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Scientists Join Forces for Regional Fisheries Research

By Jessica Smits

It's an act of nature that goes largely unnoticed. Every year, larval fish — barely visible to the naked eye — leave their birthplace in the offshore Atlantic and make their way into the waters of the Delaware and Chesapeake bays. Survivors of the journey find food and shelter in the bays' nursery areas and ultimately grow to become important parts of the ecosystem. Not to mention its recreational and commercial fisheries.

And although this movement ultimately determines what fishermen find at the end of their lines, we know little about how the larvae find their way to each bay. What forces drive their movement? Do these forces differ between the Delaware and Chesapeake bays? And what could an increased understanding of them mean for fisheries management?

A team of researchers from Delaware, Maryland, and Virginia has come together to seek answers. Funded by Sea Grant programs in each of the three states with additional support from the National Oceanographic and Atmospheric Administration, the scientists are collaborating to study patterns in the abundance and movement of fish larvae (ichthyoplankton) — particularly Atlantic croaker, Atlantic menhaden, and American eel. These species spawn offshore, then enter the Delaware and Chesapeake bays in fall and winter.

The results of this regional project should help fisheries managers better understand fluctuations in fish populations — an essential variable in harvest quota decisions. Fish populations can vary wildly. One year may bring a large group of larvae into the estuaries, while the next year may bring relatively few.

Given this uncertainty in what scientists call recruitment, it's a challenge for managers to set harvest guidelines that support fisheries and maintain sustainable populations. Understanding factors that guide young croaker, menhaden, and eel into Delaware and Chesapeake bays should help managers make more informed decisions.

A trawl takes an early morning dip into a glassy Delaware Bay. The hard part is hauling the full net back on board. Graduate student Jim Connelly says it handles like a 200-pound wrecking ball. Researchers deploy the trawl at multiple sites across the mouths of Chesapeake and Delaware bays to get an accurate snapshot of entering larvae. Photo by Tammy Beeson, Delaware Sea Grant.

To determine the abundance of larval fish entering the two bays, the team conducts plankton tows across the mouths of both bays aboard the *Research Vessel Hugh R. Sharp*. As researchers fish for ichthyoplankton at sea, colleagues at the Virginia Institute of Marine Science (VIMS) and the University of Delaware College of Marine & Earth Studies simultaneously deploy plankton nets at shore-based stations near the entrances of the two bays. Weekly sampling from shore provides an important

source of information on recruitment success. By comparing data gathered on board the *RV Sharp* with shore-based station data, researchers get an idea of how accurately the shore-based stations depict the abundance of fish larvae moving into the estuary.

Although plankton tows and station sampling give insights into the timing, abundance, and kinds of larvae moving into the estuaries, they do little to uncover the factors that direct this movement. To get a clearer picture of possible relationships between larval fish movement and physical conditions, researchers on board the *RV Sharp* turn to oceanographic instruments that measure properties such as salinity, temperature, and the direction and speed of water movement.

The scientists hypothesize that these physical factors — including winds, tides, and freshwater flow — influence circulation patterns and interact with larval behavior to determine when and how the larvae move into the bays.

To test the specifics of their hypotheses, Elizabeth North, a fisheries oceanographer at the University of Maryland Center for Environmental Science (UMCES) Horn Point Laboratory, uses data gathered on the cruises, as well as data recorded year-round by Delaware Bay and Chesapeake Bay Observing System stations, to build computer models that explain possible mechanisms of larval movement into the two bays. The simulations will help the researchers understand how winds, tides, and river flow pull or push larvae into the bays.

The bay in her hands. Fisheries oceanographer Elizabeth North disembarks the *Research Vessel Hugh R. Sharp* holding the results of several days at sea. These samples will bring insights into the movement of fish larvae into the Delaware and Chesapeake bays. Photo by Jessica Smits.

Will these fundamental drivers have the same effect in both the Chesapeake and the Delaware? Maybe not.

The two bays have markedly different physical conditions, North says. Tidal currents at the mouth of the Delaware can be over one and a half times stronger than those at the mouth of the Chesapeake, while freshwater inflow to the Chesapeake is four times greater than in the Delaware. Since freshwater is less dense than saltwater, North thinks it's a factor that could affect circulation at the estuary's mouth, which could in turn affect how fish enter the estuary.

Being able to compare the two bays, North says, will greatly extend knowledge of the recruitment process. "Comparison gives you power." Understanding the differences and similarities in how larvae move into the Chesapeake and Delaware will give insight into the environmental and physical conditions that drive coastwide population fluctuations — insight that would be harder to achieve by looking at just one bay, she says.

By looking at the mouth of one estuary, one can infer something about how larval fish get into that particular estuary, North says. But looking at both estuaries allows for more general conclusions about the strategies a species uses to enter the nursery areas. Preliminary results of their sampling indicate that the timing and size of larval fish at entry differs between the Delaware and Chesapeake bays. North predicts that this difference may have implications for understanding stock structure and spawning patterns of adults, factors that ultimately control juvenile recruitment and how coastal fish populations may respond to climate change.

It is this type of large-scale comparative analysis that the Delaware, Virginia, and Maryland Sea Grant programs had in mind when they developed the funding opportunity for scientists in the three states to design a joint project that addresses an issue of regional priority. An opportunity that, North says,

is unique in fostering collaboration, rather than the usual competition between research labs in the region.

In addition to North, project leaders include physical oceanographers Bill Boicourt from UMCES Horn Point Laboratory and John Brubaker from VIMS, fisheries biologists Ed Houde from UMCES Chesapeake Bay Biological Laboratory, Tim Targett from University of Delaware College of Marine & Earth Studies, and John Olney from VIMS. The late Richard Garvine from University of Delaware was also a part of the research team.

Working with four institutions across three states and two bays does have its challenges. Developing compelling scientific questions and combining them into a proposal, “that’s fun stuff. That’s like planning a party,” North says. The hard part, she notes, is coordinating administrative logistics, things like overhead and budgets, for their respective state’s Sea Grant program.

Even the Sea Grant programs themselves had to do a bit of wrangling to make projects like this possible. A few years back, Maryland Sea Grant shortened its usual two-year funding cycle to just one year, so it could align its schedule with the Delaware and Virginia Sea Grant programs.

The result has led to rewarding science says team member and University of Delaware marine biologist Tim Targett.

“It allows these programs to do things that are larger than any one program could do alone,” he says.

Delaware Sea Grant College Program
Delaware Sea Grant College conducts research, education, and outreach projects to help people from all walks of life wisely use, manage, and conserve Delaware's ocean and coastal resources. The program is funding research projects in coastal ocean studies, marine biotechnology, environmental technology, fisheries, coastal engineering, and education and outreach. Delaware Sea Grant is affiliated with the University of Delaware at Newark, DE.

Maryland Sea Grant College Program
Maryland Sea Grant won Sea Grant College status in 1982 and plays a major role in programs to help restore the Chesapeake Bay, mainly by supporting advanced research that will lead to sound policymaking and more effective management of the Bay's threatened resources. Research areas include remote sensing of Chesapeake Bay phytoplankon, oyster disease research, fisheries resources, including aquaculture and seafood technology, and toxicants in the Bay. Maryland Sea Grant is located at the University of Maryland at College Park, MD.

Virginia Sea Grant College Program
Virginia Sea Grant funds marine science research in aquaculture, seafood safety and quality, marine resources, coastal ecosystems through a competitive, peer-reviewed grant proposal process. In addition to its core programs, Virginia Sea Grant coordinates research in oyster disease and toxics in the Chesapeake Bay. Virginia Sea Grant is associated with the University of Virginia at Charlottesville, VA.

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