**Appendix A6: VPA Indices Workshop**

**Striped Bass VPA Indices Workshop – Baltimore, July 28 & 29, 2004**

**List of Participants**

| NAME | AGENCY | ADDRESS |
|---|---|---|
| Linda Barker Alexei Sharov | Maryland Department of Natural Resources | Tawes State Office Building 580 Taylor Avenue Annapolis, MD 21401 |
| Tom Baum | New Jersey Department of Environmental Protection – Bureau of Marine Fisheries | P.O. Box 418 Port Republic, NJ 08241 |
| Peter Fricke | National Marine Fisheries Service – NOAA F/SF5 | 1315 East West Highway #3221 Silver Spring, MD 20910 |
| Megan Gamble Patrick Kilduff | Atlantic States Marine Fisheries Commission | 1444 I Street, NW 6$^{th}$ Floor Washington, DC 20005 |
| Bob Harris John Hoenig Phil Sadler | Virginia Institute of Marine Science | P.O. Box 1346 Gloucester Point, VA 23062-1346 |
| Des Kahn Greg Murphy | Delaware Department of Natural Resources & Environmental Control, Fisheries | 254 Maine Street P.O. Box 330 Little Creek, DE 19961 |
| Andy Kahnle | New York Department of Environmental Conservation – Bureau of Marine Fisheries | 21 South Putts Corner Road New Paltz, NY 12561 |
| Laura Lee | Atlantic States Marine Fisheries Commission/ RI DEM | 3 fort Wetherill Road Jamestown, RI 02835 |
| Gary Nelson | Massachusetts Division of Marine Fisheries | 30 Emerson Avenue Gloucester, MA 01930 |
| Gary Shepherd | Northeast Fisheries Science Center | 166 Water Street Woods Hole, MA 02543 |
| Clif Tipton | United State Fish & Wildlife Service | 177 Admiral Cochrane Annapolis, MD 21401 |
| Vic Vecchio | New York Department of Environmental Conservation – Bureau of Marine Fisheries | 205 North Belle Mead Road East Setauket, NY 11733 |

**Workshop Purposes**
- *Impetus*: "An objective discrimination of which tuning indices to include or withhold from the model should be integrated in the next assessment." 36th SAW Advisory
- *Goal*: Develop criteria for the inclusion/exclusion of current and future indices for aggregate or age-specific ($\geq$age 2+) used in the striped bass virtual population model.
- *Objectives*: Critically evaluate the survey design and precision of the index, and validate each index by comparing it to other area indices. If applicable, determine how the survey design should be modified to be more valuable.

**Background: The Role of Indices in the VPA**

Indices are used in the tuning process as a relative index of abundance (abundance at age). Some surveys provide an aggregrate index and others provide an age specific index. Some may be appropriate for aggregation due to precision; others are more precise as an age-specific index.

ADAPT uses the entire time series to determine relative abundance of the cohort in the terminal year. The longer the time series the more information the model has to produce an estimate. After the model produces the estimate, the stock assessment subcommittee evaluates the correlation of the index to the known abundance as the VPA has estimated it.

**Evaluation Criteria**

The Workshop participants began the discussion with the some suggested guidelines provided by Gary Nelson prior to the meeting. The guidelines are as follows:

a. Have a sampling design
b. Have an acceptable level of precision (if applicable)
c. Has it been validated? (i.e., is it correlated with indices of abundance of other life stages, etc.)

The sampling design should be appropriate to achieve the objectives of the survey. Additionally, the sampling design should produce a precise estimate. Further indication of a good index is the validation of the survey, comparing it to another index that shows similar trends. There should be a correlation between indices sampling similar portions of the coastwide stock. If an age class can be followed through time, it is also indicative of a good survey.

Taking Gary's suggestions a step further, John Hoenig developed a set of discussion points regarding the index. The following list includes the John points plus additional comments from other participants.

1) Correlation of an index with the VPA is not an appropriate evaluation criterion unless the index pertains to the whole stock. (If substocks in the North go up, as reflected in three indices, and substocks in the South go down, as reflected in one index, you'd get a biased picture if you eliminated the southern index just because it disagreed with the average (which is dominated by the North)).

