WINTER DISTRIBUTION OF PLAICE (*Pleuronectes platessa*) AND LEMON SOLE (*Microstomus kitt*) LARVAE IN THE ENGLISH CHANNEL AND NORTH SEA INFERRED FROM THE 2016 IBTS SAMPLING

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Although most fish species spawn during spring, ensuring a temporal coincidence of their larvae with the planktonic bloom, several spawn during winter. During the International Bottom Trawl Survey (IBTS), the MRN (Midwater Ring Net) sampling is performed each year during winter (January-February) all over the eastern English Channel (EEC) and North Sea. Until now, MRN data have been mainly used for stock assessment of North Sea Herring. Hence, the aim of the present study is to focus on others species (especially flatfishes) found in samples collected in 2016 and to determine spatial patterns in larval fish assemblages in relation to environmental conditions.

SAMPLING

- January-February **IBTS 2016**
- **6 countries** : France, Netherlands, Scotland, Germany, Norway, Denmark
- **MRN ,** at night, 10 minutes (Fig 1)
- **CTD** = environmental parameters (depth, salinity, temperature)
- **347** samples (Fig 2)

Figure 1 : Midwater Ring Net.

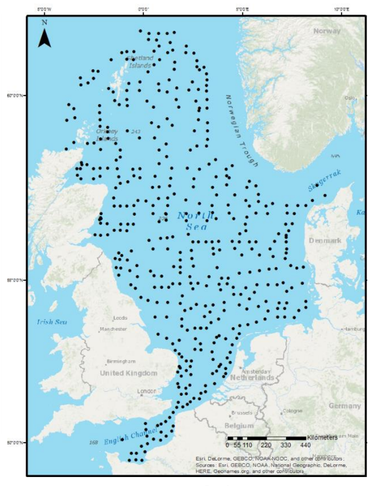


Figure 2 : Locations of the 347 samples.

LABORATORY WORK

- Identification to **gender** or **species by stage**
- Flatfishes = 5 **developmental stages** (Fig 3)

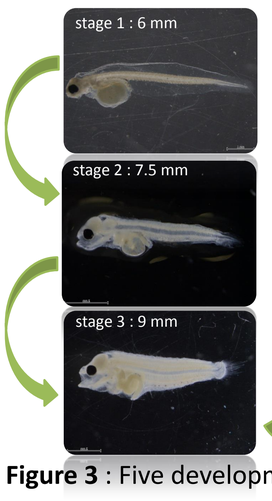
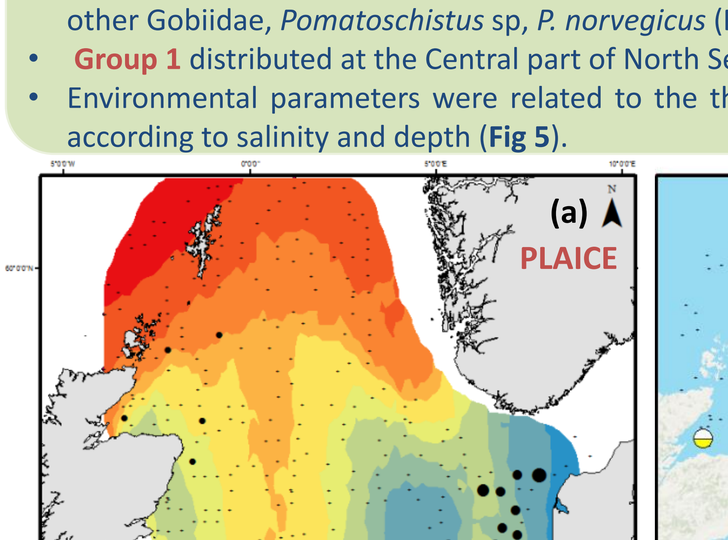


Figure 3 : Five developmental stages of flatfishes.

STATISTICAL ANALYSES

- Calculation of **abundances**
- **Multivariate analysis (OMI ;** Dolédec *et al.,* 2000**) and cluster analysis** with R software
- **Mapping & kriging** with ArcGIS 10®

RESULTS



*Inertia ratio : 76% . BGA MCTest p-value : 0.001

Figure 4 : Hierarchical cluster of species (log abundance nb.ind/5000 m^3). Distance = Euclidean, method = Ward.

