Add: No. 7 Donghu South Road, Wuhan, Hubei Province, P.R.C.
Tel: +86-27-68780839
http://english.ihb.cas.cn

INSTITUTE OF HYDROBIOLOGY,
CHINESE ACADEMY OF SCIENCES
AN OVERVIEW

IHB

Institute of Hydrobiology, Chinese Academy of Sciences (hereinafter referred to as "IHB") is China's sole comprehensive academic research institution dedicated to studying life processes of inland aquatic organisms, ecological environment protection, and the utilization of biological resources. Its origin traces back to the Natural History Museum founded in 1930 in Nanjing under the Academia Sinica. In 1934, it was reorganized into Institute of Zoology and Botany, which later was divided into separate Institute of Zoology and Institute of Botany in 1944.

Following the founding of the Chinese Academy of Sciences (CAS), IHB was officially formed in 1950 through the merger of the former Institute of Zoology of Academia Sinica, Institute of Zoology of National Academy of Peiping, and Division of Phycology of the Institute of Botany of Academia Sinica. Initially headquartered in Shanghai, IHB relocated to Wuhan in 1954.

In 2011, it was selected as a pilot institute for CAS's "Innovation 2020" initiative, a program aims to further promote innovation and turn scientific discoveries into technologies that power economic growth and sustainable development. Currently, IHB is designated as a "Feature Institute of Ecological Civilization" under CAS's "Pioneer Initiative" strategic plan, an action in response to the call of the Chinese government for deepening reform of China's S&T structure and mechanisms.

CORE VALUES

Innovation · Rigor · Collaboration · Perseverance

HISTORICAL DEVELOPMENT

1930

Evolved from Natural History Museum of Academia Sinica founded in Nanjing.

1934

Reorganized as Institute of Zoology and Botany of Academia Sinica in Nanjing.

1937

Moved from Nanjing to Nanyue in Hunan province, then to Yangshuo, Guangxi province.

1939

Moved to Beibei, Chongqing.

1944

Divided into two institutes under Academia Sinica - Institute of Zoology and Institute of Botany, in Beibei, Chongqing.

1950

February, IHB was established by merging the Institute of Zoology of Academia Sinica, Institute of Zoology of National Academy of Peiping, and Division of Phycology at Institute of Botany of Academia Sinica. Located in Shanghai, it was one of the first 15 institutes set up by the CAS.

August, IHB's Qingdao Laboratory of Marine Biology was established.

August, IHB's Taihu Laboratory of Freshwater Biology was established.

1951

IHB's Xiamen Laboratory of Marine Biology was established (cancelled in January 1953).

※(Illustrated by LIU Xin)

▲ Administration Building

▲ Research Building

▲ Research Building

▲ Museum of Hydrobiological Sciences

1954

January, IHB's Qingdao Laboratory of Marine Biology became an independent institution directly led by the CAS. It was renamed as Qingdao Laboratory of Marine Biology of the CAS, the predecessor of Institute of Oceanology of the CAS.

January, IHB's Taihu Laboratory of Freshwater Biolog was cancelled.

The end of 1954, IHB settled in Wuhan, Hubei province.

1958

Wuhan College of Fishery was jointly founded by IHB and Fisheries Bureau of Hubei Province under a cooperation agreement.

1971

Five IHB researchers, including YI Bolu, a well-known fish ecologist in China, were employed by the Huazhong Agricultural University (HZAU) and led the construction of the Department of Fisheries at HZAU (the predecessor of the College of Fisheries at HZAU).

1987

IHB's Laboratory of Reservoir Fisheries became an independent institution with the name of Institute of Reservoir Fisheries, Ministry of Water Resources & CAS.

2001

IHB entered the pilot project of the CAS Knowledge Innovation Program.

2011

IHB entered the pilot project of the CAS Innovation 2020 program.

2015

CAS Pioneer Initiative recognizes IHB as an institute featuring ecological civilization.

2018

The construction of IHB as an institute featuring ecological civilization passed CAS project acceptance.

