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CURRENT STATUS AND RECENT ADVANCE OF AQUACULTURE IN CHINA

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1. Background

- Food and Agriculture Organization of the United Nations predicts that:
Worldwide harvest output of aquatic products will be decreased whereas the consumption of aquatic products will be increased at the speed of **1.0% to 2.9%**.



1. Background

- The increase of aquatic product output will mainly be attributed to the **development of aquaculture**.
- For a developing country, especially for a country with a large population and fast developing pace as China, aquaculture in the 21st century will not only face favorable developing opportunities but severe challenges as well.



2. The development of Chinese aquaculture

- Chinese aquaculture industry has witnessed the growth rates of more than **10 percent every year**.
- Since 1989, China's aquatic product output has been in **the first place of the world**.

2. The development of Chinese aquaculture

- At present, it accounts for **40%** of the world's aquatic product output, among which the aquaculture output accounts for **70%** of that of the world.
- China becomes the only fishery country that aquaculture output exceeds fishing yield, with **9** billion US dollars of export volume which accounts for **30%** of the total export volume of agricultural products.



2. The development of Chinese aquaculture

- Export of aquatic products has enhanced China's international competitiveness in the field of fishery, thus promoted the development of domestic aquaculture and aquatic processing.
- In 2006, the freshwater aquaculture area was **60,200 hectares** and the aquaculture output was **19.5 million tons** which accounted for **97%** of the total output of cultured fishes.



2. The development of Chinese aquaculture

- Aquaculture is a vibrant industry in China.
- Chinese aquaculture producers are rapidly upgrading their technology to produce species.

pond culture



Flow-through culture



culture in net cage

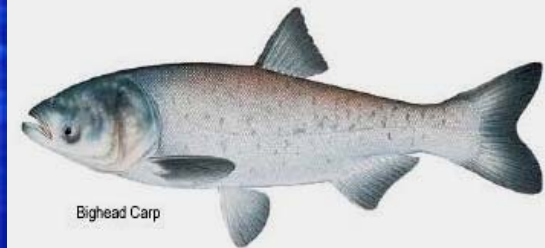




Silver Carp



Grass Carp



Bighead Carp



Black Carp

catfish



rainbow trout



tilapia



eel



shrimp

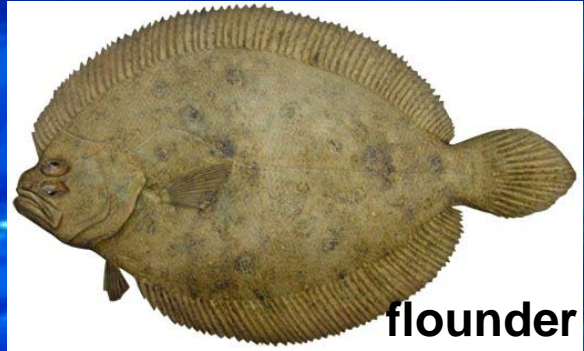


crab





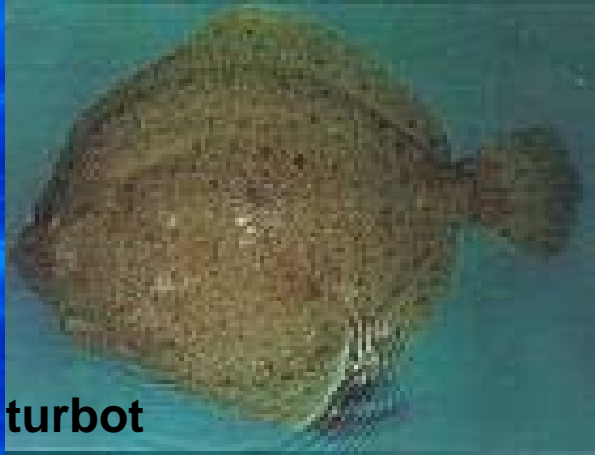
sea bass



flounder



sea bream



turbot



abalone



mussels



red drum



salmon



3. A major challenge for Chinese aquaculture

- China suffers from environmental pollution and a shortage of freshwater resources.
- The problems of shortage of water resources and water quality-induced water shortage become more and more prominent in China.

