

# Integrated management of mussel fishery and aquaculture under changing baselines due to regime shifts - DK

## 1. Policy Objective & Theme

- SUSTAINABLE USE OF RESOURCES: Preserving coastal environment (its functioning and integrity) to share space

## 2. Key Approaches

- Integration
- Participation
- Knowledge-based
- Ecosystems based approach

## 3. Experiences that can be exchanged

Development of an integrated and adaptive management plan at a national and regional scale; including spatial planning and annual EIA's of mussel aquaculture and of mussel fishery activities in a changing ecosystem; with participation of national and regional fisheries and environmental managers, end users and scientists; and in compliance with food health regulations, the EU Habitat and Birds Directives (Natura 2000) and the Water Framework Directive (WFD).

## 4. Overview of the case

Development of integrated and spatial planning and management of mussel production, including fishery and aquaculture, were initiated as a response to Natura 2000 and a changing eco-system baseline. It was developed in compliance with fisheries, food health and environmental policies, to facilitate development of use of natural resources in the coastal zone that is sustainable to both nature and man, and thus of benefit to both mussel fishermen and mussel farmers.

## 5. Context and Objectives

### a) Context

The case-study site, the Limfjord, is the largest Danish estuary, situated in the north, where it traverses Jutland from the North Sea in the West (salinity 32-34‰) to the Kattegat in the East (salinity 19-25‰). It covers an area of 1,500 km<sup>2</sup>; has a coastline of 1,000 km (mean depth: 4.9 m; max. 28 m), and an upland of 7,500 km<sup>3</sup> (ca. 62% agriculture) with a freshwater run-off of ca. 2.7 km<sup>3</sup>/year. In 1960, nitrogen (N) and phosphorous (P) emission to the fjord had doubled, and by 1980, it had increased to ca. 700%. The commercial fisheries perished after the collapse of edible fish populations and, during 1989-1995, a regime shift took place, where jellyfish, blue mussels (*Mytilus edulis*), crustaceans and echinoderms became abundant. The mussel fishery increased and, in the 1990's, dredging of wild stocks became the most important fishery (80,000-100,000 tons, ca. 85% of a total income of ca. 100,000,000 DKK/yea). In the early 1990's, hypoxia and anoxia became more abundant, both spatially and temporally. During 2005-2008, the mussel fishery had decreased to 30% of what it was before, due of to hypoxia-induced mussel mortality and failing spat recruitment. The quota of 85 t/ week/vessel, set by the authorities, was reduced to 45 t by self-regulation among the fishermen. Recently, global competition (e.g. from Chile) has reduced the sales of Danish mussels (frozen & tinned produce) and the harvest is now ca. 30 t/week/vessel.

### b) Objectives

The objectives were to: (1) to facilitate participatory policy development, (2) to aid in the development of integrated management plans to enhance sustainability for man and nature according to EU directives and national legislation, and (3) to enhance profit and sustainability of methods used in the mussel production in the Limfjord.

## **6. Implementation of the ICZM Approach (i.e. management, tools, resources)**

### **a) Management**

Under the responsibility of the Danish Ministry of Food, Agriculture and Fishery (FVM, national level), the development of planning and management of the mussel fishery and aquaculture in the Limfjord was carried out, in co-operation between the Mussel Commission members (see below), through frequent meetings and sharing of experience, knowledge and interests. This was to ensure participatory governance and local management, rather than state-centred decision-making. The mussel fishermen self-regulate the fishery concerning e.g. the weekly quotas, fishing area-opening and meat content limitation.

### **b) ICZM tools**

Mussel fishery legislation has been employed by the Danish Ministry of Food, Agriculture and Fishery (FVM) and related Directorates. In the mid 1990's, mussel legislation was developed to secure food health of the products (surveying of harmful algal blooms, algal toxins and E. coli bacteria). Based on national and EU funding, the local research facility 'Dansk Skaldyrcenter' was established in 2002 to advance shellfish production methods and sustainability. In 2003, the Minister of FVM appointed a 'Mussel Commission' that became permanent in 2004. It is chaired by the FVM with managers of the Danish Directorate of Fisheries and the Danish Veterinary and Food Administration; with representatives of the NGO's, the Danish Society for Nature Conservation, Danish Ornithological Society and WWF-DK; managers of the Danish Ministry of Environment, the Danish Agency for Spatial and Environmental Planning and environmental centres; commercial organisations, such as the Danish Fishermen's Association, Danish Aquaculture Association, Confederation of Danish Industry, United Federation of Danish Workers; and university research institutes (DTU Aqua, AU NERI).

Today, policy development and applied research initiatives are often based on discussions and agreements reached in the Mussel Commission. For example, a public national GIS portal was developed to aid in mussel-plant licence application. In 2006, a few line-mussel farms were established (not yet profitable). In 2008, the Habitats and Birds Directives (Natura 2000) were implemented in the Danish fishery and aquaculture legislation. Over the years, new and combined methods have been developed and improved to enhance profit and sustainability of mussel production in the Limfjord, for example, relaying of small mussels in benthic farm areas for later harvesting, catch of recruits on lines and restriction of harvesting of wild stocks in shallow water to allow potential re-establishment of eel grass. The Mussel Commission has been urged by NGO's to take action. This was met positively by the mussel fishermen and farmers organisations. Several pilot projects, EIA's, and research projects were initiated to develop integrated policy development, eco-system and an ICZM approach. The projects were carried out in co-operation with mussel fishermen and farmers to enhance profit and sustainability of methods used in the Limfjord mussel production.

## **7. Cost and resources**

The research was based on funding from the European Fishery Fund and other, EU and national sources, of projects on bottom culturing activities, development of sustainable fishing practices, and of the projects 'Regime shift in the Limfjord' (national) and 'SPICOSA: Science and Policy Integrations for Coastal System Assessment' (EU).

## **8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)**

The objectives were achieved, or nearly so. However, it is still an ongoing process to adapt to new legislation, such as the implementation of the WFD (new plans are expected to be released in 2010).

## **9. Success and Fail factors**

Helpful to the process was a well-established network among the Limfjord stakeholders, and informed meetings with an opportunity to share experience, knowledge and visions. The Mussel Commission has been a solid platform and has been essential in the work to reach consensus agreements between parties of different, and often opposing, interests. EU requirements (Natura 2000, WFD) have helped to advance national development of sustainable mussel production and associated legislation (EIA's, etc.). Obstacles were the limited mandate of the fishermen. Unresolved is a complaint by the Danish Society for Nature Conservation about a mussel fishery occurring in three Natura 2000 sites.

## 10. Unforeseen outcomes

Establishment of self-regulation of the mussel fishery (quotas, size/quality, production methods) was not expected but has proved to be valuable in the initial effort to develop ICZM and spatial planning of the use of resources in the Limfjord. No unforeseen negative outcome has been observed.

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## 13. Sources

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- Regime shift in the Limfjord during 1984-2007 (2010). Dinesen, G.E. & Støttrup, J. DTU Aqua Report.
- [www.Limfjord.dk](http://www.Limfjord.dk) (see also [www.blst.dk](http://www.blst.dk))
- [www.spicosa.eu](http://www.spicosa.eu)