CMER RESEARCH TOPICS - 2005

The following list of research topics was prepared by the staff of the Northeast Fisheries Science Center (NEFSC) and the Northeast Regional Office for guidance to faculties at the Virginia Institute of Marine Science, Hampton University, the University of Rhode Island, Rutgers University, and University of Massachusetts in developing cooperative research projects for funding through the Cooperative Marine Education and Research (CMER) Programs. Faculty interested in responding to any of these suggested topics, or a topic of their own, must submit a 2-page pre-proposal to their respective CMER Director no later than December 17, 2004. The pre-proposal should include an introduction or background section, a brief discussion of the proposed methods, anticipated results, cooperation required from NOAA (e.g., staff assistance, access to data, equipment needs, office and laboratory space, vessel time) and an anticipated budget. Please see the section on the format of pre-proposals located on the web page http://www.wh.whoi.edu/cmer/.

High priority topics include: preparation of antibodies specific to bluefish; pollutant effects on bluefish; habitat use and recruitment of weakfish; and understanding the behavior of bluefish.

Faculty are encouraged to contact the individuals identified with each topic prior to submitting the pre-proposal to ensure that it is responsive to the research need. Phone numbers of the NOAA contacts are listed with each topic description. Faculty who are submitting a pre-proposal on a topic of their own choosing are also encouraged to develop collaborations with NEFSC scientists.

Investigators with continuing projects should submit a brief progress report with updated objectives and budget to their program director before December 17, 2004.

CMER Program Directors:

University of Massachusetts - Dr. Kevin Friedland (413-545-2842, e-mail Kevin.Friedland@noaa.gov)

Rutgers University - Dr. Sybil Seitzinger (732-932-6555 x342, e-mail sybil@imcs.rutgers.edu)

University of Rhode Island - Dr. Lawrence Buckley (401-874-6671, e-mail lbuckley@gso.uri.edu)

Virginia Institute of Marine Science/Hampton University – Dr. Richard Brill (804-684-7875, e-mail Richard.Brill@noaa.gov)

1) ATLANTIC WOLFISH – BYCATCH CHARACTERIZATION AND GENETIC ANALYSIS

In the western North Atlantic, Atlantic wolffish (*Anarhichas lupus)* range from the Gulf of Maine to western Greenland and southern Labrador with occasional strays having been documented as far south as New Jersey (O'Dea et al. 2002). West of the Scotian Shelf, the highest abundance of this species appears to be in southwestern portion of Gulf of Maine from Jeffreys Ledge to Great South Channel at depths of 80 to 120 m.

The Northeast Fisheries Science Center (NEFSC) spring bottom trawl survey biomass index fluctuated from 1.0 kg/tow to 2.0 kg/tow between 1968 and 1988, but has shown a consistent downward trend since the late 1980s. The 1997 through 1999 biomass indices were less than 0.2 kg/tow, which is the lowest in the survey time series at about 8% of the 1968-1988 average. The decline since the late 1980s indicates that biomass has been substantially reduced, and that this stock remains overexploited and severely depleted. In 1970, total U.S. landings from the southwestern portion of the Gulf of Maine were approximately 200 metric tons (mt). This increased to approximately 1,200 mt in 1984 but declined sharply to less than 500 mt in 1992. Landings declined even further to 300 mt in 1998 and 249.6 mt in 2001.

This species is also affected by indirect negative impacts from human related activities. Examples include loss and degradation of habitat due to use of otter trawls and dredges. Bottom trawling causes the re-suspension of bottom sediments, which can smother spawning areas, damage gills, and release settled toxic heavy metals.

Due to these demographic and diversity concerns, Atlantic wolffish was designated as a Species of Concern under the Endangered Species Act (ESA) in 2004. While there is limited information on this species, genetic data indicating whether distinct population segments exist is lacking. This information is crucial to a comprehensive review of the status of this species. It has been theorized that the geographical and depth-related variability in the reproductive season of Atlantic wolffish may indicate that discrete geographical populations of Atlantic wolffish exist (O'Dea et al. 2002). According to O'Dea et al. (2002), these populations may have distinct and different life histories, and this is a possibility that requires further study.

