Northeast Fisheries Science Center Reference Document 04-01

Current Fisheries Research and Future Ecosystems Science in the Northeast Center

Collected Abstracts of the Northeast Fisheries Science Center's Eighth Science Symposium, Atlantic City, New Jersey, February 3-5, 2004

compiled by

Donna L. Johnson, Thomas W. Finneran, Beth A. Phelan, Ashok D. Deshpande, Catherine L. Noonan, Suellen Fromm, and Danielle M. Dowds

January 2004

Recent Issues in This Series

03-01 **Manuscript/Abstract/Webpage Preparation, Review, & Dissemination: NEFSC Author's Guide to Policy, Process, and Procedure.** By J.A. Gibson, T.L. Frady, E.L. Kleindinst, and L.S. Garner. January 2003.

03-02 **Stock Assessment of Yellowtail Flounder in the Southern New England - Mid-Atlantic Area.** By S.X. Cadrin. [A report of Northeast Regional Stock Assessment Workshop No. 36.] February 2003.

03-03 **Stock Assessment of Yellowtail Flounder in the Cape Cod - Gulf of Maine Area.** By S.X. Cadrin and J. King. [A report of Northeast Regional Stock Assessment Workshop No. 36.] February 2003.

03-04 **Report of the 36th Northeast Regional Stock Assessment Workshop (36th SAW): Public Review Workshop.** [By Northeast Regional Stock Assessment Workshop No. 36.] February 2003.

03-05 **Description of the 2002 Oceanographic Conditions on the Northeast Continental Shelf.** By M.H. Taylor, C. Bascuñán, and J.P. Manning. March 2003.

03-06 **Report of the 36th Northeast Regional Stock Assessment Workshop (36th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.** [By Northeast Regional Stock Assessment Workshop No. 36.] March 2003.

03-07 **Implementation of Electronic Logbook Reporting in a Squid Bottom Trawl Study Fleet during 2002.** By L.C. Hendrickson, D.A. Hiltz, H.M. McBride, B.M. North, and J.E. Palmer. April 2003.

03-08 **Northeast Fisheries Science Center Publications, Reports, and Abstracts for Calendar Year 2002.** By L. Garner and J.A. Gibson. July 2003.

03-09 **Stock Assessment of Summer Flounder for 2003.** By M. Terceiro. August 2003.

03-10 **Comparison of Invertebrate Abundances in Four Bays of the Northeastern United States: Two Bays with Sparse Quahogs and Two Bays with Abundant Quahogs.** By C.L. MacKenzie, Jr. August 2003.

03-11 **Accuracy Enhancement of Microscope Enumeration of Picoplankter *Aureococcus anophagefferens*.** By J.B. Mahoney, D. Jeffress, J. Bredemeyer, and K. Wendling. August 2003.

03-12 **A Taxonomy of World Whaling: Operations, Eras, and Data Sources.** By R.R. Reeves and T.D. Smith. August 2003.

03-13 **Distribution of the Brown Tide Picoplankter *Aureococcus anophagefferens* in Western New York Bight Coastal Waters.** By J.B. Mahoney, D. Jeffress, C. Zetlin, P.S. Olsen, H. Grebe, and J. Brooks. August 2003.

03-14 **Assessment of the Gulf of Maine and Georges Bank Witch Flounder Stock for 2003.** By S.E. Wigley, J.K.T. Brodziak, and L. Col. September 2003.

03-15 **Estimates of the Number of Vessels and Quantity of Gear Deployed in the Lobster and Gillnet Fisheries in 1999 off the Northeast Coast of the United States.** By K.D. Bisack. September 2003.

03-16 **Report of the 37th Northeast Regional Stock Assessment Workshop (37th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.** [By Northeast Regional Stock Assessment Workshop No. 37.] September 2003

03-17 **Report of the 37th Northeast Regional Stock Assessment Workshop (37th SAW): Advisory Report.** [By Northeast Regional Stock Assessment Workshop No. 37.] September 2003.

03-18 **Estimates of Marine Mammal Bycatch in the Northeast (New England) Multispecies Sink Gillnet Fishery in 1996.** By K.D. Bisack. September 2003.

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National Marine Fisheries Serv., 74 Magruder Rd., Highlands, NJ 07732

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

January 2004

Northeast Fisheries Science Center Reference Documents

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The Eighth NEFSC Science Symposium

Current Fisheries Research and Future Ecosystems Science in the Northeast Center

February 3 – 5, 2004
Trump Plaza Hotel and Casino
Atlantic City, New Jersey

Tuesday - February 3, 2004

11:00 am – 12:00pm	**Registration**	Imperial Ballroom
12:00pm – 1:00pm	**Lunch**	Fortune's Restaurant
1:00pm – 1:15pm	**Welcome Address** DR. THOMAS NOJI Chief, Ecosystems Processes Division *(EPD)* NEFSC/James J. Howard Laboratory at Sandy Hook	Imperial Ballroom
1:15pm – 2:00pm	**Introduction** DR. JOHN G. BOREMAN JR. Acting Science and Research Director, NEFSC/Woods Hole Laboratory **Keynote Speaker:** DR. REBECCA LENT Deputy Assistant Administrator for Regulatory Programs	Imperial Ballroom
2:00pm – 2:30pm	Break	

Session I
Jerome Prezioso, Session Moderator
EPD, Oceanography Branch
NEFSC/Narragansett Laboratory

2:30pm **A history of ecosystem studies of the U.S. northeast shelf ecosystem, 1807 – 2004**
SARA P. ADAMS and Kenneth Sherman
NEFSC/Narragansett Laboratory

2:45pm **Potential contribution of new technologies to essential fish habitat designation**
JEFFREY PESSUTTI and John Manderson
NEFSC/ James J. Howard Laboratory at Sandy Hook

3:00pm **Bay scallop, *Argopecten irradians irradians*, restoration efforts in the northeastern United States**
RONALD GOLDBERG
NEFSC/Milford Laboratory

3:15pm **Condition of young-of-the-year bluefish (*Pomatomus saltatrix*) from two different estuaries along the Mid-Atlantic Bight**
JENNIFER C. SAMSON and Ashok D. Deshpande
NEFSC/ James J. Howard Laboratory at Sandy Hook

3:30pm **The distribution, diet, and growth of young-of-the-year bluefish, in a northwest Atlantic estuary**
JOHN G. HILBERT JR., Beth Phelan, John E. Rosendale, and Carol Meise
NEFSC/ James J. Howard Laboratory at Sandy Hook

3:45pm **True confessions: lessons learned and new research initiatives in the microalgal mass culture room at Milford**
MARK S. DIXON and Gary H. Wikfors
NEFSC/Milford Laboratory

4:00pm – 7:00pm **Hotel Check-in**

7:00pm – 9:00pm **Poster Social** Indoor Pool Room

Poster Session

7:00pm – 9:00pm

Identification of *Pseudocalanus moultoni* and *Pseudocalanus newmani* from the northeast continental shelf

Jacquelyn Anderson and Jack Green
NEFSC/Narragansett Laboratory

Safer surveys: a model for developing safer marine mammal aerial surveys

Nicole Cabana
NEFSC/Woods Hole Laboratory

Evidence of rapid evolution in an estuarine dependent gadid, Atlantic tomcod (*Microgadus tomcod*), in response to environmental contamination with PCBs

R. Christopher Chambers[1], David Witting[1], David Cerino[1], and Ike Wirgin[2]
[1]NEFSC/James J. Howard Laboratory at Sandy Hook
[2]Dept. of Environmental Medicine, NYU School of Medicine

Hard-substrate reef as a habitat for finfish, preliminary results

Paul E. Clark[1], Ronald Goldberg[1], Catherine Kuropat[1], Renée Mercaldo-Allen[1], Jose J. Pereira[1] and
Lauren M. Vinokur[2]
[1]NEFSC/Milford Laboratory
[2]Skidmore College, Saratoga Springs, NY

Stomach content analysis of northern, *Prionotus carolinus* (Linnaeus) and striped, *Prionotus evolans* (Linnaeus) searobins from Long Island Sound

Paul E. Clark[1], Jose J. Pereira[1], and Francis Juanes[2]
[1]NEFSC/Milford Laboratory
[2]Univ. of Massachusetts, Natural Resources Conservation Dept., Amherst MA

Mid-Atlantic Fishing Communities Project

Bonnie J. McCay
Dept. of Human Ecology, Cook College, Rutgers University

Sediment grain size and groundfish assemblage structure in the northeastern continental shelf ecosystem

Elizabeth Methratta and Jason Link
NEFSC/Woods Hole Laboratory

Seasonal movement of black sea bass

Joshua Moser and Gary Shepherd
NEFSC/Woods Hole Laboratory

Natural spawning of black sea bass, *Centropristis striata*, at the NMFS Milford Laboratory and the UMASS Dartmouth Laboratory with observations on spawning behavior
David A. Nelson[1], Dean M. Perry[1] and Edward Baker[2]
[1]NEFSC/Milford Laboratory
[2]136 Beechwood Hill Tr, Exeter, RI 02882

The abundance and distribution of *Temora longicornis* (Copepoda) within the Northwest Atlantic shelf waters, 1977-2002.
Jerome Prezioso and Joseph Kane
NEFSC/Narragansett Laboratory

Culture and rearing techniques of scyphozoans and hydrozoans (jellies) in public aquaria for exhibit display
Brandon Schmidt
NEFSC/Woods Hole Laboratory

Sectioning otoliths in the 21st century: increased efficiency through the use of new technology
Nina Shepherd, Sandra J. Sutherland, Sarah Pregracke, Daphne Cassidy, Christine Esteves, Blanche Jackson, Elizabeth O'Neill, and Jay Burnett
NEFSC/Woods Hole Laboratory

Spawning duration and frequency of weakfish, *Cynoscion regalis*, near the northern margin of its geographic range based on the size and age structure of young-of-the-year
Donald D. Shrump Jr. and R. Christopher Chambers
NEFSC/James J. Howard Laboratory at Sandy Hook

Age-structure reference collections: the importance of being earnest
Vaughn Silva, Nancy Munroe, Sarah E. Pregracke, and John Burnett
NEFSC/Woods Hole Laboratory

Communal effects between *Argopecten irradians irradians* and *Nassarius obsoletus*.
David J. Veilleux and Katlyn Mihalek
NEFSC/Milford Laboratory

PCB bioaccumulation trends and ecosystem stress responses in young-of-the-year bluefish (*Pomatomus saltatrix*)
Shayla D. Williams and Ashok D. Deshpande
NEFSC/James J. Howard Laboratory at Sandy Hook

Wednesday - February 3, 2004

7:00am – 8:00am **Breakfast** Fortune's Restaurant

Session II
Maureen H. Taylor, Session Moderator
EPD, Oceanography Branch
NEFSC/Woods Hole Laboratory

8:00am

Species-habitat characterization for the Georges Bank ecosystem
SUKWOO CHANG[1], Peter Berrien[1], Donna Johnson[1], Joseph Kane[2], John O'Reilly[2] and Maureen Taylor[3]
[1]NEFSC/ James J. Howard Laboratory at Sandy Hook
[2]NEFSC/Narragansett Laboratory
[3]NEFSC/Woods Hole Laboratory

8:15am

Density-dependent habitat use in the Gulf of Maine and Georges Bank or what do Fretwell and Lucas know about fish anyway?
JOSE J. PEREIRA[1], Eric Schultz[2] and Peter Auster[3]
[1]NEFSC/Milford Laboratory
[2]University of Connecticut, Storrs, CT
[3]National Undersea Research Center, University of Connecticut at Avery Point, Groton, Connecticut

