Ecosystem based fishery management in Yangtze River Delta basin and fishery management opinions for Jiangxin island of Nanjing

Zhang Xiao

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The Norwegian College of Fishery Science

University of Tromso, Norway

&

Nha Trang University, Vietnam

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Abstract

In the past ten years, China has developed to be one of the most important countries of fishery production field. Annually Chinese fishery products is increasing . In 2009 the total fishery production is 50.4 million tones.(China statistical reports,2009) As the same rate as the increase economy, the sharply development of fishery production is also remarkable.

But there are serious problems behind the promising surface. The conflicts between the economic development and ecological and environmental declaration are becoming prominent. The most serious situation is in Yangtze River basin. According to a Chinese governmental report , the total annul aquatic production in Yangtze River is about 20% of total national fishery production. But from the latest 20 years, the fishery biomass situation is continue damaging. How to fix Yangtze River ecosystem is the top priority in fishery management. And how to deal with the fishery of Yangtze River is also the main problem of Chinese freshwater industry.

Chinese government has authorized many measures and policies in the last 10 years, but the situation became even worse during this period. Because of the historical and political reasons. Chinese academic levels in fishery economics and management is limited, and the fisheries research is not given enough priority. There is hardly any effective research on Yangtze River fishery resources today.

At a global level , a new term is becoming quite popular, within the field of fishery management namely ecosystem-based fishery management. Many foreign countries has implemented this theory into practice and also FAO support this theory as the most important management theory in fishery in the future.(FAO, 2005) The same as many other new theories, there are so many disputes and controversies on this theory. Problems often pointed at are shortage of data and poor knowledge, the theory

is still not fully developed.

Based on the investigation of the formal management failure in China. We figure out that may be the ecosystem-based fishery management can save the environment and fishery resources in Yangtze River. We are going to analysis the main principles, goals and policies for the fishery management, which is the original in Yangtze River academic research.

Good theory needs to be tested by facts. Based on the theory of EBFM in Yangtze River, we chose a small island in Yangtze River to implement the theory . According to the local conditions and new development perspective, we chose Jiangxin island of Nanjing as a research field. We gave management advices for this island and hope it can be a good example that balance the environment profit and economic benefit.

This paper will be a operation advices give to the development company of Jiangxin island for the implementation of ecosystem based fishery management on that island.

Key words: Yangtze River fishery, Ecosystem based fishery management, Human oriented, Jiangxin island, Recreational fishery

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Content

1. Introduction：

Although China has an impressive number in fisheries production, but there are still many serious problems on several levels. The goal of this paper is to identify other and better management measures in Chinese freshwater fishery. As the Yangtze River basin is the most important water system of China, with special reference to make the freshwater industry develop in a sustainable way and also deal with ecological which is going on in Yangtze River Delta.

Chinese fisheries has many weaknesses such as the conflicts between the economic development and ecological environmental protection. As the land-based pollution is still a serious problem, growth and reproduction of some fish stocks and aquatic wildlife habitats have been severely damaged, some fishing areas have problems which could be referred as "desertification" phenomenon. Although in recent years, there has been some effort to protect the fish stock resources, the environmental problems are still getting worse. Similarly the quality control is still poor. Low quality aquatic exports increased trade barriers, which affecting market development of China's aquatic products. In recent years, some countries have taken many measures China's trade on aquatic products, such as trade barriers, and disputes on trade issues are increasing. For example in 2006 the FDA of USA has detained 216 batches account for 34.5% of the whole year. The same situation happens in EU, Japan and many other important fishery market.(Guo Fang et. al. 2007)

Because of poor organization, Chinese businesses still don’t have well mechanism for dealing with trade disputes. China's export of aquatic products faced a lot of constraints, coupled with our quality and safety monitoring and management of aquatic systems are imperfect; quality and safety control measures restricting the aquatic international and domestic market development. Aquaculture water planning and management issues become increasingly prominent, seed import, disease control systems and measures is backward than the world , all these problems restricts the healthy development of Chinese fishery.

China is an important fishery nation, having vast water area, large amounts of resources and many aquatic spices The China seas contain about 3,000 marine species, of which more than 150 species are fished commercially. Some major marine fishing species in recent times are hair tail, chub mackerel, black scraper, anchovy and some species of shrimps, crabs and smaller fishes. In the freshwater area China has 709 freshwater fish species and 58 subspecies, with another 64 species migrating between sea and inland waters(Anonymous,2010d).Carps are the most important commercially species, particularly silver carp, bighead carp, black carp, grass carp, common carp and crucian carp. Other commercially important species are bream, reeves shad, eel, cat fish, rainbow trout, salmon, whitebait, mullet, mandarin fish, perch, sturgeon, murrel and pangolin. Commercial shellfish include freshwater shrimp and river crabs, mollusks include freshwater mussels, clams and freshwater snails. Aquatic plants are also harvested: lotus, water chestnut and the gorgon nut. Other commercial species include the soft-shell turtle and the frog.（Chinese Ministry of Agriculture Bureau of Fisheries,2003）

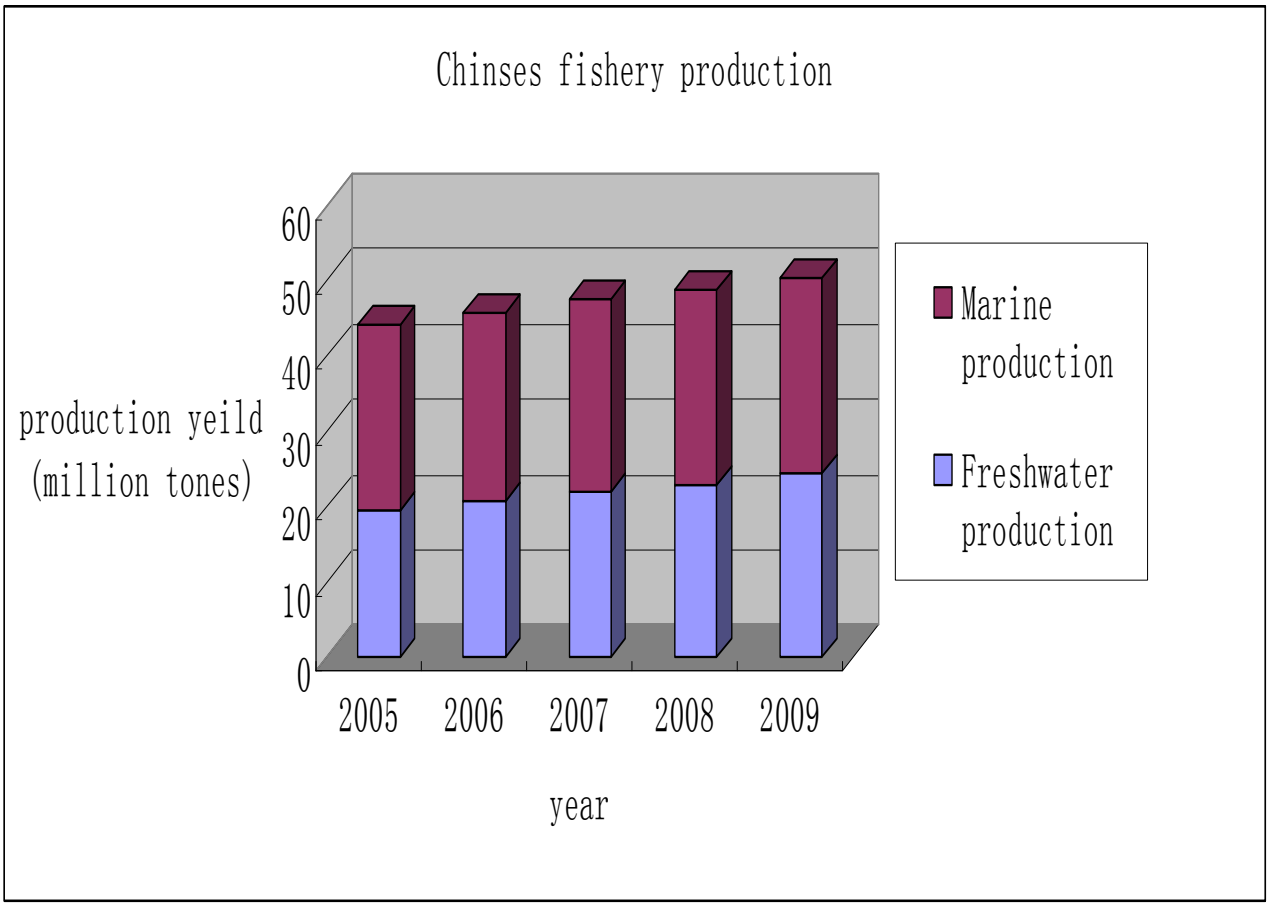
In 2006 the total amount of fishery products was 45.84 million tones, the production yield of seawater aquaculture was 12.64 million tons and the number of freshwater aquaculture was 18.54 tons. The yield of seawater fishing was 12.45 million tons and fresh water fishing production only 2.2tons. In 2007, the total product output of fishery is 47.4 million tons, an annually growth of 3.58%. The same year it was produced 13.07 million tones of seawater aquaculture products and 19.71 million tones of freshwater aquaculture products. The yield from freshwater fishing was 2.26 million tones and the amount of seawater fishing was 12.44 tones.(China Customs , 2008)

Table1.1 Chinese fishery production from 2005-2009[1]

year		Total fishery production	marine production	freshwater production
2005		44.199	24.659	19.54
2006		45.836	25.096	20.74
2007		47.475	25.509	21.966
2008		48.956	25.983	22.973

[1] Data is from China statistical reports,2009

2009		50.4	26	24.4
				(million tones)



In the table above, we can find out that the freshwater production of China is becoming more and more important, as the continuing increasing in total fishery production the amount of freshwater production is continue booming. We can easily foresee that the freshwater production will soon catch up the production of marine.

Fishing has a long history in China; traditional fishers are mainly settled along the coast, rivers and lakes. The culture related to fishing is very rich and has a profound influence on rural livelihoods. With socio-economic development and adjustments to the structure of the fishery sector however, traditional fishers have recently started to move gradually away from capture fishery production towards aquaculture and other industries. Also because of the development of economic, people began to care more about the healthy and living level, based on the traditional eating habit, the production of high quality freshwater fishery is becoming more and

more popular in China.

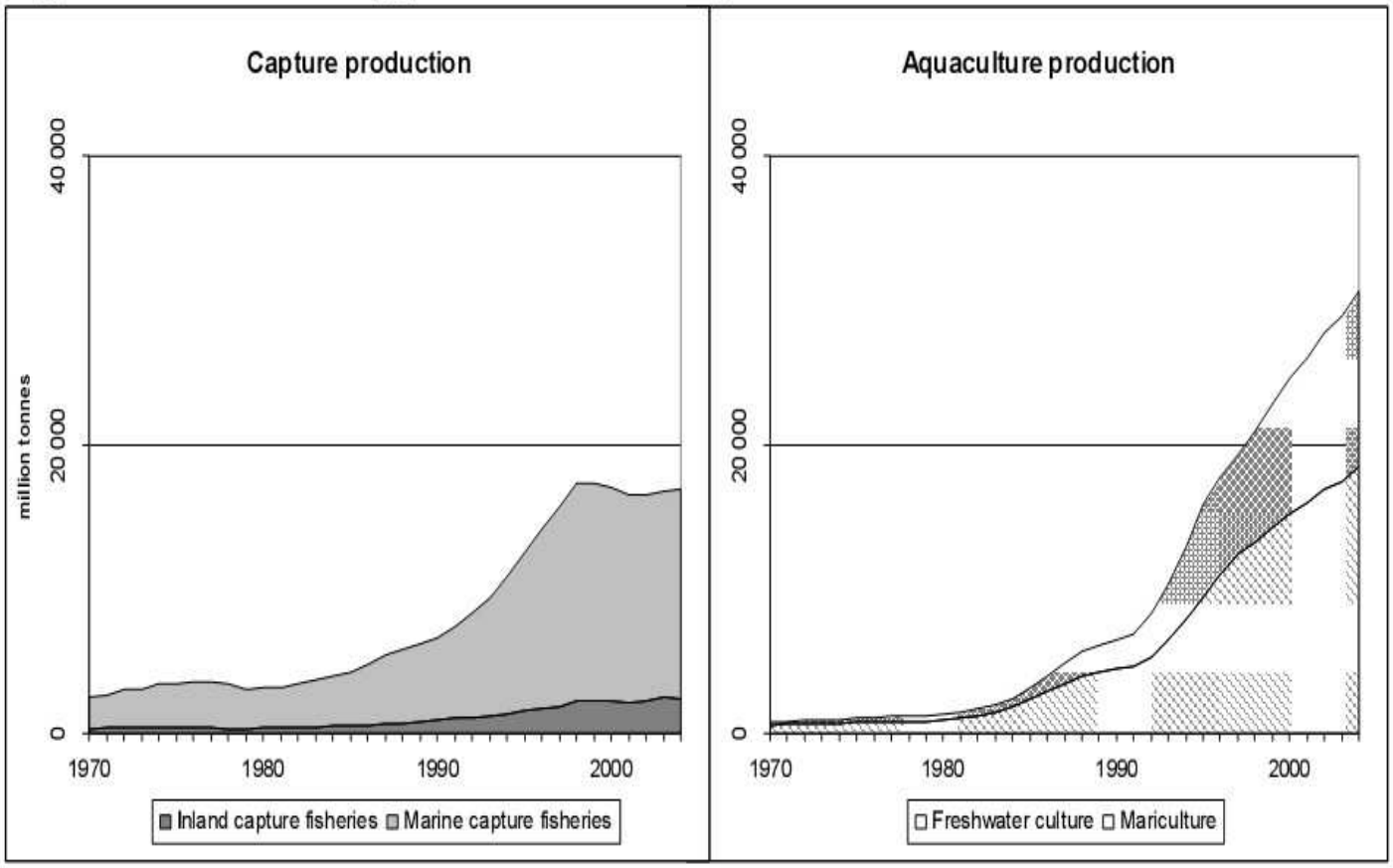


Figure 1.1 The fishery production of China by sub-sector[2] (Guo, Xie, Zhang etc, 2008)

Total export volume of Chinese fisheries products in 2009 was 6.68 million tones, and the amount of value is 16 billion USD. Among it, the export number was 2.94 tons and 10.7 billion USD.(China Customs,2009) Chinese seafood products constitute around 1/3 of the world's total fisheries production. From international trade, the quantity and value of China's ocean aquatic export production is much higher than the production of freshwater. Chinese freshwater aquatic export has many problems such as slow growth, low international market share ,low competition ability.

