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Classification of Fish Species by Processing the Hydroacoustic Signal and Canonical Discriminant Analysis

Kuo-Tien Lee[1], Cheng-Hsin Liao[1], Long-Jing Wu[1]
and Wen-Hung Shih[1]

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Since the application of hydroacoustic quick assessment method is unable to discriminate species within a multi-species fish community, field experiments were carried out in the summer seasons of 1988 and 1989 at Yen-Liao Bay, northeastern corner of Taiwan, as an attempt to solve this problem. School signals from the combinations of two (squid and carangid) or three species (squid, carangid and bonito) were recorded on audio magnetic tapes. Afterward, the analog signals were digitized to obtain 14 acoustic explanatory variables in laboratory. The principal components correlated with both internal structure, shape and behavior pattern of schools were extracted by stepwise discriminant analysis. Canonical discriminant functions based on the discriminators were obtained. The discriminanting rate of the species tested in this study exceeds 94%.

Accordingly the potential of applying the hydroacoustic signal processing and canonical discriminant analysis to fisheries acoustic will be evidenced. Furthermore, it is also indicated that the discriminators or coefficients of discriminant function may vary with species, seasons and environmental conditions.

Key words: Acoustic quick assessment, Signal processing, Canonical discriminant analysis, Species identification in multi-species community.

關鍵詞：超音波迅捷評估、信號處理、典型判別分析、複雜魚種之判別。

INTRODUCTION

The application of hydroacoustic quick assessment method is rather limited since it is unable to discriminate sound scatters of any sources, hence it is considered as an important topic for the fishery acoustic research (Inagaki and Aoyama, 1983; Rose and Leggett, 1988; Throne, 1983). Dual-beam and split-beam techniques have shown potential prospect for separating organisms of different sizes (Burczyuski and Johnson, 1986; Dickie *et al.*, 1983; Foote *et al.*, 1986; Traynor and Ehrenberg, 1979; Wu *et al.*, 1989). These methods are constrained, however, by that they are poor in resolving individual targets. Many commercially important marine species gather with high densities. Consequently, it is difficult to make good resolution of individual targets (Dickie *et al.*, 1983). As size classification enables taxonomic classification only when target taxa have discrete size classifications, some researchers have used complex wideband and multiple-frequency echo-sounders to characterize the acoustical responses of targets of

1. Department of Fisheries, National Taiwan Ocean University, Keelung, Taiwan 20224, Republic of China.