Naked goby

Gobiosoma bosc

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DESCRIPTION

Taxonomy and Basic Description

The naked goby was described by Lacepède in 1800 and given the name *Gobius bosc*. The genus was changed to *Gobiosoma*, and *Gobiosoma bosc* is the current scientific name. There are 9 to 10 broad, dark, vertical bars on the body, separated by narrow lighter interspaces (Dawson 1969). The common name reflects the lack of scales on the body. Dorsal fins are separate and pectoral fins are united to form a disk. Modal counts of fin elements are: dorsal spines (7), dorsal rays (13), anal rays (11), and pectoral rays (18).

Gobies represent the largest family of marine fishes, with more than 1,500 species worldwide (Murdy 2002). Like most gobies, naked gobies are small, less than 60 mm (2.5 inches) in total length, secretive, bottom-dwelling fish that depend on structures, both non-living (burrow or sunken log) or living (oyster reef), for habitat.

Status

Given its small size, the naked goby is not of economic importance; however, it is of ecological importance. Although it is not a species of concern at the state or federal level, it has the potential to serve as an indicator species of estuarine health, in particular, the health of oyster reef habitat.

The naked goby is an estuarine-dependent species that is numerically dominant in oyster reef habitats and likely has an integral role in the estuarine food web. Only recently have oyster reefs been formally recognized as essential habitat for finfish and crustacean species of ecological and economic importance and given the designation of Essential Fish Habitat (Coen et al. 1999a). The naked goby is considered an estuarine-resident species (McGovern 1986; Jackson 1990; Hoffman 1991) and, more specifically, a resident species of oyster reefs in tidepools and subtidal areas (Crabtree and Dean 1982; Coen et al. 1999a; Lehnert and Allen 2002).

In the Chesapeake Bay, larval naked gobies are the most abundant species in ichthyoplankton studies conducted in lower salinity areas (Dovel 1971; Breitburg 1999), and, owing to their abundance, they may consume a significant portion of copepod production in tributaries of the Chesapeake Bay (Breitburg 1999). Larval naked gobies are prey for pelagic predators like striped bass, bluefish and weakfish that are associated with oyster reef habitat (Markle and Grant 1970; Harding and Mann 1999; Breitburg 1999).

POPULATION DISTRIBUTION AND SIZE

The naked goby occurs along the Atlantic coast from Massachusetts to Florida, except for extreme south Florida (Robins et al. 1986). It also occurs in coastal areas from Florida through Campeche (Mexico) in the Gulf of Mexico (Murdy 2002). All life stages (egg through adult) are very common in estuarine waters throughout the South Carolina.

No estimate of population size is available. Density estimates of naked gobies in oyster habitat are available, but area estimates of their preferred habitats, intertidal oyster habitat with tidepools and subtidal oyster habitat, need to be made in South Carolina before population size can be estimated.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The naked goby occurs in a variety of generally shallow estuarine habitats like patches of oysters, oyster reef, saltmarsh and bare sand/mud substrate, but it is most abundant in tidepools and subtidal areas with oyster shell (Dahlberg and Conyers 1973; Crabtree and Dean 1982; Breitburg 1999; Harding and Mann 2000; Lehnert and Allen 2002; Coen 2002). In the study by Lehnert and Allen (2002) in North Inlet estuary near Georgetown, South Carolina, general trends were that: 1) numbers of fishes of all species were higher in trays of oyster shell placed in subtidal areas vs. intertidal areas, and 2) numbers of fishes were higher in shell-filled trays vs. trays with sand/mud substrate and empty trays. In the Charleston Harbor, South Carolina, estuary, Coen (2002) found that the mean density of naked gobies was significantly greater on oyster reef vs. marsh and mud substrates.

Density estimates of juveniles and adults are available from four sources. The mean density of naked goby juveniles and adults in lift nets with oyster shells and clumps in two tidepools along the North Edisto River (Charleston County, South Carolina) ranged from 8 to 25 individuals per 1 square meter (2.3 individuals per square feet) during June through October (Crabtree and Dean 1982). While investigating long-term oyster recruitment and predators and parasites of this bivalve, Giotta (1999) found much higher densities of naked gobies. Using shell-filled trays placed in subtidal areas of Inlet Creek behind Sullivans Island in Charleston County, South Carolina, Giotta found 18 to 20 individuals per 0.42 square meter (0.04 individuals per square fott) for seven months, from mid-June through mid-January.

Lower densities have been reported from intertidal oyster habitat without tidepools. Coen (2002) reported mean densities of 4 and 9 individuals per 1 square meter (0.4 and 0.8 individuals per square foot) during September and May, respectively, on natural oyster reefs in intertidal areas of

Inlet Creek. During sampling in Jamy, July and October, Wenner et al. (1996) found an overall density of 1 goby per square meter (0.09 individuals per square foot) on natural and artificial oyster reefs in intertidal areas of Inlet Creek and Tolers Cove in Charleston County, South Carolina. These studies show that intertidal oyster habitats without persistent pools of seawater at low tide are utilized less frequently by the naked goby.

