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Full Length Research Paper

The economics of rebuilding fisheries in Korea: National comprehensive approaches

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Korea's coastal and offshore fisheries have experienced a reduction in their catch in the early twenty-first century. The total catch from coastal and offshore fisheries dropped from 1.7 million tonnes in 1986 to one million tonnes in 2004. To address such catch reduction, conventional fish stock enhancement programs have been constantly developed and implemented. However, as fish stocks have been estimated to decrease since 2000 in spite of various management measures, the Korean government has begun to genuinely acknowledge the necessity of enhancing fisheries productivity through the recovery of depleted fish stock. Based on such acknowledgement, a fish stock rebuilding plan (FSRP), combined with conventional fish stock enhancement programs, and was established in 2005. For stocks which have shown a drastic decrease, a FSRP has been set up and promoted. So far, 10 FSRPs have been established and operated up until 2008, and it is planned that this number will expand to 20 species by 2012. The results of pilot projects show that stocks are increasing after the introduction of FSRPs. For instance, the catch per unit effort (CPUE) of sandfish in the East Sea has increased from 0.44 in 2005 to 0.78 in 2007. Consequently, fishing income has increased by 10%. The key lessons learned during the implementation of FSRPs are that causes for the stock decrease are various and complicated, and that it is necessary to adjust and eliminate some conventional policies that could have unforeseen negative impacts on fish stocks. The FSRP-based fisheries management policy in Korea carries great significance, for it has changed the focus of policy from simply maintaining the status quo to stock recovery, and it allows relevant stakeholders to get actively involved in the procedures of establishing and promoting the plan, leading to effective implementation of the plan. While the current FSRP is operated by species, if the FSRP can be gradually expanded to encompass the whole ecosystem it will greatly contribute to more effective management and fish stock recovery for all species in offshore and coastal waters surrounding Korea.

Key words: Fish stock rebuilding plan (FSRP), ecosystem based FSRP, voluntary participation, stock enhancement programs, comprehensive approach.

INTRODUCTION

Based on the licensing system of fishing vessels and fisheries, the Korean government has traditionally used technical measures such as closed time, closed area, mesh size regulation, etc., as well as input control to manage fish stock and the fishing industry for the last century.

Although each species' situation is different, the stock assessment conducted in coastal and offshore areas in Korea has shown that the total fish stock has consistently decreased, from 10 million tonnes in 1980 to 7.9 million tons in 2004. In addition, if the current catch ability remains unchanged, it is likely that the total fish stock would be even further reduced to 3.9 million tons in ten years.

In particular, it was found that the rate of adult fishes among main catch species has declined to lower than 20% since 2000. This indicates that the reproductive capacity of fish stock has drastically declined which not only aggravates the trend of the decrease of fishery resources but also increases the proportion of low-grade catch.

The main reasons to reduce the fish stocks and catches may include habitat destruction by contamination of marine environment and climate change and ecological changes in fish species. In addition, due to the geographical characteristics of fishing grounds, joint management with adjacent nations has not been effec-

tively conducted.

Regarding the management aspect, traditional fisheries management policies had focused more on maintaining fishing orders and arbitrating among fisheries than recovering stocks. Management policies based on stock data and the strict management and control of fisheries activities had also been insufficiently implemented.

Particularly, the features of multi-species/multi-fisheries in coastal and offshore fisheries set limitations in developing and implementing management policies considering the characteristics of each fish species. Failure to effectively prevent over fishing of juvenile fishes due to mixed fishing is also considered to be one of the causes of the reduction and depletion of resources. (Lee, 2004).

Against these backdrops, the Korean government set fish stock rebuilding as a main objective of the fisheries policy. To effectively achieve this objective, the Korean government established the Fish Stock Rebuilding Plan (FSRP), combined with conventional management measures and stock enhancement programs, in 2005.