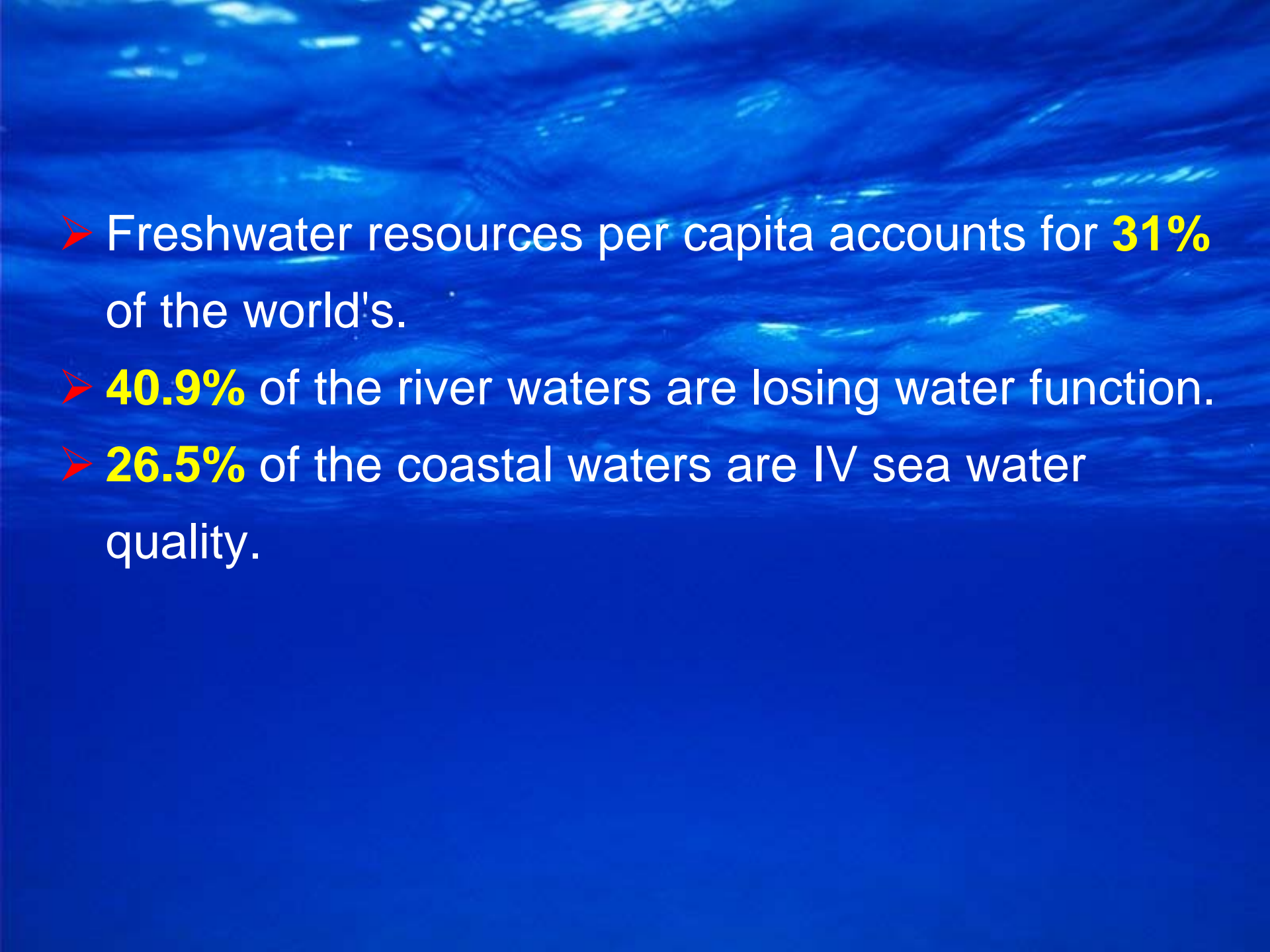


algal bloom



Sea grass
Enteromorpha prolifera



- 
- Freshwater resources per capita accounts for **31%** of the world's.
 - **40.9%** of the river waters are losing water function.
 - **26.5%** of the coastal waters are IV sea water quality.



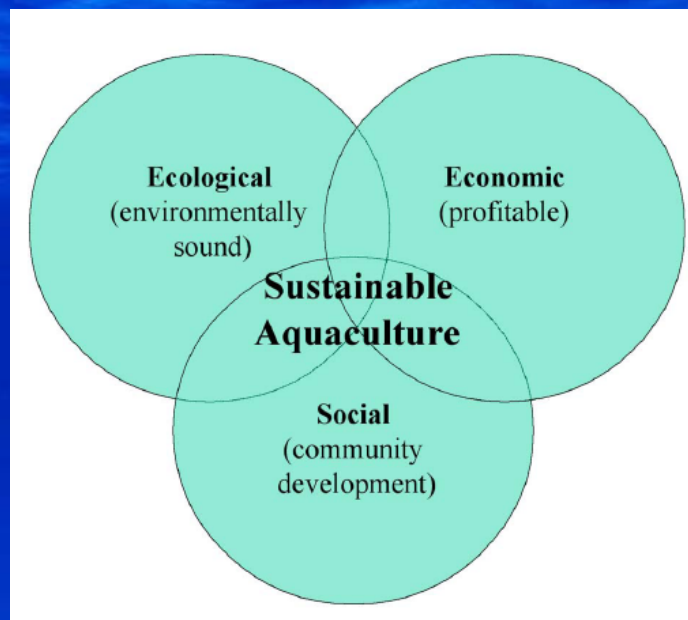
3. A major challenge for Chinese aquaculture

- The current fishery pattern costs a great deal of resources and we need to shift the fishery pattern to the resource saving and environmentally friendly orientation.
- However, the current scientific development of fishery in China does not meet the transformation of fishery growth modes.



