CONSERVATION AND UTILIZATION DIVISION
END-OF-YEAR REPORT 1991

PRELIMINARY EVALUATION OF HARBOR PORPOISE BY-CATCH SIGNIFICANCE: Based on preliminary estimates of by-catch and abundance, the significance of the by-catch of harbor porpoise was evaluated by comparing the by-catch levels and the abundance levels. This suggested that the by-catch was likely 2 or 3% of the total abundance, but could be as high as 5%. The by-catch is thus now likely to be biologically significant but not catastrophic as previously suggested (Dr. Tim Smith, FTS 700-840-1251 or (508) 548-5123).

DISTRIBUTION OF PELAGIC DELPHINID SPECIES ON CONTINENTAL SHELF BREAK DESCRIBED: The distribution of cetaceans along the continental shelf break was mapped during a June 1991 line transect sighting survey, showing high densities of such species as pilot whales, sperm whales, beaked whales, and common, striped, and bottlenose dolphins. These were strongly associated with undersea canyons and oceanographic features such as warm core rings (Gordon Waring, FTS 700-840-1311, or (508) 548-5123).

THE NATURAL RATE OF INCREASE OF KILLER WHALES ESTIMATED FOR INDIVIDUAL PODS: New mathematical analysis methods were developed to allow estimation of the natural rate of increase of killer whale pods individually, rather than for the whole population in aggregation. These methods will allow estimates of the contribution of particular population components such as post-reproductive females to the overall viability of the pods (Dr. Solange Brault, FTS 700-840-1388 or (508) 548-5123).

HERRING RECOVERY CONTINUES: Production estimates for larval Atlantic herring increased 7-fold in the Georges Bank/Nantucket Shoals/Massachusetts Bay area between 1988 and 1990. The center of spawning activity during the 3-year period was located on Nantucket Shoals. Despite a 20-year high in larval abundance in 1990, the historically prominent spawning beds on the Northeast Peak of Georges Bank remained dormant (W. G. Smith, FTS 908-872--3060 or (908) 872-3060).

HERRING FECUNDITY AND GROWTH RATES DECLINE AS POPULATION GROWS: Growth rates and fecundity estimates of Atlantic herring declined significantly between 1989 and 1990, a period of dramatic population growth in the Georges Bank study area. In 1989, 3 to 5 year old herring had an average weight of 212.7 g and produced 84,071 eggs per female; in 1990 average weight and fecundity declined to 182.0 and 68,599, respectively (Myron Silverman, FTS 908-872-3033 or (908) 872-3033).

SEAROBIN LARVAE IN MIDDLE ATLANTIC BIGHT LARGELY ONE SPECIES: Despite the reported occurrence of several species of searobins in the Middle Atlantic Bight, two of which are considered common,

in the Middle Atlantic Bight, two of which are considered common, an ongoing descriptive study of searobin larvae from 1984-87 MARMAP surveys reveals that 93% are northern searobins, Prionotus carolinus (Michael P. Fahay, FTS 908-872-3061 or (908) 872-3061).

LARVAL FISH DISTRIBUTIONS RELATED TO ECOLOGICAL VARIABLES: An analysis of distribution patterns of larval fishes in the Northeast Shelf Ecosystem showed that they were significantly related to zooplankton and water temperature on Georges Bank and in the Middle Atlantic Bight and to depth in the Gulf of Maine. Water column stratification was a significant factor only in the Middle Atlantic Bight in summer (Wallace Morse, FTS 908-872-3040 or (908) 872-3040).

PROCEEDINGS OF LARGE MARINE ECOSYSTEMS SYMPOSIUM PUBLISHED: "Food Chains, Yields, Models, and Management of Large Marine Ecosystems" was published focusing on the food chains and biomass yields of the U.S. Exclusive Economic Zone and adjacent waters, providing case studies of LMEs and offering new insights on the trophodynamics and management strategies for increasing the long-term sustainability of the living marine resources under the jurisdiction of the United States (Kenneth Sherman, FTS 401-782-3210 or (401) 782-3210).

FUNCTIONAL MORPHOLOGICAL SERIES OF EARLY LIFE STAGE COD AND HADDOCK DESCRIBED: A morphological developmental series of Atlantic cod and haddock was described, illustrated, and compared for the larvae through demersal juveniles (ca 4-100 mm) from a series of specimens collected in the Georges Bank area. Cod and haddock differ in their development as early larvae in fin formation and ray counts, and overall fin size. Haddock possess a greater total number of caudal, anal, and dorsal fin rays than cod which altogether may provide greater swimming maneuverability. Differences between cod and haddock can be related to differences in larval-juvenile feeding behavior and prey preference manifest in the adult fish (Dr. R. G. Lough, FTS 700-840-1290 or (508) 540-5123).

FEMALE SIZE AFFECTS REPRODUCTIVE PARAMETERS OF WINTER FLOUNDER: Vital statistics and embryo and larval viability were determined for winter flounder, Pseudopleuronectes americanus, spawning in Narragansett Bay, Rhode Island, USA, over the course of the spawning season. Fish approaching spawning condition were collected throughout the spawning season and hand-stripped in the laboratory. Larvae were reared through the first month of life. Female size affected most of the reproductive parameters examined, including both absolute and relative measures of total reproductive output (reproductive rate and gonadosomatic index), egg size, fecundity, and viability. The implication is that larger females may have more reproductive success (Dr. Lawrence Buckley, FTS 401-782-3278 or (401) 782-3278).

HIGH GROWTH RATES OBSERVED FOR EARLY LIFE STAGES OF WINTER FLOUNDER AND TAUTOG IN EXPERIMENTAL FIELD STUDIES: Field research to demonstrate the usefulness of in situ mesocosms for monitoring growth and survival of early life stage fishes was completed. Environmental chambers were deployed and stocked with larval winter flounder at sites in Wickford Harbor, the Providence River, and the Kickamuit River in Narragansett Bay, RI. Plankton levels and physical parameters were monitored at the three sites. Winter flounder larvae held in 5 m open mesh enclosures set in the Kickamuit River grew at between 20 and 26%/day in dry weight. Tautog larvae held at the same location grew 25%/day. These are the highest growth rates observed for these species (Thomas Halavik FTS 401-782-3220 or (401) 782-3220).

SIZE OF WINTER FLOUNDER LARVAE MAY AFFECT SURVIVAL POTENTIAL: Winter flounder, Pseudopleuronectes americanus collected at selected locations in Long Island Sound (LIS), New York, and Narragansett Bay (NB), Rhode Island, USA, were spawned in the laboratory and the larvae reared for a month after hatching. A direct correlation was observed between size of yolk-sac larvae and survival suggesting that when differences in size among newly hatched larvae are sufficiently large, survival potential can vary (Dr. Lawrence Buckley FTS 401-782-3278 or (401) 782-3278).

HERRING HAVE NOT RE-COLONIZED NORTHEASTERN GEORGES BANK: A collaborative effort of the USGS, NMFS, and Bigelow Laboratory to map the marine environment of the northeastern Georges Bank margin resulted in improved interpretations of the sedimentary environment but was unsuccessful in locating herring egg beds in historic spawning grounds located on gravel sea bed. Our data suggest the herring have not yet re-colonized this spawning area, as we detected no sign of egg beds during the peak spawning season (Dr. R.G. Lough FTS 700-840-1290 or (508) 548-5123).

HABITAT FOR JUVENILE COD ON GEORGES BANK DESCRIBED IN DETAIL IN COOPERATIVE STUDIES: Cooperative research between the US Geological Survey and the NEFSC showed linkages between the physical and biological aspects of the marine environment in detail. New digital data base maps were compiled that showed topography, sedimentary environment, tidal currents, and water column properties. Distribution patterns of pelagic and demersal juvenile cod on eastern Georges Bank (1984-89) suggest that the gravel-based habitat of the northern edge favors the survival of recently settled cod and may be essential for their recruitment success (Dr. R.G. Lough FTS 700-840-1290 or (508) 548-5123).

VIDEO PLANKTON RECORDER UNDER DEVELOPMENT: The VPR is designed to quantify abundance of plankton on scales from microns to kilometers and identify them to major taxa (eg., copepods, chaetognaths) in near real-time at towing speeds of 0.5--3.0 m/s.

It consists of a video camera/strobe unit and an image processing system. Four video cameras are synchronized at 60 fields/s to a read strobe light positioned 1 m away. The field of view of each camera is adjustable between 0.5--10 cm (10--300 field of 4.0--20 cm (plus or minus 3%). Imaged volumes are concentric with their center located 0.5 m between cameras and strobe. Each strobe pulse is about 1 microsecond allowing clear stop-action pictures of plankton and seston. Outlines of video images are determined in real time by an image processor and computed and organisms are sorted to major taxa using discriminant analysis (Mark Berman, FTS 401-782-3343 or (401) 782-3243).

ECOSYSTEM SURVEY COMPLETED: The first of MARMAP/EMAP ecosystem surveys was completed. The objective of the ecosystem surveys is to assess the impact of changing biological and physical properties of the Northeast Continental Shelf ecosystem which influence the health and the sustainable productivity of the living marine resources. New sampling protocol included towed-body sampling with the Continuous Plankton Recorder (CPR) between station transects, as well as along new transects. The key station transects were located off the major estuaries and across areas of particular interest (e.g., Georges Bank and the Gulf of Maine). Surface chlorophyll measurements were made along the entire track of the cruise (J. Green, FTS 401-782-3240 or (401) 782-3240).

ZOOPLANKTON AT DEEP WATER DUMPSITE 106: An interim report to NOS on the status of data analysis of Plankton and KMT samples from DWD 106 was prepared. The report included information on species composition and abundance of the zooplankton community of the dumpsite study area and the feeding habits of the mid-water fish populations from bongo and stomach samples. Of particular interest was the high incidence of species of the copepod genus, Pleuromamma in the stomachs of the myctophids Benthosema glaciale, Ceratoscopelus maderenis, Hygophum hygomi, and Lobianchia dolfleini. The prevalence of these copepods was not reflected in their abundance in the samples, but may be due to the presence of luminescent organs in most species of Pleuromamma which make them easy targets for predators (J. Green, FTS 401-782-3240 or (401) 782-3240).

