Aquaculture and Agriculture - Working Together for Solutions

In 1996, clam hatcheries on Virginia's Eastern Shore began to claim that runoff from local farms was harming their aquaculture operations. Hatchery owners alleged that the use of plastic sheeting on tomato fields was helping to channel pesticides and heavy metals into area waters, killing clam larvae. Tomato growers argued that "plasticulture" allowed them to use fewer pesticides, and is a recognized "Best Management Practice" for arid environments.

Since then, scientists from VIMS, other universities, and several state agencies have been working alongside the clam and tomato farmers to help clarify the science behind their competing claims, and to develop management solutions acceptable to both parties. Their efforts have been funded since 1998 by a grant from the Virginia Department of Agriculture and Consumer Services (VDACS).

Those efforts are now bearing fruit. Tomato farmers are beginning to voluntarily implement the changes in farming practice that research shows are most likely to reduce the effects of runoff on neighboring clam hatcheries.

"The big story," says Mark Luckenbach, director of VIMS Eastern Shore Laboratory, "is not that the research itself is all that startling, but that it was done in such a collaborative way."

Luckenbach has conducted the research along with fellow VIMS scientists Mory Roberts, Mike Unger, and Mike Newman, with assistance from the Eastern Shore Resource Conservation and Development Program and the local Soil and Water Conservation District. Area tomato farmers and landowners have also been important contributors, allowing the researchers free access to their fields and property, and underwriting the sometimes expensive changes in farming practice that the research suggests.

Gretchen Arnold, a research specialist at the VIMS Eastern Shore Lab, points out that the research has also benefited from its multi-disciplinary approach. Arnold, who has managed the field studies on the project for the past three years, notes that the research involves land-use characterization, agricultural science, environmental chemistry, toxicology, and ecology.

Clam aquaculture on Virginia's Eastern Shore.

In a preliminary 1996 study, the researchers caged grass shrimp larvae (which have known sensitivity to pesticides) in six watersheds along the Eastern Shore. By monitoring the health of these larvae during a two-month period, the team found that mortality peaked following heavy rains in those watersheds exposed to runoff from plasticulture operations. Although the research didn't uncover the direct cause of the mortality, it did suggest a strong need for improved management practices.

The team used the VDACS grant to study the impacts of plasticulture runoff in more detail, and to test how various management practices might mitigate those impacts. They confirmed that water quality in tidal creeks is most affected by pulses of runoff following heavy rain, and thus realized, says Luckenbach, that those effects "could be eliminated or reduced by controlling the run-off from fields." Tomato farmers have responded by installing retention ponds, modifying existing buffer zones to better control runoff, and altering the way they use pesticides.

Luckenbach notes that the response of the farmers to the suggested changes has been remarkably rapid. "There was almost no lag between the research and the implementation of management strategies," says Luckenbach.

His team has so far found little evidence that plasticulture is having any chronic effects on native organisms in affected waters. For instance, they have observed no relationship between plasticulture in a watershed and toxicity levels in migrating finfish or bottom-dwelling invertebrates.

"However," cautions Luckenbach, "that doesn't mean the toxins aren't there. It may simply be a detection problem." His team continues to monitor for any long-term effects by measuring levels of organic pesticides and heavy metals within the tissues of oysters that they have deployed in their field sites.

The ultimate goal, says Luckenbach, is to contribute to a better understanding of how sustainable tomato cultivation can be practiced without negatively impacting the health of coastal waters.

Marine Finfish Culture Activities

By Mike Oesterling

During 2000, the VIMS Marine Finfish Culture Program achieved a milestone with the spawning of captive cobia *(Rachycentron canadum)*. The project is ongoing with the continued culture of juvenile cobia from that spawning. Cobia are considered prime candidates for commercial aquaculture because of an expanding market as a food fish, a fast growth rate, and their adaptability to confinement systems. Indeed, the cobia that are currently in the VIMS recirculating water grow-out facility have demonstrated both the fast growth and adaptability aspects. After only 200 days of growth, the juvenile cobia weigh an average of 2 pounds, with some fish topping the scales at 3 pounds. These animals are part of a graduate student's Master degree thesis and will contribute much usable information to fish culturists. Plans are currently being made for the upcoming season to continue the development of aquaculture protocol for cobia.

While not as momentous as the cobia spawning, the Marine Finfish Culture Program has just completed the spawning of spot *(Leiostomus xanthurus)*. These fish were collected in the fall prior to their migration out of Chesapeake Bay to offshore spawning areas, held within a 1,000-gallon recirculating water system for final maturation, and spawned in early January using hormonal injection techniques. Unlike cobia, spot are not considered candidates for aquaculture based upon their appeal as a food fish. Rather, cultured spot are being investigated for their potential as a live-bait for the recreational fishing industry. The Marine Finfish Culture Program is working cooperatively with a private individual who intends to grow fingerling spot to a bait size, test market the animals, and evaluate the potential for large-scale spot production. This project is being supported in part by the Fishery Resource Grant Program administered by the Virginia Sea Grant College Program.

Graduate student Patrick Kilduff injects an anesthetized spot in preparation for spawning