

**2019 Recommendations
of the
Barnegat Bay Partnership
Shellfish Working Group**

October 2019



INTRODUCTION

The Barnegat Bay Partnership's (BBP) Shellfish Working Group (SWG) is an *ad-hoc* committee formed in May 2014 under the purview of the BBP Science and Technical Advisory Committee (STAC) as set forth in the STAC charter document. The SWG charge was to review the conclusions and recommendations of the BBP sponsored white paper "Status and Trends of Hard Clam, *Mercenaria mercenaria*, Shellfish Populations in Barnegat Bay, New Jersey" by [Bricelj et al. \(2012\)](#), and develop short, medium, and long term research, restoration, and policy recommendations that the BBP, and its partners, can pursue as part of an overall shellfish restoration program (including, but not limited to hard clam (*Mercenaria mercenaria*), eastern oyster (*Crassostrea virginica*), and bay scallop (*Argopecten irradians*)) within Barnegat Bay.

Released in December of 2014, the original [BBP Shellfish Working Group Recommendations](#) document contained ten short-term (0-3 years), four medium-term (3-7 years), and three long-term (7+ years) actions that the group felt was necessary to advance the enhancement and/or restoration of shellfish in Barnegat Bay. The recommendations spanned the research, management, and policy arenas, and were collaborative in nature, attempting to leverage the expertise of the various organizations that worked with shellfish in the bay.

From 2015 to 2019 the BBP and partners made progress on a number of short- and medium- term recommendations from the 2014 document. These include:

Conduct a hard clam population survey every five years – The NJDEP conducted a population survey of Little Egg Harbor in [2011](#) and Barnegat Bay in 2012, with a reassessment in [2013](#) post-Sandy. It is the intent of the NJDEP to resurvey the Barnegat Bay/Little Egg Harbor system as part of a regular survey schedule.

Develop a brood stock program – In 2018 Rutgers Haskins Shellfish Research Lab and Aquaculture Innovation Center received funding to establish an oyster, bay scallop, and surf clam breeding program specific to a high salinity waterbody like Barnegat Bay. This program will focus on an aquaculture suitable product but will likely have restoration benefits as well. Although hard clams were not funded in the 2018 program, efforts to secure funding to develop a breeding program for hard clams continues.

Increase aquaculture opportunities for hard clams and oysters – The Atlantic Coast Shellfish Council implemented a new Aquaculture [Leasing Policy](#) in 2017 designed to provide more guidance on where and how the Council will consider new shellfish leases.

Identification of demonstration/pilot projects – The BBP, through the STAC, provided funding to Stockton University to support the development of oyster reef restoration techniques specific to Barnegat Bay. The first phase of the project included the deployment of remote set spat-on-whelk-shell and transplanted Mullica River oysters to a one-acre portion of a research lease in Little Egg Harbor and a reef restoration site near Toms River. Based on the results of that project a second phase was funded to place additional remote set spat-on-whelk-shell on a second acre of the Little Egg harbor research lease. Additional funding from NJDEP will add a third oyster restoration site further north of the Tuckerton lease, likely around the Manahawkin Bay/Rt 72 bridge by

2021. Both BBP and NJDEP-funded projects aim to document water quality improvements by implementing an oyster filtration model for the bay.

Revisit the moratorium on restoration/enhancement in restricted waters - In 2016 the State proposed a number of rule changes related to shellfish aquaculture, including a significant change allowing for shellfish research and restoration activities in less than approved waters provided a number of criteria are met, including the need for 24/7 monitoring.

With some recommended actions completed, new research released about Barnegat Bay in general ([Journal of Coastal Research Special Issue 78](#)) and shellfish in the bay in particular (Goodwin et al 2019), and an increasing interest in shellfish aquaculture and restoration in the bay (the premier in 2018 of [The Oyster Farmers](#) documentary, ReClam the Bay’s 2016 and 2018 Shellfish Forum), the STAC thought it appropriate to reconvene the SWG to review and update the recommendations put forth in 2014. Membership on the SWG in 2019 is composed of many of the same organizations, and individuals as 2014, with some additions designed to ensure representation from a variety of stakeholders, including resource managers, non-governmental organizations (NGOs), researchers, and the shellfish industry (Table 1).