The purpose of this study is to introduce the processes and the contents of Korea's ecosystem-based FSRP and its fisheries management policy in detail. It also aims to reveal any current issues in the promotion of the FSRP and its fisheries management policy, and to propose an improvement plan to achieve effectiveness of the FSRP and its fisheries management policy.

This study examines the concept, objectives, operational plans and the FSRP and its fisheries management policy, and analyzes the biological and economic effects of FSRP. Using the analysis, some issues derived from the operation of the FSRP and suggestions for efficient management in the future were provided.

FSRP LEGISLATIVE POLICY AND SCIENCE FRAMEWORK

FSRP legislative and policy framework

Since Korea's fisheries law is complicated and fractionized into three Presidential decrees and 15 Ministerial ordinances, it is hard for fishermen to fully understand and follow the fisheries law. Moreover, some standards in the law that were set in the 1960s when fishery resources were abundant still apply. Some measures are even contradictory to current fishery resources management measures and fishery resource rebuilding plans.

In this context, the government established and announced the "Fisheries Resources Management Act" on April 22, 2009 to conduct comprehensive and systematic fisheries resource management and to establish and implement a fisheries resource recovery plan. The objectives of the Fisheries Resource Management Act are to strengthen research and assessment of fisheries, establish and implement fish stock rebuilding plans, and continuously implement resource management, including fisheries resource fish stock enhancement. The Act incorporates protection and management of resource parts from the conventional Fisheries Act and a resource creating part from the Promoting Nurturing Fisheries Act.

The characteristics of the Fisheries Resource Management Act are as follows:

1.) Research and assessment of fisheries resources shall be conducted every year
2.) A basic fisheries resource management plan shall be established every five years for the comprehensive and systematic recovery and management of fisheries resources
3.) Institutional grounds for self-regulated fisheries resource management, such as settlement of disputes, was established
4.) International rules, such as promoting international cooperation, sharing information on fisheries resource management, and using environmentally-friendly fishing methods and precautionary approaches

Key terminology of the Fisheries Resource Management Act is defined as below:

1.) "Fishery resources" means the marine plants and animals which are useful for national economy and people's living
2.) "Fishery resources management" means the acts to protect, recover, and create fishery resources
3.) "Total allowable catch" means the annual catch limit allowed for certain fish species.
4.) "Fish stock enhancement" means acts that artificially enhance fishery resources, including the creation of artificial reefs and seaweed forests which can improve reproduction of marine living organisms
5.) "Marine ranching" means a certain area where some equipment is placed to facilitate fishery resources

The Ministry for Food, Agriculture, Forest, and Fisheries (MIFAFF, 20005) created the Fishery Resources and Environ-ment Division to develop and implement comprehensive fish stock rebuilding plans.

In addition, the National Fisheries Research and Development Institute (NFRDI) established a Fishery Resource Recovery Team to con-duct scientific research and resource management and implement resource creation projects (Lee, 2008b).

Under the Fish Stock Rebuilding Plan (FSRP), participation of actual players (fishermen, academics, government, and researchers) is encouraged at all processes of development, implementation, and assessment of the FSRP. In addition, decisions for the development and implementation of the FSRP are made at the Science Committee (SC) and the Fishery Resource Management Committee (FRMC), which were newly organized for the FSRP.

FSRP scientific framework

In a specific ecosystem-based FSRP, the management and recovery of fishery resources are attempted by dividing them into recovery of target fish and management of target fish with consideration for stock condition by species of fish. That is, for fish whose stock has drastically decreased, a fish stock rebuilding plan is set up and promoted, while a management plan is set up and promoted for fish with low decreasing rates. Here, when TAC target species are key staples, intensive management is to be provided with the total allowable catch (TAC) management policy. In addition, the selection of species for stock rebuilding and the recovery target quantity are determined through a series of steps of understanding the condition of fishery and biological resources in offshore and coastal seas; examining applicable materials and recovery target fish; classifying fish into recovery target fish and management target fish; and setting the target quantity of recovery for each stage.