8:30am

Three-dimensional visualization of fisheries' acoustics data and models
DAVID F. CHEVRIER and J. Michael Jech
NEFSC/Woods Hole Laboratory

8:45am

Plankton monitoring utilizing a MOCNESS mounted Video Plankton Recorder
ELISABETH BROUGHTON
NEFSC/Woods Hole Laboratory

9:00am

A comparison of organic nutrient levels in near-shore and offshore environments
JOHN E. MCCARTHY, Vincent G. Guida, and Andrew F. J. Draxler
NEFSC/ James J. Howard Laboratory at Sandy Hook

9:15am **The outer shelf of the mid-Atlantic: *Terra incognita* at our doorstep**

VINCENT G. GUIDA[1], Page C. Valentine[2], Frank Almeida[3], Michael Fahay[1], Joseph J.Vitaliano[1], Maureen H. Taylor[3], Martha S. Nizinski[4], and Lauren Pandolfo[5]
[1]NEFSC/ James J. Howard Laboratory at Sandy Hook
[2]USGS, Woods Hole Field Office, Woods Hole, MA
[3]NEFSC/Woods Hole Laboratory
[4]NEFSC/National Systematics Laboratory
[5]Roger Williams University, Bristol, RI

9:30am **Preliminary Observations on the Diversity of the Invertebrate Fauna Associated with *Lophelia* Banks off North Carolina**

MARTHA S. NIZINSKI[1], Steven W. Ross[2], and Kenneth J. Sulak[3]
[1]NEFSC/National Systematics Laboratory
[2]Center for Marine Science, University of North Carolina-Wilmington,
[3]U.S.G.S, Biological Resources, Gainesville, FL

10:00am – 10:30am **Morning Break**

Session III
Jeffrey Pessutti, Session Moderator
EPD, Behavioral Ecology Branch
NEFSC/ James J. Howard Laboratory at Sandy Hook

10:30am **Long-term effects of quahoging and crabbing gear on the benthic ecosystem of Raritan Bay**

CLYDE L. MACKENZIE, JR., Donald G. McMillan, Robert Pikanowski, John Rosendale, Daniel Wieczorek, John Hilbert, and Chad Brown
NEFSC/ James J. Howard Laboratory at Sandy Hook

10:45am **A system for simulating the biogeochemical habitats of lobsters, and its use for determining survival at elevated temperature**

Andrew F. J. Draxler[1], Richard A. Robohm[2], DANIEL WIECZOREK[1] and Michael Schafer[1], Diane Kapareiko[2], Steven Pitchford[2]
[1]NEFSC/ James J. Howard Laboratory at Sandy Hook
[2]NEFSC/Milford Laboratory

11:00am **Effects of environmental stressors on disease susceptibility in lobsters: a controlled laboratory study**
Richard A. Robohm[1], Andrew F. J. Draxler[2], DIANE KAPAREIKO[1], Steven Pitchford[1], Daniel Wieczorek[2] and Lori Davias[2]
[1]NEFSC/Milford Laboratory
[2]NEFSC/ James J. Howard Laboratory at Sandy Hook

11:15am **Methods and importance of analyzing PCB concentrations in lobster Hepatopancreas tissues**
Ashok D. Deshpande, MICHAEL W. SCHAFER, A. F. J. Draxler, and Daniel Wieczorek
NEFSC/ James J. Howard Laboratory at Sandy Hook

11:30am **Comparison of two different methods of lipid analysis in fish tissue**
THOMAS H. CLEARY, Vincent Guida, and Jennifer C. Samson
NEFSC/ James J. Howard Laboratory at Sandy Hook

12:00pm – 1:00pm **Lunch** Fortune's Restaurant

Session IV
Dr. Martha S. Nizinski, Session Moderator
NEFSC/National Systematics Laboratory

1:00pm **Modeling study of movement and settlement of the Atlantic sea scallops in the Northeast United States Coastal Region**
ZHIZHANG YANG, David G. Mountain, Dvora Hart, and Paul Rago
NEFSC/Woods Hole Laboratory

1:15pm **The influence of surface layer salinity changes on wintertime convection in Wilkinson Basin, Gulf of Maine**
MAUREEN H. TAYLOR and David G. Mountain
NEFSC/Woods Hole Laboratory

1:30pm **Benthic macrofauna and sedimentary habitats of the closed areas on Georges Bank**
JOSEPH J. VITALIANO[1], Robert N. Reid[1], and Page Valentine[2]
[1]NEFSC/ James J. Howard Laboratory at Sandy Hook
[2]USGS, Woods Hole Field Office, Woods Hole, MA

1:45pm **Yellowtail flounder cooperative tagging study**

AZURE D. WESTWOOD and Steve X. Cadrin
NEFSC/Woods Hole Laboratory

2:00pm **Results from PSAT attachments to swordfish…a cautionary tale**

RICHARD BRILL[1] and Michael Musyl[2]
[1]NMFS/NEFSC, VIMS-HU CMER Program, Virginia Institute of Marine Science, Gloucester Point, VA
[2]NMFS/PIFSC, Joint Institute for Marine and Atmospheric Research, University of Hawaii, Honolulu, HI

2:15pm **Monitoring the juvenile sandbar shark, *Carcharhinus plumbeus,* population in the Delaware Bay nursery grounds**

CAMILLA T. MCCANDLESS[1], Harold L. Pratt, Jr.[2], and Nancy E. Kohler[1]
[1]NEFSC/Narragansett Laboratory
[2]Mote Marine Laboratory, FL

3:00pm – 3:30pm **Afternoon Break**

Session V
Diane Kapareiko, Session Moderator
Aquaculture and Enhancement Division, Biotechnology Branch
NEFSC/Milford Laboratory

3:30pm **Indirect age estimation of butterfish *(Peprilus triacanthus)* based on otolith weights: preliminary results**

SANDRA J. SUTHERLAND, Nancy Munroe, Elizabeth O'Neill, and Jay Burnett
NEFSC/Woods Hole Laboratory

3:45pm **A model to estimate growth rate in young-of-the-year tautog, *Tautoga onitis*, based on RNA/DNA ratio and seawater temperature**

RENEE MERCALDO-ALLEN[1], Catherine Kuropat[1], Elaine Caldarone[2] and Ronald Goldberg[1]
[1]NEFSC/Milford Laboratory
[2]NEFSC/Narragansett Laboratory

4:00pm **Growth of juvenile black sea bass, *Centropristis striata*, in a recirculating seawater system**
David A. Nelson[1], DEAN M. PERRY[1], Robin Katersky[1], Stephen Metzler[2] and Dylan Redman[2]
[1]NEFSC/Milford Laboratory
[2]End to End Technical Services Inc., Portsmouth, VA

4:15pm **How different light regimes and intensities affect growth rates and nutrient uptake in *Tetraselmis chui* (PLY429)**
SHANNON L. MESECK and Jennifer Alix
NEFSC/Milford Laboratory

4:30pm **The effects of shell hash on the survival and transport of juvenile *Spisula solidissima***
SHANNON NEWBY
CMER program/IMCS, Rutgers University

4:45pm **Mid-Atlantic Fishing Communities Project**
BONNIE J. MCCAY
Dept. of Human Ecology, Cook College, Rutgers University

7:00pm **Dinner** Chelsea Ball Room

Thursday – February 5, 2004

8:00am – 9:00am **Breakfast** Fortune's Restaurant

Session VI
Joseph J. Vitaliano, Session Moderator
EPD, Coastal Ecology Branch
NEFSC/ James J. Howard Laboratory at Sandy Hook

9:00am **A petroleum fingerprinting study of ribbed mussels and sediments from a previously contaminated and freshly contaminated site in the Arthur Kill.**
BRUCE W. DOCKUM[1], Ashok D. Deshpande[1], and Amy M. Tesolin[2]
[1]NEFSC/ James J. Howard Laboratory at Sandy Hook
[2]Dow Chemical Company, Midland, Michigan

9:15am **Update on coastal Maine river Atlantic salmon smolt studies: 2003**

JAMES HAWKES[1], John Kocik[1] and Gregory Mackey[2]
[1]NOAA Fisheries Maine Field Station/ NEFSC, Orono, ME
[2]Maine Atlantic Salmon Commission/Downeast Regional Office
Jonesboro, Maine

9:30am **Changes in the proportion of naturally reared Atlantic salmon smolts to hatchery smolts emigrating from the Penobscot River, ME, during 2000-2003**

CHRISTINE LIPSKY[1], James Loftin[1], Edward Hastings[1], and Russell Brown[2]
[1]NOAA/NMFS/NEFSC, 31 Main St., Orono, ME 04473
[2]NEFSC/Woods Hole Laboratory

9:45am **Update on NOAA Fisheries aerial surveys for right whales (*Eubalaena glacialis)* off the northeastern United States**

TIMOTHY V.N. COLE, Peter A. Duley, Kelly A. Houle, Misty D. Nelson, Richard M. Pace III, Brenda K. Rone, Alison K. Stimpert and Frederick W. Wenzel
NEFSC/Woods Hole Laboratory

10:00am **Sand lance as an intermediate vector in the trophic transfer of contaminants in the endangered humpback whales**

ASHOK D. DESHPANDE[1], Bruce W. Dockum[1], and Salvatore Testaverde[2]
[1]NEFSC/ James J. Howard Laboratory at Sandy Hook
[2]National Marine Fisheries Service, Northeast Regional Office

10:30am – 11:00am **Closing Remarks**

Frank Almeida
Acting Deputy Science and Research Director,
NEFSC/Woods Hole Laboratory

IN MEMORIAM

Christine E. Zetlin was a regular presenter
and participant at the Northeast Center Science Symposia.
Her frequent attendance and contribution exemplified
her devotion to her craft, colleagues and friends.

A history of ecosystem studies of the U.S. northeast shelf ecosystem, 1807 – 2004

Sara P. Adams and Kenneth Sherman
NOAA/NMFS/NEFSC, 28 Tarzwell Drive, Narragansett, RI 02882-1152

In 1807, President Jefferson sent a request to the American Philosophical Society for proposals for a Coast Survey that was to serve as the agency that would later be joined to the National Marine Fisheries Service in 1970 to form the foundations of today's NOAA. Now in 2004, the principal NOAA mission goal is to protect, restore, and manage the use of coastal and ocean resources through ecosystem based management. We trace the evolution of scientific exploration and the genesis of the marine ecosystem based approach in the United States from the early days of the Coast Survey through the joint studies of Ferdinand Hassler, Alexander Dallas Bache, Louis and Alexander Agassiz, Spencer Baird and Henry Bigelow through the succession of directors of the NMFS Woods Hole Laboratory from 1846 to the present day demonstrating that NOAA's principal goal of today is attributable to studies of the US Northeast Shelf.

Potential contribution of new technologies to essential fish habitat designation

Session I, Abstract I-2
ORAL PRESENTATION

Jeffrey Pessutti and John Manderson
NOAA/NMFS/NEFSC, 74 Magruder Road, Highlands, NJ 07732

It is generally accepted that habitat conservation is necessary for the protection of ecologically important species and sustainable fisheries. However, the habitat requirements of many species, particularly those using the continental shelves are still largely unknown. Advancements in marine remote sensing, specifically the development of sensors deployed on satellites, ships, autonomous underwater vehicles, and on the bottom, offer the potential to monitor variation in pelagic and benthic habitat characteristics and animals' movements. The extents and resolutions provided by these technologies may permit the development of robust and spatially and temporally explicit functional habitat models. Remotely sensed data combined with underwater video, acoustic fish tracking, and traditional sampling approaches will allow for the development of distribution-based models of habitat use for shelf species. Such models could provide the framework to implement the same technologies for the study of fine-scale patterns of habitat use and habitat effects on growth, survival, reproduction and dispersal. The combination of fine-scale habitat suitability and use studies with distribution based models of habitat will help to identify not only where essential habitats are found, but at what life history stages specific habitats become important. In this presentation we review environmental data available or soon to be available for the New York Bight and present sampling approaches and a conceptual framework for a shelf habitat research program.

