Thesis for the Degree of Doctor of Philosophy

Policy Alternatives for Implementing Environment Fisheries in Korea

By

Tae Jin Bang

Department of Marine Business and Economics

The Graduate School

Pukyong National University

February 2007

Policy Alternatives for Implementing Environment Fisheries in Korea

Advisor: Sang-Go Lee

By

Tae Jin Bang

A thesis submitted in partial fulfillment of the requirements
For the degree of

Doctor of Philosophy

In the Department of Marine Business and Economics
The Graduate School
Pukyong National University

February 2007

Policy Alternatives for Implementing Environment Fisheries in Korea

A Dissertation

By

Tae Jin Bang

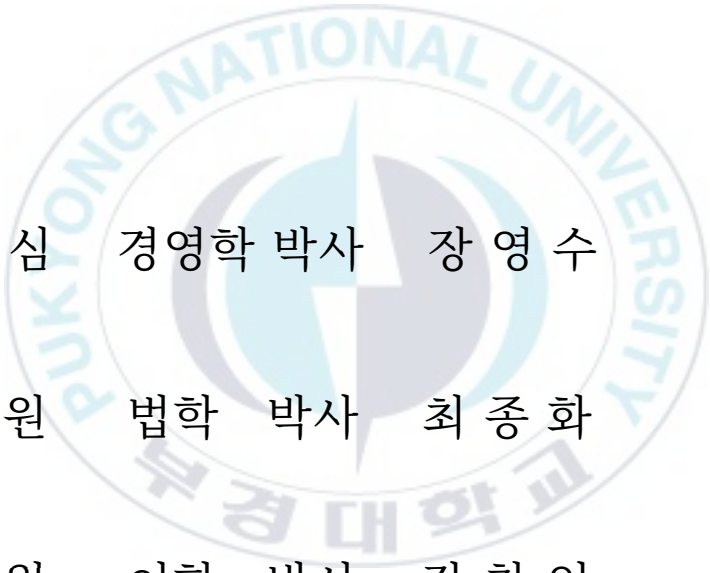
Approved as to style and content by

Young-Soo Jang	Jong-Hwa Choe
Chang-Ik Zhang	Seong-Ae Choe
Sang-Go Lee	

February 2007

방 태진의 경영학박사 학위를 인준함

2007 년 2 월



주 심 경영학 박사 장 영 수 인

위 원 법학 박사 최 종 화 인

위 원 이학 박사 장 창 익 인

위 원 사회학 박사 최 성 애 인

위 원 경제학 박사 이 상 고 인

우리나라 환경어업의 효과적인 이행을 위한 정책 대안 연구

방 태 진

부경대학교 대학원 해양산업경영학과

요 약

우리나라 어업에서 어선척수, 어구어법 및 어획시기의 제한 등으로 대표되는 어획통제수단인 전통적인 어업자원의 관리는 오랜 역사에도 불구하고 무주물 선점이라는 어업의 특성을 감안할 때 효과적인 자원관리에 한계가 있었다. 아무리 강력한 제도적 장치가 있다 하더라도 광활한 바다에서 집행상에 있어 과도한 행정비용 등을 감안할 때 실효성에 문제가 있는 것이다. 그 결과 과잉 어획노력은 여전히 해결되지 못하고, 남획과 혼획으로 인한 자원고갈은 심각한 문제로 남아있다.

또한 그 동안 성장위주의 사회경제 정책의 결과로 연안서식지의 오염과 파괴는 이러한 자원고갈문제의 심각성을 한층 더 가중하게 만들었다. 그리고 세계화, 개방화로 대표되는 21 세기 자유무역의 가속화는 채산성이 악화일로에 있는 국내 수산업을 존폐위기로 몰아가고 있다.

이러한 시장 개방적 상황은 값싼 자원은 수입에 의존하고 국내산은 질적 관리체제로 구조조정을 통하여 자원관리를 강화시킬 수 있는 기회인 반면에 개방으로 인한 막연한 불안감으로 인하여 오히려 어획강도를 높이는 빌미를 제공할 수 있는 여지도 있다.

그러나 우리나라의 경우 수산업은 다른 1 차 산업과는 달리 재생 가능한 자원으로서 경쟁력 있는 소비시장 이 존재하고 활어를 선호하는 소비특성상

시장개방에 한계가 있는 점, 건강식품으로서 소비증가 등을 감안한다면 비록 그 규모는 적을지라도 자원관리만 잘 한다면 충분한 경쟁력 있는 산업으로 존속시킬 수 있는 가능성이 있다.

그러나, 그 동안 수산자원관리는 시장에서의 소비자 선호도나 소비성향은 고려하지 않은 채 생산자 집단에만 관리대상으로 정책을 집중해 왔다. 이러한 자원고갈 문제는 국민 평균 수산물 소비량뿐 아니라 소비특성인 어린 고기의 소비 선호도 등을 고려하지 않은 채 생산관리만을 고려했을 때는 근원적인 문제점을 해결할 수 가 없는 실정이다. 비교적 자원관리가 정착된 수산선진국의 대부분의 국가를 보더라도 소비자들의 인식전환이 함께하지 않는 한 성공하지 못한다는 교훈을 보여주고 있다.

따라서, 지금까지 효과적인 자원관리를 위하여 TAC, 자율관리, 보호구역 설정 등 다양한 정책을 강구하고 있음에도 불구하고 그 실효성에 대하여는 여전히 의문을 남겨두고 있다. 이러한 문제점들을 보완하기 위하여 한국정부에서는 지난 1998 년에 이미 생산적인 자원관리측면과 소비적인 측면을 모두 고려한 환경어업 기본계획을 수립 시행한 바 있었다.

그 주요내용을 살펴보면, 우선 정책목표로서 지속 가능한 어업생산기반을 유지하고, 수산물 품질 고급화를 통한 경쟁력을 향상시키는 것이다. 이를 위한 주요 추진전략으로서는 첫째, 연안어장 환경평가 및 환경친화적 어장관리제도를 마련함으로써 연안어장의 환경관리체계를 구축하고, 둘째, 육상 및 해상기인 오염원을 저감함으로써 연안어장의 환경보전 및 개선을 도모하고, 셋째, 환경수산물의 품질 인증제와 유통체계를 완비함으로써 수산물의 품질 고급화를 선도하고, 마지막으로 어업인과 소비자의 의식개혁, 제도적 장치를 마련함으로써 환경어업 추진기반을 조성하는 것을 골자로 하고 있다.

그러나 이 같은 정부의 노력은 한. 일 어업협정 등 주변국과의 어업협정 체결 및 배타적 경제수역 협상을 기점으로 수산물 생산위축을 우려한 나머지 대규모

양식단지 조성 등 수산물의 양적 생산에 치중하게 됨으로써 그 빛을 발휘하지 못하게 되었다.

또한 이러한 양적 생산체제는 수입자유화에 따른 시장개방정책과 유기적으로 연계되지 못함으로써 효과적이고 능동적인 자원관리정책에 적지 않은 지장을 초래했을 뿐만 아니라 수요 및 공급에 대한 불확실성으로 이어져 일부 양식어업인의 사회문제로 까지 촉발하게 되었다.

이에 따라 본 연구에서는 생산적인 측면뿐 아니라 가공, 유통, 무역에 이르기까지 소비적인 측면과 통합하여 실질적인 자원관리가 될 수 있는 환경어업정책의 효과적인 이행방안을 살펴보고 이러한 환경어업정책을 효율적으로 추진할 수 있는 최적 정책대안을 모색하기로 하였다.

우선 환경어업을 효과적으로 집행할 수 있는 현실적으로 가능한 정책대안들을 모두 나열하고 그 대안들을 지속 가능한 어업과 어촌기반유지라는 정책목표와 그 목표를 달성하기 위한 과학적인 지표들을 선정하고 각각 정성적인 평가를 한 다음 최적 정책대안을 찾아 보았다.

본 연구에 실질적으로 제시된 정책대안으로는 첫째, 현행 추진중인 정책의 지속적인 추진방안으로 TAC 또는 자율관리어업의 점진적인 확대 실시, 둘째, 실질적인 자원회복을 위한 생태계 기반중심의 해양보호구역의 설정, 셋째, 소비적인 측면을 관리하기 위하여 자원 고갈 형 소비성향에 대한 인식전환과 완전개방화 시대의 소비자 후생증진을 위한 경쟁력 확보 및 유통, 위생관리방안을 설정하였다. Weimer(1999) 등이 개발한 과학적이고 객관적인 정책지표에 의한 정책평가 기법으로 정성적인 방법으로 평가한 결과 환경어업을 지속적으로 추진할 수 있는 단기적인 선결과제는 소비자의 자원관리에 대한 인식전환 및 완전 시장개방화에 따른 질적 경쟁력 확보, 이를 효과적으로 관리할 수 있는 제도적인 체계, 다시 말하자면, 세 번째 정책대안이 가장 절실하였고, 중장기적으로는 생산적인 측면에서 현재 추진중인 단순 TAC 또는 자율관리어업의

확대실시보다는 보다는 실질적인 자원회복을 도모할 수 있는 생태계기반 중심의 해양보호구역의 실시가 바람직한 것으로 나타났다.

이와 더불어 생산중심의 모든 자원관리를 함에 있어서는, 종전의 상업적으로 유효한 종들에 대한 한정된 자원관리는 지양하고, 특정 어업자원과 그를 둘러싸고 있는 생태계와의 상호작용, 이를 객관적으로 이해할 수 있는 과학적이고 체계적인 모니터링, 기후와 생태계의 상호작용, 어업이 생태계에 미치는 영향 등을, 종합적이고 체계적으로 고려할 수 있는 생태계 기반중심의 어업자원관리를 현 사회, 경제적 상황에 따라 점차적으로 확대 적용하는 것이 바람직한 것으로 나타났다.

Table of Contents

LIST of FIGURES

Figure Number page

LIST OF TABLES

Table Number Page

Acronyms

APEC	Asia Pacific Economic Co-operation
CBD	Convention on Biological Diversity
CSD	Commission on Sustainable Development
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FTA	Free Trade Agreement
GDP	Gross Domestic Product
ITQ	Individual Transferable Quota
IUCN	The World Conservation Union
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
OECD	Organization for Economic Cooperation and Development
POPs	Persistant Organic Pollutants
SPS	Sanitary and Phytosanitary Measures
TAC	Total Allowable Catch
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	Untied Nations Environment Programme
WTO	World Trade Organization
WSSD	World Summit on Sustainable Development
WWF	World Wide Fund for Nature

1. Introduction

1.1. Background and Study Objectives

The effectiveness of conventional fisheries management, despite its relatively long history, has been challenged by various problems such as over-fishing, overcapacity, overexploitation, destructive fishing, by-catch, and habitat degradation. These problems stem from the open access and the resultant economic incentives favoring short-term exploitation over long-term sustainable use.

These problems are also predominant in the seas of the Republic of Korea (hereinafter Korea), which have suffered from high development pressure on marine and coastal resources under the growth-oriented socio-economic development policy.

The sustainability of fisheries resources in Korean seas is also threatened by various external factors such large-scale coastal reclamation projects. Although the government has been investing huge amounts of financial resources to curtail the fishing efforts every year, we often found that the management actions were not conservative or expeditious enough and not responding to the root causes appropriately.

To address such threats, Korea has made continuous efforts in strengthening its ocean and coastal governance. Such efforts culminated with the creation of Ministry of Maritime Affairs and Fisheries (hereinafter MOMAF) on August 1996.

Under the umbrella of MOMAF, integrated coastal and ocean governance system was created covering various marine related sectors such as fisheries, shipping and port development, deep seabed mining as well as marine environment, coastal zone management, and marine science and technology.

However, the management framework and specific measures are yet to be developed to address the identified problems related to fisheries resources and habitat in a holistic manner. This alarming situation heightened the interest in ecosystem-based approach and the establishment of marine protected areas (MPAs) as an implementation tool.

MPAs, areas designated for special protection to enhance the management of marine resources, show promise as components of an ecosystem-based approach for conserving the ocean's living resources (National Research Council in U.S, 2001).

However, the policy proposal for MPA often face obstacles in Korea particularly due to economic constraints such as the cost involved in buy-back or compensation as well as political constraints such as fishermen's opposition. Significant controversy lies in the provisions for "no-take zone" where removal or disturbance of resources is prohibited.

Recognizing such needs and difficulties, this study attempts to identify alternative approaches and compare their effectiveness to implement Environment Fisheries as a tool for management of the consumption by controlling market and trade on fisheries as well as management of the production on living resources in Korean ocean and coast within its political and socio-economic context.

1.2. Definition of Terms

When the term, Environment Fisheries (hereinafter EF) is used in this study without any reference, it indicates the term suggested by MOMAF (MOMAF, 1998), which is defined as "Fisheries which is sustainable to let resource reproductive both quality and quantity in terms of fishing ground management, at the same time, and is to manage the consumption by controlling quality of products in the fishery distribution.

Even though there is a lot of similar terminology to EF such as Environment Friendly Fisheries or Sustainable Fisheries, most of them may focus on managing the production of fisheries. Therefore, EF is used to manage both the production and the consumption of fisheries in this paper although it may be a little argument to use EF as terminology in term of the general concept on these kinds of fisheries.

When the term, MPA (Marine Protected Area) is used in this study without any reference, it indicates the term suggested by IUCN (World Conservation Union), which is defined as “Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (IUCN, 2002).

When it is used to indicate the term defined by the Marine Pollution Prevention Act (MPPA, 1999), it is defined as “coastal waters in relatively pristine and good ecological conditions which need to be preserved and protected continuously.”

The term ‘Integrate Coastal Policy’ refers to the national policy defined by the Coastal Management Act (1999) and the amended Marine Pollution Prevention Act (1999) which addresses the issues of environment and resources allocation at land and seawater interface within the national territorial sea, balances preservation and development, adopts multi-sectoral and multi-agency approaches, and is implemented under the integrated ocean governance of MOMAF.

The term ‘Coastal Zone’ is used to describe the national territorial sea up to 12 nautical miles seaward, as well as the administrative boundary of coastal cities and counties. When used with specific reference to the Coastal

Management Act and the Marine Pollution Prevention Act, the definitions provided by each of these Acts must be followed.[1]

1.3. Methods and Approaches

A. Collection of Relevant Articles, Reports, Legislation, and Documents

a) Previous studies and articles on fisheries management of Korea were collected and reviewed.

b) Relevant articles, reports and policy documents relating to EF such as socio-economic and development policy, environmental management, coastal management, and other related fields, which were mostly produced by the Ministry of Maritime Affairs and Fisheries (MOMAF), Ministry of Construction and Transportation (MOCT), Ministry of Environment (MOE), Ministry of Agriculture and Forestry (MOAF), Office of Prime Minister, National Statistical Office(NSO),National Fisheries Research and Development Institute (NFRDI), Korea Maritime Institute (KMI), and Korea Ocean Research & Development Institute (KORDI) were collected and used for analysis.

c) The following legislative instruments were collected for analysis:

- National Land Plan and Use Act (Korean Act No.6655,2002)
- Natural Park Act (Korean Act No.6841, 2001)

[1] According to the Coastal Management Act, the landward boundary of coastal zones is 500 meters to 1 kilometer (km) inland from the shoreline, and the seaward boundary is the limit of the national territorial sea. The Marine Pollution Prevention Act does not use the term “coastal zone.” It does, however, increase the coverage of coastal zone management by designating certain areas (called “Coastal Environment Management Areas”) that extend up to the inland limit of the watershed where land activities can make direct or indirect impacts on adjacent coastal water bodies.

- Natural Environment Preservation Act (Korean Act No.6846, 2002)
- Marine Pollution Prevention Act (Korean Act No.6515, 2001)
- Wetland Preservation Act (Korean Act No.6825, 2002)
- Marine Ecosystem Preservation Act (Korean Act, No.8045,2006)
- Draft of Marine Environment Management Act (Korean Act)
- Draft of Act for Facilitation of Fisheries Trade (Korean Act)

B. Collection of Monitoring Data, Maps and Statistics

a) Coastal environmental monitoring data produced from National Fisheries Research and Development Institute (hereinafter NFRDI) were used for the analysis.

b) Fish resources monitoring data produced from NFRDI Statistics relevant to MPAs and environment was collected from the annual statistics books produced from MOMAF, MOE, MOAF, and local governments.

C. Analysis, Synthesis and Evaluation of Collected Information

Policy analysis and synthesis of collected information were conducted employing the method suggested by David L. Weimer and Aidan R. Vining. in the "Policy Analysis[2]" (2001). Specifically, focus was given on the following:

a) Policy framework and legislation related to EF;

b) Challenges and issues related to EF implementation

[2] Weimer points that it should provide a strong conceptual foundation of the rationales for, and the limitations to, public policy. In addition, it should demonstrate the application of advanced analytical techniques rather than discuss them abstractly.

c) Alternatives including status quo;

d) Analysis and evaluation based on goal and criteria; and

e) Recommendation.

1.4. Scope of the Study

To achieve the objectives of this study, following specific tasks were conducted:

- The background on EF in Korea was were described (Chapter I);
- The origin of EF were identified (Chapter II);
- Challenges to Marine Ecosystem and Living Resources Management in Korea was described (Chapter III);
- Policy framework for MPA in Korea was described (Chapter IV);
- Constraints to implement EF in Korea were identified (Chapter V);
- Policy goals and alternatives based on policy analysis to overcome challenge were identified (Chapter VI)
- After evaluating alternatives, the best solution was chosen (Chapter VII)

2. Origin of EF

2.1. History and Study

Even though it is difficult to find out any document and paper both internationally and domestically that use exact term, EF, except Basic Plan on EF of MOMAF, there are several cases to use similar term that is the similar meaning like EF. Above all, internationally there is used mainly sustainable development. According to UNCLOS, there is State's right and duty on the fisheries management of costal countries, and EEZ. There is provision related to

the Right of coastal State on all kinds of resource including living resource in the Article 56. In addition, State has to decide TAC on living resource in the EEZ. Lee et al. point out that Coastal State has Right to decide TAC of the other country in the EEZ in the Article 61.

Next, according to COFI of FAO in 1997, there is implementation of 1995 Code of conduct for responsible fishery. It consists of total 12 Article and 82 provisions including the preamble. This Code stipulates basic guide line on responsible fishery that includes all kinds of parts, process and trade as well as product parts such as fishing, aquaculture.

Through the Johannesburg Declaration on Sustainable Development in 2002, global leaders expressed their firm commitments toward achieving sustainable development, which embraces the balanced pursuit for economic growth, social development and environment protection, by implementing a set of strategies and action programmes at local, national, regional, and global levels to create a new and brighter world of hope.

Three decades ago, global community first recognized, in Stockholm, the urgent need to respond to the problems of environmental deterioration. Two decades after the Stockholm, the United Nations Conference on Environment and Development was held in Rio de Janeiro and reaffirmed through Rio principles and Agenda 21 that the protection of the environment on social and economic development are fundamental to sustainable development. The Rio Summit was a significant milestone that set a new agenda for sustainable development.

Between Rio and Johannesburg the world's nations met in several major conferences under the guidance of the United Nations, including the Monterrey Conference on Finance for Development, as well as the Doha Ministerial Conference. These conferences defined for the world a comprehensive vision for the future of humanity.

As consequences, the Commission on Sustainable Development (CSD) is tasked with implementing huge amount of commitments to address mounting challenges we face from poverty to environment issues.

Next, there are a variety of studies related to EF directly or indirectly. First of all, The Ocean Studies Board (OSB) in U.S has been interested in topics concerning marine ecology and the preservation of marine biodiversity. Notable reports in this area include Priorities for Coastal Ecosystem Science (1994), Understanding Marine Biodiversity (1995), and From Monsoons to Microbes: Understanding the Ocean's Role in Human Health (1999).

At the same time, the board has concerned itself with the sound, science-based management of marine fisheries, as exemplified by studies such as Improving Fish Stock Assessments (1998), Sharing the Fish: Toward Fisheries (1999). These two interests come together on the issue of marine reserves, which have been proposed as an ecosystem- based approach for conserving living marine resources, both for fisheries management and for preserving marine biodiversity.

National Research Council (NRC) in U.S also reported Marine Protected Areas (2001). This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by NRC.

The purpose of this independent review is to provide candid and critical comments that will assist the institutional standards for objectivity, evidence, and responsiveness to the study charge.

Domestically, there are a few studies concerned EF. Zhang reported 'Prospect of Ecosystem- based Fisheries Resource Management' (Zhang, 2002). Huh and Zhang published the paper 'Ecosystem-based Approaches to Management of Living Marine Resources and Their Environment – A New Paradigm for Managing Fisheries Resources-(Huh and Zhang, 2005).