Also, because this species is not the subject of a directed fishery, it is not presently managed. However, it is taken as bycatch. The extent and the effects of this take are unknown. Thus, a review of reported landings combined with the spatial and temporal distribution would be helpful in assessing the effects of this take on the species.

We would invite proposals to analyze worffish bycatch. Finclip can be recovery with the help of port agents for use as microsatellite DNA markers for genetic analyses. Information on the location of capture and size of the fish caught could be analyzed with the help of the Fishery Statistics Office using information from the Fishing Vessel Trip reports on locations of Atlantic wolffish captures, length and weight, depth, gear type, and date landed. This information should be used to generate a fishery dependent distribution map for this species utilizing GIS.

(Contact: Kim Damon-Randall, 978-281-9328 ext 6535, Kimberly.Damon-Randall@noaa.gov)

2) INCREASED PUBLIC AWARENESS AND INVOLVEMENT IN THE MARINE MAMMAL AND SEA TURTLE STRANDING NETWORK

Along the east coast, NOAA Fisheries has established a network of organizations and entities to respond to stranded marine mammals and sea turtles. It is critical that a strong,

effective network be in place to increase the potential for rapid response and the likelihood of successful response and rehabilitation. Stranded animals serve as a tremendous source of information providing indicators of ecosystem problems and perturbations as well as signs of human interaction.

A request is made for CMER proposals to investigate ways in which to increase the efficiency of the existing stranding network and the utility of the scientific data collected from stranded animals. The maintenance of a strong stranding network is critical to ensuring the ability of NOAA Fisheries to meet its mandates under the Endangered Species Act and Marine Mammal Protection Act.

One component of a plan for an improved stranding network could be the creation of a single 800 number for reporting all stranded marine animals. This would reduce confusion and greatly assist in our outreach efforts with the public. This could result in increased response time and more comprehensive data collection.

The second component of this project would be an analysis of the data collected from the stranding network. An analysis of how the data collected can be utilized to gain insights into threats to particular species or to the larger marine ecosystem should be conducted. Options for utilizing the data collected through the stranding network to inform management measures should be identified.
(Contact: David Gouveia, 978-281-9280, David.Gouveia@noaa.gov)

3) PREPARATION OF MONOCLONAL ANTIBODIES FOR CYTOCHROME P450 1A (CYP1A) AND VITELLOGENIN (Vtg) PROTEINS THAT ARE SPECIFIC TO BLUEFISH, *POMATOMUS SALTATRIX,* AND ARE APPLICABLE FOR USE IN ENZYME LINKED IMMUNOASSAYS (ELISA) AND WESTERN BLOT.
There are no antibodies currently available for these two critical biomarker proteins that have been purified from bluefish. Both proteins (CYP1A and Vtg) are commonly used as indicators of exposure of fish to anthropogenic contaminants in the habitat. Researchers attempting to answer the question of exposure are forced to use antibodies produced from other fish species. It is presently unclear whether any of the different antibodies currently available are similar enough that they will cross-react with the appropriate bluefish protein. The fact that *Pomatomus saltatrix* is the sole member of the Family: *Pomatomidae*, means there are no closely related species that can be substituted. This makes it difficult to determine which available host-species would make the most appropriate surrogate. We recently succeeded in using a striped bass monoclonal antibody for detecting artificially induced vitellogenin expression in young-of-the-year bluefish, however the sensitivity of detection using a non-bluefish antibody is not known for the purpose of quantification.

Companies like Biosense and Cayman Chemicals currently sell antibodies for both of these proteins produced from several different host-species, and they are regularly adding new species when they become available. Bluefish is a popular recreational and commercial species which has experienced a substantial decline in landings in recent years, creating concerns about stock sustainability. The availability of specific antibodies for CYP1A and Vtg would provide an important monitoring tool to determine the extent and magnitude of the populations' exposure to anthropogenic contaminants, a critical factor in understanding the health of the bluefish populations.