For many years, the quantity of export freshwater products only accounted for 40% of the total aquatic production in China, less than 3% of total export value.(China Customs,2009) At present, Chinese freshwater aquaculture products basically have low value and quality, most of them are domestic products. The

[2] Details of species items reported from China, shows that marine capture production shows a good species breakdown

problems of extroverted degree and low in certain extent, all restricts the development of Chinese freshwater industry.

However, due to irrational use of resources over a long period, the country's freshwater fishing industry has been declining in over the last 20 years. The issue of protection of fishery resources in China is now urgent.

Yangtze River is one of Chinese inland waters; it is the longest river of China and the 3rd longest river of the world. Yangtze River area produces nearly 50% of all freshwater products of China.(Anonymous, 2010a) ,and is the most important water system of China. It is therefore, It is therefore important to develop knowledge and methods for sound exploitation of the Yangtze River fish resources. Such knowledge has the greatest importance for securing long-term sustainability and a stable development of the Chinese economy.

Chinese authorities took on this issues more than 20 years ago and proposed several management measures, but since then the resource situation has become even worse than before. Current research on effective fishery management issues in foreign countries is more advanced than in China, ecosystem based management being one of the recently developed management ideas. The situation in Chinese fisheries calls for more research and investigation to improve system knowledge and management measures.

In this paper, the research background of Yangtze River and Yangtze River Delta is presented in Chapter 2. And in Chapter 3, based on the situation of Yangtze River we chose a research method theory to deal with it. Then, according to the case study on the Yangtze River we gave some of management advices in Chapter 4. As Yangtze River Delta is a big area, In Chapter 5, we selected an small island in Yangtze River delta basin belonging to Nanjing city to present more details in ecosystem-based fishery management based on a close field research of the island. Final conclusion and discussions for further research are presented in Chapter 6.

2. Research Background

2.1 Introduction of Yangtze River

In Chinese people's mind the Yangtze River is the mother river of China , which has many tributaries, lakes, clouds, where drainage area of more than 10,000 square km of 26 main tributaries 4048 lakes with 24,172 square kilometers. (Anonymous ,2010a)

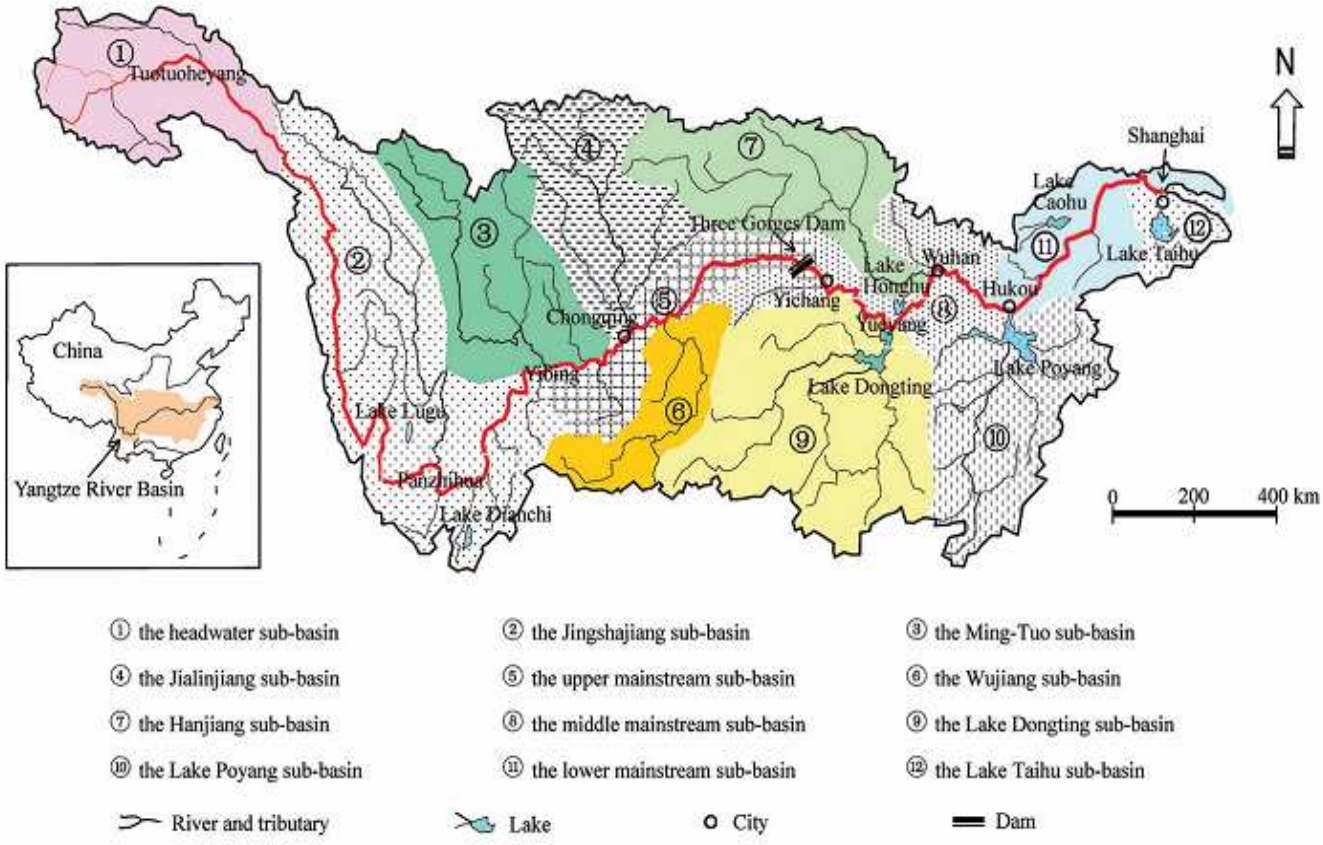


Figure 2.1. Map of Yangtze river basin (source: Fu Guizhang, et.al. 2003)

Because of adequate water quality and favorable natural environment, Yangtze River has a rich variety of aquatic resources for thousands years. There are 370 species in Yangtze River, belonging to 17 orders, 52 families and 178 genera. 164 of the species are Carp, the Yangtze River accounts for 46.51% of the total number of freshwater fish in China,(Fu Guizhang, et al., 2003) followed 30 species of Cobitidae,

accounting for 8.02%; 25 species of Catfish, accounting for 6.68%; 20 species of Gobiidae, accounting for 5.34%;16 species of Homalopteridae, accounting for 4.27%; the other 115 species and 47 families, accounting for 30.74%. Yangtze River has 294 kinds of pure freshwater fish, 22 species of salty freshwater fish, 9 species of sea-migratory freshwater fish, 45 species of marine fish. (Chen Daqing, Etc. 2002) Yangtze River Delta area is the fastest economics developing area of China and nowadays this river is facing a serious ecological crisis.

Table 2.1 Orders of freshwater fishes in the Yangtze River basin and in the world[3]

Order		Number of species of freshwater fishes	
		World	Yangtze River Basin
Cypriniformes		2662	273
Siluriformes		2280	43
Perciformes		1922	23
Synbranchiformes		84	1
Clupeiformes		72	4
Scorpaeniformes		52	1
Salmoniformes		45	1
Osmeriformes		42	6
Acipenseriformes		14	3
Tetrodontiformes		12	3
Anguilliformes		6	2
Pleuronectiformes		4	1

After entering the 1990s, the state has increased the protection of natural resources in Yangtze River, which includes the protection of fishery resources. But by implementing a series of measures, not only can’t solve the problem, but rather a serious impact on fishermen's life, even experts and researchers didn’t have significant effective measures for the ecological disaster. It shows that in the study of the harmonious development of man and nature of the Yangtze river problem requires new methods and theories, is conducive not only to resolve the majority of the fishermen's survival issues, while enabling China's fishing industry is conducive to

[3] Freshwater fishes in the Yangtze River basin and in the world (Fu Guizhang, etc. 2003), Species number of freshwater fishes in the world from Nelson (1994).

economic development and prosperity. More importantly, the study on deal with natural resources and economic development can play a very important role to help China maintain long-term high-speed development, and the establishment of a harmonious society.

Yangtze River also has many unique, rare fish and wild animals. It is a typical ecological river with full of biological diversity in our country with many valuable commercial fish, the famous four major family fish, eels and many other fish species with the economic base, its quality is the best of all the water system in China, as any other genetic or artificial water system can not be replaced. Yangtze fishery resources with seed resources, famous resources, germless resources and aquatic wildlife resources are all unique strengths of Yangtze River fishery resources.

2.2 Introduction of Yangtze River Delta

Based on the critical situation of Yangtze River, it is important to examine all possibilities of improving the management of the resource exploitation, including ecosystem-based fishery management.

Today the area related to the river constitute an economy of the size of a medium-sized developed country, encompassing a GDP (when measured to purchasing power parity) of 2 trillion US$ per year, which is 40% of the national economy (about the size of that of France, 2.05 trillion US$ in 2007 according to the to the International Monetary Fund). The urban build-up in the area has given rise to what may be the largest concentration of adjacent metropolitan areas in the world. It covers an area of 99,600 km^2 and is home to over 80 million people as of 2007, of which an estimated 50 million are urban.(Anonymous, 2010c).

As the development of economy , the environmental situation in Yangtze river Delta is still getting worse. Not only does it directly affect health and living condition of the residents along the river side, but it has long lasting negative effects on Yangtze River’s ecological system. The delta is one of the most densely populated regions on earth, and includes one of the world's largest cities on its banks—Shanghai,

with a density of 2,700 inhabitants/km². (Anonymous ,2010c)

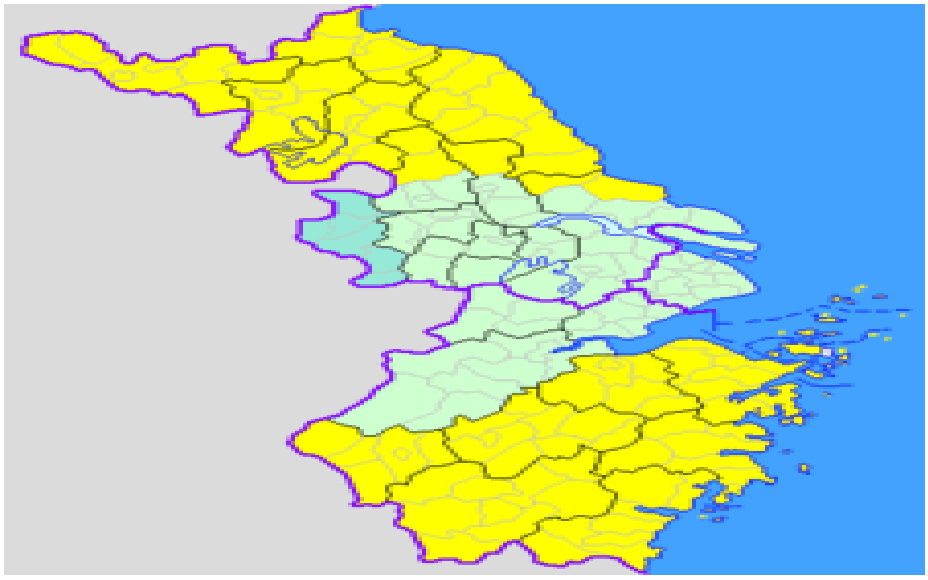


Figure.2.2 The map of Yangtze River Delta (Anonymous 2010c)

Yangtze River Delta is one of the most important economic regions in China, and its importance is growing. The 2010 EXPO is going to be held in Shanghai from May to Oct, and the area will be more exposed to the world.