2) Validity of sampling design can be used to determine inclusion. An index should not be evaluated based on an inappropriate variance. The appropriate variance can be determined based on the survey's sampling design. For example, if one site is sampled repeatedly (e.g., a pound net) the sample size is one (i.e., one site).

3) The number of sites and the number of days sampled may be useful criteria; a minimum number of fish sampled might be appropriate *in combination* with other factors (number of sites, etc.)

4) All indices should be treated "equally" to be "fair".

    a. If you evaluate one index you should evaluate all of them.

    b. You can kick out indices but there must be a way to reinstate them and there must be a way to introduce new indices that is "fair" in the sense of holding the index to the same standards as other indices.

5) If you want to make a change to the set of indices, it is important to do two assessments in parallel – one the old way and one the new way for several (e.g., 3) years. Otherwise, you can't distinguish between changes in stock perception due to methodology and changes due to stock dynamics.

6) If an index represents only a portion of the stock complex then it should receive a weight less than one. The stock assessment subcommittee has typically weighted the indices according to how well they fit the VPA, e.g., using iteratively reweighted least squares.

7) If an index is unique in representing a particular portion of the stock complex, then it may be desirable to retain the index even if it is not perfect.

8) The primary criterion thus would appear to be whether an index tracks weak and strong year classes well. An index can be considered poor if year-to-year changes in catchability obscure abundance trends.

    a. In looking for year effects, it is not appropriate to look at the residuals from the VPA unless the index being evaluated pertains to the whole stock.

    b. If one plots age-specific indices versus time, then synchronous peaks and valleys (all indices going up and down together) is problematic.

9) If age-specific indices are problematic, the program might still provide an aggregate index

10) Validation of one index against another index from the area provides support for the two indices.

Some of the indices used in the VPA assessment are age-specific and some are age-aggregated indices. It might be necessary to develop different criteria for the two kinds of indices. Before eliminating an age-specific index, the survey should be considered as an aggregated index. The problem with the index may be the ageing. It could still track the stock appropriately as an aggregate.

The Stock Assessment Subcommittee currently uses iterative reweighting for the surveys, meaning the survey weighting is based on how well the index fits the estimate produced by the VPA. The VPA is currently used to derive a single estimate of the fishing mortality on the coastal migratory stock. Ideally, there would be stock specific VPAs that are combined into one coastwide assessment.

If you believe that the particular index gives you reliable representation of the dynamics and abundance of the species in the particular area, then an estimate of variability of the index is needed. Also, you need to know if the same index is representative of the stock coastwide because we are looking for an ideal index of relative abundance that would be truly

representative of the stock coastwide. An alternative to the VPA's iterative reweighting would be to assign weights to each index based on an assumed contribution to the overall coastwide migratory stock.

There is some concern about apriori weighting because an index may represent the local stock accurately. Also, as the stocks have rebuilt over time the contribution to the coastal stock has increased. There is uncertainty as to how this can be accounted for in the apriori weighting.

**Review of Sampling Program and Indices**

The participant agreed to many of the points in John Hoenig's list, but not all. The group decided to continue with a review of the sampling programs. The evaluation criteria would be further refined as the surveys are reviewed.

*Massachusetts – Commercial CPUE Index (Gary Nelson)*

The Massachusetts Commercial catch per unit effort index has been used in the VPA assessment since the Striped Bass Stock Assessment Subcommittee has used the VPA. The unit of effort has changed over the course of the time series. The method for calculating the CPUE has changed over time with different MA DMF personnel. The time series has been recalculated using a consistent methodology.

The index is really a measure of commercial harvest per effort or an estimate of the number of fish sold per trip. It uses the weight of the fish reported by the dealer and the average weight of the fish measured in the fish house. The average is then weighted by the total fish (whole fish) landed in each county. The total weight reported is an absolute (no variance), but the average weight is estimated so the variance is included. The number of trips comes from the required catch reports. Fishermen must submit catch reports to receive a license for the following year. Catch reports include information such as hours fished, number of fish sold and released by month, and dealer transactions. This survey is used as an age aggregated index and age-specific index.

The sampling design is not ideal for this index because the sampling is dependent on which fish house lands striped bass. Three counties in Massachusetts make up about 80% of the total landings. The information gathered in the fish house does not provide information about the trip, whether it was landed as a direct or indirect take. Most of the Massachusetts striped bass fishermen are weekend warriors.

