

NC DIVISION OF MARINE FISHERIES

Research Priorities for the North Carolina Division of Marine Fisheries

Biological Review Team
Research Priority Committee

April, 2012

Introduction

In early 2010, the deputy director of the Division of Marine Fisheries (DMF) requested the Management Review Team (MRT) to examine the Fishery Management Plan Process. A FMP Process Workgroup was established to evaluate the process of producing division FMPs and develop recommendations to improve this process. One workgroup recommendation was to develop research needs within an FMP. Another recommendation was to advertise the FMP research recommendations to the university community. This document compiles a list of state and federally managed species that are considered data poor (Table 1) and other high priority research needs from all state and federal FMPs and from the Coastal Habitat Protection Plan (CHPP) for distribution to researchers outside the DMF.

State managed species listed in Table 1 are those species of highest priority to the DMF because of their data poor status. The federally managed species listed are also considered a priority. Beginning April 6, 2012, Atlantic sturgeon will be listed as a federally endangered species. This listing will result in wide ranging impacts to fisheries in North Carolina. Focus on population abundance and fishery interactions of Atlantic sturgeon should also be considered a high priority in the list below, specifically improving anadromous species indices and improving bycatch and discard data. In addition, research on specific habitat and water quality issues that may adversely affect Atlantic sturgeon and other anadromous fish species is needed.

Table 1. Data poor state and federally managed species (in order of priority)

State Managed Species	Federally Managed Species
Central Southern Striped Bass	Atlantic Sturgeon
River Herring	American Eel
Bay Scallop	American Shad
Oyster	Hickory Shad
Hard Clam	Reef Fish
Kingfish	Black Sea Bass (N)
Blue Crab	Shark
Striped Mullet	Spot
White Perch	Spanish Mackerel
Catfish	Monkfish
Yellow Perch	Dolphin

Click on a species name or Coastal Habitat Protection Plan to navigate through the document. *Immediate research needs are in italics and marked with an asterisk (*)*.

State FMP Species

Striped Bass (ASMA and RRMA)	White Perch
Striped Bass (CSMA)	Yellow Perch
Catfish	Spotted Seatrout
Red Drum	Hard Clam
Southern Flounder	Blue Crab
River Herring	Eastern Oyster
Kingfishes	Bay Scallop
Striped Mullet	Shrimp

Federal FMP Species

Black Sea Bass (North of Hatteras)	Atlantic Menhaden
Black Sea Bass (South of Hatteras)	Monkfish
Striped Bass (Atlantic Ocean Migratory Stock)	Reef Fish
Bluefish	Scup
Atlantic Croaker	American Shad
Dolphin	Hickory Shad
American Eel	Coastal Sharks
Summer Flounder	Spiny Dogfish
Gag Grouper	Spot
King Mackerel	Atlantic Sturgeon
Spanish Mackerel	Weakfish

Coastal Habitat Protection Plan (CHPP)

Top Research Priorities – State FMP Species

** Immediate research needs*

STRIPED BASS

Albemarle Sound and Roanoke River Management Area

Status: Viable

Based on results of the 2010 stock assessment the stock is not experiencing overfishing and biomass remains high. The stock age structure is broad including fish 17 years old. Development of Amendment 1 to the N.C. Estuarine Striped Bass FMP is currently underway.

Research Needs

- Ageing methods between agencies (NCDMF and NCWRC) and between systems (Roanoke, Tar/Pamlico, Neuse, Cape Fear rivers) should be validated (ongoing)
- Examine modeling methods, including alternative stock-recruitment models, alternate ASAP2 configurations that may reduce the number of model parameters, and develop likelihood profiles for input parameters (e.g., natural mortality (M))
- Improve precision of weight measurements of age 1 and age 2 fish
- Improve estimates of discard losses from the ASMA commercial gill net fisheries
- Re-evaluate hook and release mortality rates from the ASMA and RRMA recreational fisheries incorporating different hook types and angling methods at various water temperatures (e.g., live bait, artificial bait, and fly fishing)

Contact Charlton Godwin at Charlton.Godwin@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

Central/Southern Management Area

Status: Depleted

Stocks lack a quantified stock assessment, and show a truncated size and age distribution that lacks older age classes. Improved dependent and independent data collection must be conducted before an accurate stock assessment can be made. Development of Amendment 1 to the N.C. Estuarine Striped Bass FMP is currently underway.

Research Needs

- Determine system of origin of fish on the spawning grounds.
- Acquire life history information (maturity, fecundity, size/weight at age (short term research projects)).
- Conduct a mark-recapture study utilizing conventional tags and telemetry.
- Conduct independent surveys that capture all life stages of striped bass.
- Determine if suitable striped bass spawning conditions exist in the Tar/Pamlico, Neuse, and Cape Fear rivers.

Contact Katy West at Katy.West@ncdenr.gov or 1-800-338-7804 or (252) 948-3884.

