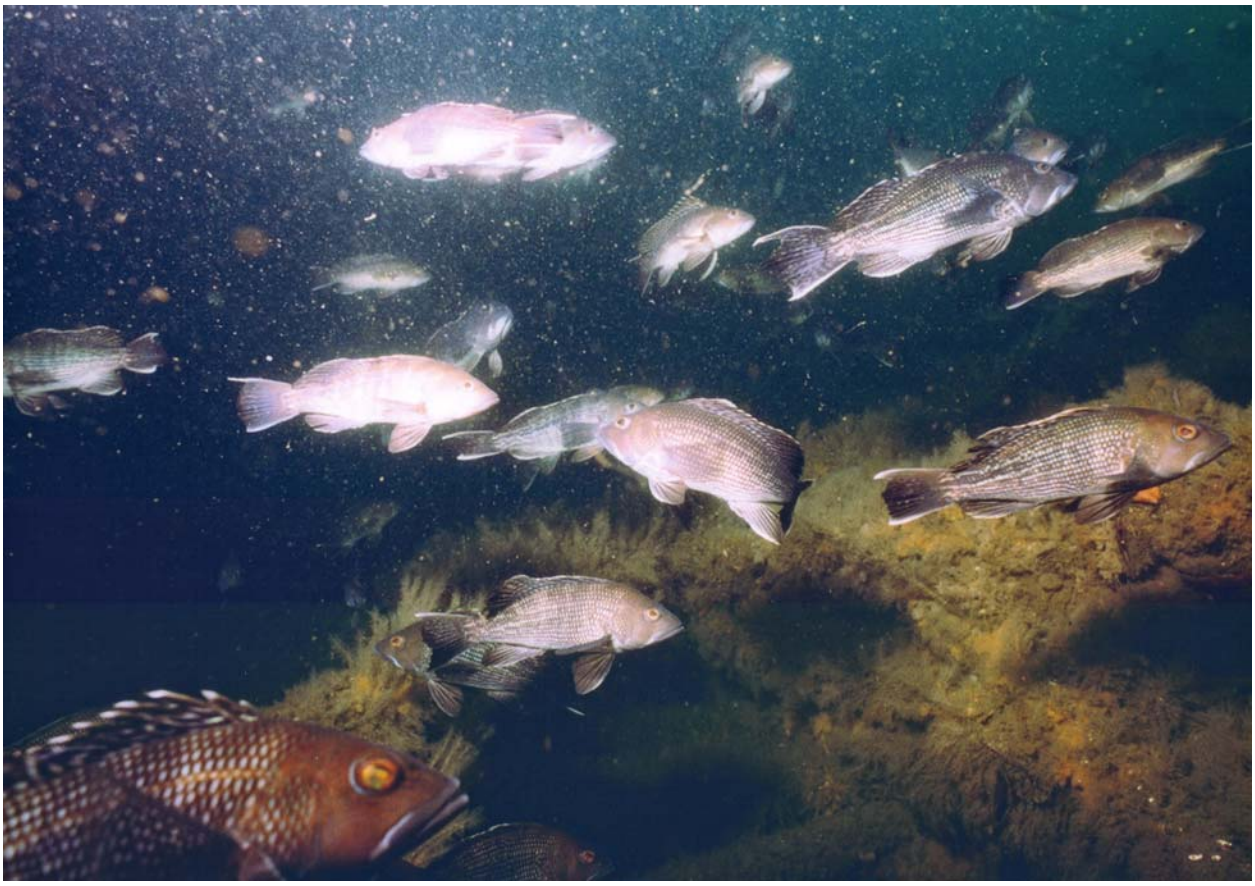
ARTIFICIAL REEF MANAGEMENT PLAN FOR MARYLAND



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under
Maryland Environmental Service Contract 06-07-58

June 2007

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ADOPTION STATEMENT

Artificial Reef Management Plan for Maryland

The fisheries of the Chesapeake Bay, Atlantic Coast, and coastal bays are vitally important to the citizens of Maryland and to our state's economic future. Unfortunately, much of the natural underwater reef habitat that once supported healthy aquatic communities, including some of these fisheries, has slowly diminished over the past century, resulting in degraded benthic habitat, and lost fishing opportunities for citizens of our state.

I am pleased to adopt this *Artificial Reef Management Plan for Maryland* as one step that the Department of Natural Resources is taking to ensure the health of our fisheries resources and to enhance opportunities for vibrant recreational fisheries. This plan establishes guidelines that Maryland will follow when deciding placement, construction techniques, and other aspects of artificial reef development. The plan is based on the most current information available from experts nationwide, customized to meet the unique needs and desires of Maryland constituents. The guidelines provided in this plan will ensure that artificial reef construction in Maryland is conducted in an organized and scientifically acceptable manner that helps to ensure that artificial reefs are effective tools for improving marine and estuarine habitat, and enhancing fishing opportunities.

For the first time ever in our state, we are establishing a Maryland *Artificial Reef Committee* to guarantee that decisions on artificial reef development are made in partnership with a broad cross section of interested constituents. Working together, Maryland agencies, federal agencies, nonprofit organizations, the private sector and the fishing public, will create a program for artificial reef development that will provide a solid foundation for enhancing the future of Maryland's fisheries.

John Griffin
Secretary

June 25, 2007
Date

EXECUTIVE SUMMARY

Artificial reefs, for purposes of enhancing fish populations, have been constructed in Maryland's tidal waters for at least 40 years. During part of this time, the Maryland Department of Natural Resources maintained a formal artificial reef program, including program staff and funding. However, there has never been a formal plan to coordinate the development of artificial reefs in the Chesapeake Bay, coastal bays, or ocean waters. There are presently 20 such permitted artificial reef sites in the Chesapeake Bay, nine in the waters of the Atlantic Ocean off Maryland, and one in the coastal bays. Interest from Maryland's fishing community to further develop these sites and add new sites continues to grow, particularly as some productive fishing areas and opportunities have been lost.

The Artificial Reef Management Plan for Maryland establishes broad goals, guidelines, and criteria for future development of artificial reef sites. The plan and supporting material reflects state-of-the art scientific understanding of artificial reef development. Specifically, it outlines criteria for program management and coordination, reef site selection, material selection and acquisition, funding, monitoring and evaluation requirements, and other aspects of artificial reef development. As the state authority for managing the Chesapeake Bay, ocean, and coastal bays bottomlands, the Maryland Department of Natural Resources will coordinate implementation of the plan but may enter into agreements with other entities to carry out specific aspects of the plan, including responsibility for permitting.

This management plan is composed of three distinct documents:

- A broad, general plan for development of Maryland's reefs;
- "Guidelines for Marine Artificial Reef Materials"
- Decision Making Document for Artificial Reef Construction in Maryland.

Each component serves as an integral piece to balanced management and development of Maryland's artificial reefs. This plan is intended to provide broad guidance to assist in future development of artificial reefs in Maryland's tidal waters and should be viewed as a dynamic plan that can be modified as new information and research on artificial reef construction becomes available.

** * * *

ACKNOWLEDGMENTS

We would like to acknowledge the many state artificial reef coordinators and their staffs who provided information to us and allowed us to use material from their plans or guidance documents. We particularly appreciate the help from Bill Figley, now retired, and Hugh Carberry of New Jersey, Jeff Tinsman from Delaware, Mike Meier of Virginia, Jim Francesconi of North Carolina and Jon Dodrill and Keith Mille from Florida. The format for this plan is a modified version of the New Jersey Plan but we obtained a lot of very good information from the other plans and the Virginia guidance documents plus previous work that had been done in Maryland. We appreciate the assistance of the staff of the Maryland Department of Natural Resources and Maryland Environmental Service for their input and guidance, as well as the Ocean City Reef Foundation staff and volunteers and in particular Monty Hawkins, Greg Hall and Gail Blazer. John Foster helped us find significant historical information. Substantial input was provided by Maryland constituents and organizations, as well as the Maryland Sport Fish Advisory Commission, Tidal Fish Advisory Commission, and Coastal Bays Advisory Committee. Special thanks to Doldon Moore of the Maryland Board of Public Works, Stephanie Reynolds and Bill Goldsborough of the Chesapeake Bay Foundation, and Keith McGuire for their particularly thorough reviews of the draft plan. Paul Genovese of the Maryland DNR provided the maps of reef locations found in the document. Development of this plan was funded through Maryland Environmental Service Contract 06-07-58.

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1.0 DEFINITIONS, PURPOSE /GOAL/OBJECTIVES OF MARYLAND'S ARTIFICIAL REEF PROGRAM

1.1 Purpose of Maryland's Artificial Reef Program

The purpose of the Maryland Artificial Reef Program is to provide artificial reef habitat on selected Chesapeake Bay, Atlantic Ocean and coastal bay sites to:

- Enhance habitat for fish and benthic organisms associated with reefs;
- Increase reef biological carrying capacity;
- Enhance biological diversity;
- Increase fish populations, and;
- Provide sustainable fishing opportunities.

This program will be guided by the Artificial Reef Management Plan for Maryland. This plan provides state-level guidelines and standards based on the best scientific information and management advice available in the National Artificial Reef Plan (Stone, ed., 1985) and current draft revision to that plan (dated 2002), earlier Maryland artificial reef efforts, other state plans, guidelines from Interstate commissions, Maryland constituent input, and other reference documents and publications.

IMPORTANT: Site specific or regional specific plans should be prepared within this plan's guidelines for final decisions on exact composition and location of materials and the details of monitoring and research on selected sites.

1.2 Reef Program Goal/Objectives

The goal of Maryland's Artificial Reef Program is to develop, maintain, monitor, evaluate and administer a successful, diverse system of fishing reefs in the Chesapeake Bay, Atlantic Ocean, and coastal bays that provide effective artificial reef habitat for fish and invertebrates, provide sustainable fishing opportunities, and be integrated into a broader fishery management program in Maryland.

The primary objectives of the Maryland Artificial Reef Program are to:

- Enhance reef habitat at the existing permitted artificial reef sites where appropriate;
- Create new reefs based on siting criteria and need expressed by advisory organizations, the fishing public, and other constituents;
- Improve fishing opportunities;

- Work cooperatively with the Maryland DNR Shellfish Program to address common goals for establishing healthy reef communities that sustain fishing;
- Determine the types of natural and fabricated materials (including materials of opportunity) appropriate for specific site locations and reef objectives;
- Improve intergovernmental coordination and public/private sector cooperation and support;
- Make public participation and public education an integral part of the artificial reef program;
- Site artificial reefs to promote the long-term social, economic, and quality of life values that will benefit the citizens of Maryland and visitors;
- Encourage research and monitoring on the artificial reefs and the maintenance of long-term artificial reef data bases, including location through Geographical Information System (GIS) mapping;
- Periodically evaluate the artificial reefs based on their biological, social and economic impact and communicate findings to constituents; and
- Identify, procure and maximize new and existing sources of funding for the artificial reef program.

1.3 Definitions of Natural and Artificial Reefs

Natural reefs are normal rises, ridges, rock or other naturally occurring hard substrate in aquatic environments that are conducive to sustaining populations of reef associated fauna and flora. In Chesapeake Bay most natural reefs were created by the accumulated growth of oysters over hundreds of years. Artificial reefs are man-made or natural objects placed in selected areas of aquatic environments to provide or improve rough bottom habitat and thereby enhance populations of reef-associated species and the opportunity to harvest some of these species.