This report accentuated that a comprehensive ecosystem-based fisheries management approach would require to holistically consider ecological interactions for target species with predators, competitors, and prey species, the effects of climate on fisheries ecology, the complex interactions between fishes and their habitats, and the effects of fishing on fish stocks and their ecosystems. In addition, Jo et al published 'The Study for inducing Ecosystem-based Fisheries Management' (KMI, 2005).

In the other field, according to the Act for promoting environment friendly agriculture, the objective of this act is to pursue sustainable and environment friendly agriculture by promoting the function of environment preservation in the agriculture, curtailing pollution from activity of agriculture, and training farmers who can work in environment friendly agriculture.

In the main framework, ministry of agriculture has to establish basic plan for promoting environment friendly agriculture. To promote environment friendly agriculture, there is e-mark which guarantees excellent product in term of environment friendly process.

Nevertheless, it is difficult to find out the studies that have tried to combine fisheries production with fisheries consumption to save more effective solution because most of the studies are interesting in fisheries production.

In this regard, it is essential to cooperate with the nature science and the social-science for managing fisheries resource. Therefore, this study will try to consider both of them.

2.2. New International Environment and Fishery Regime

To implement a variety of global commitments and mission on environmental management, various kinds of international organizations and/or prorgrammes have been created, namely UNEP, UNDP, IMO, IPCC, and FAO.

According to Ernst Hass in “When Knowledge is Power (1990)” all intergovernmental organizations are designed to solve problems which require collaborative action for their solution (Hass, 1990).

The critical problems faced by existing international organizations in dealing with the issues related to sustainable development, which are transboundary, inter-related, and multi-sectoral, originated from the limitedness in their implementation capacity imposed by sectoral mandates.

For example, IMO is mandated to marine pollution focusing on ship-originated pollution, while UNEP[3] is mandated to environment protection focusing more on land-side.

In this regard, both organizations are limited in addressing the issues arising from land-sea interface. Moreover, both organizations are limited in linking poverty issue or public health problems in their environmental management programs as they are beyond their scope of mandates, and thus can be very ineffective in implementing the goal of sustainable development unless effective coordination and integration measures are provided to address overarching objectives.

The declaration of WSSD in 2002 stated that poverty eradication, changing consumption and production patterns, and protecting and managing the natural resource base for economic and social development are overarching objectives of, and essential requirements for sustainable development. In addition the deep fault line that divides human society between the rich and the poor and the ever-increasing gap between the developed and developing worlds pose a major threat to global prosperity, security and stability (WSSD, 2002).

[3] UNEP created GPA(the global programme of action for the protection of the marine environment from Land-Based Activities

In addition, the efforts toward the implementation of sustainable development need to be tailored into emerging social-economic and political systems reflecting changing consumer pattern and political regime under globalization and regional alignment.

Therefore, it is suggested that efforts be made toward refining or strengthening existing international environmental and fishery regime to effectively address such challenges mentioned so far.

As such, the refined environmental and fishery regime shall deal with not only malign problems, problems of incongruity like pollution and exploitation of fish stock, but also benign problems, problems of coordination and integration such as limited sharing of information and fragmented policy direction.

According to a new regime[4] which makes national jurisdiction of coastal states extends from territorial sea to EEZ, coastal states can take countermeasures against the exploitation of fish stock by foreign fleet under flag state jurisdiction. With the increasing responsibilities of coastal states in protecting and maintaining fisheries resources in their jurisdictions, coastal states can benefit from the regional network as it can provide information and data necessary for establishing policies and regulations to implement responsible fishery such as TAC as well as facilitate joint research and technology transfer among member states.

However, there are still a number of challenges in managing sustainable fishery. First of all, even though coastal states can be successful in protecting fish stock from foreign countries in EEZ, they often fail to manage fishing ground overexploited by domestic fleets. Increasing world population and wealth have led to higher demand for edible fish and excess capacity of fishing boats.

[4] The United Nations Convention on the Law of the Sea (UNCLOS) in 1982

FAO forecasts that by 2010, worldwide demand for seafood will reach 110 million tons, but catches will fall short by 40 million tons. Nearly 70% of the world's marine fish stocks are overfished and fully exploited (FAO). Whereas fishery industry tends to decrease its economic contribution in the developed countries as it becomes marginalized economic sector, over-fishing may increase in the developing countries to gain more economic profit by exporting fish stock. The fact that people who don't consume fish join fishing industry only to export products makes this situation worse.

Next, in the case of migratory fish species, it is impossible to operate networks effectively without cooperation and trust among regional countries. For example, when one country makes efforts for controlling domestic fishing fleet by implementing TAC agreed by neighboring countries, which are in big discrepancy of economic development, such efforts could become useless if the other country focuses on catching more stock to export. To overcome these challenges, it is necessary to establish regional partnership to foster sustainable and responsible fishery. Collective assessment of resources problems and identification of feasible alternatives would help coastal states pursue a win-win game in their development and management of fisheries resources.

It should be noted that the refined environmental and fishery regime would not replace the existing ones, it would rather supplement and strengthen the existing regime by providing effective coordination and integration, promoting synergies and partnership among various stakeholders, increasing the efficiency of existing resources, and enhancing the knowledge sharing.

2.3. Strategies for Adoption and Effective Implementation

According Underdal, there are three factors for problem-solving capacity (Miles et al, 2000):

- The institutional setting (the rules of the game)
- The distribution of power among the actors involved, and

- The skill and energy available for the political engineering of cooperation solution

The new environmental and fishery regime suggested above needs to be also equipped with appropriate institutional setting, management resources and power, skills and expertise, and political force to lead cooperation. Whether the regime is institutionalized at global, regional, or sub-regional level would depend on the specific environmental or sustainable development issues that it attempts to address. As the proposed environmental and fishery regime focus on integration and coordination among existing international organizations with sectoral mandates, however, it is recommended that regional or sub-regional mechanism be developed to link international mandates with national/sub-national implementation. The regional coordinating mechanism would then focus on providing guidance to participating countries toward integrated implementation of various international environmental and fishery instruments. More importantly, it can identify the specific needs of the region for capacity development and facilitate appropriate measures for strengthening the capacity of various stakeholders including national governments, local governments, NGOs, private sector, and community with regard to implementation of Agenda 21 and WSSD commitments.

In order to secure the adoption of proposed environmental and fishery regime, it is fundamental to achieve a common vision and understanding of sustainable development, which can be shared by participating countries and stakeholders. To promote government buy-in of the proposed regime, the global issues need to be translated into local concerns and global commitments toward sustainable development should be mainstreamed into national policy and governmental agenda. It is also critical to facilitate the perception change of political leaders as well as their understanding on the benefits of working together with neighboring countries. Therefore, major communication and consultation efforts toward key stakeholders need to be made to move forward to the adoption

of new environmental and fishery regime. Whether the adoption of the proposed environmental and fishery regime will be done through “convention” or “partnership” approaches will be determined by the political practices and behaviors of the concerned region. For example, in Mediterranean region, the regional seas programme has been successfully developed and implemented through conventional approach, while in the East Asian region, concerned governments prefer voluntary, partnership approach for regional cooperation in the environmental and fishery management.

Implementation involves promulgation and administration at the national level of the laws, standards, and regulations which transfer the international commitments to the national level; compliance refers to state behavior in the issue-area in question which is in accord with international obligations; and effectiveness encompasses both behavioral change in the required direction and problem-solving from the point of view of scientific-technical rationality (Miles, 1987).

In most parts of the world, countries suffer from the lack of technical and managerial capacity when they attempt to implement the global commitments toward the sustainable development. Therefore, capacity building shall be the central theme of implementation strategies of the proposed environmental regime. Capacity building should focus on strengthening the practical capability of integrated, cross-sectoral, participatory planning and management.

In addition, for the sustainability of the newly established regime, it is critical to develop sustainable financing mechanism. The financial resources provided by global source such as GEF or other international donors/ financing agencies should be used to leverage national and local resources. As in most cases, government lack the financial resources for environmental management, it is required to develop a partnership mechanism between public and private sectors, which will bring the technical and managerial expertise as well as financial resources of private sector to fishery management and sustainable development.

2.4. Functional Coordination

International organizations can be considered actors to the extent that they provide independent inputs into the problem-solving process or somehow amplify outputs of these processes (Miles et al., 2002).

Therefore, it can be argued that the regional level has a higher comparative advantage over the global level to attain functional coordination and integration to strengthen existing international environmental regime.

Miles also pointed out that regional initiatives are more effective for facilitating ecosystem-based approaches to environmental assessment and management and for empowering governments and stakeholders to develop flexible and equitable solutions to environmental problems (Miles, 1999).

A regional intergovernmental coordination body in which participating countries are in charge of the design and implementation of regional action plans offers the most promising approach. In order to effectively achieve the functional coordination at regional level, it is suggested that the regional environmental regime be equipped with the followings:

- Common understanding on the values of natural resources and environmental assets
- Shared vision for the regional environment and natural resources
- Principles of actions to achieve shared vision and goals
- Strategies and action programs articulated to achieve shared vision and goals
- Roles and responsibilities clarified for concerned governments, private sector, NGOs, academe, community, and other civil society groups toward the implementation of strategies and action programmes
- Sustainable financing mechanism

- Monitoring and evaluation mechanism

In summary, the regional environmental and fishery regime should be able to provide participating countries with a multi-faceted enabling environment toward achieving the common goal of sustainable development. By doing so, the global community will be able to more effectively address existing barriers against local implementation of global commitments.

3. Challenges to Marine Ecosystem and Living Resources Management in Korea

3.1. Physical Characteristics

The Korean peninsula is about 1,000 km long and 250 km wide. It is situated in the northeastern part of the Asian continent and is bordered on the north by China and on the northeast by Russia. The peninsula and all of its associated islands lie between 124°11' and 131°53'E and between 33°06' and 43°01'N.

To the east of the country lies The East Sea; to its west lies the Yellow Sea5; the East China Sea to its south, which extends up to the Korea Straits (Table 1).

Table 1. Korean Seas.

Seas	**Area (1000 sq. km)**	**Volume (1000 cubic km)**	**Average depth (m)**	**Maximum depth (m)**
East Sea	1,007.6	1,698.30	1,684	4,049
Korea Strait (South Sea)	75.4	7.63	101	228
Yellow Sea	404.0	17.62	44	103

[5] The Yellow Sea, bordering China on the west, is a semi-enclosed sea with an average depth of 44 m. It has been recognized as one of the most vulnerable large marine ecosystems in the world due to the rapid industrial development along the Korean and Chinese coasts.

Korea has territorial waters of 447,000 Km^2, which is 4.5 times greater than the area of national land. On the west and south coasts, wide areas of coastal shelves (345,000 Km^2) have been developed, providing productive fishing ground and mineral resources.

The coastal shoreline extent of Korea adds up to 11,542 km including the coastline of more than three thousands islands (MOMAF, 2001a).

The Korean Peninsula borders the Yellow Sea on the west coast, the East Sea on east coast and the Korea Strait on the south coast. The west coast is characterized by the wide and long-stretches of tidal mud flat under strong influence of tidal flow.

The Yellow Sea is semi-enclosed sea, with an average depth of 44m, bordering China on the west. With the rapid development of industry along Korean coast and Chinese coast, Yellow Sea has been recognized as one of the most vulnerable large marine ecosystem in the world.

The southern coastal waters are characterized by the presence of various semi-enclosed bays and islands. This unique physical setting of southern coast allowed the development of various kinds of coastal use activities such as aquaculture, fishing, port and coastal industries at different levels of intensity.

The east coast is characterized by the narrow extent of coastal shelf along the coast and the development of sandy beaches and lagoons under strong influence of waves.

Tidal action characterizes the west coast while wave action is the determining factor for the geomorphology of the east coast. The maximum tidal range along the west coast is around 9.5 m, and the range gradually decreases from north to south in the west coast.

Long stretches of tidal mudflat are found along the west; sandy and rocky beaches are widely distributed in the east. The southern coastal waters are

characterized by the presence of various semi-enclosed bays and islands. The uniqueness of the physical setting has allowed different kinds of coastal use activities such as aquaculture, fishing, and port and coastal industries at different levels of intensity to proliferate in the southern coast of Korea.

The Korean coastline extends to 11,542 km, including the coastline of more than 3,000 islands. Excluding the islands, however, the coastline of the Korean mainland peninsula is approximately 6,228 km long.

Due to the numerous islands and small bays, the west and south coasts cover most of the coastal extension (Table 2). The high proportion of artificial coast in the west (20.6%) and east (28.6%) reflects the coastline alteration caused by various reclamation projects, the construction of sea dikes, and the development of ports and harbours.

Table 2. Oceanographic and Meteorological Characteristics of Korean Coasts.

Characteristics	**West Coast**	**South Coast**	**East Coast**	**Jeju Island**
Coastline (km)	5,256.6	5,594.9	428.1	262.9
Artificial	1,086.1	408.8	122.4	14.8
Wetland (sq. km)	1,980.0	413.0	0	0
Islands	1,551	1,507	33	62
Air temperature	12	13.6	12.7	16.1
Maximum	34	34.1	35.6	33.0
Minimum	-14.0	-9 .3	-11.6	-3.2
Precipitation (mm)	1,207.6	1,440.8	1,207.2	1,852.1
Humidity (%)	74.8	71.7	66.7	70.5
Wind speed (m)	2.4	2.1	2.4	3.0
Storm days	6	4	3	4
Fog days	30	24	9	19
Max. tidal range (m)	6.0 - 8.0	1.0 - 3.0	0.2-0.5	
Ave. wave height (m)	1.2 - 2.5	1.2 - 2.3	5.4-7.0	

Source: MOMAF, 2004.

3.2. Territorial Sea, EEZ, and Continental Shelf

Korea claims a 12-nautical mile (nm) territorial sea (3 miles of which lies in the Korea Strait) by the Law of Territorial Sea and Contiguous Zone (December 1995, Law No. 4986). As such, it has an estimated total area of 85,838 square kilometers (Km^2) of sea within its territory (KMI, 1998). The country also claims a 200 nm area of EEZ on the basis of Law No. 5151.

It has about 286,543 Km^2 of such zones (KMI, 1998). The continental shelf along the west and south coasts covers about 355,013 Km^2. It is considered to be a potential source of various minerals, oil, and natural gases.

3.3. Coastal Wetlands

Korea has a wealth of tidal mud flats on the west and south coasts (2,393 Km^2), which are home to important fish species and migratory birds, and function as purifiers of the incoming polluted waters from rivers and streams.

These national treasures have come under threat in recent years due to large-scale coastal development projects, such as coastal reclamation and infilling, port development, and tourism development. The loss of coastal wetland has caused the decline in fisheries resources and the carrying capacity of coastal waters.

3.4. Socio-Economic Characteristics of the Coastal Zone

There are 90 cities, counties, and districts facing the sea. They occupy 31,797 Km^2 of area or 32 percent of the total national land. About 33 percent of the total population lives in these areas (Table 3).

The population density in coastal cities (1,298 /km^2) is much higher than that of inland cities (871 / Km^2) (MOMAF, 1998). This reflects the heavy concentration

of the population in a few coastal cities – particularly in Incheon, Busan, and Ulsan where 47 percent of the total coastal population is distributed.

Korea's coastal zones are centers for industrial development because these areas are easily accessible by marine transportation, thus facilitating the export and import of goods. A total of 84 out of the 184 mostly large-scale national and local industrial complexes, and 40 of the 81 power plants have been established along the coasts because these zones provide comparatively cheap land (i.e., land created by coastal reclamation and infilling projects). The gross regional product (GRP) of the industries located in coastal areas is 42 percent of the total national production (MOMAF, 2000a).

3.5. Fishing and Aquaculture

Aside from large-scale industries, Korea's coastal zones are also heavily used for fishing and aquaculture. There are a total of 2,266 fishing harbors and small fishing harbors in these areas. A total of 1,092Km^2 of coastal water is utilized for aquaculture; 1,387Km^2 is designated as a port management area; 2,649 Km^2 of coastal water is set aside for national parks; and 2,556 Km^2 is designated as a "Fishery Resources Preservation Zone." Based on 1996 figures, coastal fisheries in Korea produced 1,623,000 M/T of fish and 874,000 M/T of aquaculture.

Maritime transportation plays a strategic role in the country's export-led trade, economy, and defense (Hong, 1991). In order to properly arrange and manage the country's ports, the government enacted the Ports Act, which segregated ports into "Local Ports" (those established by Provincial Governors or Mayors) and "Designated Ports" (those established by Presidential Decree). "Designated Ports" include "Coastal Ports" and "Trade Ports" – the latter being those that are developed and managed by MOMAF.

There are 28 Trade Ports (including those in Busan and Incheon) and 22 Coastal Ports along the Korea coast (MOMAF, 2000a). The total length of the

country's wharfs is estimated at 78 km, roughly 36.7km (47%) of which is comprised of the Busan, Incheon and Pohang ports.

Category	Unit	Total	Coastal Zone
Land area	Km^2	99,707.0	31,867.00
Population	thousand persons	46,430.0	15,484.00
			Coastal City: 76.6% of total coastal population
Population density	persons/ Km^2	466.0	486.00
Employment	1000 persons	20,416.0	6,156.00
Gross regional product (GRP)	Billion won	359,009.0	130,555.00
Cities, counties, and districts		232.0	90.00
Industrial complexes	Km^2	479.0	312.00
Power plants	Number (Km2)	81.0 (46.4)	40.00 (27.93)
National parks	Km^2		4,043.00 (2,649 Km^2 of sea area)
Tourism areas	Km^2	180.2	61.30
Zoning under National Land Utilization Management Act (Sea Water Area)	Km^2		
Urban zones		13,975.2 (608.6)	5,450.00 (607.60)
Semi-urban zones		1,029.3 (14.4)	361.90 (1.50)
Rural zones		51,370.9	14,983.00
Semi-rural zones		26,319.2	8767.20
Natural environment preservation zones		7,003.2 (4,804.9)	23,342.00 (4,804.90)
Ports and fishing harbors		Trade ports Coastal ports Fishing harbors	28.00 22.00 2,266.00
Sea dikes	Number (km)		1,731.00 (1,410.00)
Mariculture areas	Km^2		1,092.00
Port management areas	Km^2		1,387.00
Salt farms	Km^2		131.00
Coastal reclamation (since 1962)	Km^2		2,622.00

Table 3 . Demographic and Socio-Economic Characteristics of the Korea Coast.

Source: MOMAF (2001), KMI (1998)

A. Fishing Household and Population

Most fishermen are employed in traditional small-scale fisheries based on coastal communities. The number of fishing households has declined over time mainly because of aggravated fishery resource bases, changing market situation opened to foreign fish products (i.e. lowering tariffs), and uncertain prospects for domestic fisheries. In addition, there is a high degree of uncertainty in the existing government financial support to the fisheries owing to market liberalization and free trade agreements.

Table 4. Fishing Household and Total/Female Population

(Unit: thousand person, %)

	2001	2002	2003	2004	04/ 03
Fishing household	77 717	73 124	72 760	72 513	99.7
Population	234 434	215 174	212 104	209 855	98.9
Female	117 409	107 486	105 720	104 493	98.8
(%)	(50.1)	(50.0)	(50.0)	(49.8)	-

Source: NSO

The Korean fishing population has been getting aged and womanized. As seen in table 5, the age structure of fishing population shows the same problem as that of the entire Korean population. The population ratio of those under 30 has declined from 3.1% in 2003 to 2.7 % in 2004, while those of men and women older than 60 have increased over time. Such structural change in the fishing population must have a great influence on the future of Korean fisheries.

In recent years, on-shore fisheries tend to have had a characteristic of family management instead of using hired labor whose wages have been soaring, while off-shore and distant-water fisheries operations are more and more dependent on

foreign crews who come from China and south-east Asian countries. In fact, foreign crews are unskilled and their wages are much lower than their Korean counterparts.

Table 5. Fishing Population by Sex and Age

(Unit: person, %)

		2001	2002	2003	2004	04/ 03
Total		136 869	127 694	125 023	122 384	97.9
Sex (%)	Man	70 851 (51.8)	69 666 (54.6)	67 870 (54.3)	66 380 (54.2)	97.8 -
	Woman	66 018 (48.2)	58 027 (45.4)	57 153 (45.7)	56 004 (45.8)	98.0 -
Age (%)	< 30	4 149 (3.0)	3 817 (3.0)	3 854 (3.1)	3 313 (2.7)	86.0 -
	30~39	14 914 (10.9)	13 067 (10.2)	11 600 (9.3)	10 490 (8.6)	90.4 -
	40~49	35 280 (25.8)	35 401 (27.7)	33 974 (27.2)	32 097 (26.2)	94.5 -
	50~59	40 190 (29.4)	37 994 (29.8)	36 916 (29.5)	37 171 (30.4)	100.7 -
	> 60	42 336 (30.9)	37 414 (29.3)	38 680 (30.9)	39 312 (32.1)	101.6 -

Source: NSO

B. Importance of Fishing Industry to the Overall Economy

Prior to the economic crisis of 1997, Korea's impressive economic growth performance was part of what has been described as the 'East Asian miracle'. The three decades of extraordinary economic growth that transformed Korea from one of the poorest agrarian economies to one of the largest exporting countries, culminated in its becoming a member of OECD on December 12, 1996.

