RELATIONSHIPS BETWEEN GROWTH, MORTALITY AND MAXIMUM OBSERVED AGE OF FISH IN THE GULF OF ADEN

by
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Introduction

Growth and mortality rates of demersal and pelagic fish have been studied in the Gulf of Aden (Edwards et al., 1985). The mortality rates were compared with calculations from the formula of Pauly (1980a) where close agreement was found. Beverton and Holt (1959) proposed that T_{max}, longevity in years, was related to mortality rate in curvilinear fashion. These relationships have been examined for a variety of fish in the Gulf of Aden.

Methods

Demersal and pelagic fish were trawled during 580 hours from R/V Ibin Magid, Aden, and R/V Dr. Fridtjof Nansen, Bergen. Fish were separated by species, then measured and weighed. Age was determined from sections of vertebrae (Edwards et al., 1985). Mortality rates were calculated from numbers of fish at age in random samples (Pauly, 1980b). This was compared with the formula of Pauly (1980a):

$$\log M = -0.0066 - 0.279 \log L_{\infty} + 0.6543 \log K + 0.4634 \log T$$

where M is the coefficient of natural mortality and L_{∞} and K are growth parameters. The average water temperature, T, is $28^{\circ}C$ in the Gulf of Aden. Only data from unfished areas have been used in the results given here.

Results

The values obtained for K have been plotted against values for Z in Fig 1. Where length frequency data were insufficient, values from Pauly (1980a) have been used for an estimate of Z. The high values of K and Z were for small pelagic fish (e.g. oil sardines and scads) whereas the low values were for large demersal fish (e.g. groupers). The relationship was linear, where

$$Z = 2.1 K.$$

In Fig. 2 the mortality coefficient Z has been plotted against the maximum observed age of 17 species of fish. Included are points from the curve of Beverton and Holt (1959). The relationship appeared close, with a suggestion that some demersal fish attaining more than 10 years of age had higher mortalities than the cold water fish cited in Beverton and Holt (1959). This agrees with Pauly (1980a), where fish in warm waters were found to have higher mortality rates than their cold water counterparts.

Discussion

The relationship of K to Z agrees with that of Beverton and Holt (1957) where a first approximation of Z was proposed as 2K. The small pelagic fish with short life span had high values of Z around 1.0 for a T_{max} of 5 years, whereas larger demersal fish had values of Z between 0.2 and 0.4 for life spans between 12 and 21 years.

The good agreement with Pauly (1980a) in Fig. 1 supports the estimate of mortality using L_{∞}, K and water temperature. It is also suggested here that the growth factor K alone may be used for a first approximation of Z in the Gulf of Aden, before L_{∞} has been accurately determined.

References

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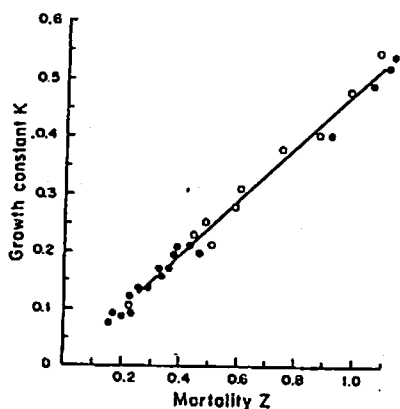
Fig. 1. The relationship of the growth constant K to the mortality coefficient Z for demersal and pelagic fish in the Gulf of Aden. (o-o, after Pauly 1980a).
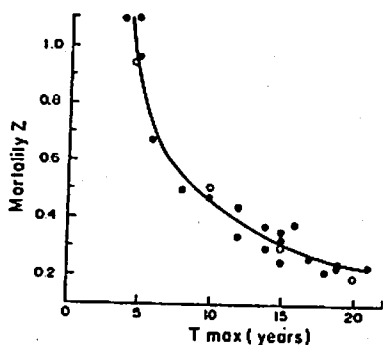

Fig. 2. The relationship of the mortality coefficient Z to maximum observed age of demersal and pelagic fish in the Gulf of Aden (o-o, from Beverton and Holt 1959).

SOFTWARE DEVELOPMENTS

A very useful "Bibliography of computer programs and applications in fisheries research — with emphasis on the use of microcomputers" has recently been compiled by Dr. J.G.H. Maxwell (KAMPSAX-PACIFIC, 124 Walker Street, North Sydney, N.S.W. 2060, Australia) and published in the August issue Fisheries Software Register (FSR 1 (8):112-121.) The bibliography lists nearly 100 references to computer applications in fisheries ranging from compilation of survey results to data logging, plotting and analysis. Obtainable from Dr. Maxwell or from Abbie Cruz at ICLARM.

ARTIFICIAL REEFS

Members who are interested in artificial reef development can obtain information from the Artificial Reef Development Center (1010 Massachusetts Avenue, N.W., Suite 100, Washington, D.C. 20001, U.S.A.). They produce a newsletter called "Reef Briefs" which contains useful references and addresses.

NEWS ITEMS FROM ICLARM

Paul Dalzell, who was previously employed by the Papua New Guinea Fisheries Division, where he worked primarily on the baitfish stocks supplying the PNG skipjack tuna fishery, recently joined ICLARM to manage a World Bank-funded project on "Assessment and management of small pelagic stocks in the Philippines" which will be conducted in collaboration with the Philippines' Bureau of Fisheries and Aquatic Resources (BFAR).

The project will collate, analyse and publish information, gathered in the past by regional offices of BFAR and other fisheries groups, on gears, regional distribution of catch and catch-per-unit-effort, size frequency data and economic information on scads, mackerels, sardines and anchovies and formulate management options for these fisheries.