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BROAD-SCALE INVERTEBRATE TUBE COVERAGE ON THE SEABED: IMPLICATIONS FOR SEDIMENT PROPERTIES, ANIMAL-SEDIMENT INTERACTIONS, HABITAT CHARACTERISTICS AND HABITAT MAPPING ON GEORGES BANK

Joseph Vitaliano[1], Robert Reid[1], David Packer[1], Vincent Guida[1], Thomas Noji[1], Steven Fromm[1], Jason Link[2], and Frank Almeida[2]

NOAA, NMFS,NEFSC, [1]Highlands, NJ 07732. [2]Woods Hole MA 02543.

Introduction

Benthic habitats provide spawning, nursery, refuge, and foraging grounds for living marine resources. Sediment features including sediment grain size, bedform structure, and biogenic structure are important for the survival of demersal fish populations especially juveniles. Ecosystem-based fisheries management requires fisheries managers to map benthic habitat features and to quantify the usage of these habitats by demersal resource species.

Observations in the Closed Areas on Georges Bank

Beginning in 1999, NOAA Fisheries, Northeast Fisheries Science Center conducted a series of habitat cruises to collect biotic and sedimentary data in and immediately adjacent to areas closed to fishing on Georges Bank (Fig. 1). During the June 1999 cruise, we found vast areas of the seabed, both inside and outside Closed Area II to have high percent cover of emergent invertebrate tubes overlying flat sand (Photo 1). Based on video and still photo data, it was estimated that the area of the seabed covered by these tubes exceeded 3,000 km^2 (Fig. 2). The tubes were likely built by the tubicolous amphipod, *Ericthonius rubricornis* (Fig. 3), which was the dominant species present in grab samples from this area. Average densities ranged up to 2,000 individuals/ 0.1 m^2 (Fig. 4). Sediment TOC (Fig. 5) was generally higher in the deeper areas of Closed Area II. When we returned to Georges Bank in June 2000, the percent cover of emergent tubes was greatly reduced (Fig. 6) and the seabed was mostly flat sand (Photo 2). Comparable grab data was not available for the June 2000 cruise. It could not be determined from our data if the reduction in tube coverage on the seabed was due to storms, the limited scallop fishery in July and August 1999, and/or natural variability in population numbers of this tubicolous amphipod.

Historical Data from Georges Bank

It is difficult to determine if the large populations of *E. rubricornis* and the broadscale tube forests they built have occurred on Georges Bank in the past. Historical data (Dickinson & Wigley, 1981; Maciolek-Blake et al., 1984) indicate substantial numbers of *E. rubricornis* at stations on Georges Bank near the present Closed Area II. The Ocean Pulse program (1978-1984, bi-annual sampling protocol) (NMFS, unpubl. data) found comparable densities of *E. rubricornis* to our survey at one station near the present Closed Area II during only one sampling time. Comparisons between our data and historical data were problematical because of differences in methodology and spatial sampling resolution. Also, historic surveys took place during times of heavy trawling on Georges Bank.

Implications of invertebrate tube fields on benthic habitats

Invertebrates and the tubes they construct can change the physical and chemical properties of the sediments. Depending on density and degree of emergence, tubes have been shown to influence sediment stability and near bed flow. Further, they impinge particles from the benthic boundary layer and enhance transport across the sediment-water interface (Noji and Noji, 1991 and references therein). Further studies will be needed on GB to determine if the dense tube fields affect the flux of organic matter to the sediments (Fig. 5) and to what extent this organic matter is incorporated into the food web that supports fisheries.

Recent evidence indicates that emergent invertebrate tubes provide shelter from predators especially for juvenile fish (Auster et al., 1997; Diaz et al., 2003). The invertebrates living within the tubes and other biota living among the tubes are also important to fisheries since they are directly or indirectly part of the food network that supports demersal species. *Ericthonius rubricornis* is preyed on by a number of resource species on Georges Bank (NEFSC Food Habits Database).

The persistence of invertebrate tube fields in time and space will be dependent on many ecosystem variables including currents and storms, the population dynamics of tube building invertebrates, and the effects of fishing. Therefore, it will be challenging to quantify the effects of tube fields on fisheries and to map these habitat features. For example, is there a "boom and bust" cycle in the population numbers of *E. rubricornis* on Georges Bank? How will the temporal – spatial variability in tube coverage match or mismatch the life cycle stages of demersal fishes that utilize these tubes?

Station 8E
CAII June 1999

Photo 1

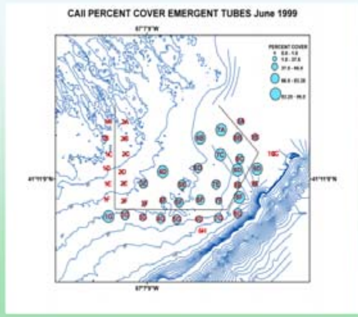

Fig. 2

Station 8E
CAII June 2000

Photo 2

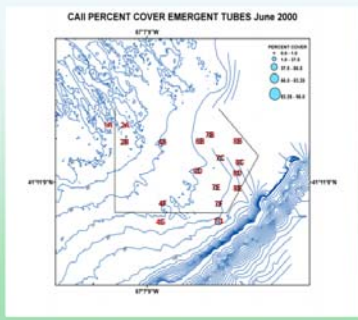

Fig. 6

Georges Bank Closed Areas

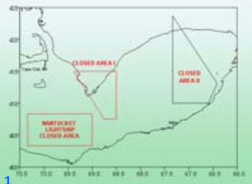

Fig. 1

Ericthonius rubricornis

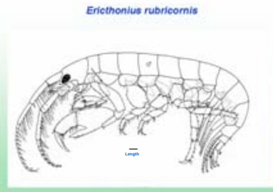

Fig. 3

CA II June 1999

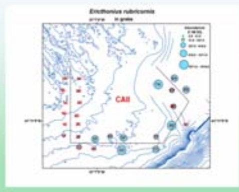

Fig. 4

CAII June 1999

Fig. 5

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