



Report of the FACTS stakeholder workshop at CNRS, Paris, Wednesday, 9th February 2011

CNRS (3 rue Michel Ange, Paris 16th)

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Introduction:

Removal of a forage fish has consequences for both predators and prey of forage fish. As everything is connected, every management action has a price which goes beyond the apparent, direct effect on the target species. The fishery on forage fish can therefore not be seen in isolation, as the immediate gain in profit from the fishery has to be discounted by the lowered potential for production of large piscivorous fish. Management actions on other species also influences forage fish, i.e. conservation efforts on marine mammals or sea birds have direct consequences for the predation pressure on forage fish.

The objective of the project is to provide insight and quantitative advice on the ecosystem wide consequences of management actions directly or indirectly related to forage fish. The two overarching questions are:

- 1) What are the consequences of forage fish fisheries on (a) predator growth and abundance, (b) economic output of fisheries on piscivorous species, and (c) ecosystem stability and the risk for regime shifts?
- 2) What are the consequences of changes in predator populations on forage fish populations and fisheries?

The methods is a combination of ecosystem models, of process studies aimed at feeding into the models, of economical models, and of data-analysis of existing data sources. The project covers four ecosystems in detail; Norwegian-Barents Sea, Baltic Sea, North Sea and Bay of Biscay.

FACTS bring together leading European fisheries and university institutes working on creating the tools for ecosystem based management. The active involvement of the institutes in the current management provides a means for the results of the project to feed into management. The project furthermore includes



a network component which ensures a wider dissemination of methods and results within the marine scientific community.

Stakeholders, such as fishermen, NGOs and the public will benefit from operationalising the ecosystem management: more effective and user-friendly management programmes that are better tailored to specific ecosystem related questions, e.g. the costs of conservation, will integrate the dialogue between the different users of the European marine ecosystems and in the end enable a more effective use of European marine resources, while maintaining them in a healthy status.

The goal of this stakeholder workshop was to inform about and discuss the focus of the project with relevant stakeholders. Results of the project will be presented and discussed in connection to the project's concluding symposium 2012 in Nantes, France.



Agenda:

Time	Topic
11:00-11:20	Welcome - FACTS project Introduction
11:20-11:35	Ecosystem-based management: The tragedy of the commons and multiple optima
11:35-12:00	Ecosystem-based management in Canada
12:00-12:30	Ecosystem-based Management: Where are we, what are the major challenges (by case study)
12:30-13:30	Lunch break
13:30-14:30	Stakeholder expectations (discussion)
14:30-15:00	Conclusion

Participants:

FACTS project:

Marga Andres (AZTI, Spain)

Geraldine Lasalle (CNRS, France)

Niels Vestergaard (SDU, Denmark)

Lars Ravn-Jonsson (SDU, Denmark)

Daniel Howell (IMR, Norway)

Myron Peck (UHAM, Germany)

Georg Engelhardt (Cefas, UK)

Stefan Neuenfeldt, STN, (DTU-Aqua, Denmark)

Mark Dickey-Collas (Imares, The Netherlands)

Associated partners:

Gary Melvin (DFO, Canada)

Axel Rossberg (Queens University, Belfast)

Stakeholders:

Henk Offringa (Ministry of Economic affairs, Agriculture and Innovation, The Netherlands)

Pehr Eriksson (Baltic Sea RAC; Sweden)

Bjarte Bogstad (Chair Arctic Fisheries Working Group, Norway)

Vicky Kloppenburg, Personal Assistant to Britta Reimers, EU parliament, Fisheries Committee (PECH)

Kerstin Kober (Joint Nature Conservation Committee, UK)

Commission:

Philippe Moguedet (DG RTD)



Topic 1: FACTS project introduction and the ecosystem approach to management

In the start of the meeting, the term 'forage fish' was defined, and the stakeholder stated why they think, forage fish should be managed:

- "Clean ocean, healthy seas, top predators"
- "Functional relationship with seabirds is important to quantify effects on seabirds and spatial overlap, to explain seabird distribution from fish distribution"
- "Cannot maximise yield of both prey and predators, assess the cost of marine mammal consumption"
- "Ethical issues of passing forage fish through other predators, food security"
- "Understand how to manage highly fluctuating populations, the trade-off between small fish catch and large fish catch, fish hare moving in and out of legal units/waters"
- "When it comes down to business, it is all about economics. What is the cost/value of this?"