(Contact: Ashok Deshpande, James J. Howard Laboratory at Sandy Hook, 732-872-3043 ashok.deshpande@noaa.gov)

4) INVESTIGATION OF POLLUTANT EFFECTS ON LIPID CONDITION OF BLUEFISH.

The objective of this project is to investigate the causes of enhanced lipid storage in juvenile bluefish living in PCB-contaminated environments. Recently, J. Samson of this laboratory found that young bluefish from the Hackensack River, a known area of polychorobiphenyl (PCB) contamination, had significantly higher triacylglycerol (TAG: storage fat) content than those from the relatively pristine Great Bay, NJ (1). This parallels other findings that lipid metabolism may be altered by PCB exposure (2,3). Partitioning of energy resources between fat accumulation, muscle protein, and gonadal development during growth is a critical issue for survival and recruitment, so factors that alter this process are of potentially great importance. The investigator is asked to devise a program that will address the following issues:

a) Is this phenomenon related to PCB exposure, or to site- or year-specific environmental conditions? A field sampling program is suggested with laboratory lipid/protein analysis for bluefish from several sites of known PCB contamination versus relatively pristine sites. Since lipids are important to survival, the existence of site- or year-specific differences in storage lipid is of great interest, even if not related to PCB exposure.

b) How is the alteration manifested? Is TAG accumulation traded off against phospholipid accumulation, muscle protein growth or gonadal development? The same sampling program suggested above may provide data to bear on this issue. Here again, the outcome is of great interest, even if not related to PCB exposure.

c) How does the alteration arise? Is some difference in diet and/or activity level responsible, or is there an alteration in metabolic pathways? Experiments and/or field sampling are suggested in order to distinguish possible effects of diet, other environmental factors, and metabolic changes related to alterations in lipid pathway enzyme production.

(Contact: Vincent Guida, Phone: (732) 872-3042, e-mail vincent.guida@noaa.gov)

References:

1. Samson, J. 2004. pers. comm.

2. Adams, SM, KD Hann & JJ Beauchamp. 1994. Environ. Toxicol. Chem. 13:1673-1683.

3. Feeley, MM. 1995. Environ. Health Perspect. 103(9) suppl: 7-16.

5) DETERMINATION OF TRAWLABLE AREAS IN THE GULF OF MAINE AND GEORGES BANK

Both fishery resource surveys and commercial fisheries harvesters rely on information concerning trawlable habitat to conduct bottom trawling operations in the Gulf of Maine and Georges Bank. Federal and State agencies generally conduct stratified random surveys to index abundance and biomass of marine finfish and invertebrate resources. This random survey design results in the placement of sampling locations in areas that may not be suitable for bottom trawling operations. Trawling in these areas results in gear damage or loss and potentially in disruption or destruction of key habitat characteristics. The introduction of side scan and multibeam acoustic technology has resulted in detailed descriptions of the bottom features for some areas of the Gulf of

Maine and Georges Bank. Several federal and state agency survey programs have considerable information in the form of tow locations where gear damage has been encountered in the past. In addition, commercial fishery stakeholders also maintain extensive records of "hangs" and other features that inhibit trawling operations. The objective of this project would be to develop GIS coverages that describe areas suitable for bottom trawling and areas where bottom trawling should be avoided. Key activities would include gathering information from governmental and stakeholder sources to incorporate into GIS coverages. Once these coverages have been established a key product output could include estimates of the total trawlable area within certain regions of the Gulf of Maine and Georges Bank. Products produced by this project will have considerable value to government scientists and the commercial fishery sector. (Contact: Russ Brown, Resource Surveys Branch, (508) 495-2380, rbrown@whsun1.wh.whoi.edu)