During the economic development and growth period (1970-2000) (except for the 1997-1998 economic crisis), the rate of economic growth was quite high despite a variety of domestic and international challenges. Between the 1970s and 1990s, Korea's GDP grew at an average annual rate of higher than 7.0%, thus resulting in about a 4.6-fold increase in the level of GDP.

Table 6. Fishing Industry vs. National GDP

(Unit: billion won, %)

Year	National GDP (A)	Fisheries GDP (B)	B/A (%)
1970	69 046	1 087	1.57
1980	138 898	1 738	1.25
1990	320 696	2 499	0.78
2000	578 665	2 155	0.37
2001	600 866	2 164	0.36
2002	642 748	2 000	0.31
2003	662 655	2 006	0.30
2004	693 996	1 954	0.28
2005	721 491	1 961	0.27

Source: NSO

However, since 2001(except for 2002), GDP has grown at an average annual rate of some 5%. Also, globalization has facilitated Korea's rapid economic structural transformation from the conventional manufacturing industries to a high-tech and service economy.

In 1970 the Korean fisheries sector GDP accounted for 1.57% of the national GDP, which made a significant contribution to foreign exchange earnings through export, necessary for economic development. However, the economic structural transformation has lowered such contribution to the national economy over time, and accounted for merely 0.27% of the national real GDP in 2005.

C. Fishing Fleet

All fishing vessels in Korea must have permits including coastal vessels below ten meters in length. All permits tie vessels with their owners, and they are tradable in the market. The total number of the Korean fishing fleet in 2004 amounted to 91,608, including the motorized of 89,327 and the non-motorized of 5,061.

Out of the total vessels, adjacent, aquaculture, inland and distant-water fisheries hold 72.5%, 20.6%, 4.4%, 0.5%, respectively. Currently, more than 97.5 percent of the vessels of are motorized and Korean fisheries depend highly on imported oil. For this reason their operations are much more susceptible to the changes in international oil prices than ever before.

Korea has suffered serious resource depletion such as over exploitation of many bottom fish species. It is implementing a coastal and offshore fishery restructuring project aimed at establishing a sustainable fishery system (Fisheries Act, 1995). The program provides for reducing the number of the fishing fleet, readjusting fishing zones, and developing environmentally-sound methods. Since 1994, the Korean government began to on a large scale reduction of fishing vessels through the 'Buyback' programs. 2,500 fishing vessels (mainly offshore) have been decommissioned, almost half of these since 2000.

Table 7. Fishing Fleet by Fisheries

(Unit: vessel, ton, %)

		2003	2004	04/ 03
Total	No. of vessels	93 257	91 608	98.2
	Motorized	88 521	87 203	98.5
	Non-motorized	4 736	4 405	93.0
	Tonnage	754 439	724 980	96.1
	Motorized	750 763	721 398	96.1
	Non-motorized	3 676	3 582	97.4
Adjacent fisheries	No. of vessels	66 698	66 063	99.0
	Tonnage	345 066	330 203	95.7
Aquaculture	No. of vessels	19 228	18 792	97.7
	Tonnage	28 034	27 296	97.4
Inland	No. of vessels	4 510	3 991	88.5
	Tonnage	3 941	3 102	78.7
Distant water	No. of vessels	517	491	95.0
	Tonnage	273 086	261 237	95.7
Others	No. of vessels	2 304	2 271	98.6
	Tonnage	104 312	103 142	98.9

..

Table 8. Newly Constructed Vessels

Year	2002	2003	2004	2005
vessels	1 669	1 265	1 137	969

During the period from 1994 to 2005 the ‘Buyback’ schemes have been extended to distant-water fisheries. In particular, the strengthening of global and regional fishery resource managements within the EEZs and on the high seas as well has facilitated vessel retirements of off-shore and distant-water fisheries.

In 2005, 969 fishing vessels were newly constructed, which was a reduction of 42% against 1,669 vessels in 2004.The Fishing vessel production capacity of the shipbuilding industry is difficult to measure, but its production has declined over time mainly because of the government ‘Buyback’ programs and the lowering demand

D. Fisheries Production

In 2005, the quantity and value of capture fishery production, consisting of adjacent (43%) and distant-water fisheries (20 %), increased slightly compared to 2004. Six important species of adjacent fisheries were hair tail, croakers, mackerels, anchovies, flounders, and squids.

Of these, catches of most bottom fish species such as hair tail and croakers have continued to decline since 1980, but catches of squids and anchovies showed a significant increase. Increased exploitation of species with a one-year life cycle, such as squid, is an unusual phenomenon.

Table 9. Catch Volume and Value by Fisheries (Unit: thousand M/T, billion won)

Fisheries	2004		2005		05/04(%)	
	Quantity	Value	Quantity	Value	Quantity	Value

Total	2,519	4,731	2,714	5,049	107.7	106.7
Adjacent	1,077	2,610	1,097	2,706	101.9	103.7
Aquaculture	917	1,217	1,041	1,348	113.5	110.8
Inland	25	167	24	176	96.0	105.4
Distant-water	499	737	552	819	110.6	111.1

Source: MOMAF

In spite of many difficulties and challenges facing Korean distant-water fisheries, their catch (e.g., tuna, squid, and trawl fisheries capture) in 2005 showed a slight increase of 53,000 tones over 2004. Taking into consideration the present and future trend of global/regional fisheries regulations within the EEZs and on the high seas, international environments of surrounding them would be far more unfavorable on the road ahead.

In terms of catch volume, the adjacent fisheries did not show unusual trends during the last five years. The CPUE (Catch per Unit Effort GT) has remained at 3.0-3.2 tones. However, the ratio of juvenile to adult bottom fish in the catch has increased, implying a heavy depletion of resources. There is a clear indication of overexploitation of most bottom species such as croakers, hair tail and sea breams. However, abundance of typical pelagic fish species in Korean waters such as squid, mackerels and anchovies has been confirmed. For instance, squid traditionally caught in the East Sea is now abundant in all coastal waters.

For the last decade, the government has implemented the ambitious fishing vessel retirement programs, which made a great contribution to a considerable reduction of vessel numbers. However, many fishery experts claim that in spite of such vessel retirement the present level of fishing power exceeds the optimal

fishing capacity. Even though 30% of vessels have been further reduced, Korean fisheries production will remain at the present level.

Table 10. Catch per Unit Effort (CPUE, GT)

Year	Production (MT)	Vessel (GT)	Catch per G/T
1970	724 365	244 799	3.0
1980	1 370 324	379 295	3.6
1990	1 524 013	451 272	3.4
2000	1 189 000	397 868	3.0
2001	1 252 098	386 179	3.2
2002	1 095 787	362 114	3.0
2003	1 096 473	344 883	3.2
2004	1 076 687	330 203	3.2

Source: MOMAF

Korea is located in a monsoon climate (i.e. humid, warm and heavy rainfall in summer; cold and heavy snow in winter) unfavorable to aquaculture development. Under the monsoon climate, fish farming must go through a long/cold winter season that requires a fish farm to have a heating system.

In spite of high heating costs in the cold winter, aquaculture technological advancements have made fish farmers enable to efficiently produce two main species such as flat fish and black rockfish. In particular, flat fish most favored by Korean people as sashimi species are commercially produced in land-based large salt-water tanks. Farmed flat fish accounted for some 50% of the total farmed-fish production (excluding inland aquaculture production) in 2004.

Fresh water aquaculture enjoyed a favorable business climate in the early 1990 and its production amounted 30,000 tons. However, after the moratorium on cage fish farming in the large-scale natural/artificial lakes in 1998, production declined to 17,000 tons in 1999. Since then the joint effort of government and fish farmers provided them with a good opportunity to again increase production to 24,000 tons in 2005.The main species of inland fish farming includes eel, rainbow trout, catfish, loach (or mudfish), carp, crucian carp, and so forth. In particular, rainbow tout is one of the leading fresh-water farmed species, which accounted for 15.3% (3,320 tons) of the total inland farmed-fish production (21,760 tons) in 2005. Rainbow trout is farmed by using high quality underground water or natural water in mountain areas. Most of farmed trout is consumed as sashimi at trout farm restaurants.

E. Self-Sufficiency Level of Seafood

Overexploitation of fishery resources in Korean waters and the declaration of EEZs by far-east countries such as Korea, China and Japan made a significant contribution to the decline of Korean fisheries production. In addition, the strengthening of global and regional fisheries management seriously limited Korean distant-water fishing opportunities on the high seas as well as within other coastal nation's EEZs.

Table 11. Seafood Self-Sufficiency

	2001	2002	2003	2004
Total production (Thousand M/T)	2 665	2 476	2 486	2 519
Total consumption (Thousand M/T)	3 221	3 433	3 578	3 922

Self-sufficiency (%)	83	72	69	64

Source: MOMAF (2005)

On the contrary, since the 1980s, seafood consumption in Korea has been rapidly expanded over time. Until the 1990s, domestic supply exceeded consumption by more than 20 percent, but from 2000 the supply/demand structure began to be reversed.

In 2001, this resulted in the first fisheries trade deficit in Korean fisheries history, which implies that Korea's seafood import market would be getting larger as far as its present economic growth and development are maintained.

3.6. Challenges to Coastal Environment Management

Korean coastal waters are classified into three classes according to water quality criteria such as pH, COD, DO, SS, fecal coliform, Total-N, Total-P, oil and heavy metals (Table 12).

The 1st class standard implies that coastal water is suitable for fisheries, and aquaculture requiring high oxygen, and swimming. The 2nd class standard is suitable for recreational purposes and fisheries requiring low oxygen. And the 3rd class standard identifies quality suitable for use of industries and port activities.

According to the COD monitoring results of 2005, some enclosed bays in coastal waters such as Masan, Jinhae, and Shihwa show water quality over second grade which is not suitable for fisheries and aquaculture (MOMAF & Office of Prime Minister, 2005).

The degradation of coastal water quality has been caused by combined factors including increasing pollution load from land-based activities, increasing

oil-spills from shipping accidents, pollution load from aquaculture activities and the reduction of natural purification capacity due to the loss of coastal wetland (MOMAF, 2005).

Table 12 . Seawater Quality Standards in Waters of Korean Seas (2005)

Category	PH	COD (mg/l)	DO (saturati-on %)	SS (mg/l)	E.coli MPN(100ml)	Normal Hexane Extracts (mg/l)	TP (mg/l)	TN (mg/l)
I	7.8-8.3	≤1	≥95	≤10	≤200	ND	≤0.05	≤0.007
II	6.5-8.5	≤2	≥85	≤25	≤1000	ND	≤0.1	≤0.015
III	6.5-8.5	≤4	≥80	-		-	≤0.2	≤0.03
All Areas (Hazardous Substances)	Cd≤0.01mg/l, As, Cr^{+6} ≤0.05mg/l, Zn, Pb≤0.1, Cu≤0.02, CN, Hg, Organic phosphorous, PCB< Detection limit							

Source: MOMAF

Since the 1970s, there has been a rapid increase in land-based pollution due to the increase and concentration of human population and industrial activities in a few coastal cities.

The population growth rate in coastal cities is three times higher than the national average rate. As a consequence, BOD loading to Korean coastal waters has increased about 40% during last decade, aggravating coastal eutrophication and increasing the occurrences of red-tides in terms of areal expansion and frequency (MOMAF, 2000c).

Due to the increase in shipping activities, Korea has also observed the increase of oil-spill accidents. For example, annual accidents in 1970s showed an average of 100 cases, while the rate has increased up to 600 cases in the late 1990s. Coastal waters used for aquaculture grounds have been degraded also due to intensive culture activities above the carrying capacity. Presently, about

8000 licenses are issued for aquaculture activities for the coastal waters covering 113,000 ha (KMI, 2000).

Korea has a wealth of tidal mud-flats on the west and south coasts (2,393 km^2), which is a home to important fish species and migratory birds. The coastal wetlands have also served the function of purifying the incoming polluted waters from rivers and streams.

This national treasure has been threatened by large-scale coastal development projects such as coastal reclamation and infilling, port development and tourism development. The loss of coastal wetland would affect the fisheries resources as well as the carrying capacity for mitigating incoming pollutants.

3.7. Threats to the Sustainable Development of Coastal Zones

A. Multiple-Use Conflicts

Over the past three decades, Korea has achieved a remarkable economic growth at average growth rate of 8.3 percent. Its GDP has increased 191 times. Such swift economic growth has led to rapid urbanization and industrialization on the coast, large-scale coastal reclamation, construction of ports, and increase in shipping activities.

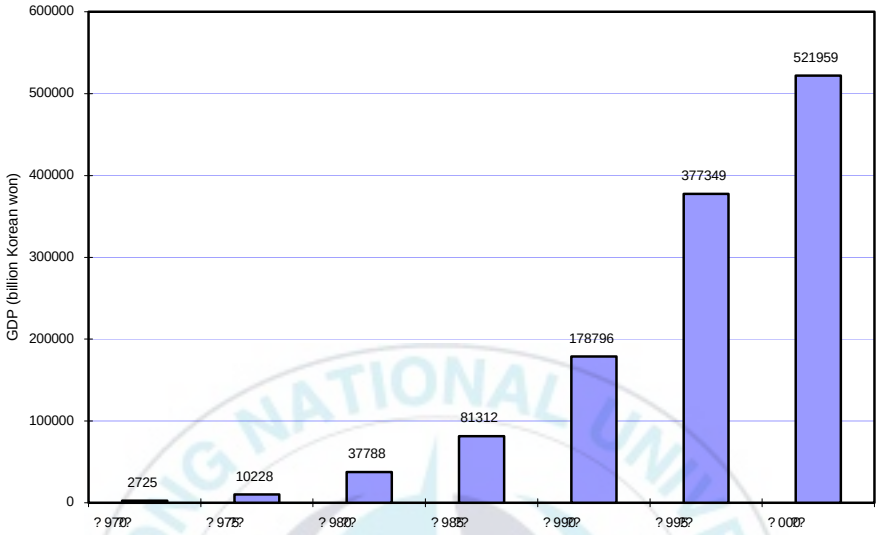
These activities have caused the significant discharge of untreated sewage and industrial waste into coastal water, loss of fishing ground and important coastal habitat (estuaries and tidal mudflats), increased incidences of oil spills, and discharge of wastes from shipping activities.

Various types of multiple-use conflicts have been observed between coastal reclamation projects and coastal fisheries, industrialization/port development and coastal fishery, aquaculture and shipping, and tourism development and marine habitat/beach protection.

The conflicts are manifested through adverse environmental impacts in different sectors and the competition for space and resources. Other forms of

conflict are described in the following sections.

Figure 1. GDP increase in Korea from 1970-2000.



Source: NSO

Multiple-use conflicts in the coastal and ocean areas have been aggravated by the fragmented and single-use oriented management system. The fact that more than 10 different government agencies and about 50 individual pieces of legislation manage various sectors (fishery, shipping and port development, marine environment, coastal construction and reclamation, and industrial development) has compounded the problem.

B. Threats Caused by Land-based and Sea-based Activities

Land-based Marine Pollution. The water quality monitoring results (Figure 2, Table 13) show that Korea coastal water quality continually improved since 1990. There are, however, parts of the south and west seas (i.e. semi-enclosed bays

and waters located near industrial and urban complexes) that exhibit certain levels of pollution (Table 14) (Office of the Prime Minister and MOMAF 1999).

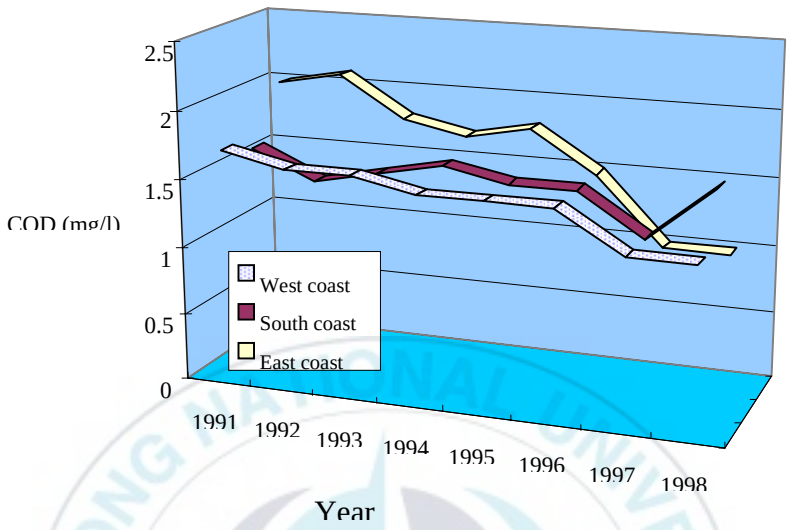


Figure 2 . Average Chemical Oxygen Demand Monitoring Results

Source: Office of Prime Minister and MOMAF, 1999.

The deterioration of coastal water quality has been caused by several factors, including the increased pollution load from land-based activities, point source and non-point source pollutants, increased sea-based activities, oil-spills from shipping accidents, and pollution load from aquaculture. Another factor to be taken into consideration is the loss of coastal wetlands, which led to the reduction of natural purification capacity and expedited the deterioration of coastal water quality.

Since the 1970s, the concentration of human population and industrial activities in a few coastal cities resulted in a rapid increase in land-based pollution (a major source of marine pollution along Korea coast). More specifically, sewage discharges into Korea coastal waters have increased from

12,323,000 m3/day in 1990 to 17,870,000 m^3/day in 2001. The Biochemical Oxygen Demand (BOD) loading was estimated to increase to 7,184 tons/day in 2001 (from 6,030 tons/day in 1995).

Table 13. Status of Pollution in Major Coastal Areas.

Coast		Temp (C)	COD (mg/L)	DO (mg/L)	H	SS (mg/L)	T-N (mg/L)	T-P (mg/L)
West Coast	Incheon	15.5	1.6	6.9	7.9	59.8	0.756	0.026
	Asan	15.8	1.3	7.5	8.1	27.8	0.353	0.038
	Taean	16.0	1.0	8.4	8.1	33.7	0.178	0.045
	Kunsan	19.0	2.2	7.7	8.0	25.3	0.688	0.044
	Mokpo	16.4	1.7	9.5	8.0	14.6	0.310	0.008
South Coast	Yeosu	16.4	1.4	8.9	8.3	10.2	0.157	0.017
	Kwangyang Bay	17.0	1.8	8.5	8.3	10.5	0.194	0.023
	Chungmu	16.6	1.7	9.6	8.3	3.0	0.217	0.024
	Chinhae Bay	18.2	2.5	11.0	8.5	2.1	0.249	0.025
	Masan Bay	18.3	4.1	11.0	8.6	3.3	0.704	0.063
	Pusan	17.3	1.9	9.2	8.4	2.1	0.364	0.024
East Coast	Onsan	16.8	1.6	9.2	8.4	2.0	0.579	0.020
	Ulsan	16.5	1.5	8.7	8.4	2.2	0.858	0.036
	Youngil Bay	15.6	1.7	8.7	7.8	4.2	0.612	0.015
	Samchuk	12.6	1.4	8.8	8.0	4.5	0.103	0.009
	Chumunjin	12.8	1.9	8.2	7.9	4.4	0.324	0.057
	Sokcho	13.2	1.8	8.8	8.2	4.3	0.122	0.014
Cheju Island	Cheju	18.2	0.9	7.6	8.1	3.3	0.178	0.012
	Seoguipo	20.0	1.5	7.7	8.2	4.0	0.169	0.010
	Peosun	19.8	1.3	7.4	8.2	3.1	0.110	0.006

Source: MOMAF, 2002.

Despite the continuous increase of land-based pollution load, wastewater treatment efforts along the coastal area remain inadequate and insufficient.

In 1998, only 66 percent of the households in the country had sewage treatment facilities. The figure was only 39 percent in coastal areas. These facilities were composed mostly of those at the primary treatment level (Bang, 2001).

As a consequence, the BOD loading in Korea coastal waters has increased to 40 percent during the last decade and aggravated coastal eutrophication and contributed to the increasing occurrence of red tide.

Sea-based Marine Pollution. The incidence of oil-spill accidents has increased during the past three decades, due to the rising role of shipping in the Korea economy. The annual occurrence of oil-spill accidents in the 1970s was pegged at around 100 cases and increased to 600 cases in the late 1990s.

Table 14 . Seawater Quality Standards.

