

RESEARCH PRIORITIES OF THE CHINESE ACADEMY OF FISHERY SCIENCES (CAFS)

N.S. Yang

Information Center, Chinese Academy of Fishery Sciences

ABSTRACT

China has made outstanding progress in the fisheries industry since 1978 when the open policy and economic reforms were adopted. This chapter looks at the performance of the fisheries industry and the major problems it faces. The final section examines the role and scope of CAFS in addressing some of the concerns in the fisheries industry.

CHINA'S FISHERY INDUSTRY

China has made outstanding progress in the fisheries industry since 1978 when the open policy and economic reforms were adopted. As a top fish producer in the world, China's fisheries output in 2000 was 42.79 million t, making up one third of the world's total. The total fisheries production value was RMB 184 billion (US\$ 22.17 billion). The country's aquaculture production has exceeded its capture fisheries, reaching 24 million t in 2000 and contributing to two third of the world's aquaculture. The GDP of the fishery sector was RMB 280.8 billion (US\$ 33.83 billion), accounting for 11.6% of the country's agricultural GDP. Fishers' average income has gone up to RMB 4474 (US\$539), about double that of agriculture farmers. The industry has provided 12.57 million job opportunities. In terms of international trade in 2000, China's fish exports were reported as 1.534 million tons in volume and US\$ 3.83 billion in value, and the imports as 2.52 million tons in volume and US\$ 1.85 billion in value. The following figures and tables (Tables 1-7) illustrate the recent development of China's fisheries industry.

MAJOR PROBLEMS OF CHINA'S FISHERIES INDUSTRY

China has made great achievements in its fisheries industry, but it is also faced with a number of problems.

Decline of natural fish resources

Marine capture fisheries used to be important to China's fisheries industry. Between the 1950s and 1960s, China's annual marine fishing production was about 2 million t, and the products mainly comprised commercially important bottom species such as great yellow croakers, small yellow croakers, hairtails, flounders, cods and squids. However, from the mid 1970s, low valued species gradually took over from the above species. It was reported that since the 1980s, pelagic species accounted for a larger share of production. For example, survey statistics between 1982 and 1988 showed that small pelagic fishes such as anchovy, black scrapper, and pacific herring accounted for 60 per cent of the total biomass. From 1992 to 1993, marine invertebrates declined by 39 per cent and fish

Table 1. Import and export of China fish products.

Year	Export Volume (1 000 t)	Export Value (billion US\$)	Import Volume (1,000 t)	Import Value (billion US\$)
1996	802	3.297	1 387	1.204
1997	922	3.140	1 513	1.220
1998	1 003	2.840	1 141	1.020
1999	1 348	3.140	1 305	1.290
2000	1 534	3.830	2 520	1.850

spawning biomass fell to only 30 per cent compared to that of 10 years earlier. Biomass of commercially important species like perch, Chinese herring, sea bream, flounder, sole, shrimp and crab decreased to 29 per cent while anchovies increased by 2.4 times. Data from 1998 again revealed that biomass in the Bohai Sea was down to 11 per cent of that in 1992. A similar situation took place in the East China Sea, where although some species stayed stable in biomass (such as hairtail, chub mackerel and some shrimps), their populations tended to be younger and smaller.

Fish resources in inland waters are in an even worse state than those in marine waters. Most places have been over-developed by improper production modes, which have threatened China's fresh water ecosystems and biodiversity.

Deterioration of water environment

With the rapid development of China's economy, it is inevitable that pollution becomes more and more serious. It is reported that among the 1 200 rivers in China, 850 have been more or less polluted, and 61 per cent of the lakes are estimated to be eutrophic. Pollution in coastal waters is increasingly severe. Three hundred and ten red tides were recorded during the 1990s along China's coastal areas. Cage fish farmers in Guangdong and Hongkong lost about RMB 350 million between October 1997 and April 1998 due to successive red tides. Not long after that, an area of 50 million mu in the northern China Sea was invaded by red tide, killing a great number of molluscs and resulting in RMB 500 million losses. Most pollutants are from industrial and household discharges such as petroleum, paint, detergent, textile, plastics, pesticides and herbicides. Aquaculture itself in some areas also results in pollution.

