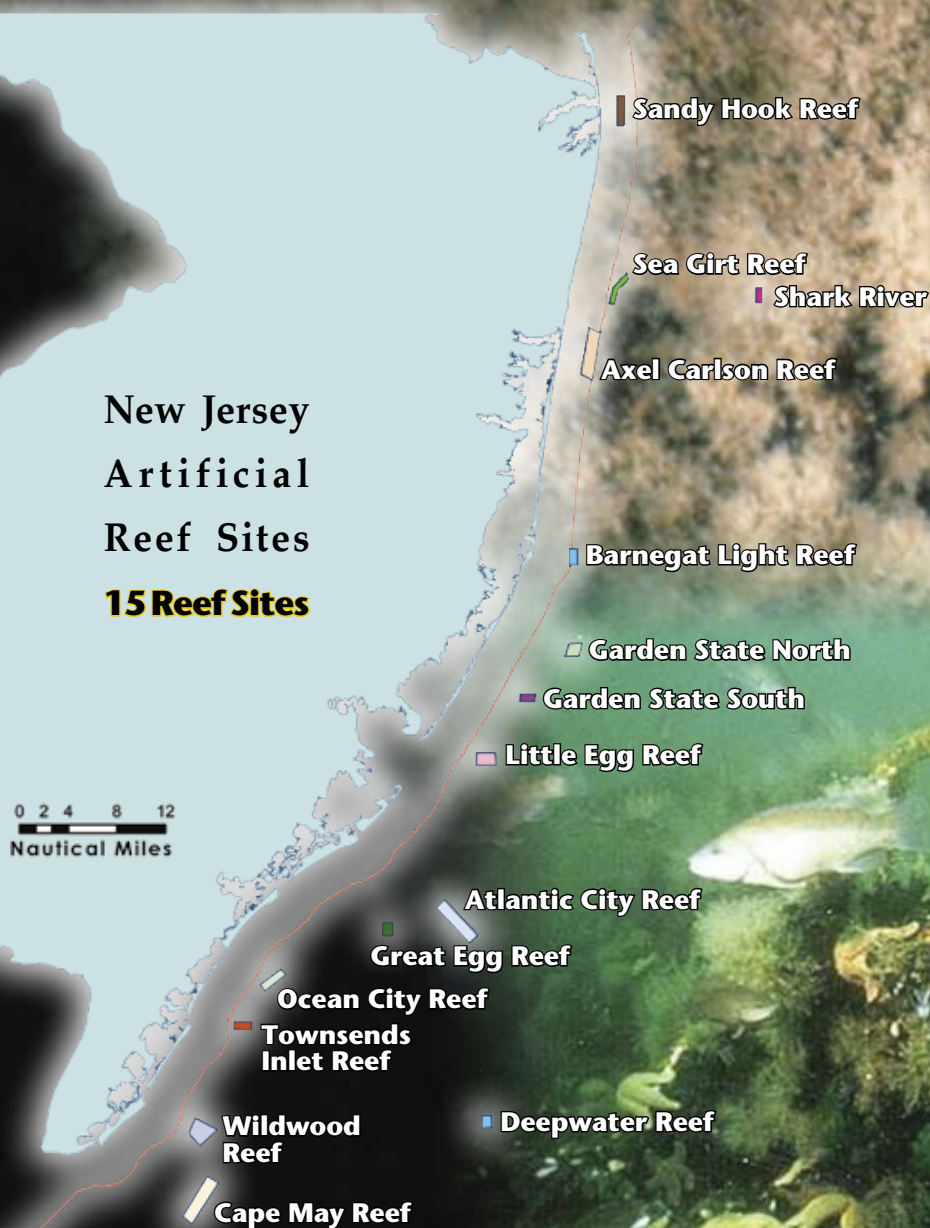


New Jersey's Reefs: an UNDERWATER METROPOLIS

By Hugh Carberry; Artificial Reef Coordinator
Photos by Herb Segars, www.gotosnapshot.com

New Jersey Artificial Reef Sites 15 Reef Sites



New Jersey's seafloor consists of sandy plains with mud and clay interrupted by submarine ridges. Within this nearly featureless and barren seafloor are 15 reef sites encompassing more than 25 square miles. These reefs range in size from ½ to four square miles and are placed strategically along New Jersey's 120-mile coastline near navigable inlets. Contained within these reefs are more than 4,000 "patch reefs" which serve as premier underwater real estate for more than 150 species of fish and marine life. Recognized nationally as having some of the best artificial reefs in the nation, New Jersey's reef network is an experience unparalleled along the Atlantic coast.