Oyster habitat provides a site for the naked goby to feed and reproduce, and offers protection from predators (Dahlberg and Conyers 1973; Crabtree and Middaugh 1982). Adhesive eggs are most commonly laid inside hinged shells of clean dead oysters in tidepools and subtidal areas (Dahlberg and Conyers 1973; Crabtree and Middaugh 1982). The oyster shells chosen by the naked goby have a narrow gape so as to prevent predation on eggs (Crabtree and Middaugh 1982); shell gape is just large enough to allow entry of the fish (Dahlberg and Conyers 1973). In subtidal areas, all nests remain submerged during low spring tides and nests seem to be located where tidal current restricts siltation and stagnation at low tide (Dahlberg and Conyers 1973). In addition, late-stage larvae utilize the down-current side of high relief structure within oyster reefs, where reduced current velocity allows larvae to maintain their general position during high-flow portions of the tidal cycle (Breitburg et al. 1995).

The naked goby occurs over a wide range of salinities, from 0 to 45 parts per thousand (ppt), in estuaries along the Gulf of Mexico (Dawson 1969). In South Carolina, the salinity at capture locations in estuaries near North Santee River ranged from 0.2 to 31.9 ppt (McGovern 1986); North Inlet estuary ranged from 11 to 35 ppt (Lehnert and Allen 2002) and Charleston Harbor estuary ranged from 0.8 to 36.2 ppt with an average of 18.1 ppt (Roumillat unpubl. data[1]). High abundances of juvenile and adult naked gobies have been noted in subtidal oyster reef habitat in mesohaline (5 to 18 ppt) and polyhaline (18 to 30 ppt) areas of North Inlet estuary (Lehnert and Allen 2002) and Charleston Harbor estuary (Roumillat unpubl. data[1]). Studies in the Chesapeake Bay have shown that larval naked gobies are most abundant in oligohaline waters (less than 5 ppt) (Massman et al. 1963; Shenker et al. 1983), the result of upriver transport in the salt wedge (Shenker et al. 1983). A similar distribution pattern for larvae was not noted in the Charleston Harbor estuary (Jackson 1990).

CHALLENGES

Naked goby population size is very likely linked to the quantity and quality of their preferred habitat, oyster reef in tidepools and subtidal areas. This fish utilizes these reefs for its entire life cycle and requires specific physical structure within the reef, hinged shells of clean dead oysters with a narrow gape, to ensure successful reproduction. Harvesting oysters reduces the vertical relief of reefs and removes the shells of dead oysters, thereby reducing the quantity and quality of habitat for reef-associated invertebrates and fishes. Breitburg et al. (2000) argue that harvest and conservation goals are compatible and that the same strategies will result in: 1) a sustainable harvest of the oyster resource, 2) increased filtration of estuarine waters, and 3) increased provision of structured habitat for invertebrates and fishes that utilize oyster reefs directly or indirectly.

CONSERVATION ACCOMPLISHMENTS

Two related efforts at South Carolina Department of Natural Resources (SCDNR) in the past 10 years have sought to restore oyster habitat. In 1994, researchers in the Shellfish Research section at SCDNR (Coen et al. 1999a,b; Luckenbach et al. 2005) began to conduct research on evaluating the functioning of oyster reefs and related restoration approaches. One outcome of this early research was the establishment of a community-based Oyster Habitat Restoration and Enhancement project in 2000. This project is a cooperative effort involving SCDNR and local and state partners. Project partners include:

- Charleston Math and Science Hub
- The South Carolina Aquarium
- The South Carolina Coastal Conservation League
- SCDNR - Coastal Education Office
- SCDNR - MRRI - Shellfish Research Section
- SCDNR - OFM-Shellfish Management Section
- South Carolina Sea Grant Consortium
- University of South Carolina - Baruch Laboratory
- University of South Carolina - Pritchard's Island

To generate the shell necessary for oyster habitat construction, a shell recycling program was initiated through the establishment of land-based drop-off points in the coastal counties of South Carolina (SCDNR 2005). Shell recycling is also critical to maintaining the state's existing oyster habitat. Returning shell to areas of oyster habitat functions to maintain the amount of hard substrate available to oyster larvae at the time of settlement.

CONSERVATION RECOMMENDATIONS

- Determine population size and status of the naked goby.
- Inventory quantity and quality of naked goby key habitat, oyster reefs.
- Determine water quality requirements of the naked goby for all life history stages.
- Investigate aspects of the reproductive biology of the naked goby, including size/age at maturity, spawning season and annual fecundity.
- Determine the effect of oyster harvesting on the abundance and diversity of reef-associated invertebrates and fishes.
- Continue the Oyster Habitat Restoration and Enhancement project based at the Marine Resources Division of SCDNR. Restoration of damaged oyster habitat and creation of new habitat has the potential to reduce shoreline erosion, improve water quality and increase the abundance of invertebrates and fishes that utilize oyster habitat for refuge, feeding and spawning.
- Develop an oyster management plan (see Theiling 2001 for current SC laws)
- Protect water quality by encouraging communities to use Best Management Practices (BMPs).

MEASURES OF SUCCESS

The measurement of success is the continued abundance of this ecologically important species. Additionally, by monitoring abundance trends in this species, SCDNR will be better able to assess habitat quality for several marine species.

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