SHARK TAGGING NEWSLETTER PUBLISHED: The Center distributed to cooperators in the NOAA/NMFS Cooperative Shark Tagging Program its annual newsletter, The Shark Tagger, highlighting distance and time records for sharks tagged and recaptured, results of field studies, and an update on the Shark Fisheries Management Plan (J. Casey, FTS 401-782-3320 or (401) 782-3320).

NMFS COOPERATIVE TAGGING PROGRAM: In 1991, a total of 6902 fish representing 34 species of sharks, 13 species of teleosts, and 7 species of rays were tagged in the NMFS Cooperative Shark Tagging Program. The majority were blue sharks (3818), sandbar sharks

(789), tiger sharks (537), dusky sharks (313), and blacktip sharks (213). This is the second largest number released for any year in the history of the Program (just 300 fish fewer than the record number tagged in 1985). Anglers accounted for 72 % of the total releases followed by commercial fishermen (15 %), NMFS and other biologists (7 %), R/V Geronimo biologists (6 %), and domestic observers (< 1 %). Fish were released by taggers representing 8 countries-United States, Italy, Portugal, Spain, England, Netherlands, South Africa and Ireland (N. Kohler, FTS 401-782-3332 or (401) 782-3332).

MIGRATION PATTERNS OF THE SHORTFIN MAKO DETERMINED: A total of 2,459 mako sharks (I. oxyrinchus) were tagged by the Cooperative Shark Tagging Program off the Atlantic coast of North American and in the Gulf of Mexico in the 28-year period between 1962 and 1989. The sharks were tagged by volunteer fishermen, scientists aboard research vessels, and U.S. Foreign Fisheries Observers on foreign vessels fishing in U.S. waters. A total of 231 recaptures (9.4% of releases) of tagged I. oxyrinchus have been reported by fishermen representing 16 countries. The maximum time at liberty is 8.2 years and the maximum distance travelled between tag and recapture location is 2,452 nautical miles. One tag was recovered from the European side of the Mid-Atlantic Ridge. Mako shark distribution and migratory patterns in relation to temperature are discussed for the western North Atlantic (Jack Casey FTS 401-782-3320 or (401) 782-3320).

SANDBAR SHARKS PREY ON BONY FISH AND SKATES: Food habits of 415 sandbar sharks collected in the area between Cape Hatteras and Georges Bank (Great South Channel) were determined. Forty-nine percent of the juvenile and adult stomachs contained food. Although prey is primarily fish (teleosts and skates), eighty percent of the stomachs from pups held food remains consisting almost exclusively of soft blue crabs. The daily ration estimates as percentage of the mean body weight are 1.43 for pups, and 0.86 for juveniles and adults. Annual food consumption is estimated to be 5.1 times the mean body weight for pups, and 3.1 times body weight for juveniles and adults (Chuck Stillwell FTS 401-782-3327 or (401) 782-3327).

SANDBAR SHARK AGE ESTIMATES REVISED: In our study of age and growth of the sandbar shark published in 1985, age estimates were based on vertebral rings with additional evidence provided by tag and recapture data, length-frequency distributions, and sharks maintained in aquaria. Despite the attempt to support vertebral ring interpretation by these other methods, tag recoveries in subsequent years provided evidence that our age determination from vertebrae were underestimated. Recent long-term tag returns suggest the sandbar shark grows much slower than we previously proposed and may take nearly 30 yr to reach maturity (Jack Casey FTS 401-782-3320 or (401) 782-3320).

FEMALE SHARKS STORE SPERM TO ENSURE REPRODUCTIVE SUCCESS: Spermatozoa may be routinely observed and is some times found to be stored in oviducal glands of pelagic and coastal sharks sampled off the North American east coast as revealed by light microscopy. Of eleven species surveyed, sperm was found in nine: common thresher, porbeagle, dusky shark, sandbar shark, tiger shark, blue shark, Atlantic sharpnose shark, scalloped hammerhead, and the bonnethead. Three insemination patterns are proposed to account for differences noted in these findings: (1) non-storage/immediate insemination for sharks such as the porbeagle; (2) short-term storage/delayed insemination as found in sharks in which ovulation is prolonged over weeks or months such as the Atlantic sharpnose, and (3) long-term storage/repeated insemination, a characteristic of nomadic sharks such as the blue shark and the dusky shark which can store sperm in specialized tubules for months to years (Wes Pratt FTS 401-782-3323 or (401) 782-3323).

ENVIRONMENTAL TEMPERATURE HAS NO EFFECT ON ANNUAL BAND DEPOSITION IN SKATES: Skates injected with antibiotic tetracycline, used as a biological marker, were maintained in aquaria for one year. Band deposition patterns from skates kept under fluctuating environmental temperature conditions were compared to deposition patterns of skates kept under constant temperature conditions, all other factors being the same. The results suggest that although temperature does not seem to have an effect on band deposition in the little skate it may be a factor for other elasmobranch species which may have a difference in life history or metabolism (Jack Casey FTS 401-782-3320 or (401) 782-3320).

DUSKY SHARKS IN DIFFERENT OCEANS GROW AT SAME RATE: Age and growth of the dusky shark, Carcharhinus obscurus, in the Western North Atlantic Ocean and the South West Indian Ocean were estimated from bands in vertebral centra. Additional growth information from tag-recapture and length-frequency data were available for the Western North Atlantic population. Comparison of growth parameters for the two populations indicated that they grow at the same rate. Maturity was estimated at approximately 17 yr for both sexes in the Indian Ocean. The oldest fish aged in each population was 34 yr. (Jack Casey FTS 401-782-3320 or (401) 782-3320).

FOOD CHAIN DYNAMICS AND FISHERIES MANAGEMENT: The relationship of food chain dynamics to fisheries management was explored in "Resource Productivity and Fisheries Management of the Northeast Shelf Ecosystem", a recent publication. It describes fishery resource productivity, energy flow in the fish community, and the biological basis for management of the important multispecies demersal fishery resource and how the fishing has responded to management. It identifies potential future courses of action that should be considered to improve the resource situation and the fishery (Marvin Grosslein, FTS 700-840-1252 or (508) 548-5123).

ROLE OF PREDATION ON SAND LANCE ANALYZED: Evidence for the regulation of sand lance populations by Atlantic mackerel and Atlantic herring in the Northeast Shelf ecosystem was analyzed. Diets of mackerel and herring indicated important interactions among the species, population levels of each have fluctuated widely during the last two decades, and similar changes in system structure have also occurred in the North Sea ecosystem. Changes in the abundance of sand lance are consistent with predatory control by herring and mackerel (Michael J. Fogarty, FTS 700-840-1255 or (508) 548-5123).

LOCAL SCALE FACTORS AFFECT RECRUITMENT: Results of a study comparing the influence of large scale (several hundred to thousands of kilometers) and local scale (10 to a few hundred kilometers) factors on the recruitment of cod and haddock in the Northwest Atlantic indicate that local-scale processes, rather than large-scale physical forcing, dominate the recruitment patterns of cod and haddock (Marvin Grosslein, FTS 700-840-1252 or (508) 548-5123).

FACTORS AFFECTING RECRUITMENT REVIEWED: A study characterizing interactions among various factors affecting recruitment in harvested marine living resources was published. Problems in distinguishing among the factors are reviewed and suggestions for contemporary approaches to address them are outlined (Michael J. Fogarty, FTS 700-840-1255 or (508) 548-5123).

COMMERCIAL DATA AVAILABLE FOR 1991: Basic landings and value data for Northeast commercial fisheries have been completed and are now available. (Ronnee L. Schultz, FTS 700-840-1264 or 508-548-5123.)

GULF OF MAINE STATISTICAL DATA COLLECTION INTENSIFIED: A program was initiated to more directly monitor and document landings and effort by vessels operating from smaller Gulf of Maine ports where little direct contact between fishermen and NMFS port agents has occurred in the past. The first year of collection will be completed this summer. Roving port agents have been conducting personal interviews with vessel captains to obtain fishing location, depth and effort information and biological samples of the landings, thus providing data previously unavailable on this segment of the Gulf of Maine fisheries. (Ronnee L. Schultz, FTS 700-840-1264 or 508-548-5123.)

EFFORT AND CATCH OF BIG-GAME SPECIES: Recreational effort and catch data, as well as biological data, were obtained and processed for tunas, billfishes and sharks in southern New England and Mid-Atlantic waters. Approximately 6,000 dockside and phone interviews were obtained yearly from 1986 to 1991. (Harold A. Foster, FTS 700-840-1212 or 508-548-5123.)

MANDATORY OBSERVER COVERAGE OF NORTHEAST'S COMMERCIAL FISHERIES CONDUCTED: Through a contract with Manomet Bird Observatory, we covered 1290 sea days aboard groundfish sink gillnetters and

swordfish drift gillnetters (both are Category I fisheries, requiring mandatory observer coverage under the Marine Mammal Protection Act). Coverage of the sink gillnet fishery (1210 sea days) was increased significantly beginning in June, to a level of approximately 10%. Coverage of the drift gillnet fishery (139 sea days, provided by both Manomet Bird Observatory staff and NMFS, NEFSC contract observers) increased to a level of 77%. Interactions with marine mammals were documented and biological samples collected. Data were also collected on fishery practices, catches, economics and interactions with sea turtles. (Gregory R. Power, FTS 700-840-1266 or 508-548-5123.)

VOLUNTARY SEA SAMPLING OF NORTHEAST'S COMMERCIAL FISHERIES CONDUCTED: Through a contract with Manomet Bird Observatory, we conducted 871 days of voluntary domestic vessel coverage from Maine to North Carolina onboard otter trawlers,lobster and seabass pot vessels, longline vessels, and scallop-dredge vessels. An additional 90 sea days onboard squid factory trawlers and 28 sea days onboard summer flounder trawlers were covered by NMFS, NEFSC contract observers. Data were collected on fishery practices, catches, economics and interactions with marine mammals and sea turtles. (Patricia Gerrior, FTS 700-840-1291 or 508-548-5123.)

