

아시아 연안 하구역의 지속적인 수산자원이용에 관한 모델 구축

Establishment of an Asian Model for Sustainable Resource Use in Estuarine and Coastal Regions

アジア沿岸河口域における持続的な水産資源利用モデルの構築



개최일시 2010년 3월 6일-8일
개최지 인하대학교
6-8, March, 2010
Inha University, Korea

"A study of the Sustainable Resource-use Model in Aquaculture
and the Application for Asia" supported by JSPS





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Welcome Message

I am Jae-Sang Hong, a professor of marine ecology in the Department of Ocean Sciences, Inha University. As a matter of fact, it is a great pleasure for me to welcome you all to Incheon to participate in the International symposium for the “Establishment of an Asian Model for Sustainable Resource Use in Estuarine and Coastal Regions”.

The Incheon City now became a gateway to Northeast Asia that holds both an international port and an international airport. Incheon is located in the mid-west of the Korean peninsula, facing to the Yellow Sea. Located 28 km from the nation’s capital, Seoul, and in the estuary of the Han River which is flowing through the center of Seoul, Incheon lies at 126° 37’ east longitude and 37° 28’ north latitude, the same latitude as Sendai in Japan, Yantai and Weihai in China.

The city has a total population of 2.8 million and is rapidly developing into the third largest city in Korea, following Seoul and Busan. Incheon has a geomorphologically ria coast, with a megatidal, long, jagged coastline and numerous islands. There are 155 islands off the coast altogether, 115 of which are unmanned.

Therefore, this symposium is especially significant, because you all are interested in the estuary and you are now in the most important estuarine area in Korea. Right after the symposium, one and a half day field trips are organized. I hope that during this trip and your stay here you will explore many things interesting to you around this beautiful but often urbanized estuarine city of the Han River, Korea.

Finally, I hope that the symposium will be successful and you will explore Korean foods and cultures as well.

Thank you.

Prof. Jae-Sang HONG
Professor of Marine Ecology
Department of Ocean Sciences
Inha University

2006 년에서 2009 년까지의 하구역 연구 개요

An Overview of the Kakoken Study 2006-2009

2006年から2009年までの河口域研究の概要

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Coastal estuary regions are home to a broad variety of aquatic species, and preventing the loss of such biodiversity in these areas is a particularly urgent task for three main reasons. First, in the inner bay area, there is a high level of genetic diversity due to the large number of species reproducing in a relatively small area. Second, the diverse landscapes and aquatic environments formed between the rivers and the ocean provide habitats for a rich variety of species. Third, in these areas, a considerable amount of human activity takes place that has a significant impact on the relationship between living things and the environment, such as the development of ports and urban areas, and watershed farming and forestry.

This raises the question as to how a harmonious balance can be achieved with human activity such that this biodiversity can be preserved in these coastal estuary regions. Thus, this study aims to draw attention to the sustainable development of the fishing industry in coastal estuary regions as one possible solution. This is because fisheries rely heavily upon the aforementioned mutual relationship between wild species and the natural environment, and the inherent awareness of such a need for its preservation and its significance for regional communities leads to a natural desire to preserve the diversity of species unique to the inner bay. Sustainable fishing entails the participation of people in a variety of social positions and constitutes an economic activity that contributes to an abundant lifestyle. Indeed, it is a form of human wisdom and culture that must be handed on to future generations. By clearly demonstrating such awareness, we can reconsider the structure of regional communities and co-existent fisheries to create multi-centered human societies while preserving biodiversity in the region.

This study entitled “A study of the sustainable resource-use model in aquaculture and the application for Asia” supported by JSPS involved empirical comparative research carried out throughout Asia between 2006 and 2009. The study aimed to clarify regional similarities and differences in the utilization of diverse aquatic resources in Asia, where there is a particularly abundant food culture. This report provides an overview of the research so far, presenting examples from the Ise bay – the Kiso river estuary in Japan, Mokpo and Seoul in Korea, the Mekong delta in Vietnam, and Xiamen in China.

