

The distribution of blue whiting larvae (*Micromesistius poutassou*) to the west of the British Isles in March/April 1996

I. McFadzen and K. Cook

Plymouth Marine Laboratory, Prospect Place, West Hoe, Plymouth, PL1 3DH, UK

ABSTRACT

Within the EU funded SEFOS project (Shelf Edge Fisheries and Oceanography Studies) ichthyoplankton sampling was carried out to determine the distribution and abundance of larvae of blue whiting (*Micromesistius poutassou*) west of the British Isles. Plankton was sampled from March 24 to April 19 1996, along the shelf-edge from Little Sole Bank (48°30'N) to the Færoe Isles (62°N). Blue whiting larvae were found in highest concentrations along the shelf-edge, around Porcupine Bank and west of Scotland as far as the Hebrides (~58°N). The high incidence of larvae along the shelf-edge west of Scotland and at the northern end of the Porcupine Bank indicates that in 1996 these areas were the most prolific spawning areas, in agreement with long-term historical records. Larval numbers were low (<1/m²) from west of the Hebrides to the Færoe Isles, suggesting spawning had not yet commenced in that region. Larvae were from 2.6-9.6mm in length with a mode at 4.1-4.5mm and comprised 87% of the total sampled ichthyoplankton.

INTRODUCTION

The SEFOS (Shelf-Edge Fisheries and Oceanography Studies) project was funded, in part, to study the interaction between several commercially important fish species and the hydrography of the Shelf-Edge Current (SEC). A number of important fisheries are based on fish stocks that spawn along the continental margin of the European shelf. One of these, the blue whiting (*Micromesistius poutassou*), is common from west of Ireland to Norway and was selected to study the interactions of the SEC and how changes in the current affect the early life stages.

Blue whiting is an abundant species, with a stock size of around 4.5-5.8 million tonnes (Monstad *et al.*, 1996), an extended spawning season from around February to May, and an extensive spatial distribution from at least Biscay to the Færoes and Norwegian Sea (Bailey, 1982). It is known that the abundance of the stock varies from year to year but the relative influence of fishing mortality or natural environmental effects remain to be clarified. It has been suggested that changes in the generally northwards-flowing shelf-edge current might lead to variations in dispersal and survival of the young stages (Bartsch and Coombs, 1996).

Studies of the dispersion of eggs and larvae requires input on the distribution and abundance of these planktonic stages. A number of publications have shown the general distribution of blue whiting at the shelf-edge west of the British Isles (Bailey, 1982; Bainbridge and Cooper, 1973; Coombs, 1979 and 1980; Coombs and Pipe, 1978 and 1981) and others have given useful results on particular years (Bailey, 1974; Belikov *et al.*, 1993 and references cited therein; Kloppmann *et al.*, 1996; Monstad *et al.*, 1994 and 1995). Few of the surveys have given extensive coverage in any single year. It was in this context that sampling for blue whiting larvae was planned in 1996 to give detailed coverage over a wide area of the spawning ground.

MATERIALS AND METHODS

Sampling was carried out from the RV Johan Hjort during the sixth joint Norwegian-Russian survey to determine the spawning stock of blue whiting (Monstad *et al.*, 1996). The cruise track and survey area (Fig. 1) were determined from the observed distributions of adult blue whiting as recorded by acoustic survey (Monstad *et al.*, 1996). A subsidiary study was undertaken to investigate the distribution of blue whiting larvae within the constraints of the main programme on acoustic determination of the size of the adult spawning stock.

For the investigation of the distribution of blue whiting larvae a series of 90 stations were sampled from the Celtic shelf, through Porcupine and west of Scotland to the F eroes (Fig. 1). Plankton sampling was by means of oblique slow speed (~ 2.5 knot) 50cm diameter Bongo net tows (200 m mesh aperture) to a depth of 60-100m, the depth sampled being monitored by a PRO-LOG depth sensing system. A flowmeter was fitted to one side of the Bongo to measure the volume of water filtered. On completion of a haul (12-15 minutes duration), the nets were briefly rinsed before removal of the cod-ends for preservation in 4% buffered formaldehyde and preliminary sorting of the 200 m mesh samples for blue whiting larvae.