▲ Main Campus

▲ Guanqiao Campus

▲ Liangzi Lake Research Center

CURRENT PERSONNEL STRUCTURE

418
Full-time Employees

366
Research and Technical Personnel

84
Professors and Other Senior Personnel of Equivalent Rank

101
Associate Professors and Other Personnel at Deputy Senior Rank

6
Members of the Chinese Academy of Sciences (CAS)

3
Fellows of The World Academy of Sciences (TWAS)

Current Leaders: MIAO Wei, XIE Shouqi, LIANG Qiong, XU Jun, and XU Zhen.

DISTINGUISHED SCHOLARS

DISTINGUISHED SCHOLARS

BING Zhi (Ping Chih)
1886-1965
CAS Member;Pioneer of modern biology in China, the founder of the first biology department in China, the founder of the first biological research institute in China, the founder of China Zoological Society, and the co-founder of the first Chinese scientific journal—Ke Xue (meaning 'Science' in Chinese). His many pioneer studies were carried out in vertebrate morphology, neurophysiology, fauna and taxonomy and paleontology. He worked at IHB during 1950-1955.

WANG Jiaji (Wang Chia Chi)
1898-1976
CAS Member; Pioneer of protozoology and rotiferology in China. He worked at IHB since 1930 and served as director of IHB during 1934 and 1976.

WU Xianwen (Wu Hsien Wen)
1900-1985
CAS Member; Pioneer of fish taxonomy, morphology, physiology and hydrobiology in China, and one of the founders of Chinese Society for Oceanology and Limnology. He worked at IHB since 1932, where he served as director during 1978 and 1983, and director emeritus during 1983 and 1985.

RAO Qinzhi (Jao Chin Chih)
1900-1998
Phycologist, limnologist and a pioneer of algal studies in China. He worked at IHB from 1936 to 1941 and continued to work here since 1950.He served as deputy director of IHB during 1961 and 1981.

TONG Dizhou (Tung Ti Chou)
1902-1979
CAS Member; Biologist, educator and one of the founding members of experimental embryology in China and a pioneer of marine sciences in China. He worked at IHB during 1950 and 1954 and served as deputy director of IHB during 1953 and 1954.

NI Dashu (Nie Dash; Nie D.S.)
1907-1992
Protozoologist and founder of ichthyopathology in China. He worked at IHB since 1934 and served as deputy director of IHB during 1980 and 1984.

ZENG Chengkui (Tseng C.K.)
1909-2005
CAS Member; Marine biologist and one of founders of phycology in China. He worked at IHB during 1950 and 1953.

LI Shanghao (Ley S.H)
1917-1993
CAS Member; Freshwater phycologist and a pioneer in establishing experimental freshwater phycology in China. He worked at IHB from 1943 to 1944 and continued to work here since 1950. He served as deputy director of IHB during 1980 and 1984.

LIU Jiankang (Liu C.K.)
1917-2017
CAS Member; Ichthyologist and freshwater ecologist, founder of freshwater ecology in China and a pioneer of fish experimental biology. He worked at IHB since 1941, where he served as director during 1983 and 1987, and director emeritus during 1987 and 2017.

LIU Ruiyu (Liu J.Y.)
1922-2012
CAS Member;Marine biologist and carcinologist, founder of marine benthic ecology and pioneer of carcinology in China. He worked at IHB during 1950 and 1953.

YIN Wenying (Wen-Ying Yin)
1922- 2023
CAS Member;Entomologist, a pioneer of systematics and evolution of protura in China, and a pioneer of the origin and evolution of hexapods in China. She worked at IHB during 1947 and 1962.

SHEN Yunfen
1933-2006
CAS Member; Protozoologist, a pioneer of protozoology in China, and one of the world leaders in establishing microbial community assessments. She worked at IHB since 1953.