4. Aquaculture should be resource saving and environmentally friendly

- In order to realize the goal of shifting to the resource saving and environmentally friendly orientation, sustainable aquaculture mode will become the direction of China's aquaculture.
- **Sustainable aquaculture must consider the ecological, social, and economic aspects of development.**





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4. Aquaculture should be resource saving and environmentally friendly

- Recently, governments and industry have realized that the focus of aquaculture must evolve into the development of an industry that is both environmentally and socially sustainable in the long term. Positive changes are being made with this growing interest and awareness of improving the sustainability of aquaculture.



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4. Aquaculture should be resource saving and environmentally friendly

- With the expected expansion of aquaculture in the coming years it will be vital that sustainable practices be implemented and further developed to avoid environmental and social problems.



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4. Aquaculture should be resource saving and environmentally friendly

- There are a number of alternative ways forward in the development of aquaculture, which can offer more sustainable solutions.
- In some cases these methods have been around for centuries, but they have rarely been adopted in the modern aquaculture industry, and in other cases they are innovative practices that can be explored by aquaculture proponents.



4. Aquaculture should be resource saving and environmentally friendly

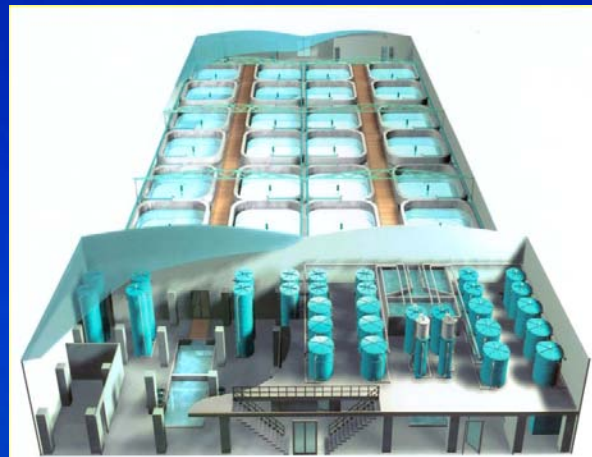
- Alternatives include ecological aquaculture, organic aquaculture, polyculture, and closed and low discharge systems.
- These alternative practices have been successfully implemented in different areas of the world.
- however, they must be examined for their application on a wider scale.





