

RATIONAL PLAN EXECUTIVE SUMMARY

PURPOSE OF REPORT

This report addresses a plan of research and monitoring to support the following:

1. Restoration of native oyster resources and continued viability of other shellfish resources
2. Continued development of molluscan shellfish
3. Elucidation of the significance of shellfish and shellfish habitat in ecosystem function and the natural benefits of ecosystem and economic development that result from a fully functional resource.

One component of this plan involves testing, in quarantine and in the field, the response of non-native oyster species to the two oyster pathogens endemic to the Chesapeake Bay and other regions on the East Coast. Identification of oyster species with superior natural resistance is pivotal to any alternative species strategy to rejuvenate oyster resources. In-field testing of non-native species constitutes an "intentional introduction" of non-indigenous species. Hence, those components of the plan requiring exposure to non-quarantine conditions must conform with international, national, regional, and Commonwealth terms of approval and associated protocols.

STATUS OF RESOURCE AND DEPENDENT FISHERIES

Once the leading producer of *Crassostrea virginica*, the oyster species extant on the East and Gulf Coasts, the Virginia fishery has diminished to crisis level. Three factors appear to be responsible. First, historical evidence clearly documents over-harvesting and habitat depletion. Second, since the late 1950s, two oyster pathogens have decimated oyster populations in higher salinity zones. More recently the pathogens have spread into most growing areas. Third, over time land uses in the watershed of the Chesapeake Bay system have evolved with resulting increased loads of suspended sediment and other loadings that compromise water quality. Thus, resource restoration efforts are being pursued in the face of challenges not prevailing during past times.

Today, shellfish resources other than oysters—most notably, the hard clam—support very significant native fisheries. Other fisheries, including whelks and ark shell clams, are active. "Aquaculture," the controlled husbandry of various species, has flourished in Virginia. Already a leading producer of cultured hard calms, significant aquaculture efforts are underway with the native oyster, and research and development is near completion for husbandry of the bay scallop.

As well, there are additional shellfish species—the softshell clam and others—offering significant potential.

CURRENT PROGRAMS IN RESEARCH AND MONITORING

The Virginia Institute of Marine Science (VIMS) has a long and distinguished record of research, monitoring, and advisory service in support of resource conservation, native fisheries, and development of shellfish aquaculture. The efforts continue as a principal thrust of Institute programs.

In addition to receiving state funds, the staff has been successful in competing for extramural funds directly applicable to Commonwealth needs. In brief, the recent and current efforts include:

- in support of the native fisheries and related industry, formal assessment of oyster stock monitoring surveys of oyster spatfall and post-settlement mortality
- monitoring the distribution and intensity of oyster diseases
- intensive research on the dynamics of oyster diseases endemic to the Chesapeake Bay
- limited life history studies on shellfish species having developing fisheries
- assessments of human health threats associated with shellfish
- assessment of oyster-reef restoration
- limited economic assessments of the shellfish industry
- in support of shellfish aquaculture, developing hatchery, nursery and grow-out technology and training for the private sector
- providing seed oysters, clams, and bay scallops to private sector collaborators to demonstrate and revise grow-out strategies
- developing methods for predicting oyster growth rates to assist in selection of grow-out rates for oyster aquaculture
- research in testing triploid oysters, algal diet formulations, and evaluation of toxic algal blooms

RECOMMENDATIONS

The Virginia Institute of Marine Science has provided essential research and advice to resource managers as well as industries associated with both the native fisheries and shellfish aquaculture. Development of the Ten-Year Strategic Research Plan has enabled the Institute to critically examine current activities and to identify areas where program enhancements are essential. Those program elements include:

- In support of the native fisheries and related industry, highest priority should be placed on continuation of the fisheries independent stock assessment program for oysters, which was initiated in 1993 via federal funding. Federal funding ends in 1996. This program provides the firm foundation for ongoing management and long-term resource restoration. In addition to surveys of the public oyster bottoms, the program should be expanded to include hard clams.
- The ongoing program to monitor oyster spatfall and post-settlement success provides guidance to managers and industry members as to the levels of potential recruitment to the stocks. Modest expansion is required to include assessments on the seaside of the Eastern Shore.
- Oyster disease monitoring provides information on the abundance and distributions of disease for resource managers, industry members, and scientists. The program should be expanded to include the Eastern Shore and aquaculture sites. In addition, sampling and evaluation should include parasites of the hard clam.