6) MULTI-SPECIES PREDATOR-PREY MODELING FOR MARINE FISHES OF THE NORTHWEST ATLANTIC

Over the last three decades, the Northwest Atlantic ecosystem has undergone dramatic changes in biomass partitioning, fisheries production, and species composition. The response of this fish community to sustained perturbations is directly related to intra- and interspecific interactions. Thus, we research the feeding ecology of the fish in this community to evaluate critical linkages between ecologically and economically valuable stocks. Particularly, we have executed field and laboratory studies that are coupled with a temporally and spatially broadscale (>30 years) survey to assess ecosystem dynamics and to quantify predator-prey interactions. Critical to the enhancement of our understanding and management of this ecosystem is the development of multi-species models, emphasizing the magnitude of natural mortality (i.e. predator-prey interactions) relative to fishing mortality. Modeling activities associated with our food habits database include multi-species VPA, time-series analyses, aggregate species production models, structural dynamic models, and classical food web analyses. Application and extension of these or other models are encouraged, with the ultimate goal being a highly interactive series of models useful for real-time simulation to evaluate the consequences on the yield, productivity and community structure that alternative harvesting strategies might have on important species in this ecosystem. Thus, the primary focus of this project will be to develop multi-species models that simulate species interactions in this community. (Contact: Jason Link, Food Web Dynamics Program, (508) 495-2340, jlink@whsun1.wh.whoi.edu)

7) INTERACTION STRENGTHS AMONG SPECIES OF THE NORTHWEST ATLANTIC FOOD WEB

Research on the Northwest Atlantic food web has indicated that species interaction strengths should be of limited magnitude due to theoretical constraints for system-wide stability, multiple and abundant alternate-prey, the generalist and omnivorous nature of most predators in this ecosystem, the openness and higher energy content of marine systems, and limited spatial-temporal overlap between predators and prey. As we continue to examine the causal mechanisms for historic changes in this fish community, it is clear that the multi-variate response of this fish community to sustained over-

exploitation is directly related to intra- and interspecific interactions. Multi-species simulations also merit an understanding of the key interactions impacting these fish populations. Thus, elucidating the most important species interactions that determine community composition and dynamics remains a major goal. The primary focus of this project will be to assess relative interaction strengths (population flux rates, consumption rates, mortality rates, interaction coefficients, the community matrix, etc.) of the species in this ecosystem, determine the strongest species pairings from the >2000 possible, and estimate the more important interactions. In addition to access to over a 30 year database of food habits for over 120 species (>450,000 stomachs), opportunities exist for specified field and laboratory studies as needed.
(Contact: Jason Link, Food Web Dynamics Program, (508) 495-2340, jlink@whsun1.wh.whoi.edu)

8) HABITAT USE AND RECRUITMENT DYNAMICS IN WEAKFISH IN THE RARITAN BAY / HUDSON RIVER ESTUARY ECOSYSTEM
Weakfish, *Cynoscion regalis*, is the target of an important recreational and commercial fishery throughout the Mid-Atlantic region. The abundance of weakfish adults, and especially that of young-of-the-year (YOY) juveniles, varies dramatically from year to year. Inter-annual variability in abundances appears to be especially pronounced in waters of southern New England and the New York Bight which are near the northern limit of the species' geographic range. Scientists at the NOAA-Fisheries Howard Laboratory, Sandy Hook, are initiating a new research effort on weakfish of the Raritan Bay / Hudson River Estuary with emphasis on the relative contribution to recruitment of spawning (i.e., the timing and amount of egg production and potential maternal effects) and post-settlement processes. We seek collaborators who will complement this effort by conducting research on local (RB/HRE) weakfish in one of three theme areas:

1. Habitat use and movement of YOY weakfish. Weakfish are believed to move up-estuary upon settlement but to nevertheless be broadly distributed below the salt front as YOY juveniles. The quality of these habitats for weakfish production and the degree of weakfish movement through them are largely unknown. A suggested approach would be to use elemental analysis of YOY weakfish otoliths in order to determine habitat use and movement along the estuarine gradient. Such an approach would be integrated with ongoing collections and experimentation on YOY weakfish and analyses of otolith microstructure by NOAA scientists. A well-designed laboratory validation experiment on the relationship(s) between key environmental variables and the elemental composition of otoliths would lay a solid foundation for these types of studies.

