actually complying with the effort reduction measure. In addition, beyond just capping effort, a recovery plan should be adopted to rebuild the stock over a specific time period with reasonable certainty. Action must be taken (e.g. closing an area, reducing capacity, etc.) to reduce fishing mortality rates. Even though skipjack stocks are reported to be in good shape, the fact that no management measures have been enacted to regulate fishing effort is worrying.

A good example of precautionary management by WCPFC is its initiative with regard to the South Pacific albacore stock. Even though the Scientific Committee has stated that annual catch levels from the stock appear to be sustainable, WCPFC has adopted precautionary conservation measures for South Pacific albacore tuna in the Convention Area south of 20° S, namely a cap on vessel numbers actively fishing for albacore at 2005 levels.[410] The rationale for this decision is threefold:

(1) there is considerable biological uncertainty about South Pacific albacore;

(2) owing to the age-specific mortality of longline fleets, any significant increase in effort would reduce CPUE to low levels with only moderate increases in yields, and CPUE reductions may be more severe in areas of locally concentrated fishing effort; and

(3) estimates of MSY are highly uncertain because of the extrapolation of catch and effort data well beyond any historical levels. Projections have demonstrated that longline exploitable biomass, and hence CPUE, would fall sharply if catch and effort were increased to MSY levels. Therefore, the economic consequences of any such increases should be carefully assessed beforehand.[411]

In 2006 the Scientific Committee reported that overall fishery impacts on the total biomass were low (10%), although considerably higher impacts occurred for the portion of the population vulnerable to longline. Therefore, the Committee did not vary its advice provided to the Commission in the previous year, given that the current catch levels appeared to be sustainable and yield analyses

[409] Ibid., pp. 32–3.

[410] UN Secretary-General, *Impacts of fishing on vulnerable marine ecosystems: actions taken by States and regional fisheries management organizations and arrangements to give effect to paragraphs 66 to 69 of General Assembly resolution 59/25 on sustainable fisheries, regard the impacts of fishing on vulnerable marine ecosystems: Report of the Secretary-General*. 61st session, Item 69 (b) of the provisional agenda, Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, A/61/154, 2006, p. 31.

[411] Conservation and Management Measure for South Pacific Albacore, Conservation and Management Measure-2005-02.

suggested that increases in fishing mortality and yields were possible. However, the Committee did caution that given the age-specific mortality of the longline fleets, any significant increase in effort is forecast to reduce CPUE to low levels, with only moderate increases in yields.[412]

4. Data collection and sharing

4.1 Target species (effort, catch, area, time)

The short-term work plan for the Fishing Technology-Specialist Working Group is to expand data inputs to assist the standardization of fishing effort; improve the characterization of current and historical operational details at the fleet level; improve technical and behavioural knowledge of fish aggregation devices and associated species; identify technically based initiatives to increase targeting and reduce bycatch; and develop training materials useful to improve the quality of fisheries data.[413]

In 2005 WCPFC adopted the recommendation of the Scientific Committee relating to scientific data provided to the Commission on standards for the provision of operational-level catch and effort data. The Technical and Compliance Committee agreed to a two-part reporting format:

(1) information on fisheries, research and statistics; and

(2) information on management and compliance.

Standards on verification and timely exchange of fisheries data are yet to be developed. All Contracting Parties submitted Part 1 Reports to the Scientific Committee in August 2006. In addition, Contracting Parties whose vessels operate in the northern area submitted additional reports for North Pacific albacore, as required under Conservation and Management Measure 2005–03.[414]

The WCPFC also requires that Contracting Parties fishing for albacore south of the equator cooperate to ensure the long-term sustainability and economic viability of the fishery for South Pacific albacore, including cooperation and collaboration on research to reduce uncertainty with regard to the status of this stock.[415] It does not appear that any programmes have been enacted as yet.

WCPFC hopes to implement a large-scale tagging programme for the main target species in the WCPO to provide additional information on recent levels of fishing mortality, refine estimates of natural mortality, and possibly allow time-series behaviour in movement to be incorporated into the model.[416]

Another priority for the Commission is to improve observer coverage of the Western and Central Pacific pelagic fisheries by increasing coverage rates, centralizing and expanding observer data collection, designing specific observer programmes to address specific objectives, and improving catch reporting information by species as well as collecting information on the fate and condition of fish caught.

