

**2013 and 2014 Surveys of Maryland Artificial Reefs
Using the Volunteer Angler Logbook Technique**

A Report to the Maryland Artificial Reef Committee

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BACKGROUND

The 2007 Artificial Reef Management Plan calls for the Maryland Department of Natural Resources to design a monitoring program to produce catch-per-unit and other information on artificial reef sites from data collected by volunteer anglers (Loftus and Stone 1997).

MD DNR held a series of internal meetings between December 2012 and June 2013 to develop ideas for a monitoring survey which would provide information on artificial reefs in Maryland. In June, MD DNR staff developed a survey plan to provide information on reef performance based on a volunteer logbook program. A phone conference was held with the Artificial Reef Committee (ARC) in July 2013 to discuss this plan and request commitment for funding. The ARC unanimously voted \$4,000 of support for a Volunteer Angler Logbook study of fishing success in September and October 2013.

The 2013 survey was designed as a short-term pilot study to compare the fishing experience between paired artificial reef and nearby natural structure sites in Chesapeake Bay (Figure 1). Catch rate, caught species diversity and fish length were designed as the primary indicators of the fishing experience. In addition, the data were analyzed to provide information on the viability of using this volunteer angler approach to provide valid data over the long term. The survey was not designed to provide habitat information, fish production aggregation information, or to provide explanation for any differences in fishing success observed between sites.

Based on the success of the 2013 survey, the volunteer angler logbook approach was repeated in the summer of 2014.

METHODS

Survey Design and Management

DNR provided administrative and statistical support for the project. Erik Zlokovitz, DNR Artificial Reef Coordinator, served as survey coordinator and coordinated outreach, obtained incentive materials, oversaw printing of logbooks, interacted with interested anglers, mailed materials, and input logbook data to the electronic database. Linda Barker, DNR Fisheries statistician, designed the surveys and logbooks, developed and conducted the web-based training seminars, conducted quality review of the data, analyzed the data, and presented results. Karin Dodge, DNR Fisheries graphics and web design manager, provided website and graphics support. Brett Greenfield, DNR Fisheries GPS specialist, developed survey-specific maps. Brad Walters, DNR Fisheries database manager, developed the survey database in Access.

We used all typical forms of electronic outreach to solicit anglers in 2013 – DNR Fisheries press releases, a presentation on the Allan Ellis radio show, articles for the DNR Fisheries Angler's Log website, the DNR Artificial Reef website and angler blogs, and networking with the Maryland Saltwater Sportfishing Association (MSSA) and Coastal Conservation Association through members of the ARC. A member of the ARC solicited members from the MSSA Perry Hall chapter. Hats with the name of the study were offered as incentive.

The study was designed using the “angler logbook” method. Anglers were assigned to the pair of sites closest to their reported address. Volunteers were asked to commit to a minimum of 6 trips per site over the 2-month study period (September-October) and use the logbook provided to keep a record of all trips.

A webinar–conference call training session in late August (one week before fishing began) was conducted to review fishing and data collection instructions and emphasize that all trips had to be recorded for calculation of accurate measures of fishing success.

Anglers recorded the following information in their logbook for each trip (Figure 2):

- location and hours fished;
- species targeted from a list of 15 species;
- species caught from a list of 15 species;
- total number of species caught;
- total number caught/released for each species;
- length of first 10 fish caught of each species.

Changes in 2014

Because essentially all 2013 participants had been recruited through personal outreach to an angler group, this form of outreach was emphasized in 2014. Twelve presentations were made to angler groups and Dave Zajano, a particularly interested angler from 2013, made several of these presentations for an “angler-to-angler” approach. The study period was changed to the summer season (June-July-August) and volunteers were asked to commit to a minimum of 2 trips per month, fishing at both sites on each trip. The training webinar–conference call training session was held in late May for a June 1 start date.

Statistical Analysis

Survey management

Survey management data were analyzed to characterize volunteer response and participation, staff time required and total survey cost. Angler data were analyzed to characterize adherence to instructions (correctly completed forms, correctly recorded lengths and “zero-catch” trips reported).

CPUE

Fishing success was calculated as a Catch Per Unit Effort (CPUE), calculated as the mean number of fish caught per hour per trip per angler, across all anglers. The calculation was done for white perch and for all fish caught per trip across species. Student’s t-tests were conducted to determine if CPUE was significantly different between and among site pairs, and across years.

Biological measurements

Species diversity was calculated as the mean number of species caught per angler per trip per site, and is therefore NOT a measure of the diversity of species on the reefs. Student’s t-tests were conducted to determine if diversity was significantly different between paired sites. (In 2014, ANOVA was used to compare mean difference among Memorial Stadium, Man O’ War Shoals and Cook’s Point.) Length distributions were developed per site and a chi square test was conducted to determine if the length distributions were significantly different between paired sites.