OBSERVERS COVER EAST COAST FOREIGN FISHING: NMFS foreign fishery observers covered all East Coast foreign fishing which involved Dutch and Soviet vessels either catching Atlantic mackerel or engaging in at-sea transfers of U.S.-caught mackerel. (Patricia Gerrior, FTS 700-840-1291 or 508-548-5123.)

MARKET NEWS SERVICE FUNCTIONS PRIVATIZED: The broadcasting and publishing functions of the former Market News Service of NMFS have been privatized. Urner Barry Inc. of Toms River, NJ now provides printed, fax and computer access to NMFS-collected market news information. Short-term market information continues to be made available to fishermen by the new Economics Data Offices in New York and Boston through enhanced access to recorded messages. (Dr. Phil Logan, FTS 700-840-1354 or 508-548-5123.)

FISH AND INVERTEBRATE RESOURCE SURVEYS CONDUCTED: We conducted spring and autumn bottom trawl surveys from Cape Lookout, North Carolina, to the Gulf of Maine (687 sampling sites in all) and a summer inshore Gulf of Maine bottom trawl survey (84 sampling sites). A summer sea scallop survey covered the Mid-Atlantic to Georges Bank region (437 sampling sites). Another 214 sites in the Gulf of Maine were sampled with bottom trawls during gear comparison trials (Thomas R. Azarovitz, FTS 700-840-1283 or 508-548-5123).

RESOURCE SURVEY REPORTS DISTRIBUTED: Fishermen's Reports listing the sampling locations, catches of selected species, and bottom temperatures during our resource surveys were distributed to fishermen and other interested parties immediately following our

spring and autumn bottom trawl surveys and summer sea scallop survey (Linda I. Despres-Patanjo, FTS 700-840-1346 or 508-548-5123).

STATUS OF FISHERY RESOURCES DOCUMENT RELEASED: The 1991 Status of Fishery Resources Document evaluates the current status of 45 species/stocks exploited in the Northeast region. New overviews in this year's report include evaluations of goosefish (monkfish), windowpane flounder, and tilefish. Also included in this report is an evaluation of recreational fishery sampling programs in the Northeast, including the National Marine Recreational Fishery Survey Statistics (MRFSS) Program, and the Large Pelagics Fishery Sampling Program conducted by the Center. (Dr. Steven Murawski, FTS 700-840-1303 or 508-548-5123.)

STRIPED BASS STOCK IDENTIFICATION STUDY COMPLETED: A comparative study of stock discrimination methods applied to striped bass revealed that morphometric measurements (truss networks) achieved the highest rates of correct classification of 5 methods considered. The other methods were (1) immunoassay of blood serum proteins, (2) scale morphometry, (3) mitochondrial DNA, and (4) fatty acid profiles of heart tissue. The study also highlighted the need to consider bias in stock composition estimates when evaluating techniques. (Dr. Anne Richards, FTS 700-840-1357 or 508-548-5123.)

EMERGENCY STRIPED BASS STUDY ANNUAL REPORT COMPLETED: The Center produced the 1990 annual report of the Congressionally mandated study on the reasons for declines in Atlantic striped bass populations, and on the current status of those populations. The report covers recruitment indices, fishing mortality rates, environmental factors in early-life-stage survival, and alternative management measures. (Dr. Anne Richards, FTS 700-840-1357 or 508-548-5123.)

EMERGENCY STRIPED BASS STUDY ANNUAL WORKSHOP CONDUCTED: The Center co-chaired the 1990 annual workshop of the Emergency Striped Bass Study at which federal, state, and academic scientists evaluated research projects on factors affecting striped bass population dynamics. (Dr. Anne Richards, FTS 700-840-1357 or 508-548-5123.)

YIELD PER RECRUIT MODEL DEVELOPED FOR HERMAPHRODITIC FISHES: A length based yield and spawning biomass per recruit model was developed for black sea bass, a protogynous hermaphrodite. Incorporation of sex transformation dynamics drastically reduced estimates of female spawning stock biomass per recruit, although effects on yield per recruit are relatively small. (Gary Shepherd, FTS 700-840-1368 or 508-548-5123.)

DELURY MODEL FOR SEA SCALLOPS DEVELOPED: The non-age-structured DeLury model is extended to incorporate partial recruitment of incoming year-class to research survey gear. The method, incorporating length-based features, can be extended to partial

recruitment to the commercial fishery. Catch in number can then be estimated from commercial landings, age composition from research surveys and partial recruitment to the commercial fishery. (Dr. Ramon Conser, FTS 700-840-1336 or 508-548-5123.)

MODEL DEVELOPED TO EXAMINE EFFECTS OF ALTERNATIVE MINIMUM FISH SIZES ON LANDINGS OF SUMMER FLOUNDER: The effects of alternative regulated minimum fish sizes on recreational, commercial landings and discards of summer flounder were evaluated using a simulation model that incorporated quarterly growth and recruitment to gear, and quarterly distribution of effort in the two fisheries. (Dr. Wendy Gabriel, FTS 700-840-1213 or 508-548-5123.)

LENGTH-BASED STOCK ASSESSMENT METHODS EXAMINED: Alternative methods for generating catch at age from length composition data were compared for bluefish. Methods included cohort-slicing, MULTIFAN and traditional age-length keys. In addition, previous applications of MULTIFAN for northern shrimp were extended to evaluate length frequency data from research vessel surveys. Results were consistent with those obtained from a more detailed knowledge of species biology. (Dr. Mark Terceiro, FTS 700-840-1203 or 508-548-5123.)

SEA HERRING ASSESSMENT COMPLETED FOR GEORGES BANK STOCK: An analytical assessment was performed to estimate fishing mortality rates and stock abundance at age for an aggregate stock complex of herring including those from coastal waters, Nantucket shoals, Georges Bank and fish caught in New Brunswick weirs. The stock appears to be currently under=exploited and at a high level, although individual components of the stock complex may be over exploited. (Dr. Kevin Friedland, FTS 700-840-1369 or 508-548-5123.)

ATLANTIC SALMON TAGGING DATA EVALUATED: Harvest estimates of US origin salmon in Greenland (1967-1990) and Canada (1989) were made using Coded Wire tag and Carlin tag return data. In addition, recovery and de-coding of coded wire tags continued during the 1991 Newfoundland and Labrador salmon fisheries. (Dr. Kevin Friedland, FTS 700-840-1369 or 508-548-5123.)

NEW GEORGES BANK AND SOUTHERN NEW ENGLAND YELLOWTAIL FLOUNDER ASSESSMENTS: Assessments for these two stocks were completely revised for 1973-1991. The assessments included new survey abundance indices, landings-at-age, inclusion of discards, and new ADAPT VPA's for both stocks. Results suggest that both stocks are severely overfished and at extremely low levels of abundance. (Dr. W.J.Overholtz, FTS 700-840-1256 or 508-548-5123).

NORTHWEST ATLANTIC MACKEREL ASSESSMENT INDICATES LARGE STOCK BIOMASS: The assessment for this stock was updated for 1988-1991 including new catch-at-age (Canada and USA), survey indices, and ADAPT VPA run. Results suggest that the stock is under-exploited, stock biomass is at a high level, and it would be

possible to increase catches to a much higher level (Dr. W.J.Overholtz, FTS 840-1256 or 508-548-5123).

NEW LOLIGO SQUID PREDICTION MODEL USED: A Leslie-DeLury model for loligo squid was used to predict population abundance and mortality rates for this species in Vineyard Sound. Indications are that this empirical approach may be useful for improving NEFSC prediction capabilities for this fishery. (Dr. Jon Brodziak, FTS 700-840-1335 or 508-548-5123).

INNOVATIVE MODELS FOR BLACK SEA BASS AND AMERICAN LOBSTERS APPLIED: New modeling approaches (distributed delay growth models) for understanding the population responses of these two species were tested. Results are positive, suggesting that these methods may be more useful than traditional models for describing key components of the dynamics of these species. (J.S.Idoine, FTS 700-840-1217 or 508-548-5123).

PILOT WHALE AND COMMON DOLPHIN DIET STUDY COMPLETED: Detailed diet compositions, feeding selectivity indices on Atlantic mackerel, and energy budgets of five pilot whales and four common dolphins during Spring 1989 were completed. Analysis suggests that Atlantic mackerel and loligo squid are important in mammal diets and stomach contents may underestimate daily rations for these small cetaceans. (Dr. W.J.Overholtz, FTS 700-840-1256 or 508-548-5123).

KEY COMPONENTS OF ICES MULTISPECIES MODEL DOCUMENTED: NEFSC, ICES, and University of Massachusetts scientists cooperated to complete a sensitivity analysis of the Multispecies model currently in use by ICES to assess stock status and forecast trends for important North Sea fish stocks. This study suggests that model results are most sensitive to annual consumption estimates and recruitment to various prey stocks. (J.S.Idoine, FTS 700-840-1217 or 508-548-5123).

FACTORS INFLUENCING MACKEREL DISTRIBUTION AND RECREATIONAL CATCH IN MID ATLANTIC REGION ANALYZED: Factors influencing spring distribution, availability and recreational catch in this region were analyzed and documented by center staff. Results suggest that spring temperatures are most important in determining the availability of mackerel to the recreational fishery along the coast from Virginia to New Jersey. Temperature combined with other factors such as wind direction and intensity may be more important than stock abundance in determining the level of recreational catch in any year. (Dr. W.J.Overholtz FTS 700-840-1256 or 508-548-5123)

NEW ENGLAND GROUNDFISH STOCKS REMAIN OVERFISHED: Updated analytical assessments of the Georges Bank and Gulf of Maine cod stocks and the Georges Bank haddock stock indicate that all of these stocks continue to be overexploited. Fishing mortality rates in 1990 were far above those required to maintain or rebuild any of these resources. Abundance of the Georges Bank

haddock in 1990 was at a record-low, and due to poor recruitment prospects, no improvement is expected in the near future unless exploitation levels are significantly reduced (Dr. Fred Serchuk, FTS 700-840-1245 or 508-548-5123).

EARLIER MATURATION OF MANY FINFISH STOCKS: Many groundfish and flounder species are now attaining sexual maturity at younger ages and smaller sizes than in the past. An analysis and review of maturation patterns during 1985-1990 of 19 species of finfish off the northeast coast of the United States indicates that fish are maturing earlier than they did during the 1970s and early 1980s, perhaps as a compensatory response to reduced stock abundance (Loretta O'Brien, FTS 700-840-1273 or 508-548-5123).

