

CULTURED MARINE FOREST AS A KEY CONCEPT FOR RESPONSIBLE FISHERIES

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ABSTRACT

Human beings are now recognizing that fish are no longer free gifts from the nature and we have to manage it wisely. The current management schemes are more or less based on the allocation of fish by individuals or communities through rules and regulations, resulting in illegal fishing, high MCS (Monitoring, Control and Surveillance) cost, high wastes including discards and mortalities other than landings, depletion of resources, environmental degradation and corruption of rural communities. To take advantage of natural resources of vast seas, new responsible fisheries management schemes must be based on fare cost and benefits sharing by fishermen, resulting in prosperities of rural communities and a large contribution to the society. Cultured marine forest has resulted in a huge increase of fish production in China. In Japan, similar attempts have been made recently, learning from the past resource enhancement experiences in both China and Japan. This paper reviews the current attempts in Japan and discuss the future of such activities.

Keywords: resource enhancement, responsible fisheries, marine forest, China, Japan

INTRODUCTION

The UNCLOS III has impacted greatly on the use of sea. Coastal states were given the unparalleled opportunity to show the world how protein and recreational resources of the sea can be developed fully without risk of depletion. This is a difficult task and weighty responsibility (Matsuda, 1982). Approaches taken to fisheries management include new approaches such as precautionary approach, preservationist approach, protection of biodiversity, ecosystem integrity, and privatization of property rights in fisheries as well as conventional ones such as zoning, input controls, and mono-species approaches. Two decades of innovation resulted in frustration (Scheiber 2001). Fisheries are more complex and dynamic than it was thought. Although fisheries have the longest history in our economic activities, it is still a frontier industry dealing with aquatic lives. Unlike land-based industrial objects, fisheries objects as aquatic species have characteristics of insensibility in hydrosphere, renewable resources as a common property, wide exposure to environmental pollution and destruction by development, high natural dependency and catch/price uncertainty, perishable catch/products and market limitation, and poor knowledge on scientific base. Thus, to value the fisheries just from a monetary based short-term interest is not enough. Sustainable fisheries management should be rational not only from short-term prospect (0-5 years), but also from medium (6-30 years) and longer-term (more than 30 years affecting future generations) (Matsuda 2002). This paper discusses such sustainable fisheries management.

WHAT IS FISHERIES MANAGEMENT?

Without government intervention, fisheries could be sustained in such a way that fishermen move to one species to another according to changing resource and market situations. Under this system, there needs

no administrative cost for research, monitoring, control, and surveillance. Fishermen behave rationally and it is free to enter into or exit from fisheries based on their own decision.

If governments or other entities commit themselves in fisheries management, productivities of seas must be increased drastically as compared with natural productivity as seen in agricultural experience which increased productivity drastically when they changed from the hunting age to the farming age.

However, current world fisheries production is decreasing with heavy fisheries management costs by both governments as well as individuals concerned. Something is definitely wrong in fisheries. Thus, assumptions behind fisheries management should be reexamined. These assumptions include 1) fisheries research, education and management are government responsibility, 2) MCS as well as making fisheries rules and regulations are government's job, 3) every institution is properly functioning, 4) scientific base is easily strengthened and uncertainty is easily reduced, 5) resources are free, 6) technology is more important than management, and 7) mismanagement can be eliminated without transparency.

RESOURCE ENHANCEMENT IN CHINA

In China, kelp has been very important because it contains a lot of iodine and is an important medicine for iodine deficiency disease which is regarded as a local disease in inland areas. However, kelp is not native so that China imported it from Japan. In 1934, Mr. Yoshiro Otsuki stationed in Tairen and invented a kelp culture method and practiced. It was successful and he promoted it. After World War II, the kelp import from Japan was stopped and Mr. Otsuki continued to guide how to culture kelp in Chingtao, China and returned home in 1953. As a result, China developed their own kelp culture program based on Talien and Chingtao (Sakai, 2001).