Definition of 'forage fish':

Forage fish are small- to medium-sized pelagic fish that provide food for predatory fish as well as marine mammals and birds. They feed mainly on zooplankton and hence constitute the central link between lower trophic levels and predatory fish production.

Major forage fish species considered in the FACTS project by case study region:

Barents Sea	<i>Capelin</i>
North Sea	<i>Herring, Sprat, Sandeel Norway Pout</i>
Baltic Sea	<i>Herring, Sprat</i>
Bay of Biscay	<i>Sardine, Anchovy</i>

The overall objective of the FCATS project was presented as 'to establish the role of forage fish, particularly with regard to *ecosystem stability and biodiversity* ... and to establish the *costs and benefits* of maintaining high levels of foraging fish in an ecosystem.', and thereby to contribute to support the integration of the ecosystem approach in the Common Fisheries Policy.

After characterizing the goals of the meeting (information and discussion), the stakeholder pointed out their aims for the meeting:

- "A Scientific officer would like to know how the project is doing, how will it approach management and implementation, possibly through ICES. "
- "What is the project about and what can be the future results of this project and how will it be implemented in the CFP"
- "To contribute and influence, to get informed. When implementing, perhaps we need to take the step from single species to multispecies and then the final jump to ecosystem based management. Add the most important predators first and see if that helps. Can there be too many forage fish in an area? Will there then be growth effects and is there a carrying capacity for forage fish. "
- "Information. How far is this project, are seabirds involved and how, can we help with data etc."
- "It will be good to know if we already can see problems with large forage fish stocks. How do we operationalise the ecosystem approach in management? Right now, comments are usually ignored.



A solution may be to move to long term management plans which account for ecosystem effects. National problem which to prioritise highest, ecosystem or fisheries?"

The powerpoint presentation used in the topic is attached in Appendix 1.

Topic 2: Ecosystem-based management in Canada

Gary Melvin, Department of Fisheries and Ocean (DFO) in Canada pointed out in his presentation that there is a lot of discussion in Canada, but still few examples on how to implement the ecosystem-based approach to fisheries management. It is unclear, if all aspects of the ecosystem have to be explored, but there has been a substantial improvement in monitoring and documenting by-catch. The ecosystem-based approach to fisheries management has led to a number of policies and initiatives, including long term sustainability, economic prosperity and improved governance. Current activities include marine protected areas, focused activities on several ecosystem models, and major by-catch initiatives.

Conducting forage species fisheries depends on assessment of effect in Canada. Industry has the responsibility to carry part of the cost to developing fisheries (the level is not fixed). Goal is to avoid local depletion and by-catch and to protect the sea bottom. There are moves towards taking existing fisheries through the same process. Pelagic fish are currently poorly described in health-of-the-ecosystem indicators. Four categories of forage fish are defined: Commercial, non commercial (e.g. krill and sand lance), or migratory forage fishes (e.g. shad, alwives, smelt), and Plankton. The categorizing efforts should result in a workshop, but due to funding problems, the WS postponed to 2011/2012.

Discussion:

"Strong fish focus, how are you going to approach seabirds and marine mammals? "

- "Still unknown how this will work, there is not a strong history of working in projects like in the EU.

"What economic indicators/impacts?"

- " Don't not know exactly, persons hired."

"Do you cooperate with US and Australia?"

- "Yes in stock assessment, no in management in most cases, no in the implementation of EBM, court complications investigated. "

Dr Melvin's presentation is attached in Appendix 2.

Topic 3: Case studies

Work within the Case Studies is based on a set of core *questions* that are specific for each Case Study so that the most germane research regarding forage fish populations within the four different regions (Baltic Sea, Barents Sea, North Sea, and Bay of Biscay) can be addressed. The answer to the questions posed by Case Studies provides the means to fulfil the objective of each work-package and ultimately the objectives of FACTS.



The **North Sea** case study addresses three questions:

- 1. What are the costs and benefits of maintaining small mesh fisheries on herring, sprat, sandeel and Norway pout in the North Sea?*
- 2. How would reductions in herring, sprat, sandeel and anchovy populations impact seabirds, marine mammals, and predatory fish?*
- 3. Should forage fish populations be managed as a core component of the ecosystem and what is their role in ecosystem stability and dynamics?*

Discussion in relation to the North Sea case was mostly focusing on seabirds:

“How will you look at the effect of seabirds?”