On return to the laboratory all fish larvae were removed from each sample and identified to species. The preserved blue whiting larvae were counted and measured to the nearest 0.1mm (total length) under a dissecting microscope.

RESULTS

Species composition.

The majority of larvae sampled were those of blue whiting (87.2% of all larvae). Larvae of *Trisopterus esmarkii* were second in abundance (1.5%) and other species were only present at <1%. Of these, larvae of *Callionymus* spp., rocklings and *Lepidorhombus* were more common with only sporadic occurrences of *Gadiculus*, *Microstomus kitt*, myctophids, *Melanogrammus aeglefinus*, *Gadus morhua*, *Maurolicus*, *Ammodytes* spp., *Pollachius pollachius*, *P. virens* and Triglids.

Distribution and abundance of blue whiting larvae.

Larvae of blue whiting were widespread, occurring in most samples except those to the north of Scotland (Fig. 2). They were present at moderate levels (>100 larvae/m²) around Porcupine Bank and along the shelf-edge to the west of Ireland and at relatively high levels (~1000 larvae/m²) associated with the 200m contour to the west of Scotland (Fig. 2). Lower concentrations (<100 larvae/m²) along the edge of the Celtic Shelf extending towards Porcupine Bank. Between the north of Scotland and the F eroes larval numbers were negligible. Highest abundances were at two stations at the shelf-edge west of Scotland (1066 and 1212 larvae/m²).

Length of blue whiting larvae and timing of spawning.

The length frequency distribution of blue whiting larvae showed most larvae were in the 3.1-5.0mm length range with a mode at 4.1-4.5mm and a tail of lesser numbers of larger larvae extending to 9.6mm (Fig. 3). The length frequency distribution of larvae along the shelf-edge west of Scotland and north-east of Porcupine was not significantly different to those over the remainder of Porcupine and further south.

