

ATTACHMENT I SHELLFISH MANAGEMENT AND RESTORATION IN EAST COAST STATES

1.0 Introduction

The following is a summary of information, projects, programs, and policies for managing shellfish stocks in the thirteen other east coast states. Information regarding state and private programs was obtained from various resources, including shellfish management plans and studies, newspaper articles, and state resource management websites. Management and conservation activities for the following thirteen east coast states were considered: Florida, Georgia, South Carolina, North Carolina, Virginia, Maryland, Delaware, New Jersey, Connecticut, Rhode Island, Massachusetts, New Hampshire, Maine, and New York. The primary resource management techniques identified in these states by this investigation include:

- construction of reefs;
- designating and reserving areas as shellfish spawning sanctuaries;
- increasing hatchery production;
- seeding, depuration and transplanting;
- shell recycling;
- oyster habitat restoration;
- rotating areas opened and closed for shellfishing;
- limiting areas open to mechanical harvesting;
- establishing commercial and recreational catch limits;
- permitting underdock growing areas;
- conducting coastal land management planning and implementing environmental protection strategies to improve or maintain water quality;
- protection against shellfish pests, predators, pathogens, and parasites, including those from the importation of shellfish seed;
- enhancing law enforcement, including addressing poaching;
- authorization of municipal shellfish conservation ordinances, town intertidal management plans, and shellfish conservation districts;
- public education and citizen involvement;

- increasing funding for shellfish management programs;
- requiring licensees to contribute time to shellfish management activities;
- performing ongoing monitoring of shellfish area conditions, trends, and catches; and
- continuing scientific research and resource management studies and plans.

A more in-depth synopsis of shellfish management activities and programs by state is provided below.

2.0 Florida

Florida Oyster Resource Development

The shellfish industry is primarily based on aquaculture operations of clams and oysters, as well as other species. The State of Florida has a strong shellfish industry and is ranked 7th overall in the nation in aquaculture. Philippakos, et al, (2001) found the economic benefit to the Florida economy from the commercial culture of hard clams in 1999 was \$34 million. Adams et al, (2009) found the economic benefit, in 2007, to be \$52 million. These values were not adjusted for inflation and include (with the exception of direct wholesale dealer sales to consumers) only transactions at the dealer sales level, and not, final consumer sales at the restaurant, retail seafood shops and other sectors. The actual benefit to the Florida economy is therefore expected to be higher than what the numbers suggest.

Aquaculture Clam Production

Aquaculture production of hard clams in Florida experienced substantial growth from 1989 to 1999, under state and federally-funded programs to provide educational and technical support for clam culture development. Clam production increased from \$3.7 million in 1993 to \$15.9 million in 1995. The success of the program continued and from 1995 to 2005 hard clam production became Florida's most rapidly growing aquaculture industry segment. The dramatic increase in clam production was largely due to retraining programs in the Counties of Dixie, Levy, Taylor, Volusia, Charlotte, and Lee aimed at helping eligible commercial fishermen who were adversely affected by changing fishery regulations. Florida farm-raised clams increased in consumer acceptance which was reflected in increased market value and absorption of dramatic

increases in supply. Distribution and consumer acceptance were also supported through several programs including: promotional support from private and public sources to increase buyer knowledge of Florida farm-raised clams; consumer directed clam promotional and educational efforts; improved product quality and handling practices implemented by the industry; and state and nationwide educational campaigns that boosted general consumer confidence in seafood safety and quality (Florida Department of Agricultural and Consumer Services, Division of Aquaculture, 2011).

In 2001, Florida marketed 142 million clams, most being sold outside of the state (Florida Sea Grant, 2001; Florida Sea Grant, 2003). Production experienced a decline in 2004-2005 due to hurricanes, but increased in 2007 to 184 million clams (Florida Sea Grant, 2011). Production in Florida is based on leased state-owned underwater lands, and the industry touts its ability to grow clams almost year-round in warm, highly productive waters and its ability to raise clams to marketable size in half to a third of the time required in the other clam producing states (Florida Sea Grant, 2011).

Cultch Planting, Oyster Relaying and Transplanting, and Oyster Habitat Enhancement

Major resource management strategies in Florida include: shell or “cultch” planting, oyster relaying and transplanting, and oyster habitat enhancement. Positive results have been shown from the enhancement of habitat through placement of processed oyster shells on depleted oyster reefs and suitable bottom habitat over the course of many years. These efforts have helped in assuaging resource impacts, bolstering productivity, and enhancing the economic well-being of the industry. Reef development has been targeted at previously productive locations, especially in Apalachicola Bay. Area shellfish processing plants provide much of the shells necessary for this program.

Florida has been maintaining a successful shell planting program since the early 1900s. Since its conception, the Department of Agriculture and Consumer Services has amassed and planted over 10 million bushels of shucked oyster shells and approximately 250,000 bushels of shucked shells have been planted each year since 1999. The cultch material provides an excellent base for oyster larvae or “spat” to attach and thrive. Calico Scallop shells have also been used when and where

oyster shells are not available. Cultch material is barged from the Apalachicola stockpile and distributed to other bay systems throughout Florida.

Many of the productive oyster reefs in Florida are within waters that are affected by water quality issues. These conditions have resulted in prohibitions of harvesting at these locations; however, “relaying” the oysters from these waters to cleaner locations has been effective in purifying the stock and making it safe for human consumption.

The State has also recognized that plentiful stocks of juvenile oysters growing on intertidal oyster bars often do not reach legal size due to the stresses of exposure during low tides. Oysters that are transplanted from these less than optimal conditions to higher quality habitat areas have been found to thrive and reach legal and marketable size in little time. When seed oysters are transplanted in the summer, harvesting may begin the following season and continue for several years as oysters grow to market size.

Florida’s Department of Agriculture and Consumer Services and area oystermen associations have worked cooperatively in these relaying and transplanting efforts, and over the past twenty-five years, millions of juvenile and adult oysters have been relayed and transplanted within six coastal counties. These efforts have been integral to sustaining Florida’s shellfisheries and have provided substantial economic benefit. (Florida Department of Agriculture and Consumer Services, Division of Aquaculture, 2011)

3.0 Georgia

Limited information was found regarding Georgia’s shellfish management. Shellfishing aquaculture is relatively new to the State of Georgia; however, at one time the State enjoyed the largest oyster production in the nation. In 2005, the hard clam industry generated \$614,000 dollars in State revenues. The State has 17 approved commercial growing areas and approved harvest areas in the State total 145,700 acres. Shellfish seed is not produced in the State but is available from Florida and South Carolina Georgia’s Department of Natural Resources Coastal Resources Division does not provide technical support for shellfish mariculture, but encourages individuals with innovative ideas for new shellfish farming techniques or fisheries to create a

comprehensive management plan and explore ideas and feasibilities with qualified fisheries experts.

(Georgia Department of Natural Resources Coastal Resources Division, 2011 and University of Georgia Public Service and Outreach, 2011)

4.0 South Carolina

The South Carolina oyster fishery consists primarily of the eastern oyster (*Crassostrea virginica*). The prevalence of oysters in South Carolina is lower than they were in the 1900s but have remained relatively stable in recent years. The four primary reasons for the reduction in oysters in the State include: increased siltation from modifications to in stream flow, exploitation of the resource, physical disturbances to the shell beds, and diseases, especially in locations with high salinities.

The hard clam, *Mercenaria mercenaria*, is another resource in the State. Over 85 percent of the State's commercial clam production is shipped out of state in the shell to be processed and returned in part as Manhattan or New England clam chowder.

Issues in recent years affecting the shellfish resource in the South Carolina include physical disturbance and alterations to the environment, reduced water quality degradation, limited shell for replanting, and changes in the industry and harvesting demands.

Shellfish Management

The shellfish industry in South Carolina is managed jointly by the South Carolina Department of Natural Resources (SCDNR), Marine Resources Division (MRD) and the South Carolina Department of Health and Environmental Control (SCDHEC). The SCDNR Marine Resources Division is responsible for the management of the State's shellfish resources. Sustainable stocks are promoted through a series of regulations including licensing for commercial harvesting on state shellfish grounds. Licenses include powerboat licenses, equipment licenses, land and sell licenses, and commercial shellfish licenses. A state shellfish grounds card and a commercial license are required on State shellfish grounds. Mechanical device shellfish harvesting permits

are required when mechanical harvesters are to be used. A commercial shellfish license is not required for culture permit grounds, but a culture permit card is necessary

The State of South Carolina designates three types of shellfish areas for oysters and clams, including those open to the public for recreational use (public shellfish grounds and state shellfish grounds) and those permitted to commercial harvesters (shellfish culture permits). The State has approximately 4,500 acres of state shellfish grounds.

Commercial Harvest Permits

In 1986, the South Carolina General Assembly established new shellfish culture permits. The permit allows exclusive rights to harvest shellfish for a period of five years for a rental fee and a shell “planting” requirement. Recycling and replanting is a major component of the State’s resource management efforts.

Commercial Size Limits and Quotas

South Carolina does not limit the size or number of bushels of oysters that can be harvested commercially. The oyster harvesting method (hand picking), puts a functional limit on the amount that an individual can harvest per day. An average harvester can pick approximately 20 bushels of oysters per day. There is a size limit for hard clams which must have a minimum thickness of one inch, measured at the point of maximum distance between the outside surfaces of the two valves. There is no limit on the volume of hard clams that can be harvested commercially. Commercial escalators may harvest a high volume if operating on dense clam beds. In general, total catch is limited by the density and accessibility of the clam bed and not by the harvesting method. Mechanical devices, including escalator vessels, are not permitted to operate in intertidal areas.

(Keith and Anderson, 2011; Riekerk, 2011; and Walker, 2005)

5.0 North Carolina

In order to promote shellfish production and protect vital shellfish habitat, the North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries (DMF) maps coastal waters to identify concentrations of oysters, clams and scallops and delineate areas that are well suited for growing shellfish. The DMF has mapped over 95,000 acres of waters from the Cape Fear River to the Newport River, including South River and areas within Core and Roanoke sounds.

The DMF systematically delineates areas by bottom type using hydraulic tongs and sounding poles. The bottom is classified as either: soft, firm or hard; vegetated or non-vegetated; and with or without shell. Shellfish densities are sampled in each bottom type using tongs, rakes and meter squares, and the information compiled is entered into a biological database. Habitat coverage is provided in the state's Geographical Information System. The two databases are merged to produce resource maps of shellfish producing areas and to identify potentially productive bottom habitat.

Shellfish habitat and abundance maps essentially identify and protect critical fisheries habitat. Coastal resource managers use the information in the permit review process, in the designation of critical habitat, and in shellfish restoration and augmentation efforts. Recreational and commercial fisherman that harvest shellfish from public or private underwater lands can also benefit from this information. Coordination and cooperation with other local, state and federal agencies and universities are important objectives of the program.

North Carolina's Oyster Sanctuary Program

Reefs are constructed on once viable oyster producing locations to create shellfish sanctuaries. The reefs are composed of a combination of natural oyster shell and/or Class B rip-rap marl. The reefs attract native oyster larvae, as well as clams, juvenile finfish, crabs and marine organisms, which in turn attract larger fish and improve the prospects for fishermen. The state prohibits oyster harvesting and the use of bottom disturbing gear in the sanctuaries, which allows a brood stock of oysters to generate. The typical sanctuary consists of 6-foot high mounds of rip rap with

each mound containing about 150 tons of material. Seven feet of water clearance is provided above the mounds.

Each oyster produces millions of eggs per year and the eggs are transported by currents and tides to other areas. By developing and protecting a brood stock, the availability of hardy native oysters in adjacent waters increases.

Because bottom disturbing gear is prohibited in sanctuaries, the Division of Marine Fisheries seeks input regarding the best area to locate a site to minimize interactions with trawls, while maximizing the benefits of the site to oystermen and recreational fishermen.

Recently, there were as many as nine existing oyster sanctuaries located in the estuaries of North Carolina from Dare to Carteret counties.

North Carolina Underdock Oyster Culture Program

In 2004, the North Carolina General Assembly created the Under Dock Oyster Culture (UDOC) Program which allowed individuals the opportunity to grow oysters under privately owned coastal docks and piers. The program allows qualified permit holders to attach up to 90 square feet of oyster cultivation containers to a dock or pier owned by the permit holder. In order to be eligible for this permit, docks must be located in waters approved for shellfish harvesting.

The program is administered by the North Carolina Division of Marine Fisheries, in conjunction with the North Carolina Sea Grant.

Oyster Shell Recycling – Trash to Treasure (“If you shuck it, don’t chuck it”) Program

The state of North Carolina has implemented an innovative recycling program that collects oyster shells from individuals and businesses and discharges them back into the water to lessen the decline of oyster stocks.

Baby oysters begin life as free-floating organisms, but quickly settle to the bottom and attach themselves to hard surfaces, preferably other shells. A mound of oyster shells placed in brackish water with good tidal flow will quickly become colonized by a multitude of marine organisms, including oysters. This oyster reef serves a number of purposes, but most importantly helps in producing oysters.

Secondly, the shells provide habitat for other beneficial organisms, such as algae, worms, barnacles, crabs, small minnows and fish. The small fish attract a diversity of larger fish and soon there is a multitude of marine life congregating at the reef. A second benefit is that oysters clean water by feeding on plankton and waterborne detritus. One oyster is said to filter up to 50 gallons of water a day.

