

## **2014 TRAC Georges Bank Yellowtail Flounder Diagnostic Review and Empirical Approach Benchmark**

### **SUMMARY –OVERVIEW**

A Diagnostic Review and Empirical Approach Benchmark have never been conducted in the TRAC process before. The goal is to explore all sources of data, including those typically not included in stock assessments directly, looking for possible causes of the poor diagnostics in the current VPA for Yellowtail Flounder.

The diagnostic issues from the current assessment can be summarized as: Given the large reductions in catch in recent years, why has the population not responded by increasing abundance and expanding its age structure? The relative fishing mortality rate, computed as the catch divided by any of the three bottom trawl surveys, declined substantially in 1995 and has remained low since. In contrast, the total mortality estimated from the age structure of these same surveys (and confirmed with an independent tagging study) indicated a high and relatively constant level throughout the time series, with perhaps an increase in recent years. These conflicting signals result in a strong retrospective pattern in the current VPA for this stock. Splitting the surveys to alias the source of this conflict initially resolved the retrospective pattern, but the retrospective pattern has returned recently. Additionally, splitting the surveys has resulted in abundance estimates from the VPA which are less than some estimates of the population abundance from independent sources. All three bottom trawl surveys have shown a strong declining trend in recent years despite low catches. Thus, issues to consider as diagnostic problems include: trends in abundance over time, the magnitude of the population, the disparity between trends in F and Z, the lack of expansion in the age structure of the population, the spatial concentration of yellowtail, and the retrospective pattern. These issues are the same ones that led to the 2005 benchmark assessment for this stock.

The Term of Reference for this meeting are:

- 1) Summarize all available data for Georges Bank yellowtail flounder which can be used to explore possible causes of the poor diagnostics in the current VPA for this stock.*
- 2) Determine which pieces of information are consistent with alternative hypotheses regarding current stock status (e.g., current population is near carrying capacity, current population is near a desired amount, and current population is well below a desired amount).*
- 3) If possible, describe how catch advice could be provided based only on the data (e.g. without relying on a stock assessment model). If feasible, identify and estimate appropriate fishing mortality reference points.*

The following summarizes decisions made by the TRAC during the Benchmark.

- **Movement and Distribution** Movement of Georges Bank Yellowtail Flounder outside of stock boundaries is not a likely source for the poor diagnostics in the current VPA formulation.
- **Missing Catch** Examination of the magnitude of change required in the estimated discards or reported landings to explain the amount of missing catch needed to fix the retrospective pattern demonstrated these are unlikely the primary sources of the retrospective pattern.
- There has been a consistent **aging** of yellowtail that has been verified historically and also recently based on the number of growth marks from tagged and recaptured yellowtail. Issues with age determination do not appear to be a major source of uncertainty in the stock assessment.
- **Natural Mortality** Based on the expected equilibrium age compositions and the range of M values estimated from life history attributes, the TRAC agreed that  $M=0.2$  is likely an underestimate and that an  $M=0.4$  is more consistent with these attributes. *TRAC recommends that the  $M=0.4$  be applied as a sensitivity VPA for the June 1014*
- **Productivity** Several indicators suggest major change in productivity in recent years. The most recent survey biomass estimates are among the lowest in the time series and recent recruitment has generally been below average. The Georges Bank Yellowtail Flounder larval index dropped sharply since 2006. Condition factor has been variable but declining since 1998 and fecundity declines with poor condition factor. *TRAC concluded that the stock biomass is low and productivity is poor.*
- **Catchability** Absolute biomass estimates for NEFSC and DFO survey trawl time series will be based on the door spread footprint rather than by the wing spread as done previously. Estimation of biomass based on wing spread is confounded by the herding effect. Empirical estimates of survey efficiency, e.g. whole net efficiency for trawl surveys, should be considered to inform the scale of area swept biomass estimates. Such estimates impose realistic constraints on estimated catchability from the model outputs. *TRAC recommends that door spread swept area biomass estimates be applied in a sensitivity VPA for the June 2014. TRAC also recommends further research to refine estimates of survey gear efficiency.*
- **Absolute Biomass** estimates from surveys or other approaches can be used to inform the plausibility of model estimates, even in cases when the information applies to only part of the stock area. Model results well below the absolute estimates can be used to reject model results, but only when uncertainty in both estimates indicates a real difference. *TRAC agreed that the empirical estimates of biomass should be used to inform and evaluate consistency of VPA biomass estimates*

- There is **gear avoidance** in all surveys. Catchability should always be assumed to be less than one for whole gear. Preliminary analyses indicate there is gear avoidance by yellowtail flounder even during HABCAM surveys, in which catchability has previously been assumed to be 1.0.
- **Biomass Estimation and Exploitation** TRAC agreed to use time series from 1995 forward for interpretation of biomass estimated in the empirical approach. Current biomass will be estimated as the average of the estimated absolute biomass from the NMFS spring and DFO bottom trawl surveys from year  $i$  and the NMFS autumn bottom trawl survey from year  $i-1$ . Although these are multi-species surveys, these are the only surveys that sample the entire stock area. A Mass Balance Approach was developed that reconciles time series of survey biomass, catch, survey based total mortality, and individual growth. This approach estimates that  $M$  has ranged between 0.8 and 2.0 since 2009. This  $M$  represents all losses other than those due to estimated catch. The exploitation rate is calculated as catch/the average of the survey biomasses.

This method was used to guide the selection of an appropriate harvest rate based on yield per recruit analyses. The target *exploitation rate*, based on the ratio of yield per recruit / total biomass per recruit over a range of  $M = 0.4$  to 1.1, ranged between 0.24-0.27 at  $F_{0.1}$  and between 0.22-0.24 at  $F_{40\%}$  and is estimated to be = 0.25 (averaged over all 16 values).

- **Catch advice** will be based on the current average biomass described above, the target exploitation rate and qualitative criteria (e.g. is there convincing evidence that the stock is increasing or decreasing; is recent recruitment above or below average, etc.). In the current year  $y$ , the catch is being set for the next fishing year,  $y + 1$ , without making projections for population dynamics (e.g. catch, survey catch, recruitment, weight at age, selectivity) in year  $y$ .