

Estimation of Potential yields in (more or less) virgin stocks

Introduction

- When the available data on the stocks in certain areas are not sufficient for accurate estimation of stock, the following equation could be used for assessing potential yields ($= P_y \approx MSY$).
- In this chapter, few empirical formulae are given for estimate of MSY based on scanty data.
- These formulae could be used for bottom trawl surveys / acoustic surveys.

(i) Gulland Equation

The following equation is most commonly used for estimation of potential yields.

$$MSY = M \cdot 0.5 \cdot B_v \dots\dots\dots (1)$$

B_v is the Virgin standing stock (Estimated in a trawling or acoustic survey)

M = Natural mortality coefficient

For less exploited stocks, the following equation is used.

$$MSY = Z_t \cdot 0.5 B_t \dots\dots\dots (2)$$

Z_t is the exponential rate of total mortality ($F + M = Z$) of the year t .

(ii) Ricker equation

To estimate MSY, the equation of Ricker could be used

$$MSY = \frac{r_m * \overline{B_{\infty}}}{4} \dots\dots\dots(3)$$

B_{∞} = carrying capacity of the environment for a given stock
 (This is assumed to be corresponding to B_v , the Virgin stock size).

' r_m ' = "Intrinsic rate of increase" of the population

' r_m ' could be computed using the equation of Blueweiss *et. al.* (1978).

$$r_m = 0.025 * W^{-0.26} \dots\dots\dots(4)$$

r_m = expressed in daily basis

W = is the mean weight (in g.) of the adult animals under consideration.

B_t = standing stock size in that year

(iii) Combing the above two equations

(Ricker and Bluewiess *et. al* 1978) and converting to the year as a time unit the following equation may be written.

$$MSY = 2.3 * W - 0.26 * \dots\dots\dots (5)$$

This equation can be used to estimate potential yields when virgin stock size and mean weight (in g) of the adult in that stock are known.

(iv) Cadima's formula

For estimation of exploited fish stocks for which limited stock assessment data are available, following equation is used.

$$MSY = 0.5 * (Y + M^*) \dots\dots\dots (6)$$

Y = total catch in a year

= the average biomass in the same year.

M = Natural mortality

The above equation could be used for assessing the stock where catch and effort time series are not available and in such cases the biomass estimates could be obtained from trawl or acoustic surveys.

(v) Estimation of MSY

Using Schaefer and Fox model, MSY could be estimated by following equation.

$$\text{MSY} = -0.25 \bullet a^2 / b \text{ (Schaefer)}$$

$$\text{MSY} = - (1/d) \bullet \exp. (c-1) \text{ (Fox)}$$

$$\text{FMSY} = -0.5 \bullet a / b \text{ (Schaefer)}$$

$$\text{FMSY} = - (1/d) \text{ (Fox)}$$

In Schaefer equation, 'a' is the intercept and 'b' is slope and this is replaced by 'c' and d in Fox model.

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