In 1978, China took an open policy so-called "*Kaikaku Kaiho*" and promoted privatization in economic activities. This triggered fisheries development in China (Pao, 2004). The Fisheries Resources Conservation and Enhancement Act was enacted in 1979 and seaweed culture including kelp culture became a national program. In early 1980s, about 200 people are working on seaweeds in Chintao's scientific communities alone. Recognitions of roles of seaweeds production was widened from just for medical use to water purification by absorbing nitrogen and phosphates, resource enhancement by providing spawning and nursing grounds, and creating opportunities for income and employment as well as food and feed sources. Seaweed production increased by 4.8 times from 250,400 mt (dry weight) in 1979 to 1,194,400 mt (dry weight) in 1999. About the 95% of these seaweeds are produced in the coasts of Bo Hai, Yellow Sea, and East China Sea. At present, seaweeds culture grounds stretch over 1,300 km in Chinese coasts from Tairen to Fukken Provinces. From 1979 to 1999, marine capture fisheries production including fish, crustacean, and shells from Bo Hai, Yellow Sea, and East China Sea excluding seaweeds production increased by 4.1 times from 2,560,710 mt to 10,558,120 mt (Chinese Government, 2001).

Chinese export structure changed in 1984. Before 1984, major species exported are shrimp. However, after that year fresh fish began to be included in the exported commodities. Fisheries exports increased from 115,200 mt in 1984 to 1,534,000 mt in 2000 (Chinese Government, 2001). Export items exceed 120 at moment. Major fishing ports in western Japan such as Nagasaki, Fukuoka, and Shimonoseki are now playing a role of leading landing ports of fish imports from China.

Bo Hai, Yellow Sea and East China Sea used to be a good fishing grounds of Japanese fishermen, in particular during the 1950s and the 1960s. However, their production never exceeded 1 million mt, but Chinese fishermen now catch over 10 million mt of fish a year there, even since sardine catch decreased

drastically in the 1990s. It is difficult to find other reasons for this high catch in Chinese coasts except for marine forest consisting of massively cultured seaweeds dominated by kelp along the coasts.

RESOURCE ENHANCEMENT IN JAPAN

Historical Background of the Fisheries System in Japan

The first legal document dealing with Fisheries in Japan occurs as a miscellaneous part of the *taiho-ritsuryo* (Code of Conduct), written in A.D. 701. This concerns the public and private benefits to be derived from mountains, rivers, bushes, and marshes (Hamamoto, 1988). Although partial control over waters by such local authorities as lords and shrines existed, the principle of freedom of fishing and other uses of sea and rivers is rooted to this code of conduct. During the feudal era or Edo Period (1603-1868), all sectors of Japanese society were strictly controlled and carefully organized according to a rigidly hierarchical system. Fishing villages were legally formed, and most present-day fisheries and the original forms of all current fishery rights were also in existence at that time.

Although each local lord owned the adjacent coastal waters and controlled the fisheries therein, local administration was also controlled by the Code of Conduct of the Tokugawa Shogunate, enacted in 1615. In this code, three basic principles of local fisheries administration are identified. These are 1) the exclusive fishing right area for fishing villages and one or several people extended seaward from the coast to about 500m; 2) a straight seaward extension of the village boundaries; and 3) shared fishing by residents of two or more fiefdoms in the offshore fishing grounds.

Although centralization of the administrative system was highly developed during the Edo-era, the political interest of Tokugawa Shogunate was to keep local loads as poor as possible to prevent any violent change in government. As a result, heavy taxes in the forms of rice and other local products such as salt and fish were levied, resulting in promotion of local industries by local loads. At the same time, no one helps solving local disasters except for themselves. This resulted in the practices of the ecosystem management which considers all aspects of mountains, waters, lands, seas and people in an integrated way at the local level all over Japan to reduce any disasters within the communities, villages, towns, and cities. They realized a recycled society based on organic farming. Edo, now Tokyo, with one million people at that time was the cleanest big city in the world at that time.

