

OYSTER RESEARCH

OYSTER DISEASE RESEARCH PROGRAM AND GULF OYSTER INDUSTRY PROGRAM

Since the late 1950s, parasitic diseases have increasingly reduced the populations of native oysters along the nation's coasts; especially heavy losses have occurred in the mid-Atlantic estuaries where two diseases abound. In the Chesapeake Bay, oyster landings are now on the order of 50,000 bushels annually; three decades ago, the yearly harvest exceeded one million bushels. Annual landings from Virginia waters are now measured in mere tens of thousands of bushels. Such declines in natural oyster stocks have serious economic and environmental impacts.



The Gulf Oyster Industry Program (GOIP) resulted from information provided by Gulf oyster industry leaders, state resource managers and academic researchers spanning the five-state Gulf of Mexico region. Specific needs identified were subsumed into 12 concise issue statements at a workshop held in New Orleans, Louisiana in 1997 and reaffirmed in 2000. The GOIP has focused largely on issues related to human health, product processing and safety, and maintaining a sustainable resource through research and extension.

Both initiatives have received Congressional support since their respective beginnings.

Why Sea Grant?

Sea Grant remains an essential catalyst for these activities, building upon its past and continuing to offer proactive scientific and policy insights for the future. It is particularly important that the nation receive unbiased, science-based expertise to synthesize and interpret research results to date, to develop consensus on how best to proceed with new initiatives and to forge a coherent strategy for future oyster-related research and outreach. Sea Grant brings together input from key stakeholders – scientists, industry representatives, managers and the public – to ensure an integrated approach to creating new knowledge and the transfer of that knowledge for broad use. No other federally supported program can muster the combination of university-based research, outreach and education along with flexibility and cost-effectiveness concerning the nation's oyster resource issues. Because Sea Grant is non regulatory, stakeholders can continue to expect research and outreach objectivity and credibility.

Sea Grant's Impacts

Both the Oyster Disease Research Program and the Gulf Oyster Industry Program efforts are specifically targeted at reversing the decline of oysters due to disease and other environmental pathogens. These efforts aim to benefit not only decimated oyster populations on both coasts, but also the fishing communities that rely on oyster harvests for their livelihoods. Stakeholders are realizing the benefits from current Sea Grant efforts in the following areas.

Oyster Fisheries Management and Restoration

Quantitative shellfish management models have been developed and are in use by resource managers in the Chesapeake and Delaware bays to adjust harvest seasons, quotas and other management options where disease is a key factor. Simulation models are helping managers investigate effects of long-term climate variation on MSX disease prevalence and intensity in oyster populations for the Delaware and Chesapeake bays.

Genetics and Oyster Populations

DNA libraries, genetic markers and pedigreed families determined for *C. virginica* through genetic engineering and biotechnology are contributing to the production of disease-resistant oysters. Protease inhibitory (PI) activity is used as an index of disease resistance – by identifying protease inhibitors and lytic peptides in oysters that are naturally resistant to *Perkinsus marinus* (dermo), two applications are now on the horizon: the development of endogenous genes that demonstrate high PI for producing transgenic species or employing PI as selection markers for identifying and breeding oysters that are more resistant to *P. marinus*. New DNA markers are being used to track the contributions of different oyster stocks to restoration projects.

Frontiers in Disease Management

Great strides have been made in characterizing MSX and Dermo disease, leading to the potential of a number of anti-*P. marinus* chemotherapies. New molecular probes and PCR for rapid detection of *P. marinus* have significantly improved the sensitivity and discrimination of different *Perkinsus* species and strains. Studies of the dynamics of interactions between disease and oysters, in concert with genetic analyses, have

produced significant knowledge about the mechanisms of disease, pointing to development of markers for selecting disease-resistant strains of oysters.

Aquaculture and Hatchery Issues

ODRP support has catalyzed regional cooperation on the advanced development and use of hatchery-bred strains of oysters – by aquaculturists, resource management agencies, researchers and oyster gardeners – that can tolerate MSX and Dermo. The best-known strains – CROSBreeds and DEBYs – originally bred for use by aquaculturists, are also being evaluated for promoting



sustainable oyster populations.

Public Health and Processing

Post-harvest treatments have been developed to eliminate the potential of *Vibrios*, particularly *V. vulnificus*, in raw and processed oysters. Forecasting of disease-related mortality and improved coastal wastewater treatment of oyster processing houses has advanced significantly. Consumer preference studies are providing information about the safety of raw and processed oysters while developing a stronger foundation of understanding that is helping the oyster industry assess public attitudes toward value-added processing.

Expectations: 2004-2008

Both the ODRP and GOIP employ competitive peer review procedures to select research and extension projects of the highest priority and quality. Each program has gathered appropriate stakeholder input in order to identify the priority topics noted below. Priorities are updated periodically, and an Oyster Summit planned for 2003 will serve as the next forum through which stakeholder input is used to revise the ODRP and GOIP priorities. Current ODRP priorities focus on the following:

- Design, application and evaluation of disease management strategies and their effectiveness for enhanced natural or aquaculture production, including possible use of non-native oyster species.
- Parasite life cycles, the dynamics and mechanisms of disease transmission, and the effects of environmental factors on disease dynamics.
- Host-parasite interactions, mechanisms of infection/entry into the host, mechanisms of disease resistance at the cellular/molecular level, and development and application of immunostimulants or chemotherapeutics.
- Development and application of diagnostic methods for all oyster diseases.
- Development and application of selective breeding strategies, including genome analysis and gene transfer techniques related to disease resistance. Current GOIP priorities focus on the following:
 - Providing at-risk consumer education and evaluation about *Vibrio vulnificus*.
 - Developing and evaluating (1) procedures
- to eliminate human pathogens from processed products and (2) educational programs for the oyster industry.
- Analyzing consumer attitudes and preferences, developing media relations protocols for the oyster industry, and determining the market characteristics for Gulf oysters.
- Developing rapid detection methods for toxic marine algae relative to reopening closed shellfish growing waters.
- Educating oyster men, public officials and citizens regarding the economic and environmental role of the oyster industry, and demonstrating strategies for relocating oyster farms that are impacted by coastal restoration projects.
- Developing cost-effective mechanized approaches to oyster harvesting and processing.
- Developing polyploid broodstock for the Gulf Coast, including disease resistant transgenic oysters.



Mission

The mission of the Aquaculture Theme Team is to identify the most pressing research needs in aquaculture related to the coastal, marine and Great Lakes waters of the United States, and to develop a research and outreach agenda aimed at prioritizing and addressing those needs.

For more information:

Jonathan Kramer
Maryland Sea Grant
(301) 405-7500
kramer@mdsg.umd.edu

<http://www.SGA.seagrant.org/ThemeTeams>