일본 중부지역 이세만 연안의 변 - 역사, 현재 그리고 미래 - Environmental Change and Reclamation History in the Coast, Ise Bay, Central Japan

日本中部地域伊勢湾沿岸の変化—歴史、現在と未来

Kawase Kumiko

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Coast in the Ise Bay has been modified during the long history. Coastline of the Ise Bay has the length of 443 km, in which there are only 24% coasts in natural condition. Around the Nagoya port and the Yokkaichi port, where are ones of the leading industrial regions in Japan, reclaimed land has increased especially since 1960. Artificial island was made for new airport after 2000. Although tidal flats in Ise Bay have vanished one after another, Fujimae tidal flat located close to the Nagoya port were protected against the development through the people's efforts. Now the pace of modification in the coasts seems to becoming slower.

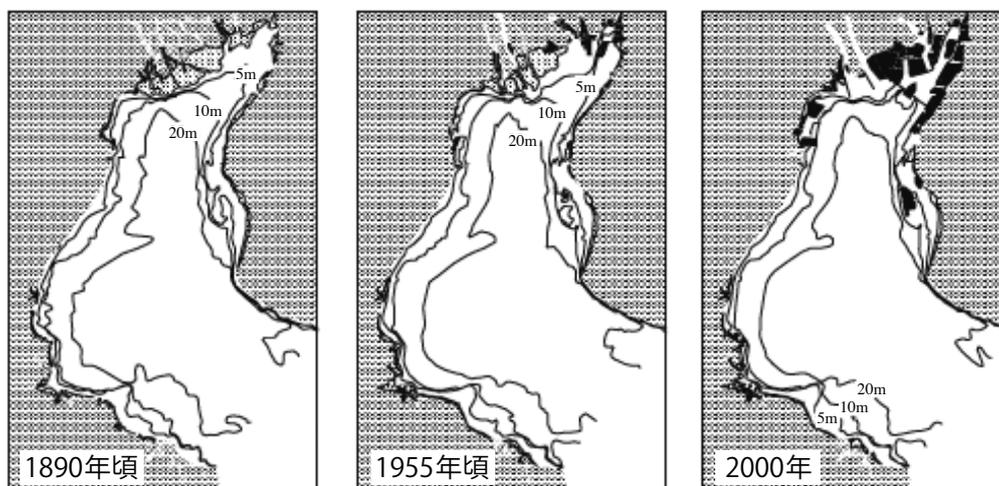


Fig.1 The change of tidal flat in the coast, Ise bay (Mizuno 2004)
Tidal flat: small dot, Reclaimed land: black painted

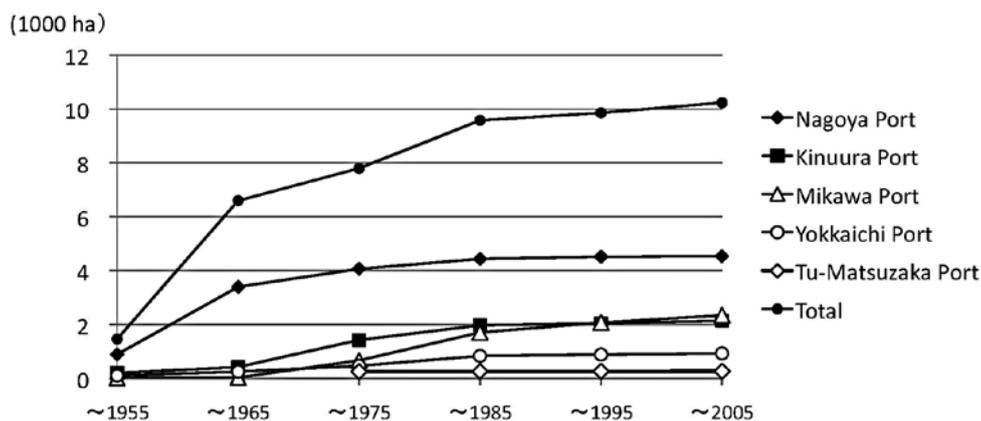


Fig. 2 Increase in reclaimed land on the coast, Ise Bay
Source: Ise Environmental Database, The Chubu Regional Bureau, MLIT

