Sea Nettle Polyp Settlement Pilot Study

Barnegat Bay Partnership

2013

Introduction

Anecdotal evidence throughout the world suggests a rise in jellyfish within local coastal communities. Although there is a perceived increase in jellyfish populations, the bulk of scientific literature fails to acknowledge the presence of jellyfish, making it difficult to prove that populations are, in fact, on the rise (Purcell 2012, Condon *et al* 2012, Henson *et al* 2010, Boero *et al* 2008). Many human-induced environmental changes could drive favorable conditions for jellyfish proliferation, including eutrophication, overfishing, and coastal construction (Purcell 2012, Richardson *et al* 2009). Plankton communities, including gelatinous zooplankton (jellyfish) pulse in abundance as a result of favorable conditions for reproduction, in many cases favoring the most appropriate developmental stage (Boero 2008). The primary focus of this study was the link between human development and the developmental stages of jellyfish along the coast of New Jersey.

Within the Barnegat Bay, New Jersey, the Atlantic Sea Nettle (*Chrysaora quinquecirrha)* has become a nuisance species, affecting tourism and recreation within the bay. Reproduction in most jellyfish species (including the Atlantic sea nettle) consists of two main forms; the medusa and polyp stages. The polyp stage of a jellyfish occurs after a sexually created planula attaches to a smooth surface under the water. In normal circumstances, polyps will form on rocks, shells, etc., however an increase in development throughout the Barnegat Bay provides many more suitable habitats for sea nettle polyps to form (plastic floating docks, bulkheads, etc.). Once a polyp has settled it undergoes strobilation, a process in which exact duplicates of the parent are "stacked" and detach, eventually forming a fully mature medusa. (Hoover and Purcell 2009).

Previous studies suggest that sea nettle polyps develop primarily in the lower salinity, eutrophic northern portions of the Barnegat Bay, specifically in the region of Cattus Island County Park (Bologna 2011). However, materials used in previous polyp settlement studies in the Barnegat Bay have been limited to flat PVC plates submerged below the surface. Jellyfish have been known to favor a variety of materials for substrate settlement, including expanded polystyrene (EPS) dock flotation blocks, high and low density polyethylene, pressure treated lumber, and vulcanized rubber; all of which are common deck building materials (Hoover and Purcell 2009).

The main objective of the Sea Nettle Polyp Settlement Pilot Study was to determine which pre-existing structures throughout the Barnegat Bay provided suitable habitat for sea nettle polyp settlement. Using private docks and bulkheading of a variety of materials in a wide range of habitat types (lagoons, rivers, open bay), the Partnership aimed to assess the feasibility of underwater photography to determine preferred materials and locations for polyp settlement.

Methods

To get an accurate idea of polyp settlement throughout the bay on various structures, the BBP selected locations in a wide range of habitat types including lagoons, rivers, and open bay. Locations have been selected from a pool of waterfront homeowners from throughout the watershed who offered the use of their properties for the study (See Table 1).

Table 1: Sampling locations used for polyp study. Crossed out locations had to be removed from study, since these properties had poor access (mainly due to Superstorm Sandy). 16 Capstan Rd. in Waretown was added to the sampling locations after the study had begun.

Region One	
Address	**City**
~~88 Archer~~	~~Bayville~~
68 Top Sail Court	Bayville
~~706 Chesapeake Dr.~~	~~Forked River~~
25 Rico Ave	Toms River
1464 Riviera Ave	Toms River
13 St Thomas ave	Toms River
15 Capstan Rd.	Waretown
16 Capstan Rd.*	Waretown
352 11th St.	Surf City NJ
32 Selma Dr.	Manahawkin
~~131 Laguna Lane~~	~~Beach Haven~~

RegionTwo	
Address	**City**
31 Bay Way	Brick
221 Bryn Mawr Ave	Lavallette
246 N Street	Seaside Park
1947 Ship Ct.	Toms River
~~406 Cove Court~~	~~Ortley Beach~~
1882 Monitor Dr.	Toms River
1885 Lookout Drive	Toms River
1886 Compass Court	Toms River
~~3353 Moonrise Lane~~	~~Lavallette~~
24 Lagoon Dr. E.	Toms River
900 Barnegat Lane	Mantoloking