Most of the recycled shells are used in annual cultch planting. The shells are loaded onto barges and sprayed off with a high-pressure water hose to create reefs. These sites are located in brackish to salty coastal waters and make great homes for oysters. A single oyster produces millions of eggs annually. The eggs are carried by currents and tides to surrounding areas, enhancing oyster production in adjacent waters. Once the shells are placed on a reef they begin to attract baby oysters. Oysters are ready for harvest in 2 to 3 years.

Shell recycling drop-off areas are provided so that people can properly dispose of the shells and so that they can be put back into the water. Many restaurants and seafood markets participate. The DMF manages shellfish mariculture in coastal waters, including leasing of public bottom lands with the option of leasing the water column above. The lease program includes pre-lease biological sampling, data management, lease fee collection, and enforcement of applicable statutes and rules. By law, leases must be for commercial purposes (sale of products). As of August 2007, there were 249 shellfish bottom leases in North Carolina totaling approximately 1,800 acres. There are no legal provisions for culture of finfish or crustaceans in coastal waters.

(The Nature Conservancy, 2011)

North Carolina Department of Environment and Natural Resources Division of Marine Fisheries “North Carolina Fisheries Management Plan: Hard Clam”

In 2001, the North Carolina Department of Environment and Natural Resources Division of Marine Fisheries published a comprehensive plan entitled: “North Carolina Fisheries Management Plan: Hard Clam”. Some shellfish management strategies that were evaluated by the plan include:

- Clam relaying during extended shellfish closures (in the wake of storms or from polluted waters under supervision of the State);
- Rotating (alternative opening and closing of shellfishing areas) for mechanical clam harvest to prevent overharvest and repopulation;
- Minimizing adverse effects of mechanical harvesting by decreasing the amount of area open to mechanical harvests and shortening the season;
- Prohibitions against unloading oysters after dark to prevent harvest of shellfish from polluted areas and poaching of oysters from lease and franchise areas when stocks are low and prices are high;
- Educating of lease holders on best management practices;
- Requiring shellfish culture training certification for new lease applicants;
- Leasing areas or permit harvesting for personal consumption by private dock owners around their docks;
- Eliminating size restrictions on oysters raised in aquaculture operations;
- Constructing reefs;
- Designating and planting managed seed bed areas for subsequent relay;
- Attaining state assistance with shellfish planting efforts;
- Increasing funding for research and development education initiatives;
- Establishing shellfish depuration plants to increase production by utilizing shellfish from public and private culture areas normally closed due to pollution;
- Developing policies to protect waters from the introduction of shellfish pests, predators, pathogens, and parasites from the importation of shellfish seed;

- Evaluating water quality issues and protecting water quality that affects the harvest and consumption of shellfish;
- Restricting clam harvesting in oyster habitat;
- Increasing clam production by stock and habitat enhancement and creating spawning sanctuaries.

(North Carolina Department of Environment and Natural Resources, North Carolina Marine Fisheries, 2001)

6.0 Virginia

As with many east coast states, Virginia's shellfish industry is a valuable component of the state's economy. The state has been effective at promoting its clam and oyster production through shellfish aquaculture and reversing a long-term decline in the wild stock harvest. Limited seed availability and poor water quality are among some of the lingering challenges in recent years. (Bosch et al., 2008)

The following is a discussion of some of the studies, programs, and actions that have been undertaken to enhance and conserve shellfishing stocks in Virginia.

Virginia Department of Environmental Quality, Virginia Coastal Zone Management Program

Virginia has worked toward resolving conflicts between shellfish farming and other uses of shallow near shore waters. The first conflict the Virginia Coastal Zone Management (CZM) Program studied was seagrass restoration versus clam farming. Results showed less of a conflict than perceived because seagrass must always be underwater; whereas clam farmers prefer to grow their crop in the intertidal zone where mud flats are exposed at low tide. However, as noted by the VCZMP, as clam farming expands and space becomes increasingly limited, the conflict could increase unless clam farmers find economical ways to grow and harvest clams in deeper waters, beyond the areas where underwater grasses can grow.

The second conflict the Virginia CZMP studied was shorebird foraging versus clam farming. Research concluded that there was not a conflict, and in fact, there may be a benefit to shorebirds from clam farming since shorebirds were observed foraging on small plants and animals growing on the plastic mesh used to protect clam beds from predators.

The Virginia CZM Program analyzed numerous potential conflicts between shellfishing and other near shore activities and came up with seven recommendations to address them. The study led to additional grants to refine maps depicting where coastal waters were optimal, suitable and unsuitable for oyster and clam farming and mapping of shellfish growing waters that were considered vulnerable to degradation.

Best Management Practices

Virginia's Eastern Shore clam farming generates approximately \$50 million per year. Virginia CZM looked at how operations could be further improved. With input from scientists and industry representatives, voluntary best management practices and an environmental code of practice was developed.

Policy Options and Economics

Since 1996, the Virginia CZM Program has awarded seven grants to the Marine Resources Commission to develop policies regarding the use of existing shellfish bottom leases to ensure they were being used to develop: draft legislation to provide for a three-dimensional aquaculture leasing program; criteria for siting aquaculture operations; and general permits and regulations for certain shellfish aquaculture activities; and to refine maps and GIS data layers of all existing and proposed aquaculture sites. The above has culminated in the adoption of a new regulation that authorizes shellfish aquaculture structures that may be placed on and immediately above privately leased shellfish grounds without an individual permit from the commission.

The Virginia CZM Program has also recently completed work that examined the economic implications of alternative shellfish aquaculture management strategies. That work involved investigation of three types of policy options:

1. Proposals to redefine or clarify the current leasing system;
2. Proposals to invest state funds in research and development for oyster and clam production; and
3. Proposals to create direct economic incentives to boost commercial production.

Policy options were assessed based on results from a survey of oyster and clam producers, a general model of oyster supply and demand that was specified in part with results from the survey, and information obtained from other sources, including a bioeconomic model of oyster growth and mortality developed by Miller (2008).

In one study conducted by Virginia Tech, oyster and clam growers reported that inadequate protection of water quality was a critical constraint to shellfish aquaculture expansion. In 2008, the DEQ formed a technical advisory committee to assist in the development of a draft regulation to better protect Eastern Shore waters from point source discharges by requiring permit applicants to conduct analyses of alternatives to discharging waste into adjacent waters.

The Virginia CZM Program's Seaside Special Area Management Plan has also been useful in supporting appropriate siting and promotion of shellfish farming on the seaside of the Eastern Shore. One of the first enforceable policies being developed is by Accomack County to extend the Chesapeake Bay Preservation Act to Accomack's Atlantic coast to better protect seaside water quality. The Board of Supervisors voted to adopt an Atlantic Preservation Overlay District which, among other things, will help to protect the Accomack shellfish farming industry.

(McKay, 2008)

Virginia Marine Resources Commission

The State of Virginia's Marine Resources Commission strongly encourages gardening and farming of oysters and clams. The goal of shellfish gardening and farming is to reduce harvest pressure on wild stocks, while increasing the overall number of shellfish that help clean the water and serve as habitat for fish and crabs. Oyster gardening under private piers and along the

shoreline of privately owned waterfront property has become increasingly popular among environmentally concerned citizens in this area.

Permits and/or licenses are typically required to establish shellfish gardens or farms. The permits and licenses help to ensure fair use of the public bottomlands, reduce potential user conflicts, mitigate navigation issues, lessen the potential for contaminated shellfish to be mistakenly harvested from polluted waterways, and preserve underwater grasses that shelter juvenile fish and crabs from predators.

The shellfishing permit system is based on three conditions: 1) intent to sell the shellfish grown; 2) intent to grow shellfish in floats or in cages resting on the bottom; and 3) intent to grow shellfish on underwater lands leased from the state. The Department of Health's Shellfish Sanitation Division identifies both seasonally and permanently closed waterways, where harvesting or consumption of shellfish is prohibited due to high bacteria levels. Persons wishing to grow shellfish for personal consumption at private piers in either floats or cages in the riparian area of the shoreline of their waterfront property (not to exceed 160 square feet in area), are required to obtain an oyster gardening permit (General Permit #3) from the State's Habitat Management Division. There is no cost for this permit.

(Virginia Marine Resource Committee-a, 2011)

Persons that own a minimum of 205 linear feet of upland along a tidal waterway in Virginia can qualify for a riparian oyster ground lease. The State's Habitat Management regulation 4 VAC 20-335-10, allows individuals to grow shellfish for sale in cages that extend no more than twelve inches off the bottom on a regular oyster ground lease obtained from the state pursuant to regulations.

(Virginia Marine Resource Committee-b and Virginia Marine Resource Committee-c, 2011)

Virginia Conservation and Replenishment Department

Virginia's Conservation and Replenishment Department is tasked with the management and replenishment of the public oyster grounds in Virginia. The Department Chief with the assistance from an Advisory Committee formulates strategies to improve and restore the public oyster grounds. Restoration activities include the spreading of cultch as oyster setting substrate, rejuvenation of old oyster beds using dredges, creation of oyster reefs for optimal oyster habitat, and the relay of oysters from seed areas to grow-out areas. The Department systematically and scientifically monitors all the restoration activities to determine their success.

Management strategies are developed and regulations enacted to protect oyster resources using season and time limits, catch limits, and gear restrictions. Conservation and Replenishment personnel also coordinate all shellfish relaying information to ensure compliance with the Code of Virginia and FDA guidelines for handling shellfish taken from condemned shellfish areas.

(Virginia Marine Resource Committee-d, 2011)

Virginia Department of Environmental Quality Coastal Zone Management Program

The Virginia CZM Program has invested significant coordinative effort and funding to help protect and restore its native oyster populations. Between 2001 and 2003 Virginia CZM invested over \$1.5 million in the Virginia Oyster Heritage Program, a public-private partnership initiated by the Program. This partnership constructed over 80 sanctuary reefs and 1,000 acres of harvest area in Virginia's coastal waters.

(Virginia Coastal Zone Management Program, 2011)

Virginia Oyster Heritage Program

The State of Virginia created the Oyster Heritage Program to help restore oyster populations in its waters through a unique public-private partnership. The Oyster Heritage Program was created by the Department of Environmental Quality and the Virginia Marine Resources Commission to establish a partnership of Virginia state agencies, federal agencies, nonprofit organizations and

business groups. Participants in the program have agreed to combine resources for a large-scale oyster restoration effort in the Commonwealth.

Funding for the Program allows the state to enhance its oyster reef program. The Oyster Heritage Program has three goals:

1. to provide a sustainable fishery for Virginia watermen;
2. to improve water quality as oysters filter nutrients and sediment from the water; and
3. to create habitat for the many species of finfish and shellfish that obtain food and shelter from oyster reefs.

Phase one of the program includes construction of eight one-acre oyster reefs on the Rappahannock River. Each of the 8- to 10-foot-high broodstock sanctuary reefs will be surrounded by about 25 acres of 10-inch-deep oyster shell, at a total cost of about \$384,000 per site. Total cost for the first phase of work in the Rappahannock is estimated at more than \$3 million. As funds become available, the program will focus on restoring oysters in other Virginia waters.

Other focuses of the program include periodic examination of the reefs to assess their success, and public outreach to inform the public about oyster restoration. The Virginia Oyster Reef Heritage Foundation was created to help raise funds for the program. The foundation is expected to raise the private funds necessary to match challenge grants and public agency grants that are made for the program.

The Virginia Coastal Program has received funds from various private and public entities, including but not limited to: the Virginia Marine Resources Commission, the Virginia Environmental Endowment, the National Oceanic and Atmospheric Administration, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the Chesapeake Bay Foundation and the Virginia Manufacturers Association have donated a total of \$2.6 million dollars to the program.

(Virginia Coastal Zone Management Program & National Oceanic and Atmospheric Administration, 2010 and TheChesapeakebay.com, 1999)

Virginia Clam Production

Wild clam harvests in Virginia steadily declined after 1993, but there was a dramatic increase in clam production from aquaculture operations from 1991 to 2004. Clam production increased along the Eastern Shore based on a cooperative effort between the shellfish industry and academia to develop and implement improved culture and harvest operations for clams, supported under state programs and grants. Clam production is based on leased grounds using mesh nets or shell aggregate for predator control, and improved hatchery raised seed. In 1998 and 1999, approximately 70 million clams a year were produced by the state's aquacultural operations. Production increased to 212 million clams in 2007. Production decreased slightly, but the state still produced 102 million clams in 2010 with a value of \$25 million. The state also has substantial hatchery capacity, and the seed produced in Virginia is used for planting in the state aquacultural operations. The clam is considered the most valuable single commodity in the aquaculture produce portfolio of the Eastern Shore. Approximately 90 percent of the clam product is sold to out-of-state suppliers. The average price for the clams has remained steady at about \$0.16 to \$0.17 per clam (littleneck size category) (Virginia Sea Grant, 2011; Virginia Sea Grant, 2009; Virginia Institute of Marine Science, 2006; Virginia Sea Grant, 2005).

7.0 Maryland

The State of Maryland has a comprehensive approach to the management of its shellfish resources and a wealth of information was found on the State's shellfish management efforts. The following is a summary of conditions and activities, actions, plans, studies and programs that have or are being conducted in the State of Maryland to manage shellfish habitat and stocks.