과거 대량 배출된 유황화합물이 일본 삼림토양에 남긴 흔적

Effect of Industrial Sulfur Emissions on Japanese Forest Soil

過去大量排出された硫黄化合物の森林土壌における痕跡

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Introduction

A large amount of sulfur had been emitted to the atmosphere from oil industrial complexes since 1960s in Yokkaichi city, Japan. The mean SO_2 concentration in the atmosphere was 0.083 ppm in 1965 ten times higher than in 2003. The sulfur gases were transported to forests and deposited. This anthropogenic sulfur was taken into the sulfur cycling in forest ecosystems. The major sulfur pool in forest ecosystem is the mineral soil and constitutes from 84 to 98% of the total sulfur content in the ecosystem (Mitchell et al., 1992). Investigation of the sulfur dynamics in Japanese forest soil is few even in Yokkaichi region. The purpose of this study is to clarify effect of industrial sulfur emissions on sulfur dynamics in forest soil in Yokkaichi region. To achieve this purpose, sulfur content, the stable sulfur isotope ratios and the soil factor related to sulfur accumulation was investigated.

Material and methods

The investigation was conducted at two study sites, Yokkaichi site located 20 km north-west of Yokkaichi city and Misugi site, 70 km south-west of Yokkaichi city. The bedrock is granite. The vegetation is plantation forest of Japanese cedar. Three soil pits was excavated in each site. Mineral soil samples were obtained from 0-5, 5-10, 10-20, 20-30, 30-40, 40-60 and 60-80 cm of depth. An S speciation into total S, organic S, adsorbed $\text{SO}_4\text{-S}$ and water-soluble $\text{SO}_4\text{-S}$ was conducted for all soil samples. The stable sulfur isotope ratios of total S of the soil samples from 40-60 cm depth for Yokkaichi site and 30-40 cm for Misugi site, where the S content was highest. Total C and oxalate-extractable Al and Fe related to sulfur accumulation were determined.

Result

Total S concentrations were 55~997 mgS/kg in Yokkaichi site and 94~1005 mgS/kg in Misugi site. And there was no difference between the two sites. Concentrations patterns were divided into two patterns, increase trend with depth or no trend. The stable sulfur isotope ratios of Yokkaichi site (4.90~5.67‰) were smaller than Misugi site (6.99~7.37‰). Since the stable sulfur isotope ratio in fossil oil is low, the sulfur in soils in Yokkaichi site was more affected by anthropogenic sulfur than that in Misugi site.

골프장 유출물의 화학적 특징

Chemical Characteristic in Outflow Water from the Golf Course

ゴルフ場の流出水の化学的特徴

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There are about 2,300 golf courses with a very large area (mostly about 100 ha) in Japan. Most of the golf courses have been developed in suburban forest area because of their land costs. Generally, outflow from forested area dissolves various elements through water flow process and is considered as an important source of mineral nutrients for ecosystem in a lower basin and estuary. Therefore, it is supposed that a golf course located in the upper forest area might influence on the quality of the outflow from the area, and also affect on material cycle in the ecosystem of the lower basin. Most of previous studies related with golf course itself and its effects on water quality focused on chemical fertilizer and pesticides including nitrogen and phosphorus, which have been used abundantly in a golf course, but few studies concerned other chemical components, especially trace elements. Therefore, the objective of this study was to clarify the influence of a golf course on water quality, specifically on trace element contents. The study sites are three golf courses (one is closed now) located in the north part of Mie Prefecture in Japan. The outflow waters from the golf courses and the upper forest area were sampled. Water samples were collected once a month from May 2009. In addition, sampling of waters just after rain events were conducted several times. The pH and EC of samples were measured using a pH meter and EC meter. Cation, anion, trace element, and dissolved organic carbon (DOC) concentration were analyzed using an ICP-AES, ion chromatography, TOC meter after filtration by a glass filter of 0.4- μm . As a result, in all of the outflow water from three golf courses, iron(Fe) concentrations in base flow reached about 5-50 times as high as those in the outflow from the upper forested basin, and about 100 times after rain. In addition, the correlation between Fe and DOC concentrations suggests a possibility that Fe combines with organic matter and flows out.

베트남 하우장성 산성유산염 토양에서의 지속가능한 양식 시스템 수질 개선을 위한 바이오 가스 슬러리 이용

Using Biogas Slurry to Improve Water Quality for the Sustainable Aquaculture Systems in Acid Sulfate Soil Areas in Hau Giang province.

ハウザン省における酸性硫酸塩土壌地域での持続可能な養殖システムの水質を改善するバイオガスのスラリーの利用

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In order to produce a best method for improving water quality in aquaculture ponds in the acid sulfate soil areas by using biogas slurry, a topic on “The experimental research on using biogas slurry to improve the water quality of culture systems in acid sulfate soil areas in Hau Giang province” was conducted at the practical field of Hoa an Center – Can Tho University from 3/2009 – 9/2009.

