APPENDIX 5

EFH SOURCE DOCUMENT: ATLANTIC SURFCLAM

NOAA Technical Memorandum NMFS-NE-142

Essential Fish Habitat Source Document:

Atlantic Surfclam, *Spisula solidissima*, Life History and Habitat Characteristics

U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
Northeast Fisheries Science Center
Woods Hole, Massachusetts

September 1999

Contents

Tables

Figures

INTRODUCTION

The Atlantic surfclam, *Spisula solidissima* (Figure 1), is a bivalve mollusk that inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Merrill and Ropes 1969). Atlantic surfclams are managed under the Mid-Atlantic Fishery Management Council Atlantic Surfclam and Ocean Quahog Fishery Management Plan (MAFMC 1997).

This Essential Fish Habitat source document provides information on the life history and habitat requirements of Atlantic surfclams inhabiting United States waters in the Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight.

LIFE HISTORY

A brief synopsis of the life history characteristics of Atlantic surfclams is provided in Amendment #10 of the Fishery Management Plan for Atlantic Surfclam and Ocean Quahog Fisheries (MAFMC 1997). More detailed information is provided here and in reviews by Ropes (1980) and Fay *et al.* (1983).

EGGS

Unfertilized Atlantic surfclam eggs are 56 µm in diameter, unpigmented, and relatively free of yolk (Allen 1951, 1953) -- characters that are generally associated with planktotrophic eggs. Fertilization occurs in the water column above the beds of spawning clams (Ropes 1980). In the laboratory, the optimal concentration of gametes for fertilization is 0.8-4 x 10^6 sperm/ml and 5-30 x 10^3 eggs/ml (Clotteau and Dubé 1993). No information on fecundity in *S. solidissima* is available (Fay *et al.* 1983), however, fecundity of the southern subspecies *S. solidissima similis* ranges from 0.14-13 million eggs in individuals 26-50 mm shell height (Walker *et al.* 1996).

LARVAE

Fertilized eggs develop into pyramid-shaped, planktonic trochophore larvae approximately 9 h after fertilization at 21.7°C (Ropes 1980) and 40 h at 14°C (Loosanoff and Davis 1963). Veliger larvae, the first larval stage to possess a bivalved shell, appear in 72 h at 14°C and 28 h at 22°C (Loosanoff and Davis 1963). The pediveliger stage, a transitional "swimming-crawling" larval stage with development of a foot for burrowing (Fay *et al.* 1983), occurs 18 d after fertilization at 21.7°C (Ropes 1980). Metamorphosis to juveniles, which consists of complete absorption of the velum and settlement to the substrate, occurs anywhere from 19 to 35 d after fertilization depending on temperature (Fay *et al.* 1983). Size at metamorphosis is 230-250 µm shell length; however Ropes (1980) noted that larvae metamorphosed at 303 µm.

JUVENILES AND ADULTS

The size and age of sexual maturity is variable. Off New Jersey, Atlantic surfclams may reach maturity as early as 3 months after settlement and at lengths of less than 5 mm (Chintala and Grassle 1995; Chintala 1997). At the other extreme, clams from Prince Edward Island, Canada, may not reach maturity until 4 yrs of age and 80-95 mm shell length (Sephton 1987; Sephton and Bryan 1990). In Virginia, the minimum length at maturity is 45 mm; size rather than age is more important in determining sexual maturity (Ropes 1979). Because of the wide variability in age at maturity, juveniles and adults will be discussed together in this report.

Atlantic surfclams may reach a maximum size of 226 mm (Ropes 1980) and a maximum age of 31 yrs (Jones *et al.* 1978). Growth appears to be similar among different localities during the first 3-5 yrs of life (Ambrose *et al.* 1980; Sephton and Bryan 1990). However, after the first 5 yrs, clams offshore grow faster and attain a larger maximum size than clams inshore (Jones *et al.* 1978; Ambrose *et al.* 1980; Jones 1980; Wagner 1984). High clam density may negatively affect growth rate and maximum size (Fogarty and Murawski 1986; Cerrato and Keith 1992); density effects on growth have been detected at relatively low densities (> 50 clams per 352 m^2) (Weinberg 1998b). Growth lines in Atlantic surfclams are deposited at times of spawning and high temperature, but there is a question as to whether lines are annual (Jones *et al.* 1978; Jones 1980; Wagner 1984; Walker and Heffernan 1994). Growth is not uniform over the year; temperature significantly affects Atlantic surfclam growth, physiology, and behavior (Ambrose *et al.* 1980; Davis *et al.* 1997).

Atlantic surfclams are susceptible to several parasites, including the thigmotrich *Sphenophyra dosinae*, the cyclopoid copepod *Myocheres major*, a cestode of the genus *Echeneribothrium*, a nematode tentatively identified as *Paranisakiopsis pectinis*, and the hyperparasite haplosporidian *Urosporidium spisuli* (Ropes 1980; see also Perkins *et al.* 1975 and Payne *et al.* 1980). Payne *et al.* (1980) found an anisakine nematode of the genus *Sulcascaris* in clams from New Jersey to Virginia. Yancey and Welch (1968) noted the presence of trematodes in Atlantic surfclams, but their effects are unclear.

REPRODUCTION

Atlantic surfclams spawn in the summer and early