CATFISH

Status: Unknown

Independent and dependent sampling began March 2004 to fulfill data/research needs for the

upcoming FMP.

Research Needs

- Characterize the recreational fisheries including tackle, geographic locations, seasonality, bait, discards, effort, and harvest.
- Characterize the commercial harvest including gears, species composition, effort, harvest, discards, areas fished, target species, and mortality.
- Fecundity estimates by species and geographic region.
- Develop tagging program that can be used to estimate natural and fishing mortality and migration information; include tagging mortality estimates, retention, and reporting rates.
- Develop spawning area survey to identify spawning locations and time by species.

Contact Michael Loeffler at Michael.Loeffler@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

RED DRUM

Status: Recovering

Overfishing is not occurring. A stock assessment completed in 2009 by the ASMFC continues to indicate that current regulations have been successful.

Research Needs

- Improve catch/effort estimates and biological sampling from recreational fisheries for red drum (including increased effort to intercept night fisheries). This should include significant effort to determine the size and age structure of discards of red drum in this sector.
- Develop and a red drum tagging program that can be used to estimate fishing and natural mortality and movements. This should include concurrent evaluations of tag retention, tagging mortality and angler tag reporting rates.
- Obtain discard estimates from commercial fishery (include information on size and disposition; improved coverage).
- Release mortality in gill nets.
- Conduct a comprehensive study to characterize users of the resources. In particular, gill net fishers (including information on species targeted, gear characteristics and areas fished) and fishers in the adult recreational fishery (tackle, geographic location, bait, water temperature, seasonality, hook types, etc.).

Contact Lee Paramore at Lee.Paramore@ncdenr.gov or (252) 473-5734.

SOUTHERN FLOUNDER

Status: Depleted

Stock is overfished and overfishing is occurring based on the 2009 stock assessment. Development of Amendment 1 to the DMF FMP is currently underway. Supplement A to the FMP was implemented in February 2011 for the recreational fishery. These reductions, combined with existing commercial measures, achieve sustainable harvest.

Research Needs

- **Further research on size distribution of southern flounder from pound nets with 5.75 and 6.0 inch escape panels.*

- **Research on deep hooking events of different hook types and sizes on southern flounder.*
- Coast wide at-sea observations of the flounder pound net fishery.
- Discard mortality estimates of southern flounder from pound nets.
- **Investigate the feasibility of a quota as a management tool for the commercial southern flounder fishery.*

Contact Chris Batsavage at Chris.Batsavage@ncdenr.gov or 1-800-682-2632 or (252) 808–8088.

RIVER HERRING

Status: Depleted

The MFC implemented a no harvest provision for commercial and recreational fisheries in joint and coastal waters of the state, beginning in 2007. Current research is being conducted by DMF in the Albemarle Sound area to re-evaluate spawning habitat, expand juvenile sampling and monitor the Chowan River adult spawning stock.

Research Needs

- Continue to monitor all stock recovery indicators outlined in 2007 FMP.
- Continue to evaluate spawning and nursery habitat areas in all tributaries of the Albemarle Sound as well as expand independent sampling programs to include all areas of the state.
- Endorse additional research coast wide to collect and assess river herring bycatch and discards to a high level of precision from Atlantic mackerel, Atlantic herring, and other pelagic fisheries to determine the effects on river herring populations and improve management.
- Identify and evaluate all potential blockages to historical spawning areas and develop strategies to minimize the impacts of these blockages.
- Evaluate the impacts of predation on river herring by other species with emphasis on striped bass, as well as expand predation work outside of the Albemarle Sound area.

Contact Kathy Rawls at Kathy.Rawls@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

KINGFISHES

Status: Unknown

The DMF FMP completed in 2007 indicated a healthy age structure in the stock along with increasing trends in fishery independent and dependent abundance indices.

Research Needs

- Continue to collect life history data including data on age and growth, reproduction and mortality.
- Identify Strategic Habitat Areas for southern, Gulf and northern kingfishes.
- Continue discard sampling; expand to collect information on depth and location and age and size distribution of discarded fish.
- Determine if stock structure exists in kingfishes.
- Develop methods to assess the sustainability or estimate sustainable biological reference points for kingfishes.

Contact Chip Collier at Chip.Collier@ncdenr.gov or 1-800-248-4536 or (910) 796-7215).

STRIPED MULLET

Status: Viable

The stock is not overfished. Landings for 2010 were within management threshold limits. Historically, the commercial fishery has had sustained landings similar to current levels. Future harvest levels are expected to be affected by rule changes enacted in 2010 aimed at reducing interactions with sea turtles in the large mesh gill net fishery.

