POPULATION BIOLOGY OF STOLEPHORUS HETEROLOBUS (PISCES: ENGRAULIDAE)

IN PALAU, WESTERN CAROLINE ISLANDS

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ABSTRACT

This study sought to assess the biological and fishery parameters which affect the population dynamics of S. heterolobus in order to evaluate management alternatives for the bait fishery in Palau. Monthly pooled length frequencies from samples of the commercial bait catches from December 1971 to June 1973 yielded estimates of growth, recruitment, and mortality. The von Bertalanffy growth equation for standard length in millimeters, L_t, at time t months was: $L_t = 91.1$ $(1-\exp(-0.174(t+0.150)))$. Counts of daily growth rings on the otoliths from 13 fish agreed with the growth pattern derived from the length frequencies. The length-weight relationships for males and females were similar and the combined relationship for adults was: $W = 7.61 \times 10^{-6}L^{3.09}$. The sex ratio did not significantly differ from 1:1. The average total mortality, $Z = 0.65$ per month, was estimated from catch curves based upon the combined length frequencies. Biweekly tows from each of the four sectors of the baiting area, for eggs and zooplankton, identified the primary locus of spawning as the open lagoon. Spawning was correlated to salinity. Time series analysis suggested three months between successive spawnings. Mature eggs were found in females whose ovaries comprised over 2% of their body weight. The smallest female containing mature eggs was 51.7 mm SL. The relative fecundity was 450 mature eggs per gram of body weight and the absolute fecundity was given by: $F = 457 W + 2.70$ where W is the body weight in grams. Few recruits were observed in the bait samples during the drought in the spring of 1973 which prompted the inclusion of a rainfall term in the Ricker stock and recruitment model. The inclusion

of a rainfall term produced a satisfactory fit to the recruitment data
(r^2 = 0.56). A rough estimate of 1% larval survival to recruitment
at age three months came from a relative life table depicting the
equilibrium state of the population. A second life table was prepared
using only the natural mortality, M = 0.37 per month, which indicated
that one effect of the increased mortality from fishing has been to
decrease the number of repeat spawners.

Fishing logs from the first day of fishing in August 1964 through
December 1974 were tallied and analyzed. The mean annual catch was
72,161 buckets per year with an effort of 1607 boat nights per year.
The average catch per effort was 44.9 buckets per boat night. Since
the bait are nightlighted, fishing mortality was estimated with the
swept area concept applied to the volume of illuminated water. The
average catchability was 0.0012 per lift and the average fishing
mortality for 232 lifts per month was 0.28 per month. The exponential
yield model and the dynamic pool model suggested that the present
fishery is operating near its optimum fishing intensity. Simulations
with a population projection matrix, integrating the life table info-
mation and the stock and recruitment model, suggested that variations
in recruitment explained the increased catch rates in 1969 and the
decreased catch rates in the latter half of 1970 and in 1973. The low
catches in 1971 were a combination of the earlier poor recruitment
coupled with high fishing during the spring and summer months. Judging
from the 1972 and 1974 catch rates, the bait fishery is resilient.

Recommended management techniques included continuing the policy
of limited entry and possibly augmenting this with a closed season

during March and April. It was further recommended that these findings be periodically reviewed as more information accumulates on the bait fishery.

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