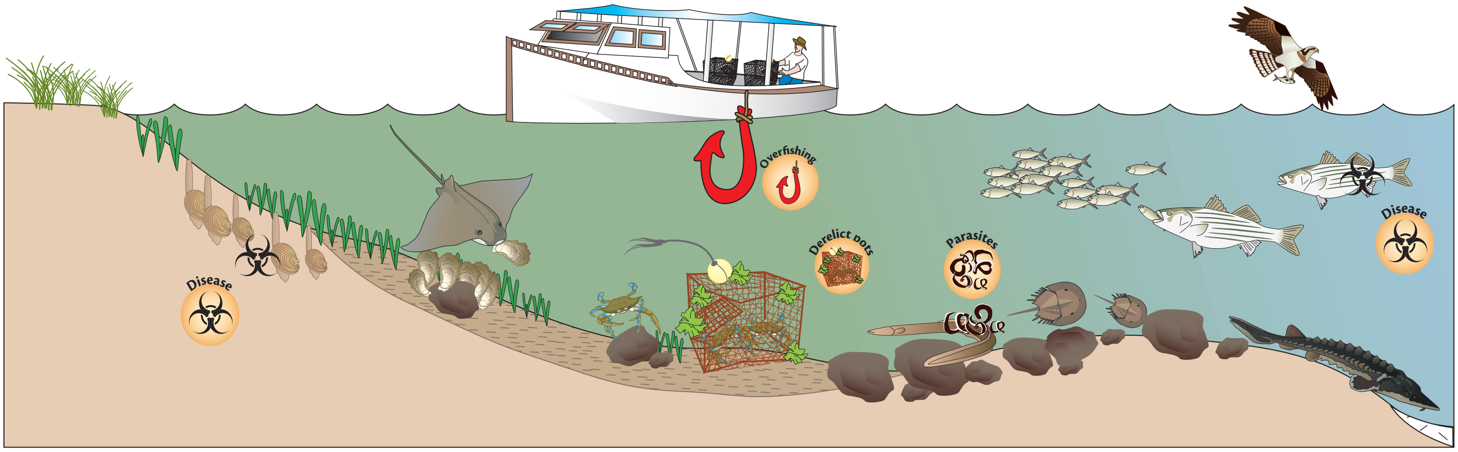
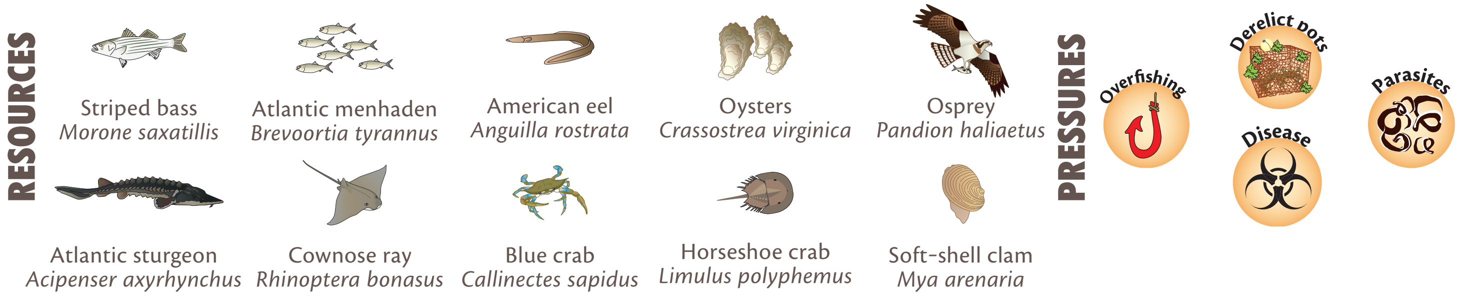
# NOAA Chesapeake Bay Office 2009 Fisheries Science Symposium

# RESEARCH FINDINGS FOR KEY BAY FISHERIES SPECIES

*Fisheries research funded by the NOAA Chesapeake Bay Office (NCBO) provides science and information to enable natural resource managers to make informed decisions. The NCBO Fisheries Science Symposium is a chance for fisheries scientists in the Bay area to present their research findings and create collaborations. This document summarizes some of the key topics presented at the 2009 symposium.*

