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Northeast Area Monitoring and Assessment Program

Report No. 09-01
of the

Atlantic States Marine Fisheries Commission

Terms of Reference & Advisory Report
of the NEAMAP Nearshore Trawl Survey Peer Review

January 2009

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

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Terms of Reference & Advisory Report
of the NEAMAP Nearshore Trawl Survey Peer Review

Conducted on
December 10-11, 2008
Virginia Beach, Virginia

Prepared by the
ASMFC NEAMAP Nearshore Trawl Survey Peer Review Panel

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Preface

The first goal of the Northeast Area Monitoring and Assessment Program identified in the NEAMAP Memorandum of Understanding is to: cooperatively plan, evaluate, and administer fisheries independent data collection programs, including a state/federal near shore trawl survey and other NEAMAP-sponsored activities. Objective number seven under this goal is to conduct periodic coordinated external reviews of specific management, administrative, and technical elements of the program. The purpose of the peer review process is to: (1) improve the quality of the trawl surveys; (2) improve the credibility of the scientific basis for management; and (3) improve public understanding of the trawl surveys.

On December 10-11, 2008, a peer review of the NEAMAP Nearshore Trawl Survey was conducted in Virginia Beach, Virginia. The main objective of this survey was established in a Memorandum of Understanding (MOU) between the various states, fisheries management councils, and relevant federal organizations in the area. It is as follows:

- To collect a consistent time series of fishery independent data in Atlantic near-shore waters from the western shore of Cape Cod, MA, to Cape Hatteras, NC, in support of analytical stock assessments of managed species.

The survey also has two secondary objectives:

- To conduct independent data summarizations and analyses in support of assessment and management.
- To participate in collaborative research programs which leverage and extend the survey's capabilities.

An external panel was invited to review the technical aspects of this survey following the terms of reference provided in this report. Background documents and survey reports were provided to the panel in advance. Presentations on the survey were made by the research team during the peer review meeting (see agenda Appendix I). Each presentation was followed by questions from the review panel and discussions with the scientific team. This report summarizes the consensus view of the review panel. The organization of this report follows the terms of reference. Participants at the review are listed in Appendix II. The report was submitted to the survey team for their examination and they provided responses to the review team comments (Appendix III). Additional comments were then prepared by the review team where warranted and are also included in Appendix III.

Main Findings and Conclusions of the Panel

- Overall, the "NEAMAP Nearshore Trawl Survey" is considered to be a valuable project with high scientific standards.
- There is a need for a new electronic data collection system.
- The panel recommends some modifications and suggestions for improvement in survey operations, biological sampling, data collection, and statistical analyses.
    - A re-examination of the survey stratification.
    - Tightening of towing protocols including the use of a constant target towing speed and full documentation of gear setting, towing, and gear haul-back protocols.
    - Additional gear certification standards.
    - Changes to the sampling protocols including the collection of sexed length frequencies for sexually dimorphic species (Partial sampling) and length stratified random selection of fish for Full sampling.
    - Estimation of population parameters such as age structure or maturity should make use of age-length or maturity-length keys and the length frequencies, rather than based on expansion of Full samples by individual tows.
- The work is considered to be an excellent example of a cooperative project with extensive outreach work and good data accessibility.
- Data collected has high potential for use in stock assessments, ecosystem analysis, and increased understanding of the nearshore waters from Cape Hatteras to Cape Cod.
- Permanent funding should be obtained.

General Observations

The documents provided in advance of the meeting were thorough and provided a good overview of the survey goals, procedures, and methods as well as results to date. The presentations during the meeting were of high quality, clear, and concise. Attention to detail was apparent in both the documentation and the presentations and it was clear similar care had been exercised in all aspects of the design, planning, execution, and analysis of the surveys. The scientific team was responsive to questions and comments raised by the review panel and the collaboration was appreciated. The meeting was successful in addressing all of the terms of reference of the review.

Overall, the survey is on sound footing; however there are some issues with regard to sampling procedures and the panel offers some suggestions for improvements. There are no major deficiencies that would affect the data collected to date.

Acknowledgements

The Atlantic States Marine Fisheries Commission thanks all of the individuals who contributed to the development of the NEAMAP Nearshore Trawl Survey Report and the Terms of Reference and Advisory Report. The Commission extends its appreciation to the NEAMAP Nearshore Trawl Survey Peer Review Panel (Mr. Ghislain Chouinard - Chair, Fisheries and Oceans Canada; Mr. Mark Wilkins, NOAA Alaska Fisheries Science Center; Mr. David Beutel, Rhode Island Sea Grant) for their efforts in evaluating the trawl survey and developing this Terms of Reference and Advisory Report.

The Commission and the NEAMAP Nearshore Trawl Survey Review Panel thank the Virginia Institute of Marine Science (VIMS) researchers who developed background documentation for the Peer Review, most notably, Chris Bonzek, Rob Latour, and James Gartland for their in-depth and clear presentations describing the survey's protocols, methodology, and subsequent new data available for assessments.

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Terms of Reference for the NEAMAP Nearshore Trawl Survey Peer Review

1. Statistical Design

The review panel should evaluate the statistical and scientific validity of the survey design relative to the survey goals and objectives, highlighting strengths, weaknesses, and potential biases. In particular, evaluate the temporal and spatial design elements relative to survey objectives including:

a. selection of strata boundaries, station cell boundaries, random stations, and alternate stations
b. timing of the surveys
c. spatial coverage
d. evaluate the estimation of survey area as it relates to absolute biomass estimates and the validity of such estimates

2. Operational Protocols and Standardization

The review panel should evaluate operating procedures and performance, and gear selection and maintenance. The review panel should evaluate the standardization methods employed, considering such items as:

a. gear inspections with documentation
b. trawl performance and mensuration
c. vessel speed and haul-back
d. trawl symmetry and routine cable measurement
e. standardization of tow distance and tow time
f. development, documentation, and quality assurance of protocols
g. 'good tow' criteria and treatment of tows not meeting those criteria

3. Biological Sampling Protocols and Standardization

The review panel should evaluate biological sampling procedures and performance, including the quality and consistency of:

a. Processing of biological materials and total catch, including documentation and quality assurance.
b. Sampling protocols, including documentation and quality assurance
c. Sub-sampling procedures, including documentation, quality assurance, and the adequacy and accuracy of sub-samples to represent discarded catch.

4. Data Post-processing and Audit Procedures

The review panel should evaluate shipboard data acquisition and shoreside data post-processing procedures, including integration of gear performance data, sub-sampling expansion, and data auditing. The panel should also review the archival process, including accessibility procedures and policies, relational database structure, and data storage safety and integrity.

5. Statistical Analysis

The review panel should evaluate quantitative analysis techniques, measures of statistical precision, and recommend design or analytical processes that will promote the utility of existing survey data, to include:

a. Evaluate methods and units for calculation of overall and age-specific abundance estimates.
b. Evaluate variability (coefficients of variation) in data collected with respect to priority commercial and recreational stocks captured in the NEAMAP survey.

6. Integration

The review panel should evaluate the potential for integrating the NEAMAP Survey with other inshore trawl surveys or fishery-independent monitoring programs, in particular, the NEFSC bottom trawl survey.

7. Future of the NEAMAP Survey

The review panel should make recommendations concerning the continuation of the NEAMAP Survey, including measures to ensure consistency in the development of time series. The panel should comment on any protocols to be followed in anticipation of changes to the survey (i.e., vessel) in the future, including recommending prioritization of calibration studies with alternative vessels, or vessel performance and mensuration requirements with an alternative vessel.

Advisory Report

1. Statistical Design

The survey uses a stratified random design which is widely used and considered appropriate for this type of survey. Currently, station allocation is approximately proportional to area with a minimum of two stations per stratum to allow for an estimate of catch rate variance. Because of the requirement to have two stations per stratum, very small strata are sampled at a density that is higher than the target of one station per 30 nm^2 density. The density of stations is relatively high compared to other surveys and much higher than the NEFSC survey conducted offshore.

a. selection of stratum boundaries, station cell boundaries, random stations, and alternate stations

   Originally, the survey area was to extend to 27.4 m (90 feet), however given that the new federal vessel (*FSV Henry B. Bigelow*) would be available to fish from depths of 18.3 m (60 feet), a decision was made that there would be no overlap in coverage between the two surveys. Consequently, the NEAMAP survey extends from 6.1 m (20 feet – minimum trawlable depth) to 18.3 m for most of the area except for the Rhode Island Sound (RIS) and Block Island Sound (BIS) areas where waters less than 18.3 m cannot be sampled. In those areas, waters from 18.3 m to 36.6 m (120 feet) are sampled.

   Considerable care was taken in establishing the stratum boundaries and sampling units, which are based on the most up-to-date soundings available. In a survey manual, it would be useful to have a table describing each stratum with the depth

range, number of sampling units and total area in square nautical miles (Note Table 1 in the peer review documentation contains most of that information).

The survey area is considered to be over-stratified. It should be possible to re-stratify by combining some strata of similar depth range. This would result in fewer strata and thus a larger number of tows within each stratum which may help reduce the estimated variance. Since the objective of the stratification is to reduce variability among station catch rates within each stratum, this may mean strata from various states may be combined. If information on a state basis is desired, this can be obtained by multiplying the density in the stratum by the area of the stratum within that particular state. Information gathered during the surveys on the distribution of the various species should be considered in establishing a new stratification scheme. The impact of various re-stratification options on the variance of estimates would help guide the process. (see Smith, S.J. and Gavaris, S. 1993. Improving the Precision of Abundance Estimates of Eastern Scotian Shelf Atlantic Cod from Bottom Trawl Surveys. North American Journal of Fisheries Management 13:35-47 and references therein for potential approaches)

The selection of the stations and alternate stations within strata is done by random selection from all available sampling units except in the Rhode Island area where 20 units from 126 are excluded from the selection because they are not trawlable. During the survey, once the need to go to an alternate is identified, the same rule for selecting the alternate (closest) should be used in all cases.

