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Occurrence of Grey Gurnard (*Eutrigla gurnardus*, Linnaeus 1758) in West Greenland Waters

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Abstract

Grey gurnard *Eutrigla gurnardus* L. (Triglidae) normally inhabits the East Atlantic region from Norway and Iceland to Morocco, Madeira, the Mediterranean and Black Sea. In October 2004, a specimen of *E. gurnardus* was captured during a groundfish survey in waters to the east of Greenland. In October 2009, a specimen was caught during a groundfish survey of West Greenland waters. This is thought to be the first specimen ever reported so far west, indicating an extension of the distributional area from the North East towards the North West Atlantic. Changes in hydrographical conditions, particularly a rise in bottom temperatures around Greenland, is suggested to have allowed the distributional shift from Icelandic habitats westward.

Keywords: *Eutrigla gurnardus*, grey gurnard, Triglidae, Greenland, species diversity, distribution extension, climate change, Irminger Current

Introduction

Groundfish bottom trawl surveys carried out by research or commercial vessels have been undertaken primarily to obtain information on the relative abundance, spatial distribution and biological parameters of fish stocks. Research vessel surveys also allow environmental parameters to be collected at individual fishing stations. Historically, this was achieved by Nansen bottles although in recent times the standard methods often rely on electronic equipment. With this information, there is the potential to correlate distribution patterns of fish species with thermal trends in the ocean. Long-term time series of biological and environmental data thus enable us to analyze whether shifts of distribution ranges of marine species might be related to warming or cooling of ocean regions.

The present paper considers how the grey gurnard (*Eutrigla gurnardus*) could have spread to the waters off East and West Greenland.

Material and Methods

Since 1982, the demersal fish assemblages off West and East Greenland (NAFO Subarea 1 and ICES Subarea XIV) have been monitored annually by German groundfish surveys that were originally designed for the assessment of cod (Rätz, 1996). Autumn was chosen for the time of the surveys, due to favourable weather and ice conditions during that season and to avoid spawning aggregations. A standardized 140-feet bottom trawl (22 m horizontal net opening) was used as fishing gear (Rätz, 1996). The net frame was rigged with heavy ground gear to enable fishing performance on the rough sea beds of the area, especially off East Greenland. A small mesh liner (10 mm) was used inside the codend. The horizontal distance between wing ends was 25 m at 300 m depth, the vertical net opening was 4 m. The towing time was normally 30 min at a speed of 4.5 knots over the ground.

Vertical profiles of temperature and salinity were obtained at each fishing station by using a Seabird 911+ CTD, equipped with rosette water sampler.

Results and Discussion

Surveys and occurrence of grey gurnard

From 1982–2009 a total of 3654 stations were fished by German fishery research vessels in Greenland waters (since 1994 FRV *Walther Herwig III* and within the cod and redfish survey areas (Rätz, 1996). According to the data base, 138 fish species (no commercial shellfish and cephalopods included) have so far been recorded, with

one of the most recent species being *E. gurnardus.* Only two specimens were retrieved from the catches, the first in 2004 from East Greenland waters, and a second one in West Greenland waters in 2009. Station details are given in Table 1.

The survey area is characterised mainly by rough and rocky ground along the narrow Greenland shelf. All trawl stations undertaken in 2004 and 2009 are shown in Fig. 1. Trawling depths of the entire time series ranged from 14–950 metres. The two specimens were caught at depths of 148 (2004) and 111 metres (2009), which is within the described 10 to 150 metres depth range (*e.g.* Muus and Nielsen, 1999). The specimens from Greenland waters were both adult (approx. 33 cm total length and a wet weight of 0.3 kg). It is most likely that these two fish originated from the population occurring on the Icelandic continental shelf, as grey gurnard is known to occur here (Jonsson, 1992).

Grey gurnard is generally a bottom species and therefore targeted by the survey gear. It matures at about three years of age depending on sex (males at 3 years and 18 cm, females at 4 years and 24 cm, *e.g.* Bauchot, 1987) and inhabits coastal areas from the Black Sea, Mediterranean, Western Africa and Madeira to Northern Norway and Southern Iceland (*e.g.* Pethon, 2005).

The eggs and larvae are pelagic, and the planktonic stages may range up to 27 mm in length (Russell, 1976). These stages may drift with the prevailing currents.

The occurrence of grey gurnard in Greenland waters may relate to occasional vagrancy of adult fish, which may be due to changing distributional limits due to warming of the water masses around Greenland.

