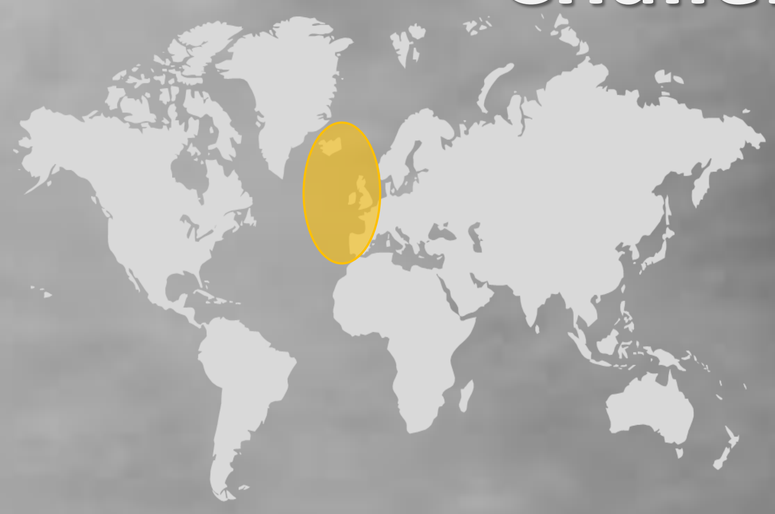
Challenges in DEPM implementation
NE Atlantic Mackerel



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DEPM MACKEREL IN ICES

Egg production surveys provide an independent method of estimating SSB to inform the stock assessment process. There are two primary methods, the annual egg production method (AEPM) designed for species with a determinate fecundity and the daily egg production method (DEPM) that can be applied to indeterminate and determinate spawners. Since 1977 the AEPM has been used for estimation of NEA mackerel SSB under the assumption that mackerel has a determinate fecundity.

Working Group on Mackerel and Horse Mackerel Egg Surveys

The Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS) coordinates the mackerel egg survey in the Northeast Atlantic and in the North Sea, both which are carried out every third year. The group decided to hold a workshop in 2012 in response to indications of indeterminate fecundity in mackerel.

Workshop on Survey Design and Mackerel and Horse Mackerel Spawning Strategy

The Workshop (WKMSPA 2012) recommend investigate the application of the DEPM for mackerel. The survey design should not be changed to continue the AEPM time-series, but participants in the assumed period of peak spawning will collect extra adult samples for estimation of adult parameters in DEPM to compare AEPM and DEPM.

Working Group on Widely Distributed Stocks

The Working Group on Widely distributed stocks (WGWIDE) compiles and analyses data on large stocks of pelagic species, mackerel included, for stock assessment. The WGWIDE advised a series of five points of comparison AEPM - DEPM in order to be able to change to DEPM without losing the historical series.