Bay scallop, *Argopecten irradians irradians*, restoration efforts in the northeastern United States

Ronald Goldberg
NOAA/NMFS/NEFSC, 212 Rogers Ave., Milford, CT 06460-6499

Over the last several decades, there has been a marked decline in population abundance of bay scallops, *Argopecten irradians irradians* (Lamarck, 1819), in nearshore waters and estuaries of the northeastern United States. Losses of habitats, deterioration of water quality, and harmful algal blooms have probably contributed to this decreased abundance. Bay scallops generally spawn only once in their short 18-22 month lifespan and this characteristic increases the possibility of recruitment limitation when year-class survival is poor. In northeastern coastal states, local shellfish commissions, community groups, and shellfishers have explored many ways to restore or enhance the bay scallop resource. Establishment of spawner sanctuaries, direct transplantation of hatchery seed, and collection of native spat have all been attempted, but results have been highly variable. In most cases, no genetic analysis relating parent stock to progeny is available. Additionally, unpredictable and relatively abrupt changes in habitat (eelgrass decline), environmental quality (harmful microalgal blooms), or low levels of natural spatfall available for collection can negate enhancement efforts. Unfortunately, many projects have been curtailed after one or two seasons, when sustained and adaptive efforts are required. Some of the bay scallop stock enhancement projects in this region have, however, documented increased production or have resulted in improved methodology. Specific projects in Massachusetts, Rhode Island, Connecticut, and New York are reviewed in an attempt to determine promising strategies to pursue in the future.

Keywords: bay scallops, *Argopecten,* stock enhancement

Condition of young-of-the-year bluefish (*Pomatomus saltatrix*) from two different estuaries along the Mid-Atlantic Bight

Jennifer C. Samson and Ashok D. Deshpande
NOAA/NMFS/NEFSC, 74 Magruder Road, Highlands, NJ 07732

Estuaries along the Mid-Atlantic Bight (MAB) have been identified by the National Marine Fisheries Service as essential fish habitat for young-of-the-year (YOY) bluefish, *Pomatomus saltatrix*. Several MAB estuaries are contaminated with PCBs, PAHs, and heavy metals. YOY bluefish utilizing polluted MAB estuaries during periods of rapid growth and development are conceivably chronically exposed to contaminants in the water column, sediments and food. The objective of the study was to compare the condition of YOY bluefish from two different MAB estuaries (Great Bay, New Jersey-pristine and Hackensack River, New Jersey-contaminated) using biomarkers that target different levels of biological organization. Fish were collected upon immigration into estuaries in summer and just prior to emigration in fall. Summer collections were analyzed for baseline PCB contamination in whole fish. From the fall collection, fish have been analyzed for gross pathologies, class and concentration of lipids in tissues, and DNA adducts. Analyses in progress include concentration of PCBs in tissues and vitellogenin and cytochrome P-450 induction in the liver. Analysis of biliary FACs is planned. Significant differences were detected between bluefish from the two different estuaries including higher total lipid content and an increase in hepatic DNA adducts in fish from the contaminated estuary. Analyses of field-collected fish from two different estuaries are expected to provide much needed information on the impact of habitat quality on the condition of YOY bluefish condition. Understanding the impact of habitat qualities on fish health is an important aspect of essential fish habitat designation, management and protection.

The distribution, diet, and growth of young-of-the-year bluefish, in a northwest Atlantic estuary

Session I, Abstract I-5
ORAL PRESENTATION

John G. Hilbert Jr., Beth Phelan, John E. Rosendale, and Carol Meise
NOAA/NMFS/NEFSC, 74 Magruder Road, Highlands, NJ 07732

We used multi-panel gill nets and 100-foot haul seines to study the distribution, diet, and growth of young-of-the-year bluefish. Bluefish were collected from June to October 2003 in the Navesink River/ Sandy Hook Bay estuary. Gill nets were fished biweekly for 2h at stratified random sites at depths less than 3m. Haul seines were fished biweekly at 6 fixed stations. A total of 2966 fish was captured, (seine: N=1986, 30-248 mm FL, mean FL=108 mm); (gill net: N=980, 72-385 mm FL, mean FL=164 mm). Bluefish were first collected in June and reached peak abundance in July (bay=1745, river=185). Overall, more fish were caught in the bay than the river. Length frequencies derived from catch data were used to estimate daily growth rates. Preliminary analysis showed that bluefish grew at an average of 1.34mm/day. A total of 372 individuals was analyzed for stomach contents. Four indices: percent weight (%W), percent number (%N), percent occurrence (%O), and percent index of relative importance (%IRI) were calculated for all prey items consumed. Mysids were the most important prey (%W=37, %IRI=91) followed by silversides *Menidia menidia* (%W=22, %IRI=3) and sand shrimp *Crangon septemspinosa* (%W=9, %IRI=4). The presence of a large amount of invertebrate prey may suggest that they are more important diet items than previously expected.

True confessions: lessons learned and new research initiatives in the microalgal mass culture room at Milford

Session I, Abstract I-6
ORAL PRESENTATION

Mark S. Dixon and Gary H. Wikfors
NOAA/NMFS/NEFSC, 212 Rogers Ave., Milford, CT 06460-6490

The Milford Mass Culture Room (MCR), houses a unique system for the cultivation of research-grade microalgae. The research of Dr. Ravenna Ukeles, of the Milford Laboratory, on techniques for the mass culture of microalgae led to the design and construction of the MCR that was completed in 1970. A 1973 publication describes the carboy system that, with only minor modifications, is in current use. This system allows for production of large quantities of contaminant-free algal biomass. Semi-continuous culture management under consistent conditions of light, temperature, and media composition provides a product of repeatable and reliable quality. Large (500-l) open tanks, also in the MCR, serve as models for commercial aquaculture applications and provide large volumes of algae to other Milford research initiatives.

Despite a long history, the MCR is not static. Recent challenges, new research directions and applications, and technological developments have taught us not to rest on past success. For example, research on bivalve and rotifer nutrition led to the replacement of some algal strains traditionally used in aquaculture with others (e.g., high-lipid *Tetraslemis*, and *Pavlova*). In the past, open cultures mixed with bubbled air were very susceptible to bacterial degradation and limited to short-term (5-7 days) batch harvesting. Replacing bubbling with mechanical mixing (initially a wooden paddle and currently a mechanized foil) significantly increased production and permitted long-term (2-3 years), semi-continuous production. We also found that open cultures with higher air-surface area-to-volume ratio were more productive and sustainable. Ciliate contamination in open cultures became an issue in rotifer-feeding applications. This problem was addressed first by using fresh water and artificial salt to eliminate the seawater source – effective, but too expensive. More recently, we are using sub-micrometer, capillary tangential-flow filtration of seawater. The importance of supplemental carbon dioxide, as both carbon source and pH regulator, in bacteria-free carboy cultures was re-enforced through chance observations and subsequent adjustments. And most recently, we discovered that the pH buffer in our carboy and tank media degrades to ammonia (and much faster in bacterized cultures). This ammonia stresses grazers in closed systems, and degradation of the buffer reduces its effectiveness; the buffer problem is a top MCR priority. Current MCR work is a combination of refining existing procedures and applying them to new initiatives, including: studying harmful algal effects upon native and aquacultured grazers, using flow-cytometry to evaluate algal culture dynamics and grazer physiology, gaining a better understanding of the chemical processes within the algal media, and developing new and more effective methods of algal production.

Species-habitat characterization for the Georges Bank ecosystem

Session II, Abstract II-1
ORAL PRESENTATION

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Field studies of the MARMAP (MArine Resources Monitoring Assessment and Prediction) program (1977-1987) provide observations on the changes of hydrographic and nutrient measurements, as well as zooplankton, ichthyoplankton, fish distribution and abundance in the shelf ecosystem. These results can be used in determining the impacts of temporal and spatial variability of biotic and abiotic components and in establishment of their associations as well. Association analysis of MARMAP data from Georges Bank (GB) utilized a multiple-tier, species-habitat characterization procedure. The first two tiers are time (i.e., month, season or Julian date) and space (i.e., sub-regions or distinct water masses) attributes. Bottom temperature ranges can be used as the third tier attribute. Species associations, trophic associations and habitat associations have been estimated for 80 habitat units (4 seasons x 4 regions x 5 temperature ranges) for three tiers. Extended analysis of associations including 8 subdivisions of Julian date over a year and 9 water masses has been performed. Using 5 bottom temperature ranges as a third tier, then 360 (= 8 X 9 X 5) habitat units can be created, and including 3 additional depth zones used as a fourth tier, results in 1080 habitat units created. The more attributes that are added as tiers in analysis, the more refined species-habitat associations can be estimated in the smaller habitat units, if data are available for those habitat units. These species-habitat associations provide important understandings of fish habitats as well as their populations and community structure of the GB ecosystem. Associations may further explain why some fish species are not only more abundant and flourish longer than other species, but also what are the contributing factors for essential fish habitat (EFH) of the species in the GB ecosystem.

Density-dependent habitat use in the Gulf of Maine and Georges Bank or what do Fretwell and Lucas know about fish anyway?

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The addition of essential fish habitat (EFH) provisions to fisheries management plans by the Sustainable Fisheries Act of 1996 and the concern over the effect of fishing gear on the sea bottom have prompted much interest in more accurate definitions of fish habitat use. The effort to implement this legislation has identified four different levels of information that could be used for EFH designations:

1. Presence-absence data
2. Habitat-specific population densities
3. Growth, reproduction or survival rates within habitats
4. Habitat-specific production rates

Many EFH designations rely heavily on the first two levels of information and provide little insight into which portions of the habitat are critical for the population. One way to improve the sophistication of these descriptions, when long-term records are available, is to take into account density-dependent habitat use as described by Fretwell and Lucas (1970)[1]. The Fretwell and Lucas model predicts that at low population densities, organisms should occupy only optimal habitats. Organisms colonize less desirable habitats only when higher population levels result in density-dependent degradation of optimal habitat quality.

Trawl survey data collected by the NEFSC represent a long time series collected at many different population densities and provide a unique opportunity to look for evidence of density-dependent habitat use and perhaps to identify optimal fish habitats. I have examined a subset of this dataset, the abundance and distribution of cod (*Gadus morhua*) from 1970-1994 in the Gulf of Maine and on Georges Bank, for evidence of density-dependent habitat use by statistical and geostatistical methods. First, I examined the degree of aggregation at different population densities by modeling the data as a negative binomial distribution and examining the value of the k-exponent (an inverse measure of aggregation) at different overall population densities. I also examined the coefficient of variation of the trawl data and how it varied with density. Semivariograms were used to examine spatial relationships in the data. Preliminary results do not support the theory of density-dependent habitat use, at least at large spatial scales.

[1] Fretwell, S. D., and H. L. Lucas Jr. 1970. On territorial behavior and other factors influencing habitat distribution in birds I. Theoretical development. Acta Biotheoretica **19**:16-36.