The number of stations fished in the survey is set at 150 based on a target density of stations. With the data already collected from three surveys, it would be useful to conduct simulations to assess the benefits of different levels of survey intensity (suggest 100-150 stations, increments of 10). This would help assess whether significant improvements in variance are attainable with different levels of sampling and might suggest some benefit in adding stations to the survey. This work could be done in conjunction with analyses to examine the re-stratification.

The stations are currently allocated proportionally to the area of the strata. One advantage of the stratified random design is strata with high variance can be allocated a higher number of stations by unit area in order to reduce variance. Given that the survey is multi-species in nature, gains for one species could result in losses in terms of precision for others. A list of priority species for which variance would need to be minimized should be determined in order to identify strata where more stations should be sampled. Some surveys use multiple criteria to allocate stations among strata, such as AFSC's Gulf of Alaska survey that employs a Neyman allocation algorithm based upon stratum area, historical survey catch rates for important species, and some rank of importance among species (e.g., ex-vessel value).

b. timing of the surveys

The spring surveys which start about April 20 are conducted later than the NEFSC surveys which are conducted in March-April. This is considered appropriate given that the NEFSC surveys indicate few fish are found inshore while that survey is being conducted. It is understood the timing of the spring survey represents a

trade-off since many of the species caught in the survey are migrating from offshore waters into estuaries. Depending on the timing of the migration, some species may not be within the survey area every year and biomass estimates for these species can thus be expected to exhibit large inter-annual variability. There was little information presented that would help better identify whether the timing of the survey is optimum. However, catches were significant in this survey suggesting it is carried out at a time when many species are present within the survey area.

The fall surveys are conducted within the time period NEFSC surveys are conducted. While some fish species may have started to migrate during that time, the timing of the survey is believed to occur before the peak of the migration. Catches in the fall surveys were also significant and it is recommended the current timing be maintained.

Survey planners were asked to consider whether conducting the survey when fish were more stationary would be possible in order to improve accuracy and precision. Planners were concerned, however, some species would have migrated beyond survey depths to estuaries and be altogether unavailable to the survey.

The survey is conducted so that stations are sampled in the same direction as the general pattern of most species' north-south migrations (south to north in spring and opposite in fall). This choice was made to maintain the same direction of survey coverage relative to the direction of migration and is appropriate.

c. spatial coverage

The target station density of one station per 30 nm^2 provides relatively good spatial coverage of the area. The extent of the survey inshore is as good as possible. As indicated above, extending the survey to cover the 60-90 feet strata could allow, over time, to establish relative efficiency coefficients with the vessel used to carry out the NEFSC survey. This may prove useful in deriving combined indices of abundance for some species with wide distributions. It is understood a decision not to follow this approach has already been taken.

d. evaluate the estimation of survey area as it relates to absolute biomass estimates and the validity of such estimates.

The calculation of the area for each sampling unit should include the appropriate correction for longitude. Currently, one degree of longitude is considered equal in distance to one degree of latitude and that incorrect assumption affects the estimate of survey area. It should be noted biomass estimates from such a survey should not be considered to be absolute but represent an estimate of the minimum trawlable biomass in the area.

2. Operational Protocols and Standardization

a. gear inspections with documentation

The current process of gear review before each trip is critical for consistent performance. The gear review and proposed changes for gear certification are thorough and the review panel suggests some certification standards for the process for both new and existing nets.

Additional new net certification standards:

- Make sure the tripper size and the lengths of tripper lines are consistent.
- Measuring the bull rope and splitting strap will be valuable; the tolerance for the bull rope could be plus or minus 10%; the tolerance for the splitting strap could be plus or minus 5% (neither of these measurements is as important as the other measurements suggested).
- The random selection of meshes should be from at least 10 meshes away from a gore or lacing; it should consist of measuring 10 consecutive meshes in the depth of the webbing (in the "run of the twine"). An acceptable measurement tolerance would be 0.3 cm for the 12 cm webbing and 0.15 cm for the 6 cm webbing*.
- Determine the width mesh count without opening the gores, if possible.
- The headrope, wing end lines, footrope, and sweep should be held to a plus or minus 1% tolerance. A random sample of the depth of the traveler bights would be appropriate. The float line could be plus or minus 5%.
- Float placement could be plus or minus 5%.
- All extension pieces should be held to a 1% tolerance.

Additional used net certification standards:

- Maintain the bull rope length tolerance at plus or minus 10%; allow 10% for the splitting strap tolerance.
- Use the mesh measuring technique for new nets; change the webbing if the tolerances are attained*.
- The headrope, footrope, wing end, and sweep tolerance may change up to 2%; the float line can remain at 5% tolerance; traveler bights should still be consistent in depth.
- Float placement could remain at 5% tolerance.
- Extension pieces may be 2% tolerance.

The changes in tolerances from new nets to used nets are small, but will allow for differences through use. This trawl package has areas of adjustment built into the gear design. Adjustments to used nets can be made to achieve almost new parameters. Please note polyethylene webbing exhibits little change due to stretching and shrinking.

It should be noted the twine measurements for the 12 cm and 6 cm are including one knot for each mesh of depth. The correct method to measure this webbing is to mark the ten meshes in a row of depth; starting at the inside of the knot on the first mesh, measure down the ten meshes just past the last knot (with a metric tape measure); divide the distance measured by ten to get the average mesh size within that panel of webbing.

The Program may find it useful to develop net measurement and certification diagrams and flowcharts to assist them in certifying their nets (see examples in Stauffer, G. (compiler). 2004. NOAA Protocols for Groundfish Bottom Trawl Surveys of the Nation's Fishery Resources. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-65, 205 p.)

b. trawl performance and mensuration

The protocols and standards described in the report are thorough and appropriate. The bottom trawl chosen for sampling had rigorous development through the Trawl Advisory Panel formed by the Mid-Atlantic and New England Fishery Management Councils and is almost identical to the trawl chosen for the *FSV Henry B. Bigelow*, with the difference being the design of the sweep and an extra last belly that was added to the trawl used by the *FSV Henry B. Bigelow*. The sweep chosen for this project is appropriate for the depths and bottom types sampled. The trawl doors, bridle configuration, flotation scheme, and towing warp specifications are appropriate for the sampling gear as designed. The flume tank testing at the Marine Institute at Memorial University, St. John's, Newfoundland, Canada ensured the effectiveness of the sampling package.

The Netmind system is a valuable mensuration tool that has been used effectively to ensure each tow is within acceptable parameters. The range of acceptability is tight which allows for only small variations of gear performance. Correct trawl configuration is monitored during each tow. The measurement and remarking of the towing warps before each trip minimizes the chance for error.

An important aspect of survey trawl performance that is not monitored during this survey is assuring good contact between the footrope and the bottom. Instruments are available which collect this information (NMFS AFSC's bottom contact sensor) and could provide valuable insight to the way this net is fishing prior to brakeset (beginning of effort measurement) and after haul-back (end of effort measurement). Some survey teams have found the distance fished and net spread during these transition periods are important, though variable, components of the trawl sampling effort and it is important to consider quantifying them.

The review panel also suggested net mensuration data collection begin preceding brakeset and continue until the net has reached the surface rather than the current practice of logging these data only between brakeset and the beginning of haul-back. Again, more knowledge of how the net behaves during these transition periods would help the Program understand the dynamics of the sampling tool.

c. vessel speed and haul-back

The range of speed of towing and hauling back is within appropriate boundaries for sample trawling. Maintaining wing spread, door spread, and headrope height within the appropriate range is often a function of speed, so for inshore trawling at a constant speed, one or more of the parameters may be compromised. If the trawl shape is the guiding parameter, then sometimes the range of speed of trawling will be broader. Areas with stronger currents will affect the speed the most, but the

speed at which the fish encounter the trawl may still be in a narrow range. However, the review panel recommends the survey should target a speed of 3.0 knots which should ensure trawl shape is maintained. If the trawl shape cannot be maintained at the 3.0 knot speed, the speed may be modified (as little as necessary) to keep the net in the 5% range of configuration for the other parameters. It is unclear whether the 5% range is the most appropriate and this issue should be examined with existing data at towing speeds of 3.0 knots and with new data from tows with towing speeds of 3.0 knots. The current tow duration of 20 minutes should be maintained.

In case there is a vessel change at some point in the future, it would be useful to have a complete description of the procedures (vessel speed during setting and haul-back, winch adjustments, etc.) during the deployment and retrieval of the trawl. This would ensure procedures would be as similar as possible. Both AFSC and NEFSC employ questionnaires skippers fill out at the beginning of each survey recording the parameters of important gear handling operations.

The manner in which the trawl is set and retrieved, while less than optimal in some respects, is constrained by a) the shallow depth range of this survey and b) aspects of the mechanical capabilities of the *Darana R.* In particular, prior to haul-back, forward progress of the vessel is slowed, the hydraulic power take-offs are engaged to power the winches, and haul-back is initiated while the vessel maintains a slow speed (sometimes effectively backing down towards the gear). As a result, fish herded into the bosom of the trawl but not captured by the end of the tow are able to escape capture. Some other surveys maintain towing speed or accelerate at the end of the tow to prevent this from happening. The Program should consider this effect and, if deemed an important enough issue, should consider finding a vessel capable of retrieving the net in this manner. The shallow depths being sampled preclude any changes to the way the trawl is set, since the trawl doors usually reach bottom well before the winch brakes are set.

d. trawl symmetry and routine cable measurement

Information on trawl shape presented indicated the net usually conforms to specifications. The link between towing speed and trawl configuration was noted and maintaining a constant speed should be a prime consideration. Towing speed should only be modified if the trawl shape cannot be maintained within the acceptable range of trawl dimensions. Although there were sensors to measure trawl symmetry, it appears these were not functioning properly and giving erratic measurements. The research team is investigating the problem with the trawl mensuration equipment supplier. The panel raised the possibility the sensors are mounted on the net in a manner that allows them to move about more than they should when measuring symmetry. This should be examined and mounting plates or attachments to bridles should be considered if corrections are needed.

