Underwater counts of fish and lobster inhabiting Reef Ball habitats on New Jersey ocean reef sites

By Bill Figley,
Principal Fisheries Biologist
and Jennifer Daetsch

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INTRODUCTION

Assessing the effectiveness of reef structures in providing habitat for marine life is an important component of New Jersey's reef-building program. Since providing fish for anglers to catch is one of the objectives of the Reef Program, assessments of fish numbers and species on reef materials is essential. However, counting the total number of fish on large or diffuse reef structures, such as shipwrecks, rock piles or concrete fields, is difficult, especially in the low-visibility conditions common off New Jersey. Reef Ball habitats were selected for fish count sampling for the following reasons:

(1) they are small and easily scanned in entirety, even in visibilities of 10 feet;
(2) they are spaced on the sea floor so that discrete counts can be made on individual habitats; and,
(3) since they are identical in size and shape, it is possible to extrapolate sampling results to estimate fish populations on larger numbers of Reef Ball habitats deployed on the sea floor.

METHODS

Underwater counts of fish on Reef Balls were performed by Capt. Roger Hoden and George Dreher. Counts were conducted during April through November of 2001-2003. During the 3-year study period, a total of 276 Reef Balls were sampled. Sampling locations included the Barnegat Light (BL), Garden State North (GSN) and Garden State South (GSS) reef sites.

Scuba divers were instructed to count fish by species within a 5-foot radius around and over each Reef Ball sampled (Attachment 1). This technique resembles the Point-Count Method described by Seaman et al. (1992). Divers sampled 4 Reef Balls on each dive. In addition to species counts, other data recorded included water depth, bottom temperature, visibility and orientation and condition of the Reef Ball habitats.

REEF BALL SPECIFICATIONS

Reef Balls were designed as ocean reef habitats by Reef Balls, Inc. of Sarasota, Fla. These habitats can be described as hollow, igloo-shaped structures with numerous access holes. They are made entirely of concrete. The Pallet Ball is the model used in New Jersey. Each habitat is 4 feet in diameter at the base, 3 feet high, weighs over 1600 pounds and has a volume of 0.8 cubic yards. Each habitat can function independently as a micro-reef with its own population of marine life. For this reason, the typical methods of deployment are to either disperse Reef Balls over the sea floor at a low density of 2 to 10 per acre of sea floor, to create drift fishing areas, or in small clusters of 10 to 20 habitats. As of 2003, a total of 3,356 Reef Balls have been deployed on 8 New Jersey Reef Sites.

RESULTS

A total of 276 Reef Ball habitats were censused during the 2001-2003 study period. Fourteen species of fish and American lobster (*Homarus americanus)*, totaling 5,001 individuals, were observed during the study. The 14 species included 7 reef fishes, American lobster and 6 non-reef fishes.

The mean number of individuals of all species combined for samples during the 3-year survey was 18.12 (Table 1). Black sea bass (*Centropristis striata)* was the most abundant species by far, representing 86.3 of the total, tautog (*Tautoga onitis)* was second at 5.6 percent and scup (*Stenotomus chrysops*) was third at 4.5 percent. Cunner (*Tautogo labrus adspersus),* which is typically abundant on reef structures, accounted for only 1.8 percent of the total. Other reef species included red hake (*Urophycis chuss*), conger eel (*Conger oceanicus*) and gray triggerfish (*Balistes capriscus*). The 6 non-reef-associated species were counted in the sand within 5 feet of the Reef Balls; these species combined represented only 0.9 percent of the total. Young-of-year fish, probably cunner and sea bass, comprised 0.9 percent of the total. American lobster was also uncommon, accounting for 0.2 percent.

Reef Balls have a volume of 0.8 cubic yards. Converting mean sampling results to whole units of measure yields the following values:

Volume	Mean number of fish/lobster per Reef Ball
$0.8yd^3$	18.12
$1.0yd^3$	22.65
$1.0m^2$	29.53

Broken down by the reef site sampled, mean combined species counts ranged from 13.84 to 20.91 (Table 2). Given the 5-foot radius search area around the 4-foot diameter Reef Ball habitats, the area of sea floor included in the fish counts was 17.1 yd^2 or 14.3m^2 per habitat. Breaking the fish count data down to the area of sea floor influenced by the Reef Ball habitats yields a mean total of 1.06 and 1.27 fish of all species per yd^2 or m^2 of sea floor, respectively.

The GSN Reef Site had the largest mean abundance of fish/lobster over the study period, with black sea bass accounting for this dominance. GSN is the deepest of the 3 reef sites. Tautog was most abundant on GSS Reef Site and scup was greatest on BL Reef Site.

Monthly mean counts of all species were relatively consistent during May to November, ranging from 14.56 to 22.33 fish/lobster per Reef Ball (Table 3). April had a mean count of 5.69. April is typically the month when water temperatures warm enough (48^0F) for sea bass to begin migrating into their inshore summering grounds, a process that they complete by late May. The migration reverses itself in November, when sea bass respond to cooling waters and move offshore.

There was no statistically significant correction between the numbers of fish counted and the visibility divers encountered (Figure 1), suggesting that visibility did not play a significant role in influencing counts of fish. It is unknown what effect disturbance by divers had on fish avoidance and scattering and consequently, on resulting fish counts. However, experience demonstrates that many fish do avoid divers, therefore, it is probably reasonable to assume that fish counts obtained by scuba divers are conservatively low.

Bottom water temperatures varied between 46^0 and 70^0F during the census periods. Neither sea bass nor tautog showed any variation in abundance in that bottom water temperature range (Figures 2 and 3). Sea bass numbers would probably have declined at temperatures below that range; tautog prefer colder temperatures and may have exhibited higher abundance levels during December to March. Angler catch rates of tautog on reef sites typically increase during the cold water period.

Sample counts were conducted on Reef Balls that were underwater (soak time) for 7 to 50 months. Initial colonization of reef habitats by encrusting organisms begins within weeks after deployment, extensive growth of early colonizers occurs within 1 to 2 years, and a full community of marine life species is reached in about 5 years (Figley 2003). Fish typically appear within days or weeks of structure deployment. Neither black sea bass nor tautog abundance showed any statistically significant correlation with the length of Reef Ball soak time (Figures 4 and 5).

Sampling depths on the 3 reef sites ranged from 55 to 80 feet. Within this relatively narrow depth arrange, neither sea bass nor tautog abundance had a statistically significant correlation with water depth (Figures 6 and 7).

CONCLUSIONS

1. Reef Balls provide habitat for adult reef fishes, particularly black sea bass.
2. Reef Balls provide habitat for minimal numbers of lobster and young-of-year fish.
3. There are no statistically significant correlations between numbers of fish inhabiting Reef Balls and variance in depths between 55 and 80 feet, bottom water temperatures between 46^o and 70^oF, habitat soak time between 7 and 50 months and the time of year between May and November.

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