Studying on this area is not only because the government of this area has more capital and ability to solve the ecological crisis but also make a solid basis for the whole area's developing market. After the great economic development, people will demand more and more healthy and self-satisfaction for their own living condition. The fishery market of this area is huge and will rapid expand in the foreseeable future. The fishery of Yangtze River Delta can be another economic assistor for this area.

The slogan for the Shanghai 2010 EXPO is "Better city, better life" and the environmental situation of the Yangtze River is directly affecting people's lives along the river. The situation of the river also directly affects the city's image in the world. How to change from the miserable ecological situation of the Yangtze River is a serious problem for the region.

2.3 Biomass and over fishing situation in Yangtze River

In history, the highest natural output of Yangtze River fishing production is up to

427,000 tons. The total catch in Yangtze River from 1949-1999 shows that the fluctuation of fisheries resources in the Yangtze River, according to statistics can be divided into three periods, which is recovery, stable and decline. From 1949-1954, it is recovery period, beginning with the founding of a fundamental change in the relations of production, the rapid restoration of fisheries production and development of river development and utilization of fish resources, fisheries fishing production increased year by year, the peak of 1954 reached 427,221t. The period 1955-1971 is relatively stable yield, the average annual catch over production 261,025t. Followed by decline of 80's average annual fluctuations in fish production is about 200,000 t, in 90's the annul fisheries production is about half of 80's. In recent years, only 10 tones per year.(Chinese Ministry of Agriculture Bureau of Fisheries, 1994-2002) Many commercial fish, such as the four big family fish, whitebait, eel, etc., don't have formal fishing season; the annual production of fries of Yangtze River four big family fish decline from the highest 30 billion tail down to the present hundreds of millions tail; Chinese Cashmere crabs natural seedlings had the highest annual output in 1981 reached 72 tons, 90's of last century the average catch yield is only 2 tons of production. Since 2001 this number is hardly create. the famous Yangtze River reeves shad on the verge of extinction; Aquatic wild animals like Chinese river dolphin, sturgeon, white sturgeon, porpoise, are all increasing the degree of endangered. In the catch, the migratory fish continue reducing and fishing species tend to be single, the catch of individual is becoming smaller and younger in age.(Chen Daqing, etc. 2002)

In Yangtze River Fishery, because of the extensive use of the harmful fishing gear. Despite illegal fishing phenomenon repeated prohibit, as the water level changes and resources continue to decline, some fishermen chose to give up their traditional fishing methods, using electricity, poison or explosives and other illegal practices Terra Tragedy, damage to fish resources, a direct result of the number of aquatic organisms reduced.

The situation of over-fishing for spawning brood stock and juvenile fish is serious. The class of fish resources were severely damaged. In Gulland's research that

the optimal development of fish stocks was about 0.5,but while the present Yangtze River, the catch rate of Herring, Grass carp, Silver carp, Bighead carp, Common carp, copper fish, Coreius, Long kiss fish, Vachelli, River catfish and other fish, 10 kinds of major economic fish, respectively with the number of 0.761, 0.706, 0.803, 0.829, 0.898, 0.876, 0.846, 0.774, 0.765, 0.691.(Chen Daqing et al, 2003) In this judgment standard, River catfish is mild over-development, Black carp, Grass carp, Long kiss, Vachelli for the moderate over-development, Silver carp, Bighead carp, Copper Fish, Coreius, are series over-development. This shows that current fishing levels are not conducive to the normal maintenance of fish resources. The population has been faced growth type over fishing, If does not control the fishing effort in Yangtze River, the intensity and fish resources would be worse.

Yangtze River has several unique fishes, including Chinese sturgeon, Chinese reeves shad, *Leiocassis longirostris*, *Myxocyprinus asiaticus* and so on. But all of these are nearly extinct.

Chinese sturgeon, is thought to have lived at the same time as dinosaurs, dating back to a period 140 million years ago. Because of that, it is sometimes also known as a living fossil. It is an animal strictly protected by the Chinese government, named a "national treasure" much like its mammalian counterpart, the Giant Panda. In 70th and 80th of 20 century, the production of it is about 30000 kilo, but nowadays the wild aquatic of Chinese sturgeon is nearly extinction.(Anonymous, 2010b)

Chinese reeves shad, it is another famous fish in China. In Chinese history, this kind of fish was only supply for the ancient emperor. And this kind of fish is not only quite delicious but also full of nutrition. It has the highest unsaturated fatty acid rate of all known species of fish. But this kind sharply decreased from 1960, and nowadays there is none wild catch in Yangtze River.

White-flag dolphin is a freshwater dolphin found only in the middle and lower reaches of the Yangtze River in China. Nicknamed "Goddess of the Yangtze" in China, the dolphin was also called Chinese River Dolphin, Yangtze River Dolphin, White fin Dolphin and Yangtze Dolphin. The population declined drastically in recent decades as China industrialized and made heavy use of the river for fishing,

transportation, and hydroelectricity. Efforts were made to conserve the species, but a late 2006 expedition failed to find any in the river. Organizers declared that this creature is "functionally extinct".

As mentioned before not only three kinds of animals facing the extinction crisis but all the living creatures in Yangtze River are facing great danger now. How to resolve this serious ecological disaster in Yangtze River, it is a wonderful research target. More and more scientists, government managers, fishery researchers started to work out this tragic situation.

3. Research methods

3.1 Formal method in fisheries management

In the past, when we discussed about fishery economics management field, the most common term is single species stock assessment, which is based on the Gorden-Schaefer model initiated in 1954 attempted to equate the concept of sustainability with the notion of optimum fishing mortality, leading to some form of maximum sustainable yield. This management theory has been widely implemented in the world for over 50 years. Especially in developed countries, the government spent a large amount of budget on the routine acquisition and interpretation of catch and age-composition data, which determined as important parameters in the single species model. But in modern fishery research, some researchers have different view on it, as the single species stock assessment and related policies haven't served the global fishery well. Some one even listed four broad problems on this management theory.(Daniel Pauly, et.al. 2002) The shortcomings of recent single species stock assessment include problems with stock unit, catch statistics, environmental effects, multiple species effects and so on. So many constraints make the assessment has problems in deal with fishery management

Compare to this, because of budgetary constraints and reduced capacity of the fishery departments and research institutions in many developing countries, there is shortage of knowledge about the local fish biology, fisheries and fish stock status (Aas 2002). How can we manage the fishery resources in developing country as China is also a tough question. When we investigated the fishery research situation in Yangtze River, we found out that the fisheries data is extremely shortage, the clear stock size and biomass condition is unknown. According to the shortage of fund and academic level. The single species stock assessment in Yangtze River couldn't be available.

Things are developing all the time, including management theory. It is becoming more and more precisely based on countless studies and researches. Nowadays, new theories of fishery economics management are continuing improving. Our mission is

trying to figure which is the most fits to our objectives. The focus of this thesis is the problem of Chinese fisheries on the basis of the current situation of Yangtze River Delta, with special emphasis on identifying efficient management measures for inland fisheries in general.

3.2 Definition of new management method

Recently, a new word has become quite popular in China, which is named as ecological fishery. This word appears frequently in Chinese governmental reports and newspapers, but there is no precise definition of the term in China. Although it may indicate that the government emphasizes environment protection and keeping a sound balance between economy and environment, there are still only few measures related to this word. According to the experience of the author after spending some time outside China, it appears that the Chinese expression of managing ecological fisheries has the same meaning as the internationally well-known idea of *ecosystems based fisheries management* (EBFM).

What is ecosystem based of fisheries management? There are huge number of studies referring to the term. The phrase 'Ecosystem Based' was first coined in the early 80s, but found formal acceptance at the Earth Summit in Rio in 1992 where it became an underpinning concept of the Convention on Biological Diversity(United Nations, 1992) and was later described as:

'a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.' (FAO, 2005)

Ecosystem management has been introduced as a concept since at least 1967(Czech & Krausman, 1997) It is *"a management philosophy which focuses on desired States rather than system outputs and which recognizes the need to protect or restore critical ecological components , functions and structures in order to sustain resources in perpetuity "* (Cortner et al.,1994)

In fisheries, a large amount descriptions of the ecosystem-based approach have been developed. For example, the FAO Fisheries Atlas, in its section on 'Basic

Principles of Ecosystem Management', states:

'The overarching principles of ecosystem-based management of fisheries.....aim to ensure that, despite variability, uncertainty and likely natural changes in the ecosystem, the capacity of the aquatic ecosystems to produce food, revenues, employment and, more generally, other essential services and livelihood, is maintained indefinitely for the benefit of the present and future generations.....to cater both for human as well as ecosystem well-being. This implies conservation of ecosystem structures, processes and interactions through sustainable use. This implies consideration of a range of frequently conflicting objectives and the needed consensus may not be achievable without equitable distribution of benefits.' (FAO, 1999)

This definition is useful in demonstrating that ecosystem-based management is not about managing or controlling ecosystem processes. Further more, ecosystem-based management is concerned about ensuring that fishery management decisions do not adversely affect the ecosystem function and productivity, so that harvesting of target stocks is sustainable in the long-term.(JNCC,2008) Traditional theory in fishery management, which have intend to focus on individual stocks or species, have not achieved this objective and usually the ecosystem supports has become compromised to affect the economic activity.

Some researchers use pillars theory to identify the definition of ecosystem-based management, such as: *Ecosystem management reflects a stage in the continuing evolution of social values and priorities; it is neither a beginning nor an end .It is place–based and the boundaries of the place of concern must be clearly and formally defined .It should maintain ecosystems in the appropriate condition to achieve desired social benefits; the desired social benefits are defined by society, not scientists. It can take advantage of the ability of ecosystems to respond to a variety of stressors, natural and man–made, but there is a limit in the ability of all ecosystems to accommodate stressors and maintain a desired state. Ecosystem management may or may not result in emphasis on biological diversity as a desired social benefit. The term sustainability, if used at all in ecosystem management, should be clearly defined — specifically, the time frame of concern, the benefits and costs of concern, and the*

relative priority of the benefits and costs. Scientific information is important for effective ecosystem management, but is only one element in the decision-making process that is fundamentally one of public or private choice.(Lackey, Robert T.1998)

Another article summarizes the principles and objectives of EBFM from the UN Convention on the Law of the Sea, the UN Convention on the Environment and Development and the Convention on Biological Diversity as: *manage marine living resources sustainable for human nutritional, economic and social goals; protect and conserve the marine environment; protect rare or fragile ecosystems, habitats and species; use preventative, precautionary and anticipatory planning and management implementation；protect and maintain the relationships and dependencies among species; conserve genetic, species and ecosystem biodiversity.* (Sainsbury et al. 2000)

As the research on ecosystem-based fishery management is continuing improving. The next step is how to implement this theory into practice.

3.3 Implementation of EBFM theory

According to the global fisheries resources declining in the world, many scientists and researchers are trying to solve the situation in another way. Many research methods of EBFM has been implementing for years. One of the most important implementation of EBFM is appeared in USA, some researchers chose three main elements to figure out the appropriate management measures for ecosystem-based fishery, these are Principles, Goals and Polices. (EPAP, 1996)

Principles

* *The ability to predict ecosystem behavior is limited.*

* *Ecosystems have real thresholds and limits which, when exceeded, can effect major system restructuring.*

* *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.*

Goals

* *Maintain ecosystem health and sustainability.*

Policies

* *Change the burden of proof.*
* *Apply the precautionary approach.*
* *Purchase "insurance" against unforeseen, adverse ecosystem impacts.*
* *Learn from management experiences.*
* *Make local incentives compatible with global goals.*
* *Promote participation, fairness and equity in policy and management.*

Besides, a number of measures can be regarded as addressing ecosystem considerations in the management of marine. The ecosystem issues addressed in the present management regime are interactions between species (i.e. through the use of multi species stock assessment procedures); fisheries effects on the supply of food for predators (ICES, 2001, 2003a) seabirds (ICES, 1999); and the additional fishing mortality of non-target species (e.g. pincers to prevent cetaceans entering set nets (EC, 2004b). There has been less progress in providing protection of habitat areas and the ecological functions they deliver, or in conserving genetic diversity. (Chris L .J. Frid etc, 2006) It is also recognized that the influence of the ecosystem on fisheries is not well addressed by current management procedures; for example, there is no mechanism for accounting the variations in climatic factors and hydrograph.(ICES, 2005).

There is an apparent argument when considering ecosystem approaches to fisheries management. The argument has polarized at two extremes: either one can approach management from the perspective of the entire ecosystem, or from a single species approach that is cognizant of broader ecosystem considerations. (Jason S. Link, 2004) Several scientists and researchers still have many differences on the debate of the study angle.

In May 2004, the Norwegian Parliament implemented a new policy (Norwegian Ministry of Fisheries and Coastal Affairs 2004a) on managing human interactions with marine mammals within waters over which Norway has jurisdiction. This is clearly linked to EBFM: “forms part of Norway’s efforts to implement the ecosystem approach to the management of its marine resources” (Norwegian Ministry of Fisheries and Coastal Affairs 2004b). Furthermore, the white paper detailing the measures states that “ecosystem based management shall use resource-ecological arguments as the basis for establishing objectives for determining the size of marine mammal populations, and it is necessary to work out reference limits for biologically secure frameworks and precautionary levels” (Norwegian Ministry of Fisheries and Coastal Affairs, 2004a). Norwegian research assessing the ecological relationships between marine mammals and fisheries relies heavily on model-based inference but These models are far simpler in construction than other approaches that seek to understand the influence of fisheries on marine ecosystems (Bascompte et al. 2005; Frank et al. 2005), yet they are far more precise in their purported predictive ability.

