Peconic Bay Scallop Technical Review Committee Initial Findings and Recommended Research
March 2020

On November 22, 2019 the Peconic Estuary Partnership, in response to the adult scallop die-off in the Peconic Bays convened a group of scientists, regulators and experts to assess the known and unknown factors that may have contributed to the demise of the Peconic Bay scallops in 2019 in the Peconic Estuary. This group, the Peconic Bay Scallop Technical Review Committee, has worked together to review all available data relating to Suffolk County water quality, scallop health, the Cornell Cooperative Extension (CCE) scallop restoration program, the New York State Department of Environmental Conservation (NYSDEC) Division of Marine Resources Peconic Trawl survey, shellfish landings and environmental monitoring, relevant past and on-going research, regional experiences, and information from local baymen.

Environmental conditions throughout the Peconic Estuary system vary temporally and spatially. Changes in water temperature, dissolved oxygen levels and pH have the potential to negatively affect the physiology of the Bay scallop *Argopecten irradians* populations. These changes happen on a variety of timescales. For instance, rapidly increasing water temperatures and warmer water temperatures over time may affect the ability of *A. irradians* to tolerate otherwise normal conditions like parasitic occurrence or predation. The 2019 collapse of the Peconic Bay scallop underscores the need for high-frequency monitoring of environmental parameters (i.e. water temperatures, dissolved oxygen concentrations), bay scallop physiological responses, existing conditions and nuances of wild and harvested populations and how these interplay.

The identification of the coccidian parasite and the findings that environmental stressors contributed to the susceptibility of the scallops highlights the importance of high frequency work and the need to understand and form a response to changing climates that result in warmer waters and altered conditions in the Peconic Estuary. Both lab and in-situ experiments that characterize the response of *A. irradians* to these stressors, as well as, tracking of infection in parallel is also needed. While work is on-going, we are providing here basic preliminary results with a series of initial recommendations to begin the necessary work as fastidiously as possible. The group will continue to meet and review data to form a more comprehensive final set of findings and research recommendations over the coming months.

Preliminary Findings

After reviewing the Harmful Algal Bloom (HAB) data from 2019 we conclude that HABs were not a cause of the die-off. Additionally, a review of 2019 Chl-a data, CCE scallop program data phytoplankton data from independent studies, and discussions with oyster aquaculture license holders who reported

increased landings in 2019, we conclude that the die-off was not a result of a lack of phytoplankton (food) in the Peconic Estuary system. Nor was it related to the quantity of oyster aquaculture operations in the Peconic system and oyster competition for food.

NYSDEC led efforts to collect samples for examination by Stony Brook University's Marine Animal Disease Lab resulted in two findings: the known scallop parasite *Perkinsus* hypnospores was not present in any of the samples, and a coccidial infection was present in all samples, although presenting at different life stages in various samples. Coccidian parasites are single celled protozoan members of the Apicomplexa that typically need, at least for some stages of their life cycle, to live inside host cells. Apicomplexan parasites of bivalve shellfish are typically acquired from the water column during water filtration. The Coccidian parasite caused mortality in some, but not all samples and environmental factors were likely an extremely important contributing factor to the mortality event in 2019. Parasite-driven mortality is often worsened by a combination of stressors and some of the environmental factors causing stress on bay scallops in 2019 may have included rapidly increasing water temperatures, sustained high water temperatures, changes in pH, and low dissolved oxygen levels.

The Bay is now experiencing the effects of climate change and understanding the effects of changing species regimes is essential. Increased water temperatures and resulting warmer water currents in 2019 brought new predators to the Peconic Bay waters in the form of the cownose ray *Rhinoptera bonasus*. NYSDEC reviewed all information relating to their annual trawl surveys and carried out a review of species logged by pound-net fishermen. These results indicated increased populations of cownose rays in specific locations around the estuary. Additionally, based on anecdotal information from baymen and other water users, high numbers of cownose rays were present in certain specific areas of the Peconic Bays. This may have led to increased predation and as such been a contributing factor.

Eelgrass provides nursery habitat for bay scallops and has seen a dramatic decline in the past 20 years. Juvenile scallop populations were not as severely affected by the die-off as adults and eelgrass habitat decline is not believed to be a direct factor of this particular event. However, the increasing loss of eelgrass over the past decades may be a contributing factor to scallop survival. This decline has failed to provide nursery habitat to allow for a full and thriving recovery of the Bay scallop population. Eelgrass decline must be closely monitored and restoration efforts that support existing beds should be prioritized. The examination of utilizing seed sources from warmer southern waters may be a valuable strategy to allow eelgrass to adapt to the warming water temperatures is warranted. Eelgrass survival is driven by several factors including water temperature, light attenuation and the prevalence of hardened shorelines in proximity to the beds. All of these should be addressed as part of a long term eelgrass management plan. NYS legislation relating to eelgrass should be closely followed and the hiring of a NYSDEC eelgrass specialist should be a prioritized hiring.

Recommended Research

More research is necessary to fully understand the die-off and the interplay of environmental stressors, parasite driven mortality, and changing predation patterns as waters warm and potentially new species are present in our waters. Research recommendations are listed here:

1) Peconic Estuary distribution and analysis of coccidian infection:
    a. Establish the distribution and dynamics of coccidian infection in bay scallops (spatial distribution and temporal changes);
    b. Contrast two scallop populations: (1) natural "wild" scallops, and (2) hatchery-reared animals produced by CCE to be deployed on the bottom or in nets suspended above the bottom (where no unusual mortality was reported in 2019);
    c. Characterize the Bay Scallop coccidian;
    d. Develop a molecular diagnostic method (quantitative PCR);
    e. Study the effects of environmental factors on disease development (lab and field experiments);
2) Peconic Estuary high-frequency water quality and bay scallop monitoring:
    a. Conduct high frequency summer environmental monitoring at multiple sites in the Peconic Estuary, including sites that displayed significant mortality in 2019, and exhibiting a gradient of temperatures and dissolved oxygen levels.
    b. Conduct high frequency summer monitoring of bay scallop cardiac activity, growth, and survival, and presence/absence of infection at all sites.
    c. Bay scallop monitoring:
        i. Expand the current Scallop Program in the Peconic Estuary to, a minimum, double the sample locations.
        ii. Increase the frequency of monitoring of newly expanded monitoring sites.
        iii. Deploy first and second year scallops at each site.
        iv. Monitor scallops weekly for growth, survival, condition, gonadal development, and disease and parasite prevalence.
        v. Conduct maximum thermal tolerance laboratory experiments.
        vi. Conduct temperature and dissolved oxygen factorial experiments.
        vii. Deploy optical infrared sensors to assess scallop cardiac activity to indicate correlation with respiration rates and suggest sensitivity to both warming temperatures and low dissolved oxygen concentrations.
        viii. Measure metabolic rate in *A. irradians* using intermittent flow respirometry (Q-Box series) at increased monitoring sites.

d. Conduct further research into predation in the Peconic Bay system with relation to scallops.
    i. Establish corrals or caged scallops at all of the survey sites to understand predation.

3) Direct Program funding for support
    a. Increase personnel in the DEC Division of Marine Shellfish Unit
    b. Increase support of the Peconic Estuary Program
    c. Hire an eelgrass specialist in DEC (position currently vacant)

4) Eelgrass research and restoration:
    a. Research into the freshwater subaqueous groundwater discharge into the Peconic Estuary to determine hydrodynamic conditions and their relationship to eelgrass health.
    b. Develop a management system and establish eelgrass zones for discrete and successful management of these zones that may have different requirements for success.
    c. Establish an appropriate seeding program.