Hard Clam Management

Maryland's Department of Natural Resources' (MDNR's) main issue regarding hard clam management is the leasing of bay bottom within 300 feet of the shoreline for clam mariculture. This zone is preferred because water depths and bottom types are usually suitable for clam

mariculture. In addition, leasing this area of bay bottom avoids conflicts with commercial clambers who are prohibited from working within 300 feet of the shore. However, property owners adjacent to these lease areas object to the proximity of such activities, primarily for aesthetic reasons, although water access is also an issue. Despite the disagreement, two administrative law hearings have upheld the right of the state to lease these bottomlands. MDNR is currently working to address these issues and determine appropriate best management practices for hard clam mariculture in Maryland's coastal bays. The goal of MDNR's hard clam management program is to conserve the coastal stock, protect its ecological and socio-economic values, and optimize the long-term utilization of the resource.

Much of MDNR's shellfish management efforts focus on oysters. There is a fairly extensive oyster sanctuary in place, and there are plans to expand the sanctuary network during the coming years. There are also oyster aquaculture programs in place within some oyster sanctuaries, and in 2011, it was announced that more areas are available for leasing. The MDNR hopes that the expansion of the oyster aquaculture program will help revive the natural oyster population.

Research Efforts

Surveys have indicated that hard clam stocks are low in all Maryland bay regions. The reasons for the low densities are unclear, but may be due to unfavorable water conditions or high predation by blue crabs. In addition to stock assessments, MDNR is looking to examine the importance of habitat closures on hard clam success and to determine their effectiveness as a hard clam brookstock area. MDNR have also conducted studies examining improving habitat bottom to reduce predation on hard clams. It was found that although clam survivorship is enhanced, it is not sufficient to justify the cost and difficulties associated with these projects.

Commercial Catch

In Maryland, hard clam commercial effort has varied over the years. Harvests in the mid-1990's were below 25,000 pounds per year. Successful recruitment during this period resulted in an increase in landings, exceeding 100,000 pounds in 1999 and peaking at 163,000 pounds in 2002. In 2008, harvesting of clams and oysters by hydraulic dredging and other mechanical means was

prohibited, which essentially eliminated the commercial fishery. Clammers may harvest up to 250/person/day and the minimum size is one inch.

In order to limit the number of individuals into the commercial hard clam fishery, MDNR has planned to grant permits based upon those individuals who have landed at least 100 bags of hard clams (as documented by dealer reports) in Maryland's coastal bays in at least two years over a 10 year period. This permit would be transferable with a license, or to an individual who purchases a clam rig from an individual who meets the criteria stated above, and relinquishes their permit to the new clam rig owner. However, lawyers determined that this licensing technique was inadvisable and it was not needed since MDNR indicated that the commercial fishery is non-existent in its coastal bays.

The MDNR believes that the hard clam industry is self-regulating. As densities drop to 0.2 clams/square meter, commercial clammers begin to leave the industry.

Recreational Catch

Information from the recreational fishery is largely unknown because there has been no documentation of the recreational fishery in the State.

(Maryland Department of Natural Resources, 2010 and Maryland Department of Natural Resources & Coastal Bays Fishery Advisory Committee, 2002)

Maryland Department of Natural Resources (MDNR)

Oysters in Maryland are currently at less than one percent of historic abundance due to disease related mortality, habitat degradation, reduced water quality, and harvest pressure. The State's ecological restoration team has considered available scientific restoration approaches for addressing the limited abundance of native oysters in Chesapeake Bay and is working with many partners in implementing a targeted approach to optimizing ecological benefits and population recovery while minimizing costs. The MDNR has worked with its partners in rehabilitating degraded habitat. It has used dredged shell and/or alternative substrates to improve bar quality

and planted disease-free hatchery oysters produced by its Piney Point Aquaculture Facility and the University of Maryland's Horn Point Hatchery.

Maryland's Ten-Point Oyster Restoration Plan

In order to achieve its oyster restoration goals, the State of Maryland is following a comprehensive Ten-point restoration plan. Many aspects of the plan have already been implemented and are ongoing, while others, such as those pertaining to aquaculture and new sanctuaries, are relatively new. The plan is outlined below, with more detail provided for items pertaining directly to restoration.

1. Focus on targeted restoration strategies;
2. Expand the sanctuary program;
3. Support a more targeted and scientifically managed wild oyster fishery;
4. Shift commercial production to aquaculture;
5. Rehabilitate oyster bar habitat;
6. Manage against oyster disease;
7. Increase hatchery production;
8. Enhance law enforcement;
9. Increase citizen involvement; and
10. Integrate inmate labor.

Targeted Restoration

The State of Maryland is implementing multiple strategies for native oyster restoration using a targeted approach. The State plans to set goals to maximize ecological benefits, facilitate population recovery and create positive outcomes for the commercial oyster fishery. Because some of these goals may conflict, the state targets specific areas for each restoration goal.

To identify possible sites for rehabilitation, the MDNR combined bottom survey data with historical oyster bar locations. Knowing the average salinity in a tributary allows them to select a restoration alternative that appropriately address disease and recruitment issues at each site. Although successful recruitment occurs in waters having higher salinities, oysters there are

subject to greater disease pressure. Conversely, oyster populations in lower salinities are recruitment-limited but benefit from the inability of disease-causing organisms to flourish there.

Oyster Bar Rehabilitation

The amount of suitable bottom habitat on which oyster larvae can settle is a key limiting factor for native oyster population recovery. Approximately 90 percent of oyster habitat has been lost during the past 25 years, resulting in the need to rehabilitate at least 10,000 acres of habitat to facilitate large-scale recovery.

Cost of Rehabilitation

Depending on the method chosen, rehabilitation costs can range between \$2,000 and \$100,000 per acre. To date, the State of Maryland has spent \$2.3 million in capital funds to design, coordinate, and implement oyster bar rehabilitation. In the process, jobs were provided for 600 watermen. The total yield thus far from these expenditures has been 250 acres of rehabilitated oyster reef.

Shell Shortage

Oyster shell, either recently shucked or from buried deposits, is said to be the best and most available cultch for oyster habitat projects in Chesapeake Bay. Since 1960, the primary source of shells for restoration is from dredged materials from the Upper Bay; however, improving degraded oyster habitat across large areas will require more shell than is available from traditional shell deposits. To obtain sufficient cultch for upcoming restoration projects, the State of Maryland has obtained a permit for a reclamation program that would provide up to 25 million bushels of shell. Also pending is a shell dredge permit application to obtain up to an additional 5 million bushels of shell from what is known as Man O' War shoal.

Alternative Substrates

Maryland has also considered alternative substrates. The most feasible function of alternative substrates is to provide a firm base for constructed oyster bars. Alternate materials that replace the need for natural shell and can be economically manufactured in large quantities have not yet been identified.

Oyster Hatcheries

In order to meet the demands of an aggressive rehabilitation agenda, a rapidly growing “Marylanders Grow Oysters” program and a new commercial aquaculture initiative, the State must have access to large quantities of disease-free oyster larvae (up to 2 billion per year) for restoration and dissemination. To achieve this goal, the MDNR has accomplished the following:

- Established a new Memorandum of Understanding with the University of Maryland Center for Environmental Science (UMCES) for future hatchery production;
- Purchased all available oyster shells from shucking houses in the state and transported them to the UMCES Horn Point Hatchery for 2011-2012 production;
- Supported legislation that increased the price paid per bushel of oyster shell from \$.25 to \$.50; and
- Initiated oyster production at its own Piney Point Aquaculture Facility in St. Mary’s County. Approximately 50 million oysters were produced there in 2009.

Ecological Restoration - Sanctuaries & Reserves

The 2004 Chesapeake Bay Oyster Management Plan adopted pursuant to Natural Resources Article, § 4-215, Annotated Code of Maryland and Code of Maryland Regulations (COMAR) 08.02.01A directs the MDNR to establish oyster sanctuaries under Strategy 4.2. The authority of the Department to establish and regulate opening and closing of Harvest Reserves as a fisheries management tool exists under Natural Resources Article §4-1009.1 of the Maryland Annotated Code and COMAR 08.02.04.14.

Current Maryland Oyster Sanctuaries

Maryland has established a number of shellfish sanctuaries in its coastal waters. In December of 2009, after recommendations were received by the Oyster Advisory Commission’s 2008 Legislative Report and a comprehensive Federal/State Programmatic Environmental Impact Statement for Oyster Restoration in Chesapeake Bay was completed, the governor of Maryland released Maryland’s Oyster Restoration and Aquaculture Development Plan. One objective of

the plan was to expand the size of the oyster sanctuary network from nine percent (9%) to twenty-five (25%) percent (approximately 9,000 acres) of remaining oyster bar habitat over a broad geographical distribution. Within this wider sanctuary network, a number of large areas were selected (up to entire river systems) in strategically located areas for targeted restoration.

Prior to 2009, Maryland's oyster sanctuaries covered just 1,475 acres of underwater land. Individually, the sanctuaries were sparsely distributed and small making them difficult to protect against illegal poaching and relatively ineffective as restoration tools. In 2009, the MDNR added three new oyster sanctuaries. Though these sanctuaries more than doubled the percentage of protected area, they still only amounted to 2,581 acres (nine percent) of geographically dispersed oyster habitat. The remainder of Maryland's portion of the Bay, exclusive of private lease areas, was left open to public shellfish harvesting.

The most recent sanctuaries established in September 2010 were specifically targeted to:

- Facilitate development of natural disease resistance as a long-term strategy for restoring oysters;
- Protect about fifty percent of the Bay's most productive oyster grounds ("best bars") as determined by an analysis of Fall Survey data compiled between 1996 to 2007;
- Have high restoration potential based on water quality and other factors;
- Provide essential natural ecological functions that can not be obtained on a harvest bar;
- Serve as reservoirs of reproductive capacity, generating larvae to populate other areas, including public shellfish fishery areas;
- Furnish a broad geographic distribution over all salinity zones; and
- Increase the State's ability to protect these important areas from poaching.

It is anticipated that both recreational and commercial fishing will benefit from improved oyster bar habitat in sanctuaries because oyster bar habitat provides critical habitat to blue crabs, striped bass, white perch and other important finfish species. Oysters within sanctuaries are also expected to increase the number of adult oysters whose larvae are likely to settle not only within the sanctuary, but also on public shellfishing areas near the sanctuaries. A complete list of

Maryland's current oyster sanctuaries, listed by region and inclusive of coordinates, is available from the State.

Clamming and Leasing in Sanctuaries

As a result of the dramatically expanded sanctuary network, sanctuaries in Maryland no longer solely consist of natural oyster bars. Instead, the expanded sanctuary network includes additional non-oyster bottom that surrounds the larger areas of interconnected natural oyster bars. The State's 2010 legislation also modified Strategy 4.2 of the Chesapeake Bay Oyster Management Plan to allow clamming from within the new sanctuary boundaries. The plan limits clamming to existing clamming areas, and maintains the existing 150-foot buffer from any natural oyster bar and leased area. The prohibition of all wild shellfish harvest, including clamming, is maintained for previously established sanctuaries.

Current law prohibits the MDNR from issuing new aquaculture leases in designated sanctuaries. The MDNR is, however, supportive of this concept under certain conditions, and is pursuing legislative change during the 2011 General Assembly. Aquaculture in sanctuaries under specified conditions can be compatible to restoration by adding to localized water quality improvements, providing ecosystem functions through oyster shell habitat creation, and enhancing natural recruitment of baby oysters within the sanctuary when reproductive oysters are used. If aquaculture leasing were allowed in sanctuaries, the MDNR is interested in establishing initial limits on the amount of allowed leased area, prohibiting leases on and within 150 feet of natural oyster bars described in the survey of 1906 – 1912, and implementing stringent penalties for poaching on a natural oyster bar within a sanctuary. Aquaculture leases existing at the time of the enactment of the 2010 legislative changes are excluded from the sanctuary until terminated or surrendered.

Sanctuaries versus Reserves

Sanctuaries are areas where the wild harvest of oysters, and both oysters and clams in previously established sanctuaries, is prohibited. They often contain oyster restoration projects to help enhance native oyster populations for their environmental benefits. Reserves are areas periodically seeded with oysters or otherwise restored by the MDNR, then later opened for

commercial harvest when the shellfish meet certain criteria, such as a minimum size limit of not less than 3 inches, low disease prevalence and intensity, and other biological reference points. Harvesters are responsible for culling oysters on the Reserve from which they are caught and returning every shell to the bar to serve as settlement substrate for oyster larvae. The Department opens and closes Reserve bars through an established public notice process. To date, Maryland has designated nearly two dozen areas as reserves; however, there are a limited number of resources, including both shell and funding, to support the continued maintenance of reserves.

Other sections of Maryland's oyster harvesting waters, as with other states, may be occasionally closed due to existing pollution or high potential for contamination by fecal coliform bacteria pursuant to the Maryland Department of the Environment (MDE) classification status of oyster and clam harvesting waters.

(Maryland Fisheries Service, Shellfish Division, 2011)

Citizens Working to Enhance Maryland's Oyster Reefs

An organization called Marylanders Grow Oysters, consisting of hundreds of citizens who own waterfront property, has taken steps to protect juvenile oysters in their first year of life, so that they may be planted on local sanctuaries where the oysters enrich the ecosystem and the oyster population. Participants grow millions of young oysters in cages suspended from private piers. The oysters help sanctuaries that are closed to harvesting regenerate fish and other aquatic life.

Marylanders Grow Oysters is managed by MDNR in conjunction with the Oyster Recovery Partnership, the University of Maryland Center for Environmental Science, and local organizations. Maryland Department of Public Safety and Corrections inmates produce the cages for the program.

(Marylanders Grow Oysters, 2011)

Recent reports from Maryland indicate that the state is engaged in programs to increase the number and quality of oyster sanctuaries as part of restoration efforts in the Chesapeake Bay (Bay Journal, June 2010). On the negative side, recent reports indicate that poaching is increasing in severity in oyster sanctuaries in the Chesapeake, with a third or more of sanctuary oysters being harvested illegally.