3.4 Disputes on ecosystem-based fishery management

The same as any new theory, ecosystem based fishery management is full of controversies since it first appeared. As The theory of ecosystem based fishery management first implemented in 90^{th} of 20 century. Many scientists and researchers expressed their own explanation on this term and most of them has only one agreement that is the objective of this management is to maintain ecosystem health and sustainability. (EPAP;NMFS 1999)

Some other scholars have proposed a three-step approach to implementing EBFM that consists of goals, metrics, and management.(Jon Brodziak et al, 2002). Societal goals typically include maintaining extractive uses, such as food supply, revenues, employment, recreational fishing opportunities, and traditional lifestyles. Non extractive goals also be considered. Metrics, alternatively referred to as performance measures or reference points, are used to indicate the status of system

attributes.(Gislason et al., 2000) Reliable and effective management is probably the most difficult step in EBFM, partly because of the nature of fishery-management institutions and the lack of a management- oriented paradigm (de la Mare, 1998).

Based on the uncountable different conditions, there are various disputes on EBFM, some researchers even create a similar theory as ecosystem-based approach management which emphasized the difficulty in ecosystem research. For example: The North Pacific Fishery Management Council (Witherell et al. 2000)

An ecosystem-based approach to fisheries management is defined as the regulation of human activity towards maintaining long-term system sustainability (within the range of natural variability as we understand it) of the North Pacific covering the Gulf of Alaska ,the Eastern and Western Bering Sea, and the Aleutian Islands region.

The Scientific Consensus Statement on Marine Ecosystem-Based Management (McLeod et al. 2005)

Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive, and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers cumulative impacts of different sectors.

The National Research Council (NRC 1999)

Ecosystem-based management is an approach that takes major ecosystem components and services — both structural and functional —into account in managing fisheries. It values habitat, embraces a multispecies perspective, and is committed to understanding ecosystem processes. Its goal is to achieve sustainability by appropriate fishery management.

National Oceanic and Atmospheric Administration (Murawski and Matlock 2006)

An ecosystem approach to management (EAM) is one that provides a comprehensive framework for living resource decision-making. In contrast to

individual species or single-issue management, EAM considers a wider range of relevant ecological, environmental, and human factors bearing on societal choices regarding resource use.

Someone emphasize several other important factors(Richard J. et al 2007) The following seven elements are specific to EBFM and are distinct from those considered routinely in single-species approaches to fisheries management. (1) Ensure that broader societal goals are taken into account. (2) Employ spatial representation. (3) Recognize the importance of climatic–oceanic conditions. (4) Emphasize food web interactions and pursue ecosystem modeling and research. (5) Incorporate improved habitat information (target and non target species). (6) Expand monitoring. (7) Acknowledge and respond to higher levels of uncertainty.

According to the researches and articles we mentioned before, most of the process of implementing the ecosystem-based fishery management is in marine area, because of the different culture and history, the freshwater fishery industry is so important in China, but there is nearly non research of EBFM in Chinese freshwater area. The author is planning to conclude some own opinions about EBFM in Chinese fresh water fishery especially in Yangtze River Delta. And also based on Chinese political and environmental situation, EBFM will be a key measure for Chinese freshwater fishery recovery.

3.5 Theoretical Framework of Yangtze River EBFM

As we mentioned before, there has been figured out many research approaches to management issues, but most of them are considering marine fisheries and there are much less formal studies on inland freshwater areas as the case of Yangtze River. It means that, now we have a good opportunity to investigate a better management theory of Yangtze river, which is based on EBFM theory.

On the basis of observations and theoretical studies it is possible to get an overview of the current ecosystem situation of the river. Based on the investigation of the main problems of Yangtze River ecosystem to build an analysis model. The next

step is to identify the objectives related to the utilization of the Yangtze River ecosystem. Finally the knowledge and the objectives is expressed in a ecosystem-based approach to fisheries management in the Yangtze River delta, also taking into consideration the economy of harvest and output markets. In my opinion, the ecosystem-based management of fishery in Yangtze River Delta can implement this theory into a new face, the ecosystem-based management of fishery which is particularly focused on human-oriented objectives.

The ecosystem-based management principles will be applied in a case study of Jiangxin island ,which is located in the middle of Yangtze River belongs to Nanjing city, where some management measures will be discussed. These are not only measures of fishing for food but also several other measures for increased conditions both with respect to environment and economy.

Jiangxin island of Nanjing city has specific significance in fisheries and agriculture, as well as being a famous tourism spot for the latest 15 years. People of this island also are interested in ecosystem based management because of it is considered having a more ecological way compare to the way people lives in Nanjing city. Based on the geography and historical conditions of this island, the ecosystem based fisheries management will be applied on many measures and policies.

In the next part, we will study on the case of Yangtze River Delta and Jiangxin island to identify a better fishery management theory, which focus on ecosystem based.

4. Case Study on Yangtze River

4.1 Reason for Yangtze River fishery resources decline

Consider the current situation of Yangtze River fishery resources, we should get a close view of the river. As we have presented the basic ecological condition and biological situation before. Here we focus on how the ecological disaster arise and what is the main problem in Yangtze River. The decline of fishery resources is caused by many facts, and the population of catch in Yangtze river dropped sharply after 1980s, which is the same time when Chinese economic started to accelerate the speed of development. Based on many formal research and data, the author concluded several main reasons for resources decline in Yangtze River. And most of the reasons are closely related to human behavior. The serious situation lasts for nearly the latest 30 years. There are several reasons, which includes as follows:

4.1.1 Hydraulic construction

Because of the fast economy development, highly demand in electronic power and base installation also appeared. Water sluices and dams that cut off the migration channels of Fish and crabs, destroyed fish, crab migration law. Directly effect to the normal activities such as growth, reproduction, feeding and the amount of fish added. At present, the Yangtze River has more than 50 over 66.7 square Km lakes is artificial blocked from Yangtze River, causing fisheries fishing output was only 25% before the construction of the sluice, and the catch products become smaller, the migratory fish catch amount declines from 50% to 10%.(Chen Daqing, etc. 2000)

Rapid economic development of Yangtze River, wading construction development has reached an unprecedented level. Hydraulic construction on the Yangtze River now include: hydropower construction, channel dredging, port construction, shipping, bridges, cofferdam, dam, tree planting and so on. (Dudgeon.D, 2000) The development and construction in the creation of huge economic benefits,

but also had a significant negative ecological effects, resulting in aquatic habitat are seriously encroached upon migratory route is cut off, spawning grounds were flooded or destroyed, the consequences of living aquatic resources decline rate accelerated degradation of germless, genetic mutation, sharp drop in total resources. Such damage is often devastating and irreversible, leading to aquatic species can not adapt to the environment becoming more and more a result of destruction, the Yangtze River will gradually lose biodiversity. (Shi Huigang, 2009)

As we mentioned before, several kinds of special fish of Yangtze is migrate fish. According to the Gezhou Dam started function in 1980s, the biomass of Chinese sturgeon dropped rapid from that time. And after the world famous Three gorges dams completely effective in 2003, the fries of The four major family fish , decreased 90% in 2004-2006.(Chen Daqing, 2003)

4.1.2 Water pollution of Yangtze River

Industrial and mining enterprises and cities along the Yangtze River discharge of industrial wastewater and domestic sewage, according to incomplete statistics, up to more than 142 million tons, accounting for more than 42% wastewater in whole China in 2002, exceeded 90 percent of which was untreated, and the drinking water of more than 500 cities threatened. (Sichuan Daily, 2004)Water pollution not only affects fish migration, leading to a large number of fish killed and the direct impact of river fish resources, but also harm plankton, benthos and other fish food organisms, destruction of fish food chain, indirectly affect fish resources of rivers, natural resources leading to reduced fish.

According to one government report shows the total water resources in the Yangtze River flat with year-round; total amount of sewage discharge in 2005 is 296.4 million tones, compared with the previous year 230 million tons, an increase of 2.9%。In Tai Lake, West Lake, Boyang Lake and other lakes in the monitoring of 11, only the overall water quality of Erhai lake, and reached Class III Class III or better than that, there are some other lakes water situation worse than Grade III.(Anonymous,

2000) A large number of sewage discharge, resulting in aquatic habitat destruction, decreased primary productivity, reduce total biomass, biodiversity Losing. Pollution incident not only damaged the ecological environment of water, to the fishery caused direct economic losses, but also affect human safety of drinking water. Some experts warn that, "Now do not lose control pollution in the Yangtze River, Yangtze River within 10 years to the brink of ecological collapse."

4.1.3 Illegal sand-digging

Yangtze river sand mining has a long history, but the mechanical excavation began in the late 20th century, the large-scale exploitation of the late evolving trend start by 80th. In the 90th with the Yangtze River Economic Belt developed rapidly increasing demand for construction sand and gravel, the sand prices rise, driven by economic interests, all kinds of sand boats swarmed around the middle and lower stream of Yangtze River, the formation of excessive and indiscriminate dig chaos. Although limiting the Yangtze River sand mining system, steal digging rate is still very high.

In recent years, due to restrictions on the sand-digging in Yangtze River, a large number of dredge ran to the tributaries and lakes. Dredge in some large tributaries and two lakes (Poyang Lake, Dongting Lake) in the intensified. Dredge on the water environment is also a great and lasting damage, and it directly damage the habitat of fish to survive and multiply, affecting fish spawning, feeding, fattening, reduced to lakes' fish, the variety tends to uniformity. (Shi Xiaoping, 1998)At the same time many of the traditional capture fisheries have been eroded due to sand mining and to a large number of professional fishermen face the loss of fishing sites production and survival crisis, affecting the social stability of the fishery.

4.2 Formal management measures of Yangtze River

What is the formal management measures of Yangtze River? It is an important question for us to learn from. The main management measures of Yangtze River

fishery is the whole basin and all species fishing ban system. Ministry of Agriculture of China introduced a period of three month fishing ban period system in the Yangtze River from 2002, in the fishing ban period, except knives and anchovy coilia fishing license operations, the prohibition of all other fishing practices is illegal , so that aquatic resources can have a respite. The fishing ban period started from February to April at the upstream and started from April to June at the downstream. This measure played a certain role on the trend of resources in mitigation. Continue to improve and consolidate, and as a means to continuously promote the various resources and environmental remediation measures are implemented. Strengthen the effort in crack down illegal fishing practices, reduce the damage the aquatic biological resources.

Strengthen the nature reserves and protected areas, construction of spawning grounds, effectively protect the aquatic habitat At present, the Yangtze River basin, Chinese fisheries management has established nine national and provincial nature reserves, more than 30 municipal and county nature reserves, protected species include dolphin, white sturgeon, Chinese sturgeon, giant salamander and other aquatic wildlife that some species unique in the Yangtze River.

Chinese government try to fully launched propaganda, for all social members to fully realize the importance, urgency and necessity of Yangtze river of fishing ban. Fishery administrative departments at all levels and their subordinate fishery agencies along the river adopted various ways to extensive propaganda. First, by post fishing notices, publicity posters, sending leaflets, the wall newspaper and other forms of publicity; second, using television, radio, newspapers and other kind media to widely publicized; third is sent promotional vehicles, promotional publicity ship; through various activities such as the destruction of prohibited fishing gear and other public advocacy.(Shen Xueda et al, 2008)

Then, government and professional fishermen signed letters of responsibility. And improve the quality of fishery administration employees, Timely arrangement of public security, civil affairs and other departments for joint law enforcement. The establishment of a social monitoring mechanism. Some fishermen may employ coordinators and joint participation in management, telephone hotlines and other

measures. Try to solve the fishermen worry about. Governments at all levels take the people-oriented ideology, attaches great importance to work out the production and living difficulties of some fishermen during the fishing ban period , according to their actual situation to take into the social subsistence allowances. Give the lesson of other skill, and keep the living condition of the fishermen during the fishing ban.

Continue releasing the proliferation of artificial efforts to repair biological resources. Proliferation releasing activity is a biological group quickly added, effective measures to stabilize the number of species, its protection of aquatic life, the preservation of biological diversity has a very important role. Since the 2002 trial of the Yangtze River fishing system, the government have organized an annual large-scale proliferation of releasing activity, more than 1 trillion fries sent in to Yangtze River in 5-year cumulative time.

4.3 Management results of Chinese Government

As the management measures have been implemented for 10 years, why we hold the view that the formal management is unsuccessful?

First, Through extensive publicity and fishing practices by all levels Chinese government along the Yangtze riverside, all the measures has set up a idea of ecological environment and fishery resources protection. More important is that the necessity of protect the environment and fishery resources, has been further awareness and understanding by all the cities along Yangtze river sides. Resources and environment protection by rising for government behavior instead of industry behavior. Because of everyone of society concentrate focus on the protection along the river sides, make the implementation of fishing ban on the system with a solid social basis.

