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Short communication

Northward range extensions of some mesopelagic fishes in the Northeastern Atlantic

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In a period mainly from 1995 to 1998, 19 species of southern temperate and subtropical mesopelagic fish have been caught in Norwegian blue whiting, *Micromesistius poutassou* (Risso), surveys in the Rockall Trough area. Six of the species have not previously been recorded that far north, and the other 13 only rarely in adjacent waters. The species were of the following families: Stomiidae (four species), Microstomatidae (one species), Bathylagidae (one species), Opisthoproctidae (one species), Myctophidae (four species), Evermannellidae (one species), Nemichthyidae (one species), Derichthyidae (two species), Melanonidae (one species), Melamphaidae (one species), and Chiasmodontidae (two species). We discuss whether these range extensions are real and attributable to the recent ocean warming, or only apparent, caused by increased sampling effort.

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INTRODUCTION

In the 1980s, the demersal fish fauna west of the British Isles was described in detail from catches with various fishing gear at numerous stations spread over the whole of the Rockall Trough and adjacent banks (Rätz 1984; Gordon & Duncan 1985; Gordon 1986). Less attention has been paid to the mesopelagic fishes occurring in these waters.

The main spawning areas of blue whiting, *Micromesistius poutassou* (Risso), are along the shelf edge and banks west of the British Isles. Surveys have regularly been conducted in the area in order to estimate the size and structure of the blue whiting spawning stock. The sampling mostly targets blue whiting, and particularly during the earlier surveys other species were often not identified or preserved. Here we report on a number of mesopelagic fishes with their main distribution farther south that have been caught during the Norwegian blue whiting surveys. The fishes were caught in 1973 (one haul) and from 1995 to 1998 (11 hauls) along the eastern slope of the Rockall Trough. By publishing these fish records we hope to encourage future monitoring of the fish diversity in these waters. Furthermore, we discuss the interpretation of these findings in light of two hypotheses: (i) these occurrences represent recent faunal changes that could represent a response to ocean warming, and (ii) the faunal changes are only apparent and caused by more sampling effort.

MATERIAL AND METHODS

The fishes were obtained during research cruises carried out by the Institute of Marine Research, Bergen, in order to investigate blue whiting population spawning west of the British Isles. These cruises have, with a few exceptions, been conducted annually since 1972. The sampling gear has varied over the years, but most of the sampling has been carried out using pelagic trawls with small meshes in the cod-end (11–22 mm stretched mesh sizes). The fore-nets have much coarser meshes that gradually shrink towards the cod-end. This makes it difficult to estimate the actual sampling volume for small mesopelagic species that are not retained in the fore-net; as a rough estimate, the effective opening is probably in the range of 20–30 m^2. The sampling with pelagic trawls has occasionally been supplemented by bottom trawls [a 4 m opening shrimp trawl with bobbins

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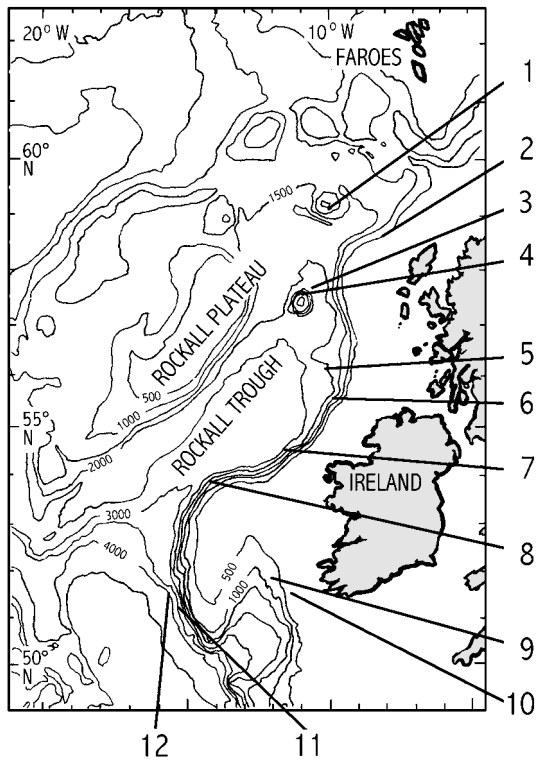

Fig. 1. Locations (1–12 along the margin) of the present fish records. For station details see Material and methods and Table 1.

(before 1990) or rockhopper ground gear; Blindheim & al. 1971; Monstad & al. 1996].

The locations at which the reported fishes were caught are shown in Fig. 1 and station details (vessel, station number, coordinates, date, fishing depth) are given in Table 1. The specimens were brought to the Museum of Zoology, University of Bergen, where they were identified (primarily using Whitehead & al. 1984–1986 and by comparisons with museum specimens) and subsequently preserved in alcohol or as skeletal specimens. Distributional information was extracted from the literature, as shown in Table 2.