Cable is measured and marked at the beginning of each survey and in a manner consistent with the protocols for the NEFSC survey; this method is considered adequate.

e. standardization of tow distance and tow time

Current standardization is based on area swept calculated as the average wing spread during the tow multiplied by the distance towed. The sampling net fishes in three dimensions and useful calculations should include both area swept and volume swept by the trawl. The area swept is valuable information to be included in demersal fish calculations, while the volume swept is more important for the pelagic and semi-pelagic species.

f. development, documentation, and quality assurance of protocols

The documentation provided during the peer review was relatively detailed and the specifications of the gear were well documented and included plans. The review panel encourages the research team to upgrade and publish the information in a formal survey manual.

g. 'good tow' criteria and treatment of tows not meeting those criteria

The criteria for determining valid tows included minimum tow time, gear malfunction, and net damage. These were clearly specified and are consistent with standard practices. In terms of net damage, the review panel considered that some of the rules for declaring a tow invalid may be overly stringent when the damage occurs in the forward portion of the trawl. However, it was noted that, for the most part, the survey area is smooth and despite being stringent, the standards for net damage have not resulted in a large number of tows being declared invalid.

The fishing configuration of survey trawls can, however, be altered unintentionally through the cumulative effects of continually repairing damage. Net repair diagrams or log sheets should be developed and used to record all repairs made to each net (examples shown in Stauffer, 2004). Repair logs for each net should be provided to the net maintenance professionals following each survey for them to evaluate how any changes in net configuration or behavior might be related to repair practices.

General comments regarding safety of operations.
A number of practices were noted as not being as safe as possible. These included the placement of deck processing stations directly beneath overhead trawl cables, the presence and use of chemicals in the confined (though ventilated) laboratory below decks, and some instances of leaving the bridge unmanned while setting the net. Personal safety equipment (hard hats, steel toe boots, etc.) should be worn where circumstances warrant. Some sources of future funding may find such practices unacceptable so alternative practices should be considered.

3. Biological Sampling Protocols and Standardization

a. Processing of biological materials and total catch, including documentation and quality assurance.

The process used to collect data on catch species composition and biological data is described. It is a complex schema with points along the way where different decisions can be made about the methods employed.

As it is done currently, the catch is sorted by species and, in some cases, species are sorted into 2-5 size-classes (i.e., small and large; or small, medium, large) to be sorted and processed as separate 'taxa'. The decision to use size-classes and their definition is made by the Chief Scientist prior to sorting each catch. After completing the sort and before baskets are weighed, fish are selected "haphazardly" (read "approximately random") from each taxon for FULL (see below for description) processing (10 fish/taxon [or all if <10 caught] in most cases, but for some taxa this number is 3 or 5). The remainder, or if the catch is large, a sub-sample (see next section for description and comments) of the taxon is PARTIALLY processed on deck. Data are collected using Limnoterra fish measuring boards feeding into a LDCE database. Three board stations are set up on deck to process the sample (or sub-sample) of each taxon. A fourth board station is set up down below in the lab to collect data from the samples selected from each taxon for FULL processing. Fish chosen for FULL processing are taken to the lab below deck where fish are individually weighed, measured, sexed, and the stomachs and otoliths are collected. This procedure continues as described until 5 fish of a given taxon with full stomachs have been processed or all 10 have been processed, whichever comes first. If, after 5 full stomachs have been collected, there are fish left over in the FULL portion, they are returned to the deck and added to the complete or subsampled PARTIAL portion of that taxon. PARTIAL subsampling entails obtaining an aggregate weight and individual lengths (unsexed in most cases) for each taxon.

Generally, current methods ensure the catch is entirely processed. The system is well documented and there is an established quality assurance program to ensure the quality of the data. The methods for estimating catch conform to established protocols used by NEFSC. One drawback of the current data collection is that no real-time data checking is being conducted. While errors can be obvious and easily corrected after the fact, this can also result in some data loss. The current trend is for survey data capture systems (e.g., FSCS, http://www.publicaffairs.noaa.gov/grounders/fscs.html) and others to do real-time quality assurance so errors can be detected as data are being collected and measurements can be re-done if necessary.

Shoreside laboratory staff processing otoliths for estimates of age use a generally accepted protocol of blind age assignment to avoid biasing their estimates by prior knowledge of fish size, sex, or location collected. Some agencies performing this task have chosen to use as much prior information as possible to help accurately assign ages to otoliths. The Program should research the best practices for these

protocols through associations with other institutions which age fish. One such institution on the Pacific coast is the Committee of Age Reading Experts (CARE) which includes staff from US and Canadian agencies that age groundfish from the northeast Pacific Ocean and Bering Sea (http://care.psmfc.org/). Otolith sections are examined separately by three technicians and discrepancies are resolved by consensus, if possible. No information was provided as to whether a senior age reader would have influence over the quality control of this process, but that practice might be appropriate.

b. Sampling protocols, including documentation and quality assurance

The species size-class sorting process was explored by the review panel in regard to the adequacy of sampling various components of the catch, whether it be for FULL or PARTIAL data. The advantage of employing this technique, if done correctly, serves to stratify the range of sizes of a species for collecting length and biological samples more efficiently and effectively. The panel registered their concern about how this method gets employed in cases where the size range of a species is a more continuous spectrum versus when distinct size classes are evident. The technique apparently gets used in both cases. In the continuous instance, choice of the size-class breakpoints would seem to be rather arbitrary, but would presumably still serve to stratify the size range.

Age compositions and sex ratios, as well as other biological parameters, are derived by expanding data from the FULL samples to match the number of fish caught (see discussion of expansions in the Statistical Analysis section). A more conventional method of deriving these biological parameters is to construct an age-length key, a length-sex ratio, or a length-maturity key by combining data from an appropriate set of tows (for example, if there are no growth differences by area, all fish would be aggregated in one key) from the FULL data samples and apply that to the size composition from the length frequency collection (which is sexed for dimorphic species; the PARTIAL samples, in this case). The panel pointed out the method currently used discounts the power of the length data collected. In addition, it would seem the majority of the processed catch, which is processed above deck, is measured without recording sex of the fish. Only the fish selected for full processing are sexed. So apparently estimates of sex ratio come only from the "haphazard" samples selected for full processing. Reliable estimates of population parameters this important should be derived from either a random sample or a size- or size-sex-stratified sample. For sexually dimorphic species, the length frequency collections (PARTIAL samples) should be sex-specific; otherwise estimates of size at age by sex can be biased.

Particular attention focused on selection of the sample for FULL processing. The "haphazard" sampling method is undocumented and subject to bias by being the easiest fish to grab (consequently, perhaps, the larger ones) or other effects. The panel suggested a stricter sampling scheme be developed and adhered to for selecting this sample. One such solution might be to weigh and measure ALL (or an adequate sub-sample of) fish from each taxon, selecting every x^{th} fish for FULL sampling. Ideally, the selection of fish for FULL sampling should be length-stratified, as many of the variables of interest (age, maturity, food habits) tend to vary according to size. In those sampling schemes, the first fish encountered by

length group are selected for FULL sampling. This ensures at least one fish from each length class has been sampled and the catch of these fish can be attributed to an age group. Further, once a fish is selected for FULL sampling, it should remain in that class, whether a stomach is collected or not; the return of leftover FULL specimens to the PARTIAL process is confusing and unnecessarily complex.

Much of the process and work flow is influenced by the data collection system itself, although that system is being considered for upgrade or change. However, it is more appropriate that the data needs drive the data collection system. It is recommended that a full re-evaluation of the work flow and collection process be undertaken considering all of the recommendations that stem from this review. One way of keeping the same configuration would be for the teams responsible for PARTIAL sampling to retain fish on a length-stratified basis for FULL processing and pass them to the team responsible for that work.

Catch data from fish and selected invertebrates are processed differently and even wind up in different data tables. Some invertebrates (sponges, corals, etc) are not treated as invertebrates, but are rather classified as "habitat". Fisheries management has progressed to the "ecosystem-based management" stage and surveys providing fishery independent data should ensure data on all taxa are collected. The catch that comes up in the tows should be fully censused to the extent possible. Information on all species, including sponges, corals, and sessile invertebrates that are high on the visibility list, should be collected rather than only for commercially important species.

It is recommended that all information on the weight and number of organisms be collected similarly, with weight being a "must" datum and numbers being a "should" datum, although it can be null for species that are uncountable (sponges, coral, others) or mashed up beyond countability. All these should appear in the CATCH table. The INVERTEBRATE table should be done away with. Those organisms in the HABITAT table should appear in the CATCH table and should be weighed and counted, if possible.

In terms of the PARTIAL and FULL sampling, it is understood all species in the A, B, and C species lists are sampled consistently from tow to tow. This should be maintained at all costs. Irregular sampling can result in biased estimates. It is recognized that there are a large number of species caught in the survey and it is not possible to sample them all without delaying significantly the progress of the survey. For the D and E lists, PARTIAL and FULL sampling of some tows and not others can result in biased estimates. Another approach is to collect basic information (weight of catches) on every survey but to do the PARTIAL and FULL sampling on a rotational basis (the PARTIAL and FULL sampling could be done for all tows in the spring surveys for some species and in the fall surveys for another set of species or some species could be done on a biennial basis. This would ensure consistent estimates of age-structured indices of abundance for these species.

The value of collecting catch information about true "habitat" (rocks, tires, sticks, trash, etc.) was discussed. This needs to be done in part to comply with the need to address the issue of essential fish habitat (EFH). The panel pointed out the fact

that “catchability” of these items is extremely variable and the best one can hope to glean from these observations is that there was some of it in the path of the net and the net happened to catch some. Since no conclusions can be drawn about relative abundance or the absence of it where it isn’t caught, the value of collecting it is extremely limited. On the other hand, nothing is being lost by recording it.

The on-board data collection equipment relies heavily on electronic acquisition. The Program does not use an uninterruptable power supply (UPS) to guard against sudden power loss resulting in loss of data. UPS units should be added to the system.

c. Sub-sampling procedures, including documentation, quality assurance, and the adequacy and accuracy of sub-samples to represent discarded catch.

Catch subsampling is used when there are large numbers of one or several species or species-size-classes (or ‘taxa’). Only designated species or species/size classes are subsampled; the remaining taxa are fully sampled. Three different methods of subsampling are described but the criteria for which method to use when are vague and confusing.