The results showed that biogas slurry could improve pH of water in acid sulfate soil infected ponds. In experiment 1, treatment II (75% biogas slurry) increased water pH from 3.3 to 6.5 after 1.5 month and maintained at this value until the end of experiment. Dissolved oxygen and Chlorophyll-a concentrations were also reasonably high (5.2 ppm and 143.05 µg/L, respectively) after 45 days of treatment. Consequently, the fingerlings of Snakeskin gouramy and Climbing perch could grow and survival well in the treated ponds. The daily weight gain (g/day) of Snake skin gouramy (0.002 g/day) in treatment 1 were significantly lower than that in treatment 2 (0.051 g/day) and treatment 3 (0.049 g/day). However, the survival rate and the fish yield of fingerling nursing in treatment 2 (22.19 % and 270 kg/1,000 m² respectively) were similar to those in treatment 3 (22.44 % and 264 kg/1,000 m²). For Climbing perch, the daily weight gain of the fingerlings in treatment I (0.004 g/day) was significantly lower than those in treatment II (0.045 g/day) and in treatment III (0.048 g/day) ($p < 0.05$). Treatment III resulted in the best results with high survival rate and yield of (14.06 % and 161 kg/1,000 m², respectively).

In conclusion, treatment of 75% biogas slurry (153 m³/1,000 m²) is considered the best treatment to improve water pH and produce reasonably good yield of fish to increase farmer's income.

Key words: Acid sulfate soil area, biogas slurry, water pH treatment, fish nursing.

베트남 메콩델타에서의 지속가능한 쌀-새우 시스템 The sustainable freshwater prawn - rice farming system in the Mekong delta, Vietnam

ヴェトナムメコンデルタでの持続可能な稲作エビ養殖複合のシステム

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Freshwater prawn (*Macrobrachium rosenbergii*, de Man 1879) is a high value product for aquaculture in the world. The rice - prawn farming system is applied in some countries of Asia. In Vietnam, the area for the rice - prawn system has increasing rapidly in many provinces of the Mekong Delta after the success of artificial seed reproduction since 2000. In 2008, culture area for prawns in the Mekong Delta was 7,512 m² and the production was 8,100 tons. Presently, most farmers apply the rotational one crop of rice and one crop of prawn in their rice fields in both freshwater and brackish water areas. Most farmers have fed their prawns with a combination between the meat of snails and commercial feeds. Around 8 - 14 t of snails (with shells) was used for 1 ha prawn farming in rice fields. Food conversion Ratio (FCR, dry food fed ratio wet weight gain) of combination pellets (90 % dry matter) and snail meat (18 % dry matter) was estimated around 2.0 - 2.5. The rotational rice - prawn system was better than the integrated one with regard to production and economic aspects. Production and economic parameters for stocking juveniles was not better than for stocking post larvae. There were no significantly difference ($P>0.05$) between feeding pellet or a combination of pellet and snail meat on production of prawns, but net profits at the treatments of feeding low cost feed (snail meat) were significantly higher than the others. Survivals of prawn in the rice fields were 30 - 50%. Prawn yields varied considerably from field to field and ranged 500 - 1,500 kg/ha. Prawn farming in paddies can replace the wet rice crop which needs high investment costs during the wet season, but offers low profit. Thank to a higher economic return than monoculture of rice or rice - fish systems, rice - freshwater prawn system is spreading very rapidly in the Mekong Delta of Vietnam. However, prawn farmers were faced with many problems due to the lack of seeds, culture techniques and unstable markets. In generally, freshwater prawns are one of the most valuable cultured species in the rice fields to improve rice farmers' income.

중국 후지엔성 남부의 어촌 및 어민 생활
- 큰 어촌과 작은 어촌의 두 사례를 통해서 -

The Fishing Village and the Life of its Fishing Population in Southern Fujian Province of China
- Example of a Big and a Small Fishing Village -

中国福建省南部の漁村及び漁民生活-ある大漁村と小漁村の事例を通して-

Pan Hongli

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Fujian Province is situated in the southeast coast of China. Its northwest is surrounded by the Wuyi Mountain Range and it has many mountains and hills within its territory. Along its 3752km east coastline, the area of fishing grounds is more than 120 thousand square kilometers, which is bigger than its land area. The per-capita usable marine areas like the shallow sea and the tidal land is 21 times more than the national average. Apart from these, it also has many rivers like the Minjiang River, Jinjiang River and Jiulongjiang River flowing into the sea. Therefore, the Fujian people in this geographic environment have from the ancient times *used the sea as the cultivated land* and have developed a rich culture closely related to the sea.