Except for a few species, in most cases information available to evaluate the state of fish stock by species is only the catch data by year. To evaluate the state of fish stock by using the catch data by species, according to the method used by Garibaldi and Caddy (2004), the three-year moving average of the fishery-related data was analyzed. Then, when the current level of catch was less than 20% of the maximum value of the moving average, it was categorized as a depleted resource. From the first analysis, the species of fish that decreased by 30% and lower were selected as recovery target species.

Meanwhile, since fish stock considerably decreased before the 1990s, the data from the first analysis could not properly reflect the state of stock by species, so the fluctuation trends of catch by species were analyzed to add more recovery target species. That is, with consideration for the characteristics in the fluctuation trends of catch, they were divided (π) increasing, (θ) stable, (ρ) fluctuating, (σ) decreasing after increasing, (τ) decreasing, (υ) low, and (ϖ) very low; and the species of fish in (τ), (υ), and (ϖ) were finally selected as recovery target species. Among the species excluded from recovery target species, the levels of fish stock that were (π) increasing, (θ) stable, and (ρ) fluctuating were selected as management target species.

Currently, for recovery target fish (sand fish, blue crab (swimming crab), octopus, Tokobushi Abalone, Skate Ray, Cod, Yellow Croaker, file fish, Korean flounder, Purplish Washington Clam), stock research and assessment are conducted and their stock amount and MSY are estimated. Based on this research and estimations, the recovery target for each stage and recovery period is set. (Kim, 2004a).

Research and assessment are carried out to determine fishery resources which need comprehensive and systematic management. Measures such as fish stock rebuilding plan, TAC, or designation of protected waters are implemented through research and assessment plans. For the systematic implementation and management of FSRPs, a Total Fishery Resources Information Database has been developed and operated. The Total Fishery Resources Information Database includes fishery resources information by ecological, habitat, and fishing activities. Based on the Database, an effective scientific research assessment system is built.

Currently, to build more effective scientific research and assessment systems for better development and management of the FSRP, the Korean Central government and local government share in the roles of research and assessment, considering the characteristics of each species and strengthening human resources on stock research and assessment Research and assessment models and manuals fully considering the characteristics of each species are developed. In addition, when stock assessment by species is conducted, ecological changes including climate change are taken into account. The stock assessment by species is provided as basic data for developing and implementing the FSRP.

FISH STOCK REBUILDING PLANS (FSRP)

In 2005, the Korean government established the basic plan for the FSRP and its fisheries management policies in order to overcome the limitations with the conventional fisheries management policies and to achieve an actual recovery of fishery resources within the EEZ since the UN Convention on the Law of the Sea and the Korea-Japan/Korea-China Fishing Agreements have come into effect.

The FSRP is a comprehensive plan to rebuild fish stock that is excessively caught to a target level within a certain period of time. More specifically, the policy aims to increase the level of fish stock from the current level to a target level within a rebuilding period, so it consists of a series of specific and scientific fish stock management programs including selecting the most effective fisheries management measure as well as complimenting any necessary fishery management supports.

Korea's FSRP has been established from a holistic approach at the national level and it also has adopted an ecosystem-based approach to fisheries management explicitly as a policy framework.

It was primarily aimed to achieve fish stock recovery by overcoming the limitations of the conventional fisheries management policy, so it is different from the conventional fisheries policy in many ways.

First, while the conventional fisheries management policy does not have a clear goal of stock rebuilding, the FSRP specifies the target fish stock recovery in policy.

Second, the conventional fisheries management policy was not implemented based on scientific research and evaluation on fishery resources. The FSRP specifies which type and what content of a fishery management measure will be used after analyzing the condition of fish

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stock by sea area and by type of fish, and establishing a clear stock rebuilding goal and rebuilding period with consideration of the characteristics of target resources.