1.4 Effects of artificial reefs

Properly designed and sited artificial reefs, as they mature, should function similar to natural reefs of the same size in the same area. While the number of species may be low for the first few months after construction, the numbers of individuals may be high depending on the numbers of larval or juvenile fishes in the area that find the reef. Within a year, the reefs often have similar number of fish species and individuals as similar size natural reefs in the area (Stone 1979), or perhaps many more, depending on the configuration and complexity of the reef relative to the surrounding bottom area. This is not to say that the reefs will reach carrying capacity in that time period. The time to reach carrying capacity is uncertain, but what is certain is that reefs, properly constructed, can be dynamic, productive additions to the existing habitat. The reefs will exhibit seasonal variations in numbers of species and individuals but should grow over time as carrying capacity is approached. Artificial reefs can be used in certain situations to jumpstart benthic growth of organisms, such as oysters, that ultimately may lead to ecologically functioning reef complexes that support fish populations.

2.0 STATE AND NATIONAL AUTHORITY FOR ARTIFICIAL REEF PROGRAMS

The development of state and federal artificial reefs programs is based on numerous state and federal acts, laws and statutes that have been incorporated into state code, U.S. Code, or the U.S. Code of Federal Regulations. The following table (Table 1, modified from Myatt and Myatt 1998) lists federal legislation that could directly or indirectly impact artificial reef development or funding. This legislative history is based on the premise that properly sited and constructed artificial reefs can be effective management tools to improve recreational fishing opportunities, benefit coastal economies, and enhance populations of reef associated species.

Table 1. Federal Legislation that Could Impact Artificial Reef Development or Funding.

1. Federal Aid in Sport Fish Restoration Act of 1950 (16 U.S.C. 777-777k Stat. 430).
2. Federal Aid in Wildlife Restoration Act of 1937 (Pittman-Robertson Act).
3. Sport Fish Restoration Act of 1984 (P.L. 98-369) (Wallop-Breaux Amendment).
4. Fish and Wildlife Act of 1956 (16 U.S.C. 742a, 3 et seq. 1), the Migratory Marine Game-Fish Act (16 U.S.C. 760c-760g), the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c).
5. National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.; Appendix B, 33 CFR Part 325).
6. Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c), Sec. 307).
7. Marine Protection and, Research, and Sanctuaries Act of 1972 (P.L. 92-532, 33 U.S.C. Sec. 1401-1402).
8. Maritime Programs Appropriations/Authorizations Act of 1972 (Liberty Ship Act) (P.L. 98-402).
9. Saltonstall-Kennedy Act of 1954, as amended (15 U.S.C. 713c-).
10. National Sea Grant College and Program Act of 1966 (P.L. 89-688; H.R. 16559).
11. Clean Water Act (33 U.S.C. 1341, Sec. 401).
12. The Endangered Species Act (16 U.S.C. 1531 et seq.).
13. The National Fishing Enhancement Act of 1984 (P.L.98-623; 33 U.S.C., Chap. 35, Sec. 2101-2106).
14. Surplus Vessel Act of 1990 (H.R. 5118; P.L.98-623).
15. Magnuson-Stevens Fishery Conservation and Management Act, as amended through 2006 (P.L. 94-265; 16 U.S.C.1801-1882).
16. Water Resources Development Act of 1986 (33 U.S.C. 2263(b); Section 704(b)).

The primary state legislation governing the construction of artificial reefs in tidal waters of Maryland is the Tidal Wetlands Act (Annotated Code of Maryland, Environment Title 16 and Code of Maryland Regulations, Environment Title 26). Open waters influenced by tidal actions, where artificial reefs covered under this plan are placed, are included under the definition of tidal wetlands. The Maryland Board of Public Works is responsible for the final issuance of permits under this law.

2.1 National Standards

The "Proposed Amendments to the National Artificial Reef Plan of 1985," prepared by the Joint Artificial Reef Technical Committee of the Atlantic and Gulf States Marine Fisheries Commissions (June 1998) states that the purpose of the National Fishing Enhancement Act is to promote and facilitate responsible and effective efforts to establish artificial reefs in the navigable waters of the US and waters superjacent to the outer continental shelf (as defined in 43 U.S.C., Section 1331) to the extent such waters exist in or are adjacent to any State.

Section 203 of the National Fishing Enhancement Act establishes the following standards for artificial reef development. Based on the best scientific information available, artificial reefs in waters covered under the Act "…shall be sited and constructed, and subsequently monitored and managed in a manner which will:

1. Enhance fishery resources to the maximum extent practicable,
2. Facilitate access and utilization by US recreational and commercial fishermen,
3. Minimize conflicts among competing uses of waters covered under this title and the resources in such waters,
4. Minimize environmental risks and risks to personal health and property, and
5. Be consistent with generally accepted principles of international law and shall not create any unreasonable obstruction to navigation."

2.2 Maryland Policy

The state of Maryland maintains the authority for fishery management and enhancement of the Chesapeake Bay, coastal bays, and ocean bottom within the state's territorial boundaries. Artificial reef construction authority originates within the Maryland Department of Natural Resources (MDDNR), with the permitting authority for placement of materials in the waters being held by the U.S. Army Corps of Engineers (Chesapeake Bay Program 1994). Final authority for the placement of reefs in Maryland tidal waters rests with the Maryland Board of Public Works.

Chesapeake Bay - Currently, the aquatic reef permits (Corps of Engineers No. 97-62368-7 and Wetlands License No. 05-1531) are held by the Maryland Environmental Service (MES) who is working cooperatively with MDDNR on long term reef management. Both permits are current

until December 2015. The permits are for the improvement of benthic habitat on 20 reef sites in the Chesapeake Bay and tributaries by the placement of hard substrate on the reef sites in accordance with the permit conditions.

As a condition of the permits issued in 2005, the permit holder has implemented the following policy to provide quality assurance of construction activities:

- The permit holder will inspect and approve all materials prior to delivery to the reef site.

- The permit holder will specify the position within the site and the design configuration of the material on the bottom to the material donor prior to delivery. The permit holder may authorize field modifications to the planned configuration to address deployment specific conditions.

- The permit holder will supervise and inspect the placement of the material per contract, permit and wetland license requirements and certify that the material is in the specified location, and meets the required clearance prior to the permit holder accepting title to material. The contractor will be responsible for correcting placed material to bring it into conformance with permit criteria. The contractor will provide reasonable access to deployment equipment for onsite inspection. The contractor will also provide reasonable onsite access to U.S. Army Corps of Engineers and Maryland Department of the Environment for any compliance inspections, announced or unannounced, during placements.

*Atlantic Ocean and coastal bay*s – The Ocean City Reef Foundation currently holds aquatic reef permits for the nine artificial reef sites in the Atlantic Ocean and one artificial reef site in the coastal bays area. Each reef site is governed by different policies dictated by the conditions of the individual permits.

3.0 FACTORS PROMPTING THE NEED FOR THE MARYLAND ARTIFICIAL REEF PROGRAM

3.1 Loss or lack of hard substrate habitat

The upper Chesapeake Bay and ocean waters off Maryland's coast provide very limited reef habitat. Much of the currently existing bottom in these areas is a rather flat, sand, mud or composite substrate that offers few features or hard substrate necessary for reef assemblages. In the Chesapeake Bay, natural reef habitats consist mainly of oyster reefs, which were once more common. Historically, many of these oyster reefs provided three-dimensional relief, with significant inter-tidal habitat that was the primary reef structure in the Bay (Foster 1994). This habitat has decreased significantly with the decrease in oyster abundance and other productive natural reefs have been degraded or covered as a result of heavy sediment loads from runoff (MES, January 2006) and as oyster bars were scraped down from centuries of oyster harvesting. In the ocean waters off Maryland, reef habitat may be even less abundant (Maryland Aquatic

Reef Program 1995 Annual Report), consisting mainly of a few rocky ridges and outcroppings, augmented by shipwrecks and other manmade structures. This habitat also deteriorates over time through corrosion, biodegradation, storm damage, the sand blasting effect from strong currents or wave action, sedimentation and other forces. In the coastal bays, fewer opportunities for reefs exist due to the relatively shallow nature of those waters.

3.2 Continuing Need to Enhance Recreational Fishing Opportunities

Recreational fishing is a major industry in Maryland with over 1,750,000 trips by over 800,000 anglers on private/rental boats and charter/headboats in bay and ocean waters off Maryland coastlines in 2004. Since a significant portion of this effort takes place on reef-like habitat, it is important to continue to enhance this type of habitat and make it accessible to anglers. Enhancing this habitat not only benefits anglers but also benefits many of the species that anglers seek (Table 2). Pelagic species also may be found seasonally around ocean reefs.

Table 2. Reef or Reef-Associated Fish Species Sought By Anglers in Maryland Waters.

Chesapeake Bay	**Ocean and Coastal Bays**
Striped bass	Black seabass
Bluefish	Summer flounder
Atlantic croaker	Striped bass
Summer flounder	Bluefish
Weakfish	Weakfish
Black seabass	Tautog
Spot	King mackerel
White perch	Pollock
Catfish	Red hake
Yellow perch	Northern kingfish
Tautog	Scup
Spotted sea trout	Cunner
Black drum	Spotted hake
Red drum	

In 2003, significant fishing habitat on the western side of the Chesapeake Bay was put off limits to recreational anglers due to increased homeland security measures when the liquefied natural gas terminal at Cove Point was reopened. For decades earlier, while this facility was dormant, it was arguably one of the most popular and productive destinations for recreational fishing. Other areas of hard bottom in the Bay that traditionally supported significant recreational fishing have become silted in and no longer offer the opportunities that that once did. Anglers and the Department of Natural Resources view replacing these lost fishing opportunities as a priority.

4.0 MARYLAND'S ARTIFICIAL REEFS

4.1 Origin of the Maryland's Artificial Reef Program

Chesapeake Bay –According to available records, the earliest permitted Chesapeake Bay reef was the Hollicutt's Noose Reef site that has an original permit date of 1966 (Figure 1). There are indications that material was first placed on this site in 1968 and continued into 2004. The Love Point reef site and six other Bay sites were permitted in 1967. During the 1970s, additional sites were added to arrive at the current, 20 officially permitted reef sites.

Atlantic Ocean and coastal bays - Ocean artificial reefs have been cooperative efforts, with the State, Town of Ocean City and the Ocean City Reef Foundation involved in the planning and development of these reefs. Some of the history of ocean reefs is documented in a paper by Hawkins (2004). He reports that three wooden menhaden purse seiners, a wooden dragger and several barges were sunk in 1966 at the Bass Grounds approximately nine miles offshore in the debris field of the African Queen wreck. According to Hawkins, they are still in place and, although badly degraded, are still heavily fished.

Until 1997, the Maryland Department of Natural Resources maintained an artificial reef program with program staff. At least two full time staff maintained this program, supplemented with additional personnel at various times. Site planning and management as well as observation and evaluation of reef sites were conducted. In 1997, this program was disbanded and permit authority was transferred to the Maryland Environmental Service (Chesapeake Bay) and the Town of Ocean City (Atlantic Ocean and coastal bays).

4.2 Existing reef sites

There are 20 artificial reef sites in Maryland waters of Chesapeake Bay (Table 3; Figures 1 and 2) with permits authorized through December 31, 2015 and 10 permitted reef sites on the ocean side/coastal bays; eight fishing reefs in the ocean, one research reef in the ocean, plus one small reef in the bay behind Ocean City (Figure 3). All sites will be included in a GIS mapping program.

Figure 1. Maryland Chesapeake Bay Artificial Reef Site Locations.