RESULTS

Survey management

2013

Twenty-one anglers initially expressed interest. All but 2 were in the “Upper Bay” area so the survey was confined to the Memorial Stadium / Man O’ War Shoals site pair. Thirteen anglers volunteered to participate (50%) and 7 participated in the webinar training. Ultimately, 7 anglers participated and returned their logbooks of data, for a final participation rate of 33%.

Although we asked for a minimum of 6 trips over the 2-month period, volunteers fished at a fairly steady rate of about 2 trips/month (Figure 3), indicating that interest in the survey could be sustained at this rate over a few months. They followed instructions and did fish the site pairs fairly evenly, with 19 trips to Memorial Stadium vs. 23 trips to Man O' War Shoals. Anglers fished a mean of 1.5 hours per trip at both sites. Anglers did report zero-catch ("skunk") trips, and the rate of skunk trips was the same on both sites (3 skunk trips on each site, 12.5 % of trips). All anglers correctly completed the log sheets.

Approximately 200 staff hours were expended on the survey and the cost of materials and postage was approximately \$1,200.

2014

One hundred anglers initially expressed interest, and the same rate of anglers volunteered (48%), but the final participation was only 19 anglers (19%). Only the Memorial Stadium / Man O' War Shoals site pair had clearly sufficient volunteers (15). The Cook's Point / Cook's Sanctuary site pair had 4 volunteers, so was included in the study. No other sites were included.

A total of 135 trips were reported with 11% "skunk" trips, approximately the same rate as 2013. The sample size of trips on the Cook's Point / Cook's Sanctuary was too small for statistical comparison, but the rate of skunk trips was the same on Memorial Stadium and Man O' War Shoals sites (10% of trips). Volunteers fished as requested at a rate of about 2 trips/month. They followed instructions and did fish their site pair fairly evenly, with 57 trips to Memorial Stadium vs. 61 trips to Man O' War Shoals, and 10 trips to Cook's Point vs. 7 trips to Cook's Sanctuary. The mean time fishing was not significantly different among sites (1.5 hours per trip) and was the same as 2013. All but one angler correctly completed the log sheets (this angler reported group catch, not his individual catch) but length measurements were problematic at half-inch intervals (see below).

Approximately 250 staff hours were expended on the survey and the cost of materials and postage was approximately \$1,900.

CPUE

2013

There was no significant difference between fishing success on the artificial and natural reef ($\alpha = 0.05$, $p = 0.17$). Because white perch dominated the catch, the overall CPUE and white perch CPUE were indistinguishable (15 fish/hour).

2014

With only 17 trips, the Cook's Point / Cook's Sanctuary site pair had insufficient sample size for most analyses. There was no significant difference between fishing success on artificial and natural reefs (10 fish/hour, $n = 135$, $\alpha = 0.05$, $p = 0.25$), nor between Memorial Stadium and Man O' War Shoals (11 fish/hour, $n = 118$, $\alpha = 0.05$, $p = 0.25$). Because white perch dominated the catch, the overall CPUE and white perch CPUE were indistinguishable on Memorial Stadium and Man O' War Shoals.

Biological measurements

2013

Seven species were caught. White perch constituted 90% of fish caught, followed by Atlantic croaker (4.4%), bluefish and striped bass (2% each), spot and channel catfish, and one toadfish. There was no significant difference between mean diversity of fish caught on the artificial and natural reef (1.5 species per trip, $\alpha = 0.05$, $p = 0.60$).

Sample sizes were insufficient to compare species distributions or develop length distributions for any species but white perch. The white perch length distribution was robust using half-inch increments. Although the statistical analysis showed slightly larger fish on Man O' War Shoals (mean length 7.3 inches on Memorial Stadium vs. 7.6 inches on Man O' War Shoals, $\alpha = 0.05$, $p = 0.005$), the length

distributions indicate no practical biological difference (Figure 4). Most white perch caught were between 7 and 8 inches, with a maximum size of 10.5 inches recorded at both sites.

2014

Seven species of fish were caught. White perch constituted 88% of fish caught, followed by spot (4%) Atlantic croaker and striped bass (3% each), bluefish, channel catfish and yellow perch. There was no significant difference between mean diversity of fish caught on the artificial and natural reef (1.5 species per trip, $\alpha = 0.05$, $p = 0.09$).