STRUCTURAL AND PRODUCTIVITY CHANGES IN THE GEORGES BANK ECOSYSTEM: Fundamental changes in the structure and productivity of the Georges Bank ecosystem were induced during the 1960s and early 1970s by intense fishing operations by distant water fleets. Although system-wide fishing effort has since been reduced, production of commercially desirable species has remained depressed while the biomass of lower-valued fish-eating species (particularly dogfish, mackerel, and skates) has increased. It is possible that because of predation by these lower-valued species, reductions in exploitation rates alone on commercially desirable groundfish species may be insufficient to increase recruitment and overall production (Ralph Mayo, FTS 700-840-1310 or 508-548-5123).

METHODS EXAMINED FOR ESTIMATING DISCARDS FROM NMFS SEA SAMPLING DATA: Exploratory analyses were conducted on various methods for estimating discards from the NMFS sea sampling data base. Although no one methodology proved optimal, comparison of the results indicated that the representative nature and number of discard samples, as well as the statistical properties of the estimators themselves, were important factors in accurately and reliably estimating the quantities of fish discarded (Dr. Dan Hayes, FTS 700-840-1317, or 508-548-5123).

SEA SCALLOPS INCREASE ON GEORGES BANK BUT DECLINE IN MID-ATLANTIC: Results from the summer 1991 NEFSC sea scallop research vessel survey indicate that sea scallop abundance increased on Georges Bank due to very strong recruitment from the 1988 year class, but sharply declined in the Mid-Atlantic region (Susan Wigley, FTS 700-840-1359 or 508-548-5123).

SALT ABSORPTION BY BRINE DIPPED FILLETS: Experiments with time, temperature, fillet thickness and brine strength on cod, perch, and flounder were completed and results published. Brine concentration and time in brine impacted the most on salt uptake. Cooking, days postmortem, brine temperature, and/or frozen storage had no effect on resulting salt uptake. (Judith Krzynowek FTS 508-281-9226 or (508) 281-9226).

ATLANTIC FINFISH AS A POTENTIAL FISH OIL SOURCE: Primarily by-catch species were analyzed for lipids, cholesterol, and omega-3 fatty acids. Published results show menhaden, bluefish, mackerel, sand lance, and spiny dogfish fall into medium to high fat categories and would be good candidates for, or already in use for, fish oil production. Smooth dogfish would not be good for this purpose. (Judith Krzynowek FTS 508-281-9226 or (508) 281-9226).

FATTY ACID CONTENT OF HYBRID STRIPED BASS: Hybrid striped bass raised in an artificial environment were analyzed for fatty acid composition. As has happened with other species raised by aquaculture, the substitution in the diet of vegetable feeds for the natural food of marine origin has resulted in elevated levels of omega-6 fatty acids in the edible portion with a concomitant lowering of the omega-3 fatty acids. The latter are purported to be beneficial in the prevention of heart disease. (Judith Krzynowek FTS 508-281-9226 or (508) 281-9226).

FATTY ACID CONTENT OF POND RAISED SHRIMP: Fatty acid analysis was performed on both wild and pond-raised shrimp, P. vannamei. There were exceptionally high amounts of omega-6 fatty acids in the cultured shrimp fed primarily soy products. (Judith Krzynowek FTS 508-281-9226 or (508) 281-9226).

FROZEN STORAGE STUDY: An investigation of frozen storage quality characteristics was initiated for four representative seafood products (shrimp, cod, surimi and salmon). Each product is held at either 0°,-10° or -20°F. Control samples are stored at -80°F. The products are evaluated at five week intervals for sensory, chemical and physical attributes. This study is supported by the Refrigeration Research Foundation (TRRF), a privately financed trade association. The results of this study will be used by wholesalers and distributors to help determine cost effective commercial storage practices. (Kurt Wilhelm FTS 508-281-9308 or (508) 281-9308).

106-MILE DEEPWATER MUNICIPAL SLUDGE DUMPSITE INTERIM REPORT: An interim report was completed on chlorinated pesticides, PCB's and polynuclear aromatic hydrocarbons found in epibenthic samples of Antimora rostrata (Blue hake), Coryphaenoides armatus (Rattail), and Halosauropsis macrochir (Halosaurs). Samples were collected in a large area delineated as a potential area of influence of sludge disposal at the site. Lobster (with or without shellfish disease) and tilefish were also collected from adjacent major canyons. The objective of this work was to perform an assessment of the impact of sewage sludge dumping on bottom fish residing near the 106-mile site. The report has been submitted to NOAA'S Office of Ocean Assessment for review. (Donald Gadbois FTS 508-281-9286 or (508) 281-9286).

MONOCLONAL ANTIBODIES DETECT INFECTIOUS SARCOMA DISEASE IN SOFTSHELL CLAMS: Two monoclonal antibodies have been isolated which specifically detect sarcoma cells in haemolymph from infected clams. These highly specific antibodies are being used to develop a rapid diagnostic test for the disease. (Ronald Lundstrom FTS 508-281-9277 or (508) 281-9277).

MONOCLONAL ANTIBODIES USED FOR IDENTIFICATION OF TROUT AND SALMON SPECIES: A panel of ten monoclonal antibodies, developed last year, have been used to identify trout and salmon species. One antibody is specific for pink salmon while the other 9 antibodies react with specific combinations of species. Used together, the antibodies can differentiate all salmonid species except Atlantic salmon, lake trout, chinook salmon, and sockeye salmon. Additional monoclonal antibodies are being evaluated to allow differentiation of these species. (Ronald Lundstrom FTS 508-281-9277 or (508) 281-9277).

SURIMI/BEEF CONTENT TEST DEVELOPED: A monoclonal antibody based immunoassay has been developed which can be used to determine the amount of beef and Alaska pollock surimi in beef/Alaska pollock surimi mixtures. A "anti-finfish" antibody developed at the Gloucester Lab is used to quantify the Alaska pollock surimi content while a commercially available "anti-bovine albumin" antibody is used to quantify beef content. (Ronald Lundstrom FTS 508-281-9277 or (508) 281-9277.

CANNING REDUCES TOXICITY IN ATLANTIC SURF CLAMS: Shellfish poisons recently found in some Atlantic surf clams from Georges Bank can be partially eliminated by processing. Toxins present in edible parts after shucking and initial cleaning are reduced dramatically by conventional canning techniques. Depending upon initial concentration of the toxins present, acceptable levels of residual toxin may be achieved in canned mince and sliced product. Heat treatment apparently destroys certain of the toxins preferentially as revealed by high performance liquid chromatographic analysis. (Kurt Wilhelm FTS 508-281-9308 or (508) 281-9308 and Chris Martin FTS 508-281-9297 or (508) 281-9297).

ATLANTIC MACKEREL LIVERS REMAIN TOXIC: During four successive years, analysis of liver tissues from Atlantic mackerel has revealed the presence of paralytic shellfish toxins. Edible parts (muscle tissue and gonad) have remained free of poison. (Chris Martin FTS 508-281-9297 or (508) 281-9297).

ATLANTIC DEEPSEA SCALLOP VISCERA RETAIN PARALYTIC TOXINS: Scallop viscera (parts normally discarded) from widely distributed stations on Georges Bank have retained toxicity over a one-year period. These findings raise concerns about the safety of consumption of scallop parts other than the adductor muscle which remains toxin-free. The composition of toxins present is consistent with a dinoflagellate source although no toxic blooms have been reported for this offshore area. (Chris Martin FTS 508-281-9297 or (508) 281-9297).

MANDATORY OBSERVER COVERAGE OF NORTHEAST'S COMMERCIAL FISHERIES CONDUCTED: Through a contract with Manomet Bird Observatory, we covered 1290 sea days aboard groundfish sink gillnetters and swordfish drift gillnetters (both are Category I fisheries, requiring mandatory observer coverage under the Marine Mammal Protection Act). Coverage of the sink gillnet fishery (1210 sea days) was increased significantly beginning in June, to a level of approximately 10%. Coverage of the drift gillnet fishery (139 sea days, provided by both Manomet Bird Observatory staff and NMFS, NEFSC contract observers) increased to a level of 77%. Interactions with marine mammals were documented and biological samples were collected from animals caught in the fishing gear. Data were also collected on fishery practices, catches, economics and interactions with sea turtles. (Gregory R. Power, FTS 840-1266 or (508) 548-5123)

VOLUNTARY SEA SAMPLING OF NORTHEAST'S COMMERCIAL FISHERIES CONDUCTED: Through a contract with Manomet Bird Observatory, we conducted 871 days of voluntary domestic vessel coverage from Maine to North Carolina onboard otter trawlers, lobster and seabass pot vessels, longline vessels, and scallop-dredge vessels. NMFS, NEFSC contract observers covered an additional 90 sea days onboard squid factory trawlers and 28 sea days onboard summer flounder trawlers. Data were collected on fishery practices, catches, economics and interactions with marine mammals and sea turtles. (Patricia Gerrior, FTS 840-1291 or (508) 548-5123)

OBSERVERS COVER ALL EAST COAST FOREIGN FISHING: NMFS foreign fishery observers covered all East Coast foreign fishing which involved Dutch and Soviet vessels either catching Atlantic mackerel or engaging in at-sea transfers of U.S.-caught mackerel. (Patricia Gerrior, FTS 840-1291 or (508) 548-5123)

Submissions for the 1991 End-of-Year Report
Fisheries Oceanography Investigation

1. Changes in fish distribution in response to temperature changes:

   Data from the Center's spring bottom trawl survey indicate between year shifts in the distribution of many fish species in response to changes in water temperature. In general by shifting their distribution north/south or towards shallower/deeper water, the species appeared to compensate for about half of the temperature change that was occurring over the shelf region as a whole. The results may be an indicator of potential response of the fish stocks to anticipated climate change. (David G. Mountain, FTS 840-1271)

2. Bottom sediment transport in the inner New York Bight:

   Estimates of resuspended sediment transport in the region of the Hudson Shelf Valley were made using observed bottom currents and a bottom boundary layer model. The results suggest that resuspension occurs approximately 5% of the time, primarily in winter. Although the wind-induced bottom current is most often in the upvalley direction, the actual net sediment transport may be downvalley because of a decrease in wave-induced resuspension in the downvalley direction. (James P. Manning, FTS 840-1211).