The 2009 specimen seems to be the most westerly record for the species in the North Atlantic, and none of the available reference books indicate occurrences beyond Icelandic waters (*e.g.* Duncker and Ladiges 1960, Hureau 1986, Jonsson 1992, Pethon 2005, Ryland 1990, Wheeler 1969 and 1978). Grey gurnard is mainly distributed off the south coast and to some degree off the west coast of Iceland, but rarely seen off the north coast (Palsson, pers. comm.). Our specimen was catalogued by R. Thiel, University of Hamburg, Biocenter Grindel und Zoological Museum, Section Ichthyology, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany, catalogue no. ZMH 25674.

Changes in distribution patterns are actually a common observation due to changes in environmental conditions (*e.g.* Neumann *et al*., 2008; Gunnarsson *et al*., 2007). Even fish from the Southern Hemisphere may occur unexpectedly in Greenland Waters, as shown by the recent

Table 1. Station parameters of hauls where *Eutrigla gurnardus* was found in Greenland waters. (OTB-BT140 stands for Otter Trawl Board, 140 foot net).

FRV *Walther Herwig* Cruise No.	327	268
Survey Type	Cod/Redfish	Cod/Redfish
Total No. Hauls	67	118
Date	27.10.2009	21.10.2004
Station No.	1193	1296
Shooting Position	60° 12' 10" N 046° 30' 59" W	61° 16' 30" N 041° 41' 17" W
Shooting Time	19.43	10.08
Hauling Position	60° 12' 24" N 046° 34' 58" W	61° 18’ 15" N 041° 40' 41" W
Hauling Time	20.11	10.38
Mean Depth (m)	111	148
Gear	OTB-BT140	OTB-BT140
Tickler Chains	0	0
Speed Over Ground (kn)	4.3	3.8
Sea Surface Temperature (°C)	1.921	1.452
Bottom Temperature (°C)	4.223	5.972
O_2 Saturation Bottom	94.66	–
Turbidity Bottom	0.12	–

report of *Allocyttus verrucosus* (Oreosomatidae) caught on 22.09.2008 by MS *Baldwin* between positions 62°08' N, 40°37' W (shot) and 62°26' N, 40°23' W (haul) from depths between 850 and 1085 m (Kloppmann and Thiel in prep.).

Hydrography in Greenland Waters

General oceanography of the area

Greenland waters are influenced by two ocean currents - the cold East Greenland Current and the warm Irminger Current (Fig. 1). Both currents are part of the North Atlantic Subpolar Gyre (Stein, 2005). The East Greenland Current originates from the Greenland Sea, and flows southward along the East Greenland shelf carrying with it polar waters. This Current rounds Cape Farewell, the southern tip of Greenland, and flows northward along the west coast of Greenland. Parallel to the East Greenland Current, the Irminger Current (a western branch of the Gulf Stream system) flows southward off East Greenland and then turns northwards after rounding Cape Farewell. As this latter current flows northward

Fig. 1. Schematic of surface currents around Greenland. Solid: warm Irminger Current; dashed: cold East Greenland Current/ Baffin Island Current (off Canada). Positions of *Eutrigla gurnardus* catches are given by circle (2004), and by square (2009). Depth contours: 200 m, 1000 m, 1500 m, 2000 m, 3000 m. Small dots: CTD/fishery positions 2004 and 2009.

Fig. 2. Specimen of *Eutrigla gurnardus* on measuring board with 0.5cm gradations (Length: 33.5 cm, weight 291 g) caught on October 27, 2009, at station no.1193 in West Greenland waters by German FRV *Walther Herwig III* (for station details compare Table 1).

along the slope, its warm, saline waters mix with the colder, fresher sub-arctic water masses in the Labrador Sea and on the Greenland Shelf, and upon reaching Davis Strait with waters coming south from Baffin Bay. On the West Greenland Shelf and banks, the near bottom waters become warmer when moving from south to north, due to an increasing influence of the warm Irminger Water. With the warming climate during the 1920s, the influence of this warm water increased at the expense of the colder water originating from East Greenland (Stein, 2007). Cold and low saline events were observed during the early-1970s, 1980s and 1990s. Observations of the sea surface temperature anomalies in the North Atlantic Subpolar Gyre indicate cold conditions in the 1980s and warming from the mid-1990s onwards, with maximum temperatures observed during October 2003. This is consistent with air temperatures at Nuuk, Greenland, which document that 2003 was the warmest year since 1950 (Stein, 2007).

Ocean temperatures off West Greenland show a significant upward trend (0.096°C y^{-1} in 0–300 m layer during 1983–2004), which is considerably higher than that for the North Atlantic Basin over the period 1955–2003. Long-term (1964–2004) observations from Fyllas Bank off West Greenland also reveal warm conditions during the 1960s, although the highest temperatures on record are from the recent years of the present century. Geostrophic transports estimated from autumn 2004 hydrographic data suggest increased northward transport of warm water with the West Greenland Current. Ocean properties at this time were more saline and up to 2°C warmer than normal (Stein, 2005).