Sample sizes supported development of length distributions for white perch on Memorial Stadium and Man O' War Shoals. The length distribution was only robust using full inch increments (Figures 5 and 6). Statistical analysis showed no difference in the 2014 mean lengths at Memorial Stadium and Man O' War Shoals (7.3 inches, $\alpha = 0.05$, $p = 0.09$), although larger maximum sizes were recorded at both Memorial Stadium (11.5 inches) and Man O' War Shoals (12.5 inches). There was no significant difference between 2013 and 2014 mean lengths on Memorial Stadium (7.3 inches, $\alpha = 0.05$, $p = 0.64$), indicating a stable population across the 2 years, whereas the mean size had increased from 7.0 inches in 2013 to 7.3 inches in 2014 on Man O' War Shoals. Cooks Point (further south) showed a distinctly different length distribution with more larger fish ($\alpha = 0.05$, $p < 0.001$).

DISCUSSION

Survey management

The final participation rate was approximately 20-30% of initial interest. The typical participant was willing to fish about twice per month and was willing to travel no more than about 30 minutes by boat. Therefore, successful solicitation of participants was in population centers with active recreational angler groups, within 20-30 minutes of a study site. For example, the Baltimore area consistently produced the majority of volunteers. Anglers perceived artificial reefs as good places to fish, and were patently unwilling to fish at "barren" sites. Therefore, comparative studies of "reef vs structure-less" sites are not possible with this method.

CPUE

The artificial reef provides anglers with about 11 fish per hour, dominated by white perch between 7-8 inches. Usually one of 4 other species is caught per trip. Fishing was consistently successful on reefs, as only about 15% of trips were skunk trips.

Based on Brett's original Yates Bar data layer, Man O War Shoals is approx 730 acres (300 hectares), and the Memorial Stadium Reef site which is only about 3 acres (1.2 hectares). Because all measures of reef fishing performance were similar between the two sites, the data suggest that the artificial reef is functioning as effectively as a much larger area of natural structure.

Biological measurements

The catch was dominated by white perch. The length distribution of white perch was not biologically different on Memorial Stadium and Man O' War Shoals and was fairly stable across the 2 years, with some larger fish reported in 2014. The difference seen in the white perch length distribution provided guidance that results cannot be extrapolated to other sites.

The different functional precisions of the 2013 and 2014 length distributions (half-inch vs. full inch increments) emphasizes the importance of angler training.

CONCLUSIONS

These data indicate that there is no difference in performance between Memorial Stadium (artificial reef) and Man O' War Shoals (natural reef).

The following aspects of the survey design and management were critical to success - recruitment through personal presentations, engagement of interested anglers to help recruit, requirement of commitment (including participation in a training webinar), a relatively short survey time frame.

Almost all trained volunteer anglers will fish according to instructions and correctly report the data. Although the anglers liked their hats, the primary motivation for participation appeared to be interest in contributing data used in management. They were very interested in receiving feedback of the results, and were enthusiastic that the survey at the same site over multiple years.

With at least 15 anglers per site, the angler participation pattern seen in this study (2 trips per month) produces sample sizes that can support "trip" catch rates, white perch catch rates and length distributions, and hook-and-line species composition at a site.

RECOMMENDATIONS

The Artificial Reef Committee and DNR Fisheries should continue this survey, as these results show that committed, trained volunteer recreational anglers can provide valid data on artificial reef fishing with minimal cost, including catch rates, fish lengths and hook-and-line species diversity.

Catch rate, species diversity and rate of skunk trips were all equivalent and stable across the two years of the study, indicating that Memorial Stadium & Man O War Shoals provide a stable and reliably successful fishing experience for anglers.

No results obtained thus far can be extrapolated to the reef system in general. Data from more sites are needed to determine whether general results can be obtained. Future surveys should be targeted at single MARI sites close to population centers with active fishing groups, such as Kent Island, Solomons Island, and the Ocean City area.

The survey team should begin investigation into future use of a "smart phone" angler log app to submit the data.

REFERENCE

Loftus A.J., and R. B. Stone. 2007. Artificial Reef Management Plan for Maryland. Prepared for Maryland DNR, under Maryland Environmental Service Contract 06-07-58, June 2007, 198 pp. .