2. Ecosystem differences in production potential of weakfish. It remains unclear whether reproduction and processes affecting weakfish recruitment success are region-wide and generally applicable across systems or are specific to local systems (e.g., Raritan, Delaware, and Chesapeake Bays). A suggested approach would be to gather and compare parallel data to those being collected on weakfish from in the RB/HRE system by NOAA scientists (i.e., adult demographics and YOY survival / otolith-based evidence of differential survival) for weakfish from other systems in the southern New England / Mid-Atlantic Bight.

3. An integrative, process-specific, population model of weakfish. One challenge in fisheries ecology is to identify the key variations among individual fish that affects their fate and likelihood of recruitment. Such a challenge requires a multi-pronged investigative effort.

A suggested approach would be a physical-biological coupled process model of weakfish for the RB/HRE system. Such a model might be individual-based and include processes from reproduction through the first year of inshore nursery existence in weakfish, and would take advantage of existing abundance data and experimentally derived process studies from the NOAA scientists at Sandy Hook.
(Contact: Chris Chambers, Howard Lab, 732 872-3075, chris.chambers@noaa.gov)

9) TAXONOMIC ANALYSIS OF THE WEAKFISHES AND SEA TROUTS
Conduct an alpha-level taxonomic analysis of the weakfishes and sea trouts of the genus *Cynoscion* concentrating on the 4 western Atlantic species including investigations of hybridization in this genus. If material is available, include as many as possible of the 7 additional species found in northern South America. These fishes form an important components of the sport fishery.
(Contact: Bruce B. Collette, NMFS National Systematics Laboratory, 202-633-1287, collettb@si.edu)

10) PHYLOGEOGRAPHIC RELATIONSHIPS OF GLOBAL BLUEFISH POPULATIONS
Investigate phylogeographic relationships of global bluefish populations by sequence analysis and combine this with a similar analysis of cobia relationships. Cobia are considered to be closely related to bluefish and have a similar almost world-wide distribution. NMFS needs to understand the population structure of these species which are important elements of sport fisheries in order to manage them efficiently.
(Contact: Bruce B. Collette, NMFS National Systematics Laboratory, 202-633-1287, collettb@si.edu)

11) DEVELOPMENT AND APPLICATION OF AN ENVIRONMENTAL ACCOUNTING METHODOLOGY TO ESTIMATE THE ASSET VALUES OF FISHERY RESOURCES IN THE NORTHEAST SHELF LARGE MARINE ECOSYSTEM
NOAA recently committed itself to an ecosystem approach to management expecting to increase the value of fishery and other living marine resources and their environments. Although the annual economic activity of fisheries is measured each year from landings statistics, we do not have a methodology to measure the capitalized value of in situ fishery resources. That is, we measure economic flows but not economic stocks. Policy evaluation and the economics of fishery resources are incomplete without asset valuation because high levels of economic activity can mask asset losses caused by resource depletion, degradation, or misallocation.

Several developments now make it possible to conduct environmental accounting research on fishery resources. First, the National Research Council (NRC) has reviewed the accounting methodologies developed by economists to expand the national economic accounts (e.g., NIPA, GDP) to include the environment. The NRC's review was positive, and it actually singled out fishery resources as an important area needing attention. Second, a conceptual model described as a portfolio approach to multi-species management has been published by NEFSC staff and now needs to be applied in a case study of the Northeast Shelf Large Marine Ecosystem (LME). The portfolio approach

requires estimates of the expected value and uncertainty of fishery resource returns (changes in asset values between years plus resource rent). Finally, the Northeast Fisheries Science Center (Center) has developed two types of data during the past several years that are required for environmental accounting. Fishing cost data have been collected from major fisheries in the region by CMER projects and now by the Observer Program. In addition, the EMAX Working Group is developing biomass estimates of the populations of finfish and shellfish in the Northeast Shelf LME.