Name	Organization
Dr. Jim Vasslides (chair)	Barnegat Bay Partnership
Russ Babb	Chief, NJDEP Bureau of Shellfisheries
Jeff Normant	NJDEP Bureau of Shellfisheries
Scott Stueber	NJDEP Bureau of Shellfisheries
Dr. Amanda Wenczel	NJ Department of Agriculture
Barbara Spinweber	EPA Region 2, Barnegat Bay Program Coordinator
Dr. Daphne Munroe	Rutgers University - Haskins Shellfish Research Lab
Dr. Christine Thompson	Stockton University
Steve Evert	Stockton University
Dr. Doug Zemeckis	Rutgers Cooperative Extension
Matt Gregg	40 North Oyster Farm
Dale Parsons Jr.	Parsons Seafood
Rick Bushnell	ReClam the Bay
Zack Greenberg	The Pew Charitable Trusts

SHELLFISH HISTORY IN BARNEGAT BAY

As detailed in Bricelj *et al.* (2012) the Barnegat Bay ecosystem has experienced a major decline in the landing of hard clams since the middle of the last century, with the steepest drop apparently occurring during the 1980s and 1990s. Concurrent with the decline in landings was a 65% reduction in the number of recreational clamming licenses and a 56% decrease in commercial licenses statewide, with a majority of those losses occurring in the Barnegat Bay system. The drop in landings is reflected in an apparent decrease in the clam population based on surveys conducted in the southern part of the bay by the New Jersey Department of

Environmental Protection in 1985/1986 (Joseph 1986, 1987), 2001 (Celestino 2003), and 2011 (Celestino 2013). The 2011 survey estimated the hard clam resource in Little Egg Harbor at 85.7 million clams, an increase of 32% from the 2001 survey, but a 57% decline from the 1986/87 survey. The 2012 survey of Barnegat Bay north of Manahawkin Bridge (Dacanay 2015) estimated a population of 138.2 million clams, a decrease of around 23% from the 1985/1986 survey. The 2013 post-Sandy truncated investigation of hard clams throughout the entire system was not designed to repeat a full survey and produce a stock estimate, but rather determine if hard clams suffered marked mortality or changes in local abundance due to the storm. No statistically significant difference was found in either hard clam abundance or mortality after the storm.

Historically, the oyster beds of Barnegat Bay extended from the southern end of the bay to the mouth of Forked River (Ford, 1997). These beds were abundant in the late 1880's and were used as a source of seed oysters for planting in other areas of New Jersey and New York. In 1880, it was estimated that 675 vessels harvested a total of 330,000 bushels of oysters in the Atlantic coast of southern Jersey (Ingersoll, 1881). Overfishing pressure on the oyster resource in the late 1800's and early 1900's, coupled with a change in salinity in the bay resulting from a 1919 storm, began to take its toll on the oysters in the bay (Ford, 1997). The resource suffered a prolonged period of spat settlement failures and by the 1950's was only producing a few thousand bushels of oyster per year (Ford, 1997), and today has essentially lost the wild beds. Currently, almost all of the historic oyster habitat (exposed shell) has been degraded due to siltation. Very few leases remain in Barnegat Bay and northern Little Egg Harbor Bay. It is important to note that a significant amount of seed was imported from other areas to be planted on these leases. Most recently, the state has created new shellfish leases in Little Egg Harbor Bay and Barnegat Bay.

SCOPE OF THE REVIEW

Using the draft goals and objectives set forth in the Barnegat Bay Partnership 2019 Comprehensive Conservation and Management Plan (CCMP), the SWG agreed that the recommendations contained herein should focus on regaining lost ecological services and economic opportunities that were previously provided by the shellfish resources. These two concepts are inextricably joined in the Barnegat Bay, where wild harvesters and culturists tend to the resources while they provide a range of ecosystem services (nutrient cycling, waste treatment, habitat, cultural services, *etc.*). Barnegat Bay has undergone a shift in habitat quality (water and "substrate") due to changing environmental conditions, coastal development and changes in shellfish populations. This has wide-ranging effects, including negative impacts on shellfish, and by extension those who depend on the resource for their livelihood. Given the importance of regaining a broad suite of ecosystem services and ensuring economic vitality, the SWG also decided to include surf clam (*Spisula solidissima*) in its considerations, because there has been renewed interest in culture of this species.