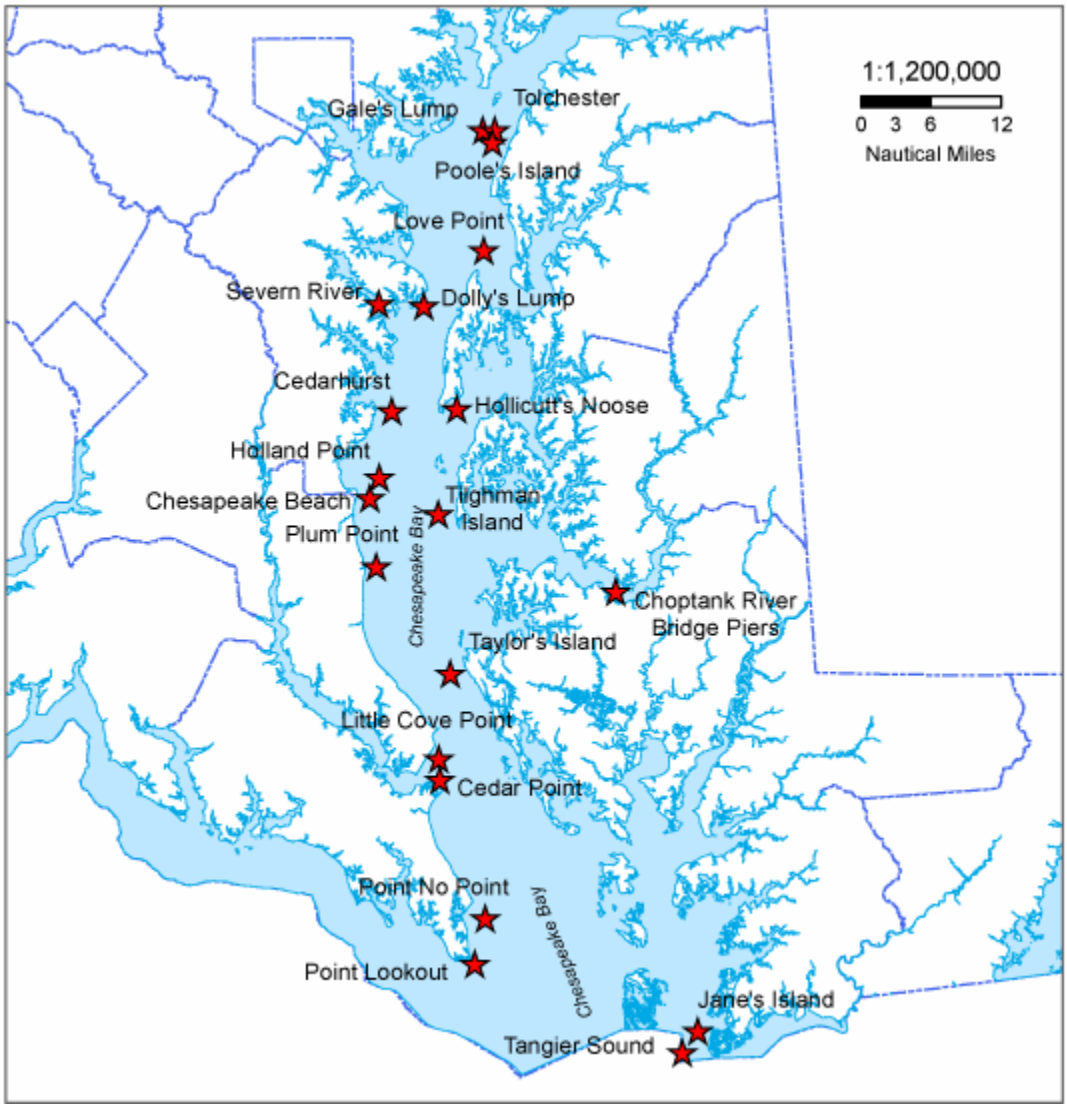


Figure 2. Chesapeake Bay Artificial Reef Sites by Region.

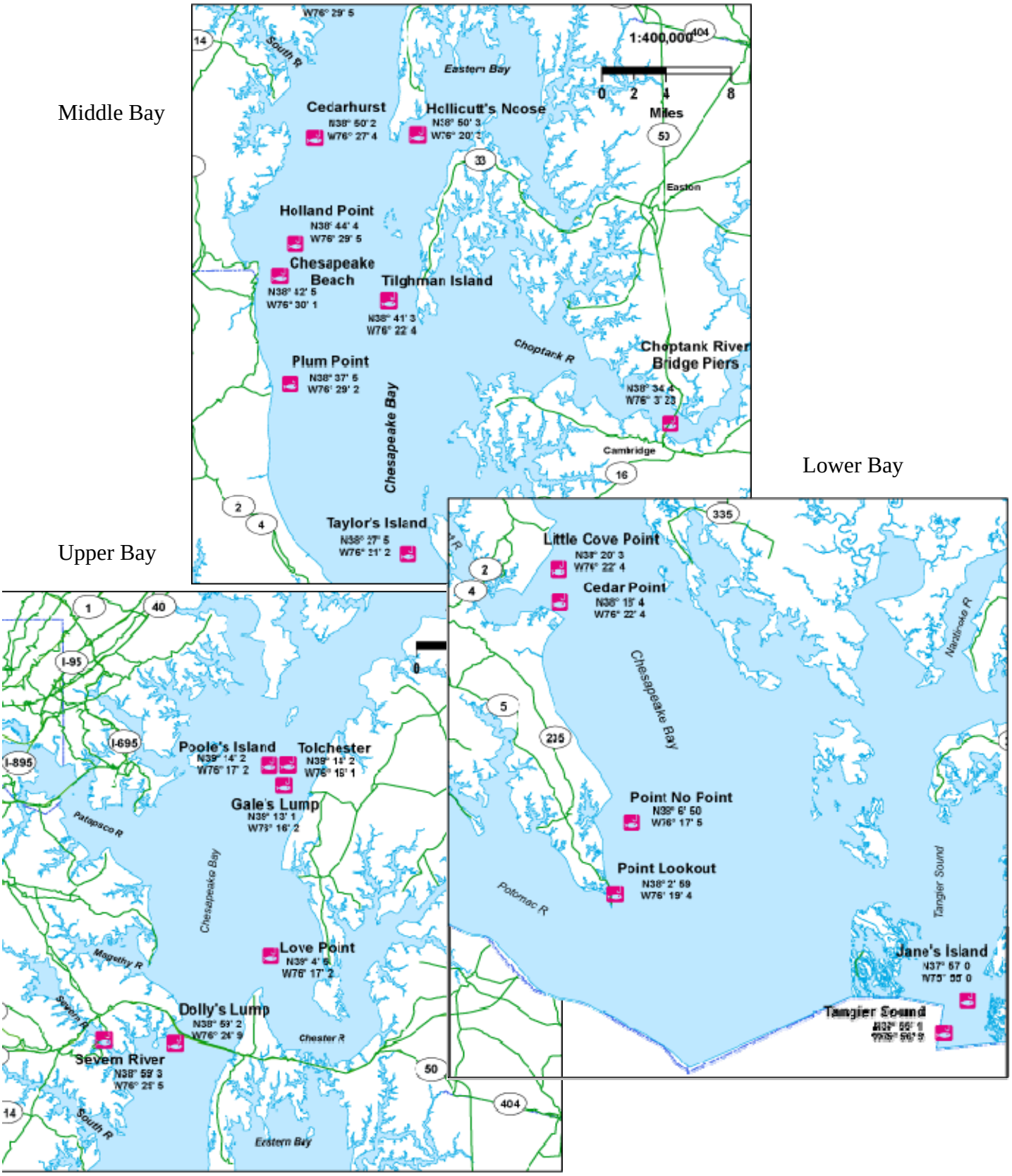
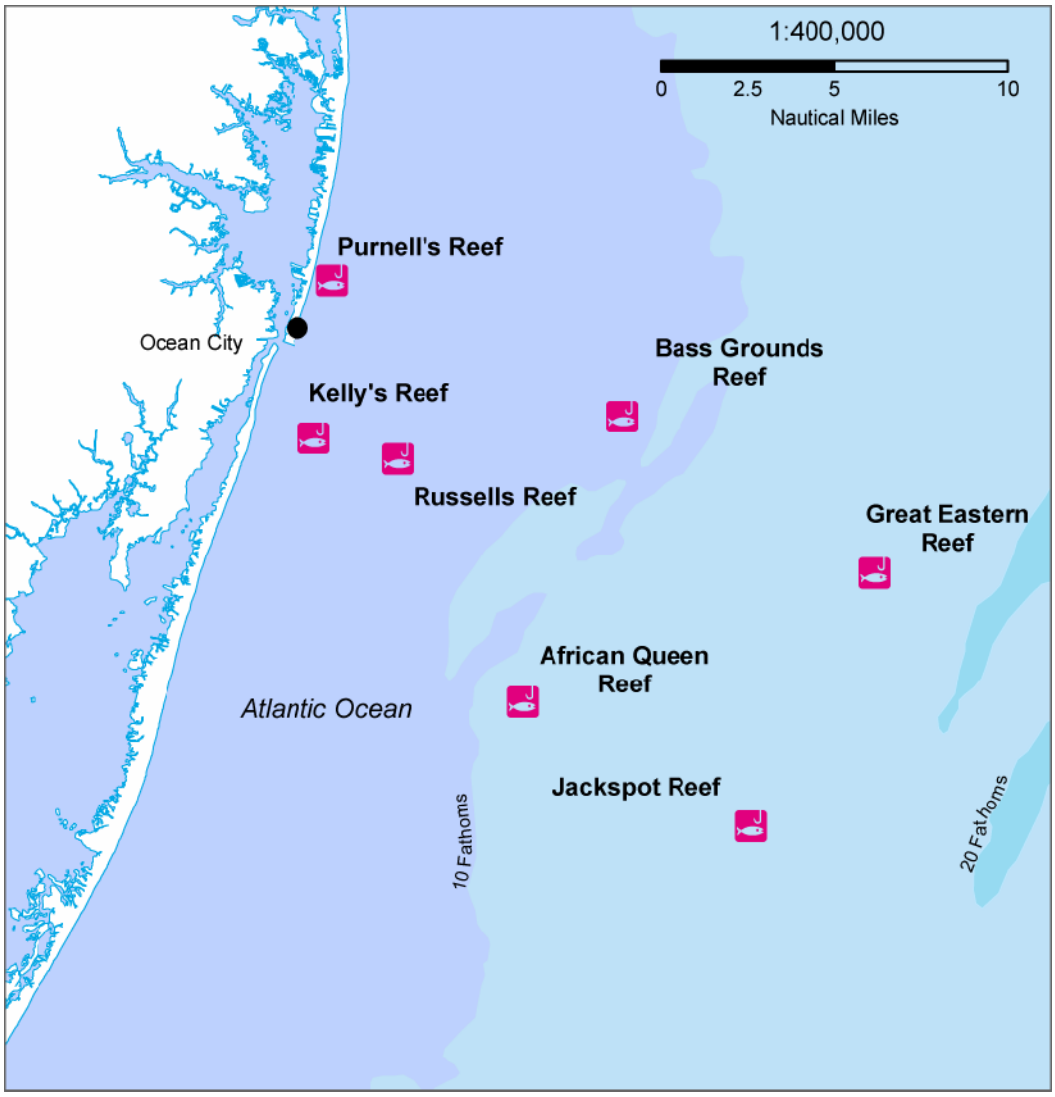


Figure 3. Maryland Ocean Artificial Reef Site Locations.



Note: "Research Reef" and "Isle of Wight" reef are not yet developed and are not depicted on this map.

Table 3. History of Artificial Reef Sites in Maryland Waters of Chesapeake Bay.