Third, under the conventional fisheries management system, the policies were established on the initiative of the central government, restricting the participation of fishermen. However, the new FSRP is based on the premise of voluntary participation of fishermen, allowing fishermen to voluntarily participate in setting up and executing the plan as well as making them responsible for the outcome.

Fourth, in the application of the conventional fisheries management measures, any analysis before and after the application was absent so it was difficult to operate it with efficiency. But the FSRP requires an analysis of management measures by species, type of fisheries, and sea area before and after an operation, so that fisheries management measures can be utilized more effectively.

The overall objective of the FSRP and its fisheries management policy is to enhance the total fish stock to the level of 10 million tons [again, tonnes or tons?] by 2017, in order to maintain the stable catch limit of 1.3 million tons annually in offshore and coastal fisheries. It is expected that this aims to reach the optimum quantity of fishery resources that the ecosystem in Korea offshore and coastal seas can retain, to break the chain of a vicious cycle of resource exploitation and the aggravation of business conditions of fisheries, and to maintain a stable fishery production (MOMAF, 2004).

Under specific ecosystem-based FSRP, the stock condition, recovery target fish and management target fish were designated. For fish whose stock has drastically decreased, a fish stock rebuilding plan is set up and promoted, while a management plan is set up and promoted for fish with low decreasing rates. If it is a TAC target species, intensive management is provided with the TAC management. The selection of species of fish for stock rebuilding and the target quantity of recovery are determined following the steps of understanding the condition of fishery and biological resources in offshore and coastal seas; examining applicable materials and recovery target fish; classifying fish as recovery target fish and management target fish; and setting the target quantity of recovery for each stage.

It is impossible to establish and promote the FSRP for all recovery target and management target species in the current policy conditions with insufficient scientific research and review systems of fishery resources and a lack of fish stock management organizations in local governments. Therefore, including the stage to establish basic planning, the fish stock rebuilding plans are divided into short-term and long-term plans. That is, the creation of a foundation and the establishment of a system for the operation of the FSRP will first allow the mid-term goal to be achieved, and then the expansion and settlement in the long-term period can increase the effectiveness of the policy. Operational objectives and promotional strategies for each FSRP stage are: Stage 1 - mid-term and long-term basic planning (2005); Stage 2 - the establishment of fish stock recovery system through a pilot program of fish stock recovery (2006 - 2012); Stage 3 - the settlement of the fish stock recovery system through the expansion of the ecosystem based FSRP (2013-2017) (Table 1). Also, in order to reach the target volume, a pilot project, the reinforcement of fish stock research and evaluation by species, and pre- and post-management for fisheries management measures will be executed step by step. (Ryu, 2004)

The Korean government has traditionally managed fisheries and fish stock through technical measures such as closed time, closed area, mesh size regulation, and input control based on the licensing system of fishing vessels and fisheries. In addition to the technical regulations and fishing efforts control, the vessel buyback program has been implemented since 1994, and the output control is also used by adopting the total allowable catch (TAC) policy since 1999.

Besides these fisheries management measures, fish stock enhancement programs such as artificial reef (1971), fry releasing programs (1976), marine ranching program (2001), and seaweed forest program (2002) have also been launched in order to increase both fishery resources and fishing income for offshore and coastal fisheries.

Government-led fisheries management has shown some negative aspects, such as deepening fishermen's reliance on the government, weakening of ownership, over fishing of resources, and confusion in fishing orders. Limited human resources and budget has limited an effective response to such problems.

Accordingly, the Korean government introduced a new self-management system. Under this system, fishermen voluntarily make decisions on the management and use of resources in order to receive support from the government on fishery resource management, and to administer sustainable fishing through ownership awareness and the independence of fishermen. A fishermen-oriented and community-based fisheries management has been implemented in 63 self-fishing communities since February, 2001, and the number of participating communities had expanded to 579 as of 2007.