The research project will build on two recent studies of the asset value of Atlantic sea scallop biomass. Methods will be reviewed, and an accounting methodology will be developed that uses existing data on biomass, revenues, costs, and fishing capital to estimate the asset value and resource rents of the major fishery resources (e.g., groundfish, sea scallops, lobster, small pelagics) in the Northeast Shelf LME during recent years. The Center will provide data for the project, and a Center staff person will collaborate closely in the research.
(Contact: Steve Edwards, 401-782-3313, steve.edwards@noaa.gov)

12) HUMAN DIMENSIONS OF ECOSYSTEM BASED MANAGEMENT
Increasing concerns to create management that is ecosystem-based will require input from social scientists interested in human-ecosystem relationships in order to rectify conceptions of fishermen as simply predators. Rather, the role of culture demands an understanding of the motivations and values underlying the practices and decision-making of different fishermen, while ecosystem management demands understandings that are temporally and spatially sensitive. Thus analyses using ethnographic and survey techniques are sought that will document seasonal and spatial changes in fishing practices of uniquely identifiable vessels and/or individual fishermen, with particular emphasis given to understanding the reasons for such changes.
(Contact: Julie Olson, Julia.Olson@noaa.gov, or Patricia.Clay, Patricia.Clay@noaa.gov)

13) CONTEXT AND CULTURE IN THE GROUNDFISH HOOK SECTOR ALLOCATION
The current Multispecies Plan of the New England Council grants a group of hook fishermen, primarily based on Cape Cod, a sector allocation. This is an unusual management tool being tried for the first time in the Northeast. While much of the impetus behind the allocation came from the Cape Cod Hookfishermens' Association (CCHA), not all members of the sector allocation group belong to the CCHA. A study, through archival and interview data, of the process of the creation of this new tool and of its ongoing implementation would provide needed information on allocation and quota management other than ITQs.
(Contact: Patricia Pinto da Silva, psilva@whsun1.wh.whoi.edu)

14) HISTORICAL USE PATTERNS AND LOCAL FISHERIES KNOWLEDGE
Recently NMFS has begun to undertake more collaborative research and to tap into fishermen's knowledge in a more systematic fashion. A social science rather than a strictly biological study involving interviews with established fishermen, archival data, possibly interviews with scientists, and preferably including a GIS component, would increase our database of such knowledge generally. It is preferred that this project also

broaden the geographical scope of such projects, which have been conducted in some areas of Maine, Massachusetts, and Rhode Island. New communities in these states or in other Northeast states would all be welcome.
(Contact: Lisa L. Colburn, lcolburn@whsun1.wh.whoi.edu)

15) BIOECONOMICS OF SURF CLAM HARVESTING: WILL "LOCAL DEPLETION" ISSUES LEAD TO AN EVER SMALLER FISHERY?
Most surf clam harvesting takes place on a relatively small area of the resource's distribution. Declining cpues indicate, to some, a need to close that area. In other areas the productivity of the resource is low, possibly because of inattention. This lack of attention is linked to the higher cost of gathering smaller clams. What will be the likely time path of harvesting given variations on these two assumptions? Is there a role for remedial harvesting in this ITQ fishery? How could it come about?
(Contact: Phil Logan, 508 485 2354, Phil.Logan@noaa.gov)

16) STOCK IDENTIFICATION OF NORTHEAST FISHERY RESOURCES
Stock assessment and management require identification of self-sustaining groups within a species. However, stock identification, stock delineation and stock composition analysis of mixed-stock fisheries are needed for many fishery resources off the northeast U.S. Sock identification involves interdisciplinary analysis if life history information, genetics, geographic variation of phenotypic traits, movement and environmental signals. Advances in several of these disciplines warrant reanalysis and re-evaluation of stock structure for most northeast fishery resources.
(Contact: Steve Cadrin, NEFSC Woods Hole Lab, 508 495-2335, steven.cadrin@noaa.gov)

