Estimates of Maximum Sustainable Yield of Fish Stocks in ICNAF Subarea 5 and Statistical Area 6

by
E. D. Anderson

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole, Massachusetts 02543

Northeast Fisheries Center
Woods Hole, Massachusetts
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Maximum sustainable yield (MSY) is defined as the highest level of catch that can be taken annually from a fish stock on a sustained basis. This value represents the average that can be harvested over an extended period of time and therefore may not be the expected catch each year. Since recruitment fluctuates yearly (in some stocks year-class size fluctuates by several orders of magnitude), catches higher than the MSY could be allowed in some years when recruitment is above average, whereas catches should be less than the MSY when recruitment is below average.

MSY estimates are only as reliable as the data from which they are determined. For most fish stocks, such data are generally incomplete, insufficient, or inaccurate. MSY values are estimated below for the species-stocks or groups in ICNAF Subarea 5 and Statistical Area 6 which are currently managed by total allowable catch. The estimates are categorized by the data and procedures used as follows:

(1) Time-series of data including survey abundance indices (13 years), age composition of catch, fishing mortality, mean weight at age, yield-per-recruit curve; assuming the exploitation of an average year-class size at a fishing mortality of $F_{0.1}$ and assuming average fishing and recruitment patterns.

(2) Extended time-series (e.g. >15 years) of catch and effort data used in a production model, and survey indices (13 years).

(3) Short time-series (e.g. $\leq$10 years) of catch and effort data used in a production model, and survey indices (13 years).

(4) Insufficient catch and effort data for use in a production model; based on biological considerations such as yield-per-recruit, possible stock-recruitment relationship, growth rate, survey abundance estimates (13 years).

(5) Based only on average catch during the last 10-12 years, and survey indices (13 years).

Species	Stock area	MSY (000's tons)	Category
Cod	5Y	8	5
	5Z	35	2
Haddock	5	50	2
Redfish	5	20	2
Silver hake	5Y	17	1*
	5Ze	55	1*
	5Zw+6	35	1*
Red hake	5Ze	20	5
	5Zw+6	40	3
Pollock	4VWX+5	55	5
Yellowtail	5(E 69°)	16	2
	5(W 69°)+6	23	2.5**
Flounders except YT	5+6	25	5
Herring	5Y	20-40	1
	5Z+6	120-180	1
Mackerel	5+6	313	3
Other finfish	5+6	150	5
Squid - *Illex*	5+6	40	4
Squid - *Loligo*	5+6	50	4

*Questionable commercial statistical base lowers quality of estimate to perhaps that of category 3.

**This stock area is composed of three separate groups, the MSY for one falling into category 2 and the MSY for the other two falling into category 5.

The above MSY estimates must, of course, be evaluated in terms of the data available and procedures utilized (i.e. category). Presumably, values in category 1 are the most reliable with estimates in categories 2-5 progressively less reliable.

MSY values for herring and mackerel are particularly tenuous due to marked variations in year-class strength. A range of values is given for the two herring stocks based on assuming either a low level of average recruitment as observed in recent years (e.g. last 5-6 years) or on a higher level of average recruitment as observed earlier (prior to the reduction of the stocks to their current very low levels). The MSY given for the mackerel stock, determined from a production model, is probably an over-estimate of long-term sustainable yield because of the effect of two strong year-classes on the catch and effort data used in the estimation procedure.

In spite of the problems associated with estimating MSY, the above values are useful as a relative guideline to the potential yield of the various stocks in the area.