Oceanographic conditions during 2004 and 2009

During autumn 2004, one *E. gurnardus* was caught on the East Greenland shelf at 148 m (Table 1). Due to its lower density, the cold and less saline East Greenland

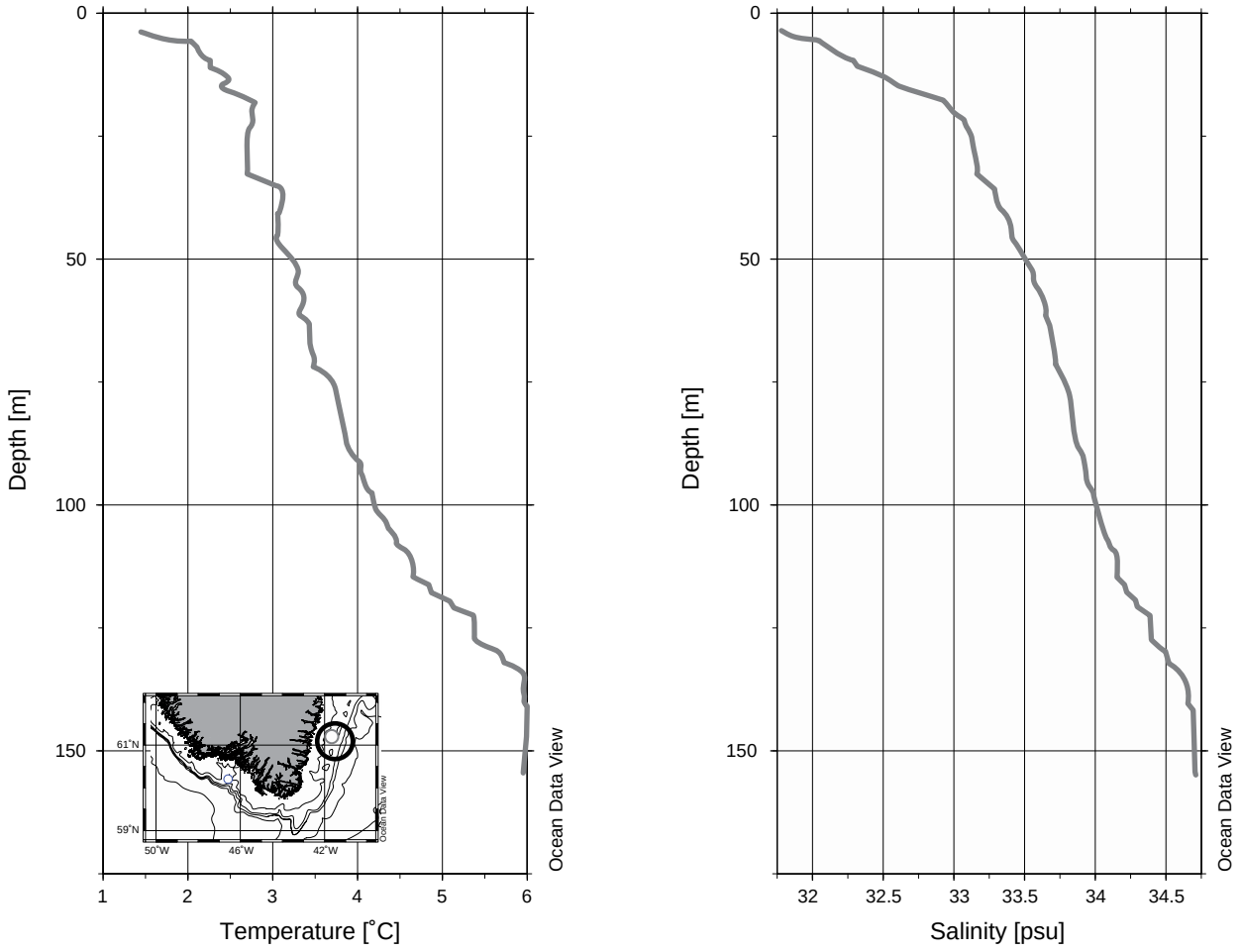

Fig. 3a. Vertical profiles of temperature [°C] and salinity [psu]; left: station 1296 (2004) East Greenland.