• Straight subsampling by weight – the catch is fully sorted by taxon. Taxa with unmanageable numbers are subsampled by selecting some of the filled containers as the subsample (baskets or pans are retained as the sampling unit). The unsampled containers are weighed and discarded. The only data lost from the unsampled containers would be the individual fish lengths.

• Mixed subsampling by weight – taxa with manageable numbers are removed, resulting in a mixture of all taxa with unmanageable numbers. This unsorted mixture is then subsampled, with the subsampled portion proceeding to the sorting phase, then the processing phase. The unsampled portion of the mixture is weighed and dumped. The information lost by this method would be the actual OBSERVED weights (and numbers) of each of the taxa involved in the mixture (the catch weights of all of those taxa would be ESTIMATED). Individual fish lengths of the discarded portion of the catch would also be lost.

• Discard by count – this is only used with very large catches of large-bodied fish. Baskets are filled with a “sufficient subsample” and the remaining fish are counted overboard. To calculate the estimated weight of those discards, one must assume the subsample will yield an accurate and representative mean fish weight. Still, the catch weight of the species will be ESTIMATED, rather than OBSERVED. An additional risk of using this method is ensuring the “sufficient subsample” is selected in such a way that its composition represents the catch of that taxon. There is a documented tendency for samplers to avoid picking up exceptionally larger or smaller fish from the catch until the latter part of the sorting process.

It is recommended that clear guidelines with examples be provided in the survey manual as to when the various sub-sampling strategies should be used. The potential biases should also be presented so that sampling personnel have a full understanding of potential issues associated with the sub-sampling.

4. Data Post-processing and Audit Procedures

a. Shipboard data acquisition procedures.

The data collection system used by VIMS on this survey (Limnoterra) is old and no longer well supported. The Program is searching for a suitable replacement system and should consider any new system's capabilities with regard to error checking and data security.

b. Shoreside data post procession procedures.

The data post-processing is somewhat convoluted but clear audit procedures are in place.

During post-processing, some fish are found to have been weighed and measured under an incorrect size-class taxon. In these cases, the data has been reassigned to the proper size-class. However, reassigning fish to a different size-class following processing can detrimentally alter the statistical assumptions of proper sampling and should be avoided. The data analyst acknowledged this point and will change the protocols to properly account for these reassignments.

GPS track data and net mensuration data used to calculate distance fished and net spread are currently analyzed as raw data streams without using moving averages or smoothing algorithms. Other bottom trawl survey programs have looked at these data types and concluded using smoothers and/or moving averages improves the accuracy and precision of these measurements. A good discussion of this practice is presented in Kotwicki et al. (In preparation. The effects of improving accuracy and precision of area swept estimates on catch per unit effort.).

5. Statistical Analysis

a. Evaluate methods and units for calculation of overall and age-specific abundance estimates.

The methods used to calculate overall abundance estimates were adequate and conform to the survey design. Extensive examination of error structure is conducted to determine the appropriate distribution to use for the calculation of abundance indices.

However, the methods to obtain age-specific abundance estimates should be re-examined. Currently, the age structure estimated from the small sample of fish examined for each individual tow is used to estimate the age structure of all fish caught in that tow. As a result, the age structure for a large catch could be based on as few as 10 fish which could likely result in significant bias of the age structure. It is noted that, generally, an age-length key derived from fish collected from several tows, strata or the entire survey (as appropriate depending on knowledge of spatial differences among growth patterns) is used to derive the age structure of fish from individual tows. Under the sampling and estimation approaches used currently (random selection of fish to be examined for age), fish

of some length interval are most likely not examined for age and the assignment of an age for these fish would become arbitrary. Having an observed estimate of the age distribution by length interval is important in determining length and/or weight at age, a common metric used in stock assessments.

b. Evaluate variability (coefficients of variation) in data collected with respect to priority commercial and recreational stocks captured in the NEAMAP survey.

The documentation and presentations indicated that the proper approaches are being used to determine variability of the estimates. However, coefficients of variation of abundance estimates for priority commercial and recreational stocks captured in the NEAMAP survey were not available. Confidence intervals of estimates should be reported for all species.

Many of the species appearing in the reports of the NEAMAP surveys are pelagic or semi-pelagic species. Deriving estimates of their density (abundance) and biological characteristics using bottom trawl survey results without acknowledging what portion of the population is available to the survey carries with it a risk of making erroneous conclusions about the stocks. Results for pelagic or semi-pelagic species should be qualified appropriately.

6. Integration

Currently, the NEAMAP survey does not overlap with the survey conducted by NEFSC. As such, there is little room for quantitatively incorporating the results of the NEAMAP survey with the NEFSC survey. In order to integrate formally the two surveys, estimates of the relative catchability of each species to the two surveys would need to be known. This would require the derivation of conversion factors through comparative fishing experiments or by conducting comparisons of survey tows fished in the same strata and at the same time of the year. These are currently unavailable.

However, there are considerable opportunities for the 2 surveys to complement each other. First, collections of structures for age determination in the NEAMAP survey can be useful to augment age-length keys of the NEFSC surveys, particularly for species encountered close to shore or for species that are at low abundance. As well, combined analyses of biological information (weight, maturity, diet, etc.) collected in the two surveys would help examine any inshore-offshore variability in these parameters. Given the spring NEAMAP survey is to be conducted at a later date than the NEFSC survey, it may provide the sole information on maturity for species that spawn later in the spring or as a source of samples for fecundity estimates.

Individual abundance estimates derived from the NEAMAP survey have the potential of contributing significantly to the assessment of a number of species. To be valid, it should be noted these abundance indices should represent trends in the population as a whole either by encompassing the full distribution of some age groups or that some constant proportion of the population can be assumed to be present in the survey area from one year to the next. Examination of the spatial distribution by age groups from both surveys may indicate, for example, juveniles of particular species are found almost entirely within the area of the NEAMAP survey and, as such, this survey would provide good abundance

indicators for calibrating Virtual Population Analyses (VPA) or other such population reconstruction analyses.

The NEAMAP survey would also be useful for stock assessment in determining the extent to which the NEFSC survey covers the entire distribution of various species and thus the potential for the abundance estimates to be biased.

There is also potential for integrating the NEAMAP Survey with other fishery independent surveys. If funding was available, calibration tows between the programs involved would be required to achieve maximum integration. The programs could work on consistency of sampling protocols between surveys without much additional funding. Cooperative workshops to share methods will help the integration process.

7. Future of the NEAMAP Survey

The near shore trawl survey effectively samples areas the new NEFSC research vessel cannot effectively sample. The fishing gear designed by the Mid-Atlantic and New England Fishery Management Councils Trawl Advisory Panel and used in scientific sampling has achieved a confidence level within the fishing industry that has not been previously demonstrated. Employing a commercial fishing vessel with the VIMS scientific sampling team controlling the process contributes greatly to industry confidence. In the event the current vessel used in the survey is no longer available, future NEAMAP cruises could employ a comparable fishing vessel that could accommodate the scientific crew. Data and results from observing gear configuration with the net mensuration system and tightening standards of the project design would facilitate the process of using a different fishing platform while maintaining the rigor of the data. It would be necessary to conduct calibration tows between different vessels used in the survey. Each vessel has a different set of limitations affecting how the gear can be fished (methods of net handling, setting, and hauling), as well as differences in equipment. A rigorous statement of work and vessel requirements accompanying the request for proposals for new vessels in the program would alleviate some of the vessel effects, but calibration tows would continue to be important.

Other trawl surveys have shown the availability of materials and equipment changes over time. This program should work to determine additional sources of the materials used to build the trawling package. New data collection systems should be explored. Data collection systems compatible with other surveys could ease the exchange of data.

The outreach program of this project has been effective and should continue. Because both commercial and recreational fishing associations agree on the value of this survey, the outreach has worked through a broad range of people. It will be important to continue providing information to all of the congressional offices as well as each member state's environmental management agency. Cooperation with environmental organizations will help keep this program visible to the public.

Permanent or long term funding should be acquired for this survey. Long term, more secure funding is required to ensure a useful time series of abundance can be generated for the near shore stock assessments. The current funding source using the Mid-Atlantic Fishery Management Council Research Set Aside program (3% of quota for specific

species used for Science) results in uncertainties in funding. These funding sources are more appropriate to address fisheries issues, primarily through short-term projects. This project is among those that deserve long term funding and funding sources designed to address longer term research should be explored. Continued funding through the Mid-Atlantic Fishery Management Council Research Set Aside Program should be temporary. Funding a program the scale of NEAMAP with fish instead of dollars creates a situation where it is difficult to plan for each year because the money available is not known at the start of the year until the set-aside fish are sold at the National Fisheries Institute auction.

It might be prudent to expand the NEAMAP study with NEFSC funds as it has demonstrated that the scientific data collected is complementary to the NEFSC trawl survey. The NEAMAP survey samples areas that are difficult or impossible for the *FSV Henry B. Bigelow* to cover. The NEAMAP scientific team and fishing team have demonstrated an effective collaboration to collect information valuable to all interested groups.

Countries around the world are developing alternative renewable energy supplies. The U.S. Congress could create a potential source of future funding from a levy to be assessed to each alternative renewable power generator (windmill, tidal generator, etc) proposed for the near shore area of the northeast coastline. It would be appropriate to assess this fee because the power supply sources would be situated in the near shore area and may impact species in the coastal zone. There may be opportunities to use the NEAMAP database to examine effects in the area.

