Atlantic States Marine Fisheries Commission

Management and Science Committee

October 24, 2012
10 a.m. – 5 p.m.
Philadelphia, Pennsylvania

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome and introductions *(M. Armstrong)* 10:00 a.m.
2. Approval of agenda
3. Approval of minutes—April 18, 2012
4. Public comment

5. Report on ASC development of guidance on characterizing uncertainty 10:10 a.m.
   (M. Cieri)
   - MSC to revisit task for developing guidance on risk and uncertainty

6. Discuss TC Guidance Document revision and update *(P. Campfield)* 11:00 a.m.
   - MSC review stock assessment scientist workload
   - Public participation at meetings
   - Independent review of alternative stock assessments

7. Updates 11:45 a.m.
   - ASMFC Research Priorities *(J. Kipp)*
   - ACCSP research proposals to address ASMFC Critical Research Priorities *(M. Paine)*

Break at Noon for 12:15 - 1:15 PM Captain David H. Hart Award Luncheon

8. Updates 1:15 p.m.
   - Atlantic Coastal Fish Habitat Partnership *(E. Greene)*
   - Cooperative Winter Tagging Cruise *(W. Laney)*
   - SEAMAP *(M. Paine)*
   - NEAMAP *(J. Gartland)*
   - Ageing workshop and manual *(K. Drew/J. Kipp)*

9. Discuss Ecosystem Based Fisheries Management 1:45 p.m.
   - Update on incorporating forage species into fisheries management *(M. Paine/K. Drew)*

The meeting will be held at the Radisson Plaza-Warwick Hotel
220 South 17th Street, Philadelphia, PA
Phone: 215.735.6000

- Update on Biological Ecosystem Reference Points Working Group *(G. Nesslage)*
- Revisit EBFM task from Action Plan *(W. Laney)*

10. Discuss need for an integrated peer review for tautog *(P. Campfield)* 2:30 p.m.

11. Update on telemetry work in Chesapeake Bay and efforts to develop a database of tags *(D. Orner)* 2:45 p.m.

12. Report from MRIP Calibration Workshop *(K. Drew)* 3:00 p.m.

13. Discuss data management issues *(C. Patterson)* 3:15 p.m.
    - Design databases for managed species' required data (e.g., annual compliance reports, standardized data for stock assessments)
    - Web-based data entry system for partners to enter data annually

14. Discuss changes in stocks from increasing water temperature *(M. Armstrong)* 3:50 p.m.

15. Discuss future issues MSC may address *(M. Armstrong)* 4:30 p.m.

16. Other Business 4:50 p.m.
17. Adjourn 5:00 p.m.

The meeting will be held at the Radisson Plaza-Warwick Hotel
220 South 17th Street, Philadelphia, PA
Phone: 215.735.6000

Management and Science Committee Meeting
Draft Minutes
April 18, 2012

Participants:
Mike Armstrong (MA), Chair
Peter Burns (NOAA Fisheries, NERO)
Linda Mercer (ME)
Mark Alexander (CT)
Steve Heins (NY)
April Valliere (RI)
Trish Murphey (NC)
Wilson Laney (USFWS)
Cheri Patterson (NH)
Mel Bell (SC)
Tom Miller (MD)

Staff: Melissa Paine, Katie Drew, Genny Nesslage, Pat Campfield

1. Welcome and Introductions
M. Armstrong welcomed everyone to the call at 10:05 a.m. M. Paine read a roll call.

2. Approval of agenda
The group approved the agenda.

3. Approval of minutes—November 9, 2011
The group did not have any changes to the minutes and they were approved.

4. Discuss development of proposal to address ASMFC Critical Research Needs
M. Paine gave an overview presentation of the how the current ASMFC Observer Program came to be. It started with an MSC subcommittee using research priorities of ACCSP and ASMFC to submit proposals which have been funded by ACCSP for two years for at-sea observer coverage of the small mesh otter trawl fisheries in RI, NJ, MD, and VA. The second year will also include hiring ageing personnel to work up all the age samples collected over the two years. It will also include more sampling of the Atlantic mackerel fishery in RI and NJ for river herring bycatch. There may also be some funds to cover a few days in NY.

Proposals for ACCSP funding will be due by the middle of June and the question before the committee is what to submit for this funding cycle (2013/2014). The choices are to submit a maintenance proposal for the current program, take a break, consider new fisheries to observe, or revisit the comprehensive needs list. Two high ranking bycatch prioritization needs are to cover the Southern Shrimp Trawl and New England Lobster Pot fisheries.

The South Atlantic Shrimp Trawl coverage would address needs for several ASMFC species. Bycatch from this fishery was the major source of uncertainty in the last croaker stock assessment. Bycatch and discard information are needed from this fishery for weakfish, Spanish mackerel, spot and coastal sharks. A 2% coverage level would be about 276 sea days based on 2010 trips; effort has gone down in the fishery which may help to achieve larger percentage coverage. The NOAA National Observer Program based out of Galveston, TX has been able to cover the South Atlantic since 2008 up to a 1% coverage level of federally permitted vessels and could cover trips for us. NC has recently acquired funding from NFWF for a 2-year project inshore and offshore. GA used to have a program in the late 1990's and early 2000's through ACFCMA so they may be able to start a project again. We do not know of any efforts in SC and FL. If we assume $950/sea day if NOP can cover as NEFOP already does for us, the cost would be about $265,000.

There is a great need for offshore data on New England Lobster Pots as fishery dependent data there is very poor. From the last two lobster stock assessments, an identified research need is for enhanced sea sampling and port sampling to create a more complete record of biological characteristics of the catch and harvest, especially in offshore waters. This would cover two comprehensive needs, one for the offshore fishery-dependent winter sampling as well as increased at-sea/port-sampling. Port sampling is needed to obtain numbers landed by sex for each stock at the best resolution possible (stat area) to calculate fishing mortality and abundance. Inshore information can be obtained through at-sea sampling because day trips are cost effective and this provides both catch and discard information. Sea sampling provides proportions of lobsters kept/discarded by size and sex due to v-notches, size regulations, body damage, etc. The SBRM calls for 452 sea days from 2011 and prioritized 0, so there is a need for coverage. NEFOP will do a 1-year pilot at-sea study in area 515. Port sampling is well set up in RI, MA, and NH since they had ACFCMA grants at one time. A potential option would be to have a rigorous port-sampling program augmented by less frequent at-sea sampling by hiring technicians to cover both. There is also potential industry funding depending on whether area 562 stays closed, so there may be the possibility of coordination there. To hire technicians for port-sampling, that would be about $50,000-55,000 in each state. The potential for these folks to be able to do at-sea sampling also under this price tag is uncertain and may assume that the state covers their at-sea insurance. If we use the same $950/day assumption, an at-sea program would be $429,400.

P. Burns supported the coverage of the offshore lobster pots and suggested that perhaps there be a mix of port and sea sampling. He noted a problem with the stock in SNE is they do not have information on the composition of the catch. L. Mercer said that in Maine they just dropped their port sampling program. She asked why Maine was not included in the states that were listed as capable of carrying out port sampling programs. M. Paine said one SASC member just noted those as previously funded through ACFCMA and no longer carrying out sampling. L. Mercer added that they had tried port sampling in winter and it was extremely hard to get out on boats then.

L. Mercer said this was a daunting list of needs and a lot of ground has been covered. W. Laney said that in relation to the first comprehensive research needs list, the Cooperative Winter Tagging Cruise did get funding for the cruise in January 2013; $238,000 for 10 days out of Cape Hatteras. He offered to collect whatever samples the group wants as they collect weakfish, spiny dogfish, and sturgeon amongst other species. Their spatial coverage is limited. They could sustain that funding for 2014/2015 if they can get matching funds. He would appreciate input from this committee on turning the cruise into a fishery-independent survey. L. Mercer said she was hesitant to start up new surveys when they are trying to shore up existing surveys, such as NEAMAP. W. Laney added that it would not be a new survey, just trying to cover identified research needs and it would not take hardly any extra work to take samples. He needs to know whether MSC would like to incorporate this cruise to address those needs so he can write it into the protocol.

K. Drew said that perhaps they can talk with TCs on upcoming stock assessments to prioritize the sample list. C. Patterson said it would be good to identify which stock assessments were coming up with a deficit of data. She asked when the next lobster assessment was, and that is scheduled for 2014. This project would not have data ready in time for that assessment. K. Drew said that weakfish is also proposed for 2014, red drum and croaker in 2015 may also benefit and maybe even spot. W. Laney suggested that the Commission collaborate with the SAFMC on covering the South Atlantic shrimp trawl.

M. Armstrong cautioned against walking away from the current mid-Atlantic program and the dangers of doing one-off studies. K. Drew said she is not sure ACCSP was designed for long term funding. She added that they would not drop that sampling all together, just not cover it continuously and then could extrapolate between years. M. Armstrong asked if we accomplished what we set out to do, and how do we evaluate the current program. L. Mercer added an important point to consider is what increased coverage would get us. It is likely too soon to be able to really evaluate the current program.

M. Armstrong thinks the offshore lobster sampling is important. L. Mercer added that Maine is covering the mackerel fishery all the way down to NJ and they have 3-4 years of data. P. Burns said with so many competing needs it is difficult to decide, but a big issue in the northeast is the lack of lobster offshore sampling especially in SNE. He suggested they could just cover some of this work by just doing port sampling for offshore. G. Nesslage stressed that if most of the fishery is in the Gulf of Maine, if the port sampling was dropped in Maine that is a big deal for the stock assessment and may jeopardize it.

M. Paine said that a subcommittee could meet and decide and bring this back to the full MSC by mid-May. The volunteers for the subcommittee were C. Patterson, T. Murphey, and P. Burns. Brandon Muffley was not on the call, but was on the previous subcommittee so he was re-volunteered by the group. M. Paine added that several people were not able to make the call, so this would enable their comment and participation. P. Burns supported this group's work and suggested that they could focus on retooling these possibilities by talking with SASC members further and finding out more about the ME port sampling. L. Mercer added that no analysis has been done yet on what has been gained by the current program and how it has improved estimates. C. Patterson said there will not be time to look at that and they will not even have age data until 2013. L. Mercer asked if ageing was the most important aspect of the project or is it the catch estimates. K. Drew said that improving the estimates of discards is the most important and the age data supplements the length data.

P. Campfield suggested that they consult with assessment leads on how many gaps this data would fill, as well as K. Drew and G. Nesslage. It would likely be another year until they could tell. He gave an idea of how ACCSP may view this; a pro would be that it addresses high priority bycatch sampling, and a negative is that these proposals take a big chunk of money so there may be some wear. He said that MSC may want to think about other sources of funding for lobster or south Atlantic shrimp trawl. He has been meaning to investigate the pursuit of industry funding, and it sounds like there may be some in NH.

5. Review completed Integrated Peer Review and discuss development of guidelines for future IPRs

P. Campfield noted that the meeting materials included comments from Joe Hightower at NC State, who served as an integrated reviewer for eel. The question before this group is whether to move forward and use IPRs in future. If we do, do we need to modify the protocol and decide which workshops in which the IPR should participate. There was positive feedback from the eel peer review. There was concern it would create extra work for the assessment team but his points seemed to improve the assessment and it did not seem to create more work. For the eel stock assessment report, the SASC did not have to write a separate response to the reviewer. J. Hightower was on the eel review panel back in 2005, so it was good to have that continuity from last time. He also has the right personality to provide critique.

The original thought was to explore IPRs since SEDAR was exploring it. But there are two different models here. With ASMFC the IPR participated at the assessment workshop and review workshop. It is different in the northeast; they proposed IPR as a substitute so they do not then go to a formal peer review panel. It was designed to speed up the assessment and peer review process. The SEDAR model is similar to ASMFC where the reviewer comes in during development of the model and provides early feedback.

P. Campfield asked again whether they should go forward with IPRs. M. Armstrong asked if we have it for an option or if we do it for all. P. Campfield said yes they can look at individual assessments. He noted that 2013 is the SARC transition year, and will be the final year of SAW/SARC, but will still have CIE reviews of benchmark assessments. The intent is to do fewer benchmarks, will add doing intermediate research assessments, and the rest will be updates. A turn of the crank will have an imbedded reviewer. P. Campfield displayed the stock assessment schedule so they can see which ones may need help.

W. Laney thinks it would be useful to keep IPRs and it would be useful to have criteria of when to apply and when you do not and that MSC should decide on those criteria. M. Armstrong thinks the data poor assessments would be good. P. Campfield said that lobster would be in the top tier for stock assessment maturity, but probably would not call it data poor, maybe data moderate/rich. Weakfish has struggled to get through peer review, and would be a contender. W. Laney agrees, especially given proposed idea of going to Bayesian approach by Virginia Tech. Croaker struggled to get out of peer review, but for a known issue—shrimp trawl bycatch. They could be ok to get by without an IPR. M. Armstrong said it is difficult to provide hard guidelines and they should leave it to the SASCs to make recommendations.

P. Campfield suggested that as MSC looks periodically at schedule, they could make recommendations to SASCs to consider IPR. He thinks the data poor issue is enough to go on. He asked what the group thinks about tautog. T. Miller said he was on the review for tautog in 2005, and the issue was in stock structure as currently there is a coastwide assessment. If it is going to come up for review, they need to determine what data is now available and perhaps consider regional models on a finer scale. G. Nesslage said there is more data in the north than in the south, and there is not any more work on what those regions would be. T. Miller said this speaks to the criteria on whether to go forward with a stock assessment; do you go because it has been several years, or because there is something new to do to it. G. Nesslage said there is the coastwide VPA currently and they are concerned it is being used to support extreme cuts but not everyone thinks that represents their region. Some of this is political, and some is science driven. K. Drew thinks it is a great time for a previous panelist to sit in on the assessment workshop before it goes to peer review to see whether it would address issues to pass peer review. It is helpful to have someone with history to provide that external input. Weakfish needs input at the model stage, but tautog needs input at the data stage.

P. Campfield said it sounds like MSC has decided to move forward with IPRs on a case by case basis and they have identified some criteria. He asked whether the IPR is only at the assessment workshop or review workshop, or both, or data workshop and assessment workshop; perhaps that has to be flexible too. M. Armstrong thinks they can do this on an ad hoc basis. W. Laney and C. Patterson agreed that it is hard to have a crystal ball, so they should look at it individually, especially since this is still new to us. T. Murphey added that looking case by case is also good to make the best decision for each particular assessment. M. Armstrong reiterated that they are agreeing to keep IPR at three different stages flexible. P. Campfield said that it is tentative for weakfish and tautog, but will revisit the idea when workshops approach.

6. NMFS Listing of Atlantic sturgeon
M. Paine said that the Sturgeon Board will meet for the first time in many years at the beginning of May, and the TC will be meeting next week. ASMFC will help states to coordinate a joint section 10 plan, which allows takes for research and incidental catch. The ASMFC petition to delay the listing was denied.

W. Laney has been advised to do a section 7 consultation with NMFS instead of a section 10, and he will be applying for a permit for the Winter Tagging Cruise. T. Murphey said that in NC, they have put in a section 10 for turtles and have been going around with that for a year. It is a long process, even state wide. The exemption for their permit has expired so they are dealing with that. M. Armstrong asked if ASMFC can pursue the avenue of a section 7 because they are a quasi-federal agency. S. Heins said the idea of ASMFC asserting that they are a quasi-federal agency was shot down, because for recent lawsuits (river herring, summer flounder) they have contended that they are not a quasi-federal agency. He added that NY got 10A and 1A permits for Hudson and offshore. The group discussed potential problems when protected resources issues a permit with a certain number, but then if the population increases with the same cap, then they may have to stop the research. Each encounter is a take. W. Laney said that with the cruise, there are short tow times, 0 mortality of sturgeon encountered, so he thought potentially they could do a section 7 of no effect. M. Bell added that there is ecotourism business in the south to watch sturgeon jumping.

7. Other Business
M. Paine asked for volunteers to assist with updating guidance documents for the ASMFC TC Meeting process, especially on guidance for the role of attendees outside the TC. There are three volunteers from ASC so we are looking for a couple more. W. Laney and C. Patterson offered to help.

K. Drew updated the group that new MRIP numbers from 2004-2011 have been released. There was a workshop recently held where they discussed calibrating pre-2004 numbers to MRIP numbers, and they decided to do so, but will have a subcommittee to make recommendations on that. K. Drew will represent ASMFC on that subcommittee. They are trying to decide how to come up with a short and long term method to calibrate to MRFSS numbers, and their goal is to provide guidance on the overall issue. One of the questions is whether to have it on a species by species basis, or weighting each intercept in the overall estimation process. The workgroup has to prioritize, because it is a lot of work for NOAA Office of Science & Technology to recalibrate and do the re-estimation, so they will rank how different tasks get done.

P. Campfield updated the group that ASMFC has had two tasks regarding managing responsibly when facing uncertainty. They need the Board to task ASC and/or MSC with moving forward on this. ASC discussed this at their last call, and had some ideas including a tiered approach depending on how complicated the assessment is. ASC touched on it and staff will provide a report to Policy Board and ask whether to move forward. He is giving the group a heads up that this may be an activity later this year.

8. Adjourn
The meeting adjourned at 12pm.

ASMFC 2013 Action Plan, Strategy 1.5 Manage responsibly when facing uncertainty.

(ASC) *Task 1.5.1 – Establish requirements (or best practices) for technical committees to provide risk and uncertainty estimates when presenting scientific advice. Assessment Science Committee develop guidelines for technical committees to characterize uncertainty for each type of assessment.*

(MSC) *Task 1.5.2 – Develop Commission policy regarding risk and uncertainty in consideration of and in coordination with Councils approaches.* ***Management and Science Committee to draft for Policy Board consideration.***

- ASC is currently developing guidance for characterizing uncertainty for technical committees to use.
- The aim is to explain uncertainty and to have some standardization or consistent presentation in stock assessments.
- ASC discussed having tangible guidance and examples for the range of stock assessments/models ASMFC species cover.
- ASC may try to develop a report card to foster consistent presentation, and promote correct use of uncertainty measure in making management decisions.
- The group will also identify species stock assessments where uncertainty is not yet characterized.
- ASC will hold a workshop at their Spring 2013 meeting to review uncertainty characterization in each species' assessment, look for commonalities, and develop consistent approaches for presenting uncertainty to managers.
- An ASC subcommittee has started to draft technical guidance for either inclusion in the ASMFC Committee Procedures and Benchmark Stock Assessment Process document, or as a stand alone paper.
- ASC recommends that MSC revisit Task 1.5.2 to determine if separate guidance or a policy on management risk and uncertainty is needed to help managers make decisions.

Questions for MSC to consider for revising the "ASMFC Technical Committee Processes and Procedures"

1. Should we add integrated peer reviewer as review option?
2. Should we change TC/SAS membership language to "One TC member per state, SAS membership as needed?"
3. Opinion on changed wording on PR workshop policies?

New:

"For ASMFC External Peer Review Workshops, the full stock assessment subcommittee, Chair of the management board, and Chair of the advisory committee should be invited to attend the review. Stakeholders are welcome to attend ASMFC External Peer Reviews, but not as participating members; the External Peer Review Panel Chair will allow public comment only if time allows."

Old:

"For external panel reviews being conducted by the Commission, the full stock assessment subcommittee, Chair and Vice-Chair of the technical committee, Chair and Vice-Chair of the management board, and Chair and Vice-Chair of the advisory committee should be invited to attend the review. Stakeholders shall be invited to attend ASMFC External Peer Reviews, but not as panel members and the External Peer Review Panel Chair will encourage public comment. Stakeholders are encouraged to participate in all levels of the stock assessment and at the ASMFC External Peer Review process."

4. Should approval of final SA schedule be done by MSC once gone through ASC (to more independently address workload issues)?
5. What are your thoughts on the Advisory Reports from the peer review panels? Is it OK if we rework Advisory Panel Report structure to make it more useful/readable? Suggestions? Staff could redraft outline to get more useful information from the panelists, rather than repeating what is in the assessment report.

III. Advisory Report

- Status of Stocks: Current and projected, where applicable
- Stock Identification and Distribution
- Management Unit
- Landings
- Data and Assessment
- Biological Reference Points
- Fishing Mortality
- Recruitment
- Spawning Stock Biomass
- Bycatch
- Other Comments

6. Opinion on making clearer the tasking of committees?

“Management Boards/Sections should develop specific and clear guidance whenever tasking committees for advice. ISFMP staff, in consultation with the Board/Section Chair and technical support group Chair, should develop the written charge with input and clarification from the entire Management Board and/or Chair. The charge from the Management Boards/Sections should clearly specify all specific tasks, the deliverable expected, and a timeline for presentation of recommendations to the Board/Section.”

7. Should we add SAW-like Rules of Engagement?

"Rules of Engagement among members of a SAW Assessment Working Group: Anyone participating in SAW assessment working group meetings that will be running or presenting results from an assessment model is expected to supply the source code, a compiled executable, an input file with proper configuration, and a detailed model description in advance of the model meeting. Source code for NOAA Toolbox programs is available on request. These measures allow transparency and a fair evaluation of differences that emerge between models."

8. Recommended text on how/when to address Peer Review panel recommendations (updates vs. benchmark triggers).

Special Report No. of the

Atlantic States Marine Fisheries Commission

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management

2012

Atlantic States Marine Fisheries Commission

Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management

Prepared by

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with the
Management and Science Committee

Acknowledgments

The Atlantic States Marine Fisheries Commission (Commission) would like to thank all state, federal, and university representatives who contributed to the completion of this document. Identification and prioritization of research needs was provided by members of various Commission committees, including species stock assessment subcommittees, technical committees, advisory committees, plan development and review teams, and management boards. Input was also provided by the Commission's Habitat Committee, Committee on Economics and Social Sciences, and Management and Science Committee. The research topics listed in this publication are consistent with those developed by the National Marine Fisheries Service Northeast Fisheries Science Center for organization and classification of Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC) research recommendations. The Commission extends its appreciation to the members of the Management and Science Committee for providing oversight to the effort to identify and prioritize Commission research needs.

Table of Contents

Introduction

Research priorities listed in this document were identified from Atlantic States Marine Fisheries Commission (Commission) fishery management plans and amendments, annual plan reviews, special reports conducted by the Commission on species technical and stock assessment issues, Commission external peer reviews, and Stock Assessment Workshop (SAW) documents by the Stock Assessment Review Committee (SARC, 1996-2012) in the Northeast US and SouthEast Data, Assessment, and Review (SEDAR, 2002-2012) process in the Southeast US in collaboration with the National Marine Fisheries Service. This publication is an update of Special Report #88 Prioritized Research Needs in Support of Interjurisdictional Fisheries Management published by the Commission in August 2008. Updates are periodically published via the Commission's website at www.asmfc.org.

Research priorities were prioritized by Commission stock assessment subcommittees and technical committees under the purview of the Plan Development/Review Teams. Additional input to priorities is provided periodically by Advisory Committees, Management Boards, the Habitat Committee, the Committee on Economics and Social Sciences, and the Management and Science Committee. The research priorities in this document should not supplant any prioritization conducted by Commission technical committees or management boards on an annual basis, or in any way hinder the management process.

It is the intent of the Commission to periodically update this document as research priorities are either met or as new research needs are identified. Research priorities that have been met since previous publications of this document have been moved to a separate section for each species and appropriate references have been included. The overall purpose of this document is to encourage state, federal, and university research programs to develop projects to meet the research priorities of Commission-managed species and thereby improve the overall management of these fisheries. It is also hoped that state, federal, and non-profit organizations will utilize this document in prioritization of research projects for future funding programs.

Abbreviations and Acronyms

ACCSP	Atlantic Coastal Cooperative Statistics Program
ADMB	Automatic Differentiation Model Builder
ASMFC	Atlantic States Marine Fisheries Commission
ASPIC	A Stock Production Model Incorporating Covariates
ASPM	age structured production model
BMP	best management practice
BRD	Bycatch Reduction Device
CAA	Catch-at-Age Analysis
CFD	computer fluid dynamics
CPUE	catch-per-unit-effort
CSA	Collie-Sissenwine Analysis; also Catch Survey Analysis
DFO	Department of Fisheries and Oceans (Canada)
DO	dissolved oxygen
EFH	Essential Fish Habitat
F	instantaneous fishing mortality rate
FERC	Federal Energy Regulatory Commission
FMP	Fishery Management Plan
GIS	Geographic Information Systems
GLFC	Great Lakes Fishery Commission
GLM	generalized linear model
GLOBEC	Global Ocean Ecosystems Dynamics
GPS	Global Positioning System
HAPC	habitat areas of particular concern
IPN	infectious pancreatic necrosis
LPUE	landings-per-unit-effort
M	instantaneous natural mortality rate
MARMAP	Marine Resources, Monitoring, Assessment, and Prediction
MCMC	Markov chain Monte Carlo
MEDMR	Maine Department of Marine Resources
MRFSS	Marine Recreational Fishing Statistical Survey
MRIP	Marine Recreational Information Program
MSE	Management Strategy Evaluation
MSVPA	multispecies virtual population analysis
MSY	maximum sustainable yield
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFSC	Northeast Fisheries Science Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCC	Northeast Regional Coordinating Council
PCB	polychlorinated biphenyl
PIT	passive integrated transponder
PRFC	Potomac River Fisheries Commission
SAFMC	South Atlantic Fishery Management Council

SARC	Stock Assessment Review Committee
SASC	Stock Assessment Subcommittee
SCA	statistical catch-at-age
SCDNR	South Carolina Department of Natural Resources
SDWG	Southern Demersal Working Group
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	SouthEast Data, Assessment, and Review
SS	Stock Synthesis
SSB	spawning stock biomass
TAL	total allowable landings
TIP	Trip Interview Program
TOR	Terms of Reference
TRAC	Transboundary Resources Assessment Committee
USFWS	United States Fish and Wildlife Service
VPA	virtual population analysis
VT	Virginia Tech University
VTR	Vessel Trip Reporting
YOY	young-of-the-year
YPR	yield-per-recruit

Research Priorities by Species

AMERICAN EEL

Fishery-Dependent Priorities

High

- Monitor catch and effort in bait fisheries (commercial and personal-use) and in personal-use fisheries that are not currently covered by MRIP or commercial fisheries monitoring programs. (2012 ASMFC Ex. (high))

- Improve knowledge of the proportion of the American eel population and the fisheries occurring south of the US that may affect the US portion of the stock. (2012 ASMFC Ex. (high-mod.))

