Atlantic Mud Crab
Panopeus herbstii (H. Milne Edwards 1834)

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DESCRIPTION

Taxonomy and Basic Description

The Atlantic mud crab or black-fingered mud crab, Panopeus herbstii (H. Milne Edwards 1834), belongs to the super family Xanthidae (family Panopeidae) and is the largest of mud crab species, with the exception of the stone crab, Menippe mercenaria (Ruppert and Fox 1988). Panopeus herbstii is a true crab, growing to a maximum carapace width of 6.4 cm (Ruppert and Fox 1988) and is distinguished from other mud crab species by its robust black or dark brown fingers (top and bottom portion of the claw) that fade into a pale white along the interior portion of the base of the claw. The outsides of the claws are often mottled. The claws themselves are dissimilar in size, with the larger one having a curved upper finger and an enlarged white tooth at the base and the smaller one exhibiting a nearly straight lower finger (Williams 1984). The brownish green, slightly granular carapace of P. herbstii is approximately \( \frac{2}{3} \) as long as it is wide and has five teeth on the anterolateral margins of which the first two are mostly fused (Williams 1984). Ryan (1956) found a red spot to be present on the third maxilliped (feeding appendage) of males and some females (Williams 1984).

Status

Panopeus herbstii is currently not included on any Federal lists of threatened or endangered species and there is no human exploitation of this species. As the dominant mud crab species in salt marshes along the Mid-Atlantic coast of the United States (Daiber 1982; Williams 1984), however, P. herbstii plays a key role in the food web structure of this ecosystem on a regional scale (Silliman et al. 2004) and may be a potential indicator of the heath of that particular ecosystem.

POPULATION SIZE AND DISTRIBUTION

Panopeus herbstii inhabits oyster reefs, mangrove swamps, and salt marshes along the Atlantic Coast of North America, from Massachusetts to Brazil and on Bermuda (Williams 1984). While the maximum age of P. herbstii is unknown, it is thought to vary between populations along the latitudinal gradient and to be driven by differences in temperature and food availability. The population density of P. herbstii can vary over small spatial scales; in a survey...
of salt marshes from Delaware to North Carolina, densities ranged from 0 to 82 individuals per square meter, with individuals positively associated with the height of the associated cord grass, *Spartina alterniflora*, and the availability of bivalve prey (Silliman et al. 2004). Like other crustaceans, the timing of *P. herbstii* reproduction is seasonally dependent on water temperature and food availability and therefore can vary between populations along the coast (Williams 1984). After hatching, the planktonic larva stays within the estuary (Dittel and Epifanio 1982) and molts through four zoeal stages and a megalopa stage before metamorphosing into the juvenile stage (Williams 1984).

**HABITAT AND NATURAL COMMUNITY REQUIREMENTS**

The type localities for *Panopeus herbstii* are oyster beds and mangrove swamps from the intertidal zone to 22 meters in depth (Williams 1984). Both adults and juveniles can be found on muddy bottoms or areas covered with shells and/or stones or in shallow burrows (4-10 cm) along the edges of the higher marsh (Williams 1984; Dittel et al. 1996). While little empirical work has been conducted on the temperature and salinity tolerances of this species, the broad latitudinal gradient that it encompasses suggests that it has the potential to withstand wide ranges. Individuals have been kept in the laboratory at temperatures between 5°C and 30°C (Dame and Vernberg 1978) and have been observed in brackish water estuaries above 10 ppt (Gosner 1978; Rodriguez and Epifanio 2000).

Primarily carnivorous, adult and juvenile *P. herbstii* have been documented to consume oysters, clams, crustaceans, annelid worms, fish, and snails (McDermott 1967; Castagna and Kraeuter 1977; Whetstone and Eversole 1981; Silliman and Bertness 2002; Silliman et al. 2004; Tolley and Volety 2005) and play an important role as prey items for a variety of birds, fish, and larger crustaceans (Grabowski 2004). Silliman et al. (2004) showed that predation by *P. herbstii* on the marsh periwinkle (*Littorina irrorata*) population had a positive effect on salt marsh vegetation growth. The megalopae of *P. herbstii* prey upon other zooplankton (Harvey and Epifanio 1997) but are also prey for blue crabs, shrimp, and fish species (Dittel et al. 1996).