(The Baltimore Sun, May 9, 2011)

***Maryland Coastal Bays Hard Clam (*Mercenaria mercenaria*)
Coastal Bays Fishery Management Plan***

In 1999, a Comprehensive Conservation Management Plan was adopted for Maryland's Coastal Bays. This plan distinguished Maryland's Coastal Bays as a separate, unique ecosystem from the Chesapeake Bay and recommended that the MDNR address fishery issues specific to Maryland's Coastal Bays. In accordance with this plan, a Coastal Bays Hard Clam Fishery Management Plan (FMP) was adopted in 2002 to conserve the coastal stock, protect its ecological and socio-economic values, and optimize the long-term utilization of the resource.

Stock Status

In 2008, hard clam densities were determined to be low in all regions of the Coastal Bays. Reasons for poor density conditions were not been determined but could be the result of unfavorable water quality conditions for hard clam survival and possible increased predation by blue crabs.

Current Management Measures

In 2007, the Maryland State Legislature passed a law prohibiting the harvesting of clams and oysters in the Coastal Bays by hydraulic escalator dredge, power dredging, or other mechanical means. This statute went into effect in September 2008 and essentially eliminated the commercial fishery. The fishery may open in the future if stocks increase to densities that support manual means of harvesting. The exclusion of hydraulic escalator dredges from the Coastal Bays, which were used in conducting stock assessments, potentially creates difficulties in evaluating the impact of this legislation on the hard clam population.

The Fishery

Harvests in the mid-1990's were below 25,000 pounds per year. Successful recruitment during this period resulted in an increase in landings, exceeding 100,000 pounds in 1999 and peaking at 163,000 pounds in 2002. Commercial effort has varied over the years and consequently, impacted annual harvest numbers. Since the implementation of the prohibition on hydraulic dredging, commercial fishery landings have been negligible. Information from the recreational fishery is largely unknown. The minimum size for hard clams is one inch with a 250/person/day limit.

(Maryland Department of Natural Resources, 1999)

2001 Coastal Bays Hard Clam Fishery Management Plan

Table 22.1 of the 2001 Coastal Bays Hard Clam Fishery Management Plan contains a number of shellfish management strategies for the State of Maryland as follows:

1. Investigate the importance of habitat closures (MDE restricted areas, SAV closures, and shoreline setback areas) to recognize their benefits as hard clam broodstock protection areas.
2. Develop an action plan for improving hard bottom habitat (i.e., shell or other suitable substrate) to reduce predation on small clams. The action plan will include the identification of:
 - a) Planting materials and sources;
 - b) Enhancement areas; and
 - c) Funding sources (i.e. improved reporting of commercial hard clam harvest will increase funding generated through the shellfish tax which could be used towards bottom enhancement activities).
3. MDNR will limit the number of individuals in the commercial hard clam fishery by permit based upon those individuals who have landed at least 100 bags of hard clams (as

documented by MDNR dealer reports) in Maryland's coastal bays in at least 2 years between the 1990/91 and 2000/01 seasons. Using these criteria, a total of 22 individuals would qualify for this permit. This permit should be transferable with a license, or to an individual who purchases a clam rig from an individual who meets the criteria stated above, and relinquishes their permit to the new clam rig owner. MDNR will evaluate this action within 3 years to determine if the desired outcomes are being achieved. This action is consistent with actions 5.1.2 and 6.1.3

4. MDNR will develop a plan (i.e. reporting requirement from commercial clammers) to improve the collection of catch, effort and economic data from the commercial hard clam fishery to assist managers in evaluating the impacts of future management decisions
5. Evaluate the legal, institutional and economic incentives and barriers to private aquaculture at the local, state, and federal level in Maryland.
6. Identify problems with the permitting process, and make recommendations to specific agencies to solve those problems.
7. Simplify the application process, and designate a single point of contact at MDNR to assist potential applicants with aquaculture permits, questions related to the regulatory requirement, guidance through the permitting process and fulfilling of regulatory obligations, tracking permit applications, and coordinating state agency permitting activities to aquaculture permits.
8. MDNR will evaluate the feasibility of hard clam aquaculture in Maryland's coastal bays by:
 - a) Identifying potential areas and size of area for hard clam aquaculture;
 - b) Initiating and providing funding for pilot hard clam aquaculture studies;
 - c) Investigating the economic impact of hard clam aquaculture; and
 - d) Assessing the ecological impacts associated with hard clam aquaculture.

9. MDNR will develop and distribute a public outreach brochure illustrating recreational clamming areas, access points, methods and harvest restrictions.
10. MDNR will work with the Town of Ocean City and Worcester County to improve access to recreational clamming areas.
11. MDNR will investigate the feasibility of planting seed to establish and/or enhance areas for recreational clamming, and if feasible, develop a seeding strategy.
12. MDNR will reduce the recreational catch limit for hard clams from 1 bushel to 250 hard clams per person per day.
13. MDNR will prohibit commercial clamming in the area between the Ocean City Airport at Marker 13, northward to the Rt. 90 Bridge on Saturdays (Sundays currently closed) between September 15 through October 15, and April 15 through May 31.
14. MDNR will reduce the by-catch allowance of hard clams for recreational purposes in the hydraulic dredge fishery from 1 bushel to 250 hard clams per person per day.
15. MDNR will establish a maximum noise level limit for commercial vessels consistent with the recreational limit.
16. MDNR will increase the shoreline setback distance for which a person may not catch hard clams with a hydraulic dredge in front of federal or state-owned property from 150 to 300 feet.
17. MDNR's Natural Resource Police will monitor the causes of reported noise complaints to facilitate future management decisions related to this issue.

18. MDNR will investigate the impacts of prohibiting or restricting the written permission provision that allows an individual to catch hard shell clams with a hydraulic dredge within the shoreline setback of 300 feet.
19. MDNR and Maryland's Coastal Bays Program will educate the public on the ecological effects of hydraulic clam dredging and the importance of the commercial hard clam fishery to the coastal bays community.
20. MDNR will encourage studies to evaluate the ecological impacts of hydraulic clam dredging in Maryland's coastal bays.
21. MDNR will continue to prohibit the use of hydraulic clam dredges in SAV beds, and delineate existing SAV beds as necessary to maintain this protection over time.
22. The Maryland Coastal Bays Fishery Advisory Committee shall become the local group to develop and provide recommendations to MDNR regarding the delineation of SAV closure areas to harvest from hydraulic clam dredging.
23. MDNR will continue to foster the support among legislators to make recommended changes in the SAV law which would benefit all stakeholder groups by making the delineation and enforcement process more manageable, and the closure areas consistent over a longer period of time.
24. MDNR and the National Park Service will investigate the feasibility and funding options for using Global Positioning System (GPS) units to improve the ability for clambers to comply with SAV closure areas and offset the maintenance cost associated with using buoys to identify SAV closure areas.
25. MDNR will evaluate the need to restrict hydraulic dredging in important female blue crab overwintering areas by:

- a) Delineating female blue crab overwintering areas;
 - b) Determining the significance or contribution of these overwintering crabs to the coastal bays blue crab population;
 - c) Determining the magnitude of overwintering blue crab bycatch in the hydraulic clam dredge fishery; and
 - d) Assessing the impact of dredging activity on overwintering female blue crabs.
26. Develop strategies to restore water quality in areas closed to harvesting hard clams because of pollution.
27. Develop an action plan for improving hard bottom habitat (i.e shell or other suitable substrate) to reduce predation on small clams. The action plan will include the identification of:
- a) Planting materials and sources;
 - b) Enhancement areas; and
 - c) Funding sources.
28. The Maryland Coastal Bays Navigation and Dredging Advisory Group (NADAG) will seek comments from MDNR's Shellfish Program on the potential impacts of proposed dredging activities on hard clams.
29. MDNR and MCBP will identify potential funding sources to support the following research and monitoring activities:
- 1) Assess the potential impact that noxious algal blooms have on hard clam populations; and
 - 2) Identify factors which might contribute to noxious algal blooms.
30. MDNR with the advice of Maryland's Coastal Bays Fishery Advisory Committee will implement measures to minimize the impact of green crabs and Japanese shore crab on

the hard clam population in Maryland's coastal bays, and coordinate this effort with Delaware and Virginia.

31. MDNR will continue to work with Maryland's Non-indigenous Species Task Force to examine invasive species issues, and develop an Aquatic Nuisance Species plan to become eligible for Federal funding
32. MDNR will continue to survey the hard clam resource on annual basis in Maryland's coastal bays to facilitate management decisions.
33. Design and implement a program to monitor the efficacy of bottom enhancement activities.
34. MDNR will establish, implement and evaluate a commercial reporting program to obtain accurate catch, effort and economic data from anyone harvesting hard clams in Maryland's coastal bays.
35. MDNR will facilitate the design and implementation of a recreational clamming survey in Maryland's coastal bays.

(Maryland Department of Natural Resources, 2002)

8.0 Delaware

Delaware Bay is rich in shellfish, but like many areas along the east coast, over exploitation, habitat degradation, parasites, and other factors have affected once abundant stocks over the years and required increased management and enhancement. Various monitoring and management efforts have been employed in recent years to revitalize and sustain shellfishing in the State's waters. The following discusses some of the activities that are being or have been conducted to address the sustainability of shellfish in the State.

State of Delaware Department of Natural Resources and Environmental Control Division of Fish and Wildlife Oyster Management Program

The Division of Fish and Wildlife manages the State's approximately 1,000 acres of natural oyster beds extending north from Port Mahon to Woodland Beach in Delaware Bay. The oyster population in this area is estimated periodically through the State's annual October dredge survey. The dredge survey provides essential data relating to the relative abundance of oysters on each individual bed. Data collected serves as the basis for establishing annual harvest quotas for the following year.

The Division also augments the resource by implementing an ongoing shell plant program. The planting of clean shell every year helps to restore the oyster beds, provides critical habitat for juvenile oyster (spat) recruitment, expands and enhances habitat for marine life and increases oyster abundance. The state's oyster beds have successfully served commercial shellfishing interests for the past six years.

(Delaware Department of Natural Resources and Environmental Control, Division of Fish and Wildlife, 2011)

Delaware Center for the Inland Bays Oyster Gardening Program

A publication by the Delaware Center for the Inland Bays Oyster Gardening Program provides a discussion regarding the raising of juvenile oysters for stocking the demonstration oyster reef at the Center for the Inland Bays (CIB's) James Farm Ecological Preserve at Pasture Point on Indian River Bay, and for planned oyster restoration work in Little Assawoman Bay.

Some shellfish restoration programs, such as in the Chesapeake Bay off Maryland, and other areas have shown that raising oyster spat to a larger size in Taylor Floats,¹ prior to placing them on reefs, can significantly reduce losses from crab predation. The oyster spat (on shell) used in the Inland Bays Oyster Gardening program is produced by the University of Maryland Hatchery at Horn Point in Cambridge, Maryland.

¹ A Taylor Float is a device with a rectangular frame of PVC pipe for floatation and a wire mesh basket suspended below that holds oysters about one foot under the surface of the water.

Oyster spat with an initial average size of 10 millimeters were deployed in Taylor floats during the summers of 2003 and 2004 at a variety of locations in the three Inland Bays. Average oyster growth ranged between 23 to 45 millimeters depending on location which was considered good to excellent.

Good oyster growth was observed in all Inland Bays locations, particularly in the Oak Orchard area of Indian River Bay and the southern portion of Little Assawoman Bay. Oyster mortality in the Taylor Floats was considered negligible at all locations. Growth rates observed during the initial deployment of oysters in Little Assawoman Bay conflict with suggestions that water quality conditions in the bay were generally insufficient for bivalves. The results also demonstrated the high potential for oyster aquaculture in the bay using off-bottom gear, and the opportunity to take advantage of the relatively closed conditions of Little Assawoman for promoting natural recruitment by developing oyster spawning sanctuaries in the bay. In addition to creating an excellent condition for nursery growth, the baskets of oysters and shell in the Taylor Floats provide exceptional habitat for grass shrimp, juvenile fish and other small invertebrates.

(Inland Bays Journal, 2005)

U.S. Army Corps. "Delaware Bay Oyster Restoration Project Delaware and New Jersey Final Environmental Assessment" April 2006

In 2006, the Army Corps. of Engineers was seeking to address habitat degradation which was affecting available natural resources. The proposed project specifically sought to recruit and sustain oysters through a shell-planting and oyster transplanting program that would significantly enhance and restore oyster populations and improve water quality and habitat complexity within Delaware Bay which lies between the States of Delaware and New Jersey. The goal was to enhance oyster habitat, increase oyster abundance, and reinvigorate natural resources through water quality improvements anticipated by increased filtration by a large shellfish stock and enhanced habitat complexity. The primary action was the planting of shell (cultch) to augment seed supply and provide habitat for juvenile oysters or spat. A Monitoring and Assessment

Program was also proposed as part of the Army Corps.' Action. The program was to consist of seven components as follows:

1. monitoring of down-bay shell plants pursuant to the decision to transplant the spat to up-bay;
2. measurement of spat settlement potential carried out from late June through late September;
3. monthly tracking of trends in growth and disease exposure for the shell plants;
4. a quantitative evaluation in October to determine the overall success of each year's program at the end of the season;
5. dredge calibration to determine the applicability of remote sampling by oyster dredge of shell plants;
6. survey targeted oyster beds to improve bed areal estimates, where required, and
7. the development of a shell budget to evaluate the efficacy of the shell-planting program in maintaining habitat integrity.