The BBP identified settlement using underwater photographs of the surfaces of privately owned docks. Once per week through June-July 2013 a field team visited each of the sampling locations. Using an Olympus Stylus Tough Waterproof 8010 digital camera, technicians swam alongside docks and pilings and photographed the same spot at each location. The initial locations of the photograph on a dock or piling were randomly selected, deep enough that the portion of the dock or piling was never exposed during a low tide. A 12cmX12cm frame was placed against the piling and attached to the digital camera at a fixed distance to maintain that photos were taken within the exact same frame each time. Technicians took two photographs at each location, one using a flash and one without a flash. To ensure the photo was being taken at the same location on each piling or floating dock, technicians marked the piling with a ribbon, tied off with a knot at the location the top edge of the camera frame to be centered on for each photograph. Photos were analyzed by technicians and experts for the existence of polyps, and the number of polyps within the 12X12 cm field will be enumerated.

Water quality parameters (temperature, salinity, DO, and pH) were measured at each location with a YSI ProPlus Quatro handheld water quality instrument. Water clarity was also measured each sampling day using a secchi disk.

Results and Discussion

Potential polyps were observed broadly within the study area, spanning from as far north as Mantoloking and as far south as Surf City, NJ (Figures 1 and 2). A total of six of the sampling sites contained polyp-like creatures, although photo quality made it difficult to determine the exact species of these organisms (Figure 3). Poor water clarity and high phytoplankton abundances throughout the summer months may have contributed to a decrease in photo quality. Resolution of the photos impaired assessment as well, as photos could only be viewed up to 200% enlargement on the computer.

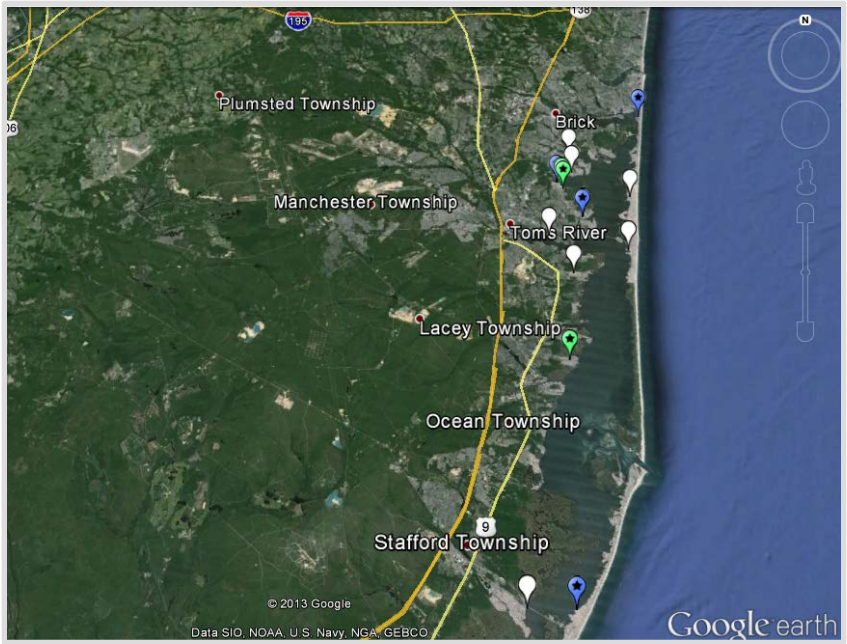

Figure 1: Locations where polyp photography occurred. White markers indicate a location with no visible polyp presence, green markers indicate locations where potential polyps are settled and dark blue markers indicated where a more definitive polyp was identified.