REEF	PERMITTED SIZE (ACRES)	PERMITS ISSUED	LAST MATERIAL	BOTTOM	LOCATION	EXISTING MATERIALS	FUTURE MATERIALS
Cedar Point	155	1986	2004	sand, sand with cultch	Middle Bay	Rock piles, concrete, fiberglass units, reef balls	Reef Balls; Materials of Opportunity
Gales Lumps	1550	1989	2004	Silt with shell	Upper Bay	Quarry stone, concrete culvert, concrete rubble	Reef Balls, Materials of Opportunity
Holland Point	81	1986	2004	Mud, silty sand	Middle Bay	Concrete rubble, monotubes, Fish Aggregating Devices	Materials of opportunity, vessels
Hollicutt's Noose	50	1966	2006	sand, sand with cultch	Middle Bay	Concrete rubble, tire units, steel tug	Reef Balls; Materials of Opportunity
Little Cove Point	50	1968	2004	silty sand with shell, mud	Middle Bay	Tire units, concrete rubble, bridge piles, reef balls	Reef Balls; Materials of Opportunity
Love Point	50	1967	2005	Silty clay, sand	Upper Bay	Bridge decks, tire units	Reef Balls; Materials of Opportunity
Plum Point	3443.5	1993	2004	sand, silty sand, clay, clayey sand	Middle Bay	Concrete rubble, cubes, riprap, steel vessels, tire units	Reef Balls; Materials of Opportunity; vessels
Taylors Island	80.5	1986	2003	mud	Middle Bay	Bridge decking, barge	None planned unless expanded

Maryland Chesapeake Bay Reefs (continued)

Tilghman Island	107	1987	2004	sand, sand with cultch	Middle Bay	Materials of opportunity	Reef Balls; Materials of opportunity
Pooles Island	234	1994*			Upper Bay	Concrete rubble	Reef Balls
Cedarhurst	50	1983*			Upper Bay	Concrete Rubble	Reef Balls; Materials of Opportunity
Hacketts Point	50	1968*			Upper Bay	Concrete Pipe	Reef Balls; Materials of Opportunity
Tolchester	50	1986*			Upper Bay	Concrete rubble	Reef Balls
Severn River	2.5	1994	1996	mud	Upper Bay	Bridge rubble; barge	Reef Balls
Chesapeake Beach	50	1968*			Middle Bay	Tire units	Reef Balls; Materials of Opportunity
Choptank River	1	1986*			Middle Bay	Bridge materials	Reef Balls
Point No Point	1059	1986*	2007		Lower Bay	Barges, vessels, shell piles; bridge decking	Reef Balls, materials of opportunity, vessels
Point Lookout	16	1990*			Lower Bay		Reef Balls
Tangier Sound	86	1988*			Lower Bay	Rock piles	Reef Balls, materials of opportunity, vessels
Jane’s Island	50	1968*			Lower Bay	Tire units	Reef Balls; materials of opportunity

* estimated based on historical documents, not permit records.

Table 4. History of Artificial Reef Sites in Maryland Oceanside Waters.

REEF	SIZE	ESTABLISHED	LAST MATERIAL	BOTTOM	LOCATION	EXISTING MATERIALS	FUTURE MATERIALS
Kelly's	467.2 acres	2005	2007	Sand	3 miles southeast of R-4 buoy	Materials of Opportunity, Designed units, Barge	Same
Russell's (Great Gull)	998.4 acres	1993	2006	Sand	4 miles southeast of R-2 buoy	Materials of Opportunity, Designed units, Vessels	Same
Jack Spot	147.2 acres	2004, placement of material began in 2005	2005	Sand	19 miles southeast of R-2 buoy	Materials of Opportunity	Materials of Opportunity, Designed units, Vessels
Research	304 acres	2005	None	Sand	7.5 miles east-northeast of R4 buoy	None	TBD
African Queen	800 acres	1994, site of existing wreck	2005	Sand	13 miles southeast of R-2 buoy	Materials of Opportunity, Designed units, Vessels	Same
Isle of Wight	90 acres	2005	None	Sand	6 miles northeast of R-4 buoy	Undeveloped	Materials of Opportunity, Designed units
Bass Grounds	878.1 acres	1997	2006	Sand	9 miles east of R-2 buoy	Materials of Opportunity, Designed units, Vessels	Same
Purnell's	413.2 acres	1997	2005	Sand	2 miles northeast of R-4 buoy	Materials of Opportunity, Designed units, Vessels	Same
Great Eastern (Twin Wrecks)	1011.2 acres	1999	2004	Sand	20 miles southeast of R-2 buoy	Materials of Opportunity, Vessels	Materials of Opportunity, Designed units, Vessels
Mason's (coastal bay)	0.92 acres	2003	2005	Silty Sand	Off bulkhead, between 2nd and 4th Streets	Designed units, 4 piles of 6 pyramids	TBD

5.0 ARTIFICIAL REEF PROGRAM PLANNING, COORDINATION AND ADMINISTRATION

5.1 Reef Types/Locations

All reefs placed in Maryland tidal waters will be classified with a specific purpose based on the intended functions. The types of reefs that will be considered, and their basic attributes, are discussed below. This includes: 1) Chesapeake Bay reefs and 2) ocean/coastal bay reefs.

Decisions on additional Chesapeake Bay artificial reefs will be based on planning (5.2), advisory committee and public input (5.10), intra and inter-agency discussions, and siting criteria (6.1). Modification of existing artificial reefs in Maryland and the construction of new reefs in the Chesapeake Bay will be covered under this plan.

Decisions on ocean reefs will involve Ocean City officials and Ocean City Reef Foundation members as well as the process mentioned above for Chesapeake Bay Reefs.

5.1.1 Fishing Reefs

The primary focus of this plan as stated earlier is to develop, maintain, monitor, evaluate and administer a successful, diverse system of fishing reefs in the Chesapeake Bay, Atlantic Ocean, and coastal bays that provide effective artificial reef habitat for fish and invertebrates, and provide sustainable fishing opportunities. While reefs may be constructed primarily to enhance fishing opportunities, one or more secondary objectives could also be a component of the project. Fishing activity associated with artificial reefs can provide substantial economic benefit to the state or region where the reef is located. For example, in Maryland, the net economic benefit derived from the addition of one artificial reef was estimated to be in excess of $20 million in 1990 (Berger and Crookshank, 1990).

5.1.2 Nursery Reefs

Nursery reefs need not be separate reefs although that is an option. Complexity is generally considered the trait that is necessary for increasing survival of juvenile fishes. Bohnsack (1991a, 1991b) states that one reason for the success of benthic artificial reefs in supporting high densities of organisms is related to increased habitat complexity. Gorham and Alevizon (1989) documented increased juvenile fish abundance with increased habitat complexity on experimental artificial reefs off Florida. Myatt and Myatt (1998) state that the biggest threats to survival of larval, post-larval and juvenile fish in the Chesapeake Bay have been the loss of habitat, primarily submerged aquatic vegetation and oyster reefs. They cite work in Virginia waters by Feigenbaum and Blair (1986) that recommends specific concrete structures with added complexity to provide better juvenile protection.

5.1.3 Research Reefs

Although research and monitoring is recommended for all artificial reefs, there may be a need for specific artificial reefs that are designed for research rather than fishing. Research reefs are typically smaller than other types of reefs and allow for controlled experiments without uncontrolled fishing pressure. Currently, one of the Atlantic coastal reef sites offshore of Ocean City is designated as a research site although no material has been placed there yet.

5.1.4 Interstate Reefs

Joint artificial reef sites with Virginia and Delaware could be used where costs would be shared and anglers from either state could access the reef site. This also may be useful for ocean sites where a large vessel, which might be in limited supply, may be available and could be shared.

5.1.5 Special Management Zone Reefs

The State could regulate the harvest, gear types, and other aspects of fisheries on artificial reefs in estuarine waters and the territorial sea if deemed necessary and beneficial to achieving the objectives of the reef. Outside of state waters, the State would need to work with the National Oceanographic and Atmospheric Administration and/or the Mid Atlantic Fishery Management Council for such regulations.

5.2 Program Planning

A planning process, a general artificial reef plan (as presented in this document), and site specific planning are essential for an effective artificial reef program. Seaman and Sprague (1991) state that a desirable sequence of events, from preliminary planning to post-deployment evaluation, is particularly important for artificial reef projects at local or regional levels. Figure 4 illustrates their sequence of planning steps for conducting artificial reef projects:

Figure 4. Sequence of Steps for Conducting Aquatic Artificial Habitat Projects.

This plan, including the "Decision Making Document for Artificial Reef Construction in Maryland" (Appendix A) is designed around this process, with Sections 5 and 6 of this plan embodying the primary components. Throughout all phases of development and implementation, it is imperative to include input from local interests who have local knowledge of the fisheries, bottom types, and other features effecting reef placement to ensure that the final product results in a reef structure that best meets the defined objectives.

5.3 Program Coordination

The Maryland Department of Natural Resources will be responsible for the overall coordination of the elements of this plan. The MDDNR may enter into agreements with other entities to carry out specific aspects of the plan, including responsibility for permitting, fundraising, and others.

All reefs permitted in Maryland, or placement of additional material on existing reef sites, shall first be subjected to a decision making process based on the criteria outlined in this plan. The basis for this process is found in the accompanying "Decision Making Document for Artificial Reef Construction in Maryland." The process for allowing the addition of permitted material to already permitted reef sites will likely not be as rigorous as new applications for reef sites or applications for placement of new types of materials on new or existing reef sites since permits for existing reefs have already been obtained.

5.4 Permit Acquisition and Administration

The U.S. Army Corp of Engineers maintains federal regulatory authority over the placement of structures, including artificial reefs, in navigable waters. Permits must be obtained under the Rivers and Harbors Act of 1899 and the Clean Water Act. In Maryland, the process for obtaining a state Tidal Wetlands Permit, which is also necessary for the placement of reef material, begins with the Maryland Department of the Environment (MDE), Water Management Administration's Wetland and Waterway Program. MDE will distribute permit requests to, and coordinate the review process with, the U.S. Army Corp of Engineers. If the request for a permit is found satisfactory from these entities, final approval must be given by the Maryland Board of Public Works before the permit will be issued.

In most cases, permit acquisition and administration for state artificial reef programs is the responsibility of the state agency that has responsibility for fisheries management. The only state program on the Atlantic coast other than Maryland that is not exclusively run at a state agency level (where the state holds all the reef site permits) is the Florida artificial reef program. In Florida, a number of counties hold the permits and work cooperatively with the state in artificial reef development and monitoring activities. In Maryland, the Ocean City Reef Foundation holds the permits for ocean and coastal bay sites and MES holds the permits for Chesapeake Bay sites.

In Maryland, the Maryland Department of Natural Resources is the primary agency responsible for marine and estuarine fisheries management in state waters. Since 1997, permitting,

construction and oversight of placements for the 20 existing Maryland Chesapeake Bay artificial reef sites have been the responsibility of the Maryland Environmental Service. Continued placement of materials at these permitted sites is authorized by the U.S. Army Corp of Engineers and The Maryland Board of Public Works until December 31, 2015. The Ocean City Reef Foundation holds the permits for the nine ocean reefs and one artificial reef in Isle of Wight Bay. All of the ocean side permits are active and the expiration dates range from 2007 to 2015 (Table 5).

Table 5. Maryland Ocean and Coastal Bay Permits and Expiration Dates.