RESULTS

Nineteen species are reported (Table 2), eight of which have the northern limit of their regular range in tropical and subtropical waters, including the Canary Basin and the Mediterranean Sea. The eight species, listed together with the total number of individuals and the number of stations at which they were caught in parentheses, are *Nansenia oblita* (1/1), *Dolicholagus longirostris* (6/2), *Lampadena urophaos atlantica* (1/1), *Lampanyctus alatus* (3/1), *Taaningichthys bathyphilus* (5/4), *Derichthys serpentinus* (1/1), *Melanonus zugmayeri* (1/1), *Chiasmodon niger* (2/2). Among the remaining, six species extend the northern part of their regular range to the Iberian Basin: *Bathophilus vaillanti* (1/1), *Opisthoproctus soleatus* (3/1), *Hygophum benoiti* (3/2), *Evermannella balbo* (3/3), *Melamphaes suborbitalis* (1/1), *Pseudoscopelus altipinnis* (5/4), while five species occur north to the West European Basin: *Astronesthes niger* (1/1), *Chirostomias pliopterus* (4/2), *Melanostomias bartonbeani* (7/3), *Nemichthys scolopaceus* (8/6), *Nessorhamphus ingolfianus* (1/1). Six of the species have not previously been recorded as far north as the Rockall Trough area: *B. vaillanti*, *H. benoiti*, *L. alatus*, *T. bathyphilus*, *M. suborbitalis*, *P. altipinnis*, whereas the other species have been found casually west of the Rockall Trough, some even at the Wyville–Thompson Ridge, or in Icelandic waters.

Table 1. Stations at which the reported fishes were caught (see Fig. 1). Location 10 was sampled with a bottom trawl, while all the others were sampled with a pelagic trawl.

Location	Coordinates	Date	Gear depth (m)	Vessel	Station no.
1	59°13′ N 10°02′ W	20 April 1998	495–450	R/V *Johan Hjort*	140
2	58°44′ N 8°13′ W	10 April 1995	500–480	R/V *Johan Hjort*	222
3	57°45′ N 10°30′ W	19 March 1973	550	R/V *G.O. Sars*	70
4	57°35′ N 10°58′ W	10 April 1996	485–450	R/V *Johan Hjort*	189
5	56°07′ N 10°01′ W	13 April 1998	480–330	R/V *Johan Hjort*	129
6	55°40′ N 9°50′ W	13 April 1998	420–380	R/V *Johan Hjort*	127
7	54°42′ N 11°29′ W	7 April 1995	470–450	R/V *Johan Hjort*	214
8	53°56′ N 14°18′ W	10 April 1998	380–300	R/V *Johan Hjort*	121
9	51°51′ N 12°01′ W	3 April 1998	560–489	R/V *Johan Hjort*	113
10	51°46′ N 11°22′ W	30 March 1996	219–212	R/V *Johan Hjort*	172
11	51°26′ N 15°21′ W	29 March 1996	765–397	R/V *Johan Hjort*	168
12	51°45′ N 15°43′ W	29 March 1996	435	R/V *Johan Hjort*	169

Table 2. Southern mesopelagic fishes caught in the Rockall Trough primarily in the period 1995–1998 by the Institute of Marine Research, Bergen, and deposited in the Museum of Zoology, University of Bergen. The regular northward limits and previous casual records are also indicated.

Taxa	Individuals recorded (location of capture)	Regular limit of range northwards	Previously recorded casually	References on distribution
STOMIIDAE				
Astronesthes niger Richardson	1 (9)	Southernmost West European Basin	Once near Rockall	9, 11, 30
Bathophilus vaillanti (Zugmayer)	1 (5)	Iberian Basin		10, 12
Chirostomias pliopterus Regan & Trew.	1 (4), 3 (8)	Southernmost West European Basin	Recorded Rockall Plateau and southwest Iceland	10, 12, 20, 28
Melanostomias bartonbeani Parr	1 (8), 1 (9), 5 (11)	West European Basin*	Southeast of Iceland	10, 12, 20, 27, 28
MICROSTOMATIDAE				
Nansenia oblita (Facciolà)	1 (7)	Mediterranean and northwest Africa	Once southwest of Ireland	2, 6
BATHYLAGIDAE				
Dolicholagus longirostris (Maul)	1 (6), 5 (8)	Subtropical waters	Iberian Basin, Rockall Plateau, Iceland	3, 7, 28
OPISTHOPROCTIDAE				
Opisthoproctus soleatus Vaillant	3 (5)	Iberian Basin	Rare in Rockall Trough	4, 22, 25, 28, 29
MYCTOPHIDAE				
Hygophum benoiti (Cocco)	2 (2), 1 (6)	Iberian Basin†		14, 15
Lampadena urophaos atlantica Maul	1 (11)	Madeira	Rockall Plateau	14, 15, 28
Lampanyctus alatus Goode & Bean	3 (11)	Tropical waters	Madeira; off Portugal	14, 15
Taaningichthys bathyphilus (Tåning)	1 (4), 2 (7), 1 (8), 1 (11)	Canary Basin	Madeira; off northern Spain	14, 15
EVERMANNELLIDAE				
Evermannella balbo (Risso)	1 (1), 1 (8), 1 (11)	Iberian Basin	60°N Reykjanes Ridge–Wyville–Thomson Ridge	16, 17, 25
NEMICHTHYIDAE				
Nemichthys scolopaceus Richardson	3 (2), 1 (3), 1 (5), 1 (8), 1 (10), 1 (12)	Westernmost West European Basin; Mid-Atlantic Ridge	Wyville–Thomson Ridge, south Iceland	20, 25, 26, 32
DERICHTHYIDAE				
Derichthys serpentinus Gill	1 (8)	Subtropical waters	West of Faraday Seamounts, northern West European Basin, Rockall Plateau	1, 28, 31, 33
Nessorhamphus ingolfianus Schmidt	1 (8)	West European Basin	Rockall Plateau	1, 28
MELANONIDAE				
Melanonus zugmayeri Norman	1 (8)	Tropical waters	Iberian Basin; Reykjanes Ridge	5, 8, 13, 28
MELAMPHAIDAE				
Melamphaes suborbitalis (Gill)	1 (11)	Iberian Basin	Bay of Biscay	23, 24, 33
CHIASMODONTIDAE				
Chiasmodon niger Johnson	1 (1), 1 (7)	Subtropical waters	Iberian Basin, Bay of Biscay, Rockall Plateau Rockall Trough, Iceland	18, 19, 20, 21, 28
Pseudoscopelus altipinnis Parr	1 (4), 1 (7), 1 (8), 2 (12)	Iberian Basin	Bay of Biscay, possibly Rockall Plateau	18, 28, 33