The SWG also recognized that there is a distinction between restoration and enhancement of a particular resource. Restoration in this context implies the increase of a reduced population to some level through manipulation of ecological factors, usually without a short term economic objective, while enhancement is the direct amendment of a resource to obtain a particular suite of objectives, often including economic opportunities. The SWG approached wild bay scallops and oysters from a restoration perspective given the current low levels of their populations within the

bay and their life history needs. Both of these species have specific substrate requirements (submerged aquatic vegetation and hard substrates, respectively) which are greatly reduced from their previous extents and will need to be reestablished before any population increases will be able to occur. Furthermore, their current populations are so low that there is very little to no commercial or recreational wild harvest, and thus limited ability for direct management actions. Recommendations for these species will generally focus on understanding and identifying currently suitable habitat, restoring former habitat, and creating new habitat, followed by direct population augmentation.

In contrast, the SWG is recommending an enhancement approach towards hard clams. While well below the reported historic population size, as mentioned above, this species has shown a small rebound over the past decade and currently maintains a population within the bay which is commercially and recreationally harvested. Additionally, the life history characteristics of this species make it amenable to population increases through judicious management and direct population enhancements. The SWG recommendations for research and policy changes attempt to balance increasing this population to enhance ecosystem services while providing for economic opportunities.

The SWG also recognizes that the culture of shellfish within the bay plays an important role in providing both economic opportunities and ecosystem services. Techniques and products developed by culturists often translate into the restoration realm, and vice-versa. Additionally, many of the same concerns (water quality, sedimentation, etc.) span the restoration, wild harvest, and culture communities; thus advancements in one area are likely to have beneficial effects across all three.

RECOMMENDATIONS

The SWG divided their recommendations into short term (0-3 years), medium term (3-7 years), and long term (7+ years) categories, recognizing that some of these activities can be implemented immediately while others may need to wait for additional data/research to be completed. It is also possible for recommendations to span multiple timeframes, where appropriate. The recommendations within a timeframe are in no particular order. The SWG recognizes the fiscal environment in which we all operate and encourages the identification of and application to alternate sources of funds by collaborating entities. If a recommendation is included as a part of the BBP's 2019 CCMP the specific Action Item is referenced.

Short-term (0 to 3 years)

Institute a mechanism to close areas for conservation purposes*

There is currently no mechanism available to the NJDEP Bureau of Shellfisheries for an efficient, and more importantly, enforceable way to close areas for shellfish conservation purposes in the Atlantic coastal bays in general, and Barnegat Bay in particular. In the Delaware Bay the Bureau of Shellfisheries may institute site-specific short to long-term closures to protect vulnerable populations, including restored oyster reefs, recently seeded beds, or high density broodstock biomass. The mechanism used for the Delaware Bay, found at N.J.A.C. 7:25A-2.4(b), can be used as a model. The general language authorizing the closures is as follows: *the Division, in consultation with the Council and with the advice of the Haskin Shellfish Research Laboratory, may open or close certain areas of the natural seed beds to harvest, as deemed necessary for the conservation and sustainability of the oyster resource.* Similar language should

* Recommendations held over from 2014 document

be adopted and added to an applicable Bureau of Shellfisheries rule to allow this process on the Atlantic Coast. This recommendation falls under CCMP Living Resource Action Item 1-5 “Promote management of ecologically-sensitive and other target areas.”

Develop a brood stock program*

It is well recognized within the restoration and shellfish culture communities that utilizing seed animals from the same system in which an enhancement or restoration will take place leads to increased success because those animals have become locally adapted by survival of multiple generations. Beginning in 2019 the Haskins Shellfish Research Laboratory will begin a program to develop brood stock for oyster, bay scallop, and surf clams in Barnegat Bay and other high salinity environments. This program is an excellent start, but does not include hard clams, one of the most economically and ecologically valuable species in the bay. Furthermore, the current program is focused on developing traits best suited to aquaculture demands, which might not be suitable for wild (restoration) stock (*i.e.* fast growth at the expense of reproductive potential for aquaculture purposes). Therefore, additional research and effort may be needed to complete this recommendation.

From an oyster perspective, the Mullica River seed bed oysters are the last viable natural stock along the Atlantic Coast of New Jersey. While located outside of the Barnegat Bay study area, these beds likely contribute a significant portion of the larval supply and observed increase in natural set in the southern Barnegat bay system (Little Egg Harbor Bay) and will likely be a source of brood stock and seed animals for future enhancement and restoration efforts within Barnegat Bay. Thus, in addition to potential culture activities, the maintenance and/or augmentation of this bed should be considered within the umbrella of a brood stock program.