Three-dimensional visualization of fisheries' acoustics data and models

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Fisheries' acoustics methods are an efficient and effective approach for providing fisheries-independent estimates of densities and abundances of commercially important fish stocks. Acoustical data collected during fisheries surveys provide continuous coverage of the entire water column along the cruise track. Concurrent biological sampling from net hauls and underwater video systems allow verification of the sources of acoustical echoes.

Typically the acoustical data are displayed as two-dimensional 'echo grams' - vertical dimension through the water column, and time along the horizontal axis. Traditional echograms are not suitable for viewing the data in a geographical context. We have developed three-dimensional visualizations of multi-frequency acoustical survey data to view the data in geographical space from small to large spatial scales. Acoustical data are commonly used to provide relative indices of species-specific abundance and biomass. In order to scale the relative indices to absolute estimates, we must incorporate a measure of the echo amplitude from an individual fish. Fish are complicated acoustical scatterers by nature of their complex anatomy and behavior. We have developed three-dimensional visualizations of the fish body and swimbladder from x-ray and Computerized Tomography (CT) images. These images are used in theoretical models to improve prediction of acoustical scattering over a wide range of frequencies and fish orientations. We will present three-dimensional visualizations of acoustical survey data and internal anatomy of selected fish species, and will discuss the utility and implications of 3D visualizations in fisheries management.

Plankton monitoring utilizing a MOCNESS mounted Video Plankton Recorder

Session II, Abstract II-4
ORAL PRESENTATION

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Plankton identification and enumeration are a highly specialized, time-consuming part of the Northeast Fisheries Science Center's monitoring and research programs. In an effort to speed processing and provide the vertically stratified plankton data utilized by newly developed ecosystem monitoring models, a self-contained, analog Video Plankton Recorder (VPR) was integrated with the 1m MOCNESS. VPR data collected in May 1997 along a mooring line in the Great South Channel was compared to the net samples taken simultaneously by the MOCNESS to test the accuracy relative to conventional net samplers. The VPR data was then analyzed to show fine scale (1m) vertical variance and any significant changes between casts within a single haul. A detailed picture of the zooplankton assemblage along the mooring line was created.

Currently we are working to automate the processing and identification systems. The computer will automatically extract every region of interest (ROI) as a Tiff file and tag it with a time code. ROIs can then be imported into a MATLAB based processing program that allows the user to identify the plankton and take multiple measurements. Utilizing the time stamp this data is then automatically integrated with the physical oceanographic data from the MOCNESS sensors.

In the future, a slight change in mounting brackets and the self-contained VPR can be deployed on other oceanographic sampling gear such as CTDs, bongos, or a towed V-fin. The proposed computer software can append physical oceanographic sensor data from a variety of sources. The system will be converted to digital to reduce the size of the gear and further speed processing. With the addition of software developed by WHOI, the identification stage can also be completely automated. This would provide for a small scale vertically stratified, plankton profile to be completed within 2 hours or less of the sample being downloaded to the ship’s computer.

A comparison of organic nutrient levels in near-shore and offshore environments

Session II, Abstract II-5
ORAL PRESENTATION

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Total Organic Carbon (TOC) and Total Nitrogen (N) levels were determined in marine sediments in support of a fishing gear effects study in Closed Area II of Georges Bank and a lobster mortality study in Long Island Sound. Trends in nutrient levels with sediment types and depths were examined. TOC levels were significantly higher in the finer Long Island Sound near shore sediments (0.08% - 3.37%, average 1.18%) than in the sandier Georges Bank offshore sediments (0.005% - 0.218% average 0.055%). While there is a general trend for finer sediments to have higher TOC and N levels, the difference in the two areas is so large that the impact of human activity in the Long island sound area most likely outweighs any differences due to grain size variations. TOC/N ratios were determined when possible. The similarity in TOC/N ratios in the two areas suggests that the nature of the nutrient materials is similar despite the differences in overall levels.

The outer shelf of the mid-Atlantic:
***Terra incognita* at our doorstep**

Session II, Abstract II-6
ORAL PRESENTATION

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The outer continental shelf and upper slope around Hudson Canyon is heavily fished, but little explored. Combinations of hydrology and sedimentology create a haven for resident deepwater and overwintering inshore-offshore migrant species. Details of habitat nature, distribution, and use have been scarce until recently, when NEFSC Benthic Habitat cruises began exploration. Issues addressed include:

1. Defining the extent and density of habitat islands associated with tilefish burrows;
2. Realizing the prevalence of previously underestimated and/or overlooked benthic megafauna and demersal forage species;
3. Discovering previously unexplored fish habitats, including boulder piles, *Bolocera* gardens, and canyon margins;
4. Revealing northerly range extensions for several southern species;
5. Discovering a rich and unique benthic infauna;
6. Finding the first known colonial deepwater corals on the US Atlantic shelf;
7. Investigating damage from mobile fishing gear;
8. Revealing deepwater temporal activity patterns such as crepuscular swarming and feeding;
9. Revealing large-scale spatial patterns in organism distribution; and
10. Utilizing new technologies like video, still photo and sonar analysis for defining meso-scale patterns.

The extent to which new discoveries thus far have been made "by accident," i.e., not by way of a well-planned, focused, hypothesis-driven sampling scheme, suggest that there is still much to be revealed by further field exploration. Near-term goals for continued work include more rigorous sampling to determine the extent and character of coral areas and other rich habitats, developing better field and lab methods for the characterization of resource-habitat relationships, and investigating sediment biogeochemistry as an indicator of system condition. Long-term goals include habitat characterization using multi-beam mapping.

Preliminary Observations on the Diversity of the Invertebrate Fauna Associated with *Lophelia* Banks off North Carolina

Session II, Abstract II-7
ORAL PRESENTATION

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Extensive reefs of *Lophelia pertusa* occur on the middle continental slope (350-700 m) of the Blake Plateau off the southeastern United States. Submersible observations revealed that these deep reefs support a diverse fish and invertebrate community. Preliminary analysis of data from collections, still photos, and videotapes to assess the invertebrate fauna associated with these deep reefs indicates that crustaceans and echinoderms are the numerically dominant components of the invertebrate fauna. Additionally, for some invertebrate taxa, species diversity is relatively low, however, numerical abundance of a particular species can be very high. For example, four species of galatheid crabs have been identified to date. One of these species, *Eumunida picta*, is a conspicuous and dominant member of the *Lophelia* associated fauna, while other galatheids are represented by few specimens. Community structure of these reefs remains poorly studied. However, several habitats (e.g., living coral, dead coral, coral rubble, sand) within the reef system have been identified. Aspects of the reef associated invertebrate assemblage observed at the North Carolina sites with regard to habitat utilization will be discussed and compared with that reported for associated invertebrate fauna observed at other *Lophelia* reefs in the Atlantic. Whether species within this community are unique to reef habitats, or are species of more widespread distribution that utilize reefs opportunistically, is still largely unknown. We will attempt to assess whether *Lophelia* reefs function as a primary habitat for these invertebrates, or if these reefs function only as alternative habitat that is occupied opportunistically by these species.

Long-term effects of quahoging and crabbing gear on the benthic ecosystem of Raritan Bay

Session III, Abstract III-1
ORAL PRESENTATION

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The studies of gear effects in Raritan Bay are relatively long-term. The objectives are to preserve the on-going fisheries for northern quahogs, *Mercenaria mercenaria*, and blue crabs, *Callinectes sapidus*. The effects of short rakes and bull rakes when quahogs are harvested and of 2-m-wide dredges when blue crabs are harvested on the benthic habitat were examined. Harvesting with short rakes no longer exists in Raritan Bay, but is widespread from the Canadian Maritimes to Florida. In Raritan Bay, harvesting with bullrakes is on going year-round, whereas crab dredging occurs during winter. The effect of harvesting with the short rake was examined in a sandy sediment. The study lasted only 3 months because no effect on the invertebrates or on sediment grain sizes was detected. The effects of harvesting with quahog bull rakes and crab dredges have been underway since 1999. The bottoms where the bull rakes and crab dredges are used consist of mud covered with live *Ampelisca abdita,* that have densities averaging 23,700/m^2, and nearly solid mats of their tubes in the same densities. The tubes project 2-2.5 cm above the bottom. The *A. abdita* are short-lived. They reproduce, resettle and cover the entire mud bottom of southeastern Raritan Bay with fresh tubes 2-3 times a year. At least 8 finfish species prey on the amphipods. The quahogs are abundant in this habitat: about 23/m^2 avg. In the fall of each year, blue crabs, mostly females, migrate from the rivers entering Raritan Bay and settle in the mud-tube habitat for the winter.

Bull raking has been on going since the early 1980's and crab dredging for at least 200 years in Raritan Bay. Natural bottoms and experimental plots are observed. Since the amphipod tubes are abundant where no harvesting currently occurs, but are temporarily scarcer where harvesting does occur, it has been obvious that the harvesting reduces the numbers of *A. abdita* and their tubes temporarily, but the habitat is restored as soon as another generation of *A. abdita* settles onto the bottom and constructs its tubes.

A system for simulating the biogeochemical habitats of lobsters, and its use for determining survival at elevated temperature

Session III, Abstract III-2
ORAL PRESENTATION

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The American lobster (*Homarus americanus*) in Western Long Island Sound (LIS) began dying in increasing numbers in 1997 culminating in the death of an estimated 12 million lobsters in 1999. The scientific consensus is that environmental condition, such as elevated temperature, reduced dissolved oxygen, and introduced contaminants were responsible for this mortality. The duration of high temperature was longer in 1999 then in previous years. High temperature and a stable water column resulted in hypoxic conditions in bottom water with the production of sulfide and ammonium.

We simulated western LIS habitat conditions in our multivariate flow-through exposure system consisting of eight sealed tanks in which chemical concentrations are maintained using countercurrent gas exchange and metering pump introduction of aqueous solutions. The tanks have a flow rate of 9.5 L/min, volume of 253 L, residence times of 27 minutes, and have accommodated up to 22 lobsters. Each tank has 28 partitions for shelter and a clear lid to allow monitoring three times a day for viability and behavioral response to exposure conditions. Lids can be opened to remove dead animals and animals to be sampled for pathology. The smallest available market-size lobsters were procured from commercial harvesters in eastern LIS and acclimated to temperature and bottom light conditions of western LIS in September, and to salinity at the Howard Lab (nominally salinity 26 psu). The approximate controls of system variables are: temperature (± 1°C), dissolved oxygen (± 8 μM), sulfide (± 2 μM), and ammonium (± 4 μM).

In experiments on the physical stress caused by temperature, eastern LIS lobsters survived at 24°C indefinitely under normoxia. They survived only 3 days at 95 μM dissolved oxygen, and only one day when 55 μM dissolved oxygen is combined with 9 μM sulfide and 17 μM ammonium.