Fujian people are mostly Han immigrants from central China in the past history with some scattered Yue minority peoples. Due to its historic and cultural diversity, the characteristics of fishing villages and the ways of life of their fishing populations are somewhat different. This report gives an example of the water-borne community of a big fishing village Xiangyu Village and a small one Shima Village and introduces the development of the fishing industry of Fujian Province by comparing the different fishing cultures of these two villages.

새만금 갯벌 개발과 어민의 생활전략 Tidal Flat Development and Living Strategy of Saemangeum Fishermen.

セマンガム干潟開発と漁民の生活戦略

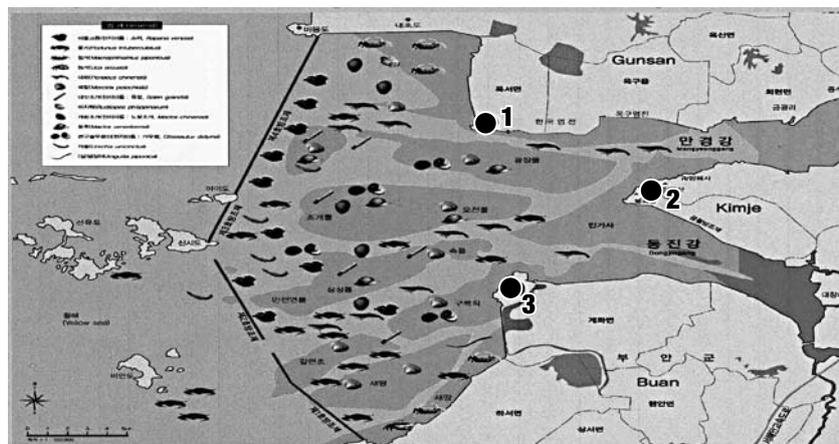
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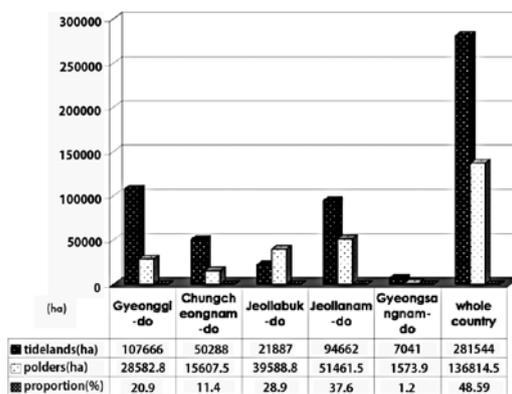
Tidal flats are a mere sea to the common people, but it will be to the developable land to the developers. But the tidal flats are a significant place to live to fishermen and migratory birds.

The fishermen have been using sustainable a tidal flats by the rules of the their fishing community. However, the tidal flats was decimated by a unilateral national policy priority to the development, the fishermen have lost their fishing place to live.

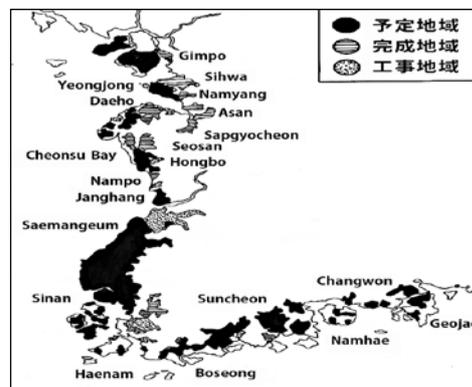
This study is to identify the living strategies Saemangeum fishermen to react to various environmental changes by development.



Distribution of fishery resources in the Saemangeum tidal flat



Regional distribution of tidelands and polders (1996)



Polders in the coastal region of southern and western parts of South Korea (1995)

영산강 하구의 자연환경변화에 따른 주민생활의 변동 Changing People's Lives and the Natural Environmental Change in the Yeongsan River Estuary

「梁山江河口の自然環境変化による住民生活の変動」

Kim Kyoungwan

Institute of Island Culture, Mokpo National University, Korea

This paper describes the history of the adaptation of the people to the natural environmental change caused by the Youngsan river basin development.

