

## BASIC CONCEPT OF FISH STOCK MANAGEMENT

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### ABSTRACT

Fish stock management is a kind of technology, which is advanced by applications to the actual fisheries and accumulation of experiences. Theoretical progress in the fish population dynamics can help the management but only through the development of the management technology. Fish stock management must be a feedback system because it is a procedure to approach the target which itself may be a variable subject. As a necessary consequence of this requirement, the management should be a dynamic procedure. As a principle fish stock-fishery system is always in non-stationary conditions and the concept of MSY is often not sufficient to provide guidance to the management. An idea of optimization strategy may be useful.

Fish stock management should contribute to the scientific researches of the stocks and its production. The management can provide useful information on the dynamics of fish stocks. In order to improve our knowledge on the biological production in the sea and to improve procedures of management, both basic studies on the biological production and practical studies through the management should be formulated under the unified framework.

A simple management procedure has been proposed (Tanaka 1980) and simulation studies have proved that this procedure is usefully particular for fish stocks which are rather independent from environmental fluctuations. In this procedure catch limit  $Y_t$  is adjusted in accordance with present stock level  $P_t$  relative to the target level  $P_U$  and the changing rate of  $P_t$ . The formula for adjustment is

$$\Delta Y_t / Y_t = h(P_t / P_U - 1) + g(P_{t-\ell} / P_{t-\ell})$$

Here  $h$  and  $g$  are controlling parameters,  $\ell$  is a time lag and indicates the difference. Only necessary information to run this procedure is relative value of  $P_t$ , which may be obtained as CPUE.

On the basis of the data for the Antarctic minke whales, Monte Carlo simulation has been conducted. With appropriate values of  $g$  and  $h$  the management system is a very stable even when estimation error of  $P_t$  is considerably large. A revising procedure of  $P_U$  is incorporated into this system and it is shown that  $P_U$  almost reaches to MSY after 50 years even starting from an arbitrary value of  $P_U$ .

### INTRODUCTION

Since the beginning of this century, we have accumulated many experiences on the behavior of an unregulated fishery which often resulted in an excess of fishing effort and depletion of stocks. The basic theory to explain this phenomenon-overfishing-has been completed until about 1960. Various models on the dynamics of fish stock have been proposed and the concept of MSY has been established. Notwithstanding the developments in the theory, overfishing spread wider and became more serious as development of fishery resources progressed. Some coastal countries tried to exercise the sovereign right on fish resources in 200 miles zone claiming that open access is the reason for overfishing. However, the 200-mile regime appears not to be effective to prevent overfishing.

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