Research Needs

- Initiate survey to estimate fecundity and validate current maturity schedule microscopically.
- Investigate the disappearance of males from the population after age-3 (300mm FL).
- **Create and validate a juvenile abundance index for striped mullet.*
- **Initiate acoustic tagging study to determine spatial and temporal variations in habitat use throughout the state to help provide better indices for stock assessments.*
- Develop a survey to provide estimates of striped mullet used as bait in recreational and commercial fisheries and obtain discard estimates from the commercial fishery.

Contact Jason Rock at Jason.Rock@ncdenr.gov or 1-800-338-7804 or (252) 948-3875.

WHITE PERCH

Status: Unknown

Independent and dependent sampling began March 2004 to fulfill data/research needs for the upcoming FMP.

Research Needs

- Validate JAI based on current sampling being conducted.
- Characterize the recreational fisheries including tackle, geographic locations, seasonality, bait, discards, effort, and harvest.
- Characterize the commercial harvest including gears, effort, harvest, discards, areas fished, target species, and mortality.
- Fecundity estimates by region.
- Develop/continue tagging program that can be used to estimate natural and fishing mortality and migration information; include tagging mortality estimates, retention, and reporting rates.

Contact Michael Loeffler at Michael.Loeffler@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

YELLOW PERCH

Status: Concern

There has been a significant increase in effort and landings since 1991. Fish are targeted in the winter and early spring during spawning within specific river systems.

Research Needs

- Validate JAI based on current sampling being conducted.

- Characterize the recreational fisheries including tackle, geographic locations, seasonality, bait, discards, effort, and harvest.
- Characterize the commercial harvest including gears, effort, harvest, discards, areas fished, target species, and mortality.
- Fecundity estimates by region.
- Develop/continue tagging program that can be used to estimate natural and fishing mortality and migration information; include tagging mortality estimates, retention, and reporting rates.

Contact Michael Loeffler at Michael.Loeffler@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

SPOTTED SEATROUT

Status: Depleted

The 2009 N.C. spotted seatrout stock assessment indicated that the stock in North Carolina and Virginia has been overfished and overfishing has been occurring throughout the entire 18-year time series. Consecutive cold stun events of 2010 and 2011 likely had a significant impact on the spawning stock biomass of North Carolina's spotted seatrout population.

Research Needs

- Develop juvenile abundance indices.
- Utilize tagging data to develop better estimates of mortality (fishing and natural)
- Determine size specific fecundity estimates for spotted seatrout in North Carolina.
- Develop a model that incorporates cold stun event information into modeling of the population.
- Collect data on the size or age of spotted seatrout released alive by anglers and the number, size and age of commercial discards.

Contact Chip Collier at Chip.Collier@ncdenr.gov or 1-800-248-4536 or (910) 796-7292.

HARD CLAM

Status: Unknown

Based on the best available indicators, harvest levels in most areas appeared relatively constant in recent years. Amendment 1 of the FMP was completed in 2008. Data limitations prevent DMF from conducting a hard clam stock assessment and calculating sustainable harvest.

Research Needs

- Increase hard clam sampling programs to collect information necessary for the completion of a stock assessment. Programs will require long-term monitoring.
 - **Determine number of separate stocks in NC*
 - Stock(s) recruitment indices of abundance
 - Adult stock(s) indices of abundance
 - Expand on commercial sampling to have a better idea of adult/recruit removals from the stock(s)
 - Validation of ageing methods in NC
 - Determine estimates of clam fecundity at each age
 - Determine natural mortality estimates
- Identify factors influencing clam growth in NC.

- **Collect recreational landings data.*
- Determine the hydrodynamics of productive areas for restoration and culture activities.
- Quantify the impact of current fishing practices on clam habitat suitability in North Carolina.
- Quantify the relationship between water quality parameters and the cumulative effect of shoreline development units (i.e., docks, bulkhead sections).

Contact Tina Moore at Tina.Moore@ncdenr.gov or 1-800-682-2632 or (252) 808-8082.

BLUE CRAB

Status: Concern

Increased concern for the blue crab stock is due to reduced landings of hard blue crabs during 2000–2002 and 2005–2007, following record-high landings observed during 1996–1999.

Research Needs

- Improve and conduct blue crab sampling programs to collect information necessary for stock management/assessment, such as: ageing, natural mortality, size and age at maturity, fecundity variation, and indices of abundance [e.g., expand trawl monitoring programs (NCDMF programs 195 and 120)].
- Collect non-commercial blue crab landings and effort information.
- Collect more comprehensive spatial and temporal information on the commercial harvest.
- Evaluate the genetic stock structure of blue crabs within North Carolina, and the magnitude of mixing between metapopulations.
- Conduct surveys of existing crab spawning sanctuary areas and other areas to determine population levels, and if these areas function as spawning grounds.
- Collect information on diamondback terrapin interaction with the crab pot fishery.

Contact Lynn Henry at Lynn.Henry@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

EASTERN OYSTER

Status: Concern

Concern status is due to long term decline caused by overharvesting and habitat disturbances. Sampling data shows DERMO has declined in recent years and commercial landings have shown marked improvement. Recreational landings are unknown.