Category	**PH**	**COD (mg/l)**	**DO (saturation %)**	**SS (mg/l)**	**E.coli (MPN 100ml)**	**Normal Hexane Extracts (mg/l)**	**TP (mg/l)**	**TN mg/l)**
I	7.8-8.3	<1	>95	<10	<200	ND	<0.05	<0.007
II	6.5-8.5	<2	>85	<25	<1000	ND	<0.1	<0.015
III	6.5-8.5	<4	>80	-	-	-	<0.2	<0.03
All Areas (Hazardous Substances)	Cd<0.01mg/l, As, Cr+6 <0.05mg/l, Zn, Pb<0.1, Cu<0.02, CN, Hg, Organic phosphorous, PCB< Detection limit							

Source: MOMAF

From 2000-2005, a total of 1,970 oil spills - mostly from oil tankers, took place, discharging 35,500 kl of oil (Table 15) into Korea's waters.

The carelessness of crewmembers was identified as a major cause of these accidents. Other possible causes include the lack of a port safety policy, poor management of small-sized vessels, decrease in quality of seamen, increase in vessel traffic, and increase in sub-standard vessels (Cho, 1998).

The coastal waters used for aquaculture have also been degraded due to intensive culture activities that do not give due consideration to carrying capacity. Presently, about 8,000 licenses have been issued for aquaculture activities covering 230,000 ha of coastal waters.

Table 15. Oil-spill Accidents. (Unit: Number of Cases)

Type	2000		2001		2002		2004		2005	
	Cases	Amount Spilled (kl)	Cases	Amount Spilled (kl)	Cases	Amount Spilled (kl)	Cases	Amount Spilled (kl)	Cases	Amount Spilled (kl)
Total	657	2,942	614	15,460	652	456	728	13,604	784	1,824

Source: MOMAF

C. Marine Debris from Land-based and Sea-based Activities.

Marine debris (trash disposed from land and dumped from ships, plastics from aquaculture activities, fishing nets and equipment, and shell fragments) is increasingly becoming a threat to safe coastal activities as well as to the health of the coastal ecosystem.

In 1997, total disposed marine debris was estimated at 380,000 tons, 50 percent of which was comprised of plastic wastes. This debris originated mostly

from land-based sources and marine-related activities such as shipping, fishing, and aquaculture (Table 16).

Marine debris impacts on fishery and aquaculture activities, the safety of shipping, the well-being of marine birds and mammals, and the coastal amenity and aesthetic value of the area.

Table 16 . Major Sources of Marine Debris Along the Korea Coasts.

Sources		Activities
Land-based		Transport of solid wastes disposed in land through rivers and streams especially during storms and the rainy season Illegal dumping from coastal resorts, commercial, and residential areas
Sea-based	Ships	Illegal dumping of food wastes, papers, and plastics from ships
	Fishing	Illegal dumping of fishing nets, fishing equipment, rope, etc. during fishing activities
	Aquaculture	Illegal dumping of fishing net or equipments from aquaculture activities Disposal of waste shells from aquaculture ground

Source: MOMAF

D. Threats Caused by Coastal Reclamation

Korea has a long history of coastal reclamation and infilling along the west and south coasts starting from the first century BC. The coasts' oceanographic and geomorphologic characteristics – shallow water depth, low slope, high tidal range, small islands, and high indentation - have made these activities cost effective and technically feasible. Coastal reclamation for food production was first conducted in 1248 in the estuary of the Choeng Chun River. During the

Japanese colonial period (1917-1938), a total of 178 sites, covering 40,877 ha were reclaimed for rice production.

Reclamation projects were re-initiated in 1970 with the construction of the Asan (2564 m) and Namyang (2060 m) dikes on the west coast. In 1980, promoted by technological developments and the vast amount of accumulated capital through the economic growth of the previous two decades, many large-scale reclamation projects were implemented to establish industrial complexes in the west coastal region in areas such as Seosan, Kimpo, Shihwa, and Saemankeum.

From 1962 to 2003, a total of 2,662 Km^2 (1,778 Km^2 of which is coastal water) of Korea's coasts have been reclaimed or are undergoing reclamation (MOMAF, 2000a). Due to the large-scale coastal reclamation and infilling projects, as well as the various construction activities conducted along the coast, 14 percent of the national coastline has been converted into artificial coast.

In addition, 10 percent of the country's coastal wetland (totaling about 700 Km^2) has been lost during the past decade. These habitat alterations and losses caused the loss of productive fishing ground, the destruction of breeding and nursery habitats, and the decline in marine biodiversity. It has also affected the migration of waterfowls.

In the early 1990s, the negative economic externality of increased pollution caused by mega-scale reclamation projects was brought to light. The public became aware, and fought for their right to fish, the right to be compensated for the loss of fishing and aquaculture opportunities, and the right to decent or acceptable levels of environmental quality.

This public awareness has grown, and as a result, the reclamation projects initiated by the private sector have been closely monitored and regulated to restrict the privatization of public assets, such as coastal water and wetland.

E. Threats Caused by Uncontrolled Coastal Development and Multiple-use Conflicts

Various laws that do not consider the long-term impacts of development have driven coastal exploitation and development in Korea. Consequently, economic development in the country has operated on the “first come, first served” principle. This led to the competition between the national and local governments and the private sector for limited coastal space and resources to be used for more than 1,000 development plans and projects (MOMAF, 2000a). This lack of a comprehensive plan or integrated guiding framework for coastal development and preservation has resulted in conflicts among various stakeholders, which have led to extreme confrontation, as in the cases of the Shihwa Lake and Saemankeum reclamation projects.

Intense coastal development has caused the degradation of resources values, and limited public access. In Korea, public access to the sea is traditionally limited for military reasons. This access has been further reduced as the coasts were converted to ports, industrial complexes, and tourism resorts; and roads were constructed along these areas (MOMAF, 2000a). Without a systematic long-term planning, commercial buildings including hotels and restaurants will continue to encroach upon the coastal waterfront to meet the increasing demand for coastal tourism and recreation. Heavy concentration of buildings on the coastal waterfront often destroy the scenic view and impose high pressure on the adjacent coastal ecosystem because of the increased load of sewage and solid wastes.

F. Challenges to Fisheries Resources Management

Increasing world population and wealth have led to higher demand for edible fish. The race to catch these fish under open access conditions has led to excess capacity of fishing boats. FAO forecasts that by 2010, worldwide demand for seafood will top 110 million tons, but catches will fall short by 40 million tons.

Nearly 70% of the world's marine fish stocks are over fished or fully exploited (FAO, 2001). Traditionally, bountiful fisheries resources and high biodiversity have characterized Korean coastal waters. The East Sea, fishing ground, formed by the exchange of warm current from the south, and a branch of Kuroshio and cold current from the North, has provided various fish species. On the west coast, the widely developed tidal mudflats are a highly productive breeding and nursery ground for benthic organisms and fisheries. The west coast has been the center of natural salt production, although most of salt ponds are closed, as economic gain is higher for coastal reclamation and infilling projects. With its geomorphologic characteristics such as rugged coastline, bays and islands, and relatively clean water, the south coast has been the best place for setting aquaculture activities (MOMAF, 2001a).

The fishing industry has grown rapidly with the development of shipping industry during the first Five-Year Economic Development phase. The distant-fishing industry made an important contribution to export earning in the1960s when the annual GDP per capita of Korea was around US 100$.

In the 1970s, although the contribution of fishing industry to Korean economy has diminished relatively due to an intensive development of heavy industries, the fishing industry continued to expand and Korea became the fourth largest fishing country in the world following Soviet Union, Peru and Japan (MOMAF, 2001a).

In the 1980s, the distant-fishing industry declined rapidly due to the expansion of EEZ declaration of coastal states as well as increased global concern on protecting fishery species on the High Seas. Coastal fisheries also began to suffer the problems of resources depletion, economic inefficiency and uncertainty, and loss of fishing ground caused by coastal reclamation and infilling projects.

To address such problems, the Korean government promoted the development of aquaculture, initially focusing on macro algal aquaculture (MOMAF, 2001a).

In the 1990s, the aquaculture technology has rapidly developed and the cultured species became diverse and expanded to finfish and crustacean species (MOMAF, 2001a).

However, since the establishment of WTO, Korea has turned from fishery-export country to fishery-import country, especially from China. For example, in 1995 Korea exported 1,170 thousand metric tons of fishery products and imported 948 thousand metric tons, while in 2004 Korea's fishery export has reduced to (1,232) thousand metric tons and fishery imports increased to (1,332) thousand metric tons.

This is mainly due to the resources depletion in coastal waters caused by overfishing, loss of marine habitat and marine pollution as well as the decreased access to fishing grounds caused by EEZ declaration of coastal states.

The main problems or issues in fisheries management include lack of due recognition as an important economic sector, growth-oriented exploitation, and lack of efforts for sustainable resources management.

As the arable land space is very limited, only 30% of total national land, Korean people traditionally treasured the land and agriculture, marginalizing the sea or coastal area as well as fisheries.

Table 17. Fishery Production from 1990-2001. (Unit: 1000 M/T)

Year	Coastal Fishery	Aquaculture	Distant Water Fishery	Inland Water Fishery	Total
1990	1,542	773	925	35	3,275
1995	1,425	997	897	29	3,348

1996	1,624	875	715	30	3,244
1997	1,367	1,015	830	32	3,244
1998	1,308	777	722	27	2,834
1999	1,336	765	791	18	2,910
2000	1,189	653	651	21	2,514
2001	1,252	656	739	18	2,665

Source: MOMAF, 2002.

Under this tradition, the important fishery habitat such as estuary and wetland has been destroyed by the national push for coastal reclamation and infilling to expand the land area for agriculture, urbanization or industrial activities (MOMAF, 2000a).

In addition, regardless of various regulations on net size and number or size of fishing vessels, the growth or expansion-oriented fishing practices led the depletion of fisheries resources. This situation was aggravated by illegal and unreported fishing activities, which hampered the development of a scientific database on fisheries resources and constrained the policy formulation on sustainable fishery management. For the case of aquaculture, despite increasing production, due consideration has not been given to carrying capacity of aquaculture ground and sustainable production. Countermeasures against toxic algal blooms or occurrence of pathogenic species have not been provided. Few efforts have been made for long-term technology development to produce high quality and highly economic fish species (MOMAF, 2001b).

The fisheries policy has been regarded as an extension of agriculture policy, focusing on the growth of quantity, and its uniqueness in contrast to the economic nature of agriculture was not given due consideration. For example, compared to agriculture, the fisheries can be of high-income industry considering its economic competitiveness even though it requires high initial capital investment. Thus, government subsidies not only could have weakened the economic

competitiveness in the view of long-term base but also could have hindered a development of new technology. In addition, the subsidy has been directed to a few capitalists instead of the majority of fisherman who are the employee of fishing industry because they have no collateral against which to borrow money (KMI, 2001a).

Since the enactment of Fisheries Act in 1953, the local governments have managed fisheries following the model developed in Japan without any review, where the management capacity of local governments and cooperatives in Japan has been quite strengthened through long-term experiences. However, the weak management capacity in Korean local governments and cooperatives caused various institutional and policy problems in managing fisheries and could not implement sustainable fisheries policy which requires strong administrative force for resources management and price control (KMI, 2001a).

The Korean fisheries industry has long played a role as a national food industry along with agriculture. Fisheries products supply about 39.2% of the animal proteins that the Korean people demand, which is on average 48.4 kg per person annually. Even though there are regulations for fisheries management such as technical measures, to restrict fish size, sex, season for fishing, and input control, which is permit or license system for fishing, it is inevitable that overfishing will happen without output control, which includes TAC, and other control tool such as restriction of fish ground.

The decrease of fish production per ton of vessel shows that it has been a progressive over-exploitation of fish stocks. For example, the output per ton of ship was 4.7 tons in 1975, but it became 3.4 tons in 1990 and it decreased to 3.0 tons in 1998 (MOMAF, 2002).

3.8. Legal Framework for EF in Korea

The legislation relevant to marine environment management can be grouped into three categories (Bang, 1999). Table 18 shows kinds of protected area in Korea based on legal framework.

The first category includes the legislation, which is oriented to preventing pollution. The main example of this category is Marine Pollution Prevention Act (MPPA wholly amended 1999). This Act originated under the umbrella of Environment Policy Act, but now becomes basic regulation on marine environment since the creation of MOMAF. Relevant Acts in this category include the Water Quality Preservation Act, Waste Management Act on Disposal and Treatment of Sewage and Animal Wastes, Environment Impact Assessment Act, and Act on Damage Compensation of Oil-Spills.

The MPPA, which is originally enacted to implement MARPOL 73/78 (the International Convention for the Prevention of Pollution from Ships) under IMO (International Maritime Organization), provides regulations to prevent marine pollution from various sources including sea-based activities and land-based activities.

However, with the establishment of MOMAF in 1996 and the resultant transfer of authority on marine environment from Ministry of Environment to MOMAF, this Act was amended to provide a mechanism of designating and managing ‘Coastal Environment Management Areas (CEMA)’, which includes both ‘Marine Protected Areas (MPA)’ and ‘Special Management Areas (SMA)’.

In addition, this Act also provides the framework of marine pollution monitoring and water quality standards. The main purpose of designating MPA and SMA according to MPPA is to protect people’s health and property as well as protect marine environment from the threats of land and sea-based pollution.

The specific definitions and management policy for MPA and SMA are provided in the next section of this thesis.

MOMAF is requested by the MPPA Act to prepare a comprehensive management plan for the areas designated for MPA and SMA. This plan shall include vision, goals and management strategies as well as a monitoring and research scheme covering marine environment parameters as well as ecosystem/biodiversity components.

The management measures in the plan shall cover preservation of pristine environment and wildlife, protection of ecosystem from threats imposed by human activities, and restoration of degraded marine environments.

Restrictions are imposed on the construction of buildings or facilities that discharge wastewater above certain levels. Especially, in the CEMA area, MOMAF can apply TMDL (Total Maximum Daily Load), which is the maximum amount of a pollutant that a water body can receive and still meet water quality standards as well as an allocation of that amount to the sources of pollutants (Tietenberg, 2001).

In addition, MOMAF is requested to prepare alternative livelihood programs for communities which are affected by the designation of MPA or SMA.

The second category includes the legislation oriented to ecosystem protection. A prime example is The Fishing Ground Management Act (2001, Act 6398). This Act is founded to implement EF in 1999. The main objectives of this Act are to construct the base of sustainable fishery production by preserving and promoting the environment of fishing ground.

Therefore, this Act provides the framework of conducting the survey on the environment of fishing ground per 5 years. It also establishes the mechanism of designating ‘Special Area for the management of fishing ground’ which is necessary to rest or to manage environment capacity due to pollution etc.

In addition, to manage and to improve the environment of fishing ground, the Act establishes the Basic Plan and the Action Plan.

The next regulation is the Wetland Preservation Act (1999). This Act is under the umbrella of the Natural Environment Preservation Act. The main objectives of the Wetland Preservation Act are to protect wetland, to protect livelihood of residents in wetland preservation area, and to enhance scientific understanding of wetland.

Thus, the Act provides the framework of conducting national survey on wetland ecosystems, and their socio-economic characteristics. It also establishes the mechanism of designating 'Wetland Preservation Area (WCA)', and formulating and implementing 'Management Plan of Wetland Preservation Area'. The purpose of this act is to maintain biodiversity in wetlands and to facilitate international cooperation about the Ramsar Convention.

Table 18 . Types of Protected Areas in Korea

Name	Related Regulation	Main Purpose	Area	Date
National Marine Park	Natural Park Act	Protection of Natural Resources	4 Places 4,043 Km^2	Since 1968
MPA	Marine Pollution Prevention Act	Preservation of Marine Ecosystem	5 Places, 1065.15 Km^2	2001
SMA		Protection of Marine Pollution	5 Places 1718.40 Km^2	2001
Wetland Preservation Area	Wetland Preservation Act	Preservation of Wetland	Proceeding	-
Natural Environment Preservation Area(Marine)	Natural Environment Preservation Act	Preservation of Natural Environment	No Marine Area	-

Source: MOMAF 2002, MOE 2002

According to this Act, MOMAF can designate wetlands in coastal areas if the area is worth protecting as habitat for wild animals or plants. After designating the area, MOMAF is requested to establish a management plan that includes

management strategies and a monitoring plan of wetlands. In addition, activities such as reclamation and land-filling are prohibited in the WCA.

The Act on Marine Ecosystem Preservation and Management, which provides a legal base for establishing Ecosystem Preservation Areas including marine components, aims at preserving and managing natural environment systematically with special focus on protecting biodiversity and endangered species of wildlife.

According to this Act, MOE is requested to prepare a master plan every five years. In this plan, following items are included:

- The present condition of the natural environment
- Management programs to preserve natural environment
- Cooperation mechanisms among national governments and local governments
- Financing mechanism to implement the management program

MOMAF can designate following marine areas as Ecosystem Preservation Areas:

- The area with pristine nature environment or significant biodiversity value
- The area with high quality natural views
- The habitats for endangered species of wild fauna and flora

In the Ecosystem Preservation Area, such activities as harvesting of wildlife, construction, reclamation, infilling and mining, are prohibited or restricted.

Third category includes the legislation oriented to regulating spatial uses of coastal land and water. Main example of this category is the Coastal Management Act (1999). This Act is under the umbrella of National Land Comprehensive Development Act, and relevant Acts under this category include

National Land Use Management Act, Public Waters Management Act, and Public Waters Reclamation Act.

The Coastal Management Act was enacted to reduce multiple use conflicts related to coastal space uses, to restore the degraded coastal ecosystem and to prevent natural hazards. It provides the mechanism of integrated coastal management planning at both national and local levels, conducting coastal zone improvement projects, and operating a 'Coastal Management Council' at both national and local levels.

The Law on Coastal Fishing Ground Management, which regulates coastal fishing ground, especially aquaculture ground, aims to preserve carrying capacity on aquaculture for sustainable development. MOMAF can designate national park in both lands and seas with excellent natural view or cultural heritage through a stakeholders' consultation including relevant governments and experts.

After designation, MOE shall prepare a master plan every ten years to manage the park effectively. This plan shall include the main goal for preserving national park, and management program for preservation and sustainable use of natural resources. Within the boundary of national parks, any activity that causes damages to natural environment is restricted or prohibited.

For example, any reclamation or landfilling in the marine park area is subject to approval by MOE. Although it can be categorized into category 2 of protected areas as defined by ICUN (Table 19), the function of recreation is accentuated rather than protection of ecosystem.

According to IUCN, MPA is defined as: "any area of intertidal or subtidal terrain together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or the entire enclosed environment."
The main goal of IUCN is "to provide for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity

through the creation of a global, representative system of marine protected areas and through the management in accordance with the principle of the World Conservation Strategy of human activities that use or affect the marine environment" (ICUN, 2002). This implies a requirement for a basic legal system to implement MPAs in Korea. Besides a legal system for the designation of MPA, there is also a need to provide a legal base for communities to manage fishing areas in cooperative manner. One of such example can be found in the Fisheries Act, which provides a mechanism to enhance fisheries resources through community- based management approach.

Table 19 . IUCN Guideline on MPA Categories

Protected areas are divided into six types, depending on their objectives:

Category I – Protected area managed mainly for science or wilderness protection(Strict Nature Reserve/Wilderness Area);

Category II – Protected area managed mainly for ecosystem protection and recreation (National Park);

Category III – Protected area managed mainly for conservation of specific natural features (Natural Monument);

Category IV – Protected area managed mainly for conservation through management intervention (Habitat/Species Management Area);

Category V – Protected area managed mainly for landscape/seascape conservation and recreation (Protected Landscape/Seascape);

Category VI – Protected area managed mainly for the sustainable use of natural ecosystems (Managed Resource Protected Area).

Source: IUCN 2002

3.9. Policy Framework for EF in Korea

A. KOREA Economic Policy

The Government of the Korea has usually controlled the allocation of human resources, the pace of capital development, the national ethos, and the pattern of coastal zone uses through centralized economic planning.

This generally involves the setting of prescriptive goals for each economic sector. Economic planning and implementation in Korea has undergone the following phases: Import Substitution Phase; Labor-Intensive and Light Industry Export-led Phase; Heavy and Chemical Industry Export-led Phase; and Technology-Intensive Industrialization Phase.

During the Import Substitution Phase (1953-1961), the government's policy was on post-war reconstruction and the maintenance of political order. The Import Substitution Policy resulted in the development of light industries in large cities like Seoul and in the acceleration of migration.

During the Labor-Intensive and Light Industry Export-led Phase (1962-1971), the government replaced its policy of import substitution and increased the export of labor-intensive and light industry goods, thereby achieving rapid economic growth. At this time, a free export zone was established at Masan on the southern coast to promote exports by lowering tariff barriers and providing state guarantees for foreign investment exports (Hong, 1991).

During the Heavy and Chemical Industry Export-Led Phase (1972-1981), the Korea government focused on agricultural self-sufficiency, rural development, and new import substitution in heavy and chemical industries.