- Require standardized reporting of trip-level landings and effort data for all states in inland waters. Data should be collected using the ACCSP standards for collection of catch and effort data (ACCSP 2004). (2012 ASMFC Ex. (high-mod.))

- Compare buyer reports to reported state landings. (2012 ASMFC Ex. (high-mod.))

Moderate

- Collect site specific information on the recreational harvest of American eel in inland waters, potentially through expansion of MRIP to riverine/inland areas. (2012 ASMFC Ex. (low-mod.))

- Monitor discards in targeted and non-targeted fisheries. (2012 ASMFC Ex. (low-mod.))

- Require states to collect fishery-dependent biological information by life stage, potentially through collaborative monitoring and research programs with dealers. Samples should be collected from gear types that target each life stage.*(1) (2012 ASMFC Ex. (low-mod.))

- Review the historical participation level of subsistence fishers and relevant issues brought forth with respect to those subsistence fishers involved with American eel to provide information on the changing exploitation of American eels. (2012 ASMFC Ex. (low-mod.))

- Investigate American eel harvest and resource by subsistence harvesters (e.g., Native American tribes, Asian and European ethnic groups). (2012 ASMFC Ex. (low-mod.))

Fishery-Independent Priorities

High

- Maintain and update the list of fishery-independent surveys that have caught American eels and note the appropriate contact person for each survey. (2012 ASMFC Ex. (high))

- Request that states record the number of eels caught by fishery-independent surveys. Recommend states collect biological information by life stage including length, weight, age, and sex of eels caught in fishery-independent sampling programs; at a minimum, length

samples should be routinely collected from fishery-independent surveys. (2012 ASMFC Ex. (high))

- Encourage states to implement surveys that directly target and measure abundance of yellow and silver stage American eels, especially in states where few targeted eel surveys are conducted. (2012 ASMFC Ex. (high))

- Develop a coast wide sampling program for yellow and silver stage American eels using standardized and statistically robust methodologies. (2012 ASMFC Ex. (high))

- Continue the ASMFC-mandated YOY surveys; these surveys could be particularly valuable as an early warning signal of recruitment failure. Standardize sampling across all surveys. Develop proceedings document for the 2006 ASMFC YOY Survey Workshop. Follow-up on decisions and recommendations made at the workshop. (2012 ASMFC Ex. (high))

Moderate

- Develop standardized sampling gear, habitat, and ageing methods and conduct intensive age and growth studies at regional index sites to support development of reference points and estimates of exploitation. (2012 ASMFC Ex. (high-mod.))

Modeling / Quantitative Priorities

High

- Perform periodic stock assessments (every 5-7 years) and establish sustainable reference points for American eel required to develop a sustainable harvest rate in addition to determining whether the population is stable, decreasing, or increasing. Investigate if a longer time interval (8-10 years) between assessments will improve population trend estimates. Longer time periods may better reflect eel generation time. (2012 ASMFC Ex. (high-mod.)

Moderate

- Develop new assessment models (e.g., delay-difference model) specific to eel life history and fit to available indices. (2012 ASMFC Ex. (high-mod.))

- Develop GIS-type model incorporating habitat type, abundance, contamination, and other environmental factors. (2012 ASMFC Ex. (low-mod.))

Life History, Biological, and Habitat Priorities

High

- Monitor non-harvest losses due to barriers such as impingement, entrainment, spill, and hydropower turbine mortality. (2012 ASMFC Ex. (high))

- Develop, investigate, and improve technologies for upstream and downstream American eel passage at various barriers for each life stage. Identify effective low-cost alternatives to traditional passage designs. Develop design standards for upstream passage devices.*(3) (2012 ASMFC Ex. (high))

- Evaluate the impact, both upstream and downstream, of barriers to eel movement with respect to population and distribution effects. Determine relative contribution of historic loss of habitat to potential eel population and reproductive capacity. (2012 ASMFC Ex. (high))

- Implement large-scale (coast wide or regional) tagging studies of eels at different life stages to determine growth, passage mortality, movement and migration, validated ageing methods, reporting rates, and tag shredding/tag attrition rates. (2012 ASMFC Ex. (high-mod.))

- Identify the mechanism driving sexual determination and the potential management implications. (2012 ASMFC Ex. (high))

- Identify spatially explicit, sex specific, triggering mechanism for metamorphosis to mature adult and silver eel life stage, with specific emphasis on the size and age at onset of maturity. A maturity schedule (proportion mature by size or age) would be extremely useful in combination with migration rates. (2012 ASMFC Ex. (high-mod.))

- Improve understanding of the effects of contaminants on fecundity, natural mortality, and overall health (non-lethal population stressors). Research the effects of bioaccumulation with respect to impacts on survival and growth by age and effect on maturation and reproductive success.* (2) (2012 ASMFC Ex. (high-mod.))

- Conduct research on the prevalence, incidence of infection, and effects of the swim bladder parasite *Anguillicola crassus* on American eel growth and maturation, migration to the Sargasso Sea, and spawning potential. Investigate the impact of the introduction of *A. crassus* into areas that are presently free of the parasite. (2012 ASMFC Ex. (high-mod.))

Moderate

- Recommend monitoring of upstream and downstream movement at migratory barriers that are efficient at passing eels (e.g., fish ladder/lift counts). Data that should be collected include presence/absence, abundance, and biological information. Provide standardized protocols for monitoring eels at passage facilities, coordinate compilation of these data, and provide guidance on the need and purpose of site-specific monitoring. (2012 ASMFC Ex. (mod.))

- Evaluate eel impingement and entrainment at facilities with NPDES authorization for large water withdrawals. Quantify regional mortality and determine if indices of abundance could be established at specific facilities. (2012 ASMFC Ex. (mod.))

- Assess available drainage area over time to account for temporal changes in carrying capacity and sex ratio. Develop GIS of major passage barriers. (2012 ASMFC Ex. (low-mod.))

- Assess characteristics and distribution of American eel habitat and value of habitat with respect to growth and sex determination. Develop GIS of American eel habitat in US. This will have to be a habitat-specific analysis based on past studies that show high habitat-specific variability in sex ratios within a drainage system. (2012 ASMFC Ex. (mod.))

- Improve understanding of within-drainage behavior and movement and the exchange between freshwater and estuarine systems. (2012 ASMFC Ex. (mod.))

- Improve understanding of predator-prey relationships, behavior and movement of eel during their freshwater residency, oceanic behavior, and movement and specific spawning location of adult mature eel in the Sargasso Sea. Determine if larger females have a size refuge during the freshwater phase. (2012 ASMFC Ex. (mod.), (HMS #9))

- Examine the mechanisms for exit from the Sargasso Sea and transport across the continental shelf to determine implications for recruitment. Examine migratory routes and guidance mechanisms for silver eel in the ocean. (2012 ASMFC Ex. (mod.))

- Research mechanisms of recognition of the spawning area by silver eel, mate location in the Sargasso Sea, spawning behavior, and gonadal development in maturation. (2012 ASMFC Ex. (mod.))

- Continue investigation of the length and weight specific fecundities of American eel. (2012 ASMFC Ex. (low-mod.))

- Examine age-at-entry of glass eel into estuaries and freshwater to determine time lag between spawner escapement and glass eel recruitment. (2012 ASMFC Ex. (mod.), 2009 FMP review)

- Improve understanding of all information on the leptocephalus and glass stages of eel, including mode of nutrition and transport/recruitment mechanisms. (2012 ASMFC Ex. (mod.), (SR 88 (low), (HMS #9))

- Develop a monitoring framework to collect and provide coast wide information on the influence of environmental factors and climate change on recruitment for future modeling. (2012 ASMFC Ex. (mod.))

NP

- Research the behavior of silver eels at downstream passages; determine specific behavior of eels migrating downstream, and research how they negotiate and pass hydropower facilities. (HMS #9)

- Research the behavior of American eel approaching hydropower dams to determine searching behavior and preferred routes of approach to confirm best siting options for upstream passage. (HMS #9)

- Investigate how river flow, lunar phase, water temperature, and behavior near artificial lighting impact the behavior of American eel, and influence the amount of time that the eels spend at a dam. (HMS #9)

- Investigate the impact of stream velocity/discharge and stream morphology on upstream migration of glass eel and elvers. (HMS #9)

- Research the factors that cause American eel to initiate downstream migration and affect their patterns of movement. (HMS #9)

- Examine the environmental conditions required for the hatching success of American eel. (HMS #9)

- Research the changes in ocean climate and environmental quality that might influence larval and adult eel migration, spawning, recruitment, and survival, including oceanic heat transport and interactions with the atmosphere and greenhouse gas warming. (HMS #9)

- Determine the importance of coastal lakes and reservoirs to American eel populations. (HMS #9)

- Investigate the impact of seaweed harvesting on American eel. (HMS #9)

Management, Law Enforcement, and Socioeconomic Priorities

High

- Implement a special permit for use of commercial fixed gear (e.g., pots and traps) to harvest American eels for personal use. Special-use permit holders should be subject to the same reporting requirements for landings and effort as the commercial fishery. (2012 ASMFC Ex. (high))

- Coordinate monitoring, assessment, and management among agencies that have jurisdiction within the species' range. (e.g., ASMFC, GLFC, Canada DFO). (2012 ASMFC Ex. (high))

- Perform a joint US-Canadian stock assessment. (2012 ASMFC Ex. (high))

- Improve compliance with landing and effort reporting requirements as outlined in the ASMFC FMP for American eel. (2012 ASMFC Ex. (high-mod.))

Moderate

- Continue to require states to report non-harvest losses in their annual compliance reports. (2012 ASMFC Ex. (mod.))

- Conduct socioeconomic studies to determine the value of the fishery and the impact of regulatory management. (2012 ASMFC Ex. (mod.))

- Develop population targets based on habitat availability at the local level. (2012 ASMFC Ex. (low-mod.))

Footnotes
*(1) SASC is developing a draft protocol for sampling fisheries.
*(2) USFWS currently has a project examining maternal transfer of contaminants in American eel.
*(3) See the report on the 2011 ASMFC Eel Passage Workshop for passage design details.
*(4) Current tagging studies are ongoing in the St. Lawrence River system. A tagging study to examine local and regional movement has been completed by a graduate student at Delaware State University and other studies on local movements and abundance are currently being conducted by other Delaware graduate students.

American Eel Research Needs Identified As Being Met

- ✓ Accurately document the commercial eel fishery so that our understanding of participation in the fishery and the amount of directed effort could be known. *Trip-level reporting of catch and effort became mandatory in 2007.*
- ✓ Evaluate the use of American eel as a water quality indicator.
- ✓ Investigate practical and cost-effective methods of re-establishing American eel in underutilized habitat.

AMERICAN LOBSTER

Fishery-Dependent Priorities

High

- Improve spatial and temporal consistency of commercial data through standardized mandatory reporting and increased sea and port sampling, particularly in offshore waters. Determine spatial trends in commercial landings. Dedicated funding is essential for sea and port sampling programs that are currently threatened by lost funding. (2009 ASMFC Ex. (higher))

NP

- Calibrate NEFSC trawl survey data from old versus new vessels (Albatross versus Bigelow). (2009 ASMFC Ex.)

Fishery-Independent Priorities

NP

- Continue effective fishery-independent surveys (i.e., ventless trap surveys) to develop an accurate coast wide index of relative abundance.*(1) (2009 ASMFC Ex.)

Modeling / Quantitative Priorities

High

- Investigate historical stock sizes relative to current stock status to avoid assessing the current stock status relative to moderate stock productivity. (2009 ASMFC Ex. (higher))

Low

- Examine size based models to determine their ability to match length frequencies and other biological characteristics observed in local lobster populations. Additionally, the utility of using yield and spawning biomass-per-recruit and surplus production models should be evaluated through simulation as a basis for developing alternative reference points. (2009 ASMFC Ex. (lower))

NP

- Revise the University of Maine model to incorporate more biological realism from the Life History model in the 2009 stock assessment. Specifically, estimate the growth matrix, include more surveys, estimate time varying catchability, specify the number of years across which to conduct the assessment (e.g., to ease performance of sensitivity and retrospective analyses), separate sex specific estimated selectivity components, estimate the trend in natural mortality, continue to explore the effects of natural and fishing mortality on growth, examine projection capabilities, improve efficiency (reduce duplication of same/similar functions), explore further the model's MCMC and likelihood profile uncertainty estimation capabilities, and retest the model with simulated data to error check any model changes. (2009 ASMFC Ex.)

Life History, Biological, and Habitat Priorities

High

- Continue and expand research on ageing techniques to improve the understanding of how many year classes support the current trap fishery, how length relates to age, and how variable the age structure is temporally and spatially. *(2) (2009 ASMFC Ex. (higher))

- Conduct research on ecological aspects that affect lobster stocks and incorporate into future stock assessments. Topics should include predator-prey interactions and structure (e.g., gut

content analysis), climatic shifts in ocean currents and temperature, and toxic substances causing chronic stress or disease. (2009 ASMFC Ex. (higher))

NP

- Reassess growth of lobsters, particularly large lobsters, and natural mortality through tagging programs. (2009 ASMFC Ex.)

- Conduct research on the sudden recent increase in proportion females in offshore Gulf of Maine and Georges Bank stocks. (2009 ASMFC Ex.)

Management, Law Enforcement, and Socioeconomic Priorities
High

- Evaluate stock mixing (larval and adult) between the US and Canada stocks and the implications of independent management strategies on the lobster population. Explore the possibility of joint US and Canadian lobster stock assessments by the TRAC. (2009 ASMFC Ex. (higher))

- Align stock management areas with area designations for landings. (2009 ASMFC Ex. (higher))

NP

- Investigate stock unit carrying capacities and how to manage a stock experiencing carry capacity decline and/or range decline. Determine what metric should be used to measure carrying capacity for lobster. (2009 ASMFC Ex.)

Footnotes
*(1) A coast wide (Gulf of Maine to Long Island Sound) ventless trap survey was conducted from 2006-2008, but was discontinued due to lack of funding.
*(2) Research on ageing techniques has been conducted in England and Australia and has been initiated in Maine and Connecticut.

AMERICAN SHAD / RIVER HERRING

Fishery-Dependent Priorities
High

- Expand observer and port sampling coverage to quantify additional sources of mortality for alosine species, including bait fisheries, as well as rates of bycatch in other fisheries to reduce uncertainity.*(1) (2012 ASMFC Ex. (high), 2010 FMP review (high), (SR 88 (high))

Moderate

- Identify directed harvest and bycatch losses of American shad in ocean and bay waters of Atlantic Maritime Canada. (SR 88 (medium))

Low

- Identify additional sources of historical catch data of the US small pelagic fisheries to better represent earlier harvest of river herring and improve model formulation. (2012 ASMFC Ex. (low))

Fishery-Independent Priorities

Moderate

- Develop demersal and pelagic trawl CPUE indices of offshore river herring biomass. (2012 ASMFC Ex. (mod.))

Modeling / Quantitative Priorities

High

- Conduct population assessments on river herrings, particularly in the south.*(2) (2010 FMP review (high), SR 88 (high))

- Analyze the consequences of interactions between the offshore bycatch fisheries and population trends in the rivers. (2012 ASMFC Ex. (high))

- Quantify fishing mortality for major river stocks after ocean closure of directed fisheries (river, ocean bycatch, bait fisheries). (2010 FMP review (high), SR 88 (high))

- Improve methods to develop biological benchmarks used in assessment modeling (fecundity-at-age, sex specific mean weight-at-age, partial recruitment vector/maturity schedules) for river herring and American shad of both semelparous and iteroparous stocks. (2012 ASMFC Ex. (high), 2010 FMP review (high), SR 88 (medium))

- Improve methods for calculating M. (2012 ASMFC Ex. (high), 2010 FMP review (high), SR 88 (high))

Moderate

- Consider standardization of indices with a GLM to improve trend estimates and uncertainty characterization. (2012 ASMFC Ex. (mod.))

- Explore peer-reviewed stock assessment models for use in additional river systems as more data become available. (2012 ASMFC Ex. (mod.))

Low

- Develop models to predict the potential impacts of climate change on river herring distribution and stock persistence. (2012 ASMFC Ex. (low))

Life History, Biological, and Habitat Priorities

High

- Conduct studies to quantify and improve fish passage efficiency and support the implementation of standard practices. (2010 FMP review (high), SR 88 (high))

- Assess the efficiency of using hydroacoustics to repel alosines or pheromones to attract alosines to fish passage structures. Test commercially available acoustic equipment at existing fish passage facilities. Develop methods to isolate/manufacture pheromones or other alosine attractants. (2010 FMP review (medium), SR 88 (high))

- Investigate the relationship between juvenile river herring/American shad and subsequent year class strength, with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, and life history requirements. (2012 ASMFC Ex. (high), 2010 FMP review (high), SR 88 (high))

- Develop an integrated coastal remote telemetry system or network that would allow tagged fish to be tracked throughout their coastal migration and into the estuarine and riverine environments. (SR 88 (high))

- Verify tag-based estimates of American shad. (SR 88 (high))

- Continue studies to determine river herring population stock structure along the coast and enable determination of river origin of catch in mixed stock fisheries and incidental catch in non-targeted ocean fisheries. Spatially delineate mixed stock and Delaware stock areas within the Delaware system. Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, genetic analysis, and/or tagging. *(3) (2012 ASMFC Ex. (high), 2010 FMP review (high), SR 88 (high/medium))

- Validate the different values of M for river herring and American shad stocks through shad ageing techniques and repeat spawning information. (2012 ASMFC Ex. (high), 2010 FMP review (high), SR 88 (high))

- Continue to assess current ageing techniques for river herring and American shad, using known-age fish, scales, otoliths, and spawning marks. Conduct biannual ageing workshops to maintain consistency and accuracy of ageing fish sampled in state programs. (2012 ASMFC Ex. (high), 2010 FMP review (high), SR 88 (high))

- Summarize existing information on predation by striped bass and other species. Quantify consumption through modeling (e.g., MSVPA), diet, and bioenergetics studies. (2012 ASMFC Ex. (mod.), 2010 FMP review (high), SR 88 (high))

- Refine techniques for tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock. (2010 FMP review (medium), SR 88 (high))

Moderate

- Determine the effects of passage barriers on all life history stages of American shad and river herring. Conduct studies on turbine mortality, migration delay, downstream passage, and sub-lethal effects. (2010 FMP review (medium), SR 88 (medium))

- Evaluate and ultimately validate large-scale hydroacoustic methods to quantify river herring and American shad escapement in major river systems. (2012 ASMFC Ex. (mod.), 2010 FMP review (med.), SR 88 (low))

- Conduct studies of egg and larval survival and development. (2010 FMP review (med.), SR 88 (low))

- Conduct studies on energetics of feeding and spawning migrations of American shad on the Atlantic coast. (2010 FMP review (medium), SR 88 (low))

- Resource management agencies in each state shall evaluate their respective state water quality standards and criteria and identify hard limits to ensure that those standards, criteria, and limits account for the special needs of alosines. Primary emphasis should be on locations where sensitive egg and larval stages are found. (2010 FMP review (med.), HMS #9)

- Encourage university research on hickory shad. (2010 FMP review (med.), SR 88 (low))

- Develop better fish culture techniques, marking techniques, and supplemental stocking strategies for river herring. (2012 ASMFC Ex. (low), 2010 FMP review (medium), SR 88 (medium))

Low

- Characterize tributary habitat quality and quantity for Alosine reintroductions and fish passage development. (2010 FMP review (low), SR 88 (low))

- States should identify and quantify potential shad and river herring spawning and nursery habitat not presently utilized, including a list of areas that would support such habitat if water quality and access were improved or created, and analyze the cost of recovery within those areas. States may wish to identify areas targeted for restoration as essential habitat. *(4) (2010 FMP review (low), SR 88 (low), HMS #9)

- Investigate contribution of landlocked versus anadromous produced river herring. (2012 ASMFC Ex. (low))

- Review studies dealing with the effects of acid deposition on alosines. (2010 FMP review (low), SR 88 (low))

NP

- Passage facilities should be designed specifically for passing alosines for optimum efficiency at passing these species. (HMS #9)

- Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles). (HMS #9)

- Ensure that water withdrawal effects do not impact alosine stocks by impingement/entrainment, and employ intake screens or deterrent devices as needed to prevent egg and larval mortality. (HMS #9)

- All state and federal agencies responsible for reviewing impact statements for projects that may alter anadromous alosine spawning and nursery areas shall ensure that those projects will have no impact or only minimal impact on those stocks. Of special concern are natal rivers of newly established stocks or stocks considered depressed or severely depressed. (HMS #9)

- When considering options for restoring alosine habitat, include study of, and possible adjustment to, dam-related altered river flows. (HMS #9)

- Ensure that decisions on river flow allocation (e.g., irrigation, evaporative loss, out of basin water transport, hydroelectric operations) take into account flow needs for alosine migration, spawning, and nursery use, and minimize deviation from natural flow regimes. (HMS #9)

- Focus research on within-species variation in genetic, reproductive, morphological, and ecological characteristics, given the wide geographic range and variation at the intraspecific level that occurs in alosines. (HMS #9)

- Ascertain how abundance and distribution of potential prey affect growth and mortality of early life stages of alosines. (HMS #9)

- Determine factors that regulate and potentially limit downstream migration, seawater tolerance, and early ocean survival of juvenile alosines. (HMS #9)

- Determine if chlorinated sewage effluents are slowing the recovery of depressed shad stocks. (HMS #9)

- Determine if intermittent episodes of pH depressions and aluminum elevations (caused by acid rain) affect any life stage in freshwater that might lead to reduced reproductive success of alosines, especially in poorly buffered river systems. (HMS #9)

- ASMFC should designate important shad and river herring spawning and nursery habitat as HAPC. *(4)(HMS #9)

- When populations have been extirpated from their habitat, coordinate alosine stocking programs, including: reintroduction to the historic spawning area, expansion of existing stock restoration programs, and initiation of new strategies to enhance depressed stocks. (HMS #9)

- When releasing hatchery-reared larvae into river systems for purposes of restoring stocks, synchronize the release with periods of natural prey abundance to minimize mortality and maximize nutritional condition. Determine functional response of predators on larval shad at restoration sites to ascertain appropriate stocking level so that predation is accounted for, and juvenile out-migration goals are met. Also, determine if night stocking will reduce mortality. (HMS #9)

Management, Law Enforcement, and Socioeconomic Priorities

High

- Develop and implement monitoring protocols and analyses to determine river herring and American shad population responses and targets for rivers and tributaries, particularly those undergoing restoration (passage, supplemental stocking, etc.). (2012 ASMFC Ex. (high), 2010 FMP review (medium), SR 88 (medium))

- Determine the impact of directed fisheries on American shad and river herring stocks and reduce F. (SR 88 (high))

- Mandate FMPs for rivers with active restoration plans for American shad or river herring. (SR 88 (high))

- Improve spatial and gear specific reporting of harvest. (2012 ASMFC Ex. (high))

Low

- Conduct and evaluate historical characterization of socioeconomic development (potential pollutant sources and habitat modification) of selected shad rivers along the east coast. *(4) (2010 FMP review (low), SR 88 (low))

- Develop appropriate Habitat Suitability Index Models for alosine species in the fishery management plan. Possibly consider expansion of species of importance or go with the most protective criteria for the most susceptible species. (2010 FMP review (low))

NP

- Manage alewife and blueback herring separately given that management actions will affect them differently due to their life history differences (currently, these species are managed as a single stock and lumped together in commercial catch records; this hinders understanding of fishery impacts to populations of river herring species). (HMS #9)

Footnotes

*(1) A prior statistical study of observer allocation and coverage should be conducted (see Hanke et al. 2012).

*(2) A peer reviewed river herring stock assessment was completed in 2012 by the ASMFC.

*(3) Genetic research currently underway in combination with otolith chemistry.

*(4) River-specific habitat recommendations for American shad can be found in: Atlantic States Marine Fisheries Commission. 2007. American shad stock assessment report for peer review, volumes II and III. Atlantic States Marine Fisheries Commission Stock Assessment Report No. 07-01 (Supplement), Washington, D.C. (HMS #9)

American Shad / River Herring Research Needs Identified as Being Met

- ✓ Develop comprehensive angler use and harvest survey techniques for use by Atlantic states to assess recreational fisheries for American shad. *To be accomplished through MRIP*.
- ✓ Determine the stock/recruitment relationships for American shad and river herring stocks.