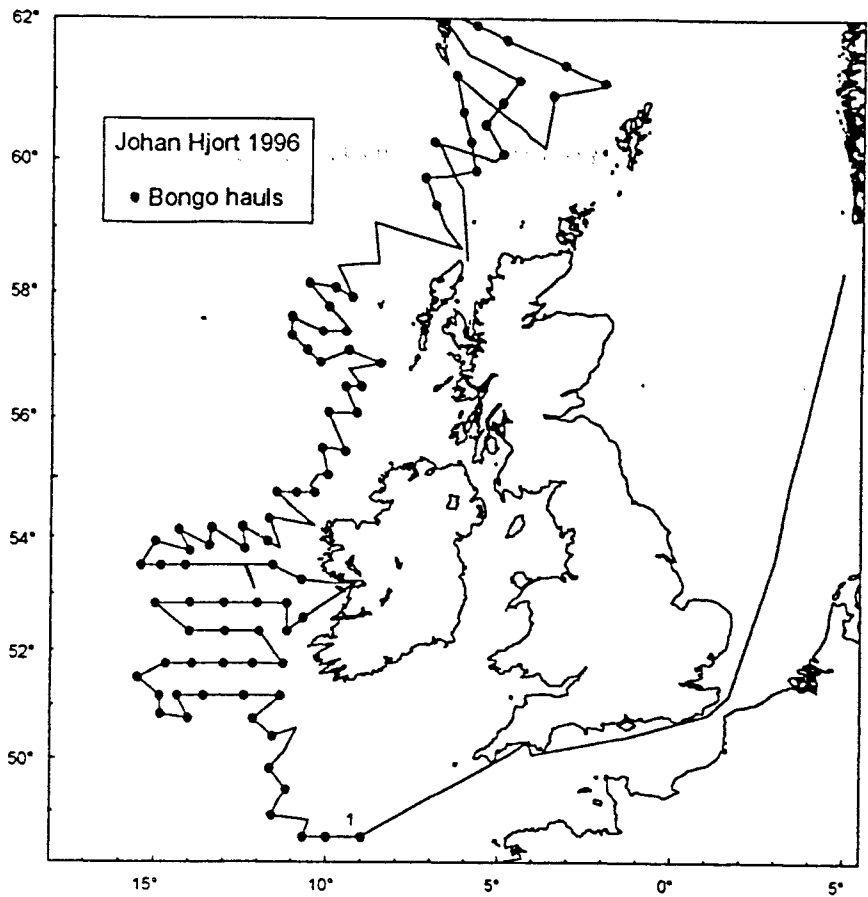


Fig. 1. Bongo station positions (March 24-April 19 1996).

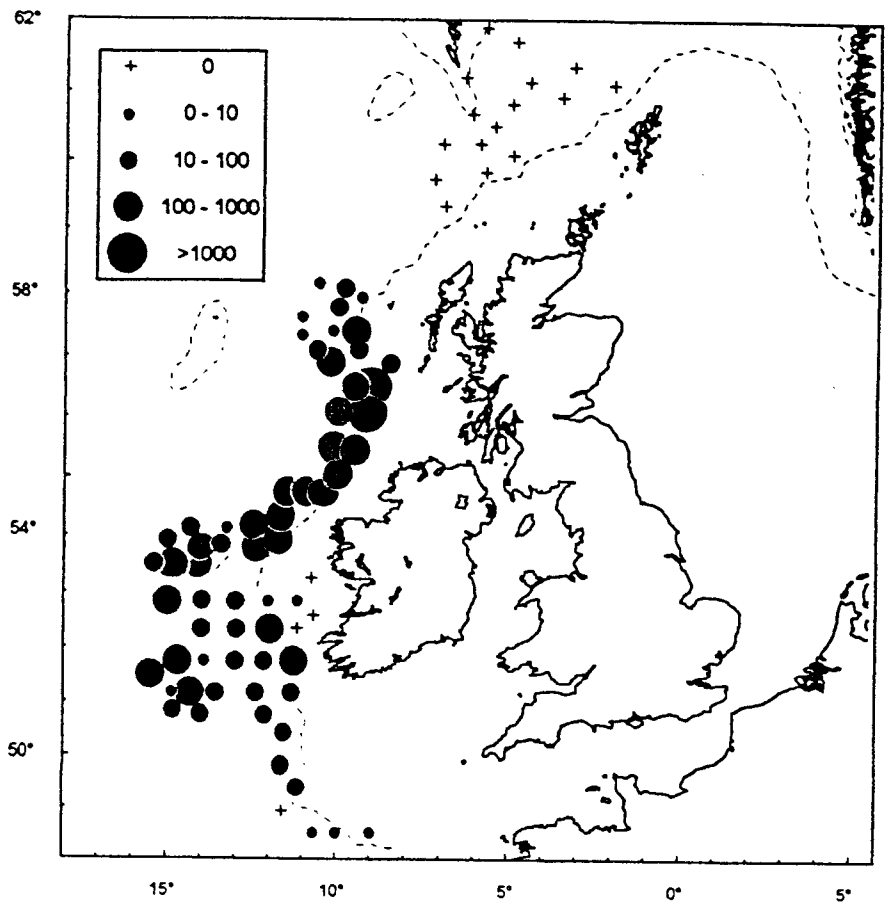


Fig. 2. Distribution and abundance (no/m²) of blue whiting larvae (March 24-April 19 1996).