Capital-intensive national efforts to achieve self-sufficiency in food supply and the dispersed industrial activity, partly to relieve population pressures in larger cities and to equalize incomes among regions resulted in the creation of many large industrial complexes, and the initialization of numerous coastal area reclamation projects along the southern coastal area (Hong, 1991).

The nation's first industrial estate was established at Ulsan, the center of the shipbuilding industry; and the Changwon Integrated Machinery Complex, Korea's largest industrial park built between Masan and Chinhae on the southern coast. Two main petrochemical complexes were established on the southeastern coast in Ulsan and Yosu and a third in Kwangyang.

To meet the drastic increase in demand for steel that was triggered by rapid industrialization, the Pohang Iron and Steel Company rapidly expanded its facilities in Pohang and Kwangyang. In addition, they built a nonferrous metal complex in Onsan near Ulsan and some new shipyards in Okpo near Pusan (Hong, 1991).

The concentration of sewage and wastes from heavy industries on the southeastern part of the Korea coast resulted in heavy stress on adjacent marine ecosystems. As a consequence, most of the coastal waters in the Masan Bay, Kwangyang Bay, Busan and Ulsan, were designated as "Special Management Areas for Controlling Coastal Pollution" in 1982 under the Marine Pollution Prevention.

In the early 1980s, Korea was still dependent on imports for sophisticated technology and critical materials. Thus, the major goal of the Technology Intensive Phase in the 1980s and 1990s was to enhance investment for research and the development of high-technology industry, as well as to direct economic focus from heavy to knowledge-intensive industries. The government's aim was to disperse industrial concentration from the capital region and the southeast coast[6] to the west coast.

[6] The southwest coast region, which was relatively underdeveloped, had advantages in hosting high-tech industries because they had cheap coastal land and relatively high potential in labor supply (Hong, 1991 391pp).

B. Policy on Land Development

The industrialization and urbanization of the past decades have changed the face of Korea's national land. The national policy on land development was formulated to support the national economic development policy (Table 20). During the 1950s, the main focus was on the reconstruction of houses and roads destroyed during the Korean War.

In the 1960s, efforts were made to construct major expressways to connect Seoul with two port cities, Busan and Incheon. Multi-purpose dams were constructed and large-scale industrial parks were built on the west and southeast coasts. During this period, the legislative framework for national land development was established. The City Planning Act and the Construction Act were legislated in 1962. The Act on Comprehensive Plan for Construction in the National Territory was in 1963.

In the 1970s, the First Comprehensive Plan for Construction in National Territory was formulated to systematically direct national land development. During this period, strategies for national development were centered on the maximization of economic growth anchored in the promotion of export-led heavy industrialization.

Despite its achievements of rapid economic growth, the country began to face problems, including unbalanced regional development, irrational land utilization, and the expansion of big cities. To effectively address such issues, the Second Comprehensive Plan on National Land Development was formulated in the 1980s.

The plan focuses more on regional balance and equitable distribution. Investment in the construction of sewerage systems and sewage treatment plants was expanded during this period.

In the 1990s, the land development policy was formulated guided by the principles of globalization, decentralization, and democratization. The Third

Comprehensive Plan on National Land Development focused on the development of small cities and rural areas encouraged the establishment of new industrial complexes, and the linkage of the mid-west and southwest regions through the construction of an expressway.

In the early part of 2000, Korea was in the midst of the Asian economic crisis. The Fourth Comprehensive Plan on National Land Development was formulated with the main goals of integration and balanced development.

The focus was on balancing environmental conservation and land development, increasing global competitiveness, promoting the cooperation between South and North Korea, and improving the quality of life of its citizens.

C. National Land-use Zoning Schemes

The use and development of Koreas national land is regulated by the Act on Comprehensive Plans for Construction in the National Territory, (Law No. 1415, Oct. 14, 1963). Five types of planning for national land construction are carried out at the national, provincial, city, and county government levels.

The planning process is extremely centralized, following the “top-down” decision-making model. National land-use planning provided the basis for provincial and special area planning, while provincial planning provided the basis for city and county planning.

The Council of Comprehensive Plans for Construction in National Territory, headed by the President, facilitates inter-ministerial coordination and is responsible for the review and harmonization of national construction plans, special area planning, and the approval of provincial plans.

To effectively implement the Comprehensive Plan for Construction in the National Territory and control national land use, the Act on the Utilization and Management of the National Territory (Law No. 2408, 30 December 1972) and the City Planning Act (Law No. 2291, 19 January 1971 as amended) were passed. These Acts effectively put in place the land-use zoning scheme.

According to the Act on the Utilization and Management of the National Territory, the Minister of MOCT is required to establish the Plan for National Territory Utilization (National Land Use Plan), which provides the zoning framework for national land. This plan divides the national land into five zones specifically urban zones, semi-urban zones, rural zones, semi-rural zones, and natural environment conservation zones.

Table 20. National Land Development Policy in Korea.

Period	Policy	Main Focus
1950s	Poverty alleviation	Constructing infrastructures (roads, railways, ports)
1960s	Promoting economic growth	Constructing infrastructures and industrialization (roads, port, Ulsan Industrial Park)
1970s	Maximizing economic growth	Heavy industrialization
1980s	Equitable distribution	Growth management of Seoul
1990s	Globalization, decentralization, democratization	Regional balance between Seoul and local cities
2000s	Integration and balance	Balance between environment preservation and development

Source: MOCT, 2001.

Under the City Planning Act, urban zones can be classified into residential areas, commercial areas, industrial areas, and open spaces. The present zoning scheme is land-oriented, and thus limited in coordinating various uses occurring in coastal zones.

Currently, 5,414 Km^2 of coastal water (about 7% of the territorial sea area) and 282 km of coastline (about 4% of Korea's total coastline) are designated as natural environment protection areas; 608 Km^2 and 1.5 Km^2 of coastal waters are designated as urban and semi-urban zones, respectively (1995 Annual Report of the National Land Use Plan).

Zoning schemes may also be found in individual pieces of legislation (Table 22), most notably the Fisheries Act (Law No. 4252, 1990), the Natural Parks Act (Law No. 3243, 1980), the Marine Pollution Prevention Act (Law No. 5915, wholly amended 1999), the Natural Environment Preservation Act (Law No. 4492, 1991), the Naval Base Act (Law No. 3564, 1982), and the Public Waters Reclamation Act (Law No. 986, 1962).

Certain activities are restricted or prohibited in specific zones as prescribed in individual legislations (Table 22). For example, according to the Natural Environment Preservation Act, the following activities are prohibited with the exception of certain cases determined by Presidential Orders:

- ✓ Construction, reconstruction and expansion of buildings and facilities;
- ✓ Unplanned deforestation;
- ✓ Cultivation, infilling, dredging and reclamation;
- ✓ Change of soil characteristics;
- ✓ Livestock husbandry and ranching;
- ✓ Capture and collection of wildlife (excluding fisheries resources); and
- ✓ Mining of soil, sand, and gravel.

According to the Fisheries Act, and Fisheries Resources Protection Areas, filling or dredging projects can be carried out only through the permission of the MOMAF or the governors of provincial/city governments. In Coastal Environment Management Areas (CEMAs), the following activities should be carried out only through consultation with MOMAF:

- ✓ Designation of hazardous materials and waste disposal sites in the port area;
- ✓ Public waters reclamation;
- ✓ Occupation and use of public water; and
- ✓ Fishing and mariculture activities.

Consultation, however, should be made before carrying out the Environmental Impact Assessment (EIA), in cases where a necessary is.

Table 21. Specific Zoning Schemes Relevant to Coastal Activities.

Specific Zoning	Legislation	Date and Law Number	Government Agency
Naval Base Area	Naval Base Act	'82.11.29; 3564	Defense
Fisheries Resources Protection Water,	Fisheries Act	'90.8.1; 4252	MOMAF
Sea-bed Mining Area	Sea-bed Mineral Resources Development Act	'70.1.1; 2184	MOTI
Marine Ecosystem Protection Area	Natural Environment Protection Act		MOE
Marine National Park Area	Natural Park Act	'80.1.4; 3243	MOHA
Tourism Area	Tourism Promotion Act	'86.12.31; 3910	MOCT
Industry Area	Industry Sitting and Development Act	'90.1.13; 4216	MOCT
Public Waters Reclamation Area	Public Water Infilling Act	'62.1.20; 986	MOMAF

Coastal Environment Management Area	Marine Pollution Prevention Act	'99.2.8 wholly amended; 5915	MOMAF

Source: MOST, 1996 and MOMAF, 2000b.

Table 22 . Restriction and Prohibition of Activities in Specific Zones Relevant to Coastal Zones.

Specific Zoning	Restriction and Prohibition of Activities
Naval Base Area	• Permission Needed • Entry into the area • Collection of floating or submerged materials • Disposal of hazardous materials • Prohibited • Surveying and photographing the naval base • Interrupting the sea land of naval vessels • Moving and destroying buoys or submerged navy facilities • Consultation Needed • Construction and reconstruction of Port • Excavation in the coast • Filling and dredging of river or coastal water • Construction and reconstruction of underwater or floating facilities • Shipping activities • Mining • Construction of communication facilities
Fisheries Resources Protection Water	• Permission Needed • Filling and dredging
Marine	• Construction, reconstruction and expansion of buildings and

Ecosystem Protection Area	facilities • Unplanned deforestation • Cultivation, filling, dredging and reclamation • Change of soil characteristics • Livestock ranching • Capture and collection of wildlife except fisheries resources • Mining of soil, sand and gravel
Marine National Park Area	• Permission Needed • Construction and reconstruction of buildings and facilities • Outside painting of buildings and facilities • Mining and deforestation • Change of soil types including the sea bottom • Filling and reclamation of coastal water • Hunting of wildlife • Livestock ranching • Storing of materials
CEMAs	• Designation of hazardous materials and waste disposal sites in the port area • Permission of public water area filling • Permission of occupation and use of public water • Permission of fishing

Source: MOST, 1996 and MOMAF, 2000c.

D. Environmental Management Policy

The development of Korea's Environmental Management Policy is divided into three phases, namely: the Initiation Phase (1945-1970s); the Establishment Phase (1980s); and the Development Phase (1990s).

There was no foundation for industrial activity during the 1950s. Virtually, there was no environmental policy in Korea. Environmental policy in the country was initiated with the enactment of the first environmental legislation during the period of the First Economic Development Five Plan (i.e., Prevention of Public Nuisance Act in 1963).

This Act, however, was limited in its extent as legislation for sanitation rather than as an environmental legislation. There were neither implementation provisions such as arrangements among responsible agencies or budget allocations nor regulatory follow-up activities.

Due to the economic development and rapid industrialization during the 1960s and 70s, various environmental pollution problems began to surface. In response to these problems, the Korea government enacted the Environmental Preservation Act in 1977, which provided measures for establishing environmental standards, environmental monitoring, establishment discharge limits, construction of pollution prevention facilities, and EIAs.

This law, however, was passively enforced due to limited financial and organizational resources.

The 1980s saw the maturation of the country's environmental policy. The Korea society, recognizing that rapid economic growth would not automatically bring about the improvement of the quality of life, began to raise their concerns over the problems on environmental degradation and the inequitable distribution of resources.

Due to this, the Environmental Administration was organized in 1980 as a sub cabinet agency of the Ministry of Public Health and Social Affairs to implement and coordinate national environmental policies.

The Constitution of the Fifth Republic (Article 35, amended in 1980) included a guarantee of the people's fundamental right to live in clean and healthy environments. The Constitution of the Sixth Republic (Article 35, amended 1987), on the other hand, declared not only the fundamental environmental rights of people but also the nation's responsibility for environmental preservation as part of public policy.

In the 1990s, environmental issues were started to be recognized as an important agenda. These issues were particularly related to limited water resources, degradation of air quality in cities; increase in hazardous materials and in waste production, decrease in urban green space, and global environmental changes.

To address these issues more effectively, the purview of the Environmental Administration was expanded in 1995, and it was converted into a full-fledged MOE. The legal framework for environmental management was also expanded to six different acts, through the division of the Environmental Preservation Act of 1977 into the Environmental Policy Basic Act, the Air Environment Preservation Act, the Water Environment Preservation Act, the Noise and Vibration Regulation Act, the Hazardous Chemical Materials Management Act, and the Conflict Resolution on Environmental Pollution Damage Act (Table 23).

The decentralized system established in 1993 also made a great impact on environmental management. The high demand for local development resulted in environmental degradation at the local level, putting forth the need for coordination between the local and national governments in environmental management.

During this time, the participation of civil society in the process of environmental policymaking and implementation grew dramatically due to the expansion of democratization and enhanced public awareness.

Table 23. Legislative Framework of Environmental Management in Korea.

Constitution	
Framework Act	Environmental Policy Basic Act
Natural environment management	Natural Environment Preservation Act Environmental Impact Assessment Act Island Ecosystem Preservation Act Natural Park Act Soil Environment Preservation Act Wetland Preservation Act Wildlife Protection and Hunting Act
Air discharge control and management	Air Environment Preservation Act Noise and Vibration Control Act Quality Control of Underground Living Space Act
Water discharge control and management	Water Environment Preservation Act Sewage and Animal Wastewater Treatment Act Sewerage Act Water Quality Improvement in the Han River Watershed and Support of Local Community Act
Waste discharge control and management	Waste Management Act Legislation on Resource Reuse and Promotion of

	Recycling Legislation on Waste Treatment Facilities and Support for Local Community Legislation on Transboundary Movement and Treatment of Wastes
Drinking water management	Drinking Water Supply Act Drinking Water Management Act
Others	Hazardous Chemical Materials Management Act Legislation on Environmental Technology Development and Support Special Act on Environmental Crime and Punishment Environmental Conflicts Resolution Act Environmental Improvement Special Accounting Act Environmental Improvement Cost Allocation Act Environmental Management Public Agency Act Resource Reuse Public Agency Act Legislation on Establishment and Operation of Capital Area Landfill Management Public Agency

3.10. Basic Plan on EF

According to EF Basic Plan made by MOMAF in 1996, there are four implementation strategies for Goal of EF that is to make sustainable fishery

production base and to improve competition of fishery product by accomplishing high quality (MOMAF, 1998):

A. Preservation and Improvement of Coastal Environment

First of all, the plan adopts preservation and improvement of coastal environment to accomplish EF. There are four main programs to accomplish this strategy. First, one of the most important things is to manage land based pollution.

Next, it is to diminish self- pollutants resulting from several kinds of fisher activities such as discarded nets. In addition, there is clean-up program to get rid of already inputted pollution in the coastal areas. Finally, the program, which is called “Submarine forest,” is to plant sea grass.

B. Construction of System on Environment Management in the Fishing Ground

Next, the plan adopts system of environment management. There are also four programs. After evaluating environment of coastal fishing ground, “break year” which is to stop agriculture is induced whereas renovation of license on aquaculture is applied simultaneously regardless of it’s expire period. In addition, feasible environment program is applied according to carry capacity of fishing ground

C. High Quality of Fish Products

Thirdly, the plan adopts high quality of fisheries products. To accomplish this strategy, there is to induce approval system on environment friendly fisheries product. In addition, system of distribution industrial for environment friendly fisheries products is adapted.

D. Construction of Implementation Base on EF

Finally, the plan adopts construction of implementation base on EF. There is program on education and public relationship to let fishermen change their

concept that is only interested in catching quantity of fish stock. In addition, there is a program to supply and develop environment friendly technique. Lastly, to launch this plan more effectively, government intends to enact a new law that is called “Law on Coastal fishing ground environment management”

This source is extracted from Basic Plan for EF in Korea of MOMAF (1998)

3.11. Strategy Plan for CEMA

According to various pieces of legislation mentioned in the previous chapter, the Korean government has designated so far four sites as National Marine Parks according to National Park Act, four marine protected areas and five special management areas according to Marine Pollution Prevention Act (Table 24). In addition, one wet land preservation area was designated in 2002. Figure 3 shows the distribution of various protected areas in Korea.

Table 24. Status of National Marine Parks in Korea

Marine Park	Location	Area (Km^2)	Year
Hanryo	South coast	510,323	1968
Dadohae	Southwest coast	2,349	1981
Taean	West coast	328,996	1978
Byun-San Peninsula	West coast	157,000	1981

Source: MOE

Because National Park Act deals with terrestrial parts, rather than the protection of habitat or biodiversity of marine parts, the analysis on the policy framework related to marine protected areas in this study will focus on the

‘Coastal Environment Management Area (CEMA)’ including ‘Marine Protected Area (MPA)’ and ‘Special Management Area (SMA)’ under the Marine Pollution Prevention Act.

The policy framework for the management of CEMA is articulated in the ‘Strategic Action Plans for Coastal Environment Management Areas (Strategic Plan hereinafter)’, which was prepared by the Ministry of Maritime Affairs and Fisheries and approved in 2001. As of 2000, nine bays along the coast were designated as CEMA covering a total area of 5,084 Km^2, which includes marine area of 2300 Km^2 (45.24%) and terrestrial part of 2784 Km^2 (MOMAF, 2001b).

The objective of the Strategic Plan was to formulate systematic and comprehensive management guidelines to improve marine environment and to protect ecosystem of coastal areas designated for ‘Coastal Environment Management Area (CEMA)’ including ‘Marine Protected Area (MPA)’ and ‘Special Management Area (SMA)’ (MOMAF 2000c). The Marine Pollution Prevention Act provides the legal authority of this Plan. The Act also establishes the basic management framework for ‘Marine Protected Areas’ and ‘Special Management Areas’. This Plan is a national plan to be established by the Minister of the Maritime Affairs and Fisheries.

This Plan is to serve as the implementation Plan of ‘Ocean Korea 21’ in MOMAF, which is the national framework plan for the sustainable development of oceans toward 21st century as well as the implementation Plan of ‘Five-year Marine Pollution Prevention Plan’.

Through consultation with heads of national agencies, provincial and local governments, the Minister of Maritime Affairs and Fisheries formulates and implements the Strategic Plan every 5 years in close relation to ‘Five-year Marine Pollution Prevention Plan’.

The Plan is subject to revision in every 2-year period to maintain the adaptability for unforeseen changes and new scientific understandings.

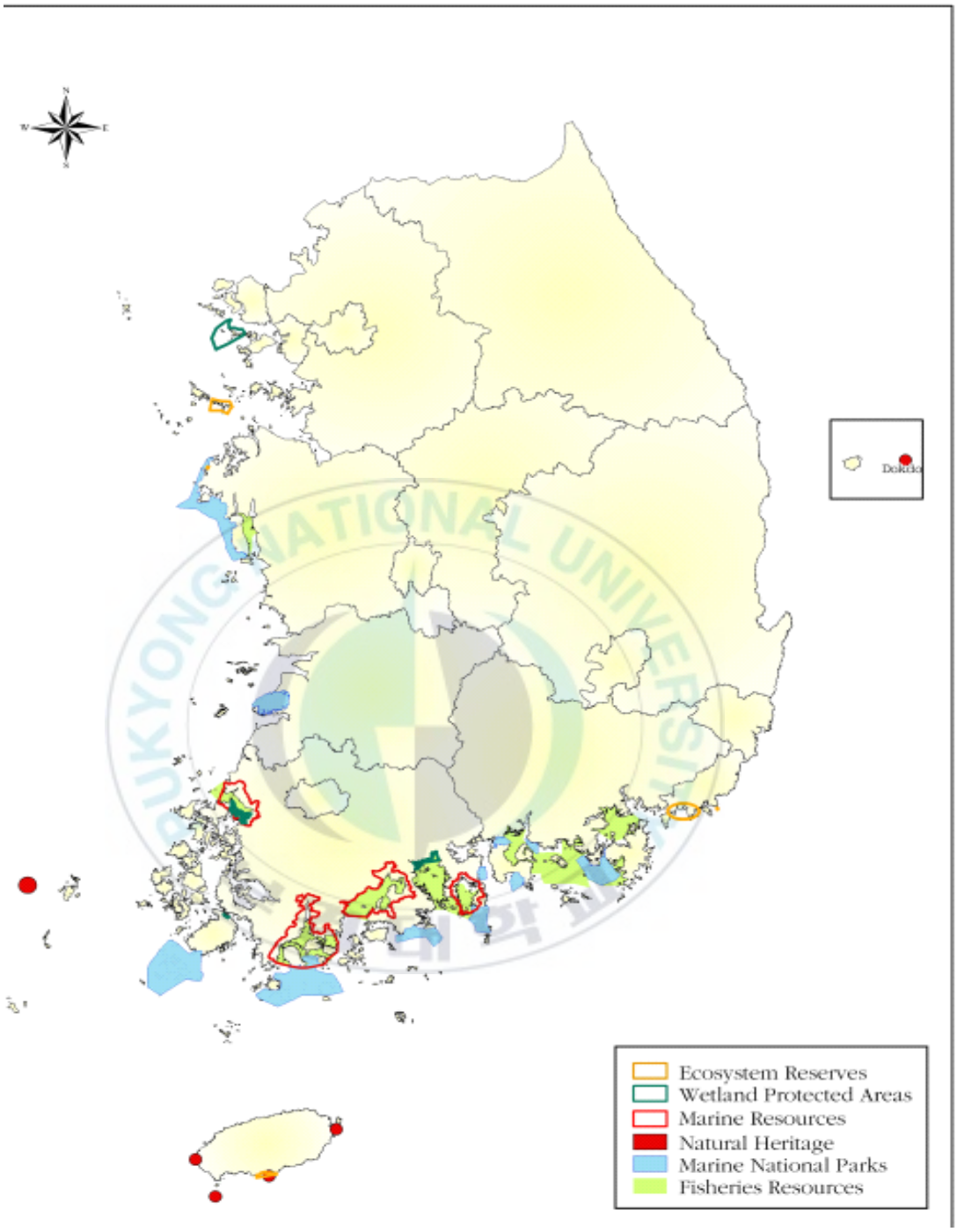


Figure 3. Distribution of Protected Area in Korea; Source: MOMAF

CEMA is defined according to Article 4, para. 4 of Marine Pollution Prevention Act and consists of ‘Marine Protected Areas’ and ‘Special Management Areas’. Marine Protected Areas (MPA) is defined as coastal waters in relatively pristine and good ecological conditions, which need to be preserved and protected continuously. Four bays on the west and south coast have been designated as MPA in February 2000.

