

NC DIVISION OF MARINE FISHERIES

Research Priorities for the North Carolina Division of Marine Fisheries

Biological Review Team
Research Priority Committee

October, 2013

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 (FMP) Process. An 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. On April 6, 2012, Atlantic sturgeon was listed as a federally endangered species. This listing resulted in the DMF developing an application for a Section 10 Incidental Take Permit. Estuarine anchored gill net fisheries will have to follow the protocols outlined in this application if attained. Focus on population abundance and fishery interactions of Atlantic sturgeon should also be considered a high priority in the list below, specifically improving diadromous 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 diadromous 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
Spotted Seatrout	American Shad
Kingfish	Reef Fish (Snapper Grouper Complex)
Striped Mullet	Black Sea Bass (N)
Blue Crab	Coastal Sharks
Oysters	Spot
Hard Clam	Weakfish
Bay Scallops	Monkfish
Sheepshead	Dolphin
	Black Drum

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

State FMP Species

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

Federal FMP Species

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

Coastal Habitat Protection Plan (CHPP)

Top Research Priorities – State FMP Species
*** Immediate research needs**

BAY SCALLOP

Status: Concern

Bay scallop abundance has shown some improvement since no harvest was allowed from 2006 to 2008 and seasonal openings have occurred for a few years in some areas since. High natural mortality from environmental change and predation cause annual variability in abundance within the areas. Sampling showed low abundance in all areas except Bogue Sound in 2012. The main harvest season (late January - March) was opened in 2013 in Bogue Sound and areas south of Bogue Sound to the NC/SC state line but no other areas were opened due to limited availability of scallops.

Research Needs

- ****Develop better methods to quantify the population including the means to have more precise measures of spatial and temporal variability at both within and between Sound scales.***
- ****Complete a more comprehensive study on treading and impacts of treading on juvenile and adult bay scallops.***
- Genetically identify how many separate bay scallop stocks exist in North Carolina.
- Assess the impacts of nutrient loading and algae on SAV and the life history of bay scallops.
- Collect more information on the value of the spring spawn to the population.

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

BLUE CRAB

Status: Concern

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. The 2012 fishery yielded the fourth lowest landings during the 10-year period of 2003–2012. Harvest from Pamlico Sound and its tributaries decreased and continued to remain below historical levels. Results of the 2011 stock assessment suggest the North Carolina blue crab stock is not overfished. Overfishing cannot be determined at this time because data are insufficient for estimating reliable fishing mortality rates.

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 Stephen Taylor at Stephen.Taylor@ncdenr.gov or 1-800-248-4536 or (910) 796-7289.

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.
- Monitor natural oyster reefs and compare to cultch plantings in Pamlico Sound.
- Determine the impacts of current oyster dredging practices on oyster habitat.
- Determine the economic and environmental value of the cultch planting program.
- Identify deep water oyster populations in the Pamlico Sound, Pamlico and Neuse rivers.
- Test and evaluate alternative cultch materials.

Contact Craig Hardy at Craig.Hardy@ncdenr.gov or 1-800-682-2632 or (252) 808-8046.

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 and the five year review of the FMP is scheduled to begin in 2013. 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
- ***Collect recreational landings data.**
- Identify factors influencing clam growth in NC.
- 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.

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. The FMP will be reviewed starting in 2013.

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.

RED DRUM

Status: Recovering

Overfishing is not occurring. A stock assessment completed in 2009 by the Atlantic State Marine Fisheries Commission (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 red drum discards in this sector.
- Develop 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 1-800-405-7774 or (252) 473-5734.