Youngsan River, which is 136km long from the Yongso upstream to the embankment of the estuary, is the shortest of the four major river in South Korea. Before the river dam was constructed (completed in 1982) in the Youngsan River estuary, the developed fisheries were very active affected by the impact of the tidal difference. The tidal flats spread wide on the both sides of the river and a large port was located. After the river dam construction in the estuary, the tidal flats were changed to the farmland by large-scale land reclamation. People living there have shifted their work from fishery to agriculture in 30 years. Now they think that they are happy to be engaged in agriculture. It is because they keep unbearably painful memories which they were suffering in the hunger and poverty when they lived on fishing. The dam and the reclamation of Henam area, however, have caused serious environmental damage to the people living on the islands in the open sea. For example, seaweed (nori) farms and fishing grounds of the Aphae island of Shinan-gun were damaged significantly by their influence.



Fig.1 Seungcheon barrage has been built in Youngsan River

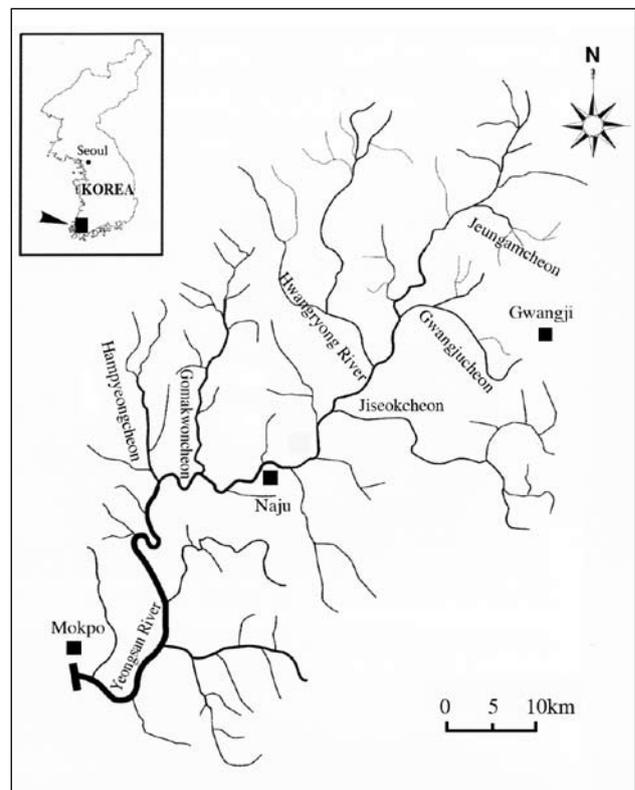


Fig.2 Yongsan River basin

하구 어업자원의 문화적·사회적 가치 –이세만 지역의 사례– Cultural and Social Value of Local Fishery Resources -A Case Study of Ise bay Region- 河口漁業資源の文化的・社会的価値－伊勢湾地域の事例－

Nonaka Kenichi

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In the coastal estuary region around Ise Bay, located in the central Japan, many fishery unions have been established and are run by local communities. The types of fisheries in the area vary depending on local variations in the aquatic environment and also cultural and marketing differences. There is also influence from differences in the development of each area, contributing to the richly varied history of fisheries in the region.

This study aims to clarify the diversity and uniqueness of the culture surrounding the fishing industry in coastal estuaries. In Japan, a variety of data is available on fish catch statistics from the end of the 19th century to the present day. Such data provides invaluable insights into the species caught, catch sizes, fishing methods, and operational frameworks. Of course, these statistics are not necessarily comprehensive, and some species and methods may not be mentioned. Nevertheless, the fact that these statistics exist is significant in itself, and the information enables regional comparisons and reveals changes through time.

This paper demonstrates the diversity of the fishing industry in the coastal estuary region around Ise Bay, based on fishery census and local statistics. Furthermore, it presents case studies whereby statistical data is supported by data from questionnaires and actual observation, providing a framework from which we can encourage the rediscovery of estuary fishing as part of regional culture, and discusses the importance of maintaining the practice as a kind of cultural resource.

