



Calculation of conversion value matrix of relative fishing impact across age classes

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1 Introduction

In 2019, the Joint IATTC-WCPFC NC Working Group (JWG) on the Management of Pacific bluefin tuna made several requests to ISC (WCPFC, 2019). Among other things, the JWG requested ISC to provide “a matrix of conversion values of fishing impact on spawning stock biomass (SSB) across age classes”. This document proposes a response to the request by the JWG.

2 Method

2.1 Calculation

The impact of a fishery on a stock depends on both the number and size of the fish caught; i.e., catching a high number of smaller juvenile fish can have a greater impact on future SSB than catching the same weight of larger mature fish.

The fishing impact of a certain amount of catch at given age on the future SSB can be calculated by the inverse of the average weight at that age and adjusting for natural mortality between that age and a target age (lost future SSB) (Maunder et al., 2014);

$$I_i = 1/W_i \exp \left[- \sum_{t=i}^a M_t \right] W_a$$

in here, I_i is lost future SSB of age a due to the catch at age i , W_i and W_a are average body weights at ages i and a , and M_t is the natural mortality at age, respectively. These calculations were carried out for future SSB of age 6 when the fishery impact by a certain amount of catch gradually decreased to the minimum level. A “matrix of conversion values across age classes” can be obtained by comparing the calculated “lost future SSB” among each age class.

2.2 Assumptions

We applied exactly same biological assumptions with those used in the stock assessment. For ease of calculation, the timing of the fishing was assumed once a year at the middle of the fishing year (beginning of 3rd fishing season).

Biological variable	Assumption
Length at Age	v Bertalanffy GF by Fukuda et al. (2015)
Weight at Length	Kai (2007)
Natural Mortality (annual)	age 0: 1.6, age 1: 0.386, age 2+: 0.25
Maturity	age 3: 20%, age 4: 50%, age 5+: 100%

3 Results

Relative fishery impact by catching a certain amount of fish at a given age on the SSB is obtained as below.

Table 1 Relative impact on the SSB of a catch of a same amount of fish, by age.

Age	Body weight at half of age (kg)	Relative fishing Impact to Age 6
0	1.42	8.8
1	9.3	3.6
2	24.5	1.9
3	46.0	1.3
4	71.6	1.1
5	99	1.0
6	126	1.0

4 References

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