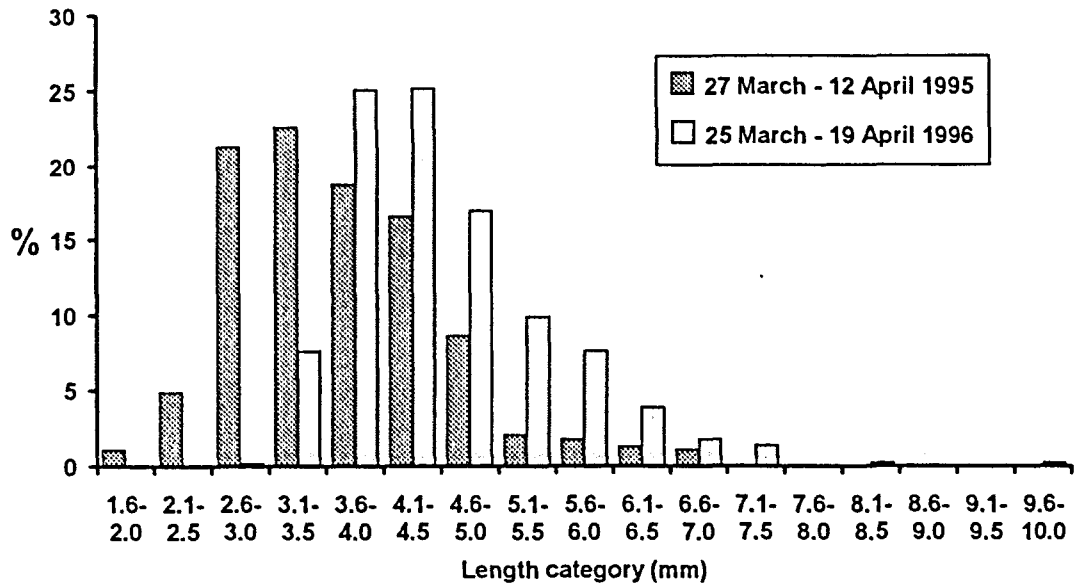


Fig. 3. Length frequency distributions of blue whiting larvae in 1995 and 1996.

DISCUSSION

Larvae of blue whiting were widespread, occurring in most samples except those taken to the north of Scotland (Fig. 2). As in previous years (Monstad *et al.*, 1994 & 1995) there was some indication of lower numbers of larvae over Porcupine Bank (<100/m²) compared with stations around the edge of the bank (typically 100-500/m²). Lower concentrations were found west of the Hebrides and negligible numbers from west of Hebrides to the F eroe Isles, implying that spawning had not been occurring much before the time of sampling in those areas (13-19 April). The high incidence of larvae along the shelf-edge west of Scotland and at the northern extreme of the Porcupine Bank indicates that in March/April 1996 these areas were the most prolific spawning grounds, in agreement with long-term historical data records (Coombs, 1979; Coombs and Pipe, 1978). This was not seen so clearly in the results from sampling on the SEFOS surveys in 1994 and 1995 partly because more effort in those years was directed to sampling at Porcupine Bank. Overall, spawning appears have been at a higher level in 1996 than in 1994 and 1995 (Monstad *et al.*, 1994 & 1995).

The abundance of adult blue whiting on the same cruise ("echo-intensity", Monstad *et al.*, 1996) showed similar concentrations to the larvae, that is from the edge of the Celtic Plateau, around Porcupine and along the shelf-edge west of Scotland. Highest numbers of adults were recorded north and north-east of Porcupine Bank, where high larval abundance was also observed (Fig. 2), and also west of the Hebrides towards the northern limit of the observed larval distribution; this latter group of adults representing the northwards post-spawning migration.

The length frequency distribution of larvae along the shelf-edge west of Scotland and north-east of Porcupine was not significantly different to that over the remainder of Porcupine and further south. However, in 1995 the larvae were slightly smaller at the same time of year (mostly 2.6-4.5mm; Fig. 3; Monstad *et al.*, 1995), possibly indicating slightly earlier spawning in 1996; this was suggested by Monstad *et al.*, (1996) as being a response to the elevated temperatures observed in 1996 compared with 1995.

