Recommendations
of the
Barnegat Bay Partnership
Shellfish Working Group

December 2014

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, rehabilitation, 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.

The composition of the working group was purposely designed to include representation from a variety of stakeholders, including resource managers, non-governmental organizations (NGOs), researchers, and the shellfish industry, in order to capture the breadth of experience and opinions present within the shellfish community (Table 1). It was hoped that the diversity of organizations participating in the SWG would lead to potentially novel approaches to difficult problems and to new partnerships that otherwise may not have formed.

Table 1: Members of the Barnegat Bay Partnership Shellfish Working Group

Name	Organization
Jim Vasslides (chair)	Barnegat Bay Partnership
Russ Babb	Chief, NJDEP Bureau of Shellfisheries
Rick Bushnell	ReClam the Bay
Gef Flimlin	Rutgers Cooperative Extension
Matt Gregg	40 North Oyster Farm
Capt. Alek Modjeski	American Littoral Society
Dr. Daphne Munroe	Rutgers University - Haskins Shellfish Research Lab
Jeff Normant	NJDEP Bureau of Shellfisheries
Dale Parsons Jr.	Parsons Seafood
Barbara Spinweber	EPA Region 2, Barnegat Bay Program Coordinator
Matthea Yepsen	The Nature Conservancy
Britta Wenzel	Save Barnegat Bay

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.

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.

SCOPE OF THE REVIEW

Using the goals and objectives set forth in the Barnegat Bay Partnership Comprehensive Conservation and Management Plan (CCMP) and subsequent Strategic Plan updates, the SWG agreed that the recommendations contained herein should be focused on regaining lost ecological services and economic opportunities that were previously provided by the shellfish resource. These two concepts are inextricably joined in the Barnegat Bay, where wild harvesters and culturists tend to the resource while it provides a range of ecosystem services (nutrient cycling, waste treatment, habitat, cultural services, *etc.*). Without the full range and magnitude of ecosystem services provided by shellfish, the bay has undergone a shift in habitat quality (water and "substrate") that has wide-ranging effects, including negative impacts on the shellfish themselves, and by extension those who depend on the resource for their livelihood.

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 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 that 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 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, or creating new habitat.

In contrast, the SWG is recommending an enhancement approach towards hard clams. While well below the presumed 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 amendments. As such the SWG recommendations attempt to balance

increasing this population to provide for enhanced ecosystem services while providing for economic opportunities through a mix of policy and research.

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 in order to effectively manage the resource. It is also possible for recommendations to span multiple timeframes, where appropriate. The recommendations within a timeframe are in no particular order. It should be noted that these recommendations may require additional commitments of staff from the Bureau of Shellfisheries above their current workload, and that their successful completion may require a commensurate increase in staff/funding. The SWG recognizes the current fiscal environment in which we all operate and encourages the identification of and application to alternate sources of funds by collaborating entities.

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. As demonstrated in the Delaware Bay oyster program, there is a need for short to long-term fishery closures of limited sized, specific areas to protect vulnerable populations, including restored oyster reefs, recently seeded beds, or high density broodstock biomass. The mechanism used for the Delaware Bay, found N.J.A.C. 7:25A-2.4(b), can be used as a model. The general language 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. Areas of the State's natural seed beds are often closed when oyster stocks are low. N.J.A.C. 7:25A-2.4(b) also specifies that the Division will provide license holders in the industry with geographic coordinates delineating boundary lines of closed areas. N.J.A.C. 7:25A-2.4(c) maintains the provisions currently codified at N.J.A.C. 7:25A-1.9(s) (Oyster Seed beds) which provides for seizure and replanting of oysters taken, transported, planted or otherwise handled in violation of these rules.* Similar language should be adopted and added to an applicable Bureau rule to allow this process on the Atlantic Coast.

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 as those animals have become locally adapted by survival of multiple generations. While some clam culturists maintain a small local broodstock, it is presumed that much of the clam seed stock planted in Barnegat Bay is from other waters, potentially diluting a Barnegat-adapted strain as the imported individuals reach spawning size. There is thus a clear need to develop a local shellfish broodstock from which the Barnegat Bay commercial culturists can obtain seed. In addition, any future enhancement/restoration undertaken by the BBP or its partners would benefit from the use of locally sourced animals.

Despite this, there has never been a concerted effort from either academia, resource managers, or industry to develop a Barnegat Bay brood stock program. Given the increasing culture capabilities of the local shellfish industry, and Rutgers' recent investments in the Aquaculture Innovation Center, the development of a broodstock program is well within our means.

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, this bed will likely be a source of broodstock and seed animals for future enhancement and restoration efforts within Barnegat Bay. Thus, in addition to potential culture activities, the maintenance and/or enhancement 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 or cultured hard clams. 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 Bureau 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.

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.

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 manpower. 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 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 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.