How Reefs Work

New Jersey's reefs are only artificial in that hard structures are placed into the marine environment intentionally. Natural processes take place after structure deployment, leading to formation of a community of encrusting organisms.

These encrusting organisms attached permanently to hard surfaces using strong threads or cement. The bond is strong enough to remain firm during northeast storms, tropical depressions and hurricanes.

Ocean water contains a living "soup" of larval filter feeders such as mussels, barnacles, hydroids, sponges and corals that actively seek hard substrate on which to attach, grow and mature. These filter feeders sustain themselves by filtering from the waste – then consuming – plankton and detritus drifting by.

Some encrusters resemble plants, like the seaweed found on jetties and bulkheads, but these organisms are animals and do not photosynthesize. Sunlight must be able to penetrate through the water column to facilitate photosynthesis, but the average depth for a New Jersey reef is greater than

50 feet, effectively blocking the plant-nourishing rays of the sun.

Larval encrusting organisms cannot attach to loose sand grains as they quickly wash away or become covered by sediment. But deployed hard reef materials such as rock, concrete or steel quickly becomes encrusted and a living reef matrix soon envelops the structure. This matrix can be several layers thick as different types of encrusters compete for an available toehold, often growing atop one another. At this stage of reef development, a multitude of minute crustaceans, amphipods, isopods, crabs, shrimp and snails take up residence in this protective matrix and in turn form an important component of the food chain.

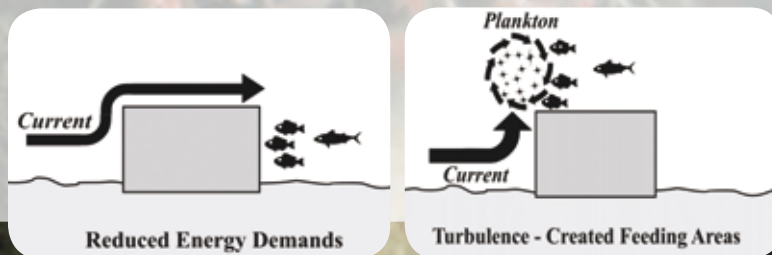
In terms of numbers and weights, fish represent a small portion of the marine life found on reefs. A nine-year study on marine life colonization conducted by New Jersey Division of Fish and Wildlife showed that fish only account for 4.5 percent of the reef's biomass. Young-of-the-year demersal

(bottom-dwelling) fish such as tautog and black sea bass represent 1.2 percent of the total biomass; adult fish represent 3.3 percent of the total.

In a healthy ecosystem, forage animals are much more abundant than the food chain's apex predator – fish, which feed on both mobile and attached invertebrates. The most abundant group forming the base of the food chain is the sessile invertebrates (those permanently attached to a substrate) such as the blue mussel, barnacle, anemone, bryozoan, hydroid, tube worm and coral. These organisms account for 84.5 percent of the total reef biomass. The multitude of minute crustaceans found on reefs form 11 percent of the total biomass. These findings demonstrate that New Jersey reefs provide a productive habitat for use by marine fish species.

Deployed reef structure dissipates underwater currents which may reduce the energy fish expend. The structure acts as a baffle, reducing current along the bottom, allowing fish to utilize

more energy for growth rather than exertion. Additionally, as water flows over and around reef structure, eddies form and carry food to waiting fish. ➔



(Continued from page 7.)



Demersal (Bottom) Fish

Reef structure does not *directly* benefit all marine fish. Only a few species actually *depend* upon reef habitat for survival, although reefs also enrich non-dependent species.

Reef-associated fish are bottom dwellers such as black sea bass and tautog. The matrix formed within the reef structure provides refuge from larger predatory fish. Black sea bass and tautog typically cluster under an overhang, cavity or crevice found on the reef. These areas harbor a diverse menu of food including rock crabs and shrimp. Tautog and cunner graze here on these foods plus nip away at blue mussels and barnacles.

Although reefs are abundant with food, reef fish also make excursions to feed on infauna such as worms and clams found on the open sandy bottom. Soon after feeding, these fish return to the safety and refuge the reef affords.