Secondly, the implementation of the closed seasons system, periodically reducing the intensity and make the protection of the fisheries resources effective. Management departments at all levels take effective measures to increase the investigation and punishment. Fisheries management has been troubled by outlawed electricity,

poison or explosives and other harmful fishing gear and methods for many years, during the fishing ban all these troubles were basically clear, fisheries resources have a respite opportunity.

Finally, by the implementation of management system and exploration our Yangtze river basin fishery resources, upgrade the formal local government and local institutions' management way into a whole basin national activity. To improve the overall effect of resource conservation and management of Yangtze river basin of fishery resources in China..

However, monitoring report also warning, fishery resources overall situation did not get better, part is not optimistic. The monitory fishery report announced by Yangtze River Fisheries Research Institute and Freshwater Fishery research center. It shows that in a 5 years fishing ban period, section of Yangtze River fisheries resources is stable, part of the section of the river during the fishing resources in getting better , fishing catches after the ban period increase in unit; a number of monitoring points where the section of the river, monitoring the catch of species is more stable; some of the section of the river has a higher biological diversity. But the monitoring report also warned that fishery resources have not been fundamentally improved in the overall situation, some section of the river is still not optimistic.

To look at the report of Yangtze River estuary fishery resources. From the fishing ban test has started in 2002 and formally ran in 2003, until 2006. The fishing yield of Anchovy, Chirocentrus dorab, Eriocher sinensis, White shrimp and eel fries resources at the estuary area of Yangtze river is not improved obviously, only the production of crab fries is a little better than before. See the table behind (Shanghai Fishery Office, 2007)

Table 4.1 :Shanghai Yangtze estuary fishing yield changes after fishing ban implementation

Yangtze river fishing yield(tones)				
year	Anchovy	Chirocentrus dorab	Eriocher sinensis	White shrimp
1999	1219.52	191	0	158
2000	509.72	165	6	228
2001	551.16	694	2	158
2002	799	137	2	164
2003	656	27	1	109
2004	493	36	0	105
2005	320	72	3	93
2006	183	54	6	111

Natural fries fishing yield(Kg)		
year	Eel fries	Crab fries
1999	2145	12780
2000	3768	6008
2001	3848	48
2002	1483	46
2003	4425	15
2004	5059	12536
2005	1688	471
2006	2981	3950

4.4 Reasons for management failure in Yangtze river

According to the fishery management measures implemented by Chinese

government. The main measure of fishery management recently is the fishing ban system. But this measures has several shortage, the same as fishing ban system in the sea, this measure can only protect fisheries resources in a short period acts as a "culture of Parent" role, not a fundamental solution to resource protection, it is a temporary solution of the ecosystem. Basically, the fishing ban system still does not solve the problem of competitive fishing and over fishing. Once the end of fishing ban period, the fishermen will demand compensate for losses due to stop fishing, directly lead to even more effort than before the fishing ban, the fishing ban result often shortly exhausted after the fishing ban period.

Second, the system is designed and enforcement by the management institutions and government authorities. Although some areas chose give certain subsidies to the fishermen during the fishing ban, in some places, put the fishermen into the range of subsistence allowances. But in the process of system design and implementation, the fishermen's voice has not been fully reflected, and thus did not fully meet the fishermen’s constraint of participation and incentive system. These constraints are not met, means that fishermen always present incentives for illegal fishing. Also according to the government enforcement efforts are limited, violation incentives will turn fishermen into illegal action for the profit. In the reality practice, such violations are often passed between fishermen and government authorities to carry out "guerrilla" warfare in the form shown. Some investigations found that fishermen may be carried out together to deal with government authorities. For example, they will join together to send one or two people patrol near the fishery monitor station, once the government fishery patrol ship amid out of the station. They immediately contact the relevant personnel who is doing illegal fishing activities and announced them leave in time. Also the fishermen chose to fishing during night and avoid government supervision.

At last, related supporting system is imperfect. A river management supporting measures are not complete. The purpose of Yangtze River fishery management is to protect the fishery resources and breeds. The stream of Yangtze river is public resources, which contains the utility of transportation, and dumping wastewater by the

industries and residents along the river side. The size of the effect of Yangtze River fishery management with not only the fishery resources management policy, but also depends on the environment protection system and industrial policies. And this corporation between different facts of the society is most shortage of formal fishery management in Yangtze river.

Further more, the welfare safeguard measures for fishermen are insufficient, we should know that the protection of Yangtze River fishery resources is not only benefit the fishermen but also benefit the general public. The limit compensation is far from sufficient. The formal management is not only damage the fish stock but also effect the fisherman's living level. In the last 20 years, the fisherman's living condition in Yangtze River Delta is becoming the worst according to the regional economic booming. According to newspaper report, the average income of Yangtze River Delta fisherman per year is only less than 1200 USD and compare to the average income of this area is over 5000 USD per year. Due to generally low personal and professional qualities of fishermen, has no corresponding professional skills, also fishermen has few cultivated area. Therefore, when fishing ban came, the fishermen wanted to work outside but because of no other skills, they only have to stay in the village to renovation equipment, or doesn't obey the request of stop fishing but against crime. This kind of circumstance in until after more serious consequences, the fishermen chose the use of banned measures such as the electric and poison means in order to survive.

From many data and researches, we can find out that the government management of Yangtze River is unsuccessful. The formal management measures are not efficiency and not only cost huge amount of funds but also make a worse situation in Yangtze River ecosystem .How to repair the environment of Yangtze River and want kind of management is more effective than before ,may be the next part will show us the answer.

4.5 Ecosystem-based fishery management in Yangtze River

As we have known the facts above, Yangtze River Ecosystem needs to be fixed as soon as possible. We chose to analyze the situation in Yangtze River by a method, which determine the Principles, Goals and Policies of ecosystem fishery management in Yangtze River. Based on the lessons from formal management failure in Yangtze River. We try to figure out the main principles in Yangtze River.

Table 4.2 Analysis the human activity effect on fisheries *

Problems	Hydraulic construction	Water pollution	Illegal sand-digging
Effect on Fishery stock	- -	- -	- -
Measures	Fishing ban	Proliferation releasing	Protected areas
Effect on Fishery stock	+	+	+

*Note: The explanation is in following text

As we investigated before, the table above has showed the problems, which are the most serious effected Yangtze River fisheries resources. And the measures that government has implemented is also on the table.

From this table we can easily consider that the fishing activities are not most problems in Yangtze River fishery, many other facts such as hydraulic construction water pollution are the real problems in the ecosystem of Yangtze River. How according to the table human activity has both negative and positive effect on the fishery system. In the Gorden-schaefer model, we can implemented as this equation. As F(X) is natural growth equation , parameter r is the maximum relative growth rate, also called the intrinsic growth rate, and K is the carrying capacity.

$$F(X) = r X (1-X / K) \quad \text{----------Equation 1}$$

$$MSY = rK/4 \quad \text{----------Equation 2}$$

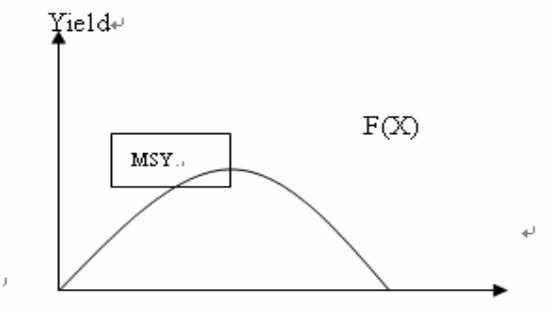


Figure 4.1

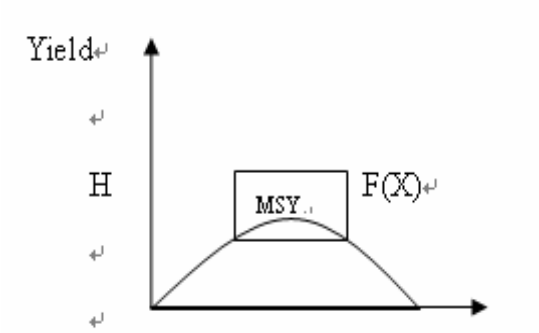


Figure 4.2

According to Equation 1, F(x) is the curve of natural growth, which always consider as the harvest target. as human activity implemented negative effect on the ecosystem such as hydraulic construction , the intrinsic growth rate will decrease which make a change on the figure and also the carrying capacity will decrease the figure will change from Figure 4.1 to Figure 4.2 and in this situation the maximum yield of this species will be decrease sharply.

In the table above, we assume that the decrease of intrinsic growth rat as one "-" and the decrease of the carrying capacity as another "-". And the positive effect on intrinsic growth and carrying capacity we chose "+" to indicate.

If the human behavior act as seedling discharge, the instincts rate will increase and the figure will change to another situation, which indicate an increase in maximum yield. As follows:

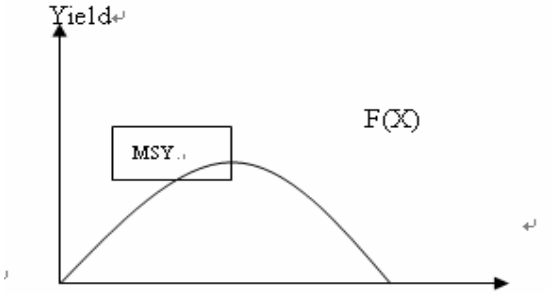


Figure 4.1

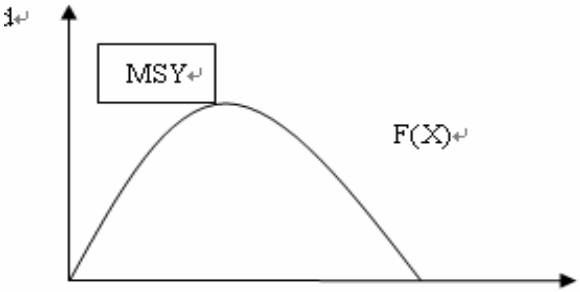


Figure 4.3

As analysis results showed in that table. The table means that although the measures has implemented for a few years, but if we don't deal with the main problems in Yangtze River, the ecosystem disaster won't become better.

However, not only the human activities can effect the growth function of fisheries. The same as others. In the food web system, any activities implemented on one kind of fish, the others will be effected as well, which means they may have the relationship of competitive or the relationship between prey and predator.

We built this graph to present the principles of Yangtze River ecosystem-based fishery management.

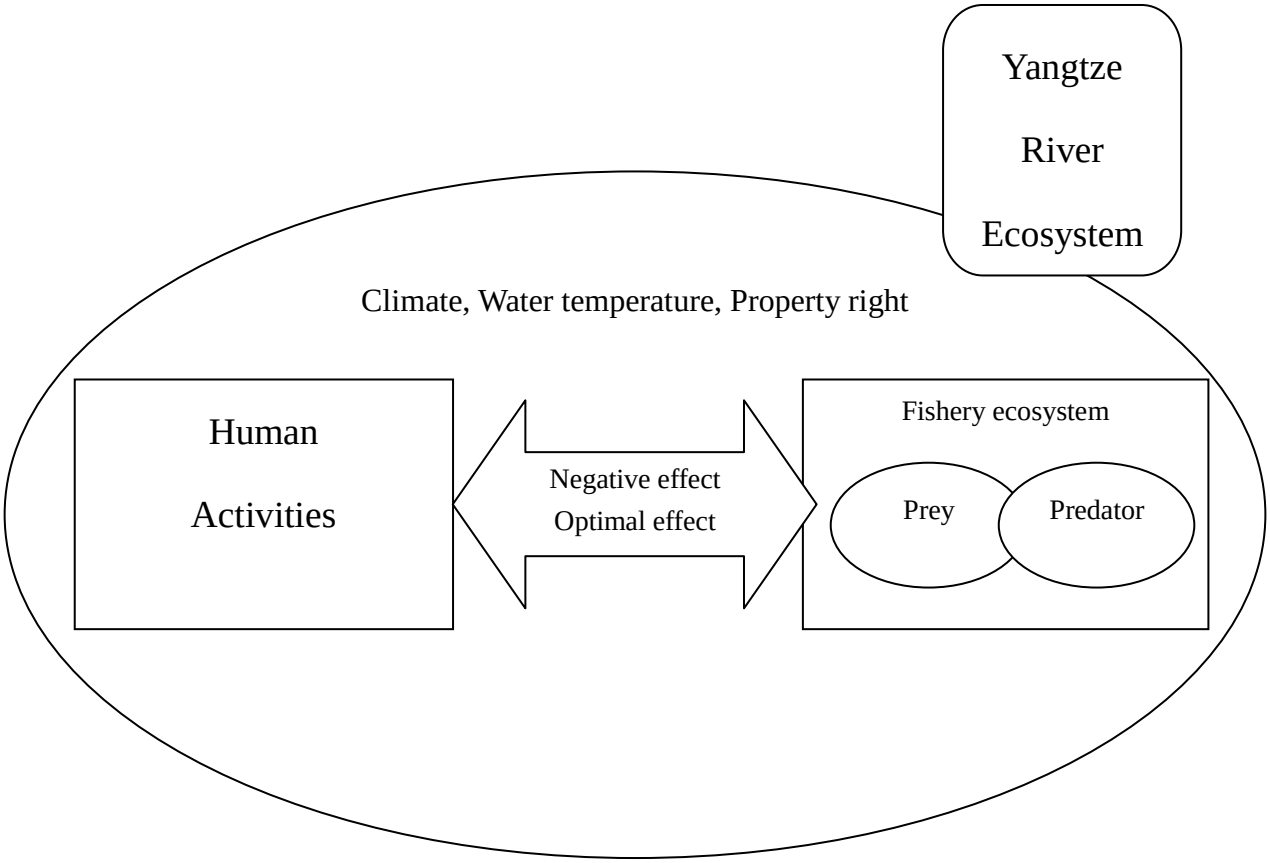


Figure 4.4 Principles of Yangtze River Ecosystem

It is clear in the figure that the human activity is one of the main principle of Yangtze River ecosystem based fishery management. In research of Yangtze River EBFM , we will focus on human-oriented field. According to this situation and based on the formal research of foreign experts we will figure out the goals and policies associated with principles of human-oriented ecosystem-based fishery management in Yangtze River.