Effects of environmental stressors on disease susceptibility in lobsters: a controlled laboratory study

Session III, Abstract III-3
ORAL PRESENTATION

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The cause of unprecedented lobster mortalities in western Long Island Sound (LIS) in 1998 and 1999 is under investigation by 50 scientists who are conducting numerous studies on paramoebiasis, pesticide poisoning, and environmental stressors. The objective of our contribution to this effort is to determine whether increased (but environmentally realistic) conditions of temperature, hypoxia, sulfide and ammonia, alone or in combination, can increase susceptibility to microbial infections. In conjunction with certain environmental conditions, a parasitic amoeba found in LIS lobsters may have contributed to deaths, but it has not been possible to culture under laboratory conditions. In order to test the lobsters' susceptibility to disease, a known bacterial lobster pathogen, *Aerococcus viridans,* was used as a surrogate organism. Market-size lobsters from commercial harvesters were acclimated for seven days to temperature and bottom light conditions that exist in LIS in September, and to salinity at the Howard Lab. Experimental lobsters were injected with $1x10^3$ or $1x10^6$ *A. viridans,* or sterile saline for control lobsters. Experimental conditions for temperature and concentrations of oxygen, sulfide and ammonium were generated in a flow-through metering system at the Howard Lab. Lobsters were monitored three times daily for viability, behavior and death. At appropriate intervals, lobsters were transported to the Milford Laboratory for enumeration of bacteria in the hepatopancreas and hemolymph. Given adequate oxygen (200µM), mortality of lobsters exposed to 6µM sulfide and 24µM ammonium increased 50% (12 days to 6.6 days). Mortalities were further accelerated to about 3 days when oxygen levels were dropped to 80 µM. Lower oxygen levels alone were sufficient to accelerate mortalities regardless of the presence of sulfide or ammonium. Temperature (14.5°C vs. 19.5°C) and bacterial dose had moderate effects on mortality. Bacterial levels in the hemolymph and hepatopancreas of non-stressed lobsters reached $1x10^9$ g^{-1} within 10 days. Counts in dying, stressed lobsters only reached $1x10^3$ to $1x10^6$ g^{-1} within the same time interval, indicating that environmentally stressed lobsters did not require as many bacteria to cause death. Further studies are in progress to examine whether the same effects are seen in lobsters infected with a second bacterium, *Vibrio fluvialis*.

Methods and importance of analyzing PCB concentrations in lobster Hepatopancreas tissues

Session III, Abstract III-4
ORAL PRESENTATION

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American lobsters, *Homarus Americanus*, are commonly found in polluted coastal waters, such as Long Island Sound. Long Island Sound consists of three distinct basins: Eastern, Central, and Western. Both the Eastern and Central basins are well mixed with good water circulation. In contrast, the Western basin is narrow and shallow so that it retains contaminants, such as, nutrients, heavy metals, and anthropogenic organic compounds from the New York metropolitan area. Lipophilic contaminants are extracted into lobsters from the surrounding water during ventilation and from prey particles in the digestive system. One major type of organic contaminant lobsters are exposed to in Long Island Sound is polychlorinated biphenyls (PCB's). The PCB compounds we are currently studying are lipophilic and accumulate in fatty tissues, especially the hepatopancreas. Methods for analyzing PCB concentrations in lobster tissue include four main parts: (1) grinding of sample in sodium sulfate and placing tissue in an Organomation instrument to extract analytes using fresh solvent over an 18 hour period; (2) column chromatography using glass wool, alumina, florosil, and silica to clean the sample from natural lipids; (3) high pressure liquid chromatography (HPLC) to further clean the tissue sample from natural lipids and fatty acids; (4) gas chromatography/mass spectrometry to identify the PCB and measure their concentrations. The results of this study will establish PCB uptake characteristics of lobsters *in situ* and potentially contribute to our understanding of the decline of lobster populations in Long Island Sound.

Comparison of two different methods of lipid analysis in fish tissue

Session III, Abstract III-5
ORAL PRESENTATION

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Lipids are a diverse group of fatty biological substances that can be polar or non-polar. The polar lipids usually make up cellular membranes that form boundaries between cells and within cells. The non-polar lipids are usually stored in the tissue and used for energy at a later time. Due to the correlation between polychlorinated biphenyl (PCBs) and lipids, it is important to conduct lipid analyses as part of the study of contaminants in fish. PCBs are anthropogenic compounds used as insulating, hydraulic and dielectric fluids until their manufacture was banned in 1978 due to environmental and health concerns. PCBs are very soluble in lipids and tend to bioconcentrate in lipid-rich organs. There are two different methods for determining lipid concentration in a sample. The gravimetric procedure provides total lipid content of the sample and is performed by evaporating a pre-determined amount of the solvent extracted sample. A second method involves Thin Layer Chromatography/ Flame Ionization Detection using an Iatroscan®, and provides actual amounts for the different classes of lipids. We will be running both analyses on the same sample in order to compare results from the two different methods. We expect that the gravimetric procedure would result in higher values, as this method does not include a back extraction to remove lipoproteins and does not differentiate between lipids and all other organic material.

Modeling study of movement and settlement of the Atlantic sea scallops in the Northeast United States Coastal Region

Session IV, Abstract IV-1
ORAL PRESENTATION

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The movement and settlement of scallops during the life stages from the fertilized egg until larval settlement are modeled using a prognostic, individual-based particle tracking model (IBM). In the model, the scallop larvae are represented by particles of various biological characteristics, which include the number of larvae each particle represents, the age and temperature dependent growth rate, life-stage dependent swimming behaviors, diel migrations, and random walks. The particles are allowed to migrate in a 3-dimensional monthly mean climatological flow field while retaining the larval biological behaviors. The flow field is resolved using a prognostic, finite volume, hydrodynamic model. The larval movement at each model time step is determined by the combined velocity of both the physical flow field and the larval swimming rate.

Three aspects of interests are researched: (1) The larval retention over Georges Bank and biological connectivity between the Georges Bank and the Mid-Atlantic Bight are investigated, (2) The biomass abundance in four shellfish closed areas, namely Closed Area I, Closed Area II, Nantucket Lightship Closed Area, and Hudson Canyon Closed Area, are examined. The origins of the settled larvae and the settlement of the larvae initiated from the areas are tracked. Statistics of the larval depth, size and age are estimated, (3) The modeled scallop abundance based on the years 1993 and 2001 egg production rates are compared with the years 1995 and 2003 recruitments, respectively. Daily mortality rates are estimated based on the comparison. In addition, the implications of the water temperature fluctuations and the random factors inherent in the physical flow fields and larval biological behaviors to the model results are examined. The potential applications to fishery management are addressed.

The influence of surface layer salinity changes on wintertime convection in Wilkinson Basin, Gulf of Maine

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Observations suggest that interannual variation of wintertime convection in Wilkinson Basin is determined to a large extent by variation in the surface layer salinity in the western Gulf of Maine (wGOM). This hypothesis is tested using the Price, Weller, Pinkel (PWP) 1-dimensional mixed layer model to simulate the water column structure over the cooling period (October through March). Comparisons are made between the convection potential for cases representing the range of observed surface layer salinity values. Model results indicate that the depth of convection can increase by as much as 50% when the salinities in the wGOM are high. In addition, density distributions in the wGOM in high salinity years suggest that winter-cooled water from the adjacent shallow coastal areas can become sufficiently dense to cascade into the deeper layers of Wilkinson Basin and enhance the convective cooling. The interannual variation in wintertime convection and in the resulting density structure has important implications for the onset of the spring production cycle. The associated variation in deeper layer temperatures has additional implications for the living marine resources in the region.

Benthic macrofauna and sedimentary habitats of the closed areas on Georges Bank

Session IV, Abstract IV-3
ORAL PRESENTATION

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The Benthic Habitat/Gear Effects Study began in June 1999 to monitor the recovery of the benthic habitats in the closed areas on Georges Bank. Bottom grab samples for enumeration of benthic macrofauna and for determination of sediment grain size and sediment TOC content were taken during each cruise. Benthic invertebrates are important to the Georges Bank ecosystem since they are a major food source for demersal resource species. Still photos and video of the sedimentary habitats were also taken and many of these correspond to the locations where benthic grabs were taken. A brief survey of the sedimentary habitats found in the closed areas and the benthic invertebrates that live on or in these sediments will be presented in this talk. The information gathered during these cruises can be used not only to monitor recovery of the closed areas but also to create habitat maps of Georges Bank. The habitat maps will help guide future research and fisheries/ecosystem management.

Yellowtail flounder cooperative tagging study

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The Northeast Fisheries Science Center is working alongside commercial fishermen in a region-wide yellowtail flounder cooperative tagging project. The study was designed, performed and revised in collaboration with New England groundfishermen; MA and RI state fisheries, fishing and conservation organizations and Canada's Department of Fisheries and Oceans. The project aims to tag yellowtail aboard commercial fishing vessels with conventional Petersen disc tags and data-storage tags from Maine to the Mid Atlantic with the objectives of estimating movement among stocks areas, mortality within stock areas as well as providing growth observations. The project also aims to demonstrate successful cooperation between the NEFSC and industry for future projects and working relations.

This project coordinates several concurrent field studies with a common tagging protocol, a single experimental and analytical design, the same tag return system as well as coordinated outreach efforts. Through the cooperation of industry leaders and fishery scientists, the study was planned to reduce uncertainty in yellowtail flounder stock assessments, thereby improving fishery management. Further details on the project design and results are available online at: www.cooperative-tagging.org.

In 2003, during cooperative field work by NEFSC, Rhode Island Fish & Wildlife and the School for Marine Science and Technology, 9334 yellowtail were tagged from the Gulf of Maine to the Mid Atlantic, 186 of which were tagged with data-storage tags. Six commercial vessels were contracted on daily and trip bases. As of December 1, 2003, tags from 369 recaptured fish were reported. Preliminary results indicate a low frequency of movement between the Cape Cod grounds and Georges Bank. Six data-storage tags have been returned, indicating distinct off-bottom movements. Five high-value ($100) reward tags have been returned, and a $1000 lottery reward was drawn in December. The movement-mortality model was developed and tested using historical tagging data.

Results from PSAT attachments to swordfish … a cautionary tale

Session IV, Abstract IV-5
ORAL PRESENTATION

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We have deployed pop-up satellite archival tags (PSATs) on 28 swordfish in the central north Pacific Ocean, as well as on sharks (bigeye thresher, blue, oceanic white-tip, shortfin mako), marlin (blue, black, and striped) and tunas (bigeye, yellowfin). The objective of the project is to determine horizontal and vertical movement patterns, and rates of survival following release from longline gear. PSAT tethers were anchored with either nylon or metal tag heads (swordfish, tunas, marlins, and bigeye thresher sharks), or attached to the dorsal fin of sharks using a cable harness. PSATs were programmed to release 1, 2, 4, 8, and 12 months following deployment.

Early detachment has been a continual problem in all species and we have found no attachment method to be clearly superior. Overall, less than 10% of the PSATs remained attached until their scheduled "pop off" date. The average time PSATs remained on swordfish was 58 days (range 5-190 days). Non-reporting has also been an issue. Only 9 of the 28 PSATs (32%) attached to swordfish reported data, which is about half the reporting rate for PSATs attached to other species.

PSATs have provided excellent data on vertical movements, and swordfish have been shown to exhibit a diurnal pattern. They are shallow at night (less than ≈80 meters), but descend to ≈500-800 meters during the day. (Bigeye thresher sharks and bigeye tuna show similar dawn and dusk movements.) These behaviors, however, prevented the PSATs from providing daily geolocation estimates. Either the low ambient light levels exceeded the limits of the light sensor, or the changing ambient light conditions caused by the fishes' rapid crepuscular movements prevented the onboard software from calculating times of dawn and dusk. Of the total days at liberty, only 11% had daily geolocation estimates.

Monitoring the juvenile sandbar shark, *Carcharhinus plumbeus,* population in the Delaware Bay nursery grounds

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Abstract was not available at press time

Indirect age estimation of butterfish *(Peprilus triacanthus)* based on otolith weights: preliminary results

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In this study, we investigated the feasibility of using otolith weights to predict the age in butterfish (*Peprilus triacanthus*). Our goal was to develop a simple and efficient method capable of providing acceptable age estimates for stock assessment modelling that could be done by less-skilled technicians.

