WP 8 Advancing Ocean Management

Responsible: St. John; Köster

Objectives

- Synthesise and extend findings of earlier WPS to develop understanding and approaches that will improve and advance ocean management by strengthening the ecosystem approach to resource management.
- Assess the future development and susceptibility of North Atlantic marine ecosystems and their key species to changes in climate and exploitation patterns.
- Evaluate existing and alternative ecosystem and key species indicators under contrasting environments and exploitation regimes.
- Assess the impact of climate change and resource exploitation on the North Atlantic carbon cycle in economic terms.
- Assess the applicability of existing management measures and directives (i.e. CFP; MSFD) or their principals for application in the wider North Atlantic Ocean management.

Task 8.1. Estimate the economic impact of changes in the North Atlantic carbon cycle.

Responsible: Manuel Barange

Activities

•Identify the extent to which primary productivity shadows the balance of carbon and therefore, its potential use as an indicator of CO_2 and climate regulatory services,

•Identify the sources and sinks of carbon within the North Atlantic, the volumes of carbon involved, and explore how the export flux of carbon might change with a restructuring of the ecosystem caused by climate change and fisheries.

•Estimate the Carbon-equivalent economic impact of changes in the North Atlantic carbon cycle due to climate change emissions and exploitation of living resources.

•Using the shadow price of carbon, calculate a value for current gas and climate regulation provided by the North Atlantic and estimate how this may change according to the climate change scenarios explored by WP6 and 7.

Task 8.2. Comparative analysis of North Atlantic marine food web structure and function.

Responsible: Mike Heath

Actions:

- Perform comparative food web analyses, based on the principles of Ecopath, for a set of North Atlantic regions. The aim of the food web analyses will be to assess the role of key species in each region, ratios of production by integrated functional groups, and a variety of network metrics. For example, ratios of benthic:pelagic production and benthic invertebrate:demersal fish production

- Conduct scenario analyses of the effects of changing fishing and environmental conditions in each region using Ecosim – the dynamic version of Ecopath

- Furthermore due to the inherent problems in the Ecopath Ecosim family we will develop an alternative simulation system incorporating more explicit representation of low-trophic level and nutrient processes drawing on output from models developed in WP5 and WP6.

- scenario analyses with Ecosim will be used to investigate indicators representing good ecological status within the MSFD.

Task 8.3. Integrative analysis of past and future ecosystem change

This task will perform an integrated analysis of changes in ecosystem structure (e.g. Key species) and function of the north Atlantic basin and shelf seas both in retrospective and forecast mode examining the potential future of ecosystems and key species in relation to climate and exploitation scenarios.

Utilizes observational and modelled data from WPs 1-8 to produce matrices of abiotic and biotic datasets integrating ecosystem components, key species and driving forces.

Task 8.3.1 Retrospective analysis of historical changes in ecosystem structure and function

Multivariate statistical analyses (Chronological Clustering and Sequential Regime Shift Analysis (STARS)) will be employed to assess structural changes in ecosystems (i.e. regime shifts ad species dominance).

•assess if changes in pressure variables precede and cause changes in food web structure

Note: multivariate analyses will be visualized using the ”traffic light framework”.

Task 8.3.2 Ecosystem Ensemble: Integrative forecasting of potential futures in ecosystem structure and function

Responsible: Mollm an/ St. John

This Task will provide potential future states of the north Atlantic and shelf sea ecosystem structure and function, using output of the various modelling approaches developed and applied in WPs. Specifically these are

- *size spectrum and habitat* models (WP3 and 7),
- *trophodynamic* models (WP4),
- *coupled ecosystem and fish* models (WP5),
- *NPZD-type* models (WP6) and
- *mass-balance* models (WP8).

The *ensemble scenario projections* will then be analysed using the same approach as described in Task 8.3.1 for the historical reconstruction involving multivariate statistical and discontinuity analyses. These integrative analyses will provide

- holistic pictures and indicators of future changes in ecosystem structure and function.
- future response envelopes of key species population dynamics and ecosystem status

WP8.4: Advancing ecosystem based fisheries management in North Atlantic open waters under climate change

Participants: DTU-AQUA; CLS; IFREMER; IMR; MIR; MRI-HAFRO and Uni HH

BACKGROUND: EU GREEN PAPER "REFORM OF THE COMMON FISHERIES POLICY"

New requests to the Common Fisheries Policy:

1. Contributing to the ecosystem approach to marine management within the Marine Strategy Framework Directive (MSFD) as environmental pillar of the Integrated Maritime Policy securing good ecological status of European seas.
2. Implement the Maximum Sustainable Yield (MSY) concept as maximum annual catch which on average can be taken year after year from a fish stock without deteriorating the productivity of the fish stock.
3. Reversal of burden of proof: encouraging the industry to take responsibility through co- or self management, leading to a reversal of burden of proof, at the same time relieving from technical micro-management.
4. To focus more on region specific management to develop ecologically and socially sustainable management and assist in the development of integrated marine management.

