How to use the Standard Precision Template

The description that follows applies specifically to the standard template (Standard-Precision.xltx). The other precision (and accuracy) templates here are comparable, but exact cell positions may differ from one template to another.

Information on symmetry tests applies only to the standard and 25-year precision templates. To test bias for data sets with older fish, use 50-year-Symmetry.xltx, which contains its own directions.

Production (prod.) age is considered to be the first age attached to a given fish, obtained while the age reader is working with the entire set of samples (survey, year, etc.). Ages determined while re-ageing fish from the precision subsample are labeled 'test ages.' (Note: In the Accuracy template, reference (ref.) age is used to indicate the known or consensus age for each fish.)

*Note: All data shown in red on the template should be updated manually.*

Directions

**Step 1:** First, the **two sets of ages must be entered** in columns A (prod. age) & B (test age), starting at row 36. Overwrite the sample ages already listed. **Fish which are omitted** in either ageing run may be listed in the table at O36, but should not be included in this section. Blank lines in the age data must also be avoided, as these can artificially reduce the total CV.

Do not change the first 34 rows of 'space-keeper' ages. They are included to ensure that the Pivot Tables list all ages, which in turn allows other calculations to refer to the correct locations.
**Step 2**: Once all ages are entered, the calculations in columns C-J (starting at row 36) **must be copied downward** to the last age pair. The computer sometimes does this automatically, depending on how the ages are entered. These columns calculate the CV for each fish (indicated by the subscript 'j'). Multiple columns were used to simplify the equations.
The column values are:

- **C**, the average age, \( X_j \);
- **D**, the sum of the squared differences (SSD) between each age and \( X_j \);
- **E**, \( CV_j \), the square root of the SSD\( j \) divided by \( X_j \);
- **F** & **G**, random numbers to be applied to each age;
- **H**, a checksum to test if the randomized age will be too high;
- **I** & **J**, each age adjusted by the random number in **F** & **G**.

For fish for which both ages are zero, the 'IF' statement in column **E** resets the **CV**\( j \) to zero to avoid an error message. Note that if your data contain blank lines, the 'IF' statement would convert them to artificial **CV**\( j \) values of zero; therefore, any blanks should be removed before copying the calculations. (On the 30- and 50-year templates, any age-0 fish in columns A or B will generate a '#ZERO!' message in column **E**, and the Pivot Tables will not work properly.)
If asterisks (**) appear in column H, either use a template that accepts higher ages, or manually edit the randomized numbers so that they will be displayed on the agreement plot.

**Step 3:** Move to the upper right portion of the template. Pivot Table 1 starts at cell AW1; Pivot Table 2 starts at AW23. **Both Pivot Tables must be refreshed.** This can be done simply by right-clicking within each Pivot Table and selecting the 'Refresh' option.

See Background Info below for more details on the Pivot Table layout. (On other templates, these tables begin different positions but they are still to the far right.)
Step 4: At the top of Columns M-R, the labels should be updated:

*M1, the sample type (e.g., survey, commercial) and year the fish were captured;*
M2, what is compared (e.g., repeated readings of the same fish/comparison between two readers);
O5, the total number of samples aged from this sample set;
R1, the species name;
R2, the date the exercise was completed; and
R3, the name of the age reader.

Also, manually update the degrees of freedom (T7) for the Evans & Hoenig test, to match the number of non-zero rows in AR6-AT15 (see Symmetry Testing below).

Example given is for a test SE conducted on Yellowtail Flounder from the 2021 Autumn Survey.

At this point, all remaining calculations & displays should be complete. Double-check that the total N, CV, and the displayed data seem reasonable. If not, review Steps 1-4 to check if anything was overlooked.
Step 5: Save the file to a new, distinctive filename before printing. It is recommended that you use a filename that incorporates species, sample source, and age reader. For example, "SE_YTFL_202104.xlsx" could refer to the exercise above.

Output

The printed data (M1-AP43) show the sample size, total CV (expressed as a percentage; Chang, 1982), percent agreement, and symmetry test results (if appropriate; see Symmetry Testing below). A breakdown of the average test age for each production age (with measures of variation) is shown, as well as both an agreement plot and an age-frequency table. The printed page also lists the document name and the date it was printed.