Appendix I – Agenda of the peer review of the NEAMAP Nearshore Trawl Survey held December 10-11, 2008, in Virginia Beach, VA

Wednesday, December 10, 2008

1.	Meeting of the Panel	8:00 – 8:45
2.	Project participants arrive	8:45 – 9:00
3.	Welcome and introduction *(P. Campfield)*	9:00 – 9:10
4.	Project Background *(C. Bonzek)*	9:10 – 9:30
5.	Survey Design *(C. Bonzek, J. Gartland)*	9:30 – 10:30
6.	Survey Preparation *(D. Lange)*	10:30 – 11:00
7.	Survey Procedures *(R. Ruhle, J. Gartland)*	11:00 – 12:00
Lunch	*12:00 – 1:00 (working lunch if desired)*	
8.	Onboard Data Collection *(D. Lange)*	1:00 – 1:50
9.	Shore-side Data Post-Processing *(C. Bonzek)*	1:50 – 2:30
10.	Laboratory Analysis *(R. Johnson)*	2:30 – 3:10
Break	*3:10 – 3:20*	
11.	Data Analysis and Use *(R. Latour)*	3:20 – 4:15
12.	Funding, Outreach, Challenges *(J. Gartland)*	4: 15 – 4:45
13.	Panel Discussion	4:45 – 5:00

Thursday, December 11, 2008

1.	Review of yesterday's discussion	8:00 – 8:30
2.	Follow-up questions and answers	8:30 – 9:30
3.	Wrap-up and Drafting of Advisory Report	9:30 – 12:00
Lunch	*12:00 – 1:00*	
4.	Finalize Advisory Report	1:00 – 4:00

Appendix II – Participants at the peer review of the NEAMAP Nearshore Trawl Survey held December 10-11, 2008, in Virginia Beach, VA

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Appendix III – VIMS Response to the Report of the NEAMAP Nearshore Trawl Survey Peer Review

Introduction

This document outlines the responses of the NEAMAP Nearshore Trawl Survey team to the Report of the NEAMAP Nearshore Trawl Survey Peer Review. Specifically, a Panel of technical experts has made suggestions for improvements and modifications to survey operations, biological sampling, data collection, and statistical analyses following a peer review of the NEAMAP Survey that was conducted in Virginia Beach, Virginia on December 10-11, 2008.

The VIMS NEAMAP team expresses its gratitude to the Review Panel. The members took their charge very seriously and it was obvious the lengthy pre-review documents had been carefully evaluated. Despite the somewhat tedious nature of the subject matter, the Panel members paid close attention to the presentations made by VIMS personnel during the review. Questions by the Panel made it clear they well understood the voluminous details offered by NEAMAP staff.

We also thank Commission staff members Patrick Campfield and Melissa Paine for their diligent and outstanding preparation for the review and their excellent work during the Panel's meeting.

Survey personnel appreciate all of the comments offered by the Peer Review Panel and have carefully considered each when crafting this response. The organization of this response follows the terms of reference for the review as well as the aforementioned report of the Peer Review Panel.

The Review Panel considered the responses of the NEAMAP Nearshore Trawl Survey team and subsequently provided further comments or clarifications where warranted. These comments can be found in this Appendix under the heading 'Additional comment from the Review Panel'.

1. Statistical Design

a. selection of stratum boundaries, station cell boundaries, random stations, and alternate stations

Review comment: "In a survey manual, it would be useful to have a table describing each stratum with the depth range, number of sampling units and total area in square nautical miles."

Response: NEAMAP Survey personnel plan to complete an official survey manual for the Nearshore Trawl Survey in 2009. This manual will include a table describing each stratum (i.e., depth range, number of sampling units, and total area in square nautical miles) as recommended by the peer review panel. Specifically, Table 1 of the NEAMAP Peer Review Document will be expanded to include depth range and total area in square nautical miles for each stratum.

Review comment: "The survey area is considered to be over-stratified. It should be possible to re-stratify by combining some strata of similar depth range…"

Response: Survey personnel recognize that the NEAMAP Nearshore Trawl Survey is likely overstratified, and will assess possible re-stratification schemes during 2009. The effect of this overstratification, in terms of sampling, is that several small strata are sampled with only two stations per survey but that those two stations represent a sampling rate considerably higher than the 1:30nm^2 target, while larger strata are sampled at a lower rate. We have not evaluated the effect of this overstratification in terms of variance estimates of survey results. It is understood that, ideally, strata should be defined such that the variability in the catch rates of priority species is minimized within each stratum, and that existing survey data can be used to assess the impacts of re-stratification on variance estimates of these species.

Regions with too few sampling cells are those along Long Island (Regions 1-4) and North Carolina (Regions 14-15). In both areas this results from steep depth gradients so that the 18.3m contour is very close to shore and the sampling area extends only 2-4 cells in width. The simplest correction would be to redefine Region boundaries such that each Region contains a larger number of potential sampling cells. A possible drawback of this approach is that the Regions serve to assure a geographic spread of sampling locations. Implementing this change would sometimes result in these long but narrow Regions being sampled with a small cluster of randomly selected stations and large unsampled areas. Another alternative would be to extend the depth range in these areas, perhaps to the original 27.4m contour, concurrently redefining the depth strata, thus providing a larger number of potential sampling locations. Obviously the drawback of this option would be that the survey would have different depth coverages in different areas (though this is already the case as the waters in RIS and BIS are considerably deeper than other survey Regions).

The Panel's suggestion to consider target species abundance and distribution as stratification criteria is intriguing, though given the temperature-dependent migratory nature of many target species this approach would seem difficult to implement. Furthermore, range shifts have been documented for a number of species in the Mid Atlantic Bight and Southern New England, which raises the concern that re-stratification based on catch rates from 2007 and 2008 may not represent the most appropriate stratification scheme for the future. Survey personnel are also concerned that existing survey data (i.e., fall 2007, spring 2008, and fall 2008) may not be sufficient to investigate the effects of re-stratification on variance estimates of these species.

We will discuss the options for re-stratification internally and will pass our proposal through the NEAMAP Operations Committee and Board for approval. Ideally, this would occur prior to the Spring 2009 cruise though the process may require more time than such a goal would allow.

Additional comment from the Review Panel
It is recognized that a stratification scheme almost always involves compromises. The concern regarding uneven coverage in long narrow regions may be addressed by the sampling intensity. If these areas are also areas of high variability then a larger number

of stations may be allocated to them thereby reducing the probability of having large un-sampled areas.

Review comment: "During the survey, once the need to go to an alternate is identified, the same rule for selecting the alternate (closest) should be used in all cases."

Response: Under the current sampling protocols, when a primary sampling site is determined to be untowable, an alternate station (occupying the same latitudinal/longitudinal and depth stratum) is selected for sampling in place of the offending primary. The alternate selected is usually the closest suitable alternate. In some circumstances, the 'most convenient' suitable alternate has been chosen rather than the closest (i.e., one that is in line with the cruise track, near a port, etc.). For all future cruises, to the extent possible, the closest suitable, towable alternate will be sampled when a primary site is untowable, following the panel's recommendation. It must be recognized however that situations will occur when uncontrollable factors will intercede (e.g., if a single Alternate station is the closest one to two different untrawlable Primary sites) and some level of flexibility is required.

Review comment: "With the data already collected from three surveys, it would be useful to conduct simulations to assess the benefits of different levels of survey intensity (suggest 100-150 stations, increments of 10)."

Response: Following the panel's recommendation, an evaluation of the current sampling intensity of the NEAMAP Survey will occur following the 2009 surveys. Survey personnel will use existing survey data to evaluate the effects of sampling intensity on the variances associated with the abundance estimates of the priority species. This analysis will be used to determine whether the number of sites sampled per cruise could be reduced without significant increases in variance or whether the number of sites sampled per cruise may need to be increased.

Review comment: "Some surveys use multiple criteria to allocate stations among strata, such as AFSC's Gulf of Alaska survey that employs a Neyman allocation algorithm based upon stratum area, historical survey catch rates for important species, and some rank of importance among species (e.g., ex-vessel value)."

Response: As we examine the possible redefinition of Region boundaries and sampling intensity, we will examine data from the previous cruises to determine if a different station allocation scheme would potentially reduce variability for some species. Similarly, variance associated with the abundance estimates of the priority species will be calculated by stratum to identify those in which variance may be consistently highest, and these strata would be candidates for increased sampling intensity.

Additional Question: The draft review did not address a question raised by the survey staff as to whether an equal allocation of stations between shallow and deep strata within each Region (with the total number of stations in each Region still be determined by stratum size or other criteria as suggested) might be useful and valid. The purpose of this

action would be to assure additional samples in the areas closest to shore which tend to have fewer available sampling locations but at times have the highest catch rates and have traditionally been the least sampled areas. If the Panel has any advice on this it would be much appreciated.

Additional comment from the Review Panel
The Review Panel suggests that stations should be allocated among strata primarily in proportion to variability of catch rates. Generally, in these types of surveys, variability is often proportional to catch rates. It would follow that the shallow areas with higher catch rates would have, proportionally, more stations than strata with low catch rates. If after allocating stations by catch rate variability, the shallow areas are still considered undersampled relative to some other variable of interest, additional rules for the allocations of stations can be implemented. It is important that the rules used do not result in unrealistic or impractical station allocations.

b. timing of the surveys
No comments.

c. spatial coverage

Review comment: "…extending the survey to cover the 60-90 feet strata could allow, over time, to establish relative efficiency coefficients with the vessel used to carry out the NEFSC survey."

Response: The Atlantic States Marine Fisheries Commission (ASMFC) NEAMAP Committees (i.e., Board, Operations, and Trawl Technical) chose to eliminate NEAMAP sampling beyond the 18.3m contour upon learning that the *FSV Henry B. Bigelow* is capable of fishing inshore to this depth. If the development of relative efficiency coefficients between the surveys becomes desirable in the future, NEAMAP survey personnel would be willing to extend NEAMAP coverage beyond the 18.3m contour to overlap a portion of the Northeast Fisheries Science Center's (NEFSC) Bottom Trawl Survey area. We note however that a more direct method of developing calibration coefficients, namely side-by-side towing experiments, would likely be more efficient and more reliable.

d. evaluate the estimation of survey area as it relates to absolute biomass estimates and the validity of such estimates.

Review comment: "The calculation of the area for each sampling unit should include the appropriate correction for longitude."

Response: Survey personnel recognize the error introduced into the determination of survey area with the assumption that one degree of longitude is considered equal in distance to one degree of latitude. We will assure that the correction will be made in all appropriate NEAMAP analytical programs.

2. Operational Protocols and Standardization

a. gear inspections with documentation

Review comment: "The gear review and proposed changes for gear certification are thorough and the review panel suggests some certification standards for the process for both new and existing nets."