OBJECTIVES OF WP8.4

Answer questions raised by the Green Paper (2009), touching on general principals of fisheries management:

- How can the management objectives regarding ecological, economic and social sustainability be defined in a clear, prioritized manner which gives guidance in the short term and ensures the long-term sustainability and viability of fisheries?
- How can indicators and targets for implementation be defined to provide proper guidance for decision making and accountability?
- How could the MSY commitment be implemented?

SUBTASK I: REVIEW AND SYNTHESIS

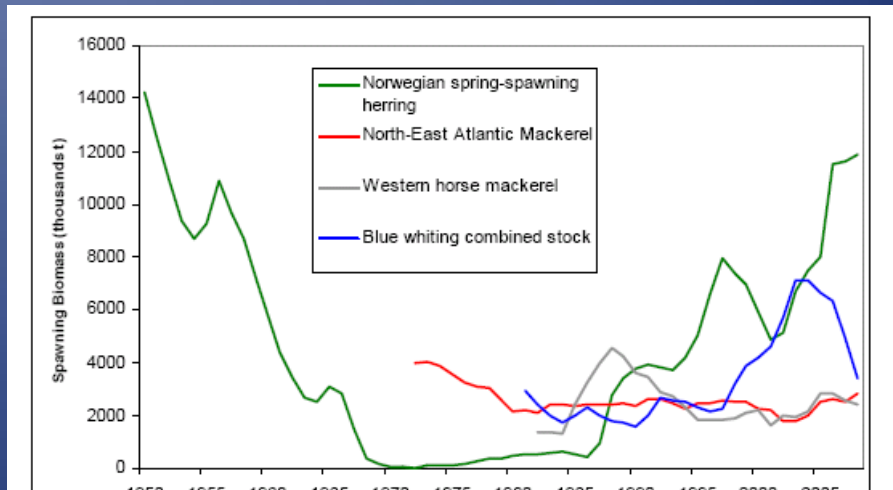
The task will investigate dependence of fish stock distribution and productivity of some of the world's largest and economically most valuable fish stocks on following drivers:

- climate change,
- species interactions
  (both bottom-up and top-down control),
- fisheries.

It will compare economic, ecological & social

importance of pelagic fisheries as provider of:

- food protein,
- income and labour,
- structuring ecosystems and affecting carbon sequestration.



SUBTASK II: SIMULATIONS AND TESTING INDICATORS

The aim is to test concepts of defining indicators of good ecological status (as outlined by the MSFD) inclusive limit and target values (as used under the CFP) under global change under various climate scenarios to isolate the response to management measures.

Simulations conducted in WP3-6 will be investigated for:

- robustness of different management signposts (e.g. biological limit and target reference points, indicators of good ecological status)
- management measures aiming at optimal resource utilisation, such as harvest control rules, against variability and trends in environmental drivers.

SUBTASK III: DEVELOP A CONCEPT FOR MSY

MSY is not necessarily constant over time, even when implemented as fishing mortality as envisaged by EU (COM (2006) 360) and the concept is problematic with respect to biological and technical interactions.

This will be done by:

- reviewing concepts under introduction, e.g. by ICES,
- simulations of long-term stock dynamics for fish ecotypes, incorporating stock recruitment relationships, density dependent growth and mortality, including uncertainty, environmental issues and possible multispecies effects,
- acknowledging regime shifts, giving guidance as to when and why a re-assessment of the reference points is to be done.

The concept should allow also for economic and social adaptation (required also for co- or self management).

SUBTASK IV: TESTING MANAGEMENT MEASURES

Implemented fisheries management plans or available concepts and templates for future management plans will be tested for their robustness against:

- climate and ecosystem change,
- changing management systems,
- new management measures (introduced e.g. by EU in response to revision of CFP,).

Finally: inform managers, stakeholders and public in a concise way on results !