For example, the feed residuals, fish wastes, dead fish, fertilizer and fish drugs are all considered sources of pollution.

Lack of advanced technologies

China's fishery, in general, is still a less industrialized industry although its production takes first place in the world. The production modes in most areas are still backward. Apart from a few modernized fishing fleets and fish farms, scattered artisanal fishers and fish farmers dominate both capture fisheries and aquaculture. The industry is considered vulnerable and has a long way to go in terms of modernization.

Lack of good breeding stocks

China has a long history in aquaculture. However, only a few breeding stocks have been strictly selected for aquaculture so far. Most breeding stocks, even 70 per cent of that of Chinese Carps that are the major aquaculture species in China, are simply taken from the wild. As a result, it impacts negatively on the aquaculture of many species and this is exemplified by degeneration, low growth rate, weak anti-disease resistance, and bad quality.

Lack of control in the management of diseases

Disease is one of the major obstacles to China's aquaculture. Up to now, few effective measures have been worked out to control diseases. So, China's aquaculture still suffers severe economic loss due to widespread diseases. It is reported that over RMB 12 billion is lost annually in China's aquaculture as a result of the lack of control in the management of diseases.

Fig. 1. Fishery production as a share of agricultural production.

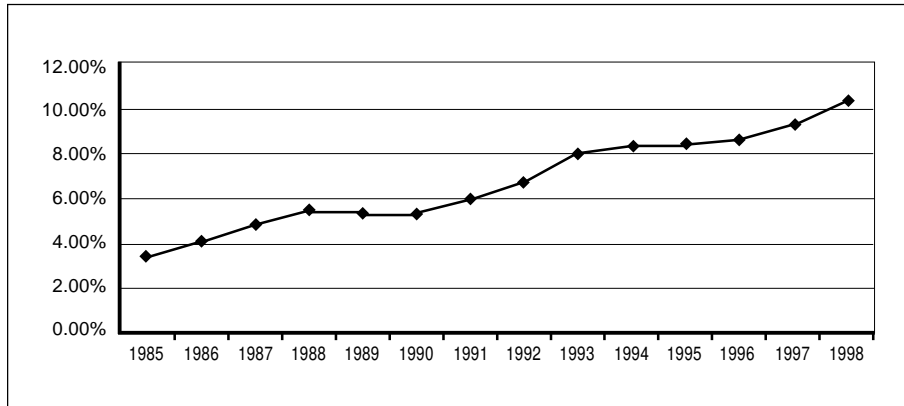


Fig. 2. Per capita availability of some animal products (kg) 1985-1998.

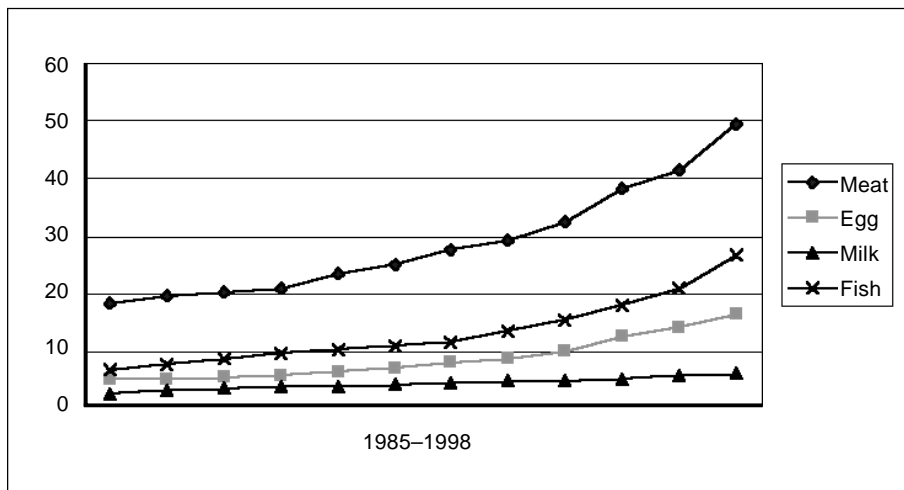


Fig. 3. China fishery production (10 000 t) 1978-2000.