In community-based fisheries management, the fishing community is responsible for its own fishing management and adjusts fishing activities. If disputes occur between communities, industries or regions in promotion of community-based management fisheries, a self control conference is operated by the private to voluntarily resolve the problems through consultations and discussions. A public fishing village guidance serviceman is appointed for each participating community from the Fisheries Office to provide technical guidance and advice to self-management communities. Also, private consultants with diverse experiences in fishing industries provide 1:1 customized education to communities that either show poor progress or are newly participating in community-based fisheries management, inducing sustaina-

Table 1. FSRP operational plan by stage.

Stage	Operational objectives	Enforcement strategies
Stage 1 (2005)	Establishment of basic mid- and long-term FSRPs and institutional improvement	[Establishment of a master plan] Institutional improvement for implementing FSRP Establishment of annual mid- and long-term FSRP Enactment of new 'fisheries resource management act' Set up fish stock rebuilding teams to fully implement FSRPs Selection of species for pilot projects and establishment of FSRPs for 2006
Stage 2 (2006-2012)	Implementation of FSRP for species	[Mid-term Plan] Establishment of targets that can maintain a total catch at 1.2 million tons Implementation of pilot projects for seven species by 2007 Establishment and implementation of FSRPs for 20 species by 2012 Annual implementation of basic research including bio-ecological research
Stage 3 (2013-2017)	Settlement of FRSP-based fisheries management system	[Long-term Plan] Achievement of targets that can sustain total catch at 1.3 million tons Implementation of annual FSRPs for all recovery target species Transition from establishment of species-based FSRPs to ecosystem-based FSRPs Review and revision of FSRPs

bility by suggesting problems and alternatives for communities.

Under the new FSRP, unlike the former government-oriented fisheries management system, a joint management system is established where actual actors in fisheries can participate to establish, execute and evaluate basic plans. Accordingly, under the ecosystem-based FSRP, it is planned that roles and functions will be efficiently distributed among the central government, local governments, research institutes, and fishermen.

Furthermore, the Science Committee (SC) and the Fishery Resource Management Committee (FRMC) were newly organized for the joint participation and role assignments of those who are related to fisheries. The SC consists of experts from diverse areas (resources, ecology, statistics etc.) to establish and promote a recovery plan based on the various and collected information from different scientific areas, and it is in charge of making suggestions regarding measures needed for fish stock rebuilding based on the data from research and review from the scientific point of view. It is intended that the operation of the plan will be carried out by having four zones – East Sea, West Sea, South Sea and Jeju Island - and a committee will be made foreach sea zone.

The FRMC is in charge of an intensive management of recovery target species and it is composed of about 10 people, including government officials, academic scholars, and fishermen related to those species of fish. The head office is housed in MIFFAF, and the Federal Fishery Resource Management Committee (FFRMC) supervises commercial species and migratory species, while the Local Fishery Resource Management Committees (LFRMC) supervises the coastal sedentary species.

The NFRDI conducts scientific research on fish stock for recovery target species and makes suggestions, and then the FFRMC and LFRMC make action plans for fish stock rebuilding. Afterwards, the FFRMC and LFRMC read all suggestions made by participants from nongovernmental, governmental, and academic fields to determine effective fisheries management measures for fish stock rebuilding.

Then, the FRMC asks the central and local governments for approval of the FSRP. Upon approval, the FSRP can be pushed forward in full scale. The FFRMC and LFRMC and the SC annually review and evaluate the progress of the FSRP and recommend any revisions or supplementary items for individual policy.

In the past, fisheries management in Korea had the purposes of resolving disputes between fisheries, maintaining fishing order, and increasing the fishing income of fishermen according to multi-fisheries/multi-species characteristics. Accordingly, resource management also enforced measures for fishing effort for each fishery and technique restrictions instead of managing individual species separately. Artificial reef programs were actively implemented to increase the overall fishery resources of the coastal seas from the viewpoint of the overall ecosystem. In addition, commercially important species were specially managed and increased through the fry releasing program. (MOMAF, 2005)

However, interests on policies for the management and recovery of individual species has increased ever since the enforcement of plans to recover fishery resources, and such effort is characterized by emphasis on 'durability of fisheries' through the management of individual species in connection with conventional stock enhancement programs. That is, unlike other nations, recovery of fishery resources is not only promoted through direct restrictions (or entire suspension of fisheries for fast recovery of resources) on fishing activities. Instead, while

Table 2. Economic effectiveness by target species of FSRP Unit: M/T, US$ million.