17) UNDERSTANDING THE BEHAVIORAL AND PHYSIOLOGICAL EFFECTS OF TAGGING IN BLUEFISH.
One of the hypotheses concerning the observed decline in catch rates of Atlantic coast bluefish is a shift in habitats used by adult fish. Habitat use by bluefish can be addressed with studies designed to follow fish throughout the coarse of at least one annual migratory cycle, and recently, coastwide tagging programs for bluefish have been proposed. Conventional tagging studies provide information on capture and release points, but their contribution is limited with respect to understanding complex seasonal- and size-related movement patterns, so the emphasis has been on newly developed ultrasonic and archival (i.e., electronic data recording) tags. Ultrasonic tags, when used in conjunction with moored receivers can provide information on location, whereas archival tags record ambient temperature and depth, and provide a daily estimate of geolocation. The use of such tags in bluefish is only now being attempted. However, before data from a large-scale, coastwide tagging program can be interpreted, it is essential to develop methods to optimally handle live bluefish, administer anesthesia, and perform surgical procedures to implant tags. In addition, short- and long-term effects of tag implantation must be thoroughly understood because analysis of data from tagging studies require the assumption that tagged fish are indistinguishable from untagged fish, and that the information gathered from tagged fish is representative of the species. For these to be viable assumptions, tagged fish must school with untagged fish, be physiologically

capable of normal predatory and escape behaviors, continue to grow at normal rates, be reproductively viable, etc. Yet, there have been few examinations of the behavioral and physiological consequences of tag implantation in fish, and none specifically on bluefish. A study that measures the performance of bluefish which have been surgically implanted with transmitters or archival tags is necessary; the study should address both the behavioral and physiological aspects of response.
(Contact: Mary Fabrizio, 732-872-3129, mary.fabrizio@noaa.gov)

18) IDENTIFICATION OF DISCRETE TAUTOG NURSERY AREAS USING OTOLITH MICROCHEMISTRY

Nearshore ecosystems with an abundance of juvenile fishes have long been assumed to be important nursery areas. Abundance data alone, in the absence of mortality and growth data, cannot determine the relative importance of different nursery areas. Areas with high abundance may also experience high mortality and therefore contribute relatively little to the adult population than areas of lower abundance, but higher survival (Beck et al. 2003). The difficulty lies in linking juveniles in the nursery areas with adults that have moved on to different habitats. This study we are proposing is the first step in making those linkages for tautog in Long Island Sound. Tautog (*Tautoga onitis*) are an important recreational fish in whose numbers have remained near historical lows in recent years (Gottschall et al. 2002).

Recent advances in the analysis of otolith microchemistry have made progress in linking nursery areas to adult populations. The ratio of strontium and calcium values in otoliths can be used to identify fish that inhabit areas of similar salinity (Secor et al. 1995). Multivariate analysis of other elements present in otoliths has been successful in identifying nursery areas and migration patterns (Edmonds et al. 1989, Edmonds et al. 1991, Campana et al. 1994, Thresher et al. 1994, Campana et al. 1995, Secor and Zdanowicz 1998).

As part of an ongoing study of nearshore habitats, we propose to collect juvenile tautog with a beach seine and/or traps at 6-8 locations along the Connecticut coast and evaluate their abundance with standardized sampling and their growth rate using RNA/DNA ratios (Kuropat et al. 2002) and otolith increment analysis (Sogard et al. 1992). Growth rates will be used as a proxy for habitat quality. Collections would be made twice in late August and early September when juvenile tautog are abundant in the nearshore zone (Pereira 1999). We are interested in a graduate student collaborator who could analyze otolith microchemistry from these juveniles and determine whether or not significant differences existed in fish collected across our sample sites. Should these results prove promising, we would proceed to examination of adult otoliths in future years in an effort to evaluate relative contributions of different nursery areas to the adult population.
(Contact: Jose J. Pereira, Aquaculture and Enhancement Division, Milford Laboratory, 203-882-6538, jose.pereira@noaa.gov)

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Thresher, R. E., C. H. Proctor, J. S. Gunn, and I. R. Harrowfield. 1994. An evaluation of electron-probe microanalysis of otoliths for stock delineation and identification of nursery areas in a southern temperate groundfish, Nemadactylus macropterus (Cheilodactylidae). Fishery Bulletin 92:817-840.