Response: NEAMAP Survey personnel will incorporate all additions and modifications to the gear certification process (for new and used nets) recommended by the peer review panel. This includes the suggested additional measurements, the changes to the acceptable measurement tolerances, and the methods by which mesh size is to be measured in the various panels of webbing. Personnel have begun to develop net measurement and certification diagrams and flowcharts for the gear certification process and plan to have these documents completed prior to the spring 2009 survey cruise. While not currently in the possession of the survey personnel, the NOAA Technical Reference cited by the review panel will be acquired and used to guide the development of these certification documents.

Additional comment from the Review Panel
The document is NOAA Technical Memorandum NMFS-SPO-65 (Stauffer 2004) and can be obtained at http://spo.nmfs.noaa.gov/tm/tm65.pdf .

b. trawl performance and mensuration

Review comment: "An important aspect of survey trawl performance that is not monitored during this survey is assuring good contact between the footrope and the bottom."

Response: Survey personnel agree that monitoring the contact between the sweep and the bottom would be a valuable addition to the data collected during NEAMAP tows. Netmind provided survey personnel with a quote for a near-real time bottom contact sensor and bracket on 21 December 2008, and NEAMAP principal investigators believe that funds are currently available to purchase this unit prior to the spring 2009 survey.

Additional comment from the Review Panel
Information on the bottom contact sensor used by the Alaska Fisheries Science Center will be provided separately to the scientific team.

Review comment: "The review panel also suggested net mensuration data collection begin preceding brakeset and continue until the net has reached the surface rather than the current practice of logging these data only between brakeset and the beginning of haul-back."

Response: Following the peer review panel's recommendation, all future net monitoring data collection will begin when the trawl doors are lowered into the water during the set-out (well before brakeset) and will continue until the net has reached the surface and the doors are out of the water (well after the beginning of the haul-back). For all 2007 and 2008 survey cruises, the collection of net monitoring data was limited to the time between brakeset and the initiation of the haul-back. Survey personnel agree with the

panel that the new protocol should provide valuable information regarding gear behavior during the setting and hauling transition periods.

c. vessel speed and haul-back

Review comment: "…the review panel recommends the survey should target a speed of 3.0 knots which should ensure trawl shape is maintained. If the trawl shape cannot be maintained at the 3.0 knot speed, the speed may be modified (as little as necessary) to keep the net in the 5% range of configuration for the other parameters."

Response: Under current sampling protocols, towing speeds are allowed to vary between 2.9 knots and 3.3 knots, the optimal towing speeds for this gear package determined by the gear manufacturers responsible for its design and confirmed by the flume tank trials of a scale model of this gear. For most tows, scientific and vessel field personnel aim for towing speeds between 3.0 knots and 3.1 knots. If, at a given speed, the configuration of the gear (i.e., door spread, wing spread, and headrope height) is outside of its optimal range, speed is adjusted until optimal gear configuration is achieved. This is similar to the protocol recommended by the advisory panel. For all future tows, scientific and vessel field personnel will use 3.0 knots as the target towing speed, and if the trawl shape cannot be maintained at this speed, towing speed will be modified as little as necessary to maintain the net in its correct geometry.

NEAMAP Survey personnel proposed a protocol in which any tows where door spread, wing spread, and/or headrope height varied outside of their optimal ranges by greater than 15% would be invalid and result in a re-tow. The review panel felt that 15% was too large and that the acceptable ranges for these gear parameters should be tightened. Some additional options were explored during the peer review session, including 2%, 5%, and 10% acceptable ranges. While it appeared that using a 5% acceptable range may yield a reasonable trade-off between gear performance and the number of tows eliminated under this protocol, additional analyses will be conducted by survey personnel before settling on a final acceptable range. These analyses and the decision regarding the acceptable gear performance range will be completed prior to the spring 2009 survey, and submitted to the NEAMAP Operations Committee and Board for approval.

Review comment: "In case there is a vessel change at some point in the future, it would be useful to have a complete description of the procedures (vessel speed during setting and haul-back, winch adjustments, etc.) during the deployment and retrieval of the trawl."

Response: The NEAMAP surveys leader will work with the captain of the vessel currently used by NEAMAP for its sampling operations to fully document all aspects of the fishing operations including vessel speed and engine RPMs during setting and haul-back, gear handing, and winch operations and adjustments, to name a few. The surveys leader and captain will meet during the winter of 2009 and spring 2009 cruise in an effort to complete this documentation. The NEAMAP surveys leader will attempt to acquire the Alaska Fisheries Science Center and NEFSC gear handling questionnaires which will be used to guide the development of this documentation.

Additional comment from the Review Panel
The Alaska Fisheries Science Center gear handling questionnaire is attached following.

Standard Trawling Procedures Form

Date:_____

Vessel name: _____

Skipper name: _____

FPC name: _____

Trawl setting procedures

- Vessel speed during cable payout _____

Approximate RPM's under good weather conditions _____

Winch speed (if applicable) _____

- Vessel speed between brake set and net on bottom _____

Approximate RPM's under good weather conditions _____

- Vessel speed at first net contact **___3 knots____**

Approximate RPM's under good weather conditions _____

Trawl haulback procedures

- Vessel speed at haulback **___3 knots____**

Approximate RPM's under good weather conditions _____

- Vessel speed between haulback and net off bottom _____

Approximate RPM's under good weather conditions _____

Winch speed (if applicable) _____

- Vessel speed after net off bottom _____

Approximate RPM's under good weather conditions _____

Review comment: "As a result, fish herded into the bosom of the trawl but not captured by the end of the tow are able to escape capture. Some other surveys maintain towing speed or accelerate at the end of the tow to prevent this from happening. The Program should consider this effect and, if deemed an important enough issue, should consider finding a vessel capable of retrieving the net in this manner."

Response: NEAMAP Survey personnel currently do not have much background knowledge or information regarding the effect of haul-back speeds on catch. As a result, personnel plan to research this issue in the primary literature during the winter of 2009 to broaden their understanding with respect to this aspect of the sampling process. Following this literature review, survey personnel may test whether the use of a "power take-off" at the end of a tow could have an effect on survey catches (and whether this technique could potentially introduce additional variability in both net geometry and catch rates). All testing would occur outside of regular survey operations (i.e., these tests would not be conducted during standard NEAMAP tows) during 2009 if funding allows. It is important to note that, due to the design of the survey vessel's hydraulic system, maintaining or increasing vessel speeds during actual haul-back operations is not possible.

d. trawl symmetry and routine cable measurement

Review comment: "Although there were sensors to measure trawl symmetry, it appears these were not functioning properly and giving erratic measurements. The research team is investigating the problem with the trawl mensuration equipment supplier. The panel raised the possibility the sensors are mounted on the net in a manner that allows them to move about more than they should when measuring symmetry. This should be examined and mounting plates or attachments to bridles should be considered if corrections are needed."

Response: Survey personnel have been in contact with Netmind regarding this problem, and NEAMAP personnel and Netmind technicians are working toward a solution. Both groups are fairly certain that these erratic measurements are the result of a hardware (i.e., sensor) problem. While it may be possible that excessive movement by the wing sensors due to loose mounting could cause this issue, these erratic measurements are seen in the door symmetry readings as well. Because the door sensors are mounted in fixed stainless brackets welded to steel doors, loose mounting is not the likely cause of these measurement fluctuations.

e. standardization of tow distance and tow time

Review comment: "The sampling net fishes in three dimensions and useful calculations should include both area swept and volume swept by the trawl."

Response: The comment is valuable and survey personnel will search the primary literature for recent advances in and uses of this methodology. We do note that in order to calculate a realistic estimate of volume-swept that flow meters would be required on the net as the volume-swept is affected by current direction and speed, not just by speed over ground.

f. development, documentation, and quality assurance of protocols

Review comment: "The review panel encourages the research team to upgrade and publish the information in a formal survey manual."

Response: NEAMAP survey personnel fully intend to formalize the information provided in the peer review documentation into a complete survey manual. It is anticipated that this survey manual will be finalized by the end of 2009.

g. 'good tow' criteria and treatment of tows not meeting those criteria

Review comment: "Net repair diagrams or log sheets should be developed and used to record all repairs made to each net (examples shown in Stauffer, 2004). Repair logs for each net should be provided to the net maintenance professionals following each survey for them to evaluate how any changes in net configuration or behavior might be related to repair practices."

Response: Based on the review panel's recommendation, gear repair logs will be developed during the winter of 2009 and will be used to note any gear repairs beginning on the spring 2009 survey cruise. The three gear manufacturers responsible for the design of this gear will be contacted during the winter of 2009 to gauge their interest in receiving these repair logs at the conclusion of each cruise. Furnishing the manufacturers with these documents will enable them to assess how any repairs (or combination of repairs) may affect gear configuration or behavior.

Review comment: "A number of practices were noted as not being as safe as possible…"

Response: NEAMAP personnel will evaluate survey operations during the 2009 survey cruises and make improvements to safety practices where needed.

3. Biological Sampling Protocols and Standardization

a. Processing of biological materials and total catch, including documentation and quality assurance.

Review comment: "If, after 5 full stomachs have been collected, there are fish left over in the FULL portion, they are returned to the deck and added to the complete or subsampled PARTIAL portion of that taxon."

Response/Correction: Any 'extra' fish taken for FULL processing are not returned to deck but are processed according to the PARTIAL processing protocol by the same lab personnel otherwise responsible for FULL processing.

Additional comment from the Review Panel
The point was rather that once a fish has been selected for FULL sampling, it should be processed as such and not mixed back in with the portion selected for PARTIAL sampling. Fish were selected randomly for the FULL sampling and should be processed

as such because fish returned to the PARTIAL group are not likely to be randomly selected.

Review comment: "One drawback of the current data collection is that no real-time data checking is being conducted."

Response: As noted in the NEAMAP peer review documentation and presentations, the Nearshore Trawl Survey currently collects catch and biological data electronically using Limnoterra Data Capture Environment (LDCE) software and automated Limnoterra Fish Measuring Boards (FMBs). This system, while it has served the NEAMAP Survey well thus far due to its flexibility and familiarity among survey personnel, has become obsolete. Both the survey personnel and review panel recognize the need to identify a replacement data collection system for NEAMAP.