RESEARCH STRUCTURE

Research Center for Aquatic Biodiversity and Eco-Environmental Conservation

- Research Division for Aquatic Biodiversity Conservation and Resources Utilization
- Research Division for Aquatic Ecology and Systematic Conservation
- Research Division for Water Environmental Science and Engineering

Research Center for Aquatic Genetic Innovation and Future Fishery Development

- Research Division for Gene Engineering and Breeding
- Research Division for Cell Engineering Breeding
- Research Division for Fish Anti-stress and Disease Prevention and Control
- Research Division for Aquaculture and Green Fisheries

Research Center for Algae and Smart Biosynthesis

- Research Division for Algal Resource Utilization and Ecological Risk Treatment
- Research Division for Synthetic Biology and Cell Factory

14 Research Innovation Platforms (National, Provincial, and Ministerial Levels)

- State Key Laboratory of Breeding Biotechnology and Sustainable Aquaculture
- State Key Laboratory of Lake and Watershed Science for Water Security (Participating Institution)
- National Aquatic Biological Resource Center:
  - China Zebrafish Resource Center
  - National Culture Collection of Algae and Protozoa
  - Yangtze River Fish Germplasm Resource Center
  - China Culture Collection of Aquatic Plants
  - Featured Aquatic Biological Resource Center
  - Yangtze Rare Aquatic Animal Resource Center
- National Research Center for Freshwater Fisheries Engineering
- National Engineering Laboratory for Lake Pollution Control and Ecological Restoration (Participating Institution)
- Key Laboratory of Algal Biology, Chinese Academy of Sciences
- Key Laboratory of Aquaculture Disease Control, Ministry of Agriculture and Rural Affairs
- Crucian Carp Genetics and Breeding Center, Ministry of Agriculture and Rural Affairs
- Research Center for Water Ecological Engineering Technology of Hubei Province
- Hubei Engineering Research Center for Aquatic Animal Nutrition and Feed
- Research Center for Integrated Rice Field Aquaculture Engineering of Hubei Province
- Engineering Technology Research Center for Aquatic Plant Resources and Utilization of Hubei Province
- Hubei Freshwater Fisheries Technology Innovation Center
- Hubei Key Laboratory of Smart Fisheries

4 Institute-level Supporting Platforms

- Analysis and Testing Center
- Center for Big Data and Artificial Intelligence in Aquatic Life Sciences
- Museum of Hydrobiological Sciences
- Baiji Dolphinarium

6 Field Stations (National, Provincial, and Ministerial Levels)

- Donghu Experimental Station of Lake Ecosystems
- Chishui River Observation and Research Station for Rare and Endemic Fish Conservation and Aquatic Biodiversity, Chinese Academy of Sciences
- Xiangxi River Ecosystem Research Station in the Three Gorges Reservoir Region, Chinese Academy of Sciences
- Qinghai Lake Observation and Research Station for Plateau Wetland Lake Ecosystems, Chinese Academy of Sciences
- Field Scientific Observation and Research Station of Hubei Province for the Lake Ecosystem of the Eastern Route of the South-to-North Water Diversion Project
- Dianchi Lake Ecosystem Observation and Research Station, Institute of Hydrobiology, Chinese Academy of Sciences

10 Affiliated Organizations

- The Division of Environmental Biology of the Chinese Society for Environmental Sciences
- Chinese Association for Aquatic Laboratory Animal Sciences
- Fish Disease Professional Committee of the Chinese Fisheries Society
- Chinese Protozoological Society
- China Zebrafish Society
- China Ichthyological Society
- Hubei Oceanography & Limnology Society
- Hubei and Wuhan Zoological Society
- Hubei Provincial Association for Fishery Science and Technology Popularization
- Wuhan Baiji Conservation Foundation

6 Administrative Offices

- Office of General Affairs
- Office of Party-Related Affairs
- Office of Research and Technology Development
- Office of Basic Science and Technology Capacity
- Office of Personnel and Talent Management
- Office of Finance and Accounting

3 Supporting Divisions

- Network Information Center
- Library
- *ACTA* and *WBS* Editorial Office

The former State Key Laboratory of Freshwater Ecology and Biotechnology (awarded "Excellent" status in four consecutive national evaluations) has been restructured into the State Key Laboratory of Aquatic Breeding and Sustainable Aquaculture.

