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A PRELIMINARY ASSESSMENT OF THE STATUS OF THE WESTERN ATLANTIC BLUEFIN TUNA STOCK (1970-2013)

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SUMMARY

This document presents an updated assessment of the western Atlantic stock of bluefin tuna using data through 2013. The analysis was conducted by the western evaluation team in accordance with the specifications of the bluefin tuna work plan and the Report of the 2014 ICCAT Bluefin Data Preparatory Meeting.

RÉSUMÉ

Le présent document contient une mise à jour de l'évaluation du stock de thon rouge de l'Atlantique Ouest au moyen des données allant jusqu'en 2013. L'analyse a été réalisée par l'équipe d'évaluation de l'Ouest en appliquant les spécifications du plan de travail du thon rouge et du rapport de la réunion ICCAT de préparation des données sur le thon rouge tenue en 2014.

RESUMEN

Este documento presenta una evaluación actualizada del stock de atún rojo del Atlántico oeste utilizando datos hasta 2013. El análisis lo llevó a cabo el equipo de evaluación del oeste de acuerdo con las especificaciones del plan de trabajo de atún rojo y del Informe de la reunión de preparación de datos de atún rojo de ICCAT de 2014.

KEYWORDS

Stock assessment, Atlantic bluefin tuna

1. Introduction

The bluefin tuna working group agreed at the data preparatory meeting (held May 5-10, 2014, in Madrid) to establish two evaluation teams to conduct preliminary stock assessments of eastern and western Atlantic bluefin tuna in preparation for the 2014 species group meeting. The western team was charged with conducting a preliminary update of the 2012 assessment for the western Atlantic stock using data through 2013. The report of the 2014 ICCAT bluefin data preparatory meeting indicated that the data series and parameter specifications should be identical to those use for the 2012 VPA assessment of western Atlantic bluefin tuna except for some minor changes relating to the indices of abundance and corresponding partial catch-at-age (described in section 7 of that report). The specifications for the projections were also to be retained with the following exceptions:

- use the 2012 Parrack and Phares, September weight-length relationship,
- use geometric mean selectivity from 2010-2012,
- compute 'low' recruitment scenario with the two line relationship where the spawning biomass at the hinge point is set equal to the lowest average of any 6 consecutive years in the series (probably during 1990-1995) and the asymptotic recruitment is the geometric mean from 1976-2010,

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- compute the ‘high’ recruitment scenario with the Beverton and Holt curve fitted to recruitment estimates from 1971-2010 and corresponding spawning biomass estimates from 1970-2009.

The report of the 2014 ICCAT bluefin data preparatory meeting also recommended the following model sensitivity analyses:

- a sensitivity of the estimated selectivity of the plus group based on results from an integrated catch-at-size model to be evaluated by changing the F-ratio parameter of the plus group to age 15,
- alternative maturity schedules to match the estimated early maturity-at-age of the eastern stock as well as a sensitivity of late maturity-at-age of 15 and 16+ aged fish under the assumption that only the largest fish spawn in the Gulf of Mexico,
- an index jackknife sensitivity where each CPUE index is iteratively removed from the VPA to assess the effect on model estimates,
- alternative natural mortality vector, using the estimated mortality-at-age of the eastern stock opposed to constant natural mortality of 0.14,
- alternative partial catch-at-age of the U.S. Gulf of Mexico larval index fixed at the maturity schedule, and
- a retrospective analysis to evaluate the effects of removing recent years data.

The western evaluation team completed all of the above analyses with the exception of the sensitivity run exploring possible alternative values of the F-ratio, which required inputs from an integrated catch-at-size model that had not yet been completed.

The team was charged with producing an SCRS document detailing the methods and results with the same format as the detailed reports from previous assessments, therefore the remainder of this report adopts the structure and numbering conventions of the 2012 Detailed Report (SCI-033 / 2012).

2. Summary of available data for assessment

A discussion of catch statistics, fishery trends and relative abundance indices is available in the Report of the 2014 ICCAT Bluefin Data Preparatory Meeting. For the most part the present document does not depart from the established work plan or the recommendations made at the data preparatory meeting. However, there was a significant departure from the work plan in regards to generating the catch at size and catch at age, which is detailed below.

2.1 Catch and other Fishery Statistics

2.1.1 Western Atlantic

Catch-at-size (CAS) and catch-at-age (CAA)

The CAS and CAA for the western Atlantic were generated by the secretariat using the methods described in documents SCRS/2010/119 (revised) and SCRS/2010/120. However, the evaluation team discovered an error in the 2011 CAS statistics submitted by the United States. While the correct statistics were submitted to the Secretariat shortly after the error was discovered, it was well after the May 31, 2014 deadline and there was insufficient time for the secretariat staff to reconstruct the CAS data base and recalculate the CAA. After consulting with the SCRS chair, Secretariat and working group chairs, it was decided that the best course of action was for the western evaluation team to reconstruct the CAS themselves and reproduce the corresponding catch-at-age estimates using the same code employed by the Secretariat (Ageit_BFT_ver4 R script). These analyses are documented in a separate paper.

The output from the R-Script AgeIT was used to generate partial CAA corresponding to the indices of abundance used in the assessment following the restrictions on sizes and month specified in **Table 2**. The final CAA and partial CAA matrices are shown with the other inputs to the VPA in **Appendix 1**.

3. Methods and other data relevant to the assessment

3.1 Methods – West

3.1.1 VPA applied to the West Atlantic

Tuned virtual population analyses (VPA) were conducted using the VPA-2BOX software featured in the ICCAT Software Catalog. The parameter specifications used in the 2014 VPA assessments were identical to those used in the 2012 base-case assessment. The same data sets were used, although in a few cases the indices of abundance were computed somewhat differently than in 2012 (see the Data Preparatory Meeting Report in 2014). This section reviews the details of these specifications. The reader may refer to **Table 1** for a summary of the parameter specifications for the various model runs and **Table 2** for the specifications for the partial catch-at-ages related to indices of abundance.

General specifications

The oldest age class represents a plus group (ages 16 and older) and the fishing mortality rate on that age is specified as the product of the fishing mortality rate on the next younger age (F_{15}) and an 'F-ratio' parameter that represents the ratio of F_{16} to F_{15}. For the 2010, 2012 and the 2014 models, the F-ratio was pre-specified at 1.0 for the entire period as there is no reason to expect the selectivity to differ on fish age 15 and older (growth is relatively slow at this age and all animals are fully mature).

The fishing mortality rates for each age in the last year of the VPA (except the oldest age) were estimated as free parameters, but subject to a constraint restricting the amount of change in the vulnerability pattern during the most recent three years with a standard deviation of 0.5 (see SCRS/2008/089 for more details).

The indices of abundance were fitted assuming a lognormal error structure and equal weighting (i.e., the coefficient of variation was represented by a single estimated parameter for all years and indices). The catchability (scaling) coefficients for each index were assumed constant over the duration of that index and estimated by the corresponding concentrated likelihood formula.

The natural mortality rate was assumed age-independent (=0.14 yr^{-1}) as in previous assessments. The maturity vector used in prior assessments assumed ages 1-8 were immature and ages 9 and older were fully mature.

Detailed specifications for the 2014 base case and alternative runs

This section details all the model settings examined during the assessment. Note that Run 4 (below) is our proposed base case because it most closely repeated the specifications of the base model from the 2012 assessment while still accommodating all the modifications recommended during the 2014 ICCAT Bluefin Data Preparatory Meeting.

- Continuity run 0: This run most strictly adhered to the specifications of the 2012 base assessment with the updated data in 2014, including catch-at-age, partial catch-at-age, weight-at-age, and abundance indices. There were some minor changes relating to the indices of abundance: 1) U.S. RR indices were calculated using a negative binomial error distribution assumption instead of the delta-Poisson assumption (SCRS/2014/055), and 2) U.S. pelagic longline index in the Gulf of Mexico was adjusted the effect of a 'weak hook' introduced in 2011 (SCRS/2014/058). Note that this run used the 'continuous' version of the U.S. pelagic longline index, i.e., without 'splitting' the series in 1992 (see description of Run 3).
- Run 1: Like run 0, but replaced the partial catch at age for the Canadian Gulf of St. Lawrence and SW Nova Scotia indices with the spatially explicit filtering to more appropriately match data used in the standardization of the indices (see **Table 2**)

- Run 2: Like run 1, but Canadian Gulf of St. Lawrence and SW Nova Scotia indices were considered indices for ages 8-16+ (13-16+ in prior assessments), and for ages 5-16+ (8-14 in prior assessments), respectively based on otolith aging results presented during the Data Workshop.

- Run 3: Like run 2, but 'split' U.S. pelagic longline index into two periods 1987-1991 and 1992-2013. The Data Preparatory working group recommended that this index be split owing to important management regulations that occurred in 1991. After a review of available catch-at-size information, it was determined that complete size data were not available for the Gulf of Mexico for the years prior to 1992 and therefore that accurate partial-catch-at-ages could not be created for those years. Therefore this run fixed the selectivity of the early part of the index, 1987-1991 at the estimated selectivity for the USA GOM PLL from Run 2 (see also Run 4).

Run 4: Like run 2, but did not use the early period (1987-1991) from the newly developed 'split' U.S. pelagic longline index. This run represented the proposed base model.

- Runs 5-16 Jack-knife sensitivity analyses. The influence of the various indices of abundance on the proposed base case model results were examined by removing one index at a time, running the VPA with the same model specifications, and comparing various reference statistics.

- Runs 17: A Retrospective analysis was conducted for the proposed base case model (run 4) by sequentially removing inputs of catch and abundance indices in annual increments, back to 2008.

- Run 18: Sensitivity analysis on Canadian Gulf of St. Laurence index. The influence of the 2010 data point for the Gulf of St. Lawrence on the proposed base case model results was examined by including it.

- Run 19: Sensitivity analysis on natural mortality. The influence of the natural mortality on the proposed base case model results was examined by assuming the estimated mortality-at-age of the eastern stock as opposed to constant natural mortality of 0.14.

- Runs 20-21: Sensitivity analyses on maturity schedule. The influence of two maturity schedules on the proposed base case model results was examined by assuming a) the estimated early maturity-at-age of the eastern stock as well as b) a late maturity-at-age of fish 9 to 16 (0% at age 8, increasing logistically to 100% at age 16 as described in SCRS/2010/018).

- Run 22: Sensitivity analysis on the larval index. The influence of alternative partial catch-at-age of the U.S. Gulf of Mexico larval index on the proposed base case model results was examined by fixing the selectivities to match the maturity schedule in the base case model.

4. Stock status results

4.1 Stock status – West

This Section summarizes the results from the VPA analyses explained in Section 5.2. The inputs and output files of the VPA-2BOX software for the proposed base VPA model (Run 4) are included as **Appendix 1**. The output reports contain a complete description of the VPA results, including the matrix of estimated fishing mortality rates, abundance-at-age, stock biomass, recruitment, fits to indices, estimated index selectivities, F-ratios and F-at-age in the terminal year

4.1.1 Diagnostics

Fits to the indices of abundance for the 2014 proposed base model (Run 4) are shown in **Figure 1** and compared to those of the 2012 base model in **Figure 2**. The fits to the relative abundance indices were similar between the 2012 base and 2014 base models, with a noticeable increase in model estimates for the Canadian Southwest Nova Scotia, U.S. rod and reel >177cm, and U.S. Gulf of Mexico longline indices (**Figure 2**).

The fits to indices from the jack-knife sensitivity analyses (where individual relative abundance indices were excluded one at a time) were similar to those of the proposed base model (**Figure 3**), even when the most influential indices (Canadian GSL or US RR > 177 cm) were removed. Fits to the indices for large fish (Canadian Gulf of St. Lawrence, Canadian Southwest Nova Scotia, U.S. rod and reel >177 cm, Japan longline Area 2, and U.S. Gulf of Mexico longline) generally showed an increase in recent years. This increasing trend was even more apparent when the US RR > 177 cm was dropped as that index is the only one that suggested a decline in the abundance of older fish over the last decade (with only a slight increase in recent years). The increasing trend in the fits to the indices for large fish was less noticeable when the Canada Gulf of St. Lawrence index was dropped. The model fits were similar to the fits of the proposed base model for most of the other sensitivity runs and are therefore not shown.

Histograms of the bootstrap estimates of 2013 stock status from the proposed base model run were constructed to examine the bias and normality of the distribution. For both the high and low recruitment scenario estimates of F_{2013}/F_{MSY} the median of the bootstraps tended to be lower than the point estimate, which implies that point estimate may underestimate the true value (**Figure 4**). Conversely, the bootstrap medians of SSB_{2013}/SSB_{MSY} tended to be slightly higher than the point estimate, implying that point estimate may somewhat overestimate the true value.

A retrospective analysis was conducted for the base run by sequentially removing inputs of catch and abundance indices in annual increments, back to 2008. **Figure 5** shows the trends of spawning biomass and age 1 recruits for the continuity model. The long-term trend in estimated SSB was not highly sensitive to the retrospective removal of data; however, a systematic decrease in SSB was estimated as data were sequentially removed, particularly when the most recent two years of data were removed. The estimated recruitment was less sensitive to the retrospective removal of data and showed no consistent pattern or evidence of a consistent bias. However, inclusion of the most recent data decreased the signal of the 2003 recruitment compared to the retrospective model runs. The retrospective results also show some variability in fishing mortality estimates for ages 5 to 9 (**Figure 6**) and in abundance estimates for ages 1 to 10 (**Figure 7**), but again with no consistent trends that indicate model bias.

4.1.2 Comparison of 2012 base model and 2014 VPA results

The 2014 continuity assessment and proposed based model (run 4) are compared with the 2012 base assessment in **Figure 8**. The 2014 runs are consistent with previous analyses in that the spawning stock biomass (SSB) was estimated to decline sharply between 1970 and 1985, level off through the 1990s, and then begin increasing over the last decade (**Figure 8**).The estimated fishing mortality rate was very high during the 1970s, but decreased substantially during the following decade. Estimated fishing mortality fluctuated around 0.2 for the period from 1984 to 2005, with an observed decline since 2006. The fishing mortality rate on spawners (ages 9 and older) is estimated to have declined markedly since 2003, with the exception of 2006 when fishing mortality was estimated to be greater than 0.2. The estimates of recruitment (age 1) are highest for the early 1970‘s, fall sharply after 1975, and showed less annual fluctuation since that period. Relatively strong year-classes were estimated during 1988 and 2003, similar to results from previous assessments (Anon., 2012).

The estimates from the three models are very similar through the mid-1990s, but diverge for more recent years. In general, the proposed base model (run 4) indicates a more rapid increase and higher absolute levels of spawning biomass over the last decade, with correspondingly lower fishing mortality rates. Run 4 also estimated a higher recruitment level in 2004 (2003 year class) and 2003 (2002 year class) than was estimated during the 2012 assessment. The median trends and 80% confidence limits in spawning biomass, apical fishing mortality and recruitment are shown for Run 4 (proposed base) in **Figure 9**.

4.1.3 Sensitivity Runs

The results of the jack-knife sensitivity analyses, in which indices were removed from the proposed base model one at a time, are summarized in **Figure 10**. The Canadian GSL and US RR > 177 cm indices were clearly the most influential of the indices; both sensitivity runs resulted in an estimated increase in SSB in recent years, similar to the 2014 proposed base model; however, exclusion of the Canadian GSL indices resulted in a lower estimated SSB and noticeably flatter trend compared to the base model, and exclusion of the US RR >177 cm resulted in a higher estimated SSB than the base model.

Comparisons between the 2014 continuity (Run 0), iterative revisions to the continuity (Runs 1, 2, and 3; revisions described in Section 5.2 and summarized in the following sentence), proposed base model, and the various sensitivity runs discussed in section 5.2 are summarized in **Figure 11**. The revision of the continuity to the proposed base included: (1) modified PCAA of the Canadian GSL and SWNS indices to be spatially explicit areas coinciding with the data used to construct the indices (**Table 2**); (2) expansion of the reference ages for the Canadian indices from ages 13-16 to ages 8-16 for the GSL index, and from ages 8-14 to ages 5-16 for the SWNS; (3) splitting of the U.S. Gulf of Mexico longline index into two periods, 1987-1991 and 1992-2013 with the selectivity of the first period fixed at the estimated selectivity from Run 2; and (4) removal of the early period of the U.S. Gulf of Mexico longline index, 1987-1991. The base model included all modifications from iterations 1, 2, and 4. The SSB, apical fishing mortality and recruitment estimates were similar between the continuity, iterative revisions, and the base model, with the exception that splitting of the U.S. Gulf of Mexico longline index resulted in a noticeable increase in SSB. Recruitment is recent years showed little deviation across all model iterations and sensitivities (**Figure 11**).

Results from the maturity sensitivity analyses indicated that the estimated SSB was sensitive to the assumption of maturity. The assumption of early maturity (i.e. eastern Atlantic ogive with 50% maturity at age 4) resulted in greater estimated SSB over the entire time series and the assumption of late maturation (i.e. approximately logistic increase in maturity from 0% mature at ages 8 to 100% mature at age 16) resulted in decreased estimates of SSB compared to the base model (fully mature at age 9). The overall estimated long-term trend in SSB was not sensitive to the maturity schedule and the estimates of apical fishing mortality and recruitment were nearly identical across model runs (**Figure 11**).

4.1.4 Stock status

A key factor in determining stock status is the estimation of the MSY-related benchmarks against which the current condition of the stock is measured. These benchmarks depend to a large extent on the relationship between spawning biomass and recruitment. Two alternative spawner-recruit hypotheses were explored consistent with several prior assessments: the two-line (low recruitment potential hypothesis) and the Beverton and Holt spawner-recruit formulation (high recruitment potential hypothesis). The two-line model assumes recruitment increases linearly with SSB from zero to a maximum value (RMAX) when SSB reaches the current carrying capacity (assumed to be lower than the historical carrying capacity observed during 1970 to 1975). Here the SSB threshold (hinge) was set at the average SSB during 1990-1995 (the period with the lowest estimated SSB), and RMAX was calculated as the geometric mean recruitment during 1976-2010 (the recruitment estimates for the last three years were deemed unreliable). The Beverton and Holt function was fit to the SSB and recruitment estimates corresponding to the period 1971-2010. The two curves are shown in **Figure 12**.

Due to uncertainty in the estimation of the spawner-recruit relationship, reference points based on $F_{0.1}$ are presented in addition to F_{MSY} (consistent with the 2012 assessment). Note that $F_{0.1}$ is calculated as the fishing mortality rate corresponding to 10% of the slope of the yield-per-recruit curve at the origin; as such it is calculated independently of the presumed spawner-recruit relationship. The spawning biomass corresponding to $F_{0.1}$, $SSB_{0.1}$, is calculated as the equilibrium level of spawning biomass achieved by fishing indefinitely at $F_{0.1.}$

Stock status was determined using the two-line (low recruitment potential) and Beverton-Holt (high recruitment potential) scenarios for the proposed base model from 1970 to current (**Figure 13**). The results under the two-line (low recruitment) scenario suggest that the stock has achieved the convention objective (level that supports MSY). The results under the Beverton-Holt (high recruitment) scenario suggest that the stock biomass has been below convention objectives since 1970 and that overfishing was occurring throughout the period of record until very recently. The estimated status of the stock in 2013 is summarized for the two alternative recruitment hypotheses in **Figures 13 and 14**. The estimated median trajectories of stock status since 1970 are shown in **Figure 13**.

Figure 14 shows the results for the proposed base case and the jack-knife analysis runs excluding the Canadian GSL and US RR > 177 cm indices. The two jack-knife runs were included because their divergence from the base model helps to bracket the uncertainty in SSB and fishing mortality. The two-line base model (low recruitment hypothesis) estimated recent F (geometric mean from 2010-2013) to be 0.35 F_{MSY} (0.28-0.43 at the 80% confidence level). In comparison, the jack-knife sensitivity analyses resulted in similar estimates of F below F_{MSY} compared to the base model. Spawning stock biomass under the two-line recruitment hypothesis was estimated to be 2.3 SSB_{MSY} (1.92 to 2.68 confidence interval) and 1.29 $SSB_{0.1}$ (1.13 to 1.52 at the 80% confidence level). Under the Beverton and Holt recruitment hypothesis, recent F was estimated to be 0.86 F_{MSY} (0.64 to 1.08 at the 80% confidence level) and 0.61 $F_{0.1}$ (0.50 to 0.72 confidence interval). Spawning stock biomass under the Beverton and Holt recruitment hypothesis was estimated to be 0.48 of SSB_{MSY} (0.35 to 0.72) and 0.76 of $SSB_{0.1}$ (0.58 to 1.04 at the 80% confidence level).

The results of this assessment do not capture the full degree of uncertainty in the assessments and stock projections. An important factor contributing to uncertainty is mixing between fish of eastern and western origin. Recent analyses have indicated that stock mixing occurs (empirical tag return information and otolith microchemistry) and that stock assessment is sensitive to the stock mixing assumptions. Based on earlier work, the estimates of stock status can be expected to vary considerably depending on the type of data used to estimate mixing (conventional tagging or isotope signature samples) and stock mixing assumption. More research and data synthesis needs to be done before mixing models can be used operationally for management advice. Another important source of uncertainty is recruitment, both in terms of recent levels (which are estimated with low precision in the assessment), and potential future levels (the "low" vs "high" recruitment hypotheses which affect management benchmarks). Improved knowledge of maturity at age will also affect the perception of changes in stock size. Finally, determining the catch at age from length samples is imprecise for larger bluefin tuna and should be addressed in a sensitivity analysis in which the catch is characterized using direct ageing results.

5. Projections

5.1 Projections WBFT

5.1.1 Methods

As in 2012, the two recruitment scenarios discussed in Section 5.2: a low recruitment potential scenario (two-line model) that assumes average recruitment cannot reach the high levels from the early 1970s (ostensibly owing to some unknown change in the environment) and a high recruitment potential scenario that assumes the number of recruits is a Beverton and Holt function of the spawning biomass in the previous year, were considered. In past assessments of the stock the working group indicated that there was no strong evidence to favor one scenario over the other and that the two scenarios provide reasonable (but not extreme) lower and upper bounds on rebuilding potential.

The projections for the western stock were based on the bootstrap replicates of the fishing mortality-at-age and numbers-at-age matrices produced by the VPA-2BOX software. Projections and benchmarks were computed for the Beverton and Holt (high) and two-line scenarios (low) to account for the uncertainty regarding the true form of the stock-recruitment relationship, consistent with the approach used during the 2012 assessment (see **Figure 6.2.12**). The Beverton-Holt stock-recruitment relationship was fitted to the estimates of spawning stock size and recruitment for the 1970-2009 year-classes by means of maximum likelihood estimation (lognormal error structure). The extent of recruitment variability, σ_R, for each bootstrap replicate was equal to the maximum likelihood estimate (0.30). As in 2012, future recruitment was allowed to deviate from its expectation as a first-order multiplicative (lognormal) autocorrelated process. Generally the lognormal structure is preferred because it does not admit negative recruitments and because it allows the variance in recruitment to increase with its expectation. The autocorrelation parameter (ρ) was estimated to be equal to 0.416 for the proposed base case.

The 2-line stock-recruitment relationship assumes a linear increase in recruitment from the origin to a “pivot” level of spawning stock size above which recruitment is independent of spawning stock size. The “pivot” spawning stock size is defined as the mean spawning stock size over 1990-95 (the period that includes the lowest estimates of spawning biomass). The constant level of recruitment is defined as the geometric mean recruitment over the years 1976-2010, a period over which recruitment showed less variation compared the full time series. Similar to the Beverton-Holt model, the 2-line stock recruitment relationship used a first-order autocorrelated process with the standard deviation (σ_R) estimated at 0.204 and the autocorrelation parameter (ρ) estimated at 0.359.

The recruitment estimates from the VPA for 2011-2013 were replaced with values generated from the fitted stock-recruitment relationship underlying the projection (for both low and high recruitment scenarios). Numbers and fishing mortality-at-age for ages 1-3 at the start of 2011 were therefore re-calculated by projecting these generated recruitments forward under the known catches-at-age. The projected partial recruitment (which combines the effects of gear selectivity and availability of fish by age) was calculated from the geometric mean values of fishing mortality-at-age for the years 2010-2012 (rescaled to a maximum of 1.0).

The average age of the plus-group at the start of the projections was computed from the observed average weight of the plus-group in the last year of the VPA by inverting the growth curve. The average age of the plus-group was then updated in subsequent years of the projection and the weight of the plus-group computed from the updated average age by use of the growth curve (as done in 2012). In this way the average weight of the plus-group is allowed to increase with reductions in the fishing mortality rate. The projected catch for 2014 was assumed to be equal 1,750 t [Rec. 12-02]. For years beyond 2014, projections were continued using various levels of constant catch with the restriction that the fully-selected F was constrained not to exceed 2 yr-1.

Medium-term projections were conducted to cover the time of the rebuilding plan (2019). Projected spawning stock size was expressed relative to the spawning stock size associated with MSY and $F_{0.1}$ (i.e., B_{MSY}, $B_{0.1}$) for the appropriate recruitment scenario. B_{MSY} was used as a reference level for rebuilding because it is the target of the current rebuilding program. The reference point $F_{0.1}$ is often used rather than F_{MSY} by other stock assessment groups, particularly when the stock-recruitment relationship is poorly known. It should be noted that $F_{0.1}$ is calculated independent of an underlying stock recruitment relationship in VPA-2BOX, and in some cases $F_{0.1}$ can exceed F_{MSY}.

5.1.2 Results

The recruitment expected at B_{MSY} was much lower with the two-line scenario (96,500) than with the Beverton-Holt scenario (210,000), with correspondingly lower estimates of MSY and B_{MSY}. However, the two-line and Beverton-Holt scenarios predict similar levels of recruitment when spawning stock sizes are low (i.e., between 5,000 and 13,000 t).

Projections of SSB from the proposed base VPA were made through 2019 under constant catches of 0 t to 3500 t in 100 t intervals, with an additional projection at the current TAC of 1,750 t [Rec. 12-02]. The associated benchmarks for the base case are given in **Table 3**. The results assuming low recruitment potential (**Figure 15**) indicate there is better than a 60% chance that the stock is currently at or above the convention objective (B_{MSY} = 12,900 t). Accordingly, there is less than a 50% chance of overfishing if catches are maintained at less than or equal to the maximum sustainable yield (2,650 t). The outlook under high recruitment potential (**Figure 16**) is less optimistic, indicating a stock that is currently overfished but not experiencing overfishing.