4.2 Bycatch, incidentally caught and non-target species

With respect to non-target catch, a priority for WCPFC in 2007 is to carry out further tests of deep-setting longline techniques to validate the method and to see if the technique is useful for

[412] http://www.wcpfc.int/wcpfc3/pdf/WCPFC3-2006-10-AnnualReport_2_.pdf, p. 2.
[413] http://www.wcpfc.int/sc1/pdf/sc1_final_report.pdf, pp. 25–6.
[414] http://www.wcpfc.int/wcpfc3/pdf/WCPFC3-2006-10-AnnualReport_2_.pdf, p. 14.
[415] http://www.wcpfc.int/.
[416] http://www.wcpfc.int/sc1/pdf/sc1_final_report.pdf, p. 51.

deep daytime swordfish fishing. The Commission also plans to collect key biological parameters for billfishes (age estimates, growth rates, sizes at age, maturity schedules, movements and habitat preferences, stock structure, identification and reporting of catch to species level).

4.3 Species listed by recognized authorities as threatened, endangered or protected

The Commission has requested that Contracting Parties provide the Commission with all available information on interactions with seabirds, including incidental catches and details of species, to enable the Scientific Committee to estimate seabird mortality in all fisheries to which the WCPF Convention applies.

In relation to the Resolution relating to sea turtles, it was agreed that the Commission, through the Scientific Committee and the Technical and Compliance Committee, should develop a programme that includes researching and developing gear and bait alternatives; promoting the use of available bycatch mitigation technology; promoting and strengthening the data collection programme to obtain standardized information for developing reliable estimates of sea turtle bycatch; conducting biological research on sea turtles, including the identification of migration routes or other areas of spatial or temporal importance; implementing industry education efforts; and developing and promoting safe handling techniques and other methods to improve sea turtle conservation. This programme will take into account the sea turtle conservation efforts undertaken in other international organizations, in particular the IATTC.[417]

In addition, the Commission requested that the Secretariat, in cooperation with the Scientific Committee, centralize bycatch and observer data to obtain better estimates of total catch and mortalities of sea turtles by fisheries that target highly migratory fish species covered by the Convention within the Convention Area. The Scientific Committee is requested to take practical steps necessary to improve monitoring and reporting of sea turtle interactions in the Convention Area, including the development of data standards and specifications and reporting requirements.[418]

In 2006 the Scientific Committee recommended specific mitigation measures in relation to sea turtles and sea birds, including:

(1) minimum observer coverage of 5%;

(2) the types of data to be collected in relation to seabirds;

(3) shark bycatch research priorities; and

(4) an outline for a data collection and research programme for sea turtles.[419]

4.4 Trophic interactions and trophically important species (e.g. key forage species for fishery target species or other dependent species in the ecosystem)

WCPFC is planning to implement an ecological risk analysis in order to prioritize species of sea turtles, sharks, seabirds and non-target fish species for future research.

The development of ecosystem models, indicators and reference points were identified as a priority for the Ecosystem and Bycatch Specialist Working Group (EBSWG).

[417] http://www.wcpfc.int/wcpfc2/pdf/WCPFC2_Records_Summary.pdf, p. 6.
[418] Ibid., p. 6.
[419] http://www.wcpfc.int/wcpfc3/pdf/WCPFC3-2006-10-AnnualReport_2_.pdf, p. 3.

4.5 Habitats

No near-term plans were identified to study habitats.

4.6 Non-party and IUU fishing activities, catch and impacts

For the past several years a monitoring project has been collecting annual catch data on pelagic tuna in the Philippines and the Pacific Ocean waters of Indonesia. The project aims to fill the significant gaps in the knowledge about actual catch levels in the region. This will have a considerable impact on the quality of the stock assessments, given that 29.9% (2002 data) of the total catch of pelagic tuna in the WCPO comes from this region.[420]

5. Content, structure and process of scientific advice

There are three primary committees which provide scientific advice to the Commission. These include the Scientific Committee, the Technical and Compliance Committee and the Northern Committee. The Scientific Committee has a number of sub-committees to collect data, develop ecosystem models and conduct stock assessments.

The Northern Committee, in coordination with the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean and other scientific bodies, conducts scientific reviews of the North Pacific albacore stock. The Northern Committee, through the WCPFC Scientific Committee, reports to the Commission on the status of the stock at each annual meeting. The Northern Committee can also make recommendations to the Commission as may be necessary for effective conservation.

Contracting Parties are required to report to the Commission annually on all catches of albacore north of the equator and on all fishing effort north of the equator in fisheries directed at albacore. The reports for both catch and fishing effort are made by gear type and reported in terms of weight. Fishing effort is reported in terms of the most relevant measures for a given gear type, including at a minimum for all gear types and the number of vessel days fished.[421]

Since 2004 the South Pacific Commission (SPC) has served as the Commission's data manager in collecting and compiling fishery-related data, subject to the terms and conditions of the Memorandum of Understanding between the Commission and the SPC.