4. Aquaculture should be resource saving and environmentally friendly

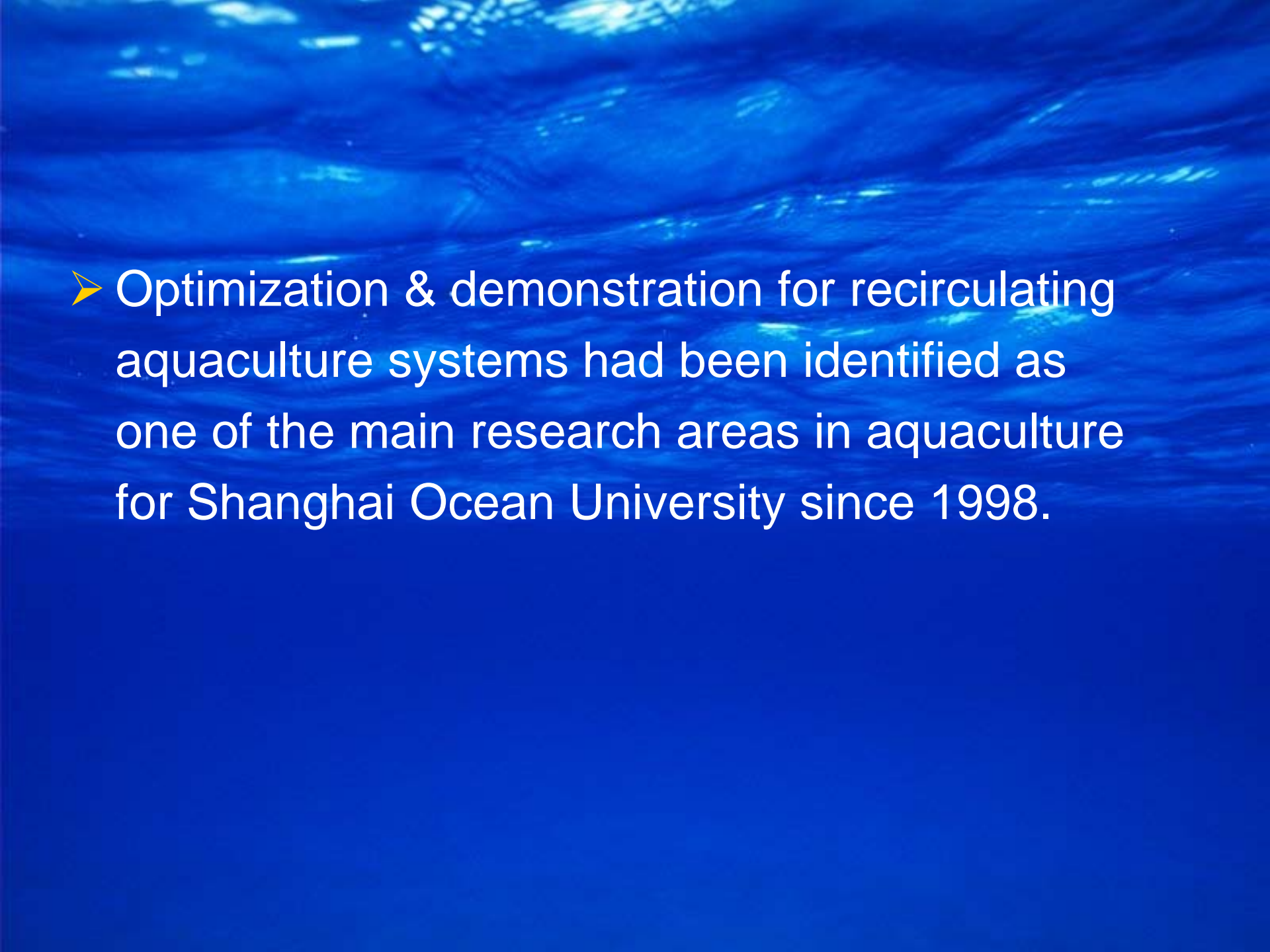
- Concerns for water conservation and reduced waste discharges have prompted the increased use of closed recirculating aquaculture systems (RAS).
- The systems are made up of three basic components: culture tank, settling tank, and biological filter.