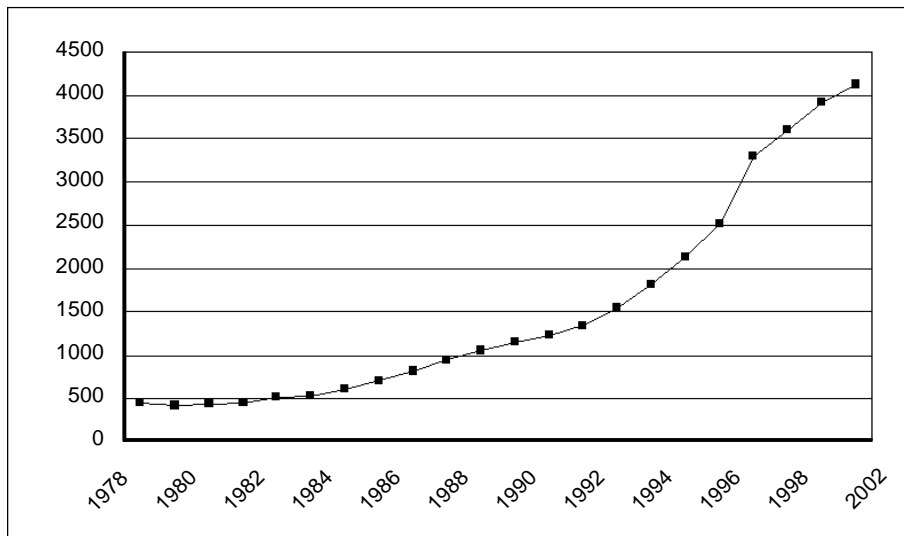


Fig. 4. Production share of aquaculture and capture fisheries.

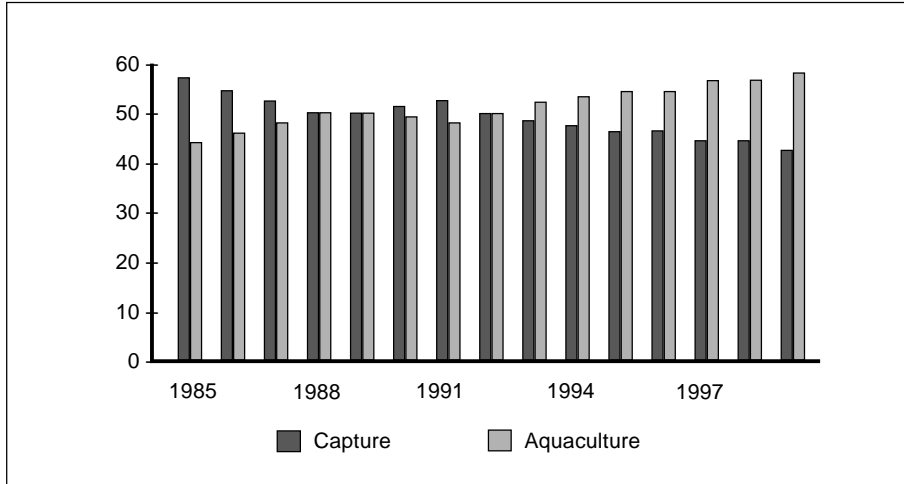


Fig. 5. Production share between marine and inland waters.