During the feudal time, planting trees by rivers, lakes, and seas by fishermen and villagers was a common practice to enhance fisheries resources and/or to prevent damages from salty winds from the sea. However, the Meiji government started in 1868 preferred to adopt western civilization based on technology, specialization, and capitalism. As a result, compartmentalization in administration and industrial management was developed. This trend and the centralization of administrative system were further promoted after World War II by a subsidy system. Constructions of Fisheries infrastructure such as fishing ports, water breaks, fishing grounds development, coastal fisheries structural improvement, hatcheries, educational and research facilities to promote fisheries has received a huge amount of fisheries budgets amounting to over US \$ 60 billion from 1962 to present. Those provided many temporary jobs in rural communities, but failed to vitalize fisheries in the long-run.

Salmon Marine Ranching

Historically chum salmon have been important food resource in Japan. Efforts to conserve salmon are recorded before 1749 such as legal introduction of closed fishing periods during spawning season at the Tsugaruishi River in Iwate Prefecture. Salmon were also protected in the Miomote River in Niigata

Prefecture, the Gekko River in Yamagata Prefecture, and the Naka River in Ibaragi/Saitama/Tochigi Prefectures (Atkinson, 1976)

In 1875, Minsei Sekizawa was dispatched to America to learn techniques pertaining to artificial fertilization and marine ranching of salmon. The first national salmon hatchery was established in Tokyo in 1876 and the second one in Sapporo in 1877. However, these attempts were not successful. It was not until 1888 that the first permanent hatchery was built at Chitose, Hokkaido, following closely the design and related information obtained by Kazutaka Ito after several months of study at the U.S. Federal Hatchery at Bucksport, Maine, and subsequent visits to the Columbia River, Washington in the U.S.A. and Fraser River in Canada. According to Kobayashi (1976), 50 salmon hatcheries were operating in the early 1930s.

Although there was no encouragement for salmon marine ranching by the General Headquarters of the Allied Occupation Administration, the political climate has changed after Japan's independence in 1952. The Fisheries Resource Conservation Law of 1952 enabled the national government to reinstate the salmon ranching program. A national subsidy for salmon marine ranching began to be provided in 1956 and the Fisheries Department of Hokkaido Government began her own salmon ranching program in 1967. The test of fed fingerling release started in 1962 in Hokkaido and the return rate was drastically improved from 1% to 2-3% (Matsuda, 1991). As a whole, 247 salmon hatcheries, including 89 government facilities are presently operating in Japan. More than 2 billion fingerlings are annually released and more than 50 million fish are caught.

Coastal Species Marine Ranching

In 1962, the Seto Inland Sea Marine Ranching Center project started at Yashima, Kagawa Prefecture and Hakatajima, Ehime Prefecture. Such centers were also built at Kamiura, Oita Prefecture in 1963, and Tamano, Okayama Prefecture and Shibushi, Kagoshima Prefecture in 1965. Resource enhancement so-called "*Saibai Gyogyo*" was attempted by massive artificial fingerling production, and release of various important commercial species such as "Kuruma" shrimp, red sea bream, blue crab and puffer fish. The objectives of the project were to increase production of important commercial species, to encourage fishermen to become involved in marine ranching activities, and to foster the philosophy of active involvement in coastal resource enhancement. By 1990, 16 national and 43 prefectural and local marine ranching centers involved in the release of 80 coastal species with national supports to infrastructure such as the Artificial Reef Construction Projects and Coastal Fishing Ground Development Project, including Seaweed Beds Rehabilitation projects so-called "*Moba-Zosei*"..

Design principles of marine ranching as a resource enhancement are as follows: 1) to prevent high mortality at critical stages in the early life cycle of important commercial species; 2) to reduce negative impacts on environment as compared to aquaculture; and 3) to manage fisheries with resource enhancement by fishermen themselves. These ideas were well received by the public, but the effects have not been clear yet.