3. Variations in Shelf Water volume in the Middle Atlantic Bight

   An analysis of hydrographic data from 1977-1987 indicated large seasonal and interannual changes in the volume of shelf water in the Middle Atlantic Bight (MAB). The seasonal changes appear to originate from seasonal variability in the primary inflows of water to the Gulf of Maine and to be advected southwestward through the MAB. The interannual variability in volume is equal to the mean volume of shelf water in the MAB. Indirect evidence suggests that these changes also originate from changes in the inflow to the Gulf of Maine. (David G. Mountain, FTS 840-1271).

R.S. Armstrong
February 4,1992

Submissions for 1991 End-of-Year Report

Fisheries Climatology Investigation

1) MONITORING OF WATER MASSES RECEIVING SLUDGE DUMPING:

Using satellite infrared data, a report was prepared which detailed the water masses present at the 106-Mile Dumpsite during dumping of sewage sludge in 1990. Of the about 2.2 billion gallons of sludge dumped, about 70% was dumped into slope water, with the remainder received by shelf water (23%) and warm core rings (7%) (LTJG Cynthia Ruhsam, FTS 838-6265 or (401) 782-3265).

2) DATA REDISTRIBUTION NODE ESTABLISHED:

As part of an effort in the NOAA CoastWatch Program to improve the use and availability of NOAA data and products, a regional node has been established at the NMFS Narragansett Laboratory. The Narragansett Node serves as a center for redistributing NOAA data by computer communications to qualified users in the northeast. During 1991, data were distributed to support a WHOI study on the development and transport of "red tide" blooms in the Gulf of Maine, an evaluation of conditions with blue crab tagging off Virginia by Old Dominion University, and estimation of cloud cover associated with U.S. Coast Guard search and rescue missions (Reed Armstrong, FTS 838-6280 or (401) 782-3280).

3. ECOSYSTEM STRUCTURE OF SHELF WATERS EXAMINED:

Multiple regression analyses were used with MARMAP data for the waters of the northeast shelf to show that up to 60% of the variation in larval fish abundance could be explained, with zooplankton density being associated throughout the year. Larval fish abundance was significantly related to water column temperature and stratification during the warm months, and to chlorophyll during the cold months (Carol Meise, FTS 838-6278 or (401) 782-3278).

4. PLANKTON AND HYDROGRAPHIC SCALES OF INTERACTION EVALUATED:

Water temperature, chlorophyll and zooplankton abundance collected on 37 cruises across the northern Gulf of Maine during 1982 are being used to evaluate the detailed time and space phasing and sequence in phytoplankton blooms and zooplankton populations, and their relation to hydrogrphic conditions (James Bisagni, FTS 838-6313 or (401) 782-3313).

5. RELATIONS BETWEEN ZOOPLANKTON AND OCEANOGRAPHIC CONDITIONS:

Abundance patterns of Calanus finmarchicus and Centropates typicus during 1977-1986 were found to be related to water temperature in most months. Abundances were also associated with chlorophyll, bottom depth and stratification (Carol Meise, FTS 838-6278 or (401) 782-3278).

6. GEORGES BANK TEMPERATURE VARIABILITY STUDIED:

Satellite-derived, time-series of sea surface temperatures (SST) were used to model vertical mixing on Georges Bank. Significant correlation was found between short-time variations in SST and tidal currents, and may account for the influx of nitrogen needed to sustain the high primary production observed during summer (James Bisagni, FTS 838-6313 or (401) 782-3313).

1991 END-OF-YEAR REPORT
EXPERIMENTAL BIOLOGY BRANCH

WORKSHOP ON WINTER FLOUNDER BIOLOGY: We sponsored a workshop on winter flounder biology which covered habitat, reproduction, growth and development, physiology, pathology, and pollutant effects. copies of the abstracts are available (Dr. Anthony Calabrese, FTS 642-5209 or (203) 783-4209).

WINTER FLOUNDER REPRODUCTIVE SUCCESS: Embryo mortality of winter flounder tested over several years at two "clean" Long Island Sound (LIS) study sites has less annual variability than at other LIS sites, even though fish from one of the "clean" sites were sampled over a large area. During 1991, the mortality/ abnormality of winter flounder embryos was nearly identical for fish from two polluted sites as well as the standard "clean" reference site. It is doubtful, however, from the perspective of annual recruitment, if this can fully compensate for the usually greater annual mortality at the worse sites (Dr. Arlene Longwell, FTS 642-5207 or (203) 783-4207).

LONG ISLAND SOUND WINTER FLOUNDER REPRODUCTION: Culture of larvae from eggs of Long Island Sound (LIS) flounder revealed that, by the time yolk is fully absorbed, mortality is three times higher than at the late embryo stage. If 1991 samples are representative, one-third of the sexually ripe fish fail to reproduce successfully. Approximately 50% of the normal larvae surviving to metamorphosis are derived from 15% of the ripe females, suggesting that the genetically effective population size of LIS flounder is much smaller than the numbers of sexually mature females. If mortality of embryos of fish from one clean site, Shoreham NY, is regarded as a reference, pollution may account for roughly half the reduction in the genetically effective population size of ripe females. The long-term significance of this depends on other environmental stressors which act as selective agents and vary over time and sites, and on different fishery quotas (Dr. Arlene Longwell, FTS 642-5207 or (203) 783-4207).

LONG ISLAND SOUND ICHTHYOPLANKTON STUDIES: As part of a cyto-embryological study of naturally occurring fish eggs and larvae, ichthyoplankton species in Long Island Sound were determined in 1991, and will be compared to their earlier recorded occurrences. This project was conducted by a foreign student/NOAA scholar for academic credit from the University of Lisbon (Dr. Arlene Longwell, FTS 642-5207 or (203) 783-4207 for Joana Carneiro da Silva, Lisbon, Portugal).

EGG MORTALITY AND ADULT ABNORMALITY DATA ON COASTAL FISH AGREE: Data on Atlantic mackerel embryos providing evidence that pollution is associated with mortality, malformation, and

abnormal chromosome division of fish embryos were substantiated by subsequent studies of adult and juvenile fish of three species. Mackerel, windowpane flounder and winter flounder from more polluted regions of the Mid- and North Atlantic all have higher frequencies of abnormal chromosome divisions in their hematopoietic tissue than do the same species from less polluted regions. Our early studies are reviewed in a publication which presents the newer studies, and discusses both in relation to total life-history exposure of individuals, possible development of genetic resistance over recruitment years, and likely population-level effects on abundance (Dr. Arlene Longwell, FTS 642-5207 (203) 783-4207).

WINTER FLOUNDER REARED FOR STUDY: Winter flounder, Pleuronectes americanus, eggs were successfully reared in semi-static cultures to juvenile metamorphosis and beyond. Antibiotics were not used, and diet consisted of laboratory-reared Brachionus and Artemia (James Widman, FTS 642-5208 or (203) 783-4208).

ORGANIC CONTAMINANT EFFECTS ON EARLY LIFE STAGES OF OYSTERS: PCBs (polychlorinated biphenyls) increased frequencies of abnormality and mortality in oyster embryos and larvae in a more delayed response than a PAH (polycyclic aromatic hydrocarbon) contaminant of petroleum which was more acutely toxic. Sublethal measures on size and cytogenetic and cytological abnormalities seemed to provide predictive evidence for mortality later in development. Responses were related to contaminant, dose, time and temperature. Synergisms and antagonisms among chemicals and with temperature and salinity were also observed. These may have implications for the universal persistence of PCBs along with petroleum aromatic hydrocarbon contamination and global warming (Sheila Stiles, FTS 642-5224 or (203) 783-4224).

NEW JUVENILE OYSTER DISEASE IN NEW ENGLAND STUDIED: A new oyster parasite associated with mortalities of juvenile oysters, 4-30 mm in size, at a Long Island Sound oyster hatchery was described (C. Austin Farley, Frederick Kern, or Earl J. Lewis, (410) 226-5193).

"DERMO" DISEASE REPORTED IN NEW ENGLAND: Examination of oysters, Crassostrea virginica, from three river systems in Massachusetts were heavily infected by the protozoan parasite Perkinsus marinus ("Dermo"). This para site has not previously been a concern in waters north of Delaware Bay (Earl J. Lewis, (410) 226-5193).

PAPER DESCRIBES DISEASE IN ADDITONAL FISH SPECIES: A short note reporting epitheliocystis-like lesions in ten additional species of marine fish was accepted for publication in the Journal of Fish Diseases (Earl J. Lewis, (410) 226-5193).

OYSTER DISEASES REPORTED FROM GEORGIA: A research paper reporting MSX and "Dermo" diseases in oysters from coastal Georgia and a discussion of disease and management implications

was accepted for publication in the Marine Fisheries Review (Earl J. Lewis, (410) 226-5193).

SPECIAL FORUM HELD: A forum entitled "Issues of Importance to Shellfisheries" was held during the June 1991 National Shellfisheries Association Meeting in Portland, Maine. Issues discussed included consideration of the introduction of exotic species with possible impacts on shellfisheries. A video tape of the forum is available (Dr. Aaron Rosenfield, (410) 226-5193).

CELL CULTURE WORKSHOP HELD: A workshop on marine invertebrate cell culture was held during the 1991 World Congress on Cell and Tissue Culture in Anaheim, California, June 1991. A proceedings is in preparation (Dr. Aaron Rosenfield, (410) 226-5193).

NEW DIAGNOSTIC TECHNIQUE DEVELOPED: A new technique using hemolymph was developed for diagnosis of Perkinsus sp. in mollusks used for clinical studies. Analytic staging of the disease was correlated with mortality and hyperbolic regression demonstrated close relationships with progression of disease over time and mortality (C. Austin Farley, (410) 226-5193).

SYNOPSIS OF PRINCIPLE DISEASES OF BLUE CRABS PUBLISHED: An atlas which gives a brief synopsis of principle diseases of blue crabs will be available as a NOAA Technical Memorandum (Gretchen Messick, or Dr. Carl Sindermann, (410) 226-5193).