Schooling Baitfish

For unknown reasons, certain schools of baitfish such as menhaden, round herring and anchovies, school around high-profile reef structure such as sunken ships. Some theorize these species use the high-profile structure as either a point of reference or find that the structure's shadow conceals them from roving predatory fish. Schooling baitfish stay near the reefs temporarily then eventually move on.



Pelagic Fish

Pelagic (open water) species such as bluefish, amberjack, cobia and sharks are at the top of the reef food chain and use the reef

as nothing more than a fast-food restaurant. These fish are attracted to the teeming bait and other swarming fish found around a reef. Pelagic predators are only transient here, as reefs are not essential for their life cycle.

Reef Materials:

Rocks



More than 90 percent of the reef material deployed by New Jersey's Reef Program is rock obtained from dredging operations. Rocks range in size from chips to cobbles to boulders as large as cars. The rock is dropped on predetermined locations via hopper scows.

Various type of rock – including sandstone, granite and igneous rock – are utilized to create rock piles, underwater rock mountains and ridges. Rock piles may be up to 300 feet long by 75 feet wide and rise four to six feet from the seafloor. Rock mountains are created by dropping dozens of hopper-scow loads of dredge rock in a single location resulting in a mountain rising 50 to 60 feet from the seafloor. Rock ridges are lower in profile than mountains and form an area of continuous relief along the bottom.

from boulder-sized pieces to monoliths as long as 10 feet. Concrete is deployed from a massive, 200-foot deck barge and is pushed off piece-by-piece using heavy machinery. Typically, a marker buoy is set at the deployment location. A tugboat pulling the deck barge circles the buoy, broadcasting the concrete over a wide area. Multiple loads are dropped atop each other to provide higher vertical relief.

Concrete Castings

Concrete castings include culverts, junction boxes and other types of pre-fabricated concrete structure. Usually this material has a slight defect, such as a crack or chip, rendering them unfit for sale by the manufacture. These hollow cavities offer much surface area for attachment of encrusting organisms, making concrete castings an effective reef material where fish, crabs and lobsters dwell.



Vessels

Various vessels have been sunk on New Jersey reefs including lightships, ferry boats, tugboats, trawlers, tankers and more. These vessels range from the 32-foot U.S. Coast Guard crew boats to the 460-foot attack cargo transport the USS Agol. To date, 164 vessels have been deployed on New Jersey reefs.



Demolition Concrete

The reef program routinely deploys concrete obtained from the demolition of bridges, sea walls and piers. This material can vary in size

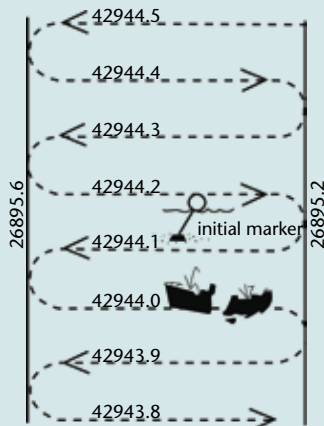


Reef Balls

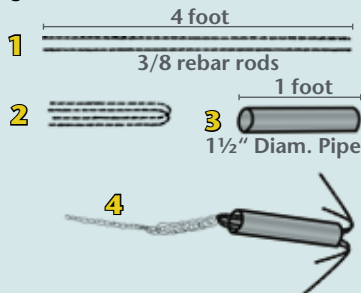
Reef balls are a hollow, designed habitat resembling small igloos with numerous holes. In 1998, Fish and Wildlife purchased seven fiberglass molds to fabricate these concrete habitats. The following year, reef ball construction was launched at Southern State Correctional Facility using inmate laborers. Annually, 500 habitats are fabricated and transported to reef sites. Fish count studies performed by scuba divers have found an average of more than 19 fish near a reef ball habitat at a given time.

Locate and Anchor on a Sunken Ship

1. Enter the lat/long or time differences into a GPS or LORAN unit, then hit "Go To."
2. Steer resulting course to the wreck; pay attention to the distance to go
3. When the GPS or LORAN unit "zeros out" watch your depth recorder for the wreck
4. When the wreck is not immediately below the boat, begin a slow-speed search pattern such as an east-west or north-south path. Once wreck is located, immediately drop a marker buoy
5. Determine set and drift, then position your boat to drift over the wreck with a grappling anchor deployed.



An inexpensive wreck anchor can be constructed of two, 4-foot sections of 3/8 rebar rods and a 1-foot length of PVC pipe.