ATLANTIC CROAKER

Fishery-Dependent Priorities

High

- Encourage fishery-dependent biological sampling, including extraction of ageing structures, to improve age-length keys. Age-length keys should be representative of all gear types in the fishery. Supplement underrepresented length bins with additional ageing samples to avoid the necessity of weighting length-at-age estimates by length frequencies. (SR 88 (high), 2010 SEDAR)

- Obtain gear specific effort information and improve fishery-dependent catch and effort statistics and catch size and age structure. (SR 88 (high), 2010 SEDAR)

Moderate

- Conduct studies on discard mortality from varying gears in recreational and commercial fisheries. (SR 88 (med.), 2010 SEDAR)

- Assess and monitor the effects of bycatch reduction devices (BRD's) on croaker catch. (med)

- Monitor fisheries with significant croaker bycatch and determine extent of unutilized bycatch and F on fish less than age 1. (SR 88 (med.))

- Determine the onshore versus offshore components of the croaker fishery. (SR 88 (med.))

NP

- Develop and implement state-specific commercial scrap fisheries monitoring programs to evaluate relative importance of croaker in scrap landing. (2010 SEDAR)

- Recover detailed historical landings data from NOAA as indicated by historical summaries. (2010 SEDAR)

- Increase observer coverage of commercial discards. (2010 SEDAR)

Fishery-Independent Priorities

Moderate

- Continue monitoring juvenile croaker populations in major nursery areas. (SR 88 (med.))

- Develop coast wide juvenile croaker indices to clarify stock status. (SR 88 (med.))

NP

- Continue and expand fishery-independent surveys and subsample for individual weights and ages, especially in the southern range. (2010 SEDAR)

Modeling / Quantitative Priorities

High

- Develop size, age, and sex specific relative abundance estimates from fishery-independent and fishery-dependent data. (SR 88 (high))

Moderate

- Incorporate bycatch estimates into croaker assessment models. (SR 88 (med.))

- Analyze croaker YPR to establish a minimum size that maximizes YPR. (SR 88 (med.))

NP

- Identify and evaluate environmental covariates in stock assessment models. (2010 SEDAR)

Life History, Biological, and Habitat Priorities

High

- Conduct studies on fecundity and reproductive dynamics and develop maturity schedules. (SR 88 (high), 2010 SEDAR)

- Conduct studies on growth rates and age structure throughout species range. (SR 88 (high))

- Conduct collaborative coast wide genetics and tagging studies to determine migratory patterns, stock identification, and stock mixing. (SR 88 (high), 2010 SEDAR)

Moderate

- Identify essential habitat requirements. (SR 88 (med.))

Low

- Determine species interactions and predator-prey relationships between croaker (prey) and predator species targeted in more valued fisheries. (SR 88 (low))

- Assess the impacts of any dredging activity (i.e., for beach re-nourishment) on all life history stages of croaker. (SR 88 (low))

NP

- Re-examine historical ichthyoplankton studies of the Chesapeake Bay for an indication of the magnitude of estuarine spawning. (2010 SEDAR)

Management, Law Enforcement, and Socioeconomic Priorities
Moderate

- Determine the optimum utilization (economic and biological) of a long term fluctuating croaker population. (SR 88 (med.))

NP

- Evaluate socioeconomic aspects of croaker fisheries. (2010 SEDAR)

Atlantic Croaker Research Needs Identified as Being Met

✓ Criteria should be cooperatively developed for ageing croaker otoliths. *Addressed at 2008 croaker and red drum ageing workshop.*

ATLANTIC MENHADEN

Fishery-Dependent Priorities
High

- Continue sampling landings, size, age, gear, effort, and harvest area in reduction and bait fisheries, especially in mid-Atlantic and New England. Determine age composition by area. Continue biostatistical sampling of bait samples in purse seine fisheries for Virginia and New Jersey to improve stock assessment. (SR 88 (high), 2010 SEDAR)

Moderate

- Evaluate other measures of effort, including spotter pilot logbooks, trip length, etc. Spotter pilot logbooks should be evaluated for search time, GPS coordinates, and estimates of observed school size. (SR 88 (med.))

Low

- Conduct studies on bycatch and discard of menhaden in other fisheries. (SR 88 (low))

NP

- Obtain annual samples of menhaden from the PRFC pound net fishery to determine selectivity and age and size structure of catch. (2010 SEDAR)

Fishery-Independent Priorities
High

- Develop a coast wide, fishery-independent index of adult abundance at age to replace or augment the existing Potomac River pound net index used in the assessment model. (SR 88 (high), 2010 SEDAR (highest))

- Develop and implement fishery-independent surveys to estimate size of recruiting year classes.*(1) (SR 88 (high))

NP

- Work with industry to collect age structure data outside the range of the fishery. (2010 SEDAR)

- Obtain more age specific data on menhaden movement rates and incorporate into a spatially explicit model. (2010 SEDAR)

Modeling / Quantitative Priorities

High

- Re-evaluate menhaden natural mortality-at-age and population response to fluctuating predator populations by updating the MSVPA as additional information becomes available (i.e., predator, prey, and/or diet data). (SR 88 (high), 2010 SEDAR)

- Develop a multispecies statistical catch-at-age model to estimate menhaden natural mortality-at-age. (SR 88 (high), 2010 SEDAR)

Moderate

- Evaluate precision of current assessment models with Monte Carlo simulations. (SR 88 (med.))

NP

- Incorporate maturity-at-age variability in the assessment model. (2010 SEDAR)

Life History, Biological, and Habitat Priorities

Moderate

- Determine the effects of critical estuarine habitat loss/degradation on juvenile and adult menhaden growth, survival, and abundance. (SR 88 (med.))

- Conduct studies on maturity, fecundity, spatial and temporal patterns of spawning, and larval survival. Update fecundity and maturity schedules. Evaluate the effects of selected environmental factors on growth, survival, and abundance of juvenile and adult menhaden, particularly in the Chesapeake Bay and other costal nursery areas.*(2) (SR 88 (med.), 2010 SEDAR)

- Assess the feasibility of estimating year class strength using a biologically stratified sampling design. The efforts could be supported by process studies linking plankton production to abundance of young menhaden (need resources). (SR 88 (med.))

- Evaluate productivity of different estuaries (e.g., replicate similar methodology to Arenholz et al. 1987). (2010 SEDAR) Update estuary specific productivity estimates used to weight the juvenile abundance indices. (SR 88 (med.))

- Assess effects of fish disease (e.g., ulcerative mycosis and toxic dinoflagellates) on menhaden.* (3) (SR 88 (med.), 2010 SEDAR)

- Determine the ecological role of menhaden (predator-prey relationships, nutrient enrichment, oxygen depletion, etc.) in major Atlantic coast embayments and estuaries. (SR 88 (med.))

Low

- Conduct growth back-calculation studies to determine historical trends in growth rate. The NMFS has an extensive database on scale growth increments which should be utilized for these studies. (SR 88 (low))

- Monitor fish kills along the Atlantic coast and use the NMFS Beaufort Laboratory as a repository for these reports. (SR 88 (low))

NP

- Continue recovery of historical tagging data from paper data sheets. (2010 SEDAR)

- Investigate the effects of global climate change on distribution, movement, and behavior of menhaden. (2010 SEDAR)

Management, Law Enforcement, and Socioeconomic Priorities

Low

- Determine effects of regulations on the fishery, the participants, and the stock. (SR 88 (low))

- Monitor the socioeconomic aspects of the menhaden reduction fishery. (SR 88 (low)

Footnotes

(1) Ongoing research is being conducted to develop and test methods for estimating size of recruiting year classes of juveniles using fishery-independent survey techniques.

(2) Ongoing research is being conducted in the Chesapeake Bay to evaluate effects of selected environmental factors on growth, survival, and abundance of juvenile and adult menhaden.

(3) Ongoing research is being conducted to determine the effects of fish diseases (e.g., ulcerative mycosis and toxic dinoflagellates) on menhaden.

Atlantic Menhaden Research Needs Identified as Being Met

- ✓ Evaluate use of costal power plant impingement data as a possible means to estimate YOY menhaden abundance.

ATLANTIC SEA HERRING

Fishery-Dependent Priorities

High

- Investigate bycatch and discards in the directed herring fishery through both at sea and portside sampling. (SR 88 (high))

- Continue commercial catch sampling of Atlantic herring fisheries according to ACCSP protocols. (SR 88 (high))

NP

- Develop (simple) methods to partition stocks in mixed stock fisheries. (2012 SARC)

Fishery-Independent Priorities

High

- Continue to utilize the inshore and offshore hydroacoustic and trawl surveys to provide an independent means of estimating stock sizes. Collaborative work between NMFS, DFO, state agencies, and the herring industry on acoustic surveys for herring should continue to be encouraged. (SR 88 (high))

- Continue resource monitoring activities, especially larval surveys to evaluate distribution and abundance of herring larvae, and to indicate the relative importance of individual spawning areas and stocks and the degree of spawning stock recovery on Georges Bank and Nantucket Shoals. (SR 88 (high))

NP

- Conduct more extensive stock composition sampling including all stocks (i.e., Scotian Shelf). (2012 SARC)

- Expand monitoring of spawning components. (2012 SARC)

- Consider alternative sampling methods such as HabCam. (2012 SARC

Modeling / Quantitative Priorities

Moderate

- Develop new approaches to estimating recruitment (i.e., juvenile abundance) from fishery-independent data. (SR 88 (med.))

- Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age structured assessment. (SR 88 (med.))

Low

- Examine the possible effects of density dependence (e.g., reduced growth rates at high population size) on parameter estimates used in assessments. (SR 88 (low))

- Investigate the M rate assumed for all ages, the use of CPUE tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring. (SR 88 (low))

NP

- Develop indices at age from shrimp survey samples. (2012 SARC)

- Develop an industry based LPUE or some other abundance index (Industry Based Survey). (2012 SARC)

- Conduct simulation studies to evaluate ways in which various time series can be evaluated and folded into the assessment model. (2012 SARC)

- Evaluate use of length based models (Stock Synthesis and Chen model). (2012 SARC)

- Develop statistical comparison of consumption estimates and biomass from model M. (2012 SARC)

- Develop objective criteria for inclusion of novel data streams (consumption, acoustic, larval, etc.) and how this can be applied. (2012 SARC)

Life History, Biological, and Habitat Priorities

High

- Continue tagging and morphometric studies to explore uncertainties in stock structure and the impacts of harvest mortality on different components of the stock. Although tagging studies may be problematic for assessing survivorship for a species like herring, they may be helpful in identifying the stock components and the proportion of these components taken in the fishery on a seasonal basis. (SR 88 (high))

NP

- Analyze diet composition of archived mammal and sea bird stomachs. Improve knowledge on prey size selectivity of mammals and sea birds. (2012 SARC)

- Evaluate prey field to determine what other prey species are available to predators that could explain some of the annual trends in herring consumption. (2012 SARC)

- Consider information on consumption from other sources (i.e. striped bass in other areas) and predators inshore of the current surveys. (2012 SARC)

- Investigate why small herring are not found in the stomachs of predators in the NEFSC food habits database. (2012 SARC)

- Research depth preferences of herring. (2012 SARC)

Management, Law Enforcement, and Socioeconomic Priorities

High

- Continue to organize annual US-Canadian workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries. (SR 88 (high))

Moderate

- Develop a strategy for assessing individual spawning components to better manage heavily exploited portion(s) of the stock complex, particularly the Gulf of Maine inshore spawning component. (SR 88 (med.))

- Develop socioeconomic analyses appropriate to the determination of optimum yield. (SR 88 (med.))

Low

- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry. (SR 88 (low))

NP

- Evaluate the current herring spawning closure design in terms of areas covered, closure periods, catch-at-age within (before fishing prohibition in 2007) and outside of spawning areas to determine minimal spawning regulations. (Maine DMR)

Atlantic Sea Herring Research Needs Identified as Being Met

✓ Evaluate the merit of acoustic surveys and other techniques to achieve sub stock complex monitoring.

ATLANTIC STRIPED BASS

Fishery-Dependent Priorities

High

- Examine reporting rates by commercial and recreational fishermen using high reward tags (ongoing, J. Hoenig). (2011 FMP review (high))

Moderate

- Develop studies to provide information on gear specific discard morality rates and to determine the magnitude of bycatch mortality (ongoing, G. Nelson). (2011 FMP review (med.), SR 88 (med.))

- Improve estimates of striped bass harvest removals in coastal areas during wave 1 and in inland waters of all jurisdictions year round. (2011 FMP review (med.), SR 88 (med.))

- Evaluate the percentage of fishermen using circle hooks. (2011 FMP review (med.), SR 88 (med.))

Fishery-Independent Priorities

Moderate

- Develop a refined and cost-efficient, fisheries-independent coastal population index for striped bass stocks. (2011 FMP review (med.), SR 88 (med.))

Modeling / Quantitative Priorities

High

- Develop a method to integrate VPA and tagging models to produce a single estimate of F and stock status (ongoing, G. Nelson). (2011 FMP review (high), SR 88 (high))

- Develop a spatially and temporally explicit catch-at-age model incorporating tag based movement information. (2011 FMP review (high), SR 88 (high))

- Continue improvements to the statistical catch-at-age model as recommended by the 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). (2011 FMP review (high))

- Review model averaging approach to estimate annual fishing mortality with tag based models. Review validity and sensitivity to year groupings. (2011 FMP review (high))

- Evaluate to what extent rising natural mortality among Chesapeake Bay striped bass affects the existing F and SSB thresholds, which are based on a fixed M assumption (M = 0.15). (2011 FMP review (high))

- Develop methods for combining tag results from programs releasing fish from different areas on different dates. (2011 FMP review (high), SR 88 (high))

- 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. (2011 FMP review (high), SR 88 (high))

- Develop field or modeling studies to aid in estimation of natural mortality or other factors affecting the tag return rate. (2011 FMP review (high))

Moderate

- Develop maturity ogives applicable to coastal migratory stocks. (2011 FMP review (med.), SR 88 (med.))

- Examine methods to estimate annual variation in natural mortality. (ongoing, Striped Bass Tagging Subcommittee). (2011 FMP review (med.), SR 88 (med.))

- Develop reliable estimates of poaching loss from striped bass fisheries. (2011 FMP review (med.), SR 88 (med.))

- Improve methods for determining population sex ratio for use in estimates of SSB and biological reference points. (2011 FMP review (med.), SR 88 (med.))

- Evaluate the overfishing definition relative to uncertainty in biological parameters. (2011 FMP review (med.), SR 88 (med.))

- Evaluate truncated matrices and covariate based tagging models. (2011 FMP review (med.), SR 88 (med.))

Low

- Develop simulation models to look at the implications of overfishing definitions relative to development of a striped bass population that will provide "quality" fishing. Quality fishing must first be defined. (2011 FMP review (low), SR 88 (low))

- Examine issues with time saturated tagging models for the 18 inch length group. (2011 FMP review (low), SR 88 (low))

- Develop tag based reference points. (2011 FMP review (low), SR 88 (low))

Life History, Biological, and Habitat Priorities

High

- Continue in-depth analysis of migrations, stock compositions, etc. using mark-recapture data (ongoing, e.g., Cooperative Winter Tagging Cruise 20 Year Report, W. Laney). (2011 FMP review (high), SR 88 (high))

- Continue evaluation of striped bass dietary needs and relation to health condition. (2011 FMP review (high), SR 88 (high))

- Continue analysis to determine linkages between the mycobacteriosis outbreak in Chesapeake Bay and sex ratio of Chesapeake spawning stock, Chesapeake juvenile production, and recruitment success into coastal fisheries. (2011 FMP review (high))

Moderate

- Examine causes of different tag based survival estimates among programs estimating similar segments of the population. (2011 FMP review (med.), SR 88 (med.))

- Continue to conduct research to determine limiting factors affecting recruitment and possible density implications. (2011 FMP review (med.), SR 88 (med.))

- Conduct study to calculate the emigration rates from producer areas now that population levels are high and conduct multi-year study to determine inter-annual variation in emigration rates. (2011 FMP review (med.), SR 88 (med.))

Low

- Determine inherent viability of eggs and larvae. (2011 FMP review (low), SR 88 (low))

- Conduct additional research to determine the pathogenicity of the IPN virus isolated from striped bass to other warm water marine species, such as flounder, menhaden, shad, and largemouth bass. (2011 FMP review (low), SR 88 (low))

NP

- Passage facilities should be designed specifically for passing striped bass for optimum efficiency at passing this species. (HMS #9)

- Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase striped bass production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles). (HMS #9)

- All state and federal agencies responsible for reviewing impact statements and permit applications for projects or facilities proposed for striped bass spawning and nursery areas shall ensure that those projects will have no or only minimal impact on local stocks, especially natal rivers of stocks considered depressed or undergoing restoration. (HMS #9)

- Federal and state fishery management agencies should take steps to limit the introduction of compounds which are known to be accumulated in striped bass tissues and which pose a threat to human health or striped bass health. (HMS #9)

- Every effort should be made to eliminate existing contaminants from striped bass habitats where a documented adverse impact occurs. (HMS #9)

- Water quality criteria for striped bass spawning and nursery areas should be established, or existing criteria should be upgraded to levels that are sufficient to ensure successful striped bass reproduction. (HMS #9)

- Each state should implement protection for the striped bass habitat within its jurisdiction to ensure the sustainability of that portion of the migratory stock. Such a program should

include: inventory of historical habitats, identification of habitats presently used, specification of areas targeted for restoration, and imposition or encouragement of measures to retain or increase the quantity and quality of striped bass essential habitats. (HMS #9)

- States in which striped bass spawning occurs should make every effort to declare striped bass spawning and nursery areas to be in need of special protection; such declaration should be accompanied by requirements of non-degradation of habitat quality, including minimization of non-point source runoff, prevention of significant increases in contaminant loadings, and prevention of the introduction of any new categories of contaminants into the area. For those agencies without water quality regulatory authority, protocols and schedules for providing input on water quality regulations to the responsible agency should be identified or created, to ensure that water quality needs of striped bass stocks are met. (HMS #9)

- ASMFC should designate important habitats for striped bass spawning and nursery areas as HAPC. (HMS #9)

- Each state should survey existing literature and data to determine the historical extent of striped bass occurrence and use within its jurisdiction. An assessment should be conducted of those areas not presently used for which restoration is feasible. (HMS #9)

Management, Law Enforcement, and Socioeconomic Priorities
Moderate

- Examine the potential public health trade-offs between the continued reliance on the use of high minimum size limits (28 inches) on coastal recreational anglers and its long-term effects on enhanced PCB contamination among recreational stakeholders. (2011 FMP review (med.))

ATLANTIC STURGEON

Fishery-Independent Priorities
High

- Determine levels of bycatch and compare to F_{50} target levels for individual populations. Bycatch, particularly in coastal waters, may represent the largest threat to Atlantic sturgeon rebuilding. Characterize Atlantic sturgeon bycatch in various fisheries by gear and season. Include data on fish size, health condition at capture, and number of fish captured. Develop markers that permit identification of bycatch by population origin. (2006 FMP review, SR 88 (high))

Modeling / Quantitative Priorities
High

- Conduct assessments of population abundance and age structure in various river systems. Particular emphasis should be placed in documenting occurrence of age 0-1 juveniles and spawning adults as indicators of natural reproduction. (2006 FMP review, SR 88 (high))

NP

- Conduct further analyses to assess the sensitivity of F_{50} to model inputs for northern and southern stocks. (2006 FMP review)

Life History, Biological, and Habitat Priorities

High

- Develop methods to determine sex and maturity of captured sturgeon. *(1) (2006 FMP review, SR 88 (high))

- Determine length, fecundity, and maturity-at-age for North, Mid, and South Atlantic stocks. (2006 FMP review, SR 88 (high))

- Refine maturation induced spawning procedures. Refine sperm cryopreservation techniques to assure availability of male gametes. (2006 FMP review, SR 88 (high))

- Continue basic cultural experiments at all life stages to provide information on efficacy of alternative spawning techniques, egg incubation and fry production techniques, holding and rearing densities, prophylactic treatments, nutritional requirements and feeding techniques, and optimal environmental rearing conditions and systems. (2006 FMP review, SR 88 (high))

- Conduct research to identify suitable stocking protocols for hatchery fish (e.g., fish size, time of year, site, marking technique). (2006 FMP review, SR 88 (high))

- Conduct and monitor pilot scale stocking programs before conducting large-scale efforts that encompass broad geographic area. (2006 FMP review, SR 88 (high))

- Establish stocking goals and success criteria prior to development of large-scale stock enhancement or recovery programs. (2006 FMP review, SR 88 (high))

- Evaluate aging techniques for Atlantic sturgeon with known age fish. Emphasis should be placed on verifying current methodology based on fin rays. (2006 FMP review, SR 88 (high))

- Establish tolerance of different life stages to important contaminants and environmental factors (e.g., DO, pH, temperature, salinity). (2006 FMP review, SR 88 (high))

Moderate

- Quantify the amount and quality of sturgeon habitat in important sturgeon estuaries and rivers, including spawning and nursery habitats. Define and map bottom water quality,

velocity, and substrates types for suitable sturgeon spawning and nursery habitat. (2006 FMP review, SR 88 (med))

- Assess loss to ship/boat strikes. (2006 FMP review, SR 88 (med.))

Low

- Identify rates of tag loss and tag reporting. (2006 FMP review, SR 88 (low))

- Analyze existing sea sampling data to characterize at sea migratory behavior. Use electronic tagging to model coastal migrations of juvenile and adult Atlantic sturgeon. (2006 FMP review, SR 88 (low))

- Continue to determine the extent to which Atlantic sturgeon are genetically differentiable among rivers. Interpret biological significance of findings. (2006 FMP review, SR 88 (low))

- Encourage shortnose sturgeon researchers to include data collection for incidentally captured Atlantic sturgeon. (2006 FMP review, SR 88 (low))

NP

- Fish passage requirements and appropriate structures for Atlantic sturgeon are largely unknown. Research all fish passage requirements for Atlantic sturgeon. (HMS #9)

- Passage facilities should be designed specifically for passing Atlantic sturgeon for optimum efficiency at passing this species. (HMS #9)

- Fish passage facilities should be designed to aid in the upstream and downstream passage of Atlantic sturgeon. Most fish ladders in Atlantic coast streams and rivers are designed to pass alosines, and the specific needs of sturgeon will need to be considered as passage facilities are improved or constructed. (HMS #9)

- The removal of dams, or the consideration of passage efforts, should be focused on those systems where Atlantic sturgeon historical habitat loss through blockage is greatest. (HMS #9)
- Water flows should be restored to appropriate levels during spawning season. (HMS #9)

- Protection or restoration of critical habitat is considered the most beneficial conservation method for the restoration of sturgeons. Restore degraded historical habitat wherever possible. Also, habitat improvements that increase the survival of YOY are likely to make a strong contribution to population growth. (HMS #9)

- New spawning habitat should be created with the use of artificial reef materials in areas where hard substrate has been degraded. (HMS #9)

- ASMFC should designate important habitats for Atlantic sturgeon spawning and nursery areas as HAPC. (HMS #9)

- Maintain database for tagged Atlantic sturgeon. (HMS #9)

- Establish coordinated tagging programs to delineate migratory patterns and stock composition. Priority should be to mark juveniles in important sturgeon rivers before they begin ocean life phase. (2006 FMP review)

- Standardize PIT tagging and ultrasonic telemetry equipment and procedures. (2006 FMP review)

- Further develop techniques for capture, transport, and long-term holding of wild brood stock. (2006 FMP review)

- Standardize collection procedures, and develop a suitable long-term repository for Atlantic sturgeon biological tissues for use in genetic and other studies. (HMS #9)

- Develop a protocol for ageing validation in Atlantic sturgeon. (HMS #9)

Footnotes
*(1) Partially done. Laparoscopic techniques have been developed to visually inspect gonads (Dr. Rob Bakal, USFWS, Aquatic Animal Health Coordinator, National Fish Hatchery System). The focus should be directed to blood chemistry analysis of compounds such as vitellogenin or sex steroids.

Atlantic Sturgeon Research Needs Identified as Being Met

- ✓ Develop and implement long-term marking/tagging procedures to provide information on individual tagged Atlantic sturgeon for up to 20 years. *PIT tags.*
- ✓ Standardize collection procedures and develop suitable long-term repository for biological tissues for use in genetic and other studies.
- ✓ Develop the capability to capture wild broodstock and develop adequate holding and transport techniques for large broodstock.
- ✓ Establish a tag recovery clearinghouse and database for consolidation and evaluation of tagging and tag return information including associated biological, geographic, and hydrographic data. *Uncertainty whether this includes acoustic tag information.*

BLACK DRUM

Fishery-Dependent Priorities

High

- Obtain better estimates of harvest from the black drum recreational fishery (especially in states with short seasons). Obtain better coverage of shore and nighttime anglers. Conduct

studies to estimate catch and release mortality estimates. (2011 report to ISMP Policy Board (highest))

Moderate

- Obtain better estimates of bycatch of black drum in other fisheries, especially juvenile fish in South Atlantic states. (2011 report to ISMP Policy Board (mod.))

