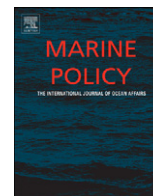




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Managing the offshore and coastal fisheries in Taiwan to achieve sustainable development using policy indicators

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ABSTRACT

This study establishes an offshore and coastal fisheries policy indicator system to evaluate the performance of policies to achieve sustainable development in offshore and coastal fisheries. A modified Delphi method is used to establish this system, and the weights of indicators are calculated using the analytic hierarchy process (AHP) to aggregate indicators. Results show that ecological policies have not achieved their goals because production and catch per unit effort are decreasing. Indicators with respect to management efficiency have increased after the implementation of the buyback and off-fishing programs. However, net returns indicator, which is affected by increasing cost and production value, is stable. Due to inefficient management resulting from insufficient resources, indicators for the number of illegal fishing cases per year and the number of smuggled aquatic production incidents have increased. This shows that requirement for enhanced compliance is necessary. The objective for cultivating talents in fisheries has not been achieved because average wage for fishers is lower than the average civil wage, resulting in an increase in the hiring of foreign fishers.

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1. Introduction

World War II resulted in a decrease in the production of offshore and coastal fisheries in Taiwan. Subsequently, between 1946 and 1950, the Taiwan government set goals to restore marine capture fisheries and promoted several policy measures, such as programs for repairing fishing vessels and fishing material provision to enhance offshore and coastal fisheries [1]. A five-stage, each taking four years, economic construction plan from 1953 to 1973 was initiated by the government to encourage production in fisheries. The first and second stages were crucial (1953–1960), in which they focused on offshore and coastal fisheries, and provided aid to fishermen to build fishing vessels using loans from America. This fishing vessel on loan program was implemented to ensure that all fishermen actively engaged in fishing. The Taiwanese government introduced a program to freeze the licensing of bull trawlers less than 120 GRT and otter trawlers less than 300 GRT to prevent the decline of offshore and coastal fishery resources.

A program to install artificial reefs and cultivate coastal fishery resource was implemented in 1974. 25 fishery resources conservation areas were established in 1978 to release fish fries.

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A program to investigate and evaluate coastal fishery resources conservation and artificial reef areas as part of the “agriculture structure promotion and farmer wage increase” plan was implemented to enhance the resources of offshore and coastal fisheries in 1986 [2]. The Executive Yuan implemented the fishery development program to conserve resources in 1990. In 1991, a program on zero-increase in fishery production was implemented, which showed that the government focused fishery policies on eco-friendly fisheries, sustainable development, and the increase of income of fishermen through multi-operation. A seventh program to freeze fishing license was also introduced in 1991. Almost 30% of large-scale longline fishing vessels and 18% of coastal fishing vessels were scrapped from 1991 to 2008 [3] (Fig. 1).

In the past 40 years, the number of fishing vessels increased 3.24 times, while total tonnage and horsepower of fishing vessels increased 7.82 times and 35.18 times, respectively [4]. Production of offshore and coastal fisheries has decreased from 370.9 thousand tons in 1980 to 135.4 thousand tons in 2007 [5], and the composition of fish species has also changed considerably [6]. These figures show the decline in fishery resources and over-investment. Consequently, the socio-economic benefits of fisheries have also decreased [4,7,8]. Despite considerable efforts by the Taiwanese government, the status quo of offshore and coastal fisheries is generally unacceptable [9]. Therefore, it is worth evaluating the policies of offshore and coastal fisheries of Taiwan using policy indicators that are based on ecological,

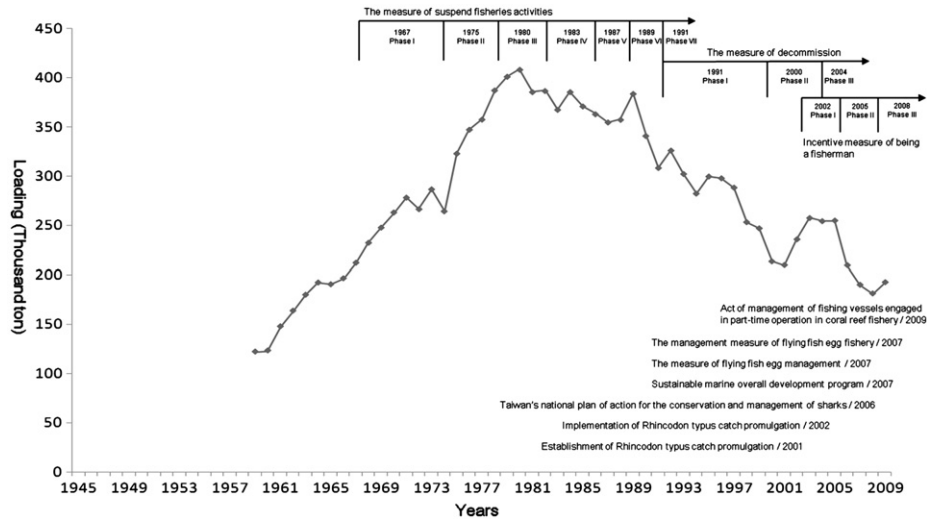


Fig. 1. Variation of offshore and coastal fisheries production and its polices.

