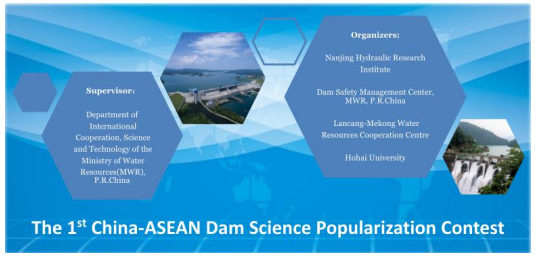

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The impacts of dam construction on fish and related measures

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1 Overview of dam construction

1.1 Definition of large dam

The definition given by the International Commission on Large Dams :

The height of dam is 15 m or more, or is 5~15 m and the storage capacity exceeds 3 million m^3.

According to this definition, there are 58,713 dams worldwide by 2020.

Top 5

- China: 23,481 dams
  Global contribution 40%
- America: 9263 dams
- India: 4407 dams
- Japan: 3130 dams
- Brazil: 1365 dams

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1 Overview of dam construction

1.2 Benefits of dams

Benefits

- Provide stable water supply for agricultural irrigation and drinking
- Hydropower ~ clean energy
- Flood regulation
- Improve navigation conditions

Dam construction can often meet multiple needs at the same time.

Such as the Three Gorges Dam

Until August 2020:

The cumulative total flood arrest exceeds 180 billion m^3;

The cumulative power generation reached 1354.1 billion kWh, which is equivalent to saving 430 million tons of standard coal and reducing carbon dioxide emissions by 1.169 billion tons.

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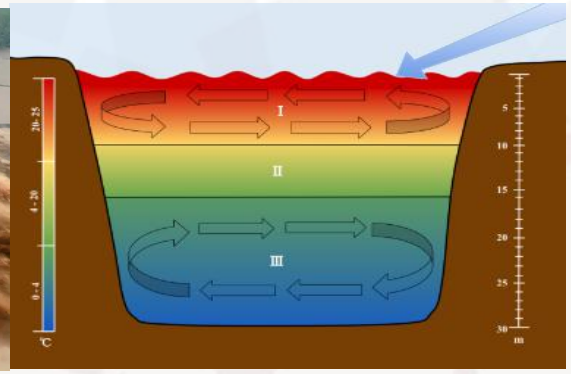
2 The impact of dam on fish

2.1 Impacts of dams on ecology and environment

The dam provides multiple benefits, but its impacts on the river ecology and environment have also attracted widespread attention.

Sediment deposition in upstream reservoirs



Temperature stratification in the reservoir

Cyanobacteria bloom in the reservoir

Downstream river erosion

The dam built on the river blocked the natural channel and changed the flow pattern of the river. This causes various changes in the hydrological characteristics of the upstream and downstream river, triggering a series of changes in ecological and environmental conditions, and these changes may have different effects on fish and their spawning, feeding and migration behaviors.

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2 The impact of dam on fish

2.2 The positive impacts on fish

After the dam is completed, the water velocity in the reservoir slows down. This will promote the sedimentation of suspended solids in the water body, thus **improving the water quality** and **optimizing the living environment** of fish.

Cyprinoid

The dam construction will create a reservoir habitat in the upstream rivers, and some fish that **adapt to deep and stable water conditions** will be actively developed, such as cyprinoid.

Artificial farming in reservoirs can also increase fish biomass. For example, after the completion of the Xin'anjiang Reservoir, the total amount of local fish catches increased by more than **300 times**.

Xin'anjiang Reservoir

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2 The impact of dam on fish

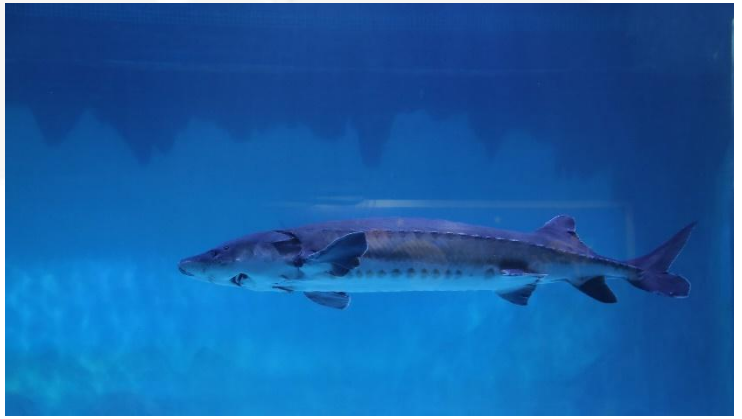
2.3 The negative impacts on fish ——the barrier of migration path

These are barriers that fish cannot overcome, including the high energy and high velocity of the water discharged from the reservoir, as well as the water level drop between the upstream and downstream of the dam, which has a blocking effect on the migratory fish in the river.