4.5.1 General principles of human oriented EBFM

According to many reports and discussions about ecosystem based fishery management, all mentioned about many principles or metrics of it, and most of them has many premise and assumptions to deal with the whole ecosystem. As in a large ecosystem, there are always more components have to be measured, that make the results more uncertainty.

In the condition of Yangtze River fishery ecosystem nowadays, the fishery situation dropped seriously until the government implemented several kind of management measures. As we mentioned before, the fishery biomass of Yangtze River still kept at a low level and even getting worse. It means not only the measures of management has a failure in activity but also the whole ecosystem has changed almost permanently. We can think that as the fishery ecosystem now can't increase the fisheries production in a short time, we may need try to make extra effort on other components of the ecosystem.

The EBFM of Yangtze River has many same principles as marine EBFM, such as *The ability to predict ecosystem behavior is limited*, *Ecosystems change with time* (EPAP, 1996)and so on .But, it has several difference between marine ecosystem, in marine systems it contains multiple species of predators and it nearly impossible to measures the relationship between all the species in the system. And also according to the better ecosystem condition, the multi species nature of some fisheries and by-catch issues further complicates the situation for fishery managers. Compare to the situation of Yangtze River, as the catch amount and biomass of all the commercial species continue decreasing, it means that the ecosystem balance of this river is totally changed and based on the formal investigation, the main reason for this disaster is human activity. The formal predators like Chinese sturgeon, Chinese reeves shad and *Leiocassis longirostris*, all these species are important predators in Yangtze River, but because of the over fishing and other situations, these predators are endanger, and human became the biggest predator in the river system.

4.5.2 Human activity effect Yangtze River Ecosystem as main principle

Human-oriented is that consider human activity as the main strength effect the ecosystem. Most of human activities are implemented by three components, including fishery managers, fishermen and fishermen community, the people who related to the river. Make sure all parts of the human system runs a stable way is a basic for all management. In this context, human activities are the only system attributes that are directly controllable.(Jon Brodziak et al, 2002） In Yangtze river fishery, the most important management practice agency is the Administration of Fishery and Fishing Harbor Supervision of China, which has branches in every important cities along the river, but the work attitude of the agency is not serious and the staffs are shortage about knowledge of ecosystem in Yangtze River.

And in the whole Yangtze River basin there are over 50000 professional fisherman and 200000 part-time fishermen, and in the Yangtze River delta basin the number is about half of the whole amount.(Chen Daqing, 2003) And in Yangtze River Delta basin, the fishery community is hardly exist, most of the fishermen is fishing alone with own family, also there are no fishery companies in the downstream of Yangtze River ,most of the fishing activity is ran by small scale fisherman , which used small wood boats and outdated fishing gears.

All the people who live along the river are also an important part in human-oriented EBFM . Because of their daily lives are related to Yangtze River. And most of the fisheries production will provide for their living. Most people still don’t have clear mind in ecosystem protection.

4.5.3 Principles of property situation and open area

However, we still need to consider other principles of Yangtze River fishery. In every ecosystem of the world, there are several facts are the same. The ecosystem is open for everyone who want to participate, the same as the ecosystem of Yangtze River. Everyone live along the river side can effect the ecosystem, as the state system of China is people republic, so the property of Yangtze river is belongs to all the

people of China. According to the property confusions in the whole basin that make the property situation of Yangtze River Delta faced many difficulties, the rights and obligations are not quite clear. The fisheries resources are under a unprofitable management condition. The public tragedy is quite clear in Yangtze River ecosystem.(Steven Ng-Sheong Cheung, 1998)

4.5.4 Other principles

The temperature and climate changes also can effects the ecosystem of Yangtze River, but because of the shortage of research data, we can't give a good explanations about the relationship between the ecosystem change of Yangtze River. However this wasn't a big reason of the fisheries situation. The same as the food web research situation in Yangtze river delta basin, still unclear at present.

We have proved that human-activities as the main principle of Yangtze River ecosystem, which is more easier for research. May be the result won't be the most accurate but we can make it more effective and available. The most important step of EBFM in Yangtze River Delta is the measures of policies and all the policies should fit the goals and principles of EBFM.

4.6 Goals of Yangtze river human-oriented EBFM

Nowadays, goals of society have emphasized humans getting the benefits from use of ecosystem components. As management of fishery has several benefits like income , employment, or maintenance of traditional lifestyles. From an ecosystem area research, these goals need to be broadened to include concepts of health and sustainability (Lubchenco et al. 1991, National Research Council 1999). Ecosystem health is the capability of an ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of the natural habitat of the region. (Sparks, 2005) This theory is also referred to as biotic integrity, which is defined as a system's wholeness, including the presence of all appropriate elements and occurrence of all

processes at appropriate rates (Angermeier and Karr 1994, Angermeier 1997).

How should we deal with the ecosystems, while maintaining their health and the array of non-use services that they also provide (Costanza et al. 1997) in the unpredictable future? The challenge for scientists and managers is to develop useful and effective measures of ecosystem that can guide the management of government and the behavior of participants. For example, how a “healthy” ecosystem sustain in fishery? How can vigor and resilience be expressed quantitatively so that managers can maintain them within healthy limits? (EPAP,1996) These questions are hard to answer in the foreseeable future, but as the increase implementation of ecosystem-based fisheries management will begin to identify ecosystem variables which are unacceptable. These could be used to guide management away from unhealthy ecosystem states.

The goal of human oriented EBFM is based on not only the fishery recovery and sustainable development but also need to have positive effect on all the participants in Yangtze River fishery. The participants of Yangtze River including government fishery manager, fisherman and the people who live along the river. It means that the ecosystem based management in Yangtze River Delta should consider about all these facts above and make sure the management measures can be implemented smoothly.

4.7 Policies of human-oriented EBFM in Yangtze River Delta

Ecosystem principles to achieve societal goals must be implemented through ecosystem-based management policies.(EPAP,1996). And based on the specific principles of Yangtze River Delta fishery, the policies must fit it mainly from human-oriented. Also we have to think from the whole ecosystem, including human activity, water living creatures and other facts. EBFM is neither inconsistent with nor a replacement for current fisheries management. It should be adopted as an incremental extension of current fisheries management approaches.(Richard J. et. al 2007) The main task of EBFM in Yangtze River Delta is to find ways to deal with the decreasing ecosystem condition and as more as possible to avoid uncertainty. Rather,

the uncertainty should be taken as a mandate to improve current understanding. The policies implement in this article is based on easy to be implemented and make it can be accepted by most of the participants, because of whatever how wonderful the policy is, if it can't pleased everyone in the ecosystem it still can't be successful.

In the EBFM of the world, the fist step always should be the research of density and diversity(EPAP,1996) to determine the ecosystem condition of the area. And this kind of research need to be ran by the management agencies and the research institutions, which always entanglements in capital and property, also the research result wasn't always accurate. However, based on the Yangtze river delta situation, we can clearly figure out that the ecosystem of Yangtze River ecosystem has been damaged. And the current situation of fishery resources is really serious so we can skip the prove step and move to the measures level.

4.7.1 Integrate EBFM system in Yangtze River Delta

In the ecosystem of Yangtze River Delta, the main metrics are that we have mentioned before, such as directly fishing activity, fishery management measures, other activity rely on Yangtze River. In addition to over-fishing, the waters of serious pollution and water conservancy construction has a serious destabilizing effect on fishery resources too. Based on this situation when we talk about management of Yangtze River delta, the formal single species management won't be enough.

In the future, we hope the first step of EBFM in Yangtze River Delta is build a integrate management system which contains multiple government agencies including the environmental protection department, fishery administrative department, water electric power sector, social security department, public transportation department and so on. Make the leadership relationship clear and effective, change the formal area management system which the agencies only focus on management several independent area and the number of production.

To establish a joint conservation system of biological resources in the Yangtze River between departments and the regional cooperation mechanism. Yangtze River is

a river across huge region, throughout the ten provinces and cities along the Yangtze River, more than 400 cities, involving multiple departments, to protect biological resources of the Yangtze River must establish an effective regional cooperation mechanisms. In the process of management, we should properly handle the relationship between biological resources ,ecological environmental protection and economic development.

Implementing the conservation work of biological resources, both subordinated and serve to the national economic construction and development of the overall situation, also through economic and social development to enhance the conservation of biological resources capacity. We should actively carry out advocacy and eco-environmental construction of the promotion work, by strengthening the early warning mechanism for water environment monitoring service to promote energy conservation and emission reduction, by strengthening the basic works such as scientific research and investigation services and by strengthening the scientific research work in such fundamental construction and ecological environment impact assessment and argumentation, through reasonably determine the water ecological function gold waterway construction and service. Yangtze river fishery resources management work for construction and environment can play an important role in build environment friendly society.

Yangtze River ecology and conservation of biological resources is a systematic project, the government in the protection of public resources take the leading role with support from relevant departments is the key to conservation of biological resources. We must focus on people's government that set along the river, among the various departments perform their duties, communicate with each other and closely cooperate with the conservation of biological resources management mechanism for promoting the work of the Yangtze River to lay a nice biological conservation organizations to protect. In 1987 Chinese government set up the agency, which has played an active role 20 years in the protection of fisheries and living resources of the Yangtze River, but with the current changes in the situation compared to the needs and management, the management committee was out date and not fully used. Considering its

appropriate adjustments to improve its working mechanisms and functions to meet with various departments and localities entering into regular communication and cooperation to strengthen the work needs to enable it play a greater role.

In the later management process, the Yangtze River Fishery Resources Management Committee need to be imply into a comprehensive management system, which make the committee has actual superior and enforcement ability. Work together with other departments associated to Yangtze river to build the public support pattern of participation in ecological protection and biological conservation of the Yangtze River. Central government and all levels of local government should continue to increase financial input in support of the Yangtze River resource protection. At the same time, we should actively explore the establishment of several other invest ways, such as corporate funding, individual donations, international aid and other diversified investment mechanism for the conservation of biological resources in the Yangtze River to provide funding. To establish a comprehensive and effective system to implement appropriate use of biological resources, improve the resources and ecological compensation system to acquire sustainable development and rational use of eco-protection mechanism. At last to form the good pattern that contains government-led, corporate abbey the law, all public participation, international support for the protection of the Yangtze River ecological environment and biological resources.

4.7.2 Build fishery protection area and continue proliferation releasing

Build the system of protected areas is an effective measure to protect fishery resources. It not only can improve the range of fishery resources and size, type and quantity, but also, can improve biodiversity. Targeted through the legal procedures to establish a reasonable aquatic nature reserves, aquatic resources protection areas or closed areas to effectively deal with the relationship between protection and fisheries activities. Play an important role in fisheries management of ecological environment. Fishery resources through the establishment of protected areas means that after few

years of protection, fishery resources will increase in the quantity and quality.

The protect area must including most part of the Yangtze River, and under the administration of Yangtze River Fishery Resources Management Committee. In the protect area all unauthorized fishing activity must be stopped. The same as MPA(Marine Protected Area), which is widely used fishery management measure in the world. This kind of research has implemented for a long time and the result is full enough. Here we don't need to talk too much about it, but only present the benefit contains of protected area. It will improve broadly the health of the ecosystem within the boundaries including increases in stock abundance, age/size composition, spawning stock biomass, yield per recruit, and restoration of healthy trophic levels. It will provide in situ conservation of marine biodiversity, provide 'undisturbed' areas for scientific research and provide opportunities for increased no consumptive use values. Also implement the Yangtze River Protected Area has several other benefits, such as increase the price of aquaculture fishery products, promote fisherman transform into other field, accelerate the industrial structure adjustment in fishery.