Although the coverage obtained in 1996 was the most extensive survey for blue whiting larvae in a single year it was restricted by lack of sampling outside the immediate area of adult concentrations as

registered in the acoustic survey (Monstad *et al.*, 1996). In particular, more sampling would be required further west in the areas of the Rockall Trough and Rockall Bank (see Bailey, 1982) to give a more representative synoptic picture of larval distribution.

The distribution of blue whiting eggs is not presented since plankton sampling in the present survey was limited to a depth of 100m while eggs of blue whiting are mainly distributed at much greater depths (200-400m, Coombs *et al.*, 1981; Monstad *et al.*, 1994). However, since post yolk-sac larvae are predominantly in the upper 100m of the water column (Coombs *et al.*, 1981) they would have been sampled effectively in the present studies.

ACKNOWLEDGEMENTS

This study was funded, in part, by the European Union under contract No AIR2-CT93-1105. The authors are grateful to Dr. T. Monstad for the invitation to participate on the cruise and to the Captain and crew and all scientific personnel of the RV Johan Hjort for their assistance on the cruise.

REFERENCES

- Bailey, R. S. (1974). The life history and biology of blue whiting in the North east Atlantic. Mar. Res. 1: 29pp.
- Bailey, R. S. (1982). The population biology of blue whiting in the North Atlantic. Adv. Mar. Biol., 19: 257-355.
- Bainbridge, V. and Cooper, G. A. (1973). The distribution and abundance of the blue whiting (*Micromesistius poutassou*), in the North-east Atlantic 1948-1970.
- Bartsch, J. and Coombs, S. (1996). A mathematical model of the dispersion of blue whiting larvae (*Micromesistius poutassou*) in the eastern north Atlantic. ICES C. M. 1996/S:40.
- Belikov, S. V., Ignashin, V. A. and Molloy, J. (1993). Preliminary results of the ichthyoplankton survey and observations of the post-spawning migration of blue whiting during April 1993. ICES C.M. H:45.
- Coombs, S. H. (1979). An estimate of the size of the spawning stock of blue whiting (*Micromesistius poutassou*) based on egg and larval data. ICES C.M. H:41.
- Coombs, S. H. (1980). Continuous Plankton Records. A plankton atlas of the North Atlantic and North Sea. Supplement 5 - Young Fish, 1948-1972. Bull. Mar. Ecol., 8: 229-281.
- Coombs, S. H. and Pipe, R. K. (1978). The distribution, abundance and seasonal occurrence of the eggs and larvae of blue whiting, *Micromesistius poutassou*, in the eastern North Atlantic. ICES C.M. H:45.
- Coombs, S. H. and Pipe, R. K. (1981). The Continuous Plankton Recorder Survey: blue whiting larvae in the Norwegian Sea in 1979. Anns. Biol., 36: 94-95.
- Coombs, S. H., Pipe, R. K. and Mitchell, C. E., (1981). The vertical distribution of eggs and larvae of blue whiting (*Micromesistius poutassou*) and mackerel (*Scomber scombrus*) in the eastern North Atlantic and North Sea. Rapp. P.-v. Réun. Cons. int. Explor. Mer. 178: 188-195.
- Kloppmann, M., Mohn, C. and Bartsch, J. (1996). The effects of currents and hydrography on the distribution of blue whiting eggs and larvae on the Porcupine Bank. ICES C.M. S:25.
- Monstad, T., Belikov, S. V. and Coombs, S. (1994). Investigations on blue whiting in the area west of the British Isles, spring 1994. ICES C.M. 1994/H:12.
- Monstad, T., Belikov, S. V., Shamrai, E. and McFadzen, I. (1995). Report of the joint Norwegian-Russian acoustic survey on blue whiting, spring 1995. ICES C.M. 1995/H:7.
- Monstad, T., Belikov, S. V. and Shamrai, E. A. (1996). Report of the joint Norwegian-Russian acoustic survey on blue whiting during spring 1996. ICES C.M. 1996/H:12.