

Maturity tool info

This spreadsheet is designed to allow users to chart changes in WP7's simple indicators for a given species over time, using length-frequency time-series data and length at first maturity.

Short indicators background

WP 7's indicators which are treated in this worksheet are as follows:

1. Percentage of mature fish in the catch, determined by length
2. Percentage of fish in the catch which are within 10 percent of "Lopt"
3. Percentage of fish in the catch which are "mega-spawners."

Mature fish are defined as those which have had a chance to spawn at least once. This is determined by the length at first maturity and converted into the length at which 90-100% of the fish of a given species is mature.

Lopt is the length at which the minimum number of individual fish must be caught in order to obtain the largest biomass. This tool charts the percentage of fish caught which are within 10% of Lopt.

Mega-spawners are defined as fish which have reached a length 10% larger than Lopt. It is likely that these fish have more than one chance to spawn and that their eggs are of a high quality and therefore will be more likely to survive into adulthood and therefore enter the fishery.

For more detailed information about these indicators, please see WP7's indicators review paper, available for download at <http://www.incofish.org/IncoFishv1/Results/Documents.php>

How to use the tool

The user simply has to copy and paste his/her length-frequency data into the blue field, and enter the length at first maturity in the given field, and the percentage of mature fish in the catch will appear in the table and chart.

Length-frequency data obtained from commercial catches is the best data to use here because it will more accurately reflect the size composition of the entire catch. Survey length-frequency data can also be used, but bearing in mind that different mesh sizes or fishing methods might have been employed than those used in the commercial fishery for the given species, so the size composition in the sample may not be representative of that in the commercial catch as a whole.

In order to chart percentage of Lopt and L mega-spawner, the user must complete the Lopt wizard under the Lopt tab (separate worksheet).

The user may also enter landings data (kilos or tons) in the given fields and it will be plotted along with the indicators. In the graph, the landings is measured on the right-hand y-axis while the percentages are measured on the left-hand y-axis.

The instructions for the whole procedure are included on the worksheets themselves in the grey fields under "steps."

Equations used in computations

The minimum maturity length is determined by multiplying L_m (length at first maturity) by 1.14 to obtain $L_{m90-100}$:

$$L_{m90-100} = L_{m50} \times 1.14$$

L_{opt} is determined by

1. Plotting the natural mortality curve of a species according to the negative-exponential function:

$$N_{t2} = N_{t1} * \text{EXP}(-M*(t2-t1))$$

Where:

N = number of individuals

$t2$ = time 2

$t1$ = time 1

M = instantaneous rate of natural mortality;

2. Plotting the “length-weight” curve for the species using the equation: $W = a + L^b$, thereby finding the average weight of an individual per size class;

3. Multiplying N by W for each size class, thereby finding which size class has the largest biomass. This is then the size class of “ L_{opt} .”

Alternatively, the following imperial equation can be used:

$$L_{opt} = L_{inf} \times (3/(3 + M/K))$$

Where:

L_{inf} = theoretical length that an individual fish approaches (but never quite reaches) as it ages

M = instantaneous rate of natural mortality

K = intrinsic rate of growth of an individual

Values for L_{inf} , M , K , a and b can be found for many species at www.fishbase.org

The tool uses both methods for calculating L_{opt} and displays the results side-by-side in the L_{opt} worksheet

The minimum length of a mega-spawner is determined simply by finding the size 10% larger than L_{opt} . The percentage of mega-spawners are therefore the percentage of fish in the sample that are this size or larger.

Contact info

For more information, questions or comments about this tool please contact:

Amanda Stern-Pirlot

astern-pirlot@ifm-geomar.de

+49 431 600 4580