19) STATISTICAL PROPERTIES AND OPTIMAL ALLOCATION FOR ESTIMATES OF CATCH AT AGE

Estimation of landings at age of commercial fish species in the Northeast Region is based on multi-stage shoreside sampling: total landings of a stock are estimated from dealer reports and logbooks. Landings at length are then estimated using length samples, often stratified by area, market category, gear type and season. Landings at length are converted to landings at age using age-length keys, often stratified by area and season. These estimates are combined with estimates of discard at age (made separately) to yield total catch at age. Optional allocation of sampling effort to the latter two stages and estimation of variance is complex.

An alternative method of estimating catch at age is to use samples of catch, catch length composition and catch age composition from observer data (collected at sea on commercial fishing vessels), to estimate total catch at age for a stock.

Statistical properties (e.g., variance) of estimates from the two sampling systems are currently unknown. In addition, stratification/allocation schemes need to be developed for candidate stocks or groups of stocks sampled by shoreside methods to determine how much sampling would be required at each stage to meet alternate levels of precision in catch at age estimates included in analytic stock assessments.

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20) CHARACTERIZATION OF THE "OFFSHORE" AMERICAN LOBSTER RESOURCE WITH COMPARISON TO HISTORIC STOCK CONDITIONS

The US offshore American lobster (*Homarus americanus*) resource has been considered an important component of the overall population, both in terms of the fishery it supports and possible augmentation of the nearshore components. This portion of the resource has been actively fished for a considerably shorter period than the more easily accessible coastal portion. However, the effects of fishing are apparent in the current size structure of the existing population.

Recently studies have been attempted to characterize the offshore resource, but they have been a bit haphazard. A study, with cooperation of harvesters to collect information to define the current status and compare that to historic information mined from NEFSC data gathered during exploratory fisheries/surveys during the 1950's through the early 1970's along with present day bottom trawl surveys. The project would require developing a sampling protocol for the offshore fleet, conducting sampling trips as well as possibly training the harvesters to collect data. The region should include at least Georges Bank and eastern Gulf of Maine (NMFS Statistical Reporting areas 521, 522, 525, 526, 561, 562 and 515).

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21) NSL STRATEGIC INTERESTS FOR CMER PROJECTS IN TAXONOMY AND SYSTEMATICS.

In addition to specific projects submitted to CMER by National Systematics Laboratory (NSL) scientists each year, NSL is interested in training students in taxonomy, systematics and natural history of marine organisms that are of potential importance to the ecosystem-based management goals of NOAA. The rationale for this is somewhat similar to that of the PEET program within NSF. The nation, and biology in general, have well-documented, critical shortages of taxonomic experts. However, unlike PEET's focus on "scientifically orphaned" taxa, NSL emphasizes taxa for which expertise is required for understanding marine ecosystems of importance to the US. Some of the many possible examples include pteropods, heteropods, and bivalve molluscs, pericarid crustaceans, polychaet worms, and numerous groups of parasites and microbes. We cannot manage what we do not understand, including the composition of marine ecosystems. Although NSL has fostered a close relationship between the National Museum of Natural History (NMNH) and VIMS, other potential connections should be explored as well. NMFS relationships with museums other than NMNH (e.g., the American Museum in NYC with Sandy Hook, Peabody at Yale with Milford or Narragansett, Harvard's MCZ with Woods Hole) could be facilitated by addressing NOAA/NMFS needs while training students at CMER universities.

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