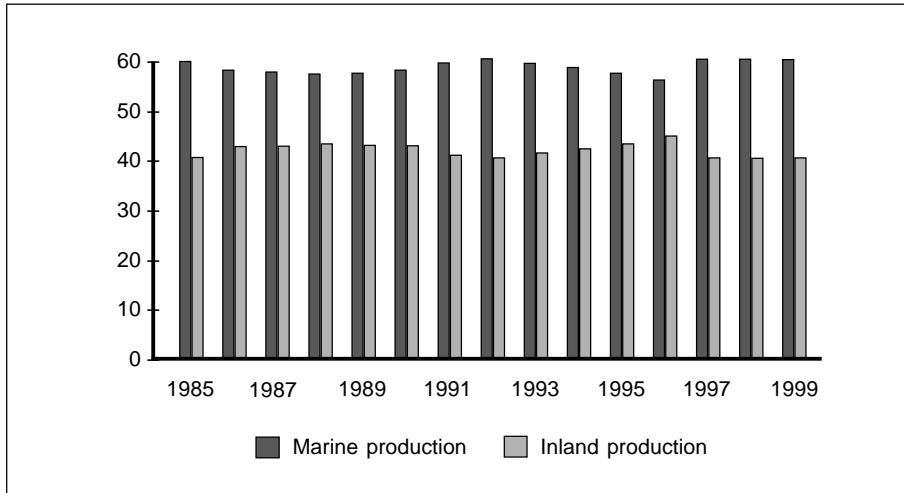
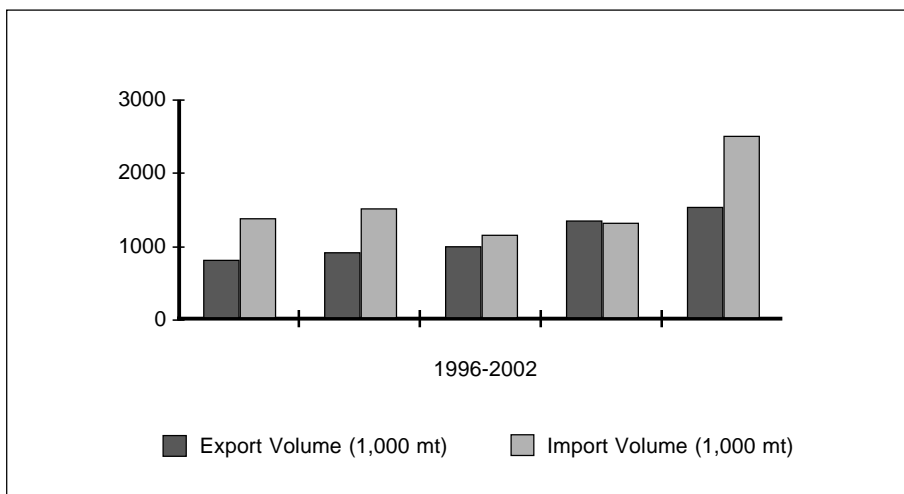


Fig. 6. Comparison of export and import in volume.



Backward fish processing technologies

China's fish processing technologies are relatively backward in the world. Only 30 per cent of landed fish are processed compared to 70 per cent in developed countries. The majority is simply iced or refrigerated. Few high value added technologies have been developed. Fresh water fish are almost always sold alive.

THE OFFICIAL ROLE AND SCOPE OF ACTIVITIES OF CAFS

CAFS, which operates directly under the Ministry of Agriculture, has a total of 2 343 staff currently, of whom about 340 are senior research fellows including three academicians of the China Engineering Academy. With its headquarters in Beijing, the capital of the country, CAFS has 15 branches located in different parts of China (Fig. 8). Among them, three are engaged in marine fisheries and aquaculture, four are focused on inland water fisheries and aquaculture, four are specialized in aquatic resource-related areas and four are responsible for fishery resource enhancement.

As a national fishery research institution, CAFS aims to conduct various and comprehensive applied research to help fishery and aquaculture production in China. Its research scope covers almost everything in terms of fishery and aquaculture such as fish breeding, disease control, fish nutrition, fish processing, fishing technology, resource assessment and conservation,

environment protection, fishery criteria, policy and development strategy, and information dissemination.

Over the last decades, CAFS has achieved a number of research results, of which 35 were given awards by the central Government and 335 by the Ministries or Provincial Governments.