(United States Army Corps of Engineers, 2006)

9.0 New Jersey

Nearly all aquacultural activity in New Jersey's waters involves hard clams (*Mercenaria mercenaria*) and oysters (*Crassostrea virginica*). An estimated two-thirds of total aquaculture farm-gate sales in New Jersey come from hard clams. The State is ranked 5th among hard clam producing states behind Virginia, Florida, Connecticut and Massachusetts (New Jersey Department of Environmental Protection, 2011). The following is a summary of activities, actions, plans, studies and programs that have or are being conducted in the State of New Jersey to manage shellfish habitat and stocks.

Barnaget Shellfish Restoration Program

Barnaget Shellfish Restoration Program provides a volunteer training program, training courses for shellfish gardening, and raises clam seed and disease resistant clams. The Shellfish

Restoration Program is a partnership between Rutgers NJAES Cooperative Extension and the New Jersey Department of Environmental Protection Division of Fish and Game Bureau of Shellfisheries. The goals of the program include educating the community about ecology and the natural processes of Barnegat Bay, promoting environmental stewardship, and using clams and oysters as teaching tools, including demonstrating how human activities can degrade water quality and shellfish populations. (Rutgers, 2010)

The Mullica River-Great Bay estuary provides habitat for one of the last remaining viable oyster populations along New Jersey's ocean shoreline. The State Bureau of Shellfisheries performs yearly surveys to evaluate the condition of the public seedbeds located upstream in the near the mouth of the Bass River and the public oyster harvest beds located at the mouth of the Mullica River.

The state recently began shell planting and seed transplantation activities in hopes of sustaining the oyster fishery. This effort began in 2001 with the transplant of 2,000 bushels of oysters from the seedbeds to a four-acre parcel within the harvest bed of Fitney Bit. That initiative led to the first public oyster harvest on the Atlantic Coast of New Jersey in over 20 years.

In 2005, the New Jersey Bureau of Shellfisheries received a grant from the Fish America Foundation and National Oceanic and Atmospheric Administration (NOAA) Restoration Center for the Mullica River Oyster Restoration Project. The goal of the project was to improve oyster habitat in the Mullica River/Great Bay estuary and increase public understanding of the ecological role of oyster habitat as nursery and foraging area for recreational finfish. The Richard Stockton College of New Jersey assisted in the educational component of the project. At the time the project was launched, the distribution of marketable-size oysters in the estuary was primarily confined to the area called Fitney Bit at the mouth of the Mullica River which was seeded with oysters in 2001.

In May 2006, 2,000 bushels of oyster seed material, equal to approximately 8.7 million oysters, were distributed over four acres within the harvest oyster Transplant Area called the "Reef". These oysters had come from a location known as Moss Point, one of two seedbeds located

approximately 10 miles upstream from the Reef. In order to protect the restored habitat, the harvesting of oysters will be prohibited for five years. In October of 2006, the Bureau of Shellfisheries performed a second transplant consisting of 2,000 bushels of seed material from the French's Point seedbed to establish another four-acre harvest bed at Fitney Bit.

To date, monitoring activities conducted over the seedbeds and restored areas indicate that those areas continue to exhibit good condition (high proportion of live oysters relative to sample volume). Transplanted oysters have shown good performance in terms of growth and survival.

In June 2006, four thousand bushels of surf clam shell were planted to enhance oyster recruitment over a 13-acre parcel within the seedbed of Moss Point. Surf clam shell provides an excellent substrate for oyster larvae to settle and Mullica River seedbeds have a high potential for recruitment.

(New Jersey Department of Environmental Protection, Division of Fish and Wildlife, 2007)

NJDEP, Division of Fish and Wildlife Bureau of Shellfisheries

Habitat Protection

One of the New Jersey Bureau of Shellfisheries' primary responsibilities is to review waterfront development projects to determine potential effects on shellfisheries habitat and resources. The bureau reviews numerous permit applications every year and provides resource information to the Land Use Regulation Program to assist in the permit process. Bureau staff provide ongoing support to other department staff in amending the Rules on Coastal Zone Management to ensure that shellfish resources and valuable coastal habitat are protected from development actions.

Leasing

The Bureau, in conjunction with the Shellfisheries Council, is responsible for administering the shellfish leasing program which supports private aquaculture activities through the leasing of bay bottomland for shellfish culture. Approximately 30,000 acres of bay bottom are currently leased

by commercial interests statewide. The leased lands primarily support the harvesting of oysters and hard clams.

Before Prior to the issuance of any shellfish lease within the Atlantic Coast Section, the Bureau will conduct a biological investigation to determine the area's natural productivity. The Bureau performs between approximately 30 and 50 biological investigations every year for its lease agreements.

The Bureau does not lease naturally productive areas so that they can remain open for all shellfishers to use. In so doing, the State can foster the continuation of aquaculture activities while making certain that naturally productive areas remain open for all to use.

Hard Clam Relay and Depuration

The State's relay and depuration programs permit hard clams from somewhat degraded waters to be used. Clams from such degraded waters are transplanted to areas having higher water quality or are processed in a State-approved depuration plant.

Oyster Investigation — Atlantic Coast

Sampling of the Mullica River oyster seed beds occurs annually in order to monitor setting success, survival and overall bed condition.

Oyster Industry - Delaware Bay

The Delaware Bay oyster industry operates with limited direct marketing of oysters from natural seed beds. This program began in the spring of 1996 when the industry decided to skip the traditional transplant program and began marketing oysters from the seed beds to avoid disease issues that have adversely affected the leased area since the 1950s. Previously, the seed beds were intensively worked during a limited period in the spring and as a result large volumes of oysters were transplanted and perished on the leased grounds.

With support from the Coastal Zone Management Program and contributions from the shellfishing industry to the Oyster Resource Development Fund, the Bureau was able to plant

clean cultch (shell) material on the seed beds in June. An important part of protecting and enhancing the natural seed beds is the regular addition of cultch which provides a perfect surface to which the juvenile oysters attach. Data support the notion that the addition of clean shell to the seed beds during the setting season is one of the most viable management techniques for increasing the production potential.

Inventory of New Jersey's Surf Clam Resource

The surf clam (*Spisula solidissima*) fishery is one of New Jersey's most valuable fisheries. Over 80 percent of the total Mid-Atlantic and New England area catch of surf clams are landed in New Jersey. Every year, the state conducts an inventory of its waters to evaluate the condition of the resource. The data collected is then used to formulate management strategies such as identifying conservation areas and establishing harvest quotas.

Shellfish Inventory Program

The principle objective of the Shellfish Inventory Program is to determine the distribution and abundance of valuable molluscan species which inhabit New Jersey's estuaries. The program provides valuable information regarding the major shellfish species, water quality, and sediment classification. This baseline data is necessary for the development of management strategies designed to protect shellfish habitat and enhance shellfish resources.

All estuarine waters, including, and between Raritan Bay and Brigantine, have been monitored since the inventory first began in 1983. Personnel and budgetary constraints since 1988 have resulted in fieldwork limited to that associated with lease ground surveys and site inspections of potential coastal development activities.

(New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Bureau of Shellfisheries, 2011)

New Jersey's Department of Environmental Protection makes about 60 arrests each year for illegal seafood harvesting in polluted waters. All the while, environmental groups and volunteers have been attempting to restore shellfish populations in these areas. These efforts have increased

shellfish populations but have also made harvesting more attractive to poachers. In response to these illegal activities, the Department banned so-called shellfish gardening.

Meredith Comi, oyster program director for the New York-New Jersey Baykeeper, raised concerns that banning shellfish restoration program would have adverse affects on jobs and the environment.

Jeff Tittel, the head of the New Jersey Sierra Club, has indicated that projects like Comi's are great for educating people on the ecological importance of shellfish. However, since the population enhancement activities take place in locations with degraded water quality, including at or near sites that contain polychlorinated biphenyls (PCBs), dioxins, mercury, lead, and other heavy metals, the act of poaching and selling contaminated shellfish can have serious health impacts. The NJ DEP agrees with Tittel's concern over public health and notes that consumer concerns over the possible consumption of poached shellfish from polluted waters could jeopardize the legitimate shellfish market. Tittel suggests that the ban is appropriate for the time being but that it's only a short-term solution and what the state should do is allocate more resources toward stopping poaching and cleaning up degraded waters to address health concerns.

(Grens, 2010)

10.0 Connecticut

Shell fishing is an important component of Connecticut's economy and its recreation and tourism industries. The Department of Agriculture/Bureau of Agriculture (DA/BA) and the state shellfishing industry have worked with Town recreational shellfishing programs to stock areas for harvest by the public. The state has been strongly supportive of oyster aquaculture, in particular, leasing submerged land, and assisting in planting culch. In fact, Connecticut leads the northeast in aquaculture production by virtue of its oyster industry. Hard clams are harvested too. Connecticut shellfishing generates \$30 million plus in farm-gate sales annually. The Connecticut shellfishing industry provides over 300 jobs statewide and Connecticut shellfish harvests exceed 450,000 bushels of Hard Clams and 200,000 of bushels Oysters each year. A summary of programs and activities to protect and restore shellfish populations are as follows:

Connecticut Department of Agriculture Leasing Shellfish Grounds

The State's shellfish leasing program is administered by the Department of Agriculture for the purposes of promoting the planting, cultivating, and harvesting of shellfish (oysters and clams) in Long Island Sound. The leases are given through a competitive bid process with a minimum bid of \$4.00/acre. Over 70,000 acres of Connecticut's coastal waters are harvested and approximately 12,000 acres of this amount are leased by local shellfish commissions. Bids must be for a minimum of 50 acres and maximum of 200 acres and the lease area must be square or rectangular in shape. The leases have terms ranging between three and ten years with renewal options, if lessees have fulfilled its rental obligations. Leases are granted by the Commissioner of Agriculture to the highest responsible bidder. Application fees and the one year rental fee are returned to the low bidders. The successful bidder pays the costs of the Application fee, a year's rental fee in advance, a fee for surveying costs, poles, buoys, buoy stones, floats, and rope used in connection with the surveying of the lease, and a legal notice fee.

(Connecticut Department of Agriculture, Bureau of Aquaculture, 2011)

Connecticut Marine Conservation Agreement (MCA) Neck River Shellfish Restoration

Steve Nikituk a leasee of Connecticut bottomlands, in cooperation with the Madison Shellfish Commission, transformed his Neck River commercial shellfish lease into an oyster restoration project. Most of the oysters in the Neck River were destroyed by dermo and MSX (two parasitic diseases) in 1998 and 1999. In 2002, Nikituk received a five-year lease, with five-year optional extension, for a half-mile section of the Neck River, which he would use to restore oysters to the river.

Mr. Nikituk became more active in the Madison Shellfish Commission and eventually became its Chairman. Ultimately, he decided to relinquish management of his lease to the Commission, which manages it as a shellfish grow-out area and sanctuary.

The Madison Shellfish Commission is responsible for granting licenses and leases to private entities for shellfish harvesting in the town of Madison. The Neck River has been closed to

public harvest, due to *E. coli* levels that have been high enough to classify it at a “restrictive relay” area. Nevertheless, leases have been issued on two sections of the river. Oysters harvested from the leased areas are transported to a depuration plant for cleansing. Areas of the Town’s shore on Long Island Sound are still open for public harvest.

The restoration project is focused on using upweller technology for quickly growing out oyster seed. The seed is later placed on the newly clean shell-lined river bottom to establish oyster reefs. The reefs provide the foundation for the natural spread of healthy, disease-resistant oyster larvae. Observations over the past couple years suggest success in the river, both on the Nikituk lease area and on the remaining commercial lease in the town. Area commercial fishermen have provided vital input to Nikituk and the Madison Shellfish Commission.

The Madison Shellfish Commission has been involved in public outreach events, including “Family Shellfishing Days” which encourages recreational clamming. The Commission is also evaluating the use of the upweller on Nikituk’s lease to grow out hardshell clams that can be released on the Long Island Sound side of the town, and has requested approval of an aquaculture permit to use grow-out in cages on sound bottomland.

11.0 Rhode Island

Hard Clam Management

The Rhode Island Department of Environmental Management (RIDFW) uses a set of management areas and a rotational transplant system to manage the hard clam resource in Rhode Island’s waterways. RIDFW restricts the fishery through both permanent and conditional pollution closures, in addition to seasons, possession limits, and management closures. The goal of the program is cited as: “Rhode Island will have a healthy bay quahog resource and a fishery management regime which provides for sustainable harvest, cooperative management by stakeholders, and appropriate opportunities for fishery participation.”

In May 2011, the RIDFW transplanted an estimated 250,000 pounds of adult hard clams from high shellfish density areas in Narragansett Bay to shellfish management areas and spawner

sanctuaries. Often shellfish are transported from high-density polluted areas to overfished areas. The areas where the shellfish were transplanted remain closed to harvest until December 2011. This temporary spawner sanctuary which is stocked with transplanted mature clams spawn in the spring and remain undisturbed until the winter harvest season promoting recruitment and allowing for more than adequate depuration. The first transplants were funded by revenues obtained through commercial licensing fees.

RIDFW has found that definitive results from sanctuary programs are difficult to attain due to the nature of the projects. Although it is rather easy to obtain pre-sanctuary and post-sanctuary population densities, it is difficult to determine the transplant or seeding efforts to be the cause of new recruitment. Without expensive and highly involved genetic testing, there is only anecdotal evidence to suggest whether the efforts were a success or not.