Fishery-Independent Priorities

High

- Increase spatial and temporal coverage of age samples collected regularly in fishery-dependent and independent sources. Analyze existing otoliths that have been collected but not aged. Prioritize collection of adult age data from fishery-independent sources in states where maximum size regulations preclude the collection of adequate adult ages. (2011 report to ISMP Policy Board (high))

- Expand existing fishery-independent surveys temporally and spatially to better cover black drum habitats, especially adult fish. (2011 report to ISMP Policy Board (high))

- Continue to collect and analyze current life history data from fishery-independent programs, including full size, age, maturity, histology workups and information on spawning season timing and duration. Any additional data that can be collected on adult black drum would be highly beneficial. (2011 report to ISMP Policy Board (high))

Modeling / Quantitative Priorities

High

- Obtain estimates of selectivity-at-age for black drum through observer programs or tagging studies. (2011 report to ISMP Policy Board (high))

Life History, Biological, and Habitat Priorities

High

- Conduct studies to estimate fecundity-at-age coast wide and to estimate batch fecundity, especially for adults in South Atlantic. (2011 report to ISMP Policy Board (high))

- Conduct otolith microchemistry studies to identify regional recruitment contributions. (2011 report to ISMP Policy Board (high))

- Conduct a high reward tagging program to obtain improved return rates. Continue and expand current tagging programs to obtain mortality and growth information and movement-at-size data. Conduct new and expand existing acoustic tagging programs to help identify spawning and juvenile habitat use and regional recruitment sources. Collect genetic material

(i.e., create “genetic tags”) over long time span to obtain information on movement and population structure and potentially estimate population size. (2011 report to ISMP Policy Board (high))

BLACK SEA BASS

Fishery-Dependent Priorities

High

- Increase sampling of commercial landings. (2011 SARC/SR 88 (high))

- Increase sample size of at sea observers and dockside validation for headboats. Increase recreational fisheries sampling. (2011 SEDAR(high), SR 88(high))

- Determine depth, temperature, and season specific discard mortality rates. Assess and incorporate the impact of circle hook fishing regulations on discard mortality. Obtain more depth specific information from the private recreational fleet, MRIP At-Sea observer program, and Headboat Survey in the range of the southern stock. (2011 SARC/2011 SEDAR(high))

Moderate

- Collect better spatial information in black sea bass fisheries to determine potential localized depletion effects. (2011 SEDAR(med.))

Low

- Determine the impact/landings of the historical foreign fleet in the South Atlantic. (2011 SEDAR(low))

NP

- Develop hard part sampling coordinated with intercept surveys. (2011 SEDAR)

- Expand electronic reporting of headboat logbook for full implementation. (2011 SEDAR)

Fishery-Independent Priorities

High

- Conduct a pot survey throughout the range of the northern management unit and consider for an index of abundance.*(1) (2011 SARC/SR 88 (high))

- Expand fishery-independent surveys to sample all sizes and age classes to develop more reliable catch-at-age and CPUE. (SR 88 (high))

- Expand sampling to cover the entire range of the southern stock over a longer time period. (2011 SEDAR(high))

NP

- Conduct at sea sex sampling to determine trend of sex change timing and assess the potential influence of population size on sex switching. *(2) (2011 SARC)

Modeling / Quantitative Priorities

High

- Investigate the effect of sex transition rates, sex ratio, and differential M by sex on the calculations of SSB per recruit and eggs per recruit. (SR 88 (high))

Moderate

- Explore alternative assessment models, including non-age based alternatives. (SR 88 (med.))

NP

- Continue development of a standardized method for calculating incomplete weight data. (2011 SEDAR)

Life History, Biological, and Habitat Priorities

High

- Analyze size or age specific spawning frequency and seasonality. (2011 SEDAR(high))

- Investigate the movement and migrations of black sea bass using otolith microchemistry, genetic studies, and expanding tagging studies. (2011 SEDAR(high))

- Conduct meta-analysis of patterns of M in protogynous fishes, specifically black sea bass. Determine sex specific mortality rates and growth rates. (2011 SARC/SR 88 (high))

- Determine the implications of removing large males on population dynamics through field studies or large scale mesocosm experiments. (2011 SARC/SR 88 (high))

- Conduct studies on the efficacy of recompression techniques such as venting to reduce discard mortality. (2011 SEDAR(high))

- Study the movement and mixing of larval and juvenile black sea bass in the southern stock. (2011 SEDAR(high))

Moderate

- Further delineate essential fish habitat (EFH), particularly in nursery areas. Further investigate possible gear impacts on EFH. (SR 88 (med.))

- Identify transport mechanisms or behaviors that transport early juvenile black sea bass into estuaries. (SR 88 (med.))

- Evaluate overwintering habitat of all black sea bass life stages. (SR 88 (med.))

- Evaluate feeding of black sea bass larvae and overwintering adults. (SR 88 (med.))

- Develop mariculture techniques. (SR 88 (med.))

Low

- Conduct studies determining the value of artificial reefs for increased production of black sea bass to improve potential yield estimates. (SR 88 (low))

NP

- Further develop the tagging model described by Rudershausen et al. (2010) to address the assumptions of the model. (2011 SEDAR)

- Continue ageing studies to provide a foundation for an age based assessment. Compare scale to otolith age estimates. (2011 SARC)

- Conduct ageing validation studies to examine the implications of sex change, as well as temperature and salinity changes associated with movement onshore and offshore, on ageing reliability. (2011 SARC)

- Continue genetics work to determine potential stock delineation in the northern range. (2011 SARC)

Management, Law Enforcement, and Socioeconomic Priorities

NP

- Evaluate the potential influence of non-compliance on high assumed M. (2011 SARC)

- Analyze logbook programs to determine current compliance and develop recommendations for improving compliance (i.e., increased education on the effect of not reporting accurately). (2011 SEDAR)

- Continue evaluation of methodology for mandatory reporting in the For-hire sector (e.g., Gulf MRIP Pilot). (2011 SEDAR)

Notes
(1) A pilot project is ongoing and proposals are being considered for funding to expand the program.
(2) The NEFSC and UMass-Dartmouth are working on trends in sex change timing for the northern stock and UNC-Wilmington is working on the same for the southern stock.

Black Sea Bass Research Needs Identified as Being Met

- ✓ A tagging program should be initiated through state fisheries agencies to estimate mortality independent of traditional methods. *Tagging study complete with peer reviewed results to be published in 2008, G. Shepherd, NMFS.*

BLUEFISH

Fishery-Dependent Priorities

High

- Evaluate amount and length frequency of discards from the commercial and recreational fisheries. (2011 FMP review, SP 88 (high))

- Collect size and age composition of the fisheries by gear type and statistical area.*(1) (2011 FMP review, SP 88 (high))

- Target commercial (especially in the northeast region) and recreational landings for biological data collection when possible.*(1) (2011 FMP review, SP 88 (high))

Fishery-Independent Priorities

High

- Increase sampling frequencies when bluefish are encountered, especially when medium size fish are encountered. (SR 88 (high))

- Evaluate fishery-independent surveys to determine if the state surveys can be combined or coordinated to yield broader temporal and spatial representation of the stock.*(2) (SP 88 (high))

- Initiate fisheries-dependent and independent sampling of offshore populations of bluefish during the winter months. (2011 FMP review, SP 88 (high))

Low

- Initiate a coastal surf-zone seine study to provide more complete indices of juvenile abundance. (2011 FMP review, SR 88 (low))

Modeling / Quantitative Priorities

High

- Test the sensitivity of the bluefish assessment to assumptions concerning age varying M, level of age 0 discards, and selection patterns. (2011 FMP review, SP 88 (high))

- Evaluate measures of CPUE under different assumptions of effective effort to allow evaluation of sensitivity of results. (SP 88 (high))

Low

- Explore alternative methods for assessing bluefish, such as length based and modified DeLury models. (SR 88(low))

Life History, Biological, and Habitat Priorities

High

- Conduct research on oceanographic influences on bluefish recruitment, including information on migratory pathways of larval bluefish. (SR 88 (high))

Moderate

- Study tag mortality and retention rates for American Littoral Society dorsal loop and other tags used for bluefish. (2011 FMP review, SR 88 (med))

- Age any archived age data for bluefish and use the data to supplement North Carolina age keys*(3). (2011 FMP review, SR 88 (med))

- Conduct studies on interactive effects of pH, other environmental variables, and contaminants on various biological and sociological parameters such as reproductive capability, survival, genetic changes, and suitability for human consumption. (2011 FMP review, SR 88 (med))

- Initiate research on species interactions and predator-prey relationships. (2011 FMP review, SR 88 (med))

Low

- Continue work on catch and release mortality. (2011 FMP review, SR 88 (low))

NP

- Conduct research to determine the timing of sexual maturity and fecundity of bluefish. (2011 FMP review).

Footnotes

*(1) Perhaps this should continue and remain a priority (e.g., Robillard et al. (2008) have data on 36 fish in 2003 from the southernmost extent of range, predominantly from the recreational fishery; analogously, Robillard et al. (2008) report that data from North Carolina were primarily from commercial gillnet fishers in 2002 and 2003).

*(2) SARC-41. 2005. 41st Chair's Report from the Northeast Regional Stock Assessment Workshop (SAW-41) Stock Assessment Review Committee (SARC) Meeting, Northeast

Fisheries Science Center, National Marine Fisheries Service, Woods Hole, Massachusetts, June 6-9, 2005.
*(3) North Carolina is currently ageing a backlog of bluefish otoliths under an ASMFC grant and anticipates completion of backlog ageing by the end of 2012.

Bluefish Research Needs Identified as Being Met

- ✓ Complete a scale-otolith age comparison study. Robillard, E., et al. 2008. Age-validation and growth of bluefish (*Pomatomus saltatrix*) along the East Coast of the United States. Fish. Res.doi:10.1016/j.fishres.2008.07.012
- ✓ Conduct research to determine the timing of sexual maturity and fecundity of bluefish. Robillard, E. et al. Reproductive biology of bluefish (*Pomatomus saltatrix*) along the East Coast of the United States. Fish. Res. 90 (2008) 198-208.

COASTAL SHARKS*

Fishery-Dependent Priorities

High

- Continue to acquire better species specific landings information on number of species, by weight, from dealers. (SR 88 (high))

- Initiate or expand dockside sampling for sharks to verify landings information and species composition. (SR 88 (high))

Moderate

- The Atlantic menhaden fishery data should be examined to determine shark bycatch estimates, if available. (SR 88 (med.))

- Conduct additional length sampling and age composition collection to improve information for developing selectivities. (SR 88 (med.))

Low

- Biological data should be collected on the illegal Mexican shark catch confiscated in US waters, including species, sex, length, gear, and effort. One central electronic database for biological and gear data should be created to keep information regarding the confiscated sharks and vessels. Scientists should help the Coast Guard create the database and teach the agents how to identify the species and gear information. (SR 88 (low))

NP

- Shrimp trawl observer coverage should be expanded to 2 to 5% of total effort, particularly during periods of regulatory or gear changes. The observer coverage program should strive for even spatial coverage (particularly adding more south Atlantic coverage), randomness in vessel selection and full identification of elasmobranch species (continuing on from the 2009 Bycatch Characterization Protocol). (2011 SEDAR)

- Increase research on post-release survivorship of all shark species by gear type. (2011 SEDAR)

Fishery-Independent Priorities

Moderate

- Develop a fishery-independent porbeagle shark survey to provide additional size composition and catch rate data to calculate an index of abundance. (SR 88 (med.))

NP

- Develop a stock wide fishery-independent monitoring program for dusky sharks that includes annual samples of length and age frequencies. (2011 SEDAR)

- Obtain more vertebral samples to age the smallest and largest segments of the sandbar shark stock. More generally, implement a systematic sampling program that gathers vertebral samples for annual ageing to allow tracking the age distribution of the catch as well as updating of age-length keys. (2011 SEDAR)

Modeling / Quantitative Priorities

Moderate

- Develop empirically based estimates of natural mortality. (SR 88 (med.), 2011 SEDAR)

NP

- Explore alternative approaches to age-length keys for estimating age from length. (2011 SEDAR)

- Continue work on reconstruction of historical catches to support the assumptions about when shark stocks are at virgin biomass. Alternatively, explore modeling approaches that do not require an assumption that the population is at virgin level at some point in time. (2011 SEDAR)

- Improve estimates of removals by identifying and incorporating the sources of uncertainty (species misidentification, non-reporting). (SEDAR 2011)

- Quantify the uncertainty in time series of catch data. (2011 SEDAR)

- Perform exploratory analyses with CPUE indices to identify indices that contribute the most information on stock trends. (2011 SEDAR)

- Conduct sensitivity analyses to determine if discard survival estimates have a significant impact on the estimated status of the dusky and blacknose shark stocks in relation to MSY reference points. (2011 SEDAR)

- Conduct simulation tests (management strategy evaluation) to assess the performance of alternative assessment methods (including the catch-free model, ASPM, ASPIC, SS, or stock

specific models), recruitment parameterizations, harvest control rules, assessment frequency and data collection. (2011 SEDAR)

- Develop a two sex model for more direct estimation of the dusky and blacknose shark spawning stocks. (2011 SEDAR)

- Explore alternative modeling approaches in the presence of uncertain reproductive information that model reproduction as a function of the number of mature females. Integrate uncertainty in the reproductive frequency, fecundity, and pup-survival into a single parameter (the slope at the origin of the stock-recruit function) and incorporate this uncertainty via priors on the parameter. (2011 SEDAR)

- Develop a set of indicators (age-structure, total mortality estimates from catch curves, changes in abundance indices values) to determine whether dusky shark stock status has changed sufficiently to warrant a full assessment. (2011 SEDAR)

Life History, Biological, and Habitat Priorities

High

- Re-evaluate finetooth life history in the Atlantic Ocean in order to validate fecundity and reproductive periodicity. (SR 88 (high))

- Develop and conduct tagging studies on dusky and blacknose stock structure with increased international collaboration (e.g., Mexico) to ensure wider distribution and returns of tags. Expand research efforts directed towards tagging of individuals in south Florida and Texas/Mexico border to get better data discerning potential stock mixing. (2011 SEDAR), SR 88 (high))

- Identify EFH and nursery areas for shark species found along the Atlantic coast of the US. (SR 88 (high))

- Determine bonnethead life history in Atlantic Ocean, spanning the range of the stock. (SR 88 (high))

Moderate

- Conduct additional life history research on sandbar sharks to supplement or replace the available data from the mid 1990's. (SR 88 (med.))

- Continue life history studies for all species of the shark complex to allow for additional species specific assessments. Particularly, natural mortality, age, fecundity, and reproductive frequency. Update age, growth, and reproductive studies of blacknose sharks, with emphasis on smaller individuals in the Atlantic and larger individuals in the Gulf of Mexico. (2011 SEDAR, SR 88 (med.)))

- Coordinate a biological study for Atlantic sharpnose so that samples are made *at least* monthly, and, within each month, samples would be made consistently at distinct geographic locations. For example, sampling locations would be defined in the northern Gulf, west coast

of Florida, the Florida Keys (where temperature is expected to be fairly constant over all seasons), and also several locations in the South Atlantic, including the east coast of Florida, Georgia, South Carolina, and North Carolina. This same sampling design could be applied to all small coastal sharks. (SR 88 (med.))

- Population level genetic studies are needed that could lend support to arguments for stock discriminations using new loci and/or methodology that has increased levels of sensitivity. (SR 88 (med.), 2011 SEDAR)

Low

- Determine reproduction biology for finetooth in the Gulf of Mexico. (SR 88 (low))

NP

- Examine female sharks during the spawning periods to determine the proportion of spawning females. *(1) (2011 SEDAR)

- Determine what is missing in terms of experimental design and/or data analysis to arrive at incontrovertible (to the extent that it may be scientifically possible) conclusions on the reproductive periodicity of the sandbar shark stock. (2011 SEDAR)

Management, Law Enforcement, and Socioeconomic Priorities

High

- Conduct species specific assessments for all shark species, with a priority for smooth dogfish. (SR 88 (high))

Footnote

* Work with NMFS on all priorities to ensure no duplication of efforts.

*(1) Biological information indicates that females of some shark species spawn less often then annually.

HORSESHOE CRAB

Fishery-Dependent Priorities

Moderate

- Improve measures to characterize landings and bycatch in the commercial fisheries by life stage. (SR 88 (med.))

- Estimate fishing discard numbers and associated mortality rates. (SR 88 (med.))

- Investigate supplemental bait and alternative trap designs to reduce the commercial fisheries need for horseshoe crabs. (SR 88 (med.))

NP

- Characterize the proportion of states' landings that comprise crabs of Delaware Bay origin. This can be done through a directed tag/release study, genetics/microchemistry study, or both. (2009 ASMFC Ex.)

Fishery-Independent Priorities

High

- Expand or implement fishery-independent surveys (e.g., spawning, benthic trawl, tagging) to target horseshoe crabs throughout their full range including estuaries. Highest priority should be given to implementing directed surveys in the New England and New York regions. (2009 ASMFC Ex., SR 88 (high))

- Estimate catchability for gear used in benthic trawl surveys and determine effect of size, sex, substrate, topography, timing, and temperature. (SR 88(high))

- Investigate factors (habitat, harvest, sampling methods, etc.) that might be causing the large discrepancies between Delaware and New Jersey in egg survey numbers. (SR 88(high))

Moderate

- Ground truth sub-sampling method used in Delaware Bay spawning survey for calibration to the "population" scale. (SR 88 (med.))

NP

- Estimate the proportion of the Delaware Bay population that is available in time and space within existing VT benthic trawl survey area. Estimate the selectivity of gear used in the survey. These estimations should take into account age class (i.e., primiparous, multiparous). (2009 ASMFC Ex.)

Modeling / Quantitative Priorities

High

- Estimate age/size specific survival of all life stages (e.g., age 0 to adult) and growth rate by instar within Delaware Bay. (2009 ASMFC Ex., SR 88 (high))

- Estimate size specific fecundity of Delaware Bay females. (SR 88(high))

- Model relationship between egg availability and spawning biomass/abundance. (SR 88(high))

Moderate

- Continue to conduct additional stock assessments and determine F. Use these data to develop a more reliable sustainable F. (SR 88 (med.))

- Estimate mortality from the entire biomedical collection process, from capture to post-return. (SR 88 (med.))

NP

- Further develop catch-survey analysis and apply assessment modeling beyond the Delaware Bay region. (2009 ASMFC Ex.)

Life History, Biological, and Habitat Priorities

High

- Assess horseshoe crab prey availability and determine whether horseshoe crab population growth will be/is limited by prey availability. (SR 88(high))

- Conduct risk assessment for the effect of oil spill (timing, location, and amount) on horseshoe crab and shorebird populations and determine best practices to reduce risk. (SR 88 (high))

Moderate

- Evaluate the impacts of beach nourishment projects on horseshoe crab populations. (SR 88 (med.))

- Characterize essential horseshoe crab habitat, other than spawning habitat, in different regions. (SR 88 (med.))

- Further evaluate life table information including sex ratio and population age structure. (SR 88 (med.))

- Estimate the proportion of sub-tidal spawning and determine if this affects spawning success (i.e., egg survivability). (SR 88 (med.))

- Conduct tagging studies and analyze tagging data to identify costal populations, population abundance, mortality rates, migration, and other movements. (SR 88 (med.))

- Characterize abundance and size structure of juveniles coast wide as indicators of recruitment to adulthood. (SR 88 (med.))

- Evaluate the effect of mosquito control chemicals on horseshoe crab populations. (SR 88 (med.))

- Evaluate the importance of horseshoe crabs to other marine resources such as sea turtles. (SR 88 (med.))

Notes
Several priority research needs are currently being addressed through the following surveys:
Delaware Bay spawning beach survey:
a) Determine sampling frame or list of beaches in the Bay with a nonzero probability of being sampled in a given year.
b) Determine how many beaches need to be surveyed on how many days to meet survey objectives.
c) Determine whether subsampling effort (no. of quadrats per beach) was adequate.
d) Consider a survey design that includes both fixed and random beaches.
Delaware Bay egg count survey:
a) Set primary objective of egg count surveys to be shorebird food availability and focus on density of eggs at the surface (< 5cm).
b) Determine survey frequency (i.e., survey eggs annually, every 3 years, every 5 years, or other?).
c) Determine where, along the beach profile, eggs should be sampled.
d) Determine sample size for sampling eggs on a beach.
e) Determine the relationship between spawning activity and density of eggs at the surface (<5cm). Is there a threshold of spawning activity below which eggs remain buried and unavailable to shorebirds?
Offshore benthic survey:
a) Design comparative surveys or experiments to determine gear efficiencies.

Horseshoe Crab Research Needs Identified as Being Met

- ✓ Evaluate the effectiveness of currently used benthic sampling gear for stock assessment (Qualitative evaluation completed through 2006 peer review)
- ✓ Determine beach fidelity by horseshoe crabs to determine habitat use.
- ✓ Develop a YOY or age 1 recruitment index from the Delaware 16-foot trawl survey.
- ✓ Conduct economic studies to determine the value of the commercial fishery and the impact of regulatory management. Such economic studies should also include an assessment of economic impacts on other fisheries as they relate to horseshoe crabs.

NORTHERN SHRIMP

Fishery-Dependent Priorities

High

- Better characterize shrimp discards in the shrimp and other small-mesh (i.e., herring and whiting) fisheries to provide more accurate estimates of shrimp removals for modeling. (2009 Amd. 2 ISFMP, SR 88 (high))

- Continue to quantify the magnitude of bycatch by species, area, and season and take steps necessary to limit negative impacts. (2009 Amd. 2 ISFMP, SR 88 (high))

- Conduct ground truthing of all the data gathered via Federal and state databases. Conduct face-to-face interviews of randomly sampled participants in all sectors of the fishery to address and resolve inaccuracies. (2009 Amd. 2 ISFMP, SR 88 (high))

- Improve separator and excluder devices to reduce bycatch and discard of non-targeted species. Explore gear modifications, such as larger mesh, to minimize shrimp bycatch in finfish trawl fisheries.*(1) (2009 Amd. 2 ISFMP, SR 88 (high))

Moderate

- Determine the short and long-term effects of mobile fishing gear on shrimp habitat. *(2) (2009 Amd. 2 ISFMP, SR 88 (med.))

Low

- Increase sampling of commercial catches, ensuring good allocation of samples among ports and months, to provide better estimates of size composition.*(3) (2009 Amd. 2 ISFMP, SR 88 (low))

Moderate

- Evaluate vulnerability of shrimp to various fishing gear. (SR 88 (med.))

- Recover and convert older port sampling data to useable database to make data available for future queries on fishing locations, catch rates, size distributions, sex stage and timing of egg hatch, other shrimp species, etc. (SR 88 (med.))

Fishery-Independent Priorities

High

- Examine several survey issues: recalculate fall survey indices for shrimp, eliminating the nighttime tows; verify that summer survey tow bottom tending times have been consistent; investigate survey design for optimal number and stratification of tows; and explore ways to quantify age 1 and younger shrimp to obtain more accurate survey indices for model estimates of F and B and earlier estimates of future recruitment. (SR 88 (high))

Moderate

- Continue sea sampling efforts. (SR 88 (med.))

Modeling / Quantitative Priorities

High

- Continue to examine values of M. Revisit older work that established M=0.25 (Rinaldo, Clark). Estimate M from year-sex-stage-class ratio data from surveys. Examine impacts of disease and variation of age over time, predation data, and other environmental factors. Investigate possible annual variation in M. This would provide a better understanding of the ecological role of northern shrimp and more accurate model estimates of F and B. (2009 Amd. 2 ISFMP, SR 88 (high))

- Continue research to refine annual estimates of consumption by predators to obtain annual estimates of *M* that would be more realistic than assuming constant *M*, for use in models that include *M* explicitly. Alternatively, consumption estimates could be used in production models as annual removals similar to fishery removals. (2009 Amd. 2 ISFMP, SR 88 (high))

- Investigate power analysis of estimates of mean weight from port sampling to optimize sample design. (SR 88 (high))

- Explore the stock-recruitment relationship and the impact of environmental factors on recruitment. Consider impacts of climate change. This would provide a better understanding of natural population fluctuations and better modeling of population dynamics. (2009 Amd. 2 ISFMP, SR 88 (high))

Moderate

- Study the possibility of using a more detailed assessment model, such as the CAA model used for Atlantic sea scallop. Use of a model with a more detailed treatment of northern shrimp population dynamics could increase accuracy and precision of assessment results. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Evaluate appropriate biological reference points and define sustainable harvest levels. The potential for improving estimates of mortality, abundance, and biomass from historical fishery and survey data from the 1960's should be investigated for further guidance on appropriate biological reference points. (SR 88 (med.))

- Explore spatial, depth, and/or temperature influences on survey catchability to contribute to better standardization of the survey abundance index. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Examine environmental effects through development of a surplus production model that includes effects of environmental variation on per capita production or carrying capacity. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Expand the time series of stock and recruitment data using catchability estimates from the production model. (SR 88 (med.))

- The CSA model requires a parameter that is the ratio of catchabilities for the two age or size classes. Sensitivity analysis on the values used would contribute to a better understanding of model stability. A thorough evaluation of possible methods for better estimating this parameter could reduce uncertainty in the assessment. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Continue examination of methods for age determination from length and ontogenetic stage information to develop the possibility of using age based assessment methods. (SR 88 (med.))

- Develop a time series of standardized effort to corroborate patterns of estimated F. (SR 88 (med.))

- Conduct research on annual variation of size-at-age to increase precision of the assessment. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Develop a bioeconomic model to study the interactions between four variables: movements of shrimp, catchability of shrimp, days fished, and market price. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Develop an economic-management model to determine the most profitable times to fish, how harvest timing affects markets, and how the market affects the timing of harvesting. (2009 Amd. 2 ISFMP, SR 88 (med.))

Life History, Biological, and Habitat Priorities
High
- Evaluate larval and adult survival and growth, including frequency of molting and variation in growth rates, as a function of environmental factors and population density. (SR 88 (high/med.))