The median estimates of projected SSB, SSB/SSB_{MSY}, F, F/F_{MSY}, F, F/F01 and recruitment for the high and low recruitment scenarios are shown in **Figure 15 to 16**. Under the low recruitment potential scenario (**Figure**s **15 and 17**) the current TAC will lead to the 2019 SSB being higher than the estimated SSB for 2014. Constant catches at 2500 t would lead to no increase in the SSB in 2019 compared to 2014, while catches above 2500 t will result in the 2019 SSB being smaller than the 2014 SSB. The high recruitment potential scenario (**Figure 16**) suggests that the western stock will not rebuild by 2019 even with no catch (0 t), although the current TAC was estimated to have ended overfishing in 2013 and initiated rebuilding in recent years. At the current TAC of 1,750 t, the high recruitment scenario indicated that the stock is not expected to be rebuilt to SSB_{MSY} before 2025. Spawning stock biomass predictions were similar between the low and high recruitment scenarios for the period 2014 to 2019 (**Figure 18**). Comparison of results with the previous update assessment showed that the 2014 estimated stock biomass trajectory under the low and high recruitment scenarios is considerably higher than the results of the 2012 assessment (**Figure 18**). The 2014 assessment indicated a higher level of SSB and SSB relative to MSY between 2014 and 2019. The 60th percentile of projected SSB/SSB_{MSY} and F/F_{MSY} were also computed, and are illustrated in **Figure 17**. The projected stock status under the two recruitment scenarios resulted in different estimates of overfished status ($B < B_{MSY}$), but both scenarios indicated that the recent harvest levels were below the overfishing threshold ($F>F_{MSY}$).

The Kobe 2 Strategy Matrices are summarized in **Tables 4-6**. **Table 5** summarizes the chance that various constant catch policies will allow rebuilding under the low and high recruitment scenarios and maintain SSB above SSB_{MSY}. **Table 4** summarizes the chance that various constant catch policies will prevent overfishing whereas **Table 6** summarizes the joint distribution ($SSB>SSB_{MSY}$ and $F<F_{MSY}$). The results are consistent with those discussed above (**Figure**s **15-17**).

Table 1. Parameter specifications for the VPA continuity run (0) and sensitivity analyses (runs 1-16). Differences from the continuity run (0) are highlighted in gray.

Run number	*0,1,4,5-16*	*2*	*3*
First Age	1	1	1
Plus Group Age	16+	16+	16+
First Year	1970	1970	1970
Last Year	2013	2013	2013
Natural Mortality	0.14 all ages	0.14 all ages	0.14 all ages
Maturity	Same as 2010: Knife-Edged; 0.0 for ages 0-8; 1.0 at 9+	Same as 2010: Knife-Edged; 0.0 for ages 0-8; 1.0 at 9+	Same as 2010: Knife-Edged; 0.0 for ages 0-8; 1.0 at 9+
Constraint on Vulnerability (Applied to Last N Years; Std Dev; First Age - Last Age)	3; 0.5; 1-15	3; 0.5; 1-15	3; 0.5; 1-15
F in last year	Estimated for ages 1-15		
F-ratio	Fixed at 1.0 for all years		
Index Weighting	Indices equally weighted (estimating a single		
Bootstrap Specifications	If bootstapped, used Stine correction to inflate		

Table 2. Specifications for indices of abundance for western bluefin tuna.

CONTINUITY MODEL INDEX SPECIFICATIONS			
Index	Ages	Time period	Partial Catch-at-Age Filter Criteria
Canadian Gulf of St. Lawrence	13-16	1981-2009, 2011-2013	FlagName="Canada" GearGrpCode="RR" or "TL" Monthc="Aug","Sep", or "Oct"
Canadian Southwest Nova Scotia	8-14	1988-2013	FlagName="Canada", GearGrpCode="RR","TL", or "HP" Monthc="Aug","Sep", or "Oct"
U.S.A. Rod and Reel <145 cm	1-5	1980-83, 1985-1992	FlagName="U.S.A." GearGrpCode="RR" Size<145 Monthc="Jun", "Jul", Aug", or "Sep"
U.S.A. Rod and Reel 66-114 cm	2-3	1993-2013	FlagName="U.S.A." GearGrpCode="RR" Size>66 and Size<115 Monthc="Jun", "Jul", Aug" or ,"Sep"
U.S.A. Rod and Reel 115-144 cm	4-5	1993-2013	FlagName="U.S.A." GearGrpCode="RR" Size>114 and Size<145 Monthc="Jun", "Jul", Aug" or ,"Sep"
U.S.A. Rod and Reel >195 cm	10-16	1983-1992	FlagName="U.S.A." GearGrpCode="RR" Size>195 Monthc="Jul", Aug","Sep", or "Oct"
U.S.A. Rod and Reel >177 cm	8-16	1993-2013	FlagName="U.S.A." GearGrpCode="RR" Size>177 Monthc="Jul", Aug" ,"Sep", or "Oct"
Japan Longline Area 2	2-16	1976-2013	FlagName="Japan"
Gulf of Mexico Larval Survey	9-16	1977-78, 1981-84, 1986-2013	Equal to Japan GOM LL 1974-1981 and U.S.A. GOM LL 2004-2013
U.S.A. Gulf of Mexico Longline	9-16	1987-2013	FlagName="U.S.A." GearGrpCode="LL" Monthc="Jan", "Feb", "Mar", "Apr", or "May" SampAreaCode="BF60"
Japan Gulf of Mexico Longline	9-16	1974-1981	FlagName="Japan"
Tagging	1-3	1970-1981	Fixed selectivity: ages 1-3 fully selected, ages 4+ not selected
MODIFICATIONS TO INDEX SPECIFICATIONS FOR BASE MODEL			
Canadian Gulf of St. Lawrence	8-16	No change	FlagName="Canada" GearCode="RR", "RRFB", or "TL" Monthc="Aug","Sep", or "Oct" Lat=45 (1991 and later) Lon=60 (1991 and later)
Canadian Southwest Nova Scotia	5-16	No change	FlagName="Canada" Monthc="Aug","Sep", or "Oct" GearCode="HARP" or "HP-E" (Lat=40, Lon=60) for 1991 and later plus GearCode="RR", "RRFP", "TL", "HARP" or "HP-E" (Lat=45, Lon=60) for 1991 and later

Table 3. WBFT: Estimated benchmarks and reference points with 80% confidence intervals.

Low Recruitment						
MEASURE	LOWER CL	MEDIAN	UPPER CL	AVERAGE	RUN 0	STD. DEV.
F at MSY	0.17	0.20	0.24	0.21	0.19	0.03
MSY	2807	3050	3307	3056	3086	200
Y/R at MSY	30.3	31.6	32.7	31.5	32.0	1.0
S/R at MSY	130	137	144	137	138	5
SPR AT MSY	0.19	0.20	0.21	0.20	0.21	0.01
SSB AT MSY	12969	13226	13645	13268	13343	263
F at max. Y/R	0.20	0.23	0.26	0.23	0.23	0.02
Y/R maximum	30.4	31.7	32.8	31.6	32.1	1.0
S/R at Fmax	113	122	129	122	113	6
SPR at Fmax	0.17	0.18	0.19	0.18	0.17	0.01
SSB at Fmax	0	0	0	514	0	2588
F 0.1	0.11	0.12	0.13	0.12	0.12	0.01
Y/R at F0.1	28.0	29.0	29.8	29.0	29.5	0.7
S/R at F0.1	226	239	250	239	229	10
SPR at F0.1	0.34	0.36	0.37	0.36	0.34	0.01
SSB at F0.1	21330	23042	24966	23140	22101	1432

High Recruitment						
MEASURE	LOWER CL	MEDIAN	UPPER CL	AVERAGE	RUN 0	STD. DEV.
F at MSY	0.07	0.08	0.10	0.08	0.08	0.01
MSY	4442	5316	5863	5233	5343	554
Y/R at MSY	24.4	25.9	27.2	25.9	25.6	1.0
S/R at MSY	288	307	323	307	312	14
SPR AT MSY	0.43	0.46	0.48	0.46	0.46	0.02
SSB AT MSY	50096	63102	72921	62443	64998	9166
F at max. Y/R	0.20	0.23	0.26	0.23	0.23	0.02
Y/R maximum	30.5	31.7	32.8	31.7	32.2	1.0
S/R at Fmax	113	121	129	121	113	6
SPR at Fmax	0.17	0.18	0.19	0.18	0.17	0.01
SSB at Fmax	0	1244	6317	2192	0	2624
F 0.1	0.11	0.12	0.13	0.12	0.12	0.01
Y/R at F0.1	28.1	29.1	29.8	29.0	29.5	0.7
S/R at F0.1	226	238	250	239	229	10
SPR at F0.1	0.34	0.35	0.37	0.36	0.34	0.01
SSB at F0.1	32329	40179	45458	39559	36554	5095

Table 4. WBFT: The annual probability that F < F_{MSY} at various levels of total allowable catch. The current TAC of 1,750 mt is highlighted in bold.

A) Low Recruitment

Probability that F < Fmsy (No Overfishing)								
TAC	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0-1600 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1700 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1750 mt	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
1800 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1900 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2100 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2200 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2300 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2400 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2500 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2600 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2700 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2800 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2900 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%
3000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.6%
3100 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%	99.4%
3200 mt	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%	99.4%	98.6%
3300 mt	100.0%	100.0%	100.0%	100.0%	99.8%	99.4%	99.2%	98.0%
3400 mt	100.0%	100.0%	100.0%	100.0%	99.4%	98.8%	98.4%	97.2%
3500 mt	100.0%	100.0%	100.0%	99.6%	99.4%	98.6%	97.6%	96.4%

B) High Recruitment

Probability that F < Fmsy (No Overfishing)								
TAC	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0-400 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
500 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
600 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
700 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
800 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
900 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
1000 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
1100 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
1200 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
1300 mt	79.8%	94.8%	97.4%	100.0%	100.0%	100.0%	100.0%	100.0%
1400 mt	79.8%	94.8%	97.4%	99.8%	100.0%	100.0%	100.0%	100.0%
1500 mt	79.8%	94.8%	97.4%	99.8%	99.8%	100.0%	100.0%	100.0%
1600 mt	79.8%	94.8%	97.4%	98.6%	98.8%	99.2%	99.6%	99.8%
1700 mt	79.8%	94.8%	97.4%	98.0%	98.2%	98.6%	98.8%	99.2%
1750 mt	***79.8%***	***94.8%***	***97.4%***	***97.2%***	***97.8%***	***98.2%***	***98.8%***	***99.0%***
1800 mt	79.8%	94.8%	97.4%	96.6%	97.4%	97.8%	98.2%	98.6%
1900 mt	79.8%	94.8%	97.4%	92.8%	94.6%	96.4%	97.2%	97.2%
2000 mt	79.8%	94.8%	97.4%	89.2%	91.6%	93.2%	94.8%	96.0%
2100 mt	79.8%	94.8%	97.4%	84.2%	87.6%	90.2%	91.8%	93.4%
2200 mt	79.8%	94.8%	97.4%	79.2%	82.2%	85.6%	88.0%	89.6%
2300 mt	79.8%	94.8%	97.4%	69.2%	75.4%	79.6%	83.8%	85.8%

Table 5. WBFT: The annual probability that SSB > SSB_{MSY} at various levels of total allowable catch. The current TAC of 1,750 mt is highlighted in bold.

A) Low Recruitment

Probability that SSB > SSBmsy (Not Overfished)								
TAC	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0-1600 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1700 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1750 mt	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
1800 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1900 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2100 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2200 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2300 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2400 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2500 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2600 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2700 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2800 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2900 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3100 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3200 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3300 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3400 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%
3500 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%

B) High Recruitment

Probability that SSB > SSBmsy (Not Overfished)								
TAC	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0-400 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	4.2%
500 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	3.8%
600 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	3.4%
700 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	3.0%
800 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.4%
900 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.4%
1000 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.4%
1100 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.2%
1200 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.2%
1300 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1400 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1500 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1600 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1700 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1750 mt	***0.8%***	***0.8%***	***1.0%***	***1.2%***	***1.2%***	***1.0%***	***1.2%***	***1.6%***
1800 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.2%	1.6%
1900 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.2%	1.4%
2000 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.2%	1.4%
2100 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.0%	1.4%
2200 mt	0.8%	0.8%	1.0%	1.2%	1.2%	0.8%	0.4%	1.2%
2300 mt	0.8%	0.8%	1.0%	1.2%	1.2%	0.8%	0.4%	1.2%

Table 6. WBFT: The annual joint probability that $F<F_{MSY}$ and $SSB > SSB_{MSY}$ at various levels of total allowable catch. The current TAC of 1,750 t is highlighted in bold.

A) Low Recruitment

Probability that F < Fmsy and SSB > SSBmsy (No Overfishing and Not Overfished)								
TAC	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0-1600 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1700 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1750 mt	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
1800 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1900 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2100 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2200 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2300 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2400 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2500 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2600 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2700 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2800 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2900 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%
3000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.6%
3100 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%	99.4%
3200 mt	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%	99.4%	98.6%
3300 mt	100.0%	100.0%	100.0%	100.0%	99.8%	99.4%	99.2%	98.0%
3400 mt	100.0%	100.0%	100.0%	100.0%	99.4%	98.8%	98.4%	97.2%
3500 mt	100.0%	100.0%	100.0%	99.6%	99.4%	98.6%	97.6%	96.4%

B) High Recruitment

Probability that F < Fmsy and SSB > SSBmsy (No Overfishing and Not Overfished)								
TAC	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
0-400 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	4.2%
500 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	3.8%
600 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	3.4%
700 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	3.0%
800 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.4%
900 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.4%
1000 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.4%
1100 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.2%
1200 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	2.2%
1300 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1400 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1500 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1600 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1700 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.2%	1.2%	1.6%
1750 mt	***0.8%***	***0.8%***	***1.0%***	***1.2%***	***1.2%***	***1.0%***	***1.2%***	***1.6%***
1800 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.2%	1.6%
1900 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.2%	1.4%
2000 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.2%	1.4%
2100 mt	0.8%	0.8%	1.0%	1.2%	1.2%	1.0%	1.0%	1.4%
2200 mt	0.8%	0.8%	1.0%	1.2%	1.2%	0.8%	0.4%	1.2%
2300 mt	0.8%	0.8%	1.0%	1.2%	1.2%	0.8%	0.4%	1.2%

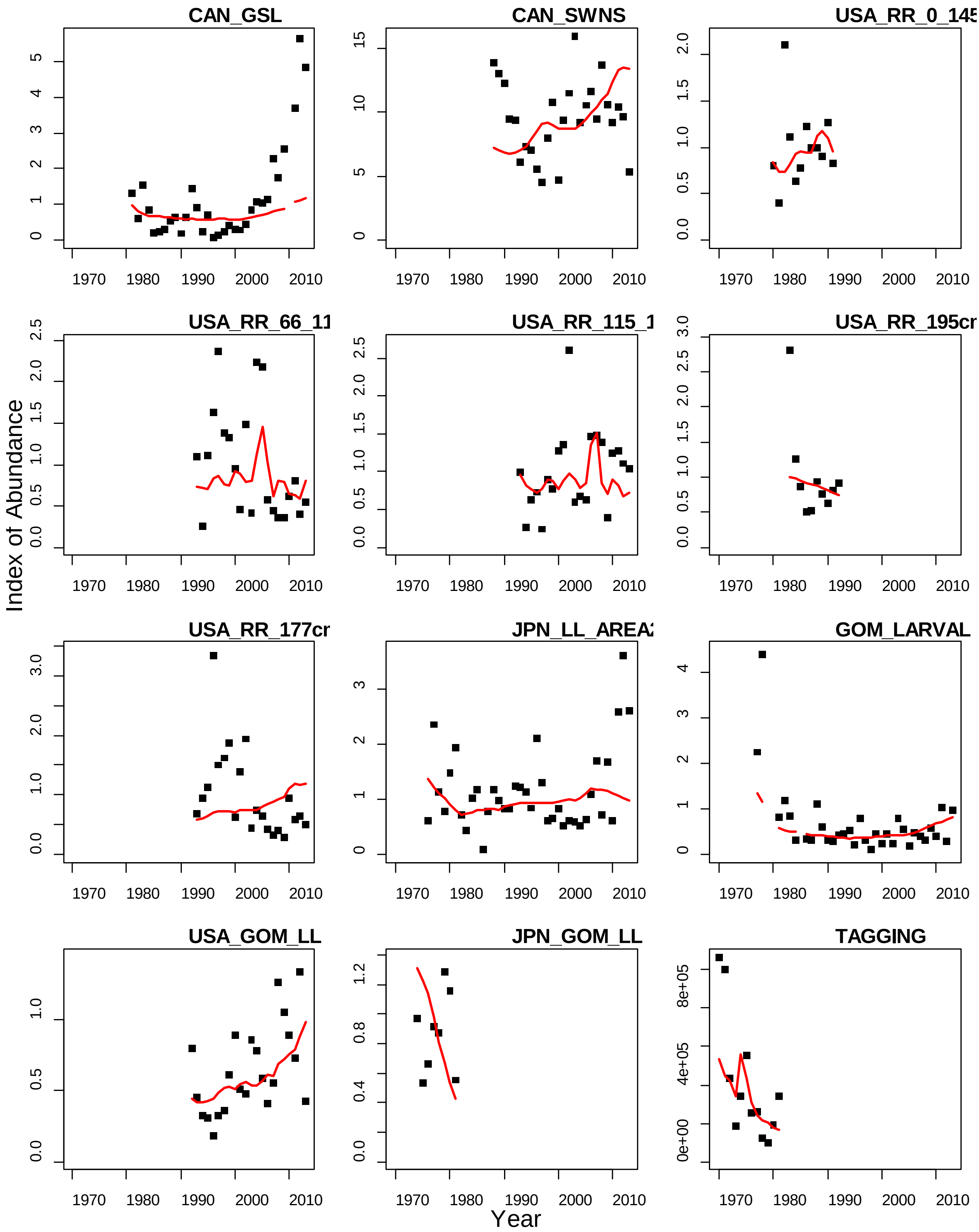


Figure 1. Fits to CPUE indices for 2014 western Atlantic BFT proposed base VPA (observed shown as black points, model predicted shown as red lines).

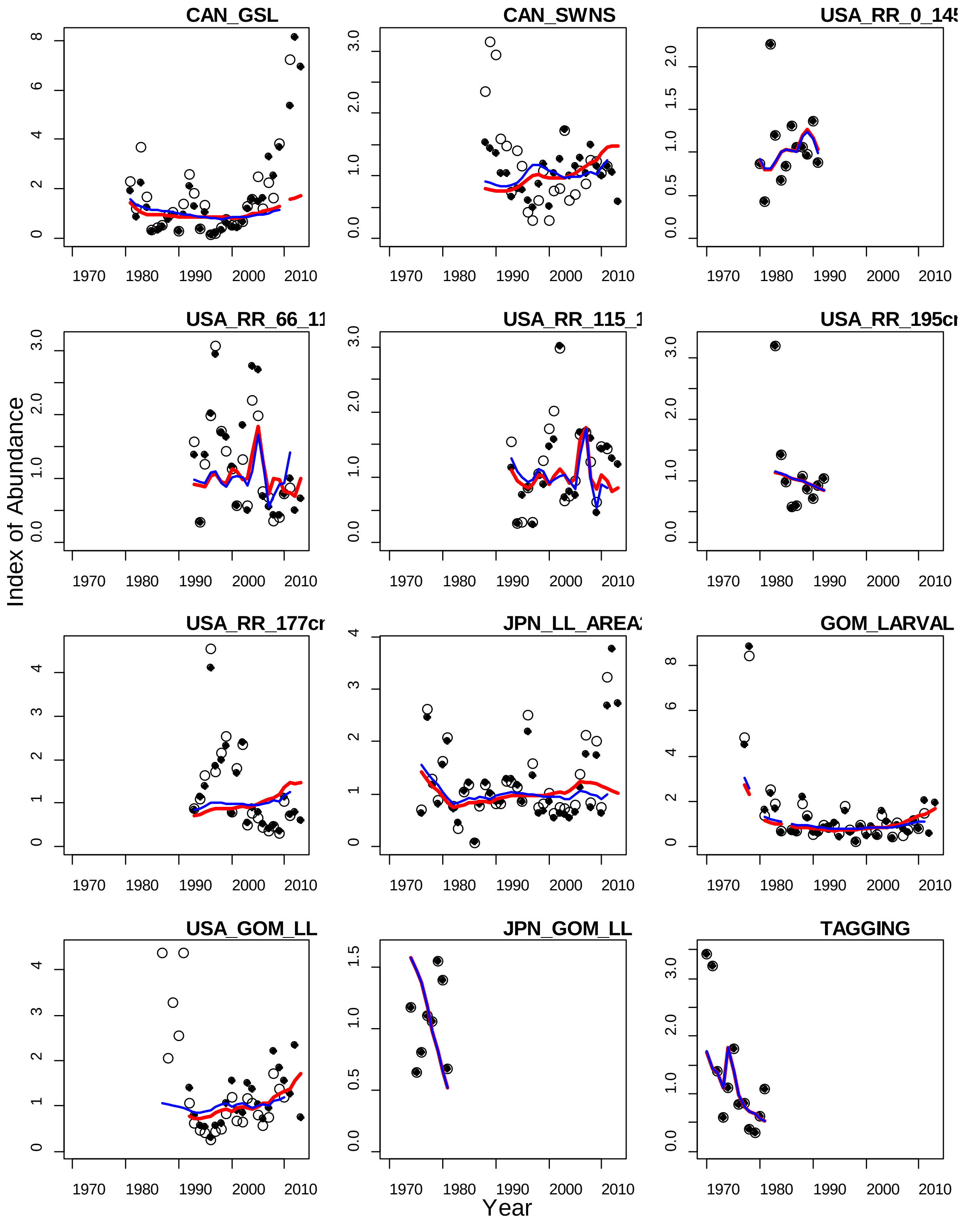


Figure 2. Fits to the CPUE indices for 2014 western Atlantic BFT proposed base VPA (observed shown as solid points, predicted shown as red lines) compared to the 2012 base model (observed shown as open circles, predicted shown as blue lines).

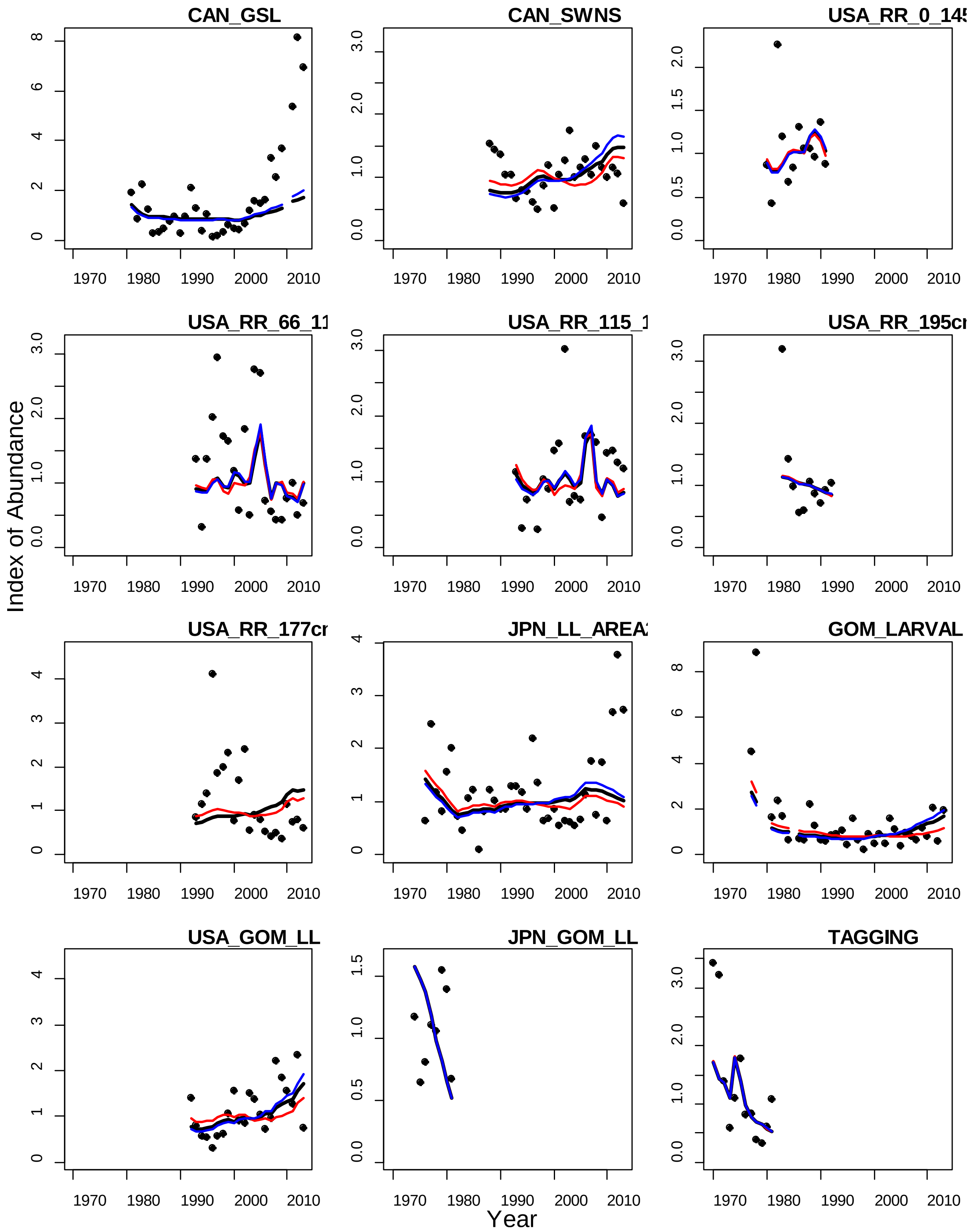


Figure 3. Fits to CPUE indices for western Atlantic BFT proposed base VPA run (black lines) compared to jackknife sensitivity runs without Canadian GSL index (red lines) and USA RR>177 cm index (blue lines).