Research Needs

- Oyster habitat identification and mapping.
- Annually monitor size, shape and volume of a representative sample for the identified oyster habitats within Pamlico Sound.
- Determine the impacts of current oyster dredging practices on oyster habitat.
- Determine the economic and environmental value of the cultch planting program.
- Assess survival and productivity of relayed oysters vs. natural recruitment on planted cultch sites.

Contact Clay Caroon at Clay.Caroon@ncdenr.gov or 1-800-682-2632 or (252) 808-8058.

BAY SCALLOP

Status: Depleted

High natural mortality from environmental change and predation cause annual variability in abundance. Sampling showed low abundance in all areas in 2010. The main harvest season (late January – March) was not opened in 2011 due to limited availability of scallops.

Research Needs

- **Identify and survey recreational fishery.*
- **Improve genetic information to determine number of separate stocks.*
- Conduct research to study impacts of scalloping activities on bay scallop habitat and recruitment.
 - **Study impacts of scallop dredging and treading activities on SAV condition and bay scallop recruitment*
- **Quantify high and low productive areas of bay scallop abundance.*
 - Identify factors influencing settlement success to determine bay scallop sanctuaries, seeding programs, culturing activities.
 - Investigate role of adult dispersion patterns in spawning success.
 - Identify source and sink areas for bay scallop production.
 - Identify factors influencing bay scallop growth.
 - Identify the habitat and water quality conditions where bay scallops are most abundant.

Contact Tina Moore at Tina.Moore@ncdenr.gov or 1-800-682-2632 or (252) 808-8082.

SHRIMP

Status: Viable

Annual shrimp stock condition is determined mainly by environmental and recruitment conditions. Natural mortality far outweighs fishing mortality.

Research Needs

- Conduct additional bycatch characterization across all strata (for example; season, areas, vessel type and dominant species).
- Obtain mortality (immediate and post harvest) estimates of culled, active and passive bycatch.
- Determine the effects trawling and recovery time of benthic community structure in different habitat types.
- Continue to develop and test methods to reduce bycatch in the commercial and recreational shrimp trawl fisheries.
- Continue to develop and test alternate gears for shrimp harvest.

Southern District: Contact Rich Carpenter at Rich.Carpenter@ncdenr.gov or 1-800-248-4536 or (910) 796-7215.

Central District: Contact Tina Moore at Tina.Moore@ncdenr.gov or 1-800-682-2632 or (252) 726-7021.

Pamlico District: Contact Sean McKenna at Sean.Mckenna@ncdenr.gov or 1-800-338-7804 or (252) 946-6481.

Top Research Priorities – Federal FMP Species

** Immediate research needs*

BLACK SEA BASS

North of Hatteras

Status: Concern

The stock is not overfished and overfishing is not occurring. However, this is a data poor stock and there is significant uncertainty associated with the natural mortality estimate, the assessment model input parameters, and managing a protogynous species (individuals change sex from female to male). A new stock assessment should be complete by December and will likely result in a new list of research needs.

Research Needs

- Develop age information (scales and otoliths) for possible re-examination of age based analytical models as soon as possible.
- **Research alternative models that would be more appropriate than traditional fisheries models when modeling protogynous hermaphrodite species.*
- Continue discard sampling, particularly from poorly sampled pot and hook fisheries.
- Consider alternative survey gear (pots or handlines).
- Conduct additional fishery independent surveys.

Contact Chris Batsavage at Chris.Batsavage@ncdenr.gov or 1-800-682-2632 or (252) 808-8088.

South of Hatteras

Status: Depleted

The stock is under a federally managed rebuilding plan which went into place in 2006. A new stock assessment will be completed in December 2011.

Research Needs

- Develop adult and juvenile indexes of abundance.
- Research methods for estimating historic landings in both recreational and commercial fisheries.
- Determine if stock structure exists in the South Atlantic in both adult and juvenile black sea bass.
- Continue discard sampling; expand to collect information on depth and location and age and size distribution of discarded fish.
- Continue to collect life history data including data on age and growth, reproduction, and mortality.

Contact Chip Collier at Chip.Collier@ncdenr.gov or 1-800-248-4536 or (910) 796-7215.

ATLANTIC OCEAN MIGRATORY STOCK STRIPED BASS

Status: Viable

Based on results of the ASMFC 2009 updated stock assessment, Atlantic coast striped bass are not overfished and overfishing is not occurring. The model estimates that the resource remains at a high level of abundance with female spawning stock biomass well above the target level. The stock assessment will be updated in the fall of 2011.

