

# Studies on fjord populations of grenadiers

## Two projects on grenadier in Masfjord

Grenadiers (family Macrouridae) are a species typically found ranging from the upper continental slope to the abyssal plains (~200-700 m). The life-history characteristics of grenadiers are not conducive to intense exploitation, either in targeted fisheries or as bycatch. One of those that has been commercially fished on both sides of the Atlantic is *Coryphaenoides rupestris*, or roundnose grenadier (skolest). Roundnose grenadier have life-history characteristics typical of deep-sea species: long-lived (max. age 60 years), late maturing (13-16 years), slow growing, low fecundity (Devine et al. 2012), and long recovery times to exploitation (under no fishing, 14-80 years; Baker et al. 2009). Although this species has not yet been assessed for the International World Conservation Union (IUCN) Red List, it is a clear candidate for the list. In the Northwest Atlantic, exploitation of this species has resulted in its listing in 2008 as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC, 2008).



Masfjorden

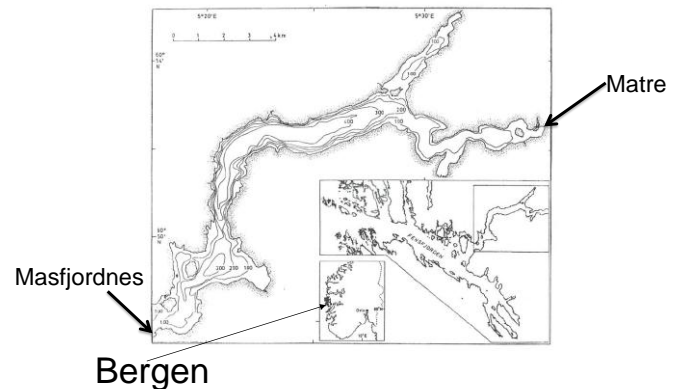
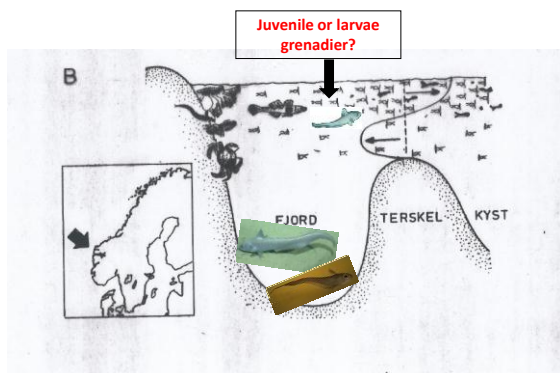


Fig. 1. Wind from north in «Masfjorden»: flush out small pelagic zooplankton and fish larvae



A small population of grenadier, *Coryphaenoides rupestris*, exists in Masfjord, which has a maximum of depth of approximately 500 m and is separated from Fensfjorden (and subsequently the open ocean) by a shallow sill at 75 m depth. It is not known how much of an exchange occurs between fjordal and oceanic roundnose grenadier populations, or if any exchange (mixing) occurs. If there is a connection between the fjord and coastal populations, it is most likely that this occurs by early life stages (egg or larvae stage) entering the upper pelagic water masses, which are in

contact with coastal waters (see. Fig. 1). Individuals originating from the fjord are then transported to coastal areas by the water masses, and later settle in deep coastal waters or *vice versa*. No study has yet addressed fjord-coast connections for roundnose grenadier. Some work on its population genetics structure in the North Atlantic shows populations in the Northwest are different from those in the Northeast (Knutson et al. 2012), while otolith microchemistry and shape analysis show there are even finer spatial scale differences in the Northeast Atlantic populations (e.g., Skagerrak populations were different from Mid Atlantic Ridge populations; Longmore et al. 2010).

One Master's project will **determine the population structure of grenadier in Masfjord**. The project will investigate whether the population is a local population, living entirely within the fjord, or if the fjord is a juvenile/nursery area. The project will involve collecting samples in Masfjord for genetic analysis. Some data has been collected during sampling in BIO 310 and other research cruises, and these data will be available to the student. The project will also investigate population dynamics, such as growth or maturation (if possible). Field work is a component of this project.

Another Master's project will **investigate the vertical migratory behavior of grenadier in Masfjord**. Grenadier are often found high in the water column, leading to questions about whether they follow diurnally migrating mesopelagic organisms (e.g., pearlside, myctophids, krill). This project will use acoustic and stomach content data collected during sampling in BIO310 to investigate the diel behavior and diet of grenadiers. Field work is a component of this project.

Both projects will require collaborating with the Institute of Marine Research. Students will be given priority to attend the BIO310 courses on G.O. Sars to Masfjorden in October so they can collect additional materials for their own research project. The projects are open to Master students in **Marine biology, Biodiversity, Evolution and ecology, and Fisheries biology and management**.

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Left: the research ship G.O. Sars; right: a sunny October day on the field course in Masfjorden.

## References

- Baker K, Devine J, Haedrich R (2009) Deep-sea fishes in Canada's Atlantic: population declines and predicted recovery times. *Environ Biol Fish* 85:79-88
- COSEWIC. 2008. COSEWIC assessment and status report on the Roundnose Grenadier *Coryphaenoides rupestris* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42 pp. ([www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm)).
- Devine JA, Watling L, Cailliet G, Drazen J, Durán Muñoz P, Orlov AM, Bezaury J (2012) Evaluation of potential sustainability of deep-sea fisheries for grenadiers (Macrouridae). *J Ichthyol* 52:709-721.
- Knutsen H, Jorde PE, Bergstad OA, Skogen M (2012) Population genetic structure in a deepwater fish *Coryphaenoides rupestris*: patterns and processes. *Marine Ecology Progress Series* 460:233-246.
- Longmore C, Fogarty K, Neat F, Brophy D, Trueman C, Milton A, Mariani S (2010) A comparison of otolith microchemistry and otolith shape analysis for the study of spatial variation in a deep-sea teleost, *Coryphaenoides rupestris*. *Environmental Biology of Fishes* 89:591-605.