While the LDCE system is far less sophisticated than Graphical User Interface systems developed more recently, it is a mischaracterization to state that *no* real time data checking is done. At the very least, each field in the database can (and most do) have range checks or valid/invalid value checks, and the hierarchical structure of the database helps ensure that data at lower levels must be accompanied by valid data values at upper levels. It is acknowledged however that this is far inferior to the capabilities built into newer systems.

Review comment: "Shoreside laboratory staff processing otoliths for estimates of age use a generally accepted protocol of blind age assignment to avoid biasing their estimates by prior knowledge of fish size, sex, or location collected. Some agencies performing this task have chosen to use as much prior information as possible to help accurately assign ages to otoliths…"

Response: With respect to otolith and vertebrae processing, the decision to use a blind age assignment was made following a fairly extensive search of the primary literature and discussions of finfish age assignment techniques with other researchers at the Virginia Institute of Marine Science with experience in ageing studies. Even so, NEAMAP personnel welcome the opportunity to discuss the merits of blind age assignment versus assigning ages with the benefit of having as much specimen information available as possible (e.g., size, sex, capture location, etc.). Survey personnel plan to contact researchers at the Committee of Age Reading Experts (CARE) on the Pacific coast as well as scientists responsible for finfish age sample processing and age determination at the NEFSC to initiate this discussion. Also, although the survey personnel failed to mention this in either the peer review documents or presentations, all final age assignments and associated quality control are handled by one of the NEAMAP Survey's three senior age readers.

b. Sampling protocols, including documentation and quality assurance

Review comment: "Age compositions and sex ratios, as well as other biological parameters, are derived by expanding data from the FULL samples to match the number of fish caught (see discussion of expansions in the Statistical Analysis section). A more

conventional method of deriving these biological parameters is to construct an age-length key, a length-sex ratio, or a length-maturity key by combining data from an appropriate set of tows…"

Response: NEAMAP personnel intend to conduct these analyses during the winter and spring of 2009 and compare the catch-level results (age-frequencies, sex-ratios, maturity schedules, etc.) with those generated using the current method. While survey personnel have not yet had the opportunity to explore this topic fully, we have at least three concerns with the proposed methodology:

- First, by applying 'keys' from FULL processed fish to length distributions, it seems that one is knowingly introducing errors. Using age data for example, one would assign all fish of a certain length range to a single age even though it is known that two-to-several age classes are likely to exist in that range. Presumably the proportions incorrectly assigned balance out over the entire size range but still one has introduced errors where it was not necessary to do so.
- Second, again using age data as an example, it would seem that one cannot 'create' additional aged specimens by assigning ages to measured-only specimens and gain any additional knowledge or decrease in variance. One is still working from the original aged sample and simply repeating that aged sample over and over again by assigning ages to un-aged fish does not result in a true increase in sample size.
- Finally, there is some concern regarding the selection of the correct subset of appropriate tows for each species when generating these keys, especially when age, maturity, and other parameters may vary geographically; also there are limited data available at this point (i.e., fall 2007, spring 2008, and fall 2008) to construct these keys.

Additional comment from the Review Panel
An age-length key is constructed from samples originating from all the tows collected in a region with similar growth variation. Length-maturity keys can be similarly constructed. For each length in a key, a distribution of the proportion for each age based on the samples used to construct the key is available to estimate the age distribution. When properly applied, an age-length key assigns various proportions of the length group population to each age class based on the key. This conventional method is widely used both for estimating the age composition of survey catches as well as the age composition of commercial catches in samples collected from landings. This is documented in many texts on estimating age composition including the FAO Manual of Sampling and Statistical Methods for Fisheries Biology - Part 1. Sampling Methods (FAO Manuals in Fisheries Science No. 3) and Kimura, D.K. (1977). Statistical assessment of the age length key. Journal of the Fisheries Research Board of Canada 34,3 17-324. Normally, annual keys are used as combining data from several years would mask any inter-annual changes in growth.

There are also many papers written on the topic of selecting the correct subset to use for building age-length keys. It is understood that once more surveys are completed, there will be more information to describe the geographic variability in growth or maturity in order to identify the appropriate subset of samples.

Using the current method, fish collected from only one tow are used to estimate the age composition while using the conventional method described above, samples from tows with similar growth characteristics are used to estimate the age composition. The latter is considered to provide a more accurate estimation. It is recommended that age-length keys be considered to estimate the age composition.

Review comment: "Only the fish selected for full processing are sexed. So apparently estimates of sex ratio come only from the "haphazard" samples selected for full processing. Reliable estimates of population parameters this important should be derived from either a random sample or a size- or size-sex-stratified sample. For sexually dimorphic species, the length frequency collections (PARTIAL samples) should be sex-specific; otherwise estimates of size at age by sex can be biased."

Response: For PARTIAL processing, length frequency by sex is currently collected for species in which the determination of the sex of a specimen is obvious externally (i.e., elasmobranches). Survey personnel plan to explore the possibility of collecting length-frequency by sex for those specimens taken for partial processing (aggregate weight and individual length only) in instances where a species is known to exhibit sexually dimorphic growth and sex is not obvious via external examination. Specifically, personnel plan to identify those priority species exhibiting sexually dimorphic growth during the winter of 2009. Collection of length-frequency data by sex will then begin for these species on the spring 2009 survey, and this effort will be evaluated (e.g., does length-frequency by sex differ significantly from that calculated from the specimens taken for full processing, can this work be completed in a reasonable amount of time, etc.) following that cruise.

Review comment: "Particular attention focused on selection of the sample for FULL processing. The "haphazard" sampling method is undocumented and subject to bias by being the easiest fish to grab (consequently, perhaps, the larger ones) or other effects…"

Response: Survey personnel agree with the review panel that the method by which specimens are selected for full processing needs more complete documentation and that changes to the current protocol of sample selection could bring the sampling closer to random. Two issues are addressed in the comment.

- Whether there may be bias in the selection of specimens for FULL processing:
  It is likely that no fishery survey in the world implements true randomization when subsampling specimens. To do so would involve untenable processes and immense amounts of time. We have simply acknowledged that fact by labeling the sampling as "haphazard" or "approximately random." Methods employed by NEAMAP are no more biased than many others but we will strive to make the methods employed more consistent and closer to true random (e.g. greater mixing of the sample, blind selection of specimens, etc.). We note that the methods suggested by the Panel would correctly be called systematic sampling, and we would submit that selecting the first fish out of certain length groups is more likely to be biased than the "haphazard" methods currently employed.

- Whether the definition of size classes should be more strictly defined: Survey personnel have wrestled with this issue many times over the past several years for both the NEAMAP and ChesMMAP surveys. Our conclusion has been that each method has certain strengths and certain drawbacks. We believe that implementing strict length-group definitions would result in FULL processing for considerably more specimens which would slow down survey operations and, if one believes in the effective sample size arguments, would be taking additional samples without contributing to a reduction in variance. It should also be noted that the current method of selecting specimens for full processing for each of the priority species is "length-stratified" in that 10 specimens are selected for full processing from each size class of each of the priority A, B, and C list species when they are collected at a sampling site. We will evaluate how any new sampling methods, as well as the other recommendations provided by the panel and implemented by the survey, would affect work flow during cruise operations and make adjustments to the work flow as necessary.

Review comment: "Further, once a fish is selected for FULL sampling, it should remain in that class, whether a stomach is collected or not; the return of leftover FULL specimens to the PARTIAL process is confusing and unnecessarily complex."

Response: 'Extra' specimens taken for FULL processing are not 'returned' for PARTIAL processing but are processed by the lab group using PARTIAL processing protocols. This typically takes only a minute or two and does not lead to entry errors. Again, taking additional samples unnecessarily slows down survey operations and does not contribute to reduced variance.

Review comment: "Much of the process and work flow is influenced by the data collection system itself, although that system is being considered for upgrade or change."

Response: The comment is not entirely true. The data collection system, while fast approaching obsolescence, and rigid once a database is defined, is extremely flexible in how databases can be defined. Virtually any data structure could be accommodated and the one implemented for NEAMAP results from 20 years of experience with the system. The process and work flow are more heavily influenced by factors such as our own agreed upon workup protocols and the physical characteristics of the vessel, which would make it difficult (though not impossible) to establish multiple FULL processing workstations.

Review comment: "Catch data from fish and selected invertebrates are processed differently and even wind up in different data tables…"

Response: With respect to the invertebrate data collected by NEAMAP, survey personnel agree that the information collected from these species should be expanded where possible. Specifically, sampling protocols will be amended such that aggregate weight data will be collected for all invertebrates when possible, whether currently classified as invertebrates or habitat, and individual length and count data will be

collected when feasible (i.e., when the organisms occur in distinct units and are not mashed beyond recognition). It is anticipated that the aforementioned changes can be made and this protocol implemented in time for the spring 2009 survey.

Review comment: "For the D and E lists, PARTIAL and FULL sampling of some tows and not others can result in biased estimates…"

Response: As noted in the peer review documents and presentations, the NEAMAP Operations Committee assigned fishes and invertebrates that were likely to be collected by the Nearshore Trawl Survey into the A, B, C, D, and E priority lists. Based on the comments of the review panel, either the documents, presentations, or both were unclear regarding the treatment of the species that comprise these lists. Species on the A, B, and C lists are sampled for full processing and partial processing from each tow in which they are collected, while those from the D and E lists are sampled using only partial processing for each tow in which they are collected. D and E list species are never taken for full processing. As such, there is no need to alternate the full sampling of D and E list species between tows or survey cruises in an effort to eliminate bias.

Review comment: "The Program does not use an uninterruptable power supply (UPS) to guard against sudden power loss resulting in loss of data. UPS units should be added to the system."