Results from oyster disease research help maintain the native fishery and also benefit aquaculture development. Five priority research thrusts have been identified:

1. Developing a disease resistant native oyster offers substantial promise for aquaculture. The objective is to provide strains that will reach market size with very low mortality from disease.
2. Determining the life cycle of MSX (*Haplosporidium nelsoni*) is crucial to developing disease avoidance strategies and potential control measures.
3. Determining the mechanisms by which pathogens invade susceptible oysters, survive the host/parasite interaction, and cause infection may lead to control methods for both pathogens.
4. Development of chemical treatments for disease would be useful in aquaculture applications.
5. Enhancing the ability to predict changes in oyster pathogen abundance in response to environmental conditions such as salinity and temperature is critical to estimating impacts on native stocks and aquaculture.

Determining oyster reef structure and function is an essential component of habitat restoration. Priority should be given to determination of ways reefs support higher levels of the food chain, including finfish. It is also important to evaluate alternative substrates for reef construction, given that shell material is in short supply.

In support of shellfish aquaculture it is critical that the VIMS aquaculture facilities at the Eastern Shore be expanded and upgraded. Recommended is construction of a new facility, an Aquaculture Research Center. This expansion is required to assist in the economic development of the growing industry. Particularly relevant is strategically directed research toward diversification to species not currently cultured. In addition, expanded effort will be required for brood stock selection and maintenance of new species in addition to current hard clam, bay scallop, and oyster brood stock.

Determining the impacts of human and natural pathogens in shellfish growing waters and the means to alleviate impacts is necessary for success in the marketplace. Program expansion is required.

Economic assessments must have a high priority. Long-range economic studies are needed because cultured and wild mollusk species have overlapping markets. Emphasis should be placed on understanding how wild and cultured products contribute to coastal economies and how to mitigate competition between the two product sources in order to optimize Virginia's position in the regional, national, and international marketplace.

Communicating research findings and providing hands-on advice to industry is essential to advance both aquaculture and the native fisheries. In addition, there is an urgent need to better integrate research and monitoring results. To this end, use of a geographic information system, compatible with that in Maryland, is recommended.

RATIONAL PLAN FOR TESTING APPLICATION OF NON-NATIVE OYSTER SPECIES

The proposed plan is intended to provide resource managers with a science-based foundation from which public policy decisions may be made regarding use of non-native oyster species for restoration of oyster stocks in the Commonwealth. The program of study requires in-water testing to assess resistance to the oyster pathogen *Haplosporidium nelsoni* (MSX) and, in the final stages, further

in-water testing to confirm response to environmental conditions. Such in-water testing constitutes an intentional introduction of non-indigenous species. The plan was submitted in December 1995 to the Virginia Marine Resources Commission for endorsement and permission for in-water testing.

The proposed program has two objectives. First, the test series will serve to screen for the candidate species, or strains, most likely to succeed in the local estuarine environment. Second, the test results will enable an assessment of environmental risk. Specifically, the geographic range over which non-native species may successfully reproduce will be estimated.

The plan, which will require four years, adopts guidelines of the International Council for the Exploration of the Seas (ICES), wherein quarantined hatchery-raised progeny from imported brood stock are utilized. Three strains of the species *Crassostrea gigas*, and the species *Crassostrea rivularis*, are proposed for testing, based upon their close resemblance to the Eastern oyster as reef-forming species tolerant of mid to sub-tropical latitude, high-stress environments.

The proposed strategy includes:

1. A series of comparative studies in quarantine systems to evaluate larval and post-settlement response to a range of environmental conditions
2. A challenge, in quarantine, with the oyster disease *Perkinsus marinus* (Dermo)
3. A field challenge with triploid (functionally sterile) animals for the oyster disease *Haplosporidium nelsoni* (MSX)
4. Via 1 through 3, evaluation of likely success of candidate species and assessment of likely geographic range of reproduction if introduced in substantial numbers
5. Given acceptable risk, limited in-water testing of normal hatchery-reared stock with small lots under secure conditions. Substantial additional resources will be required to conduct the plan proposed.