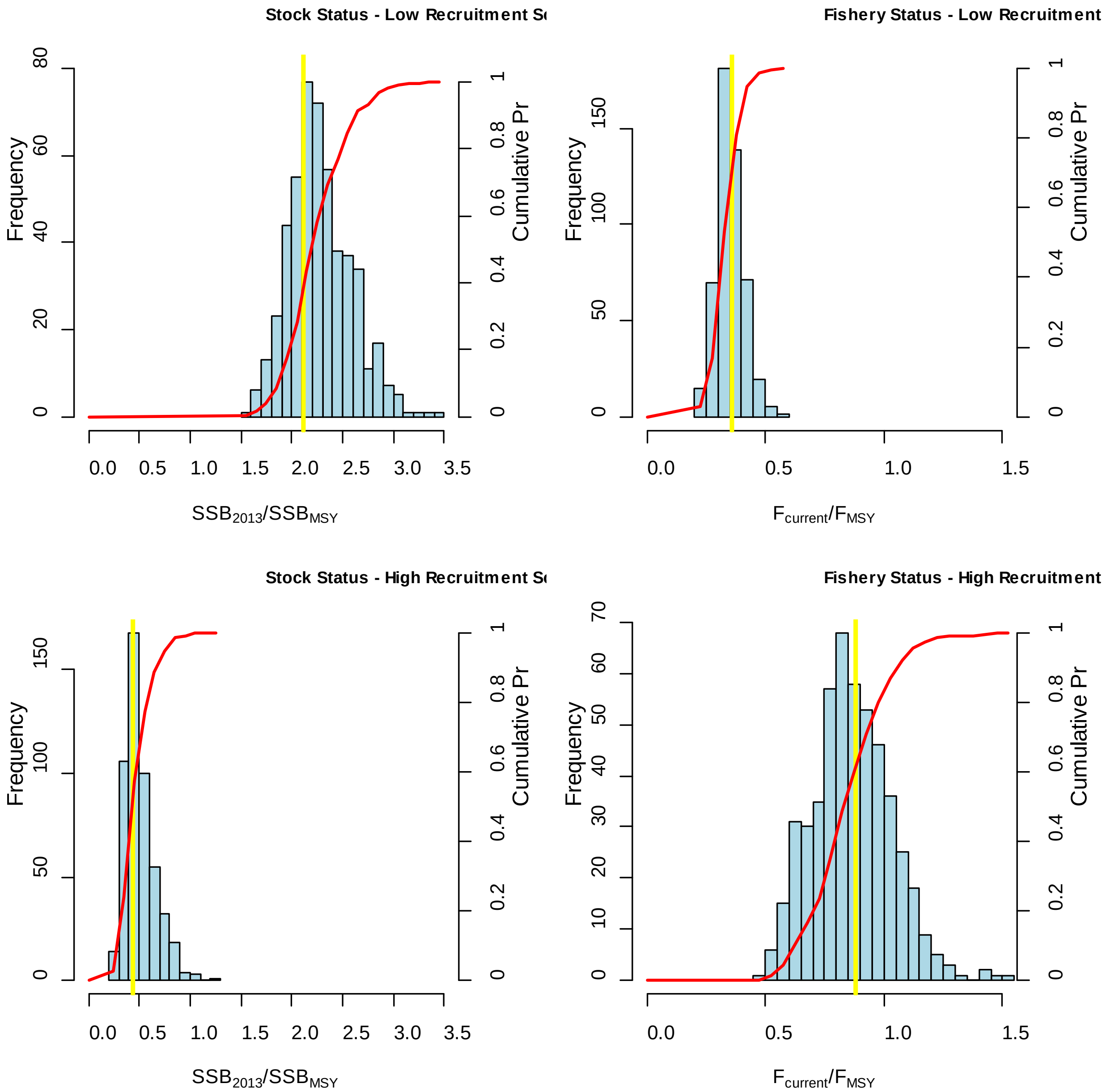


Figure 4. Histograms of bootstrap estimates of 2013 stock and fishery status. The yellow bar represents the value corresponding to the base-case deterministic point estimate. The cumulative probability is shown as a solid red line.

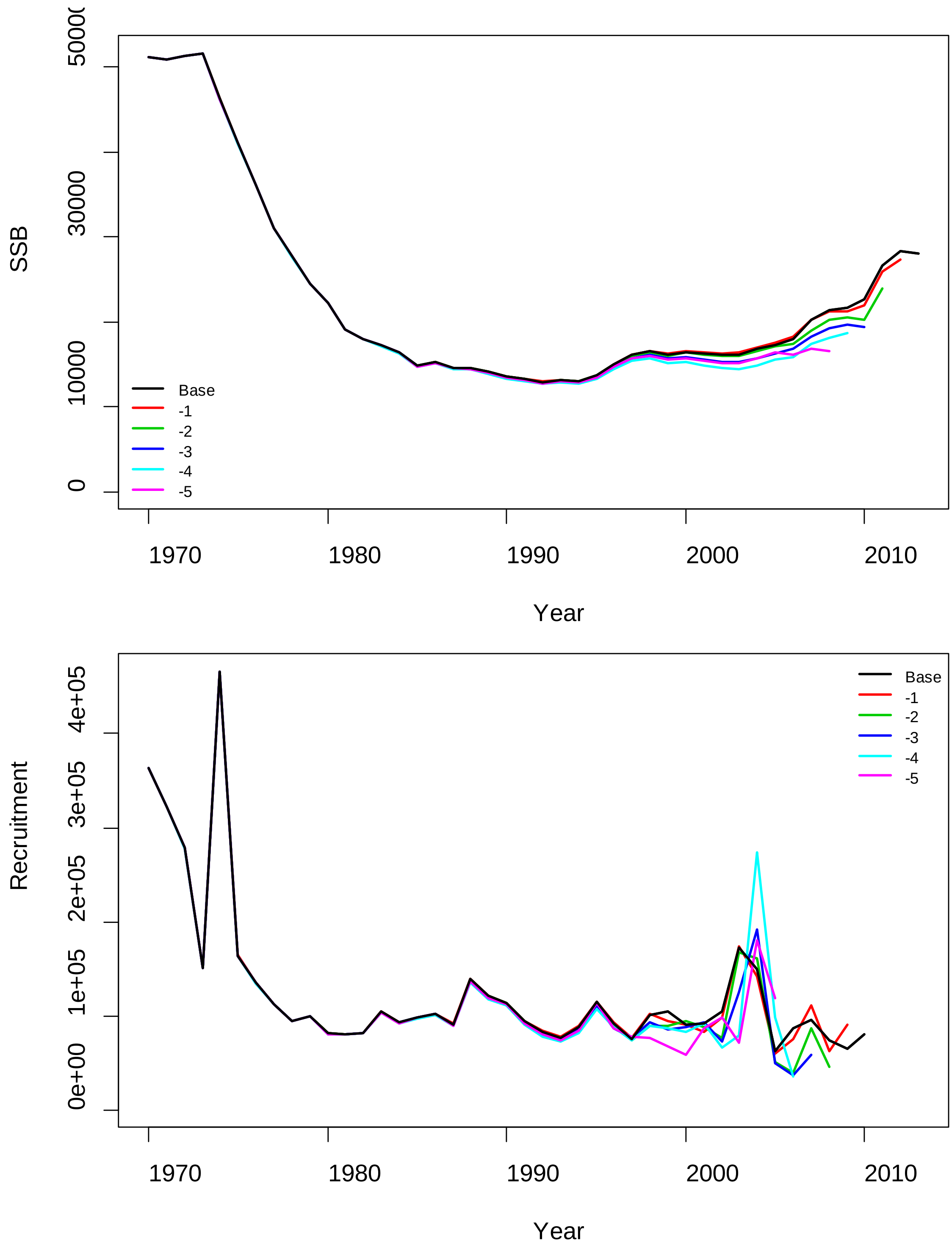


Figure 5. Retrospective trends of spawning biomass (ages 9 and older) and recruitment (age 1) from the western BFT proposed base case. The legend indicates the number of years of data removed from the 2014 base VPA.

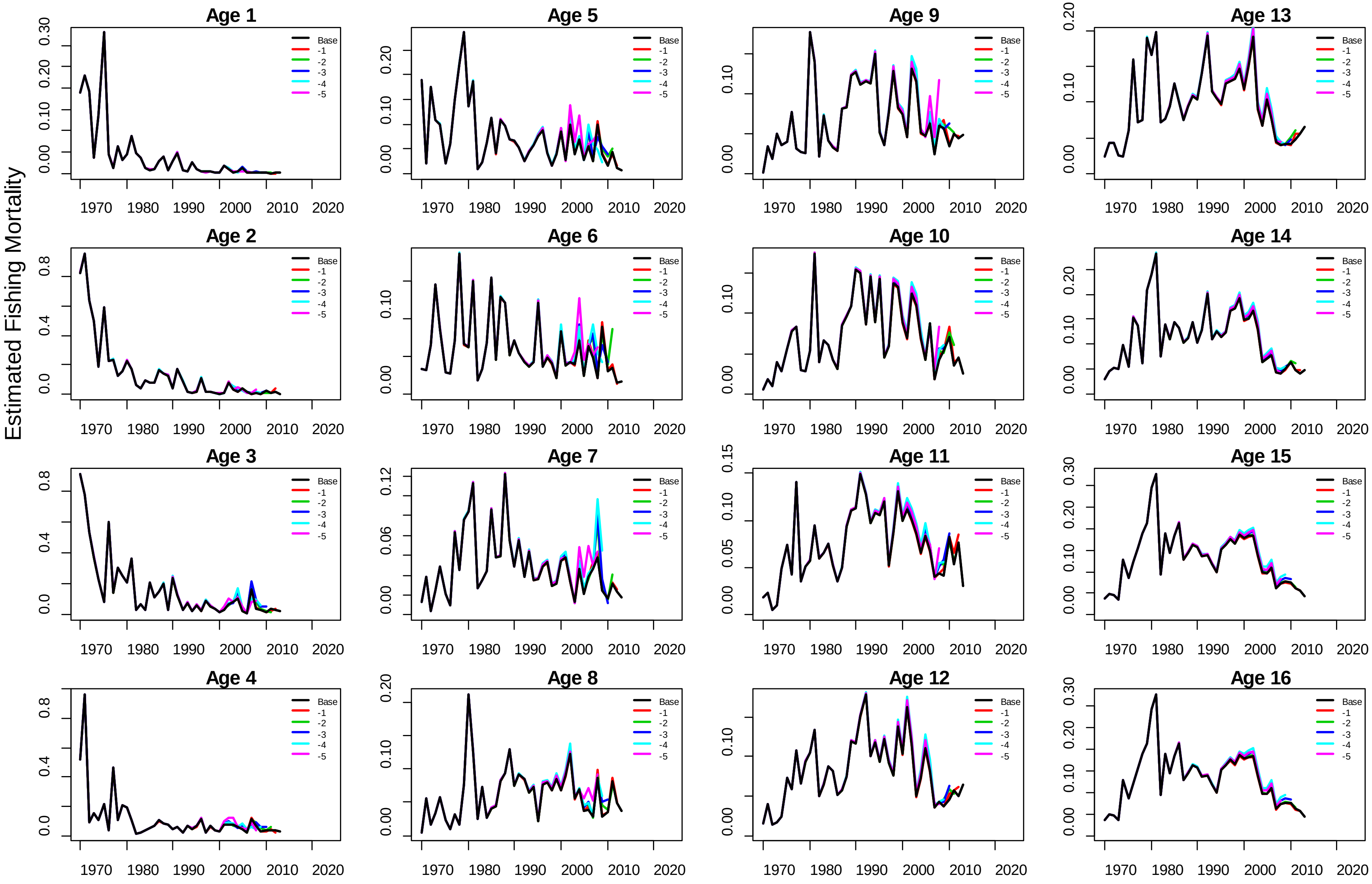


Figure 6. Retrospective patterns of fishing mortality by age from the western BFT proposed base case model. The legend indicates the number of years removed from the 2014 base VPA.

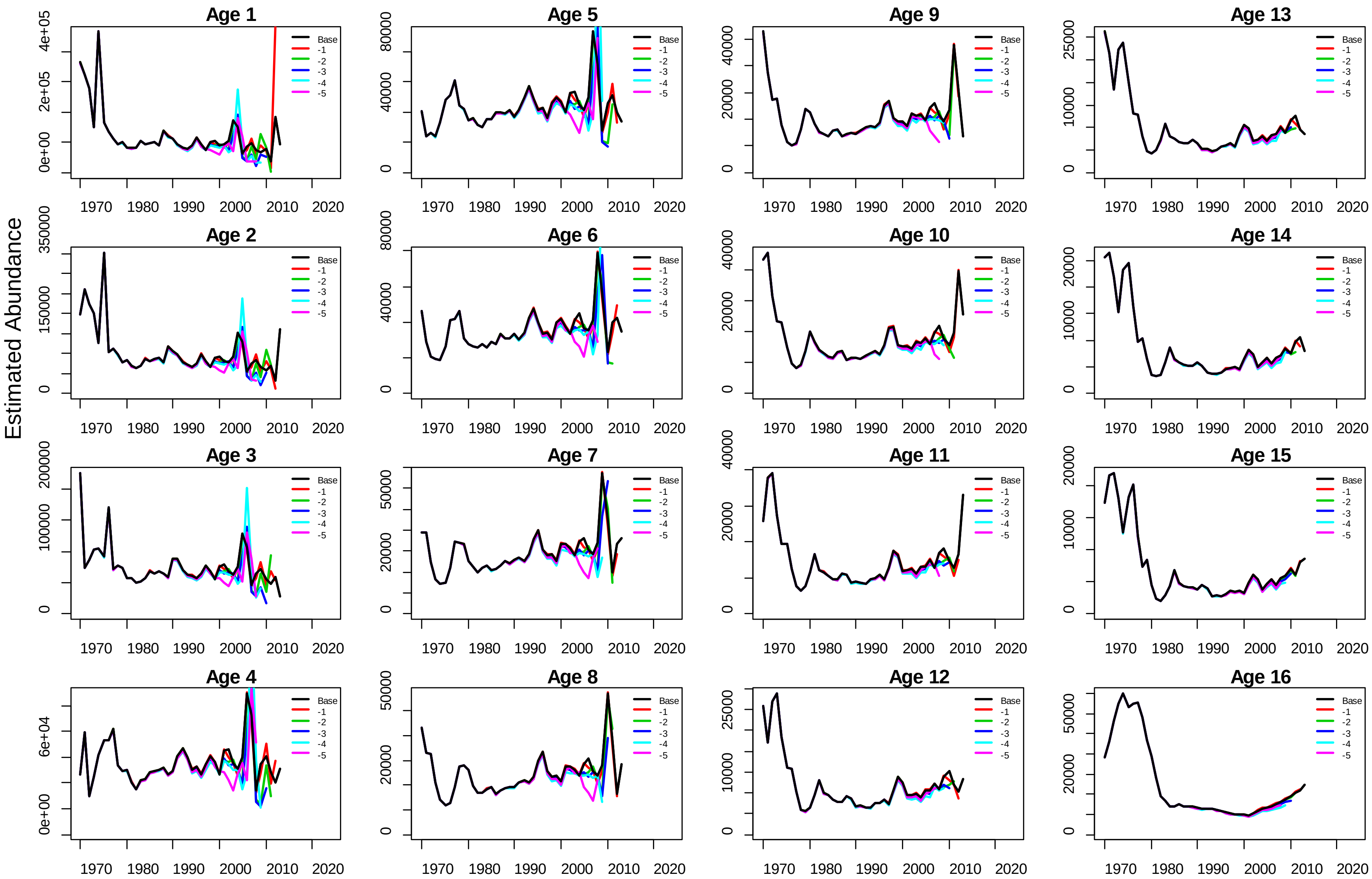


Figure 7. Retrospective patterns of numbers-at-age from the western BFT proposed base case model. The legend indicates the number of years removed from the 2014 base VPA.

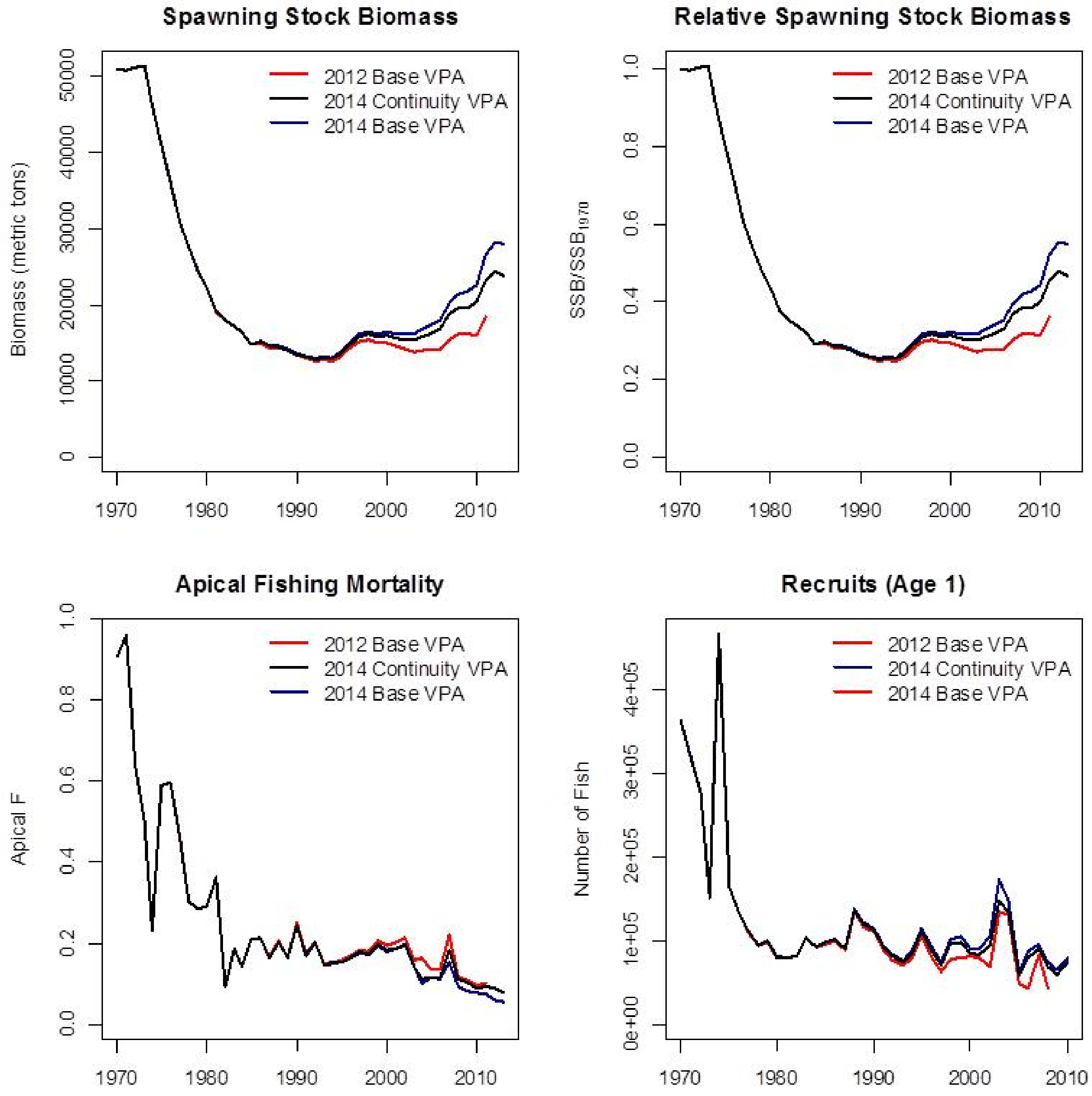


Figure 8. Annual estimates of spawning stock biomass, depletion relative to 1970, recruitment, and fishing mortality for the 2012 (red lines) and 2014 (dark blue lines) base runs.

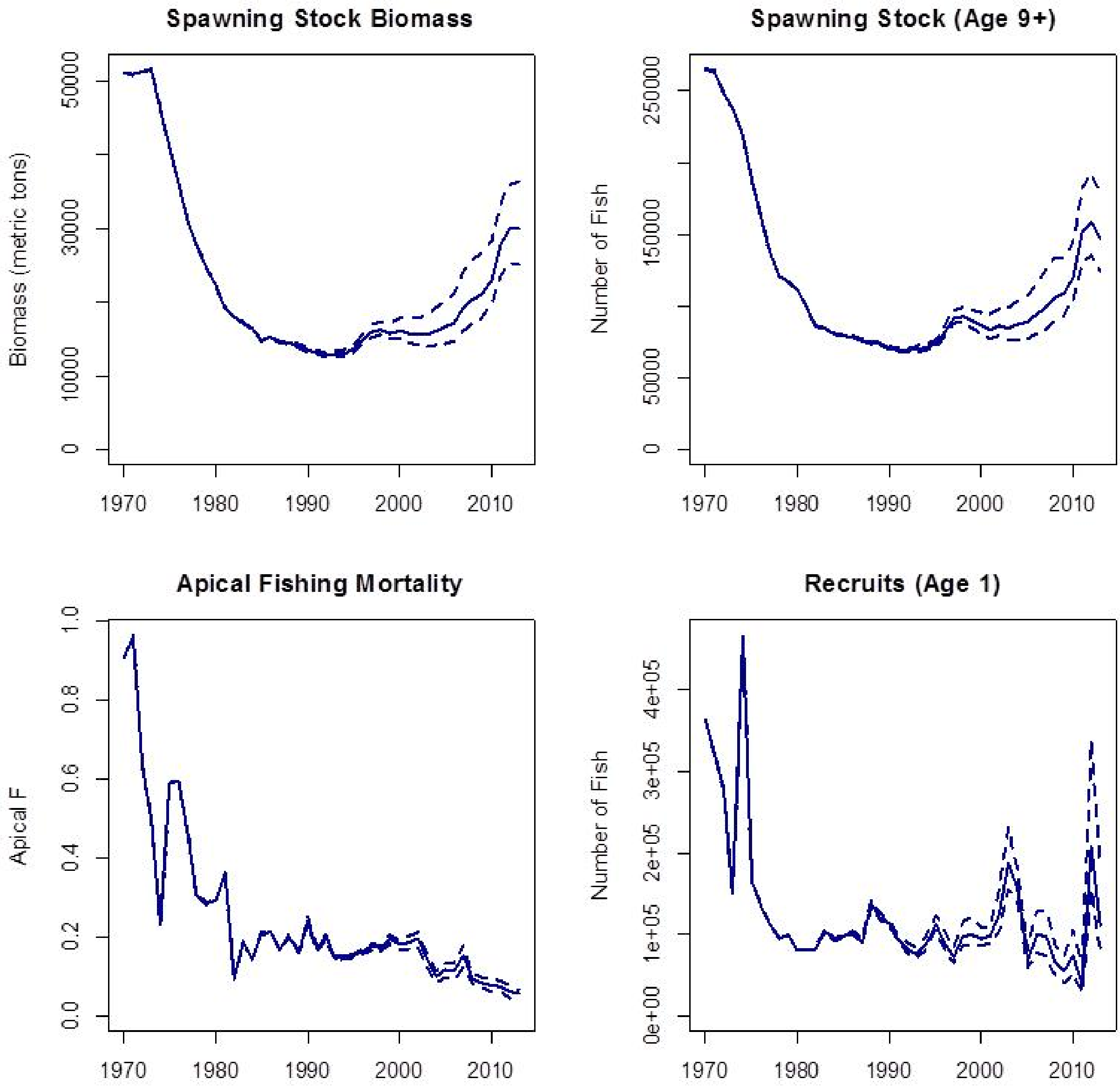


Figure 9. Median (solid line) estimates of spawning stock biomass, abundance of spawners (Age 9+), apical fishing mortality, and recruitment for the proposed base model. Dashed lines indicate the 80% confidence interval.

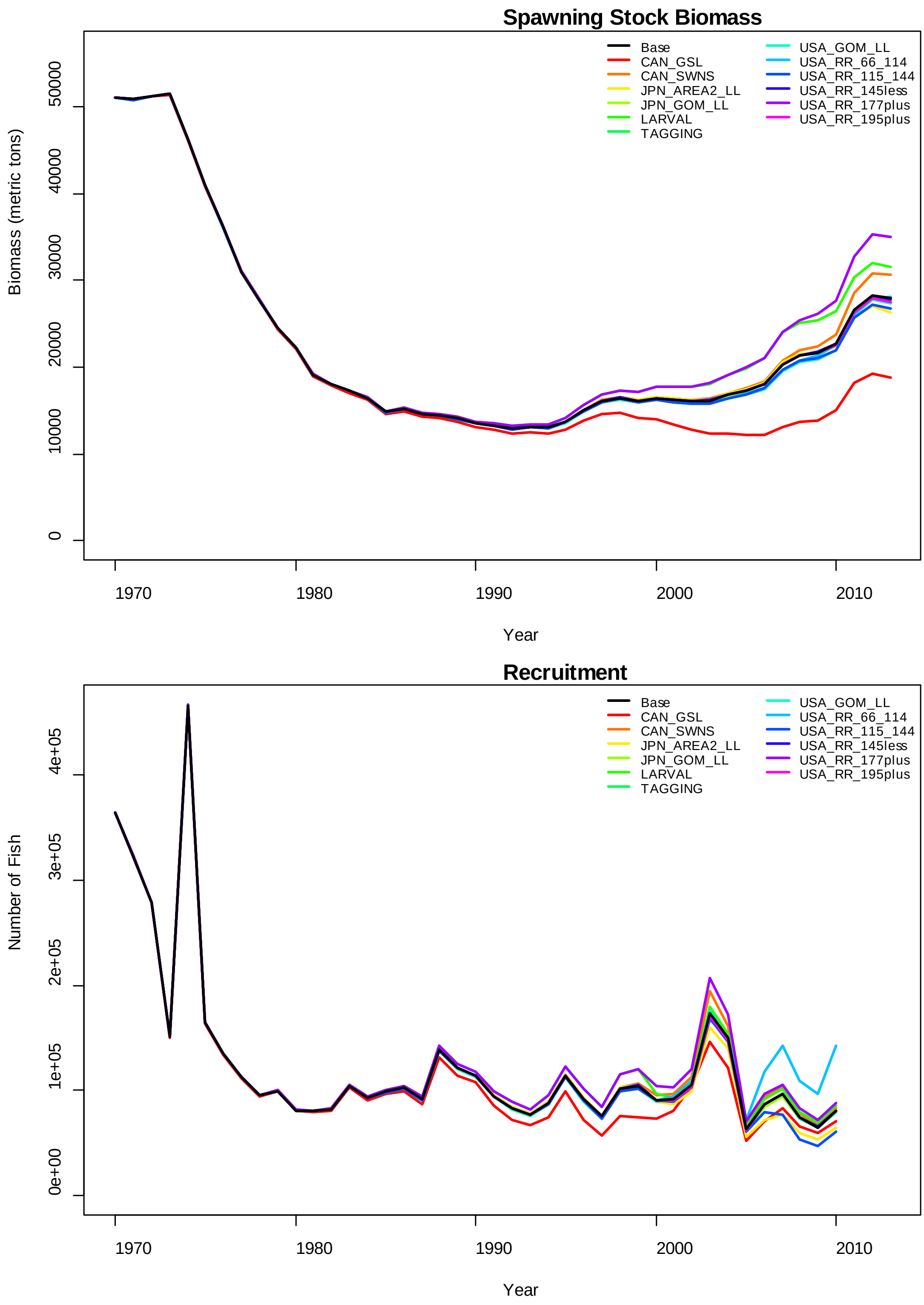


Figure 10. Jackknife analysis demonstrating the effects of iteratively removing individual relative abundance indices and associated partial catch-at-age matrices from the western BFT VPA.