There are a few problems with the survey design. Permits are issued to the boat, not individuals. Therefore, an average trip per boat is estimated not per fishermen. The number of fishermen is not collected. In Massachusetts, this fishery is hook and line only and has a trip limit of 40 fish per day. There could be five guys on a boat for one hour catching 40 fish or one guy out there all day catching 40 fish.

The catch per effort per trip is not well defined because the information is not collected. There are over 4,300 people permitted but Massachusetts only receives 100-200 voluntary logs with trip dates, numbers caught, hours fished per trip. The average hours fished is estimate from the logbooks. Average hours fished contributes to variability in the survey. There can be hours fished with zero catch. Even though commercial fishermen are required to submit catch reports, not all submit the report despite the penalty of losing the permit in the next year. So Gary has to impute the fish caught using the information he does have. Additional information may be available through the VTR data for commercial fishermen holding a federal permit.

This survey has a multiple stage sampling design, meaning it needs a randomly sample a fish house and then randomly sample the fish. The variance estimate is conditional on assumption of random sample, but sample may not be representative. The fish that end up in the fish houses are random, but the selection of which fish house is sampled is not random. Therefore, we do not know if the sample is representative of all the catch because it is not random. Bootstrapping does not confer validity on an index.

The group discussed the difficulty of setting one standard for all the surveys – the protocol for variation estimation will depend on the survey design, therefore will not be consistent across all surveys. The index should not be thrown out because it's not perfect, especially if there is not another index to replace it and its representative of the area.

The number of trips is declining because the quota is filling more quickly. There is a jump in the CPUE from 1994-1995 because there was a change in the minimum size and the commercial quota also increased. The group is not confident that the CPUE represents the population, particularly the fishery has capped out the quota since 2000. Also, in a representative catch, the cohorts can be followed through the samples. The 1993 yearclass was strong and it cannot be followed through the MA CPUE. One suggestion was to apply a length frequency to the ageing samples for a more representative sample.

For an age-specific index, Massachusetts could randomly pick a fish box to collect samples. The proportion of ages in a sample could be applied to the aggregate index. Massachusetts had to cut down on the sizes of age samples from the fish house due to personnel cut backs.

*Connecticut Recreational CPUE and Trawl Survey*

Connecticut submitted information regarding the trawl survey, but did not provide information on the recreational catch per unit effort. Additionally, there was no representative from Connecticut in attendance at the Workshop. The Connecticut surveys were not reviewed at this time.

*New York Long Island Ocean Haul Seine Survey (Vic Vecchio)*

Originally, the survey had 10 sampling locations that consisted of inshore sandy sites. The locations were randomly sampled from October to November. After the commercial striped bass fishery reopened, commercial trawls were prohibited from state waters. Some localities prohibit NY DEC from accessing traditional sampling sites. In New York, fishermen are not allowed to use ocean haul seine survey to commercially catch striped bass, but can use to fish for other species. The estimates derived from 10 sampling locations were compared to the results with fewer sampling locations. There was no difference in the ages in the catch. Additionally, funding has been reduced impacting the sampling dates and actual survey catch. The dates of the older survey have been standardized.

In reviewing the time series, it is interesting to note that the catch jumped in 1996-1998 due to the 1993 and 1996 yearclasses. Also, in some cases the coefficient of variance exceeded the catch. Bootstrapping would be appropriate for the New York data.

Age samples are taken from every fish measured in the survey. New York is able to produce an estimate of geometric mean catch at age for each survey year. The CV is then calculated for the catch at age and an averaged from 1997-2003 is produced. The survey is not very good at catching the larger fish, so the sample sizes for the older fish are pretty small.

The survey samples a mixed stock. To evaluate the survey, the ocean haul seine survey was correlated to the YOY index. Out of 13 age groups, 11 had positive correlation, but only 6 had a significant correlation.

*New Jersey Trawl Survey (Tom Baum)*

The New Jersey trawl survey has a stratified random sampling design. The survey occurs in April and October. Decreases in funding have led to reductions in annual sampling effort, from 60 to 45 seine hauls. New Jersey's survey was not designed to sample striped bass survey; it was originally for sampling groundfish. Striped bass are tagged when feasible.