- Study the effects of large-scale climatic events (i.e., North Atlantic Oscillation) on the cold water refuges for shrimp in the Gulf of Maine. (2009 Amd. 2 ISFMP, SR 88 (high))

Moderate
- Study specific habitat requirements and develop habitat maps for all life history stages. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Evaluate effects of habitat loss/degradation on northern shrimp. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Identify migration routes of immature males offshore and ovigerous females inshore. (2009 Amd. 2 ISFMP, SR 88 (med.))

- Evaluate maturation, fecundity, and lifetime spawning potential. Estimates of fecundity at length should be updated and the potential for annual variability should be explored. (SR 88 (med.))

- Investigate changes in transition and maturation as a function of stock size and temperature.*(5) (SR 88 (med.))

- Evaluate distribution of larval, juvenile, and adult shrimp. Evaluate migration and local movements.*(4) (2009 Amd. 2 ISFMP, SR 88 (med.))

- Evaluate competition and predator-prey relationships between species. (SR 88 (med.))

Management, Law Enforcement, and Socioeconomic Priorities
High

- Characterize demographics of the fishing fleet by area and season. Perform comparative analysis of fishing practices between areas. (SR 88 (high))

- Develop an understanding of product flow and utilization through the marketplace. Identify performance indicators for various sectors of the shrimp industry. (SR 88 (high))

- Explore new markets for Gulf of Maine shrimp.*(6) (SR 88 (high))

- Develop a framework to aid evaluation of the impact of limited entry proposals on the Maine fishing industry.*(7) (SR 88 (high))

- Develop a broad-based and detailed socioeconomic analysis and description of the structure, operations, markets, revenues, and expenditures of the northern shrimp fishery itself and in relation to other commercial fisheries in northern New England. (2009 Amd. 2 ISFMP, SR 88 (high))

- Determine the relative power relationships between the harvesting and processing sector and the larger markets for shrimp and shrimp products. Identify significant variables driving market prices and how their dynamic interactions result in the observed intra-annual and inter-annual fluctuations in market price for northern shrimp. (2009 Amd. 2 ISFMP, SR 88 (high))

Moderate

- Target and threshold reference points for northern shrimp are set equal to one another at F = 0.22/yr. Using a buffer of zero between target and threshold reduces the relevance of reference points to management. Specifically, the distinction between desirable exploitation rates and those that indicate overfishing is blurred. The SARC recommends dialogue with managers and industry on this matter, as well as research to illustrate whether separating threshold from target would allow more stable or robust management techniques. When a common agreement exists about the function of each reference point, assessment scientists can calculate values to best serve each function (2009 Amd. 2 ISFMP, SR 88 (med.))

- Perform cost-benefit analyses to evaluate management measures. (SR 88 (med.))

Footnotes
*(3) It would be useful to first analyze the existing sampling protocol, to determine whether more or less sampling is necessary, and whether existing sampling is representative.
*(4) Some migration work has been done by Schick et al. 2006 NEC
*(2) Some work has been done by Wieland 2004, 2005
*(5) Short term effects have been studied by A. Simpson and L. Watling, 2006.
*(1) Some work has been done by Schick and He.
*(6) Maine Fishermen's Forum panel discussions, 2006 and 2007
*(7) Maine Coastal Fishery Research Priorities, 2001, online at http://www.maine.gov/dmr/research/table_of_contents.htm, and Maine Fishermen's Forum panel discussion, 2007

Notes
In 2008, the greatest problems facing the Gulf of Maine shrimp industry were not a lack of research on stock dynamics, assessment methods, or management practices; they were high fuel prices and poor shrimp prices. Government research efforts should target energy policy and the development of markets, as well as good fishery management.

Sea sampling effort to date has probably identified adequately the catch and bycatch in the shrimp fishery in the Gulf of Maine under current gear and season constraints. Until changes are made in gear and season, sea sampling may remain minimal. Research to improve on excluder devices to reduce bycatch is still a reasonable investment in that bycatch of small whiting and small flatfish is still a problem. Bycatch by species, area and season has been adequately quantified as long as the fishing season and gear remain generally the same. Limiting negative impacts is still a fairly important area of research focus.

Dunham and Muller at the University of Maine conducted an economic study of the shrimp fishery including the characterization of demographics of the fishing fleet by area and season in 1976. This study should be updated.

Some recent work has been done on the relative distribution of shrimp and juvenile groundfish along the Maine coast. Little is known of the distribution and/or life history of the juvenile stage of *P. borealis*, therefore the age structure of the population is less certain.

Migration of *P. borealis* is known to occur to a greater extent in the Gulf of Maine than anywhere else in the world. Several aspects of this migration remain an enigma.

RED DRUM

Fishery-Dependent Priorities

High

- Conduct studies and collect time series data on discard mortality from varying commercial and recreational gears in directed and non-directed fisheries. Continue and expand observer coverage (5-10%) across all gear types in commercial fisheries to characterize discards. Evaluate the effect of slot limit management on regulatory discards. Evaluate effects of water temperature, depth of capture, and other factors on vulnerability to gear and discard mortality. (2009 SEDAR, SR 88 (high))

Moderate

- Improve CPUE estimates and fishery-dependent biological sampling. Increase efforts to intercept nighttime fisheries for red drum by the MRIP.*(1) (SR 88 (med.))

- Develop a more reliable estimate of natural and fishing mortality through directed sampling of the adult population. (SR 88 (med.))

NP

- Expand biostatistical sampling (increased otolith collection) of commercial fisheries specifically designed to characterize the age/size composition of removals. (2009 SEDAR)

- Evaluate the statistical design of volunteer logbook programs to determine if inclusion of volunteer logbook length data would improve stock assessments. (2009 SEDAR)

Fishery-Independent Priorities

High

- Conduct fishery-independent sampling of sub-adult and adult red drum (age 4 and older) in each state from Virginia to Florida. (2009 SEDAR, SR 88 (high))

NP

- Develop age based estimates of abundance based on survey specific age-length keys. (2009 SEDAR)

- Study the current survey program to identify gaps in current activities and potential expansion or refocusing of current surveys to better inform stock assessment. (2009 SEDAR)

Modeling / Quantitative Priorities

High

- Determine escapement to the spawning population, develop an index of recruitment to age 1, and develop an estimate of adult red drum biomass. (2009 SEDAR, SR 88 (high))

- Quantify relationships between red drum production and habitat. (SR 88 (high))

Moderate

- Evaluate new stock assessment techniques as alternatives to age-structured models. Conduct yield modeling on red drum. (SR 88 (med.))

NP

- Determine if effective proportion-at-age sample size is appropriate by comparing to the effective sample size calculated in the AMDB implementation of the model using the method described by McAllister and Ianelli (1997). (2009 SEDAR)

- Explore possible inconsistencies among the various data sets that contribute to the objective function of the assessment model by plotting the likelihood profiles for each component across the ranges of feasible values for the parameters that represent the major axes of uncertainty. By examining the resulting plots, it is possible to identify the values of the parameters that minimize the negative log-likelihood of the different components and thereby identify those parameters that most influence the values of the parameter estimates.

Identification of inconsistencies among the data sets provides a focus for re-assessing the extent to which inconsistent data sets are representative of the variables that they are intended to measure. (2009 SEDAR)

- Convergence of the assessment models for the base, sensitivity, and retrospective runs should be confirmed by "jittering" the initial parameter values and re-fitting the model a number of times (e.g., 100) then comparing the resulting parameter estimates and values of the objective function (e.g., Methot, 2007). Exploration of the consequences of "jittering" may also reveal whether the model converges to a region of parameter space in which the Hessian is positive definite, noting that, in several of the retrospective runs, the Hessian was found to be non-positive definite. (2009 SEDAR)

- Highly-correlated parameters indicate that the parameter estimates to which the model has converged are likely not to be unique, and that the model may be over-parameterized. In future stock assessments, the parameter correlation matrix should be explored. (2009 SEDAR)

- Explore the use of estimates of F directly from tagging data (i.e., northern stock) as the basis for stock assessment and guidance for fisheries management. Current stock assessments are undertaken every five years or so and involve the collection and synthesis of a wide array of data. The tagging program, as long as it is designed appropriately, can directly provide estimates of F at a higher frequency than the current SCA formulations. It also has the benefit of having wide fishery visibility and support. Through a simulation exercise, such as MSE, the efficacy of using the tagging-derived F estimates between applications of the SCA assessment could be explored. The use of the tagging information directly to inform management decision rules could also be investigated. (2009 SEDAR)

- Explore iterative re-weighting to better define weightings for the contribution of each data set similar to methods by DeOliveira et al. (2007). (2009 SEDAR)

- Explore the use of constraints on the age 4+ abundance to determine if model fits are improved. (2009 SEDAR)

- Develop assessment models that fit modeled size frequencies based on age based population dynamics to the size frequency observations. This would facilitate use of size frequency data when data for age-length keys are too sparse to reliably derive age composition. (2009 SEDAR)

Life History, Biological, and Habitat Priorities
High

- Continue tagging studies to determine stock identity, inshore/offshore migration patterns, abundance, and mortality estimation. Consider State-Space methods similar to those applied to New England groundfish stocks (Miller and Andersen, 2008) to avoid confounded stock parameter estimates. Integrate tagging data in assessment models. (2009 SEDAR, SR 88 (high))

Moderate

- Determine methods for restoring red drum habitat and/or improving existing environmental conditions that adversely affect red drum production. (SR 88 (med.))

- Refine maturity schedules for northern and southern stocks. Conduct studies on size, age, and spatial specific fecundity. (2009 SEDAR, SR 88 (med.))

- Identify spawning areas and abiotic components of these areas through the entire range so these areas can be protected from degradation and/or destruction. Determine the impacts of dredging and beach re-nourishment on red drum spawning and early life history stages. Identify the effects of water quality degradation on the survival of red drum eggs, larvae, post-larvae, and juveniles. (SR 88 (med.))

- Assess the efficacy of using cultured red drum to restore native stocks along the Atlantic coast, including cost-benefit analysis. (SR 88 (med.))

Low

- Determine habitat preferences, environmental conditions, growth rates, and food habitats of larval and juvenile red drum throughout the species range along the Atlantic coast. Assess the effects of environmental factors on stock density. (SR 88 (low))

- Document and characterize schooling behavior for Atlantic coast red drum. (SR 88 (low))

- Investigate the potential for estuarine reserves to increase the escapement rate of red drum along the Atlantic coast. (SR 88 (low))

NP

- Identify juvenile and adult habitat requirements and loss rates for future management planning. (2009 SEDAR)

- Continue collaborative aging efforts, such as the October 2008 red drum ageing workshop. (2009 SEDAR)

- Conduct otolith microchemistry studies to determine the life stage linking estuarine and offshore red drum and/or regional stock differentiation. (2009 SEDAR)

Management, Law Enforcement, and Socioeconomic Priorities

Moderate

- Collect socioeconomic data, possibly by add-ons to the MRIP or other methods, to determine economic value of Atlantic coast recreational red drum fishery.*(1) (SR 88 (med.))

Footnotes

*(1) MRFSS was replaced by MRIP.

SCUP

Fishery-Dependent Priorities

NP

- Continue to support and fund both the Rhode Island commercial fish trap survey and the Fishery-Independent Scup Survey of Hard Bottom Areas in Southern New England Waters. It is recommended that the fishery-independent survey be expanded to include waters further west and that scales be collected for aging. (SR 88)

- Increased and more representative sea and port sampling of the various fisheries in which scup are landed and discarded is needed to adequately characterize the length composition of both landings and discards. The current level of sampling, particularly of the discards, seriously impedes the development of analytic assessment and forecasts of catch and stock biomass for this stock. A pilot study to develop a sampling program to estimate discards should be implemented. Expanded age sampling of scup from commercial and recreational catches is required, with special emphasis on the acquisition of large specimens. *(1) (SR 88, 2008 NEFSC Data Poor Workshop)

- Commercial discard mortality had previously been assumed to be 100% for all gear types. Studies need to be conducted to better characterize the mortality of scup in different gear types to more accurately assess discard mortality. (SR 88, 2008 NEFSC Data Poor Workshop)

- Additional information on compliance with regulations (e.g., length limits) and hooking mortality is needed to interpret recreational discard data and confirm weightings used in stock assessment model. (SR 88, 2008 NEFSC Data Poor Workshop)

- Design an optimal sampling plan that would be considered for implementation by the fishery observer sampling, recreational, and commercial port sampling programs. For all sampling, these programs are designed for multi-species and are designed for optimal sampling of all species and not a single species. *(2) (SR 88)

Fishery-Independent Priorities

NP

- Current research trawl surveys are likely adequate to index the abundance of scup at ages 0 to 2. However, the implementation of new standardized research surveys that focus on accurately indexing the abundance of older scup (ages 3 and older) would likely improve the accuracy of the stock assessment. (2008 NEFSC Data Poor Workshop)

- Surveys should be evaluated to test the assumption of equal catchability-at-age in projections (i.e., through forward projection methods). (SR 88)

Modeling / Quantitative Priorities

NP

- Explore alternative biomass indices for development of biomass proxies for reference point determination based on multiple survey indices. (SR 88)

- Evaluate the current biomass reference point and consider alternative proxy reference points such as B_{MAX} (the relative biomass associated with F_{MAX}). (SR 88)

- Continue exploration of relative biomass and relative exploitation calculations based on CPUE data from the recreational private boat fishery. (SR 88)

- Explore other approaches for analyzing survey data, including bootstrap resampling methods to generate approximate confidence intervals around the survey index point estimates. (SR 88)

Life History, Biological, and Habitat Priorities

NP

- Conduct biological studies to investigate factors affecting annual availability of scup to research surveys and maturity schedules. (SR 88)

- Age backlog of samples. (NMFS, MA) (SR 88)

- Conduct an ageing comparison workshop to (1) compare otoliths and scales and (2) compare state age-length keys. (SR 88)

Management, Law Enforcement, and Socioeconomic Priorities

NP

- Explore alternative decision support methodologies for updating TAL's directly from relative trends in abundance without relying on direct estimates of F. (SR 88)

- Evaluate indicators of potential changes in stock status that could provide signs to management of potential reductions of stock productivity in the future. (2008 NEFSC Data Poor Workshop)

- A MSE of alternative approaches to setting quotas would be helpful. (2008 NEFSC Data Poor Workshop)

Footnotes
*(1) Improved sampling intensity of landings and increased funding for the observer program since 2004 have improved discard sampling in the directed and bycatch fisheries for scup, but observer coverage still needs to be increased in the winter I offshore directed scup fishery and bycatch squid fishery.
*(2) A formal sampling design has been implemented in the at sea observer program (SBRM) and MRFSS has been replaced by MRIP.
*(3) This has been explored but no alternatives have been acceptable.

Scup Research Needs Identified as Being Met or in Progress

- ✓ The SARC discussed some of the reasons why the research recommendations from previous SARCs had not been adequately addressed. There is currently no mechanism for accountability, resulting in other research needs taking priority. It was suggested that summaries of research recommendations be forwarded to the NRCC for review and comment, followed by a feasibility analysis. At that point a list of priorities and perhaps assignments for research could be made. The SARC recommends that a working group be developed to assess what group would be best suited to address each research need. *This is now a TOR that must be responded to in each assessment.*
- ✓ In the absence of reliable estimates of the catch, consideration should be given to simple forward projection models that rely on trends from the survey indices in the absence of catch information. *35th SAW Consensus Summary 141 Done, Done in AIM resulted in no improvement over VPA because inconstancy between fishery dependent and independent data.*
- ✓ Investigate the statistical properties of the three commercial discard estimation approaches presented for consideration in future analyses. *In progress.*
- ✓ Quantify the percentage of commercial fishery trips that had discards, but no landings, and evaluate how such trips contribute to the total commercial fishery discard estimate. *In progress*

SPANISH MACKEREL

Fishery-Dependent Priorities

NP

- Address the issue of fish retained for bait (undersized) or used for food by crews. Determine how to incorporate in landings. (2008 SEDAR)

- Obtain more information on discard rates and discard mortality in recreational and commercial trolling fishery, commercial gillnet fishery, and shrimp trawl fishery. Allocate 5-10% observed coverage of commercial fisheries (directed and non-directed). Determine bycatch of Spanish mackerel in directed shrimp trawl fishery. (2008 SEDAR)

- Expand TIP sampling to better cover all statistical strata, particularly gillnet and cast net catches in Florida. (2008 SEDAR)

- Continue to evaluate weight and especially length-at-age relationships. Obtain adequate data to determine gutted to whole weight relationships. (2008 SEDAR)

Fishery-Independent Priorities

High

- Increase fishery-independent sampling to collect more biological information and more information on stock size. Consider aerial surveys similar to those used in Florida and collection of age samples on SEAMAP surveys. Expand on current methods to collect more adult and age 0 fish to ensure more accurate estimates of the von Bertalanffy growth parameter t0. (2008 SEDAR, SR 88 (high))

Low

- Delineate spawning areas and areas of larval abundance through temporal and spatial sampling. (SR 88 (low))

Modeling / Quantitative Priorities

High

- Provide better estimates of recruitment, M, F, and standing stock. Specific information should include an estimate of total amount caught and distribution of catch by area, season, and type of gear. (SR 88 (high))

- Develop methodology for predicting year class strength and determination of the relationship between larval abundance and subsequent year class strength. (SR 88 (high))

- Explore simulations on CPUE trends and determine impacts on VPA and assessment results. (SR 88 (high))

- Commission and member states should support and provide the identified data and input necessary to improve the SAFMC's SEDAR process. (SR 88 (high))

Moderate

- Conduct YPR analyses relative to alternative selective fishing patterns. (SR 88 (med.))

- Evaluate potential bias of the lack of appropriate stratification of the data used to generate age-length keys for Atlantic and Gulf Spanish mackerel. (SR 88 (med.))

- Evaluate CPUE indices related to standardization methods and management history, with emphasis on greater temporal and spatial resolution in estimates of CPUE. (SR 88 (med.))

- Investigate whether catchability varies as a function of fish density and/or environmental conditions. (2008 SEDAR, SR 88 (med.))

NP

- Investigate the possibility of using models that allow catchability to follow a random walk. (2008 SEDAR)

- Investigate alternative models that include the uncertainty in landings history. (2008 SEDAR)

- Continue research on the application of assessment and management models relative to dynamic species such as Spanish mackerel. (2008 SEDAR)

- Conduct research on estimating historical recreational catches. (2008 SEDAR)

Life History, Biological, and Habitat Priorities

Moderate

- Identify traditional Spanish mackerel migration routes. Investigate how temporal changes in migratory patterns and/or climatic/environmental changes may influence fishery-dependent and fishery-independent indices of abundance. Identify any potential relationship between migration of prey species (i.e., engraulids, clupeids, carangids) and migration of Spanish mackerel. (2008 SEDAR, SR 88 (med.))

NP

- Ages provided for future assessments should be advanced when appropriate (i.e., during months when annuli are being formed) so fish can be assigned to the correct year class. If advanced ages cannot be provided, data should include assessment of otolith edge type. Classifications schemes for edge type and quality of the otolith/section have been developed by the MARMAP program at SCDNR and are currently used by MARMAP and NMFS Beaufort. (2008 SEDAR)

- Collect and age more hard parts. Conduct inter-lab ageing structure exchanges and comparison workshops to standardize age readings. (2008 SEDAR)

- Determine the tradeoff with length versus age. (2008 SEDAR)

Management, Law Enforcement, and Socioeconomic Priorities

High

- Require timelier reporting of mid-Atlantic catches for quota monitoring. (SR 88 (high))

Low

- Collect socioeconomic data from Spanish mackerel fisheries through a MRIP add-on or other mechanism. (SR 88 (low))

- Implement ecosystem-based management and monitoring/research efforts necessary to support ecosystem-based management. (SR 88 (low))

SPINY DOGFISH

Fishery-Dependent Priorities

High

- Determine area, season, and gear specific discard mortality estimates coast wide in the recreational, commercial, and non-directed (bycatch) fisheries. *(1) (2009-2010 FMP review, SR 88 (high))

- Monitor the level of effort and harvest in other fisheries as a result of no directed fishery for spiny dogfish. (SR 88 (high))

- Characterize and quantify bycatch of spiny dogfish in other fisheries. (SR 88 (high))

- Increase observer trips to document the level of incidental capture of spiny dogfish during the spawning stock rebuilding period. (SR 88 (high))

Moderate

- Increase the biological sampling of dogfish in the commercial fishery and on research trawl surveys. Complete additional work on the survey database to recover and encode information on the sex composition prior to 1980. (2009-2010 FMP review, SR 88 (med.))

Low

- Further analyses of the commercial fishery is also warranted, especially with respect to the effects of gear types, mesh sizes, and market acceptability on the mean size of landed spiny dogfish. (SR 88 (low))

Fishery-Independent Priorities

Low

- Continue to analyze the effects of environmental conditions on survey catch rates. (2009-2010 FMP review, SR 88 (low))

NP

- Conduct experimental work on NEFSC trawl survey gear performance, with focus on video work to study the fish herding properties of the gear for species like dogfish and other demersal roundfish. (2009-2010 FMP review)

- Investigate the distribution of spiny dogfish beyond the depth range of current NEFSC trawl surveys, possibly using experimental research or supplemental surveys. (2009-2010 FMP review)

Modeling / Quantitative Priorities

High

- Continue work on the change-in-ratio estimators for mortality rates and suggest several options for analyses. (SR 88 (high))

NP

- Examine observer data to calculate a weighted average discard mortality rate based on an assumption that the rate increased with catch size. (2009-2010 FMP review)

Life History, Biological, and Habitat Priorities

High

- Conduct a coast wide tagging study to explore stock structure, migration, and mixing rates. (2010 TRAC, 2009-2010 FMP review, SR 88 (high))

- Standardize age determination along the entire East Coast. Conduct an ageing workshop for spiny dogfish, encouraging participation by NEFSC, NCDMF, Canada DFO, other interested agencies, academia, and other international investigators with an interest in dogfish ageing (US and Canada Pacific Coast, ICES). (2009-2010 FMP review, SR 88 (high))

Moderate

- Identify how spiny dogfish abundance and movement affect other organisms. (SR 88 (med))

Management, Law Enforcement, and Socioeconomic Priorities

Moderate

- Monitor the changes to the foreign export markets for spiny dogfish, and evaluate the potential to recover lost markets or expand existing ones. (SR 88 (med.))

Low

- Update on a regular basis the characterization of fishing communities involved in the spiny dogfish fishery, including the processing and harvesting sectors, based upon Hall-Arber et al. (2001) and McCay and Cieri (2000). (SR 88 (low))

- Characterize the value and demand for spiny dogfish in the biomedical industry on a state by state basis. (SR 88 (low))

- Characterize the spiny dogfish processing sector (SR 88 (low))

Footnotes

*(1) A discard mortality study in the North Carolina near-shore trawl and gillnet fisheries conducted by East Carolina University has been considered in previous stock assessments.

Spiny Dogfish Research Needs Identified as Being Met

- ✓ Genetic analysis of spiny dogfish to determine if more than one unit stock exists along the Northwest Atlantic. *Canadian researchers are working on this but have not published yet.*
- ✓ Update maturation and fecundity estimates by length class.
- ✓ Recover and encode information on the sex composition prior to 1980 from the survey database.
- ✓ Quantify effort directed on spiny dogfish in waters outside of the US. *Canada should have numbers available on this soon.*

SPOT

Fishery-Dependent Priorities

High

- Conduct 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. (2010 FMP review (high), SR 88 (high))

- Evaluate the effects of mandated BRDs on spot catch in those states with significant commercial harvests. (2010 FMP review (high), SR 88 (high))

- Improve spot catch and effort statistics from the commercial and recreational fisheries, along with size and age structure of the catch, in order to develop production models. (2010 FMP review (high), SR 88 (high))

- Determine the onshore versus offshore components of the spot fishery. (2010 FMP review (high), SR 88 (high))

Fishery-Independent Priorities

High

- Develop cooperative coast wide spot juvenile indices to clarify stock status. (2010 FMP review(high), SR 88 (high))

- Continue monitoring long-term changes in spot abundance, growth rates, and age structure. (2010 FMP review (high), SR 88 (high))

- Continue monitoring juvenile spot populations in major nursery areas. (2010 FMP review (high), SR 88 (high))

Modeling / Quantitative Priorities

High

- Develop fishery-dependent and fishery-independent size and sex specific relative abundance estimates. (2010 FMP review (high), SR 88 (high))

- Develop catch-at-age matrices for recreational and commercial fisheries. (2010 FMP review (high))

- Develop stock assessment analyses appropriate to current data. (2010 FMP review (high))

- Cooperatively develop a YPR analysis. (2010 FMP review (high), SR 88 (high))

Life History, Biological, and Habitat Priorities

High

- Conduct age validation studies. (2010 FMP review (high), SR 88 (high))

- Cooperatively develop criteria for ageing spot otoliths and scales. (2010 FMP review (high), SR 88 (high))

- Determine the effect that anthropogenic perturbations may be having on growth, survival, and recruitment. (2010 FMP review (high))

- Develop stock identification methods and investigate the degree of mixing between state stocks during the annual fall migration (tagging studies). (2010 FMP review (high), SR 88 (high))

SPOTTED SEATROUT

Fishery-Dependent Priorities

High

- Collect data on the size and age of spotted seatrout released alive by anglers and the size and age of commercial discards. (2010 FMP review (high), SR 88 (high))

- Increase observer coverage in states that have a commercial fishery for spotted seatrout. (2010 FMP review (high))

- Expand the MRIP to assure adequate data collection for catch and effort data, increase intercepts, and include state add-ons of social and economic data needs. (2010 FMP review (high), SR 88 (high))

Moderate

- Collection of commercial and recreational landings data should be continued and expanded. (SR 88 (med.))

