

## 2.0 FISH AND INVERTEBRATES

### 2.1 MID-ATLANTIC BIGHT FISHES

The Study Area, located within the MAB, is one of the most productive fishing areas on the east coast of the U.S. The MAB is bounded by Massachusetts (Georges Bank) to the north and North Carolina (Cape Hatteras) to the south. In the Study Area, and similar to other temperate communities, seasonal temperature fluctuations are one of the primary factors that influence fish distribution (Sherman et al. 1996). In the MAB, a high proportion of fishes are seasonal in distribution, while few (<5%) are resident (Sherman et al. 1996). Furthermore, only 15% of the approximately 250 fish species found in the waters of the MAB are temperate species. Of the remaining species, approximately 75% are classified as subtropical-tropical species (i.e., species with preferences for temperatures above 20 degrees Celsius (°C; 68 degrees Fahrenheit [°F]; Briggs 1974; Froese and Pauly 2005).

In addition to the vast number of temperate and subtropical-tropical fish species, the Study Area supports a variety of macroinvertebrates (e.g., ocean quahog [*Arctica islandica*] and Atlantic surfclam [*Spisula solidissima*]). The distribution of macroinvertebrates is influenced by the availability of benthic habitat (Theroux and Wigley 1998). Many fish and squid species (i.e., longfin inshore squid [*Loligo pealei*]) found within the Study Area demonstrate seasonal migration patterns, moving offshore during the winter to utilize warmer waters and inshore during the spring and summer to feed and spawn (Casey et al. 1987; Chase 2002; Hatfield and Cadrin 2002). Highly migratory pelagic fishes (i.e., billfishes, tunas, swordfish [*Xiphias gladius*], and sharks) are found mostly offshore, both adjacent to or within the Study Area. These species are influenced by the Gulf Stream Current and thermal oceanic fronts (Casey et al. 1987; Block et al. 1998).

For juvenile fishes and invertebrates, especially those of commercial importance, estuarine and coastal regions provide critical nursery and settlement habitat. Most of the species found in these inshore regions are abundant in the early spring through summer (Able and Fahay 1998). For example, many larvae of subtropical-tropical species spawned in warmer waters are transported to inshore habitats via the currents of the Study Area (Epifanio and Garvine 2001; Hare et al. 2001). The coastal habitats of the Study Area are quite diverse, consisting of intertidal mudflats, wetlands, and seagrass beds (Roman et al. 2000).

### 2.2 NEW JERSEY ICHTHYOFAUNA

The marine ichthyofauna of New Jersey consists of 336 fish species represented by 116 families occurring from the upper limits of saltwater intrusion in the estuaries (including Delaware Bay) to the 200-meter (m; 656.2-foot [ft]) contour at the edge of the continental shelf (Able 1992). Along the New Jersey coastline, various inshore (e.g., estuaries, bays, salt marshes, tidal creeks, and coastal beaches) and offshore environments (e.g., sand ridges, continental shelf, canyons, hard bottom, and artificial reefs [e.g., ship wrecks and man-made structures]) are important habitats to fish and fisheries. Four distinct habitats are defined within the Study Area: coastal beaches, pelagic zone, demersal/benthic zone, and natural/artificial reef-structures.

The coastal beaches and, in particular, the surf zone is an important habitat for numerous fish species. Studies conducted off northern New Jersey reported 57 species representing 30 families utilize this habitat (Burlas et al. 2001; D.H. Wilber et al. 2003; D.H. Wilber et al. 2003; Able et al. 2010). The species were dominated by Atlantic and rough silversides (*Menidia menidia* and *Membras martinica*), bluefish (*Pomatomus saltatrix*), bay and striped anchovies (*Anchoa mitchilli* and *A. hepsetus*), and northern kingfish (*Menticirrhus saxatilis*). This ichthyofaunal composition was similar to other comparable locations within the Study Area (Avalon, New Jersey), north of the Study Area (Long Island Sound and Great South Bay and Fire Islands, New York), and south of the Study (Hog Island, Virginia; Schaefer 1967; Briggs 1975; Hillman et al. 1977; McDermott 1983; Layman 2000).