They are Hampyong Bay, Wando-Doam Bay, Deuk-Ryang Bay, and Kamak Bay. Special Management Areas(SMA) are defined as coastal waters which do not meet water quality standards, impose significant risks or potential risks to human health, ecosystem integrity and coastal uses, and thus need special management measures for restoration. Five bays on the west and south coast have been designated as SMA in February 2000. They are Shihwa-Incheon Coastal Area, Kwang-Yang Bay, Masan Bay, Pusan Coastal Area, and Wool-San Coastal Area.

The designation of MPA and SMA is conducted considering various environmental and socio-economic criteria such as water quality standards, biological diversity and resources, coastal land utilization, pollutants loading, sea-use activities, etc. In terms of physical and spatial boundaries, CEMA includes semi-enclosed bay waters and adjacent watershed areas where pollutants directly influence coastal environment.

The scope of management actions covers environmental (water quality, sediment quality) management measures, resources (living resources, space utilization) management measures, and institutional measures (human resources, organizational and financial resources).

The Strategic Plan adopts following principles for management of CEMA (MOMAF, 2000c):

Principle of Sustainable Development

The plan adopts the principle of conserving the functions and structures of ecosystem for the long-term and equal benefits of both present and future generations in terms of environmental, socio-economic and cultural values.

Principle of Ecosystem Management

The plan adopts the principle of formulating and implementing management strategies taking due consideration of ecosystem diversity and processes.

Principle of the Precautionary Approach

The plan adopts the principle of applying appropriate management measures to prevent potential risks based on limited available knowledge and information on the impacts on coastal water and ecosystem.

Principle of Integrated Management

The plan adopts the principle of establishing integrated management system by addressing land-sea interface issues, coordinating among relevant agencies, and involving stakeholders.

Principle of Building Partnerships

The plan adopts the principle of safeguarding common vision and interest, and ensuring transparency and accountability of policy making process by building effective partnership among stakeholders.

The Strategic Plan envisions Korean coastal waters to serve as sustainable resource base for ecologically responsible and economically viable marine and fisheries activities, and to serve as high-quality amenity space by developing coastal waterfront in environmentally-friendly and aesthetically-sound manner. The Plan adopted following strategies for managing Korean coastal waters and ecosystems. According to the strategies below, a specific action plan has been developed and implemented.

Strengthening the knowledge-base for coastal environment management

- Establish integrated monitoring system for the effective management of marine environment and resources
- Establish integrated information management system
- Establish continuous monitoring system for pollutants of high risk

Establishment of comprehensive system of managing marine pollution sources

- Secure wastewater treatment facilities and environmental infrastructure which are sensitive to marine ecosystem
- Apply total quantity management system of pollutants loading
- Develop an effective management system for non-point pollution sources
- Develop effective measures for managing pollution generated by aquaculture activities

Establishment of Optimal Environment Restoration Model Considering Specific Characteristics of Coastal Ecosystems

- Develop standard management model and approaches for coastal restoration
- Apply integrated management of environment restoration related projects including both coastal water and watershed
- Protection of Marine Biodiversity
- Establish the limit on allowable resources utilization for each coastal ecosystem
- Designate habitat protection area (No-Take Zone)

Establishment of Partnership among Stakeholders at Local Level

- Promote public and private environmental investments which have positive economic impacts on local economy
- Establish and operate cooperative decision-making system involving government, academia, industry, and civil society groups
- Develop public awareness and participation programs

Establishment of Systematic Planning and Management System

- Standardize the planning and management process in coastal waters
- Apply effective evaluation system at multiple levels
- Develop appropriate economic techniques and methodology for the valuation of environmental resources

Selection of a Pilot Management Areas and Focus Management Efforts

- Supply resources to appraise cost-effectiveness and transferability
- Select pilot management areas considering the feasibility and applicability of management measures
- Secure the implement ability of management measures by developing strategic action plans and applying priority actions
- Develop regional cooperative management programs with relevant regional programs and international donors

This source is extracted from Strategy Plan for CEMA in Korea of MOMAF (2001)

4. Ecosystem based Fisheries management

4.1. Impacts on Existing Marine Living Resource Management in U.S

The regional Fishery Management Councils are involving broader communities in the management of the nation's fisheries. But even with current efforts, 33% of federally managed fish stocks are overfished, and it will take ten years or more before some fisheries fully recover and become commercially viable and sustainable (Turning to the Sea: America's Ocean Future).

Increasing world population and wealth have led to higher demand for edible fish and excess capacity of fishing boats. FAO forecasts that by 2010, worldwide demand for seafood will top 110 million tons, but catches will fall short by 40 million tons. Nearly 70% of the world's marine fish stocks are overfished, fully exploited. (FAO, 2001)

Waters under U.S jurisdiction contain more than one-fifth of the world's most productive marine areas. In the past, U.S government subsidies fostered increases in capacity in the fisheries sector, and until recently, many fisheries in the U.S. had unrestricted access. As a result, too many boats were chasing too few fish. Several other factors have exacerbated the problems facing domestic fisheries.

Although a wide variety of both human-caused and natural factors affect the living resources of the ocean, the most widely studied and probably best understood is resource overuse. Overfishing generally refers to harvesting at excessive levels (YOTO, 1998).

The term was defined in the latest Sustainable Fisheries Act amendments to the Magnuson-Stevens Act as "a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis." Overcapacity, on the other hand, refers to excessive levels of catching power, usually measured in terms of the number and size of vessels,

and the power and technical efficiency of the engines and gear. In other words, overcapacity refers to boats and technology, and overfishing to the impact of the boats and gear on the target fisheries. In the past two decades, the world's fishing nations have so excessively increased their efforts that global fishing capacity in the traditional fisheries is estimated to be 30 percent greater than required to take the world catch (Garcia and Newton, 1995).

In the United States, it has been estimated that about one- third of all the fisheries for which sufficient data exist are overfished. Next, the most significant indirect impacts of fishing on marine biodiversity include bycatch, habitat destruction and ancillary impacts on interacting species or ecosystems (NRC, 1995).

Bycatch is also a major concern for endangered or threatened species e.g., sea turtle bycatch in shrimp fisheries; marine mammal drowning in gillnets; and shark, seabird, and sea turtle bycatch in longline fisheries. It is estimated that the unregulated longline fisheries for toothfish in the Southern Ocean may have contributed to the incidental mortality of 66,000 to 100,000 seabirds in 1997 alone (CCAMLR, 1997).

4.2. Chemical Pollution and Eutrophication

Land-based sources are estimated to account for more than 75 percent of the pollutants entering the world's ocean. Human communities daily generate new pollution that further degrades already diminished ecosystems. Point sources originate from a specific place, such as an industrial facility or municipal sewage treatment plant. Non-point sources originate from dispersed areas, such as agricultural lands (silt, pesticides, fertilizers, and animal wastes), roadways and other paved surfaces (hydrocarbons), deforested hillsides (silt), septic tanks, and atmospheric deposition. These sources cause at least as much harm to marine living resources as do point sources, but are generally much more difficult to address.

Habitat degradation is an important factor in the decline of many species, salmon being the prime example. Moreover, as world population increases, so do demands on the coastal environment. According to the United Nations, more than half of the world's population lives within 60 km of the shoreline and this could rise to 75 percent by the year 2020.

The past decade has seen two fundamental changes in the processes for making decisions about living marine resources: first, adoption of the precautionary, risk averse approach, and second, the new inclusiveness and openness of resource management decision making. In addition to these underlying process changes, the information base has been increased, new technologies have been applied, and a new way of looking at marine wildlife has been adopted—as ecosystems as opposed to single species.

4.3. Scientific Research

Effective stewardship of ocean living resources requires investment in science to better understand the components and processes of marine biodiversity. Only through a much better understanding of marine biodiversity and ecological relationships will it be possible to manage fisheries and marine aquaculture sustainable reap the biotechnology benefits of marine genetic resources, and conserve these critical resources for future generations.

In every aspect of the strategic vision of U.S. marine resource management agencies, the acquisition of sound biological, economic, and social information is highlighted as the first step to focused policy decision-making. Such information is crucial to pursuit of a precautionary approach to management that focuses decisions rather than allowing scientific uncertainty to fuel controversy and confusion. This information is required not just for current management decisions, but also to conserve resources and anticipate future trends, assure future use opportunities, and assess the success of management efforts.

The National Research Council (NRC, 1995) has identified five fundamental research objectives to better understand marine living resources. These objectives are:

- to understand the patterns, processes, and consequences of changing marine biodiversity by focusing on critical environmental issues and their threshold effects;
- to improve the linkages between the marine ecological and oceanographic sciences;
- to strengthen and expand the field of marine taxonomy;
- to facilitate and encourage the incorporation of 1) new technological advances in sampling and sensing instrumentation, experimental techniques, and molecular genetic techniques; (2) predictive models for hypothesis development, testing, and extrapolations; and (3) historical perspectives in investigations of the patterns, processes and consequences of marine biodiversity; and
- to use the new understanding of the patterns, processes and consequences of marine biodiversity derived from regional-scale research to improve predictions of the impacts of human activities on the marine environment.

4.4. New Regulation in U.S.

The United States has realigned its core marine fishery programs to address more effectively the domestic and global crisis confronting living ocean resources. To restore sustainability in this sector, the United States is dedicated to a long-term program of recovery for overfished fisheries in its own 200-mile Exclusive Economic Zone. It is also working with foreign governments, international organizations, and regional fishery management bodies to move toward the same goal in all other waters.

The new strategic direction in U.S. fisheries management is based upon the Sustainable Fisheries Act of 1996 (also known as the Magnuson-Stevens Fishery Preservation and Management Act). While not explicitly stated in the Act, the precautionary approach concept shapes the core of mandated actions to reverse the decline of U.S. fisheries and move toward rebuilding them.

Toward these ends, Congress has provided directives and discretionary means to:

- Establish guidelines to assist in the description and identification of "essential fish habitat" and impacts on that habitat, and to take steps to ensure that programs further the preservation and enhancement of that habitat
- To the extent practicable, avoid by-catch, and to the extent that such by-catch cannot be avoided, minimize the mortality of such by-catch
- Place stricter conditions on the use of new fishing gear

Apply measures that will eliminate over-fishing in domestic waters and identify management actions to rebuild those fisheries within ten years (except in cases where the biology of the fish, other environmental conditions, or specific international agreements dictate otherwise)

- Study and, if appropriate, implement a fishing capacity reduction

The Sustainable Fisheries Act includes U.S. commitments to apply domestically many of the same principles that have been negotiated internationally in the U.N. Straddling Stocks Agreement and the Code of Responsible Fishing.

The Act now requires the optimum yield for each fishery to be set equal to or less than the maximum sustainable yield. Overfishing is now defined in the law, and managers have explicit time frames and milestones for identifying overfished fisheries and getting them on the road to recovery.

The Act also directs that recommendations be developed to expand the application of ecosystem principles in fishery preservation and management activities.

The Sustainable Fisheries Act has set the stage for turning the product of a failed fisheries management system into healthy, productive, and sustainable fisheries in the very near future. The fundamental changes in the approach to management have begun, and some successes have already been witnessed.

4.5. Biodiversity and the Precautionary Principle

Protection marine biodiversity became a new focus for environmental organizations as well as scientists. The implications of loss of biodiversity for fisheries were examined by Boehlert (1996) who concluded that; there is little doubt that such changes in biodiversity will decrease resiliency of species, communities, and ecosystems to respond to natural perturbations that occur on longer time scales.

Marine biodiversity broadened the debate, and posited additional values to marine ecosystems beyond merely sustaining commercial fish production. It elevated the status of all marine species in comparison to fishing, and placed fishing at the top of the list of threats to biodiversity with its direct and indirect effects on habitat through gear impacts, bycatch, and discards. The emergence of the “Precautionary Principle” in environmental management literature was followed by its relatively rapid application to fisheries (Clark, 1996). However, the SFA does not address its use explicitly.

4.6. Protection of Overfishing, Bycatch, Discards

Congress still endorses MSY (maximum Sustainable Yield) as a management target despite the problems with this concept. When a stock is overfished, the SFA defines OY (Optimum yield) to “provide for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery” (Sec. 3(28) C). When the stock is overfished, the council must develop a

rebuilding plan, within one year, which includes assessment of the time period for the rebuilding to take place (10-yr limit). Where there is enormous controversy over how to manage by catch. Congress palliated those who want to see by catch reduced, but it did not require draconian measures to reduce by catch immediately. Instead, it opened opportunities to develop, implement, and study various approaches. Even though there appears to be logic behind the actions of Congress in the SFA. The big question is whether it can be implemented successfully?

4.7. Enhancing the Protection and Recovery of Marine Species by Working in Partnerships

Protected marine species in the United States include marine mammals and species listed under the Endangered Species Act. Many of the direct threats to protected marine species arise from human activities such as fishing, shipping, coastal and watershed development, water pollution, seismic exploration, and offshore mineral development. Reducing conflicts between these species and human activities in the marine environment is the key to their preservation and recovery.

In addition, some marine mammals may cause harm to other protected marine species, such as salmon, or interfere with fishing or aquaculture operations. All these conflicts require more “people management” than “wildlife management.” Years of regulatory approaches have not been completely successful in reducing human-caused mortality and injury to protected species.

A number of federal programs and policies now recognize the value of involving local stakeholders in decision making and implementation of management actions. Natural resource managers have begun employing new stakeholder models to gather information, assess problems, and find the technology or ingenuity to solve them.

Under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the National Marine Fisheries Service has been working with fishermen to identify means to reduce interactions with marine mammals during fishing operations, restore habitats for endangered salmon in the Pacific Northwest and California, develop preservation plans to restore coho salmon, and reduce the entanglement of albatrosses in longline fishing gear in the North Pacific. Similar efforts to engage user groups in helping to solve protected species problems is one strategy for recovering protected species and incorporates the new goal of openness or transparency in marine resource decision making.

4.8. Ecosystems-Based Management

Clearly, efforts to rebuild and sustain fisheries and recover and protect endangered species are important. But they rely to a large degree on traditional wildlife management approaches that concentrate on one species at a time. Single species management is limited in its effectiveness, especially as pressures on the marine environment intensify.

Each individual species has a habitat which it needs to live and reproduce, and depends on a community of other species for food and survival. This community of species—their dynamic interactions with each other and the physical environment, and their overlapping mosaic of habitats—together constitutes an ecosystem.

Ecosystem-based management can be an important complement to existing fisheries management approaches. When fishery managers understand the complex ecological and socioeconomic environments in which fish and fisheries exist, they may be able to anticipate the effects that fishery management will have on the ecosystem and the effects that ecosystem change will have on fisheries. However, there were two arguments for taking approach.

First, ecosystem-based approaches depend on management institutions that can, at least, demonstrate control over harvest rates and methods. Second, there is considerable interest in changing fishery management paradigms toward a coherent ecosystem approach.

Based upon updated knowledge and information, NMFS (1999) of the U.S. identified the following eight ecosystem principles:

- ✓ The ability to predict ecosystem behavior is limited.
- ✓ Ecosystems have real thresholds and limit which, when exceeded, can affect major system restructuring (Holling and Meffe, 1996).
- ✓ Once thresholds and limits have been exceeded, changes can be irreversible.
- ✓ Diversity is important to ecosystem functioning.
- ✓ Multiple scales interact within and among ecosystems.
- ✓ Components of ecosystems are linked.
- ✓ Ecosystem boundaries are open.
- ✓ Ecosystems change with time.

According to Huh and Zhang (2005), a comprehensive ecosystem-based fisheries management approach would require managers to consider all interactions that a target fish stock has with predators, competitors, and prey species; the effects of weather and climate on fisheries biology and ecology; the complex interactions between fishes and their habitat; and the effects of fishing on fish stocks and their habitat.

However, the approach need not be endlessly complicated. An initial step may require only that managers consider how the harvesting of one species might impact other species in the ecosystem. Fishery management decisions

made at this level of understanding can prevent significant and potentially irreversible changes in marine ecosystems caused by fishing

Ecosystem-based management is an important complement to existing fisheries management approaches. Therefore, this approach should move forward now despite current uncertainties about ecosystems and their responses to human actions because the potential benefits of implementation are as large as or greater than the potential risks of inaction (Pikitch et al., 2004).

When fishery managers understand the complex ecological and socioeconomic environments in which fish and fisheries exist, they may be able to anticipate the effects that fishery management will have on the ecosystem and the effects that ecosystem change will have on fisheries.

However, ecosystem-based management cannot resolve all of the underlying problems of the existing fisheries management regimes. Strong governmental actions to stop overfishing, protect habitat, and support expanded research and monitoring programs will be urgently necessary to improve an ecosystem-based approach

4.9. Lessons Learned

There are two important turning points on living marine resource in U.S. One is the scientific data analysis which focuses on not one species, but multi-factors such as relation between human impact and ecosystem, long term based date analysis, the other is ecosystem based management, which is not fully accepted yet by Congress, that is really helpful to control sustainable development for the next generation.

To protect overfishing, bycatch, discard of living marine resource and to manage sustainable development, there are so many factors to be considered. Of course, it is important how to balance between economic cost and benefit, how to negotiate and persuade person who have vested right presently for the future worth, but the more important thing is that multilateral analysis such as

long term and ecosystem based approach should be considered to reach the goal which is sustainable management for U.S and the world as well as present and future generation.

4.10. Sustainability in Fishery Systems

The most fundamental aspect underlying most fisheries theory and practice is that of determining the sustainable yield. For example, it is a harvest that can be taken today without being detrimental to the resource available in the future years. In many types of fisheries worldwide, the focus has been on determining a sustainable yield in the form of TAC.

In this regard, one can seek the MSY (Charles, 1992b, c). In any case, fishery science has evolved as essentially a science of sustainability, with considerable emphasis on the determination of sustainable yields (Schaefer, 1954; Beverton &Holt, 1957; Ricker, 1975; Bulland, 1977).It has become apparent, particularly in recent times, that a focus on sustainable yield has a major shortcoming in its intrinsic emphasis on the physical output from the fishery. While the balancing of present and future catches is important, there is more to a healthy future than simply a large fish stock.

4.11. A Framework for Sustainability Assessment in Fishery Systems

The idea of sustainability assessment is to evaluate, both qualitatively and quantitatively, the nature and extent of sustainability in a given resource system. This might focus on a present-day system or a proposed future activity:

- ✓ Evaluating a current situation as a form of ‘status report’, perhaps, for example, involving the assessment of both ecological and human carrying capacity;
- ✓ Predicting a priori the consequences of a proposed activity, such as a new coastal fishery or a proposed fishery management approach, in terms of enhancing or reducing sustainability.