In a typical year, there are 30-40 tows in 18 strata, which comes out to about 2 tows per site. The CVs are pretty low in the later half of the time series. The high CVs in the latter half of the time series could be attributed to low sample sizes at each stratum. The standard error should be checked to determine if it was calculated for a stratified random design.

The survey is used as an age aggregated index, aggregating ages from 2-13. April and October are used as separate age aggregated indices because the length frequencies differ significantly, representing different stock composition. April survey is more consistent and therefore probably the better candidate for an age-specific index. New Jersey has an age-length key for every year, so most of the information is available for switching over to an age-specific index. If the survey measures all of the fish caught, then it could be used as an age-aggregated index. It is possible to get age specific data, but New Jersey is not likely to produce the data.

To reduce the variance, some of the strata should be thrown out because no striped bass were caught in that location. The strata should only be removed from the index if there were no striped bass throughout the time series. The variance can be a problem with fixed station trawl surveys because there is no random element to the survey.

*Delaware Trawl Survey (Des Kahn)*

The Delaware trawl survey began during the 1960's, but the exact start date is not well documented. The survey collects weight rather than numbers of fish (kilograms per tow of striped bass). The time series is disjointed because a different vessel was used in the first two segments of the time series. In 2002, the survey began using a new custom-built stern rig trawler. Comparative tows were conducted to get a handle on the catchability of the two vessels.

The trawl survey uses a fixed sampling scheme. It was selected due to the lack of towable bottom in Delaware Bay. The index was conducted the whole year. Due to the number of zero tows, the data was jackknifed – used for situations were the distribution assumptions may not be true. Jackknife does not deal with the lack of distribution of the data; it does assume that the sample is representative of the population from which it is drawn.

The sample size is the number of months that were sampled. In some years, the trawl survey did not operate in March. In each month, the fixed sites were sample nine times.

The trawl survey is used as an aggregate index in the VPA (age 2-7). There is age data available from 1998 forward. To validate the index, it should be compared to another mixed stock index. The lagged juvenile index is often used to confirm trends.

*Delaware Spawning Stock Survey (Greg Murphy)*

The Delaware River spawning stock survey collects age, size, sex, and abundance estimates for striped bass. The survey began in 1991 experimenting with three different collection methods and has continued using electrofishing since 1994. The survey divided the

Delaware River into two zones based on river access.  There are twelve Delaware stations and fourteen Pennsylvania stations.   Over time, some of the stations have been lost due to development.

The stations cannot be considered random, but the observations at each station are random. The survey has a multistage lattice design.  The strata are sampled independently of another (i.e. sampling does not affect other sites). The lattice survey design imposes a structure to control the number of times each area sampled.

Another challenge that confronts the survey has been the moving salt line, which can restrict the sample areas upstream where electrofishing is effective.  Reviewing its correlation to other life stages, such as a juvenile survey, could validate this survey.

*Maryland Spawning Stock Survey (Linda Barker)*

The objective of the Maryland's spring gillnet survey is to characterize the Chesapeake Bay portion of the spawning stock biomass and provide a relative abundance at age.  The survey area at one time covered the Chesapeake Bay, Choptank River and Potomac River, but the Choptank River has since been dropped from the survey.  A stratified random design is used to sample the spawning areas.

The group discussed the survey's sampling design to determine if it was truly randomly stratified.  Because Maryland DNR samples the same site twice in some days, the design can be referred to as two-stage cluster sampling.  It is important to correctly identify the sampling design to properly calculate the variance.

For each sample, all of the striped bass are measured, all females are aged, but only males greater than 700 mm are aged and smaller males are subsampled. Since 2000, approximately 500 fish are aged per year.  The group recommended developing area and sex specific age length keys.  MD DNR should also look into applying selectivity coefficients.

The survey has revealed that it does not accurately capture the spawning stock biomass as it collects samples of fish ages 2-8.  There is a very low variance for ages less than 8 years old and higher variable estimates for ages greater than 8 years old. The number of age 8+ appearing in the survey has increased since the moratorium.  The fish caught in the survey are mostly males (age 2-8) and the ages 10 and greater are mostly females. The data is representative of the behavior of the fish, capturing mostly males.  The CPUE provides a decent relative abundance at age, but it is not doing a good job of characterizing the spawning stock survey.