Species	Catch (2004)	Catch after FSRP (M/T)				Recovered volume (Ave. annual)	Price ('08) (US$/kg)	Increase revenue
		2005	2006	2007	2008			
Sandfish	2,472	2,401	2,647	3,767	2,720	573	2.57	1.5
Blue crab	2,683	3,147	6,894	13,606	17,846	10,099	9.05	91.4
Octopus	7,023	7,658	7,397	6,625	7,879	277	15	4.2
Tokobushi abalone	19	66	54	62	102	54	27	1.4
Skate ray	259	255	392	375	1,343	444	6.3	2.8
Cod	2,641	4,272	6,810	7,533	5,397	3,939	3.6	14.1
Yellow croaker	17,570	15,272	21,428	34,221	33,199	12,046	2.9	34.8
File fish	1,267	1,055	1,071	2,998	2,631	966	6.3	6.1
Korean flounder	12,038	15,319	19,897	24,340	20,274	9466	5.3	50
Purplish Washington clam	4,564	3,801	2,650	2,639	2,672	0	3.1	0
Total	50,536	53,246	69,240	96,166	94,063	37,864		206.3

*Bule crab (Swimming crab).

maintaining fishing activities through restrictions on individual fishery resources based on ecological systems and fishery resources, the system allows effective and quick recovery of resources. As a result, suspension or contraction of fishing activities due to resource recovery can be minimized. Accordingly, fishing business can be maintained with relative stability while promoting resource recovery at the same time. (Lee, 2008a)

Another characteristic of the Korean ecosystem-based FSRP is that it is premised on voluntary participation of fishermen by connecting with community-based management fisheries. Self-management fisheries of Korea newly systemized the traditional management of fishing communities, focusing on fishing village communities. In this system, fishermen communities make their own decisions on managing and using available resources. Such community-based management fisheries can be linked with a fish stock rebuilding plan to actively reflect the opinions of fishermen in establishing the plans and to obtain active participation and cooperation of fishermen in management. In particular, it is advantageous in that the efficacy of the FSRP can be maximized through voluntary acceptance of restrictions for resource recovery and self control on unlawful fishing.

ECONOMIC AND SOCIAL ASPECTS OF THE FSRP

Economic aspects of the FSRP

It is difficult to clearly describe the effects of the FSRP conducted since 2006. Accordingly, the subject was limited to fisheries that had been selected as pilot projects for FSRPs for 2006 ~ 2007 to briefly analyze biological and economic benefits from the accomplishment of recovery objectives.

Ten FSRPs have been established until now and are being implemented, including sandfish, blue crab (swimming crab), octopus and tokobushi abalone in 2006, skate ray, cod and yellow croaker in 2007, and filefish, Korean flounder and purplish Washington clam in 2008. These species were selected according to the recovery target standards based on catch in 2004. Objective recovery amounts for each step were configured. Comparing the catches in 2004 and 2007, the amount was increased in most species. Though such increases in the catch cannot directly be stated as a result of performing fish stock recovery plans, they probably have resulted from control of fishing effort under the plan, protection of spawning grounds, and active stock enhancement programs (Table 2).

In addition, due to the limitations of available data on anticipated economic effects, the increase in fishing income from the FSRP was simply analyzed. Once the quantity of catch from 2004 is subtracted from the objective amount of catch for each year, the recovery amount during the period can be calculated. Once this amount is multiplied by the average market price, annual increase in fishing income for each species can be calculated. As a result of analysis, the total fishing income increase in 2008 is estimated to be 206.3 million USD (Lee, 2007).