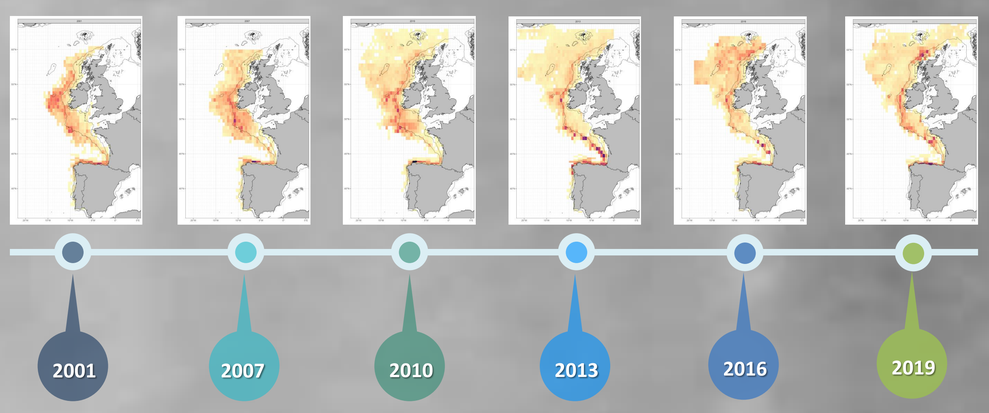
CHALLENGES

Mackerel Migration

Mackerel performs extensive migrations between spawning and feeding grounds and overwintering areas. At the end of the year and during wintertime mackerel migrate southward towards the spawning grounds through the west of the British islands. In the Cantabrian Sea (North Iberian Península) the Spanish fishery moves from east to west following mackerel spawning migration. (Punzon et al, 2009)

Spawning area Expansion

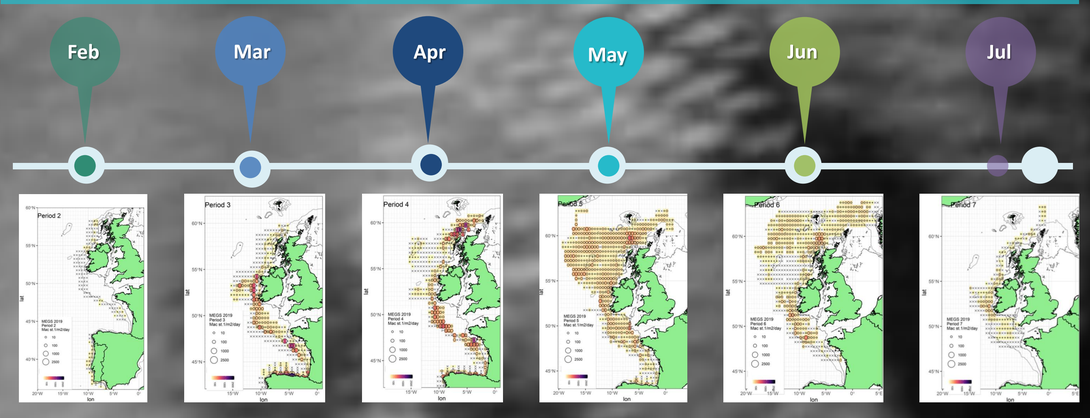
A geographical expansion of the NEA mackerel stock distribution to the North and West Atlantic has been observed in recent years, reaching waters of Iceland, Greenland and Svalbard. The mackerel spawning area has been expanding in consequence.



Mackerel total egg sampled maps by year. WGMEGS data.

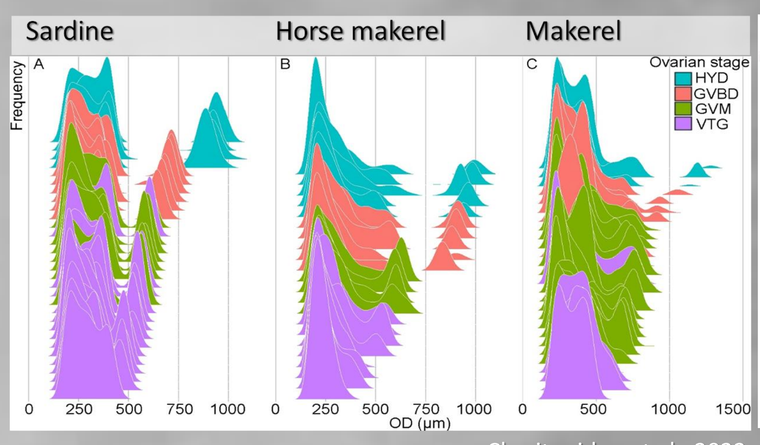
Peak spawning Location

The spawning season lasts from February to July in a large spawning area where fish are migrating. Concentrations of eggs are observed in different months. This makes it difficult to fix the spawning peak in both space and time.