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 status indicators outlined in 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.
- Endorse additional research to collect and assess river herring bycatch in North Carolina fisheries to determine the effects of river herring populations and improve management.
- Identify and evaluate all potential man-made obstructions to river herring migration and develop strategies to minimize the impacts of these blockages.
- Conduct studies of river herring egg and larval survival and development in North Carolina river systems
- Evaluate the impacts of predation on all life stages of river herring, including predation by invasive species such as blue catfish, as well as expand predation work outside of the Albemarle Sound area.
- Conduct studies on energetics of feeding and spawning migrations of river herring in North Carolina
- Evaluate effects of existing and future water withdrawals on water quality, quantity and fisheries habitat in coastal watersheds
- Determine if contaminants are present and identify those that are potentially detrimental to various life history stages of river herring

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

SHEEPSHEAD

Status: Unknown

Sheepshead had been managed by the N. C. Division of Marine Fisheries (NCDMF) through 15A NCAC 03M .0512 to comply with South Atlantic Fishery Management Council's (SAFMC) Snapper-Grouper Fishery Management Plan. Sheepshead were formally removed from the SAFMC's Snapper-Grouper Management Complex in the Comprehensive Annual Catch Limit (Comp ACL) Amendment in 2012. NCDMF is in the process of collecting data to estimate trends in abundance of sheepshead.

Research Needs

- ****Develop a tagging program to collect information on migration, fishing mortality, and natural mortality. The program should include methods to estimates of tag retention, reporting rate, and tagging induced mortality.***
- Collect life history information on age, growth, reproduction, and mortality.
- Collect age and sex information from recreational and commercial fisheries.
- Conduct spawning area surveys.
- Develop methods to assess sustainability of the N. C.'s sheepshead stock.

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

SHRIMP

Status: Viable

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

Research Needs

- Continue to conduct bycatch characterization work across all strata (for example: season, areas, vessel type, gear configuration, and dominant species).
- Continue to conduct bycatch characterization work across all strata (for example: dominant species, season, areas, vessel type, number of nets/rigs, headrope length).
- Continue to define and quantify the intensity, duration and spatial scale of trawling effort in NC estuaries.
- Effort data needs to be collected to provide estimates based on actual time fished (or number of tows), rather than number of trips.
- Determine species interactions and predator/prey relationships for prominent shrimp trawl bycatch.
- Continue to develop and test methods to reduce bycatch in the commercial and recreational shrimp trawl fisheries.

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

SOUTHERN FLOUNDER

Status: Depleted

Based on the N.C. Division of Marine Fisheries 2009 stock assessment, the southern flounder stock is overfished and overfishing is occurring. The Southern Flounder Fishery Management Plan Amendment 1 was approved in February 2013 and a new stock assessment is planned for 2014.

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.***
- ****Investigate the feasibility of a quota as a management tool for the commercial southern flounder fishery.***
- Coast wide at-sea observations of the flounder pound net fishery.
- Discard mortality estimates of southern flounder from pound nets.

Contact Tom Wadsworth at Tom.Wadsworth@ncdenr.gov or 1-800-682-2632 or (252) 808-8193.

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), mixing on fish from VA and NC, and identify if there are northern and southern NC stocks
- Determine size specific and batch 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, age, and disposition of spotted seatrout released by anglers and the number, size, age, and disposition of commercial discards.
- Survey spawning areas.
- Investigate the relationship of temperature on adult and juvenile mortality

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

STRIPED BASS

Albemarle Sound and Roanoke River Management Areas

Status: Viable

Based on results of the 2010 stock assessment the stock is not experiencing overfishing and spawning stock biomass remains high. The stock age structure is broad including fish 17 years old. The rules for Amendment 1 to the N.C. Estuarine Striped Bass FMP went into effect June 1, 2013 for the N.C. Marine Fisheries Commission and August 1, 2013 for the N.C. Wildlife Resources Commission (NCWRC).

Research Needs

- 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)).
- Incorporate high reward tagging into the current tagging program to provide estimates of tag return rates for each sector. This will allow for more precise estimates of natural mortality and fishing mortality from tag based analyses.
- Improve estimates of discard losses from the Albemarle Sound Management Area (ASMA) commercial gill net fisheries
- Re-evaluate hook and release mortality rates from the ASMA and Roanoke River Management Area (RRMA) recreational fisheries incorporating different hook types and angling methods at various water temperatures (e.g., live bait, artificial bait, and fly fishing).
- Ageing methods between agencies (NCDMF and NCWRC) and between systems (Roanoke, Tar/Pamlico, Neuse, Cape Fear rivers) should be validated (ongoing).

