Selectivity

— Selectivity —

Meaning: A fishing method's ability to target and capture organisms by size and/or species during the fishing operation.

Symbol:
P Probability of capture

L_{50} Length at which there is a 50% chance of being caught by the net

L Length

r constant parameters calculated from the data that increases with the steepness of the curve

Fishing gear does not catch all of the fish it encounters. Small fish can go through a trawl net's mesh, large fish can bounce of a mesh net, small mud crabs can escape traps through escape gaps and large fish can snap fishing line or bend hooks.

Selectivity is important for quantitative stock assessments as it is used to estimate populations numbers at age and size, and the biomass of fish available to the fishery. Selectivity is often estimated by the stock assessment model, but can be measured experimentally.

These are lots of difference formulas for selectivity. This is one of the simplest

$$P=1/(1+\exp[-r(L-L_{50})])$$
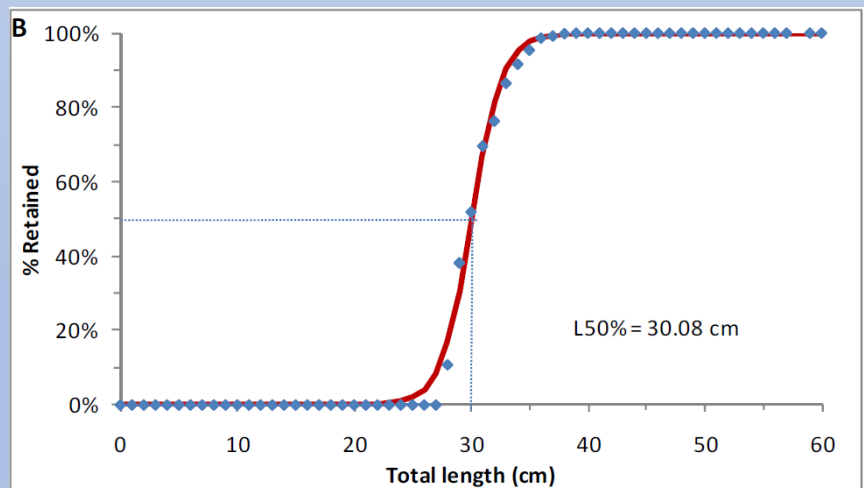
The graph above shows the selectivity curve for Tiger Flathead caught by Danish seine gear off Lakes Entrance. About 50% of 30cm fish will be caught by the net, while 50% will escape.
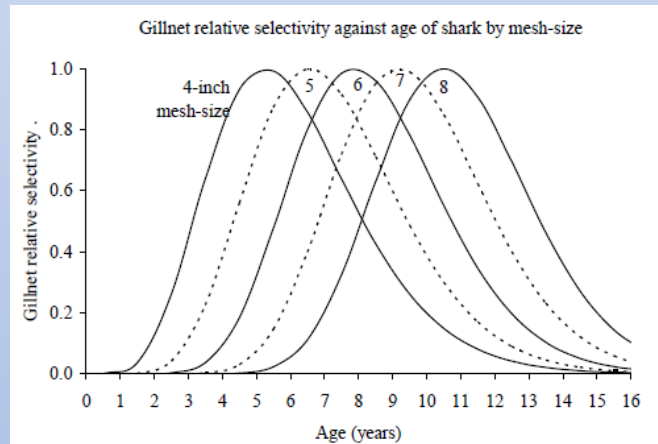
Selectivity
— Selectivity patterns —

Selectivity differs between species and fishing gears. Below are some common examples of selectivity curves in Australian Fisheries.
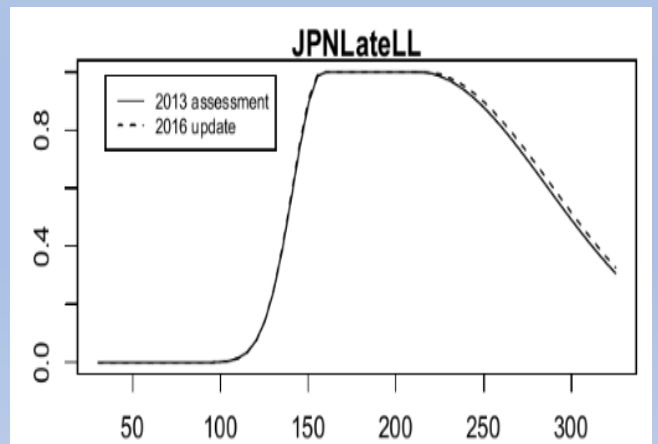
The S-shapes, or logistic curves like the one on the right are common for trawl fisheries. Very few small fish get caught, there is a large increase in selectivity at medium sizes, and then most larger fish get caught. This is for Silver Warehou in the SESSF.
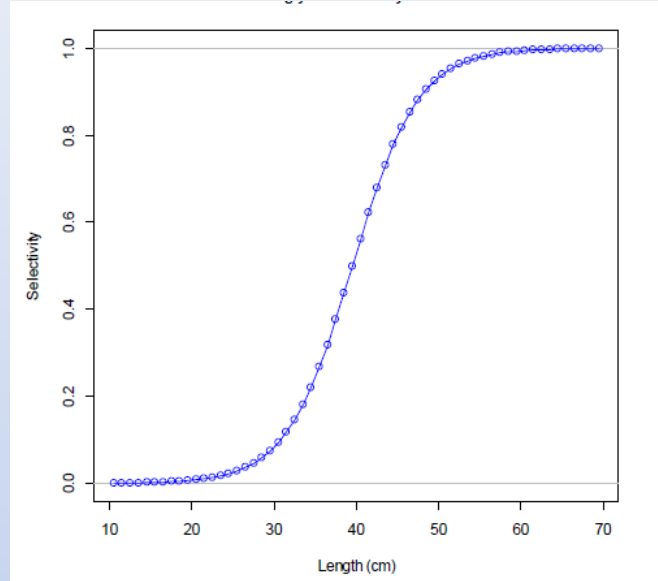
Selectivity of gillnets is often dome shaped. Small fish swim through the mesh, while very large fish bounce of it. The selectivity changes with mesh size. The graph on the right shows selectivity of Gummy Shark by age for five different mesh sizes: 4, 5, 6,7 and 8 inch.