- Improve precision of effort reporting through commercial trip ticket programs. (SR 88 (med.))

Fishery-Independent Priorities

High

- Develop state-specific juvenile abundance indices. (2010 FMP review (high))

- Initiate fishery-independent surveys of spotted seatrout. (SR 88 (high))

- Emphasis should be placed on collecting the necessary biological data to be able to conduct stock assessments and to assist in drafting fishery management plans. (SR 88 (high))

Modeling / Quantitative Priorities

High

- Utilize age structure analyses by sex in stock assessments. (SR 88 (high))

- Conduct state specific stock assessments to determine the status of stocks relative to the plan objective of maintaining a spawning potential of at least 20%. (2010 FMP review (high), SR 88 (high))

- Provide state specific batch fecundity estimates for use in stock assessments. (2010 FMP review (high))

Life History, Biological, and Habitat Priorities

High

- Identify essential habitat requirements. (2010 FMP review (high), SR 88 (med.))

- Evaluate effects of environmental factors on spawning frequency and stock density. (2010 FMP review (high), SR 88 (med.))

- Continue work to examine the stock structure of spotted seatrout on a regional basis, with particular emphasis on advanced tagging and molecular techniques. (2010 FMP review (high), SR 88 (high))

- Conduct telemetry tagging surveys to provide precise estimates of mortality attributed to winter kills. (2010 FMP review (high))

Management, Law Enforcement, and Socioeconomic Priorities

High

- Initiate collection of social and economic aspects of the spotted seatrout fishery. (2010 FMP review (high), SR 88 (med.))

Notes

Florida Department of Environmental Protection developed a spotted seatrout stock assessment in January 1995 that addressed by sex yield modeling, spawning potential ratios, use of fishery independent monitoring to tune virtual population models.

Commercial effort is collected through Florida's Marine Fisheries Information System (Trip Tickets).

Trip level landings data is collected through North Carolina's Trip Ticket Program.

The North Carolina Division of Marine Fisheries is currently reviewing an assessment of spotted seatrout as part of the state's first FMP for the species, due for completion in late 2008. A statistical catch-at-age model was used to determine the status of the NC spotted seatrout population.

SUMMER FLOUNDER

Fishery-Dependent Priorities

High

- Develop a program to annually sample the length and age frequency of summer flounder discards from the recreational fishery. (2008 SARC (high), SR 88 (high))

- Collect and evaluate information on the reporting accuracy of recreational discard estimates in the recreational fishery. (2008 SARC (high), SR 88 (high))

- Conduct more comprehensive collection of otoliths, for all components of the catch-at-age matrix, on a continuing basis for fish larger than 60 cm (~7 years). The collection of otoliths and the proportion at sex for all of the catch components could provide a better indicator of stock productivity. (2008 SARC (high), SR 88 (high))

- Develop a reference collection of summer flounder scales and otoliths to facilitate future quality control of summer flounder production ageing. In addition, a comparison study between scales and otoliths as ageing structures for summer flounder should be completed. *(1) (2008 SARC (high), SR 88 (high))

- Examine mesh selectivity patterns for a range of commonly used mesh sizes greater than the currently mandated sizes. (5.5 Diamond/6 inch square) (SR 88 (high))

- Continue to collect and analyze age-length samples and CPUE data from the commercial and recreational fisheries throughout the range of summer flounder. (SR 88 (high))

Moderate

- Research directed at evaluating the mesh exemption program should be continued, with increased sample sizes to allow reliable statistical testing of results. (SR 88 (med.))

- Use NEFSC fishery observer age-length keys for 1994 and later years (as they become available) to supplement NEFSC survey data in ageing the commercial fishery discard. (2008 SARC (med.), SR 88 (med.))

- Undertake research to determine hooking mortality on summer flounder by circle, kahle, and regular "J" hooks and make the results of work already completed available to the Management Board. (SR 88 (med))

- Collect data to determine the sex ratio for all of the catch components. (2008 SARC (med.), SR 88 (med.))

- Develop fish excluder devices to reduce bycatch of immature flatfish in fisheries that target species other than flounder. (SR 88 (med.))

Fishery-Independent Priorities

High

- Collect information on overall fecundity for the stock, both egg condition and production, as a better indicator of stock productivity. *(2) (2008 SARC (high))

- Continue fishery-independent surveys and expand existing surveys to capture all sizes and age classes in order to develop independent catch-at-age and CPUE. (SR 88 (high))

Modeling / Quantitative Priorities

High

- Investigate trends in sex ratios and mean lengths and weights of summer flounder in state agency and federal survey catches. (SR 88 (high))

Low

- Consider treating scallop closed areas as separate strata in calculations of summer flounder discards in the commercial fisheries. (2008 SARC (low), SR 88 (low))

- Examine the sensitivity of the summer flounder assessment to the various unit stock hypotheses and evaluate spatial aspects of the stock to facilitate sex and spatially explicit modeling of summer flounder. (2008 SARC (low), SR 88 (low))

- Determine the appropriate level for the steepness of the stock-recruit relationship and investigate how that influences the biological reference points. (2008 SARC (low), SR 88 (low))

- Evaluate potential changes in fishery selectivity relative to the spawning potential of the stock. Analysis should consider the potential influence of the recreational and commercial fisheries. (2008 SARC (low), SR 88 (low))

Life History, Biological, and Habitat Priorities

Moderate

- Develop stock identification methods via meristics, morphometrics, biochemical research, and tagging (particularly off Virginia and North Carolina). (SR 88 (med.))

Low

- Evaluate effects of dissolved oxygen and water current requirements for adult summer flounder and summer flounder eggs. (SR 88 (low))

- Evaluate the relationship between recruitment of summer flounder to nursery areas and Ekman transport or prevailing directions of water flow. (SR 88 (low))

- Examine male female ratio at age 0 and potential factors (e.g., environmental) that may influence determination of that ratio. (2008 SARC (low), SR 88 (low))

- Conduct the basic research necessary to develop land and pen culture techniques. (SR 88 (low))

- Conduct further research to examine the predator-prey interactions of summer flounder and other species, including food habitat studies, to better understand the influence of these other factors on the summer flounder population. (2008 SARC (low), SR 88 (low))

Management, Law Enforcement, and Socioeconomic Priorities
Moderate

- Consider use of MSE techniques to address the implications of harvest policies that incorporate consideration of retrospective patterns (see ICES Journal of Marine Science issue of May 2007). (2008 SARC (med.), SR 88 (med.))

- Conduct a detailed socioeconomic study of the summer flounder fisheries. (SR 88 (med))

Footnotes
*(1) The SDWG reported that an exchange of aging structures between NEFSC and NCDMF was completed and a report was reviewed by the 2007 SDWG, in response to a 2005 SAW 41 high priority Research Recommendation. The SDWG noted that while the Fall 2006 ageing exchange between NC-DMF and the NEFSC indicated that the current level of ageing consistency between NC and NEFSC is acceptable, there is a need to conduct and fund these exchanges more frequently, on a schedule consistent with benchmark assessments.
*(2) The SDWG noted that observed change in the sex ratio in NEFSC survey samples may result in the SSB estimates not translating as directly to egg production since there are more males proportionally in those older age categories. While these trends have not been examined in the state survey catches, these trends were examined in the NEFSC spring, autumn, and winter survey data. Additional work to examine and explain these trends in greater detail should be conducted.

TAUTOG

Fishery-Dependent Priorities
High

- Initiate biological sampling of the commercial catch for each gear type over the entire range of the stock (including weight, lengths, age, sex, and discards). (2010 FMP review, SR 88 (high))

- Increase collection of effort data for determining commercial and recreational CPUE. (2010 FMP review, SR 88 (high))

- Increase MRIP sampling levels to improve recreational catch estimates by state and mode. Current sampling levels are high during times of the year when more abundant and popular species are abundant in catches, but much lower than in early spring and late fall when tautog catches are more likely. (2010 FMP review, SR 88 (high))

NP

- Increased catch and discard length sampling from the commercial and recreational fishery for all states from Massachusetts through Virginia. (2010 FMP review)

Fishery-Independent Priorities

High

- Establish standardized state by state long-term fisheries-independent surveys to monitor tautog abundance and length-frequency distributions, and to develop YOY indices. (2010 FMP review, SR 88 (high))

Life History, Biological, and Habitat Priorities

Moderate

- Define the status (condition and extent) of optimum or suitable juvenile habitats and trends in specific areas important to the species. It is critical to protect these habitats or to stimulate restoration or enhancement, if required. (2010 FMP review, SR 88 (med.))

- Define the specific spawning and pre-spawning aggregating areas and wintering areas of juveniles and adults used by all major local populations, as well as the migration routes used by tautog to get to and from spawning and wintering areas and the criteria or times of use. This information is required to protect these areas from damage and overuse or excessive exploitation. (2010 FMP review, SR 88 (med.))

- Define larval diets and prey availability requirements. This information can be used as determinants of recruitment success and habitat function status. Information can also be used to support aquaculture ventures with this species. (2010 FMP review, SR 88 (med.))

- Define local and regional movement patterns and site fidelity in the southern part of the species range. This information may provide insights into questions of aggregation versus recruitment to artificial reef locations. More clarification is required on what the southern part of the range is and to clarify the need for local and regional assessment. (2010 FMP review, SR 88 (med.))

- Define the role of prey type and availability in local juvenile/adult population dynamics over the species range. This information can explain differences in local abundance, movements, growth, fecundity, etc. Conduct studies in areas where the availability of primary prey, such as blue mussels or crabs, is dependent on annual recruitment, the effect of prey recruitment variability as a factor in tautog movements (to find better prey fields), mortality (greater predation exposure when leaving shelter to forage open bottom), and relationship between

reef prey availability/quality on tautog condition/fecundity. (2010 FMP review, SR 88 (med.))

- Define the susceptibility of juveniles to coastal/anthropogenic contamination and resulting effects. This information can explain differences in local abundance, movements, growth, fecundity, and serve to support continued or increased regulation of the inputs of these contaminants and to assess potential damage. Since oil spills seem to be a too frequent coastal impact problem where juvenile tautog live, it may be helpful to conduct specific studies on effects of various fuel oils and typical exposure concentrations, at various seasonal temperatures and salinities. Studies should also be conducted to evaluate the effect of common piling treatment leachates and common antifouling paints on YOY tautog. The synergistic effects of leaked fuel, bilge water, treated pilings, and antifouling paints on tautog health should also be studied. (2010 FMP review, SR 88 (med.))

Low

- Define the source of offshore eggs and larvae (in situ or washed out coastal spawning). (2010 FMP review, SR 88 (low))

- Confirm that tautog, like cunner, hibernate in the winter, and in what areas and temperature thresholds, for how long, and if there are special habitat requirements during these times that should be protected or conserved from damage or disturbance. This information will aid in understanding behavior variability and harvest availability. (2010 FMP review, SR 88 (low))

Management, Law Enforcement, and Socioeconomic Priorities

NP

- Collect basic sociocultural data on tautog user groups including demographics, location, and aspects of fishing practices such as seasonality. (2010 FMP review)

Tautog Research Needs Identified as Being Met

- ✓ There is an ongoing effort to explore possible regional and local genetic differences (stock differentiation) and relate these to recruitment, growth, exploitation rates, and habitat differences. These differences can help support appropriate region-specific management strategies.
- ✓ There is an ongoing effort to determine pot and trap escape vent dimensions needed to release tautog over a range of sizes.
- ✓ Sample hard parts for annual ageing from the catches of recreational and commercial fisheries and fishery-independent surveys throughout the range of the stock. *Being conducted by all participating states.*

WEAKFISH

Fishery-Dependent Priorities

High

- 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 and further north. (2009 SARC(high))

- Continue studies on mesh size selectivity, particularly trawl fisheries.*(1) (2009 SARC(med.))

- Increase observer coverage to identify the magnitude of discards for all commercial gear types from both directed and non-directed fisheries. 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. (2009 SARC(high))

- Develop latitudinal, seasonal, and gear specific age length keys coast wide. Increase sample sizes for gear specific keys. (2009 SARC(high))

Moderate

- Continue studies on temperature, size, and depth specific recreational hook and release mortality rates, particularly catches from warm, deep waters. Investigate methods to increase survival of released fish. (2009 SARC(med.))

Low

- Determine the onshore versus offshore components of the weakfish fishery. (2009 SARC(low))

Fishery-Independent Priorities

High

- Conduct spatial and temporal analysis of the fishery-independent survey data. The analysis should assess the impact of the variability of the surveys in regards to gear, time of year, and geographic coverage of their (survey) use as stock indicators.*(2) (2009 SARC(high))

Modeling / Quantitative Priorities

High

- Investigate alternative age based models that allow error in catch-at-age estimates (e.g., SCA) and/or are less prone to retrospective patterns (e.g., extended survivor analysis). (2009 SARC(high))

- 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. (2009 SARC(high))

- 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. (2009 SARC(high))

- Analyze the spawner-recruit relationship and examine the effects of the relationship between adult stock size and environmental factors on year class strength.*(3) (2009 SARC(high))

Life History, Biological, and Habitat Priorities
High

- Develop a coast wide 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.*(4) (2009 SARC(high))

- Monitor weakfish diets over a broad regional and spatial scale. (2009 SARC(high))

Moderate

- Identify and delineate weakfish spawning habitat locations and environmental preferences to quantify spawning habitat. (2009 SARC(med.))

- Compile data on larval and juvenile distribution from existing databases to obtain preliminary indications of spawning and nursery habitat location and extant. (2009 SARC(med.))

- Examine geographical and temporal differences in growth rate (length and weight at age). (2009 SARC(med.))

Low

- Determine the impact of power plants and other water intakes on larval, post larval, and juvenile weakfish mortality in spawning and nursery areas. Calculate the resulting impact on adult stock size.* (5) (2009 SARC(low))

- Develop a coast wide tagging database. (SR 88 (low))

Management, Law Enforcement, and Socioeconomic Priorities
Moderate

- Assemble socioeconomic data as it becomes available from ACCSP. (2009 SARC(med.))

Low

- Define restrictions necessary for implementation of projects in spawning and over wintering areas and develop policies on limiting development projects seasonally or spatially. (2009 SARC(low))

Footnotes
*(1) Gillnet selectivity has been investigated by Swihart et al (2000). Information can also be obtained from the North Carolina Pamlico Sound Independent Gill Net Survey.
*(2) Research is ongoing by Dr. Yan Jiao of Virginia Tech University. See Winter et al. 2009.
*(3) Work is currently underway by the Weakfish Stock Assessment Subcommittee.
*(4) Otolith samples have been obtained by Old Dominion University, but funding has not been available for processing.
*(5) Data are available for power plants in the Delaware Bay area and North Carolina.

Weakfish Research Needs Identified as Being Met

- ✓ Conduct an age validation study. *An age validation study was completed by Lowerre-Barbieri et al. (1995). (2009 SARC)*
- ✓ Define reproductive biology of weakfish, including size at sexual maturity, maturity schedules, fecundity, and spawning periodicity. Continue research on female spawning patterns: What is the seasonal and geographical extent of "batch" spawning; do females exhibit spawning site fidelity? *This work has been completed by Nye et al 2008 and Lowerre-Barbieri et al 1996.*
- ✓ Update the scale – otolith comparison for weakfish

WINTER FLOUNDER

Coast Wide

Fishery-Dependent Priorities

High

- Increase the intensity of commercial fishery discard length sampling. (SR 88 (higher))

- Expand sea sampling to validate commercial discard estimates from VTR. (2011 SARC, SR 88 (high))

- Maintain or increase sampling levels and collect age information from MRIP samples. (SR 88 (high (SNE)/med (GOM)))

NP

- Investigate the feasibility of port samplers collecting otoliths in place of scales to mitigate under ageing larger fish. (2011 SARC)

Fishery-Independent Priorities

Low

- Evaluate the maturity-at-age of fish sampled in the NEFSC fall and winter surveys, as well as other inshore surveys (i.e., MEDMR, MADMF, NEAMAP, etc.).*(1) (SR 88 (lower))

NP

- Encourage support for Industry Based Surveys, which can provide valuable information on stock abundance, distribution, and catchability in research surveys that is independent of and supplemental to NMFS effort. (2011 SARC)

Modeling / Quantitative Priorities

Low

- Develop mortality estimates from the American Littoral Society tagging data, if feasible. (SR 88 (lower))

NP

- Explore use of a more complex Stock Synthesis model with small rates of migration between stocks. (2011 SARC)

- Revise the NEFSC assessment software to include the ability to model stock-recruit functions including environmental factors with errors/probabilities. (2011 SARC)

- Develop time series of winter flounder consumption by the major fish predators of winter flounder. (2011 SARC)

- Explore development of an index of winter flounder larval abundance based on MARMAP, GLOBEC, and other time series. (2011 SARC)

- Investigate the skipped spawning percentage for each stock and estimate inter-annual variation when sufficient data have been collected. (2011 SARC)

Life History, Biological, and Habitat Priorities

High

- Focus research on quantifying mortality associated with habitat loss and alteration, contamination by toxics, and power plant entrainment and impingement. Examine the implications of these anthropogenic mortalities on estimation of YPR, if feasible. (SR 88 (higher))

- Conduct studies to delineate all major sub-stocks in terms of geographic spawning area and seasonal offshore movements (e.g., exposure to fishing pressure). (SR 88 (high))

Low

- Conduct studies of flounder populations in impacted areas to quantify physiological adaptation to habitat alteration, and interactive effects, on an individual and population level. (SR 88 (lower))

NP

- Update and investigate migration rates between stock and movement patterns.*(2) Investigate localized structure/genetics within the stocks. (2011 SARC)

Management, Law Enforcement, and Socioeconomic Priorities
Moderate

- Investigate ways to improve compliance to help VTR. Expand sea sampling to validate commercial discard estimates from VTR. Currently about 300 of the 1,500 permitted vessels consistently under report the number of statistical areas fished. (2011 SARC)

Southern New England – Mid-Atlantic Stock Complex

Fishery-Independent Priorities
High

- Examine the sources of differences between NEFSC, Massachusetts, and Connecticut survey maturity (validity of evidence for younger size/age at 50% maturity in NEFSC data). Compare NEFSC inshore versus offshore strata for differences in maturity. Compare confidence intervals for maturity ogives. Calculate annual ogives and investigate for progression of maturity changes over time. Examine maturity data from NEFSC strata on Nantucket Shoals and near Georges Bank separately from more inshore areas. Consider methods for combing maturity data from different survey programs. Conduct periodic maturity staging workshops involving State and NEFSC trawl survey staff.*(3) (SR 88 (high))

Modeling / Quantitative Priorities
Low

- Quantify adult sex ratio to determine the possibility of population decline due to a skewed sex ratio. (SR 88 (low))

Life History, Biological, and Habitat Priorities
Moderate

- Examine egg and larvae distribution and abundance to determine YPR to predict future biomass development for the fishery. (SR 88 (med.))

- Assess distribution of winter flounder during each life stage by conducting tagging methods, focusing on juvenile to adult life stages. This information would be useful for estimating

YPR and helpful to find answers as to why recruitment is at a vulnerable state. (SR 88 (med.))

- Examine winter flounder distribution, abundance, and productivity based on oceanographic and climate warming and how that impacts biomass for the fishery. (SR 88 (med.))

Low

- Examine predator-prey relationships due to increased populations of cormorants, seals, and striped bass (examine stomach contents of predators to get a better idea on the quantification of predation on winter flounder by these predators). (SR 88 (low))

Georges Bank Stock

Life History, Biological, and Habitat Priorities

NP

- Investigate use of periodic gonad histology studies to validate maturity estimates, with particular attention to obtaining sufficient samples from the Georges Bank stock. (2011 SARC)

- Further explore the relationship between large scale environmental forcing (e.g., temperature, circulation, and climate) for effects on life history, reproduction, and recruitment in the Georges Bank stock. (2011 SARC)

- Conduct studies to better understand recruitment processes of winter flounder, particularly in the Gulf of Maine and on Georges Bank. (2011 SARC)

Gulf of Maine Stock

Fishery-Dependent Priorities

High

- Improve sampling for biological data (particularly hard parts for ageing) of commercial landings for winter flounder. (SR 88 (high))

- Process archived age samples from surveys and commercial landings and develop analytical based assessments.*(4) (SR 88 (high))

Low

- Estimate and evaluate the effects of catch and release components of recreational fishery on discard-at-age. (SR 88 (low))

Fishery-Independent Priorities

Moderate

- Evaluate size selectivity performance of survey gear compared to typical commercial gear and implications for estimation of commercial discards from research survey length frequency information. (SR 88 (med.))

Modeling / Quantitative Priorities

Low

- Evaluate the effects of smoothed length frequency distributions on the relationship between survey and commercial catches-at-length. (SR 88 (low))

Moderate

- Evaluate the feasibility of VPA based only on ages fully recruited to landings (i.e., no discards). (SR 88 (med.))

NP

- Incorporate the results from the MEDMR research trawl survey (begun in 2000) into the assessment as they become available. (2011 SARC)

Life History, Biological, and Habitat Priorities

High

- Further examine the stock boundaries to determine if Bay of Fundy winter flounder should be included in the Gulf of Maine stock complex. (SR 88 (high))

- Examine growth variations within the Gulf of Maine, using results from the Gulf of Maine Biological Sampling Survey (1993-94). *(5) (SR 88 (high))

NP

- Conduct studies to better understand recruitment processes of winter flounder, particularly in the Gulf of Maine and on Georges Bank.

Footnotes

*(1) Fall survey data have been evaluated.

*(2) The most recent comprehensive tagging study was completed in the 1960's (Howe and Coates).

*(3) This work is in progress.

*(4) MEDMR has archived WF otoliths since 2002

*(5) Biological data on WF has been collected on the MEDMR trawl survey from 2000-2008 and should be included.