Adherence to scientific advice: Contracting Parties *consistently* follow scientific advice in establishing regulatory measures. As the Commission has only been in operation for two years, it is too early to evaluate the effectiveness and level of compliance with management actions.

[420] http://www.wcpfc.int/ipdcp/pdf/IPDCP.2003.09.PrepCon_V_Proposal.pdf, p. 1.
[421] http://www.wcpfc.int/.

Brief update on interim measures in the South Pacific

International consultations are ongoing to establish a Regional Fisheries Management Organization (RFMO), the South Pacific Regional Fisheries Management Organization (SPRFMO), to provide the governance structure required to conserve and manage fisheries resources and related marine ecosystems in the region. However, it is envisaged that this process could take three to four years to complete. Given this timeframe, and to help ensure that the process is not undermined by unregulated and unreported fishing activity in the region, interim arrangements have been proposed.

The Southern Indian Ocean Fisheries Arrangement (SIOFA) consultations began in 1999–2000, initially focusing on both the high seas and the Exclusive Economic Zones (EEZs) of adjacent coastal states. An agreement to regulate non-highly migratory species in the high seas has now been concluded; a separate costal state arrangement also has been adopted. This fishery began in 1999, peaked in 2000, when 40 or more vessels fished, then rapidly declined. The total catch of orange roughy is uncertain, as some vessels did not report catches, but the recorded landings for 1999, 2000 and 2001 were 5,211 tonnes, 12,218 tonnes and 1,569 tonnes, respectively. Catches have since remained low.

A Scientific Working Group was established to guide the direction of the science and to provide specific scientific advice. This advice was utilized by the Parties to implement interim management measures deemed necessary to ensure the long-term sustainability of the fisheries resources.

Currently feedback is being sought on a draft 'voluntary declaration or statement of the Parties' emanating from the consultation process, which would enact interim measures in the region. In November 2006 a draft of interim measures was circulated to participants who attended the first international meeting on the establishment of the South Pacific RFMO.

Proposed interim management measures

The principal aim of the interim measures is that all states, territories, regional economic integration organizations and fishing entities whose fishing vessels and fishing research vessels are authorized to fish in the area should place a cap on fishing levels to prevent further increases. In addition, fishing activities for new fishery resources or in new areas should not commence until conservation and management measures are in place under the agreement.

Furthermore, fishing vessels and fishing research vessels authorized to carry out fishing activities should:

- minimize the impacts of fishing activities on associated and dependent species through the use of fishing gear and mitigation measures designed to reduce incidental mortality rates of such species, in particular seabirds; and
- refrain from fishing activities that risk causing significant damage to vulnerable marine habitats.

Other interim measures include the provision that:

- fishing activities in the area should be undertaken in accordance with international obligations and best international practice guidelines, including the application of the Precautionary Approach described in the 1995 Agreement and the requirements of the Code of Conduct;
- fishing vessels be authorized to fish;
- fishing vessels and gear are marked in accordance with generally accepted standards, such as the FAO Standard Specification for the Marking and Identification of Fishing Vessels;
- fishing vessels comply with a Documentation Scheme and are equipped with a vessel monitoring system (VMS); and
- fishing vessels and fishing research vessels authorized to carry out fishing activities in the area comply with international best practice in respect of observer coverage.

Data collection

Authorized fishing vessels and research vessels should complete logbooks which gather, *inter alia*, entry and exit information, cumulative catches and catches for each fishing event, catch by species by live weight in kilograms (both bycatch and catch data), gear type, effort, location and date and time.

Specifically, they are to:

(a) collect information on fishing activities for non-highly migratory fishery resources, including current data on catch and effort, fishing vessel and fishing research vessel movements and catches, in accordance with Annex 2 of this resolution;

(b) collate historical catch and effort data concerning fishing activities in the area for non-highly migratory fishery resources undertaken by their present or previously flagged fishing vessels and fishing research vessels; and

(c) provide such data to the Interim Secretariat before 1 September 2007, in aggregated format as specified by the Data Working Group.[422]

In addition, all states, territories, regional economic integration organizations and fishing entities whose ports are used to land or tranship non-highly migratory fishery resources caught in the area should also collect landings or transhipments data and report such data annually to the Interim Secretariat in aggregated format, as specified by the Data Working Group.

Annex 5 of the Convention follows and provides a description of the data to be collected by observers in the region.