## MULTIPLE PRESSURES AFFECT IMPORTANT CHESAPEAKE BAY RESOURCES




## FISHERIES MANAGEMENT MOVING TOWARD ECOSYSTEM-BASED APPROACH

It is increasingly understood that fisheries management in the Chesapeake Bay demands an ecosystem-based approach. In turn, this requires knowledge of multispecies interactions, complex ecological processes, and the many factors that affect the health of individual species. Recent research results have influenced important Bay-wide decisions to allow native-oyster-only restoration, and to reduce female blue crab harvest, which was showing signs of a possible collapse. These decisions were made possible because the research community provided the information managers needed to make smart decisions. Other research illustrates the challenges presented by parasites and pathogens in fish and shellfish, and how these challenges are affected by other ecosystem processes.

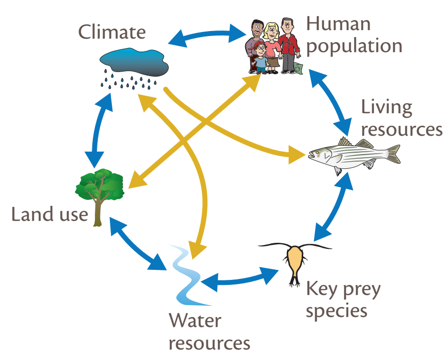



*Figure 1. Ecosystem-based management is key to the effective and successful stewardship of the Chesapeake Bay.*

# PARASITES AND PATHOGENS REDUCE HEALTH OF IMPORTANT BAY SPECIES

Research presented at the symposium suggests important discoveries about the health of several key Chesapeake Bay fish and shellfish species, including striped bass, American eel, oysters, and clams. A recurring theme from symposium presentations reflected declining health for these species due to pathogens and parasites. Research results were presented on mycobacteriosis in striped bass, *Perkinsus* in oysters and clams, disseminated neoplasia and a newly discovered pathogen in softshell clams, and swim bladder parasites in the American eel.

The bacterial disease mycobacteriosis and poor nutrition have been implicated in the recent increases in natural mortality observed in Chesapeake Bay striped bass. Prevalence of mycobacteriosis was reported as 50-70% from skin lesions and 75-98% from the spleens of these fish.

Related to the agent of oyster Dermo disease, *Perkinsus chesapeaki*, is a potentially lethal protozoan pathogen that affects clams. *P. chesapeaki* was found to infect at least six species of Bay clams, including the two major commercial species, at prevalences that can reach 100%. Disseminated neoplasia (DN) is a lethal disease in which clam blood cells are replaced with dysfunctional cells. DN infection was found in up to 33% of softshell clams. Additionally, researchers describe a previously unknown virus that infects the nuclei of *Mya arenaria* (softshell clam) gill cells in up to 97% of clams.

In American eels, researchers found the nematode parasite *Anguillicola crassus* in 18-72% of eels sampled from several tributaries (Figure 2). Maximum parasite intensities exceeded 40 parasites per eel, causing a high incidence of damaged swim bladders. This parasite is an exotic species that was originally associated with Japanese eels and was first identified in the Chesapeake Bay in the late 1990s. Results from all of these research efforts will better inform management decisions related to population health, stock assessment, interactions with other stressors, and causes of natural mortality.

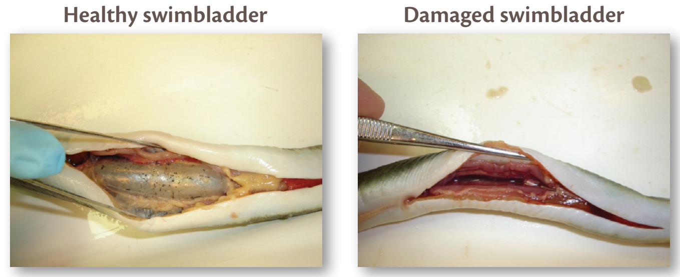



*Figure 2. A healthy swimbladder in the American eel (left) compared to a damaged swimbladder resulting from an infection by the parasite* Anguillicola crassus *(right). The parasites affect the thickness of the swimbladder wall as well as the transparency and pigmentation.*

# RECENT IMPROVEMENTS HAVE BEEN MADE IN RESTORATION AND MANAGEMENT TECHNIQUES

In addition to research on the causes of declining organism health, important results were presented on improvements to management strategies for other key Bay species, including oysters and blue crab. For blue crab, the dredge survey in winter 2008-2009 suggested that management decisions to reduce the female crab harvest in summer 2008 have been effective in protecting and increasing the blue crab population (Figure 3).