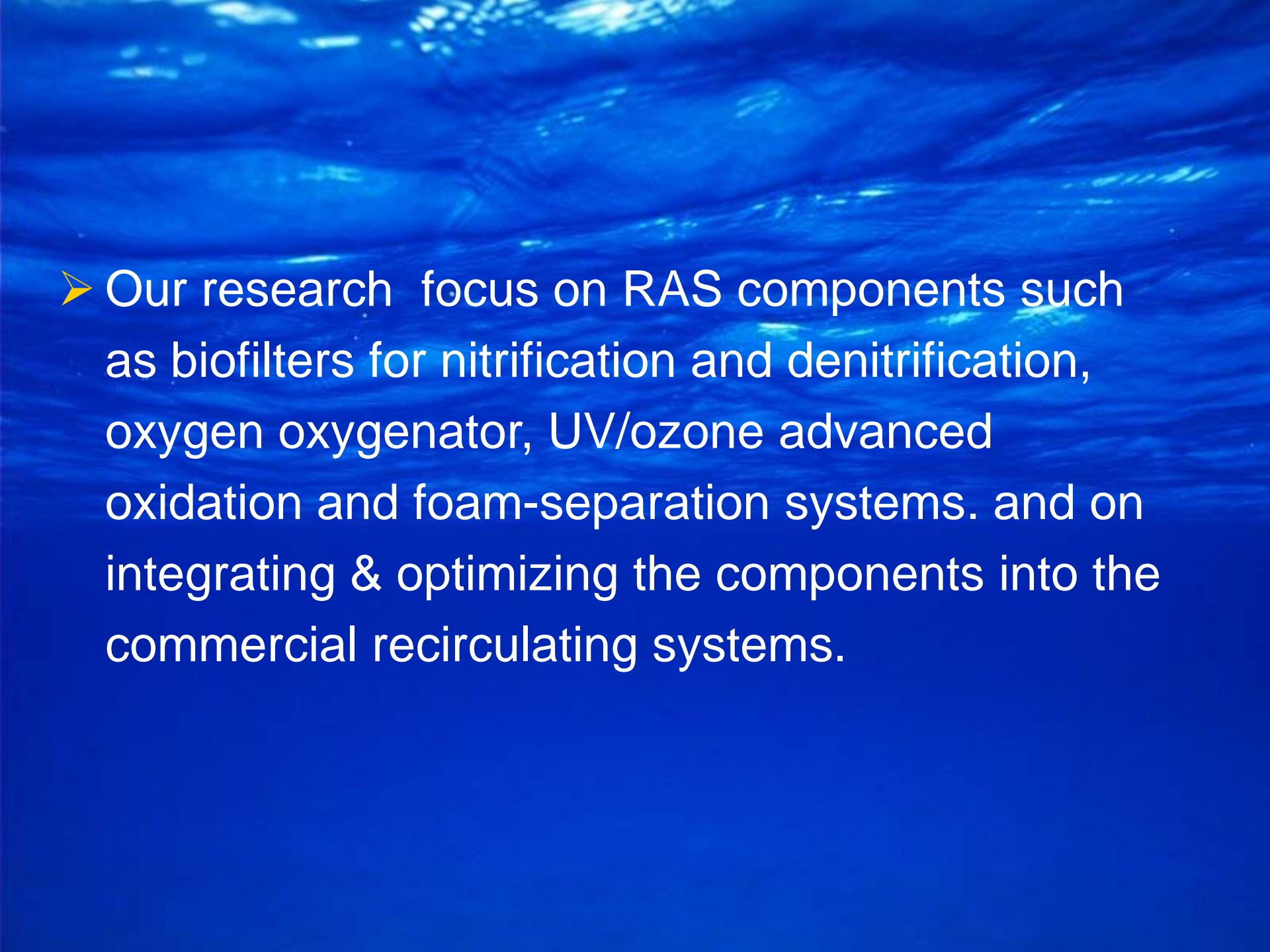


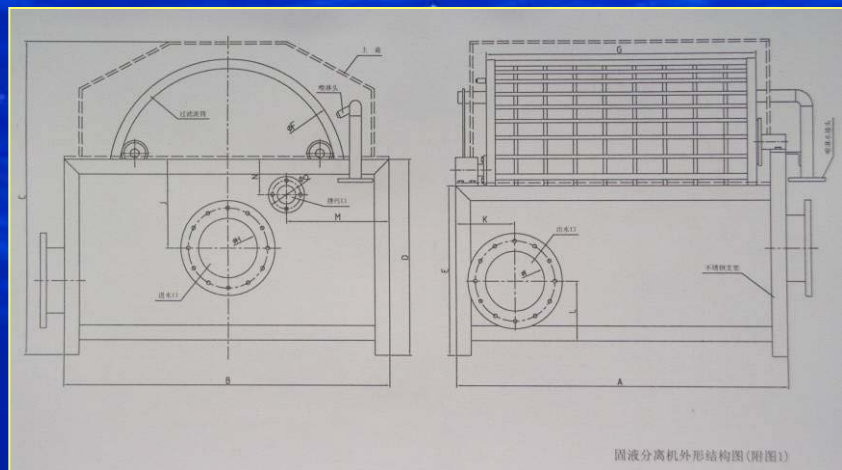
➤ Recirculating aquaculture technologies help minimize some issues.

- Limitations in quality and quantity of water.
- Availability and cost of land.
- Limitations on water discharges and environmental impacts.

➤ Recirculating technologies may allow existing operations to upgrade and expand and comply with future regulations in China.

- 
- Optimization & demonstration for recirculating aquaculture systems had been identified as one of the main research areas in aquaculture for Shanghai Ocean University since 1998.

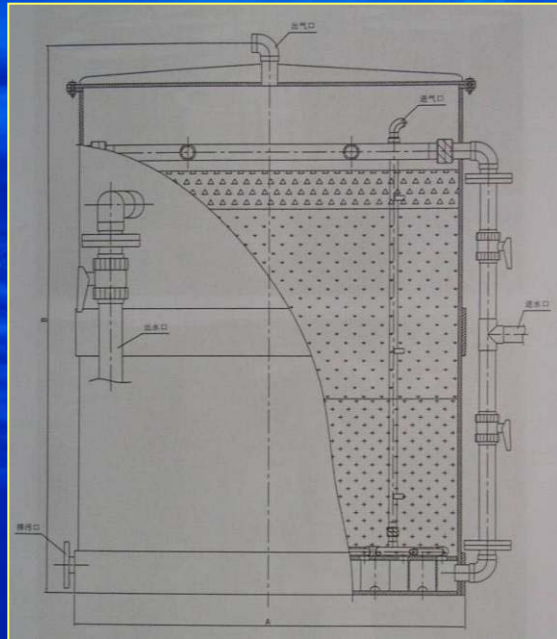
- 
- Our research focus on RAS components such as biofilters for nitrification and denitrification, oxygen oxygenator, UV/ozone advanced oxidation and foam-separation systems. and on integrating & optimizing the components into the commercial recirculating systems.