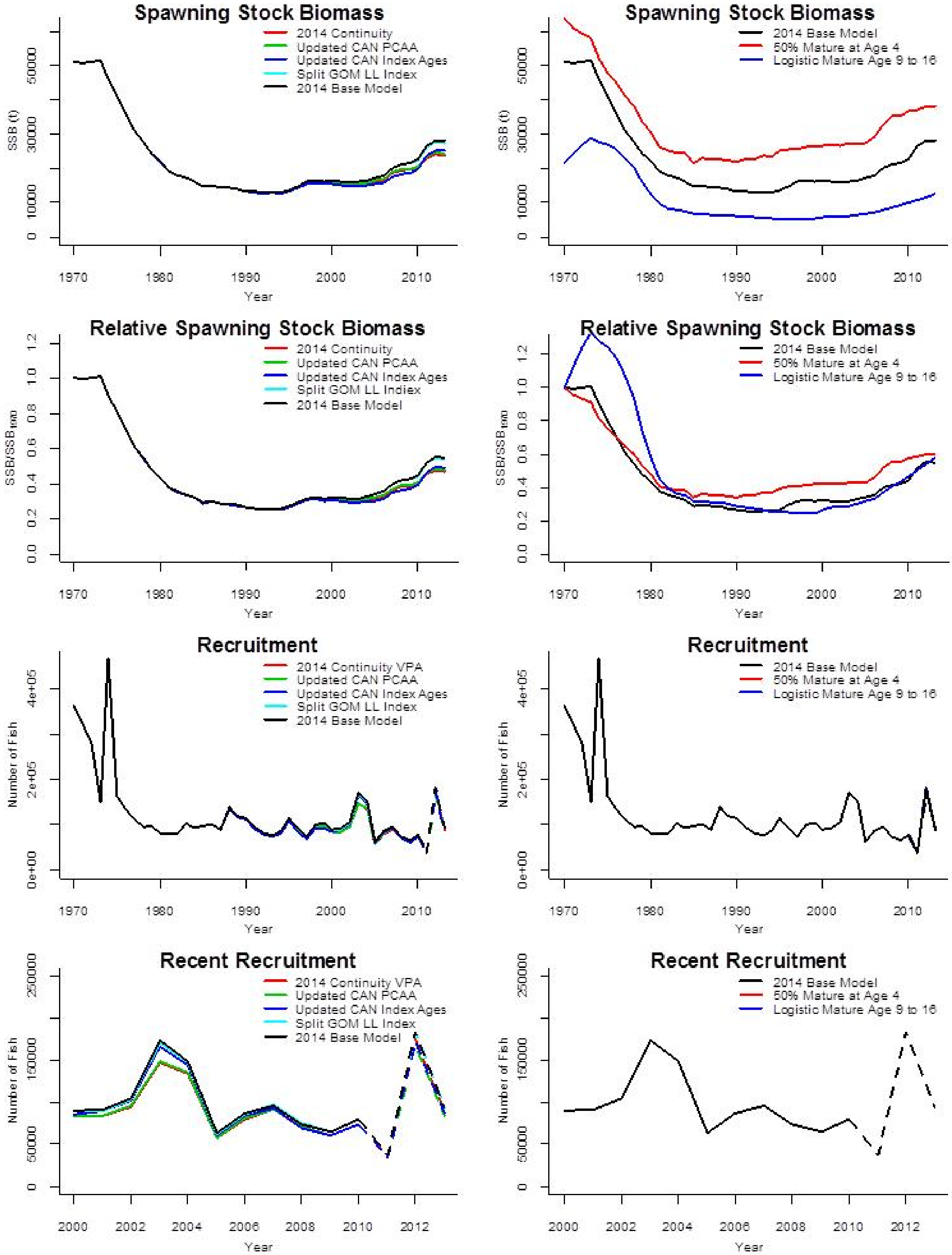


Figure 11. Annual estimates of spawning stock biomass, depletion relative to 1970, and recruitment for the 2014 continuity VPA, iterative modifications to the continuity, and 2014 proposed base VPA (left panels) and maturity sensitivity runs (right panels).

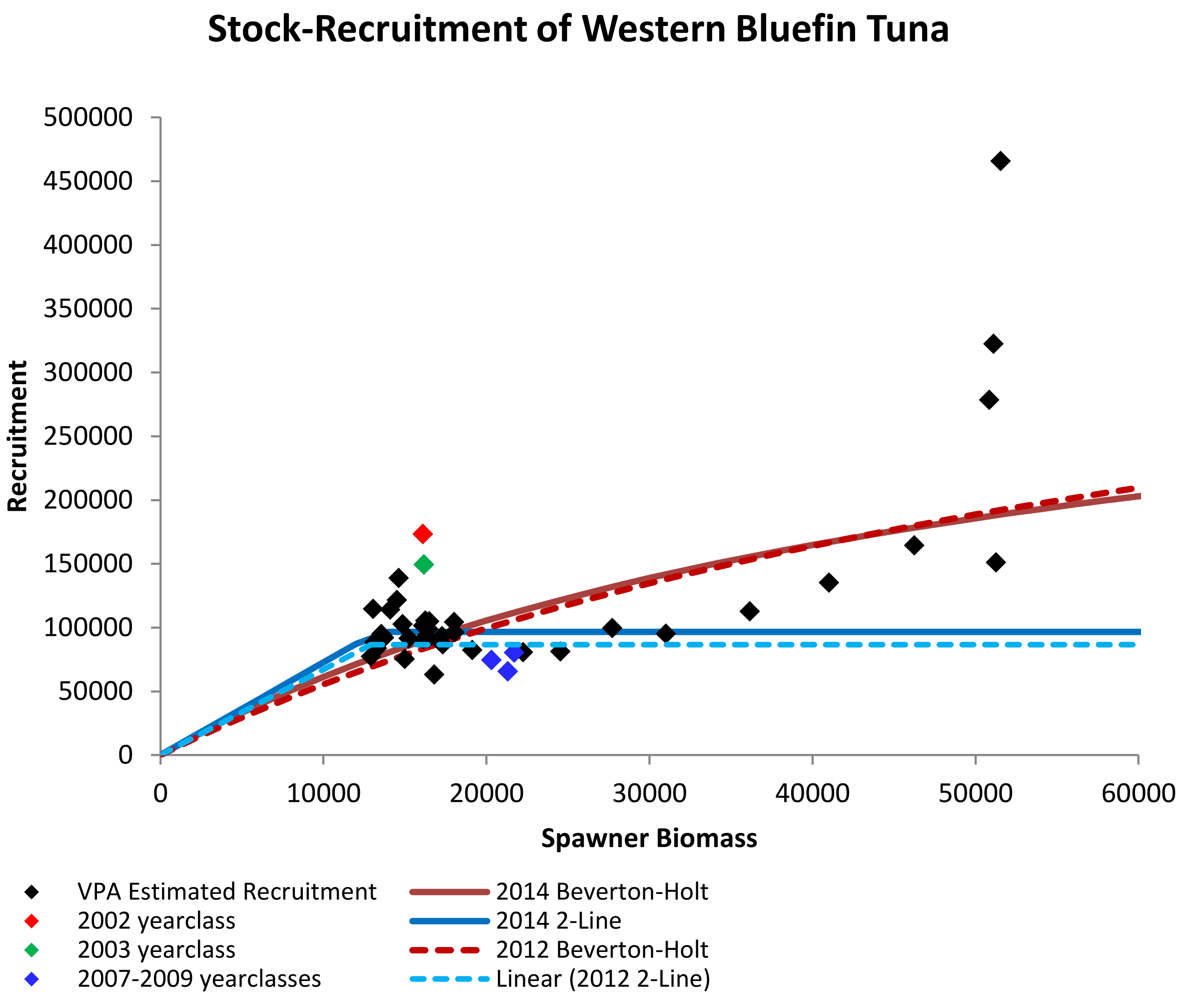


Figure 12. Spawner-recruit relationship fit to the 2014 base VPA (solid lines) compared to the 2012 base model fits (dashed lines). The two-line and Beverton-Holt models were used to calculate management reference points and project the population dynamics through 2019. Points represent the estimates from the 2014 proposed base VPA, with the 2002, 2003, and recent year class estimates (2007-2009) highlighted.

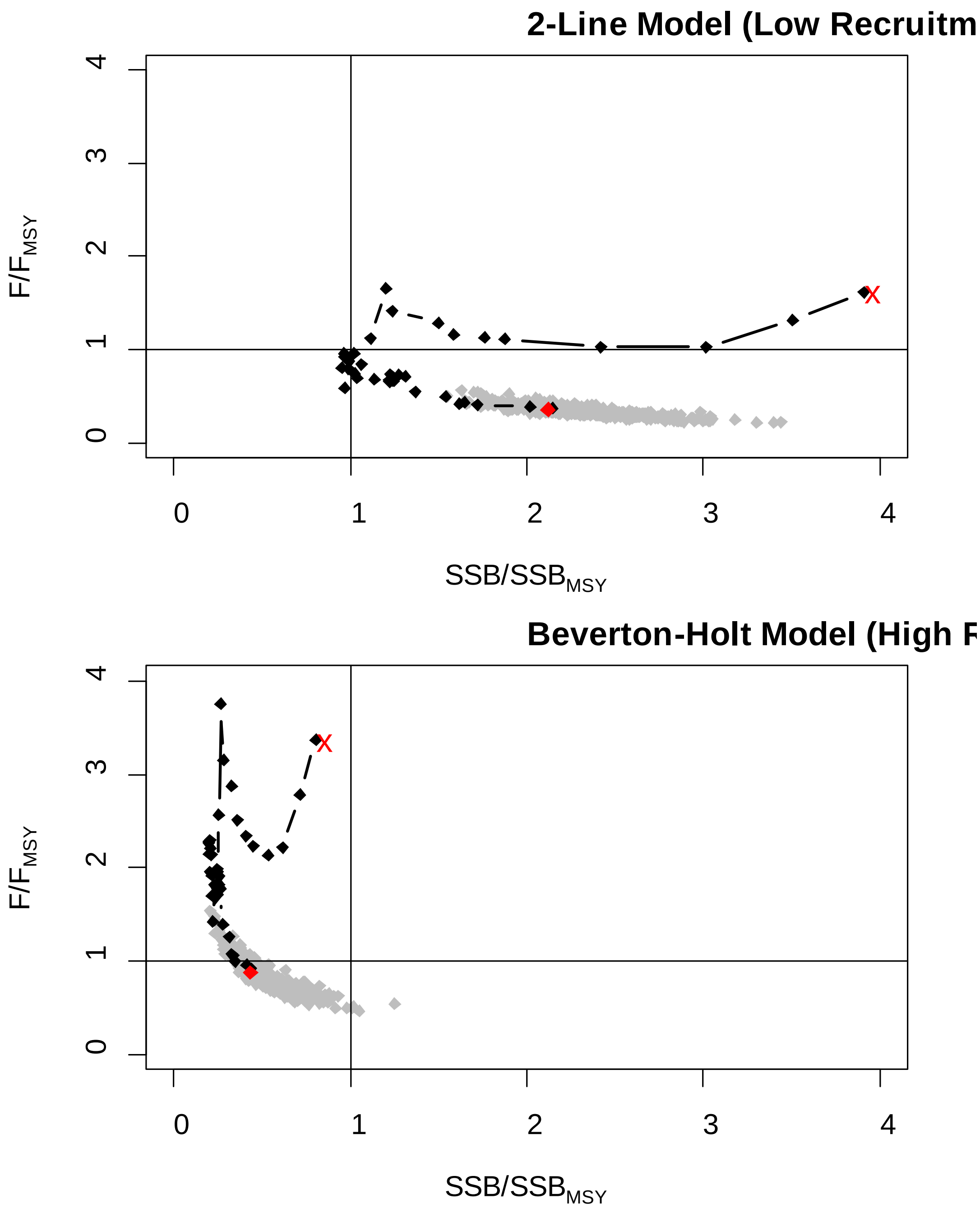


Figure 13. Estimated stock status of western BFT relative to the Convention objectives (MSY) by year (1970 to 2013). The black points and connecting line show the time series of estimates for each alternative recruitment scenario and the gray cloud of points depict the corresponding bootstrap estimates of uncertainty for the recent year, 2013. The red diamond represents the status estimate for 2013 and the red "X" represents the start year (the geometric mean fishing mortality was used as a proxy for these years, 2010-2012 for the terminal point, and 1970-1972 for the initial point).

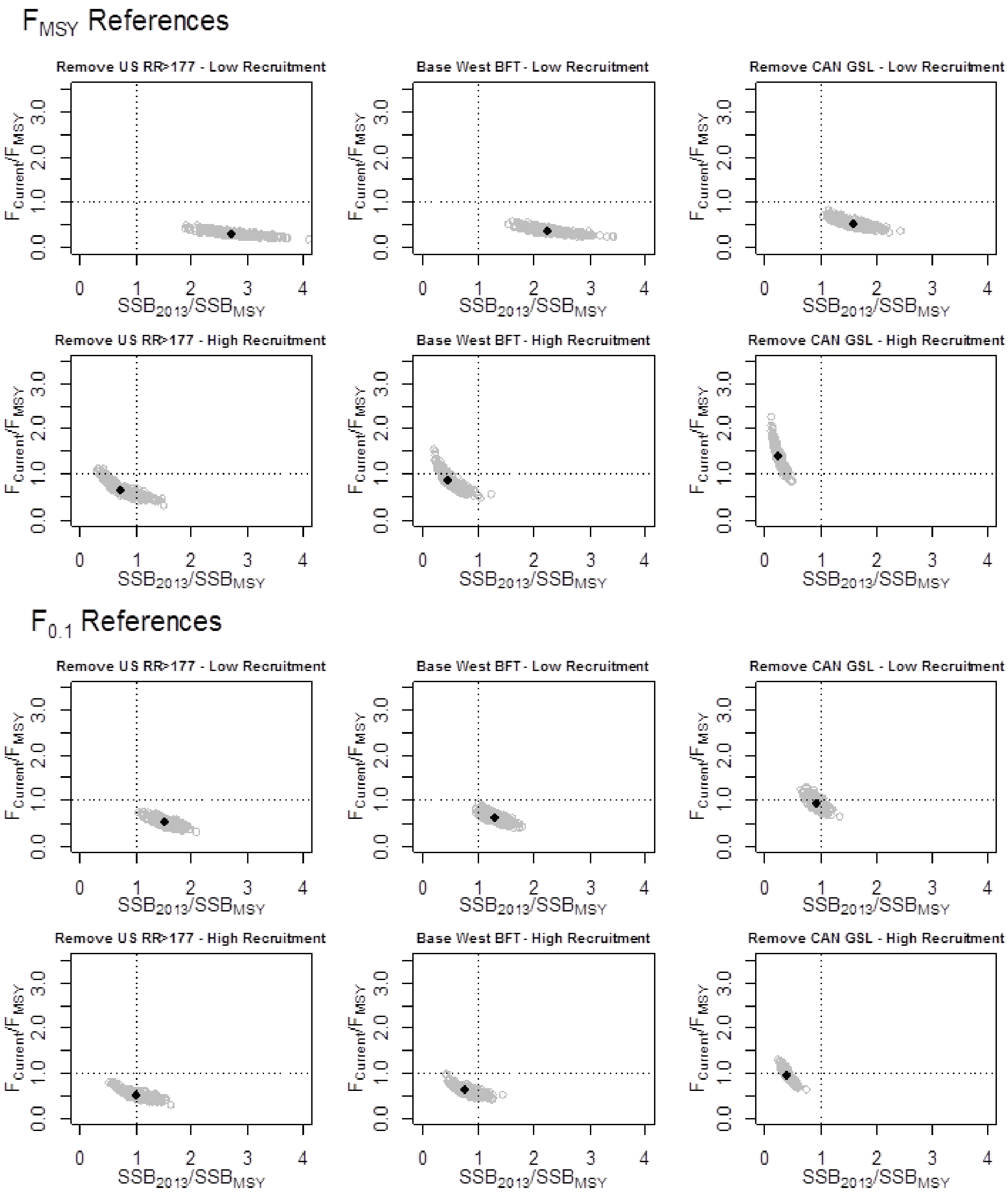


Figure 14. Western bluefin tuna stock status in 2013 estimated by the proposed base VPA, and jackknife runs removing the Canadian GSL and USA RR>177 cm indices. Two types of stock-recruitment relationships were examined, a two-line model (low recruitment) and a Beverton-Holt model (high recruitment). F current is defined as the geometric mean fishing mortality during 2010 to 2012. The filled black circle is the median results and the open gray circles are estimates from 500 bootstrap runs. The top set of panels shows the status estimates relative to a MSY reference, whereas the bottom panels used $F_{0.1}$ as a proxy.

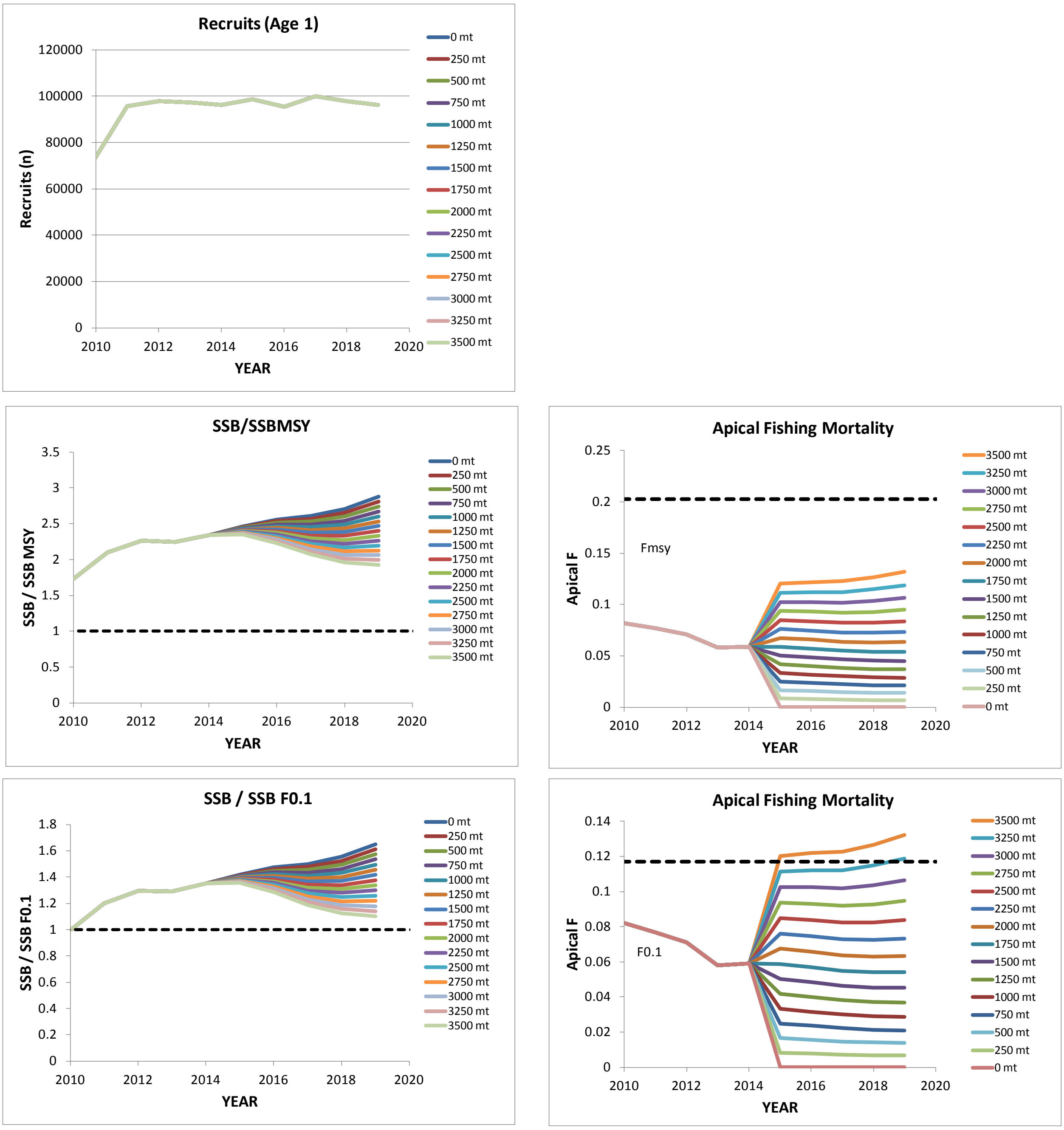


Figure 15. WBFT: Projection results for the low recruitment scenario projected at various levels of constant catch. The middle panels show the trends relative to the MSY-based reference points. The bottom panels use the alternative $F_{0.1}$-based reference points. These trajectories are the median (50%) result of 500 bootstraps.

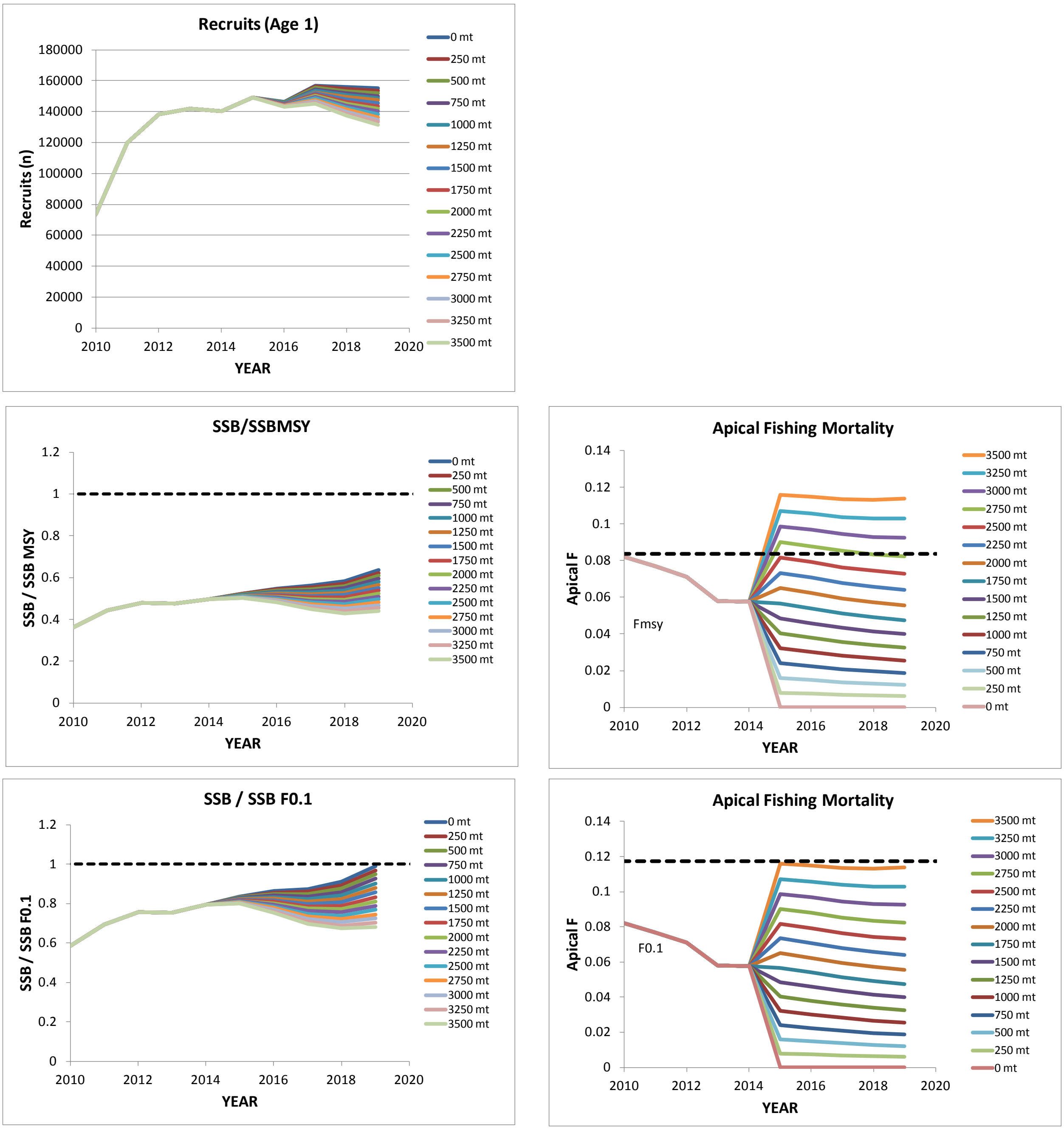
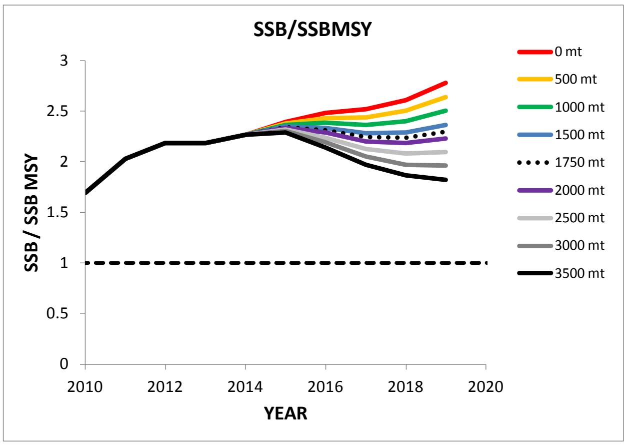
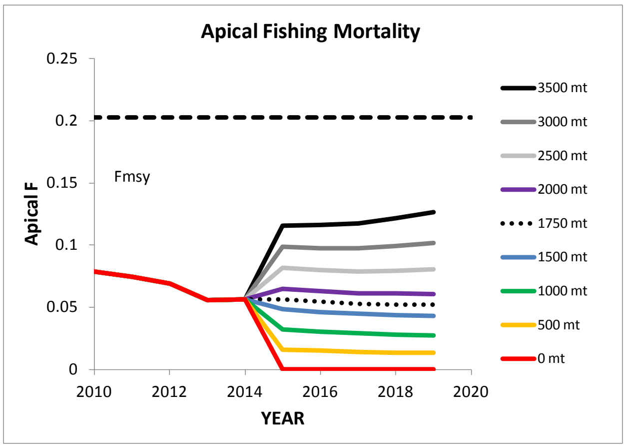


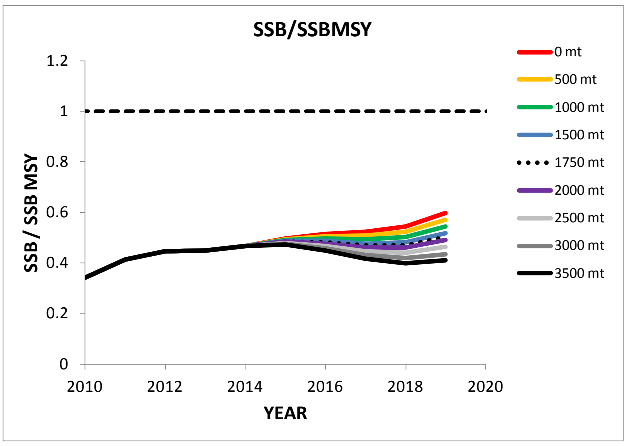
Figure 16. WBFT: Projection results for the high recruitment scenario projected at various levels of constant catch. The middle panels show the trends relative to the MSY-based reference points. The bottom panels use the alternative $F_{0.1}$-based reference points. These trajectories are the median (50%) result of 500 bootstraps.

