PROJECT Nº 95/038: BIOLOGICAL STUDIES OF DEMERSAL FISH

KEY WORDS
Demersal fishes, reproduction, spawning, age-length key, growth, otolith, illicium, ICES, hake (Merluccius merluccius), anglerfish (Lophius piscatorius; Lophius budegassa) megrim (Lepidorhombus boscii; Lepidorhombus whiffiagonis), multi-species trawl fisheries, long-line, gill-net.

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OBJECTIVES
The main objective of this project was to obtain information on the biology of the bottom-living fish species of most importance to ICES southern Shelf Demersal Stocks Working Group. These include: hake (northern and southern stock), anglerfish (northern and southern stock), two species of megrim from the southern stock and megrim in the strict sense from the northern stock.

The project was intended to improve the data for input to computer models used for fisheries assessment of these stocks.

APPROACH AND METHODOLOGY
Biological sampling was conducted on an annual basis at landing sites. Sample data were used to estimate the relationship between length and weight, and between mean weight and mean length-at-age. Differences between the participating institutes in regard to estimating age of the fish were determined in order to agree on appropriate criteria for ageing fish from examination of growth rings on otoliths (small bones found in the head of the fish). Studies were also made of the spawning season and the length-at-first-maturity. For hake, estimates were made of the egg production per unit body weight (fecundity) for fish from the northern stock, using samples collected from an EU-funded discards study.
With respect to growth studies, three Workshops (on hake, megrim and anglerfish) were held in order to share experiences and to standardise methodologies for reading otoliths.

**MAIN FINDINGS AND CONCLUSIONS**

Southern shelf demersal stocks, including European hake (*Merluccius merluccius*), anglerfish (*Lophius piscatorius*), black-bellied anglerfish (*Lophius budegassa*), four-spot megrim (*Lepidorhombus boscii*) and megrim (*Lepidorhombus whiffiagonis*) are caught in multi-species trawl fisheries, long-line and gill-net, mainly by Portugal, Spain, France, Ireland and the UK in fishing areas VII, VIII and IX. These species are of considerable importance in terms of both tonnage and economic value for each country that participated in the project. The stocks are subject to an annual TAC, implemented by EU.

Biological information for each species on growth, age, maturity and length-weight relationships is considered necessary not only to provide a reliable basis for assessing the status of the stocks but also to detect changes in population characteristics, such as the length at which they mature, which may have important implications for fisheries management.

Appropriate data on the fish stocks is required in order to assess the probable effects of applying management and conservation measures, such as total allowable catches, national quotas, and technical measures such as like mesh size, close areas and closed seasons.

The project therefore was executed in order to obtain such data through the establishment of a landing site sampling and data analysis program, co-ordinated between the participating countries.

All southern fish stocks are assessed within the ICES assessment working groups. Due to a lack of relevant data, and the fact that no analytical assessment has been made on the state of exploitation of anglerfish, only precautionary TACs have been established. Therefore prior to commencement of the project, there was insufficient biological information on these stocks, particularly for anglerfish.

The project commenced only a few years ago and considerable difficulty has been experienced through the fact that fish are gutted prior to landing. In addition, there have been disagreements over the techniques to use for calculating fish age from otolith bone analysis.

As far as the southern hake stock is concerned, the authors consider it to be at a low level of abundance. The highlight the need to continually monitor changes in spawning stock status and spawning behaviour in pursuit of improved management measures for protecting the spawning stock through measures such as seasonal bans or reduced fishing effort.

The main activities undertaken by the participating institutions are summarised below on a species by species basis:

**European hake (*Merluccius merluccius*) of ICES Divisions VIIIc and IXa.**

IEO collected biological samples of this species to determine the length-weight relationship and also collected otoliths in order to estimate age length-keys.

An attempt at defining the internal structure of hake otolith bones was initiated, based on material collected during a research survey conducted by IPIMAR in September 1995. Based on agreed age readings, an attempt was made to construct age-length keys for immature specimens, males and females (i.e. the likely age of a fish of any particular length).

**European hake (*Merluccius merluccius*) of ICES Sub-area VII and ICES Divisions VIIIab.**

Quarterly age-length keys were constructed. Egg production per unit of body weight was estimated from a certain number of gonads collected in 1994, during the sampling program of the project ‘Discards of the Spanish fleet in ICES Divisions’ (No. PEM/93/005) which had been kept at the IEO laboratory in Vigo.
Megrim (Lepidorhombus whiffiagonis) of ICES Sub-area VII and Divisions VIIIab.

The laboratories involved in the activities for this species were IEO, AZTI, CEFAS and IFREMER. IEO collected otoliths from this species with the aim of constructing quarterly length-age keys, and weight samples were taken to estimate the relationship between fish length and weight. An otolith workshop was conducted in order to maintain consistency between experienced readers and to try and eliminate discrepancies between readers in the various participating institutes.

Megrim (Lepidorhombus whiffiagonis and Lepidorhombus boscii) of ICES Divisions VIIIc and IXa.

Samples were taken to estimate the length-weight relationship, age-length keys and length-at-first-maturity (i.e. the minimum length at which fish can spawn) as well as to determine the spawning season. The laboratories involved in these stocks were IEO and IPIMAR.

Anglerfish (Lophius piscatorius and Lophius budegassa) of ICES Sub-area VII and Divisions VIIIab.

An alternative for validation of ageing anglerfish was made by analysing the lengths of fish sampled. To carry out this analysis, length measurements were taken of Lophius piscatorius and Lophius budegassa in the 45 RESSGASC surveys by IFREMER from 1995 to 1996 in the Bay of Biscay, and in additional surveys carried out in the Celtic Sea.

Samples were analysed to estimate the length-weight relationship, age-length keys, length-at-first-maturity and also to determine spawning seasonality. This activity was mainly undertaken by AZTI.

Anglerfish (Lophius piscatorius and Lophius budegassa) of ICES Divisions VIIIc and IXa.

Age-length keys were estimated semi-annually and annually for both species. Growth parameters were also estimated. Reproduction studies were carried out, but due to the difficulties of catching mature females particularly in the case of white anglerfish, it was not possible to estimate length and age-at-first-maturity. It was suggested that this difficulty may be due to the fact that mature females become inaccessible to fishing gear during the spawning season. The laboratories involved in these stocks were IEO and IPIMAR.

A Workshop was conducted so as to develop appropriate ageing criteria for both species and stocks of anglerfish and to provide inexperienced staff with adequate training to age the species independently.

A search of available written material on the target species was made at the beginning of the project. The project report provides a list of relevant articles for each species.