Fisheries Model

fish610.080 EAFM Tools: Atlantis

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Fishing mortality

Fishing mortality can be produced by three different ways in the Atlantis model: 1) with time-series of biomass that should be removed from the system, 2) with proportion that should be harvest, and 3) with a dynamic fisheries model. Method 2 is used in the Atlantis model for Icelandic waters and will be described in this section.

Fishing mortality is set as the proportion harvested each day and is the same all days and in all spatial boxes and layers unless optional management parameters are used, such as seasonal or spatial closures. The biomass harvested ($Y_{a,g,f,t,b}$) for each age-class a of group g by fleet f at time t in box b is as follows:

$$Y_{a,g,f,t,b} = HR_{g,f} + B_{a,g,t,b} + sel_{a,g,f} + mpa_{f,b} + brok_f \qquad (1)$$

where HR is the proportion harvested per day, B is the biomass of the harvested group, sel is the selectivity which is from 0 to 1, and mpa and $brok$ are optional management parameters for closures and harvest

Selectivity

The fishing mortality (proportion harvested) depends on the selectivity of the fleet (fishing gear). The selectivity can be modeled in few different ways in Atlantis. It can be set as being different between juveniles and adults or it can be modeled with curves (logistic, normal or bimodal curves). In the model for Icelandic waters the selectivity was modeled with the logistic curve which is defined as follows:

$$sel_{a,g,f} = \frac{1}{1 + exp(-b \cdot (le_{a,g} - lsm))} \tag{2}$$

where $sel_{a,g,f}$ is the selectivity (0-1) for age-class a of group g for fleet f. The b and lsm are parameters where lsm is length of fish which has selectivity of of 0.5 and b is the steepness of the curve. The $le_{a,g}$ is the length of fish in age-class a of group g.
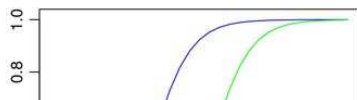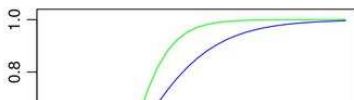
Discards

Discards can be modeled in various ways in Atlantis: 1) it can be modeled as a constant per group, 2) constant per age-class of a group, 3) size based. Also, management and marketing can affect discarding if those model components are included.

In the model for Icelandic waters discarding is modeled as constant proportion per age-class. Only two groups are modeled with discards, cod and haddock.