-“Good data historical data available, difficult to link seabirds and marine mammals to food abundance, we’re working on that.”

“What is the societal value of having seabirds?”

-“They have an intrinsic value from our point of view. They have been value based through willingness to pay experiments.”

-“We have conservation issues we must address regardless of the price.”

-“There are also non-use values of having seabirds and we cannot answer this in this project. However, we can estimate the cost of maintaining the seabird populations and hand that to politicians.”

“What is the effect of discards on birds, that would be useful to refer to.”

“Fisheries have both negative and positive effects on seabirds.”

“Where will problems come if discard bans are enforced? Often discard feeders are flexible and may not be affected too bad.”

“There is a need for improved data for cetaceans.”

The following specific questions are raised in the **Bay of Biscay** case study:

- 1. Is increasing fishing pressure on sardines and sprat likely to help restore the anchovy?*
- 2. Does forage fish overfishing modify the stability of the Bay of Biscay ecosystem?*
- 3. What is the most cost effective way to increase the profitability of the pelagic fishery with limited effects on the ecosystem as a whole?*

The Bay of Biscay discussion included also some general elements on how to account for climatic effects and high variability in recruitment for forage fish stocks:

“For question 2, we have long term data on seabirds and marine mammals so it is possible to analyse the effects of prey abundance. Seabirds will be separated into two groups. 1 and 2 will be addressed using Ecopath and qualitative modelling. “

“The key question is what is the best way to manage these highly variable stocks? There is a fixed fishing capacity, and TAC and quotas do not work. How will you deal with that as you are adding even more variation through seabirds and marine mammals.”



"I am surprised that you say TAC does not work, this has been discussed for a year in the anchovy recovery plan!"

"Scientists need to give a clear measure."

"We manage the highly variable capelin by limiting fishing in low abundance years but not regulating in high abundance years."

"It is important to look beyond correlations and evaluate whether fisheries are able to survive in this environment."

"How does the Barents Sea fishers come through this?"

- "The capelin collapses have led to a general acceptance of the need for management."

"Another fishery with similar conditions is the North Sea sandeel?"

- "This is different, sandeel can be long lived."

"Norway pout is then an example?"

"Other management measures are relevant rather than just TACs."

"You will conclude with saying that these fluctuations are not predictable. What management system should we then use?"

"Do we have a review of appropriate management measures in Europe?"

- "Yes, we want to compare with Canadian and US experience."

- "The FACTS symposium has ICES/PICES sponsorship to assure the attendance of also South American scientists."

"You should make sure you affect the revision of the CFP."

- "Therefore, we hope stakeholders will be able to attend the symposium."

These are the issues concerning capelin and herring that are addressed through modelling studies and analyses of existing survey data from the **Barents Sea**:

1. *Is the difference in the strength of the bottom-up effects between the capelin collapses due to differences in the amount of other fish prey available to the predators?*
2. *Why was there good recruitment of capelin in the Barents Sea in some years even though there a large amount of herring was present?*
3. *Why do herring leave the Barents Sea as 3-year-olds in some years, while in other years, most stay until age 4-5?*

"We're investigating the effects of capelin collapses on top predators and fishers. "

"The biomass of capelin is already included in cod assessment."

"We're managing capelin after a minimum-escapement strategy, considering the amount needed for spawning and top predators. Closures of the fishery are implemented and this is reasonably accepted by the fisheries. There is pressure to have a small quota in all years rather than closure to keep presence in the markets."

"We will do cross comparisons with the Baltic."

"How is the political interest in EBA to capelin fisheries

- "There is work on a management plans."

"What are your thoughts on question 3?"

- "Maybe they just move slower in some years than in others."

- "We will use regression analyses."



