Mid-Atlantic Fishery Management Council
Five Year (2009-2014) 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 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/Information Needs

- Collect ecosystem level data (predator/prey interactions) and incorporate into multi-species assessment and management models
- Develop assessment models to support fishery management control rules for data poor stocks (i.e., use fishery dependent data)
- Develop fishery independent indices of abundance (i.e., supplemental surveys, especially for scup and black sea bass)
- Develop bio-economic models to support fishery management
- Establish a framework for risk analysis of alternative harvest policies
- Investigate effects of climate change on ecosystems and fisheries they support
- Collect accurate size and age composition of commercial and recreational catch to develop catch at age matrices for all managed stocks
- Develop fishery management performance analysis and standards

Species Specific Research Needs

Bluefish: 1) increase sampling of size and age composition by gear type and statistical area and target landings for biological data collection and increase intensity of sampling for biological data, 2) investigate the feasibility of alternative survey methods that target bluefish across all age classes to create a more representative fishery-independent index of abundance, and 3) initiate sampling of offshore populations in winter months.

Tilefish: 1) conduct hook selectivity study and collect data on spatial distribution and population size structure and, 2) develop a bio-economic model to calculate maximum economic yield per recruit.

Surfclams: 1) consider using year-, region- or episodic natural mortality rates, 2) develop a forward casting age-structured, numbers-based stock assessment model, 3) consider

new technological methods that rely less heavily on estimating dredge efficiency, 4) review survey age data carefully to determine if strong year classes can be used to estimate mortality rates outside of a stock assessment model (e.g. "empirical" Z estimates), 5) refine survey catchabilty estimators, 6) consider alternative means for estimating B_{msy} and F_{msy}, 7) determine factors that control recruitment success in surf clams (i.e., predation or environmental factors), 8) determine if the distribution of surfclams is changing), 9) consider the potential impacts of climate change on the natural mortality of the surfclam resource given recent trends, and 10) consider the likelihood that industry will be able to utilize the surfclam resources on Georges Bank given the prevalence patterns of PSP.

Ocean Quahog: 1) consider using ecological estimates of carrying capacity (based on available food, maximum size, predation, amount of suitable habitat) to evaluate/validate model estimates of virgin biomass, 2) Consider whether future stock assessment models should be based on age and abundance, rather than shell length and weight, 3) there is little information regarding F_{MSY} and B_{MSY} or suitable proxies for long lived species like ocean quahog. Traditional proxies (e.g., $F_{MSY} = F_{35\% MSP}$, $F_{MSY} = M$, $F_{MSY} = F_{0.1}$ and B_{MSY} at one-half virgin biomass) may be inappropriate for long lived organisms (the question of F_{MSY} and B_{MSY} proxies should be considered), 4) refine survey catchability estimators, and 5) conduct further experimental work to determine the relationship between dredge efficiency, depth, substrate and clam density.

Summer flounder: 1) more comprehensive collection of otoliths, for all components of the catch-at-age matrix, needs to be collected on a continuing basis for fish larger than 60 cm (~7 years; could provide a better indicator of stock productivity). Continue to conduct exchange of age structure between NEFSC and state agencies. Reference collection of summer flounder scales and otoliths should be developed to facilitate future quality control of summer flounder production aging, 2) the 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. Collecting information on overall fecundity for the stock, both egg condition and production may be a better indicator of stock productivity, 3) investigate trends in sex ratios and mean lengths and weights of summer flounder in state agency surveys catches, and 4) conduct additional trawl gear mesh selectivity research.

Black sea bass: 1) develop valid index of stock abundance, 2) ageing of samples of black sea bass should be initiated as soon as possible, and survey indices need to be disaggregated by age to identify the impact of year-class variation in the biomass index and to investigate the magnitude of year effects, 3) a standard assessment based on a population model should be developed for the stock. A catch-at-age model would be most appropriate, and 4) tagging studies should continue (at least sporadically), to permit return rates over longer periods and the stability of estimates of exploitation rate to be established (a more sophisticated analytical model such as the Brownie should be applied to tagging data).

Scup: 1) develop valid index of stock abundance, 2) expanded age sampling of scup from commercial and recreational catches is required, with special emphasis on the acquisition

of large specimens, 3) 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, and 4) biological studies to investigate factors affecting annual availability of scup to research surveys and maturity schedules.

Atlantic mackerel: 1) explore the feasibility of acoustic surveys for monitoring stock size, 2) increase sampling of commercial landings and survey catches to better characterize age and length composition, 3) explore discard estimation, especially for years when large year classes are first entering the fishery, and 4) develop pilot survey to explore for old fish to test hypothesis regarding dome in commercial fishery selectivity.

Butterfish: 1) further work on potential information (for example the VTR database) for the estimation of discards of butterfish from all sources should be undertaken, 2) explore the utility of incorporating into the assessment model ecological relationships, predation, and oceanic events that influence butterfish population size on the continental shelf and its availability to the resource survey, 3) explore the use of an age-based model for future assessments, and 4) further investigate the estimation of suitable biological reference points.

Illex: 1) maturity and age data should be collected throughout the fishing season to evaluate the effects of differential growth and maturity within seasons and between years, 2) re-estimate biological reference points for each seasonal cohort by incorporating seasonal information regarding growth, selectivity, and natural mortality, and 3) a pre-fishery, stratified random survey would be useful to estimate initial stock size.

Loligo: 1) traditional per-recruit reference points like Fmax may be poor proxies for F*msy*. Satisfactory biomass based reference points for *L. pealeii* need to be developed, 2) additional age and growth studies are necessary to better estimate average growth patterns and to discern seasonal patterns, and 3) the spatial resolution ,coverage and accuracy of commercial catch data should be improved.

Spiny Dogfish: 1)conduct tagging and genetic studies of spiny dogfish in U.S. and Canadian waters to clarify current assumptions about stock structure, 2) Investigate the distribution of spiny dogfish beyond the depth range of current NEFSC trawl surveys, possibly using experimental research or supplemental surveys, 3) initiate aging studies for spiny dogfish age structures (e.g., fin 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, NCDMF, Canada DFO, other interested state agencies, academia, and other international investigators with an interest in dogfish aging (US and Canada Pacific Coast, ICES).