Current is bound to the near-surface waters (Fig. 3a). Below this, the warmer Irminger Current is the main water mass. At depths greater than 130 m, the vertical profile revealed a more homogenous warmer, saline bottom water layer with temperatures/salinities ranging from 5.95°C/34.608 psu (at 135 m depth) to 5.97°C/34.703 psu (at 155 m depth).

During autumn 2009, another specimen of *E. gurnardus* was found on the West Greenland shelf at a depth of 111 m (Table 1). Similar to the TS-profiles obtained during 2004, the 2009 observations (Fig. 3b) indicated cold, diluted water masses at the sea surface layer. At depth, the increased influence of the Irminger Current waters on the water mass structure is evident with the temperature/salinity changing from 3.42°C/33.748 psu (at 89 m depth) to 4.22°C/34.127 psu (at about 97 m depth). These environmental conditions are within the broad ranges experienced by grey gurnard in East Atlantic waters.

Conclusion

We assume that the recent increase in sea water temperatures in Greenland waters has allowed the necessary conditions for an extension in the overall distribution range of *E. gurnardus*. It is unclear as to whether the occurrence of these specimens is from movements of adult fish or from planktonic stages being transported from Iceland towards Greenland in the Irminger Current. However, two further specimens of that species were caught during the next survey of FRV *Walther Herwig III* along the west Greenland coastal waters even further north in November 2010 (H. Fock, pers com. 2011).

The deep and cold waters of the Labrador Sea and Davis Strait between Greenland and America seem to form a natural barrier against further westward range extension of the grey gurnard. Its occurrence in Greenland waters may be only a temporal development, as seen in haddock,

