

“MERAMED”

A tool to monitor the environmental impact of marine fish cage farms in the Mediterranean

In the last decade, aquaculture of sea bass and gilthead sea bream has experienced a period of exponential growth in the Mediterranean region. However, little detailed information is available on the environmental impacts of this industry, although it is generally assumed that these will, at least qualitatively, follow the pattern established in northern countries.

Environmental assessment strategies, developed and proven in northern European cage farms, underpin effective regulations in those areas. To ensure the sustainable development of aquaculture in Mediterranean coastal regions as part of an integrated management of the coastal zone, the development of such strategies in the Mediterranean is essential.

In order to address this concern, the **MERAMED** project aimed to develop a model based control system for the environmental monitoring of fish cage farms in the eastern Mediterranean. This required the fulfilment of three major objectives:

- to review the procedures used in the regulation and monitoring of marine cage fish farms in Norway, Scotland and elsewhere;
- to carry out a research programme for the provision of appropriate data on the environmental impact of fish cages in a range of conditions in the eastern Mediterranean;
- to develop a predictive model to simulate the environmental response to different cage stocking levels and feeding regimes.

In 2001, a screening cruise was organised to **test Scottish and Norwegian environmental monitoring techniques**, whereby surveys were undertaken at **seven Greek fish farms**, representative for environmental conditions and production practices typical of the eastern Mediterranean. Five farms were selected for more detailed follow-up studies and experiments in

spring and autumn the following year.



THE MERAMED FIELD LABORATORY.
SOURCE: MERAMED.AKVAPLAN.COM

Parallel to the fieldwork and sample analysis, a **predictive sediment deposition model, MERAMOD**, was developed, based on the existing Scottish model DEPOMOD, that was modified and adapted according to the **ecological particularities of the Mediterranean Sea**. In addition to differences in the species cultured, the climate, the current regime and the level of eutrophication, differences in the composition and diversity of fauna and flora between the North Atlantic and the Mediterranean Sea had to be addressed. Modelling parameters were gradually changed and new parameters introduced as needed (e.g. the “wild fish module” that served as an input of pelagic/benthic feeding effects by wild fish), after which the model was validated using data from a series of experiments carried out during the last field campaign.



MERAMED

Project acronym:

MERAMED

Full title of Project:

Development of monitoring guidelines and modelling tools for environmental effects from Mediterranean aquaculture

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“A SERIES OF GUIDELINES
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As a result of the comparative analysis of different survey methods, a **series of guidelines and protocols** detailing the most appropriate and cost effective suite of **techniques for routine surveillance of the environmental impact** of Mediterranean cage farms were developed. The scale and complexity of these are linked to the production levels of each farm, the purpose of monitoring (baseline, production monitoring, following) and to the need for appropriate data to drive the MERAMOD model.

The model was used to **simulate various management practices** and predict their effect on sediment deposition. Scenarios showed that cages located at deeper, more dispersive sites resulted in a less severe impact over a larger area. In addition, spacing out of cages reduced the predicted deposition markedly, especially where a large spacing was used. The model also suggested that sea bass would potentially have more impact than sea bream on sediment deposition, because of faster faecal settling velocities. Therefore, it was advised to **site bass in deeper, more dispersive sites** or, when farmed at the same site as bream, to place bass in the outer (deeper) areas of the farm.



TRANSECT OF THE SEA FLOOR UNDER A FISH CAGE. SOURCE: MERAMED.AKVAPLAN.COM

It was concluded by the project consortium that the MERAMOD model is capable of predicting the depositional foot print of cage installations and that it will enable regulators to agree with farmers on a practicable Allowable Zone of Effect (AZE, i.e. a zone within which standards may be breached), based on survey data of key hydrographic and sedimentary chemical and biological parameters. Moreover, the project results are expected to improve competitiveness amongst Mediterranean cage farms by providing standardised and effective environmental monitoring and management systems, which will guarantee long-term sustainability in the Mediterranean aquaculture industry.