Research Efforts

RIDFW has been conducting annual surveys of clam resources in their waters since 1993. They sample both fished and un-fished areas of the bay. The sampling consists of towing a small hydraulic dredge for 30.5 meters at each station. Pressurized water is delivered to the dredge manifold which dislodges shellfish from the substrate. The dredge is designed to retain legal-sized clams (> 25mm). All species retained in the dredge when hauled are identified and all shellfish are counted and measured.

The survey found that the stratified mean density of quahogs in Narragansett Bay declined from 1997 to 2003 and then increased gradually to 2009. In the future RIDFW plans to change the survey to concentrate on specific areas of concern on a rotational basis, in particular, areas closed to pollution and spawner sanctuaries. In addition, research is being conducted to improve the precision of the survey by relating observed hard clam densities to mapping of submerged sediments.

Commercial Catch

Rhode Island has seen two very distinct peaks in commercial landings of hard clams since 1947. The first occurred in 1955 followed by a rapid decline until 1974 and then a second peak in

1985. Similarly to the Great South Bay where hard clam landings have declined to low levels, in recent years Rhode Island commercial landings have reached their lowest levels. In 2009, 226 metric tons of hard clams (meat weight) were harvested, which is only 12% of the landings in 1985. RIDFW believes this decline is due to several factors. These factors include the implementation of possession limits and seasons, reduction of fishable areas due to pollution closures, limited number of licenses available and reduction in the number of participants. Most of the hard clams landed by count are littlenecks, followed by top-necks, chowders and cherrystones.

The RIDFW has actively been managing the amount of commercial hard clam licenses which are available. Due to landing levels and concerns over an aging population of licensed hard clam fishermen, issuance of new licenses or endorsements was permitted in past years on a conservative basis. The intention was to maintain current levels of effort by issuing a new license for every active license retired. Since the activity of licenses was unknown, a conservative exit/entrance ratio of 3 to 1 was used for the past several years, as recommended by industry. However, in 2010, the RIDFW amended its licensing procedure to allow a 2 to 1 exit/entry ratio. It is important to note that the availability of new commercial licenses in recent years has not caused a rise in landings, rather landings continue to decline with the lowest levels occurring in 2009.

There are two different license classes for commercial clammers. The first is a commercial license, which is applicable for residents between the ages of 19 and 65, for a fee of \$200 annually. Residents over the age of 65 may obtain a commercial license at no cost. The second is a student commercial license which is applicable for residents aged 23 or under that possesses full-time student status. The student license costs \$50 annually. Commercial clammers may harvest up to 12 bushels of clams per day and the clams may not be less than one inch in length.

Recreational Catch

RIDFW does not require recreational fishermen to obtain a shell fishing permit as long as they do not exceed the resident's daily catch limit or sell the hard clams. The daily catch limit is ½ bushel.

(Ganz, A., N. Lazar, and A. Valliere, 1999; Rhode Island Department of Environmental Management, 2010; Rhode Island Department of Environmental Management, 2011)

12.0 Massachusetts

Massachusetts Division of Marine Fisheries Shellfisheries Management, Contaminated Shellfish Resources

The Massachusetts Division of Marine Fisheries is responsible for managing contaminated shellfish resources for depuration, relaying and bait.

The management and oversight of soft-shell clam depuration is a major responsibility of Marine Fisheries. Clams are taken from certain conditionally restricted locations in Boston Harbor and transported by Marine Fisheries' licensed and bonded master diggers under strict enforcement to the Shellfish Purification Plant located on Plum Island in Newburyport. The clams are then purified in a controlled aquatic environment in one of the nine depuration units available at the Shellfish Purification Plant. Water used in the process is obtained from two deep salt-water wells. Ultra-violet light is applied to disinfect the water. The process is complex and requires constant oversight and testing, including daily sampling and analysis at an on-site certified laboratory. The depuration process takes at least three days and once completed, a depuration fee is rendered and the clams are returned to the harvesters and sold.

The Newburyport Shellfish Purification Plant began operations in 1928. It is the oldest and largest continually operating depuration facility in the country. It is also the only publicly owned and operated depuration plant in the country. The plant operates 364 days a year and processes an average of 560 bushels of soft-shelled clams a week.

Under the State's relay program, Marine Fisheries allows municipalities to transplant contaminated shellfish to clean waters for natural purification and propagation. Relays are conducted under stringent National Shellfish Sanitation Program (NSSP) specifications with oversight by state and local enforcement authorities. The process requires that affected shellfish

be kept at the relay site for at least three months as well as the period of one spawning season. To ensure that the requirements of the NSSP are met, shellfish must be tested before relaying and again prior to harvesting for human consumption. The northern quahog (*Mercenaria mercenaria*) is most often transplanted at around 14-18,000 bushels a year, though oysters and soft-shelled clams are also transplanted. The origin of most contaminated quahogs is the Taunton River/Mount Hope Bay area, and New Bedford, Fairhaven and Dartmouth. This method of shellfish propagation affords participating municipalities a relatively inexpensive source of shellfish for use as spawning stock and also allows eventual utilization of the contaminated resource thereby precluding poachers from harvesting the stock from polluted locations.

Surf Clam and Quahog Dredge Fisheries

Shellfisheries in non-contaminated waters are under municipal control; however, the commercial harvest of surf clams (*Spisula*) and ocean quahogs (*Arctica*) fall under Massachusetts Division of Marine Fisheries jurisdiction. Similarly, the taking of northern quahogs (*Mercenaria*) using dredges in some waters of the Commonwealth is managed by the Massachusetts Division of Marine Fisheries through required limited access licensing. Catch data are loaded into a multifunctional database which fishery managers can use to determine Catch per Unit of Effort (CPUE), assess the impacts of fishing in certain places, perform trend analyses and ascertain amounts and values of harvests. Much of this information is provided to the National Marine Fisheries Service (NMFS) every year and is input into total U.S. harvest data.

Shellfish Statistics

The Massachusetts Division of Marine Fisheries is responsible for gathering, examining, and maintaining an historical database of commercial and recreational shellfish landings. The State's 65 coastal cities and towns record the data on a standard "Town Landings Forms" and submit them to Marine Fisheries once a year. Data collected reflect the number and type of permits issued, the total weight of each species landed, and identifies the shellfishing methods used. In addition to these data, the municipalities submit updates of their local shellfishing regulations. This information has been maintained since 1955 in both hard copy and electronic format and is used for fisheries management on the local, state and federal levels.

Technical Assistance

In Massachusetts, cities and towns are responsible for managing the shellfisheries in all waters within their jurisdictions that have not been closed by Marine Fisheries for public health reasons, with the exception of the commercial harvest of surf clams and ocean quahogs which remain under state control. One of Marine Fisheries' primary functions is to make essential technical and regulatory information available to shellfishing interests. Information and assistance primarily involve: shellfish propagation techniques, predator controls, shellfish survey methods, area openings and closures, habitat enhancements, the preparation of shellfish management plans and shellfish aquaculture support and regulation.

Aquaculture Management

The regulation of shellfish aquaculture is a major component of the state's management and technical assistance effort. Regulation includes two categories: 1) the licensing of sites by municipalities; and 2) the permitting of aquaculturists to obtain and possess sub-legal shellfish (seed) for transplant and grow-out to legal size. Aquaculturists are required to receive a Marine Fisheries propagation permit every year. The permit is tailored toward the needs of each grower based on the information provided in the permit application. The process is designed to assist in controlling the introduction or spread of shellfish diseases, foreign shellfish species, and other pests or predators into the State's waters. Approximately 300 propagation permits are granted every year. Other related activities include: assisting individuals in the licensing and permitting process, providing information on aquaculture to interested parties, assisting municipalities with site selection prior to formal site survey in order to avoid denial by Marine Fisheries, and assisting growers in locating seed sources and working with hatcheries to become certified to sell seed in Massachusetts.

Shellfish Program staff also work with the Southeastern Massachusetts Aquaculture Center (SEMAC) by reviewing SEMAC funding proposals submitted by aquaculturists. Recommendations and comments are made regarding each proposals appropriateness, feasibility and permitting requirements.

Environmental Protection

Shellfish Program staff are also responsible for assessing potential impacts on shellfish resources and possible health effects from pollution events such as sewage discharges, boat sinkings, fuel spills, and other discharges of hazardous chemicals.

Shellfish Program and Marine Fisheries staff members are also responsible for assessing potential habitat, shellfish, and water quality impacts from coastal projects. Developing recommendations for avoiding or mitigating potential environmental impacts stemming from proposed structures, dredging, filling or discharges into the marine waters are part of the Marine Fisheries environmental review process.

(Massachusetts Department of Fish and Game, Division of Marine Fisheries, 2008)

Massachusetts Office of Coastal Zone Management

The Massachusetts Office of Coastal Zone Management prepared the Massachusetts Aquaculture Strategic Plan which includes a section on regulatory reform that was overseen by what was called the Regulatory Reform Working Group (RRWG). The primary task of the RRWG was to identify the major regulatory issues affecting the growth of the aquaculture industry and to recommend ways in which to make the process more efficient, while protecting public and private rights and environmental quality.

Three primary issues were investigated by the RRWG: 1) an improved regulatory process, 2) long-term security for capital investments, and 3) state support for the aquaculture industry. The RRWG also proposed a number of recommendations to address interagency coordination and oversight of aquaculture activities in the state.

The first recommendation was the creation of a State Aquaculture Coordinator position to provide a central contact for all aquaculture related concerns, disseminate educational material relating to permitting, examine time frames, provide application materials, determine application fees, and determine review processes for the different types of aquaculture. Review and permitting of aquaculture activities were to be coordinated by the Division of Marine Fisheries (“DMF”) and the Division of Fisheries and Wildlife (“DFW”) with DMF being the primary

regulatory agency for marine aquaculture and hatcheries. It was recommended that DFW be the lead regulatory agency for inland aquaculture and hatcheries. Each agency would provide a one-stop permit process and abide by state and federal requirements.

A general permit was recommended for certain types of activities in order to eliminate the level of review necessary for permit processing. If all general permit conditions are met, the permit would be granted, thereby providing greater predictability and improving overall efficiency.

Long-term security of aquaculture industry capital investments is the second major issue. Since significant capital investments are often necessary with aquaculture, security in the duration of the lease is of paramount importance. Limited stability in leasing intertidal and Commonwealth tidelands has been shown to be a financing obstacle. Lease security is critical to the industry and involves balancing private land use with public interests in tidelands. The plan provided several recommendations that clarify ownership of tidelands, terms and transferability of leases, and the role of local, state, and federal agencies in securing lease agreements.

Enhanced state support for the aquaculture industry and local shellfish managers was the third issue the Plan addressed. Reinstitution of the Municipal Shellfish Propagation program was recommended. The plan also noted that shellfish aquaculture licensing fees should be adjusted to reflect the economic value of public tidelands, be committed to municipalities, and be used for public shellfish propagation and/or restoration of shellfish beds. The DMF also expressed interest in developing a pilot program to allow shellfish nurseries in restricted areas. Improved record keeping for aquaculture production monitoring activities was also considered to be important.

The final specific recommendations of the RRWG are intended to address the following classes of aquaculture activities:

1. Shellfish Bottom Culture: involving minimal structure and no discharge;
2. Shellfish/Seaweed Water Column Culture: consisting of more substantial structures and no discharge;

3. Recirculating/Flowthrough Culture: involving structures located on land and having discharges;
4. Finfish Net Pen Culture: involving structures in marine waters and discharges.
5. Projects in Federal Waters: involving various culturing techniques that are taking place in part or fully within federal waters.

General Regulatory Recommendations

Some general regulatory recommendations of the RRWG include the following:

- State agencies should work closely with the ACOE and other federal resource agencies in amending the existing Programmatic General Permit (PGP) to directly address aquaculture thresholds. Develop conditions which ensure that only the largest projects and/or those with the greatest potential impacts require review as individual permits under State agencies should make test lease or pilot projects viable by reducing regulatory requirements and facilitating joint monitoring for predetermined periods.
- CZM should adopt a policy stating that aquaculture projects do not need to apply for Consistency Review unless: 1.) they require an Individual permit as determined by the ACOE and/or 2.) They are sited in part or in whole within federal waters. CZM should also draft a Program Policy which directly addresses and supports aquaculture.
- The existing fee structure for the Waterways Program (Chapter 91) should be reevaluated and revised for all aquaculture operations. The fee structure should reflect the nature of the facility and some of the benefits which aquaculture provides to the public (e.g. supplementing the wild stock, cleansing the water). Fees should adequately reflect the economic value and productivity of the operation.
- EOE (DEM and CZM) should review the existing Coastal Areas of Critical Environmental Concern (ACEC's) and existing state regulations to evaluate how the ACEC designation will affect new aquaculture facilities. If it is determined that the higher regulatory standards that accompany ACEC designation will adversely affect aquaculture operations that are compatible with the ACEC, then consideration should be given to amending the relevant state regulation.