Continue the proliferation releasing operation, which we implemented in the last 15 years. According to the present ecological situation of Yangtze River fishery resources, given the proliferation of releasing, the priority should be consider ecological protection, and natural increase, the specific principles of quality and so on. According to ecological requirements of different species, discussion and analysis. Based on current Yangtze proliferation of releasing the results, when we planning to develop that standardized discharge program, we should consider the food chain characteristics of releasing object, ecological thresholds and their ecological stability. Make a clear view that create different standard scheme of proliferation releasing in Yangtze River Delta basin. In the following management process, make unified long-term proliferation releasing plan, which fund by local government and local community. And based on the supervisors from professional academy institutions to make the releasing program has an orderly scientific development

4.7.3 Put full strength on human-oriented EBFM in Yangtze river delta

As we mentioned before, in the Yangtze River ecosystem, the main principle is human-activity, all the behavior of human beings directly lead to the catastrophic consequences of Yangtze River at present. According to the formal research the main metrics of human activities maintains fishermen and fishery community, other people who related to Yangtze river, and the managers of fishery management system. So in the future management process, we need to consider all these facts together.

Human-resource is the most important subjective factor and most initiative power, therefore, how to mobilize and carry out the subjective initiative in fishing activities and fishery resources protection is related to guarantee achieve optimal benefit in Yangtze river fishery. Fisherman and fishery community is workers in fishery industries, in the process of EBFM in Yangtze River fishery, apparently the most effected parts are these people who has low education level, no other skill and treat fishing as only way for living.

Deal with the fishermen and fishery community in Yangtze River Delta, the most important thing is not only reduce the fishing effort, ease the ecosystem stress but also have to make the living level of fisherman stable and improve. In the Yangtze River Delta area, because of the history and culture situation the living level of fishermen is highly lower than other people even lower than the people who has qualified to use the land. So according to this condition, if the fishery protection area widely implement in Yangtze river, the first damage will charge on the fishermen and fishermen community along the river. Based on these, we have to promoting job transfer field, guide fishermen to aquaculture and processing circulation, recreational fishing and transfer to other industrial, gradually reduce the fishing intensity; continue to push forward ecological aquaculture and culture of technological innovation, the implementation of pollution-free culture standardization efforts to create modern double-harvest economic and ecological benefits of fisheries development model.

Build the legal system of equal property rights is also an important way. Comply with the provisions of protection of fishing rights is a realistic need for fishermen to

move, with many of the great significance of the previously mentioned, it does not mean "Property Law" after the fishing rights will automatically be protected. Rights awareness and protection of the rights set the sound system needs a process. Therefore, governments at all levels should change their concepts, to adapt the operation of public power and to promote the protection of private rights. It should also be widely publicized the "Property Law", allow fishermen to understand the "Property Law." Fishermen should also enhance the sense of self-protection, safeguard their own legal rights

Enhanced the knowledge of aquatic products publicity and popularity, increase consumer awareness of the fishery products and enhance consumer awareness of environmental protection, to ensure the quality and aquatic origin, clear the location of aquatic origin from. Strengthen market supervision and administration, crack down illegal fishing, completely cut off private illegal fishing in Yangtze River Aquatic Product Market. And announce knowledge of Yangtze river ecological protection in the whole society, enhance people consciousness of environmental protection to prevent the pollution of Yangtze River.

Based on the high-speed development of the economic in this area, every level of local government should improve the social security system, make sure every fishermen has enough compensation for their loss, keep the measures of EBFM in Yangtze river stable, smooth and effective.

However one more important thing is that the managers and researchers in fishery or Yangtze River fishery is still not only insufficient in knowledge level but also shortage in quantity. Also the most stuff of Yangtze River Fishery Committee is not professional in fishery and related field, some them doesn’t have appropriate ability in fishery management. In the future, the government should increase the investment on the education of fishery management field, give preferential policies and measures for the academic research, also the university have to enhance the emphasis level on the research continue the international cooperation with foreign developed countries which is head before China in fishery management research. Make Chinese fishery management education level develop and teach more

professional researchers and students on this field, to improve the ecosystem management in Chinese fishery.

5. Case study on Jiangxin island

5.1 Introduction of Jiangxin island

Nanjing is also named as Nan king, in Chinese it means 'Southern capital'. This city located in the lower Yangtze River drainage basin and Yangtze River Delta economic zone, Nanjing has always been one of China's most important cities. It served as the capital of China during several historical periods and is listed as one of the Four Great Ancient Capitals of China. Nanjing was the capital of the Republic of China before the Chinese Civil War in 1949. It is also one of the fifteen sub-provincial cities in the People's Republic of China's administrative structure, enjoying jurisdictional and economic autonomy only slightly less than that of a province. Apart from having been the capital of China for six dynasties and of the Republic of China, Nanjing has also served as a national hub of education, research, transportation and tourism throughout history. It will also host the 2014 Summer Youth Olympics. (Anonymous, 2010f)

Jiangxin island is located in the middle of Yangtze River, at the western of Nanjing city. Total area is about 12 km2 and there are 12000 inhabitants. This island is famous in its agriculture based tourist and agriculture products such as grape and vegetable, also there are about 100 full-time fishermen most of them has no other skill. (Baidu, Jiangxin island) Jiangxin island is located at the southwest suburbs of Nanjing, away from the city center 6 km, the Yangtze River Delta formed this alluvial island. The entire island is long and narrow shape, most length 15 km, maximum width nearly 2 000 m, the whole territory micro tilting to the northeast from the north to south.

It is a beautiful green island considered as the name of Yangtze River emerald, the island became an important agriculture tourism spot for over 15 years. Every year the island held a grape festival, which is well known in Nanjing’s citizens. And people's living standard on the island has improved a lot in the last 20 years, but still has distance from Nanjing citizen’s average level at the same time. In the whole island

has only the 1st and 3rd industry, and there is no factories on it. The air quality and environment condition is quite suitable for living.

Figure 5.1 Point A is Jiangxin island [4]

I n recent years, more and more visitors come to Jiangxin island causes many negative effects such as environmental pollution, and serious gap between the rich and the poor residents. Although the environment of Jiangxin island is slightly effected but it still one of the best environmental quality area. The question of how to make rational use of resources and environmental advantages of the island, how to not take the old road of "treatment after pollution", how to not only efficient, sustainable, stable and coordinated development of the island's economy, but also protect the good ecological environment, maintain this small island socio-economic and ecological sustainable development had bring to Nanjing city's government.(Wan Xucai, 2007)

Now there is a wonderful opportunity for the development and the EBFM research on this island, that is Nanjing government and Singapore government has made an agreement on the cooperation of Jiangxin ecological and technological island project. According to reports, the "ecological science and technology island" project has 10 years construction period, the estimated total investment over 1.3 billion USD . The project will be "intelligent" as concept for the lead, make full use of Singapore's

[4] The map is come from Google Maps

science, technology and advanced experience in the construction of the ecological island. This island is going to be a industrial park with combine of scientific and technological research center, creative intelligence community and high-end international headquarters as a model of sustainable development community. At present, the project is actively preparing the plan, expected to be completed by the second quarter of 2010, the project will start a requisition, demolition and infrastructure construction projects, plans with 2 to 3 years to build a demonstration eco-technology island area; until 2015, complete the second phase of the project, then after another 3 to 5 years, completed a comprehensive eco-technical island.

From Nanjing local newspaper, it predicted that by the introduction of modern services, high-tech industry base headquarters, the environmental protection industry and the characteristics of ecological agriculture, in 2020 on this island, major industrial added value up to 0.5 billion USD and create 7 million new job opportunities, tax revenue will reach annually about 0.13 billion USD.

Not only Jiangxin island is going to build the ecological island. But several islands including Chongming island which is the largest island in Yangtze River. Compare to other island in Yangtze River, Jiangxin island has several specialties. Such as this island has 15 km^2, but only 12000 local population, which means there are plenty of available fields. Enough vacancy for other development such as real estate and technical research park. Then because of the history reason and water source facts, only one side of the island is main channel of Yangtze River, the other side is more stable and clean. That is a good place for river fishing and aquaculture. At last, the most importance of Jiangxin island is that some local residents of this island is familiar with ecological agriculture and fishery as this island been an important organic tourist attractions of Nanjing for many years, but constrains with the knowledge, foundation and shortage of professional management, most of the ecological agriculture and fishery activity is in small scale and at a unscientific level.

According to the planning of the new island , it will divide into three main parts, the first one is science and technology industrial park, in the future this park is going to attract the world 500 strong enterprises to put their r&d institution here, which

based on the good ecological environment and academic atmosphere of Nanjing city. Nanjing has been the educational center in southern China for more than 1700 years. Currently, it boasts of some of the most prominent educational institutions in the region, which contains over 400000 college students and about 30 universities and colleges, and also has the second largest IT industry develop and sales center of China. Nanjing is an old city full of history and culture, but the spirit of this city is “liberty, equality and fraternity” and the citizens of this city are kindly, wisdom, and friendly. In the future, this island will be one of the most important idea bank in Yangtze River delta area.

Based on this situation the support facilities must satisfy the demand of talents and researchers. So, the second part of this island is the ecological residential area, which located next to the science and technology industrial park. This area will construct the high-grade community of life, which contains the specific of high technology, low pollution, good energy conservation and environmental protection. In the community, transportation is convenient, living and entertainment facilities is perfect , community service is complete. According to the wonderful environment situation, the people who live in this area will be comfortable and healthy.

The last part is ecological agriculture area, the program will focus on to establish the services of ecological agriculture products, leisure agriculture and rural custom exhibition. In the future planning, the island will not only continue producing the current famous products of fruits and vegetables but also will develop new industry in wine, aquatics and so on. The products of this island will fully support the daily needs of that two parts we mentioned before, and also can support for the citizens of Nanjing city. Leisure agriculture has implemented in Jiangxin island for over 10 years, but according to the low level of management and organization, the environment of the island has been effected. In the future, the island will focus on developing a new leisure agriculture style including better management and organize, also improve agricultural tourism service level, reform the agricultural tourism products and create new image in Nanjing citizens’ mind.(Zhang Xuehu, Chen You, 2008)

In the plan of the new Jiangxin island, we figure out that because of the

ecological agriculture program, this could be an excellent field research location for implement EBFM in this island, which is just in the middle of Yangtze River. Then, we are going to talk about how to implement the EBFM(Ecosystem Based Fishery Management) in Jiangxin island, and forecast the future of this island.

5.2 EBFM in Jiangxin island

As we mentioned before, the ecosystem based fishery management in Yangtze River Delta should consider several facts and most important is to deal with the human activities to Yangtze River fishery. In the past, the fishermen of Jiangxin island always depends on the fishing catch in Yangtze River and some of them do the aquaculture in the pond that dig in their own field. Most of the fishermen fishing in branching channel which at the eastside of island. In northwestern is the freshwater aquaculture zone, most products is fish and crabs. But recently, because of the serious ecosystem situation in Yangtze River, and the low price in traditional aquatic products. The living level of the fishermen is becoming even worse. And According to the fishing ban measures, even the formal river aquatic restaurants on the island also met business difficulties.

In this paper, we have talked about how to deal with the ecosystem disaster of Yangtze River, according to the actual situation of Jiangxin island, we are planning to implement the EBFM from three facts. All have to based on EBFM and also concentrated on the human-oriented.

5.2.1 Aquaculture instead of fishing

According to the present situation of Yangtze River, the traditional fishing will not be profitable and sustainable. We should develop special species aquaculture, which kinds of healthy and efficient in ecology. Some kinds of special high-quality varieties of the Yangtze River such as mullet, long snout catfish, mandarin fish, river puffer, crab and catfish.(Zhu Bing, et. al. 2009) All these kinds of fishes are popular in Nanjing market, and the aquaculture technology is mature. The fishermen of Jiangxin

island can culture in shallow water of Yangtze River shore, and with boat-cage. Also can use the high quality river water, pump into big pond on the island. Build the river fish standardized breeding base in the island, open the sluices and lead the river water and the rich aquatic animals, especially the fish seeds into the island. Focus on improve the quality level and economic value of aquaculture products.

Based on formal investigation, Chinese people have known how to implement ecosystem based aquaculture for over 400 years. In several old Chinese agriculture books, which describe that Chinese ancient knows culture the fish with rice together and increase both yield. Also have mentioned that the fish in different levels of water, culture them together to save the feed and improve the yield.(Li Mingfeng, et. al. 2008) Chinese ancient people is quite intelligent and advance in ecosystem based fishery, nowadays we can still learn many things from the past and carry forward the tradition.

In the future EBFM in Jiangxin island, we can implement several mix culture technology including mix the culture of fish and livestock, mix the culture of fish and grass, mix the culture of fish and fowl and also mix the culture of fish and special fishery products. This kind of produce style is also named as ecological fishery in China. And treat the fishery production process as a core, comprehensive utilize the water system. Make full use of energy and increase the efficiency of energy, lead to energy recycle in fishery aquaculture. Developing ecological fishery, can make full use of water and land. Using the terrestrial and aquatic ecological fishery, it can set organic connection between two systems, make them recycle waste for each other together. The ecological aquaculture make the fishery products healthy and efficiency, also increase the ability to antic disease and nature disasters.(Li Mingfeng, 2008). As the world economic crisis is still continue, everyone of the world is looking for the new economic booming point in the future. In some paper researchers predicted that ecological agriculture especially the aquaculture will be a new revolution for human beings.