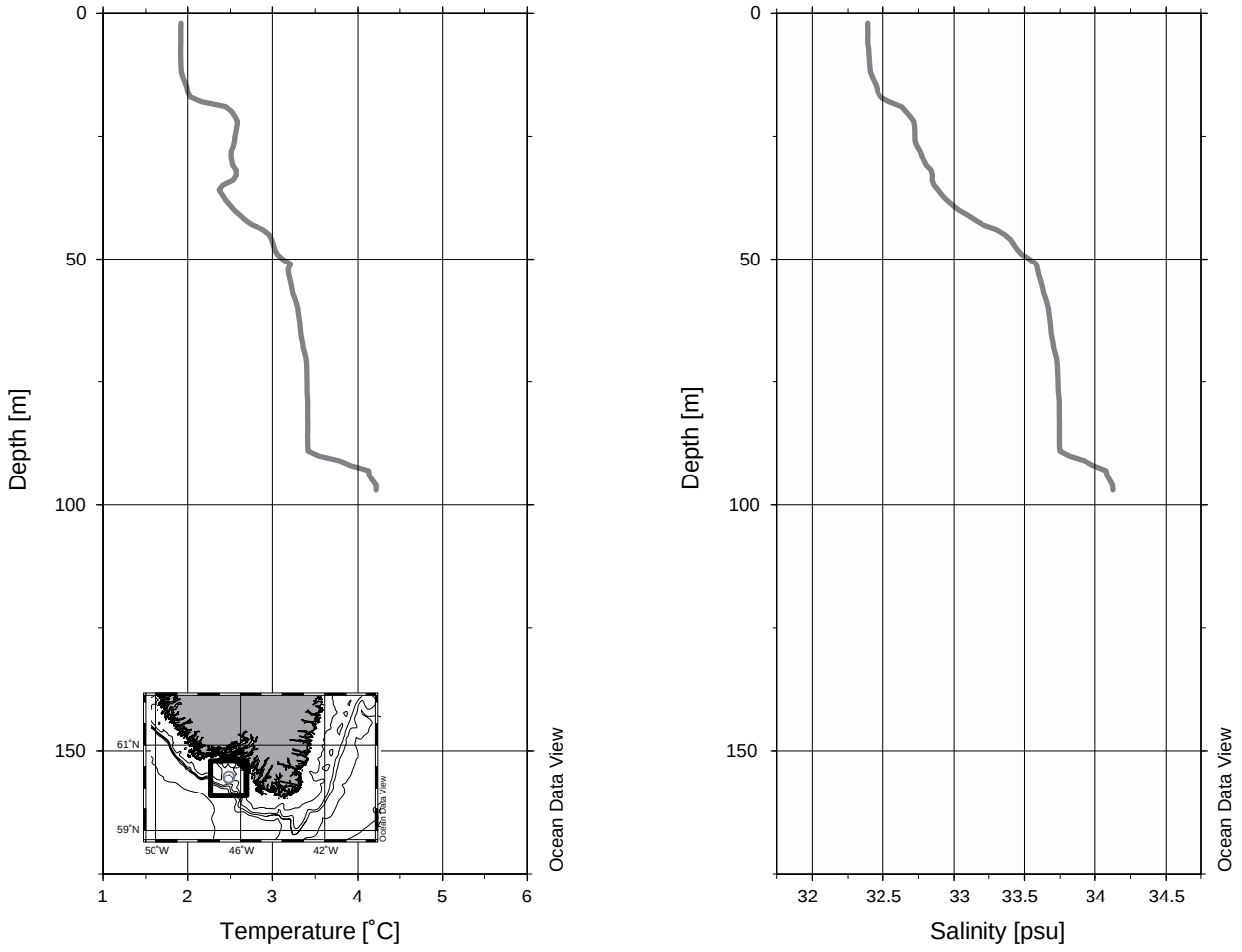

Fig. 3b. Vertical profiles of temperature [°C] and salinity [psu]; right: station 1193 (2009) West Greenland.

which may be transported by the "Iceland-Greenland-System" (Stein and Borovkov, 2004) and similar to cod, depending on favourable temperature regimes as well (Hovgård and Messtorff, 1987).

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References

BAUCHOT, M.-L. 1987 Poissons osseux. p. 891–1421. *In*: Fiches FAO d'identification pour les besoins de la pêche. (rev. 1). W. Fischer, M.L. Bauchot and M. Schneider (eds.) Méditerranée et mer Noire. Zone de pêche 37. Vol. II. Commission des Communautés Européennes and FAO, Rome.

DUNCKER, G. and W. LADIGES, 1960. Die Fische der Nordmark. Kommissionsverlag Cram, de Gruyter u. Co. Hamburg.

GUNNARSSON, Þ., H. ÁSGEIRSSON and A. INGÓLFSSON. 2007. The rapid colonization of *Crangon crangon* (Linnaeus, 1758) to Icelandic coastal waters. *Crustaceana*, **80**: 747–753.

HOVGÅRD, H., and J. MESSTORFF, MS 1987. Is the West Greenland cod mainly recruited from Icelandic waters? An analysis based on the use of juvenile haddock as an indicator of larval drift. *NAFO SCR Doc*., No. 31, Serial No. N1315, 18 p.

HUREAU, J.-C. 1986 Triglidae. p. 1230–1238. *In*: Fishes of the North-eastern Atlantic and the Mediterranean. P. J. P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese (eds.) UNESCO, Paris. Vol. 3.

JONSSON, G. 1992. Islenskir fiskar. Fiolvi, Reykjavik, 568 p.

MUUS, B.J. and J.G. NIELSEN, 1999. Die Meeresfische Europas in Nordsee, Ostsee und Atlantik. Franckh-Kosmos Verlag GmbH & Co., Stuttgart.

NEUMANN H., S. EHRICH and I. KRÖNCKE. 2008. Effects of cold winters and climate on the temporal variability of an epibenthic community in the German Bight. *Clim Res*, **37**: 241–251.

PETHON, P. 2005. Aschehougs store Fiskebok. ISBN 9788203232477 Aschehoug, Oslo.

RÄTZ, H.-J. 1996. Efficiency of Geographical and Depth Stratification in Error Reduction of Groundfish Survey Results: Case Study Atlantic Cod off Greenland. *NAFO Sci. Coun. Studies*, **28**: 65–71.

RUSSELL, F.S. 1976. The eggs and planktonic stages of British marine fishes. Academic press, London - New York - San Francisco. 524 p.

RYLAND, J.S. 1990. Cephalochordata and Euchordata. *In*: The Marine Fauna of the British Isles and North-West Europe. Hayward, P.J., Ryland, J.S., eds.: Vol. 2, Clarendon Press, Oxford.

STEIN, M. 2005. North Atlantic subpolar gyre warming – impacts on Greenland offshore waters. *J. Northw. Atl. Fish. Sci.*, **36**: 43–54. doi: 10.2960/J.v36.m568

2007. Warming periods off Greenland during 1800–2005: their potential influence on the abundance of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) in Greenlandic waters. *J. Northw. Atl. Fish. Sci.*, **39:** 1–20. doi:10.2960/J.v39.m580.

STEIN, M., and V. A. BOROVKOV. 2004. Greenland cod (*Gadus morhua*): modeling recruitment variation during the second half of the 20th century. *Fish. Oceanogr.*, **13(2)**: 111–120. doi:10.1046/j.1365-2419.2003.00280.x

WHEELER, A., 1969. The Fishes of the British Isles and North-West Europe. Macmillan, London.

WHEELER, A., 1978. Key to the Fishes of Northern Europe. A guide to the identification of more than 350 Species. Frederick Warne (Publishers) Ltd, London.