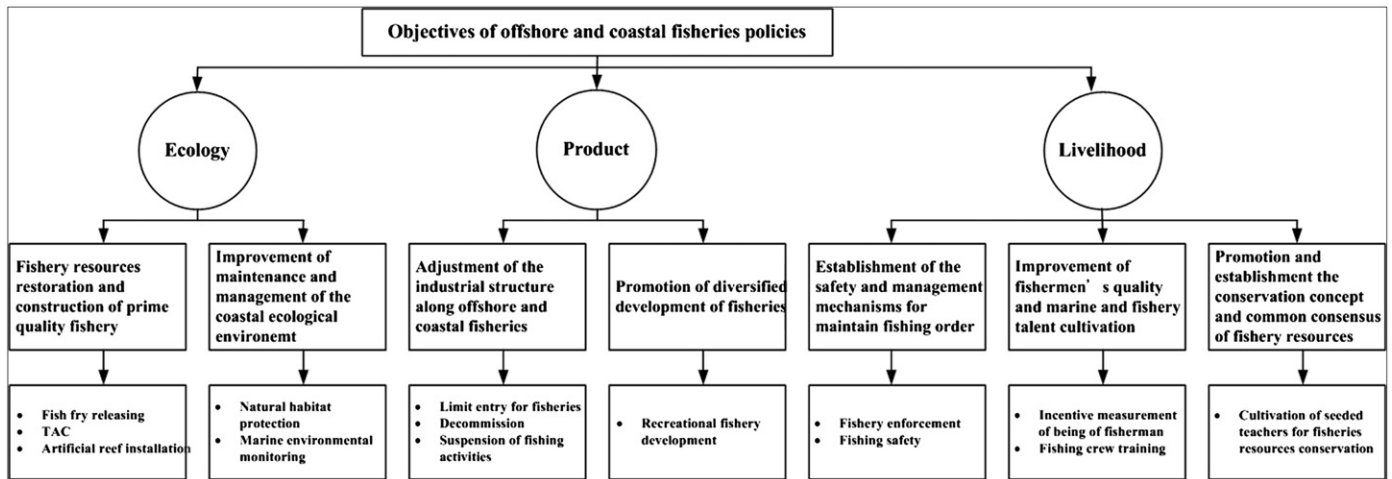


Fig. 2. The framework of offshore and coastal fisheries policies in Taiwan.

economic, and livelihood dimensions to find gaps between the goals and achievements of these policies.

2. Taiwan offshore and coastal fishery polices and their goals (2005–2008)

The goals of offshore and coastal fishery policies are to promote “sustainable fishery development, rich fishing villages, and recruit young fishermen”. Policy measures and projects on offshore and coastal fisheries can be divided into ecological, production, and livelihood dimensions (Fig. 2).

2.1. Ecological dimension

Fish fry release: The Fishery Agency started to release fish fry under the program of coastal fishery resources conservation and cultivation in 1978. A total of 72.8 billion fish fries were released from 1998 to 2008. Between 2005 and 2008, the Fishery Agency invested US\$5.1 million on biodiversity conservation and releasing measures. Ten million fish fries were set for release each year,

and fishery production was expected to increase to 10,000 t by 2008 [10].

Total allowable catch: Licenses for offshore and coastal torch fishing vessels less than 100 GRT are no longer granted since 2004 [11]. The total allowable catch for larva fishery was established in 2006 to protect fishery resources [11]. The institution of *Rhincodon typus* catch promulgation was established in 2001, and the total allowable catch was set in 2002. No *Rhincodon typus* has been caught, sold, held, exported, or imported since 2008 [12]. The Fishery Agency implemented the management of fishing vessels engaged in part-time operation in coral reef mining in 2009. Vessels decreased in number from 96 to 53 between 2008 and 2009 [13], and their allowable annual catch was restricted to 200 kg per vessel [14,15]. The total allowable catch of flying fish eggs was restricted to 300 t per year, and fishing vessels were required to comply with local government regulations and maintain daily fishing records [16].

Artificial reef installation: Measures to enhance fishing ground and accelerate marine ecological restoration were introduced between 2005 and 2008 to increase fish production to 23,000 t. Artificial reefs with 1.3 million cubic meters and

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