Researchers and management agencies are increasingly investigating alternative strategies, such as stock enhancement, to aid traditional effort-based fishery management approaches in restoring coastal fisheries. In the Chesapeake Bay, blue crab population declines have spurred field tests of the feasibility of stock enhancement as a potential tool for helping to restore depleted blue crab spawning stocks.

The Blue Crab Advanced Research Consortium has made extensive research progress in blue crab stock enhancement. Protocols for mass rearing blue crab juveniles in captivity have been developed and optimized. Advances in blue crab endocrinology, genetics, disease, population biology and community ecology have all been facilitated by the availability of hatchery crabs. Field releases of tagged hatchery juveniles more than doubled local crab abundance in release sites on average (Figure 4), and as much as sevenfold in some areas. The results clearly demonstrate that many areas of the Bay are currently below carrying capacity, and highlight the encouraging potential of stock enhancement through hatchery releases into underutilized habitats for this species.

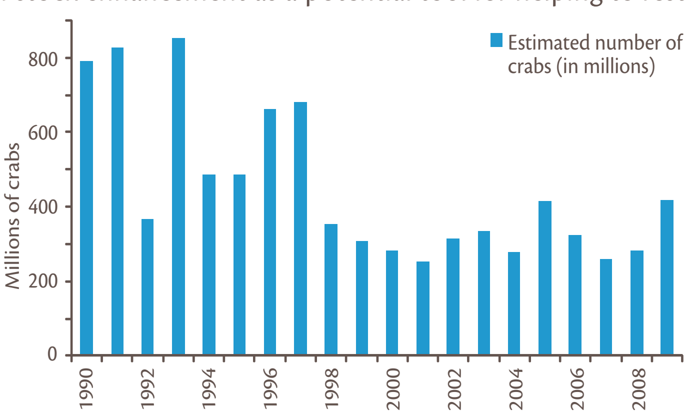



*Figure 3. Winter dredge survey results. Managers estimate the total number of crabs living in the Chesapeake Bay each year by multiplying the estimated density of all crabs by the area of the Bay. Data: MDNR.*

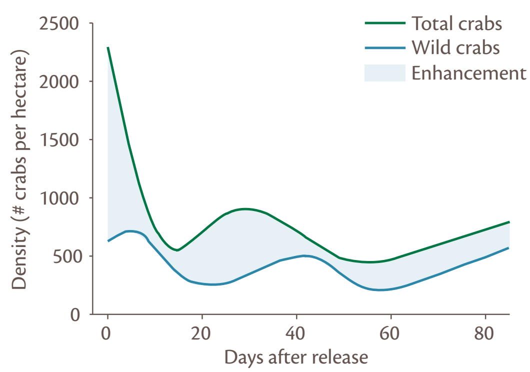



*Figure 4. Densities of wild and hatchery blue crabs in a typical enhancement site (St. Thomas Creek, Patuxent River). The shaded region represents the magnitude of hatchery enhancement. Data: Smithsonian Environmental Research Center.*

# MULTIPLE FACTORS AFFECT MENHADEN POPULATION AND GROWTH

The need for the development of a more complete understanding of local populations of Atlantic menhaden within the Chesapeake Bay has recently been identified by management agencies as high priority for research. Research presented at the fisheries symposium improves our understanding of local population size and structure, as well as factors affecting fish recruitment and growth.

## *Local population size and structure*

LIDAR is an aerial technology that is being tested for use in developing estimates of Atlantic menhaden in the Chesapeake Bay. A combination of video and laser methods are being used to measure estimates of fish biomass and school size (Figure 5). Although in the development stage, these techniques may form the basis of local population estimates, which have been unavailable previously. Patterns of growth of young-of-the-year (YOY) menhaden during the year were substantially different among regions. These findings suggest that watershed-scale actions and knowledge of local systems are key factors in appropriate menhaden recruitment management.

