Sea Grant
Science Serving America's Coasts

Science Supporting Sustainable Marine Aquaculture

Sea Grant will be at the forefront of efforts to grow the U.S. marine aquaculture industry through an integrated program of research, education and technology transfer that is focused on key scientific, engineering, environmental and socioeconomic issues and opportunities that currently inhibit this emerging industry.

Defining the challenge

A host of challenges define the need to bolster marine aquaculture. For example, this nation:

- Faces a seafood trade deficit amounting to nearly $9 billion annually.
- Imports more than 60 percent of the fish and shellfish it consumes.
- Endures collapses of some of the country's more important fisheries, forcing commercial fishermen and seafood processors out of business.
- Benefits from aquaculture's potential to supply up to 25 percent of all seafood consumed by its citizens within the next 20 years and to provide the seed for rebuilding some fishery stocks.
- Suffers from an underdeveloped marine aquaculture industry, which—while accounting for only 15 percent of total domestic aquaculture production—lags far behind its well-developed freshwater aquaculture industry.
- Represents a growing multimillion-dollar market for marine aquarium fishes—a ready outlet for aquacultured organisms that can relieve fishing pressure on wild stocks, especially in coral reef habitats.
- Endorses the emergence of a U.S. marine aquaculture industry that is constrained by its complex technology, diversity of species, multiple user conflicts, environmental and ecological concerns, and a fragmented institutional and regulatory system. Such constraints prevent traditional coastal aquaculture from expanding to reach its potential and block the application of new and innovative approaches to developing sustainable marine aquaculture in the nearshore.
- Faces the major challenge of a marine aquaculture industry that will grow only if (1) it addresses social and environmental constraints for the nearshore areas, (2) develops and applies new technologies to establish viable offshore and/or shore-based recirculating culture systems, and (3) enjoys security so that food production can occur safely and reliably.

Pushing for results

The National Sea Grant College Program—a university-based, multidisciplinary research, education and extension network committed to the balanced use and conservation of marine resources—is poised to help the nation meet these challenges. Sea Grant programs in all coastal and Great Lakes states are well positioned to address the needs and responsibilities of the marine aquaculture community, including responsible environmental approaches, through integrated aquaculture research and development efforts. Sea Grant can marshal the necessary talent, including biologists, engineers, sociologists, market analysts, legal experts and economists. Sea Grant and its allies will focus on the short-term needs facing coastal marine aquaculture as well as the long-term needs for developing recirculating systems, enhancement protocols and offshore aquaculture based upon environmentally sustainable practices and approaches for the production of food and ornamental species. In fact, the 1999 Coordinated Marine Programs to Assess and Sustain the Seas national initiative invited by the Office of Science, Technology and Policy recommended that a substantial increase in federal funding is needed to achieve the nation's goals in marine aquaculture.

Defining an agenda—priorities for action

Culture System Technology Development: Marine aquaculture operations will involve three distinct environ-

ments: (1) the nearshore/ coastal region; (2) the Exclusive Economic Zone seafloor; and (3) the open ocean surface and water column. Utilization of each environment presents unique system engineering, technological and security challenges.

Nutrition and Feeds: Research and development efforts must evaluate feed components in relation to organism growth and final product quality, as well as the stability of formulated rations and alternative protein sources.

Genetics of Cultured Species: Research must identify gene complexes responsible for reproduction, growth, disease resistance and other desirable traits so that state-of-the-art genetic manipulations can be applied to marine species.

Health and Disease: We must better understand the immune systems of marine organisms and the potential for the production of vaccines in finfish and shellfish. A great need exists for improved diagnostic capabilities for aquatic pathogens and parasites, new therapeutic treatments, and streamlining the approval process for applying therapeutics in aquaculture.

Stock Enhancement: The potential for rebuilding collapsed wild fish stocks through the use of aquacultured fish must be fully explored, including a solid scientific understanding of the impacts of hatchery-produced fish.

Public Policy and Law: Agencies involved in developing, implementing and enforcing aquaculture policies must partner with environmentalists, universities, industry and citizens in a comprehensive program to establish a viable coastal and offshore marine aquaculture industry based upon a sound understanding of the ecosystem, the economy and the particular needs of marine aquaculture. Sea Grant's access to university-based intellectual capital, plus its strong links to coastal communities, gives it a unique capability to assemble expertise to address:

- Conflicts among all users of coastal and marine resources potentially affected by marine aquaculture;
- The need for environmentally sensitive and science-based regulation, including the careful siting, operation and monitoring of coastal and offshore facilities;
- Use of exotic species in aquaculture and protection from undesired introductions of these species into local waters;
- Leasing requirements and fees for such new business ventures; and
- Navigational considerations regarding existing shipping lanes and the needs of public security and safety.

Socioeconomic Issues: Marine aquaculture has been hampered by the lack of a coordinated effort among stakeholders to achieve successful commercial development in a socially and environmentally sensitive manner. Sea Grant can integrate expertise from universities, agencies and the private sector to:

- Address scientific, engineering and socioeconomic needs;
- Assess and propose technologies and practices to protect the environment;
- Form partnerships with private industry to transfer technology, design market strategies and develop spin-off industries;
- Provide marketing and technical expertise for new or prospective entrepreneurs; and
- Enhance scientific literacy in the nation's schools by using aquaculture as a teaching tool.

Reaping the benefits

Through its long-standing leadership in aquaculture and its partnership with university-based researchers, policymakers at all levels of government, environmental advocates, aquaculture professionals and coastal communities, Sea Grant is poised to catalyze efforts to:

- Increase the value of domestic aquaculture production from $900 million to $5 billion by 2025;
- Offset the current $7 billion annual U.S. trade deficit in seafood through increased domestic production from marine aquaculture;
- Raise per-capita consumption above the current 15 pounds per annum through increased availability of domestically produced seafood in the U.S. marketplace;
- Rebuild wild fisheries stocks through enhancement programs;
- Ensure the sustainability of marine aquaculture;
- Increase annual U.S. exports of aquaculture goods and services; and
- Spur job creation in both the production and processing of fishery products, thereby revitalizing fishing communities devastated by collapsing fisheries industries.

Sea Grant

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.

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