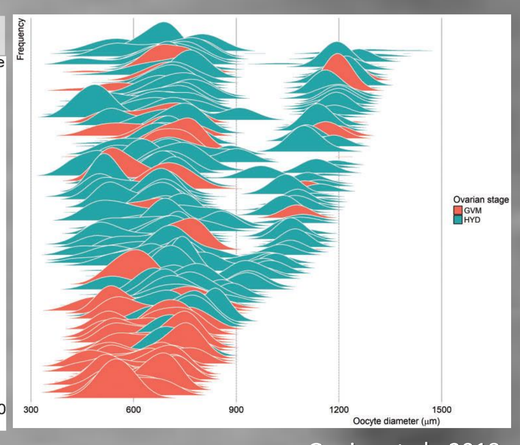


Mackerel egg sampled maps by time period in 2019 spawning season. ICES, 2021

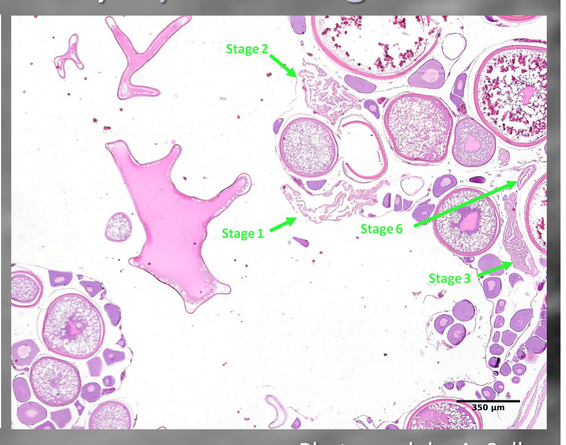
Ovary Dynamic organization



Charitonidou et al., 2022



Ganias et al., 2018



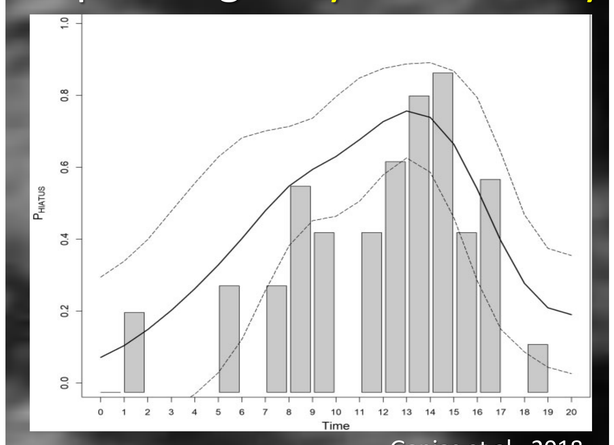
Photograph by A. Solla

Oocyte frequency distribution of different pelagic species. Mackerel exhibed a higher number of co-ocurring cohorts compared to sardina and horse mackerel. In mackerel the cohorts are hardly distinguised from each other.

In mackerel hydrated oocyte method is not fully aplicable. Only samples with a clear hiatus separating the spawning batch can be used.

One individual can show POFs in a continuum of degenerative stages , belonging to different cohorts. Moreover, the age of the different POF stages is uncertain.

Spawning Daily sinchronicity



Ganias et al., 2018

It is unclear whether mackerel show daily spawning synchronicity. In the southern component, Ganias et al., 2018 found indications of a window of time in the 24 h cycle that the advanced mode tends to separate from the smaller oocytes.

NEXT STEPS

2023 ICES Workshop on Mackerel DEPM

In 2023 the WGMEGS will hold a workshop, where all the issues in mackerel DEPM implementation will be discussed to identify the methodology and data inputs necessary to calculate a DEPM estimate for NEA mackerel

Early POFs stages Assessment

Conduct experiments to find out the degeneration times of POFs to assign each stage to the corresponding time after spawning.

Daily spawning Dynamics

Conduct experiments to elucidate the daily dynamics of spawning in mackerel, consisting of 24 hours of fishing at regular intervals. The sampling will be intensified in the period when, following Ganias et al., 2018, it is postulated that spawning occurs, i.e. from midday to early morning.

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