

# Using Fuzzy Synthesis Approach to Extract Fishing Efforts Directed on Albacore for Taiwanese Longline Fleets in the Indian Ocean

Shu-Hwei Wang<sup>1</sup>, Chien-Chung Hsu<sup>1,2</sup> and Hsi-Chiang Liu<sup>1</sup>

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## ABSTRACT

Indian albacore fishery is one of the most important tuna fisheries for Taiwanese longline fleets. The assessment of the Indian albacore stock is usually based on fishery-dependent data submitted from Taiwanese longline vessels. Moreover, those fishery data may contain two fishing types that are able to make standardizing catch per unit effort difficult. Therefore, in the present study, an alternative approach of fuzzy synthesis clustering is used to partition the fishing efforts from different fishing types, and the daily set catch information of logbooks from 1979 to 1997 is used as the fundamental data for this purpose. A fuzzy transformation is composed of weighting vector and membership function, in which the weighting vector used an unequal crisp value and the membership function used the distribution of percent catch of albacore in total of albacore, bigeye tuna, and yellowfin tuna under the factors of vessels' tonnage categories, fishing area, the number of hooks used and sea surface temperature. Subsequently, the result is obtained from the computation of fuzzy transformation, then, new catch, fishing effort and catch per unit effort series were obtained. The fuzzy synthesis is evidenced as one of the methods using for partitioning fishing efforts from different fishing types in preliminary.

**Key words:** Albacore, fuzzy synthesis, fishing effort, longline, membership function

## INTRODUCTION

Indian albacore, *Thunnus alalunga*, is one of the economically important tunas exploited by longline. Japanese fishermen have initially involved in the exploitation for this species since early 1950s, and however, have shifted their targets from albacore to more valuable tuna species, such as bigeye tuna, *T. obesus*, yellowfin tuna, *T. albacares* and southern bluefin tuna, *T. maccoyii* since 1970s. Subsequently, Taiwanese fishermen have stepped behind to become the main exploiter of Indian albacore since 1970s, and to transfer to fish bigeye tuna since mid-1980s (Chang *et al.*, 1993; Hsu, 1994).

As usual, the transformation of longline

fishing types to target different species may result in the change of fishing powers of longline fleets (Beverton and Holt, 1957; Sauthaug and Gotø, 2001), and fishermen usually search an appropriate fishing ground and use different fishing types to catch their targets from day to day. As the result, this change would cause the accuracy of standardizing catch per unit effort as an abundance index directed to study species, if the segregation of fishing efforts is not completed for different fishing types. To evaluate the Indian albacore stock encounters the similar dilemma that the fishing efforts directed to albacore are intermingled with those directed on tropical tunas. Requirement, for standardizing catch per unit effort used as abundance index of albacore, is to solve the problem

<sup>1</sup> Institute of Oceanography, National Taiwan University, Taipei, Taiwan 106

<sup>2</sup> Correspondence author