Collect wild and cultured commercial harvest data*

There is currently no data collected on the commercial harvest of wild hard clams and incomplete data on cultured hard clam harvest levels. Harvest data, when combined with stock surveys, form the backbone of a fishery management plan, which is necessary to properly manage a fishery resource. There are a number of potential avenues for collecting the necessary information for commercial landings, but the most common is through “dealer reports”, where shellfish wholesale dealers maintain records of each purchase, including the amount (number/weight/size of shellfish), harvester, general location of harvest (Barnegat Bay, Manahawkin Bay, LEH), *etc.* This information is then transmitted to the Bureau of Shellfisheries. The exact methodology should be determined by the NJDEP, NJDA, and NJDOH in consultation with the industry to minimize costs and interruptions while maximizing the usefulness of the data. This data collection is also necessary to permit the development of a fishery management plan (FMP) for hard clam. Without wild harvest data, an FMP cannot be developed. This recommendation falls under CCMP Living Resource Action Item 3-4 “Continue to monitor and assess the status of commercially-, recreationally-, and ecologically-important aquatic species.”

Develop a Multi-Use Management Plan for Barnegat Bay*

As pointed out by Bricelj *et al.* (2012), despite the importance of shellfish to many in the State of New Jersey, there has never been a coordinated effort to develop a plan to ensure that shellfish would remain an integral part of the State’s coastal resources. It is anticipated that a plan for Barnegat Bay would identify the potential roles that wild harvest, aquaculture, and

* Recommendations held over from 2014 document

restoration would play in the Bay's future, while defining priority issues and possible solutions. This plan would take a Marine Spatial Planning approach to further our understanding of how water-dependent activities utilize the bay, and lay out recommendations to avoid conflicts not only between shellfish related activities, but also with other user groups (powerboating, sailing, fishing, SAV restoration) in one of the most popular summer destinations in the region. This recommendation falls under CCMP Living Resource Action Item 2-1 "Develop a bay-wide multi-use management plan that supports sustainable aquaculture, commercial and recreational harvest, recreation, and restoration."

Research the effects of changing hydrodynamics and physical parameters

As relatively sessile organisms, hard clams and oysters are highly susceptible to changes to their environment post-settlement. Due to a variety of human alterations over the past 50+ years the bay has experienced changes in tidal flow, sediment supply and distribution, and other physical parameters. These changes have direct effects on shellfish in the bay (smothering of oyster reefs, reduced water flow over hard clam beds, *etc.*). Current human activities in the bay and our nearshore environments, including but not limited to beach replenishment, channel dredging and thin layer placement on wetlands may be having direct and indirect effects on shellfish. Therefore, there is a need to understand the impacts of tidal flow alterations, dredging, and siltation in general, on larval settlement and recruitment. Including physical oceanography components to bay-wide research activities may assist in bridging the bio-physical components of the shellfish resources.

Increase aquaculture opportunities for shellfish*

As the population of wild shellfish has declined in Barnegat Bay, a small but growing shellfish aquaculture industry has evolved. While there have been advances in aquaculture opportunities (several new oyster market brands, additional shoreside infrastructure, new Leasing Policy) there have been, and continue to be, a number of impediments. One issue that continues to vex the aquaculture industry, and is potentially polarizing, is the potential underutilization of existing leases, especially those in high productivity areas. A mechanism to document how many existing leases are actively "farmed" would allow for the more effective management of the resource. Additionally, a holistic evaluation of the rules and procedures that affect the shellfish aquaculture industry should be undertaken, with an eye toward increased opportunities while maintaining protections of coastal resources.

Identification of demonstration/pilot projects*

The SWG should work with interested parties to identify potential demonstration/pilot restoration and enhancement projects within Barnegat Bay (or within the Mullica River oyster bed) that can be submitted for funding should future opportunities arise. Furthermore, these projects should contain a citizen science program to the maximum extent practicable to further engage the broader community in shellfish programs. The Barnegat Bay Partnership will include these potential projects on the Shellfish Working Group [website](#), along with a list of potential funding opportunities.