Investigate merging the SWG with the Barnegat Bay Shellfish Enhancement Committee

The NJDEP Bureau of Shellfisheries, in conjunction with the Atlantic Coast Section of the Shellfisheries Council, has formed the Barnegat Bay Shellfish Enhancement Committee (BBSEC), an *ad-hoc* group that will provide advice and guidance to the Bureau as they plan for enhancement projects to be conducted in Barnegat Bay utilizing monies set aside as a result of an agreements with Oyster Creek Nuclear Generating Station. Many of the members of the SWG are also involved with the Enhancement Committee, and it may be of benefit to all to combine the groups to allow better integration between the recommendations of the SWG and the enhancement actions undertaken. . Due to other priorities, the BBSEC has not yet met. Combining these groups with additional industry/council seats would make a great deal of sense from a time perspective.

Develop an overall shellfish management plan for Barnegat Bay

As pointed out by Bricelj *et al.* (2012), "in spite of the importance of the hard clam to many harvesters in the State of New Jersey, there has never been an attempt to develop an overall management plan." A plan for Barnegat Bay would layout policy guidance regarding management and protection of shellfish and identify the roles that wild harvest, culture, and restoration would play, while defining priority issues and possible solutions. A plan of this magnitude is no easy (or inexpensive) task, and a recent attempt by the State of Rhode Island (www.rismp.org) is expected to take two-years to complete. However, without one we will struggle to engage the larger constituency that will be necessary to align funding with priority needs at a scale that will have an impact.

Research impacts associated with siltation and dredging

As relatively sessile organisms hard clams and oysters are highly susceptible to changes to their environment post-settlement. This is particularly true when it comes to siltation and dredging. With maintenance dredging of existing channels an ongoing activity within the Barnegat Bay, and erosional processes and sediment loading a concern, there is a need to understand the impacts of dredging, and siltation in general, on larval settlement and recruitment.

Increase aquaculture opportunities for hard clams and oysters

As the population of wild shellfish has declined in Barnegat Bay, a small but growing shellfish aquaculture industry has evolved. As the industry has matured, there have been, and continue to be, a number of impediments to increasing aquaculture opportunities within Barnegat Bay. These range from issues associated with the permitting process for new and existing culture facilities to the processes surrounding the identification and approval of lease grounds, particularly the issue of underutilized leases. 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.

Mid-term (3 to 7 years)

Conduct a hard clam population survey every 5 years

A fishery-independent determination of the size of the population repeated on a species appropriate time scale is one of the most important aspects of a properly managed fishery. While surveys in Barnegat Bay were conducted in 1985/1986, 2001, and 2011/2012, the Bricelj *et al.* (2012) report clearly identified the long lag between surveys as detrimental to our understanding of how the population has responded to environmental and fishery changes (pg. 41). A fishery independent survey conducted every five years will be frequent enough to allow the Bureau to adjust management policies to address changes in population size and structure and maintain a sustainable resource. The critical component to address during this timeframe is the identification of a continuing, stable source of funding and/or staffing. The Bureau of Shellfisheries has a plan in place that will allow for the assessment of each coastal bay every 5-6 years. This program is contingent on continued funding and staff for the Bureau.

Continue to identify opportunities for partnerships for a joint hard clam stock assessment

During years 3 to 7 interested parties should not only continue to discuss how best to collaborate on a hard clam stock assessment for Barnegat Bay, but also agree on a timeline for completion of the assessment, provided the data needs outlined as short-term priorities have been met.

Assessment of site-specific hard clam natural mortality

One of the key research recommendations of the Bricelj *et al*. (2012) report, assessment of natural mortality at the site-specific scale will aid managers and culturists in determining where best to plant seed, institute conservation closures, and take other management actions.

Revisit the moratorium on restoration/enhancement in restricted waters

Under current DEP policy there is a moratorium on research, restoration, or enhancement of shellfish species in "restricted" waters. The "restricted" designation is a prohibition on harvesting shellfish in these areas due to human health concerns. However, some of these restricted areas are located in what would otherwise appear to be suitable habitat for shellfish, and may already contain wild populations. A majority of the SWG recommends a reassessment of this policy, evaluating if research or the restoration and enhancement of shellfish in restricted waters for ecosystem services purposes can be conducted while maintaining safeguards for human health.

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, a fishery management plan lays out the goals and management actions that the Bureau of Shellfisheries will pursue in order to have 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.

Brown Tide monitoring

Barnegat 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.

Investigate the effects of improved tidal flow within Barnegat Bay

Reductions in tidal exchange over the last 50+ years due to the interruption of natural geomorphic processes have altered tidal flow regimes and circulation within the bay, with varying effects on multiple species. Based on the current distribution of productive hard clam beds it would appear that higher levels of tidal flow are a benefit the species. The feasibility of increasing tidal exchange and circulation within Barnegat Bay, and its effects on a variety of estuarine fauna, should be evaluated.