



KEYZONES

Investigate sustainable biological carrying capacities of key European coastal zones

The Challenge

Shellfish cultivation in estuaries and coastal systems is an important economic activity in many parts of the world. This is also true for Europe, where the demand for oysters and mussels is high. Shellfish producers face several challenges, which have caused production to decrease. Strong competition for space is one limiting factor – and where space is available, environmental factors may limit expansion of the production. The carrying capacity of production areas therefore needs to be quantified to allow for the responsible management of shellfish aquaculture expansion.

Carrying capacity is the ability of a discrete area to maintain the ecosystem equilibrium. Carrying capacity studies aim to provide tools which can be used to predict sustainable production levels.

Project Objective

KEYZONES main goal was the characterisation of the carrying capacity of key European coastal zones for commercial production of bivalve shellfish. The research was designed to produce tools that will enable shellfish producers in the targeted areas to optimise production capacity, recruitment of young stock, and quality whilst reducing waste. It aimed to increase local revenue in the targeted areas, to increase the scope and credibility of generic ecosystem models, and to increase sustainability by helping to manage stocking of shellfish farms and harvesting in fisheries.

The work focused on three study areas:

Site N°	Site name	Country	Species	Production (ton.y-1)	Key problems
1	Loch Creran	Scotland - UK	Mussels/Oysters	500/100	Exploitation capacity
2	Eastern Scheldt	Netherlands	Mussels/Oysters	50,000	Carrying capacity and recruitment
3	Clew Bay	Ireland	Mussels/Oysters	2,000/700	Exploitation capacity

Key Points

To collect and store historical data that describe environmental parameters and processes at each culture environment, including the physiology and culture practise for each main shellfish species cultured in those environments.



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EATiP Thematic Area of Relevance

- TA1: Product Quality, Consumer Safety and Health
- TA2: Technology and Systems
- TA3: Managing the Biological Lifecycle
- TA4: Sustainable Feed Production
- TA5: Integration with the Environment
- TA6: Knowledge Management
- TA7: Aquatic Animal Health and Welfare
- TA8: Socio-Economics and Management

Key Words

Aquaculture, sustainability, carrying capacity, coastal environments, shellfish, bivalves

Project Information

Contract number:
512664

Contract type:
Co-operative research project
Action line: SME Horizontal research activities involving SMEs

Duration:
30 months (01/02/2005 – 31/07/2007)

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To model the physiology of cultured species by developing a dynamic model structure that may be parameterized to simulate feeding, excretion, growth and reproduction in different shellfish species cultivated throughout Europe.

To describe and predict carrying capacity, using ecosystem models with variable spatial resolution, in order to combine hydrodynamics, biogeochemistry and shellfish population dynamics for multi-year simulations.

To produce models, which allow the user to investigate various management strategies, for example farm expansion, and that provide an indication of the likely environmental, and economic impacts of these strategies.

Output Highlights

- **Historical data on environmental parameters and processes, including the physiology and culture practice for each main shellfish species cultured for each site was collected.**

Additional field work recorded:

- temporal and spatial variations in the environmental parameters that acted as forcing functions driving simulations of shellfish growth and ecosystem processes (such as food availability, light and temperature);
- physiological responses required to parameterise the generic physiological model for each shellfish species; and
- natural shellfish growth and ecosystem variables (such as chlorophyll).

- **Based on these an integrated ecosystem model was developed for each study site and included primary production, primary consumption (by shellfish) and their interactions.**

Shellfish growth could be simulated in response to food availability and competing shellfish stocks.

- **Using these models, various scenarios and management strategies were investigated:**

- the effect of climate change;
- the effect of expansion of wild populations of Pacific oysters; and
- the effect of expansion of aquaculture activity

The results of these scenario simulations have stressed the usefulness of the models to address carrying capacity issues and the importance of reliable input data for shellfish stocks.

- **The models developed by the KEYZONES project had a positive impact on local production and harvest of shellfish in the selected sites, improving the quality and sustainability of the produce.**

The models produced can be used to assist in the planning and management of fisheries and shellfish farms in other coastal zones.

The Full Report:

For a description of the research project visit <http://www.keyzones.org>

Next Steps – Suggested Actions/Follow On



Policy

Carrying capacity is a prime contributor to policy decisions relating to marine development, ranging across ICZM and aquaculture zoning activities, and models such as those developed by KEYZONES should represent a critical element in these planning decisions.



RTD

There is a need for continued and extended carrying capacity research, for these and other shellfish species and across different marine environments. The further refinement of the models is equally a research priority.



Environment

Carrying capacity assessments should form the foundation of any environmental or ecological investigation for licensing, regulation and policy formation, both for governments and NGOs.

Related Publications/Projects

There are a multitude of related publications; the best source would be via the web links to the RTD partners of the KEYZONES Project, namely:

- IMAR, SAMS, RIVO, DELFT and PML.