

“COST-IMPACT”

What is the economic cost of changes in marine ecosystems, that are caused by fishing disturbance?

Maintaining sustainable fisheries in European waters, with all the economic benefits afforded to the community through the fishing industry, is of prime importance to the European Union. At the same time, the Union wishes to maintain biodiversity and limit the environmental impact of fishing. Both of these objectives are stated as such in the Common Fisheries Policy, but in many cases they are conflicting.

Trawl fishing, for example, whereby weighted nets are dropped to the sea bed and dragged along the bottom, causes a significant physical disturbance to the sea bed, altering the spatial structure, species composition and biogeochemistry of the environment.

This type of fishing strongly reduces the abundance of key benthic fauna, known as bioturbators – which have a pivotal role in the cycling of important nutrients in coastal waters – and consequently impact on pelagic productivity, i.e. the productivity of the plankton in the water column. Other ecosystem services such as the bioremediation of waste and gas and climate regulation might also be negatively influenced.

To date the economic arguments controlling fishing effort have focused on costs of fishing per unit catch and maintenance of sustainable fish stocks for the future. To be able to strike a balance between the economic needs of fishermen and the protection of the environment, it is essential to quantify marine ecosystem goods and services and the consequences of fishing on these goods and services, in economic terms.

This is exactly what the **COST-IMPACT** project has tried to achieve by answering the following questions:

- How does demersal fishing impact on the biodiversity of marine benthos and the associated goods and services, such as nutrient cycling, that they provide?

- How do these impacts influence other marine ecosystem processes?
- What are the likely values of marine ecosystem goods and services and how are these values affected by fishing?



SOURCE: CHRIS SMITH, HELLENIC CENTRE FOR MARINE RESEARCH

Data on the impact of disturbance on benthic biodiversity from 81 scientific papers were collated into a meta-database and consequently analysed, a study which highlighted that the effects of different types of fishing gear are dependent on the nature of the sea bed in which they are deployed.

Field and mesocosm experiments were also carried out to obtain fundamental data on the role of the benthic fauna in mediating the rate of nutrient transfer between the sea floor and the overlying water.

Coupled physical-ecological models were applied to

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investigate the impact of demersal trawling on benthic and pelagic ecosystems in the North Sea and in the Cretan Sea (Greece), by simulating trawl fishing with different intensity and fishing gear and in different habitats.



MESOCOSM EXPERIMENTS. SOURCE: PLYMOUTH MARINE LABORATORY.

In addition, through close collaboration between economists and natural scientists, a data matrix was constructed quantifying the goods and services from different sea bed habitats in the North Sea subjected to different trawling gears and with different intensities of effort. Changes in goods and services under different scenarios were valued with monetary and non-monetary valuation techniques, using a combination of stakeholder analysis and multi-criteria analysis (MCA).

Finally, a **bio-economic model** was developed, based on the North Sea case study and using a combination of all the research conducted within COST-IMPACT. This model provided the basis for a scenario driven analysis to demonstrate the impact of various fishing management

strategies on the benthic marine ecosystem goods and services. It is a decision support system, aimed to aid policy makers in their decision making process and to help managers to integrate fishing policy with environment policy. To this extent, a management manual was also developed, which is available from the project web site.

To ensure that these tools were closely tied to the needs of the customers, a **Reference User Group (RUG)** was set up, which included members from both commercial and governmental sectors, covering fisheries and aquaculture management and nature conservation. This RUG advised on the relevance and user-friendliness of the research conducted, and on the dissemination procedures.

COST-IMPACT has thus provided **tools that help determine whether a balance can be achieved between the economic value of a fishery and the impacts of fishing on marine ecosystems and the economic value of the goods and services they provide.** With such knowledge strategies can be developed for management of fisheries effort that balance the environmental impact on marine benthic biodiversity and the services the benthos provides for marine ecosystem functioning against the socio-economic benefits of fishing.

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