In other research, stable isotope analysis of osprey and bald eagle feathers suggests that these predators have changed prey from menhaden to resident freshwater species, providing further evidence of a recent decline in local menhaden populations.

## *Recruitment and growth*

Other factors affecting menhaden recruitment success include physical processes involved in the ingress (entrance of fish larvae from open ocean waters to an estuary) of menhaden larvae hatched in the Atlantic Ocean, and environmental factors like habitat quality and predation. Surveys show high variability of ingress and growth of menhaden larvae on an annual and seasonal basis, but peak ingress usually occurs between December and February. These survey results can provide important information to develop annual predictions of recruitment success, as well as explain the physical factors that affect larval supply annually and seasonally.

Additional research has shown that recruitment success varies locally, depending on water quality and primary production in nursery areas (Figure 6). Individually, these research efforts provide information on important pieces of the puzzle of why Atlantic menhaden recruitment has declined in recent years. Taken together, results are leading to a more complete picture of the local menhaden population which may result in more informed management decisions affecting menhaden in the Chesapeake Bay.

## *Predator-prey interaction*

Research on local Atlantic menhaden populations has further implications on the health of other key bay animals because of menhaden's place in the ecosystem of Chesapeake Bay fishes. Menhaden are an important prey species for striped bass, osprey and bald eagle, to name a few. Poor recruitment and growth of menhaden in local Bay waters means less available prey for young striped bass. Some research presented at the symposium suggests that this has in turn led to a decrease in overall nutrition in striped bass, and increased susceptibility to mycobacteriosis. Apparent shifts in diets of fish-eating birds, like osprey, and bald eagles, suggest that they must adjust their diet as a result of a shifting menhaden population. So far, effects of this shift on the ecosystem are not adequately understood.

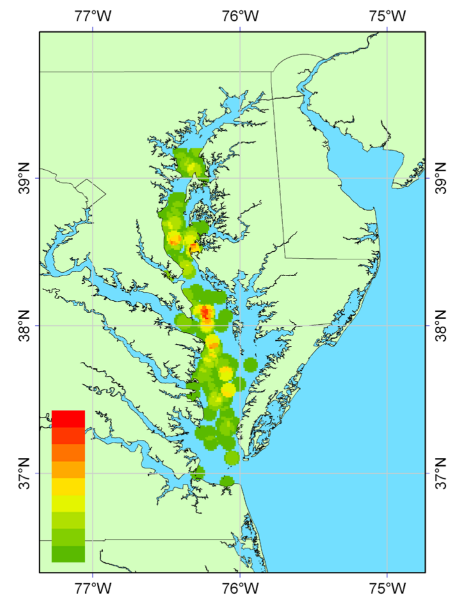



*Figure 5. Fish density distribution (thousand standard fish per square kilometer) in September 2007 determined by LIDAR (aerial technology). Data: Churnside, 2009.*

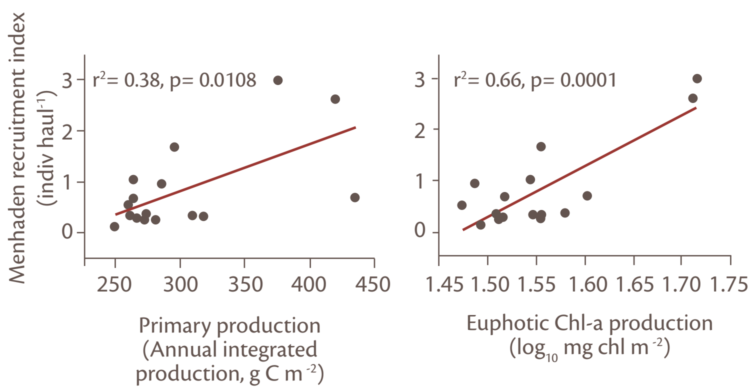



*Figure 6. Relationship between recruitment and primary production (1989–2005). Data: Houde, 2009.*