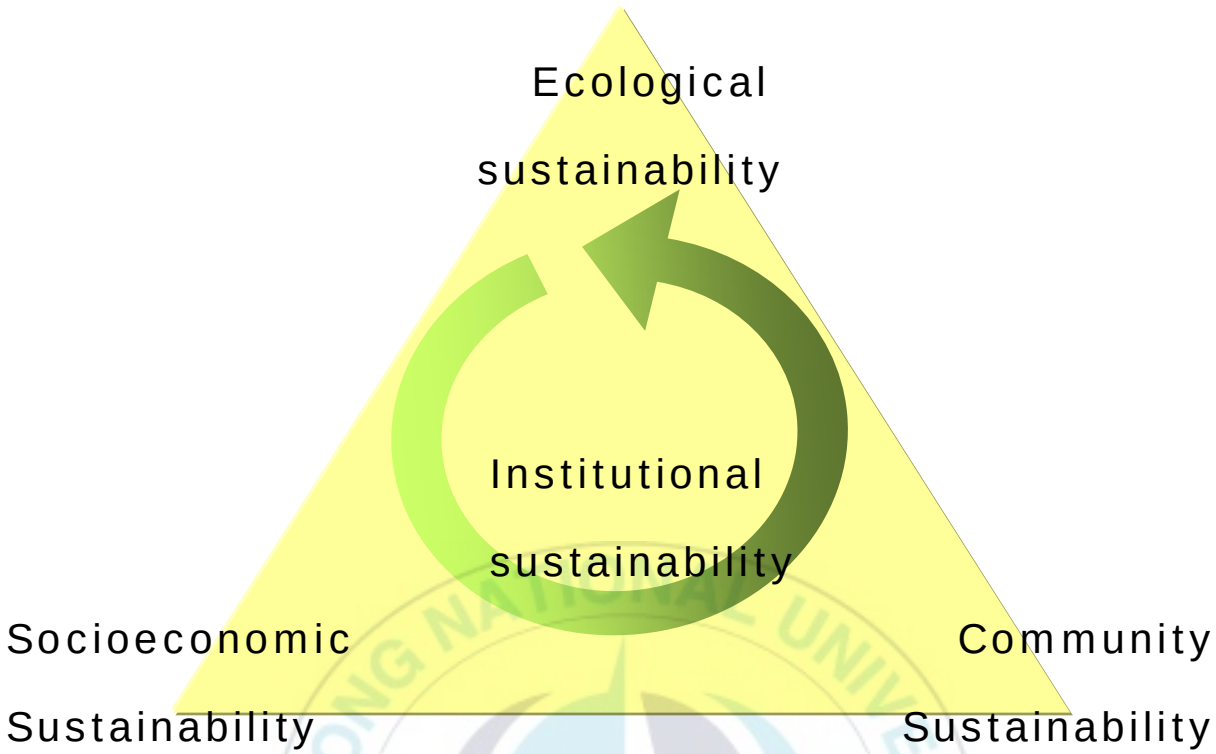


Figure 4. The Sustainability Triangle Forms the Basis of a Framework for Sustainability Assessment

According to Charles, the sustainability assessment approach involves four steps (Charles, 1995c, 1997 b, c).

- ✓ Deciding on a set of relevant sustainability components for the fishery system which together reflect the overall idea of 'fishery sustainability'
- ✓ Developing a concrete set of criteria that must be evaluated in assessing each component of sustainability (a sustainability checklist).
- ✓ Determining a corresponding set of quantifiable sustainability indicators, reflecting the measurable status of each of the criteria, and allowing comparisons between criteria.

- ✓ Formulation suitable means to aggregate the indicators into indices of sustainability.

Next, when considering components of sustainability, the process of sustainable development can be viewed as being based on the simultaneous achievement of four fundamental components of sustainability; ecological, socioeconomic, community and institutional sustainability (Charles, 1994)

5. Constraints in Implementing and Managing EF in Korea

5.1. Political and Economic Constraints in Managing EF

Even though there was firstly basic plan for implementing EF in Korea as mentioned in previous section, government is constrained in many ways in implementing the policy with various political and economic reasons. First of all, there are still many workers in fishery industry although its number has been decreasing year after year.

In 2001, the number of households engaged in fishery-based industry was about 97,000. The number of fishery workers was about 315,000. The number of workers declined by 18.5% compare to 1991.

Nonetheless, the proportion of fishing population is yet too high to achieve sustainable utilization of living resource. High proportion of people relying on fishery indicates the level of political burden associated with the implementation of EF, particularly when the public awareness is very low on the long-term benefit of EF.

Under the Fisheries Act, almost all coastal water out to the seaward limit of 40m from the shoreline, except in the areas of ports, military bases, fairways for ships, is managed by communities.

This area is called the cooperative fishing ground or village fishing ground. Considering that it is impossible to extinguish fishing right without any buy-back or compensation program, we can recognize that there is not much available near shore coastal waters to be designated for MPAs. In addition, as in most cases the cost for buy-back is calculated on the basis of exaggerated business profit, not using average capture of fish due to the uncertainty of fishery industry, a huge amount of budget would be required to implement EF.

In addition, there was historically difficult to develop the policy because it is necessary for government to adapt the policy based on increasing quantity of fishery to supplement the loss of fishing ground as a result of a new Fishery Agreement between Korea and Japan.

As a result, even though it was not only first trial policy to combine managing fishing product and fishery distribution, but it was future-oriented plan to overcome absolute open-market coming near future, there were several kinds of difficulties to receive spotlight.

5.2. Lack of Effective Pollution Control and Reduction Mechanism

The sewage discharge to Korean coastal waters has increased from 12,323,000m3/day in 1990 to 14,632,000m3/day in 1995, and the dumping waste in ocean has rapidly increased from 1,070,000 m3/year in 1990 to 9,930,000 m3 /year in 2005. The BOD loading is expected to increase up to 7,184ton/day in 2001 from 6,030ton/day in 1995.

Despite the continuous increase of land-based pollutants loading, wastewater treatment facilities along the coastal area are still inadequate because the national government has concentrated on managing fresh water to supply for drinking water.

At the national level an average of 66% of the wastes receive treatment in sewage treatment facilities in 1998, while the treatment provided in coastal areas is only 39%, which is mostly at the primary treatment level (MOMAF, 2001b).

It has been observed that increasing the number of wastewater treatment facilities will only have limited success in reducing land-based pollution. Thus, considering the aggravating problems of coastal eutrophication, pressing needs are identified to apply effective treatment measures for nitrogen and phosphorous. In addition, urgent attention should be paid in applying effective treatment measures for non-point source pollution and combined sewage overflows during heavy rain (MOMAF, 2001b).

In terms of monitoring and survey of coastal water quality, even though there is periodic survey by NFRDI, it has been addressed that systematic survey of pollution sources and monitoring of marine pollution are still insufficient.

Coordination among various types of marine survey or monitoring activities conducted by different agencies in response to legislation is in critical need. Lack of effective data quality assurance program and an integrated information management system of monitoring data has reduced the utility of monitoring and survey results for management purposes (KMI, 2001a).

Existing management measures for land-based pollutants do not take due consideration of the risks to marine ecosystems. Thus, there is a need to expand and develop wastewater treatment facilities and technologies which are sensitive to the ecosystem characteristics and carrying capacity of receiving coastal waters.

In addition, despite of emerging problems of new pollutants in coastal waters, such as POPs and endocrine-disruptors, countermeasures are still inadequate in terms of technology and institutional capacity. Effective management strategies are needed to tackle the environmental problems caused by endocrine-disruptors and POPs.

With respect of institutional capacity, more efforts should be made for effective implementation of integrated management. Although various agencies for marine environment, fisheries, and maritime affairs are consolidated under

MOMAF, sectoral responsibilities are still carried out under MOMAF separately through various departments and divisions (KMI, 2001a).

Such separate work duties need to be more effectively coordinated and integrated at operational level. Integration for marine environment management should extend to cover ship-based pollution such as oil-spills, implementation of International Conventions (e.g., IMO), environmental management of aquaculture ground, port environment management, and marine ecosystem management, etc (Lee, 1999).

5.3. Habitat Loss and Alteration due to Coastal Development Projects

The oceanographic and geomorphologic characteristics of the western and southern coasts such as shallow water depth, low slope, high tidal range, various small islands, and high indentation, has promoted coastal reclamation and infilling as they not only appear to induce high cost effectiveness in the short term but also appear to be technical feasible.

However, there is limited space in coastal areas to cultivate for producing rice, the main food in Korea, because of too many people relatively and narrow territories that mostly consist of mountain areas 70%. Traditionally, it has been popular to consider agriculture as the root of the world by affecting of Confucianism – a Chinese traditional ideology.

As a consequence, Korea has a long history of coastal reclamation since B.C. 1. Coastal reclamation for the purpose of food production was first conducted in 1248 in the estuary of Choeng Chun River (KARICO, 1996).

In Japanese colonial times 1917-1938, a total of 178 sites or 40,877 ha have been reclaimed for the purpose of rice production. Since then, reclamation projects were re-initiated in 1970 with the construction of Asan dyke (2,564 m) and Namyang dyke (2060 m) on the west coast (KARICO, 1996).

In 1980, high technology and huge amount of capital accumulated through economic growth in the past two decades promoted large-scale reclamation

projects to establish industrial complexes in the west coastal region such as Seosan, Kimpo, Shihwa and Saemankeum projects. Until then, no serious concerns have been raised on environmental issues related to such mega-scale reclamation projects.

Entering the 1990s, however, the economic merit of coastal reclamation projects has diminished with the increase of pollution as an economic negative externality. Likewise, the public awareness has heightened to claim the right for fishing and environmental quality and the demand for compensation for the loss of fishing and aquaculture activities has grown rapidly. In addition, the regulation on the reclamation projects by private sectors became stricter to restrict privatizing of public assets such as coastal water, through reclamation and infilling projects.

Since 1962, the area permitted for coastal water reclamation and infilling has totaled 2,662 Km^2, of which coastal water of 1,778 Km^2has been reclaimed or is under reclamation (MOMAF, 2000a). As a result of large-scale coastal reclamation and infilling projects as well as various construction activities along the coast, 14% of national coastline has been altered into artificial coast.

The proportion of alteration would be much higher if all the historical changes could be traced. It is estimated that 10% of coastal wetlands have been lost during past decade, totaling about 700Km^2. Large-scale coastal alteration has caused loss of productive fishing grounds, destruction of breeding and nursery habitat and decline in marine biodiversity as well as affected the migration of waterfowls.

Coastal exploitation and development in Korea has been conducted on the basis of “first-come first-served” principle directed by various laws without considering long-term impacts of development.

As a result, more than 1000 development plans and projects initiated by national or local governments as well as private sectors were competed for

limited coastal space and resources (MOMAF, 2000c). Without a comprehensive plan or an integrated guiding framework for coastal development and preservation, conflicts among various stakeholders often resulted in extreme confrontation. This was found in the cases of Shihwa Lake and Saemankeum reclamation projects.

Heavy coastal development has caused not only the degradation of resources values, including use, option, and nonuse value, but also limited public access. Without systematic long-term planning, commercial buildings such as hotels and restaurants have encroached upon the coastal waterfront to meet increasing demand for coastal tourism and recreation.

The heavy concentrations of buildings on the coastal waterfront often destroy scenic views and impose high pressure on the adjacent coastal ecosystem due to increased load of sewage and solid wastes.

Public access to the sea has been limited traditionally due to security concerns in Korea. The access has been further reduced as the coast is converted to ports, industrial complexes and tourism resorts. The construction of a coastal road along the coast also inhibits public access to the sea (MOMAF, 2000c).

5.4. Lack of Knowledge-Base for EF

Despite the fact that the basic plan on EF was found in 1999, there are not sufficient education institutions for training marine environment experts. Marine environment management in Korea has been mostly the responsibility of government.

Thus, participation or investment of private sectors in marine environment has been very limited. To maximize the effectiveness of utilizing existing resources, partnerships should be built among relevant scientific agencies especially at local level. There is also a need to support and promote local training centers and to build cooperative system among research agencies.

The existing scientific and technical capacity in Korea is insufficient to determine accurately condition of marine environment. This is partly due to the lack of investment in developing technologies for EF. Existing environment improvement measures still rely heavily on primary levels of technology such as collection of solid wastes and dredging of contaminated sediments (Lee, 1999).

In general, fishermen try to benefit in short term base under open access even though there are sever kinds of regime to control overfishing. In addition, if there are consumers who like to eat raw immature fish, it is not avoidable to happen overfishing.

The participation of civil society groups in marine environment management is still limited and the level of public awareness is still low (Lee, 1999). Conflict resolution relying on regulation and compensation has proven to be not effective.

There is insufficient capacity in civil society organization that has sound and genuine goals in conserving marine environment. The support mechanism to promote and maintain such organizations is not adequately institutionalized.

5.5. SWOT Analysis on Prospective of EF

Despite these constrains on EF, it is possible to overcome challenges and to obtain competitive power if there are some factors to solve these kinds of problems. Therefore, this chapter tries to exam Fisheries in Korea in term of SWOT analysis in order that there is competitive power on EF or Fisheries in the long term. Otherwise, we can't help giving up EF as industrial value and have to try to change structure such as compensation for buy-back program.

The SWOT Analysis is a systematic evaluation of the strengths, weaknesses, opportunities, and threats affecting tourism development in each study area in order to identify the most promising tourism development opportunities at a regional and community level.

The SWOT Analysis is fundamental to providing communities with a direction for tourism development. The SWOT Analysis both depends on, and is informed by, local input through the steering committee.

The SWOT analysis will suggest, in broad terms, how to:

- build on regional and community strengths
- overcome weaknesses that currently constrain tourism development
- approach tourism development to minimize the potential impact of threats, and;
- make the most of available opportunities.

Above all, there are good fishing grounds that have different characteristic in term of oceanography in the strength.

Compare to that of U.S, total fishing ground is below one hundredth while total capture of fish stock including aquaculture about one second, 250million metric ton a year. That means there is already happened over exploited on fish stock whereas it is also high productivity in the Korea seas.

Next, there is a good opportunity for government to bring EF up in the high consume rate on fisheries product. It is second to none for Korean to consume fisheries, 48.7kg a year in 2004 (MOMAF, 2005). When considering neighbor countries such as China, Japan, its hidden consume quantity is beyond present data when total population is estimated over one fourth of that in the world.

In conclusion, as one can see Table 25, fisheries itself can have competitive power if some conditions such as well-organized living

resource management can fit, even though its economic scale is relative small.

Table 25 . SWOT Analysis on Fisheries in Korea

Internal	**Strength**	**Weakness**
	-High productivity -High fisheries market -Integral Ocean Governance	-Overfishing -Lack knowledge base on resource management
External	**Opportunity**	**Threaten**
	-Increasing market on fisheries -Tourism from 5 days work	-Open market from WTO -Limitation to access high sea

5.6. Comparison Between Agriculture and Fisheries

In general, people intend to deal with agriculture and fisheries as same category because both of them are primary industry. Despite this fact, there are several different kinds of factor between agriculture and fisheries.

First of all, there is different in the market type. Agriculture is still high tariff barrier to protect domestic market while fisheries is admitted all kinds of products to import due to relatively low tariff. That means that fisheries may have competitiveness although complete open market is accomplished after DDA of WTO.

Next, there is absolutely different in the type of products. Agricultural products are nearly not produced from nature but are produced from cultivation of human beings whereas marine products are still gained from nature even though it is increasing products from aquaculture recently.

It is meant in term of economics that agriculture follows up general principle that saves cost by mass produce system. However, the general rule can't apply for fisheries because the system may results in over-exploit by over-fishing. As a result, the system happen huge amount of loss instead of curtailing cost.

In addition, even though there is the same culture product between agriculture and fisheries, marine products are limited in the distribution because most of the products are live fish except seaweed whereas agricultural products are relatively free to distribute through cold chain.

In conclusion, fisheries can have competitive power as far as there is well organized living resource management such as EF even though its economic scale is not as big as the other industry.

6. Policy Goals and Alternatives

6.1. Policy Goals

This paper focuses on identifying effective approaches for implementing as well as to managing EF in Korea. The ultimate goal for implementing and managing EF should be set forth in terms of both biodiversity or productivity in term of managing fishing ground and economic effectiveness in term of managing fisheries distribution. Therefore, first of all, the main goal should be biodiversity or productivity, which is primary purpose of EF. The criterion for assessing this goal is the number of species.

Even though it is difficult to assess the economic benefit from EF in the short term due to its long-term implication and the complexity of ecosystem processes and characteristic of fisheries distribution, economic efficiency should be recognized as one of the most important goals in implementing EF, especially in acquiring public support. In other words, the long-term cost-effectiveness and social benefit should be measured and informed to the stakeholders (Weimer and Vinning, 2001).

In addition, the costs and benefits of EF should be fairly distributed among important stakeholders. Equitable distribution should be another important element of setting policy goal. Fairness requires that current community members including fishermen and tourists, who have made investment decisions based on a reasonable expectation that current policy will continue, receive explicit consideration. As current fishermen are likely to be highly attentive to proposed policy changes and very vocal in opposition to changes they view as harmful, considering their interests is likely to contribute to the political fairness itself. In addition, reducing subsidies from taxpayers to the EF is desirable. These considerations suggest the following criteria for assessing progress toward achieving as equitable distribution: fairness to community members, fairness to taxpayers.

Lastly, any policy should be administratively feasible in order that it can actually produce its intended benefits. Therefore, administrative feasibility should be a goal in assessing policy alternatives. The criteria used for measuring this goal include: ease of enforcement to manage EF, and flexibility to allow the policy to accommodate dynamic characteristics of EF.

6.2. Policy Alternatives

Under the laws of Korea as presented about the context, thinking about how to implement a system of EF in Korea has 3 broad alternatives. The Status quo alternative as seen in the TAC and self-control resource management program

focuses on sequential control to manage living resource. Alternative 2 would induce conception of MPA, No take zone(a kind of moratorium) in the main fishing grounds and Break Year in the aquaculture, The third alternative is management of trade and sanitary of fisheries distribution. These alternatives are discussed in more detail below.

A. Alternative 1: Status Quo

When we review the policy on resource management in Korea, there are two kinds of policy in addition to traditional input control, TAC and SC. As indicated, TAC is to focus on controlling total catching to prevent overfishing while SC is designed to manage living resource based on community based management without any help of government.

The unique feature of SC compared to other tools such as limitation of fishing net is that it is managed by self-control based on communities rather than by regulation although the program is based on Fisheries ACT. In other words, there is no specific regulation or measure on various human activities such as fishing method. Instead, all kinds of management measures and actions are formulated in the process of establishing the Action Plan through stakeholder consultations.

The Action Plan is intended to be implemented by active participation of communities. Even though the preparation of the Plan was supported financially and technically by a national government, MOMAF facilitated stakeholders' consultation, through forming and operating local forums, in the planning process, in order to ensure the local ownership of the plan implementation. Finally, the Plan focuses on protecting marine resource depletion for themselves without any intervention from government. In the long-term perspectives, the Plan attempts to achieve its vision in three phases: preventing of resource depletion, managing living resources and construction of self-fishery village base and harmonizing.

B. Alternative 2: Ecosystem-based MPA (Moratorium and Break Year)

According to IUCN Guideline to select MPA, several criteria or factors are identified, which can be used to decide whether an area should be included in an MPA as well as to determine the boundaries of an MPA. These criteria serve for the ecological preservation and biodiversity goal of MPA, specifically (IUCN, 2002):

- to maintain essential ecological processes and life support systems;
- to preserve genetic diversity; and
- to ensure the sustainable utilization of species and ecosystems.

It is particularly important in MPA selection to balance the significance attached to preservation of biodiversity with the need for enhancing fisheries productivity. As the balance between these two objectives changes, so the criteria outlined below will have to be interpreted and weighted differently.

If preservation of biodiversity is the main objective, the best approach may be to create an MPA in an area not under major threat. Not every marine ecosystem can be protected and resources for MPA implementation will always be limited.

If productivity is the main objective, the greatest gain in fish yields may be achieved by closing the areas most degraded due to over-fishing, rather than by protecting the most pristine ones. The resulting MPA will be what is often called a “fisheries reserve,” but it will nevertheless contribute to ecosystem integrity and conservation of biodiversity (IUCN, 2002).

In fact, virtually all MPAs contribute to conservation of both biological diversity and productivity. It is desirable to establish a graded system of MPAs with differing emphasis on the two main objectives, rather than two separate types of protected areas.

The traditional approach to management of marine living resources has been undertaken based on the Fisheries Act. Management measures include:

- Restricting access to a particular stock of fish or invertebrates (Fisheries Act in Korea)
- Specifying restrictions on equipment such as minimum net mesh, in an attempt to limit total fishing effort;
- Limiting total fish catch (processing);
- Requiring licenses or permits for those entitled to fish a particular stock;
- Declaring closed seasons for target species (Fisheries Act in Korea)

Such provisions usually focus on target species. The habitat of the non-target co-inhabitants and competitors of such species is considered only when this is seen as affecting the productivity of the target stock. MPA management can go beyond conventional fisheries management by providing a comprehensive management package, covering all impacts on the marine area concerned (IUCN, 2002).

Therefore, it is essential to make no fishing zone whether or not its zone is wide or narrow, and its purpose is for productivity or biodiversity. Because there is no experience with no take zones in Korea except managing invertebrates by community self-control, no body is convinced that MPAs can produce more fish stocks even though it challenges fisheries industry in the short term.

According to NRC (National Research Council, 2001), MPAs can help control or reduce exploitation rates mainly in two ways.