[422] The Data Working Group was created at the first international meeting on the establishment of the proposed South Pacific Regional Fisheries Management Organization. A key task of the Data Working Group at the second international meeting will be to specify the format for data to be provided under paragraph 6.

Annex 5: Scientific observation and collection of information

1. States, territories, regional economic integration organisations and fishing entities represented at the second international meeting should collect from fishing vessels and fishing research vessels flying their flags and authorised to fish in the area from 1 April 2007 information to support fishery resource assessment, including the following:
   (a) samples of the composition of the catch according to length, weight (kg) and sex, including for the establishment of factors to convert production weight to live catch weight;
   (b) other biological information supporting fishery resource assessment, such as information on age, growth, recruitment, distribution and stock identity; and
   (c) other relevant information as appropriate, including by surveys of abundance, biomass surveys, hydro-acoustic surveys, research on environmental factors affecting fishery resource abundance, and oceanographic and ecological studies.
2. States, territories, regional economic integration organisations and fishing entities represented at the second international meeting should require the submission of this information, in respect of each vessel flying their flags, within 30 days of the vessel leaving the area. A copy of this information should be provided to the Interim Secretariat as soon as possible, taking account of the need to maintain confidentiality of non-aggregated data.

General socio-economic considerations

Clearly, socio-economic considerations form part of the fishery management decision-making of all 13 RFMOs reviewed in this report. However, within the scope of methods used for data collection for this report (i.e., web search of key public documents, technical reports from RFMOs and analysis of decisions related to the enactment of fishery management measures and corresponding interviews with key organization scientists and managers), it appears that only a few RFMOs have begun to articulate these socio-economic considerations. For instance, NASCO in its risk/benefit analysis assesses the socio-economic implications as part of its PA process. GFCM has established a Sub-committee on Economic and Social Science and collects various socio-economic data, in particular data that relate to the development of new economic opportunities. GFCM also considers the socio-economic ramifications before the adoption of new, environmentally friendly fishing methods or gear types (e.g. the use of square mesh on coastal fisheries and the use of pingers on fishing gear to mitigate marine mammal entanglements). It is reasonable to assume that other RFMOs explore such economic ramifications before requiring the use of new fishing techniques or methods or imposing new regulations. GFCM is also developing socio-economic indicators, which include recreational and sport fisheries. In addition, the organization collects import and export data to promote market opportunities. Several RFMOs (GFCM, ICCAT, CCAMLR, IATTC and NEAFC) are collecting economic data (e.g. trade data) as a means of strengthening their monitoring and enforcement efforts to combat IUU fishing.

Progress in advancing best practices in addressing the conservation and management of the resources and associated ecosystems under RFMO jurisdiction (most notably the advancement of EBM and the PA) is influenced by socio-economic considerations. Some generalizations can be made across RFMOs without having to analyse each management decision made by these organizations. For instance, the primary issues which EBM and the PA seek to address – overfishing, bycatch and discards and IUU fishing – are all problematic for the RFMOs reviewed, and each of these issues is grounded in short-term socio-economic concerns. There are costs (i.e., forgone profits and societal costs owing to diminished fish stocks and costs for regulation, monitoring and enforcement) and short-term profits/benefits associated with engaging in unsustainable fishing practices. Thus, there is an inherent tension between effective long-term conservation and present-day social and economic gains achieved via fishing at the status quo. Since true EBM requires the consideration of socio-economic as well as biological and ecological factors, these costs and benefits will have to be addressed accordingly.

Overfishing

The problem of overfishing is widespread throughout the developed and the developing world. Of the world's commercially important fish stocks, 75% are described by the FAO as either fully fished, overexploited, depleted or slowly recovering.[423] In 2004 the FAO reported that there had been a

[423] http://www.globalpolicy.org/socecon/envronmt/2004/0427sub.htm.

consistent downward trend since 1974 in the proportion of stocks offering potential for expansion, coupled with an increase in the proportion of overexploited and depleted stocks, from about 10% in the mid-1970s to close to 25% in the early 2000s.[424]

The majority of the RFMOs explored here contribute to the problem of overfishing by having inadequate monitoring and enforcement mechanisms, which are largely the responsibility of individual Contracting Parties, and 'opt-out provisions', which undermine their own management efforts, because Contracting Parties can choose not to implement management measures that have been adopted by their respective organizations.

A number of the RFMOs reviewed either have stocks under moratoriums (e.g. NAFO, with nine out of 19 managed stocks covered by moratoriums) or are fishing at unsustainable levels beyond established TACs. In some cases, TACs are being set beyond scientific advice (e.g. IBSFC, NEAFC, ICCAT and NAFO). The costs here are not only to Contracting Parties, which are faced with reduced quotas, but also to other nations seeking membership of the RFMOs and a share in the fish resources. Without access to a share of the quota, the incentive to engage in IUU fishing and other unsustainable fishing practices remains. This obviously hinders the effectiveness of RFMOs and leads to further overfishing.