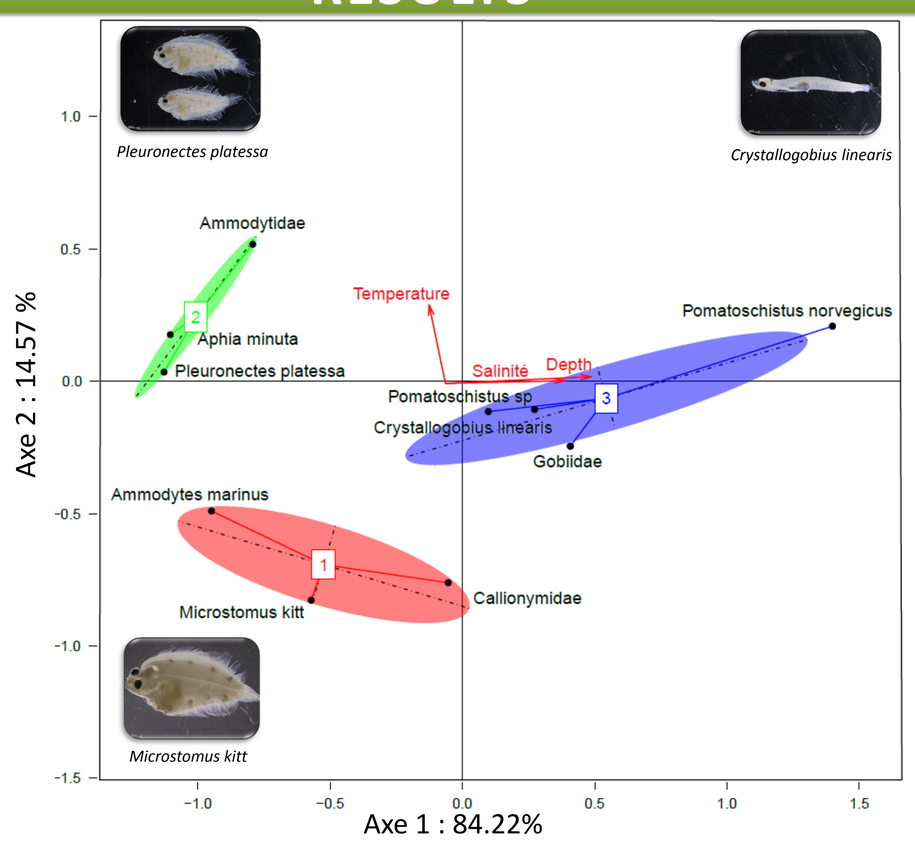


Figure 5 : OMI analysis on species abundance in relation with environmental parameters (red arrows). Ellipses correspond to significant clusters of species.

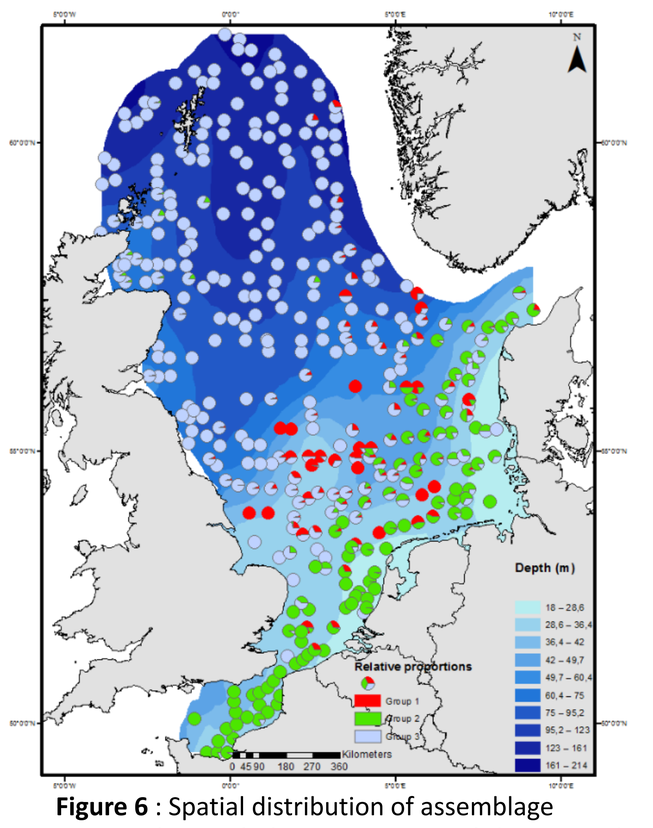


Figure 6 : Spatial distribution of assemblage species clusters (relative proportions) determined from OMI analysis. The depth is kriged.

- **37 species** were found in all samples. Only species with frequency > 5 % were used for analyses **(10 species,** *Crystallogobius linearis*, *Aphia minuta*, other Gobiidae, *Pomatoschistus* sp., *P. norvegicus*, *Ammodytes marinus*, other Ammodytidae, Callionymidae, *Pleuronectes platessa* and *Microstomus kitt***)**.
- Three groups of species were obtained from clustering (**Fig 4**). **Group 1** : *M. kitt*, Callionymidae, *A. marinus* ; **Group 2** : *A. minuta*, *P. platessa*, other Ammodytidae ; **Group 3** : *C. linearis*, other Gobiidae, *Pomatoschistus* sp, *P. norvegicus* (**Fig 5**).
- **Group 1** distributed at the Central part of North Sea, offshore ; **Group 2** EEC & southern North Sea ; **Group 3** North and Central part of North Sea (**Fig 5 & Fig 6**).
- Environmental parameters were related to the three species groups. Species of **group 1** & **2** were distributed according to temperature whereas species of **group 3** were distributed according to salinity and depth (**Fig 5**).