These have a huge impact on fish that need to be migrated on a large scale, such as the Chinese sturgeon.

At the same time, the dam will also affect the overall genetic diversity of upstream and downstream fish populations.

The high drop and the high-velocity discharge flow of the reservoir



Chinese Sturgeon

2 The impact of dam on fish

2.3 The negative impacts on fish——Habitat change

The process of turning a river into a reservoir has caused changes in fish habitats and even disappeared. Therefore, the composition and quantity of fish in the reservoir often change significantly, especially the disappearance of rare species.

Many changes

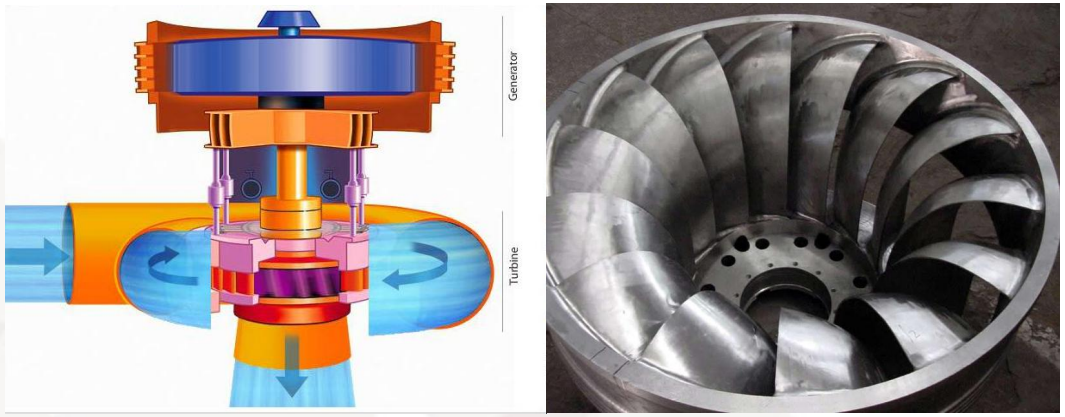
- **Water depth**
- **Water velocity**
- **Water temperature**
- **Water quality**
- **……**

2 The impact of dam on fish

2.3 The negative impacts on fish——Air bubble disease

When the fish pass through the spillway and the water turbine, they will be injured or killed by the impact of the high-pressure and high-speed water.

When water flows down from a high water level, a large amount of air will be mixed into the surface of the high-speed water flow, and the dissolved gas N_2, O_2, CO_2 in the water body are supersaturated. This will cause the fish living in the dam downstream to produce bubbles, and when the fish swim to shallow water, the fish will develop "bubble disease".



Water turbine and its blades

Air bubble disease

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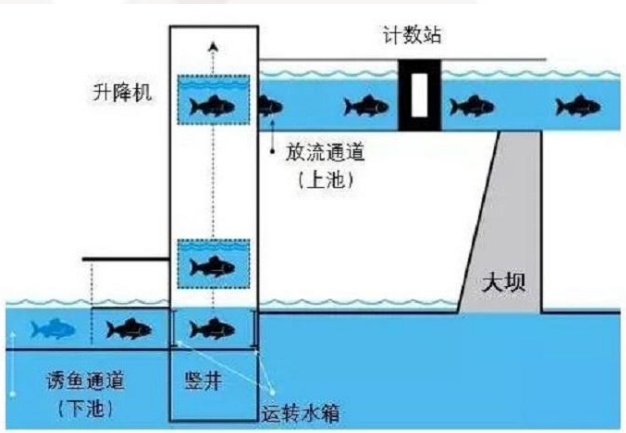
3 Related feasible measures

3.1 The fish-passing measures

The dam construction on the migration channels of rare and important fish requires fish-passing measures.
For dams with low water heads, it is advisable to build fish way, fish ladders and other permanent fish-passing structures.
For high-dam reservoirs, it is advisable to take effective measures such as fish lifts, fish pumps and fish-passing boats.