1991 WINTER BLUE CRAB DREDGE SURVEY COMPLETED: The 1991 histologic survey of overwintering blue crabs from Chesapeake Bay sampled 21 areas and 221 crabs. Virus infections were found in 5% of the crabs, 9.5% harbored microsporidan infection, and one dead crab was infected with a blood ciliate similar to that found in lobsters, shrimp, and other marine crabs (Gretchen Messick, (410) 226-5193).

POSSIBLE RARE TREMATODE MIRACIDIUM FOUND IN BLUE CRAB: A blue crab was diagnosed with a possible rare miracidium stage of trematode. Tissue samples have been sent to researchers at the Virginia Institute of Marine Science for further identification (Gretchen Messick, (410) 226-5193).

SARCOMAS IN CHESAPEAKE BAY SOFTSHELL CLAMS MONITORED: High levels of sarcomas in Chesapeake Bay softshell clams observed last winter continued until spring and decreased to moderate levels for the rest of the year--a pattern similar to cycles observed in previous years (Shawn McLaughlin, (410) 226-5193).

HIGH SUMMER MORTALITIES IN CHESAPEAKE BAY SOFTSHELL CLAMS: Temperature stress, sarcomas, and parasites--Perkinsus marinus and a chlamydia-like organism--contributed to high mortalities observed this summer in Chesapeake Bay softshell clams (Shawn McLaughlin, (410) 226-5193).

PHYTOPLANKTON PIGMENTS CAUSE BLUSH ON ARCTIC SURFCLAMS. The Arctic surfclam, Mactromeris polynyma, is a locally-landed offshore bivalve with high value in Japan; the deep red color of foot, mantle, and siphon is prized for visual effect in sushi dishes. Center scientists, in collaboration with Yale University, have shown that xanthophyll pigments from phytoplankton ingested by the clams are responsible for this color. Identification of specific xanthophylls in the clam may offer clues to phytoplankton types eaten by clams, and also suggests the possibility of feeding clams selected phytoplankton to intensify coloration. (Barry C. Smith or Gary H. Wikfors, FTS 642-5225 or (203) 783-4225).

STATISTICAL MODEL REVEALS BIOCHEMICAL BASIS FOR AMERICAN OYSTER NUTRITION AND GROWTH. Center researchers, in collaboration with the University of Maryland, have used controlled laboratory studies and multivariate statistics to show that essentially all variation in oyster growth can be explained by differences in protein, carbohydrate, lipid, essential fatty acid, and sterol contents of their algal diets. This information should help explain geographic variation in oyster growth and permit formulation of improved algal hatchery diets. (Gary H. Wikfors, FTS 642-5225 or (203) 783-4225).

RELATIVE IMPORTANCE OF MAJOR NUTRITIONAL COMPONENTS FOR CLAM GROWTH DETERMINED. Nineteen strains of cultured phytoplankton were evaluated as foods for the hard clam, Mercenaria mercenaria, in controlled laboratory studies; clam growth rates were related statistically to protein, carbohydrate, and fat contents of phytoplankton. Sufficient quantities of both protein and fat were required for rapid clam growth, but carbohydrate was less important. These findings will serve to "calibrate" field measurements of available food for clams, as measured by these major biochemical constituents in natural seston. (Gary H. Wikfors, FTS 642-5225 or (203) 783-4225).

WINTER FLOUNDER AT POLLUTED SITES HAVE MORE SERUM ANTIBODIES: A study of serum antibodies in 835 winter flounder from Long Island Sound and Boston Harbor showed that total antibody levels (against nine bacterial pathogens) were generally proportional to the estimated level of pollution at the site of fish capture (Dr. Richard A. Robohm, FTS 642-5237 or (203) 783-4237).

DATA BASE DEVELOPED FOR BACTERIAL IDENTIFICATION: To provide computer-assisted identification for bacterial pathogens, a data base was developed which contains up to 89 identifying characteristics for each of 170 bacterial strains known to infect fish and shellfish (Dr. Richard A. Robohm, FTS 642-5237 or (203) 783-4237).

SHELL DISEASE IN LOBSTERS: In a joint NOAA study we examined over 10,000 lobsters from various offshore sites in the North and

mid-Atlantic for evidence of shell disease. This work will help to determine whether a relationship exists between shell disease and municipal sludge dumping at the 106-Mile Dumpsite (John Ziskowski, FTS 642-5256 or (203) 783-4256).

STRESS-RELATED IMMUNOSUPPRESSION IN ATLANTIC SALMON: An investigation into the effects of exogenous cortisol on the immune system of Atlantic salmon (Salmo salar) demonstrated that this stress-related hormone reduces the in vitro, specific-antibody-producing-cell (lymphocyte) response and the in vivo, nonspecific, hemolytic response to TNP-labeled sheep red blood cells after a period of 10 to 17 days (Dr. Joel E. Bodammer, (401) 792-2114).

X-CELLS IN NORTHWEST ATLANTIC FLATFISH: X-cells were found in the gills of 2 of 9 American plaice collected in Massachusetts Bay. Lymphocystis virus infected cells also were found in 1 of the 2 plaice. This constitutes the first report of X-cells in NW Atlantic pleuronectids and the first report of lymphocystis and X-cells, considered mutually exclusive diseases, co-occurring in one host specimen (Sharon A. MacLean, FTS 838-6384 or (401) 782-3384).

RISK OF DISEASE IN WINTER FLOUNDER: Analysis of Status and Trends histopathology and sediment-chemistry data showed that age alone may be a risk factor in the occurrence of some lesions, and that the statistical significance of lesions relative to site contaminant load may change when size of fish is held constant (Sharon A. MacLean, FTS 838-6384 or (401) 782-3384).

SHELLFISH BIOLOGY SEMINAR HELD (ABSTRACTS AVAILABLE): We sponsored a shellfish biology seminar covering genetic selection techniques to confer MSX-disease resistance in oysters, a new juvenile oyster mortality problem, effects of nutritional and physical factors on the growth and recruitment of shellfish, identification and depuration of Vibrio disease microorganisms in human-consumed shellfish, scallop stocking techniques for stock replenishment, and some novel shellfish culture techniques. Copies of abstracts are available (Dr. Walter Blogoslawski, FTS 642-5235 or (203) 783-4235).

WINTER FLOUNDER REPRODUCTION STUDY CONTINUES: A multiyear study of reproductive success of winter flounder continued in 1991 with fish spawned from New Haven, Milford, and Black Rock Harbor areas of Long Island Sound. Data on hatching success and larval development will be provided to NEFSC modelers to better determine the effects of environmental contamination on this species (Dr. Frederick Thurberg, FTS 642-5244 or (203) 783-4244; or David Nelson, FTS 642-5221 or (203) 783-4221).

COPPER-FED BAY SCALLOPS MORE RESISTANT TO COPPER EXPOSURE: After 6 months' feeding with copper-contaminated algae, bay scallops

exposed to only 2 ppb copper in the water showed a consistent pattern of higher indicators of growth and maturation in the gonad (RNA, DNA, protein) than did unexposed scallops. The converse was true for scallops that were not exposed to copper (Edith Gould, FTS 642-5222 or (203) 783-4222).

METALS IN FISH FROM DEEPWATER DUMPSITE 106 MEASURED: Fish from a series of stations associated with the deepwater dumpsite were analyzed for eight metal contaminants. Deepwater fish that were well represented included blue hake (Antimora rostrata), cutthroat eel (Synaphobranchus kaupi), and three species of rattails (Dr. Frederick Thurberg, FTS 642-5244 or (203) 783-4244; or George Sennefelder, FTS 642-5248 or (203) 783-4248).

ISOLATION OF WINTER FLOUNDER EGG PROTEIN INITIATED: Collaborative research with the University of Massachusetts through the CMER program and scientists at the Milford and Gloucester NMFS Laboratories has been initiated to isolate the egg protein, vitellogenin, and then develop an immunoassay for it. This will result in a biomarker to be used for the measurement of winter flounder reproductive success (Jose Pereira, FTS 642-5238 or (203)783-4238).

METAL ACCUMULATION IN KELP DETERMINED: Collaborative research with scientists from the University of Connecticut has demonstrated the use of kelp (Laminaria longicruris) tissue as a biomonitor for trace metals in marine waters. Copper, cadmium, lead, and chromium were measured monthly in different types and ages of tissue during a one-year study (Dr. Frederick Thurberg, FTS 642-5244 or (203) 783-4244; or George Sennefelder, FTS 642-5248 or (203) 783-4248).

Jon - as I mentioned, a couple small changes in this annual highlight

MOLLUSC FARMING DISCUSSED WITH SHELLFISH ASSOCIATION OF GREAT BRITAIN: An invited paper given at the Association's annual conference in London highlighted ways to farm beds to minimize resistance from environmentalists, for example by spreading shells to reduce predation, and towing small pressure boards to remove silt from beds. (Clyde L. MacKenzie, Jr., FTS 342-3019 or (908) 872-3019). (reprint #3).

NEW SPECIES OF MARINE WORMS DESCRIBED: Three new species of a large polychaete family were described from collections made throughout the Northeast Shelf. The work will enhance the ability of northeastern benthic studies to describe communities and determine effects of environmental change. (Ann Frame, FTS 342-3021 or (908) 872-3021).

LIFE AND WORKS OF ERNEST INGERSOL, SHELLFISH SCIENTIST, SUMMARIZED: Ingersoll was one of the earliest writers on U.S. shellfisheries. A biographical memoir was prepared describing his life and sumarizing his descriptions of oyster, clams and scallop fisheries from Canadian Maritimes through Texas in the late 1800s. (Clyde L. MacKenzie, Jr., FTS 342-3019 or (908) 872-3019).

