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Woods Hole Sea Grant: 1996-1998 Projects

School Structure and Individual Feeding Behavior of Bluefin Tuna, Thunnus thynnus

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Bluefin tuna are an important commercial and recreational fish species from Labrador to Brazil. Unfortunately, tuna behavior is difficult to study in the field, and traditional stock assessment techniques are inaccurate. To help remedy these problems, researchers, in collaboration with The New England Aquarium, will study tuna schooling and feeding behavior by analyzing video of captive bluefin. Exploring bluefin behavior will aid in developing new stock assessment techniques, such as aerial photographic assessment. Investigators hope that, ultimately, this study will help with long-term management of this important but poorly understood species. (R/B-138)

Development of Phenotypic Markers for Identification of Seeded Scallops

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The bay scallop Argopecten irradians is an important commercial shellfish in Massachusetts, particularly on the islands of Nantucket and Martha's Vineyard. Recent years of overfishing have resulted in low populations. As such, it has become imperative to implement alternative harvesting methods such as aquaculture. Before large-scale enhancement projects begin, it is important to determine whether planted scallops contribute to the population or whether they are being consumed or "farmed" before they are able to reproduce. To find out, researchers in collaboration with The Nantucket Research and Education Foundation (NREF) will develop visible and DNA-based phenotypic markers for scallop identification. The markers will provide information for direct estimates of seeded scallop survival in their natural habitat. Through this project, investigators hope to demonstrate both the success of hatchery-bred scallops set in the wild as well as the viability of focused aquaculture programs in fisheries enhancement. (R/A-34)

The following four projects are part of a multi-institutional initiative titled "Regional Fisheries Issues," made possible by a special National Sea Grant College Program award.

Reproductive Strategies and their Contribution to Genetic Diversity and Life Cycle Flexibility in the Commercially Important Squid, Loligo pealei

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In the northeastern U.S., fisheries resources (especially in the Georges Bank ecosystem) have been altered drastically by human fishing pressure. The northeast squid fishery for Loligo pealei has increased in value to approximately $32 million (23,000 metric tons), partly due to increased fishing effort that is in some degree related to reduced groundfish resources. Unfortunately, our knowledge of the life history of this squid is poor and fishery managers believe the fishery is maximally exploited. Two recent developments in the fishery are of great concern to the local squid fishery managers: (1) the rapidly developing winter offshore fishery that concentrates on pre-spawning adults and now produces 90% of the total landings, and (2) a new export market that has developed for juvenile pre-recruits. This Sea Grant-supported study will permit us to acquire baseline information on reproductive strategies that affect gene distribution before this heavily fished resource suffers the same fate as groundfishes. Field observations and sampling plus laboratory behavioral experiments will be assayed by DNA fingerprinting to determine details of the mating system. The results will give us better predictive information about the effect of targeted fishing on reproductively active squids. (R/B-141)

Predatory Impact of Lobate Ctenophores on Commercially Important Fishes and their Prey

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Ctenophores are voracious macroplanktonic carnivores that use their tentacles or filmy oral lobes to catch their food. Because they grow and reproduce rapidly, populations of ctenophores can dramatically alter the structure of marine communities by predation on smaller zooplankton. For example, the lobate ctenophore Mnemiopsis leidyi was accidentally introduced into the Black Sea in 1982 from ship's ballast water. Its predation on zooplankton and larval fish there has caused severe damage to commercially important fish stocks and led to the complete loss of regional anchovy fisheries in the Black Sea and neighboring Sea of Azov. On our shores, Mnemiopsis exerts a strong influence on copepod populations in estuaries and coastal waters. Its close relative Bolinopsis infundibulum may significantly impact prey populations that support cod and haddock fisheries on Georges Bank. This Sea Grant-supported study will use field and laboratory studies to examine the mechanisms these ctenophores use to catch their prey; this information may enable us to predict what kinds of prey will be vulnerable. This study benefits from ongoing research investigations by the researcher and his colleagues in the NSF and NOAA-sponsored Global Oceans Ecosystems Dynamics (GLOBEC) program, which is investigating the deterioration of northeastern U.S. cod and haddock stocks on Georges Bank. This comparative study of both Mnemiopsis and Bolinopsis will provide a better understanding of how introduced predators can impact existing species and monopolize new habitats. The results will help in the development of management strategies for these predators in the Black Sea, recently-invaded Mediterranean Sea, and potentially endangered Georges Bank ecosystems. (R/B-134)

Behavioral and Hydrodynamic Components of Postlarval Bivalve Transport within Coastal Embayments

Lauren S. Mullineaux, Woods Hole Oceanographic Institution

This Sea Grant-supported study, a combination of manipulative field investigations and laboratory flume experiments, will yield valuable information about soft shell clam (Mya arenaria) recruitment and its influence on population dynamics and distributions. Commercial harvesting of these clams contributes tens of millions of dollars annually to the New England economy. The recruitment of soft-shell clams is, however, notoriously variable, both in time and space: while some years see virtually no clams settling in a particular bay, other years see clams settling at very high densities. Recruitment within a bay can be highly localized. Because recruitment has a strong influence on soft-shell clam population dynamics and productivity, variations can make the fishery difficult to manage. The present study focuses on spatial variation by investigating the interactions between burrowing behavior and hydrodynamic transport of clam larvae. The results will

facilitate our ability to predict the locations of sustained recruitment, thereby providing valuable information for those utilizing the soft shell clam fishery and fishery managers. Another component of the study will provide specific information on the mechanisms by which covering the sediment with mesh netting affects the transport and recruitment of soft-shell clam postlarvaeÑinformation of direct relevance to the aquaculture industry and fisheries management. (R/B-142)

Statistical Modelling of Environmental Effects on Recruitment in Georges Bank Haddock

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Achieving sustainability in commercial fisheries is perhaps the most difficult problem facing the managers of marine resources. Sustainability is achieved when recruitment balances removal. The "recruitment" to a fishery refers to the addition of fish to the exploitable stocks each year. It also determines the prospects for recovery in a depleted fishery in which fishing mortality has been reduced. Understanding the sources of variability in recruitment is therefore critical for managing a fishery. This Sea Grant study will detect and model physical environmental effects on recruitment to the Georges Bank haddock (Melanogrammus aeglefinus) stock. For both scientific reasons and reasons connected to fisheries management, there is great interest in understanding--and ultimately modeling--the way in which the physical environment influences recruitment. While earlier attempts to model the physical environmental effects into the stock-assessment relationship have been made, this approach represents an improvement because it explicitly accounts for the stock-size effect on recruitment. Focusing on the Georges Bank haddock is ideal for three main reasons:

(1) they are economically important and currently depleted;

(2) they are, apparently, highly sensitive to variations in the physical environment; and

(3) there is relatively long time series data available. In addition, the methodology developed during the course of this project will be more widely applicable to stocks other than haddock. (R/O-31)

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