Most of the RFMOs examined have taken some action to adopt the PA, ranging from simply defining overarching objectives to actually adopting precautionary catch limits. However, few have adopted rebuilding plans for overfished stocks. Furthermore, most recognize that the FAO Plan of Action for Capacity Reduction must be complied with if they are really going to address the problem of overfishing, but only a handful have addressed capacity reduction or curtailed national subsidies. As a result, there is a significant gap between international commitments and their implementation.

Political considerations seem to be largely influenced by near-term costs and social ramifications (e.g. loss of fishing infrastructure, decline in fishing and fishery-related jobs, immediate impacts on long-standing cultures and societal systems which derive their livelihood and a primary food/protein source from the sea, fear of consolidation of fishing power in the hands of larger fishing conglomerates, etc.), at the expense of the long-term benefits of rebuilding and conserving fish stocks and helping to ensure long-term food security. This results in a conflict between efficient harvesting and local use, employment and subsistence.

Nonetheless, there are economic and social ramifications resulting from the maintenance of the status quo. These come in the form of forgone profits when resources are depleted and fished at lower levels. It has been estimated that if fishery resources were sustainably managed, total harvests could rise by an additional 10 million tonnes, adding US$16 billion to worldwide gross revenue annually.[425] Furthermore, ineffective management and overfishing have caused the fishing industry to underperform. The FAO estimates that in 1992 worldwide revenue from first-hand sales was approximately US$70 billion, while the total operating cost for the world's fishing fleet was US$85 billion. Thus, the fleet was operating at an annual deficit of US$15 billion.[426]

In addition, there are societal costs associated with overfishing. For instance, the costs to the public

[424] FAO, *The State of World Fisheries and Aquaculture*, 2004.

[425] FAO, 'Marine Fisheries and the Law of the Sea: A Decade of Change', *The State of Food and Agriculture*, 1992, pp. 29–30 (using 1989 global fisheries data).

[426] FAO, *World Fisheries Situation*, 1992, p. 7.

of providing subsidies to the fishing sector are receiving ever greater attention. Worldwide, subsidies to the fishing sector are estimated to cost somewhere between US$14 billion and US$20 billion annually.[427]

Subsidies that reduce fixed and variable costs or increase revenue distort trade and undermine competition in global seafood markets. Because of subsidies, the level of production is higher, resulting in lower prices. As a species becomes overfished, reduced supplies can eventually lead to higher prices.[428] Subsidies at these high levels certainly exacerbate management failures. Such subsidies operate to reduce fixed and variable costs, enhance revenue and mitigate risks. Therefore, they encourage even more additional effort and investments in overfished and depleted fisheries.[429]

However, subsidies can also have positive effects if they are used to support:

- the retraining of fishermen;
- early retirement schemes and diversification;
- the modernization of fishing vessels to improve safety, product quality or working conditions, or to promote more environmentally friendly fishing methods, on condition that this does not increase the ability of the vessel to catch fish;
- fishermen and vessel owners who have to suspend their fishing activity when stoppages are the result of unforeseeable circumstances such as natural disasters, or within the framework of tie-up schemes linked to permanent capacity-reduction measures in the context of recovery plans for overexploited fish stocks; and
- the scrapping of vessels and the withdrawal of capacity.

According to the Organisation for Economic Cooperation and Development (OECD), the cost of fisheries services among the 30 OECD member governments (research, management and enforcement services) accounts for approximately 36% of total government financial transfers to the fisheries sector.[430] The cost of those services totalled approximately US$2.5 billion in 1999.[431] It is difficult to know how much of this is attributable to overfishing, but as stocks become overfished, management regulations generally become increasingly complex, entailing greater need for enforcement, and therefore increasing costs to the public sector to manage these dwindling resources.

However, there also are societal costs associated with ending overfishing and investing in ecosystem management (e.g. investment in capacity-reduction programmes; expanded research programmes to collect data not only on target species, but also on associated and dependent species and their habitats; implementation of science-based and enforced rebuilding plans; improved transparency in RFMOs; and greater collaboration and data-sharing among RFMOs, etc.). The bill for these investments will ultimately be paid by the nations that are Contracting Parties to various RFMOs.