Army Tanks

A 1994 joint military-civilian training program among the U.S. Navy, Coast Guard, Army and Navy Special Forces, Air Force and the New Jersey National Guard, donated obsolete military vehicles for reef construction activities. Obsolete army vehicles such as M-60 and M-551 tanks, M-331 armored personnel carriers and M-578 crane vehicles were cleaned and prepared at Fort Dix by the New Jersey Army National Guard. During the six-year program, a total of 397 obsolete army vehicles were placed on 11 reef sites.



Subway Cars

Subway cars are structurally complex and have proven to be a fully-functioning, safe habitat, offering a valuable food base for fish by supporting invertebrate communities.

All doors and windows are removed for good interior access, both for fish and circulating water currents. Donated by the New York City Transit Authority, more than 250 subway cars have been deployed on six reef sites. An additional 600 stainless steel subway cars are slated for deployment on New Jersey's reefs over the next four years. Fish count studies have determined that on average, 323 fish will utilize each subway car.



Acknowledgments and References:

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Citizen Network to Keep a Continued Lookout

Front view of an adult male mitten crab. Distinct 'hair' on the claws and a deep notch between the eyes differentiate this crab from others.

Sightings of the non-native and invasive Chinese mitten crab continue in waters surrounding New Jersey. The mitten crab has already invaded other areas of the United States causing significant ecological and economical losses in those areas, and has the potential to establish itself in New Jersey bays and estuaries. Both commercial and recreational crabbers plus the general public are asked to be watchful and assist scientists to document sightings of mitten crabs. Your support is important to effectively determine this invader's current distribution and possible establishment in our waters.

Mitten crabs are native to East Asia but have invaded portions of northern Europe and also California. The crabs have the potential to increase erosion along stream banks, compromise levees and impact aquatic vegetation and wildlife. Therefore, the crabs are listed as "Injurious Wildlife" under the Federal Lacey Act which makes it illegal to import or transport this species across state boundaries without a permit. Mitten crabs spend most of their life cycle in freshwater. Around age three or four years, they migrate to higher-salinity areas to mate.

To date, thirteen confirmed mitten crabs have been caught predominately by commercial crab pots in the mid-Atlantic region, ranging from the Chesapeake Bay to the Hudson River. These sightings first appeared in the Chesapeake Bay when one adult male crab was caught in the summer of 2005. Sightings have since expanded with confirmed specimens in the Chesapeake Bay (five), upper Delaware Bay (five) and the Hudson River (three). There have been no confirmed sightings in any New Jersey waters.

Nine of the thirteen mitten crabs captured were males, with four mitten crab sightings turning up females. It is unknown if a self-sustaining population of mitten crabs exists in the mid-Atlantic region, however, two of the female crabs had mated and eggs were present on the abdomen. Two mitten crabs, one female and one male, found in the Hudson River in October 2007 and January 2008, respectively, were juveniles. No larvae have been found. Scientists are also still unsure of the potential impact should the mitten crab become established in the mid-Atlantic.

New Jersey Division of Fish and Wildlife along with the Smithsonian Environmental Research Center (SERC), the lead investigator in documenting mitten crab sightings, are continuing to collect information to determine the current status, abundance and distribution of mitten crabs along the eastern United States. Recreational crabbers are asked to stay alert for mitten crabs you may catch in New Jersey's bays and coastal estuaries.



If you catch a mitten crab:

- Note the date and specific location of capture
- Photograph and/or retain the crab – *do not throw it back alive!*
- Contact either: Nacote Creek Marine Fisheries Office at (609) 748-2020 or Mitten Crab Hotline (SERC) at (443) 482-2222

Mitten Crab Identification

Mitten crabs are easy to confuse with several other crabs. Look for these key characteristics:

- Claws: equal in size with white tips and covered in hair
- Color: light brown to olive green
- Carapace: up to four inches wide with notch between the eyes
- Legs: eight sharp-tipped walking legs – no swimming legs

Thank you for helping New Jersey Division of Fish and Wildlife by staying watchful for the Chinese mitten crab. For more information on mitten crab sightings, current research and life history, visit the SERC Marine Invasions Research Lab Web site at: http://www.serc.si.edu/labs/marine_invasions/index.jsp.



Photo: Smithsonian Environmental Research Center

An adult male mitten crab; notice the four key identification characteristics described in the text: claws, color, carapace and legs.