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LENGTH-CONVERTED CATCH CURVES: A POWERFUL TOOL FOR FISHERIES RESEARCH IN THE TROPICS (III: CONCLUSION)[a]

by

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Introduction

In the previous two contributions of this series, the demonstration was made that length-converted catch curves can be used, given growth parameters (L_∞, K) and suitable length-frequency samples, to obtain reasonable estimates for the rate of total mortality (Z) prevailing in a stock (Pauly 1983) and of the probability of capture, by length (Pauly 1984).

In this contribution, which shall conclude the series, the demonstration is made that length-converted catch curves can be used, even when growth parameters are unknown, to identify changes in total mortality linked with specific life-history strategies.

In each of the three following cases, constant recruitment is assumed; also it is assumed that fishing mortality beyond the left, ascending arm of the curve is the same for all size groups. Ricker (1975) should be consulted for a discussion of the effects of fluctuating recruitment and changes of fishing mortality on catch curves.

Case I: constant total mortality

This is the most often encountered case; it has been discussed in the two other contributions of this series, and is presented here only to provide a contrast for the two cases which follow. Fig. 1A shows a typical, straight length-converted catch curve. Its shape implies a constant total mortality, and hence justifies the estimation of a single value of Z.

Case II: total mortality increasing gradually

Fig. 1B shows a length-converted catch curve typical of the fishes of the family Engraulidae (anchovies). The convex shape implies that natural mortality increases with size and/or age. Such pattern suggests either an increased accessibility of larger anchovies to their predators (here mainly fish-eating birds), and/or some form of "senility".

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Case III: abrupt change in total mortality

Fig. 1C shows a length-converted catch curve typical of those squids in which there is a marked, post spawning mortality, superimposed on the mortality characteristical of the juvenile (pre-adult) stage.

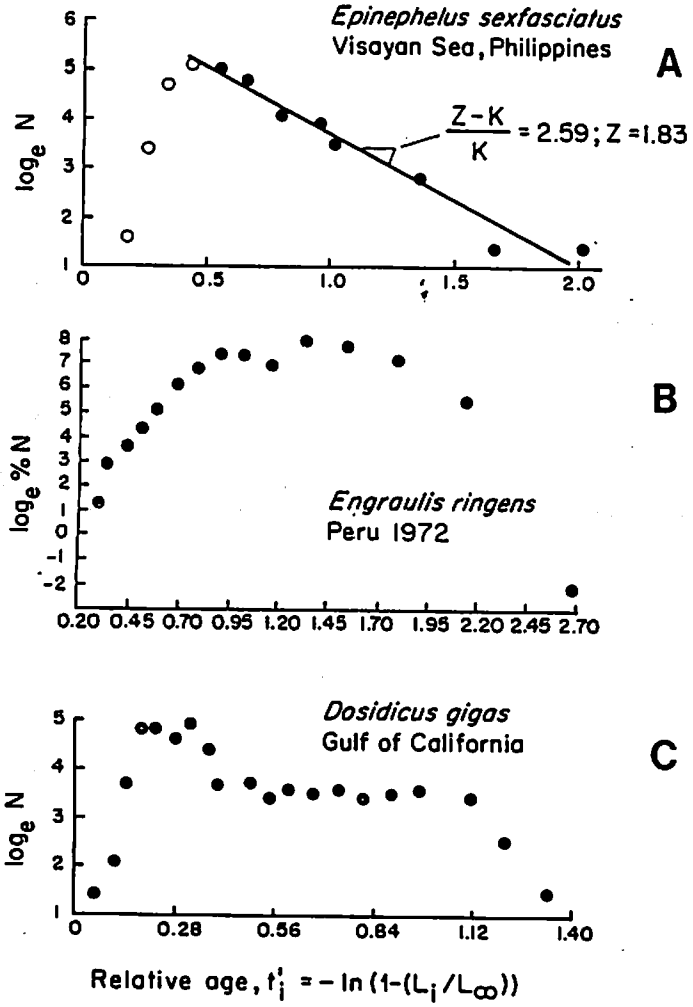

Fig. 1. Three types of length-converted catch curves, of which only one (A) allows estimation of a single, "average" value of Z. Data in (A) from Pauly 1983; data in (B) from Pauly and Tsukayama 1983; data in (C) from Ehrhardt et al. 1983.

Conclusion

Although length-converted catch curves are typically used for the estimation of a single value of Z and associated parameters (e.g. mean length at first capture), inferences on the life history strategies of animals can be drawn from the overall shape of those catch curves from which no single value of Z can be estimated, which is neat if you think about it.

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ERRATUM:

In Pauly (1983) the third column of Table 2 should have the heading Δt, not t. Also, equation (7) should be $\log_e dl/dt = \ldots$, not $dl/dt = \ldots$