The Donghu Experimental Station of Lake Ecosystems has been designated as a National Observation and Research Station.

The Museum of Hydrobiological Sciences has Asia's most comprehensive freshwater fish collection,

Baiji Dolphinarium is the world's only research base that successfully maintained the longest artificial rearing of a baiji and achieved the first complete artificial breeding of both first- and second-generations of Yangtze finless porpoises.

* Updated October 2026

INTERNATIONAL COOPERATION AND EXCHANGES

IHB has fostered extensive global engagement over the past decade

IHB Researchers Visiting Overseas

IHB researchers have undertaken over

800+ academic visits

30+ countries and regions

Visiting Overseas

Inbound Exchange

International Experts Visiting IHB

IHB has hosted more than

2,200 international experts

40+ countries and regions

As a core member, IHB participated in several international cooperative research projects, such as the U.S. National Science Foundation's Assembling the Tree of Life project, which aims to reconstruct the evolutionary origin of all living things. The institute also successfully organized the International Symposium on River and Lake Environments in 1996, 1998, 2004, 2012, and 2024. In 2025, it hosted the Ciliate Molecular Biology Meeting, marking the first time this prestigious meeting was held outside Europe or North America.

IHB has actively initiated and led international multilateral collaborations, including joint investigations of freshwater cetaceans and the multilateral cooperation project on the mechanisms of red tides and hypoxia as ecological marine disasters and technologies for its early warning along the "Belt and Road".

Additionally, it successfully conducted the CAS Science & Technology Training Program for Belt and Road Initiative and Developing Countries – 2024 International Workshop on Monitoring and Control of Harmful Algal Blooms, significantly enhancing personnel exchanges and scientific cooperation among BRI partner nations, particularly in Southeast Asia, in the field of harmful algal bloom research.

IHB successfully organized the International Symposium on River and Lake Environments in 1996, 1998, 2004, 2012, and 2024.

IHB signed a cooperation agreement with University of Ottawa in 2015.

British Princess Anne had an official visit to Baiji Dolphinarium in 2017.

IHB researchers participated in the multilateral cooperation project on the mechanisms of red tides and hypoxia as ecological marine disasters and technologies for its early warning along the "Belt and Road".

GRADUATE EDUCATION

IHB was among the first institutions authorized by the Academic Degrees Committee of the State Council to confer both doctoral and master's degrees. It maintains comprehensive academic programs, including:

6 Master Degree Programs:

- Zoology
- Hydrobiology
- Genetics
- Environmental Sciences
- Environmental Engineering
- Aquaculture

3 Postdoctoral Research Stations in

- Biology
- Environmental Science and Engineering
- Fisheries

2 Master of Engineering Degree Programs:

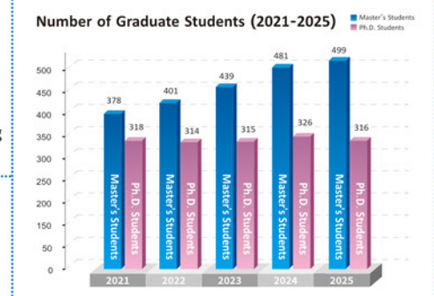
- Biology and Medicine
- Resources and Environment

4 Ph.D. Degree Programs:

- Hydrobiology
- Genetics
- Environmental Sciences
- Aquaculture

With a current enrollment of **790** students (including joint-training students).