Table 1. Species, Counts of Catch and Measured

SPECIES	2014		2014	
	CAUGHT	MEASURED	CAUGHT	MEASURED
Bluefish	41	21	8	7
Channel Catfish	16	2	24	22
Atlantic Croaker	52	33	53	53
Spot	10	10	84	82
Striped Bass	19	19	55	55
White Perch	450	265	1794	829
Yellow Perch	0	0	2	2
	588	350	2020	1050

Figure 1. Site map

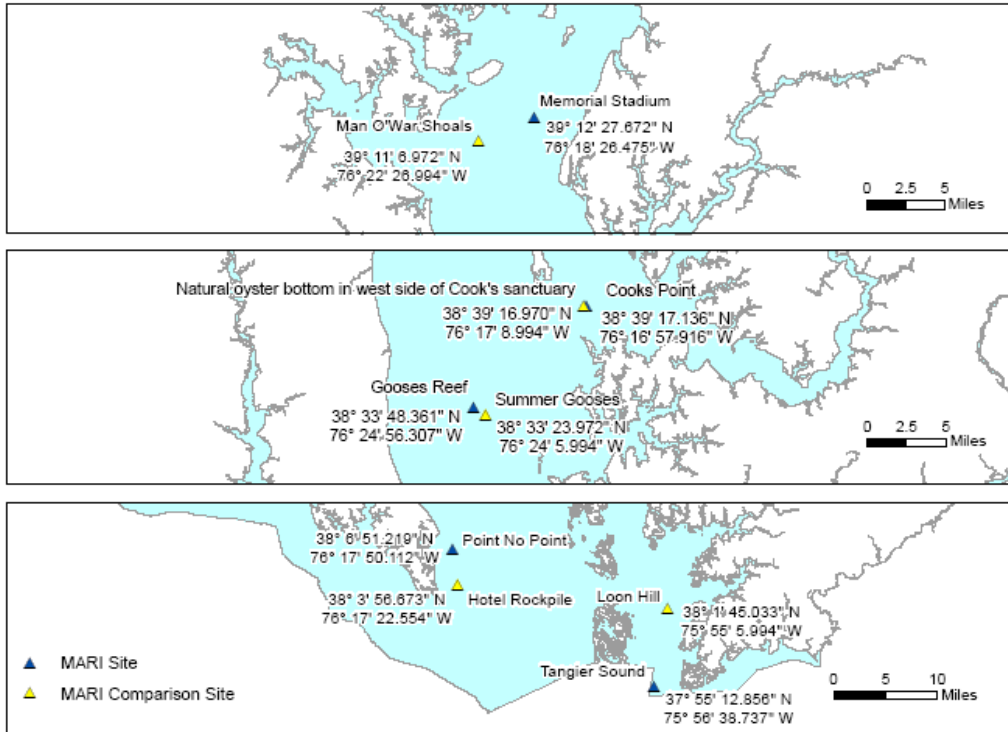


Figure 2. Log sheet

SITE	Tangier Sound		Cooks Point				Memorial Stadium			Gooses			Point No Point		
	Loon Hill		Cook's Sanctuary				Man O' War Shoals			Summer Gooses			Hotel Rockpile		
DATE	TIME AT SITE							TOTAL SPECIES CAUGHT							
TARGET SPECIES	BLACK SEA BASS	BLUEFISH	CHANNEL CAT	CROAKER	BLACK DRUM	RED DRUM	SHEEPS HEAD	SPANISH MACKEREL	SPOT	SPOTTED SEATRUT	STRIPED BASS	SUMMER FLOUNDER	TAUOG	WEAKFISH	WHITE PERCH
LENGTH 1															
LENGTH 2															
LENGTH 3															
LENGTH 4															
LENGTH 5															
LENGTH 6															
LENGTH 7															
LENGTH 8															
LENGTH 9															
LENGTH 10															
TOTAL KEPT															
TOTAL RELEASED															

Figure 3. Angler Trips per Week in 2013

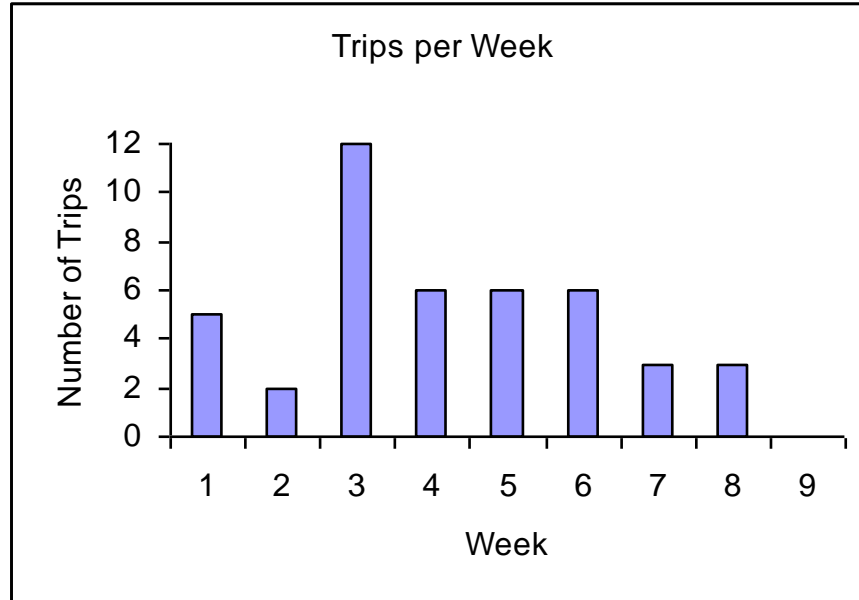


Figure 4. White perch length comparison (2013)