*Virginia Pound Net Survey (Phil Sadler)*

Since 1991, Virginia Marine Institute of Science has conducted the Viginia pound net survey.   The pound net survey takes place on the striped bass spawning grounds in the Rappahannock River between river miles 44-47.  VIMS has the option of sampling up to four commercial nets.  The upper and lower nets are used for this survey and the middle nets are used for tagging. VIMS alternates sampling between the upper and lower nets.  The sampling occurs from March 30 to May 3, when the females are on the spawning ground.  The pound nets are checked twice a week, but are fishing constantly.  When the samples are collected, the fish are sexed and measured, scales are taken from every fish, and a subsample of otoliths.

The sex ratio in the catch tends to be two males to every female.  The females captured in the survey are generally ages 4 and older and males are age 3 and older.  There appears to be no bias in net catchability.

There are several periods where no fish were caught. By averaging the CPUE data, the estimate is low. To eliminate the zero effect, VIMS could graph CPUE by date and determine the area under the curve.

The Workshop participants had a lengthy discussion on the Virginia pound net survey because it is an example of a survey that was removed in recent stock assessment due to poor performance in the VPA. The Virginia pound net survey provides an estimate of catch in the commercial fishery. If a variance is estimated, it is not an estimate of the striped bass abundance rather it is the variance for the commercial catch. The workshop participants suggested several ways to evaluate the survey. Local juvenile surveys can be used for validation. A longitudinal catch curve can also be applied to investigate year effects, specifically to detect downward trends. The catch curves explain how often the striped bass are seen and if the patterns are explainable. VIMS should also examine the temporal window and the spatial window to evaluate the survey design.

*NEFSC Trawl Survey (Gary Shepherd)*
The NEFSC trawl survey uses a stratified random design and assumes that time is irrelevant. The index samples fish from Nova Scotia to North Carolina. It is an eight-week cruise, completed in four two-week legs. Fishing occurs 24 hours per day. The survey did not really start to encounter striped bass until 1991. The survey has shown a general upward trend since 1990. The catch distribution tends to very from year to year and the sizes encountered are also variable.

The NEFSC trawl survey data would be a good candidate for an age-specific index. An age-length key from the New Jersey March-April gillnet survey could be applied to the NEFSC samples. The NEFSC survey is important because it is the only survey to cover the range of the coastal migratory stock. For a good index, the NEFSC would need 400 ageing samples. The fish are encountered in different locations in different years. So the appropriate key needs to applied to the samples. For the fish encountered in the southern range, an age-length key could be derived from the North Carolina Cooperative Cruise.

**VPA Output Compared to the Indices**
The group reviewed the ADAPT VPA output from last year's assessment to each of the indices reviewed during the workshop. The VPA predicted the indices very well when there weren't many striped bass. As the stock increased, the variance went up with the mean. If one of the criteria for inclusion was the index must follow the same trend as the VPA, then none of the indices would be used. The coastal indices should carry the same signal as the VPA output because they characterize the coastal migratory stock. Some of the indices may not align with the VPA because they were down weighted.

Several of the indices show spikes. The spikes should be compared to other indices to determine if there is correlation. The coastal indices should be reviewed to determine if there are spikes that correlate with one another or the VPA output. To determine the validation of the indices, it would be helpful to know how the VPA weighs the indices.

The stock assessment subcommittee has typically used the bootstrap estimates to determine the variation in the surveys. All of the surveys are entered into the VPA and the bootstrap estimates determine if it is appropriate to include each index.

On the other hand, the VPA produces an estimate of the overall stock complex abundance. To use the VPA to evaluate the indices may mean eliminating an index that does not

track the overall stock complex, but tracks local trends accurately. An index should not be removed without a legitimate reason for removing the index. The effect of each index on the VPA should be analyzed.

**General Overview of Survey Issues**

The sampling design of each survey was a common theme for discussion during the review of the indices. There tends to be two separate types of programs. The first group includes the NEFSC trawl survey and the Maryland Spawning Stock Survey. These two surveys are randomized over space. The second group includes other programs such as MA CPUE, which is a census of commercial catch rates, but fishermen are not fishing over random fish. The New York ocean haul seine survey is not randomized over space. The Virginia pound net survey uses two nets over fixed locations. Delaware is randomized, but only 30% can be sampled.