RESEARCH PRIORITIES FOR CAFS

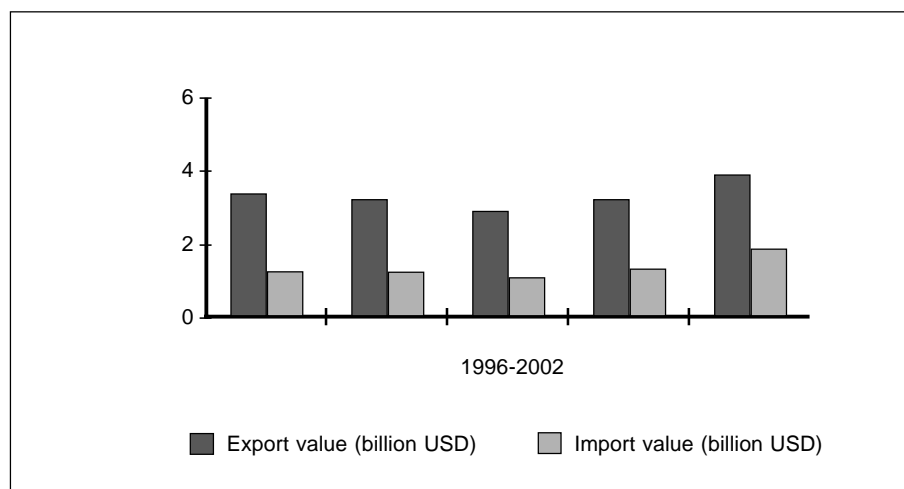
Marching into the 21st century, China's fisheries will encounter many new challenges. The main challenges are:

- increasing the income of fishers and fish farmers as most fishers and fish farmers are still living in poverty
- improving the quality and varieties of fish products in order to promote international trade
- restructuring China's fisheries industry in accordance with the new international marine management regime
- encouraging sustainable fishery development so as to save limited resources and protect the environment

According to the mandates above, CAFS as a national fishery research institution will focus its research interests in the following areas in the near future.

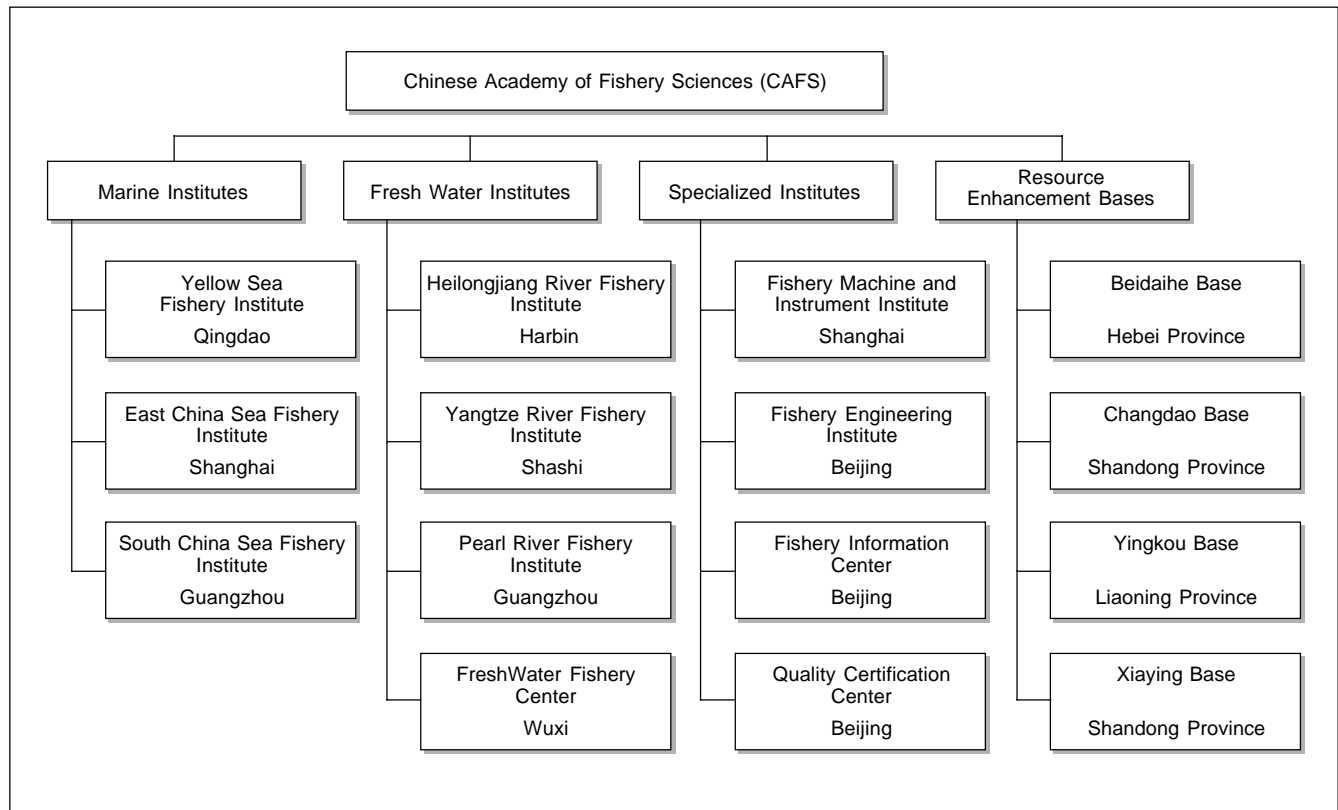
1. Marine fishery resource assessment and sustainable utilization
 - resource monitoring and assessment
 - evaluation for fishing quotas