Based on stock assessment for each species, bioeconomic modeling is used for analyzing economic impact changes and achieving target during the stock recovery period. In particular, the uncertainty of biological and economic factors is fully considered in analyzing the bioeconomic modeling. It is used for selecting effective stock rebuilding measures on the basis of impact assessment for various fishery management measures.

Social aspects of the FSRP

One of features of Korea's fish stock rebuilding plan (FSRP) is the encouragement of community-based self-regulation fishery. The community-based self regulation fishery is improving awareness and understanding for

FSRP, better reflecting fishermen's ideas and opinions and leading active participation and cooperation of fishermen in implementing FSRP. Through active participation and self regulation of illegal fisheries from fishermen, the effectiveness of the FSRP is maximized.

For example, when sandfish was selected as a target species under the FSRP, to induce active and voluntary participation of fishermen and maximize the effectiveness of the FSRP, an agreement between fishermen organizations and fishery resource management committees was concluded in connection to community-based management associations. Voluntary agreements by fishermen were implemented on the amount of fishing gear by vessel, limitation on trip days of fishing, and appointment of spawning protection regions. Ways to promote active participation of fishermen on the recommendations are discussed at the science committee. As a result, various fisheries restrictions are being observed well and the cases of unlawful fishing have been greatly reduced.

The FSRP of Korea presumes voluntary participation of fishermen by connecting with community-based management fisheries by fishermen organizations. Through voluntary participation, fishermen are voluntarily accepting the measures to manage and control the fishing resources, bringing satisfactory results. However, strengthened restrictions on fisheries with the development of the FSRP may cause losses in fishing income during the recovery periods and inflict limitations on recommending active and voluntary participation by fishermen.

Accordingly, measures to support fishermen through the stabilization of fishing business during such recovery periods are being considered in order to induce active participation (for example, support for reduction in fishing effort, such as limitation on the number of fishing days and suspension system, improvement of fishing grounds for selective fishing of small sized fishes and avoidance of mixed fishing, aid for expenses on disposal of fishing gear, and a support system for the training of fishermen) (Kim, 2004b).

Under community-based self regulation fisheries, consultant experts on fisheries who have in-depth knowledge and experience regarding fisheries, as well as local governments, provide excellent education and consultations to fishermen. Also, as a management and operational system for each FSRP, a Fishery Resource Management Committee was set up. The Committee has made efforts to improve fishermen's awareness and to provide assistance. In addition, the Committee has strengthened public relations on fish stock rebuilding.

Some challenges of the FSRP

As described above, the FSRP of Korea has not been in operation for long and therefore is accompanied by difficulties in judging the results. However, the amount of resources and catch of target species have so far been increasing with management by the science committee and regional fishery resource management committees, voluntary observance of recovery measures by fishermen, supplementation of conventional fishery management measures, and fish stock enhancement programs. However, there are several challenges in the enforcement of FSRP pilot projects, and such challenges can be summarized as follows.

First, while diverse data on the causes of reduction and depletion of fishery resources must be collected and effective plans must be established based on such data, the lack of available data brings limitations in the establishment of plans to maximize resource recovery. In addition, the number of species that can be evaluated is limited, resulting in limitations on the expansion of plans based on evaluation results of resource amounts. Accordingly, investigation and data collection on resources, environment, ecology and production must continuously be expanded to more accurately and comprehensively examine the various causes of reduction and depletion of fishery resources.

Second, properly functioning policy measures must be selected and utilized for actual recovery of resources. Particularly in the recovery of fishery resources, though direct restrictions on fishing activities to lower fishing pressure are necessary, policy measures that improve marine environment and reduce contamination of fishing grounds must accompany these restrictions. The current FSRP emphasizes policies that reduce fishing pressure and increase resources; they tend to neglect reclamation projects, ocean bottom sand gathering businesses, and waste (garbage) disposal in the seas that can contaminate coastal fishing grounds. Although the departments that enforce such matters differ, related enforcement departments must mutually cooperate to maximize the efficacy of resource recovery plans.