60% Probability – Low Recruitment Potential





60% Probability – High Recruitment Potential



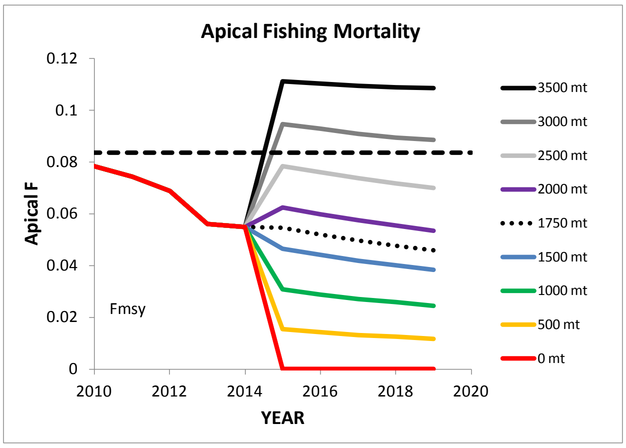
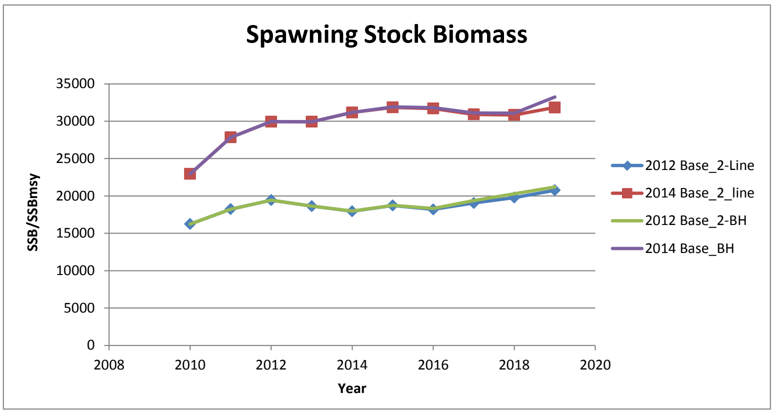
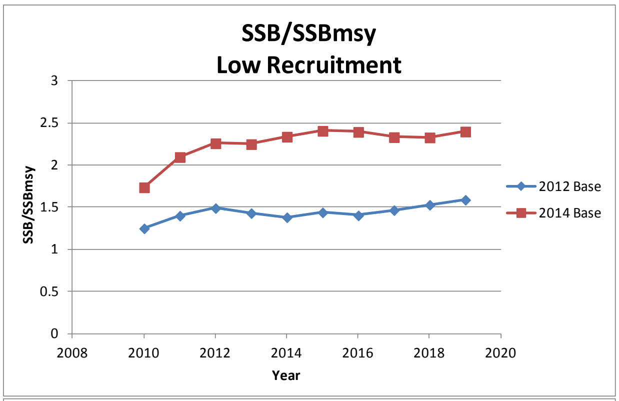


Figure 17. WBFT: The projected SSB/SSBMSY and F/FMSY trajectories at various catch levels for the two recruitment scenarios. These trajectories correspond to a 60% probability of achieving a given level of SSB/SSBMSY or F/FMSY.





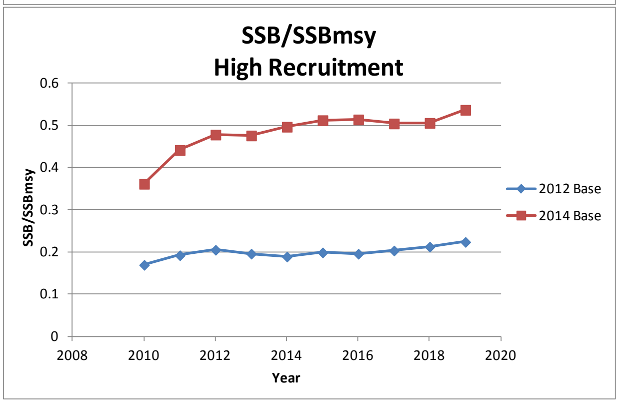


Figure 18. WBFT: Comparison of the spawning stock biomass (SSB), and SSB relative to SSB at maximum sustainable yield (MSY) for the low and high recruitment scenarios. Projections were made at the current TAC of 1,750 mt [Rec. 12-02].

Appendix 1

Western Bluefin Tuna 2014 Base VPA Program Files

A. VPA-2Box Control File

```
#-----------------------------------------------------------------------------
#--            CONTROL FILE FOR PROGRAM VPA-2BOX, Version 3.0          ---
#-----------------------------------------------------------------------------
#  INSTRUCTIONS: the control options are entered in the order specified.
#             Additional comment lines may be inserted anywhere in this
#             file provided they are preceded by a # symbol in the FIRST
#             column, otherwise the line is perceived as free-format data.
#-----------------------------------------------------------------------------
#
#-----------------------------------------------------------------------------
# TITLES AND FILE NAMES (MUST BE PLACED WITHIN SINGLE QUOTES)
#-----------------------------------------------------------------------------
#|--------must be 50 characters or less----------|
'BFT West 1970 to 2013 Continuity 16+ '           TITLE OF RUN
'BFTW2014.D01'                                DATA FILE NAME (INPUT)
'BFTW2014.P01'                                PARAMETER SPECIFICATION FILE (INPUT)
'BFTW2014.R01'                                RESULTS FILE NAME (OUTPUT)
'BFTW2014.E01'                                PARAMETER ESTIMATE FILE NAME (OUTPUT)
'BFTW2014.SPD'                                SPREADSHEET FRIENDLY RESULTS (OUTPUT)
'none'                               TAGGING DATA FILE (INPUT)
#-----------------------------------------------------------------------------
# MODEL TYPE OPTIONS
#-----------------------------------------------------------------------------
 1                    NUMBER OF ZONES (1 OR 2)
 1                    MODEL_TYPE (1=DIFFUSION, 2=OVERLAP)
#-----------------------------------------------------------------------------
# TAGGING DATA SWITCH
#-----------------------------------------------------------------------------
# tagging data switch (0=do not use tagging data, 1=use tagging data)
# |  weighting factor for modifying importance of tagging data in objective function
# |  |     tag timing factors
# |  |     |
  0  1.0   0     0          TAGGING MODEL CONTROLS
#-----------------------------------------------------------------------------
# SEARCH ALGORITHM CONTROLS
#-----------------------------------------------------------------------------
-677   RANDOM NUMBER SEED
 50    MAXIMUM NUMBER OF AMOEBA SIMPLEX SEARCH RESTARTS
 10    NUMBER OF CONSECUTIVE RESTARTS THAT MUST VARY BY LESS THAN 1% TO STOP SEARCH
 0.4   PDEV (standard deviation controlling vertices for Initial simplex of each restart)
#-----------------------------------------------------------------------------
# INDEX WEIGHTING CONTROLS
#-----------------------------------------------------------------------------
 1     SCALE (DIVIDE INDEX VALUES BY THEIR MEAN)- ANY VALUE > 0 = YES
 1.0   INDEX WEIGHTING:(0)INPUT CV's, (+)DEFAULT CV, (-)DEFAULT STD. DEV., (999)MLE
 0     (0) MULTIPLICATIVE VARIANCE SCALING FACTOR or (1) ADDITIVE VARIANCE SCALING FACTOR
#-----------------------------------------------------------------------------
# CONSTRAINT ON VulnerabilitY (PARTIAL RECRUITMENT)
#-----------------------------------------------------------------------------
# apply this penalty to the last N years (SET N = 0 TO IGNORE)
# |  standard deviation controlling the severity of the penalty
# |  |  first age affected
# |  |  |  last age affected
# |  |  |  |
  3 .5  1  15    LINKS THE VULNERABILITIES IN THE LAST N YEARS
#-----------------------------------------------------------------------------
# CONSTRAINTS ON RECRUITMENT
#-----------------------------------------------------------------------------
# apply this penalty to the last N years (SET N = 0 TO IGNORE)
# |  standard deviation controlling the severity of the penalty
  0 .1         LINKS THE RECRUITMENTS IN THE LAST N YEARS
  0 .1   1     LINKS THE RECRUITMENTS OF THE TWO STOCKS
#        |
#        ratio of stock (sex) 1 to stock (sex) 2 {a value of 1 means a 1:1 ratio}
#-----------------------------------------------------------------------------
# CONSTRAINT ON SPAWNER-RECRUIT RELATIONSHIP
#-----------------------------------------------------------------------------
# PDF of spawner-recruit penalty: 0=none, 1=lognormal, 2=normal (-)=estimate sigma by MLE
# |  first and last years to use in fitting (in terms of recruits)
# |  |
  0  1971 1998  PENALIZES DEPARTURES FROM BEVERTON AND HOLT STOCK-RECRUIT CURVE
#                 (note: check the parameter file to make sure you are estimating the S/R
#                     parameters when pdf not 0, or not estimating them when pdf=0))
#-----------------------------------------------------------------------------
# PARAMETER ESTIMATION OPTIONS
#-----------------------------------------------------------------------------
 2           OPTION TO USE (1) F'S OR (2) N'S AS TERMINAL YEAR PARAMETERS
 -1          ESTIMATE Q IN (+) SEARCH or (<0) by concentrated MLE's
#-----------------------------------------------------------------------------
# BOOTSTRAP ANALYSES
#-----------------------------------------------------------------------------
# Number of bootstraps to run (negative value = do a parametric bootstrap)
# |   Use Stine correction to inflate bootstrap residuals (0=NO)
# |   |   File Output Toggle (- number ASCII, + number BIN)
# |   |   |
  0   1   1        BOOTSTRAP OPTION
#-----------------------------------------------------------------------------
# RETROSPECTIVE ANALYSES (CANNOT DO RETROSPECTIVE ANALYSES AND BOOTSTRAPS AT SAME TIME)
#-----------------------------------------------------------------------------
 0             NUMBER OF YEARS TO GO BACK FOR RETROSPECTIVE ANALYSES
@@EOF@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

B. VPA 2-Box Data File

```
################################################################################
#  DATA FILE FOR PROGRAM VPA-2BOX, Version 3.0
#        The data and specifications are entered in the order indicated
#     by the existing comments. Additional comments must be preceded by a # symbol
#     in the first column, otherwise the line is perceived as free format input.
################################################################################
1970   2013          FIRST        AND          LAST         YEAR