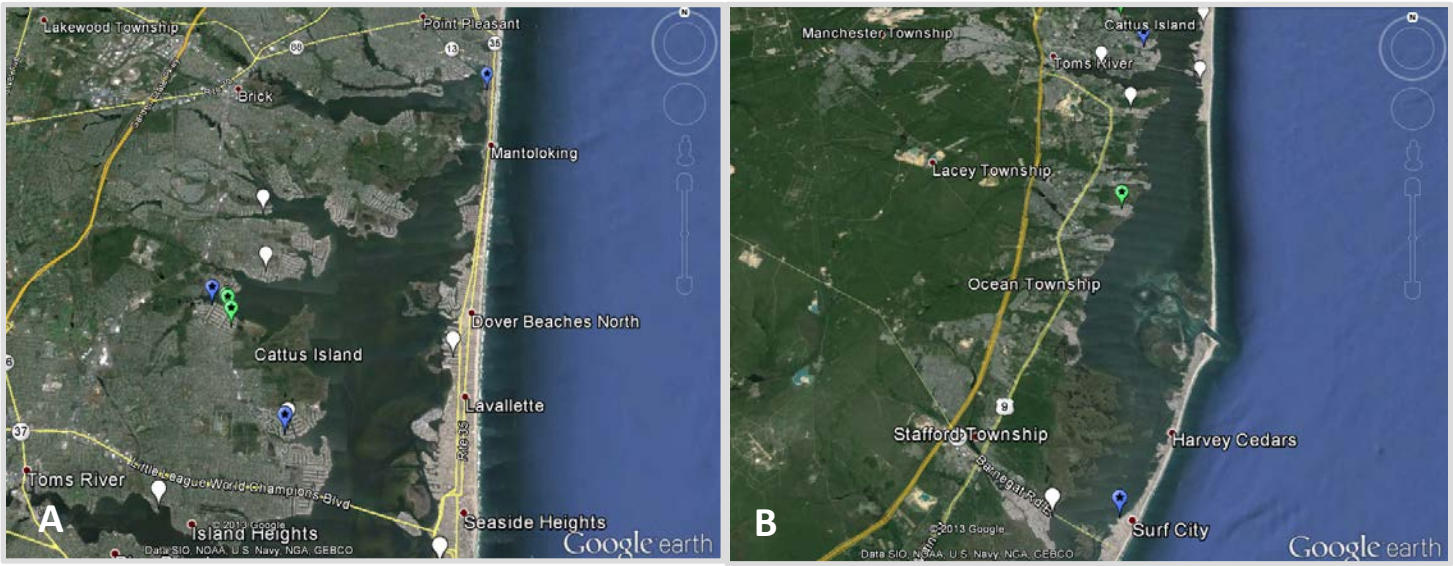

Figure 2: Closer views of sampling locations and potential polyp locations. A) Northern portion of the Barnegat Bay, from Mantoloking to Seaside Heights and including Toms River and Brick Townships. B) Southern portion of the Barnegat Bay including South Toms River, Waretown and Long Beach Island.