One is that reserves can be an effective tool to control catch rates by direct protection of some fraction of the population from the effects of fishing for species of low adult mobility. The other is that MPA can reduce fishing rate by diverting fishing effort away from areas of high fish density to areas where fish are less vulnerable (NRC, 2001). This report also indicates that MPA can help preserve fish habitat because the habitat on which targeted species depend may be severely affected by fishing (NRC, 2001)

The East Sea in Korea has been a main fishing ground for cod and pollock while yellow corvina has been produced in the Yellow Sea. However, now it is difficult to catch these species as the stocks became depleted due to overfishing. Therefore, an alternative is to apply a regulation to restrict or prohibit fishing activity by applying no-take zone in overexploited fishing ground especially by bottom trawl.

At the present time there has been little umbrella or planning for MPA design of No Take restricting for fishery. In addition, in case of aquaculture, it is necessary to induce break time, which stop working to rehabilitate carrying capacity, instead of MPA. Alternative 2 is not well developed empirically, however, in theory it could be one approach to rebuilding overfished stocks of fish, protecting key habitat for spawning and rearing habitat. Considerable research would be required to gain the necessary knowledge to properly design such a reserve system. Still this alternative must be considered along with alternative to develop Korea's long term MPA strategy.

C. Alternative 3: Consumption Management

There have been many living resource management programs that focus on output control as well as input control. Nevertheless, it is limit to manage living resource by these means if there is still demand from consumers. Traditionally, there are several kinds of trials to find out best solutions and model of developed countries on resource management but it is seldom to try combining management of fisheries product and fishery distribution.

In most developed countries on fisheries, except limit number of countries such as Japan, there is comparative low consuming rate of fish and fish products compare to those of Korea.

In addition, their preference on type of consuming fisheries products, which is to use a kind of frozen as well as chopping, not raw, is very different. When considering these reasons, it is essential to watch out difference between two

countries if a new model, which has been developing in the developed countries, is intended to induce. In other words, above all we have to consider balance between demand and supply on fisheries products.

Even though there are several kinds of regulations and policies to manage living resource, it may be useless without any managing on demand from consumers.

Therefore, as far as it is not sensitive among fisheries products, it is necessary to open market access completely by cutting tariff rate so that resource management may be more effective by alleviating fishing activity when considering there is high tariff on fisheries products, average 18%, second among OECD. Next, we have to consider changing of consumers' concept, which is to prefer young fish though it is not easy to apply a new regime on managing consumers.

6.3. Comparative Analysis of Alternatives

To deal with implementation of EF, a comparative analysis is carried out below. A set of these policy alternatives are compared using the four criteria defined for this purpose earlier in the chapter.

A. Alternative 1: Status Quo

Biodiversity and Productivity

The weakness of this alternative is that there is no regulation and no research to protect biodiversity or productivity in the short term because this alternative focuses on managing present situation on resource management. In addition, it is difficult to know that exact situation of resource may improve as result of TAC because the program focuses on only target species and there is not evaluation tool to judge biodiversity and productivity of total ecosystem.

Therefore, some improvement in evaluation of total living resource could be expanded but it is not easy to accomplish this goal without additional measures to control scientific based on TAC, not present catching base.

Economic Efficiency

The status quo will perform very poorly in terms of economic efficiency because it requires a substantial expenditure of public money to implement TAC and small benefits are seen. Furthermore, it requires a lengthy mediation process if there are involved kinds of fisheries. Its public participatory approach is an advantage of this policy. It is pointed out that involving local communities (and other stakeholders) is essential in TAC management.

It is particularly important in managing TAC to collaborate with those using the neighboring sea areas because of the inter-connected nature of the sea in which actions in one area impinge on another. Partnership with local communities is also justified on the ground of the legitimacy of many community interests in management, such as the use of traditional fishing grounds (IUCN, 2002).

In conclusion, this alternative is a low economic effectiveness when considering its outcome.

Equity

In one sense, the status quo can be though as being very generous to incumbents: There is no restriction for fishery right to keep. On the other hand, this policy is inequitable to taxpayer as almost all budgets to manage MPA from monitoring to compensation program come from taxpayers.

Administrative Feasibility

The status quo has some advantages in terms of administrative feasibility because there is no regulation to restrict any fishing activity without agreeing of fishermen if there is no conflict among different kinds of fishermen.

B. Alternative 2: MPA (No-take Zone and Break Year)

Biodiversity and productivity

A major advantage of this policy alternative can be found with regard to biodiversity and productivity. According to IUCN, there are two ways of establishing MPA systems: either many, relatively small sites, each strictly protected, or a few large multiple-use areas which contain strictly protected areas within them (IUCN, 2002).

To conserve biodiversity, both approaches should occur within an effective program of ecosystem management covering the marine ecosystem and the land areas that affect it. MPAs, if partially or entirely closed to fishing, have been proven very effective in association with conventional fisheries management in rebuilding damaged fish stocks and in giving all stocks some stability.

In several regions, fish stocks have increased rapidly following establishment of MPAs. Far from hurting the fishing industry, the MPAs led to enhanced catches, and thus provided a direct economic benefit. The larger stocks inside the reserves export their offspring to fishing grounds by ocean currents. Juveniles and adults may also emigrate from the reserves, so boosting nearby fisheries.

Therefore, if a new regulation allowing no fishing is applied to high productive areas, biodiversity and productivity can be increased by using very strict regulation regardless of its size and designation.

Economic Efficiency

The weak point of this alternative is that it presents the lowest cost efficiency on the short time as it requires a huge amount of governmental budget expenditure or buy- back or compensates designing the transaction to MPA management. As mentioned before, there are many fishery rights and types of patents for fish vessels (fish vessel), and licenses (aquaculture) in Korea.

However, the higher efficiency can be achieved on a long-term basis when high productivity in the future is taken into account. Although some might think

this is too optimistic. Nevertheless, it is difficult to count economic benefit based on present net profit. Transaction costs are likely to be high because this would be a new program and because of expected high levels of conflict.

Equity

Under this alternative, the fishing right would become invalid, which is not pleasant option for incumbent fishers. However, on a long-term basis because of increased productivity, it offers the potential for considerable rent. In addition, this policy looks like inequitable to taxpayers because compensation money should come from them in the short term, in the long term, it is reasonable because it can offer a low cost regime after restoring productivity, and it is expected that it will bring more revenue and qualify seafood.

Administrative feasibility

The weakest aspect of this policy lies in administrative feasibility: It requires a lot of initial capital for compensation. In addition, many fishers will oppose this policy as they would favor the guaranteed short-term economic benefit, not long-term benefit that may have to be shared with newcomers when the fishery recovers. Finally, the expense of performing the research to design as appropriate no take reserve system would be quite high in the given present knowledge of the resources and habitats

C. Alternative 3: Management of Consumption

Biodiversity and productivity

This alternative can’t connect to biodiversity and productivity directly when considering it deals with changing concept of consumers on fisheries distribution and trading. Nonetheless, the trade and the change of consumers’ preference may induce the change of habitual practice on fishing activity, which is easy to happen overfishing. Therefore, there is some extent of biodiversity and productivity in the long term basis.

Economic Efficiency

A major advantage of this alternative is that it does not involve any additional budget expenditure related to the compensation of fishing right, although it requires administrative expenditure to implement the policy or regulation. However, it can be expected that the more strict the regulation on sanitary is the more is the cost.

Transacting costs might be higher than alternative 1 and lower than alternative 2 because this is a new program but is less contentious than alternative 2 related to fishermen.

Equity

Because the proposed regime expects to provide a lot of fish stocks to fishers in the long term base while it seems to be negative effect in the short term base. Furthermore, the alternative doesn't require fishers to cost additional fee. As taxpayers do not need to pay for additional tax, it is also equitable to taxpayers.

Administrative Feasibility

Even though there are some challenges associated with the changing the concept of the consumers, the alternative is easier than those of fishers because it is not directly connected to economic cost. In addition, it is helpful to attain feasibility because cutting the tariff on fishery products that are not sensitive to fishers lets taxpayers to receive economic benefit.

The main difficulty in terms of administration would be to prevent illegal activity, considering that it may require a lot of labor and administrative resources to monitor illegal activities.

7. Summary and Conclusion

The issues discussed in previous section are summarized in a simple matrix (Table 26) that presents policy alternatives on one dimension and the goals/criteria on the other. The result of evaluation on alternatives shows that there is more advantage to adopt the third alternative 3.

Table 26. Evaluation of Alternatives

Goal	Alternative 1 (Status Quo)	Alternative 2 (No Take Zone)	Alternative 3 (Consumption)
Biodiversity	Low	High	Medium
Economic effectiveness	Long term: Low Short term: Low	Long term: High Short term: Low	Long: High Short: Medium
Equity	Community: Fair Taxpayer: Unfair	Community: Unfair Taxpayer: Fair	Community: Fair Taxpayer: Fair
Administrative feasibility	High	Low	Medium

In this regard, it is recommended that the third alternative (Consumption management) be adopted immediately. Even though the alternative seems not to be related to fisheries resources management, it is essential to change consumers' inclination and concept that enjoys immature fish etc. because it is useless to manage the product without considering any consumers in the market.

Therefore, the feasibility of the police to manage living resources can be high by enhancing public awareness on EF through the application of the third alternative.

In term of the production management, ecosystem-based MPA, the alternative 2, is an important complement to existing fisheries management approaches. Therefore, this approach should move forward in the long term base despite current uncertainties about ecosystems and their responses to human actions because the potential benefits of implementation are as large as or greater than the potential risks of inaction.

When fishery managers understand the complex ecological and socioeconomic environments in which fish and fisheries exist, they may be able to anticipate the effects that fishery management will have on the ecosystem and the effects that ecosystem change will have on fisheries.

Next, although there is not 'ecosystem based management' in the alternatives because it is difficult to simplify the policy, we have to consider inducing the policy in the all kinds of policy on resource management from monitoring to fishing.

A comprehensive ecosystem-based fisheries management approach would require managers to consider all interactions that a target fish stock has with predators, competitors, and prey species; the effects of weather and climate on fisheries biology and ecology; the complex interactions between fishes and their habitat; and the effects of fishing on fish stocks and their habitat.

However, the approach need not be endlessly complicated. An initial step may require only that managers consider how the harvesting of one species might impact other species in the ecosystem. Fishery management decisions made at this level of understanding can prevent significant and potentially irreversible changes in marine ecosystems caused by fishing (Huh et al 2005)

Finally, it should be pointed out that the successful implementation of EF relies heavily on an appropriate financing mechanism as well as effective stakeholder's involvement. It is important to package the various policy

alternatives for EF, within the existing political, economic and socio-cultural context, to attract necessary financial resources for implementation.

The financial resources provided by the national government should be used to leverage provincial and local resources. As in most cases, local governments lack the financial resources for fishery management. It is thus required to develop a partnership mechanism between public and private sectors, which will bring the technical and managerial expertise as well as financial resources of private sector to resource management and sustainable development.

To overcome the political constraints involved in managing EF, an effective mechanism of stakeholder's consultation and involvement should be developed and institutionalized to ensure a long-term success of EF implementation.

8. References

Anthony T. Charles. 2001. Sustainable Fishery Systems. Satin Mary's University Halifax, Nova Scotia, Canada.

Bang. T.J.1999. Legal Framework of Marine Environment Management (Lecture Material for Marine Environment Government Official Education).

Bang. T.J. 2000. Institutional framework for marine ecosystem protection in the Republic of Korea, submitted to UNEP-COBSEA

Boehlert, G.W. 1996. Biodiversity and the Sustainability of Marine Fisheries. Oceanography. 9(1):28-35.

CCAMLR 1997. Report of the 16th Annual Meeting of the Commission and Scientific Committee for the Preservation of Antarctic Marine Living Resources.

David Fluharty. April 2000. Habitat protection, ecological issues, and implementation of the sustainable fisheries act.

David L.Weimer and Aidan R. Vinning, 2001, Policy Analysis.

Edward L. Miles. 2000. "The New Ocean Regime: Facilitation Implementation, Compliance, and Evolution," in David Wilson and Dick Sherwood (eds.). Oceans Governance and Maritime Strategy.

Ernst B. Hass. 1990. When Knowledge is Power.pp.12-61

FAO. 1996. State of the World Fishery and Aquaculture. FAO Fisheries Circular. FAO

FAO. 1997a. FAO Marine Resources Service, Fishery Resources Division. 1997. Review of the state of world fishery resources: marine fisheries. FAO Fisheries Circular. No.920.Rome, FAO. pp.173.

FAO. 1997b. COFI Report of the Twenty-second session of the committee on Fisheries Rome.

FAO. 2001. State of the World Fishery and Aquaculture

Garcia, S.M. and Newton, C. 1995. Current Situation, trends and prospects in world capture fisheries. FAO Conference on Fisheries Management and Global Trends. Rome, FAO.

Haas, P. M.1990.” When Knowledge is Power.” International Organization 46:1-35

Holling, C.S., and G.K. Meffe. 1996. Command and control, and the pathology of natural resource management. Preservation Biology 10(2):pp328-337.

Hong, S.Y. 1991. Assessment of Coastal Zone Issues in the Republic of Korea, Coastal Management, 19. pp. 391-415.

---. 1994. A Framework for Emerging New Marine policy: the Korean Experience, Ocean & Coastal Management, 25, pp. 77-101.

---. 1995. Marine Policy in the Republic of Korea, Marine Policy, 19. 97-113pp.

Hong, S.Y. and Chang, Y.T. 1997. Integrated Coastal Management and the Advent of New Ocean Governance in Korea: Strategies for Increasing the Probability of Success, The International Journal of Marine and Coastal Law, Vol. 12, No. 2, pp.141-161.

Hong, S.Y. and Lee, J.H. (1995). National Level Implementation of Chapter 17: the Korean Example, Ocean & Coastal Management, Vol. 29, 231-249pp.

Huh, H.T. and Lee, J.H. (1995). National Status and Approaches to Coastal Management: Republic of Korea. Coastal Management in the Asia-Pacific Region: Issues and Approaches, (eds.) K. Hotta and I.M. Dutton, Japan

International Marine Science and Technology Federation, Tokyo, pp.167-176.

Huh H.T. and Zhang C.I. 2005. Ecosystem-based Approaches to Management of Living Marine Resources and Their Environment – A New Paradigm for Managing Fisheries Resources-. The Korean Academy of Science and Technology Review

ICUN, 2002. Guidelines for Establishing Marine Protected Areas

John Ikenberry. 2000. After victory. Princeton University Press.

Kang, J.W. 1997. The Governance of Korea's Urban Coastal Zone: The Political Economy of Environment and Development Policy, Ph.D. Dissertation submitted to the University of Delaware, pp. 246.

KARICO (Korea Agriculture Basic Cooperation).1996. Tideland reclamation in Korea.

KMI. 1997. Case Study on the Coastal Zone Management Policy and the Establishment of Information System – ICM Pilot Study in Chinhae Bay.

KMI. 2001a. The study of Effective Implementation on Fishery Policy

KMI. 2001b. The study of Effective Implementation on Marine Environment Policy

KMI. 2005. Study for inducing Ecosystem-based Fisheries Resource Management. KMI International Co-Study.

KRIHS. Korea Research Institute for Human Settlements 1993. A Study on the Coastal Management System.

Lee, J.H. 1993. Challenges for Coastal Resources Management in the Cheonsu Bay of the Republic of Korea, Proceedings of the Eighth Symposium on Coastal and Ocean Management, (eds.) O.T. Magoon, W.S. Wilson, H. Coverse & L.T. Tobin, 2004-2018.

---. 1996. The Status and Prospects of the Coastal Management Pilot study in Chinhae Bay, the Republic of Korea, Proceedings of the APEC Workshop on Integrated Management of Semi-Enclosed Bays, 2-3 September 1996, Plaza Hotel, Seoul, Republic of Korea, pp. 5-34.

---. 1998a. Application of integrated coastal management to pilot study area (in Korean). Proceedings of the Policy Forum on Integrated Coastal Management, KMI, 24 March 1998, Seoul, Republic of Korea.

---. 1998b. Dynamic Evolution of Integrated Coastal Management Policy in Korea, Proceedings of the '98 IOC-KMI International Workshop on ICM: Challenges and Strategies for Achieving Integrated Management of Coasts and Oceans, pp.39-68.

---. 1998c. Policy Issues and Management Framework of Chinhae Bay, Republic of Korea, Ocean and Coastal Management, Vol. 38(2), pp.161-178.

---. 1999. Visioning Korean Coast in the 21st Century by Integrated Coastal Management. Ocean Policy Research 14(1), pp. 325-359.

---. 2000. Developing National Coordinating Mechanism of ICM: Korean Example, presented at the APEC MRC workshop held in Seoul, September 2000.

---. 2001. Evolution of Integrated Coastal Policy in the Republic of Korea, Tropical Coasts, December 2000, pp. 12.

Lee, J.H.; Lee, Y.H.; Kwon, M.S.; and Hong, S.Y. 1993. Coastal Zone Utilization in Korea: Status and Prospects, International Perspectives on Coastal Ocean Space Utilization, (eds.) P.M. Grifman and J.A. Fawcett, Sea Grant, University of Southern California, California, pp. 99-118.

Lee, J.H.; Lee, Y.H.; and Kwon, M.S. 1998. A National Report on the Legal Aspects of the Protection of the Marine and Coastal Environment of the Northwest Pacific Region, submitted to UNEP.

Lee, J.H. 1999, Visioning Korean Coast in the 21st Century by Integrated Coastal Management. Ocean Policy Research 14(1), pp. 325-359.

Lee, S.G and Zhang, C.I. 1999. Marine Environment Fisheries Theories. Arche Press.

Marine Pollution Prevention Act, wholly amended 1999

MOCT.1996. Study on Integrated Coastal Management Mechanism.

MOCT. 2001. Fourth Master Plan for Land Use in Korea.

MOE .1996. National Agenda 21.

MOE. 2000a. Study of the Environment-friendly Land Use Framework (Environment Policy Report).

MOE. 2000b. Study of the Environment-friendly City Development Plan.

MOE. 2001. Study of the Environment-friendly Land Use Management Plan.

MOE. 2001-2005. Environment White Papers.

MOMAF & Office of Prime Minister. 1999. Handbook on Marine Environment Administration, pp. 239.

MOMAF & Office of Prime Minister. 2005. Handbook on Marine Environment Administration, pp. 222-229.

MOE. 2002. Study of environment friendly land use framework (environment policy report)

MOMAF, 1996a, Plan of Maritime Affairs and Fisheries (1997-2011)

MOMAF, 1996b, Five-year Framework Plan for Marine Pollution Prevention

MOMAF, 1997, 21st Vision of Maritime Affairs and Fisheries: Long-term Development MOMAF, 1997, Maritime and Fisheries White Papers (1993-1997).

MOMAF. 1998. National Basic Plan on Environment Fisheries.

MOMAF. 2000a. National Plan on Integrated Coastal Management Plan

MOMAF. 2000b. Ocean Korea 21

MOMAF. 2000c. Strategic Plan on Coastal Environment Management Areas

MOMAF. 2001a. National Plan on Coastal Zone Improvement Project

MOMAF. 2001b. Five-year Framework Plan for Marine Environment Preservation

MOMAF. 2001c. Action Plan on Shihwa Special Management Area

MOMAF. 2002. Maritime and Fisheries White Papers (1998-2002)

Wetland Preservation Act. 1999.

National Research Council. 2001. Marine Protected Areas: Tools for sustaining ocean ecosystems, National Academy Press. pp. 272-290.

NMFS. 1996. Our Living Oceans: Report on the Status of the U.S. Living Marine Resources, 1995. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-19, pp. 60.

NMFS. 1997. Report to Congress on the Status of Fisheries in the United States, September 1997.

NOAA.1999.ecosystem-based fishery management.

Ottar N. Bjornstad and Bryan T. Grenfell.2001. Noisy clockwork: Time series analysis of population fluctuations in animals. Science vol.293 (27 July 2001).

NOAA.1999. Turing to the sea: America's Ocean Future.

NOAA.1999. Our living oceans.

NOAA.1998. Year of the ocean discussion papers.

Peter M. Hass, Robert O. Keohane, and Marc A.Lev. 1993. "Institutions for the Earth: The effectiveness of International Environmental Institutions," 3-

24pp and “Improving the Effectiveness of International Environmental Institutions,” pp. 397-426.

Peter H. Sand. Lessons Learned in Global Environmental Governance. World Resources Institute, June 1990.

Tom Tietenberg, 2001, Environmental Economics Policy

Weimer L. David and Vining R. Aidan. 1999. Policy Analysis. Prentice Hall Press.

WSSD. 2002. World Summit on Sustainable Development. Johannesburg, South Africa. Aug.26-Sep.2

Zhang, C.I. and R.J. Marasco. 2003. New approaches in fisheries assessment and management under the exclusive economic zone regime in Korea. American Fisheries Society Symposium 38 pp.685-693.

Zhang.C.I. and Lee. S.G. 2002. Fishery Management. Sejong Press.