There is confidence that the Maryland spawning stock survey and the NEFSC trawl survey are catching a representative sample of the population because both surveys are randomized over space. Both surveys can get a valid variance. The sampling design of the other surveys may not be randomized; therefore it cannot be assumed that the surveys are a good representation of the stock. Without randomization, the estimate of variance for each survey may not be appropriate.

The Virginia pound provides a good estimate of the fishermen's catch rate, but the variance is not very useful. The NEFSC survey is not designed to catch striped bass and does catch a lot of striped bass. The variance is only useful for qualitative purposes. Variance estimates are for the survey index.

In addition to variance, age information is collected through the indices, despite some of the ageing error issues. Another important measure for the indices is the ability to track cohorts over time. There needs to be confidence that the survey is tracking cohort abundance in a logical trend. Catchability can influence the ability of a survey to track a cohort over time. If the design of the survey changes, the catchability can change.

A survey could reflect logical trends for 8 of the 10 years, straying from the trend in the remaining two years. Those two years could be eliminated if there was adequate evidence that is was due to abnormal climatic conditions influencing fish abundance.

To verify a cohort trend, the survey can be compared to a local young of the year index. States would need to be careful about using the index to validate the juvenile survey and vice versa. In some areas, a young of the year index may not be available for comparison. In these situations, a catch curve could be applied to the cohort. Longitudinal catch curves could be used, not to estimate mortality rates, but to see if there is trend that is useful.

Ideally, the stock assessment will include the same indices as in previous years and then a separate run is made to remove more questionable indices. There should be some guidelines for removing an index from the model run or at the very least an explanation provided in the assessment report. To evaluate an index for inclusion, one could plot the indices by year for each cohort. If one of the indices has a dramatically different trend, the index is not tracking things well. It is important to remember that an index can be valid for a local area, but not for the stock complex. It may track a different trend or a local stock. For example, Chesapeake Bay recruitment correlates well with the Delaware River recruitment, but not the Hudson River.

Striped bass is a stock complex measured by local indices, but the stock complex abundance is supposed to be annually evaluated.

**Recommendations for criteria to evaluate the VPA indices**

The Workshop participants developed a list of evaluation steps that should be applied to each index. The state agencies should use the evaluation list for each state survey. Each program should be analyzed to determine if the survey is conducted at the appropriate time of year, i.e. bracketing the correct spawning period. Similarly, the survey design should be reviewed by the state to determine if the sampling area is correct. If the state determines there is a lot of noise in the data, the state should attempt to refine the data. For instance, if some of the stations catch striped bass consistently and others do not, can something be done to refine these data? The states should identify if the indices are sex-specific indices or age-specific due to survey design. Because a self-evaluation by each state could be subjective, the Technical Committee should evaluate the state's program evaluation and make a recommendation to the Striped Bass Stock Assessment Subcommittee.

1. Evaluate design and best method to evaluate uncertainty of index.
2. Assess the index and/or improve the index to get the best signal.
3. Validate the index before use in the VPA.
   a. Sensitivity of the VPA results to the influence each index.
   b. Validate an index to a JAI, where possible.
   c. Longitudinal catch curves, to determine the cohort trends.
   d. Plots of age specific index v. year to see if cohorts are moving in a specific direction.
4. Evaluation by the agency conducting the survey
   a. Rank (weight) index
   b. Criticisms/Supporting Evidence
5. Evaluate by the Striped Bass Technical Committee
   a. Evaluate index based on survey design, precision, and ability to track cohorts or portion of the stock targeted.
   b. Provide recommendations to the Striped Bass Stock Assessment Subcommittee on which indices should be used in the assessment.

The Workshop participants developed a matrix in Excel that includes the important components for evaluating each index (sampling design, time of year, tracking stock or catch, etc.). Also included in the matrix are recommendations to improve and evaluate the survey.