Butterfish are a short-lived species, attaining a maximum age of six years and a length of about 25 cm. The Northeast Fisheries Science Center has aged butterfish using whole otoliths for over 25 years. However, due to increased demand for age data in recent years, this laboratory is currently seeking methods to increase our efficiency in generating the age data. Using otolith weights as a proxy for aging has been successful in various other fish species, and butterfish appears to be a good candidate for this approach.

Preliminary results (n = 75) indicate that there was no difference between the weights of left and right otoliths within a fish. Otolith weight appears to be independent of fish length, and slightly decalcified otoliths did not affect the otolith weight significantly. Therefore, most underlying assumptions necessary to using this method have been met. A preliminary linear regression explained 70% of the variability.

Further work will include measuring additional otoliths and accounting for any *a priori* growth differences between inshore and offshore groups of fish, and effects of fish length, sex, and sampling year. The predicted age distributions will then be compared to those obtained from traditional age determinations. A cost-benefit analysis will also evaluate the trade-off between increased efficiency and age determination accuracy.

A model to estimate growth rate in young-of-the-year tautog, *Tautoga onitis*, based on RNA/DNA ratio and seawater temperature

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This study defines the relationship among RNA/DNA ratios, seawater temperature, and weight-based instantaneous growth coefficient (G) in young-of-the-year (YOY) tautog, *Tautoga onitis*. Correlation results showed a significant positive relationship between RNA/DNA and weight-based growth ($r = 0.68$), and a significant negative relationship between RNA/DNA and temperature ($r = -0.51$), and RNA and temperature ($r = -0.57$). Multiple linear regression analysis indicates that RNA/DNA ratio and seawater temperature explains 60% of the variability in growth of young tautog. These results were used to develop the following equation: $G= 0.01391 (RNA/DNA) + 0.0005(T) - 0.03155$. This RNA/DNA - temperature model can be used to evaluate recent growth in YOY tautog under field conditions and may prove useful in assessing growth of fish in aquacultural systems.

Growth of juvenile black sea bass, *Centropristis striata*, in a recirculating seawater system

Session V, Abstract V-3
ORAL PRESENTATION

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The black sea bass, *Centropristis striata*, is currently being investigated as a potential aquaculture species. Although black sea bass show great potential for aquaculture, studies have not yet demonstrated the time required to produce a market-size fish. Our goal is to grow black sea bass from larvae to market size adults (454-680 grams) in 24 months or less.

Adult black sea bass broodstock collected from the wild were naturally spawned in the laboratory by photothermal manipulation. Embryos were then hatched in cone-bottom tanks that are part of a closed, recirculating seawater system. Fish remained in this system for 3-4 months and were culled by size before being transferred to three grow–out tanks that are also part of a recirculating seawater system. Fish are measured and weighed on the day of transfer and then every two weeks thereafter. Fish produced in 2001 were culled into two size groups that had mean lengths of 245.6 and 196.5 mm, and grew to mean weights of 284.2 and 203.7 g. after 24 months. Fish spawned in 2002 were culled into three size groups. These fish had mean lengths of 160.7, 190.7 and 225.1 mm and grew to mean weights of 73.0, 121.0 and 206.8 g after 19 months. To further understand factors that control growth, future research efforts should investigate temperature, lighting, reproductive physiology, and nutrition.

How different light regimes and intensities affect growth rates and nutrient uptake in *Tetraselmis chui* (PLY429)

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Mass culturing phytoplankton in large volume tanks (i.e., 18,000-L) is a practical way to produce live feeds for aquaculture. To reduce culturing costs, greenhouses can be used to minimize the amount of artificial light needed for algal growth; however, with natural sunlight there is much more variation in the light intensity and the day length than what would be found in a controlled laboratory environment. Light intensity, day length, and nutrient concentrations are important in regulating the growth of phytoplankton. This study investigated how different light intensities and day lengths affect the growth and nutrient uptake of *Tetraselmis chui* (PLY 429) an algal strain used widely as an aquaculture feed.

Tetraselmis chui cultures were grown aseptically in E/4 media (similar macro-nutrient concentrations as f/2) at a temperature of 18^{o}C. Four different light-dark cycles and three different irradiances were used, in a factorial experiment, to determine the relative importance of total light energy input and day length in controlling nutrient uptake and growth. Longer light-dark cycles and higher light intensities resulted in higher biomass production and complete utilization of nitrate and phosphate in less time, as compared with shorter days and lower intensities. Cultures exposed to 8 hours of light per day had minimal growth and nutrient uptake at all intensities. This finding that day length is important in determining growth and nutrient uptake in PLY429 suggests that, in New England during the winter months, artificial light will need to be added to algal cultures in a greenhouse.

The effects of shell hash on the survival and transport of juvenile *Spisula solidissima*

Session V, Abstract V-5
ORAL PRESENTATION

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Abstract was not available at press time.

The Mid-Atlantic Fishing Communities Project

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National Standard 8 of the Magnuson-Stevens Fishery Management Act creates a new requirement in fisheries management planning to take into account the needs of fishing communities, within the framework of conservation objectives. It poses a challenge in determining which communities are 'fishing communities' under the act and in developing adequate baseline descriptions of the communities that can be used in federal fisheries management. There are other legal requirements for similar work, which we agreed to do through a CMER grant. We focused on the Mid-Atlantic region, from Montauk, Long Island, to Cape Hatteras, North Carolina. I will present an overview of the fishing communities of the region and comment upon the changes that are taking place that influence their exposure and vulnerability to changes in the regulatory environment. One of the defining characteristics of fishing communities of the Mid-Atlantic region is that they are typically embedded in communities primarily oriented in other ways, for example tourism or urban-suburban residential development. Many are undergoing 'gentrification' processes, which result in changing values and political relations that can pose difficulties for water- and waterfront-dependent enterprises such as commercial and recreational fishing. We argue that this does not diminish their importance as fishing communities under the Magnuson-Stevens Act but rather highlights their increased vulnerability (or decreased resilience) to the short-term effects of environmental and regulatory changes.

A petroleum fingerprinting study of ribbed mussels and sediments from a previously and a freshly contaminated site in the Arthur Kill

Session VI, Abstract VI-1
ORAL PRESENTATION

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In January 1990, an oil spill damaged salt marshes along the banks of the Arthur Kill (New York and New Jersey). In the years following the spill, *Spartina alterniflora* seedlings were planted at many of the damaged sites and successfully re-established. In 1996, we began a study to compare the petroleum contamination levels at these restored sites with those found at un-restored sites in the Arthur Kill and to understand the importance of the ribbed mussels as the possible sentinel biomarkers of petroleum related spills. Our field collection protocol included sediment and ribbed mussel samples from six salt marsh sites in the Arthur Kill that included Tufts Point and Con Edison Tower. During this study, the protocols for mussel and sediment collection, mussel processing and selection, sample extraction and analysis using aliphatic hydrocarbons (normal and the branched compounds: pristane and phytane) and total petroleum hydrocarbons (TPH) were developed and used for analysis of these samples.

On May 15, 1997, a spill from RTC 320 tanker barge containing 50,000 gallons of #2 Fuel Oil occurred south of the Rahway River. This spill occurred soon after the collection of the second series of sediment and mussel samples for the original study. On May 20, 1997, additional ribbed mussel and sediment samples were collected at Tufts Point and Con Edison Tower to assess the effect of this new spill on the marsh environment and to attempt "fingerprinting" of the aliphatic hydrocarbon components present in this new oil and these new samples. The same protocols for collection and analysis of these additional samples followed those of the original study. Finally additional mussels were collected from Tufts Point during July 1997 to assess the longer term effects of the spill.

Examination of the GC/FID chromatograms shows that the spill impacted the Tufts Point site more severely than Con Edison Tower. The effects of the oil are observed most clearly in several of the ribbed mussel samples collected from Tufts Point soon after the occurrence of the spill. Weathering of the oil over time obscures the long term effect on the site. Visual inspection of the chromatographic peak pattern, a comparison of the ratio of the normal hydrocarbons n-C_{18} to n-C_{17} to the ratio of the isoprenoid hydrocarbons pristane to phytane, and factor analysis of aliphatic hydrocarbon data show a strong correlation between the hydrocarbon components in the spilled oil to those in the ribbed mussel tissue from Tufts Point. The correlation for the data from the Tufts Point sediment samples is less clear.

Update on coastal Maine river Atlantic salmon smolt studies: 2003

Session VI, Abstract VI-2
ORAL PRESENTATION

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The goal of our research is to quantify and compare Atlantic salmon smolt production across several Maine rivers. These comparisons are undertaken to (1) develop a better understanding of overwinter parr to smolt survival, population dynamics, and outmigration timing; and (2) strengthen stock assessments and population viability analyses. Atlantic salmon populations in Maine rivers are critically low and recent survival estimates from juvenile to adult stages are well below replacement levels. Beginning with the deployment of a single rotary screw trap on the Narraguagus River in 1996, NOAA-Fisheries and the Atlantic Salmon Commission have been investigating production, survival and migration of Atlantic salmon smolts in coastal Maine rivers. Today the salmon smolt research program operates 11 rotary screw traps on five rivers: four traps deployed in the Narraguagus, three traps in the Penobscot, one trap each on the Sheepscot, Pleasant and Dennys Rivers. These platforms support the field operations for the smolt production research, as well for mass marking and ultrasonic telemetry studies aimed at elucidating hatchery smolt movement patterns and survival rates. Findings of each of these field programs are summarized and briefly discussed.

Changes in the proportion of naturally reared Atlantic salmon smolts to hatchery smolts emigrating from the Penobscot River, ME, during 2000-2003

Session VI, Abstract VI-3
ORAL PRESENTATION

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Beginning in 2000, NOAA-Fisheries has operated rotary screw traps in the lower Penobscot River to capture/recapture emigrating Atlantic salmon (*Salmo salar*) smolts. One objective of this program is to determine the relative proportion of stocked smolts to naturally reared smolts, and to assess the annual variability in this ratio.

During 2000-2003, smolts were captured in the rotary traps between April and June. Fin scores were assigned to each fish based on the degree of erosion, with a fin score of 0 indicating no erosion, and a score of 3 indicating almost complete erosion of the fins, commonly seen in hatchery-reared fish. Fish with a fin score of 0 or 1 that had no tags or marks were sampled for scales, which were subsequently analyzed to determine age and life history. The proportion of stocked smolts to naturally reared smolts has remained relatively stable over the past four years. The 2003 smolt season produced a slightly higher percentage of naturally reared smolts than in previous years.

Update on NOAA Fisheries aerial surveys for right whales (*Eubalaena glacialis)* off the northeastern United States

Session VI, Abstract VI-4
ORAL PRESENTATION

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Since the last NEFSC Science Symposium in 2001, the Protected Species Branch aerial surveys for North Atlantic right whales (*Eubalaena glacialis*) have logged 1012 hours during 204 survey flights. Although most of our survey effort takes place in the spring, for the past two years the surveys have been extended into November. A new survey scheme provides systematic survey coverage over a study area that encompasses all U.S. waters north of 41° 20' N and east of 72° 50' W. Flights are performed at a speed of 100 knots at an altitude of 230 meters (750 feet) using high-wing aircraft equipped with bubble windows. All marine mammals sighted during the surveys are recorded on a computer data logging system, and photographs are taken of right whales for individual identification. In 2003, we developed and tested a new digital camera system. For this Symposium, we will present cetacean distributions observed in the study area during the 2002 and 2003 surveys, as well as images collected by the new camera system.