Questions Raised on Conventional Marine Ranching and Seaweed Beds Rehabilitation Projects

Both marine ranching and seaweed bed rehabilitation projects are regarded as government-initiated public project. As a tool for fisheries resource enhancement, Japanese government selected mono-species marine ranching approach and seaweed beds rehabilitation project based on native perennial species and all budgets were used to release target numbers of each species and to throw artificial reefs into the sea without commitment in evaluation of the effects and improvement of the approach. In fact, both are

difficult subjects and people have been limited. There was no room for people concerned to think of re-evaluation of the project. What they could do was the defense of their jobs.

Questions raised on such marine ranching and seaweed beds rehabilitation projects include the following:

- 1) Why these projects are handled independently? This is an administrative jurisdictional problem and no one can help.
- 2) Why does public investment prioritize concrete structure? Durability is very important as a public investment. Thus, the concrete structure has higher priority than soft structure such as ropes.
- 3) Have you checked the effects of the projects? Yes, we are reporting every year.
- 4) Why don't you work on kelp culture in Kagoshima? Kelp is an exotic species and we are afraid of negative environmental impacts of culturing it in Kagoshima such as becoming the dominant species or a toxic kelp. I have never heard such negative impacts in China with over 70 years of kelp culture. Kelp is also an exotic species in China. Why don't you research such impacts of kelp culture? We don't have time.
- 5) What is the difference between seaweed culture and *Moba-Zosei* (seaweed bed rehabilitation or marine forest construction) /*Saibai-Gyogyo* (Sea Farming or Marine Ranching)? Seaweed culture is the private interest while *Moba-Zosei/Saibai-Gyogyo* is the public interest.

During the 1990s after the bubble economy of the 1980s, Japan faced the unprecedented depression which still continue more than 10 years with low interest rates of less than 1% while commissions of various business have remained about 5%. Although there is no inflationary trend, people save money at home, and the economy is in the adjustment. Corruptions and mismanagement associated with authorities have been identified. The political party in power has tried to change the constitution since the Japanese independence in 1952. This trend has strengthened after September 11, 2002 and costs for risk management has increased. Proportions of interest payment in national as well as local government budgets have been increasing and an annuity problem became obvious because a fewer youngsters have to pay for a large number of elders. Authorities and establishments such as governments, banks, big companies, and parents lost confidence just like after World War II.

Both the marine ranching project and seaweed bed rehabilitation project are no exception and subject to the inspection. Although they spent a huge amount of tax money, the resource enhancement effect is not clear as a whole except for salmon, scallop, and red sea bream statistically. As a result, the project is forced to change from the conventional way to a more integrated approach. However, changes are slow because of the conservatism among people concerned.

Apart from government approaches, private approaches have been paid much attention in regard to fisheries resource enhancement.

NEW APPROACHES IN RESOURCE ENHANCEMENT IN JAPAN

Fall of Fisheries in Japan

After World War II, Japanese fisheries like coal mining was the leading sector among industries but those fishing industries in Japan have faced serious problems, in particular, after the 1970s. These are attributable to 1) degradation of coastal environment due to the government policy of industrial development and high economic growth during the 1960s; oil crises in the 1970s; development of the United Nations Conference on the Law of the Sea (UNCLOS III) and the succeeding 200 mile regime at sea; 3) increasing costs; 4) trade liberalization after the 1970s; 5) decrease in catch of Alaskan Pollack in the late 1970s and sardine in the 1990s, moratorium of antarctic whaling in 1982, and the phase-out of

Japanese North Pacific fisheries in 1988. Japanese catch decreased from over 12 million metric tons (mt) in 1988 to 5.9 million mt in 2002. Coastal capture fisheries production decreased from 2 million mt in 1945 when they fished with non-powered boats to 1.6 million mt in 2002 with highly sophisticated powered boats. Fisheries are no longer attractive jobs for youngsters. As a result, numbers of fishermen decreased from 3 million in Edo era to 790,000 in 1953 and to 238,000 in 2003. Fisheries are now regarded as a low paid job and the representative of 3K(Dirty, Hard, and Risky) industries among youngsters. As a result, this number is further expected to decrease up to 150,000 in the future.