Common Research Recommendations for All ASMFC Managed Diadromous Species

Dams and Other Obstructions
General Fish Passage

- States should work in concert with the USFWS and the NOAA Fisheries Service to identify hydropower dams that pose significant impediment to diadromous fish migration and target them for appropriate recommendations during FERC relicensing. (HMS #9)

- States should identify and prioritize barriers in need of fish passage based on clear ecological criteria (e.g., amount and quality of habitat upstream of barrier, size, status of affected populations, etc.). These prioritizations could apply to a single species, but are likely to be more useful when all diadromous species are evaluated together. (HMS #9)

- A focused, coordinated, well supported effort among federal, state, and associated interests should be undertaken to address the issue of fish passage development and efficiency. The effort should attempt to develop new technologies and approaches to improve passage efficiency with the premise that existing technology is insufficient to achieve restoration and management goals for several East Coast river systems. (HMS #9)

- Where obstruction removal is not feasible, install appropriate passage facilities, including fish lifts, fish locks, fishways, navigation locks, or notches (low-head dams and culverts). (HMS #9)

- At sites with passage facilities, evaluate the effectiveness of upstream and downstream passage; when passage is inadequate, facilities should be improved. (HMS #9)

- Dams/obstructions where upstream passage structures will be installed should be evaluated for effectiveness of downstream passage. Upstream passage structures should not be installed at these sites, unless downstream passage can be made safe, effective, and timely. (HMS #9)

- Facilities for monitoring the effectiveness of the pass should be incorporated into the design where possible. (HMS #9)

- Before designing and constructing fish passage systems, determine the behavioral response of each species of interest to major physical factors so that effectiveness can be maximized. (HMS #9)

- Protection from predation should be provided at the entrance, exit, and throughout the pass. (HMS #9)

- The passage facility should be designed to work under all conditions of head and tail water levels that prevail during periods of migration. (HMS #9)

- Passages are vulnerable to damage by high flows and waterborne debris. Techniques for preventing damage include robust construction, siting facilities where they are least exposed to adverse conditions, and removing the facilities in the winter. (HMS #9)

- Evaluate performance of conventional fishways, fish lifts, and eel ladders, and determine features common to effective passage structures and those common to ineffective passage structures. (HMS #9)

- Conduct basic research into diadromous fish migratory behavior as it relates to depth, current velocity, turbulence, entrained air, light, structures, and other relevant factors. (HMS #9)

- Use information from the previous two research recommendations to conduct CFD modeling to develop more effective fishway designs. (HMS #9)

- Research technologies (barriers, guidance systems, etc.) for directing emigrating fish to preferred passage routes at dams. (HMS #9)

- Identify low-cost alternatives to traditional fishway designs. (HMS #9)

- Develop effective downstream passage strategies to reduce mortality. (HMS #9)

Upstream Fish Passage

- Diadromous fish must be able to enter the passage facility with little effort and without stress. (HMS #9)

- To prevent fish from becoming entrained in intake flow areas of hydropower facilities, construct behavioral barrier devices and re-direct them to safer passage areas. (HMS #9)

- Fish ascending the pass should be guided/routed to an appropriate area so that they can continue upstream migration, and avoid being swept back downstream below the obstruction. (HMS #9)

Downstream Fish Passage

- To enhance survival at dams during emigration, evaluate survival of fish passed via each route (e.g., turbines, spillage, bypass facilities, or a combination of the three) at any given facility, and pass fish via the route with the best survival rate. (HMS #9)

Other Dam Issues

- Where practicable, remove obstructions to upstream and downstream migration. (HMS #9)

- Locate facilities along the river where impingement rates are likely to be lowest. (HMS #9)

- Alter water intake velocities, if necessary, to reduce mortality to diadromous species. (HMS #9)

- To mitigate hydrological changes from dams, consider operational changes such as turbine venting, aerating reservoirs upstream of hydroelectric plants, aerating flows downstream, and adjusting in-stream flows. (HMS #9)

- Natural river discharge should be taken into account when alterations are being made to a river because it plays a role in the migration patterns of diadromous fish. (HMS #9)

- Document the impact of power plants and other water intakes on larval, post-larval, and juvenile mortality in anadromous fish spawning areas, and calculate the resultant impacts to adult population sizes. (HMS #9)

- Evaluate the upstream and downstream impacts of barriers on diadromous species, including population and distribution effects. (HMS #9)

Water Quality and Contamination

- Maintain water quality and suitable habitat for all life stages of diadromous species in all rivers with populations of diadromous species. (HMS #9)

- Non-point and point source pollution should be reduced in diadromous fish habitat areas. (HMS #9)

- Implement BMPs along rivers and streams, restore wetlands, and utilize stream buffers to control non-point source pollution. (HMS #9)

- Implement erosion control measures and BMPs in agricultural, suburban, and urban areas to reduce sediment input, toxic materials, and nutrients and organics into streams. (HMS #9)

- Upgrade wastewater treatment plants and remove biological and organic nutrients from wastewater. (HMS #9)

- Reduce the amount of thermal effluent into rivers. On larger rivers, include a thermal zone of passage. (HMS #9)

- Provide management options regarding water withdrawal and land use to minimize the impacts of climate change on temperature and flow regimes. (HMS #9)

- Discharge earlier in the year to reduce impacts to migrating fish. (HMS #9)

- Conduct studies to determine the effects of dredging on diadromous habitat and migration; appropriate best management practices, including environmental windows, should be considered whenever navigation dredging or dredged material disposal operations would occur in a given waterway occupied by diadromous species. (HMS #9)

- Introduction of new categories of contaminants should be prevented. (HMS #9)

- Determine effects of change in temperature and pH for all life stages of all diadromous species. Use this information to model impacts of climate change on species. (HMS #9)

- Develop studies to document which contaminants have an impact on the various life stages of each diadromous species; also note the life stages that are affected and at what concentrations. (HMS #9)

- Determine unknown optima and tolerance ranges for depth, temperature, salinity, dissolved oxygen, pH, substrate, current velocity, and suspended solids. (HMS #9)

Habitat Protection and Restoration

- Use multi-scale approaches (including GIS) to assess indicators of suitable habitat, using watershed and stream-reach metrics if possible (it should be noted, that where site specific data is lacking, it may not be appropriate to assess at this scale). (HMS #9)

- Use multi-scale approaches for restoring diadromous fish habitat, including vegetated buffer zones along streams and wetlands, and implementing measures to enhance acid-neutralizing capacity. (HMS #9)

- Conduct studies on the effects of land use change on diadromous species population size, density, distribution, health, and sustainability. (HMS #9)

- Examine how deviation from the natural flow regime impacts all diadromous species. This work should focus on key parameters such as rate of change (increase and decrease), seasonal peak flow, and seasonal base flow, so that the results can be more easily integrated into a year-round flow management recommendation by state officials. (HMS #9)

- Investigate consequences to diadromous stocks from wetland alterations. (HMS #9)

- When states have identified habitat protection or restoration as a need, state marine fisheries agencies should coordinate with other agencies to ensure that habitat restoration plans are developed, and funding is actively sought for plan implementation and monitoring. (HMS #9)

- Any project resulting in elimination of EFH (e.g., dredging, filling) should be avoided. (HMS #9)

- Substrate mapping of freshwater tidal portions of rivers should be performed to determine suitable diadromous fish habitat, and that habitat should be protected and restored as needed. (HMS #9)

- States should notify in writing the appropriate federal and state regulatory agencies of the locations of habitats used by diadromous species. Regulatory agencies should be advised of the types of threats to diadromous fish populations, and recommended measures that should

be employed to avoid, minimize, or eliminate any threat to current habitat quantity or quality. (HMS #9)

- Each state encompassing diadromous fish spawning rivers and/or producer areas should develop water use and flow regime guidelines protective of diadromous spawning and nursery areas to ensure the long-term health and sustainability of the stocks. (HMS #9)

Permitting

- Develop policies for limiting development projects seasonally or spatially in spawning and nursery areas; define and codify minimum riparian buffers and other restrictions where necessary. (HMS #9)

- Projects involving water withdrawal (e.g., power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from impingement, entrainment, and/or modifications of flow and salinity regimes due to water removal will not adversely impact diadromous fish stocks. (HMS #9)

- State fishery regulatory agencies should develop protocols and schedules for providing input on Federal permits and licenses required by the Clean Water Act, Federal Power Act, and other appropriate vehicles, to ensure that diadromous fish habitats are protected. (HMS #9)

Other

- Determine survival and mortality rates for all life stages of all diadromous species. (HMS #9)

- Investigate predator-prey relationships for all life stages of all diadromous species. (HMS #9)

- Determine the effects of channel dredging, shoreline filling, and overboard spoil disposal in the Atlantic coast on diadromous species. (HMS #9)

- Define restrictions necessary for implementation of energy projects in diadromous species habitat areas and develop policies on limiting development projects seasonally and/or spatially. (HMS #9)

- Promote cooperative interstate research monitoring and law enforcement. Establish criteria, standards, and procedures for plan implementation as well as determination of state compliance with management plan provisions. (HMS #9)

- Diadromous fish may be vulnerable to mortality in hydrokinetic power generation facilities, and such projects should be designed and monitored to eliminate, or minimize, fish mortality. (HMS #9)

- The use of any fishing gear that is deemed by management agencies to have an unacceptable impact on diadromous fish habitat should be prohibited within appropriate essential habitats (e.g., trawling in spawning areas or primary nursery areas should be prohibited). (HMS #9)

Common Socioeconomic Research Recommendations for all ASMFC Managed Species

- Establish time series of social and economic data for use in management decisions. This is analogous to biological time series data that are currently being used in decision making for monitoring and fisheries management. (CESS 2010)

- Existing social and economic data sets are deficient and remedial. Develop and collect baseline of sociodemographic data for all Atlantic states by state, species, and community for commercial fishing and by state, species, community, and sector (boat, shore, and for-hire) for recreational and subsistence fisheries. Community profiles should include information on the infrastructure in support of the fisheries (e.g., provision of boat launches, haul-out yards, marine suppliers, recreational fishing docks). (CESS 2010)

- Update baseline data on a regular basis (e.g., every 3 years). (CESS 2010)

- Focus on research additional to the baseline for decisions to be made in the next few years. (CESS 2010)

- Evaluate existence value and non-consumptive use value (cultural and economic) for species that the ASMFC has protected through moratoria. (CESS 2010)

MSC has previously discussed how forage fish considerations may be incorporated into ASMFC's management process. MSC reviewed the following prey trend data sets at their meeting November 9, 2010. This is an example (for weakfish) for how forage information may be captured and possibly included in FMPs or other means. This topic will be revisited by MSC at their October 24, 2012 meeting.

Weakfish Diet

From Weakfish FMP (1985):

Food & Feeding: Weakfish is a fast swimmer that feeds in the upper to middle water column by sight. Young weakfish feed primarily on mysid shrimp and anchovies, while older fish feed on clupeid species that are abundant in a given area and anchovies (Merriner 1975; Michaels 1984)

Competitors & Predators: Weakfish have food habits similar to other top predators such as bluefish and striped bass. Weakfish are preyed on by bluefish, striped bass, and larger weakfish.

The diet of weakfish varies seasonally, with age and size, and by location, and there is some evidence that the diet composition has shifted over time (Figure 1), but there are few long-term, coastwide studies of the weakfish diet. Most studies focus on one or two seasons in a limited geographic range and cover only a few years and provide us with snapshots of the weakfish diet. Table 1 summarizes the results of many diet studies by weakfish size/age and geographical area.

There are some important gaps in the available data. There is little information from the southeast region. SEAMAP has been collecting weakfish stomachs, but the samples have not been processed due to time and budgetary constraints. Additionally, the diet of larger individuals from the northeast region has not been well-studied.

Table 1: Diet of weakfish by life-stage and area.

Life Stage	Major Prey	Location	Time of Year	Date
Larvae	**Copepods**, larvae of the **polychaete** Polydora ligni, and pelagic invertebrate eggs	Delaware Bay	Spawning season	1986-87[8]
Juveniles, Age-0	**Bay anchovy** Anchoa mitchilli, **Mysid shrimp** Neomysis spp.	ME-NC; North Carolina	Fall, Spring; Year round	1973-2005[1]; June 1967-Jan 1970[2]
Age-0	**Bay anchovy** Anchoa mitchilli	Chesapeake Bay	July – Dec	1978[3], Jan 1990-Mar 1992[4]
Age-0	**Mysid shrimp** Neomysis spp.	Delaware Bay		1990[5]
<100mm	**Mysid shrimp** Neomysis spp., **Bay anchovy** Anchoa mitchilli	Chesapeake Bay	Mar – Nov	2002-2006[6]
Adults, Age-1	**Bay anchovy** Anchoa mitchilli; **Atlantic menhaden** Brevoortia tyrannus	Chesapeake Bay	May – Aug; Sept – Oct	Jan 1990- Mar 1992[4]
Age-1	**Bay anchovy** Anchoa mitchilli, **Mysid shrimp** Neomysis spp.	North Carolina	Year round	June 1967-Jan 1970[2]
Age-1,-2	**Bay anchovy** Anchoa mitchilli, **Mysid shrimp** Neomysis spp.	ME-NC	Fall, Spring	1973-2005[1]
Age-1, age-2, and older weakfish	**Atlantic menhaden** Brevoortia tyrannus, **spot** Leiostomus xanthurus	North Carolina	Year round	June 1967-Jan 1970[2]
Age-2 and older	**Atlantic menhaden** Brevoortia tyrannus, **spot** Leiostomus xanthurus	Chesapeake Bay	May – June; Sept – Oct	Jan 1990- Mar 1992[4]
Small-medium (100-374mm)	**Bay anchovy** Anchoa mitchilli, **Mysid shrimp** Neomysis spp.; to a lesser extent - **spotted hake** Urophycis regia, **YOY weakfish**	Chesapeake Bay	Mar – Nov; spring and early summer	2002-2006[6]
Small-medium 130-270mm	**Anchovies** Anchoa spp., **Mysid shrimp** Neomysis spp.	NC – MA	Spring and fall	2007 - 2009[7]
Large-medium (374-474mm)	**spot** Leiostomus xanthurus**,** **Atlantic menhaden** Brevoortia tyrannus	Chesapeake Bay	Late summer and fall	2002-2006[6]

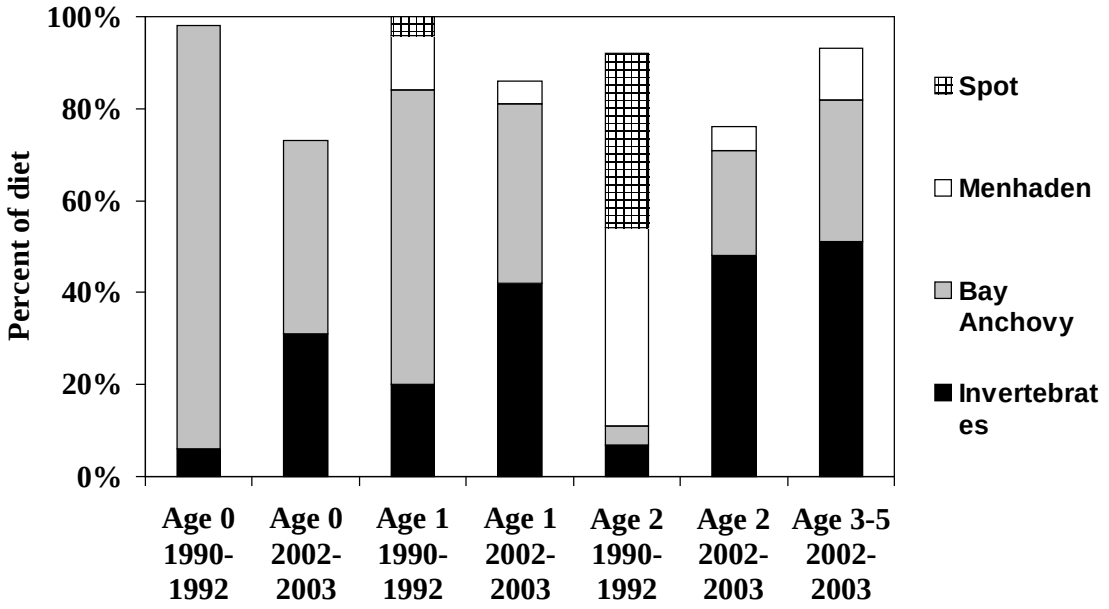

Figure 1: Comparison of age-specific weakfish diets (by weight) in Chesapeake during 1990-1992 and 2002-2003. Data for 1990-1992 were from Hartman and Brandt (1995) and data for 2002-2003 were provided by R. Latour (VIMS).

Prey Trend Data Sets

Atlantic menhaden and spot are important prey items for adult (age 2+) weakfish, while bay anchovy and mysid shrimp are more important for young (age-0 to age-2) individuals. The amount of information available about the population dynamics of weakfish prey varies by species (Table 1).

Atlantic menhaden are managed by ASMFC and undergo regular stock assessments. Trends in abundance are available from a coastwide composite juvenile abundance index developed for the most recent assessment and from a Chesapeake Bay commercial CPUE. Estimates of total abundance are also available from the stock assessment.

Spot has not been assessed by the Commission, but there are a number of surveys of both juveniles and adults that provide information on trends in abundance. However, most of these surveys are state-specific and thus don't cover the entire range of the stock.

Bay anchovy are not managed or assessed by the Commission, but there are a handful of surveys that provide indices of abundance. Like spot, though, they are geographically limited and only provide information on bay-specific trends.

Mysid shrimp are not monitored at all. There are some short-term studies that provide snapshots of species composition and CPUE for one or two years at a time at a few different sites, but there is not a long-term project that tracks changes in abundance over time.

Bay anchovy and Atlantic menhaden estimates of abundance have declined since the mid 1980s, with year-to-year variation, while spot has been highly variable with a low in the late 1990s and an increasing trend in recent years (Figure 1).

Of course, the weakfish diet is not fixedAdditionally, although bay anchovy, menhaden, spot, and mysid shrimp are important components of their diet, weakfish prey on a number of different finfish and invertebrates, some of which are monitored and assessed and some of which are not.

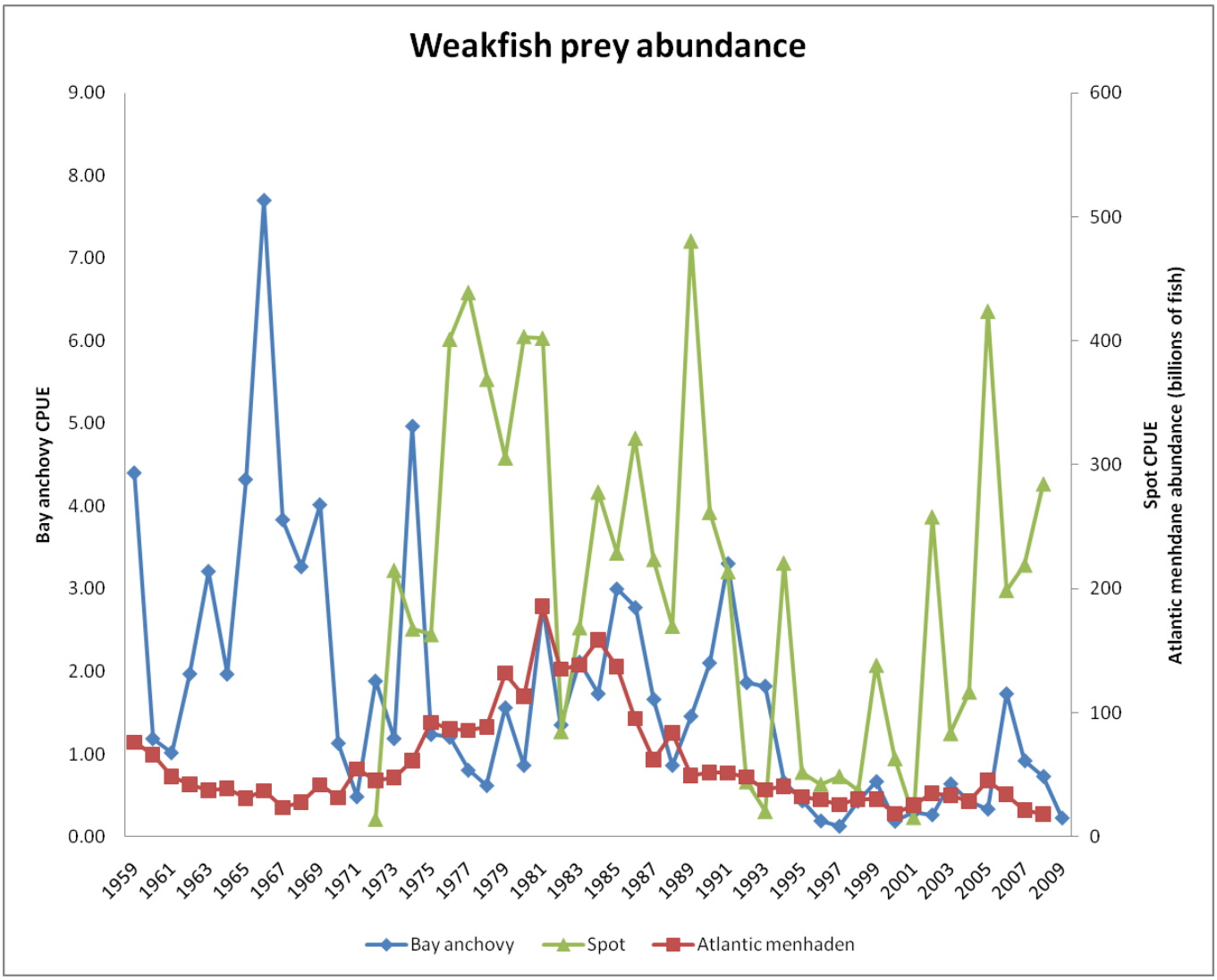

Figure 2: Trends in abundance of weakfish prey items. The bay anchovy index is from the MD Striped Bass Seine Survey. The spot index is from the NMFS Fall Trawl Survey. The Atlantic menhaden estimates of abundance are from the most recent stock assessment.

Table 2: Available data sets on trends in weakfish prey abundance by species.

Species	Type of Data	Source	Years	Location
Bay Anchovy	Survey Index	CHESFIMS	1995 – 2006	Chesapeake Bay
	Survey Index	DE River Seine Survey	1980 – Current	DE River
	Survey Index	DE Bay Trawl Survey	1991 – Current	DE Bay
	Survey Index	MD Juvenile Striped Bass Survey	1954 – Current	MD Chesapeake Bay
Threadfin Herring	Survey Index	CHESFIMS	1995 – 2006	Chesapeake Bay
Spot	Survey Index	CHESFIMS	1995 – 2006	Chesapeake Bay
	Survey Index	MD Blue Crab Trawl Survey	1989 – Current	MD Chesapeake Bay
	Survey Index	MD Coastal Trawl Index	1989 – Current	MD Coastal Bays
	Survey Index	MD Coastal Seine Index	1989 – Current	MD Coastal Bays
	Survey Index	VIMS Trawl Survey	1955 – Current	Chesapeake Bay
	Survey Index	NC Independent Gillnet Survey	2001 – Current	Pamlico Sound
	Survey Index	NC Estuarine Trawl Survey	1994 – Current	NC Coast
	Survey Index	SC Trammel Net Survey	1991 – Current	SC Estuaries
	Survey Index	SC Electroshock Survey	2001 – Current	SC Estuaries
	Survey Index	NC Pamlico Sound Juvenile Trawl Survey	1987 – Current	Pamlico Sound
	Survey Index	MD Juvenile Striped Bass Survey	1954 – Current	MD Chesapeake Bay
	Survey Index	DE Bay Trawl Survey	1991 – Current	DE Bay
	Survey Index	NJ Ocean Trawl Survey	1989 – Current	NJ nearshore ocean
	Survey Index	DE River Recruitment Survey	1980 – Current	DE River
	Survey Index	SEAMAP	1986 – Current	FL – NC
River herring	Survey Index	CHESFIMS	1995 – 2006	Chesapeake Bay

	Survey Index	NMFS Spring Trawl Survey	1968 – Current	Cape Cod, MA – Cape Hatteras, NC
	Survey Indices	2008 Stock Status Report	1960 – Current (variable)	Multiple locations
	Survey Index	MD Juvenile Striped Bass Survey	1954 – Current	MD Chesapeake Bay
Weakfish (YOY)	Survey Index	RI Trawl Survey	1979 – Current	RI bays
	Survey Index	CT Long Island Trawl Survey	1984 – Current	Long Island Sound
	Survey Index	NY Peconic Bay Juvenile Trawl Survey	1985 – Current	Peconic Bay
	Survey Index	DE Bay Juvenile Trawl Survey	1966 – Current	DE Bay
	Survey Index	MD Chesapeake Bay Juvenile Trawl Survey	1980 – Current	Chesapeake Bay
	Survey Index	MD Coast Bays Juvenile Trawl Survey	1972 – Current	MD Coastal Bays
	Survey Index	VIMS Trawl Survey	1955 – Current	Chesapeake Bay
	Survey Index	NC Pamlico Sound Juvenile Trawl Survey	1987 – Current	Pamlico Sound
Atlantic croaker (YOY)	Survey Index	VIMS Trawl Survey	1955 – Current	Chesapeake Bay
	Survey Index	SEAMAP Trawl Survey	1986 – Current	FL – NC
	Survey Index	NMFS Fall Trawl Survey	1963 – Current	NE portion of stock
	Survey Index	NC Pamlico Sound Juvenile Trawl Survey	1987 – Current	Pamlico Sound
Atlantic herring	Survey Index	Canadian Bottom Trawl Survey	1963 – Current	Gulf of Maine/ Georges Bank
	Survey Index	NMFS Fall Trawl Survey	1963 – Current	NE portion of stock
	Survey Index	NMFS Winter Trawl Survey	1992 – 2003	Cape Hatteras – Cape Cod
	Survey Index	NMFS Spring Trawl Survey	1968 – Current	US range of stock
	Survey Index	NMFS Acoustic	1999 – Current	Gulf of Maine/

		Survey		Georges Bank
	Stock Assessment	TRAC Status Report 2009/04	1967 – 2008	Entire stock
Sand lance	Survey Index	ME Groundfish survey	1990 – 1994	Maine
	Survey Index	ME – NH Inshore Trawl Survey	2000 – Current	Maine – New Hampshire
	Survey Index	NH Estuarine Juvenile Finfish Survey	1992 – Current	New Hampshire
	Survey Index	RI YOY Survey	1993 – Current	RI Coastal Ponds
Atlantic menhaden	Survey Index	Composite JAI from assessment	1959 – 2008	Coastwide
	Commercial CPUE	PRFC Poundnet CPUE (adult)	1964 – Current	Chesapeake Bay
	Stock Assessment	2010 ASMFC Stock Assessment Report	1955 – 2008	Coastwide

2013 ASMFC Action Plan, Ecosystem-Based Fisheries Management related tasks:

Task 2.5.2 – Continue to improve multispecies modeling efforts to support single-species assessments, including development of a new multispecies statistical catch-at-age model. Examine ecosystem based reference points as an alternative to single species reference points, using Atlantic menhaden as a test species.

Task 2.5.3 – Seek cooperative opportunities with state, federal, and university researchers to collaborate using existing data collection platforms to advance ASMFC ecosystem models (e.g. diet studies, surveys of spawning and nursery habitats).

2.6 Increase data collection and research for ecosystem-based management strategies.

Task 2.6.1 – Continue to advance Commission use of ecosystem-based approaches to fisheries management using development of Atlantic menhaden alternative reference points as a case study.

Task 2.6.3 - Develop Commission approach to ecosystem science to support ecosystem-based fisheries management.

Priorities and discussion from 2010 ASMFC EBFM Workshop:

The top 10 priorities by count are as follows:
2.3. Promote interstate programs to improve integrated management of fish, fish habitat, and water quality in regulatory and operational programs.
3.1 Develop Commission policy regarding ecosystem based approach to fisheries management.
1.1 Increase data collection and research for ecosystem based management strategies.
1.3 Describe ecosystem structure and function, habitats, species assemblages and socioeconomic patterns across the management region.
3.5 Evaluate implications of how management measures for one species may affect other managed species.
1.6 Expand multispecies model (MSVPA) to other suites of species.
1.7 Evaluate environmental influences on managed and unmanaged fish stocks (incorporation in MSVPA).
2.2 Seek cooperative opportunities with state, federal and university researchers to collaborate using existing data collection platforms to advance ASMFC ecosystem models. E.g., diet studies, surveying spawning habitats.
5.2 Effectively protect, restore, and enhance Atlantic coastal fish habitat through fisheries management programs and partnerships, such as the Atlantic Coastal Fish Habitat Partnership.
1.2 Develop Commission approach to ecosystem science to support ecosystem-based fishery management.