Research Needs

- Develop a spatial and temporal catch at age model incorporating tag-based movement information
- Develop methods for combining tag results from programs releasing fish from different areas in different dates
- Examine potential biases associated with the number of tagged individuals, such as gear-specific mortality (associated with trawls, pound nets, gill nets, and electrofishing), tag-induced mortality, and tag loss
- Continue improvements to statistical catch-at-age model as recommended by 46th SARC (e.g., include error from catch estimates, fit each sector of removals individually, run additional diagnostics, account for spatial differences in indices, incorporate stock-recruitment relationship)
- Review model averaging approach to estimate annual fishing mortality with tag-based models; review validity and sensitivity to year groupings
- Evaluate to what extent rising natural mortality (M) among Chesapeake Bay stripers affects the exiting F and SSB thresholds, which are based on a fixed M assumption (M = 0.15)

Contact Charlton Godwin at Charlton.Godwin@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

BLUEFISH

Status: Viable

The Atlantic stock of bluefish is not overfished and is not experiencing overfishing. The ASMFC Bluefish Technical Committee continues to work on improving and refining bluefish age data and the bluefish stock assessment.

Research Needs

- Age any archived age data for bluefish and use to supplement Virginia age keys.
- Initiate fisheries-dependent and independent sampling of offshore populations of bluefish during the winter months.
- Evaluate amount and length frequency of discards from the commercial and recreational fisheries.
- Increase intensity of biological sampling of the north east region commercial and coast wide recreational fisheries.
- Test the sensitivity of the bluefish assessment to assumptions concerning age-varying M (natural mortality), level of age-0 discard, and selection patterns.

Contact Lee Paramore at Lee.Paramore@ncdenr.gov or (252) 473-5734.

ATLANTIC CROAKER

Status: Concern

Atlantic croaker is not experiencing overfishing and is likely not overfished. Trends in independent data indicate that biomass has been increasing and more, older fish have been observed in the catch.

Research Needs

- **Conduct stock identification research on croaker via otoliths microchemistry, tagging, and/or genetics.*
- Develop estimates of fecundity and validate current maturity schedule microscopically.
- **Evaluate commercial and recreational discard mortality under varying environmental conditions and fishery practices.*
- **Improve catch and effort statistics from the commercial and recreational fisheries, along with size and age structure of the catch.*
- Determine species interactions and predator/prey relationships for croaker

Contact Jason Rock at Jason.Rock@ncdenr.gov or 1-800-338-7804 or (252) 948-3875.

DOLPHIN

Status: Viable

SAFMC's Dolphin Wahoo FMP was approved in 2004. The SAFMC continues to work on the Comprehensive Annual Catch Limit Amendment. The amendment will meet federal mandates to establish annual catch limits and accountability measures for managed species that are not undergoing overfishing by the end of 2011.

Research Needs

- Identify essential fish habitat and the ages that utilize it.
- Develop and/or improve age and growth data.
- Develop and/or improve reproductive data.
- Develop and/or improve migration data.
- Investigate release mortality estimates to evaluate the effectiveness of current size and bag limits.

Contact Randy Gregory at Randy.Gregory@ncdenr.gov or 1-800-682-2632, or (252) 726-7021.

AMERICAN EEL

Status: Unknown

Stock status is poorly understood due to limited stock assessment results and non-standard sampling protocols across the species' range. No range-wide estimate of abundance exists and reliable indices of abundance of this species are scarce.

Research Needs

- Formulate a coast wide fishery-independent sampling program for yellow and silver American eels using standardized and statistically robust methodologies.
- Investigate fecundity, length, and weight relationships for females throughout their range.

- Determine growth rates for males and females throughout their range and acquire age and maturity data.
- Investigate, develop, and improve technologies for American eel passage upstream and downstream at various barriers for each life stage. In particular, investigate low-cost alternatives to traditional fish way designs for passage of eel.
- Investigate various life stage survival and mortality to assist in the assessment of annual recruitment.

Contact Katy West at Katy.West@ncdenr.gov or 1-800-338-7804 or (252) 948-3884.

SUMMER FLOUNDER

Status: Viable

Overfishing is no longer occurring and the stock is no longer overfished.

Research Needs

- **Develop a program to annually sample the length and age frequency of summer flounder discards from the recreational fishery.*
- Comprehensive collection of otoliths from fish greater than 60 cm (~7 years).
- Continue ongoing age structure exchanges between the NEFSC and all interested state agencies and academic institutions and develop a reference collection of scales and otoliths for quality control purposes.
- **Develop a long-term protocol to sample otoliths from summer flounder caught in the recreational and commercial fisheries (e.g., purchase samples; as a component of Research Set-Aside projects; as Cooperative Research with industry).*
- Investigate trends in sex ratios and mean lengths and weights of summer flounder in state agency and federal survey catches.

Contact Chris Batsavage at Chris.Batsavage@ncdenr.gov or 1-800-682-2632 or (252) 808-8088.

GAG GROUPE

Status: Concern

The stock is not overfished but overfishing is occurring. The federally managed plan is restricting harvest to end overfishing.