Ocean City Reefs	Permit Number	Issued	Expires	Re-Issued
Kelly's	02-62089-1	4/4/2005	12/31/2015	
Russell's (Great Gull)	93-62313-4	4/10/1993	12/31/2003	12/31/2013
Jack Spot	02-62091-1	11/5/2004	12/31/2009	
Research	02-62092-4	4/5/2005	12/31/2015	
African Queen	94-61809-4	3/11/1994	12/31/2004	12/31/2014
Isle of Wight	02-62090-1	4/5/2005	12/31/2015	
Bass Grounds	97-60196-4	2/5/1997	12/31/2007	
Purnell's	97-60198-4	1/14/1997	12/31/2007	
Great Eastern (Twin Wrecks)	99-61343-4	4/2/1999	12/31/2009	
Mason's (coastal bay)	02-64446-1	6/5/2003	9/30/2011	

5.5 Contract Administration

Contracts issued for activities covered by this plan will be administered by the entity granted the responsibility for site development through acquisition of the permits from the Army Corp of Engineers and The Maryland Board of Public Works. Currently, that involves the Maryland Environmental Service for the Chesapeake Bay sites and the Ocean City Reef Foundation for the ocean/coastal bay sites.

5.6 Materials Acquisition

Acquisition of materials to be used on artificial reefs covered by this plan will be coordinated by the entity granted the responsibility for site development through acquisition of the permits from the Army Corp of Engineers and The Maryland Board of Public Works and will be determined by criteria listed under Section 6.2, by reference to information found in the "Guidelines For Marine Artificial Reef Materials' published by the Gulf States Marine Fisheries Commission and Atlantic States Marine Fisheries Commission (2004) and from other appropriate reference material. Although other entities may be enlisted to assist with materials acquisition, ultimate responsibility for approval and placement rests with the permit holder.

5.7 Funding

The lack of adequate funding has historically been the limiting factor for most state artificial reef programs. The sources of funding for most state programs include state and local government funds, federal funds, state, federal and foundation grant programs, corporate donations, and private donations.

5.7.1 State Funds

A continuing, stable state appropriated budget, with potential to increase, should be a priority for effective artificial reef development and management. A state should have at least one full time program coordinator dedicated to the artificial reef program, and any necessary support staff, supported by state appropriated funds. Currently (2007), the Maryland Department of Natural Resources does not have anyone dedicated to artificial reef activities. The Maryland Environmental Service has three individuals with varying degrees of involvement; the Ocean City Reef Foundation has one full time individual supported by an active volunteer network.

State agency involvement is necessary to administer most federal funds (Section 5.7.3) State matching funds for these programs, can come through General Appropriations to the agency that manages the artificial reef program, special appropriations, state bay and ocean fishing license or special permit revenues, and contributions from other agencies that help in any aspect of artificial reef development. For example the cost of obsolete coastal bridge demolition projects conducted by the State Department of Transportation and Department of Corrections projects (using in-kind labor from inmates who helped to build units) can be applied as the match for federal funding. Innovative fiscal thinking needs to be part of the job description for a state reef program coordinator or manager.

5.7.2 Compatible State Programs

The development of artificial reefs for the purposes of fishing is compatible with other state programs. Funding from each program can be leveraged against one another to meet mutually acceptable goals. In Maryland, the Oyster Restoration Program is focused on restoring oyster reefs in the Chesapeake Bay. Historically, oyster reefs provided the basis for productive and vibrant fish communities, and even today areas of hard oyster bottom are often areas of productive recreational fishing. When seeking funding for construction of artificial reefs, such compatible programs should be consulted from the outset to determine if funds may be combined, or reef construction can be designed, to the benefit of both programs.

5.7.3 Local Government Funds

With a number of studies showing economic benefits of artificial reefs to coastal communities (Buchanan et al. 1974, Liao and Cupka 1979), cities, towns and counties often invest money into artificial reef development. Some local governments, such as Ocean City, Maryland, have established separate artificial reef programs with program coordinators. There should be close

coordination between local and state programs and fund raising efforts. Currently, the town of Ocean City dedicates funding to their reef program coordinator, with additional funding being generated through various fundraising initiatives.

5.7.4 Federal Funds

The most popular federal funding source for state artificial reef programs is the Federal Aid in Sport Fish Restoration Act, as amended. In general, states must provide one dollar of matching funds for every three dollars received through this federal assistance program. These matching funds can be of almost any non-federal source, including private donations, volunteer/donated labor (under certain guidelines), state or local tax receipts, license funds, and others. Providing these matching funds is one reason that it is so important to maintain stable, long-term state funding. The Federal Assistance funds can be used for all aspects of a state artificial reef program including covering the costs of state personnel, building and deploying reef habitat, and implementing monitoring studies of the sport fish populations affected by reefs. Other federal agencies such as the Environmental Protection Agency and the National Oceanic and Atmospheric Administration also have funded artificial reef activities through specialized programs.

5.7.5 Grant Programs

State, federal, corporate and non-profit foundation grant programs can provide funding for development and research/monitoring of artificial reefs. The Fish America Foundation is an example of a sport fishing industry-supported foundation that has provided funding to various state and local reef building efforts. In Maryland, the Chesapeake Bay Trust, Abell, Exxon, and Constellation Energy grants have provided support for local artificial reef projects within the Bay.

The artificial reef program coordinator should compile a list of all federal, state, corporate and foundation granting sources that may be applicable to funding some aspect of the program and the dates that proposals are due.

5.7.6 Corporate Donations

The most frequent type of corporate donation has been surplus concrete that can be used in forms for fabricated reef structures and broken or damaged concrete pipe. This is often a program associated with local reef programs where community involvement by the corporation is a major factor. Also, concrete or other suitable materials from demolition projects have been delivered to artificial reefs at the contractor's expense if they can save money over other disposal or recycling alternatives. The Memorial Stadium demolition and the Woodrow Wilson bridge demolition are examples of large scale projects where corporations have donated materials and/or funds for artificial reef construction in Maryland. A list of potential materials and donors should be prepared and contacts made well in advance of any demolition or ongoing construction project that might provide suitable materials. Direct cash contributions from corporations wanting to be

involved in environmental causes are becoming a large part of Maryland Artificial Reef Program at present.

5.7.7 Private Donations

Private donations of funds can be very helpful, particularly at the local level. In some cases, particularly in Maryland at present, private donations provide a significant source of overall funding for a reef program. Donations of money most often come from fund raising events for a specific artificial reef and fishing tournaments where a part of the proceeds go for state or local reef construction in an area used by participants in that particular tournament.

5.7.8 Mitigation

Mitigation for the loss of habitat or fishing opportunities is another potential use for artificial reefs and also a potential funding source for reef construction. While the use of artificial reefs as mitigation for loss of dissimilar habitat has been and will continue to be a controversial topic, it continues to be proposed. Artificial reef program personnel need to be prepared, when this approach is selected, to design a reef that will benefit fishery resources and a plan for monitoring its success in meeting those goals.

The Maryland Department of Natural Resources will consider mitigation funding as an option for the artificial reef program in all future actions which result in the loss of recreational fishing opportunities and/or destruction/degradation of Bay/ocean habitat.

5.7.9 Funding Collaboration and Coordination

Statewide collaboration on funding issues can have many benefits since the need for increased funding is a universal issue among all reef programs. In many circumstances, statewide collaboration is favored over coordination since many local entities are successful at raising funds for reefs in their geographic region, but may lose such funding if it were necessary to cycle those funds through a "statewide" entity first.

However, central coordination can be beneficial in many instances, particularly where a "match" is required to secure specific funds (e.g., Federal Aid in Sport Fish Restoration). For instance, a project to support "Maryland Artificial Reef Initiative" (i.e., statewide, not specific to a particular site) could utilize the entire pool of volunteer (donated) labor as a match. If a reef development effort in one specific area secured donated labor valued in excess of the necessary match for that effort, the value of that excess labor could be applied as a match in another area. Additionally, coordination through a single fiscal entity would be advantageous in cases of appropriations from the state legislature, establishment of a statewide mitigation funding bank, and other circumstances. To achieve the necessary level of collaboration and central coordination of funds, the following actions will be taken:

Fiscal coordination – Coordination of funding through a non-profit (501(c)3) organization has numerous benefits. The Maryland Department of Natural Resources will investigate all opportunities to partner with such an organization for the purposes of establishing a "Maryland

aquatic habitat fund" that will be capable of accepting donations, reviewing and disseminating funds to appropriate projects in Maryland (as recommend by the artificial reef advisory committee - see section 5.10) and maintaining adequate fiscal control and accounting measures in administering the funds. Where deemed beneficial, the MDDNR shall enter into cooperative programs with appropriate entities.

As an example of this type of arrangement, in December 2006, the Maryland Artificial Reef initiative (MARI) was formed between the State of Maryland and the Coastal Conservation Association of Maryland (CCAMD). MARI is designed to allow for the "receipt of donations of monies for conservation of marine habitat through artificial reef development" and for administering such funds through the nonprofit CCAMD. These funds can only be used for projects to "conserve marine habitat through artificial reef development." The process for selecting projects for funding closely follows that outlined in Section 5.10.

Fiscal planning – The Maryland Department of Natural Resources will establish a working group consisting of representatives of the Department's fiscal and fisheries offices, statewide artificial reef permit holders, representatives of the Artificial Reef Committee (section 5.10) and other interested parties to develop a long-term funding plan for Maryland's artificial reef program. This group will be responsible for outlining the appropriate mix and roles of coordination and collaboration between artificial reef projects; identifying long-term financial and programmatic needs; identifying funding sources; and developing a strategy to secure such funding in 1, 3, 5, 10, and 15 year funding cycles.

5.8 Program Evaluation

Administering any program requires evaluations of success or failure. Generally, the success of an artificial reef program designed to enhance recreational fishing can be measured by fisheries and socioeconomic evaluations. However, ecological enhancements provided by reefs will also benefit non-game species that are integral components of the food chain of most fishes that anglers seek (Myatt and Myatt, 1990). The fisheries portion of the evaluation should address, at a minimum, the fish species composition on the reef including the sizes of fish available to anglers, an evaluation of angler success relative to other fishing grounds, and other non-sport fish and aquatic life present in the reef community.

As Milon et al. (2000) point out "…most decision makers will judge the value or performance of a reef on its contribution to human satisfaction, i.e., a reef that is not useful (used by) people is not a successful reef." While this statement is not altogether true because of potential environmental benefits, it is an important factor and one that should be measured. The paper by Milon provides suggested methods for collecting the socioeconomic data needed for such an evaluation and should be considered, along with other sources, by artificial reef coordinators.

5.9 Liability

Proper planning, siting and construction usually can avoid all but the most improbable liability situations. The National Fishing Enhancement Act (NFEA) of 1984 (P.L. 98-623, Title II), in Section 205 C, provides guidance on various aspects of artificial reef liability including that of the site permit holder, the materials donor and the federal government. Liability is not created when the Federal government issues a permit for a particular site or for a particular material, even if there were some risks involved, assuming that the explicit requirements of the Act have been satisfied. Entities donating reef material are immune from liability when the title has been transferred to the permit holder if the materials meet the requirements of the NFEA. The NFEA does not address the transport of reef materials from the staging area to the reef site. This would be addressed under existing maritime law. The permit holder is liable for failure to place and mark reefs properly, but strict adherence to the requirements of the permit will immunize the permit holder from liability for injuries resulting from those activities required in the permit and from collisions by vessels using the area. The liability in cases of diving accidents on the reef is similar to a municipality's liability for accidents in a public park. Liability in each case would involve determination of comparative negligence of the diver and the permittee. The states of Delaware and New Jersey use similar policies to ensure compliance with the conditions of the NFEA and to minimize liability:

- State fisheries personnel or authorized representatives will monitor and inspect all reef construction activities to insure compliance with all permits issued to the state. These personnel will also work with federal representatives to insure compliance with appropriate federal codes.
- Vessels and materials donated to the Reef Program will be the responsibility of the donor until the vessel or material is sunk or placed on the designated reef site. This is protocol in many states and is stated as such in the Artificial Reef Plans for New Jersey (Figley 2005) and Delaware (Tinsman 2005). In certain cases, such as the procurement of an obsolete military vessel or other federally owned vessel, the Reef Program will assume both ownership and responsibility for the materials prior to their deployment.
- Marine contractors performing work for the Reef Program will assume full responsibility and liability for all donated materials from the time the materials are turned over to their custody by the donor until the materials are placed on the designated site, in accordance with permit specifications. The marine contractor also will be required to assume responsibility for the safety and actions of its personnel and equipment and have insurance appropriate to cover this liability.
- Artificial reef users will be advised through public announcements that they may use a state artificial reef at their own risk.
- No portion of this document is intended to imply that the State shall or intends to wave sovereign immunity as described in the State constitution.