* From 45°N off Iberian Peninsula to 56°N at 30°W.
† From 44°N off Iberian Peninsula to 50°N at 30°W.
References: 1 – Bauchot & Saldahna (1986); 2 – Cohen (1984a); 3 – Cohen (1984b); 4 – Cohen (1984c); 5 – Cohen (1986); 6 – Cohen (1990a); 7 – Cohen (1990b); 8 – Cohen (1990c); 9 – Gibbs (1984a); 10 – Gibbs (1984b); 11 – Gibbs (1990); 12 – Gibbs & Barnett (1990); 13 – Gordon & al. (1996); 14 – Hulley (1984); 15 – Hulley (1990); 16 – Johnson (1984); 17 – Johnson (1990); 18 – Johnson & Keene (1986); 19 – Johnson & Keene (1990); 20 – Jónsson (1992); 21 – Mauchline & Gordon (1983); 22 – Mauchline & Gordon (1984); 23 – Maul (1986); 24 – Maul (1990); 25 – Minchin & Isaev (1989); 26 – Nielsen (1986); 27 – Petersen (1992); 28 – Post (1988); 29 – Quero (1990); 30 – Rätz (1984); 31 – Smith (1990a); 32 – Smith (1990b); 33 – Swinney & al. (1986).

DISCUSSION

The observations reported here suggest that several fish species have a more northern distribution in the eastern part of the North Atlantic than previously thought. The present occurrence of the reported species north of their range might represent a recent change in their distribution or merely reflect a previous lack of reporting of these fishes of no commercial value.

A warming in the upper 1200 m has occurred in the East Atlantic during the 1990s (Bersch & al. 1999). In the Faroe–Shetland Channel, just north of the Rockall Trough, the period of 1995 onwards shows striking positive temperature and salinity anomalies (Skjoldal & Sætre 2004). Oceanographic conditions in the area are known to have a significant impact on the ecosystem in the nearby areas that are closely monitored (e.g. Reid & al. 2001; Jákupsstovu & Reinert 2002; Skjoldal & Sætre 2004). One would thus expect that the recent warm period in the Rockall Trough would encourage a northward spread of warm water fish species. The critical question is, however, whether our data are good enough to show such a response. The lack of the species reported in this paper from Norwegian blue whiting surveys prior to 1995 (with the exception of one survey in 1973) may well represent a mere lack of attention on mesopelagic species other than blue whiting. Most of the other earlier effort has targeted demersal species (but see Minchin & Isaev 1989). We must, therefore, conclude that the data do not allow distinguishing "range extension" and "sampling artefact" hypotheses that could both explain the observations. The latter hypothesis may be considered as the more parsimonious one and thus favoured.

As global warming is becoming increasingly apparent, poleward range extensions have been reported for a range of taxa from temperate to polar areas (Hughes 2000; Walther & al. 2002; Parmesan & Yohe 2003), yet investigations on climatic changes on fish communities are still few. Murawski (1993) was able to correlate shifts in latitudinal distribution of fishes in the continental shelf area in the western North Atlantic to annual temperature anomalies. Holbrook & al. (1997) have shown how a climate shift towards warmer temperatures resulted in an increased dominance of southern relative to northern reef fish species. Pelagic species, to a much larger extent affected by ecological factors of the open water, should respond more immediately to temperature changes than benthic species, and thus be ideally suited for monitoring responses to global warming. The present fish records suggest that it would be worthwhile to increase attention to the species composition in pelagic catches in order to obtain a more complete picture of the fish diversity in these waters.

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