[427] M. Matteo, *Subsidies in World Fisheries: A Reexamination*, 1998, p. 73.
[428] http://usinfo.state.gov/journals/ites/0103/ijee/somma.htm.
[429] http://usinfo.state.gov/journals/ites/0103/ijee/mattice.htm.
[430] OECD, *Fisheries Management Costs Study: Experiences and Insights from OECD Countries*, 2002, p. 5.
[431] Ibid., p. 6.

Bycatch and discards

The most recent global assessment of discards estimates that the rate of discards is about 8% for all marine fisheries within the EEZs and on the high seas. In shrimp trawling, discard rates range from zero to 96%, with an average of 62.3%. The average discard rate for trawlers targeting demersal finfish is 9.6%, or 1.7 million tonnes, taken primarily within EEZs. Bycatch of marine mammals is also known to occur in some trawl fisheries (particularly large, high-speed pelagic trawls), and to a lesser extent on longlines.[432] Bycatch and discarding of fish and other marine life is recognized as a significant problem for the RFMOs reviewed.

The social and economic costs incurred as a result of dealing with bycatch and discards also apply to overfishing. However, there are some costs that are specific to discarding practices, namely the economic costs of 1) discard mortalities induced by a fishery on a species of commercial value to another fishery; 2) discarding immature individuals or non-legal sexes of the same species group the fishery is targeting; 3) discards of non-target species of little commercial value, which represent an economic loss because of the cost of catching, sorting and throwing fish/marine species overboard, not to mention the forgone value of these discards if they were better exploited; and 4) discards that contribute to the loss of a charismatic species or to ecosystem change.

One of the most detailed studies on the estimated costs of discards was carried out in the North Sea. The study estimated that approximately 15,000 tonnes of landings of plaice, sole, cod and whiting were forgone as a result of discards in the North Sea Crangon fishery (Revill et al., 1999). These forgone landings were valued at 25.7 million.[433] In examining RFMOs, it would be worthwhile to analyse the level of estimated discards and associated economic costs alongside the corresponding costs to Contracting Parties and fishermen of regulatory measures imposed on them.

These include investment in, *inter alia*, 1) capacity-reduction programmes; 2) expanded observer programmes (i.e., training and data collection and analysis); 3) environmentally friendly gear technology development; and 4) bycatch utilization programmes. The latter regulatory costs to reduce bycatch and discards are generally borne by the Contracting Parties of the various RFMOS. Generally, these costs are passed on to fishermen and may result in a higher cost of doing business. For instance, the use of bycatch reduction devices to reduce mortalities in the red snapper fishery was estimated to result in losses of US$117 million in the shrimp fishery.[434]

Clearly, there is an inherent conflict between the very real short-term economic and social costs to the fishing industry and fishing nations, and the long-term benefits to society and future fishermen of not wasting or threatening the viability of marine species.

[432] J.J. Maguire, M. Sissenwine, J. Csirke, R. Grainger and S. Garcia, 'The State of World Highly Migratory, Straddling and Other High Seas Fishery Resources and Associated Species', *FAO Fisheries Technical Paper*, No. 495, Rome, FAO, 2006. See also A. Kelleher, 'Discards in the world's fisheries: an update', *FAO Fisheries Technical Paper*, No. 470, Rome, FAO, 2005.

[433] A. Revill, S. Pascoe, C. Radcliffe, S. Riemann, F. Redant, H. Polet, U. Damm, T. Neudecke, P.S. Kristensen and D. Jensen, *Economic Consequences of Discarding in the* Crangon *Fisheries* (the ECODISC Project). Final report, ECC DG XIV 97/SE/025, July 1999.

[434] Ibid.

Illegal, Unreported and Unregulated fishing

It was estimated that prior to 2004 between 5,000 and 10,000 tonnes of tuna (excluding skipjack) were taken annually in the Atlantic through IUU fishing. In the Indian Ocean, the Indian Ocean Tuna Commission (IOTC) estimates IUU catches to be about 130,000 tonnes or 10% of annual reported catches. In the Pacific Ocean, most of the reported IUU fishing occurs inside EEZs.[435] Redfish are also are vulnerable to IUU fishing in the high seas (i.e., within pelagic and deep-sea demersal areas of ICES sub-areas V, VI, XII and XIV, but outside EEZs). In 2004 a provisional total catch of 137,000 tonnes was reported for redfish.[436] Marine mammals and sharks also are vulnerable to IUU fishing, either as bycatch or as directed catch. For instance, a recent study of the shark fin trade in Hong Kong estimated that the total catch of sharks must be between three and five times larger than the figures reported to that FAO, i.e., between 1.1 and 1.9 million tonnes per year – an estimated value of US$292 to US$476 per shark fin. This indicates that between 66% and 80% of the total global catch of shark is unreported, and probably 50% of the total catch derives from high seas waters.[437]