5.10 Advisory Boards/Public Involvement

The Maryland Department of Natural Resources will create an Artificial Reef Committee (ARC) to provide regionally representative advice and comment on all aspects of the artificial reef

program. This committee will meet for briefings, to provide guidance and advice based on local interest and knowledge, and for information exchange at least biannually or more frequently as issues develop. The committee will be involved in the pre-application review of all proposed artificial reef permitting, provide guidance on the use of private funds through any agreements that may be made with a 501(c)3 entity for funding, and comment on artificial reef resource management issues. The MDNR Secretary shall make the final decision regarding project selection.

The general public will be involved in artificial reef planning activities through publication of proposed actions on existing projects/reefs and public meetings on new activities. MDDNR personnel will coordinate pre-application planning and review of all proposed new artificial reef sites with other state agencies and any potentially affected interests.

5.11 Outreach

Outreach is an integral part of the Maryland Artificial Reef Program. Wide dissemination of information on program accomplishments and successes, including dollars generated in the local economy from activities related to the artificial reef program, is very important. This information can be used to help identify existing and projected needs for the reef program and help get additional support from stakeholders and better compete for public funds.

The foundation of this outreach program will include the development of an e-mail/mailing address database that will allow collection and dissemination of information on artificial reef program activities. Additionally, an artificial reef web site will be designed and maintained. Other outreach activities may include, but are not limited to, press releases, reef charts, films, presentations on television, articles in magazines and journals, seminars and slide presentations. As fiscal and personnel resources are available, the Maryland Department of Natural Resources will implement a program to more widely disseminate to the fishing public information about the location, composition, and fishing opportunities available on artificial reefs in the Chesapeake Bay (note: the Ocean City Reef Foundation currently maintains such a program for ocean side reefs).

6.0 ARTIFICIAL REEF DEVELOPMENT, MANAGEMENT AND MAINTENANCE

6.1 Site Selection

Site selection is a very important element in artificial reef development. The selection process for new reef sites should use the exclusionary mapping technique, a method developed by the Artificial Reef Development Center to exclude poor locations for building reefs and select optimum areas (Myatt and Ditton, 1986). This process highlights major population centers, geographic areas of greatest user demand, land and water access points, existing fishing grounds, and areas to be avoided. User information and suggestions from the fishing constituency are part

of this process. Maryland has the advantage of having a number of existing, permitted reef sites; therefore site selection may not be as significant an issue for the artificial reef program except in cases of selecting new sites for reef placement. The following criteria, however, will be considered even when adding to existing reef sites.

6.1.1 Distance from Access

Most new fishing reef sites should be within a reasonable distance of access points so anglers and the for-hire sector can reach them easily. This is a consideration for additions to existing reefs as well, particularly when fuel prices are high. This "reasonable distance" can be determined from discussions with local anglers and for-hire captains and by reference to literature on this subject. Figley (1996) provided statistics that showed that a high percent of private, charter and party boat fishing trips targeting reef or reef-associated species off New Jersey were within 15 miles of shore. Both shore-based access (i.e., fishing piers) for near-shore shallow water reefs as well as boat-based access will be considered.

6.1.2 Depth

Depth is important for both regulatory reasons and for determining species composition on the reef. The U.S. Army Corps of Engineers (ACOE) and The Maryland Board of Public Works permits require that depth must be sufficient to assure adequate clearance over reef structures for safe navigation. The ACOE, U.S. Coast Guard, or Maryland Board of Public Works may require a certain amount of clearance on particular water bodies but a variance from the normal amount of clearance may be requested if a site is surrounded by a series of navigational hazards, such as shoals or shipwrecks. Reef sites may have changes in depth significant enough to affect the species of fish that will use the reef. This has been noted by the Maryland Charter Boat Association in their "Artificial Reef Site Evaluation and Recommendations" for Chesapeake Bay artificial reefs.

As a condition of the current (2006) permits issued by the Army Corp of Engineers, Chesapeake Bay reefs must meet the following depth requirements:

- Minimum clearance 12 ft. Mean Low Water (MLW) in tributaries.
- Minimum clearance 15 ft. MLW in Bay (Except site #8 Hollicutt's Noose [8 ft.], site #20 Tolchester [12 ft.], and Point Lookout [6 ft.]).

In the Chesapeake Bay, depths below 25'-30' often experience critically low dissolved oxygen levels during the summer. Therefore, Chesapeake Bay reefs will generally be located within the 15'-30' zone although shallower or deeper reefs will be considered on a case-by-case basis and as the condition of permits allows.

6.1.3 Substrate Types

Sites should have a hard sand, clay, sand and clay, gravel or shell substrate that will support reef materials without subsequently being covered by sediments, shoaling or subsidence. In general,

sites with soft "mud" bottom will not be chosen unless plans for the reef structure call for laying a solid foundation and building up from this bottom. Sites will be chosen so as to avoid active beds of submerged aquatic vegetation and active (live) oyster bottom. Local knowledge of bottom type and substrate can be very helpful in determining an appropriate location for reef placement and such knowledge will be sought through the Artificial Reef Committee pre-review process.

6.1.4 Conflicts with Commercial Fisheries

Conflicts with active commercial fishing operations should be avoided. Pre-site selection discussions, as part of the exclusionary mapping process, should have resolved this potential problem. This should be a limited problem for existing permitted sites but must be a consideration in the development of new sites. Outreach with the affected parties also will minimize this issue.

6.1.5 Shipping Lanes/Military Use Areas

Reefs will not be constructed within charted shipping lanes, anchorages and military use areas, as defined by official navigational charts. Homeland Security considerations must also be addressed for potentially sensitive areas, including sites in the proximity of facilities such as liquefied natural gas terminals, bridges, and other such infrastructure.

6.1.6 Pipelines and Cable Crossings

Reefs will not be constructed within pipeline or cable corridors. A general guideline of allowing ½ nautical mile clearance on either side of such corridors for artificial reef construction will be followed unless special exemption is explicitly requested and approved during the review process.

6.1.7 Water Quality/Productivity

Areas known to commonly experience reduced dissolved oxygen levels, waste dumpsites such as for dredge spoil, and areas near sewage outfalls will be avoided. Highly productive areas if they contain existing reefs, shellfish beds or large clumps of live bottom or aquatic vegetation, will be avoided unless there is a specific objective, based on research or monitoring findings, to enhance these areas.

6.1.8 Currents

Strong currents may be a source of material instability, scouring, or sanding over reef materials; lack of current may be the cause of poor water quality. Local knowledge and pre-site selection studies can provide information needed to integrate these factors into decisions. There have been very effective reefs in high current situations but there must be certainty that materials will stay in place.

6.1.9 Other Criteria

Known archeological sites or designated beach replenishment sites generally will be avoided.

6.2 Construction Materials

Construction materials are generally classified as materials of opportunity or fabricated (designed) structures. Materials of opportunity have been the material of choice for many years and still play a major role in reef construction. The Japanese were early leaders in using their experience in observing fish behavior around structures with observations on the physical environment to specifically design units for specific conditions (Grove et al., 1991). More recently a number of companies in the U.S. and elsewhere have experimented with, and designed units for specific uses that are readily available to reef builders.

Two of the desired criteria for artificial reef materials mentioned in the Revised National Artificial Reef Plan are stability and durability. Stability is needed to assure that material will not move off the reef site and durability assures that the material will last for a long time and be cost effective. Habitat complexity is another factor to consider since researchers have linked this to the success of benthic reefs in supporting high densities of organisms (Bohnsack, 1991a,b).

In general, allowable materials for artificial reefs in Maryland's tidal waters will follow the most recent edition of Guidelines for Marine Artificial Reef Materials. This is a joint publication of the Gulf and Atlantic States Marine Fisheries Commissions (Lukens and Selberg 2004).

As a condition of the current (2006) permits issued by the U.S. Army Corp of Engineers, the following provisions apply to Chesapeake Bay reefs:

- Materials used for construction shall conform to the Atlantic States Marine Fisheries Commission's Reef Material Criteria Handbook and permit conditions.
- Materials shall be free of petroleum and toxic contaminants.
- Materials shall be free of materials or items that may float or be moved off site by normal natural phenomenon and create a violation of the reef permit.
- Materials shall be of a size and mass that will not interfere with the biological functions of the epifaunal communities.
- Concrete shall have projecting reinforcement steel removed.
- Materials not to be used without the expressed written approval of the permitting authorities shall include:
    - Tire modules;
    - Wooden vessels or structures;
    - Fish aggregating devices (FADs).

A brief discussion about select materials follows. However, these and other materials are discussed in much greater detail in "Guidelines for Marine Artificial Reef Materials" which is appended by reference to this reef plan.

6.2.1 Concrete and Steel Construction Materials

Concrete from construction or demolition projects has proven to be an excellent material for reef construction. It is both durable and stable and provides a good substrate for the attachment of epifauna (Tinsman 2005). Additional information from Tinsman contained in the Guidelines for Marine Artificial Reef Materials publication (Lukens and Selberg 2004) indicates that "Monitoring of Delaware's concrete patch reefs has shown a 50 to 100 fold increase in invertebrate biomass, compared with the natural bottom." There are various types of concrete; some of which are very resistant to ocean or estuarine environments. Studies conducted by the Portland Cement Association (Stark 1995) have shown that all concretes exhibited a high level of durability in seawater regardless of type. Even though the pH of some uncured concrete may be higher than seawater, most of the concrete used in reef construction is not in the uncured form and may have been aged months or years (Lukens and Selberg 2004). Studies have shown that abundant growth of encrusting organisms can occur on concrete after less than two months on a reef site. Oyster spat, under certain conditions, have shown greater survival and growth on concrete blocks than on oyster shell in studies conducted in Chesapeake Bay (Alspach et al. 1996). However, successful growth and colonization of organisms such as oysters depends on more than just the substrate (in this case, concrete). Factors such as placement of the concrete, interstitial space, and even size and shape of the concrete will influence the success of colonization. Damaged concrete pipe, junction boxes, and manhole covers are examples of commonly used, cured concrete materials. Bridge demolition material often contains steel as well as concrete. While steel will not last as long as concrete, when it comes from heavy construction, it will last for a considerable time and may be cost effective. Plans to utilize steel-reinforced concrete must consider the potential for diver and fishing gear entanglements on protruding pieces of rebar.

6.2.2 Rock, Shell and Stone

Rock and stone are durable and can make effective reefs but are expensive unless there is a source close to the reef site construction staging area. Florida has used limestone bolder artificial reefs in both bay and near shore coastal environments and Mississippi made low profile reefs with one to two inch limestone rocks at 11 different inshore, estuarine sites (Lukens and Selberg 2004). All 11 sites had oyster spat settle on the rocks and developed into oyster reefs. The Lukens and Selberg (2004) publication also referenced that 4,500 tons of limestone rock were used in Maryland for estuarine reef construction. These reefs (DeWitt Myatt, personal communication) effectively sustained populations of fish and encrusting organisms. Rock jetties, which are often good fishing locations, can provide an indication of their potential effectiveness in a given area.