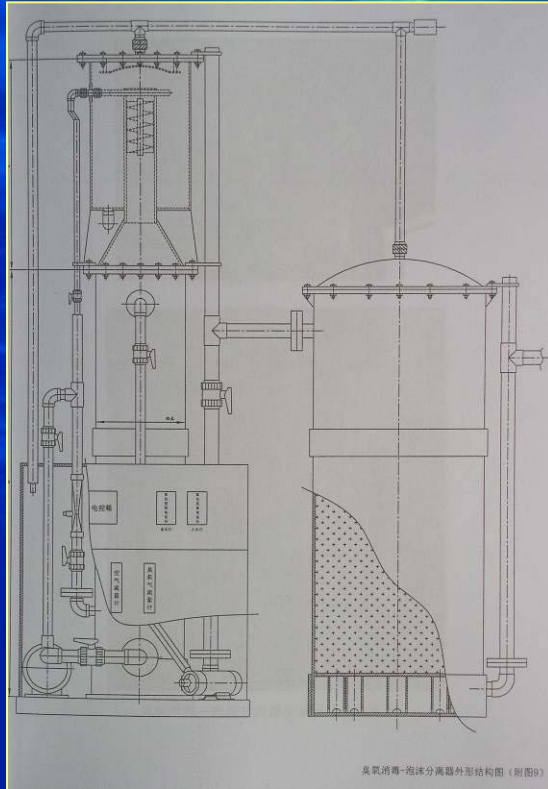
Drum filter



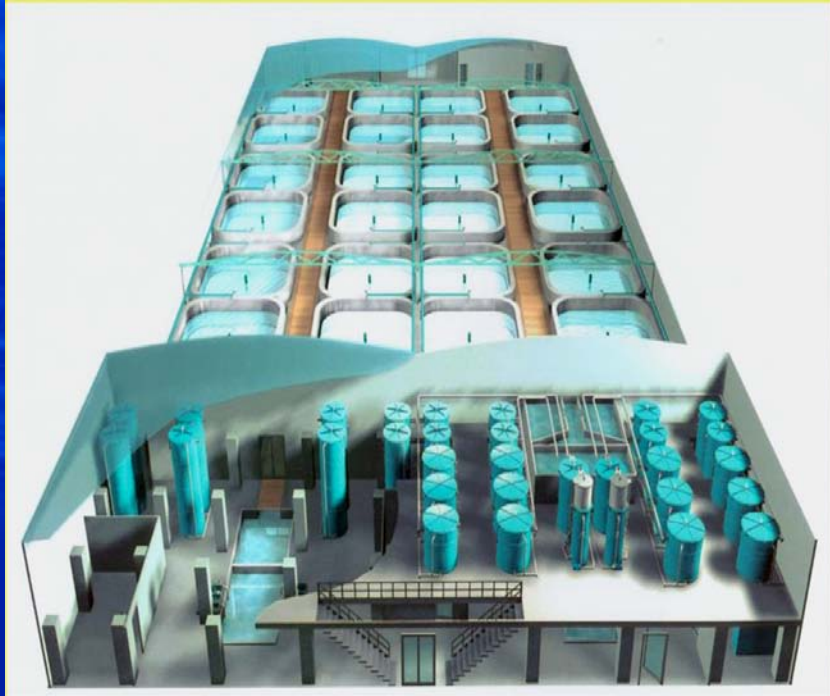
Plug-flow filter



Nitrifying biofilter



UV/ozone advanced oxidation and foam-separation systems



- Including four rearing systems.
- Design fish loads per ton water are 60 kilogrammes.
- Water treatment components include drum filters, biofilters, UV/ozone advanced oxidation systems, oxygenator, and water heating systems.

Integrating & optimizing the components into the commercial RAS

The background of the slide is a close-up photograph of blue water with gentle ripples and reflections of light, creating a textured, shimmering effect. The color is a deep, vibrant blue.

Commercial applications of RAS



Zhejiang province (浙江省)



Xinjiang autonomous region (新疆)



Guizhou province (貴州省)

