

## II. A Note on the Simple Assessment of a Proposal for Mesh Regulation

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Let  $R$  be the number of fish recruited at age  $1t_c$  corresponding to the mean selection point of the existing mesh. Let  $Y$  be the mean annual catch in weight, and let

$$Y = {}_1Y + {}_2Y$$

where,  ${}_1Y$  is the catch of fish of ages from  $1t_c$  to  $2t_c$ , the latter corresponding with the selection point of the proposed larger mesh, and  ${}_2Y$  is the catch of all fish above this age.

Let  $E$  and  $I$  stand for instantaneous coefficients of emigration and immigration from and to the stock respectively, and using the standard notation for other parameters, we have a general equation for the catch of fish over any age range  $ut$  to  $vt$  :—

$$\begin{aligned} {}_uY_v &= N_u \int_{ut}^{vt} [w(t) \cdot F(t) \cdot e^{-\int (F+M+E-I) dt}] dt \\ &= N_u \int_{ut}^{vt} [A] dt \end{aligned}$$

In the situation we are considering

$${}_2Y = R e^{-\int_{1t_c}^{2t_c} (F+M+E-I) dt} \int_{2t_c}^{\infty} [A] dt$$

Using primes to indicate post-regulation catches, we should have, if mesh were increased,

$${}_2Y' = R e^{-\int_{1t_c}^{2t_c} (M+E-I) dt} \int_{2t_c}^{\infty} [A] dt$$

so that

$${}_2Y' = {}_2Y e^{\int_{1t_c}^{2t_c} F dt}$$

The expected benefit from regulation is

$$100 \left\{ \frac{{}_2Y' - ({}_1Y + {}_2Y)}{{}_1Y + {}_2Y} \right\} = 100 \left\{ {}_2y [e^{\int_{1t_c}^{2t_c} F dt} - 1] - {}_1y \right\} \%$$

$$\text{where } {}_1y = \frac{{}_1Y}{Y} \text{ and } {}_2y = \frac{{}_2Y}{Y}$$

If  $F$  is constant from  $1t_c$  to  $2t_c$ , this reduces to

$$100 \left\{ {}_2y [e^{F(2t_c-1t_c)} - 1] - {}_1y \right\} \%$$

The meaning of this result is that: the benefit of a mesh regulation to the fishery for which it is imposed, in saving small fish for later capture, depends on the proportions of fish below and above the new selection size in the pre-regulation catches and on the original fishing mortality over the range of fish ages between the original and new selection sizes. This is true if the change in the mesh size does not result in changes in the natural mortality rates, the pattern of migration in or out of the fished area, or in the relative intensity of the fishing on smaller and larger fish above the new selection size. Its validity does not otherwise depend on constancy of mortality rates with respect to time or age of fish, or on whether fish move in or out of the area fished by the regulated fleets.