The main questions tackled in FACTS for the **Central Baltic Sea** are:

1. *To what degree does the strength of the impact of forage fish on the Baltic Sea food web differ between sub-systems and how do these regional differences influence advice on ecosystem-based management?*
2. *How important are density-dependent feedback loops between forage fish, their prey and predators and how do these influence ecosystem stability?*
3. *What are the economic costs and benefits (for fisheries and other ecosystem services) of changes in the management of Baltic Sea forage fish, taking into account interactions with top predators (cod and seals) and climate induced ecosystem changes?*

The discussion addressed issue with mixed fisheries and spatial overlap, which are going to be addressed in FACTS:

“Fisheries are mixed and we think that herring are increasing in the Baltic. In Sweden, there have been a change in the proximity to the coast where fishing can take place, and this coastal area is where the herring is, hence the increase in herring is not seen in assessments. Therefore, be careful with using catch data for abundance. Herring are caught in mixed catches with sprat and is mostly used for fish meal. Mostly they are small herring, but even large herring cannot be landed for human consumption due to dioxin issues. “

“You need to evaluate the total sprat and herring as this is what Per says is important to the fishery.”

“Management plan on its way for pelagic stocks. It is heavily influenced by politics. “

“ To what extent is the ecosystem component included in the plan?”

-“No final plan yet. Commission has sent a non-paper. Plan based on sprat and herring only, does not account for Good Environmental Status. In the cod boom in the 80’s, the cod brought in a good price and hence many people fished it. At the same time, there was no market for sprat, hence no-one fished it.”

“Are the long-term plans coordinated between herring, sprat and herring?”

-“Not so far. We hope to change that.”

“Problem with overlap between herring/sprat and cod makes it difficult to coordinate plans.”

-“Will be looked at an implemented in ICES Working group on integrated assessments for the Baltic.”

“Weight of cod has decreased though there was food enough.”

-“We’re looking into this.”

Questions to be answered in the **Generic** Case Study are:

1. *What is the expected response to forage fish fishery in terms of abundance, yield, growth and change in total economic output for the ecosystem as a whole?*
2. *What is the expected ecosystem wide impact of large piscivorous fish and marine mammals on forage fish in terms of abundance and change in economic output of forage fisheries?*

“The model is simple, you eat whatever is of the appropriate size. You then get a distribution of sizes.”

“ What about MSY (Maximum Sustainable Yield)?”

-“We have just applied for a new project on that.”



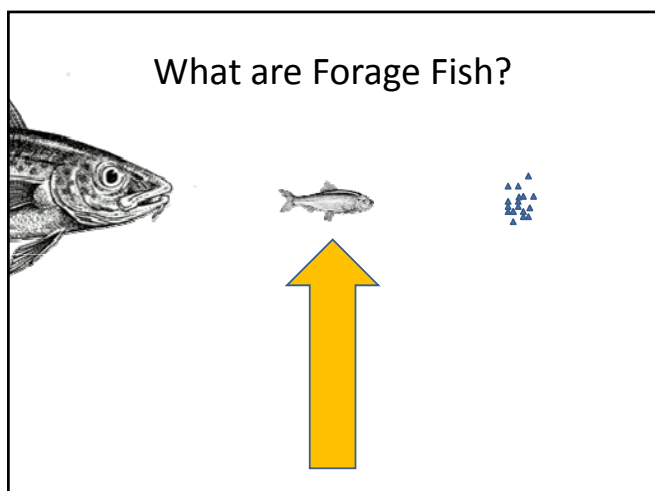
The FACTS project has received funding from the European Community's Seventh Framework Programme



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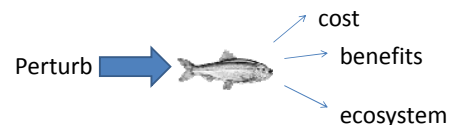
- ### The train is approaching...
- Common Fisheries Policy
 - Marine Strategy Framework Directive
 - Conservation issues
 - Good Environmental Status

FACTS - Forage Fish Interactions

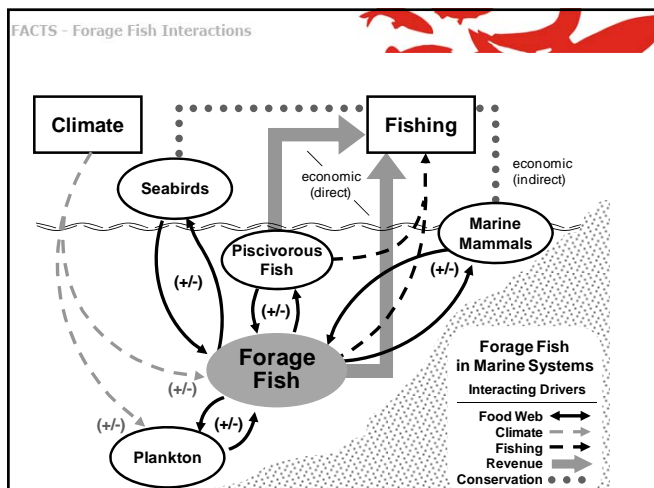
Overall question

“The objective of the project is to establish the role of forage fish, particularly with regard to *ecosystem stability and biodiversity* ... and to establish the *costs and benefits* of maintaining high levels of foraging fish in an ecosystem.”