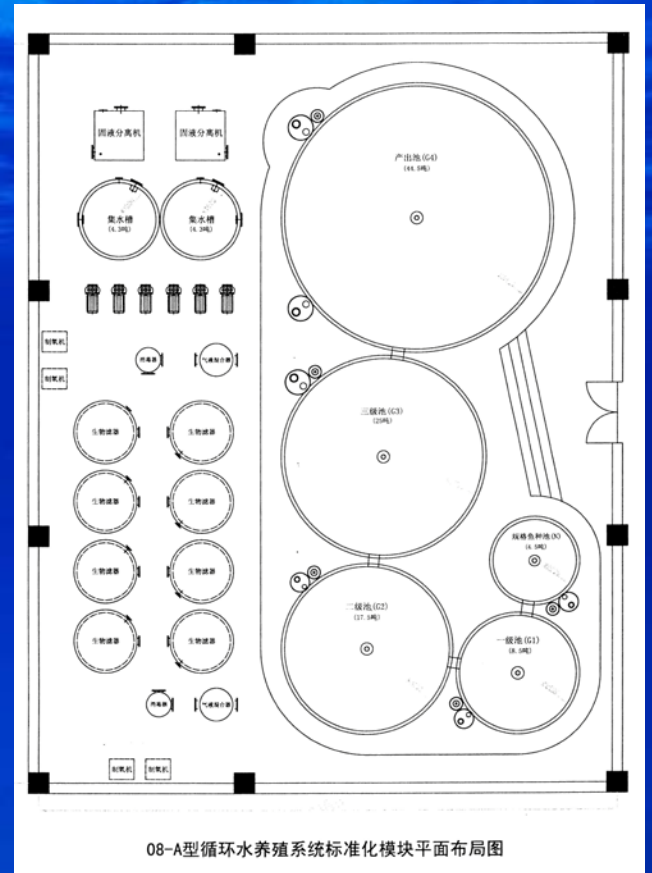
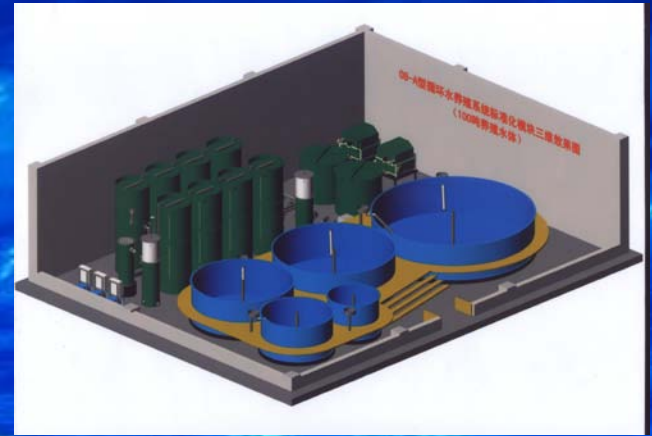


Shanghai(上海)



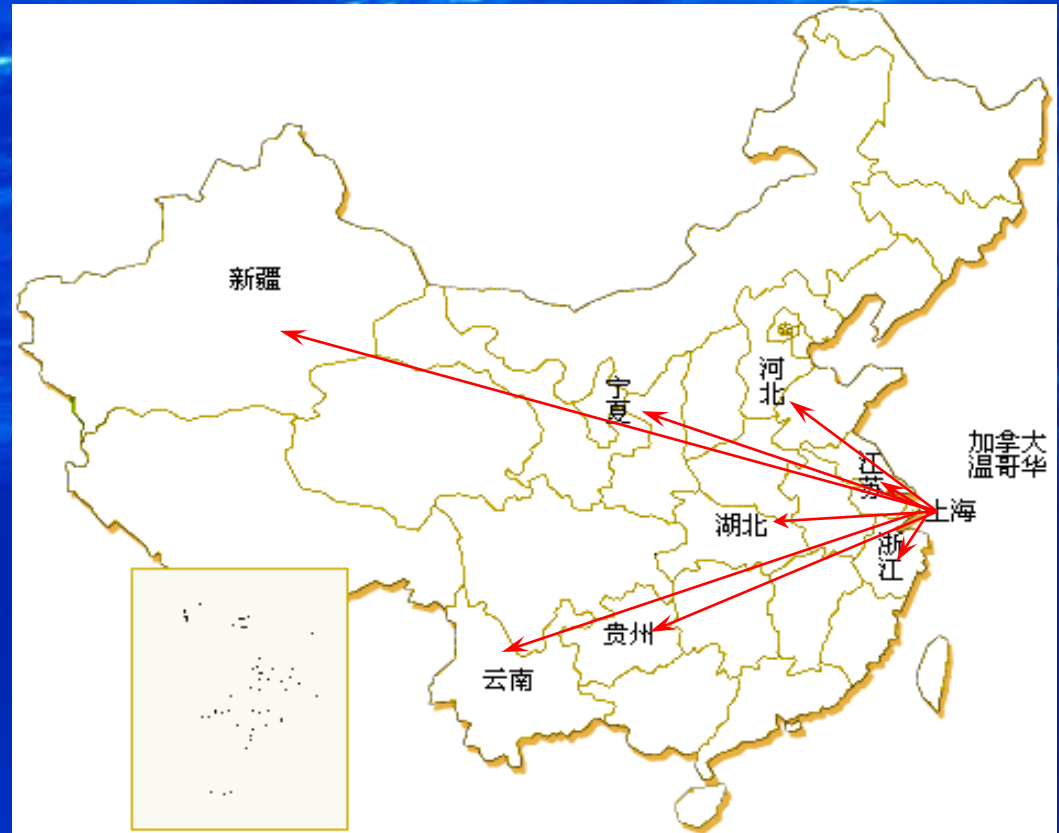


Fujian province (福建省)