Sand lance as an intermediate vector in the trophic transfer of contaminants in the endangered humpback whales

Session VI, Abstract VI-5
ORAL PRESENTATION

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The humpback whale (*Megaptera novaeangliae*) is the fourth most numerically depleted large cetacean worldwide behind the right whale (Eubalaena glacialis), the blue whale (*Balaenoptera musculus*), and the bowhead whale (*Balaena mysticetus*). Some of the major actions recommended in the NMFS 1991 Humpback Whale Recovery Plan include the monitoring of parasite load and anthropogenic contaminant levels in the tissues of whales and their prey, and the identification and mitigation of possible adverse impacts of human activities and pollution on important habitat.

A mature humpback whale is estimated to require approximately 800,000 calories or almost 0.75 metric ton of food a day. Generally, humpbacks consume 95% fish and 5% zooplankton on the Stellwagen Bank, and their principal food source is a small, demersal school fish called sand lance or sand eel (*Ammodytes* spp.). We hypothesized sand lance as an intermediate vector in the trophic transfer of contaminants in the humpback whales.

Previous attempts at measuring contaminants in sand lance in our laboratory and in the laboratories of other researchers were marginally successful due to a variety of reasons including analytical interferences and the presence of contaminants near the detection limits. We modified and tested an analytical procedure that minimized the interferences and increased the concentrations of target contaminants above the detection limits. Polychlorinated biphenyl (PCB) congeners and organochlorine pesticides were positively detected and quantified in samples of individual sand lance. Based upon daily consumption rates we estimated the potential exposure of humpback whales to contaminants on the Stellwagen Bank.

Identification of *Pseudocalanus moultoni* and *Pseudocalanus newmani* from the northeast continental shelf

Abstract P-1
POSTER PRESENTATION

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In recent years population levels of the copepod *Pseudocalanus* have undergone wide fluctuations throughout the northeast continental shelf. In 2001 abundance levels of *Pseudocalanus* were nearly an order of magnitude greater than the long term mean throughout the area. These copepods are a major forage organism of larval stages of economically important demersal fishes and understanding the reasons for population fluctuations has significant implications for understanding larval feeding success and growth. What was once identified as a single widely distributed species *Pseudocalanus minutus* has recently been described as two species with over lapping ranges, P. *moultoni* and *P. newmani*. Currently, it is uncertain if one or both species are undergoing the observed fluctuations in abundance.

At present the most reliable method of species identification is through DNA analysis, which is expensive, time consuming, and cannot be performed on the formalin preserved organisms that are routinely collected in plankton samples during ecosystem monitoring surveys. This study, which has relied on an extensive literature search and intensive microscope work, demonstrates the results of efforts to develop a set of characteristics that will allow routine identification of adults to the species level with a reasonable degree of certainty.

Safer surveys: a model for developing safer marine mammal aerial surveys

Abstract P-2
POSTER PRESENTATION

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Safety in marine mammal aerial surveys is an important yet often overlooked issue. The crash of a survey plane off the coast of Florida in January 2003 in which all four people died brought the issue of safety to the forefront. There is also a history of other plane crashes involving marine mammal scientists. After the January accident, the National Oceanic and Atmospheric Administration (NOAA), undertook the task of developing safety standards for all NOAA chartered aircraft. Aerial safety is a multifaceted issue; safety standards for the aircraft, pilot(s), and scientific crewmembers all need to be considered. NOAA's workshops and discussions have resulted in specific requirements for pilot experience and training, scientific crewmember training, and safety equipment to be carried aboard the aircraft and worn by personnel. This includes mandatory aircraft ditching training and the constant wear of safety vests due to the risks involved with low altitude flight over water. In addition, NOAA now requires standards similar to FAA Part 135 for aircraft, and has established a safety council to oversee the program and certify acceptable aircraft. It is hoped that the process developed by NOAA will be of use to others in establishing similar standards.

Evidence of rapid evolution in an estuarine dependent gadid, Atlantic tomcod (*Microgadus tomcod*), in response to environmental contamination with PCBs

Abstract P-3
POSTER PRESENTATION

R. Christopher Chambers[1], David Witting[1], David Cerino[1], and Ike Wirgin[2]
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Little is known about the immediate and long-term toxic effects of PCBs in fish populations in the Hudson River Estuary, New York – a system with high levels of industrial contaminants. Atlantic tomcod, a common forage fish of estuaries from the Hudson River (HR) to Atlantic Canada, exhibits high tissue burdens of contaminants in populations inhabiting impacted estuaries. HR tomcod possess much higher levels of PCBs than tomcod examined from other sources. We used controlled exposure experiments to evaluate whether environmentally relevant congeners and concentrations of PCBs could induce toxic responses in the offspring (F_1s) and grand-offspring (F_2s) of wild fish, and whether evidence exists for genetically based tolerance to these compounds in populations with a history of exposure. We concurrently exposed and compared toxic responses in early life-stages of tomcod from a less-contaminated source, the Miramichi River, NB, Canada (MR). Eggs were exposed to a range of water-borne doses of PCBs (0.01 to 100-fold) that bracketed levels ('×') measured previously in livers of adult HR tomcod. Morphometric, developmental, behavioral, and viability variables constituted the suite of measured responses in eggs and larvae. Significant source-population effects were evident, as were effects of doses within the MR groups, for all classes of response variables. MR fish exhibited lower viability, less activity, slower development, and higher levels of abnormalities than HR fish at doses ≥ 1 ×. HR eggs and larvae were largely insensitive to PCBs across the entire range of doses in both the F_1 and F_2 generations. Not only is the tolerance exhibited by HR tomcod believed to have arisen recently, likely in the last 100 years, but the high levels of PCBs in tomcod tissues are likely to bioaccumulate in the array of piscivorous fish species that regularly consume tomcod in the Hudson River Estuary.

Hard-substrate reef as a habitat for finfish, preliminary results

Abstract P-4
POSTER PRESENTATION

Paul E. Clark[1], Ronald Goldberg[1], Catherine Kuropat[1], Reneé Mercaldo-Allen[1], Jose J. Pereira[1] and Lauren M. Vinokur[2]
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Hard-bottom substrates, such as reefs, have been shown to be an important habitat for fishes such as tautog (*Tautoga onitis*), cunner (*Tautogolabrus adspersus*), and black sea bass (*Centropristes striatus*). We investigated spatial and temporal distribution of adult, juvenile, and young-of-the-year fishes on and in proximity to a natural reef near Charles Island in Long Island Sound using traps, trammel nets, gill nets, and hook and line sampling. Stomach content analyses were performed on all carnivorous fishes sampled. Tautog captured in traps were found to consume mainly calanoid copepods (85.71% frequency of occurrence). The species composition of fishes captured in traps on the reef did not differ significantly from those off the reef, however significantly more recently settled cunner were captured on the reef than off ($p<0.025$). During the period of peak settlement for cunner, late July through mid-August, a soak-time for the traps of 1-day was determined to be most effective. To investigate the stock enhancement potential of fishes, it is important to understand the habitat requirements of all life stages, as well as the ecology of possible enhancement sites.

Stomach content analysis of northern, *Prionotus carolinus* (Linnaeus) and striped, *Prionotus evolans* (Linnaeus) searobins from Long Island Sound

Abstract P-5
POSTER PRESENTATION

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[2]*University of Massachusetts, Natural Resources Conservation Department, Amherst MA 01003*

Northern and striped searobins are sympatric in Long Island Sound from April through October. Striped searobins have consistently ranked among the most abundant fishes captured as part of the CT DEP Long Island Sound trawl survey. Abundant fish species can potentially impact commercially and recreationally important fish and shellfish populations through competition for resources and predation. Searobins were collected for stomach content analysis by various methods (beach seine, otter trawl, gill net, and CT DEP Trawl Survey) throughout the Sound in 1998 and 1999 to investigate prey type and size selectivity, ontogenetic shifts, resource partitioning, food habits, and possible impact on other species. In this study, the 1308 striped and 489 northern searobins sampled, were measured, weighed, sexed, dissected, and the stomachs preserved in formalin. Prey were identified to the lowest taxon possible, and measured, dried to a constant weight at 50 ^{o}C, and weighed. Although the diets of both species were dominated by crustaceans such as *Crangon septemspinosa, Cancer irroratus,* unidentified Brachyura, and Xanthidae, northern searobins consumed more *Gammarus spp.,* and Amphipoda while striped consumed more *Squilla empusa* and *Ovalipes ocellatus*. Northern searobins consumed a significantly smaller number of piscine prey taxa than striped searobins (2 vs.27). *Pseudopleuronectes americanus* occurred with the greatest frequency among fishes consumed by striped searobins. Preliminary results from this study suggest that striped searobins consumed a wider variety, larger amounts, and greater size ranges of prey than northern searobins.

The Mid-Atlantic Fishing Communities Project

Abstract P-6
POSTER PRESENTATION

Bonnie J. McCay**,** Kevin St. Martin, Bryan Oles, Brent Stoffle,
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Dept. of Human Ecology, Cook College, Rutgers the State University, New Brunswick, New Jersey

National Standard 8 of the Magnuson-Stevens Fishery Management Act creates a new requirement in fisheries management planning to take into account the needs of fishing communities, within the framework of conservation objectives. It poses a challenge in determining which communities are 'fishing communities' under the act and in developing adequate baseline descriptions of the communities that can be used in federal fisheries management. There are other legal requirements for similar work, which we agreed to do through a CMER grant. We focused on the Mid-Atlantic region, from Montauk, Long Island, to Cape Hatteras, North Carolina. I will present an overview of the fishing communities of the region and comment upon the changes that are taking place that influence their exposure and vulnerability to changes in the regulatory environment. One of the defining characteristics of fishing communities of the Mid-Atlantic region is that they are typically embedded in communities primarily oriented in other ways, for example tourism or urban-suburban residential development. Many are undergoing 'gentrification' processes, which result in changing values and political relations that can pose difficulties for water- and waterfront-dependent enterprises such as commercial and recreational fishing. We argue that this does not diminish their importance as fishing communities under the Magnuson-Stevens Act but rather highlights their increased vulnerability (or decreased resilience) to the short-term effects of environmental and regulatory changes.

Sediment grain size and groundfish assemblage structure in the northeastern continental shelf ecosystem

Abstract P-7
POSTER PRESENTATION

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The relationships between groundfish assemblage structure and benthic habitat characteristics over large spatial scales are not well defined. GIS methods were used to integrate two synoptic data sets including a high resolution surficial sediment grain size data set compiled by the USGS and a multi-species groundfish biomass data set collected by the NEFSC bottom trawl surveys over the past 40 years. Multivariate statistical methods were then employed to determine the linkages between groundfish assemblages and the grain size of their benthic substrate in sequential five-year time blocks. The results of this analysis show that some species consistently dominate all substrate types whereas other species associate with particular ranges of sediment grain size. With some exceptions, species-habitat associations were generally consistent over the 40-year time interval examined. This work provides the foundation for planned future studies of vital population rates and habitat linkages for groundfish species in the northeastern continental shelf ecosystem.

Seasonal movement of black sea bass

Abstract P-8
POSTER PRESENTATION

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Black sea bass (*Centropristis striata*) undergo annual migrations from coastal habitats to offshore shelf waters in autumn, with a return migration during spring months. Our knowledge of migration patterns has been based on seasonal distribution information from NEFSC survey and fishery data; however, little is known about offshore mixing among coastal components of the population.