1      16            16           16           FIRST AGE, LAST AGE, PLUSGROUP AGE, Expanded plusgroup
#################################################################################
# BEGIN INPUT FOR ZONE/STOCK 1
#################################################################################
16
6           SPAWNING SEASON (elapsed months, 0 is beginning of year)
# Age 1              Age 2        Age 3        Age 4        Age 5        Age 6        Age 7        Age 8        Age 9        Age 10       Age 11       Age 12
       Age 13        Age 14       Age 15       Age 16
0      0             0            0            0            0            0            0            1            1            1            1            1
       1             1            1                         FECUNDITY MODIFIER (MATURITY) AT AGE
# 50 CHARACTER TITLE WITHIN SINGLE QUOTES ‘ ’ ----->]  PDF OF CATCH
# |                                |     SIGMA CATCH
'Western Bluefin Tuna Assessment'              0     .1
#============================================================================
# NOW ENTER THE CATCH-AT-AGE DATA. ROW=YEAR, COLUMN=AGE
#============================================================================
#YEAR                1            2            3            4            5            6            7            8            9            10           11
       12            13           14           15           16
1970   58920         104298       127233       17510        6528         1430         463          161          43           259          435          436
       655           732          593          1299
1971   62033         152003       37948        46241        456          865          1357         1661         1180         758          805          797
       1030          1090         968          2078
1972   45351         98312        33605        2514         3963         1222         92           470          465          292          185          403
       730           1053         929          2372
1973   5065          73591        29957        5877         2254         2443         387          652          1270         829          265          506
       643           696          587          2103
1974   55806         19939        20430        5639         2972         1448         640          739          595          609          869          516
       600           2027         1425         7855
1975   43303         147653       6554         13155        907          709          283          253          419          775          1290         1058
       1080          1202         1395         4813
1976   5532          19427        71850        2576         2743         1062         200          117          702          679          480          844
       1802          2179         2176         6992
1977   1508          22182        9014         28496        7931         2699         2592         546          309          607          947          971
       830           1157         1619         8751
1978   5564          10530        18969        4889         8281         7341         1392         447          405          252          208          348
       536           588          1181         9324
1979   2828          10585        15537        8581         9754         1861         2843         1946         554          349          359          458
       771           1137         1525         8423
1980   3246          16081        9991         8124         4129         1552         2327         4658         3447         973          599          584
       620           685          1088         9286
1981   6290          9814         16530        3729         5692         3462         2613         2191         2271         2470         1392         1101
       833           737          611          7370
1982   3608          3652         1517         523          245          460          490          391          297          500          662          600
       458           239          176          1603
1983   3474          2463         3091         771          615          860          705          1102         953          773          682          585
       739           705          463          2717
1984   1126          7240         1691         1493         2005         1577         927          451          521          642          702          743
       676           858          551          1775
1985   776           5395         12162        2131         3523         3880         1957         728          480          436          457          612
       834           794          1066         2194
1986   967           5898         6478         2914         1437         1177         1136         657          436          381          303          366
       607           670          863          2701
1987   2326          12579        8766         4517         3830         3741         1240         1316         985          1037         507          414
       441           492          501          1578
1988   4935          9303         11087        3821         3362         3299         3132         1575         1064         926          902          619
       546           523          526          1765
1989   842           12925        1542         3104         2519         1480         1621         2160         1615         1090         835          900
       716           641          575          1921
1990   2993          3583         17800        1798         2207         2135         1141         1308         1646         1534         885          681
       611           522          531          1789
1991   4111          14055        10072        3081         1944         1484         1836         1727         1536         1457         1110         902
       628           583          544          1514
1992   589           6088         1922         1053         1187         1332         871          1639         1723         935          932          980
       849           663          481          1577
1993   416           1066         4385         3482         2276         1429         1644         1232         1749         1641         831          569
       472           360          286          1326
1994   2052          720          1235         2140         2516         1828         1154         1519         2232         1082         937          793
       469           399          257          1076
1995   933           1347         3242         2979         2860         4258         1310         609          883          1584         1015         637
       505           402          366          1549
1996   526           9349         1676         4657         3341         1122         1385         2318         806          636          1015         909
       671           502          429          1522
1997   249           1103         6392         928          1338         1502         1357         1816         1851         1138         605          609
       736           672          537          1548
1998   341           889          3486         3483         652          1136         756          1436         2321         2586         1353         725
       681           731          486          1437
1999   102           560          1946         1849         1760         799          743          1817         1402         1803         1879         1677
       1096          735          577          1583
2000   98            287          1053         1174         3599         3127         1661         1321         1275         1204         1051         1140
       1093          824          489          1497
2001   1430          361          2402         4352         987          1303         1748         2227         735          960          1193         1319
       1282          1068         753          1481
2002   847           5559         4081         4528         4581         1305         990          2962         2542         1576         1124         949
       1124          1056         957          1632
2003   283           2704         4521         3661         1874         1466         327          1314         2155         1633         853          444
       585           570          648          1424
2004   814           2674         6944         2586         2752         2907         1454         1522         999          1018         769          582
       492           336          331          1139
```

2005	721	4890	2470	2561	1083	840	688	977	840	703	992	1041
	653	424	405	1146								
2006	211	630	1245	1746	2452	2004	1063	1073	1373	1253	914	775
	572	397	520	1380								
2007	65	258	6687	9284	2119	1794	1214	664	575	353	469	402
	341	270	253	856								
2008	85	788	2292	2102	6401	1614	1797	1829	1190	850	677	415
	376	272	364	1059								
2009	72	222	2192	1194	987	4540	1559	713	986	876	705	476
	337	387	409	1217								
2010	66	1097	840	1830	635	632	691	1901	730	995	1094	629
	439	438	471	1262								
2011	3	560	1617	1592	2055	1261	556	2789	2172	643	624	614
	540	431	343	1178								
2012	110	404	1854	1212	466	606	692	718	1231	1614	1144	476
	489	388	419	1143								
2013	48	268	557	1254	196	555	588	957	601	599	923	792
	509	352	354	999								

-1 end of catch data

#==

 # NOW ENTER IN THE ABUNDANCE INDEX SPECIFICATIONS

#==

#INDEX PDF (0= do not use,1=lognormal, 2=normal)

#| | UNITS (1 = numbers, 2 = biomass)

#| | | VULNERABILITY (1=fixed, 2=frac.catches, 3=part. catches, 4=Butt. & Gero.

#| | | | TIMING (-1=average, +integer = number of months elapased}

#| | | | | FIRST TO LAST AGE INDEX TITLE (IN SINGLE QUOTES)

1	1	1	4	-1	8	16	'CAN_GSL'
2	1	1	4	-1	5	16	'CAN_SWNS'
3	1	1	4	-1	1	5	'US_RR<145'
4	1	1	4	-1	2	3	'US_RR_66_114'
5	1	1	4	-1	4	5	'US_RR_115_144'
6	0	1	4	-1	6	8	'US_RR_145_177'
7	1	1	4	-1	10	16	'US_RR>195'
8	0	1	4	-1	10	16	'US_RR>195_COMB'
9	1	1	4	-1	8	16	'US_RR>177'
10	1	1	4	0	2	16	'JLL_AREA_2_(WEST)'
11	0	1	4	0	2	16	'JLL_AREA_3_(31+32)'
12	0	1	4	0	2	16	'JLL_AREAS_17+18'
13	1	2	4	-1	9	16	'LARVAL_ZERO_INFLATED'
14	1	1	4	0	9	16	'GOM_PLL_1-6'
15	1	1	4	0	9	16	'JLL_GOM'
16	1	1	1	-1	1	3	'TAGGING'

-1 end index specifications

#==

 # NOW ENTER IN THE INDICES OF ABUNDANCE

#==

#ID	YEAR	INDEX	CV	INDEX_NAME
1	1970	-999	-999	'CAN_GSL'
1	1971	-999	-999	'CAN_GSL'
1	1972	-999	-999	'CAN_GSL'
1	1973	-999	-999	'CAN_GSL'
1	1974	-999	-999	'CAN_GSL'
1	1975	-999	-999	'CAN_GSL'
1	1976	-999	-999	'CAN_GSL'
1	1977	-999	-999	'CAN_GSL'
1	1978	-999	-999	'CAN_GSL'
1	1979	-999	-999	'CAN_GSL'
1	1980	-999	-999	'CAN_GSL'
1	1981	1.32	0.16	'CAN_GSL'
1	1982	0.60	0.38	'CAN_GSL'
1	1983	1.54	0.10	'CAN_GSL'
1	1984	0.85	0.09	'CAN_GSL'
1	1985	0.21	0.23	'CAN_GSL'
1	1986	0.24	0.22	'CAN_GSL'
1	1987	0.32	0.32	'CAN_GSL'
1	1988	0.53	0.25	'CAN_GSL'
1	1989	0.65	0.28	'CAN_GSL'
1	1990	0.19	0.27	'CAN_GSL'
1	1991	0.65	0.22	'CAN_GSL'
1	1992	1.45	0.20	'CAN_GSL'

1	1993	0.90	0.13	'CAN_GSL'
1	1994	0.25	0.13	'CAN_GSL'
1	1995	0.72	0.09	'CAN_GSL'
1	1996	0.08	0.20	'CAN_GSL'
1	1997	0.13	0.17	'CAN_GSL'
1	1998	0.24	0.15	'CAN_GSL'
1	1999	0.42	0.12	'CAN_GSL'
1	2000	0.32	0.13	'CAN_GSL'
1	2001	0.29	0.16	'CAN_GSL'
1	2002	0.45	0.13	'CAN_GSL'
1	2003	0.83	0.09	'CAN_GSL'
1	2004	1.08	0.10	'CAN_GSL'
1	2005	1.04	0.08	'CAN_GSL'
1	2006	1.14	0.09	'CAN_GSL'
1	2007	2.28	0.15	'CAN_GSL'
1	2008	1.74	0.11	'CAN_GSL'
1	2009	2.56	0.16	'CAN_GSL'
1	2010	-999	-999	'CAN_GSL'
1	2011	3.70	0.11	'CAN_GSL'
1	2012	5.62	0.11	'CAN_GSL'
1	2013	4.81	0.09	'CAN_GSL'
2	1970	-999	-999	'CAN_SWNS'
2	1971	-999	-999	'CAN_SWNS'
2	1972	-999	-999	'CAN_SWNS'
2	1973	-999	-999	'CAN_SWNS'
2	1974	-999	-999	'CAN_SWNS'
2	1975	-999	-999	'CAN_SWNS'
2	1976	-999	-999	'CAN_SWNS'
2	1977	-999	-999	'CAN_SWNS'
2	1978	-999	-999	'CAN_SWNS'
2	1979	-999	-999	'CAN_SWNS'
2	1980	-999	-999	'CAN_SWNS'
2	1981	-999	-999	'CAN_SWNS'
2	1982	-999	-999	'CAN_SWNS'
2	1983	-999	-999	'CAN_SWNS'
2	1984	-999	-999	'CAN_SWNS'
2	1985	-999	-999	'CAN_SWNS'
2	1986	-999	-999	'CAN_SWNS'
2	1987	-999	-999	'CAN_SWNS'
2	1988	13.86	0.19	'CAN_SWNS'
2	1989	13.03	0.18	'CAN_SWNS'
2	1990	12.32	0.18	'CAN_SWNS'
2	1991	9.51	0.19	'CAN_SWNS'
2	1992	9.41	0.18	'CAN_SWNS'
2	1993	6.09	0.19	'CAN_SWNS'
2	1994	7.28	0.18	'CAN_SWNS'
2	1995	7.04	0.19	'CAN_SWNS'
2	1996	5.56	0.18	'CAN_SWNS'
2	1997	4.48	0.17	'CAN_SWNS'
2	1998	7.95	0.17	'CAN_SWNS'
2	1999	10.82	0.18	'CAN_SWNS'
2	2000	4.66	0.18	'CAN_SWNS'
2	2001	9.37	0.19	'CAN_SWNS'
2	2002	11.49	0.18	'CAN_SWNS'
2	2003	15.90	0.18	'CAN_SWNS'
2	2004	9.15	0.19	'CAN_SWNS'
2	2005	10.55	0.17	'CAN_SWNS'
2	2006	11.66	0.18	'CAN_SWNS'
2	2007	9.48	0.18	'CAN_SWNS'
2	2008	13.65	0.20	'CAN_SWNS'
2	2009	10.57	0.18	'CAN_SWNS'
2	2010	9.18	0.21	'CAN_SWNS'
2	2011	10.43	0.21	'CAN_SWNS'
2	2012	9.66	0.20	'CAN_SWNS'
2	2013	5.34	0.19	'CAN_SWNS'
3	1970	-999	-999	'US_RR<145'
3	1971	-999	-999	'US_RR<145'
3	1972	-999	-999	'US_RR<145'
3	1973	-999	-999	'US_RR<145'
3	1974	-999	-999	'US_RR<145'
3	1975	-999	-999	'US_RR<145'
3	1976	-999	-999	'US_RR<145'
3	1977	-999	-999	'US_RR<145'
3	1978	-999	-999	'US_RR<145'
3	1979	-999	-999	'US_RR<145'
3	1980	0.80	0.43	'US_RR<145'
3	1981	0.40	0.52	'US_RR<145'
3	1982	2.10	0.33	'US_RR<145'
3	1983	1.11	0.26	'US_RR<145'
3	1984	-999	-999	'US_RR<145'
3	1985	0.63	0.64	'US_RR<145'
3	1986	0.78	0.43	'US_RR<145'
3	1987	1.22	0.40	'US_RR<145'
3	1988	0.99	0.38	'US_RR<145'
3	1989	0.99	0.43	'US_RR<145'
3	1990	0.90	0.34	'US_RR<145'
3	1991	1.26	0.35	'US_RR<145'
3	1992	0.82	0.42	'US_RR<145'
3	1993	-999	-999	'US_RR<145'
3	1994	-999	-999	'US_RR<145'
3	1995	-999	-999	'US_RR<145'
3	1996	-999	-999	'US_RR<145'
3	1997	-999	-999	'US_RR<145'
3	1998	-999	-999	'US_RR<145'
3	1999	-999	-999	'US_RR<145'
3	2000	-999	-999	'US_RR<145'
3	2001	-999	-999	'US_RR<145'
3	2002	-999	-999	'US_RR<145'
3	2003	-999	-999	'US_RR<145'
3	2004	-999	-999	'US_RR<145'
3	2005	-999	-999	'US_RR<145'

3	2006	-999	-999	'US_RR<145'
3	2007	-999	-999	'US_RR<145'
3	2008	-999	-999	'US_RR<145'
3	2009	-999	-999	'US_RR<145'
3	2010	-999	-999	'US_RR<145'
3	2011	-999	-999	'US_RR<145'
3	2012	-999	-999	'US_RR<145'
3	2013	-999	-999	'US_RR<145'
4	1970	-999	-999	'US_RR_66_114'
4	1971	-999	-999	'US_RR_66_114'
4	1972	-999	-999	'US_RR_66_114'
4	1973	-999	-999	'US_RR_66_114'
4	1974	-999	-999	'US_RR_66_114'
4	1975	-999	-999	'US_RR_66_114'
4	1976	-999	-999	'US_RR_66_114'
4	1977	-999	-999	'US_RR_66_114'
4	1978	-999	-999	'US_RR_66_114'
4	1979	-999	-999	'US_RR_66_114'
4	1980	-999	-999	'US_RR_66_114'
4	1981	-999	-999	'US_RR_66_114'
4	1982	-999	-999	'US_RR_66_114'
4	1983	-999	-999	'US_RR_66_114'
4	1984	-999	-999	'US_RR_66_114'
4	1985	-999	-999	'US_RR_66_114'
4	1986	-999	-999	'US_RR_66_114'
4	1987	-999	-999	'US_RR_66_114'
4	1988	-999	-999	'US_RR_66_114'
4	1989	-999	-999	'US_RR_66_114'
4	1990	-999	-999	'US_RR_66_114'
4	1991	-999	-999	'US_RR_66_114'
4	1992	-999	-999	'US_RR_66_114'
4	1993	1.10	0.36	'US_RR_66_114'
4	1994	0.26	0.45	'US_RR_66_114'
4	1995	1.11	0.35	'US_RR_66_114'
4	1996	1.63	0.38	'US_RR_66_114'
4	1997	2.37	0.33	'US_RR_66_114'
4	1998	1.39	0.37	'US_RR_66_114'
4	1999	1.33	0.43	'US_RR_66_114'
4	2000	0.95	0.50	'US_RR_66_114'
4	2001	0.46	0.35	'US_RR_66_114'
4	2002	1.48	0.40	'US_RR_66_114'
4	2003	0.41	0.35	'US_RR_66_114'
4	2004	2.23	0.32	'US_RR_66_114'
4	2005	2.18	0.32	'US_RR_66_114'
4	2006	0.58	0.35	'US_RR_66_114'
4	2007	0.45	0.31	'US_RR_66_114'
4	2008	0.35	0.33	'US_RR_66_114'
4	2009	0.35	0.33	'US_RR_66_114'
4	2010	0.61	0.33	'US_RR_66_114'
4	2011	0.80	0.35	'US_RR_66_114'
4	2012	0.40	0.41	'US_RR_66_114'
4	2013	0.55	0.36	'US_RR_66_114'
5	1970	-999	-999	'US_RR_115_144'
5	1971	-999	-999	'US_RR_115_144'
5	1972	-999	-999	'US_RR_115_144'
5	1973	-999	-999	'US_RR_115_144'
5	1974	-999	-999	'US_RR_115_144'
5	1975	-999	-999	'US_RR_115_144'
5	1976	-999	-999	'US_RR_115_144'
5	1977	-999	-999	'US_RR_115_144'
5	1978	-999	-999	'US_RR_115_144'
5	1979	-999	-999	'US_RR_115_144'
5	1980	-999	-999	'US_RR_115_144'
5	1981	-999	-999	'US_RR_115_144'
5	1982	-999	-999	'US_RR_115_144'
5	1983	-999	-999	'US_RR_115_144'
5	1984	-999	-999	'US_RR_115_144'
5	1985	-999	-999	'US_RR_115_144'
5	1986	-999	-999	'US_RR_115_144'
5	1987	-999	-999	'US_RR_115_144'
5	1988	-999	-999	'US_RR_115_144'
5	1989	-999	-999	'US_RR_115_144'
5	1990	-999	-999	'US_RR_115_144'
5	1991	-999	-999	'US_RR_115_144'
5	1992	-999	-999	'US_RR_115_144'
5	1993	0.99	0.41	'US_RR_115_144'
5	1994	0.26	0.55	'US_RR_115_144'
5	1995	0.63	0.41	'US_RR_115_144'
5	1996	0.73	0.48	'US_RR_115_144'
5	1997	0.24	0.48	'US_RR_115_144'
5	1998	0.90	0.38	'US_RR_115_144'
5	1999	0.77	0.51	'US_RR_115_144'
5	2000	1.27	0.56	'US_RR_115_144'
5	2001	1.36	0.39	'US_RR_115_144'
5	2002	2.60	0.45	'US_RR_115_144'
5	2003	0.59	0.39	'US_RR_115_144'
5	2004	0.67	0.38	'US_RR_115_144'
5	2005	0.63	0.38	'US_RR_115_144'
5	2006	1.46	0.38	'US_RR_115_144'
5	2007	1.48	0.35	'US_RR_115_144'
5	2008	1.38	0.36	'US_RR_115_144'
5	2009	0.39	0.40	'US_RR_115_144'
5	2010	1.24	0.37	'US_RR_115_144'
5	2011	1.27	0.41	'US_RR_115_144'
5	2012	1.11	0.46	'US_RR_115_144'
5	2013	1.04	0.43	'US_RR_115_144'
6	1970	-999	-999	'US_RR_145_177'
6	1971	-999	-999	'US_RR_145_177'
6	1972	-999	-999	'US_RR_145_177'
6	1973	-999	-999	'US_RR_145_177'
6	1974	-999	-999	'US_RR_145_177'

6	1975	-999	-999	'US_RR_145_177'
6	1976	-999	-999	'US_RR_145_177'
6	1977	-999	-999	'US_RR_145_177'
6	1978	-999	-999	'US_RR_145_177'
6	1979	-999	-999	'US_RR_145_177'
6	1980	-999	-999	'US_RR_145_177'
6	1981	-999	-999	'US_RR_145_177'
6	1982	-999	-999	'US_RR_145_177'
6	1983	-999	-999	'US_RR_145_177'
6	1984	-999	-999	'US_RR_145_177'
6	1985	-999	-999	'US_RR_145_177'
6	1986	-999	-999	'US_RR_145_177'
6	1987	-999	-999	'US_RR_145_177'
6	1988	-999	-999	'US_RR_145_177'
6	1989	-999	-999	'US_RR_145_177'
6	1990	-999	-999	'US_RR_145_177'
6	1991	-999	-999	'US_RR_145_177'
6	1992	-999	-999	'US_RR_145_177'
6	1993	0.31	3.74	'US_RR_145_177'
6	1994	0.38	3.12	'US_RR_145_177'
6	1995	1.33	1.78	'US_RR_145_177'
6	1996	0.70	2.72	'US_RR_145_177'
6	1997	0.46	3.05	'US_RR_145_177'
6	1998	0.36	3.46	'US_RR_145_177'
6	1999	1.07	2.06	'US_RR_145_177'
6	2000	0.96	2.06	'US_RR_145_177'
6	2001	3.42	2.57	'US_RR_145_177'
6	2002	-999	-999	'US_RR_145_177'
6	2003	-999	-999	'US_RR_145_177'
6	2004	-999	-999	'US_RR_145_177'
6	2005	-999	-999	'US_RR_145_177'
6	2006	-999	-999	'US_RR_145_177'
6	2007	-999	-999	'US_RR_145_177'
6	2008	-999	-999	'US_RR_145_177'
6	2009	-999	-999	'US_RR_145_177'
6	2010	-999	-999	'US_RR_145_177'
6	2011	-999	-999	'US_RR_145_177'
6	2012	-999	-999	'US_RR_145_177'
6	2013	-999	-999	'US_RR_145_177'
7	1970	-999	-999	'US_RR>195'
7	1971	-999	-999	'US_RR>195'
7	1972	-999	-999	'US_RR>195'
7	1973	-999	-999	'US_RR>195'
7	1974	-999	-999	'US_RR>195'
7	1975	-999	-999	'US_RR>195'
7	1976	-999	-999	'US_RR>195'
7	1977	-999	-999	'US_RR>195'
7	1978	-999	-999	'US_RR>195'
7	1979	-999	-999	'US_RR>195'
7	1980	-999	-999	'US_RR>195'
7	1981	-999	-999	'US_RR>195'
7	1982	-999	-999	'US_RR>195'
7	1983	2.81	0.10	'US_RR>195'
7	1984	1.25	0.19	'US_RR>195'
7	1985	0.86	0.30	'US_RR>195'
7	1986	0.50	1.10	'US_RR>195'
7	1987	0.53	0.48	'US_RR>195'
7	1988	0.94	0.36	'US_RR>195'
7	1989	0.76	0.36	'US_RR>195'
7	1990	0.63	0.34	'US_RR>195'
7	1991	0.82	0.28	'US_RR>195'
7	1992	0.91	0.28	'US_RR>195'
7	1993	-999	-999	'US_RR>195'
7	1994	-999	-999	'US_RR>195'
7	1995	-999	-999	'US_RR>195'
7	1996	-999	-999	'US_RR>195'
7	1997	-999	-999	'US_RR>195'
7	1998	-999	-999	'US_RR>195'
7	1999	-999	-999	'US_RR>195'
7	2000	-999	-999	'US_RR>195'
7	2001	-999	-999	'US_RR>195'
7	2002	-999	-999	'US_RR>195'
7	2003	-999	-999	'US_RR>195'
7	2004	-999	-999	'US_RR>195'
7	2005	-999	-999	'US_RR>195'
7	2006	-999	-999	'US_RR>195'
7	2007	-999	-999	'US_RR>195'
7	2008	-999	-999	'US_RR>195'
7	2009	-999	-999	'US_RR>195'
7	2010	-999	-999	'US_RR>195'
7	2011	-999	-999	'US_RR>195'
7	2012	-999	-999	'US_RR>195'
7	2013	-999	-999	'US_RR>195'
8	1970	-999	-999	'US_RR>195_COMB'
8	1971	-999	-999	'US_RR>195_COMB'
8	1972	-999	-999	'US_RR>195_COMB'
8	1973	-999	-999	'US_RR>195_COMB'
8	1974	-999	-999	'US_RR>195_COMB'
8	1975	-999	-999	'US_RR>195_COMB'
8	1976	-999	-999	'US_RR>195_COMB'
8	1977	-999	-999	'US_RR>195_COMB'
8	1978	-999	-999	'US_RR>195_COMB'
8	1979	-999	-999	'US_RR>195_COMB'
8	1980	-999	-999	'US_RR>195_COMB'
8	1981	-999	-999	'US_RR>195_COMB'
8	1982	-999	-999	'US_RR>195_COMB'
8	1983	-999	-999	'US_RR>195_COMB'
8	1984	-999	-999	'US_RR>195_COMB'
8	1985	-999	-999	'US_RR>195_COMB'
8	1986	-999	-999	'US_RR>195_COMB'
8	1987	-999	-999	'US_RR>195_COMB'

8	1988	-999	-999	'US_RR>195_COMB'
8	1989	-999	-999	'US_RR>195_COMB'
8	1990	-999	-999	'US_RR>195_COMB'
8	1991	-999	-999	'US_RR>195_COMB'
8	1992	-999	-999	'US_RR>195_COMB'
8	1993	-999	-999	'US_RR>195_COMB'
8	1994	-999	-999	'US_RR>195_COMB'
8	1995	-999	-999	'US_RR>195_COMB'
8	1996	-999	-999	'US_RR>195_COMB'
8	1997	-999	-999	'US_RR>195_COMB'
8	1998	-999	-999	'US_RR>195_COMB'
8	1999	-999	-999	'US_RR>195_COMB'
8	2000	-999	-999	'US_RR>195_COMB'
8	2001	-999	-999	'US_RR>195_COMB'
8	2002	-999	-999	'US_RR>195_COMB'
8	2003	-999	-999	'US_RR>195_COMB'
8	2004	-999	-999	'US_RR>195_COMB'
8	2005	-999	-999	'US_RR>195_COMB'
8	2006	-999	-999	'US_RR>195_COMB'
8	2007	-999	-999	'US_RR>195_COMB'
8	2008	-999	-999	'US_RR>195_COMB'
8	2009	-999	-999	'US_RR>195_COMB'
8	2010	-999	-999	'US_RR>195_COMB'
8	2011	-999	-999	'US_RR>195_COMB'
8	2012	-999	-999	'US_RR>195_COMB'
8	2013	-999	-999	'US_RR>195_COMB'
9	1970	-999	-999	'US_RR>177'
9	1971	-999	-999	'US_RR>177'
9	1972	-999	-999	'US_RR>177'
9	1973	-999	-999	'US_RR>177'
9	1974	-999	-999	'US_RR>177'
9	1975	-999	-999	'US_RR>177'
9	1976	-999	-999	'US_RR>177'
9	1977	-999	-999	'US_RR>177'
9	1978	-999	-999	'US_RR>177'
9	1979	-999	-999	'US_RR>177'
9	1980	-999	-999	'US_RR>177'
9	1981	-999	-999	'US_RR>177'
9	1982	-999	-999	'US_RR>177'
9	1983	-999	-999	'US_RR>177'
9	1984	-999	-999	'US_RR>177'
9	1985	-999	-999	'US_RR>177'
9	1986	-999	-999	'US_RR>177'
9	1987	-999	-999	'US_RR>177'
9	1988	-999	-999	'US_RR>177'
9	1989	-999	-999	'US_RR>177'
9	1990	-999	-999	'US_RR>177'
9	1991	-999	-999	'US_RR>177'
9	1992	-999	-999	'US_RR>177'
9	1993	0.69	0.31	'US_RR>177'
9	1994	0.94	0.29	'US_RR>177'
9	1995	1.13	0.27	'US_RR>177'
9	1996	3.33	0.26	'US_RR>177'
9	1997	1.50	0.37	'US_RR>177'
9	1998	1.62	0.26	'US_RR>177'
9	1999	1.88	0.29	'US_RR>177'
9	2000	0.63	0.28	'US_RR>177'
9	2001	1.38	0.30	'US_RR>177'
9	2002	1.94	0.24	'US_RR>177'
9	2003	0.45	0.29	'US_RR>177'
9	2004	0.74	0.28	'US_RR>177'
9	2005	0.65	0.27	'US_RR>177'
9	2006	0.43	0.38	'US_RR>177'
9	2007	0.33	0.37	'US_RR>177'
9	2008	0.40	0.36	'US_RR>177'
9	2009	0.29	0.40	'US_RR>177'
9	2010	0.94	0.27	'US_RR>177'
9	2011	0.59	0.30	'US_RR>177'
9	2012	0.65	0.27	'US_RR>177'
9	2013	0.50	0.29	'US_RR>177'
10	1970	-999	-999	'JLL_AREA_2_(WEST)'
10	1971	-999	-999	'JLL_AREA_2_(WEST)'
10	1972	-999	-999	'JLL_AREA_2_(WEST)'
10	1973	-999	-999	'JLL_AREA_2_(WEST)'
10	1974	-999	-999	'JLL_AREA_2_(WEST)'
10	1975	-999	-999	'JLL_AREA_2_(WEST)'
10	1976	0.61	0.43	'JLL_AREA_2_(WEST)'
10	1977	2.36	0.22	'JLL_AREA_2_(WEST)'
10	1978	1.14	0.29	'JLL_AREA_2_(WEST)'
10	1979	0.78	0.25	'JLL_AREA_2_(WEST)'
10	1980	1.49	0.21	'JLL_AREA_2_(WEST)'
10	1981	1.93	0.16	'JLL_AREA_2_(WEST)'
10	1982	0.71	0.25	'JLL_AREA_2_(WEST)'
10	1983	0.43	0.32	'JLL_AREA_2_(WEST)'
10	1984	1.02	0.22	'JLL_AREA_2_(WEST)'
10	1985	1.18	0.21	'JLL_AREA_2_(WEST)'
10	1986	0.09	0.60	'JLL_AREA_2_(WEST)'
10	1987	0.78	0.26	'JLL_AREA_2_(WEST)'
10	1988	1.18	0.21	'JLL_AREA_2_(WEST)'
10	1989	0.99	0.21	'JLL_AREA_2_(WEST)'
10	1990	0.82	0.24	'JLL_AREA_2_(WEST)'
10	1991	0.82	0.26	'JLL_AREA_2_(WEST)'
10	1992	1.25	0.21	'JLL_AREA_2_(WEST)'
10	1993	1.23	0.23	'JLL_AREA_2_(WEST)'
10	1994	1.14	0.22	'JLL_AREA_2_(WEST)'
10	1995	0.84	0.29	'JLL_AREA_2_(WEST)'
10	1996	2.11	0.20	'JLL_AREA_2_(WEST)'
10	1997	1.30	0.25	'JLL_AREA_2_(WEST)'
10	1998	0.61	0.29	'JLL_AREA_2_(WEST)'
10	1999	0.66	0.31	'JLL_AREA_2_(WEST)'
10	2000	0.82	0.27	'JLL_AREA_2_(WEST)'

10	2001	0.52	0.40	'JLL_AREA_2_(WEST)'
10	2002	0.61	0.31	'JLL_AREA_2_(WEST)'
10	2003	0.60	0.40	'JLL_AREA_2_(WEST)'
10	2004	0.53	0.39	'JLL_AREA_2_(WEST)'
10	2005	0.64	0.23	'JLL_AREA_2_(WEST)'
10	2006	1.10	0.23	'JLL_AREA_2_(WEST)'
10	2007	1.69	0.23	'JLL_AREA_2_(WEST)'
10	2008	0.73	0.35	'JLL_AREA_2_(WEST)'
10	2009	1.68	0.33	'JLL_AREA_2_(WEST)'
10	2010	0.61	0.37	'JLL_AREA_2_(WEST)'
10	2011	2.59	0.24	'JLL_AREA_2_(WEST)'
10	2012	3.61	0.30	'JLL_AREA_2_(WEST)'
10	2013	2.62	0.26	'JLL_AREA_2_(WEST)'
11	1970	-999	-999	'JLL_AREA_3_(31+32)'
11	1971	-999	-999	'JLL_AREA_3_(31+32)'
11	1972	-999	-999	'JLL_AREA_3_(31+32)'
11	1973	-999	-999	'JLL_AREA_3_(31+32)'
11	1974	-999	-999	'JLL_AREA_3_(31+32)'
11	1975	-999	-999	'JLL_AREA_3_(31+32)'
11	1976	-999	-999	'JLL_AREA_3_(31+32)'
11	1977	-999	-999	'JLL_AREA_3_(31+32)'
11	1978	-999	-999	'JLL_AREA_3_(31+32)'
11	1979	-999	-999	'JLL_AREA_3_(31+32)'
11	1980	-999	-999	'JLL_AREA_3_(31+32)'
11	1981	-999	-999	'JLL_AREA_3_(31+32)'
11	1982	-999	-999	'JLL_AREA_3_(31+32)'
11	1983	-999	-999	'JLL_AREA_3_(31+32)'
11	1984	-999	-999	'JLL_AREA_3_(31+32)'
11	1985	-999	-999	'JLL_AREA_3_(31+32)'
11	1986	-999	-999	'JLL_AREA_3_(31+32)'
11	1987	-999	-999	'JLL_AREA_3_(31+32)'
11	1988	-999	-999	'JLL_AREA_3_(31+32)'
11	1989	-999	-999	'JLL_AREA_3_(31+32)'
11	1990	-999	-999	'JLL_AREA_3_(31+32)'
11	1991	-999	-999	'JLL_AREA_3_(31+32)'
11	1992	-999	-999	'JLL_AREA_3_(31+32)'
11	1993	-999	-999	'JLL_AREA_3_(31+32)'
11	1994	-999	-999	'JLL_AREA_3_(31+32)'
11	1995	-999	-999	'JLL_AREA_3_(31+32)'
11	1996	-999	-999	'JLL_AREA_3_(31+32)'
11	1997	-999	-999	'JLL_AREA_3_(31+32)'
11	1998	-999	-999	'JLL_AREA_3_(31+32)'
11	1999	-999	-999	'JLL_AREA_3_(31+32)'
11	2000	-999	-999	'JLL_AREA_3_(31+32)'
11	2001	-999	-999	'JLL_AREA_3_(31+32)'
11	2002	-999	-999	'JLL_AREA_3_(31+32)'
11	2003	-999	-999	'JLL_AREA_3_(31+32)'
11	2004	-999	-999	'JLL_AREA_3_(31+32)'
11	2005	-999	-999	'JLL_AREA_3_(31+32)'
11	2006	-999	-999	'JLL_AREA_3_(31+32)'
11	2007	-999	-999	'JLL_AREA_3_(31+32)'
11	2008	-999	-999	'JLL_AREA_3_(31+32)'
11	2009	-999	-999	'JLL_AREA_3_(31+32)'
11	2010	-999	-999	'JLL_AREA_3_(31+32)'
11	2011	-999	-999	'JLL_AREA_3_(31+32)'
11	2012	-999	-999	'JLL_AREA_3_(31+32)'
11	2013	-999	-999	'JLL_AREA_3_(31+32)'
12	1970	-999	-999	'JLL_AREAS_17+18'
12	1971	-999	-999	'JLL_AREAS_17+18'
12	1972	-999	-999	'JLL_AREAS_17+18'