The paper indicates the diverse nature of the fishing culture and the utilization of a diverse variety of fish species. The author aims to create a framework from which concern for aquatic regions and resources can be encouraged by discussing a cultural scientific approach that incorporates the epistemological, cultural-historical, and environmental-geographic aspects in order to promote the preservation of the environment and the production and use of sustainable resources. This is particularly important in the light of the historical simplification of the operational organization of traditional fisheries and the decline in catch sizes and consumption.

하구역 환경정책의 어업공동체 참가에 관한 상태와 문제
Status and issue on participation of fishing communities
in environmental policy in Asian estuarine regions
アジア河口域の環境政策における漁業共同体の参加に関する状況と問題

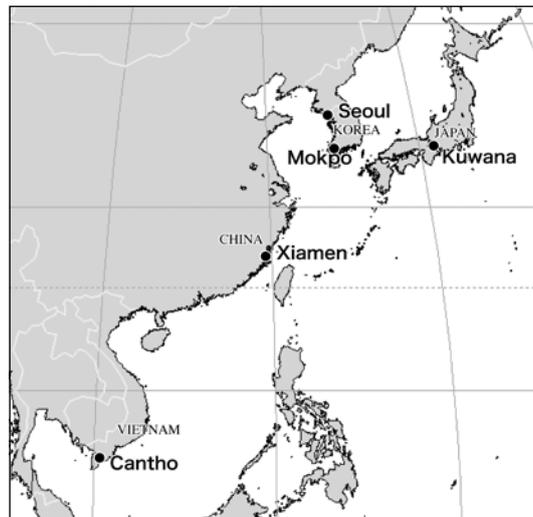
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Deterioration of fishing grounds is a serious problem in many estuarine regions in the world. Since UNCED meeting in Rio, Brazil in 1992, Integrated Coastal Zone Management [ICZM] has been considered as an ideal policy to keep healthy coastal waters, however, successful cases has been few. Exchanging information about progress and problems between the regions should bring insight into how fisheries researchers, either in academic institutions or NPO, could play their roles. This paper compares physical condition, fisheries, and on-going coastal policies in four study sites; Tien River estuary [Vietnam], Jiulong River estuary [China], Sihwa River estuary [Korea], and Ise Bay [Japan]. Then, I would like to describe status and some issue of ICZM in Ise Bay, and discuss the common issue that we should share.

One of the important issue is conflict between different farming activities, or different fisheries operation over coastal management, which needs understanding both from fisheries science and human-social sciences. In Tien River basin, modernization of agriculture and fisheries has brought rapid economic growth, and some of significant activities are rice paddy, shrimp farming and Pangasius cat fish farming. The products are exported to various countries including China, Korea, and Japan. Nutrient flow from these land use are likely to cause eutrophication especially in narrow channels which is the closest water to the settlement. In Jiulong River estuary, the coastal areas are greatly changed since the city was designated as special economic zone in 1980. Real estate profit in this area is about 60 times higher than that of fisheries overall, not to mention small scale fisheries who heavily depend their life on fisheries. It is a model area for ICZM in China, but the participation of fisheries communities seem to be put behind. Sihwa estuary in Korea was an advanced case that the researchers severely evaluated its impact both on ecological system and fisheries community. In Ise bay, Ise Bay Restoration Action Plan was published in 2007. It is aimed at ICZM at basin-scale, after many trials to reduce nutrient discharge into the estuary in the level of local government-scale. Among other estuarine regions in Japan, Ise Bay receives greatest volume of river discharge, largest basin area, and active agricultural activities, which gives complex problems in understanding land-sea relationship. It is needed to reconsider diversity fisheries and its physical basis in order to achieve restoration in sustainable basis.

Keywords: fisheries community, Asian estuarine region, researcher, participation



Surveyed sites in this project

아시아 연안 하구역의 지속적인 수산자원이용에 관한 모델 구축
 Establishment of an Asian Model for Sustainable Resource Use in Estuarine and Coastal Regions
 アジア沿岸河口域における持続的な水産資源利用モデルの構築

개최일시 2010년 3월 6일 - 8일
 6 - 8, March, 2010

개최지 인하대학교
 Inha University, Korea

"A study of the Sustainable Resource-use Model in Aquaculture and the Application for Asia" supported by JSPS

Edit and issue Tamasaya