We initiated a black sea bass tagging project to examine seasonal migrations as well as to identify movement patterns during the coastal residency period. The project has released 9,537 fish over three distinct tagging sessions (September 2002, May 2003 and September 2003); as of 12/31/2003, there were 1,198 recaptures reported by recreational and commercial fishermen from Cape Cod, MA to Cape Hatteras, NC. Comparison of release and recapture location data has led to the demonstration of several migratory patterns along the coast of the North Atlantic. Preliminary data suggests that fish from separate coastal areas mix within relatively small (2˚) latitudinal ranges, but there is not significant mingling between groups over greater distances.

In addition to traditional internal anchor tags, we dispersed 117 electronic data storage tags at four locations along the coast, prior to the autumn 2003 offshore migration. Measuring temperature and depth at regular time intervals (15 minutes or greater), they will supply a third dimension to the location information of black sea bass during winter months and help in the determination of their range of depth and temperature preferences while crossing the continental shelf.

Natural spawning of black sea bass, *Centropristis striata*, at the NMFS Milford Laboratory and the UMASS Dartmouth Laboratory with observations on spawning behavior

Abstract P-9
POSTER PRESENTATION

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Attempts at spawning black sea bass (1984-2003) have centered on artificial spawning, collecting adult black sea bass in spawning condition and hand stripping both males and females. Other attempts have focused on inducing ovulation by intramuscular injection of two hormones; human chorionic gonadotropin or luteinizing hormone releasing hormone analog (LHRHa) and then stripping the fish. These attempts were all successful to varying degrees, however, induction of natural spawning had not been reported.

Milford Laboratory and UMASS Dartmouth Laboratory staff, have used photothermal manipulation to induce natural spawning. Photothermally manipulated fish have spawned from mid-April to mid-July at the Dartmouth Laboratory and from the end of May until the beginning of July at the Milford Laboratory. Percent viable embryos have ranged from 0% (first eggs produced) to 100% (middle of the spawning season).

Natural spawning of black sea bass removed stress to the fish caused by hand stripping and eliminated the costs and procedures associated with the use and injection of hormones. The numbers of viable embryos produced were sufficient to support culture activities. We have also made observations on the spawning behavior of black sea bass in the course of our conditioning procedures and found that one dominant male (alpha) appeared to control spawning activity.

Keywords: black sea bass, spawning, photothermal manipulation

The abundance and distribution of *Temora longicornis* (Copepoda) within the Northwest Atlantic shelf waters, 1977-2002

Abstract P-10
POSTER PRESENTATION

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Seasonal abundance and distribution of the neritic copepod *Temora longicornis* were examined within the Northwest Atlantic Large Marine Ecosystem for the years 1977-2002. Preliminary results of the interannual variability indicated that the copepod's abundance had surged during late spring in recent years. Examinations of the copepod's late spring distribution indicate that *Temora* has shifted northward, becoming substantially more abundant in the Georges Bank and Gulf of Maine regions.

Culture and rearing techniques of scyphozoans and hydrozoans (jellies) in public aquaria for exhibit display

Abstract P-11
POSTER PRESENTATION

Brandon Schmidt
NOAA/NMFS/NEFSC, 166 Water Street, Woods Hole, MA 02543-1026

To properly exhibit the delicate medusae of scyphozoans and hydrozoans in aquaria requires culturing and rearing a constant supply of animals due to the excessive costs associated with their collection and the ephemeral nature of their lifespan. This poster summarizes the techniques of propagation which include initial collection of wild stock, proper transport of specimens, the establishment of new cultures, collecting and handling larval planulae and polypoid phases, manipulating polyps to strobilate, and then the final process of rearing ephyrae to the adult medusae stage for exhibit.

Sectioning otoliths in the 21st century: increased efficiency through the use of new technology

Abstract P-12
POSTER PRESENTATION

Nina Shepherd, Sandra J. Sutherland, Sarah Pregracke, Daphne Cassidy, Christine Esteves, Blanche Jackson, Elizabeth O'Neill, and John Burnett
NOAA/NMFS/NEFSC, 166 Water Street, Woods Hole, MA 02543-1026

The Fishery Biology Program at the Woods Hole laboratory has recently acquired an Otolith Sectioning (OS) System from Benetec Ltd. This is the first machine of its kind to be used in North America, and only the eighth in the world. This new system will replace the methodology that has been used to section otoliths in this lab for over 40 years. Our previous technique had been to embed a single otolith in paraffin wax on a cardboard tag, and then thin-section it using an Isomet low-speed saw with two closely spaced diamond-impregnated blades. Each section was then removed from the wax and returned to an individual envelope.

With the new OS System, however, otoliths are embedded in polyester resin in aluminum molds. Four to eight otoliths are aligned in each row, with six rows per mold. The blocks of resin are then cut using a high-speed saw with one thin metal-bonded diamond blade. Two cuts are made for each row of otoliths, yielding a thin strip of resin in which the sections are embedded. These six strips are then glued onto a Plexiglas slide. Because this system allows up to 48 otoliths to be sectioned at once, it greatly increases efficiency. It takes less than 30 minutes to cut one block of otoliths. Also, by mounting the sections on Plexiglas slides, it makes much easier for the age reader by eliminating the need to pull each individual section out of an envelope. It is hoped that this machine will also reduce breakage of otolith sections, and eliminate the need for fine-tuning the thickness of the cuts.

A study was undertaken to determine if sections obtained from the new methodology generated ages comparable to those using prior methods. One age reader viewed both otoliths from 198 haddock and obtained 90.4% agreement, with an overall coefficient of variation of 2.14%. This high precision level between the two sectioning methods indicates that the OS System yields ages similar to those obtained from the standard method.

Spawning duration and frequency of weakfish, *Cynoscion regalis*, near the northern margin of its geographic range based on the size and age structure of young-of-the-year

Abstract P-13
POSTER PRESENTATION

Donald D. Shrump Jr. and R. Christopher Chambers
NOAA/NMFS/NEFSC, 74 Magruder Road, Highlands, NJ 07732

Weakfish, *Cynoscion regalis*, is a key member of the commercially and recreationally important species of the Mid-Atlantic Bight that inhabits inland waters during its larval and juvenile life-stages. Most studies on the timing of weakfish reproduction have used gonadal analysis and have focused on populations to the south of the Hudson River. Some studies have inferred the frequency of weakfish spawning from length distributions of young-of-the-year (YOY) juveniles, but this method is imprecise due to the variations in growth rate of YOY. This study utilizes sizes and otolith-based ages of YOY weakfish to evaluate the frequency and duration of spawning. YOY weakfish were collected from the Hudson River by trawling during monthly surveys from April through October of 2001 and 2002 (surveys were not conducted in May or September). YOY were collected by 5-min trawl tows at up to 10 stations, from the Battery to Newburgh, New York. YOY weakfish were abundant in our July, August, and October surveys in both years and each monthly length-frequency distribution was unimodal. In 2002, however, YOY weakfish were collected as early as June. Analysis of the otolith-based hatch-date distribution of YOY weakfish from 2002 suggests some early spawning in April with the median hatch-date in late June. We also estimated hatch-date distributions of YOY for both year-classes based on size-at-collection and estimates of year-specific growth rates. This size-based reconstruction of the hatch-dates also suggested an earlier initiation of spawning in 2002 than in 2001. The interannual variability in the timing of spawning that we observed may be due to variations in environmental factors and/or variation in the demographic composition and condition of the mature females.

Age-structure reference collections: the importance of being earnest

Abstract P-14
POSTER PRESENTATION

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After decades of relying on the "two-reader" system for Quality Assurance/ Quality Control in production aging, the Fishery Biology Program (a.k.a. Age and Growth Unit) is in the process of implementing age-structure reference collections to ensure the accuracy and precision of the age data generated by the group. Diminishing staff, coupled with the increasing number of analytical age-based stock assessments, has spelled doom for the luxury of having two age readers for each species. Moreover, calibration of age readers against reference collections provides a superior measure of age-reader error than agreement levels between two readers. Reference collections also provide an ideal training platform for the orientation of new age readers, an important consideration for a group facing numerous retirements in the near future.

The development of a reference collection requires the comprehensive selection of age structure samples from representative stock areas, sizes, sexes, seasons, habitats, and sampling sources/fisheries for each species. Ideally, samples should be from known-age fish, such as those provided by tag/recapture or age validation studies, but these are hard to obtain. For most species, reference collection samples are consensus-aged fish obtained from age structure exchanges and/or workshops in cooperation with other aging laboratories. Reference collections need to be dynamic, regularly incorporating new samples to reflect changing stock conditions and to prevent age-reader memorization of the collection.

Currently, the Fishery Biology Program has viable reference collections of 400+ fish for cod and haddock, with those for yellowtail flounder, scup, Atlantic herring, winter flounder, and summer flounder nearing completion. For cod and haddock, age readers will be given 100 randomly selected digital images for aging and annotation. When desired species-specific levels of precision are achieved from this exercise, the reader is cleared for production aging. This drill will be repeated at the conclusion of production aging, and aging-error statistics will be made available for the stock assessment process.

Communal effects between *Argopecten irradians irradians* and *Nassarius obsoletus*

Abstract P-15
POSTER PRESENTATION

David J. Veilleux and Katlyn Mihalek
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Groups of bay scallops, *Argopecten irradians irradians*, and mud dog whelks, *Nassarius obsoletus,* were placed in pearl nets to test if the presence of the snails would control biofouling and reduce sedimentation within the suspended culture gear. The nets were hung for thirty-three days in order to attain settlement of the fouling communities and the level of sediments common to aquaculture gear. We compared survival and growth of scallops in treatments (n=2) with and without the presence of snails. The wet weights and shell heights were measured for all animals at the start and finish of the experiment. Scallop wet weight averaged 32 g greater in treatments containing snails compared to those without snails. This increase in weight may be attributed to the snail's ability to clear the mesh of fouling, and therefore increasing water flow rates to the scallops. The results from this trial suggest that this simple low-cost approach may improve aquaculture productivity.

PCB bioaccumulation trends and ecosystem stress responses in young-of-the-year bluefish (*Pomatomus saltatrix*)

Abstract P-16
POSTER PRESENTATION

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The early life stages of fish are sensitive to habitat degradation. The poor condition of fish in the early life stages could eventually result in adverse effects in the adult population. We will look at contaminant bioaccumulation, such as PCBs, and the potential adverse effect of habitat quality on the condition of young-of-the-year (YOY) bluefish in the Hudson River Estuary. The overall goal of this dissertation research is to document PCB trends over a two-year period and to investigate the cellular and physiochemical ecosystem stress responses that may be related to xenobiotic contamination or poor habitat quality. Biomarker induction of emigrating YOY bluefish will be used as an indicator of contaminant exposure and cumulative ecosystem stress. We will examine three variables: CYP1A, vitellogenin, and DNA adducts. Second, we will document condition factor, length-weight regression, and lipid classes as physiochemical indicators of habitat quality of the Hudson River Estuary.

This project is part of an effort at the NMFS-Sandy Hook Laboratory to assess ecosystem stress responses of YOY bluefish from different nursery estuaries with varying levels of contamination. The results of these combined studies would allow us to compare and contrast the effects of the Hudson River's habitat quality on juvenile bluefish with bluefish utilizing other estuarine ecosystems as nursery habitats. Since cellular and physiochemical-level stresses could be correlated with alterations in such behavior as reproduction and predation at the organism level, the results of this study may have implications on the bluefish population and community level.

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