The fish way

The fish ladders



The fish lifts

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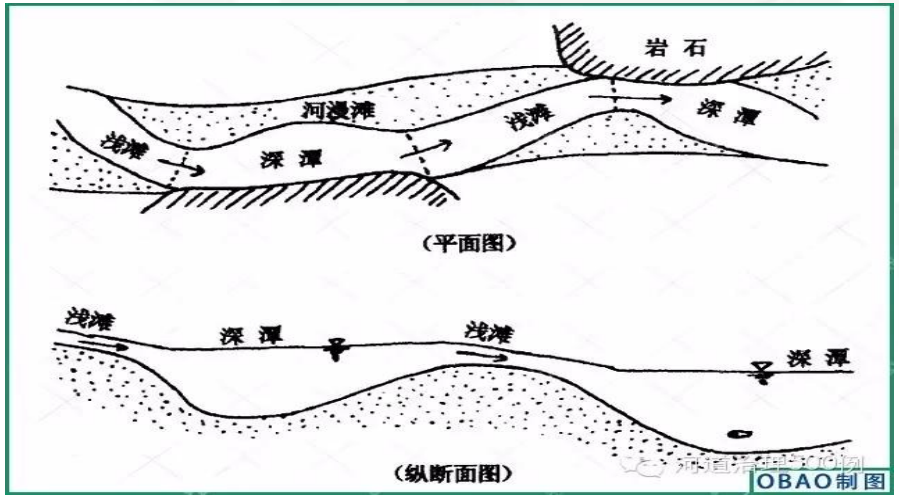
3 Related feasible measures

3.2 Improve the diversity and connectivity of fish habitats

The diversity of fishes is directly related to the diversity of their habitats. The higher the diversity of the habitat, the higher the biodiversity. The solutions should focus on improving the diversity of habitats:

1) **Increase the water surface area in river and riverside waters, and improve the connectivity of water bodies;**
2) **Increase waters with low velocity and different depths, such as harbors and lakes.**



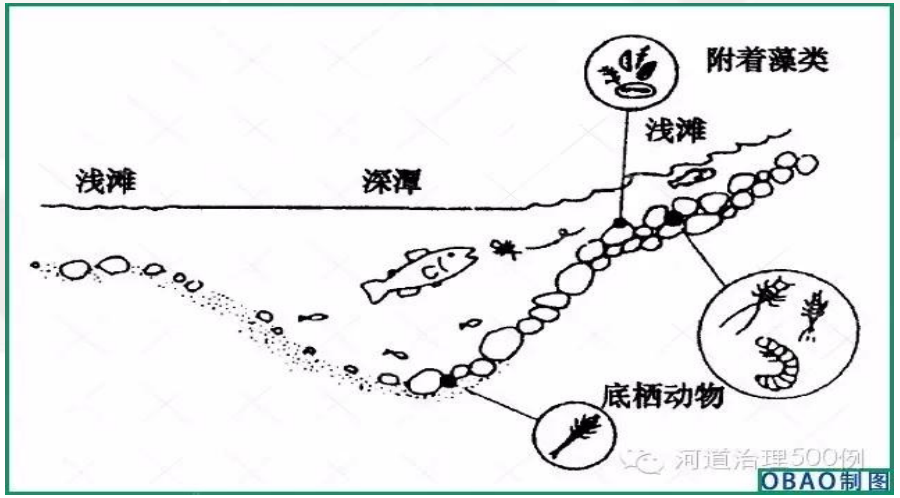
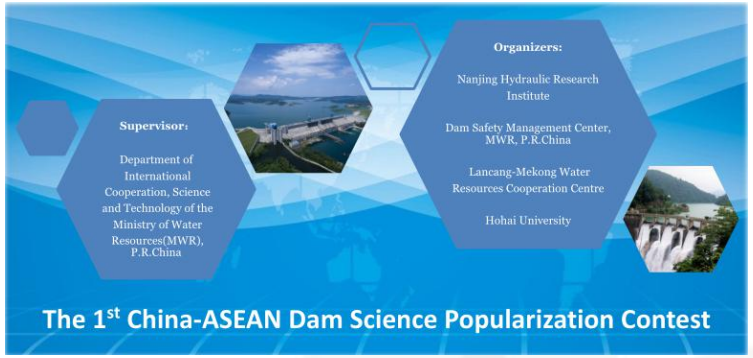


diagram of Pool-riffles distribution



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Thank you!