The pelagic zone within the Study Area supports large schools of seasonally abundant herrings (i.e., blueback herring [*Alosa aestivalis*], alewife [*A. pseudoharengus*], and Atlantic menhaden [*Brevoortia*

*tyrannus*]) along with fast swimming oceanic wanderers (e.g., bluefin tuna [*Thunnus thynnus*] and swordfish), various elasmobranchs (sharks: sand tiger [*Carcharius taurus*] dusky [*Carcharhinus plumbeus*], sandbar [*C. obscurus*], skates: clearnose [*Raja eglanteria*], winter [*Leucoraja ocellata*], and little [*L. erinacea*], and rays: cownose [*Rhinoptera bonasus*], large predatory fishes (e.g., bluefish, various sciaenids), and several species of cephalopods (i.e., longfin inshore squid) (MMS 1999).

The non-vegetated, sandy benthic habitat is important to various demersal fish and invertebrate species within the Study Area (Steimle and Zetlin 2000). It is characterized as a sand or sand-mud plain interrupted by submarine sand ridges separated by mud or clay-bottomed depressions or sloughs. Solitary rather than schooling fishes are found within this habitat which consist of species such as sand lances (*Ammodytes* species [spp.]) and flounders (i.e., winter flounder [*Pseudopleuronectes americanus*], windowpane flounder [*Scophthalmus aquosus*], and witch flounder [*Glyptocephalus cynoglossus*]) and hakes (red hake [*Urophycis chuss*] and silver hake [*Merluccius bilinearis*]) that are an important food resource for many predatory species.) These solitary species tend to prey upon the benthic communities (MMS 1999). Moderate densities of crustaceans (amphipods), polychaetes, mollusks (bivalves), and echinoderms dominate these benthic communities off New Jersey (Wigley and Theroux 1981; Reid et al. 1991; Chang et al. 1992).

An important component of this demersal/benthic zone is the more than 71 shoreface sand ridges that occur along the New Jersey coastal areas (McBride and Moslow 1991). These shoreface sand ridges, especially the near-ridge habitats (e.g., Beach Haven Ridge off Little Egg Inlet), have higher species abundance and richness than to the surrounding inner continental shelf. They possess distinct species assemblages, comprised of important recreational and commercial species (Vasslides and Able 2008). The following fish families, anchovies (Engraulidae), flounders (Pleuronectiformes), cod (Gadidae), searobins (Triglidae), sea basses (Serranidae), drums (Sciaenidae), and butterfishes (Stromateidae), along with the Atlantic surfclam and epibenthic decapod crustaceans (sevenspine bay shrimp [*Crangon septemspinosa*], Atlantic rock crab [*Cancer irroratus*], spider crab [*Libinia emarginata*], and lady crab [*Ovalipes ocellatus*]) are common components of this unique habitat and may be representative of other New Jersey shoreface sand ridges (Viscido et al. 1997; Ma et al. 2006; Vasslides and Able 2008). The dominant fish species were similar to those species found on the inner continental shelf waters off the northeastern (Colvocoresses and Musick 1984; Mahon et al. 1998) and southeastern U.S. (Walsh et al. 2006).

Benthic man-made structures, such as artificial reefs, shipwrecks, and other man-made structures (groins, jetties, seawalls, bridges, and piers) are important habitat types for the fish and fisheries found off New Jersey. These man-made structures add complexity and diversity to the non-vegetated, sandy bottom and open ocean environments (Figley 2005). Nine of the 15 artificial reef sites off New Jersey are located within the Study Area in addition to the 3,500 patch reefs that have been added to these sites since 1984. Depending on the depth and average annual and seasonal water temperatures, artificial structures (reefs, 3,000 documented shipwrecks, etc.) can be colonized by various species of invertebrates (e.g., sponges, crustaceans, and mollusks) and algae, which then attract fish searching for food or refuge (MMS 1999). This was supported in a study conducted over a five-year period off New Jersey which reported that 1 square meter (m<sup>2</sup>; 10.76 square feet [ft<sup>2</sup>]) of reef habitat was colonized by 432,000 marine animals consisting of 145 species with a collective biomass of 58,000 grams (g; 128 pounds [lbs]; Figley 2003). Artificial reefs within the Study Area support around 150 different fishes and other marine life that are indigenous to New Jersey waters, such as black sea bass (*Centropristis striata*), tautog (*Tautoga onitis*), red hake, gray triggerfish (*Balistoides viridescens*), Atlantic cod (*Gadus morhua*), pollack (*Pollachius virens*), American lobster (*Homarus americanus*), and Atlantic rock crab (Figley 2005).