L. Mercer asked the group what their highest priorities were amongst this list. G. Lapointe said that everything begins with data collection, so collection of new data should rank higher. T. Fote added that existing data should be compiled to see where the data gaps are. M. Duval noted that many of the data gaps have been identified, and she agrees with G. Lapointe's suggestion of a high priority for data collection. T. O'Connell suggested that there needs to be a strategic plan to forward information and available science to decision makers, especially land use managers, such as what the socioeconomic values of the fishery are as that drives use.

L. Mercer noted that in general it appears from the prioritized list that there is a lot of agreement amongst the groups. She asked the groups whether they identified any recommendations not on the list. G. Lapointe suggested that partnerships should embody a broader set of collaborators. L. Mercer asked the participants what next steps they would like to see the EBFM workgroup take on and what the impediments might be as they move forward. A.C. Carpenter suggested that task 3.5 (Evaluate implications of how management measures for one species may affect other managed species) is a tangible task which can be done on a shorter term basis. T. Stockwell supported task 4.1 (Facilitate coordination and distribution of information for ecosystem-based management and marine protected (managed) area activities) as he does not want to move forward in a vacuum.

G. Lapointe suggested that task 3.1 (Develop Commission policy regarding ecosystem based approach to fisheries management) would be important to develop and then the other recommendations can be separate components identified underneath that policy. He noted that the discussion during the Menhaden Management Board meeting the previous day involved EBFM, but the Board was unsure as what that means. He thought it wise to consider a step wise approach to identify how to move forward and developing this structure will be useful for the managers to understand what is needed, especially in tasking TCs more effectively. D. Grout agreed that the development of this plan is most important, and then the top five or six ways to address it will fall out under that. B. Adler also likes task 3.5, as he sees it as actually happening, and it would be good to have a plan to see what will happen to other species. L. Mercer noted that task will fit nicely in the development of the plan. J. Duren recommended that the word 'evaluate' be removed in 3.5 and it should just be done. M. Duval noted that they are at various stages of evaluating how implementing management measures are quantitatively affecting other species. G. Lapointe added that there is a lot of qualitative discussion on these effects, but there is not a lot of information to evaluate them quantitatively.

L. Mercer asked the group how they see ASMFC interfacing with other regional activities. G. Lapointe said that is a logical part of task 3.1 in developing policy that supports information flow without redundancy by coordinating with research and management entities. L. Mercer reiterated that it sounded like the group supports developing that policy and fitting in top priorities into that and there was general agreement. She asked again for any guidance or direction for the workgroup. T. Stockwell asked how coordination is carried out now, and she answered that there has not been any work done yet. He suggested that they should start working with the Councils and NEFSC to marry ASMFC efforts and needs with theirs. M. Fogarty noted that the NEFMC SSC had developed a white paper on moving towards EBFM and he emphasized that it has to be a joint effort. He said the nearshore domain is where ASMFC involvement is critical where there are estuaries and spawning areas. He has proposed the formation of a working

group with members of ASMFC and the Councils. He noted the difficulty facing ASMFC as the Commission has the greatest number of FMPs, but they should be looked at as interconnected parts. M. Fogarty said that integrated FMPs for ecological regions would be a tremendous stride forward. He added that ecosystems are not simple, but this effort should start simply and keep pulse of what is happening so they can make course corrections. J. Geiger noted that this workshop has provided good examples of pilot efforts in the ASMFC area, and the group can begin by looking at these pilot studies to see how aspects or combinations of these existing efforts may meet the needs of ASMFC. He added that it is important to have well defined management objectives, and then work towards implementing them. D. Grout said they should seek help from people from NEFSC and NMFS who know how to integrate these efforts. M. Fogarty noted that he is happy to help in any way he can.

L. Mercer said that this has been helpful to her as a member of the EBFM workgroup to consider next steps. The workgroup will work on the draft strategy and present it during the ASMFC Annual Meeting in November. P. Campfield asked for feedback on the workshop via the questionnaire distributed to participants, on what they got out of this workshop and what topics they would interested in for the future. J. Gilmore thanked the speakers, L. Mercer, and staff, on behalf of R. Boyles, Jr., for putting together the workshop.

MATOS

Mid-Atlantic Acoustic Telemetry Observation System

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DATE SUBMITTED
13 September, 2012

RPS asa

ASA BACKGROUND

ASA is a global science and technology solutions company. Through consulting, environmental modeling, and application development, ASA helps a diverse range of clients in government, industry, and academia investigate their issues of concern and obtain functional answers.

ASA is a subsidiary of the RPS group with headquarters in the UK. The ASA division is headquartered in South Kingstown, Rhode Island, ASA also has offices in Abu Dhabi, China, Brazil, and Australia. ASA's website, www.asascience.com contains numerous scientific reports written by its staff and extensive information about its products and services.

ASA's technical staff members hold advanced degrees in ocean engineering, biological oceanography, physical oceanography, biology, chemistry, chemical engineering, mechanical engineering, environmental engineering, water resources engineering, hydraulic engineering, civil engineering, geology, geomorphology, computer science, mathematics, and business administration. This diverse combination of backgrounds offers a thorough range of capabilities for solutions to a wide variety of problems.

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- ChevronTexaco
- ConocoPhillips
- Dubai Petroleum
- ExxonMobil
- Maersk (Qatar)
- Qatar Petroleum
- RAK Petroleum
- Shell

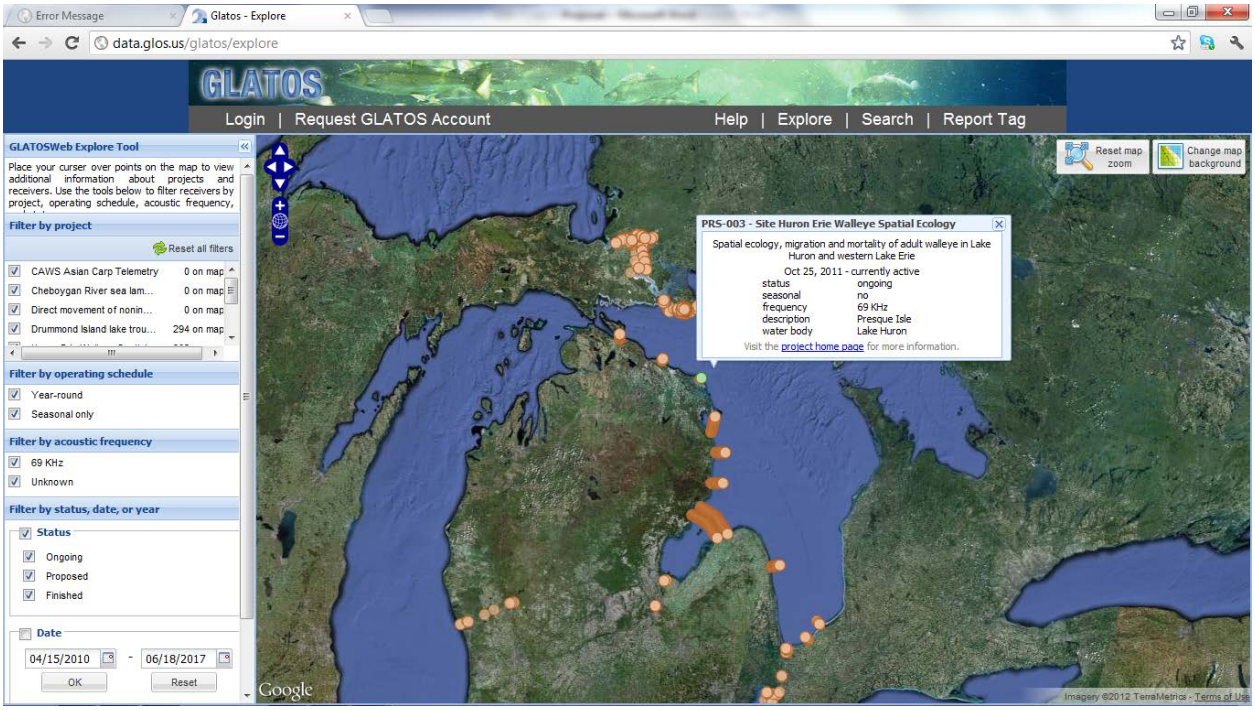
as well as international government agencies in the UAE, UK, U.S., Netherlands, Spain, France, Ireland, Singapore, China, Australia, and New Zealand.

ASA has been involved in developing and utilizing environmental data management and Geographic Information Systems for more than 25 years. ASA's diverse project experience and multi-industry contract work has led to a wide spectrum of cutting edge GIS applications and data solutions. ASA has confronted and met the challenge of integrating disparate environmental data often stored in non-GIS data formats and by a wide array of data providers by developing integration tools and support for normalizing and homogenizing various data formats.

RPS asa

ASA has developed a number of new generation web-based ocean data and GIS management systems including:

- Mid Atlantic Regional Coastal Ocean Observing System (MARACOOS)
- Great Lakes Observing System (GLOS)
- Great Lakes Acoustic Telemetry Observation System (GLATOS)
- Abu Dhabi Coastal Atlas (won Special Achievement Award at 2010 ESRI User conference)
- Dubai Coastal Zone Monitoring and Forecasting Program
- Massachusetts Ocean Resource Information System (MORIS)
- Northeast Regional Data Portal to support Coastal and Marine Spatial Planning



Great Lakes Acoustic Telemetry Observation System (GLATOS)

OBJECTIVE

This proposal outlines data management tasks to support acoustic fish tagging projects in the Chesapeake Bay and Mid-Atlantic regions. The project will leverage work previously completed under the Great Lakes GLATOS web services and website project (http://data.glos.us/glatos). The project will deliver a Mid-Atlantic version of the GLATOS system that allows researchers to manage data and activities related to fish tracking in this region.

The Mid-Atlantic Acoustic Telemetry Observation System (MATOS) will establish a central repository for fish telemetry projects and data in the Mid-Atlantic and Chesapeake Bay regions. The web-based

system will give researchers and investigators involved with fish telemetry the ability to pool and share their data with one another.
The deliverable is a web-based system showing all acoustic telemetry projects that have been completed, are active, and are being proposed in the region. This collection of data can benefit many different user groups:

- **Researchers** looking for data regarding telemetry in the great lakes can visit a single website and get information regarding the geospatial and temporal ranges of data available.
- **Investigators** can visualize the entire footprint of telemetry projects and identify gaps in the network.
- **Public** users can get information regarding fish telemetry and who is doing the research.

MATOS will facilitate regulated exchange of data among fish tagging investigators, acoustic receiver data collectors, researchers, and fisheries management and communications product developers.

The MATOS system will be based on the existing GLATOS system, which was modeled on the Ocean Telemetry Network's (OTN) architecture, allowing for future collaboration and data interchange between projects. The system relies on the use of open interoperable standards and leverages open source technologies.

The ASA Team will deliver a well-designed, extensible and expandable relational database and a working, tested web-based interface that together allows users to share information about acoustic telemetry projects in the Mid-Atlantic region.

Database design and tool specification will be led by ASA staff in close collaboration with the end users. The project will draw heavily on the metadata and practical experience of other telemetry projects under way and the design and specification will be informed by existing guidelines promulgated by the Integrated Ocean Observing System (IOOS) office as well as experience from relevant efforts such as the IOOS Marine Animal Telemetry Network (ATN) project, the NOAA Chesapeake Bay Office (NCBO) fish-tracking project, the Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS) eastern seaboard tracking project, and the Ocean Tracking Network (OTN).

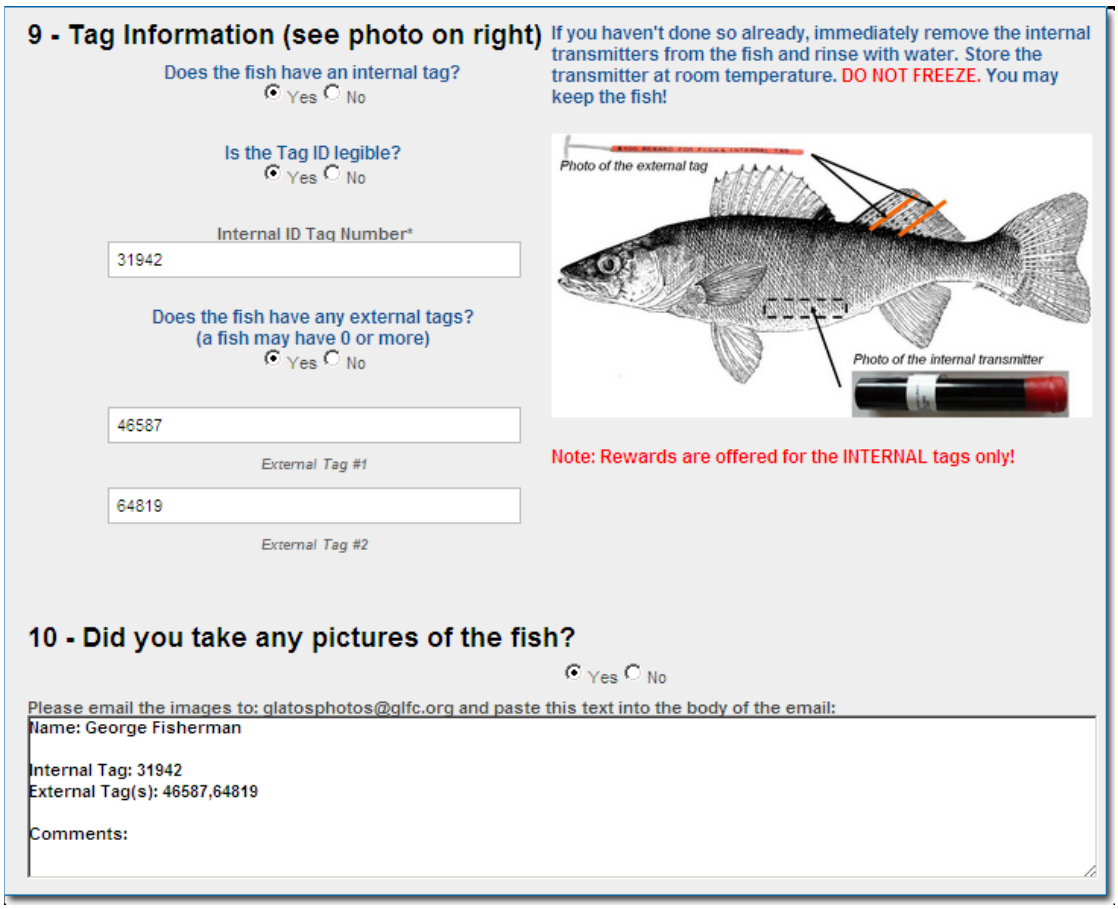
ASA will take the lead role in setting up and populating the MATOS database and the implementation of the web-based interface. ASA has developed an internal testing procedure that relies on QA personnel to mimic user workflow for validation of systems. The goal of internal testing is to perform end to end system validation as close to production as possible.

- Technical staff, including the system developers, will perform initial testing to ensure that the system is mature enough for QA testing. The developer testing may include both unit testing where developers test specific items they have worked on and integration testing where developers test that their components perform as expected within the overall system.

- The next step in the process is regression testing. At this point the system is passed along to QA personnel along with a high-level test plan. Regression testing is performed both to test new or updated components of the system as well as testing how these components affect system functionality as a whole. As such the testing script stresses every bit of functionality in order to

assure proper testing. Results of this testing phase may be a return to the development team for resolution of identified issues or QA sign-off, which moves testing into the next phase, user acceptance testing (UAT).

- UAT is not necessarily performed by the client, but is always performed by non-developers. This level of testing is higher than the detailed functionality testing (regression) performed during QA and tasks users with testing general functionality of the system without using formal test scripts. The testers need to record steps taken to produce failures for QA personnel to confirm. Upon UAT sign-off the system is ready for final review by the project manager.



Example Data Entry component from the GLATOS system

DELIVERABLES

Task 1: Redesign	Modify GLATOS software for implementation in the Chesapeake and Mid-Atlantic region. This will involve a rebranding and redesign of the entire website.
Task 2: Receiver Data	Implement a system to import receiver data into the MATOS system. The current GLATOS system does not allow actual receiver data to be uploaded. This project will complete the capability to upload tracking data from each receiver.
Task 3: API	Implement an API Web Service (REST) on top of the MATOS to allow external application developers to use the data.
Task 4: Documentation	Provide documentation on submitting data into the MATOS system and using the MATOS API.
Task 5: Management	Management of the MATOS program, covering everything from being the designated point of contact to helping data providers get their data into the MATOS system. Will provide connection to users in the James River, Chesapeake Bay network, and MARACOOS.

A Proposal to Expand the Network of Real-time Bio-Telemetry and Water Quality Assets in the James River and Chesapeake Bay

Background

Recent discussions among agency (NOAA) and academic (VCU and VIMS) partners have identified a significant opportunity to leverage existing CBIBS buoys and related assets in the James River, Virginia to create a synoptic and real-time network of fish migration sensors linked with water quality information. Although a few sensors are currently distributed throughout Chesapeake Bay and its tributaries, the proposed project would establish the first longitudinal network within a single important river system. The system would form the basis of an integrated James River/Chesapeake Bay node in the Ocean Tracking Network (OTN), and contribute substantially to a larger Mid-Atlantic network of acoustic telemetry receivers. It would also be the observational foundation for an outreach project highlighting the Atlantic sturgeon Chesapeake Bay Distinct Population Segment (DPS), which was recently listed under the ESA as Endangered. The James River supports the only viable population of Atlantic sturgeon in the region and researchers have implanted nearly 100 James River adult Atlantic sturgeon with long-term transmitters (VEMCO). In addition, sturgeon from other Atlantic slope rivers, including the Hudson and Delaware, are documented regularly in the tidal James River. The proposed array of acoustic telemetry receivers will provide higher density, better spatial resolution, and year-round support for NOAA-sponsored VEMCO Positioning System (VPS) deployments in the James and Delaware rivers, planned for 2012 and 2013, to investigate Atlantic sturgeon behavioral responses to commercial vessel traffic. During the next several years, the tidal reaches of the James River will be the focus of several important research initiatives, including habitat assessment and improvement for restoring endangered Atlantic sturgeon and a long-term, multi-agency study of the factors that trigger harmful algal blooms (HABs) in coastal environments. The proposed program would benefit from, and contribute to, these important collateral efforts. Virginia Commonwealth University's Rice Center (VCU; www.vcu.edu/rice) and the Virginia Institute of Marine Sciences (VIMS) will be the primary institutions conducting these studies and have agreed to partner to accomplish the following goals and objectives:

Project Goal and Objectives

Establish the James River as a unique pilot program among Mid-Atlantic estuaries for synoptic data (water quality and bio-telemetry) collection focused on a single, significant river network.

Objective 1: Build a passive bio-telemetry array that will provide broad and timely access to real-time acoustic telemetry data for a diverse group of stakeholders. The system will: aid in documenting spawning behavior and other critical activities of Atlantic sturgeon in the James River and its major tidal tributaries; form the basis for an observational array and data management system for a Chesapeake Bay node of the Ocean Tracking Network (OTN) and the Atlantic Cooperative Telemetry Network (ACT); provide information for fisheries

management *and* outreach and education programs focused on endangered Atlantic sturgeon and other species of conservation need (e.g. sea turtles).

Task A: Deploy real-time telemetry assets (VR4s and VR2Cs) at several locations within the James River (see map below) to create two new 'gates' for migrating Atlantic sturgeon and other tagged species and to extend the bio-telemetry array into the upper tidal James River and Appomattox River. Both areas are putative spawning and nursery habitats for endangered Atlantic sturgeon and the site of several habitat restoration projects for the species. However, the current passive array (VR2W) does not extend into these critical, tidal freshwater reaches. That array will also be made denser with the addition of several VR2W receivers. Data from these internally recording (but much less expensive) receivers will be downloaded monthly and included in the ACT database.

Task B: Deploy conventional VR2W receivers in several upper York River locations (e.g. Pamunkey River) where young-of-year Atlantic sturgeon were recently (2011) collected by VIMS biologists, suggesting the possibility of previously undocumented spawning in novel locations. We will also attempt to place acoustic transmitters in up to 5 adult or sub-adult Atlantic sturgeon collected in the upper York River system.

Task C: Using established and approved surgical protocols (VCU IACUC AD20127) and all necessary permits (NMFS ESA Permit 16547), implant up to 55 additional adult and sub-adult Atlantic sturgeon collected in the James River with long-term V16 transmitters and collect all necessary biological information (including tissue for genetic analysis) on each fish captured. During the period 2009-20012, VCU biologists caught and examined over 200 adult and sub-adult Atlantic sturgeon in the James River. We anticipate no difficulty with tagging and releasing up to 60 fish during the project period from both river systems.

Task D: Perform necessary data management and quality assurance protocols on all acoustic telemetry data generated by the new receivers; coordinate data management activities with interested stakeholders, including OTN, NOAA, and the ACT Network (D. Fox, DSU).

Objective 2: Extend the CBIBS network into the tidal freshwater reach of the James River with a new buoy owned and operated by VCU in collaboration with the NOAA CBIBS system.

Task A: Collaborate with NOAA on the deployment of a new CBIBS unit in the tidal freshwater reach of the James River adjacent to the VCU Rice Center, thereby extending the current array approximately 50 km upstream into the James River estuary.

Task B: With NOAA training and technical support, VCU will perform all regular and necessary maintenance on the new Rice Center buoy and the existing Jamestown CBIBS buoy (the latter activity will be funded independently by NCBO).

Figure 1. Existing and proposed locations for a real-time acoustic telemetry and water quality network of assets in the James River estuary.

Consultant's Report: Summary of the MRFSS/MRIP Calibration Workshop

27-29 March 2012
Raleigh, NC

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North Carolina State University

KEY WORKSHOP RECOMMENDATIONS

The following recommendations related to matching MRFSS-derived catch estimates with estimates derived from the new MRIP methodology were agreed-upon by a consensus of the workshop participants:

1. There is a need to re-estimate the marine recreational catch for years prior to 2004.
2. Officially re-estimated catch data for 2004 to 2011 represent the best available data and should be used, to the extent available, in stock assessments.
3. Updated and benchmark stock assessments should increase coefficients of variation (CVs) for hind-casted recreational catch estimates, based on 2004-2011 relationships. The methodology for increasing the CVs is still to be determined, but a first order approximation would be to use the ratio of the CVs generated by the MRFSS vs MRIP estimation methodologies for 2004-2011.
4. Prior to 2004 (or whichever year is the first year for which direct re-estimates are available, since the NMFS Office of Science and Technology (ST) is still working on re-estimation for years prior to 2004), hind-casted catch data should use a ratio (MRFSS/MRIP) estimator, either constant throughout the hind-casted time series or trended, based on ancillary information. This approach would not preclude more extensive species-specific approaches, but would be a default "acceptable" approach if other procedures were not available. For species that are rare in the catch and have high variance in the estimate of this ratio, then using the ratio for other related species may be prudent.
5. Until there is a new (updated or benchmark) stock assessment, the new MRIP-derived catch numbers should be adjusted to be in the same scale as catch numbers used for calculating the current recreational annual catch limits (ACLs). When these stocks are re-assessed, landings relative to ACLs would be tracked by using non-adjusted MRIP

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estimates.

6. For data poor stocks that have developed ACLs on the basis of historical catch, the same methodology should be used to recalculate these ACLs, but with MRIP re-estimated numbers where available, and adjusted MRFSS numbers for earlier years.
7. Caution is urged regarding applying MRFSS/MRIP ratios on a scale smaller than the spatial scale of the stock. Uncertainty in the estimates will increase in direct relation to the diminution of scale.
8. Integration of new numbers should not require a full benchmark stock assessment. An update should be sufficient if the magnitude of the "bias" is relatively small, recreational catches do not dominate the overall catch, and major changes in the age composition (induced by re-weighting of the intercept biological samples) do not occur. If re-weighting occurs, then there is the potential for changes in the selectivity pattern for the fishery, which may have implications for biological reference points (BRPs) and may then require a new benchmark assessment.
9. The above recommendations are based on the re-estimation of the MRFSS intercept data and represent the current state of the best science information available. Ongoing work on revision to the effort data collection procedures could result in future recommendations for revision of historical effort estimates. Implementation of the current set of revisions based on the intercept data should not be delayed to wait for possible revisions based on the effort data. The potential effects of revisions to the biological data could be important if the age or size structure of the recreational landings and discards change.
10. At the end of the workshop, participants agreed that a working group should be formed to: (1) identify a list of species whose catch estimates are the most affected by the transition to MRIP, and present this list to the regional stock assessment steering committees for their consideration when scheduling upcoming stock assessments; and (2) develop a technical approach (or approaches) to hind-casting and forecasting catch estimates. Work on both tasks should be completed by May 1st.

Since the new MRIP methodology for catch estimation has already undergone independent peer review, and the applications proposed at the workshop only involve applying ratio estimators to adjust the MRFSS time series to match the MRIP time series (and vice versa), the workshop attendees saw no need to subject the consensus recommendations listed above to further independent peer review. A peer review may be needed, however, if a methodology is developed to expand the variance estimates for catch in hind-casted years.

The sequential release of MRIP data may cause some inconsistencies in the provision of scientific advice. These inconsistencies may arise if adjustment factors derived from the 2004-2011 data are different than estimators derived from the 1998-2011 data (assuming ST can successfully develop re-estimates for 1998-2003). If the entire data set is ultimately available, then we can compare hind-casted values with the revised estimates as a check for consistency. Similarly, changes in selectivity could occur when the length samples are revised. As noted previously, changes in selectivity could result in some changes to the BRPs, which could then require new benchmark assessments.