Fig. 7. Comparison of export and import in value.



- selective fishing gears
 - evaluation of resource enhancement with artificial reefs
2. Protection of fishery ecosystem
 - evaluation of fishery environment and ecosystem
 - bio-restore and optimize ecosystem technologies
 - evaluation of technology for increasing aquaculture capacity in natural waters
 - aquaculture technologies in shallow sea, mud field and lake
 - pollution control in aquaculture
 3. Conservation of aquatic biodiversity and fish germplasm
 - fish germplasm identification and characterisation
 - fish genetics and gene mapping
 - conservation technology for fish germplasm
 - conservation technology for endangered species
 4. Selection of improved varieties and fish breeding
 - identification of new varieties
 - combination of conventional selection with biotechnology
 - artificial breeding of fish and shrimp on a large scale
 5. Disease control
 - healthy aquaculture
 - prediction for hazard disease in aquaculture
 - fast detection and diagnosis of aquaculture pathogens
 - vaccine preparation and technology for improved immunity
 - creation of low residual fish drugs, non-hazardous to the public
 6. Technology aquaculture
 - high density culture technology
 - water processing technology
 - anti-wave technology for inshore aquaculture
 - aquaculture engineering

Fig. 8. The organisational structure of Chinese Academy of Fishery Sciences (CAFS).



7. Distant water fishing
 - fishing technology for tuna and squid
 - high technology fishing vessels
8. Fish processing and food safety
 - improvement of fish quality and flavor
 - fish processing technology
 - healthy fish products
9. Information technology
 - fishery management information system
 - networking and development
 - information and publication
 - Geographical Information System (GIS), Global Positioning System (GPS) and Remote Sensing (RS) technologies
10. Fishery policy
 - market economy reform
 - fishery development strategy
 - international trade
 - WTO and China's fishery policy

CURRENT RESEARCH PROJECTS OF CAFS

“973” National Significant Basic Research Program

- Ecological dynamics of the East China Sea and Yellow Sea and sustainable utilization of the biological resources, *Yellow Sea Fishery Research Institute, Qingdao*

“863” National High-Tech Research Program

- Development of new Marine enzyme, *Yellow Sea Fishery Research Institute, Qingdao*
- Engineering optimization for breeding facilities of molluscs, *Yellow Sea Fishery Research Institute, Qingdao*
- Genetic improvement of *Penaeus chinensis*, *Yellow Sea Fishery Research Institute, Qingdao*
- Engineering optimization for industrial high density aquaculture, *Yellow Sea Fishery Research Institute, Qingdao*
- Comprehensive disease control and demonstration of industrial culture of Turbot (*Scophthalmus maximus*), *Yellow Sea Fishery Research Institute, Qingdao*
- Immunity mechanism and factors analysis on