Figure 7 : Spatial distribution of plaice by (a) total abundance (nb.ind/5000 m^3) (b) developmental stages. Temperature (°C) is kriged.

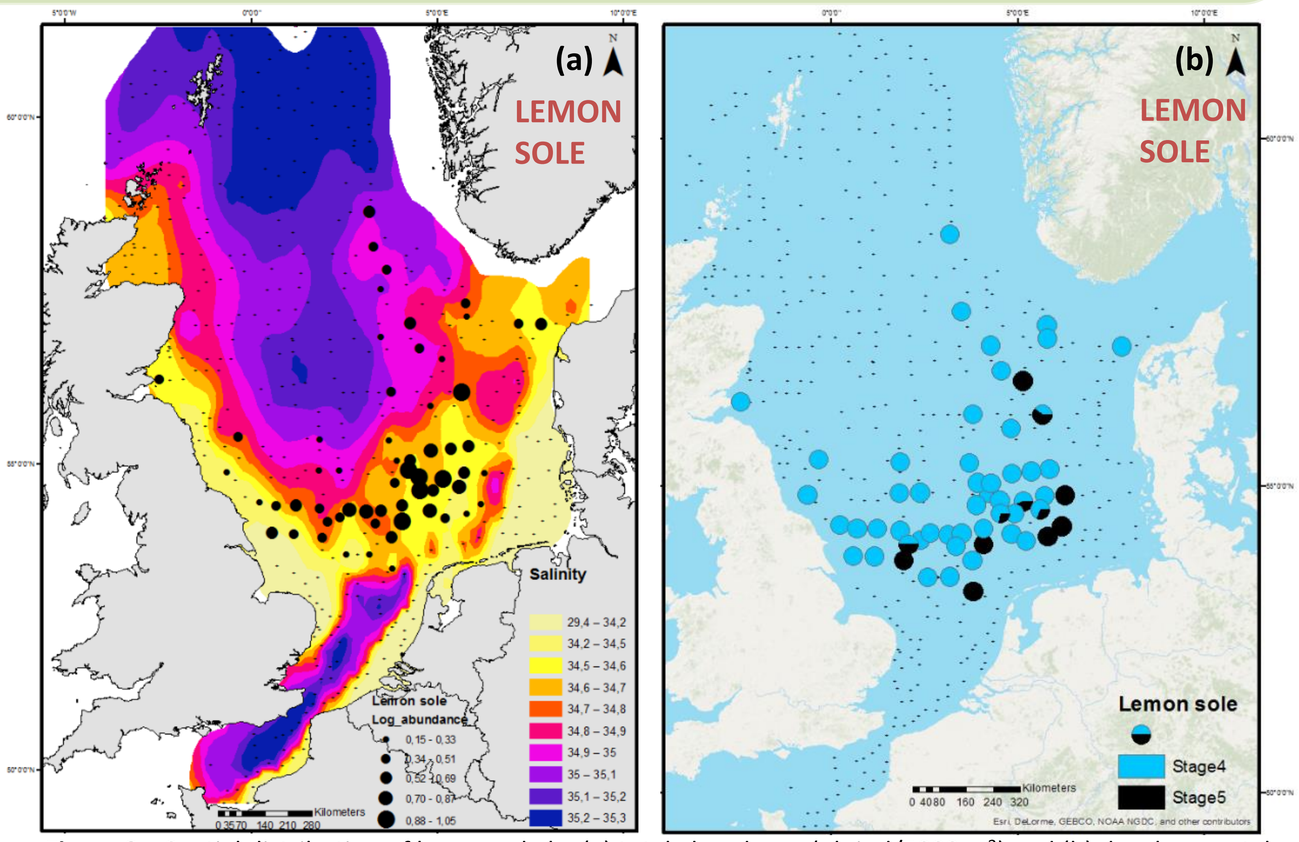


Figure 8 : Spatial distribution of lemon sole by (a) total abundance (nb.ind/5000 m^3) and (b) developmental stages. Salinity is kriged.

- Plaice was present in the EEC and Southern North Sea. Abundances were higher along the coasts (Fig 7a).
- Stages 1 & 2 were distributed offshore in the EEC and southeastern part of the North Sea (Fig 7b). Stages 3 & 4 were distributed closer to the coasts. Only one individual of stage 5 was collected.

- Lemon sole was present in the central offshore part of North Sea (Fig 8a).
- Only stages 4 & 5 were present with a majority of stage 4 (Fig 8b).
- **Abundance of plaice was twice more abundant than lemon sole.**

For the first time, all other larval species apart from herring were identified during winter in the entire North Sea. Three main assemblages of ten dominant fish larval species have been identified, including two flatfish species, plaice and lemon sole. These two species showed contrasting spatial distribution according to environmental conditions. Plaice larval distribution corresponds quite well with known spawning grounds locations whereas for lemon sole, this study provides for the first time a map of its winter larval distribution.

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