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

Central/Southern Management Area

Status: Concern

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. The rules for Amendment 1 to the N.C. Estuarine Striped Bass FMP went into effect June 1, 2013 for the N.C. Marine Fisheries Commission and August 1, 2013 for the N.C. Wildlife Resources Commission.

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 (beginning in 2013).
- Conduct independent surveys that capture all life stages of striped bass.
- Determine minimum flow and other water quality and habitat requirements for successful striped bass spawning in the Tar/Pamlico, Neuse, and Cape Fear rivers.
- Ageing methods between agencies (NCDMF and NCWRC) and between systems (Roanoke, Tar/Pamlico, Neuse, Cape Fear rivers) should be validated (ongoing).

Contact Garry Wright at Garry.Wright@ncdenr.gov or 1-800-338-7804 or (252) 946-6481.

STRIPED MULLET

Status: Viable

The striped mullet stock is not experiencing overfishing. Landings for 2012 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

- ****Create and validate a juvenile abundance index for striped mullet.***
- ****Initiate a striped mullet tagging program to estimate fishing and natural mortality. Include evaluations of tag retention, tagging mortality, and tag reporting rates.***
- Initiate survey to estimate fecundity and validate current maturity schedule microscopically.
- Investigate the disappearance of males from the population after age-3 (300mm FL).
- Develop a survey to provide estimates of striped mullet used as bait in recreational and commercial fisheries and obtain discard estimates from each fishery.

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

Top Research Priorities – Federal FMP Species
*** *Immediate research needs***

AMERICAN EEL

Status: Depleted

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 Garry Wright at Garry.Wright@ncdenr.gov or 1-800-338-7804 or (252) 946-6481.

AMERICAN SHAD

Status: Concern

Commercial landings increased in 2012, and are above 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 Amy Larimer at Amy.Larimer@ncdenr.gov or 1-800-338-7805 or (252) 264-3911.

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 otolith 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.

ATLANTIC MENHADEN

Status: Concern

Based on the updated 2010 benchmark stock assessment, Atlantic menhaden are experiencing overfishing. It is unknown whether the stock is overfished. The Atlantic States Marine Fisheries Commission Atlantic Menhaden Board approved Amendment 2 to the fishery management plan in December 2012.

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.
- Work with industry to collect age structure data outside the range of the fishery.
- Validate MSVPA model parameters through the development and implementation of stomach sampling program that will cover major menhaden predators along the Atlantic coast.
- Investigate interannual maturity variability via collection of annual samples of mature fish along the Atlantic coast.
Explore additional sources of information that could be used as additional indices of abundance for juvenile and adult menhaden.

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

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. Atlantic sturgeon were listed under the Endangered Species Act on April 6, 2012. This listing resulted in the DMF developing an application for a Section 10 Incidental Take Permit. Estuarine anchored gill net

fisheries will have to follow the protocols outlined in this application if attained. 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.

BLACK SEA BASS

North of Hatteras

Status: Concern

The stock is not overfished and overfishing is not occurring according to recent assessments, but these were rejected by reviewers due to 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). Future assessments may be postponed until data deficiencies are resolved.

Research Needs

- ****Research on how the black sea bass life history pattern may impact stock assessments.***
- ****Research alternative assessment models for protogynous hermaphrodite species.***
- ****Develop a consistent fishery-independent survey of black sea bass north of Hatteras adults (e.g. fish pot or hook and line surveys) and juveniles (e.g. ocean trawl surveys).***
- ****Collect age and sex data from the commercial and recreational fisheries.***
- Further research on adult migration patterns and implications for assessment.

Contact Tom Wadsworth at Tom.Wadsworth@ncdenr.gov or 1-800-682-2632 or (252) 808-8193.

South of Hatteras

Status: Viable

The stock went under a federally managed rebuilding plan in 2006. The stock was declared rebuilt in 2013 after years of strict harvest controls.

Research Needs

- 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 and investigate movements and migrations.
- 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.
- Collect better spatial information to determine potential of localized depletion effects.