Establishing a perfect attract investment system, and provide all kinds of preferential measures for enterprises. The aquaculture condition of Jiangxin island is

excellent, the objective of developing ecosystem based fishery in Jiangxin island is not only to produce the fishery products for the demand of the talents and researchers in the high technical and ecological park, but also provide the high quality fishery products for Nanjing's market.

Using the ecosystem based fishery management in the aquaculture activities needs the fishery science technology and integrative fishery management. Next, we are going to talk about another importance of EBFM in Jiangxin island, that is the comprehensive fishery management system on this island in the future.

5.2.2 Integrated management system in Jiangxin island

The implement of EBFM in Jiangxin island depends on many facts, including the local government, project management company, the local functional department in fishery, and the residents of the island. How to deal with the relationship between each other is the key point in management. At the front of this article, we have mentioned a word, the integrated management. It means that in the management process, not only manage the fishery by one or two facilities but also we need to consider all the participants in the ecosystem management.

Because of the political and history situation, Jiangxin island started govern by Jianye district of Nanjing in 2003. And directly lead by Jiangxin island street management office. And because of the current management situation in Yangtze River. The fishery of Jiangxin island is most manage by residents themselves, the management level is low and the produce scale is small. Also because of the unclear property right of fishery resources in this area the management has met several difficulties.

The first step EBFM of Jiangxin island is set a clear supervisor agency to lead the fishery activities in the island. Of course in political, the Jiangxin island street management office is take charge in the government issues, but the economic organization duty should release to the company, which take full responsibility in planning and implementing the ecological and technological project. Correct divide

the level of political institutions and economic organizations, correctly handle the relationship between government and enterprise. Chinese government always eager to get a shining result as soon as possible, but hardly think about how to implement it in a property way. If any thing want to develop well, must base on a solid basis, which is a wonderful plan. A project planning is half of success, and the other half is to implement. In the fishery industry reform, the government should release the right to enterprise and make the company plan it. Make the development company has full of freedom on this island. And keep the planning of this island scientific and stable for a longtime.

Property right of fishery resources in the Yangtze River is another important issue to deal with. As the agreement between the development company and Nanjing government, the whole island will be whole developed by the develope company. However, it means that the use right cover all the island. Based on the request of unified development and unified guidance of the development plan, island residents need to fully understand the project aims to improve living standards, increasing household income, adjusting economic structure and increasing economic benefits. In the ecosystem based fishery management system in Jiangxin island, the company can buy the fishery property right of this island and the river region around the island. In the future, we can not treat the island local residents as farmer or fishermen any more, change them into workers who work for fishery companies and they can get higher payment than before.

Build a fishery property protected area in the branching channel of Yangtze River will be a good option for the management. As we mentioned before, the Yangtze River fishery is manage by the Yangtze River Fishery Resources Management Committee, in this case the developments company of the island can chose to corporate with the government facility and make the protected area available and efficiency. In the process of integrated management of this island. The development company should take the leadership, consider every parts in the ecosystem and society, chose the best plan and make sure every participants be comfortable. Also provide good excellent preferential measures and conditions to attract the world advanced fishery aquaculture

enterprises..

However, the measures above is not enough for the EBFM in JIangxin island. In the next part, based on the actual condition of Jiangxin island, we are going to present the most important management measures in the future, and we hope that will be inspiring and effective.

5.2.3 Recreational fishery in Jiangxin island

The EBFM in Jiangxin has its own specialty that is the good tourism experience and basis, it will be a good opportunity to combine tourism and fishery together. Nowadays, the recreational fisheries is becoming more and more popular, as people's living level improved, the fun of fishing is becoming more and more popular in China. What is recreational fishery? Recreational and sport fishing describe fishing for pleasure or competition. Recreational fishing has conventions, rules, licensing restrictions and laws that limit the way in which fish may be caught; typically, these prohibit the use of nets and the catching of fish with hooks not in the mouth. The most common form of recreational fishing is done with a rod, reel, line, hooks and any one of a wide range of baits or artificial lures such as spinners or 'dry flies'. The practice of catching or attempting to catch fish with a hook is generally known as angling. In angling, it is sometimes expected or required that fish be returned to the water.(Anonymous, 2010e). But some researchers hold different views that the recreational fishery refers to the fishermen, fishing groups and fishing organizations and economic entities. Through the use of natural resources and fisheries-related human resources, develop a way to give the consumer entertainment and other fishing industry experience of fishermen. Recreational fisheries should have the following characteristics: (1) entertainment rather than for the purpose of access to fisheries resources; (2) Related to fisheries (referring to a large fishing industry) with the use of fisheries-related (defined by wild and farmed fish and other living resources, landscape resources, etc.) natural resources and fisheries-related human resources (including fisheries production, processing, sales, fishing boats, fishing gear and

methods, fishing culture, fishing facilities, etc.) (Liu Xiaojun, Huang Shuolin 2009)

In Yangtze River area, the recreational fishing is just started, which means that the market will be quite open and the demand will be high. Recreational fisheries has been developed in other countries and places for several years and become a quite efficiency economic point. Such as in USA, Canada, Norway, Japan and Chinese Taiwan, the marine recreational fisheries and inland freshwater recreational fisheries are quite popular. (A.-L. Toivonen, et. al. 2004)As both in East Asia, the recreational fisheries in Japan and Chinese Taiwan implemented not only full of profit but also ecological and environment friendly. Which means that could be good example for us to watch and learn.

In Taiwan, recreational fisheries development rapid because of it is promoting and counseling by management department, the content is rich, including of entertainment fishing boat activities, tourism in fish market, fishery festival activities and fishery culture activities.

According to the law of Taiwan, the management organization of recreational fishery industry is fishery authorities. In addition, local fisheries community also play an important role the management of recreational fisheries, particularly in the promotion of recreational fisheries. In the management of recreational fisheries not only taken top-to-bottom management, but also full use of bottom-up management style, specifically local fishery community play a very important role in fisheries management and development of recreational fisheries, and some fishing unit own some leisure fishing business, such as tourism fish market, entertainment fishing boat. Mean while, local fishery community also plays an important effect on recreational fishing within its area development, promotion, fishermen training and financial support.(Liu Xiaojun.et.al.2009)

In Japan, recreational fishery developed very fast. Because of the environment and geographical location of Japanese island. According to the province of forestry and aquatic 2002 recreational fisheries survey report shows that Japanese boats entertainment service number is 14 300, recreational fishing participants for 4480000, total catch capacity for about 29300 tons about 3% percent of coastal

fishing. In 2007, the recreational fishery development in Japan more rapidly and the number of people who participate in recreational fishing activities is about 600 million, which is more than one-third of the total population. Japan's recreational fisheries is well known as the plenty of amusement way in water, modern equipment, and strict safety security. The development of undertaking recreational fisheries improve the living level of fishing village, to increase the income of fisheries staff, change diversification of fishing village life. Recreational fisheries has become a powerful impetus to the economic development of fishing and living environment improvement. In a certain extent, help fishing village to contain the outflow of young people to the city, effectively relieve the outflow of fishery labor shortage.(Lei Ming, Pan Yonghui.2008)

So in the recreational fishery of Jiangxin island, based on the location and natural condition, we can figure out that the recreational fishery of Jiangxin island should have its own characteristics. The residents of Jiangxin island are familiar with tourism service, they have enough service consciousness. The consumers will have wonderful service in the future. And because of the island was determined as well-known tourist attractions, it has high reputation in Nanjing tourism market. Prospects for development of recreational fishery is quite bright. In the planning of Jiangxin island development, it is going to build a yacht dock in the island, the services of recreational fishery will be a great attraction for the yacht owner, who is delicate in their entertainment life.

Based on these situation, here we present some management ideas of recreational fishery development in Jiangxin island. At first, according to the location and geography situation of the island also because of the aquaculture condition, the aquaculture fishing industry is the basic and the most common type of recreational fishery. This is coming from aquaculture, use breeding base fence fishing facilities to culture large-sized fish and some mature one in Yangtze River tidal zone. And it also can be implemented in the island with the pond which connect to the river. Make residents of the island aware the profit and advantage of recreational fishery and management it by experienced companies, which means in this field the international

cooperation will be effective and useful. For example, build a fishery protected area is a good place for recreational fishery, which needs a precisely and experienced management. Norway, Japan and Taiwan all has many companies that have plenty experience in it.

However, this is not the only way of recreational fishery. With the economic development and people's living standards improvement. The construction along the Yangtze River also has been changed a lot. Yangtze River view fishery will be a good sell point in the future, although Nanjing is located at the river side, but still many people don’t have an opportunity to take a close look on their mother river. The Yangtze River sightseeing fishery is a new industry, which combine the restaurant and cruises, let the consumer can not only see the river view but also can have delicious aquatic cousin on the ship.

Further more, the success of recreational fisheries in Jiangxin island is also depends on continue management and marketing strategy. Continue figuring out the demand of consumers, chose accurate marketing strategy to expand the reputation of Jiangxin island, use various media in various ways, facing the urban residents, and extent fishing culture to publicity. Based on comprehensive understanding of consumer, including income level, consumer behavior, cultural background of its consumption tendency is affected. According to the different target groups and demand, formulate the correspond marketing strategy. Adjust measures to local conditions, outstanding the features of Jiangxin island. The development of divergence route to attract more tourists, so as to improve the number of participants in recreational fisheries and overall economic benefits. Promote the improvement of the fishery economic, social and ecological benefits.

7. Discussion and Conclusion

In China, although Chinese economy is developing quite fast. The speed of the economics is based on the high level consumption of natural resources and environment. Chinese fisheries production has a large number in the world, but hardly few people knows the real situation in China, foreigners often has a misunderstanding in Chinese fishery. And because of the history and political reasons, the research and investigation of ecosystem and environment is still at a low level. Figure out the major problems in Yangtze River ecosystem, make everyone clearly understand that the formal management measures for Yangtze River and even the whole ecosystem could determined as failed. Based on the real situation of Yangtze River Delta area and the current problems, show the readers a insight view of Chinese fishery and Yangtze River fishery.

According to this situation, based on the shortage of data and research. We try to figure out the basic management way for Chinese environment and ecosystem, which is not only the Chinese people's habitats but also important treasures of the world. In this paper we have analysis the main principles, goals of Chinese Yangtze River ecosystem-based fishery management and shows several implements of management. We hope the advices and measures can be implemented by Chinese government and inspire more people aware the problems of Yangtze River. Attract more people participate into the research and manage of Yangtze River fishery to protect the mother river of China.

According to the formal investigation on fishery which focus on the fishery biomass and fishing effort on single species, the result is still not very optical. World fishery resources are still damaging, the quantity and quality is still decreasing. People try to find another way to deal with the bad situation. Ecosystem based fishery management is one of the most new fishery management theory, which just appeared in the latest century, and the theory of this management issue has many expected.

But because of the ecosystem is competitive organization, which means

according to the shortage of knowledge and abilities we can't consider every facts in an ecosystem. Even the definition of this word still have disputes on it. However, in world wide, many researchers, experts and even governments, try to figure out the most useful and precisely theory to implement ecosystem based fishery management. They all believe in that the EBFM will be successful in the future. Such as USA, Canada, Norway and Australia has implemented several policies and systems which apply with EBFM. (Stephen J Hall & B Mainprize 2004).

However, this paper can be determined as the first paper that explain the ecosystem-based fishery management in Yangtze River, which combine the ecological fishery theory in China and the marine ecosystem-based fishery of the world. We believe in that as the formal measures didn't have a optimal result, we should find out what is the major effect to ecosystem and environment, although this paper constrained by the shortage of data and knowledge, but still can focus on the main available point, which is the human activities and relationships. That is the human-oriented EBFM. To implement this theory should be a new basic for Chinese fisheries reform and the original of Yangtze River fishery reborn. As Yangtze River Delta area has enough funds and the people who has the most desire needs in the improvement in environment. As the Chinese government highly centralized the resources and foundation. This management theory can be implemented and tested easily in the future.

As we chose a small island, Jiangxin island as a research field, we hope the develop company of the island can have enough interests and understanding of the EBFM theory, which can not only protect the ecological environment of the island but also can have more profit in the future. If the EBFM can be implemented in the Jiangxin island, that will be a good opportunity for all the researchers have a good example and research subject.

There are so many research opportunities for EBFM of Yangtze River fishery, this paper is just a start for the future. We hope more and more people will attend into the investigation of the problems. More and more agencies, universities and even foreign countries can cooperate on the research of protect the ecosystem and resources

in Yangtze River. Everybody work together to protect Yangtze River and to protect our own Earth.

For this paper, there are still many limitations. The ecosystem based fishery management is competitive theory, in this paper we chose the human-oriented part to focus. If the condition permit, we should consider more principles, to make the management theory more precisely. But this work will beyond my ability, here I invite experts and researchers who interested in Yangtze River fisheries come to Jiangxin island, come to Nanjing, come to Yangtze River Delta. I am on behalf of Chinese people, show our warmest welcome.

Welcome to Nanjing . Welcome to Shanghai 2010 EXPO.

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