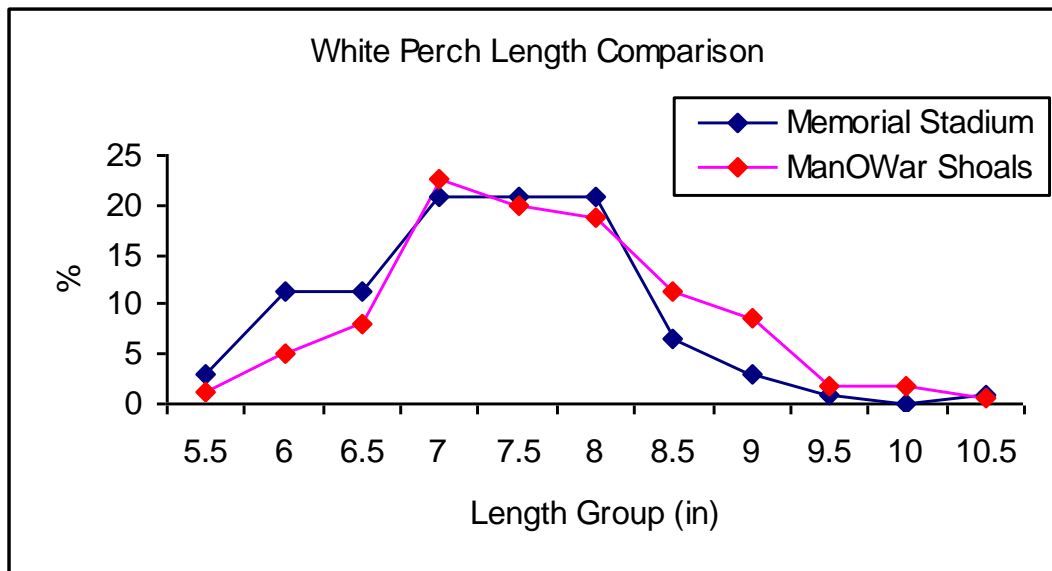


Figure 5. White perch half-inch length distributions (2014)

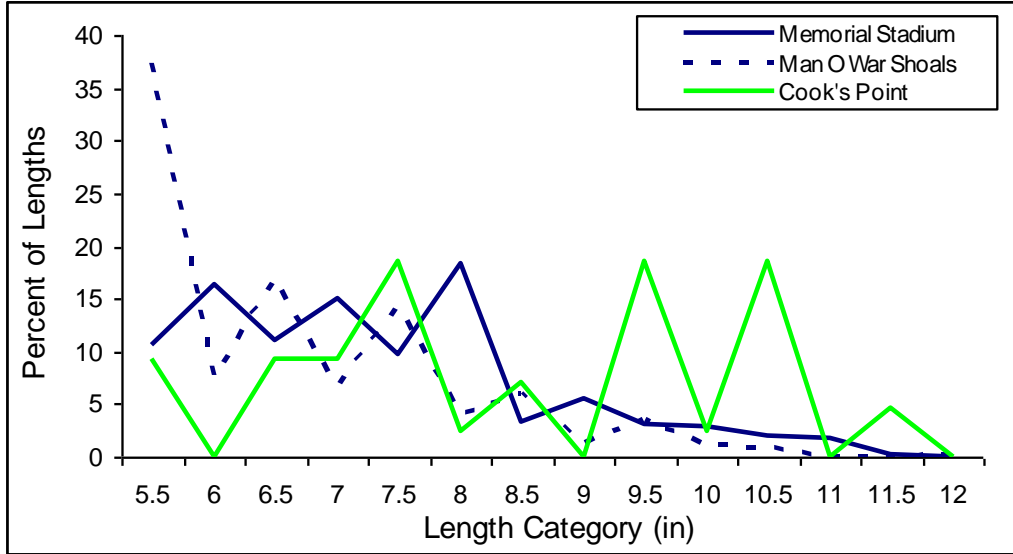


Figure 6. White perch full-inch length distributions (2014)