Gillnet relative selectivity against age of shark by mesh-size

Selectivity of some hook and line fisheries are also somewhat dome shaped. This is for Blue Marline caught by longline. As the fish get very big, they can break the line or bend hooks and escape.


JPNLateLL

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Selectivity

— Measuring selectivity —

Two common methods of measuring selectivity of fishing gear such as a trawl net are covered codend experiments and alternate haul experiments.
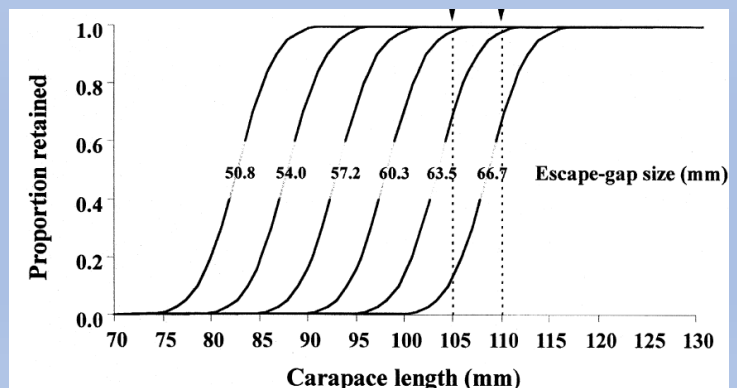
In covered codend experiments, as fine mesh cover net is placed around the experimental codend, and held open by a series of hoops. This allows small fish to escape the experimental codend, and be caught in the cover. After measuring fish from both the codend and the cover, the selectivity of the experimental codend can be estimated.
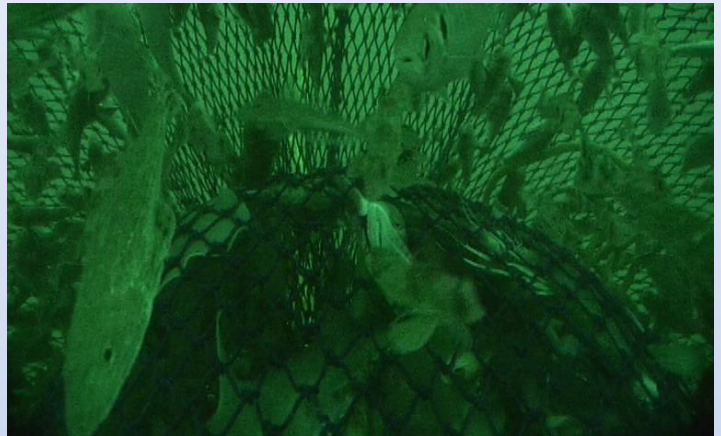
Alternate haul experiments do not use a fine mesh cover, but instead rely on repeated deployments of fishing equipment with different characteristics (for example crab traps with different sized escape gaps).
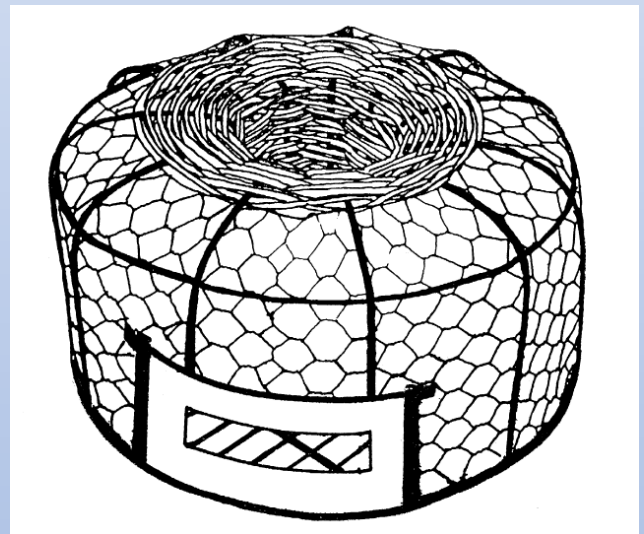
Selectivity curves for the different escape gaps can be used to evaluate the effect on the stock and the on the fishery of changes to fisheries regulations relating to escape gaps.

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Retention

— Retention —

Meaning: What proportion of each sized fish landed on deck is retained by fishers..

Symbol: *P*   Probability of retention

L_{50} Length at which there is a 50% chance of being retained

L   Length

r constant parameters calculated from the data that increases with the steepness of the curve

Some fisheries choose return part of their catch to the sea based on size. Small fish of some species are not suitable for market, or smaller or larger fish might attract a higher price. Large Southern Rock Lobster for example get a lower price than small to medium sizes animals and are often returned to the water, while larger Tiger Flathead attract a higher price than smaller fish.

Retention can take the same form as the selectivity curve, and can use the same mathematical formula.

The graph on the right shows selectivity and retention curves for catches of Blue Grenadier. It shows that half of the fish caught at 50cm are retained, while nearly 100% of 80cm fish are retained.