- Aquaculture licenses should be subject to performance criteria set by individual towns. Such criteria or license conditions shall be valid for the term of the license. It is recommended that initial license terms should be a minimum of five years with 15 year renewals. Renewal of the license shall be authorized by the licensing authority provided that the license holder meets the performance criteria. Renewals shall also be contingent upon a determination that there have been no unacceptable adverse impacts from the initial license period.
- Shellfish aquaculture licenses should be transferable during the license period with the approval of the licensing authority. Denial of transfer shall only be authorized if the performance criteria set by the town was not met.
- Municipalities should be given the option to pre-approve areas (with DMF, DEP, Conservation Commissions, CZM and ACOE) of its jurisdiction for aquacultural uses.
- The state should provide written guidance to towns regarding the legal requirements relating to the administration of shellfish licenses. This guidance should include the appropriate scope of review, relevant issues and criteria and public hearing formats.
- Shellfish aquaculture licensing fees paid by aquaculturists to towns should be increased to reflect their economic value and productivity. DMF should also evaluate the necessity to charge a (one time) application fee which covers the costs of surveying an area. License fees paid to municipalities should be directed to Shellfish programs for use in public shellfish propagation and/or restoration. Municipalities should provide an option to culturists to pay fees and/or provide seed for public propagation.
- DMF requirements for reporting shellfish production should be improved. All reporting requirements (town and state) should be coordinated. Productivity thresholds (for keeping license) should be evaluated and increased. All reports to towns and state involving production and/or financial disclosure should be made confidential. (Amend Ch. 130, section 65)
- DMF should develop a pilot program of authorizing towns to lease restricted areas for use as shellfish nursery areas. Pilot projects would only be initiated at the request of and with the cooperation of, individual municipalities.
- DEP and EOE, in conjunction with the EPA, should aggressively pursue the development of NPDES general permits for aquacultural activities (inland and marine).

An initial estimate of 6 - 9 months has been suggested as the time period needed to draft, public notice and publish these two permits. In order to accomplish this goal considerable effort and coordination with EOE, EPA, Mass Aquaculture Association and interested environmental groups must be dedicated in order to complete the project.

- DEP's Office of Watershed Management should issue a policy outlining the procedures for water withdrawals in brackish or saline waters from either surface or groundwater. The policy should also indicate that no individual permit is needed for salt water withdrawals from surface or groundwater.
- The state should work with the New England Fisheries Management Council (NEFMC) and other federal agencies to develop a clear and coordinated administrative process for authorizing aquaculture activities in the Exclusive Economic Zone (EEZ). CZM Consistency Review will be linked to this process. The state should ensure that federal regulatory processes and actions are compatible with state interests.

(Massachusetts Office of Coastal Zone Management, 1995)

13.0 New Hampshire

With just 18 miles of coastline, the State of New Hampshire has the smallest shoreline of any coastal state in the country. Information reviewed regarding shellfishing in the New Hampshire indicates that the primary resource management activities are ensuring public safety (i.e., monitoring water quality and a safe supply), public education relating to returning shells to harvest areas for cultch, identifying shellfish that are affected by parasites and not returning these to the water, and environmental protection.

In the State of New Hampshire, the management of shellfish sanitation, harvesting, and resource health is divided among three state agencies. The New Hampshire Department of Environmental Services (DES), which is responsible for ensuring that open harvest areas have water quality that is consistent with the standards for human consumption of molluscan shellfish. The Fish and Game Department which is responsible for issuing harvesting licenses, managing shellfish resources, and enforcing the open/closed decisions made by DES. The Department of Health of

Human Services regulates various aspects of the commercial shellfish industry, including shucking, packing, and shipping.

In the mid-1990s, high water temperatures combined with higher-than-usual salinities and the presence of two parasitic protozoan pathogens caused a collapse in the numbers of oysters throughout the State's waters. The Nannie Island area was hit particularly hard. A decade of poor spawning followed, perhaps from the continued presence of oyster pathogens. Over-harvest and pollution in places like the Great Bay by industrial and lumbering operations affected oyster stocks as well.

In recent years, prohibitions against commercial oystering and the cleanup of pollution sources encouraged by environmental laws like the Clean Water Act have helped to mitigate impacts. By 2006, young oysters were making a comeback, and to a degree that far exceeded historical records. The year 2007 saw another good spat-fall but spat-fall during the years 2008 and 2009 declined. Assistance from oyster harvesters and innovative programs to return shell to oyster beds have been helpful in managing the stock

(Smith, 2010 and New Hampshire Department of Environmental Services, 2008)

14.0 Maine

Maine's shellfish industry is estimated to be worth \$60 million annually, but certain factors have adversely affected the industry. The State has historically had high levels of Paralytic Shellfish Poison (PSP), more commonly known as "Red Tide" during the warmer periods of the year. Moreover, a recent article in the Bangor Daily News, suggests that atmospheric deposition of CO₂ from automobiles, heating of buildings and other sources has contributed to lowered pH and increased acidification of the State's coastal waters and has affected shellfish stocks in some areas. Placement of clam or oyster shells in these areas where acidic muds (also called "dead muds") may be affecting shellfish stocks can help to address pH issues, though greater control of CO₂ emissions, nationwide, would also help in reducing ocean and mud acidification In Maine and other locations. (Koenig, 2011 and Maine Department of Marine Resources, 2008)

Municipal Shellfish Conservation Ordinances and Town Intertidal Management Plans

The State of Maine authorizes the creation of Municipal Shellfish Conservation Ordinances and Town Intertidal Management Plans. The ordinances are based on a state Model Shellfish Conservation Ordinance but are unique to each municipality, to allow for greater local control and the tailoring of efforts toward specific local needs. Shellfish management and enforcement is also believed to be easier at the local level. Municipal Conservation Ordinances typically address:

- A. Licensing.
- B. Limiting the number of shellfish harvesters.
- C. Restricting the time and area where digging is permitted.
- D. Limiting the minimum size of clams taken.
- E. Limiting the amount of clams taken daily by a harvester.

There are currently 75 separate Municipal Shellfish Conservation Ordinances and one Town Intertidal Management Plan. Two Shellfish Conservation Districts have also been created in the state. Hancock County Shellfish Conservation District includes a total of seven local municipalities. Past overharvesting in the district has prompted the district to identify and adopt shellfish closure areas. Most of the areas have a closure term of six months to allow stocks to rebound.

Licensing is conducted at the district level rather than at the state level thereby allowing the district to grant most licenses to local residents. These restrictions have reduced the number of harvesters who live outside the district area but who have contributed to the past depletion of the resource from attaining a license. The district hopes that rotating areas for harvesting and closure judiciously will have an overall positive effect on resource sustainability. District license holders are also required to put in at least twelve hours of conservation time, such as shore cleanups, seeding, conducting flat surveys, or other administrative work, to the district. (Trotter, 2011)

15.0 Management of Other Commercially-Important Bivalves in Federal Jurisdictions

The National Marine Fisheries Service (NMFS) is held responsible for the sustainable management of several bivalve species off the northeast coast of the United States (including

Long Island) including the Atlantic sea scallop, Atlantic surf clam, and the ocean quahog. The goals of the Fishery Management Plans which are in place are to increase the sustainable yield of the species, as well as to decrease adverse effects on the environment, including those to the physical environment and other living resources. Like the hard clam, these bivalves are all important species for commercial harvest. The review of the regulations set in place to manage these species, indicates that a culmination of catch quotas, size limits, and seasonal closings have been essential to achieving a sustainable yield. The techniques used to achieve sustainable yields for these species may provide insight into the best ways to manage the hard clam resource in the Great South Bay.

Below is a summary of key regulations set by NMFS for the Atlantic sea scallop, the Atlantic surf clam, and the ocean quahog:

Atlantic Sea Scallop (*Placopecten magellanicus*)

The Atlantic sea scallop is managed by the New England Fishery Management Council in cooperation with the Mid-Atlantic Fishery Management Council (NMFS) under the Atlantic Sea Scallop Fishery Management Plan (ASSMP). The five stock components (eastern Georges Bank, the Great South Channel, the Gulf of Maine, the New York Bight and the waters adjacent to Delaware, Maryland and Virginia) are managed as a single unit throughout its range in US waters. Since the original Fishery Management Plan was enacted in 1982, the Plan has been amended to help rebuild the adult population. Key amendments to the original Management Plan included a significant decrease in fishing effort by limiting resource access, instituting Days-at-Sea (DAS) allocations, implementing gear restrictions to increase the escapement of small scallops and finfish, and lastly, limiting crew size. These efforts proved to be successful, as the population, which once was considered depleted, reached a full recovery by 2001, and is now considered to be sustainably harvested.

- *Access Areas*

The NMFS has implemented a carefully designed access program for the Atlantic sea scallop. There is a complete access area plan which includes several areas which are completely closed to fishing and others where fishing is only allowed at designated times of the year (Table 1). Each open area has specified Target Allowable Catch (TAC) limits and

limited number of trips based on permit categories (Table 2). Permit categories are based on historical fishing records and gear type.

In addition to the access areas described above, the ASSMP includes a rotational scallop management program which calls for the rotation of open and closed areas to maximize yield. Typically, some areas follow three year cycles in which there is a one year closure followed by two years of access.

A final component of the ASSMP which should be mentioned is that a DAS allocation has been set for limited access vessels. Full time vessels may have 38 days at sea fishing scallops, which part time vessels may have 15, and Occasional vessels only 3. By limiting the days at sea, the management plan aims to decrease fishing effort.

Table 1: Access Areas Effective March 2011

Area	Status
Nantucket Lightship (NLCA)	Open 6/15/11-1/31/12
Closed II	Closed
Closed I	Closed
Elephant Trunk (ETAA)	Open 3/1/11-2/29/12 except 9/1/11-10/31/11 for seasonal closure
Delmarva	Open 3/1/11-2/29/12 except 9/1/11-10/31/11 for seasonal closure
Hudson Canyon Closed Area	Closed

Table 2: Access Area Trip Allocations and Possession Limits

Permit Category	Possession Limit	Total Access Area Trips	ETAA	Delmarva	NLCA
Full Time	18,000 lbs/trip	4	2	1	1
Part Time*	14,400 lbs/trip	2	Up to 2	Up to 1	Up to 1
Occasional**	6,000 lbs/trip	1	Up to 1	Up to 1	Up to 1
Limited Access General Category	400 lbs/trip	NA	1,377 fleetwide	714 fleetwide	714 fleetwide

*Part time vessels have the option of the following trips: 1 trip in the ETAA and 1 in the Delmarva; 1 trip in the ETAA and 1 in the NLCA; or 2 trips in the ETAA.

**Occasional vessels have the option of the following trips: 1 trip in the ETAA; or 1 trip in the NLCA; or 1 trip in the Delmarva.

- *Size Limits*

The minimum shell-height for in-shell scallops that may be landed, or possessed after landing, is 3.5 inches.

- *Additional Information*

- Allocations have been set aside to fund sea scallop research
- An incidental catch target has been set at 50,000 pounds per year.
- Limits are also set for vessels not declared into an access area fishing seaward of the VMS demarcation line.
- Specific gear and crew restrictions have been set in place for scallop fishing vessels. These include a maximum length of trawl sweep and a minimum mesh size, among others.

Atlantic Surf Clam (*Spisula solidissima*) and Ocean Quahog (*Arctica islandica*)

The Atlantic surf clam and the ocean quahog are managed by the Mid-Atlantic Fisheries Management Council under the Surf Clam-Ocean Quahog Fishery Management Plan (SCOQFMP). With the exception of the Maine Mahogany quahog fishing zone, the fishery has operated under an individual transferable quota (ITQ) system since 1990. This program allocates fishing quotas to individual fishermen or fishing vessels, which may then be sold or leased. This system gives private property rights to fishermen by assigning them a fixed share of the catch.

Additional aspects of the management plan include an annual quota that applies to federal waters and mandatory logbooks for each fishing trip. Both surf clam and ocean quahog populations remain relatively high, and harvesting is occurring at a sustainable rate.

- *Setting Allocation Limits*

The amount of surf clams or ocean quahogs which may be caught each fishing year is established by the NMFS regional administrator, and the allocation will be specified for

three years. The three year specification is based on the most recent available stock assessments. The amount of surf clams annually available for harvest must lie in the range of 1.85 to 3.4 million bushels and the amount of ocean quahogs available must lie in the range of 4.0 to 6.0 million bushels.

Each year, NMFS determines the initial allocation of surf clams and ocean quahogs for the upcoming fishing year for the allocation owner by multiplying the total quota by each holder's allocated percentage of the total catch. Each allocation is then converted to a set number of clam cage tags.

- *Size Limits*

The minimum shell length for surf clams is 4.75 inches. There is no federal size limit for ocean quahogs.

- *Closed Areas*

There are certain areas which will be closed to both surf clam and ocean quahog harvesting due to environmental degradation. Additionally, locations may be closed if the region contains a large percentage of small surf clams.

- *NYSDEC Regulations*

NYSDEC has enacted a surf clam and ocean quahog management plan for areas of the Atlantic Ocean within three miles of the coastline in New York State, and all other tidal waters in New York. The goals of this Plan are to limit mechanical surf clam and ocean quahog harvesting activities to select areas, to require a special surf clam and ocean quahog mechanical harvesting permit, to control the design of mechanical harvesting gear, set weekly and annual harvest quotas, open and closed seasons, and to require recordkeeping and reporting. Key aspects of the NYSDEC plan are mentioned below.

NYSDEC has restricted harvesting to the following areas:

1. Long Island Sound east of a line extending due north from the easterly breakwater at the entrance to Mt. Sinai Harbor; and

2. Gardiners and Napeague Bays east of a line extending between Orient Point, Town of Southold, New York, and Hog Creek Point, Town of East Hampton, New York.