While IUU fishing is a major problem for all the RFMOs reviewed, several RFMOs (e.g. ICCAT, IATTC, CCAMLR, NEAFC and NAFO) have adopted blacklists of fishing vessels which violate conservation measures in order to deter IUU fishing. Both CCSBT and CCAMLR have trade information schemes. CCAMR has gone a step further by incorporating IUU fishing effort into stock assessments for toothfish, including trade analysis. This appears to be reducing the impact of IUU fishing within its Convention Area, and possibly in waters bordering the Convention Area. However, no RFMO has actually imposed strict measures to deter IUU fishing effectively (e.g. trade sanctions).

The costs of IUU fishing include, *inter alia*, 1) lost revenue to fishing nations which are playing by the rules and have to endure subsequent allocation cuts as fish stocks decline; 2) investments in extensive monitoring and analysis (e.g. trade); and 3) cross-cutting data and information exchange efforts among RFMOs to link and integrate data on IUU fishing activities.

Nevertheless, for fishing nations the economic incentives for engaging in IUU fishing are high. On the one hand, the annual total first-sale value of IUU fishing on the high seas has been estimated at US$1.2 billion, which primarily comprises fisheries for tuna, tuna-like species and other large pelagics (e.g. swordfish), as well as shark, squid and groundfish (e.g. toothfish, cod, redfish, roughy and alfonsino).[438] On the other hand, the risk of being apprehended, the ease of reflagging vessels, the difficulties in tracking company structures and identifying beneficial owners of IUU vessels, and the lack of harmonization of penalties across countries are generally insufficient to act as a deterrent to IUU fishing activities. In moving forward, strategies for combating IUU fishing must include measures that reduce the relative benefits and raise the costs of IUU fishing. If RFMOs are to be successful in effectively implementing Ecosystem-Based Management, the daunting and complex task of considering short-term socio-economic costs and benefits alongside the long-term benefits must be undertaken.

[435] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), pp. 14–15.

[436] ICES, *Redfish in Sub-areas V, VI, XII and XIV*, Advisory Committee on Fishery Management Report, Vol. 2, 2004, pp. 67–70.

[437] MRAG, *IUU Fishing on the High Seas: Impacts on Ecosystems and Future Science Needs*, Final Report, August 2005. Report prepared by MRAG for the UK Department for International Development (DfID), with support from the Norwegian Agency for Development Cooperation (NORAD), p. 17.

[438] Ibid., p. 7.

Appendix

Key Aspects of the FAO Code of Conduct for Responsible Fishing Pertaining to RFMOs and Contracting Parties

6. General Principles

6.1 States and users of living aquatic resources should conserve aquatic ecosystems. The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources.

6.2 Fisheries management should promote the maintenance of the quality, diversity and availability of fishery resources in sufficient quantities for present and future generations in the context of food security, poverty alleviation and sustainable development. Management measures should not only ensure the conservation of target species but also of species belonging to the same ecosystem or associated with or dependent upon the target species.

6.3 States should prevent overfishing and excess fishing capacity and should implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilization. States should take measures to rehabilitate populations as far as possible and when appropriate.

6.4 Conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors. States should assign priority to undertake research and data collection in order to improve scientific and technical knowledge of fisheries including their interaction with the ecosystem. In recognizing the transboundary nature of many aquatic ecosystems, States should encourage bilateral and multilateral cooperation in research, as appropriate.

6.5 States and subregional and regional fisheries management organizations should apply a precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment, taking account of the best scientific evidence available. The absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species and non-target species and their environment.

6.6 Selective and environmentally safe fishing gear and practices should be further developed and applied, to the extent practicable, in order to maintain biodiversity and to conserve the population structure and aquatic ecosystems and protect fish quality. Where proper selective and environmentally safe fishing gear and practices exist, they should be recognized and accorded a priority in establishing conservation and management measures for fisheries. States and users of aquatic ecosystems should minimize waste, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species.

6.7 The harvesting, handling, processing and distribution of fish and fishery products should be carried out in a manner which will maintain the nutritional value, quality and safety of the products, reduce waste and minimize negative impacts on the environment.

6.8 All critical fisheries habitats in marine and fresh water ecosystems, such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas, should be protected and rehabilitated as far as possible and where necessary. Particular effort should be made to protect such habitats from destruction, degradation, pollution and other significant impacts resulting from human activities that threaten the health and viability of the fishery resources.