12	1973	-999	-999	'JLL_AREAS_17+18'
12	1974	-999	-999	'JLL_AREAS_17+18'
12	1975	-999	-999	'JLL_AREAS_17+18'
12	1976	-999	-999	'JLL_AREAS_17+18'
12	1977	-999	-999	'JLL_AREAS_17+18'
12	1978	-999	-999	'JLL_AREAS_17+18'
12	1979	-999	-999	'JLL_AREAS_17+18'
12	1980	-999	-999	'JLL_AREAS_17+18'
12	1981	-999	-999	'JLL_AREAS_17+18'
12	1982	-999	-999	'JLL_AREAS_17+18'
12	1983	-999	-999	'JLL_AREAS_17+18'
12	1984	-999	-999	'JLL_AREAS_17+18'
12	1985	-999	-999	'JLL_AREAS_17+18'
12	1986	-999	-999	'JLL_AREAS_17+18'
12	1987	-999	-999	'JLL_AREAS_17+18'
12	1988	-999	-999	'JLL_AREAS_17+18'
12	1989	-999	-999	'JLL_AREAS_17+18'
12	1990	-999	-999	'JLL_AREAS_17+18'
12	1991	-999	-999	'JLL_AREAS_17+18'
12	1992	-999	-999	'JLL_AREAS_17+18'
12	1993	-999	-999	'JLL_AREAS_17+18'
12	1994	-999	-999	'JLL_AREAS_17+18'
12	1995	-999	-999	'JLL_AREAS_17+18'
12	1996	-999	-999	'JLL_AREAS_17+18'
12	1997	-999	-999	'JLL_AREAS_17+18'
12	1998	-999	-999	'JLL_AREAS_17+18'
12	1999	-999	-999	'JLL_AREAS_17+18'
12	2000	-999	-999	'JLL_AREAS_17+18'
12	2001	-999	-999	'JLL_AREAS_17+18'
12	2002	-999	-999	'JLL_AREAS_17+18'
12	2003	-999	-999	'JLL_AREAS_17+18'
12	2004	-999	-999	'JLL_AREAS_17+18'
12	2005	-999	-999	'JLL_AREAS_17+18'
12	2006	-999	-999	'JLL_AREAS_17+18'
12	2007	-999	-999	'JLL_AREAS_17+18'
12	2008	-999	-999	'JLL_AREAS_17+18'
12	2009	-999	-999	'JLL_AREAS_17+18'
12	2010	-999	-999	'JLL_AREAS_17+18'
12	2011	-999	-999	'JLL_AREAS_17+18'
12	2012	-999	-999	'JLL_AREAS_17+18'
12	2013	-999	-999	'JLL_AREAS_17+18'

13	1970	-999	-999	'LARVAL_ZERO_INFLATED'
13	1971	-999	-999	'LARVAL_ZERO_INFLATED'
13	1972	-999	-999	'LARVAL_ZERO_INFLATED'
13	1973	-999	-999	'LARVAL_ZERO_INFLATED'
13	1974	-999	-999	'LARVAL_ZERO_INFLATED'
13	1975	-999	-999	'LARVAL_ZERO_INFLATED'
13	1976	-999	-999	'LARVAL_ZERO_INFLATED'
13	1977	2.25	0.51	'LARVAL_ZERO_INFLATED'
13	1978	4.39	0.25	'LARVAL_ZERO_INFLATED'
13	1979	-999	-999	'LARVAL_ZERO_INFLATED'
13	1980	-999	-999	'LARVAL_ZERO_INFLATED'
13	1981	0.81	0.49	'LARVAL_ZERO_INFLATED'
13	1982	1.18	0.30	'LARVAL_ZERO_INFLATED'
13	1983	0.84	0.35	'LARVAL_ZERO_INFLATED'
13	1984	0.31	0.57	'LARVAL_ZERO_INFLATED'
13	1985	-999	-999	'LARVAL_ZERO_INFLATED'
13	1986	0.35	0.43	'LARVAL_ZERO_INFLATED'
13	1987	0.31	0.47	'LARVAL_ZERO_INFLATED'
13	1988	1.11	0.35	'LARVAL_ZERO_INFLATED'
13	1989	0.62	0.38	'LARVAL_ZERO_INFLATED'
13	1990	0.33	0.36	'LARVAL_ZERO_INFLATED'
13	1991	0.30	0.61	'LARVAL_ZERO_INFLATED'
13	1992	0.42	0.36	'LARVAL_ZERO_INFLATED'
13	1993	0.44	0.69	'LARVAL_ZERO_INFLATED'
13	1994	0.54	0.35	'LARVAL_ZERO_INFLATED'
13	1995	0.22	0.54	'LARVAL_ZERO_INFLATED'
13	1996	0.79	0.52	'LARVAL_ZERO_INFLATED'
13	1997	0.33	0.39	'LARVAL_ZERO_INFLATED'
13	1998	0.11	0.55	'LARVAL_ZERO_INFLATED'
13	1999	0.46	0.53	'LARVAL_ZERO_INFLATED'
13	2000	0.25	0.54	'LARVAL_ZERO_INFLATED'
13	2001	0.46	0.33	'LARVAL_ZERO_INFLATED'
13	2002	0.24	0.65	'LARVAL_ZERO_INFLATED'
13	2003	0.79	0.40	'LARVAL_ZERO_INFLATED'
13	2004	0.55	0.71	'LARVAL_ZERO_INFLATED'
13	2005	0.18	0.30	'LARVAL_ZERO_INFLATED'
13	2006	0.47	0.35	'LARVAL_ZERO_INFLATED'
13	2007	0.39	0.45	'LARVAL_ZERO_INFLATED'
13	2008	0.31	0.39	'LARVAL_ZERO_INFLATED'
13	2009	0.58	0.34	'LARVAL_ZERO_INFLATED'
13	2010	0.39	0.52	'LARVAL_ZERO_INFLATED'
13	2011	1.02	0.40	'LARVAL_ZERO_INFLATED'
13	2012	0.30	0.49	'LARVAL_ZERO_INFLATED'
13	2013	0.98	0.36	'LARVAL_ZERO_INFLATED'
14	1970	-999	-999	'GOM_PLL_1_6'
14	1971	-999	-999	'GOM_PLL_1_6'
14	1972	-999	-999	'GOM_PLL_1_6'
14	1973	-999	-999	'GOM_PLL_1_6'
14	1974	-999	-999	'GOM_PLL_1_6'
14	1975	-999	-999	'GOM_PLL_1_6'
14	1976	-999	-999	'GOM_PLL_1_6'
14	1977	-999	-999	'GOM_PLL_1_6'
14	1978	-999	-999	'GOM_PLL_1_6'
14	1979	-999	-999	'GOM_PLL_1_6'
14	1980	-999	-999	'GOM_PLL_1_6'
14	1981	-999	-999	'GOM_PLL_1_6'
14	1982	-999	-999	'GOM_PLL_1_6'
14	1983	-999	-999	'GOM_PLL_1_6'
14	1984	-999	-999	'GOM_PLL_1_6'
14	1985	-999	-999	'GOM_PLL_1_6'
14	1986	-999	-999	'GOM_PLL_1_6'
14	1987	-999	-999	'GOM_PLL_1_6'
14	1988	-999	-999	'GOM_PLL_1_6'
14	1989	-999	-999	'GOM_PLL_1_6'
14	1990	-999	-999	'GOM_PLL_1_6'
14	1991	-999	-999	'GOM_PLL_1_6'
14	1992	0.80	0.35	'GOM_PLL_1_6'
14	1993	0.45	0.37	'GOM_PLL_1_6'
14	1994	0.33	0.39	'GOM_PLL_1_6'
14	1995	0.31	0.40	'GOM_PLL_1_6'
14	1996	0.18	0.40	'GOM_PLL_1_6'
14	1997	0.33	0.37	'GOM_PLL_1_6'
14	1998	0.36	0.37	'GOM_PLL_1_6'
14	1999	0.61	0.33	'GOM_PLL_1_6'
14	2000	0.89	0.33	'GOM_PLL_1_6'
14	2001	0.51	0.38	'GOM_PLL_1_6'
14	2002	0.48	0.39	'GOM_PLL_1_6'
14	2003	0.86	0.32	'GOM_PLL_1_6'
14	2004	0.78	0.33	'GOM_PLL_1_6'
14	2005	0.59	0.34	'GOM_PLL_1_6'
14	2006	0.41	0.39	'GOM_PLL_1_6'
14	2007	0.55	0.38	'GOM_PLL_1_6'
14	2008	1.26	0.34	'GOM_PLL_1_6'
14	2009	1.05	0.36	'GOM_PLL_1_6'
14	2010	0.89	0.34	'GOM_PLL_1_6'
14	2011	0.73	0.49	'GOM_PLL_1_6'
14	2012	1.34	0.34	'GOM_PLL_1_6'
14	2013	0.43	0.41	'GOM_PLL_1_6'
15	1970	-999	-999	'JLL_GOM'
15	1971	-999	-999	'JLL_GOM'
15	1972	-999	-999	'JLL_GOM'
15	1973	-999	-999	'JLL_GOM'
15	1974	0.968	0.266	'JLL_GOM'
15	1975	0.534	0.205	'JLL_GOM'
15	1976	0.666	0.207	'JLL_GOM'
15	1977	0.913	0.216	'JLL_GOM'
15	1978	0.876	0.225	'JLL_GOM'
15	1979	1.287	0.283	'JLL_GOM'
15	1980	1.158	0.265	'JLL_GOM'
15	1981	0.553	0.239	'JLL_GOM'
15	1982	-999	-999	'JLL_GOM'

15	1983	-999	-999	'JLL_GOM'
15	1984	-999	-999	'JLL_GOM'
15	1985	-999	-999	'JLL_GOM'
15	1986	-999	-999	'JLL_GOM'
15	1987	-999	-999	'JLL_GOM'
15	1988	-999	-999	'JLL_GOM'
15	1989	-999	-999	'JLL_GOM'
15	1990	-999	-999	'JLL_GOM'
15	1991	-999	-999	'JLL_GOM'
15	1992	-999	-999	'JLL_GOM'
15	1993	-999	-999	'JLL_GOM'
15	1994	-999	-999	'JLL_GOM'
15	1995	-999	-999	'JLL_GOM'
15	1996	-999	-999	'JLL_GOM'
15	1997	-999	-999	'JLL_GOM'
15	1998	-999	-999	'JLL_GOM'
15	1999	-999	-999	'JLL_GOM'
15	2000	-999	-999	'JLL_GOM'
15	2001	-999	-999	'JLL_GOM'
15	2002	-999	-999	'JLL_GOM'
15	2003	-999	-999	'JLL_GOM'
15	2004	-999	-999	'JLL_GOM'
15	2005	-999	-999	'JLL_GOM'
15	2006	-999	-999	'JLL_GOM'
15	2007	-999	-999	'JLL_GOM'
15	2008	-999	-999	'JLL_GOM'
15	2009	-999	-999	'JLL_GOM'
15	2010	-999	-999	'JLL_GOM'
15	2011	-999	-999	'JLL_GOM'
15	2012	-999	-999	'JLL_GOM'
15	2013	-999	-999	'JLL_GOM'
16	1970	1065132	0.2	'TAGGING'
16	1971	1001624	0.2	'TAGGING'
16	1972	431955	0.2	'TAGGING'
16	1973	183616	0.2	'TAGGING'
16	1974	341589	0.2	'TAGGING'
16	1975	554596	0.2	'TAGGING'
16	1976	253265	0.2	'TAGGING'
16	1977	257385	0.2	'TAGGING'
16	1978	121110	0.2	'TAGGING'
16	1979	98815	0.2	'TAGGING'
16	1980	192541	0.2	'TAGGING'
16	1981	337995	0.2	'TAGGING'
16	1982	-999	-999	'TAGGING'
16	1983	-999	-999	'TAGGING'
16	1984	-999	-999	'TAGGING'
16	1985	-999	-999	'TAGGING'
16	1986	-999	-999	'TAGGING'
16	1987	-999	-999	'TAGGING'
16	1988	-999	-999	'TAGGING'
16	1989	-999	-999	'TAGGING'
16	1990	-999	-999	'TAGGING'
16	1991	-999	-999	'TAGGING'
16	1992	-999	-999	'TAGGING'
16	1993	-999	-999	'TAGGING'
16	1994	-999	-999	'TAGGING'
16	1995	-999	-999	'TAGGING'
16	1996	-999	-999	'TAGGING'
16	1997	-999	-999	'TAGGING'
16	1998	-999	-999	'TAGGING'
16	1999	-999	-999	'TAGGING'
16	2000	-999	-999	'TAGGING'
16	2001	-999	-999	'TAGGING'
16	2002	-999	-999	'TAGGING'
16	2003	-999	-999	'TAGGING'
16	2004	-999	-999	'TAGGING'
16	2005	-999	-999	'TAGGING'
16	2006	-999	-999	'TAGGING'
16	2007	-999	-999	'TAGGING'
16	2008	-999	-999	'TAGGING'
16	2009	-999	-999	'TAGGING'
16	2010	-999	-999	'TAGGING'
16	2011	-999	-999	'TAGGING'
16	2012	-999	-999	'TAGGING'
16	2013	-999	-999	'TAGGING'

-1 end index data

#==

 # NOW ENTER IN THE Vulnerabilities OR PARTIAL CATCHES FOR THE INDICES OF ABUNDANCE

#==

#INDEX		Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16						
1	1970	0	0	0	0	0	0	0	0	2	1	2
	7	39	51	68	170							
1	1971	0	0	0	0	0	0	0	0	0	0	1
	5	11	35	37	136							
1	1972	0	0	0	0	0	0	1	0	0	0	0
	1	5	28	46	312							
1	1973	0	0	0	0	0	0	0	0	1	0	0
	6	3	21	44	489							
1	1974	0	0	0	0	0	3	0	0	0	0	0
	1	5	15	52	748							
1	1975	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	5	535							

1	1976	0	0	0	0	0	0	0	0	0	0	1
	0	0	2	11	842							
1	1977	0	0	0	0	0	0	0	0	0	0	1
	0	1	5	6	729							
1	1978	0	0	0	0	0	0	0	0	0	1	1
	0	0	3	6	468							
1	1979	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	6	476							
1	1980	0	0	0	0	0	0	0	0	0	0	0
	1	0	4	5	620							
1	1981	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	1	626							
1	1982	0	0	0	0	0	0	0	0	0	0	0
	0	0	3	6	506							
1	1983	0	0	0	0	0	0	0	0	0	0	0
	0	0	28	10	1012							
1	1984	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	2	546							
1	1985	0	0	0	0	0	0	0	0	0	0	0
	0	1	1	3	266							
1	1986	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	93							
1	1987	0	0	0	0	0	2	1	2	2	0	1
	1	1	1	2	41							
1	1988	0	1	0	0	1	6	22	64	34	140	331
	156	42	29	29	261							
1	1989	0	0	0	0	0	1	22	399	508	391	270
	210	138	118	76	524							
1	1990	0	0	0	0	0	1	49	275	550	385	142
	94	63	66	81	348							
1	1991	0	0	0	0	0	0	0	0	0	0	2
	1	21	27	10	111							
1	1992	0	0	0	0	2	0	0	2	1	1	2
	4	5	11	9	180							
1	1993	0	0	0	0	0	0	0	0	1	1	7
	4	7	4	10	339							
1	1994	0	0	0	0	0	1	0	2	0	1	3
	6	2	6	7	236							
1	1995	0	0	0	0	0	0	2	3	1	14	12
	12	12	16	16	501							
1	1996	0	0	0	0	0	0	1	0	0	0	0
	0	1	1	3	247							
1	1997	0	0	0	0	0	0	0	0	0	0	0
	1	0	2	2	221							
1	1998	0	0	0	0	0	0	0	0	0	0	0
	0	0	3	3	255							
1	1999	0	0	1	0	1	0	0	0	1	0	2
	12	6	2	7	375							
1	2000	0	0	0	0	1	0	0	1	0	1	2
	8	20	28	22	477							
1	2001	0	0	0	0	0	0	0	0	0	0	4
	1	18	37	34	291							
1	2002	0	0	0	0	0	0	0	1	7	0	5
	9	25	49	79	413							
1	2003	0	0	0	0	0	0	0	1	8	7	14
	15	17	39	51	343							
1	2004	0	0	0	0	0	0	2	1	2	10	28
	40	32	29	63	523							
1	2005	0	0	0	0	0	0	0	0	4	6	25
	60	57	49	70	521							
1	2006	0	0	0	0	0	0	1	0	2	11	19
	47	64	80	77	646							
1	2007	0	0	0	0	0	0	0	1	2	3	12
	22	41	51	58	394							
1	2008	0	0	0	0	0	0	0	0	0	5	11
	14	42	63	72	488							
1	2009	0	0	0	0	0	5	9	6	21	21	27
	29	38	62	69	373							
1	2010	0	0	0	0	0	0	14	19	5	19	22
	11	17	39	43	387							
1	2011	0	0	0	0	1	0	1	15	42	16	19
	22	44	60	50	363							
1	2012	0	0	0	0	0	0	1	7	43	100	82
	47	35	47	93	341							
1	2013	0	0	0	0	0	0	0	0	8	24	70
	86	72	60	53	358							
2	1970	0	0	0	0	0	0	0	0	2	1	2
	7	39	51	68	170							
2	1971	0	0	0	0	0	0	0	0	0	0	1
	5	11	35	37	136							
2	1972	0	0	0	0	0	0	1	0	0	0	0
	1	5	28	46	312							
2	1973	0	0	0	0	0	0	0	0	1	0	0
	6	3	21	44	489							
2	1974	0	0	0	0	0	3	0	0	0	0	0
	1	5	15	52	748							
2	1975	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	5	535							
2	1976	0	0	0	0	0	0	0	0	0	0	1
	0	0	2	11	842							
2	1977	0	0	0	0	0	0	0	0	0	0	1
	0	1	5	6	729							
2	1978	0	0	0	0	0	0	0	0	0	1	1
	0	0	3	6	468							
2	1979	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	6	476							
2	1980	0	0	0	0	0	0	0	0	0	0	0
	1	0	4	5	620							
2	1981	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	1	626							

2	1982	0	0	0	0	0	0	0	0	0	0	0
	0	0	3	6	506							
2	1983	0	0	0	0	0	0	0	0	0	0	0
	0	0	28	10	1012							
2	1984	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	2	546							
2	1985	0	0	0	0	0	0	0	0	0	0	0
	0	1	1	3	266							
2	1986	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	93							
2	1987	0	0	0	0	0	2	1	2	2	0	1
	1	1	1	2	41							
2	1988	0	1	0	0	1	6	22	64	34	140	331
	156	42	29	29	261							
2	1989	0	0	0	0	0	1	22	399	508	391	270
	210	138	118	76	524							
2	1990	0	0	0	0	0	1	49	275	550	385	142
	94	63	66	81	348							
2	1991	0	0	0	0	0	1	76	288	378	500	299
	116	65	45	25	16							
2	1992	0	0	0	0	1	2	32	147	187	182	238
	237	152	90	78	90							
2	1993	0	0	0	0	0	0	15	18	107	216	162
	129	127	104	60	105							
2	1994	0	0	0	0	0	3	16	102	88	152	186
	139	103	74	49	66							
2	1995	0	0	0	0	1	12	13	18	83	268	262
	183	117	87	63	102							
2	1996	0	0	0	0	0	0	14	40	54	70	149
	207	145	103	77	258							
2	1997	0	0	0	0	1	12	28	85	172	148	109
	89	104	91	80	269							
2	1998	0	0	0	0	0	10	12	51	226	372	328
	166	154	120	93	170							
2	1999	0	0	0	0	1	1	31	122	177	372	383
	306	155	70	33	71							
2	2000	0	0	0	0	0	3	4	20	111	142	141
	159	137	99	56	56							
2	2001	0	0	0	0	3	19	278	289	103	213	255
	181	147	116	63	53							
2	2002	0	0	0	0	0	2	42	395	483	133	129
	167	130	103	47	36							
2	2003	0	0	0	0	0	1	12	231	666	435	109
	26	16	16	8	12							
2	2004	0	0	0	0	7	21	101	345	357	264	122
	99	56	18	18	5							
2	2005	0	0	0	2	23	20	23	79	131	200	261
	234	123	71	75	107							
2	2006	0	0	0	0	12	24	133	138	209	296	283
	260	187	91	46	77							
2	2007	0	0	0	0	2	28	56	116	156	106	119
	120	97	66	32	45							
2	2008	0	2	2	63	390	774	495	374	212	67	20
	2	2	0	0	0							
2	2009	0	0	0	0	0	37	23	67	88	90	50
	59	50	66	42	48							
2	2010	0	0	0	0	0	3	22	26	38	70	71
	60	68	70	54	101							
2	2011	0	0	0	0	0	0	38	104	75	56	85
	72	49	34	36	85							
2	2012	0	0	0	0	0	5	12	52	126	66	47
	47	51	41	36	72							
2	2013	0	0	0	0	0	1	7	30	37	34	60
	79	55	39	28	142							
3	1970	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1971	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
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	0	0	0	0	0							
3	1973	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1974	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1975	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1976	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1977	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1978	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1979	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
3	1980	786	4119	290	160	67	1	0	0	0	0	0
	0	0	0	0	0							
3	1981	2975	1484	422	59	20	0	0	0	0	0	0
	0	0	0	0	0							
3	1982	2708	3009	619	117	50	0	0	0	0	0	0
	0	0	0	0	0							
3	1983	1640	2344	813	115	38	0	0	0	0	0	0
	0	0	0	0	0							
3	1984	922	5543	1085	300	186	0	0	0	0	0	0
	0	0	0	0	0							
3	1985	741	5267	5482	85	50	0	0	0	0	0	0
	0	0	0	0	0							
3	1986	963	5764	5250	678	48	0	0	0	0	0	0
	0	0	0	0	0							
3	1987	2297	12228	7212	2193	669	0	0	0	0	0	0
	0	0	0	0	0							

3	1988 0	4783 0	8903 0	7322 0	74 0	148	0	0	0	0	0	0
3	1989 0	779 0	12589 0	1186 0	1943 0	1596	3	0	0	0	0	0
3	1990 0	1953 0	2066 0	13030 0	645 0	584	0	0	0	0	0	0
3	1991 0	3812 0	11614 0	8493 0	1502 0	418	0	0	0	0	0	0
3	1992 0	507 0	5813 0	1424 0	122 0	256	0	0	0	0	0	0
3	1993 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	1994 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	1995 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	1996 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	1997 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	1998 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	1999 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2000 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2001 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2002 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2003 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2004 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2005 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2006 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2007 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2008 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2009 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2010 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2011 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2012 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
3	2013 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1970 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1971 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1972 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1973 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1974 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1975 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1976 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1977 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1978 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1979 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
4	1980 0	161 0	4119 0	290 0	34 0	0	0	0	0	0	0	0
4	1981 0	1702 0	1484 0	409 0	7 0	0	0	0	0	0	0	0
4	1982 0	117 0	3009 0	619 0	50 0	0	0	0	0	0	0	0
4	1983 0	344 0	2344 0	813 0	30 0	0	0	0	0	0	0	0
4	1984 0	192 0	5543 0	1085 0	54 0	0	0	0	0	0	0	0
4	1985 0	198 0	5267 0	5482 0	0 0	0	0	0	0	0	0	0
4	1986 0	383 0	5764 0	5250 0	20 0	0	0	0	0	0	0	0
4	1987 0	889 0	12228 0	6631 0	264 0	0	0	0	0	0	0	0
4	1988 0	0 0	8903 0	7322 0	0 0	0	0	0	0	0	0	0
4	1989 0	66 0	12589 0	1186 0	246 0	0	0	0	0	0	0	0
4	1990 0	919 0	2066 0	13030 0	140 0	0	0	0	0	0	0	0
4	1991 0	1634 0	11614 0	8493 0	153 0	0	0	0	0	0	0	0
4	1992 0	429 0	5813 0	1424 0	0 0	0	0	0	0	0	0	0
4	1993 0	121 0	1016 0	3660 0	650 0	0	0	0	0	0	0	0

4	1994 0	37 0	645 0	913 0	257 0	0	0	0	0	0	0	0
4	1995 0	283 0	1288 0	2957 0	340 0	0	0	0	0	0	0	0
4	1996 0	184 0	9166 0	1104 0	458 0	0	0	0	0	0	0	0
4	1997 0	38 0	1095 0	6174 0	112 0	0	0	0	0	0	0	0
4	1998 0	80 0	880 0	3231 0	674 0	0	0	0	0	0	0	0
4	1999 0	29 0	507 0	1805 0	339 0	0	0	0	0	0	0	0
4	2000 0	0 0	249 0	572 0	47 0	0	0	0	0	0	0	0
4	2001 0	37 0	327 0	2345 0	571 0	0	0	0	0	0	0	0
4	2002 0	549 0	5477 0	4026 0	235 0	0	0	0	0	0	0	0
4	2003 0	121 0	2085 0	3481 0	347 0	0	0	0	0	0	0	0
4	2004 0	518 0	2631 0	6704 0	44 0	0	0	0	0	0	0	0
4	2005 0	372 0	4819 0	1866 0	582 0	0	0	0	0	0	0	0
4	2006 0	129 0	436 0	859 0	105 0	0	0	0	0	0	0	0
4	2007 0	9 0	210 0	3958 0	1755 0	0	0	0	0	0	0	0
4	2008 0	19 0	684 0	1994 0	118 0	0	0	0	0	0	0	0
4	2009 0	26 0	191 0	1905 0	123 0	0	0	0	0	0	0	0
4	2010 0	12 0	990 0	734 0	71 0	0	0	0	0	0	0	0
4	2011 0	0 0	393 0	1443 0	456 0	0	0	0	0	0	0	0
4	2012 0	25 0	385 0	1787 0	401 0	0	0	0	0	0	0	0
4	2013 0	4 0	265 0	550 0	329 0	0	0	0	0	0	0	0
5	1970 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1971 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1972 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1973 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1974 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1975 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1976 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1977 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1978 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1979 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
5	1980 0	0 0	0 0	0 0	126 0	67	1	0	0	0	0	0
5	1981 0	0 0	0 0	13 0	53 0	20	0	0	0	0	0	0
5	1982 0	0 0	0 0	0 0	67 0	50	0	0	0	0	0	0
5	1983 0	0 0	0 0	0 0	85 0	38	0	0	0	0	0	0
5	1984 0	0 0	0 0	0 0	246 0	186	0	0	0	0	0	0
5	1985 0	0 0	0 0	0 0	85 0	50	0	0	0	0	0	0
5	1986 0	0 0	0 0	0 0	659 0	48	0	0	0	0	0	0
5	1987 0	0 0	0 0	581 0	1929 0	669	0	0	0	0	0	0
5	1988 0	0 0	0 0	0 0	74 0	148	0	0	0	0	0	0
5	1989 0	0 0	0 0	0 0	1697 0	1596	3	0	0	0	0	0
5	1990 0	0 0	0 0	0 0	505 0	584	0	0	0	0	0	0
5	1991 0	0 0	0 0	0 0	1349 0	418	0	0	0	0	0	0
5	1992 0	0 0	0 0	0 0	122 0	256	0	0	0	0	0	0
5	1993 0	0 0	0 0	0 0	1333 0	1005	0	0	0	0	0	0
5	1994 0	0 0	0 0	0 0	317 0	653	0	0	0	0	0	0
5	1995 0	0 0	0 0	0 0	1495 0	2171	0	0	0	0	0	0
5	1996 0	0 0	0 0	0 0	2810 0	2155	0	0	0	0	0	0
5	1997 0	0 0	0 0	0 0	213 0	580	0	0	0	0	0	0
5	1998 0	0 0	0 0	0 0	1684 0	116	0	0	0	0	0	0
5	1999 0	0 0	0 0	0 0	664 0	514	0	0	0	0	0	0

5	2000 0	0 0	0 0	0 0	331 0	256	2	0	0	0	0	0
5	2001 0	0 0	0 0	0 0	3660 0	768	0	0	0	0	0	0
5	2002 0	0 0	0 0	0 0	4200 0	4436	0	0	0	0	0	0
5	2003 0	0 0	0 0	0 0	1409 0	808	1	0	0	0	0	0
5	2004 0	0 0	0 0	0 0	1992 0	1136	0	0	0	0	0	0
5	2005 0	0 0	0 0	0 0	1329 0	302	0	0	0	0	0	0
5	2006 0	0 0	0 0	0 0	931 0	1942	9	0	0	0	0	0
5	2007 0	0 0	0 0	0 0	5076 0	1173	1	0	0	0	0	0
5	2008 0	0 0	0 0	0 0	1099 0	4555	6	0	0	0	0	0
5	2009 0	0 0	0 0	0 0	864 0	722	4	0	0	0	0	0
5	2010 0	0 0	0 0	0 0	1393 0	410	0	0	0	0	0	0
5	2011 0	0 0	0 0	0 0	641 0	600	3	0	0	0	0	0
5	2012 0	0 0	0 0	0 0	692 0	375	0	0	0	0	0	0
5	2013 0	0 0	0 0	0 0	920 0	167	0	0	0	0	0	0
6	1970 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
6	1971 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
6	1972 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
6	1973 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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6	1975 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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6	1986 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
6	1987 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
6	1988 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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6	1998 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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6	2006	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2007	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2008	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2009	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2010	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2011	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2012	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
6	2013	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1970	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1971	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1972	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1973	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1974	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1975	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1976	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
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7	1982	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
7	1983	0	0	0	0	0	0	0	0	7	82	110
	91	143	185	141	440							
7	1984	0	0	0	0	0	0	0	0	14	64	102
	130	168	168	143	307							
7	1985	0	0	0	0	0	0	0	0	9	54	70
	82	145	136	164	288							
7	1986	0	0	0	0	0	0	0	0	7	34	32
	51	36	55	54	135							
7	1987	0	0	0	0	0	0	0	0	5	54	46
	43	47	51	43	159							
7	1988	0	0	0	0	0	0	0	0	8	57	43
	40	33	45	39	181							
7	1989	0	0	0	0	0	0	0	0	11	58	42
	62	48	46	47	207							
7	1990	0	0	0	0	0	0	0	0	20	119	47
	58	47	70	85	399							
7	1991	0	0	0	0	0	0	0	0	16	63	73
	112	76	89	105	251							
7	1992	0	0	0	0	0	0	0	0	9	60	72
	117	128	119	84	352							
7	1993	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
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	0	0	0	0	0							
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	0	0	0	0	0							
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	0	0	0	0	0							
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7	2012 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
7	2013 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
8	1970 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
8	1971 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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8	1973 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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8	2011 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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9	1970 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
9	1971 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0
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9	1974	0	0	0	0	0	0	0	0	0	0	0
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9	1975	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
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	0	0	0	0	0							
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	0	0	0	0	0							
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	0	0	0	0	0							
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	0	0	0	0	0							
9	1980	0	0	0	0	0	0	0	9	72	51	28
	26	37	22	21	297							
9	1981	0	0	0	0	0	0	0	1	45	139	180
	127	67	45	49	249							
9	1982	0	0	0	0	0	0	0	11	56	101	210
	157	135	42	34	198							
9	1983	0	0	0	0	0	0	0	37	127	82	110
	91	143	185	141	440							
9	1984	0	0	0	0	0	0	0	41	68	64	102
	130	168	168	143	307							
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	82	145	136	164	288							
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	51	36	55	54	135							
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	43	47	51	43	159							
9	1988	0	0	0	0	0	0	0	26	64	57	43
	40	33	45	39	181							
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	62	48	46	47	207							
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	58	47	70	85	399							
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	112	76	89	105	251							
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	117	128	119	84	352							
9	1993	0	0	0	0	0	0	0	104	124	200	136
	78	70	75	73	252							
9	1994	0	0	0	0	0	0	0	296	526	163	122
	192	107	115	76	199							
9	1995	0	0	0	0	0	0	0	147	232	361	258
	163	138	144	157	450							
9	1996	0	0	0	0	0	0	0	620	253	121	139
	167	127	111	98	262							
9	1997	0	0	0	0	0	0	0	448	658	406	190
	210	278	277	233	477							
9	1998	0	0	0	0	0	0	0	280	787	243	232
	155	188	225	198	392							
9	1999	0	0	0	0	0	0	0	378	290	289	452
	471	276	264	253	475							
9	2000	0	0	0	0	0	0	0	37	204	232	345
	348	345	366	195	337							
9	2001	0	0	0	0	0	0	0	308	122	185	455
	435	648	566	401	658							
9	2002	0	0	0	0	0	0	0	401	281	131	285
	272	415	595	516	681							
9	2003	0	0	0	0	0	0	0	184	212	144	156
	121	226	266	318	503							
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	88	72	84	85	226							
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	79	80	61	38	123							
9	2006	0	0	0	0	0	0	0	61	12	22	27
	42	34	34	24	149							
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	35	30	17	19	95							
9	2008	0	0	0	0	0	0	0	147	39	26	18
	19	15	33	22	106							
9	2009	0	0	0	0	0	0	0	68	108	64	59
	61	34	43	46	379							
9	2010	0	0	0	0	0	0	0	557	220	283	304
	140	89	107	127	261							
9	2011	0	0	0	0	0	0	0	381	480	194	141
	179	169	116	87	244							
9	2012	0	0	0	0	0	0	0	128	375	442	232
	141	116	71	75	159							
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	61	40	40	40	72							
10	1970	0	0	0	0	0	0	0	0	12	43	61
	43	55	59	28	14							
10	1971	13	244	31	132	89	272	830	1525	1114	699	679
	538	393	229	112	240							
10	1972	27	49	52	15	131	50	41	94	327	188	46
	66	67	60	24	108							
10	1973	84	427	543	458	666	250	218	572	1077	670	170
	276	301	261	86	237							
10	1974	104	2549	2669	1556	494	97	449	599	517	493	439
	419	388	247	257	324							
10	1975	2	37	54	76	187	20	16	159	335	614	1146
	910	855	821	842	1837							
10	1976	175	1176	5491	2375	2502	982	173	104	617	570	346
	676	1462	1817	1664	4157							
10	1977	58	411	5173	9269	2230	1777	1702	394	152	239	208
	331	467	929	1351	5898							
10	1978	79	187	1392	2719	2454	2611	967	385	309	169	172
	316	453	460	906	6193							
10	1979	47	332	1410	1209	669	1537	2513	1713	510	299	296