08-A型循环水养殖系统标准化模块平面布局图

- To date, RAS have been demonstrated at 8 areas in China.
- **Rearing species:**
- **Jade perch**
- **Tilapia**
- **obscure puffer**
- **Rainbow trout**
- **Sturgeon**



- Our laboratory received the Shanghai Science & Technology Award (first prize) for Research and Exploitation on Key Technology of the Recirculating aquaculture system for freshwater fish rearing in 2006.





- Received the Best Tech-transfer Potential Prize of China International Industry Fair (CIIF) for Recirculating Aquaculture Systems and Healthy Rearing Technique in 2006.

Current research interests

- Formation, activity, bacterial diversity and population dynamics of autotrophic nitrifying biofilm in seawater.
- The acclimation of biofilters, particularly in marine environments, will require additional research, particularly in bacterial identification and population dynamics.

Current research interests

- Nitrate removal by denitrifying biofilters.
 - Using biodegradable polymers (DBPs) as carbon source and biofilm carrier of heterotrophic denitrifying microorganisms.
 - Sulfur-limestone/corallite reactor used to promote autotrophic denitrification from wastewater.
- With the increase in the culture of marine species and the focus on larvae and broodstock, the denitrifying biofiltration will take a more prominent position to increase water reuse rate.

- Integrating & optimizing of commercial RAS rearing **banded grouper (*Epinephelus awoara*)** based on queuing network approaches.
- Application of queuing network approaches would be particularly appropriate for RAS, where optimal design and management are crucial for success.



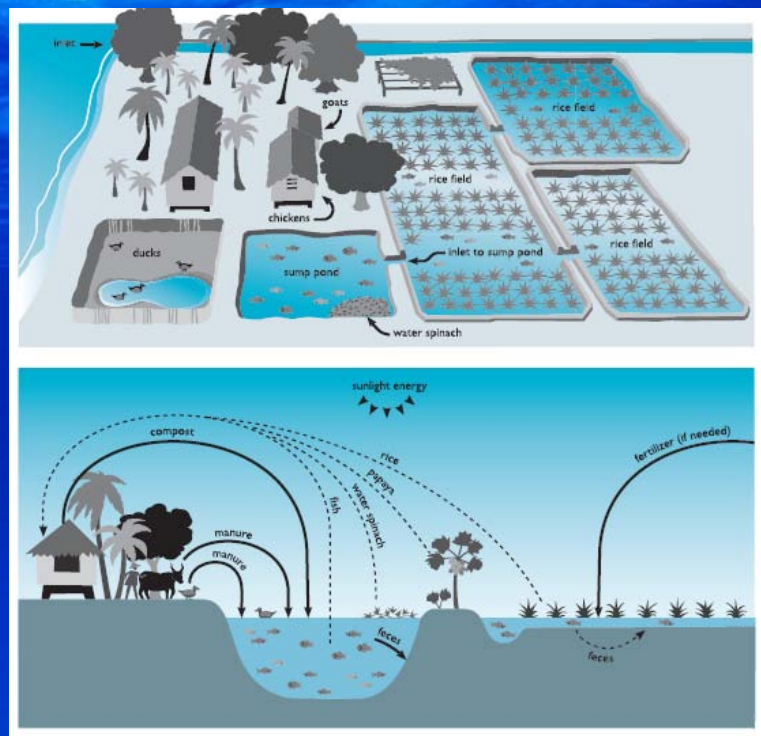
4. Aquaculture should be resource saving and environmentally friendly

- Ecological aquaculture focuses on the development of farming systems that preserve the environments in which they are situated and enhances the quality of these environments while at the same time maintaining a productive culture system.
- All aspects of the operation are interconnected in order to minimize negative impacts on the community, both natural and social.



4. Aquaculture should be resource saving and environmentally friendly

- In 2007, Shanghai has launched the construction of standard ecological aquaculture bases.
- as a means to transform its traditional aquaculture model.





- The base will form an ecological system, with **20 ponds** with distinct functions such as **seedling raising**, **prawn-farming**, a **fish pond** and **artificial wetland**.
- A **1200 hectares** ecological aquaculture area will be completed during the 11th five-year-plan period.
- **Shanghai will explore a low-cost and highly efficient way to popularize the application of aquaculture model.**





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Thank You

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