Mid-Atlantic Fishery Management Council
Five Year (2013-2017) Research Plan

The Magnuson Stevens Reauthorization Act of 2006 requires that each Council, with the assistance of its Scientific and Statistical Committee (SSC), develop a five-year research priority plan. To facilitate this process, the Mid-Atlantic Fishery Management Council (MAFMC) examined the research needs which have been identified in numerous stock assessments, Council FMP/Amendment documents and through the Council's Research Set Aside Program. In addition, the NE portion of the NMFS Strategic Plan for Fisheries Research and the research needs list which formed the basis for proposed changes to marine recreational fisheries statistics in the US as part of the Marine Recreational Information Program were evaluated. The Council, in consultation with its SSC, identified the top research needs for each of its managed species based on documented research needs contained in the sources described above. In addition, the Council and SSC identified research needs common to all species which are of high priority to address future assessment and fishery management needs.

General Research and Information Needs

- Collect accurate size and age composition of commercial and recreational catch (especially the discarded component of the catch) to develop catch at age matrices for all managed stocks; estimate mortality of discards by gear type
- Implement novel supplemental surveys to derive fishery independent indices of abundance (where appropriate; see species specific needs below)
- Develop assessment models to support fishery management control rules for data poor stocks (i.e., use fishery dependent data)
- Build the regional capacity within governmental agencies and academia to undertake management strategy evaluations of MAFMC managed stocks to evaluate management performance
- Develop bio-economic models to support fishery management
- Establish a framework for risk analysis of alternative harvest policies
- Incorporate ecosystem level data (predator/prey interactions, trophic dynamics, etc.) into single and multi-species assessment and management models
- Investigate effects of climate change on ecosystems and fisheries they support
- Review and improve capacity for social and economic impact analyses, including updated data on fisheries organization and structure, participation, community linkages; for regular FMP work and at scales appropriate for ecosystem-based management
- Quantify uncertainty in biological reference points

Species specific research needs

***Loligo* squid**

1) evaluate approaches to real time management including expanding age and growth studies to better estimate average growth patterns and to discern seasonal productivity/catchability patterns;

2) evaluate methods of incorporating ecological relationships, predation, and oceanic events that influence abundance and availability;
3) until real-time assessment is feasible, expand cohort analysis to refine stock assessments and their incorporation of seasonal indices (currently spring and fall are just averaged);
4) refine understanding of stock range and structure; and
5) refine understanding of catchability in surveys.

Black sea bass

(1) develop a first principles foundation for establishing reference points and assessment methods to account for black sea bass' life history;
(2) explore the utility of a spatially-structured assessment model for black sea bass to address the incomplete mixing in the stock;
(3) consider a directed study of the genetic structure in the population north of Cape Hatteras (evaluate stock ID);
(4) evaluate and, if appropriate, continue a fixed gear survey of black sea bass similar to the one used for scup.

Summer flounder

1) evaluate uncertainties in biomass to determine potential modifications to default OFL CV; evaluate the size distribution of landed and discarded fish, by sex, in the summer flounder fisheries;
2) evaluate past and possible future changes to size regulations on retention and selectivity in stock assessments and projections;
3) incorporate sex-specific differences in size at age into the stock assessment; and
4) evaluate range expansion and change in distribution and their implications for stock assessment and management
5) evaluate thermal effects on stock distribution

Scup

(1) Improve estimates of discards and discard mortality for commercial and recreational fisheries;
(2) evaluate indices of stock abundance from new surveys;
(3) quantify the pattern of predation on scup;
(4) conduct biological studies to investigate maturity schedules and factors affecting annual availability of scup to research surveys;
(5) explore the utility of incorporating ecological relationships, predation, and oceanic events that influence scup population size on the continental shelf and its availability to resource surveys into the stock assessment model; and
(6) evaluate alternate forms of survey selectivity in the assessment to inform indices of abundance at higher ages.

Bluefish

1) evaluate amount and length frequency of discards from the commercial and recreational fisheries;
2) collect data on size and age composition of the fisheries by gear type and statistical area;
3) initiate fishery-dependent and fishery-independent sampling of offshore populations of bluefish during the winter months (consider migration, seasonal fisheries, and unique selectivity patterns resulting in the bimodal partial recruitment pattern; consider if the migratory pattern results in several recruitment events); and
4) develop bluefish index surveys (proof of concept), including abundance/biomass trend estimates for the offshore populations in winter.

***Illex* squid**

1) collect demographic information on growth, mortality, reproduction by sex, season, and cohort;
2) consider a length-based assessment with a sub-annual time step, undertaking cooperative research with the fishing industry;
3) evaluate methods of incorporating ecological relationships, predation, and oceanic events that influence abundance and availability;
4) expand investigations into oceanographic correlates with trends in recruitment and abundance;
5) investigate range and range dynamics at depths >185 m;
6) refine between-vessel survey calibration estimate for *Illex*, and consider a size-based calibration;
7) analyze the change in availability of Ilex to the survey and fishery, resulting from long-term changes in climate or other oceanographic factors;
8) consider an *Illex* index standardization for the NEFSC trawl survey.