**PURPOSE: TO ESTIMATE FINAL YEAR ABUNDANCE**

| SURVEY | SINCE | SAMPLING DESIGN | TIME OF YEAR | STOCK OR CATCH | WHAT STOCK? | AGES | VARIANCE? |
|---|---|---|---|---|---|---|---|
| NMFS (TOTAL, REC HARVEST) | | SURVEY | ALL | CATCH | MIXED | | YES?? |
| NEFSC CRUISE | | STRAT RANDOM | SPRING/FALL | STOCK | MIXED | | YES |
| MASS COMM CATCH | | NONE | ALL | CATCH/HARVEST | MIXED | | |
| RI - FLOATING TRAPS? | | | | | | | |
| CONN TRAWL SURVEY | | | | STOCK | MIXED | | |
| CONN REC CATCH | | | | CATCH | MIXED | | |
| NY HAUL SEINE | | FIXED STATION | FALL | STOCK | MIXED | | |
| NY HUDSON SPAWN SURVEY | | STRAT RANDOM | | STOCK | HUDSON | 5-10 | YES |
| PA RIVER SURVEY | | | | | | | |
| NJ TRAWL SURVEY | | STRAT RANDOM | SPRING | STOCK | MIXED | | YES? |
| NJ REC CATCH | | NONE | ALL | CATCH | MIXED | | NO |
| DEL RIVER SURVEY | | CLUSTER?? | SPRING | STOCK | DEL | | |
| DEL TRAWL SURVEY | | FIXED STATION | ALL | STOCK | MIXED | | |
| MDJI | | FIXED STATIONS | SUMMER | STOCK | CBAY | | |
| MD SPRING GILLNET SURVEY | 1985 | STRAT RANDOM | SPRING | STOCK | CBAY | | |
| VA POUND NETS | 1991 | FIXED STATIONS | | CATCH | RAPP | 3+ | YES/NO |

| SURVEY | EVALUATION/CRITERIA | RECOMMENDATIONS |
|---|---|---|
| NMFS (TOTAL, REC HARVEST) | | Define what an index would be using total catch and effort |
| NEFSC CRUISE | | Age fish samples from trawls; review strata choices |
| MASS COMM CATCH | | Standardize minimum length numbers; compare lengths of subsamples to length of all; examine applying age-length keys;develop index with total catch; adjust index for covariates; examine whether change in week-end warrior composition |
| RI - FLOATING TRAPS? | | see if data is available for development of an index |
| CONN TRAWL SURVEY | | segregate into age-specific indices; use age-length key instead of VB equation |
| CONN REC CATCH | | Describe and evaluate |
| NY HAUL SEINE | AGAINST TOTAL JI? NY JI? | resestimate precision using bootstrap; compare index at age to JIs individually |
| NY HUDSON SPAWN SURVEY | | Describe and evaluate; generate age-specific indices with appropriate variance |
| PA RIVER SURVEY | | Describe and evaluate |
| NJ TRAWL SURVEY | | Examine strata choices; generate age-specific indices using April data |
| NJ REC CATCH | | determine if development of an index is possible |
| DEL RIVER SURVEY | | investigate area under curve method for possible spatial distribution issues; examine temporal distribution within strata; compare upper river index to PA survey |
| DEL TRAWL SURVEY | | change biomass index to numbers; generate age-specific indices; compare indices to VPA for age 1 |
| MD JI | AGAINST LAGGED CATCH | |
| MD SPRING GILLNET SURVEY | | examine first vs second set;review impact of sex-specific catchabilities |
| VA POUND NETS | AGAINST JI, LONG CATCH CURVES, YEAR EFFECTS, CATCH VS. TEMPORAL WINDOW | AGAINST JI, LONG CATCH CURVES, YEAR EFFECTS, CATCH VS. TEMPORAL WINDOW; examine flow regimes; compare index to MDs |

Summary of Responses to Workshop Recommendation

| Survey | Index Type | In VPA? | Workshop Recommendations | Recommendations Addressed? | PSE Range | Attempted Validation? |
|---|---|---|---|---|---|---|
| NEFSC | Age-specific: ages 3-11 | Yes | Age fish samples in trawl;review strata choices | No | No PSEs provided for age-specific indices. Untransformed, aggregate index PSEs (91-04): range= 0.13-0.58, mean=0.29 | No |
| MA Comm Catch | Aggregate and age-specific commercial Index | Yes | Standardize min. length numbers; compare lengths of subsamples to length of all; examine applying age-length keys; develop index with total catch; adjust covariate; examine week-end warrior composition | Yes A total catch index was developed using covariates, making most recommend ations moot. | Old index age 7-12 average PSE: 7-0.51,8-0.23,9-0.13, 10-0.13,11-0.18,12-0.23. New Index age7-12 PSE (for 2000): 7- 0.05, 8-0.08, 9-0.10,10-0.11,11-0.15,12-0.22 | Yes, correlation of aggregate indices to other aggregate indices (MRFSS, NYOHS, NJ, CT) but no significant correlations of new age indices to other programs; only 1996 YC could be tracked over only three years; influence of age-specific and aggregate index on VPA results increased. |
| RI – Floating Traps | ? | No | See if data is available for development of an index | No | None | No |
| CT Trawl Survey | Aggregate Index (spring) | Yes | Segregate into age-specific indices using age-length keys instead of VB equation | No | Ln transformed, aggregate index PSEs: range=0.1-0.5, mean=0.20 | No |