“...contribution to support the integration of the *ecosystem* approach in the Common Fisheries Policy.”



- ### Goals of this workshop:
- INFORMATION
 - DISCUSSION
 - ?



One billion people, depend on seafood as their primary source of protein and 25% of the world's total animal protein comes from fisheries. Yet a third of the stocks worldwide are overexploited or depleted.

FAO Fisheries Yearbook 2009

Soon 1.3 billion people

Precaution  Food security



FACTS - Forage Fish Interactions

- What are the major short- and long-term **drivers** of changes in commercially and ecologically important forage fish populations within European waters?
- What are the biological and economic **consequences of changes in forage fish populations** in terms of their prey, their competitors and their predators?
- What are the biological and economic consequences of **changes in predator populations** on forage fish populations and their fisheries?
- What is the role of forage fish species in maintaining **biodiversity and ecosystem stability**?

What are FACTS results going to be used for?

CFP elements	FACTS contributions
Industrial fishing	Impact of industrial fishing (mostly forage fish) on eco-systems
Incorporating environmental concerns into fisheries management	Impact of forage fish populations and their fisheries on ecosystem stability and resilience
Improvement of scientific advice for fisheries management	Implementation of FACTS in ICES (International Council for the Exploration of the Seas) and STECF assessment working groups
Socio-economic consequences of multi-annual fisheries strategies	Linkage of ecosystem and economic models of fisheries impact on ecosystems

- Process knowledge
- Reduce uncertainty in advising
- Aid in defining ecological and economic targets

FACTS - Forage Fish Interactions

ICES ASC 2011 Theme session I:

Integrating top predators into ecosystem management

Symposium on "Forage Fish Interactions and Ecosystem Approach to Fisheries Management" will be held in Nantes, France, 8-12 November 2012.



Background:

- A lot of effort and discussion about Ecosystem Based Management Approach (ESBMA), but few examples of how to do it .
- Stumbling point: Some researchers feel to truly achieve ESBM there is a need study and understand all interactions.
- This is unrealistic. Currently we are exploring ways to expand existing fisheries management plans to include ecosystem based management objectives.
- One emerging approach is to look current management approaches in a broader context. Researchers evaluate management and resource development plans in terms of not only stock productivity, but gear interaction, biodiversity, and habitat as well other potential anthropogenic effects.
- By-catch documentation has become an important component of ecosystem based management.

Moving toward EBMA

- Led to a number of policies, initiatives and checklists
 - Fisheries Renewal Initiative Themes
 - Long-Term Sustainability
 - Economic Prosperity
 - Improved Governance
 - <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/index-eng.htm>
 - Policy of developing fisheries (expand a little)
 - Policy on new fisheries on forage species (expand a little)
 - Policy on Species at risk
 - Sustainable Development Strategy
- Current activities leading toward a EBM approach
 - Marine Protected Areas
 - Several near-shore and offshore
 - Focused activities on broader and complex systems
 - Ecopath, Ecosim – ESS cod study
 - Exploring MVPFA approach to stock assessment
 - Major by-catch evaluation for most commercial fish species
 - Early Stages of Forage species initiative

Policy of developing fisheries

- *NEW FISHERIES Definition:* Fisheries involving new species and/or stocks that are not utilized or not fully utilized, and not currently covered by a management plan.
- To use a precautionary approach to guide decision making. Information on the abundance, distribution, and productivity of the target species is identified as the key scientific requirement for development of precautionary management strategies.
- The potential impact or interaction of any new fishery or gear on associated or dependent species, fishing or gear type and on habitat will be assessed.