More information on these statistical measures and displays can be found here.
Example above uses data for Ager 2 versus Ager 1, as shown in Table 1 of Campana et al. (1995).

For much of the printout, zeroes are not shown. Disregard any "#DIV/0!" and "#NUM!", as all ages may not be adequately represented in your sample. Do not attempt to remove these from the template, as the calculations in those cells may be needed in another precision exercise.

(The output for the 50-year template is arranged differently, but contains the same elements.)

Symmetry Testing

At the beginning of 2022, the Fishery Biology Program decided to switch from the Bowker's test (Bowker, 1948) to the Evans & Hoenig test (Evans and Hoenig, 1998), based on simulation studies by
Nesslage et al. (2022) and McBride (2015). These templates were updated then, but other versions may still be requested via email.

The difference between these tests is that the Bowker’s test is unpooled, while the Evans & Hoenig test is pooled along the diagonal. Both tests consider only the samples for which the age was not agreed upon.

![Diagram showing matching colors to indicate which cells are compared in an unpooled (A) vs. diagonally-pooled (B) symmetry test. Blank cells are not compared.](image)

Evans & Hoenig Test of Symmetry

The results of the symmetry test are reported in the printout (T6-T9) only if the percent agreement is below 90%. A significance level of $P<0.05$ is used to distinguish between significance (**) and non-significance (n/s). For agreement levels above 90%, the test is not reported, and these cells contain 'N/A' for 'not applicable.'

Cells AR5-AU15 are used to calculate the chi-square value for each age difference (1 to 10 years). These are summed in cell AR19.

For the Evans & Hoenig test, it is necessary to manually edit the degrees of freedom (d.f.) in cell T7. This is the number of rows in AR6-AT15 with non-zero values (zero values are not displayed). Below are a few examples of different degrees of freedom.
Note: Differences of 10 or more years are not calculated. Hopefully, there will be no disagreements of this magnitude.

Note: The standard and 25-year precision templates are the only files in this set which incorporate a symmetry test. This type of test is not applicable to an accuracy exercise against known-age samples. If a symmetry test is needed for older fish, use 50-year-Symmetry.xlsx and its embedded directions. Standard-Symmetry.xlsx is also available.

Bowker's Test of Symmetry

Although we no longer use this statistic, the Bowker’s test results are still calculated on the standard template, for comparison with the Evans & Hoenig results. They are in the gray area below the printout (O45-AN85).
Cells X48-AN64 calculate the chi-squared value for each diagonal pair of ages, based on the data in the age matrix table. Cells X69-AN85 indicate which of these pairs include actual fish; this total (cell P59) is the number of degrees of freedom for the test.

In cells P46-P55, the chi-squared values are summed for each difference between the two ages (i.e. 1 year, 2 years, etc.). Differences of 10 or more years are combined in cell P55.

The results of the Bowker's test are reported in cell P58-P60. As above, this statistic is only reported if the percent agreement is below 90%. Otherwise, these cells contain 'N/A' for 'not applicable.'
Background information

Pivot Table 1

The upper Pivot Table (AW1-BA20) calculates the Total CV and statistics for the test ages at each production age. The Pivot Table refers to data in columns A, B, and E.

Line 21 is included to make necessary adjustments to the Pivot Table results, by accounting for blank spaces in A2-B35. Total CV is later calculated as (Sum of Total CVs)/N from cells BA21 and AZ21. Data from this pivot table is displayed in cells N13-R30 on the printout.

*Note: The use of production age as the basis for these calculations is arbitrary and is not meant to indicate that either set of ages is more accurate. Either set could be used here and as the x-axis in the agreement plot.*

Pivot Table 2

The lower Pivot Table (AW23-BP43) is the basis for the age-frequency table in the printout, and the source of counts of fish and percent agreement values by age. It refers to columns A and B only. Again, line 44 is present to adjust the totals because of blank spaces at the top of Columns A and B.

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Contact Info

Please contact Sandy Sutherland (sandy.sutherland@noaa.gov) if you need any assistance with these templates, or would like advice on adapting these for your own applications.

References