| Survey | Index Type | In VPA? | Workshop Recommendations | Recommendations Addressed? | PSE Range | Attempted Validation? |
|---|---|---|---|---|---|---|
| CT Rec Catch | Age-specific: ages 2-11 | Yes | Describe and evaluate | No | None | No |
| NY Ocean Haul Seine | Age-specific Index: ages: 3-13+ | Yes | Re-estimate precision using bootstrap; compare index at age to juvenile indices individually | Yes | Aggregate PSEs:mean=0.08; Age-specific PSEs: 2-0.17,3-0.11,4-0.13,5-0.16,6-0.22,7-0.23,8-0.39,9-0.51 | Yes, strong correlations between CB juvenile index and indices for ages 2-5; not so for older ages. |
| NY Hudson Spawn Survey | ? | No | Describe and evaluate; generate age-specific indices | No, but survey would be inappropriate | None | No |
| PA River Survey | Electrofishing survey | No | Describe and evaluate | No | None | No |
| NJ Trawl Survey | Aggregate Index | Yes | Examine strata choices; generate age-specific indices using April data | No | Aggregate index PSEs (91-03): range 0.18-0.69, average 0.38 | No |
| NJ Rec Catch | RecCatch/Effort | No | Determine if development of an index is possible | No | None | No |

| Survey | Index Type | In VPA? | Workshop Recommendations | Recommendations Addressed? | PSE Range | Attempted Validation? |
|---|---|---|---|---|---|---|
| DE Spawning stock River Survey | Electrofishing aggregate and age-specific: ages 2-15 | No | Investigate area under the curve method for possible spatial distribution issues; examine temporal distribution within strata; compare upper river index to PA survey | Yes – claims multistage lattice design addresses spatial and temporal distribution issues. | Aggregate PSEs (96-03): mean=0.20. Age-specific mean PSEs: 2-0.52,3-0.3,4-0.31,5-0.29,6-0.27,7-0.27,8-0.26,9-0.27,10-0.36,11-0.34,12-0.47, 13-0.46 | Yes, compared age-specific indices to NJ juvenile fish index and found 6 out of 14 were significantly correlated. However, only 3 of nine comparisons between DE and PA surveys were significantly correlated. |
| DE Trawl Survey | Aggregate Index | No | Change biomass index to number; generate age-specific indices; compare indices to VPA for age 1 | Some – developed numbers index using GLM | Aggregate mean PSE (91-04): 0.29 (I calculated from Table 3) | No |
| MD Spring Gillnet Survey | Age-specific 2-13+ | Yes | Examine first vs second set;review impact of sex-specific catchabilities | In progress, showed differences in catchability and visibility | Age-specific mean PSEs (91-04):2-0.11, 3-0.02, 4-0.02,5-0.03,6-0.03,7-0.03,8-0.04,9-0.06,10-0.14,11-0.10,12-0.10,13-0.71 | No |

| Survey | Index Type | In VPA? | Workshop Recommendations | Recommendations Addressed? | PSE Range | Attempted Validation? |
|---|---|---|---|---|---|---|
| VA Pound Net Survey | Fixed Pounds Net | No | Validate Index against MD and VA juveniles indices; examine year effects,; use longitudinal catch curves; examine catch versus temporal window, flow regimes. | Yes – no relationship between river flow and index; Mar 30-3May window better for inter-annual assessment of stock | Can't be calculated due to fixed sites | Yes, compared age-specific indices for age 3 8 to VA JI index but found poor correlation; weak correlation for age 9-10; high correlation between age 11-12 index and JI; there were no correlations between index and MD juvenile indices. |