Operational Stages:

- **STAGE I (Feasibility):** The preliminary feasibility stage. The objective of this stage is to determine if harvestable quantities of the species/stock known to be present in a particular fishing area exist, if the species/stock can be captured by a particular gear type, identify multi-species and habitat impacts, if markets exist and, the best approach for proceeding further, e.g. to Stage II.
- **STAGE II (Exploratory):** The commercial and stock assessment stage. This stage is reached if and as soon as feasibility has been demonstrated. The objective of this stage is to determine whether a species/stock can sustain a commercially viable operation and to collect biological data in order to build a preliminary database on stock abundance and distribution.
- **STAGE III (Commercial):** The commercial fishery stage. This stage is reached once it has been determined that a species/stock can sustain (commercially and biologically) commercial fishing operation. A formal Integrated Fisheries Management Plan is introduced.

Policy on new fisheries on forage species

- Definition under Policy:
A **forage species** is a species which is below the top of an aquatic food chain, is an important source of food for at least some predators, and experiences high predation mortality. From the perspective of fisheries management, the species will fully recruit to the fishery at ages which still experience high mortality due to predation. Forage species often undergo large natural fluctuations in abundance in response to environmental factors, on time scales comparable to or shorter than a generation. Forage species also usually form dense schools for at least a part of the annual cycle, are relatively short lived and have a coastal distribution for at least a part of the year.
- Forage species often support **dependent predators**, which are species that obtain a significant part of their annual food ration from the forage species. When the forage species declines markedly in abundance (whether due to natural causes or over-exploitation) the dependent predator is likely to show biological responses such as: major changes in diet, reduced growth rate and fat storage, reduced reproductive success and/or delayed maturation, and changes in normal seasonal distribution patterns.

The objectives of a conservation-based policy for new fisheries on forage species:

- maintenance of target, bycatch, and ecologically dependent species within the bounds of natural fluctuations in abundance;
- maintenance of ecological relationships (e.g predator-prey and competition) among species affected directly or indirectly by the fishery within the bounds of natural fluctuations in these relationships;
- minimization of the risk of changes to species' abundances or relationships which are difficult or impossible to reverse;
- maintenance of full reproductive potential of the forage species, including genetic diversity and geographic population structure,
- allowance of opportunities to conduct commercially viable fisheries.

Biological Pre-requisites for Commercial Fisheries on Forage Species

- B.1 to monitor the status of the forage species on a regular basis, and use the monitoring results to evaluate whether or not the stock is meeting conservation targets.
- B.2 to identify some species of predators which would be appropriate for evaluating the sustainability of the fishery in the context of ecologically related species. Appropriate species of predators to monitor are ones which have relatively high food requirements, have the forage species comprise much of their diets, have relatively greater difficulty switching prey or finding adequate food when the forage species is not common, and have relevant biological traits such as abundance or breeding success that can be monitored accurately.
- B.3 to estimate the risk that the proposed level of harvest poses to the forage species and ecologically dependent species. In situations where risk presented by a particular level of harvest and consequences of over-harvesting are especially uncertain, exceptionally risk-averse decisions are necessary.
- B.4 There should be sufficient knowledge of the forage species and its relationships to major predators to guide the proper prosecution of the fishery in space and time. This knowledge includes both some knowledge of the distribution and degree of aggregation of the forage species (and how they change seasonally, if appropriate), and the seasonal and spatial distributions of predators.

Management Pre-requisites for Commercial Fisheries on Forage Species

- M.1 There should be clearly identified conservation (limit) reference points and associated harvest control rules, for both the forage species and some dependent marine predators.
- M.2 For the reference points and harvest control rules to be able to ensure conservation is achieved, monitoring and enforcement in the fishery must be adequate to ensure high compliance with the management plan.
- M.3 Administrative and management costs for these commercial fisheries are expected to be high, to cover monitoring of the status of the forage species and selected dependent marine predators, and to ensure high compliance of the fishery with the management plan. Industry has a responsibility to carry a fair share of these costs.
- M.4 Management plans for commercial fisheries on forage species should include explicit provisions to ensure that fisheries do not unduly concentrate harvest and do not produce local depletions of the forage species.
- M.5 Harvesting plans must include measures designed to detect and manage bycatch of non-target species, whether of commercial value or not, and protect sea floor vegetation and physical structures where fisheries on forage species operate near-shore or near-bottom.
- M.6 Management of commercial fisheries on forage species should include long-term plans which delineate the expected sizes of the fleet and harvests over several years, specify the long-term strategic objectives for the fishery.