Research Needs

- Develop adult and juvenile indexes of abundance, especially fishery independent indexes of abundance.
- Continue to collect life history data including data on age and growth, reproduction, and mortality.
- Continue discard sampling and methods to reduce discard mortality; expand to collect information on depth and location and age and size distribution of discarded fish.
- Research alternative stock recruitment relationships to determine most appropriate sustainability benchmarks.
- Research methods for estimating historic landings in both recreational and commercial fisheries.

Contact Chip Collier at Chip.Collier@ncdenr.gov or 1-800-248-4536 or (910) 796-7215.

KING MACKEREL

Status: Concern

Based on the SAFMC 2008 stock assessment, the South Atlantic king mackerel stock is not overfished. It is uncertain whether overfishing is occurring.

Research Needs

- Investigate and quantify mixing between Atlantic, eastern Gulf and western Gulf populations.
- Conduct ageing workshops and training to standardize techniques and increase the ageing precision among laboratories.
- Conduct studies and monitoring that will allow estimation of natural mortality.
- Examine population connectivity throughout the Gulf and S. Atlantic using otolith elemental and stable isotope signatures of age-0 fish as natural tags of various regions.
- Determine recreational release mortality estimates.

Contact Randy Gregory at Randy.Gregory@ncdenr.gov or 1-800-682-2632, or (252) 726-7021.

SPANISH MACKEREL

Status: Viable

The Spanish mackerel stock in the South Atlantic is not undergoing overfishing; however, the 2008 SAFMC stock assessment model and underlying data are insufficient to make a determination on whether or not the stock is overfished.

Research Needs

- Investigate the discard mortality of Spanish mackerel in the commercial and recreational trolling fishery, commercial gillnet fishery, and the shrimp trawl fishery.
- Expand existing fishery independent sampling and/or develop new fishery independent sampling of the Spanish mackerel population off the southeastern U.S.
- Expand age collections.
- Conduct inter-lab comparisons of age readings from test sets of otoliths in preparation for any future stock assessments.
- Conduct observations of Spanish mackerel fisheries (gillnets, pound nets and shrimp trawls for bycatch).

Contact Randy Gregory at Randy.Gregory@ncdenr.gov or 1-800-682-2632, or (252) 726-7021.

ATLANTIC MENHADEN

Status: Concern

Based on the corrected version of the 2010 benchmark stock assessment, Atlantic menhaden are not overfished but is experiencing overfishing. The ASMFC Atlantic menhaden board has tasked its Technical Committee to develop alternative reference points for the stock.

Research Needs

- Develop a coast wide fishery independent index of adult abundance at age to replace or augment the existing Potomac River pound net index in the model.

- Re-evaluate female maturity schedule and fecundity, as most recent studies on these characteristics are several decades old.
- Re-evaluate menhaden natural mortality-at-age and population response to changing predator populations by updating and augmenting the MSVPA (e.g. add additional predator, prey, and diet data when available).
- Evaluate productivity of different estuaries (e.g., replicate similar methodology to Ahrenholz et al. 1987).
- Collect age-specific data on movement rates of menhaden to develop regional abundance trends.

Contact Trish Murphey at Trish.Murphey@ncdenr.gov or 1-800-682-2632 or (252) 726-7021.

MONKFISH

Status: Recovering

Based on revised biomass reference points, NMFS no longer considers the Northern or Southern stocks overfished. The biomass indices for both stocks are above the minimum biomass threshold and biomass target index.

Research Needs

- Continued research to define stock structure, including genetic studies, reproductive behavior analyses, morphometric studies, parasite studies, elemental analyses, and studies of egg and larvae transport.
- Aging validation studies to confirm the accuracy of catch at age estimates.
- Tagging studies as a basis to evaluate adult movement, rates of growth, natural mortality (M) and longevity.
- Estimate biomass by sex since age 6+ fish that are predominantly female appear to be decreasing in biomass at a greater rate.
- Evaluate spatial distribution of mature and immature fish and the potential effects of size limits on fishing behavior as a basis for advising on strategies to minimize catch and discard of immature fish.

Contact Holly White at Holly.White@ncdenr.gov or (252) 473-5734.

REEF FISH

Status: Concern

Of the 73 species in the SAFMC unit, several are considered overfished. The overfished stocks include snowy grouper, red porgy, red snapper, red grouper, and black sea bass south of Cape Hatteras.

Research Needs

- Develop adult and juvenile indexes of abundance, especially fishery independent indexes of abundance.
- Research methods for estimating historic landings in both recreational and commercial fisheries.
- Continue discard sampling and methods to reduce discard mortality; expand to collect information on depth and location and age and size distribution of discarded fish.
- Continue to collect life history data including data on age and growth, reproduction, and mortality.

- Research alternative stock recruitment relationships to determine most appropriate sustainability benchmarks.