HISTORY OF FISHERIES OF RARITAN BAY DESCRIBED: Trends in fishing gear and landings are summarized, as are environmental influences on finfisheries and shellfisheries in this polluted bay. Much of the information is based on interviews with 82 elderly fishermen. A book on the same subject is now in press. (Clyde L. MacKenzie, Jr., FTS 342-3019 or (908) 872-3019). (reprint #1)

TEN-YEAR CHANGES IN BOTTOM INVERTEBRATES OF NY BIGHT REPORTED: Relatively sensitive indicators of change, such as numbers of species and amphipods, showed downward trends over the period 1979-1989, but little change was seen in the basic composition of the fauna. (Robert Reid, FTS 342-3020 or (908) 872-3020). (reprint #2)

FACTORS PROMOTING BLOOMS OF PSP DINOFLAGELLATE STUDIED: Assays suggested that chemicals other than nutrients may explain the apparent exclusion of *Alexandrium tamarense* from Great Bay, NJ (though it is present in the general vicinity), while it does bloom in Long Island waters. (John Mahoney, FTS 342-3055 or (908) 872-3055).

RECURRENCE OF BROWN TIDE IN LONG ISLAND WATERS: The Center participated in studies of brown tide, which in June 1991 reached densities similar to those that devastated scallop and eel grass populations in 1985. Samples were collected for algal assays from the Peconic system, Hudson-Raritan estuary and Barnegat Bay during June through November. Attempts continued to purify a culture of the brown tide species; a pure culture is needed to determine factors promoting the blooms (John Mahoney, FTS 342-3055 or (908) 872-3055).

ENVIRONMENTAL ASSESSMENT BRANCH
1991 END-OF-YEAR REPORT

DELAWARE BAY ARTIFICIAL REEF IS PRODUCTIVE: The second year of an interagency (Army Corps of Engineers, EPA, NMFS) cooperative study monitoring the biological productivity of a prefabricated concrete reef in lower Delaware Bay found biomasses of reef benthic organisms to be 78 to 155 times that of the nearby non-reef community, per equal area of bay bottom (Frank W. Steimle, Jr., FTS 342-3059 or (908) 872-3059).

ESTUARINE STUDY INITIATED: A preliminary collaborative study with Rutgers University and the Milford Laboratory was initiated in the Hudson/Raritan estuary in June. Beam and otter trawling has been conducted monthly to determine the distribution and abundance of juvenile fisheries and invertebrates in various bottom habitat types. Nine strata are sampled, including areas of dredge channel, mud, sand, mussel and open bottom. Initial findings indicated an unusually high frequency of young weakfish in the summer of 1991 followed by a paucity of young red and silver hake in fall and winter (A. L. Pacheco, FTS 342-3090 or (908) 872-3090).

FISH SAMPLES FROM THE 106-MILE DUMPSITE: Offshore samples were taken in August to determine if heavy metals and organic contaminants are being bioaccumulated in deepwater fishes. Rattails, blue hake and cutthroat eel were dominant in collections deeper than 1000 m and spotted hake, fawn cusk-eel and witch flounder predominated at depths less than 1000 m. Thirty percent of a small (46) sample of red crabs showed shell disease (Stuart J. Wilk, FTS 342-3008 or (908) 872-3008).

SEA SAMPLING FOR CHITINOCLASIA: Manomet sea samplers documented nearly 6000 trawl and pot catches inspected for shell disease of lobsters. Evidence of shell disease was seen in 200 of the catches which caught some 2500 lobsters. Of those, an average of 1.82% were found infected. Infections occurred from the Gulf of Maine to New Jersey although the samples were taken as far south as Virginia (Stuart J. Wilk, FTS 342-3008 or (908) 872-3008).

MATERIAL OF SEWAGE SLUDGE ORIGIN REACHES THE SEABED AT 106 SITE: Human health artifacts found at stations in close proximity to the 106-Mile Deepwater Dumpsite in 2600 m of water off New Jersey support previous observations that contaminants (silver and *Clostridium* spores) are introduced to the sediment at the site by sewage sludge dumping. (Andrew Draxler, FTS 342-3054 or (908) 872-3054).

MOLLUSC FARMING DISCUSSED WITH SHELLFISH ASSOCIATION OF GREAT BRITAIN: An invited paper given at the Association's annual conference in London highlighted ways to farm beds to minimize resistance from environmentalists, for example by spreading shells to reduce predation, and towing small pressure boards to remove silt from beds. (Clyde L. MacKenzie, Jr., FTS 342-3019 or (908) 872-3019). (reprint #3).

NEW SPECIES OF MARINE WORMS DESCRIBED: Three new species of a large polychaete family were described from collections made throughout the Northeast Shelf. The work will enhance the ability of northeastern benthic studies to describe communities and determine effects of environmental change. (Ann Frame, FTS 342-3021 or (908) 872-3021).

LIFE AND WORKS OF ERNEST INGERSOL, SHELLFISH SCIENTIST, SUMMARIZED: Ingersoll was one of the earliest writers on U.S. shellfisheries. A biographical memoir was prepared describing his life and sumarizing his descriptions of oyster, clams and scallop fisheries from Canadian Maritimes through Texas in the late 1800s. (Clyde L. MacKenzie, Jr., FTS 342-3019 or (908) 872-3019).

HISTORY OF FISHERIES OF RARITAN BAY DESCRIBED: Trends in fishing gear and landings are summarized, as are environmental influences on finfisheries and shellfisheries in this polluted bay. Much of the information is based on interviews with 82 elderly fishermen. A book on the same subject is now in press. (Clyde L. MacKenzie, Jr., FTS 342-3019 or (908) 872-3019). (reprint #1)

TEN-YEAR CHANGES IN BOTTOM INVERTEBRATES OF NY BIGHT REPORTED: Relatively sensitive indicators of change, such as numbers of species and amphipods, showed downward trends over the period 1979-1989, but little change was seen in the basic composition of the fauna. (Robert Reid, FTS 342-3020 or (908) 872-3020). (reprint #2)

FACTORS PROMOTING BLOOMS OF PSP DINOFLAGELLATE STUDIED: Assays suggested that chemicals other than nutrients may explain the apparent exclusion of *Alexandrium tamarense* from Great Bay, NJ (though it is present in the general vicinity), while it does bloom in Long Island waters. (John Mahoney, FTS 342-3055 or (908) 872-3055).

RECURRENCE OF BROWN TIDE IN LONG ISLAND WATERS: The Center participated in studies of brown tide, which in June 1991 reached densities similar to those that devastated scallop and eel grass populations in 1985. Samples were collected for algal assays from the Peconic system, Hudson-Raritan estuary and Barnegat Bay during June through November. Attempts continued to purify a culture of the brown tide species; a pure culture is needed to determine factors promoting the blooms (John Mahoney, FTS 342-3055 or (908) 872-3055).

CENTER ENTERS NOAA'S DAMAGE ASSESSMENT AND RESTORATION PROGRAM: Three NEC representatives were assigned to work part-time with the Northeast Region on restoration of natural resources damaged by releases of oil and other hazardous substances. Under SUPERFUND and the Oil Pollution Act of 1990, NOAA is charged to attempt to recover costs of such damages and restore or replace the damaged resources. (Robert Reid, FTS 342-3020 or (908) 872-3020).

12-MILE DUMPSITE SYMPOSIUM: In June, a 2-day symposium was held to report preliminary findings of a 3-1/2 year study on the hydrographic, chemical, and biotic aspects of the dumpsite closure. Following the presentations, a panel of managers and environmentalists discussed policies related to the future of nearshore dumping based on several significant indicators of the areas recovery (Anne L. Studholme, FTS 342-3001 or (908) 872-3001).

12-MILE DUMPSITE BOTTOM TRAWL STUDY COMPLETED: Three years of a monthly trawl survey in the 12-mile dumpsite area showed Atlantic rock crab the summer biomass leader, replaced by little skate and spiny dogfish in winter. Total fish and megainvertebrates, Atlantic rock crab, little skate and winter flounder showed no significant change in abundance after dumping ceased. American lobster, however, increased significantly in relative abundance (Stuart J. Wilk, FTS 342-3008 or (908) 872-3008).

LIMITED RESPONSES OF BOTTOM INVERTEBRATES TO SLUDGE PHASEOUT: There was a significant increase in numbers of species, and decrease in abundance of a pollution-indicator worm, in the highly altered area within 22 months after cessation. However, overall biomass was still low, and there was little colonization by dominant species from surrounding areas, by 39 months post-cessation (Robert Reid, FTS 342-3020, (908) 872-2030).

CESSATION ALTERS DUMPSITE SEDIMENTS: During dumping, the "highly altered" station near the dumpsite had finer sediments with higher total organic carbon content than did two reference areas. Cessation led to a significant decrease in carbon content and increase in sediment density in the highly altered area (David Packer, FTS 342-3044 or (908) 872-3044).

CESSATION LOWERS NUMBERS OF MICROBIAL SLUDGE INDICATORS: Concentrations of fecal coliform bacteria and spores of the sludge indicator *Clostridium perfringens* were well below those reported while sludge dumping was ongoing. Results suggest it may be possible to reopen some or all of the inner Bight shellfish closure area (Robert Reid, FTS 342-3020 or (908) 872-3020).

DUMPSITE WINTER FLOUNDER MIX WITH FISH TO THE NORTHEAST AND IN ESTUARIES: Returns from three years of tagging flounder in the 12-Mile Dumpsite Study indicate that in addition to regular seasonal migrations, there is intermixing with stocks from New York and New Jersey estuaries as well as some movement toward shelf waters to the northeast (Beth Phelan, FTS 342-3079 or (908) 872-3079).

MICROBIOLOGICAL MARKER DECLINED AT "12-MILE" DUMPSITE: The concentration of *Clostridium perfringens* spores in the surface layer decreased from 10^5/g sediment at the station nearest the dumpsite while dumping was in progress to 10^4 after cessation. The area of the NY Bight with spore counts $>10^4$/g decreased from 70 km^2 in 1987 to 10 km^2 in 1991. The decreases were not as rapid as with some other sludge tracers and it is estimated that one to two decades will be necessary for spore counts to decline to "background" levels. (Andrew Draxler, FTS 342-3054 or (908) 872-3054 and John O'Reilly, FTS 838-6290 or (401) 782-3290).