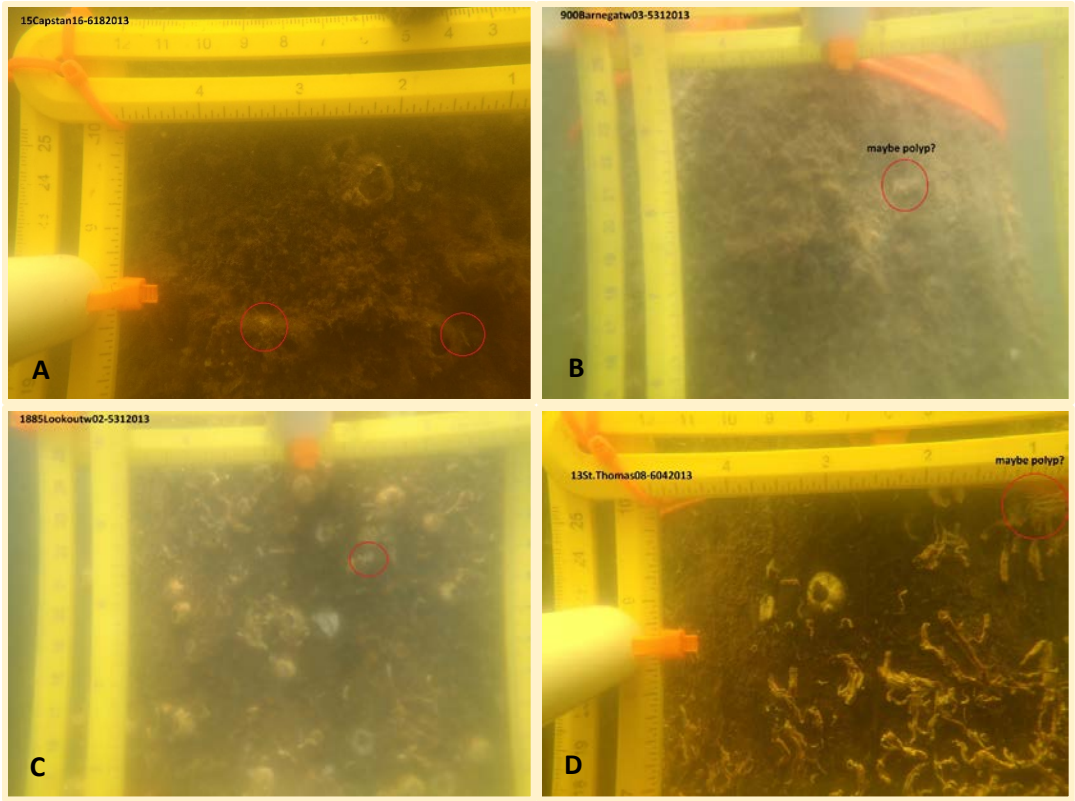

Figure 3: Sample of images containing potential polyps. Location where photo was taken is indicated in the top left of each image, and polyps are circled. Photo quality is compromised by poor water clarity, and polyp species cannot be definitively identified.

Suggestions for the Future

The effectiveness of the use of underwater photography for determining sea nettle polyp settlement throughout the Barnegat Bay proved inconclusive in the 2013 season. Poor photo quality, photo resolution and water clarity contributed to uncertainty in polyp identification. There are many sessile organisms that settle on the man-made structures examined during this study, and many resemble the structure of the polyps of *Chrysaora quinquecirrha.*

When in their polyp stage, sea nettles form cysts at the base of the polyp stalk to aid in asexual reproduction and mobility (Cargo and Shultz 1966). These cysts (also known as podocysts) are key features that can be used in the identification of sea nettle polyps (Figure 4). Sea nettle schyphistomae cyst production occurs almost continuously throughout the summer, although Cargo and Rabenold (1980) determined that the highest production rates of cysts occurs in the months of August and September in the Chesapeake Bay, once sea nettles have finished their strobilation period (Figure 5). Since there is a higher frequency of cyst development during these months, there is a higher likelihood that sea nettle polyps can be identified via the presence of podocysts using photos taken during the months of August and September.

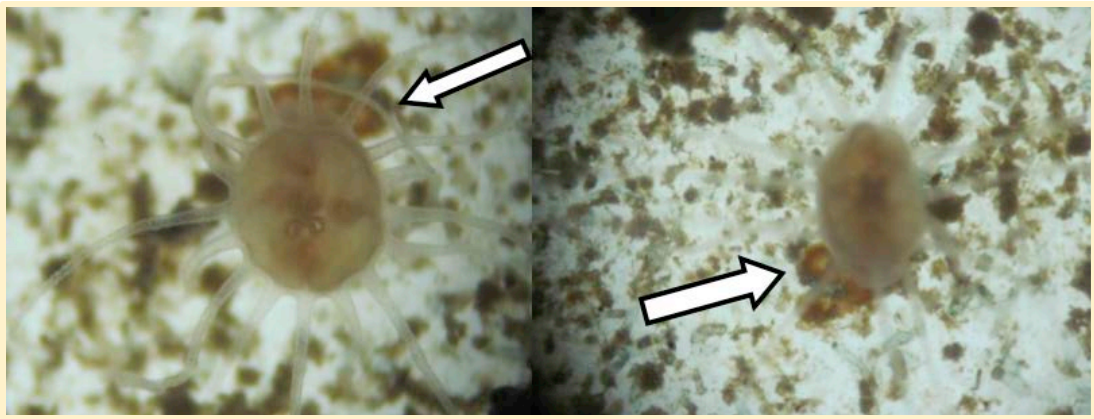

Figure 4: Sea Nettle polyps on settling plates, with podocysts identified by arrows. Photo source: Bologna 2011.