Nature of the Crisis

The first problem is the optimism for the future within the fisheries sector. Fisheries in Japan are in crisis in terms that people concerned are not committing themselves in respective positions, sabotaging the jobs and optimistic about the future. No one believes that there will be no political power when the number of fishermen decreased to 150,000. This means no Fishery Agency at the national level and no Fisheries Section at Prefecture and Local Municipality levels. There will be no higher educational institutions specialized in fisheries science and technology. Fisheries high schools, colleges and universities have tended to change their names, not including the word “Fisheries” because the name of fisheries is no longer attracts youngsters. As a result, fisheries educational institutions have tended to change from industry-oriented institutions to science-oriented institutions which the nation is no longer afford.

The second problem is lack of public support. Fishermen based on local communities are the representative of a few professions to live with marine environment and know the environment surrounding them most. They are only people who internalize external economies at sea through harvest. They also have developed their own autonomy and excluded outsiders from the use of the seas in the past. Along with the decline of fishing industries, ironically, important contributions of fisheries to the societies have been forgotten by general public due to their ignorance on characteristics of fisheries and such contributions, and difficulties with wisely utilizing sea because they are custom to live on land. Characteristics of fisheries include an oldest but frontier industry which bridges between land and sea with the highest uncertainty due to the fact that they are targeting aquatic lives which are complex and difficult to sense. In addition, their fishing grounds and target species are common property in nature and difficult to manage. Further, fisheries contributions to the societies include 1) quality food supply, 2) solving environmental problems, 3) income and employment opportunities in very rural areas, 4) leisure and educational opportunities, 5) succession of traditional culture and 6) national security.

The third problem is misunderstandings by the so-called environmental activists. Environmental movement against fisheries is another issue because fisheries is the most environmentally sound recycle-based industry and the mutual cooperation between environmentalists and fishermen is essential to save this earth dominated by the current civilization with mass production and mass consumption if so-called environmentalists really wish to concern about marine environment. There is no industry except for fisheries and guano industries to recover nutrients from the aquatic environment, though fisheries recover only 7% of nutrients at sea from land-based sources annually. Without fisheries, we are forced to face over-eutrophication or marine pollution. Fishermen also play an important role as an environmental monitor. There was no Minamata Disease incident if people had listened to the fishermen’ warning at the beginning (Matsuda, 1995, and Matsuda, Tai and Kusairi, 2002). This is not the time to fight each other.

Responsible Fisheries

Fish are no longer free gifts from the nature and we have to manage it wisely. The current management schemes are more or less based on the allocation of fish by individuals or communities through rules and regulations, resulting in illegal fishing, high MCS cost, high wastes including discards and mortalities other than landings, depletion of resources, environmental degradation and corruption of rural

communities. To take advantage of natural resources of vast seas, new responsible fisheries management schemes must be based on fare cost and benefits sharing by fishermen, resulting in prosperities of rural communities and a large contribution to the society.

In Japan, we could find many successful community-based fisheries management cases. Scallop marine ranching fisheries in Hokkaido such as Sarufutsu, Saroma, Tokoro, and Notsuke are some of them.

In the 1960s, these communities are hamlets with part-time fishermen. Mr. Ando, a Cooperative Movement leader traveled those hamlets frequently and discussed the issues at Fisheries Cooperative Associations (FCAs) and helped them. "One for all and all for one" is the basic philosophy of FCAs. Mr. Ando encouraged savings among them up to 10 % of needs at the beginning and the amount equivalent to afford livings of 3 bad years later. They adopted the pooled system as well as salaried system, increased propensity to save, took advantage of comparative advantages, promoted rationalization, adopted a rotation crop system for scallop marine ranching, practiced the research on resource assessment in the marine ranching grounds and planned production, and utilized FCA's network on credit, insurance, supply, and marketing.