NYSDEC has also set up harvest restrictions:

1. Harvest should not exceed the annual harvest limits established for surf clams in a year; limits are based on the findings of population surveys and assessments. If this is met before the end of the year, the DEC can stop further harvesting.
2. No vessel may be used to harvest more than 21 standard cages of surf clams (equivalent to 672 industry standard bushels) in any weekly, Sunday through Saturday, period between January 1st and June 14th and between September 16th and December 31st. No vessel may be used to harvest more than 100 industry standard bushels in any weekly, Sunday through Saturday, periods between June 15th, and September 15th, all dates inclusive.
3. No vessel may be used to harvest more than 14 standard cages of surf clams (equivalent to 448 industry standard bushels) in any one day between January 1st and June 14th and between September 16th and December 31st. No vessel may be used to harvest more than 50 industry standard bushels in any one day between June 15th and September 15th, all dates inclusive.
4. No vessel may be used to harvest more than 14 standard cages of ocean quahogs (equivalent to 448 industry standard bushels) in any one day.

Overall, the management of the surf clam fishery is based on the establishment of harvest quotas from population density surveys, and the implementation of harvest controls to ensure that the desired yield is not exceeded. Harvest limits are typically set at about 5 percent of the fully recruited biomass based on the most recent surf clam population survey. The harvest limit is

meant to protect the long-term sustainability of the resource and economic viability of the surf clam fishery.

16.0 New York

Long Island Towns

In addition to New York State shellfish regulations, the Towns on Long Island implement additional regulations pertaining to shellfishing in town-owned waters. Specific regulations pertaining to permitting; size restriction of harvested shellfish; gear restrictions; reserved areas; and seasonality for each town is provided below.

Town of Babylon

Shellfishing in the Town of Babylon waters in Great South Bay is permitted under a Town permit. Permits are restricted to Town residents and are issued for recreational use or commercial use. Town residents may not hold a shellfishing permit for both recreational and commercial uses at the same time. Daily harvest limit for a commercial permit holder had been unrestricted but was changed to 2,000 clams in 2011 as part of an interim hard clam harvest regulation. Recreational permit holders may only harvest one-quarter bushel of shellfish per day. Size restrictions are set for both types of shellfish permits; no more than three percent of a bushel of hard clams can consist of clams of less than one-inch in thickness. Harvesting hard clams through mechanical means is restricted in the Town's waters; only tongs or rakes with no less than one-inch of clear space between teeth is permitted. There are no seasonal restrictions for shellfish other than oysters within the Town's waters.

Town of Brookhaven

The Town of Brookhaven issues shellfish permits to Town residents for commercial purposes. Residents are not required to obtain a permit to harvest clams recreationally, but are limited to a total of 100 clams of any kind per day during the harvesting season. The Town did not impose any catch amount restrictions for commercial shellfish permit holders but the daily catch limit was set at 2,000 clams in 2011 as part of an interim hard clam harvest regulation. Any hard clams harvested must be more than one-inch in thickness. Commercial permit holders wishing to harvest hard clams from Great South Bay must first apply for a hard clam endorsement from the Town. Recreational harvesting is limited to non-mechanical gear, allowing only hand rakes with

certain specifications. Harvesting shellfish via dredging equipment is not permitted except under special circumstance. The Town Board has the authority to place restrictions on certain harvest areas, including implementing a no-take zone, and designate certain shellfish locations as management areas or winter grounds areas.

Town of Islip

The Town of Islip issues personal (i.e. recreational) and commercial shellfish permits for the Town waters within Great South Bay. Mechanical harvest of shellfish is not permitted and there are restrictions on the type of hand-rakes allowed. Personal shellfish permits are restricted to a harvest of no more than one-half bushel per day. There had been no catch amount restrictions for commercial permit holders but the limit was set at 2,000 clams per day in 2011 as part of an interim hard clam harvest regulation. No more than three percent of each bushel can consist of clams less than one-inch in thickness. The Town does not have seasonality restrictions; shellfishing is permitted year-round, however, commercial harvesting is restricted to six days per week (shellfishing is not permitted on Sundays). The Town Board has the authority to designate areas within its jurisdictional boundaries as “management areas”, which can be treated as no-take zones.

Town of East Hampton

The Town of East Hampton issues personal and commercial shellfish permits for Town waters. Hard clam harvest is restricted to 100 clams per day for personal permit holders, and three bushels for commercial permit holders. Size restrictions of greater than one-inch thickness for hard clams is posed on both personal and commercial shellfish permits. Mechanical harvest is not permitted in Town waters. The Town Board has the authority to close any Town-owned shellfish underwater lands for no more than 21 days at a time.

Town of Hempstead

The Town of Hempstead issues non-commercial (i.e. recreational) and commercial shellfish permits for Town residents. A total of 100 individuals of shellfish for harvest is permitted for non-commercial permit holders. Commercial permit holders are permitted to harvest is restricted to six bushels per day. Shellfish within Town waters is restricted to non-mechanical methods

and areas designated open for shellfishing. Harvested clams must be greater than one-inch in thickness.

Town of Huntington

The Town of Huntington issues personal and commercial shellfishing permits. Commercial digger permits are limited to 400 permits a year; however, an unlimited number of employees may work under their employer's commercial permit. The majority of the permit fee costs are transferred into a Town trust fund which is used to replenish shellfish stock and performing shellfish management on Town-owned lands. Personal permit holders are restricted to harvesting no more than one-half bushel of shellfish per day. Commercial permit holders are permitted to harvest a maximum daily total of no more than 7,500 "points" per day. "Points" are allotted as follows:

- Hard Clams
 - Littlenecks = each worth 1 point (7,500 individuals may be harvested per day)
 - Cherrystones = each worth 2 points (only 5,000 individuals may be harvested per day)
 - Chowder = each worth 5 points (only 1,000 may be harvested per day).

Personal digging permits are not seasonally restricted; however, commercial harvesting of chowder clams is restricted to September 1st to May 14th. All hard clams harvested must be greater one inch in thickness, with no more than three percent of any bushel being made up of clams smaller than this limitation.

Town of Oyster Bay

The Town of Oyster Bay issues personal and commercial shellfish permits; commercial permits limited to 110 per year (preference is given to previous permit holders for renewals). Fifty-percent of the commercial permit cost (\$400 per commercial permit) is allocated for Town seed projects on shellfish beds. Harvest methods are restricted to non-mechanical means (i.e. rakes and tongs). Personal permit holders are limited to the harvest of one-quarter bushel of shellfish per day. Commercial permit holders may harvest no more than ten bushels of shellfish per day.

The Town Board has the authority to establish conservation management areas to limit shellfish taking from these areas.

Town of Riverhead

The Town issues three shellfish permit types: personal, commercial and temporary. Temporary permits are issued for 15 days, 30 days, 60 days and 90 days. Commercial permits are limited to 110 permits issued per year. Personal and temporary permit holders are restricted to the harvest of one-half bushel of shellfish per day, of which no more than 100 can be hard clams. Commercial permit holders are limited to the harvest of five bushels per day. All hard clams harvested must be greater than one-inch in thickness. No mechanical harvesting of shellfish is permitted in Town waters.

Town of Shelter Island

Shelter Island issues personal and NYSDEC diggers permits (equivalent of a commercial permit). Personal permit holders may harvest not more than one peck (approximately 12 pounds) per day of total shellfish. Digger permit holders are restricted to a total of five bushels per day. Shellfishing is not permitted in Town-designated Marine Reserve Zones. All hard clams harvested must be greater than one-inch in thickness. No mechanical harvesting of shellfish is permitted in Town waters.

Town of Smithtown

The Town of Smithtown issues commercial shellfish digging permits to those who have a New York State Permit. Town residents who would like to harvest shellfish for their own personal use are permitted to do so without a Town permit, but are limited to one-half bushel per day. Commercial permit holders are permitted to harvest no more than five bushels of shellfish per day. All shellfish must be harvested by non-mechanical means. Restrictions to basket configurations apply. The Town Board has the authority to close waters at its discretion and prevent the taking of any shellfish from those waters. Shellfishing is not permitted in areas designated by NYSDEC as uncertified. All hard clams harvested must be greater than one-inch in thickness.

Town of Southampton

The Town issues several types of shellfish permits: freeholder, resident, taxpayer (all three of which expire after three years); temporary resident; and commercial. Freeholder, resident, taxpayer permits are restricted to the harvest of one-half bushel per day of total shellfish, of which no more than 100 may be hard clams. There is no shellfish harvest limit for commercial permit holders. Shellfishing is restricted to NYSDEC and Town certified waters. The Town Trustees have the authority to designate management zones as they deem necessary and may restrict or regulate shellfishing from these zones. All hard clams harvested must be greater than one-inch in thickness.

Town of Southold

The Town of Southold issues three shellfishing permits: personal, non-resident and commercial. Commercial permit holders may harvest no more than 2,000 hard clams per day, while all other permit holders are limited to 100 clams per day. All hard clams harvested must be greater than one-inch in thickness. The Town Board of Trustees has the authority to restrict areas within Town waters to shellfish harvesting. A habitat sanctuary zone is present in Hallock Bay. Churning by power is not permitted for the taking of clams on land below the high tide line Town waters. No dredging, or hydraulic or otherwise, is permitted unless permitted by the Town Trustees.

New York State Department of Environmental Conservation (NYSDEC)

The NYSDEC Bureau of Marine Resources, Division of Fish, Wildlife and Marine Resources administers the State's statutory and regulatory requirements relating to shellfish. Under Part 41 of the Environmental Conservation Law (ECL), NYSDEC is responsible for the certification of shellfish grounds and inspection of these grounds relative to standards established as provided in Part 47 of the ECL. NYSDEC also regulates shellfish digger permits, maintains records of harvesting and sales of shellfish and monitors the diggers' recordkeeping. Digger permits are pursued in the state of New York in a comprehensive manner – a permit holder may harvest shellfish in general; permits are not granted for a particular species of shellfish. No permit is required for recreational shellfish harvesting from state lands.

NYSDEC designates shellfish lands where shellfish may be harvested for consumption, identified as Certified Shellfish Lands. The Shellfish Sanitation Unit, a subdivision of the Division of Fish, Wildlife and Marine Resources, is responsible for performing water quality monitoring, closures of unsanitary shellfish beds, and reporting to the public of shellfish sanitary conditions in the State’s shellfish growing areas. NYSDEC is authorized to issue more regular warnings, reclassify areas and close shellfish lands whenever it is determined that unsanitary conditions exist rendering shellfish hazardous for food. NYSDEC may allow the taking of shellfish from uncertified lands for propagation purposes, controlled through regulations and permitting. Changes in the regulatory classifications of shellfish harvest areas are determined by water quality over a long period and are not changed often. NYSDEC may issue temporary emergency closures when an area that is normally open experiences sudden, short-term degradations in water quality. Special shellfish closures are implemented when predictable conditions posed a threat to water quality. These usually occur during high use periods, such as holidays and special events, when increased numbers of mooring boats increases the possibility that boaters may occasionally discharge waste overboard.

Seasonal shellfish harvest closures are limited to bay scallops, which may be taken only from the first Monday in November through March 31st. All clams, oysters, mussels and other scallops may be taken throughout the year. State law limits recreational harvest to no more than one bushel (combined total volume) of clams, oysters and mussels per day. In addition, one bushel of bay scallops per day may be taken during the season.

NYSDEC Restrictions on Catch Limits				
Species	Size Limits	Recreational Catch Limits	Commercial Catch Limits	Gear Restrictions
Hard clam	1 inch thickness across the hinge	100 clams	Any Number	No mechanical means. Rakes and tongs allowed. Teeth - 1 in spacing Basket - 15/16 in spacing
Soft clam	1-1/2 in length	1/2 bushel	Any Number	No mechanical means except churning by propeller allowed below low tide
Oyster	3" longest diameter	1/2 bushel	Any Number	No mechanical means. Dredge with

				sail allowed on state land and in some towns. Size limit exempted for oysters cultured or transplanted under permit from DEC.
Blue mussel	None	1/2 bushel	Any number. See Note 1	No mechanical means, except that dredges may be used in some areas.
Bank mussel	None	1 bushel	Any number	No mechanical means
Bay scallop	2-1/4 inch length from mid hinge to mid bill and an annual growth ring	1 bushel	10 bu/person 20 bu/boat per day	Dredges allowed, 36 inch max. width. Use of mechanical means to retrieve dredge prohibited. Use of dredge prohibited on Sunday.
Sea scallop	None	1 bushel	Any number	None
Surfclam	3 inches 4 inches in Atlantic Ocean for use as food	1 bushel	See Note 2	Special permit required for mechanical harvest
Ocean quahog	None	1 bushel	See Note 2	Special permit required for mechanical harvest

Note 1: 15 bushels/person of blue mussels by dredge allowed in certain areas. Further information is included with the commercial harvesting (diggers) permit.

Note 2: There are restrictions on mechanical harvesting for surf clams and ocean quahogs.

Source: NYSDEC website

Surfclam Fishery

NYSDEC regulates the surfclam fishery under a Fishery Management Plan (FMP) and regulations. The surfclam fishery regulation provides controls through a permit system designed to limit mechanical harvesting activities, identifies permitted harvesting seasons, and defines harvesting quotas. Pursuant to NYSDEC FMP and regulations, the annual harvest limit for surfclams shall not exceed 5% of the fully recruited biomass, based on the most recent surfclam population assessment for the Atlantic Ocean. The 5% fraction of the quota has historically been applied to surfclam harvest quotas in New York. The setting of the quota is based on a percentage of the fully recruited biomass which more closely reflects the level of harvest that may be allowed to take place based on the current health of the stock without resulting in negative impacts to the long-term sustainability of the resource.