### 2.3 SURVEY ANCILLARY FISH OBSERVATIONS

Ancillary fish observations were collected during the ship surveys from January 2008 to December 2009 and from the aerial surveys from January to June 2009. These sightings are listed by survey date, time, and latitude in **Table 2-1** and **Table 2-2** and were collected opportunistically, usually in very calm sea conditions. Observed species included 19 ocean sunfish (*Mola mola*), 14 unidentified sharks, 4 unidentified rays, 2 basking sharks (*Cetorhinus maximus*), 1 hammerhead shark (*Sphyrna* spp.), and 1

houndfish (*Tylosurus crocodrilus*). On August 3, 2009, a large group of elasmobranchs were observed along the shipboard surveys tracks for three hours.

**Table 2-1. List of fishes observed during the shipboard surveys in the Study Area.**

Survey Date	Time Observed	Latitude/Longitude	Species Observed
07/15/2008	13:28:10	39:36.60°N 073:53.28°W	Ocean sunfish
08/31/2008	10:45:46	39:38.52°N 073:56.91°W	Ocean sunfish
10/15/2008	13:45:24	39:48.74°N 073:50.60°W	Ocean sunfish
	13:49:07	39:48.35°N 073:51.28°W	Ocean sunfish
	14:42:30	39:41.56°N 073:50.01°W	Ocean sunfish
10/16/2008	15:36:31	39:16.86°N 074:13.31°W	Ocean sunfish
11/12/2008	12:46:36	39:20.94°N 074:06.99°W	Unidentified shark
11/14/2008	12:59:38	39:10.78°N 074:23.37°W	Ocean sunfish
06/02/2009	13:29:38	38:54.77°N 074:27.46°W	Ocean sunfish
06/03/2009	16:56:37	39:21.37°N 073:59.86°W	Unidentified shark
06/06/2009	06:22:41	39:25.86°N 074:16.44°W	Ocean sunfish
	12:54:02	39:02.32°N 074:28.90°W	Ocean sunfish
08/01/2009	08:57:21	39:01.33°N 074:41.64°W	Large group unidentified rays
	13:45:49	39:10.25°N 074:35.46°W	Unidentified shark
08/03/2009	11:38:13	39:47.06°N 073:44.66°W	Unidentified shark
	12:22:12	39:41.20°N 073:42.15°W	Hammerhead shark
	12:24:14	39:40.87°N 073:42.00°W	Unidentified shark
	12:30:50	39:39.84°N 073:41.48°W	Houndfish
	12:47:42	39:39.61°N 073:41.87°W	Unidentified shark
	12:54:50	39:40.56°N 073:42.97°W	Two unidentified shark
	12:59:26	39:41.12°N 073:43.67°W	Unidentified shark
	13:07:04	39:42.03°N 073:44.80°W	Unidentified shark
	13:11:24	39:42.54°N 073:45.44°W	Unidentified shark
	13:50:06	39:47.18°N 073:51.12°W	Two unidentified rays
	14:34:52	39:50.21°N 073:56.22°W	Large group unidentified rays
14:37:07	39:50.61°N 073:56.26°W	Large group unidentified sharks	
10/02/2009	08:25:45	39:19.03°N 077:00.99°W	Unidentified shark

**Table 2-2. List of fishes observed during the aerial surveys conducted in the Study Area.**

Survey Date	Time Observed	Latitude/Longitude	Species Observed
04/18/2008	14:50:21	39.71743°N -73.92712°W	Basking shark
05/23/2009	18:57:08	39.71749°N -73.16521°W	Basking shark
06/23/2009	15:14:00	39.613258°N -74.13105°W	Ocean sunfish
	15:15:48	39.629032°N -74.117714°W	Ocean sunfish
	15:19:35	39.595341°N -73.917221°W	Ocean sunfish
	16:59:59	39.834251°N -74.042091°W	Ocean sunfish
06/24/2009	15:11:37	39.455307°N -73.933235°W	Ocean sunfish
	15:23:34	39.52765°N -74.1117°W	Ocean sunfish
	15:47:44	39.25641°N -74.0328°W	Ocean sunfish
	16:20:42	39.15287°N -74.25888°W	Ocean sunfish
	17:26:26	38.9988°N -74.71338°W	Unidentified shark
	19:46:08	39.07491°N -74.30554°W	Ocean sunfish