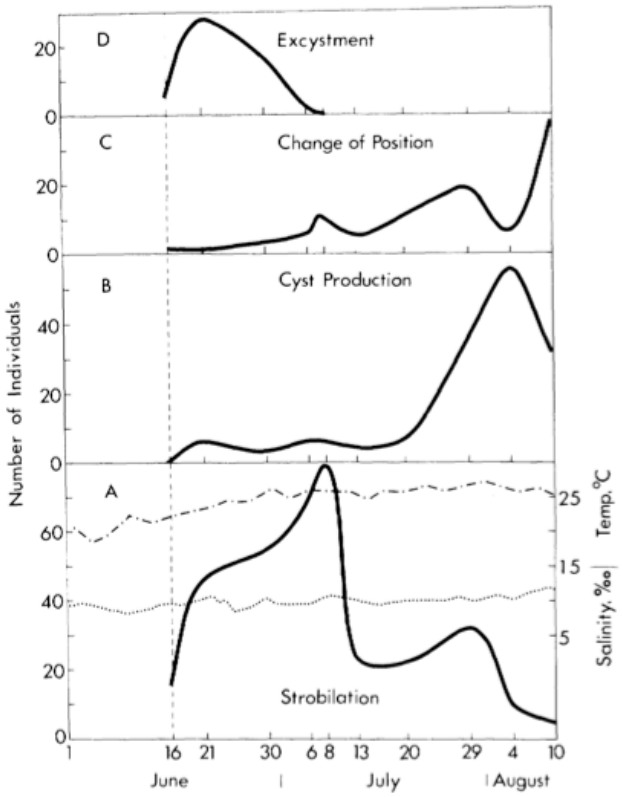

Figure 5: Rates of activities throughout various life stages of the sea nettle *Chrysaora quinquecirrha*, in the Chesapeake Bay, 1976. The rates of cyst production (B) are the highest in the months of August and September. Figure source: Cargo and Rabenold 1980.

To reduce uncertainty of sea nettle polyp identification in the future of this project, it is recommended that a higher power camera be used through the months of August and September. It is possible that the Olympus Stylus Tough Waterproof 8010 camera used during the 2013 season is adequate for this project, although using a camera with higher resolution and megapixels would also increase chances of definitive identification of sea nettle polyps, since details will be clearer and more easily enlarged. September is an ideal month for the photography of polyps since the Barnegat Bay should have clearer waters while phytoplankton blooms are not occurring and boat traffic is at a minimum. Furthermore, there is a greater chance of observing podocysts on the polyps in September, which will provide a more definitive means of sea nettle polyp identification.

Work Cited

Bologna, P. 2011. Sea Nettle (Chrysaora quinquecirrha) Polyps in Barnegat Bay, NJ: a Pilot Assessment. Submitted to the Barnegat Bay Partnership. Available: http://bbp.ocean.edu/Reports/Assessment%20of%20sea%20nettle%20final%20project%20report.pdf

Boero F, G. Bouillon, M. P. Miglietta, T. Parsons, S. Piraino. 2008. Gelatinous plankton: irregularities rule the world (sometimes). Marine Ecology Progress Series. 356:299-310

Cargo, D. G., and G. Rabenold. 1980. Observations on the asexual reproductive activities of the sessile stages of the sea nettle Chrysaora quinquecirrha (Scyphozoa). Coastal and Estuarine Research Federation 3:1, 20-27.

Cargo, D. G., and L. P. Shultz. 1966. Notes on the biology of the sea nettle, *Chrysaora quinquecirrha* in the Chesapeake Bay. Chesapeake Science 7:95-100.

Condon, R. H., W. M. Graham, C. M. Duarte, K. A. Pitt, C. H. Lucas, S. Haddock, K. R. Sutherland, K. L. Robinson, M. N. Dawson, S.-i. Uye, S. Gelcich & L. P. Madin, 2012. Questioning the Rise of Gelatinous Zooplankton in the World's Oceans. BioScience 62(2):160-169.

Henson S. A., J. L. Sarmiento, J.P. Dunne, L. Bopp, I. Lima, et al. 2010. Detection of anthropogenic climate change in satellite records of ocean chlorophyll and productivity. Biogeosciences 7:621–40

Hoover, R. A. and J. E. Purcell. 2009. Substrate Preferences of scyphozoan *Aurelia labiate* polyps among common deck building materials. Hydrobiologia Journal (616): 259-267

Purcell J. E. 2012. Jellyfish and ctenophore blooms coincide with human proliferations and environmental perturbations. *Ann Rev Mar Sc*i 4:209-235

Richardson A., A. Bakun, G. Hays, M. Gibbons. 2009. The jellyfish joyride: causes, consequences and management responses to a more gelatinous future. *Trends in Ecology and Evolution.* 24: 6 312-322