- triploid *Chlamys farreri*, *Yellow Sea Fishery Research Institute*
- Large scale artificial breeding of *Peneaus monodon*, *South China Sea Fishery Institute, Guangzhou*
- Development of major vaccines for some cultured marine fishes, *Pearl River Fishery Institute, Guangzhou*
- Industrialized breeding of high rate male Tilapia with gene engineering, *Fresh Water Fishery Research Center, Wuxi*
- Establishment of pure and ecologically secured gene transferred Common Carp, *Heilongjiang River Fishery Institute, Harbin*

National Key Research and Development Program

- Key technologies and facilities on plant and fish culture
- Anti-wave technology and facilities for deep sea net cage fish culture
- Ecological aquaculture technologies in inland waters
- Technologies for healthy marine aquaculture
- Selection of improved aquaculture varieties and the artificial breeding technology
- Manufacturing of high value fish feed

Internal cooperation within China

In addition to the strong linkages among its internal institutes, CAFS also seeks collaboration with other institutes in China such as the Oceanic Institute of CAS; the Institute of Hydro-Biology, CAS; the institutes from the State Oceanic Administration (SOA), universities like Qingdao Oceanic University, Shanghai Fishery University, and Dalian Fishery University and local fishery research institutes and extension stations.

ONGOING INTERNATIONAL COLLABORATIONS OF CAFS

Currently CAFS has extensive international collaboration. Over the last decade, it has developed a number of international projects with countries including the United States, Japan, Norway, Korea, and EU, and such international organizations as FAO, UNDP, The WorldFish Center, and NACA (see the project list of international collaboration). Examples are as follows:

China-US Marine and Fishery S&T Agreement

- Shrimp virus
- Specified Pathogen Free (SPF)/Specified Pathogen Resistance (SPR)
- Effect of sex hormone on fish reproduction physiology and behavior
- Ecology of marine virus
- Analysis of harmful algae bloom
- Analysis of mollusk toxin (PSP)
- Biological decomposition of organic pollutant in marine environment
- China information web page

China-Norway Project

- Utilization of liquid protein

China-EU Project

- Marine aquaculture capacity and sustainable resource management

China-Korea Projects

- Prevention of fish diseases with natural medicines
- Analysis of harmful red tide organisms along the China and Korea coasts
- Comparison of mollusk germplasm and aquaculture ecosystems in different areas

Responding to National Priorities

Most of the priorities are based on the requirements of the State Council. CCAFS applies to conduct national research projects according to the guidelines released from various agencies of the State Council, especially from the Ministry of Science and Technology and the Ministry of Agriculture. The State Council research bidding system has only started in recent years, and most projects are now subjected to public bids. Some projects are conducted with support from local Governments and the industries in line with their demands.

The Chinese Government has paid great attention to the issues of environment protection and sustainable development. So, a number of research projects from the Government are concerned about production and also concerned about the environment and ecosystem protection. For example, CAFS is conducting such projects as:

- marine fishery resource assessment and sustainable utilization, resource monitoring and assessment
- evaluation for fishing quotas, selective fishing gears
- evaluation of resource enhancement with artificial reefs
- evaluation of fishery environments and ecosystems
- bio-restoration and optimization of ecosystem technologies
- evaluation technology for aquaculture capacity in natural waters
- aquaculture technologies in shallow sea, mud field and lakes
- pollution control in aquaculture.

For all areas of research, the research results are basically provided to the Government as advice for policy making. They are also provided to the industry to alert them to the problems faced by the national agency so as to influence and adapt the behavior of the fishery and aquaculture sectors.

OPPORTUNITIES FOR COLLABORATION

Noting The WorldFish Center's focus on the poor, livelihoods, and environmental management it may, in the future, play a significant role in collaborative approaches to the following key areas:

- health in aquaculture
- the introduction of new varieties for aquaculture
- disease control
- facilitating the practices of aquaculture
- resource and environmental management
- post-harvesting technologies
- information exchange, and seminars
- personnel training.