Contact Chip Collier at Chip.Collier@ncdenr.net or 1-800-248-4536 or (910) 796-7292.

SCUP

Status: Viable

The 2009 updated assessment indicates that the stock is not considered overfished and is not currently experiencing overfishing. Greatly improved recruitment and low fishing mortality rates have occurred since 1998. This stock is no longer considered a data poor stock.

Research Needs

- **Implementation of new standardized research surveys that focus on accurately indexing the abundance of older scup (ages 3 and older).*
- Continuation of at least the current levels of at-sea and port sampling of the commercial and recreational fisheries in which scup are landed and discarded.
- Quantification of the biases in the catch and discards, including non-compliance.
- Experimental work to better characterize the discard mortality rate of scup captured by different commercial gear types should be conducted to more accurately quantify the magnitude of scup discard mortality.

Contact Chris Batsavage at Chris.Batsavage@ncdenr.gov or 1-800-682-2632 or (252) 808-8088.

AMERICAN SHAD

Status: Concern

Commercial landings increased in 2010, and are approaching the 10–year average. The 2007 ASMFC coast wide stock assessment concluded that the Albemarle Sound area stocks were stable, but well below historical levels and the stock status of the other systems in N.C. were unknown.

Research Needs

- Evaluate spawning and nursery habitat areas in all tributaries of the Albemarle Sound as well as expand all independent sampling programs to include all areas of the state.
- Develop sampling programs to adequately monitor recreational landings and takes of American shad throughout all areas of the state.
- Identify migratory passage impediments and determine the effects of these impediments during all life history stages and develop strategies to minimize the impacts of these blockages.
- Identify all fisheries where bycatch occurs and quantify the amount and disposition. Initiate programs to determine extent and impact of Atlantic Ocean bycatch on NC stocks.
- Utilize observer coverage to verify the reporting rate of commercial catch and harvest as well as bycatch and discards.

Contact Kathy Rawls at Kathy.Rawls@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

HICKORY SHAD

Status: Unknown

Commercial landings have increased since 2007 and are above the ten year average for the first time since 2005. The DMF has not conducted any directed sampling since 1993.

Research Needs

- Establish long term dependent and independent monitoring programs and aging directed at hickory shad to be used in the development of stock assessments and Fisheries Management Plans.
- Evaluate spawning and nursery habitat areas in all tributaries of the Albemarle Sound as well as expand all independent sampling programs to include all areas of the state.
- Identify all fisheries where bycatch occurs and quantify the amount and disposition. Initiate programs to determine extent and impact of Atlantic Ocean bycatch on NC stocks.
- Identify migratory passage impediments and determine the effects of these impediments during all life history stages and develop strategies to minimize the impacts of these blockages.
- Develop sampling programs to adequately monitor recreational landings and takes of hickory shad throughout all areas of the state.

Contact Kathy Rawls at Kathy.Rawls@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

COASTAL SHARKS

Status: Concern

The ASMFC has developed a Coastal Shark FMP. Recent assessment results indicate great uncertainty about the various shark species, their current status is of concern because of the overfished status of sandbar shark, shortfin mako shark, blacknose shark, and scalloped hammerhead shark.

Research Needs

- Improve dockside monitoring of catches.
- Increase observer coverage of the commercial fleet.
- Use biochemical and/or genetic testing of products to produce reliable species identifications.
- Use all appropriate abundance series available.
- Conduct research on life history of all species in the complex.

Contact Michael Loeffler at Michael.Loeffler@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

SPINY DOGFISH

Status: Viable

Spiny dogfish are currently managed under the joint MAFMC and NEFMC FMP in federal waters (3–200 miles) and the ASMFC Spiny Dogfish Interstate FMP in state waters (0–3 miles). The 2009 Transboundary Resource Assessment Committee assessment update indicates that the spiny dogfish stock is considered to be rebuilt.

Research Needs

- Gather accurate discard mortality estimates, with consideration for the differences in mortality rates among seasons, areas and gear types.
- Gather length frequency and sex data from at-sea observer programs.
- Conduct a standardized aging study that includes age validation of the structures used.
- Study the Genetics throughout the range of spiny dogfish.
- Increase knowledge of reproductive potential for females of varying size.
- Continue ongoing age structure exchanges between the NEFSC and all interested state agencies and academic institutions.
- Conduct a coast-wide tagging study for spiny dogfish to explore stock structure, migration patterns, and mixing rates.

Contact Michael Loeffler at Michael.Loeffler@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

SPOT

Status: Concern

Recreational and commercial landings decreased in 2010 to historical lows, however the catch per unit effort in the commercial fisheries (inshore/offshore gillnet and long haul) increased and the juvenile abundance index increased.