Butterfish

1) evaluate the potential for age structured assessment model and reference points;
2) evaluate sub-annual time step in assessment model;
3) re-evaluate natural mortality rate for formal inclusion in assessment model;
4) further analyze covariation and consistency of trends among surveys, to include analysis of spatial patterns in survey data to examine potential for changes in spatial distribution of population;
5) analyze additional estimation of consumptive demand of predators to identify critical periods of overlap of predators and prey;
6) continue support of habitat modeling to refine survey estimates;
7) reconsider stock structure and degree of exchange with south Atlantic stock component; and
8) calculate age- and size-structured efficiencies to convert R/V ALBATROSS estimates to R/V BIGELOW

Atlantic mackerel

1) explore patterns in consumption as an additional index of abundance;
2) evaluate methods of incorporating ecological relationships, predation, and oceanic events that influence abundance and availability;
3) collaborate with industry to explore the spatial and temporal pattern and variability in catch to evaluate issues of abundance and availability;
4) consider tagging studies to directly evaluate movement patterns;
5) examine co-variation among survey and fishery-dependent indices;
6) examine growth trajectories from different areas of the stock to evaluate possible stock structure;
7) evaluate spatial catch patterns in the small pelagic fisheries to identify "hot spots" of co-occurrence; and
8) explore management complementarities among small pelagic fisheries (e.g., mackerel, Atlantic herring and river herring).

The SSC also endorses the following research recommendations developed during the 2010 TRAC:

1) explore opportunities for the development of alternative indices of abundance;
2) attempt to develop estimates of total stock abundance;
3) initiate broad scale international egg surveys covering potential spawning habitat that is consistently representative of the total stock area, including the shelf break;
4) investigate potential to conduct work in cooperation with commercial fishing industry;
5) explore spatial distribution of stock relative to the mixing of the northern and southern 'contingents' of mackerel i.e. tagging, genetics, chemical assay, microchemistry of otoliths;
6) explore influence of environmental factors on spatial distribution of the stock e.g. rate of mixing and distribution of stock relative to the survey area (high priority, short term).
7) extend predation estimates to include DFO data and entire predator spectrum (marine mammals and highly migratory species).
8) examine methodology for incorporating consumptions estimates in the assessment.
9) quantify the magnitude of additional sources of mortality in Canada including the bait fishery, recreational catch and discards;
10) explore bottom trawl characteristics for catchability of mackerel.
11) participate with industry in investigating the contemporary overlap of survey stock area, commercial fishery, and mackerel distribution and explore historical databases for the same purpose to better understand interpretation of abundance indices (survey, cpue);
12) collaborate with industry to investigate alternative sampling gear (i.e. jigging) to survey adult abundance;
13) explore MARMAP database relative to spatial distribution of survey indices;
14) investigate alternative assessment models that incorporate spatial structure (i.e. northern and southern contingents, different age groups);
15) explore alternative assessment models that incorporate covariates; and
16) initiate a technical TRAC WG in order to advance and monitor progress of research recommendations.

Tilefish

1) understand the role of tilefish in creating secondary habitats through their burrowing activity, thereby increasing diversity and the extent to which this diversity is compromised by the removal of these ecosystem engineers by the fishery;
2) understand the causes in the pattern and variability in recruitment;
3) quantify and understand the spatial dynamics of the stock and the fishery (specifically, assess historical changes in the distribution of fishing effort, develop haul-by-haul information on the spatial and temporal distribution of catch, and evaluate the potential of a rigorously-designed study fleet program);
4) assess the potential for and extent of local population structure;
5) assess coherence between north and south Atlantic stocks and evaluate the effects of climate indices in driving stock dynamic;
6) evaluate the potential effect of time-varying catchability on assessment models that rely on commercial CPUE data; and
7) evaluate the potential for a stakeholder survey to assess extent of population outside of normal fishing area.

Surfclam

1) develop a forward-projecting, age-structured stock assessment model based estimate of abundance and investigate model formulations that accommodate spatial heterogeneity;
2) consider using year-, region- or episodic natural mortality rates;
3) consider the potential impacts of climate change on the natural mortality and distribution of the surfclam resource given recent trends;
4) determine factors that control recruitment success in surf clams (i.e., predation or environmental factors); and
5) determine how much of Georges Bank is suitable habitat for surfclams, and if depletion and selectivity experiments done in the mid-Atlantic are applicable to the Georges Bank region.

Ocean Quahog

1) Carry out simulations to determine optimum proxies for Fmsy and Bmsy in ocean quahogs, given their unusual biological characteristics;
2) improve estimates of biological parameters for age, growth (particularly of small individuals), and maturity for ocean quahogs in both the EEZ and in Maine waters;
3) investigate model formulations that accommodate spatial heterogeneity; and
4) additional age and growth studies are required to determine if extreme longevity (e.g. 400 years) is typical or unusual and to refine estimates of natural mortality. Similarly, additional age and growth studies over proper geographic scales could be used to investigate temporal and spatial recruitment patterns.
5) consider the potential impacts of climate change on the natural mortality and distribution of the surfclam resource given recent trends;

Spiny dogfish

1) Revise the assessment model to investigate the effects of stock structure or distribution, sex ratio, and size of pups on birth rate and first year survival of pups;
2) continue large scale (international) tagging programs, including conventional external tags, data storage tags, and satellite pop-up tags, to help clarify movement patterns and migration rates;
3) investigate the distribution of spiny dogfish beyond the depth range of current NEFSC trawl surveys, possibly by using experimental research or supplemental surveys;
4) continue aging studies for spiny dogfish age structures (e.g., fins, spines) obtained from all sampling programs (include additional age validation and age structure exchanges), and conduct an aging workshop for spiny dogfish, encouraging participation by NEFSC, Canada DFO, other interested state agencies, academia, and other international investigators with an interest in dogfish aging (US and Canada Pacific Coast, ICES); and
5) evaluate ecosystem effects on spiny dogfish acting through changes in dogfish vital rates.