	390	650	910	1105	4976							

10	1980	134	477	1753	2661	1222	1322	2257	4582	3070	768	484
	454	511	594	980	6883							
10	1981	354	1453	8404	3335	4345	3033	2514	2043	1679	1005	439
	655	578	545	442	5211							
10	1982	14	78	156	225	152	352	370	280	136	186	126
	97	124	87	40	101							
10	1983	6	120	2151	577	550	774	560	922	529	365	223
	114	113	47	35	44							
10	1984	56	1523	602	1189	1805	1481	767	352	308	277	179
	103	61	109	2	110							
10	1985	35	128	6653	2013	3463	3695	1740	590	358	245	155
	112	180	67	239	332							
10	1986	4	133	1222	2210	1340	1043	972	496	326	271	72
	39	55	38	28	73							
10	1987	7	346	1436	1959	3020	3437	1023	990	720	621	165
	108	18	27	30	61							
10	1988	56	260	3309	3227	2768	2413	2486	1133	741	332	159
	80	84	23	56	134							
10	1989	0	177	129	461	633	749	730	764	519	205	90
	72	64	42	18	95							
10	1990	0	92	698	329	1225	1187	740	574	599	388	211
	73	73	9	23	103							
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	165	92	22	7	109							
10	1992	10	14	255	284	743	803	525	811	843	201	139
	74	80	63	38	87							
10	1993	0	10	323	861	1009	1283	1183	490	540	444	188
	69	38	29	13	97							
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10	2001	24	6	15	29	101	214	812	842	296	269	172
	256	103	73	73	88							
10	2002	11	21	31	82	35	68	284	1128	968	769	285
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	85	15	46	1	15							
10	2005	0	40	590	606	641	396	500	580	304	108	176
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	236	148	85	115	245							
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	80	32	29	15	58							
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	238	217	68	73	103							
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	75	34	26	20	38							
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	207	121	63	59	102							
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	162	159	98	53	111							
10	2012	0	0	0	73	50	219	213	44	188	456	226
	80	78	51	47	79							
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	328	212	124	76	86							
11	1970	0	0	0	0	0	0	0	0	12	43	61
	43	55	59	28	14							
11	1971	13	244	31	132	89	272	830	1525	1114	699	679
	538	393	229	112	240							
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	66	67	60	24	108							
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	276	301	261	86	237							
11	1974	104	2549	2669	1556	494	97	449	599	517	493	439
	419	388	247	257	324							
11	1975	2	37	54	76	187	20	16	159	335	614	1146
	910	855	821	842	1837							
11	1976	175	1176	5491	2375	2502	982	173	104	617	570	346
	676	1462	1817	1664	4157							
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11	1979	47	332	1410	1209	669	1537	2513	1713	510	299	296
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	97	124	87	40	101							
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11	1986	4	133	1222	2210	1340	1043	972	496	326	271	72
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11	1987	7	346	1436	1959	3020	3437	1023	990	720	621	165
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	165	92	22	7	109							
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	69	38	29	13	97							
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	62	23	9	0	5							
11	1995	54	54	121	390	605	2448	995	50	200	90	0
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11	1996	6	176	408	697	1021	525	886	655	235	44	107
	95	70	49	21	63							
11	1997	0	0	66	132	635	496	825	464	506	116	34
	26	16	32	8	16							
11	1998	0	0	143	714	462	841	602	680	837	1134	302
	141	24	94	4	106							
11	1999	0	25	27	398	1062	533	573	580	294	110	73
	57	87	34	12	18							
11	2000	0	11	14	232	1909	1285	731	446	271	77	12
	28	8	19	9	32							
11	2001	24	6	15	29	101	214	812	842	296	269	172
	256	103	73	73	88							
11	2002	11	21	31	82	35	68	284	1128	968	769	285
	140	108	43	9	74							
11	2003	0	10	10	158	203	163	88	51	25	15	10
	10	0	0	0	0							
11	2004	0	0	0	231	1378	2208	1047	488	200	238	70
	85	15	46	1	15							
11	2005	0	40	590	606	641	396	500	580	304	108	176
	116	43	9	28	24							
11	2006	0	128	271	542	328	1141	586	549	905	563	271
	236	148	85	115	245							
11	2007	0	3	2430	1895	666	604	365	214	153	66	70
	80	32	29	15	58							
11	2008	0	3	4	215	573	345	833	715	561	392	311
	238	217	68	73	103							
11	2009	2	0	6	0	0	0	0	65	194	169	107
	75	34	26	20	38							
11	2010	0	0	0	35	78	16	129	224	263	437	359
	207	121	63	59	102							
11	2011	0	0	0	42	953	414	289	1323	933	192	161
	162	159	98	53	111							
11	2012	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
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12	1971	13	244	31	132	89	272	830	1525	1114	699	679
	538	393	229	112	240							
12	1972	27	49	52	15	131	50	41	94	327	188	46
	66	67	60	24	108							
12	1973	84	427	543	458	666	250	218	572	1077	670	170
	276	301	261	86	237							
12	1974	104	2549	2669	1556	494	97	449	599	517	493	439
	419	388	247	257	324							
12	1975	2	37	54	76	187	20	16	159	335	614	1146
	910	855	821	842	1837							
12	1976	175	1176	5491	2375	2502	982	173	104	617	570	346
	676	1462	1817	1664	4157							
12	1977	58	411	5173	9269	2230	1777	1702	394	152	239	208
	331	467	929	1351	5898							
12	1978	79	187	1392	2719	2454	2611	967	385	309	169	172
	316	453	460	906	6193							
12	1979	47	332	1410	1209	669	1537	2513	1713	510	299	296
	390	650	910	1105	4976							
12	1980	134	477	1753	2661	1222	1322	2257	4582	3070	768	484
	454	511	594	980	6883							
12	1981	354	1453	8404	3335	4345	3033	2514	2043	1679	1005	439
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12	1982	14	78	156	225	152	352	370	280	136	186	126
	97	124	87	40	101							
12	1983	6	120	2151	577	550	774	560	922	529	365	223
	114	113	47	35	44							
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12	1985	35	128	6653	2013	3463	3695	1740	590	358	245	155
	112	180	67	239	332							
12	1986	4	133	1222	2210	1340	1043	972	496	326	271	72
	39	55	38	28	73							
12	1987	7	346	1436	1959	3020	3437	1023	990	720	621	165
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12	1988	56	260	3309	3227	2768	2413	2486	1133	741	332	159
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12	1989	0	177	129	461	633	749	730	764	519	205	90
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12	1990	0	92	698	329	1225	1187	740	574	599	388	211
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	165	92	22	7	109							

12	1992	10	14	255	284	743	803	525	811	843	201	139
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12	1993	0	10	323	861	1009	1283	1183	490	540	444	188
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16	1970	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1971	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1972	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1973	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1974	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1975	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1976	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1977	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1978	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1979	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1980	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1981	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1982	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1983	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1984	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1985	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1986	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1987	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1988	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1989	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1990	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1991	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1992	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1993	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1994	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1995	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1996	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1997	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1998	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	1999	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2000	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2001	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2002	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2003	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2004	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2005	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2006	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2007	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2008	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2009	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2010	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2011	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2012	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							
16	2013	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0							

-1 end index selectivities

#==

NOW ENTER IN THE WEIGHTS AT AGE FOR THE INDICES OF ABUNDANCE (row=year, col=age)

#==

13	1970	3.20	8.32	16.89	35.53	47.69	67.01	85.42	113.30	145.53	154.62	173.72	
	198.66	223.25	247.98	264.63	327.72								
13	1971	3.48	8.30	20.89	31.44	51.20	69.88	86.65	106.89	126.82	149.12	172.48	
	198.50	224.12	248.76	272.98	317.23								
13	1972	4.39	9.67	19.16	37.67	51.60	62.39	90.02	112.49	129.30	149.55	176.77	
	202.21	227.65	246.89	271.55	330.94								
13	1973	3.74	8.86	20.70	38.19	47.93	69.19	89.03	115.65	134.10	152.95	179.96	
	208.23	230.76	249.75	277.68	333.91								
13	1974	3.64	10.04	17.09	34.89	49.38	64.21	87.67	101.47	131.83	151.27	169.97	
	196.81	219.92	247.50	263.25	323.11								
13	1975	3.86	8.63	22.42	32.61	47.14	66.90	83.76	110.46	134.72	152.31	168.00	
	193.83	216.42	243.31	264.63	321.65								
13	1976	4.01	10.20	18.75	32.08	45.09	64.23	91.77	113.95	144.21	160.36	176.03	
	195.67	218.10	236.65	256.84	322.16								
13	1977	4.77	10.26	20.48	33.84	45.65	63.04	81.33	102.93	128.31	150.47	172.98	
	195.58	218.15	241.28	258.37	325.90								
13	1978	5.14	10.94	21.48	30.99	47.02	64.38	83.55	108.92	138.73	163.12	185.70	
	200.09	219.03	242.24	259.19	339.25								
13	1979	5.29	11.23	21.63	35.67	44.23	65.72	84.76	108.11	133.88	160.37	183.17	
	202.12	220.03	239.99	260.03	337.85								
13	1980	5.03	12.21	20.70	32.53	46.78	69.48	91.69	112.92	136.22	167.63	191.76	
	215.43	237.19	255.17	267.43	343.01								
13	1981	5.57	11.05	21.53	32.18	45.47	65.46	85.67	108.94	133.87	158.13	183.98	
	205.00	226.06	240.89	259.84	371.83								
13	1982	4.12	10.81	20.79	31.57	52.63	68.14	89.17	113.21	139.44	160.58	186.81	
	208.75	233.71	250.95	271.81	392.38								
13	1983	3.99	10.10	19.59	33.63	50.48	66.93	91.45	115.44	140.46	163.89	188.31	
	213.90	236.55	257.03	279.26	377.54								
13	1984	5.27	11.31	22.88	35.72	50.98	74.31	92.85	114.86	139.74	162.14	186.85	
	208.02	234.01	262.67	281.77	382.24								
13	1985	4.57	10.21	17.17	31.22	43.60	61.94	79.63	101.58	125.71	152.56	178.75	
	201.84	223.01	246.50	265.01	337.83								
13	1986	5.28	10.27	19.68	38.09	50.58	70.12	91.86	114.91	137.95	162.73	182.25	
	204.62	229.21	253.11	278.64	350.40								
13	1987	5.08	9.82	22.26	36.63	49.94	67.19	85.61	109.71	130.38	155.50	180.41	
	202.51	230.00	258.81	279.73	349.06								
13	1988	3.87	11.19	20.06	34.56	49.80	67.74	86.98	110.54	132.99	157.72	182.83	
	208.51	232.25	251.74	280.53	354.36								
13	1989	4.53	11.06	21.45	35.96	47.78	68.37	89.97	111.91	133.99	160.88	182.93	
	205.20	229.78	254.88	277.00	356.31								
13	1990	5.24	12.23	18.84	35.12	47.04	66.41	85.78	112.04	138.01	162.77	185.16	
	206.44	231.34	253.26	278.50	347.01								
13	1991	5.38	13.46	19.63	36.89	53.42	70.16	93.31	114.29	142.16	166.12	184.45	
	205.67	232.92	255.70	277.58	348.73								
13	1992	5.94	12.72	19.04	35.88	50.11	71.08	88.61	110.29	134.87	160.84	183.60	
	205.63	231.70	252.07	275.39	347.62								
13	1993	5.10	11.57	23.82	33.36	51.24	66.94	89.28	110.87	135.71	157.85	182.17	
	204.81	227.22	250.52	275.46	364.06								
13	1994	4.71	12.03	22.14	31.87	45.52	62.76	82.88	109.25	132.38	157.32	183.82	
	203.76	226.70	249.73	269.64	350.71								
13	1995	4.90	13.62	22.44	35.13	48.60	71.02	89.57	109.22	137.50	160.01	182.17	
	204.74	228.28	251.22	273.36	369.78								
13	1996	5.15	11.08	22.82	34.79	48.72	69.94	92.56	113.19	137.70	159.85	187.90	
	209.75	234.84	257.75	282.53	361.90								
13	1997	5.05	12.66	20.26	36.31	51.22	68.43	91.24	112.02	135.70	157.20	183.61	
	207.67	233.38	257.23	276.85	356.01								
13	1998	4.99	11.75	20.51	32.71	52.63	68.77	90.94	116.61	139.29	162.02	182.95	
	207.52	233.18	254.40	275.06	352.47								
13	1999	5.42	11.22	21.77	35.53	53.96	71.60	93.71	113.88	136.24	159.02	184.11	
	206.73	230.95	254.11	276.93	355.41								
13	2000	4.81	11.79	19.09	34.07	46.49	73.15	90.76	110.77	138.97	159.48	188.69	
	211.82	236.15	264.28	284.54	376.50								
13	2001	4.72	12.80	22.48	33.89	49.13	68.23	95.00	116.01	141.83	166.01	190.73	
	215.14	242.84	265.54	289.89	352.62								
13	2002	6.33	10.93	19.91	35.15	48.00	63.66	90.69	114.11	137.95	160.88	186.75	
	209.61	238.08	265.79	284.83	352.40								
13	2003	5.66	11.51	21.60	34.02	50.70	69.17	92.12	115.31	137.43	158.80	184.14	
	210.24	241.65	265.21	286.90	342.31								
13	2004	6.33	11.94	21.93	35.51	46.15	64.95	89.10	111.40	134.73	158.94	184.57	
	210.08	230.56	259.66	277.51	344.93								
13	2005	5.38	9.80	19.79	30.70	47.55	62.27	82.59	105.75	132.23	160.12	183.99	
	207.86	231.99	254.63	276.59	349.01								
13	2006	5.52	12.63	17.81	33.27	46.90	64.04	84.60	109.63	128.02	155.10	182.21	
	206.80	231.96	255.90	269.42	348.34								
13	2007	4.51	11.76	22.41	30.40	49.64	63.54	82.38	111.84	136.63	162.07	186.44	
	211.78	237.65	262.72	278.79	365.83								
13	2008	4.56	11.92	21.83	36.66	49.11	70.13	93.26	114.70	138.27	157.86	179.43	
	207.84	231.34	259.44	278.87	377.80								
13	2009	5.39	13.24	21.76	34.43	51.29	69.43	83.92	112.09	133.36	156.42	180.31	
	207.54	235.55	260.51	277.31	372.46								
13	2010	5.12	11.01	22.02	35.60	49.02	67.91	89.40	112.96	133.56	157.33	182.60	
	210.61	237.15	264.11	286.54	366.28								
13	2011	4.88	10.77	23.04	31.74	48.20	63.95	87.78	110.99	135.13	159.59	184.86	
	211.25	239.99	263.70	286.75	361.16								
13	2012	5.19	13.07	21.96	34.06	47.77	73.65	89.05	114.08	137.19	163.41	185.83	
	212.36	236.08	262.05	283.80	359.29								
13	2013	5.24	12.22	22.48	32.68	47.83	64.47	90.57	111.06	133.01	161.57	188.18	
	216.72	241.04	266.07	282.79	362.64								

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#==

NOW ENTER IN THE FECUNDITY AT AGE FOR THE SPAWNING STOCK BIOMASS (row=year, col=age)

#===

# Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
1970	3.20	8.32	16.89	35.53	47.69	67.01	85.42	113.30	145.53	154.62	173.72	198.66	223.25	247.98	264.63	327.72
1971	3.48	8.30	20.89	31.44	51.20	69.88	86.65	106.89	126.82	149.12	172.48	198.50	224.12	248.76	272.98	317.23
1972	4.39	9.67	19.16	37.67	51.60	62.39	90.02	112.49	129.30	149.55	176.77	202.21	227.65	246.89	271.55	330.94
1973	3.74	8.86	20.70	38.19	47.93	69.19	89.03	115.65	134.10	152.95	179.96	208.23	230.76	249.75	277.68	333.91
1974	3.64	10.04	17.09	34.89	49.38	64.21	87.67	101.47	131.83	151.27	169.97	196.81	219.92	247.50	263.25	323.11
1975	3.86	8.63	22.42	32.61	47.14	66.90	83.76	110.46	134.72	152.31	168.00	193.83	216.42	243.31	264.63	321.65
1976	4.01	10.20	18.75	32.08	45.09	64.23	91.77	113.95	144.21	160.36	176.03	195.67	218.10	236.65	256.84	322.16
1977	4.77	10.26	20.48	33.84	45.65	63.04	81.33	102.93	128.31	150.47	172.98	195.58	218.15	241.28	258.37	325.90
1978	5.14	10.94	21.48	30.99	47.02	64.38	83.55	108.92	138.73	163.12	185.70	200.09	219.03	242.24	259.19	339.25
1979	5.29	11.23	21.63	35.67	44.23	65.72	84.76	108.11	133.88	160.37	183.17	202.12	220.03	239.99	260.03	337.85
1980	5.03	12.21	20.70	32.53	46.78	69.48	91.69	112.92	136.22	167.63	191.76	215.43	237.19	255.17	267.43	343.01
1981	5.57	11.05	21.53	32.18	45.47	65.46	85.67	108.94	133.87	158.13	183.98	205.00	226.06	240.89	259.84	371.83
1982	4.12	10.81	20.79	31.57	52.63	68.14	89.17	113.21	139.44	160.58	186.81	208.75	233.71	250.95	271.81	392.38
1983	3.99	10.10	19.59	33.63	50.48	66.93	91.45	115.44	140.46	163.89	188.31	213.90	236.55	257.03	279.26	377.54
1984	5.27	11.31	22.88	35.72	50.98	74.31	92.85	114.86	139.74	162.14	186.85	208.02	234.01	262.67	281.77	382.24
1985	4.57	10.21	17.17	31.22	43.60	61.94	79.63	101.58	125.71	152.56	178.75	201.84	223.01	246.50	265.01	337.83
1986	5.28	10.27	19.68	38.09	50.58	70.12	91.86	114.91	137.95	162.73	182.25	204.62	229.21	253.11	278.64	350.40
1987	5.08	9.82	22.26	36.63	49.94	67.19	85.61	109.71	130.38	155.50	180.41	202.51	230.00	258.81	279.73	349.06
1988	3.87	11.19	20.06	34.56	49.80	67.74	86.98	110.54	132.99	157.72	182.83	208.51	232.25	251.74	280.53	354.36
1989	4.53	11.06	21.45	35.96	47.78	68.37	89.97	111.91	133.99	160.88	182.93	205.20	229.78	254.88	277.00	356.31
1990	5.24	12.23	18.84	35.12	47.04	66.41	85.78	112.04	138.01	162.77	185.16	206.44	231.34	253.26	278.50	347.01
1991	5.38	13.46	19.63	36.89	53.42	70.16	93.31	114.29	142.16	166.12	184.45	205.67	232.92	255.70	277.58	348.73
1992	5.94	12.72	19.04	35.88	50.11	71.08	88.61	110.29	134.87	160.84	183.60	205.63	231.70	252.07	275.39	347.62
1993	5.10	11.57	23.82	33.36	51.24	66.94	89.28	110.87	135.71	157.85	182.17	204.81	227.22	250.52	275.46	364.06
1994	4.71	12.03	22.14	31.87	45.52	62.76	82.88	109.25	132.38	157.32	183.82	203.76	226.70	249.73	269.64	350.71
1995	4.90	13.62	22.44	35.13	48.60	71.02	89.57	109.22	137.50	160.01	182.17	204.74	228.28	251.22	273.36	369.78
1996	5.15	11.08	22.82	34.79	48.72	69.94	92.56	113.19	137.70	159.85	187.90	209.75	234.84	257.75	282.53	361.90
1997	5.05	12.66	20.26	36.31	51.22	68.43	91.24	112.02	135.70	157.20	183.61	207.67	233.38	257.23	276.85	356.01
1998	4.99	11.75	20.51	32.71	52.63	68.77	90.94	116.61	139.29	162.02	182.95	207.52	233.18	254.40	275.06	352.47
1999	5.42	11.22	21.77	35.53	53.96	71.60	93.71	113.88	136.24	159.02	184.11	206.73	230.95	254.11	276.93	355.41
2000	4.81	11.79	19.09	34.07	46.49	73.15	90.76	110.77	138.97	159.48	188.69	211.82	236.15	264.28	284.54	376.50
2001	4.72	12.80	22.48	33.89	49.13	68.23	95.00	116.01	141.83	166.01	190.73	215.14	242.84	265.54	289.89	352.62
2002	6.33	10.93	19.91	35.15	48.00	63.66	90.69	114.11	137.95	160.88	186.75	209.61	238.08	265.79	284.83	352.40
2003	5.66	11.51	21.60	34.02	50.70	69.17	92.12	115.31	137.43	158.80	184.14	210.24	241.65	265.21	286.90	342.31
2004	6.33	11.94	21.93	35.51	46.15	64.95	89.10	111.40	134.73	158.94	184.57	210.08	230.56	259.66	277.51	344.93
2005	5.38	9.80	19.79	30.70	47.55	62.27	82.59	105.75	132.23	160.12	183.99	207.86	231.99	254.63	276.59	349.01
2006	5.52	12.63	17.81	33.27	46.90	64.04	84.60	109.63	128.02	155.10	182.21	206.80	231.96	255.90	269.42	348.34
2007	4.51	11.76	22.41	30.40	49.64	63.54	82.38	111.84	136.63	162.07	186.44	211.78	237.65	262.72	278.79	365.83
2008	4.56	11.92	21.83	36.66	49.11	70.13	93.26	114.70	138.27	157.86	179.43	207.84	231.34	259.44	278.87	377.80
2009	5.39	13.24	21.76	34.43	51.29	69.43	83.92	112.09	133.36	156.42	180.31	207.54	235.55	260.51	277.31	372.46
2010	5.12	11.01	22.02	35.60	49.02	67.91	89.40	112.96	133.56	157.33	182.60	210.61	237.15	264.11	286.54	366.28
2011	4.88	10.77	23.04	31.74	48.20	63.95	87.78	110.99	135.13	159.59	184.86	211.25	239.99	263.70	286.75	361.16
2012	5.19	13.07	21.96	34.06	47.77	73.65	89.05	114.08	137.19	163.41	185.83	212.36	236.08	262.05	283.80	359.29
2013	5.24	12.22	22.48	32.68	47.83	64.47	90.57	111.06	133.01	161.57	188.18	216.72	241.04	266.07	282.79	362.64

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@end of the data input file

C. VPA 2-Box Parameter File

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#-----------------------------------------------------------------------------
# PARAMETER FILE FOR PROGRAM VPA_2BOX, Version 3.0
#         The specifications are entered in the order indicated
#         by the existing comments. Additional comments must be preceded by a # symbol
#         in the first column, otherwise the line is perceived as free format input.
#
#         Each parameter in the model must have its own specification line unless a $
#         symbol is placed in the first column followed by an integer value (n), which
#         tells the program that the next n parameters abide by the same specifications.
#
#         The format of each specification line is as follows
#
#         column 1
#         |  number of parameters to which these specifications apply
#         |  |   lower bound
#         |  |   |      best estimate (prior expectation)
#         |  |   |      |      upper bound
#         |  |   |      |      |      method of estimation
#         |  |   |      |      |      |      standard deviation of prior
#         $  5   0      1.2    2.0    1      0.1
#
#         The methods of estimation include:
#         0                 set equal to the value given for the best estimate (a fixed constant)
#         1                 estimate in the usual frequentist (non-Bayesian) sense
#         2(0.1)            estimate as a random deviation from the previous parameter
#         3(0.2)            estimate as a random deviation from the previous constant or type 1 parameter
#         4(0.3)            estimate as random deviation from the best estimate.
#         -0.1              set equal to the value of the closest previous estimated parameter
#         -n                set equal to the value of the nth parameter in the list (estimated or not)
#-----------------------------------------------------------------------------
#=============================================================================
# TERMINAL F PARAMETERS: (lower bound, best estimate, upper bound, indicator, reference age)
#         Note 1: the method indicator for the terminal F parameters is unique in that if it is
#         zero but the best estimate is set to a value < 9, then the 'best estimate'
#         is taken to be the vulnerability relative to the reference age in the last
#         (fifth) column.  Otherwise these parameters are treated the same as the
#         others below and the fifth column is the standard deviation of the prior.
#         Note 2: the last age is represented by an F-ratio parameter (below), so the number
#         of entries here should be 1 fewer than the number of ages
#-----------------------------------------------------------------------------
 0                 9869                          5000000          1                 0.1  Age 1
 0                 31233                         5000000          1                 0.1  Age 2
 0                 70437                         5000000          1                 0.1  Age 3
 0                 17391                         5000000          1                 0.1  Age 4
 0                 14446                         1000000          1                 0.1  Age 5
 0                 27115                         1000000          1                 0.1  Age 6
 0                 22619                         1000000          1                 0.1  Age 7
 0                 6716                          100000           1                 0.1  Age 8
 0                 23940                         100000           1                 0.1  Age 9
 0                 23940                         100000           1                 0.1  Age 10
 0                 23940                         100000           1                 0.1  Age 11
 0                 10000                         100000           1                 0.1  Age 12
 0                 9000                          100000           1                 0.1  Age 13
 0                 8500                          100000           1                 0.1  Age 14
 0                 8000                          100000           1                 0.1  Age 15
#=============================================================================
# F-RATIO PARAMETERS F{oldest}/F{oldest-1} one parameter (set of specifications) for each year
#-----------------------------------------------------------------------------
$ 44   0.00  1.000   4.0            0                            0.2
#=============================================================================
# NATURAL MORTALITY PARAMETERS: one parameter (set of specifications) for each age
#-----------------------------------------------------------------------------
$ 16 0  0.14 1.0  0  0.1
#=============================================================================
# MIXING PARAMETERS: one parameter (set of specifications) for each age
#-----------------------------------------------------------------------------
$ 16 0  0.0  1.0  0  .1
#=============================================================================
# STOCK-RECRUITMENT PARAMETERS: five parameters so 5 sets of specifications
#-----------------------------------------------------------------------------
 0  220982.5   1.D20   0  0.4                                   maximum recruitment
 0  16441.44   1.D20   0  0.0                                   spawning biomass scaling parameter
 0  0.000                   0.9               0  0.0                                 extra parameter (not used yet)
 0  0.5        1            0  0                                autocorrelation parameter
 0  10         1000      0  0   (0.3464)    variance of random component (discounting the autocorrelation)
#=============================================================================
# VARIANCE SCALING PARAMETER (lower bound, best estimate, upper bound, indicator, std. dev.)
#   this parameter scales the input variance up or down as desired
#   In principal, if you estimate this you should obtain more accurate estimates of the
#   magnitude of the parameter variances-- all other things being equal.
#-----------------------------------------------------------------------------
$ 1  0  0.4  1.0  1    .1
$ 15 0  0.4  1.0  -.1  .1
@ END PARAMETER INPUT
```