Research Needs

- Initiate/increase state monitoring and reporting on the extent of unutilized bycatch and fishing mortality on fish less than age-1 in fisheries that take significant numbers of spot.
- Evaluate the effects of mandated bycatch reduction devices on spot catch in those states with significant commercial harvests.
- Develop fishery-dependent and fishery-independent size and sex specific relative abundance estimates; improve spot catch and effort statistics from the commercial and recreational fisheries and develop catch-at-age matrices.
- Identify stocks and determine coastal movement, migratory patterns, and the extent of stock mixing via genetic and/or tagging studies.
- Conduct discard mortality studies for gears used in the recreational and commercial fisheries.

Contact Kevin Brown at Kevin.H.Brown@ncdenr.gov or 1-800-682-2632 or (252) 808-8089.

ATLANTIC STURGEON

Status: Depleted

The ASMFC is responsible for managing this species and considers the stocks to be depleted along the Atlantic coast. There is a coast-wide prohibition on possession. Beginning April 6, 2012, Atlantic sturgeon will be listed as a federally endangered species. This listing will result in wide ranging impacts to fisheries in North Carolina. Focus on population status and incidence of bycatch in various fisheries should be considered a high priority in the list below.

Research Needs

- Monitor population status through juvenile indices.
- Develop program to identify abundance and age composition of spawning population.
- Characterize incidence of bycatch in various fisheries and associated mortalities.

- Conduct tag and recapture studies to evaluate migrations and movements between DPS's.
- Identify spawning habitat.

Contact Michael Loeffler at Michael.Loeffler@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

WEAKFISH

Status: Depleted

The weakfish stock along the Atlantic coast is at a level of low abundance. Coast-wide landings are at their lowest levels on record. The most recent assessment indicates that the cause is likely due to factors other than fishing mortality. The ASMFC has set strict harvest limits in response to the decline in an effort to aid in stock recovery.

Research Needs

- Assess the impact of the variability of the surveys in regards to gear, time of year, and geographic coverage on their (survey) use as stock indicators.
- Collect catch and effort data including size and age composition of the catch, determine stock mortality throughout the range, and define gear characteristics. In particular, increase length-frequency sampling in fisheries from Maryland north.
- Derive estimates of discard mortality rates and the magnitude of discards for all commercial gear types from both directed and non-directed fisheries. In particular, quantify trawl bycatch, refine estimates of mortality for below minimum size fish, and focus on factors such as distance from shore and geographical differences.
- Conduct an age validation study.
- Identify stocks and determine coastal movements and the extent of stock mixing, including characterization of stocks in over-wintering grounds (e.g., tagging). Conduct spatial and temporal analysis of the fishery independent survey data.

Contact Lee Paramore at Lee.Paramore@ncdenr.gov or (252) 473-5734.

Coastal Habitat Protection Plan (CHPP)

The Marine Fisheries Commission (MFC) and Division of Marine Fisheries (DMF) manage the commercial and recreational fisheries in North Carolina's estuarine and ocean waters. These waters, including their specific physical habitats (water column, wetlands, sea grasses, soft and hard bottoms, and shell bottoms), produce the finfish, shrimp, crabs, oysters, and other economically important species sought by fishermen, as well as the forage base that supports them.

Research Needs

- **A basic need of Strategic Habitat Area assessment continues to be the development of accurate and up to date distribution maps for habitats and threats, particularly subtidal oyster reefs in Pamlico Sound. Continue the bottom mapping program (Submerged Aquatic Vegetation, Shell bottom, detritus).*
- **Compile a prioritized list of physical impediments to anadromous spawning migration routes for removal or modification that would benefit the recovery of anadromous species. Restoration efforts should remain a high priority to continue in North Carolina, focusing on the lowermost structures in rivers or streams, and advancing upstream.*

Removing unnecessary dams should be undertaken with consideration for both upstream and downstream impacts.

- Implement a comprehensive cumulative impacts study that compares changes in habitat coverage and condition to fish, shellfish, and crustacean abundance, particularly those with depleted or concern status. Investigate the cumulative impacts of various threats (e.g., marinas and multi-slip docking facilities, shoreline hardening, coastal development, animal operations, stormwater runoff, dams, dredging, endocrine disruptors, jetties and groins, bottom disturbing fishing gear, water withdrawals, etc.) to coastal fishery habitats.
- Conduct spawning area surveys to identify new and monitor existing areas (river herring, other anadromous, red drum, blue crab).
- Establish fish habitat indicator species for all six CHPP habitats.

In addition to the high priority research needs listed above, the CHPP Development Team has also identified, in a separate document, the latest research needs for the six coastal fish habitats. These research needs are organized by ecosystem functions and threats from both human activities and natural events. This document can be downloaded from:

http://portal.ncdenr.org/c/document_library/get_file?uuid=a94488a9-3c5b-4e9c-92db-a1809f28fdb2&groupId=38337

Contact Christine Jensen at Christine.Jensen@ncdenr.gov or 1-800-682-2632 or (252) 808-8068.