Third, as indicated in limitations of conventional fisheries management, coastal fisheries of Korea show incomplete fulfillment of the FSRP on individual species due to multi-species/multi-fisheries characteristics. Accordingly, the effects of ecosystem-based FSRPs for individual species and other related species must also be taken into consideration. Furthermore, to accomplish recovery of overall fishery resources, an FSRP must gradually be established. Means to systematically manage related multi-fisheries must also be looked for.

Fourth, as in the case introduced earlier, the FSRP of Korea presumes voluntary participation of fishermen by connecting with community-based management fisheries by fishermen organizations. As a result, fishermen are voluntarily accepting the measures to manage and control the fishing resources, bringing satisfactory results. However, strengthened restrictions on fisheries with the development of the FSRP may cause losses in fishing income during the recovery periods and cause limitations on recommending active and voluntary participation by fishermen. Accordingly, measures to support fishermen

through the stabilization of fishing business during such recovery periods must be considered in order to induce active participation (for example, support for reduction in fishing effort such as limitations on the number of fishing days and suspension system, improvement of fishing grounds for selective fishing of small-sized fishes and avoidance of mixed fishing, aid for expenses on disposal of fishing gears, and a support system for the training of fishermen).

Fifth, major coastal and offshore species of Korea are jointly utilized in the EEZ of the East Sea, West Sea and South Sea by Korea, China and Japan. Therefore, operation of a FSRP only by Korea cannot obtain complete efficacy in resource recovery. A joint regional fisheries management system between Korea, China and Japan must be established in the future to mutually cooperate on a large marine FSRP between adjacent nations.

Conclusion

The newly established FSRP and its fisheries management policy are meaningful because they realize the limitations of the conventional fisheries management policy and change the policy focus by shifting the objective of fisheries management policy from the maintenance of fishery order or fishery adjustment to fish stock recovery. In addition, the establishment of a FSRP that can more effectively and quickly recover the fishery resources through controlling individual resources based on the creation of an ecological system through traditional stock enhancement programs is also meaningful. Furthermore, preparation of a new management system for ecosystem-based recovery of fishery resources and the promotion of participation of fishermen by connecting with traditional self-management fisheries can also be considered as important. This new fisheries management policy could satisfy international recommendations including the 1995 FAO Code of Conduct for Responsible Fisheries, so a prospect is that the policy could make a strong contribution to the management and rebuilding of domestic fish stock.

The FSRP is showing an increase in amount of catch and corresponding economic benefits through pilot projects. However, it has yet to improve many aspects, including a system of research and evaluation of fish stock, scientific analysis of the effects of the fisheries management measures, a management system involving active participations of fishermen, and the establishment of a fishermen support system. Also, there are many who voice their concerns on whether the fixed mid-term and long-term target numbers can actually be achieved.

Instead of making a hasty conclusion regarding of the FSRP and its fisheries management system, if we can address these problems to strengthen the policy, the sustainable and stabilized development of fisheries, which actively utilizes the characteristics of fish stock, can be promoted. Also, in order to achieve an expected success in practical stock rebuilding, confining the policy development for the FSRP to Korea may present limitations due to particular characteristics of fishery resources. Thus, it is important to continue this endeavor for fish stock recovery with adjacent countries like China and Japan. Japan in particular has implemented the FSRP since 2001, so if a FSRP is established and effectively implemented jointly by Korea and Japan for fishery resources migrating between the two countries, the effects of an effort in fish stock recovery in offshore and coastal seas around Korea could be maximized. Also, while the current FSRP is operated by species, if the FSRP can be gradually expanded to encompass the whole ecosystem, this FSRP may more effectively manage and rebuild fish stock for all species of fish in offshore and coastal waters surrounding Korea.

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