6.10 Within their respective competences and in accordance with international law, including within the framework of subregional or regional fisheries conservation and management organizations or arrangements, States should ensure compliance with and enforcement of conservation and management measures and establish effective mechanisms, as appropriate, to monitor and control the activities of fishing vessels and fishing support vessels.

6.11 States authorizing fishing and fishing support vessels to fly their flags should exercise effective control over those vessels so as to ensure the proper application of this Code. They should ensure that the activities of such vessels do not undermine the effectiveness of conservation and management measures taken in accordance with international law and adopted at the national, subregional, regional or global levels. States should also ensure that vessels flying their flags fulfil their obligations concerning the collection and provision of data relating to their fishing activities.

6.12 States should, within their respective competences and in accordance with international law, cooperate at subregional, regional and global levels through fisheries management organizations, other international agreements or other arrangements to promote conservation and management, ensure responsible fishing and ensure effective conservation and protection of living aquatic resources throughout their range of distribution, taking into account the need for compatible measures in areas within and beyond national jurisdiction.

6.13 States should, to the extent permitted by national laws and regulations, ensure that decision making processes are transparent and achieve timely solutions to urgent matters. States, in accordance with appropriate procedures, should facilitate consultation and the effective participation of industry, fishworkers, environmental and other interested organizations in decision making with respect to the development of laws and policies related to fisheries management, development, international lending and aid.

6.14 International trade in fish and fishery products should be conducted in accordance with the principles, rights and obligations established in the World Trade Organization (WTO) Agreement and other relevant international agreements. States should ensure that their policies, programmes and practices related to trade in fish and fishery products do not result in obstacles to this trade, environmental degradation or negative social, including nutritional, impacts.

6.15 States should cooperate in order to prevent disputes. All disputes relating to fishing activities and practices should be resolved in a timely, peaceful and cooperative manner, in accordance with applicable international agreements or as may otherwise be agreed between the parties. Pending settlement of a dispute, the States concerned should make every effort to enter into provisional arrangements of a practical nature which should be without prejudice to the final outcome of any dispute settlement procedure.

6.16 States, recognising the paramount importance to fishers and fishfarmers of understanding the conservation and management of the fishery resources on which they depend, should promote awareness of responsible fisheries through education and training. They should ensure that fishers and fishfarmers are involved in the policy formulation and implementation process, also with a view to facilitating the implementation of the Code.

6.18 Recognizing the important contributions of artisanal and small-scale fisheries to employment, income and food security, States should appropriately protect the rights of fishers and fishworkers, particularly those engaged in subsistence, small-scale and artisanal fisheries, to a secure and just livelihood, as well as preferential access, where appropriate, to traditional fishing grounds and resources in the waters under their national jurisdiction.

6.19 States should consider aquaculture, including culture-based fisheries, as a means to promote diversification of income and diet. In so doing, States should ensure that resources are used responsibly and adverse impacts on the environment and on local communities are minimized.

7. Management

7.1.5 A State which is not a member of a subregional or regional fisheries management organization or is not a participant in a subregional or regional fisheries management arrangement should nevertheless cooperate, in accordance with relevant international agreements and international law, in the conservation and management of the relevant fisheries resources by giving effect to any conservation and management measures adopted by such organization or arrangement.

7.5 Precautionary approach

7.5.1 States should apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.

7.5.2 In implementing the precautionary approach, States should take into account, inter alia, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distribution of fishing mortality and the impact of fishing activities, including discards, on non-target and associated or dependent species, as well as environmental and socio-economic conditions.

7.5.3 States and subregional or regional fisheries management organizations and arrangements should, on the basis of the best scientific evidence available, inter alia, determine:

(a) stock-specific target reference points, and, at the same time, the action to be taken if they are exceeded; and

(b) stock-specific limit reference points, and, at the same time, the action to be taken if they are exceeded; when a limit reference point is approached, measures should be taken to ensure that it will not be exceeded.

7.5.4 In the case of new or exploratory fisheries, States should adopt as soon as possible cautious conservation and management measures, including, inter alia, catch limits and effort limits. Such measures should remain in force until there are sufficient data to allow assessment of the

impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment should be implemented. The latter measures should, if appropriate, allow for the gradual development of the fisheries.

7.5.5 If a natural phenomenon has a significant adverse impact on the status of living aquatic resources, States should adopt conservation and management measures on an emergency basis to ensure that fishing activity does not exacerbate such adverse impact. States should also adopt such measures on an emergency basis where fishing activity presents a serious threat to the sustainability of such resources. Measures taken on an emergency basis should be temporary and should be based on the best scientific evidence available.