DECREASING TREND IN THE MEAN ORGANIC CONTAMINANT CONCENTRATION IN SEDIMENTS FROM THE NEW YORK BIGHT: A decreasing trend in the mean organic contaminant concentration was apparent in sediments collected between 1986 and 1989 in the area of "12-mile" dumpsite. Variability in concentration among replicates precludes statistical significance of this trend. (Ashok Deshpande, FTS 342-3043 or (908) 872-3043).

SEDIMENT METAL CONTAMINATION DECREASING SINCE SLUDGE DUMPING ENDS IN NY BIGHT: Results from a study of the "12-mile" dumpsite indicate that sludge-related metal contamination in surface sediment has decreased since the cessation of sludge dumping in the New York Bight Apex. The area covered by the most polluted sediment began to decrease soon after sludge dumping stopped. Projections indicate that the "worst" of the pollution will be eliminated by January 1992. (Vincent Zdanowicz, FTS 342-3032 or (908) 872-3032).

BOTTOM WATER DISSOLVED OXYGEN CONDITIONS IMPROVED WITH THE END OF SEWAGE SLUDGE DUMPING IN THE NY BIGHT: Dissolved oxygen gradients in the bottom water near the "12-mile" dumpsite declined from >1 mg/L/m during dumping to nil 18 months after dumping had stopped. This represents the decrease in the importance of seabed oxygen consumption as a major controlling force on oxygen content (relative to the water column) and the eradication of seasonal bottom water hypoxia in the area. (Linda Arlen, FTS 342-3093 or (908) 342-3093).

SPECIES RICHNESS STRONGLY RELATED TO SEDIMENT BIOGEOCHEMISTRY: Benthic macrofauna species richness was found to be highly correlated with sediment redox potential (E_H) in areas of the New York Bight manipulated by the cessation of sewage sludge dumping. Variations in sediment E_H are explained by labile carbon availability which controlled the conditions to which infaunal animals were subjected. (Andrew Draxler, FTS 342-3054 or (908) 872-3054 and Robert Reid, FTS 342-3020 or (908) 872-3020).

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*1. NEW SPECIES OF VIVIPAROUS HALFBEAKS: Six species of the Asian freshwater halfbeak genus Hemirhamphodon, including two previously unknown, were recognized in a recent study. Contact Dr. Bruce B. Collette (202) or FTS 357-2524.

*2. NEW FOSSIL CRAB FROM WESTERN INTERIOR UNITED STATES: A new species of fossil calappid crab was described from the Cretaceous Carlile Shale from the Black Hills Uplift in South Dakota and Wyoming. Contact Dr. Austin B. Williams (202) or FTS 357-2639.

*3. HETEROCHRONY IN JAW MORPHOLOGY OF NEEDLEFISHES: Jaw morphology of needlefishes (Belonidae) passes through distinctive ontogenetic stages. When hatched, larvae have short jaws of equal length. The lower jaw first elongates to produce a "halfbeak" form, then the upper jaw elongates to produce the adult "needlenose" morphology. Growth trajectories of upper and lower jaws change independently of each other. The resulting developmental diversity may be correlated with the change from planktivory to piscivory. Contact Dr. Bruce B. Collette (202) or FTS 357-2524.

*6. NEW ZOOGEOGRAPHIC PROVINCE CHARACTERIZED: Study of shallow-water fishes collected on Walters Shoals, 400 nautical miles south of Madagascar, during a cooperative cruise on the Russian oceanographic vessel Vityaz in 1988 has led to the characterization of a new zoogeographic province, the West Wind Drift Islands Province. Contact Dr. Bruce B. Collette (202) or FTS 357-2524.

*9. NEW SPECIES OF MORAY EEL FROM WALTERS SHOALS, MADAGASCAR RIDGE: A new species of moray eel described from Walters Shoals and named for Dr. N.V. Parin, expert on the fish fauna of seamounts and scientific leader of cruise 17 of the Vityaz, is the second of three endemic fishes from Walters Shoals discovered on that cruise. Contact Dr. Bruce B. Collette (202) or FTS 357-2524.

*10. NEW SPECIES OF TONGUEFISHES FROM THE WESTERN ATLANTIC: Within the Symphurus plagusia complex of tonguefishes, it has been common practice to recognize one widespread species (S. plagusia) with two subspecies ranging from the Caribbean to Uruguay and a second species, S. civitatium, occurring in inshore areas from southeastern United States to northern Mexico. A recent study shows that specimens previously identified as S. plagusia comprise four largely sympatric species, including two species previously unknown to science. Contact Dr. Thomas A. Munroe (202) or FTS 357-4255.

*11. NEW SPECIES OF TONGUEFISH FROM THE EASTERN PACIFIC: The final of a series of 7 new species of tonguefishes from the eastern Pacific was described from shallow waters from northern Mexico to central Peru. Contact Dr. Thomas A. Munroe (202) or FTS 357-4255.

*12. PARALARVAL ECOLOGY OF A EURYHALINE SQUID: Paralarvae of the euryhaline squid Lolliguncula brevis were found in coastal waters of southwest Louisiana from April through January, but in nearby estuarine waters only in May, July, and August. Overall, paralarvae were most often collected near-bottom in inshore coastal waters during May-June. Paralarvae were not found in salinities as low as adults tolerate. Surprisingly, paralarval L. brevis were collected throughout the range of dissolved oxygen concentrations sampled, including waters considered to be hypoxic. Contact Dr. Michael Vecchione (202) or FTS 357-4990.

*14. NEW BURROWING SHRIMP FROM THE GULF OF MEXICO: A new species of burrowing shrimp (Upogebia) was taken in box core samples of live bottom material from the continental shelf in the northeastern Gulf of Mexico during a Minerals Management Service sponsored baseline study. Contact Dr. Austin B. Williams (202) or FTS 357-2639.

*15. NEW DEEPWATER CRABS FROM THE MARIANAS: Deepwater sampling during the Resource Assessment Investigation of the Mariana Archipelago (RAIOMA) program in the western North Pacific Ocean, conducted by the NMFS Southwest Fisheries Science Center Honolulu Laboratory, captured two novel species of crabs. These include a new genus and species of spider crab, family Majidae and a rare homoloid crab of a recently described species in the family Poupiniidae. Contact Dr. Austin B. Williams (202) or FTS 357-2639.

*indicates item covered by published paper

RECENT PUBLICATIONS

*1. Anderson, William D. III and BRUCE B. COLLETTE. 1991. Revision of the freshwater viviparous halfbeaks of the genus Hemirhamphodon (Teleostei: Hemiramphidae). Ichthyol. Explor. Freshwaters 2(2): 151-176.

*2. Bishop, Gale A., and AUSTIN B. WILLIAMS. 1991. Necrocarcinus olsonorum, new species, a crab (Decapoda: Calappidae) from the Cretaceous Carlile Shale (Turonian), Western Interior United States. J. Crust. Biol. 11(3):451-459.

*3. Boughton, David A., BRUCE B. COLLETTE,, and Amy R. McCune. 1991. Heterochrony in jaw morphology of needlefishes (Teleostei: Belonidae). Syst. Zool. 40(3): 329-354.

4. COHEN, DANIEL M. 1991. Families Argentinidae (pp. 235-238), Bathylagidae (pp. 239-240), Moridae (pp. 520-523), Gadidae (pp. 526-531), and Bregmacerotidae (pp. 524-525). In: Check-list of Fishes of the Eastern Tropical Atlantic, ORSTOM, Paris, J. C. Quero et al., eds.

5. COLLETTE, BRUCE B. 1991. Family Scombridae. In: Check-list of Fishes of the Eastern Tropical Atlantic, ORSTOM, Paris, J. C. Quero et al., eds., pp. 978-996.

*6. COLLETTE, BRUCE B. and N.V. Parin. 1991. Shallow-water fishes of Walters Shoals, Madagascar Ridge. Bull. Mar. Sci. 48(1): 1-22.

7. COLLETTE, BRUCE B. and N. V. Parin. 1991. Family Hemiramphidae. In: Check-list of Fishes of the Eastern Tropical Atlantic, UNESCO, J.C. Quero et al., eds., pp. 579-582.

8. COLLETTE, BRUCE B. and N.V. Parin. 1991. Family Belonidae In: Check-list of Fishes of the Eastern Tropical Atlantic, UNESCO, J. C. Quero et al., eds., pp. 592-597.

*9. COLLETTE, BRUCE B., David G. Smith, and Eugenia B. Böhlke. 1991. Gymnothorax parini, a new species of moray eel (Teleostei: Muraenidae) from Walters Shoals, Madagascar Ridge. Proc. Biol. Soc. Washington 104(2): 344-350.

*10. MUNROE, THOMAS A. 1991. Western Atlantic tonguefishes of the Symphurus plagusia complex (Cynoglossidae: Pleuronectiformes), with descriptions of two new species. Fish. Bull., U.S. 89(2): 247-287.

*11. MUNROE, THOMAS A., MARTHA S. NIZINSKI, and M. N. Mahadeva. 1991. Symphurus prolatinaris, a new species of shallow-water tonguefish (Pleuronectiformes: Cynoglossidae)from the eastern Pacific. Proc. Biol. Soc. Washington 104(3): 448-458.

*12. VECCHIONE, MICHAEL. 1991. Observations on the paralarval ecology of a euryhaline squid Lolliguncula brevis (Cephalopoda: Loliginidae). Fish. Bull., U.S. 89(3): 515-521.

13. WILLIAMS, AUSTIN B. 1991. Comments on the proposed conservation of the specific name of Artemia franciscana Kellogg, 1906 (Crustacea, Branchiopoda). (Case 2728: see BZN 47:178-183, 48:57). Bull. Zool. Nomencl. 48(3): 246-247.

*14. WILLIAMS, AUSTIN B. and Richard W. Heard. 1991. Upogebia spinistipula, a new burrowing shrimp from the Florida Shelf, northeastern Gulf of Mexico (Decapoda: Thalassinidea: Upogebiidae). Proc. Biol. Soc. Washington 104(1):49-54.

*15. WILLIAMS, AUSTIN B. and Robert B. Moffitt. 1991. Crabs from the Mariana Archipelago: Bothromaia griffini new genus and species (Brachyura: Majidae), and remarks on Poupinia hirsuta Guinot (Homoloidea, Poupiniidae). Proc. Biol. Soc. Washington 104(3): 569-582.