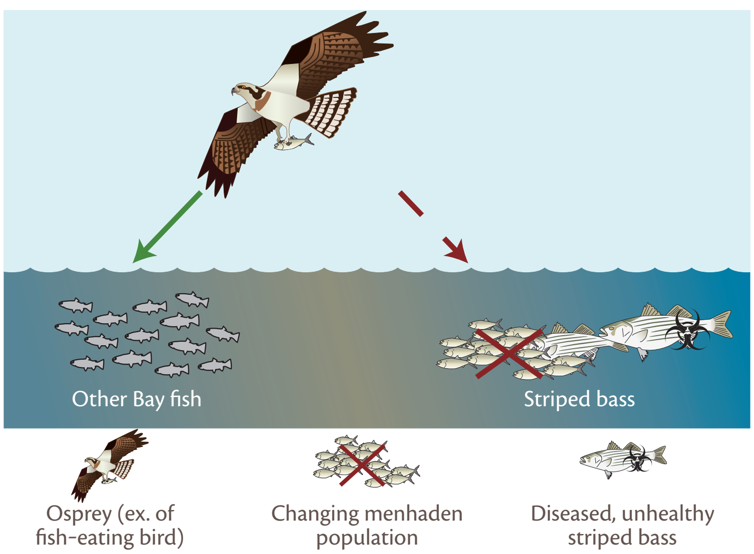
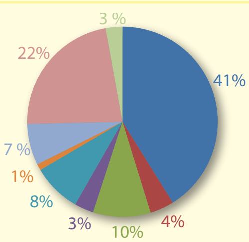



*Figure 7. Predators may be adjusting their diets based on changes in the menhaden population and unhealthy striped bass.*

# IMPORTANT MANAGEMENT IMPLICATIONS

| RESEARCH FINDINGS | MANAGEMENT IMPLICATIONS |
|---|---|
| Parasites and pathogens are found to infect substantial numbers of striped bass, American eel, and several species of clams (approaching as high as 100% prevalence). | Significant negative impacts have been demonstrated on some species but further research is required to determine direct impacts. |
| The 2008–2009 winter dredge survey showed a substantial increase (70%) in the spawning stock of blue crab, in particular for mature females. | Management actions implemented in 2008 should be maintained until their impacts on recruitment and future spawning potential can be assessed. |
| Aerial technologies are being tested for use in developing regional estimates of Atlantic menhaden in the Chesapeake Bay. | LIDAR sampling alone underestimates menhaden populations, but when combined with other techniques, HDvideo, a more accurate estimate of the menhaden population is possible. |
| Otolith chemistry shows young-of-the-year (YOY) menhaden populations vary more locally than previously thought, and that first year movement is generally restricted. | With additional sampling coast-wide, the percent contribution from the Chesapeake Bay (specific to the tributary level) to the coastal stock will be available. This shows that management of menhaden needs to include local level actions. |
| Physical processes involved in the ingress of menhaden larvae hatched in the Atlantic Ocean and environmental factors like habitat quality and predation play a role in the process. | Annual indices of menhaden larval ingress (larval supply) can be developed to relate spawning biomass and recruitment success. |
| Recruitment success varies locally, depending on water quality and primary production in nursery areas. | Models can now be developed to describe and predict recruitment success in the Chesapeake Bay if water quality and primary production are also included. |
| Apparent shifts in the diets of fish-eating birds like osprey and bald eagles, suggests birds are now looking to freshwater fish as their source of food. | Bird population estimates and prey handling needs to be included in ecosystem models in addition to the current fish-eat-fish modeling. |

Since 1985, NOAA has received significant financial support through annual congressional appropriations for fisheries stock assessment, monitoring, modeling and related research in the Chesapeake Bay. These fisheries research efforts have been administered by the NOAA Chesapeake Bay Office since 1992. NCBO works closely with the State fisheries management agencies, the Atlantic States Marine Fisheries Commission, and the Chesapeake Bay Program to ensure these efforts are directly related to and in support of identified research, monitoring, and assessment needs. Funding between 2007–2009 has been allocated to various projects and species as presented in the chart.




**Projects and species funded between 2007–2009:**

- Blue crab
- Striped bass
- Monitoring and modeling
- SAV
- Menhaden
- Shellfish
- Non-native oyster
- Misc. (CRC, sponsorships)
- Other (perch, cownose rays, eel)

**~$10 M total funds**

# ACKNOWLEDGEMENTS

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*For one-page summaries of projects presented at the Fisheries Science Symposium, log on to http://chesapeakebay.noaa.gov/docs/fss09program.pdf*

*For further information, contact the NOAA Chesapeake Bay Office: 410-267-5660*

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