After a long trial and error, those FCAs became an integral part of community development and the pooled system with fare cost and benefits sharing was adopted. With both administrative and economic functions, these FCAs have contributed to the society in various ways by: reduction of administrative fisheries management cost, creation of employment and economic opportunities for rural development, promotion of environmental security, education and guidance to local people, research and resource enhancement, and national security. (Matsuda, 2002)

Regardless of rainy days in Japanese fisheries as a whole, these cases are quite different. Fishing households have a saving of more than US\$1 million and a member of respective FCA earns disposable income of about US\$200,000 a year. They do neither have any successor's problem nor bride's problem. Many college graduates are now working with these FCAs and they have the research capability to assess the fisheries resources by themselves. Along Japan's coast, all fishing villages have similar opportunities if they wisely manage fisheries.

Fisheries must have a balance between community-based fisheries and industrial fisheries based on capital. In other word, industrial fisheries are short-lived while community-based fisheries are permanent as far as the community lasts. This is because capital moves freely from fisheries to land-based economic activities while community-based fisheries cannot move to others easily.

Thus, responsible community-based fisheries with fare cost and benefits sharing as an integral part of the community development should have higher priority in rural communities limited by alternative economic opportunities. Involvement in resource enhancement is a part of good fare cost sharing system among fishermen, fostering the sense of responsible fisheries. This concept has been widely accepted by fishermen all over Japan. Now, fishermen and his families have planted trees in mountains again.

Cultured Marine Forest as a Key Concept for Responsible Fisheries

Seaweeds, sea grasses, marshes, coral reefs and mangrove are regarded as spawning and nursing grounds for many aquatic lives. However, areas covered by these plants have been declined due to coastal development. This has threatened the fisheries resources. However, the cultured marine forest based on

seaweed culture stretching for 1,300 km from Tairen to Fukken Province, has resulted in a huge increase of fish production in China. In Japan, similar attempts have been made recently.

Unlike conventional resource enhancement programs like marine ranching, the cultured marine forest is not mono-species approach, but a bio-mass approach. It creates a new ecosystem enhancing marine environment by absorbing carbon dioxide and nutrients such as nitrogen and phosphate, and supply oxygen as well as providing spawning and nursing grounds for marine organisms. These ecosystems are developed in much wider areas than those areas where natural seaweeds exist. If each capture fisherman involves in this kind of activity, he contributes to the responsible fisheries form resource enhancement point of view and his catch will be justified. Capture fisheries without considering actual resource enhancement will no longer justified under the resource sharing problem.

Unlike conventional rehabilitation of seaweed beds, cultured marine forest has the following characteristics: 1) management body is fishermen or FCA and takes care of a cycle of work consisting of seed management, planting and harvesting every year, 2) it contributes to improvement of water quality, 3) cultured kelp will not dominate in the environment because they are living less than a year, 4) it complements functions of both conventional marine ranching and seaweed beds rehabilitation activities, and 5) it enhances community activities.

In 1994, an experiment on cultured marine forest using kelp (*Laminaria* sp.) started at Azumacho FCA in Kagoshima. It was successful but we could not get cooperation from Kagoshima Prefecture because kelp is northern species and many marine botanists were afraid of introduction of such exotic species to Kagoshima. However, rationales for cultured marine forest using kelp in Japan are as follows: 1) capability to absorb nutrients resulting in prevention of eutrophication, red tide, blue tide, and withered seashore, 2) resource enhancement effects of cultured kelp in China and complement to conventional marine forest projects emphasizing perennial local algae; 3) controllability of mal-impacts if any due to established kelp culture technology and repetition of a short cycle activity less than a year; 4) easy culture method and handling because of large seaweeds; and 5) wide utilization including feed, food, drug, fertilizer, and industrial materials.

Beginning at Azuma-cho FCA in 1994, this activity has evolved to extend similar experiments in Kumamoto, Nagasaki, Ehime, Shimane, Hiroshima, Kanagawa, Chiba, Toyama and Okinawa Prefectures as well as other parts of Kagoshima Prefecture. Although cases are still rather small and it is difficult to estimate the resource enhancement impact. All these activities associated with the formation of the new non-profit organization (NPO) Marine Forest Promotion Association in 2002.