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

BLACK DRUM

Status: Unknown

Concern for the stock has been expressed because fishing effort has increased on the stock since the 1980s and a majority of black drum harvested is young, potentially juvenile fish. It is unknown if the stock is overfished. The ASMFC has developed a draft FMP and a coastwide stock assessment is to be completed in 2014.

Research Needs

- Continue to collect life history data including data on age and growth, reproduction, and mortality.
- Improve catch/effort estimates and biological sampling from recreational fisheries for black drum (including increased effort to intercept shore and nighttime angling).
- Expand existing fishery-independent surveys in time and space to better cover black drum habitats, specifically adult black drum (include information on size, sex, age, maturity, and disposition).
- Develop fishery-independent adult and juvenile indexes of abundance.
- Obtain discard estimates from commercial and recreational fisheries (include information on size, age, and disposition).
- Determine commercial and recreational gear selectivity.
- Identify stocks and determine coastal movement and migration patterns (i.e., tagging and genetic surveys).
- Identify spawning and nursery habitats.

Contact Chris Stewart at Chris.Stewart@ncdenr.gov or 1-800-248-4536 or (910) 540-8333.

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

- Evaluate amount and length frequency of discards from the commercial and recreational fisheries.
- Increase sampling frequencies when bluefish are encountered, especially when medium size fish are encountered.
- Test the sensitivity of the bluefish assessment to assumptions concerning age-varying M (natural mortality), level of age-0 discard, and selection patterns.
- Conduct research on oceanographic influences on bluefish recruitment, including information on migratory pathways of larval bluefish.

- Initiate fisheries-dependent and independent sampling of off shore populations of bluefish during winter months.

Contact Beth Egbert at Beth.Egbert@ncdenr.gov or 1-800-405-7774 or (252) 473-5734.

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.
- Expand or develop monitoring programs to collect appropriate length and age samples from the catches in the commercial sector by gear type from catches in the recreational sector, and from catches taken in research surveys to provide reliable length and age compositions for stock assessment
- Evaluate to what extent the different CPUE indices track population abundance (e.g., through power analysis).
- Explore modeling approaches that do not require an assumption that the population is at a virgin level.

Contact Holly White at Holly.White@ncdenr.gov or 1-800-405-7774 or (252) 473-5734.

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.

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.

GAG GROUPER

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.

HICKORY SHAD

Status: Unknown

Commercial landings fell in 2012 for a second year in a row and are below the ten year average. 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 Amy Larimer at Amy.Larimer@ncdenr.gov or 1-800-338-7805 or (252) 264-3911

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. Amendment 18 established annual

catch limits, annual catch targets and accountability measures for king mackerel, Spanish mackerel and cobia. A benchmark assessment will be conducted in 2014 (SEDAR 38).

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.

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. Below are the current research set aside needs for monkfish from the New England Fisheries Management Council (NEFMC).

Research Needs

- Research on monkfish life history focusing on: (a) Age and growth, (b) longevity, (c) reproduction, and (d) natural mortality.
- Stock definition, stock movements, mixing, and migration through tagging studies, DNA markers, morphological characteristics and other means, focusing on: (a) Short-and long-term movements and (b) habitat use in relation to broad scale movements.
- Research concerning trophic interactions of monkfish with other species and monkfish cannibalism.
- Research concerning bycatch and discard mortality focusing on: (a) Target species (i.e., monkfish or Northeast multispecies), and (b) non-target species (e.g., monkfish or skate).
- Trawl and gillnet gear studies focusing on: (a) Size and/or species selectivity, and (b) bycatch reduction, including reducing bycatch of and interactions with protected species.

Contact Holly White at Holly.White@ncdenr.gov or 1-800-405-7774 or (252) 473-5734.

REEF FISH (Snapper Grouper Complex)

Status: Concern

Of the 60 species in the SAFMC unit, several are considered overfished. The overfished stocks include snowy grouper, Warsaw grouper, speckled hind, red porgy, and red snapper.

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.gov or 1-800-248-4536 or (910) 796-7291.