**CHALLENGES**

As one of the most important habitats for *Panopeus herbstii* is oyster reef, the declining populations of oysters, especially the Eastern oyster, *Crassostrea virginica*, could be detrimental for *P. herbstii* populations. Populations of *C. virginica* have declined along much of the Mid-Atlantic Coast of the United States during the last century due to a combination of over-harvesting (Gross and Smyth 1946), habitat degradation (Rothschild et al. 1994), reduced water quality (Seliger et al. 1985), disease (Ford and Tripp 1996; Lenihan et al. 1999), the interactions among these factors (Lenihan and Peterson 1998), and ecosystem shifts (see Rothschild et al. 1994; Luckenbach et al. 1999; Dame et al. 2002). Wild populations of *C. virginica* are harvested both commercially and recreationally in South Carolina, and aquaculture on leased grounds (culture and mariculture permit areas) is increasing. Although *C. virginica* in South Carolina have not been as extensively exploited as the *C. virginica* populations in the mid-Atlantic states, the rapid pace of coastal development has created numerous threats to tidal creek habitats with inevitable undesirable impacts (e.g. Lerberg et al. 2000, Van Dolah et al. 2004, Holland et al. 2004). Threats involve increased runoff from upland clearing and associated non-pervious
surfaces; contaminants (particularly detrimental to larval stages) such as pesticides and heavy metals (see Capuzzo 1996 and Roesijadi 1996, respectively, for recent reviews); water quality closures resulting in concentrated harvest pressure on open, harvestable beds; impacts from dredging and other channel manipulations; and boat-related impacts.

CONSERVATION ACCOMPLISHMENTS

Due to their importance as habitat for several species of conservation concern in South Carolina, including *Panopeus herbstii*, oyster reefs are also considered critical habitats of concern in both the State Conservation Plan and this State Wildlife Action Plan. As such, the South Carolina Department of Natural Resources (SCDNR) and others are actively involved in the restoration and enhancement of oyster reef habitat. Newly created oyster reefs provide the foundation for the settlement of oyster larvae that will eventually develop into natural oyster habitat. These new oyster reefs will benefit *Panopeus herbstii* and all of the associated marine species that utilize this habitat. To ensure that populations of *C. virginica* in South Carolina remain abundant, extensive efforts at the SCDNR Marine Resources Division, both by the Office of Fisheries Management and the Marine Resources Research Institute Shellfish Research Section, continue to be directed towards assessments of the distribution of *C. virginica* statewide to monitor changes in the acreage and condition of intertidal oyster reef habitat using ground-, boat-, and helicopter-based survey techniques.

CONSERVATION RECOMMENDATIONS

- Assess the impacts of oyster reef restoration projects on *Panopeus herbstii* populations in South Carolina.
- Establish estimates of population size and determine population trends for *Panopeus herbstii* in South Carolina by widespread and long-term monitoring of their abundance, both in oyster reef habitats as well as alternative habitats.
- Understand the importance of *Panopeus herbstii* in the overall marine species community structure on oyster reef habitats in South Carolina.
- Develop a state or federal management plan for *Panopeus herbstii* based on population assessments.
- Continue SCDNR and others’ oyster reef restoration and enhancement projects to ensure viable habitat exists for *Panopeus herbstii* and other marine species that rely on this important ecosystem engineer.

MEASURES OF SUCCESS

If measures of abundance and population demographics of *Panopeus herbstii* are conducted as part of regular monitoring efforts that are currently established to monitor macroinvertebrates associated with oyster reefs, this could be a cost-effective way to collect data to provide baseline information. If continued over a longer period, these data would be able to follow population trends, which will allow managers to make decisions regarding possible conservation measures for this species. The overall measure of success for *Panopeus herbstii* will be stable population trends along the entire coast, as part of the increased conservation and restoration of oyster reef habitat in South Carolina.
LITERATURE CITED