Summary of Policies:

- Current policy applies only to new or developing fisheries
- Most commercial fisheries are being compared with policy.
- Conflict between two policies
- Limited Social or economic factors integrated into the approach

Forage Species and Ecosystem Approach to Management

- Explicit need for consideration of forage and its importance to energy transfer sustainability within the pelagic habitat.
- Increasing interest among Clients (OHM,FAM, NGO's and industry) on the management of key forage species.
- Recognition that the Forage theme extends far beyond single species fisheries.

Forage Species Initiative

- Began as a Science driven regional based initiative in 2008
- General feeling Pelagic component of marine environment was overlooked in the ecosystem approach relative to groundfish and bottom habitat.
 - Vastness
 - Species diversity
 - Multi-trophic interactions
 - Sampling/survey complexity

Some Major Issues to be addressed:

- Ecosystem (Climate) changes as it relates to forage species abundance and distribution.
- Impact of total removals of one trophic level in relation to another (F&M).
- Indicators of the health of the ecosystem and its sub components
- Cumulative impacts of fisheries on the ecosystem.
- Incidental catch of "forage" species.

Scope of Initiative

- Establishment a comprehensive "Expert Group" for consideration of the forage issue(s) under a wide range of subjects (eg., Working Group).
- Encourage interaction among public and private (Government, University, and industry) experts and precipitate the synthesis of information on forage species and their associated dynamics.
- Promote the development of relevant performance indicators and reference points for trophic level productivity under the guidelines of an Ecosystem Approach to Management.
- Explore approaches/methodologies to estimate "forage" requirement budgets for the ecosystem through trophic level interactions.
- Coordinate the regional, zonal, and National forage research related activities through a working group.

Terms of Reference for Working Group established in 2008

- To define and identify key forage species of the western Atlantic.
- To identify deficiencies in the knowledge/information necessary to evaluate the trophic interactions of forage species within the ecosystem.
- To promote the standardization of methods, greater survey coverage, adaptation of new technologies, and basic research for evaluating forage species.

Identified 4 Broad Categories of Forage Species

- Commercially exploited forage species. These species typically are forage throughout their life history and are very important to the ecosystem. Key species include herring, mackerel, capelin, sardine and shrimp. In addition to their importance as a forage species, all support significant commercial fisheries throughout their distribution.

Category 2

- Non-commercially exploited forage species. Species are important to the ecosystem but are not subject to high levels of fishing mortality and are generally not fished commercially, but may be taken as by-catch in other fisheries. Forage species such as sand lance, Arctic cod, and krill fall into this category.

Category 3

- Transient and migratory forage species. Typically these species are marine forage during some stage of their life history. Species may be subject to predation during a short time period due to their size or may provide forage during a particular phase of their migration. Many anadromous species enter the marine environment in large numbers as juveniles, are the main forage for a wide variety of fishes and mammals, but are often overlooked in the overall ecosystem scheme. Shad, alwives, smelt
- **Category 4 Plankton**

Working Group Conclusions/Recommendations

- The forage theme is complex and extends far beyond a single species fisheries subject into the multi-species, inter-disciplinary world of seabirds, marine mammals, fishes, oceanography, and plankton.
- The working group recommended that effort focus on the key species in first two categories. These include herring, mackerel, capelin, sardine, shrimp, sand lance, arctic cod, and krill.
- The working group acknowledged the importance of many other forage species and will encourage efforts to address issues related to species in all categories and for developing fisheries.
- To hold a Regional/Nation/International workshop on forage related issues from a science perspective. The workshop would operate under the general title of "Forage and Fisheries in the Marine Ecosystem" with several theme sessions.

International Workshop:

- Originally proposed in April 2009 for a January 2010 workshop.
- In February 2010 a National coordinating meeting was held to develop the format and content of a workshop
- Unfortunately funds not made available for the 2010/2011 fiscal year and we are now awaiting resources for 2011/2012
- NHQ wants to focus only on policies and thereby commercial species where working group members want to broaden it to include, most key forage species.

Summary:

- Concept of ESBM well thought out in Canada and objectives defined.
- Overall limited activity to quantitatively and integrate the EBMA or put it into practice.
- Accounting of by-catch is major biological thrust
- Some economic evaluation of impacts.
- Programs such as FACTS will help guide/assist other countries in the practical application of the ESMA.