Oyster shell has been used effectively by Maryland and most coastal states to create or replenish oyster reefs and to improve recreational fishing opportunities (Lukens and Selberg 2004). Shell reefs can be used as low profile reefs in relatively shallow water. Since shell is relatively light, caution must be taken in selecting the proper sediment and current regimes. Silty, low energy environments may result in habitat loss due to sediment cover over the materials. High-energy environments with shifting sand or strong currents also may result in the shell material being covered or washed away.

6.2.3 Ships and Barges

Ships and barges have been used off many coastal states. Maryland is no exception with a number of vessels on reefs off Ocean City. They make good high profile reefs that tend to attract pelagic species as well as demersal reef species. Ships and barges can be augmented with lower profile materials of opportunity to provide more suitable habitat for reef fish species and juvenile fishes. Anglers and divers are attracted to artificial reefs with good cause for the most part because of fishing success and interesting diving. The use of ships can have a beneficial economic impact because of the publicity they garner when placed on a reef site which attracts additional users from outside the local area.

There are a number of issues, however, that must be considered before deciding to use these materials. The high profile associated with ships and barges requires deeper water where clearance over the reef will not be a hazard to navigation. As such, these may not be a suitable choice for Chesapeake Bay or coastal bay sites. Also, there is a concern over movement of these materials during strong storms if the water is not deep enough. Deeper water usually means longer boat rides and the use of more fuel. There are specific federal regulations addressing toxic or hazardous materials that might be present in the ships or barges and cleaning the material to meet these standards may be very expensive. Conflicts between divers and anglers trying to use the same location can be a problem but one that usually may be resolved through discussions with these groups before putting the materials on site.

6.2.4 Fabricated Reef Structures

Fabricated reef structures provide many more options than in years past. Designed structures can provide stability, desired profile, surface area and complexity for meeting multiple objectives for the same reef site. While materials, such as fiberglass and steel, have been used for fabricated structures, concrete seems to be the material of choice. Even surface texture and the pH of concrete can be modified to make the units more effective for specific objectives such as increasing the biomass of encrusting organisms. Complexity for many of the commonly used units may still not be adequate for nursery reefs but other smaller materials (such as small limestone rock or other small, irregular shaped materials of opportunity) can be placed in or around the designed units. Also, there are other designs that resemble types of coral that could be used in conjunction with the commonly used designs. Program personnel should be aware of all the options available and conduct or contract for, research as needed to address specific questions that may arise for specific reef site objectives. The cost of obtaining and transporting these units to a reef site has been an issue for programs with limited funding.

The fabricated reef structures of choice in many Chesapeake Bay and east coast reef efforts have been “Reef Balls”. As the “Reef Ball” web site states, “over 500,000 “Reef Balls” have been deployed worldwide in over 3,200 projects.” The Reef Ball Company encourages monitoring/evaluation of reefs built with “Reef Balls” so there is information available on this material that demonstrates its effectiveness as essential fish, invertebrate, and plant habitat. Their web site also contains suggested treatments for “Reef Ball” units to improve their effectiveness. While “Reef Balls” have been deployed extensively (over 350 in 5 sites in the

Chesapeake Bay) and have shown success, their success in the Chesapeake Bay is still being evaluated.

As with any material, the selection of reef balls as a material of choice for an artificial reef is only one factor that must be considered. When low cost reef materials become available, important factors such as siting requirements, water quality, distance to access, monitoring plans and other criteria can be mistakenly overlooked in the enthusiasm to deploy the materials. It is important also to recognize that developing "reef complexity," or variation in the types and sizes of materials composing a reef site, is important to developing a stable reef community. A field of homogenous materials (size, shape, and composition) may not be as effective at developing a sustainable and diverse community of fish and other organisms as would be achieved by varying the materials.

6.2.5 Materials Coated With Lead Paint

Materials coated with lead paint will be avoided. According to the "Guidelines for Marine Artificial Reef Materials", EPA does not consider the lead paint used on vessels deployed as artificial reefs as a significant environmental or health hazard. The permits issued for artificial reefs in Maryland do not bar materials containing lead paint (the permits say nothing about lead paint). However, Maryland stakeholders have expressed concern over these materials. Therefore, use of lead paint-coated materials will be evaluated on a case-by-case basis.

6.2.6 Other Materials

Other potentially suitable materials may become available and reef program personnel can test these for possible use in Maryland.

6.2.7 Materials Unsuitable for Reef Construction

Materials that are toxic to the environment, are not stable and may move off reef sites, or are not durable with a short life expectancy will be avoided. Good examples of material that should not be used are automobile bodies and household appliances such as washers, dryers, and refrigerators. Although tire units embedded in concrete are proving to be effective in some areas, due to concerns over potential toxicity and concerns expressed by constituents, tires are not allowed and will not be used in the Maryland Artificial Reef program. Tires are also excluded from the Chesapeake Bay reef permits issued by the U.S. Army Corp of Engineers in 2005. A procedure will be developed for inspecting all materials to be used in building artificial reefs in Maryland.

6.3 Reef Characteristics

The following characteristics are considered important for effective reef performance and are taken from the Revised National Artificial Reef Plan.

6.3.1 Reef Configuration

The overall configuration of the materials on a reef will play an important role in determining how the reef works as well as how effectively it can be used. Placement of different types of structures on separate parts of the reef will provide increased diversity of reef fish assemblages, and also allow multiple uses of the reef site. Divers and fishermen can be separated in this manner, as can troll fishermen and fishermen wishing to anchor over the structure. While the purpose of the Maryland Artificial Reef Program may be to improve recreational fishing, other users, such as divers, will use the reef sites. Open spaces between reef materials have been shown to be important as well. This "edge effect" can bring species like flounders close to the reef to feed where they become available to anglers fishing the reef.

6.3.2 Reef Profile

The vertical profile of a reef structure may be important in determining the overall fish species composition and biomass of a given reef. Low profile reefs are thought to be most successful in providing a suitable habitat for demersal species, while high profile reefs appear to work better for many pelagic fishes. A combination of high and low profile construction materials can be used within one permitted location to create a reef targeting a potentially more diverse fish and invertebrate assemblage.

6.3.3 Interstitial Space

The quantity and nature of interstitial spaces in reef structures are important in determining the degree and complexity of the biological community developing on and around the reef. Numerous holes, crevices, walls and overhangs in a reef structure allow for a much more diverse community in general than that which would develop on a reef material with less structural complexity. Adequate interstitial space (complexity) is necessary to establish a rich diversity of motile invertebrates as well as numerous cryptic fish species and for increasing survival of larval and juvenile fishes.

6.3.4 Total Surface Area

In most cases, the total biomass that can be supported on an artificial reef will be directly related to the quantity and quality of effective surface area available. This is particularly true of low profile benthic reefs in which the community of sessile marine organisms occurring on the reef may be important to the subsequent development of the demersal fish community established on and around the reef materials. Many sessile and motile invertebrates are important food items for many of the fish species inhabiting the reefs. The greater the surface area available to these organisms, the more significant the food source available to other levels of the reef community.

6.3.5 Openness of Reef Materials

Reef materials should be selected which offer suitable openness to allow adequate water circulation through as much of the reef as possible. This should prevent the stagnation of water in some parts of the reef, which could result in minimized effectiveness of the overall reef. Openness of the reef also allows for better use of all surfaces of structures for the establishment of sessile invertebrates, as well as the potential for improved access to fish and motile invertebrates that may be more cryptic in nature.

6.4 Site Monitoring/Evaluation/Research Programs

6.4.1 Compliance Monitoring

The U.S. Army Corp of Engineers issues artificial reef permits with the assumption that materials placed on the permitted site will remain there. It is a responsibility of the permit holder to assure that is the case. Reef sites should be monitored on a periodic basis with side scan sonar, GPS and other shipboard instruments capable of defining location and height of material on the reef site. Lukens (1989) provides a good description of the use of side scan sonar for pre- and post-reef development monitoring. These pictures-in-time should be kept on file and used for comparison to the next monitoring survey to assure that no movement of material is occurring. Divers can set up grids on the bottom and document stability as well as other physical aspects of the reef such as durability. Diver surveys are more costly and time consuming but desirable if possible. Physical, or compliance, monitoring can be done by divers while biological surveys are being conducted. All plans submitted for reef construction under the Maryland Artificial Reef Program will contain some measure of compliance monitoring meeting or exceeding the level specified in the permits.

6.4.2 Buoys

Part of compliance monitoring is checking on the location and condition of buoys. The USCG regulates the marking of reefs, when required, with appropriate aids to navigation. They will determine which reef sites will require a buoy and provide the standards for buoying the site. The cost of placing and maintaining these navigational aids resides with the owner/custodian of the reef structure, which in most cases will be the state management agency (Chesapeake Bay Program 1994) if buoys are required. As a condition of the current Chesapeake Bay permits (2006), where marking of the reef site is necessary, the Department of Natural Resources Hydrographic Operations Division will place buoys and maintain the buoys as has occurred in the past. Placing and maintaining buoys can be expensive and it is recommended that materials be placed on reefs in a way to eliminate or minimize the need for buoying the reef site.

6.4.3 Performance Monitoring

While a thorough understanding of the performance of reefs is a laudable objective, it is often difficult to achieve within the fiscal and personnel constraints of any state artificial reef program. This should not discourage program personnel from establishing a plan to gather data to evaluate the performance of the reefs in its program. This plan should include any and all scientific or fishing interests in the area that might have the expertise and desire to help. Also, all monitoring plans should attempt to be part, where practicable, of regional efforts that have coordination such as through the ASMFC Artificial Reef Committee. Since the goal of this plan is successful fishing reefs, fishing success and socio-economic assessments will be particularly important but biological assessments are needed as well. In Artificial Reef Evaluation (Seaman 2000), Chapter 1, there is good information on developing the assessment concept and setting up a framework for the evaluations and it emphasizes that with "…an articulate, focused, and quantitative objective, the features of a reef to be measured can be defined." Another comprehensive and detailed document on all aspects of monitoring and assessment for artificial reef programs is in an unpublished document prepared by William Figley for the Virginia Artificial Reef program in 1998 and is entitled "A Pre- and Post-Development Artificial Reef Monitoring And Assessment Plan For Virginia."

All reefs constructed in Maryland will incorporate some degree of performance monitoring. Applications must outline these components.

6.4.4 Biological Assessments

Biological assessments of reef success should include the invertebrates as well as fish populations since they provide a forage base for many reef fish. One study that is typical for assessments of reef success is a comparison of biomass of invertebrates on reef structure versus biomass on surrounding bottom areas. An evaluation of the species diversity and abundance of fish on and around artificial reefs is an important part of assessing the effectiveness of reef-building activities and evaluating the relative value of different types, designs, profiles and arrangement of reef materials. Bortone et al. (1991, 2000) provides a comprehensive description of fish and invertebrate evaluation methods.

6.4.5 Fishing Success Assessments

Studies of fishing success usually include participation, catch, effort, catch-per-unit-of-effort, size information and species composition. There are existing federal and state fishing surveys for both reef species and pelagic species that can provide these data to some degree. It may be better, however, to design special surveys or add on to the existing surveys to get more detailed data for fishing success on the reefs. The Maryland Department of Natural Resources will design a program based on a standard format for use by volunteer fishing organizations that wish to participate and contribute catch-per-unit and other information on artificial reef sites.

6.4.6 Socio-economic Assessments

Most artificial reefs are built for use by people and judged on their ability to contribute to user satisfaction. Therefore, socio-economic assessments are needed to demonstrate this. Information on economic impact, user satisfaction, and cost effectiveness can be extremely helpful for artificial reef program managers as they seek public and private funds to conduct their program.