Submerged Aquatic Vegetation (SAV) mapping

The Barnegat Bay is home to the majority of New Jersey's SAV beds, mainly eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*). These beds are important

habitat for a variety of commercially, recreationally, and ecologically important wildlife, including birds, fish, and invertebrate species. They also serve a critical role in the early life history of bay scallops. Because of SAV's importance to a variety of species and the health of the Bay, regulations exist that prohibit human disturbances within beds, including the siting of aquaculture leases and restoration projects. The spatial extent of SAV beds naturally fluctuate through time, increasing in years of favorable water quality characteristics and decreasing in less favorable years. It is also thought that climate change and sea level rise have had, and will continue to have, an effect on seagrass beds. Although the NJDEP's Inventory of Estuarine Shellfish Resources (Celestino, 2013; Dacanay, 2015) documented the presence or absence of SAV during the 2011 and 2012 surveys of hard clam populations, the data collection was not robust due to its nature as an ancillary component of the hard clam survey. Consequently, the last directed bay-wide mapping of SAV beds occurred in [2009](#) (Lathrop and Haag, 2011). To better understand the distribution of seagrasses within the bay, and its implication for shellfish culture, harvest, and restoration, a routine mapping program should be implemented. This recommendation falls under CCMP Living Resource Action Item 3-1 "Assess distribution and abundance of SAV through coordinated, regular surveys to evaluate their structure and function."

Brown Tide monitoring*

Barneget Bay has been prone to brown tides of *Aureococcus anophagefferens*, a picoplanktonic alga that can cause deleterious effects on hard clam populations at levels an order of magnitude below those that cause discoloration of the water (Bricelj *et al.* 2012). Because of differences in pigment between brown tide and other common phytoplankton, aerial surveys that utilize chlorophyll *a* concentrations as an indicator for additional sampling are insufficient. Monitoring for *A. anophagefferens* should be included in routine phytoplankton monitoring programs using the immunofluorescence method or other highly specific method. This recommendation falls under CCMP Living Resource Action Item 2-5 "Monitor, manage, and control invasive and nuisance species through ecologically appropriate methods."

Mid-term (3 to 7 years)

Identify opportunities to create partnerships for a joint hard clam stock assessment*

One component of a complete fishery management plan is a stock assessment, where the current (and often past) status of a resource is documented through both empirical and modeling means. Stock assessments are complicated undertakings, even with robust data sets and sufficient expertise and resources. One way to accomplish this task while reducing the load on any one agency/office has been to create partnerships between managers, academics, and the industry, as is done on the Delaware Bay for the oyster stock assessment. While the data necessary for a hard clam stock assessment will not be available during the 0-3 year timeframe, this is the appropriate time for the Bureau of Shellfisheries to approach potential partners and begin this discussion, with a vision to begin collecting necessary data and plan for implementing an assessment in the 3 to 7 year timeframe. Given current staffing and budget conditions within the Bureau of Shellfisheries, potential funding opportunities for this initiative should also be explored.

* Recommendations held over from 2014 document

Assessment of life history bottlenecks for hard clams

Based on plankton sampling conducted by various organizations, hard clam larvae are often present in the water column during the appropriate time of year. Thus, it does not appear that the bay is a larval limited system, but rather mortality appears to be high during and immediately after settlement. A better understanding of the causes of this mortality may lead to management measures that improve settlement rates and the age class distribution of the bay. This recommendation falls under CCMP Living Resource Action Item 4-3 “Conduct studies that identify and document the life history and/or ecology of pertinent living resources.”

Collect recreational harvest information*

Of the types of data needed to properly manage a fishery, the most difficult to obtain is often the recreational harvest. In New Jersey, a recreational license is required to harvest hard clams, but there are currently no reporting requirements. For a resource like hard clams, where recreational harvest is often a cultural or family tradition, the recreational harvest may represent a substantial removal of biomass. The Bureau of Shellfisheries, with the support of interested groups, should pursue a method of obtaining recreational harvest information, including coordinated education and outreach efforts. This recommendation falls under CCMP Living Resource Action Item 3-4 “Continue to monitor and assess the status of commercially-, recreationally-, and ecologically-important aquatic species.”

Long-term (7+ years)

Development of a hard clam fisheries management plan for Barnegat Bay*

The ultimate goal of the hard clam commercial and recreational harvest data collection and stock assessment efforts is a fishery management plan that lays out the goals and management actions of the Bureau of Shellfisheries. A successful fishery management plan includes actions that result in a sustainable hard clam fishery in Barnegat Bay that provides for economic opportunities while maintaining important ecosystem services. This action should utilize a collaborative approach to reduce the work-load on any one agency/office given the effort required to develop a new FMP. This recommendation falls under CCMP Living Resource Action Item 3-4 “Continue to monitor and assess the status of commercially-, recreationally-, and ecologically-important aquatic species.”

* Recommendations held over from 2014 document

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