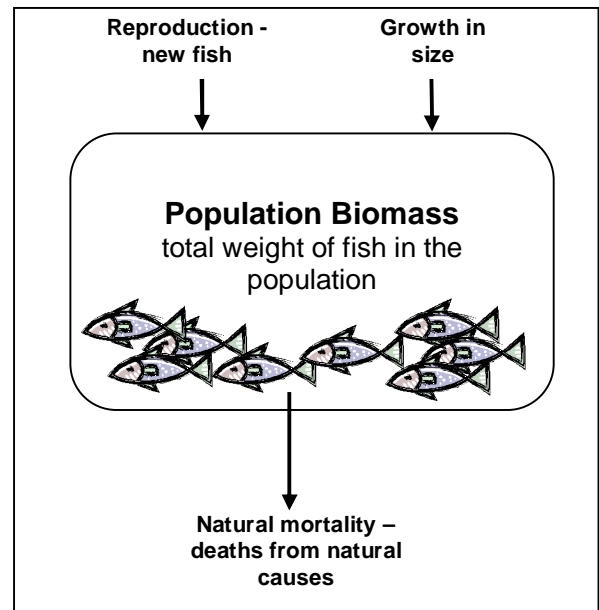


A brief explanation of biomass and maximum sustainable yield (MSY).

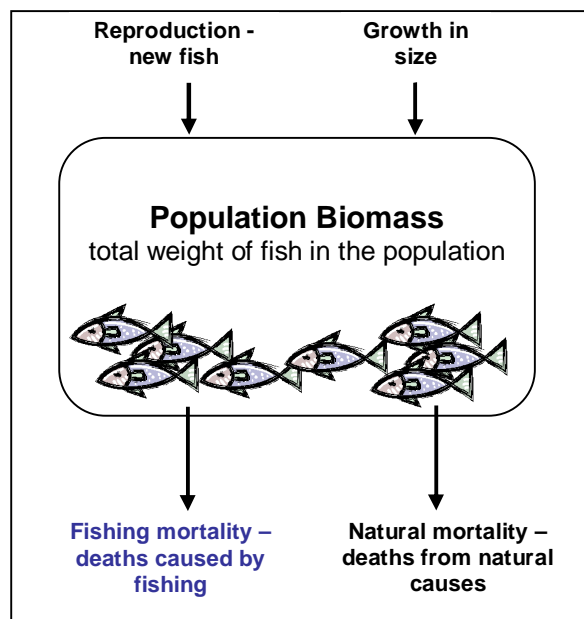
July 2006

In a fisheries context, **biomass** is the total weight of a stock or biological unit of fish or a defined fraction of it.

Factors that add to or take away from biomass in an **unfished** population are outlined in the figure to the right. These factors can vary substantially between different fish species. For example, growth of the fish over time can be rapid (e.g. flounder), or slow (e.g. orange roughy). Large numbers of new fish can be produced at a time (many fish species), or only a few (e.g. sharks). Equally, some species have higher rates of natural mortality than others (e.g. scallops have high levels of natural mortality). For all these reasons, unfished populations may be quite stable over time, or they might vary a lot.



In a **fished** population, there is another factor that affects overall population biomass: the level of fishing mortality (i.e. how many fish are caught).



A sustainable catch (or 'yield') is one where:

$$\begin{array}{c} \text{Reproduction + growth} \\ > \\ \text{natural mortality and fishing mortality} \end{array}$$

A **sustainable yield** is one that will leave enough fish in the water to keep on breeding, so new generations of fish are created. i.e. where inputs to the fishery don't exceed what is coming out of the fishery (with an appropriate level of buffer against natural fluctuations over time).

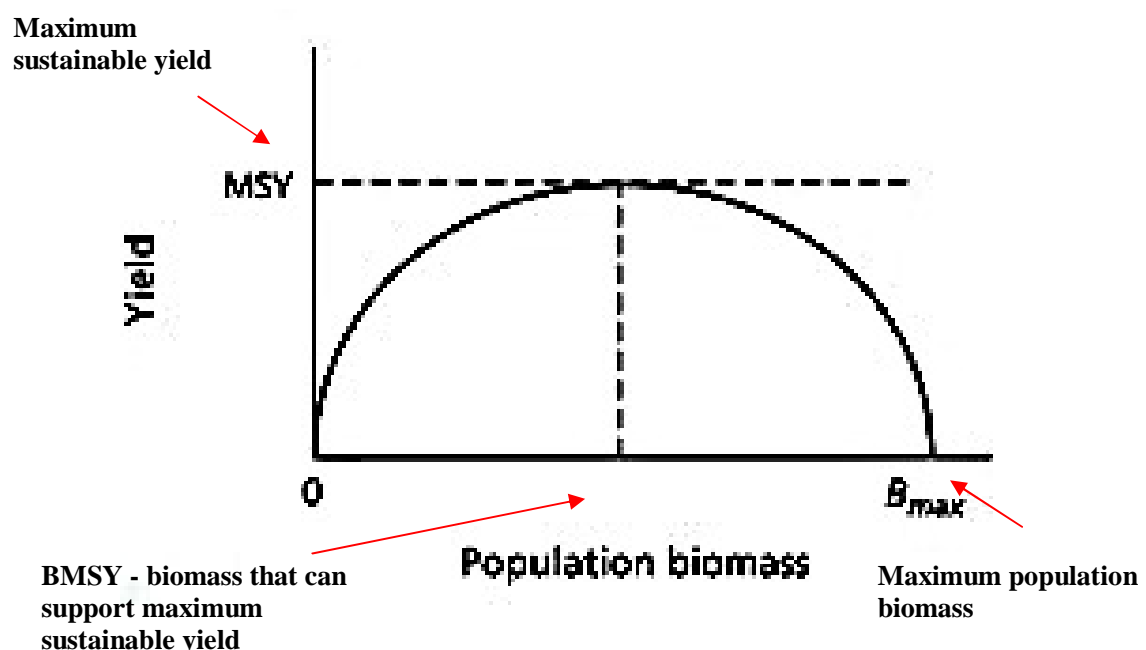
The **"maximum sustainable yield"** or MSY is the largest amount of fish you can take out of the water, while still leaving enough to ensure sustainability (i.e. to ensure there are enough fish in the water to produce new generations). Maximum sustainable yield is defined in the Fisheries Act 1996 as follows:

"Maximum sustainable yield' in relation to any stock, means the greatest yield that can be achieved over time while maintaining the stock's productive capacity, having regard to the population dynamics of the stock and any environmental factors that influence the stock."

A number of factors contribute to the determination of MSY for a species. These include how fast they grow, when and how they reproduce and the pattern of harvesting in the fishery. Typically MSY for a fish stock is also variable over time, because of changes in productivity and environmental factors.

BMSY (or B_{MSY}) is the biomass (total weight of fish) that can support harvest of the maximum sustainable yield.

This relationship is illustrated in the figure below:



Most New Zealand fish stocks are managed to maintain them at or above BMSY. If stocks aren't at that level, management has to adjust stock catch levels so stocks move towards BMSY. The exact proportion of the unfished biomass that produces MSY will vary by species. It is often between 25 and 35 percent of unfished biomass.

If biomass is **below** the BMSY level (left hand side of the above figure), less fish are available, and you can't catch as many sustainably. Catch rates and average fish size are also lower (because there's less fish in the water).

If biomass is **above** the level that produces maximum sustainable yield (right hand side of the above figure), then catch rates, availability and the average size of fish can be expected to increase; but the total catch is less; and the fishery is less productive (lots of big old fish that aren't growing much anymore).