SCUP

Status: Viable

The most recent assessment update in 2011 indicates that the stock is not overfished and overfishing is not occurring. Recruitment has been greatly improved and fishing mortality rates lower since 1998. The stock is considered rebuilt. Given the success of the latest modeling approach, the stock is no longer considered data poor.

Research Needs

- ****Develop new standardized research surveys that focus on accurately indexing the abundance of older scup (ages 3 and older).***
- Develop program to estimate the discard and discard mortality rate of scup captured by different commercial fishery gears.
- Conduct biological studies to investigate factors affecting annual availability of scup to research surveys and maturity schedules.
- Conduct an ageing comparison workshop to (1) compare otoliths and scales and (2) compare state age-length keys.

Contact Tom Wadsworth at Tom.Wadsworth@ncdenr.gov or 1-800-682-2632 or (252) 808-8193.

SPANISH MACKEREL

Status: Viable

Based on the 2012 SAFMC stock assessment, Spanish mackerel in the South Atlantic is not overfished and is not undergoing overfishing. Amendment 18 established annual catch limits, annual catch targets and accountability measures for king mackerel, Spanish mackerel, and cobia.

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.

SPINY DOGFISH

Status: Viable

Spiny dogfish are currently managed under the joint MAFMC and New England Fishery Management Council (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 Holly White at Holly.White@ncdenr.gov or 1-800-405-7774 or (252) 473-5734.

SPOT

Status: Concern

Recreational and commercial landings decreased in 2012 to historical lows in 2010. However, the juvenile abundance index increased. In 2011, the Atlantic States Marine Fisheries Commission approved the Omnibus Amendment for spot. The Amendment updates the plan with requirements under the Atlantic Coastal Fisheries Cooperative Management Act (1993) and the Interstate Fishery Management Program Charter (1995).

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.

STRIPED BASS (Atlantic Ocean Migratory Stock)

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.

SUMMER FLOUNDER

Status: Viable

Summer flounder is managed through the ASMFC and Mid Atlantic Fishery Management Council (MAFMC). A new benchmark assessment was completed by the Northeast Fishery Science Center (NEFSC) in 2013 and found the stock was not overfished and overfishing was not occurring. The spawning stock biomass was at 82% of the biomass target in 2012.

Research Needs

- ****Determine annual flounder species composition (summer, southern, Gulf) and length frequency of recreational discards.***
- ****Develop a long-term protocol to sample otoliths from the recreational and commercial fisheries (e.g., purchase samples; as a component of Research Set-Aside projects; as Cooperative Research with industry).***
- ****Collect sex ratio data from state agency surveys and fisheries for use in future assessments.***
- ****Conduct age structure exchanges among the NEFSC, interested state agencies and academic institutions and develop a reference collection of scales and otoliths for quality control purposes.***

Contact Tom Wadsworth at Tom.Wadsworth@ncdenr.gov or 1-800-682-2632 (252) 808–8193.

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

- Increase observer coverage to identify the magnitude of discards for all commercial gear types from both directed and non-directed fisheries.
- Evaluate predation of weakfish with a more advanced multispecies model (e.g., the ASMFC MSVPA or Ecopath with Ecosim) to validate estimates calculated by production models with predation-competition extensions.
- Develop a bioenergetics model that encompasses a broader range of ages than Hartman and Brandt (1995) and use it to evaluate diet and growth data.
- Analyze the spawner-recruit relationship and examine the effects of the relationship between adult stock size and environmental factors on year class strength.
- Quantify trawl bycatch. Refine estimates of discard mortality based on factors such as distance from shore and other geographical differences for all sizes including below minimum size.
- Develop a coastwide tagging program to identify stocks and determine migration, stock mixing, and characteristics of stocks in over wintering grounds. Determine the relationship between migratory aspects and the observed trend in weight-at-age.

Contact Lee Paramore at Lee.Paramore@ncdenr.gov or 1-800-405-7774 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.***
- ****Compile a prioritized list of physical impediments to diadromous spawning migration routes for removal or modification and develop specifications for and test culvert designs that would benefit the recovery of diadromous species, particularly river herring. 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 diadromous, 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.