A 10 Year Project Proposal for Fisheries Resource Enhancement in Japan

This is a proposal prepared by the Marine Forest Promotion Association promoting cultured marine forest all over Japan at moment. This proposal, consisting of “Marine Forest Project” and “Post-harvest Project”, aims at doubling the coastal fisheries production in Japan and adding US\$10 billion new incomes per year to coastal fisheries in 10 years. Total cost for the projects is about US\$1.5 billion (Sakai and Matsuda, 2001).

Taking advantage of existing network of FCAs with their members and municipalities concerned, a new net work connecting Seas, Mountains, Rivers, Forests, Villages, Towns, and Cities toward a recycled society will be developed.

The Marine Forest Project consists of two sub-projects: Kelp Seeding Yarn 100 m Movement and a Large Scale Marine Forest Project. At this preparatory stage, Kelp Seeding Yarn 100 m Movement is the dominant form of the project. The Association instructs how to culture kelp and provide 100 m seeding

yarn to fishermen at about US\$180. The 100m seeding yarn has about 100,000 seeds. If one seed makes 200 g of kelp, the 100 m seeding yarn will result in 20,000 kg or 20 mt of kelp. However, usually they harvest 5-10 tons (wet) from 100m seeding yarn in 6 months from December to May. In doing this, we are developing a network among fishermen and educating citizens about the recycled society including fisheries. These small scale culture are handled by individuals using empty fish culture cage, set-net, and ropes just during winter and spring seasons. Complementing kelp by other species such as sea lettuce (*Ulva sp.*) and sea mustard (*Undaria sp.*), fishermen culture seaweed all year round, and involvement of 100,000 units makes production of 1-2 million mt a year possible in ten years. This is more than current seaweed production in Japan and these definitely affect both capture fisheries as well as aquaculture in a better way from both environmental and economic points of view.

The Large Scale Marine Forest Project is a proposal for public investment at sea. This is an idea to harvest 10,000mt of kelp in the outer zone of Common Fishery Right Area by each FCA of 500 FCAs who are interested and commit themselves in this project. Submergible marine forest facilities using tuna long line and set net technologies will be adopted because of economic efficiency including avoidance of risk associated with natural hazards such as Typhoon. This creates a new harvest of 5 million mt of kelp every year. The first 5 years of the project devote to research and dissemination of findings including the impact assessment of massive kelp culture and physical strength of the facilities, as well as construction of demonstration facilities and seed yarn production facilities using 10 % of total budget. Based on the result, the second 5 years will concentrate continuation of research and dissemination of the findings as well as an implementation of the revised plan using the rest of total budget. This will add another 5 million mt of kelp harvest per year in 10 years. Together with the Kelp Seeding Yarn 100m Movement, production of 6-7 million mt of seaweeds will be realized. These man-made marine forest will definitely has a function of spawning and nursing grounds, resulting in double of coastal fisheries production together with conventional projects such as marine ranching and reconstruction of seaweed beds.

The Post-Harvest Project is also very important to develop an economic autonomy of the project. For the Kelp Seeding Yarn 100 m Movement is for both production and consumption at the same region. For aquaculturists, kelp will be a good feed for commercial herbivorous species such as abalone, sea urchin, top shells and leather fish; a good food as salad, healthy food, additives to processed food and ice cream like alginic acid, increasing substance in quantity for processed food such as noodle, physiological activation substance; medicines for iodine deficiency and cancer; fertilizers to increase sweetness of melons and to promote conversion of Nitrogen in the form of NO_x to protein; catalysts to increase decomposition bacteria for compost; and industrial additives for dying, lubricant, and beauty aids.

Products from the Large Scale Marine Forest Project are used for industrial use such as a bio-mass energy source. Five million mt of kelp also contribute to reduction of Carbon Dioxide equivalent to 250,000 mt a year. These incomes are definitely contribute to economic autonomy of the project and to the local communities, providing opportunities for employment and incomes. Further, this will be strengthened further if these projects enhanced fisheries resources in front of the local communities.