Response: The data collection system used by the NEAMAP Survey does rely heavily on electronic acquisition. While the survey currently does not use an uninterruptible power supply (UPS) to guard against sudden power loss, the catch and biological sample database, Netmind software, and tow track collection software are all run on laptop computers which can operate without AC power for some time. Further, each of the Limnoterra FMBs is equipped with an internal battery and can operate without AC power as well. To provide an additional layer of protection to guard against power spikes, power loss, and possible data loss, UPS units will be added to each of these systems beginning on the spring 2009 cruise.

c. Sub-sampling procedures, including documentation, quality assurance, and the adequacy and accuracy of sub-samples to represent discarded catch.

Review comment: "Discard by count – this is only used with very large catches of large-bodied fish. Baskets are filled with a "sufficient subsample" and the remaining fish are counted overboard. To calculate the estimated weight of those discards, one must assume the subsample will yield an accurate and representative mean fish weight. Still, the catch weight of the species will be ESTIMATED, rather than OBSERVED."

Response: The comment use of this method results in an ESTIMATED measurement of biomass and an OBSERVED measurement of numbers is undeniably true. We note that with straight subsampling by weight the reverse is true. To date we have considered numbers and biomass to be equally important abundance metrics. We perceive from the Panel's comment that biomass should be considered the more important metric and will implement that viewpoint in the future.

Review comment: "It is recommended that clear guidelines with examples be provided in the survey manual as to when the various sub-sampling strategies should be used. The potential biases should also be presented so that sampling personnel have a full understanding of potential issues associated with the sub-sampling."

Response: Based on the comments of the review panel, it is likely that the NEAMAP peer review documents and presentations were unclear regarding the criteria for determining the appropriate subsampling method or methods in a given situation. Straight subsampling by weight is used when a moderately large amount (defined as 200 to 500 specimens) of a given size class of a given species is collected in a tow. It is also used when a very large amount (i.e., greater than 500 specimens) of a species/size class is collected, and the specimens of that species/size class are small or medium-bodied (e.g., bay anchovy or Atlantic croaker). Finally, straight subsampling by weight is used if a moderately large amount of each of a four or fewer species/size classes are collected in a tow.

Mixed subsampling by weight is used when a moderately large amount of each of five or more species/size classes is collected. All specimens in the mix (across species/size classes) should generally be about the same size and should be small to medium-bodied animals. This subsampling procedure will also be used when a very large amount of two or more species/size classes are collected in a tow; again all specimens in the mix should generally be about the same size and should be small to medium-bodied animals. Discard by count subsampling is used when a very large amount of one or more species/size classes is collected in a tow, and all specimens are large-bodied (e.g., spiny dogfish).

These guidelines, accompanying examples, and the potential biases of each of the subsampling methods will be included in the aforementioned survey manual that is to be completed by the end of 2009.

4. Data Post-processing and Audit Procedures

a. Shipboard data acquisition procedures.

Review comment: "The data collection system used by VIMS on this survey (Limnoterra) is old and no longer well supported. The Program is searching for a suitable replacement system and should consider any new system's capabilities with regard to error checking and data security."

Response: As noted above, NEAMAP survey personnel are presently searching for a data collection system to replace the LDCE system currently in use. Both the ability to conduct real-time data checking and to provide for data security will be high on the list of requirements for the new system.

b. Shoreside data post procession procedures.

Review comment: "GPS track data and net mensuration data used to calculate distance fished and net spread are currently analyzed as raw data streams without using moving averages or smoothing algorithms. Other bottom trawl survey programs have looked at these data types and concluded using smoothers and/or moving averages improves the accuracy and precision of these measurements."

Response: Survey personnel will investigate the reading-to-reading variability of our existing data files and the effects of possible smoothing algorithms in determining tow averages. Our sense is that (except for symmetry readings previously discussed) that the readings are generally consistent already and smoothing may not be necessary.

5. Statistical Analysis

a. Evaluate methods and units for calculation of overall and age-specific abundance estimates.

Review comment: "However, the methods to obtain age-specific abundance estimates should be re-examined. Currently, the age structure estimated from the small sample of fish examined for each individual tow is used to estimate the age structure of all fish caught in that tow…"

Response: The Panel makes excellent points on this subject, especially the point that using current methodology, catch per station for an age class could be estimated from a very small number of aged specimens. To date, we have not actually reported age-specific indices of abundance while we considered the various issues surrounding such calculations (we have reported overall age-distributions as calculated using current methodology). We will consider these recommendations as we work to develop these indices.

b. Evaluate variability (coefficients of variation) in data collected with respect to priority commercial and recreational stocks captured in the NEAMAP survey.

Review comment: "However, coefficients of variation of abundance estimates for priority commercial and recreational stocks captured in the NEAMAP survey were not available. Confidence intervals of estimates should be reported for all species."

Response: Estimates of variability were included on the figures reporting minimum trawlable abundances in the Fall 2007 report (e.g. Figure 8, Figure 34) and those reporting overall and state-specific catch per area swept in the Spring 2008 report (e.g. Figure 7, Figure 16) though the methodology used to calculate the reported CVs in the Spring 2008 report may have been imperfect based on literature reviews recently completed (this is being examined and will be corrected, if necessary, in future reports).

Review comment: "Many of the species appearing in the reports of the NEAMAP surveys are pelagic or semi-pelagic species. Deriving estimates of their density (abundance) and biological characteristics using bottom trawl survey results without acknowledging what portion of the population is available to the survey carries with it a

risk of making erroneous conclusions about the stocks. Results for pelagic or semi-pelagic species should be qualified appropriately."

Response: A number of the species appearing in the reports of the NEAMAP surveys are pelagic or semi-pelagic species and should be acknowledged as such when reporting abundance estimates and biological characteristics from catches using a bottom trawl. It must also be acknowledged that trawl efficiency varies widely among and within species, with typical placement in the water column being just one of the factors affecting catchability. In future reports we will make note of those species thought to be captured inefficiently by our sampling gear.

Further, while the gear used by the NEAMAP Survey is a bottom trawl, its construction enables this net to sample the water column to approximately 5.5m off of the bottom. The average depth of a NEAMAP tow is 15.9m (includes data from the three survey cruises conducted thus far), meaning that the lower 35% of the water column is sampled on average each tow. Even so, survey personnel agree that the results for pelagic or semi-pelagic species should be handled with caution and intend to appropriately qualify these data.

Finally, referring again to gear efficiency regarding pelagic or semi-pelagic species, we note that calculating the "portion of the population available to the survey" is likely to be an impossible (or at least impossibly expensive) metric to measure.

6. Integration

Review comment: "In order to integrate formally the two surveys, estimates of the relative catchability of each species to the two surveys would need to be known. This would require the derivation of conversion factors through comparative fishing experiments or by conducting comparisons of survey tows fished in the same strata and at the same time of the year."

Response: While there are no current plans to conduct comparative experiments or overlap survey areas, NEAMAP personnel would be willing to do either if it is determined that these are desirable in the future. Indeed, we fully anticipate that at some future date there will be a need to conduct extensive comparative tows with NEFSC surveys.

With respect to using NEAMAP data to augment NEFSC age-length keys, plans are already underway to begin conducting NEAMAP/NEFSC finfish ageing workshops in 2009. Following these workshops and the determination that both groups age their samples using similar techniques and protocols, it will be appropriate to incorporate the NEAMAP data into the NEFSC age-length keys. Survey personnel are also willing to collaborate with NEFSC staff to determine the extent of any inshore/offshore variability in the biological parameters of the various species as well as of the spatial distributions of the fishes and invertebrates found in the Mid Atlantic Bight and Southern New England.

With respect to other fishery independent programs, survey personnel concur that comparative fishing experiments would be needed to fully integrate the surveys.

Currently, funding is not available to initiate these efforts. Some efforts have already been made to share methods with the intent of promoting survey consistency. Formally, NEAMAP personnel have participated in the Maine/New Hampshire Trawl Survey and the North Carolina Pamlico Sound Trawl Survey. All three groups (NEAMAP/VIMS, Maine Department of Marine Resources, and North Carolina Division of Marine Fisheries) incorporated what they learned from the other groups to strengthen their respective surveys. Informally, members of the NEAMAP Trawl Technical and Operations Committees are usually technicians or lead scientists for their states' trawl surveys, and these meetings are often used to share ideas that would strengthen the protocols of each of these surveys. While cooperative workshops would serve as an excellent opportunity to work toward survey integration in the future, a limitation of funds will likely preclude the initiation of these workshops in the near term.

7. Future of the NEAMAP Survey

Review comment: "It would be necessary to conduct calibration tows between different vessels used in the survey."

Response: The survey personnel agree with the peer review panel that, should a replacement vessel be needed for NEAMAP field operations, calibration tows between the new vessel and the current boat would be necessary to maintain the continuity of the time series. Indeed, it would be our preference, given adequate funding, that such calibration experiments be conducted sooner rather than later, with a vessel likely to be the chosen alternative. With respect to the panel-recommended statement of work and vessel requirements for future request for proposals, survey personnel created these documents for the initial NEAMAP vessel search in 2005 and will ensure that these documents are updated as necessary as the survey moves forward.

Review comment: "Other trawl surveys have shown the availability of materials and equipment changes over time. This program should work to determine additional sources of the materials used to build the trawling package."

Response: NEAMAP personnel intend to work with the gear manufacturers responsible for the design of the survey gear over the winter of 2009 to identify materials needed to build the gear package that might be in short supply over the coming years. Once these components have been identified, survey personnel will purchase sufficient material to cover the survey's needs for the next several years. Plans regarding the acquisition of a new data collection package in the near future have been discussed above.

Review comment: "The outreach program of this project has been effective and should continue…"

Response: The NEAMAP Survey plans to continue its outreach efforts in 2009. Specifically, survey personnel intend to keep the congressional offices and each of the state environmental management agencies contacted thus far informed of the survey

progress, both through the annual survey reports and invitations to participate in demonstration tows during the spring and fall 2009 survey cruises. It is also expected that the NEAMAP outreach efforts will expand in 2009 and 2010 to include congressional offices and environmental management agencies yet to be reached by this survey.

Review comment: "Permanent or long term funding should be acquired for this survey."

Response: NEAMAP survey personnel agree that permanent or at least long-term funding should be acquired for this survey and will make every effort to do so.