Since social and economic theory and application are complicated and require special surveys, it is prudent to contract with university programs or professional firms that have qualified social scientists and economists to conduct these assessments unless these staff resources are available within the state agency. An excellent description of social and economic evaluation methods is available in a paper by Milon et al. (2000). It also contains a number of useful references to other work on valuation and economic impact assessment.

6.4.7 Other Research

A list of questions or problems should be prepared that might be answered through specific research on controlled or active artificial reefs. As pointed out for funding, a list of grant sources that can fund artificial reef research should be developed. Also, program personnel will consider cooperative research with other state or university programs that could provide additional, cost effective capabilities for research, data sharing and funding and reduce research duplication.

7.0 REGULATORY AGENCIES

The following description of federal regulatory agency responsibilities is taken from the New Jersey Artificial Reef Plan (Figley 2005). Maryland agencies concerned with artificial reefs are also included below.

7.1 Federal Agencies

7.1.1 Department of Defense

7.1.1.1 U.S. Army Corps of Engineers

The U.S. Army Corp of Engineers (ACOE) is responsible for regulating activities within navigable waterways under sections 9 and 10 of the Rivers and Harbors Act of 1899. They also have permit authority under Section 404 of the Clean Water Act and Section 103 of the Marine Protection, Research and Sanctuaries Act. The agency is directly responsible for permitting artificial reef sites under the National Fishing Enhancement Act of 1984 (Section 203, 33CFR: 320-330). ACOE mandates conditions of the permits and approves the types of materials

allowable for reef construction. ACOE also both generates and regulates the discharge of dredge materials, some of which (rock) may be used for reef construction.

7.1.2 Department of Homeland Security

7.1.2.1 U.S. Coast Guard

The U.S. Coast Guard (USCG) has authority to:

1. Regulate aids to navigation (buoys) on reef sites;
2. Establish navigation channels and navigational clearance (depth) requirements over reefs under the Ports and Waterway Safety Act;
3. Enforce fishery laws;
4. Monitor and enforce international environmental statutes, including inspecting vessels for potential pollutants before deployment on reefs.

7.1.3 Environmental Protection Agency

The Environmental Protection Agency (EPA) has authority to regulate ocean dumping and point source pollution under the Marine Protection Research and Sanctuaries Act. The agency is responsible for inspecting and approving vessels acquired from the Maritime Administration before deployment as reefs. The EPA developed the cleaning protocol for the preparation of obsolete military vehicles destined for artificial reefs. The EPA also develops standards for materials or chemicals that are introduced into natural waters.

7.1.4 Department of the Interior

7.1.4.1 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) requires the State to submit an Environmental Assessment for the creation of reefs built with funding from the Sportfish Restoration Program. The Service also participates in the development of fishery management plans (FMPs) through regional fisheries management councils.

7.1.5 Department of Commerce

7.1.5.1 National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) is charged with the management of marine fisheries under the Magnuson Act as amended by the Sustainable Fisheries Act of 1996 and the coordination of interstate fisheries management under the Fish and Wildlife Act of 1956, the Inter-jurisdictional Fisheries Act of 1989 (P.L. 99-659) and the Atlantic Coastal Cooperative Fisheries Act (Section 804). NMFS works with the MAFMC and the ASMFC to develop FMPs for reef-associated species. NMFS is responsible for approving and implementing all FMPs between 3 and 200 miles of the coast. NMFS also plays a lead role in the oversight and development of the nation's reef programs, including the review of permits and programs and the publication of the National Artificial Reef Plan.

7.1.5.1 National Ocean Survey

The National Ocean Survey (NOS) is responsible for plotting reef site locations on nautical charts and ascertaining the accuracy of the navigational coordinates of reef site boundaries, which the permit holder is required to provide.

7.1.6 Department of Transportation

7.1.6.1 U.S. Maritime Administration

The U.S. Maritime Administration has authority to transfer obsolete naval vessels to the state for reef deployment under the National Fishing Enhancement Act (P.L. 98-402: Section 207).

7.2 Maryland State Agencies/Organizations

7.2.1 Maryland Department of Natural Resources (MDDNR)

The Maryland Department of Natural Resources, Fisheries Service, is responsible for managing commercial and recreational fishing. Freshwater, estuarine, and migratory fish stocks are managed for sustainable fisheries, to enhance and restore fish or shellfish species in decline; to promote ethical fishing practices, and to ensure public involvement in the fishery management process.

The mission of the Fisheries Service is to:

- Develop a management framework for the conservation and equitable use of fishery resources;
- Manage fisheries in balance with the ecosystem for present and future generations
- Monitor and assess the status and trends of fisheries resources
- Provide high quality, diverse, accessible fishing opportunities

7.2.2 Maryland Environmental Services (MES)

The Maryland Environmental Service is a self-supporting, not-for-profit public corporation created by the Maryland legislature and governor in 1970. The mission of MES is to protect and enhance the state's air, land and water resources. The agency does not have regulatory authority and is not funded through direct appropriations. MES works with both governmental and private sector clients to find innovative solutions to some of the most complex environmental challenges.

The unique combination of public purpose and private resources allows the agency to combine the public sector's commitment to environmental protection with the private sector's efficiencies,

flexibility and responsiveness. MES offers its services at competitive rates and works on projects related to water and wastewater treatment, solid waste management, composting and organic products marketing, recycling and marketing of recovered materials, dredged material management and recycling, hazardous materials cleanup and engineering, monitoring and inspection services.

7.2.3 Maryland Department of the Environment (MDE)

The Maryland Department of the Environment's Water Management Administration administers Wetland and Waterway Program. Under this program, MDE is the lead state agency for administering the provisions of the Maryland Tidal Wetlands Act and reviewing Tidal Wetlands applications, subject to the approval of the Maryland Board of Public Works. Open waters of the Bay and ocean are included under the definition of tidal wetlands and hence, reef building activities in these areas are subject to permitting.

7.2.4 Maryland Board of Public Works

The Maryland Board of Public Works, which is composed of the Maryland Governor, State Comptroller, State Treasurer, maintains final authority over the issuance of permits for activities impacting Maryland's tidal wetlands. After the permit application has met the approval of the MDE and U.S. Army Corp of Engineers, it is forwarded to the Board of Public Works for final review and decision.

7.3 Fisheries Management Council/Commissions

7.3.1 Maryland Sport Fish Advisory Commission (SFAC)

Through the Code of Maryland Regulations (COMAR) 08.01.01, Title 08 Department of Natural Resources, Subtitle 01 Office Of The Secretary, Chapter 01 Advisory Committees Authority: Natural Resources Article, 1-102, 1-105, and 4-204, Annotated Code of Maryland 4-204 the Sport Fish Advisory Commission has the duty of advising the Director of Fisheries Service on all matters referred to the commission by the Director. SFAC is comprised of individuals from across the State who represent the interests of various constituencies in recreational fisheries.

7.3.2 Mid-Atlantic Fishery Management Council

The Mid-Atlantic Fishery Management Council (MAFMC) is responsible for management of fisheries in federal waters which occur predominantly off the mid-Atlantic coast. States with voting representation on the Council include New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. (North Carolina is represented on both the Mid-Atlantic and South Atlantic Fishery Management Councils.)

The MAFMC is further responsible for the granting of special management zones (SMZs) on artificial reefs in Federal waters. SMZs are areas that have special restrictions on fishing gear. SMZ proposals must be submitted to the MAFMC for consideration by the reef permit holder.

7.3.3 Atlantic States Marine Fisheries Commission (ASMFC)

The Atlantic States Marine Fisheries Commission (ASMFC) is an interstate commission composed of representatives from the coastal states from Maine to Florida. It is primarily responsible for managing species that move across state boundaries and inhabit the Atlantic Coast territorial sea. The ASMFC also has an Artificial Reef Technical Committee. This committee is composed of representatives from member states as well as federal environmental agencies. The Committee goals are to exchange information, resolve coast-wide issues, coordinate research and construction efforts and standardize procedures and criteria.

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APPENDIX A: DECISION MAKING DOCUMENT FOR ARTIFICIAL REEF CONSTRUCTION IN MARYLAND

This document is intended to assist project planners with constructing or enhancing artificial reefs in Maryland's tidal and coastal waters and on offshore sites. The questions are taken directly from the *Maryland Artificial Reef Plan* that has been adopted as the guidance for reef projects in the state.

Project Name_____
Project Site _____
Waterbody_____
Coordinates (to center of reef) _____
Reef size_____

Project Leader (organization) _____
Project Partners (organizations) _____
_____

I Which specific objectives of the *Maryland Artificial Reef Plan* does the project fulfill? Outline how the project fulfils each one listed.

II What is the purpose of the reef?
- A. Fishing Reef
- B. Nursery Reef
- C. Research Reef
- D. Interstate Reef
- E. Special Management Zones
- F. Other _____

III Permits
- A. Is there a current permit holder for the reef site?
- B. If so, who is it?
- C. Is the applicant the permit holder?
- D. If there is no permit holder presently, has the process been initiated to acquire permits?

IV Materials
- A. What type of material will be used for the reef:
  - ____ Concrete and Steel Construction Materials
  - ____ Rock and Stone
  - ____ Ships or Barges
  - ____ Fabricated Reef Structures
    - ____ Reef Balls
    - ____ Other fabricated material
  - ____ Other Materials

B. Acquisition: Where are the materials that will be used?
__ Have on hand and ready to use.
__ Do not have, but have ordered.
__ Have not ordered, but have investigated and know where to get them.
__ Available from donor on donor site
__ Will produce/manufacture when ready.
__ Have not investigated-don't know where to get them.
__ Other. Explain_____
_____
_____

V List Sources of Funding

SOURCE	**AMOUNT EXPECTED**	**HAS APPLICATION BEEN MADE?**	**AMOUNT SECURED (IN HAND OR AVAILABLE)**
State funds			
Local Government funds			
Federal funds			
Grant Programs			
Corporate donations			
Private donations			
Local Fundraising			
Donated Materials			
Other_____ _____			
TOTAL PROJECT BUDGET			

VI Site Selection

A. Access
1. Distance of reef site from nearest public access point/marina _____
2. Name of nearest public access point/marina _____

B. Depth (at mean low water)
1. Minimum depth of reef _____
2. Maximum depth of reef _____

C. Substrate Types
1. What is the bottom type at the reef location? _____
_____

D. User Conflicts

1. Is there any commercial fishing or other activity (boating, etc.) which might conflict with the placement of the reef? _____
2. If so, have the parties who may potentially be impacted been contacted? _____
3. What activities may have conflicts? _____

E. How far is the reef location from:
Shipping Lanes/Military Use Areas _____
Pipelines and Cable Crossings _____

F. Water Quality/Productivity
1. Have any water quality tests been conducted at the reef site?
2. Have any agencies been consulted about conducting water quality?

G. Currents
1. Have any water current assessments been conducted at the reef site?
2. Have any agencies been consulted about conducting water current assessments?

VII Are there plans for conducting outreach or advertising the reef location to the interested parties? If so, please summarize.

VIII Site Monitoring/evaluation
Are there plans to monitor:
A. Compliance with permit requirements?
B. Performance Monitoring
1. The effect of the reef on the biology (e.g., colonization by different animals)?
2. The success of anglers on the reef?
3. The impact of the reef on any local economy, etc?

Please attach a description of any monitoring program that you plan and list cooperators that will involved.

IX Are there plans to mark the reef with any buoys or any other surface markers? Are there plans to maintain these markers?

APPENDIX B: GUIDELINES FOR MARINE ARTIFICIAL REEF MATERIALS