Possible sources for the costs for this project include 1) 5% tax of imported fish and fish products for fisheries resource enhancement for next 10 years; 2) environmental tax for carbon dioxide reduction for 250,000 mt (Carbon in dry weight) a year; 3) transfer of budgets for existing fisheries infrastructure buildings; 4) transfer of budgets of non-fisheries public works associated with energy development which destroyed spawning and nursing grounds and heavily influenced fisheries resource depletion; 5) transfer of fisheries compensation money for reclamation of coastal seas; and 6) 1% income tax from fisheries harvest value. In fact, 1% of fish import tax is enough to cover all expenses of the 10 year project. Others could be used capacity reduction of over-capitalized fishing vessels including small-scale trawlers and purse-seiners as well as management cost for responsible fisheries. This should be a national project, not only a volunteer work of any NPO.

DISCUSSION AND CONCLUSION

The Fundamental law of the Fisheries was enacted in 2001. The basic philosophy of the law is the stable supply of fisheries products and the sound development of the fisheries. At the same time, the Law of Fisheries Infrastructure are also enacted. The fishery should change from merely catching fishery to farming fishery. To manage resources and to maintain the lasting productivity, the fishing port should act as the base. Inevitably, fishing ports, villages, resources, and fishing grounds should be managed in an integrated manner. These two laws will change the fisheries administration and impact on the future of fisheries in Japan.

To meet the demand for the stable supply of fisheries products and the sound development of the fisheries, we must consider trade issues in Japan. WTO encourages free trade without exception. However, our societies are too heterogeneous to allow free trade. Unfortunately, this is not the world without war and food embargo. This is particularly so regarding food items which are strategic commodities. Food is the basic need for any nation. As a result, high dependency on imported food means higher risk of the national security. Unlike manufacturing commodities, food production is heavily dependent on nature and associated with the environmental health of the nation. Thus, if any country wishes to be independent, she has to have food security. With this criterion, Japan is in crisis since the food sufficiency rate is less than 40%.

In order to meet the demand for the sound development of the fisheries, just increasing production is not enough. Economic independence is needed. One of the problems in fisheries is sustainable low prices of fish due to too much imports. Japan changed from fish exporting country to fish importing country in after the first Tokyo round: Market Access Negotiations of GATT (General Agreement on Tariffs and Trade) in 1973. Fisheries, the leading industry at that time, were forced to concede to promote exports of manufacturing commodities such as automobiles and electronics. In order to promote exports of manufacturing goods and services, the same negotiations have been repeated. As a result, annual fisheries imports amounted to US \$ 15 billion, next to oil import of US\$20.4 billion in 1999. IQ items in Japan related fisheries commodities were limited only to mackerel, horse-mackerel, sardine, saury, cod, Alaska pollack, yellowtail, squid, scallop, lavers and kelp. The average tariff is 4.1%, lowest in the world as compared to 38.9% in China, 19% in Norway, 13.6% in South Korea, and 10.2% in EU. Tariffs of salmon and squid in Japan are 3.5 % and fishermen face on economic difficulty with too low domestic prices.

In order to meet the demand for employment opportunities for 1 million people in fishing villages, we must proceed the marine forest promotion project now. This is because: 1) Fisheries in Japan is in crisis and this is the last opportunity for their revival; 2) Domestic supporting systems have been developing; 3) Contributions of fisheries to other sectors are large; 4) The world is seeking for Japan's leadership in fisheries, in particular, wise utilization of the sea based on her long experience.

Together with doubling their coastal production, the sound community development based on responsible fisheries is essential all over Japan's coast. As a result, FCAs will develop their credibility and be able to play an important role in the fishing community again as well as in the nation. However, current fisheries problems have not been solved within the fisheries sector alone. In the past, the fisheries sector has developed autonomy and has been treated as an untouchable sector in Japan because of its history, rural location, and complexity. However, time has come for the sector to open its eyes and responsible fisheries have to lead marine affairs based on rural communities. Cultured Marine Forest will be a key concept for responsible fisheries in the 21st Century.

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