Number of Graduate Students (2021-2025)



Graduation Ceremony

Graduate students participated in the Elite Challenge of Fisheries

Chinese and international graduate students actively participated in the Spring Festival couplets writing activity

RESEARCH PROJECTS AND AWARDS

Since the Establishment of IHB

200+ National, Provincial or Ministerial Awards

170+ Academic Monographs

9,000+ Papers

Recent 5-Year Highlights (2021-2025)

11 Academic Monographs

400 Patents Granted

2,183 Provincial/ ministerial-level awards

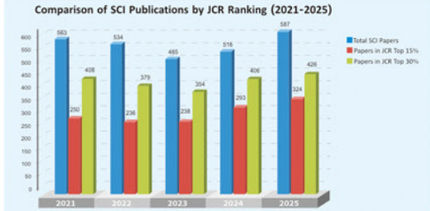
Including **1,385** SCI-Indexed

8 Provincial / ministerial-level awards

In recent years, IHB scientists have been leading a series of national key S&T projects:

- **National Science and Technology Major Project**
  - e.g., Major S&T Program for Water Pollution Control and Treatment
- **National Key Research and Development Program**
  - e.g., Blue Granary S&T Innovation Project, Synthetic Biology Project, Developmental Programming and Metabolic Regulation Project
- **National Natural Science Foundation of China Programs**
  - e.g., Science Fund for Creative Research Groups, Distinguished Young Scholars Fund, Excellent Young Scientists Fund, Major Research Plan and Key Program
- **CAS Strategic Priority Research Program**
- **Other important research programs supported by local governments, and large and medium-sized enterprises.**

Comparison of SCI Publications by JCR Ranking (2021-2025)



KEY ACHIEVEMENTS

IHB Lays Foundation for Hydrobiology in China

Since the 1930s, especially since IHB established the Taihu Laboratory of Freshwater Biology besides Lake Wuli - a shallow hypereutrophic bay of Lake Taihu, in 1951, IHB researchers have been conducting comprehensive investigations of the freshwater biological resources, which helped find out the biodiversity pattern of freshwater organisms in China for that period of time.

The Museum of Hydrobiological Sciences, established by the institute, houses a collection of 400,000 specimens ranging from algae, aquatic invertebrates, and aquatic mammals, with a large contribution from freshwater fish specimen. More than 10 monographs, compiled by IHB researchers, were published. These include *The Crprinoid Fishes of China(Vol I, II), Rotifera Sinicarum Aquae Dulcis, Monographia Oedogoniales Sinicae, Aquatic Invertebrates of the Tibetan Plateau, Fauna Sinica Invertebrata Vol. 45 Ciliophora Oligohymenophorea Peritrichida.*

In 2019, IHB led the establishment of the National Aquatic Biological Resource Center which is composed of six subsidiary platforms, including China Zebrafish Resource Center, National Culture Collection of Algae and Protozoa, Yangtze River Fish Germplasm Resource Center, China Culture Collection of Aquatic Plants, Featured Aquatic Biological Resource Center, and Yangtze Rare Aquatic Animal Resource Center. The center is among the 30 national biological resource and experimental material centers, and the largest aquatic biological resource center in the world.

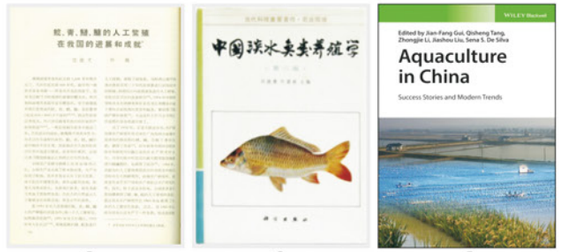
In the same year, IHB set up the Hydrobiological Data Analysis Center which aims to support the sample collection, species identification, data storage, data archiving and large-scale data analysis and management in aquatic resources investigation.

Based on its investigation of aquatic resources, IHB developed the theories and techniques of lake resources investigation. The book *Basic Guideline for Conducting Lake Survey*, published in 1956, is the first book on lake survey in China. Even now, it is still very helpful in guiding aquatic ecosystem protection and water resource environmental protection in China.

① ② ③ ④ ⑤ ⑥

① *Basic Guideline for Conducting Lake Survey*
② *The Crprinoid Fishes of China*
③ *Rotifera Sinicarum Aquae Dulcis*
④ *Monographia Oedogoniales Sinicae*
⑤ *Aquatic Invertebrates of the Tibetan Plateau*
⑥ *Fauna Sinica Invertebrata Vol. 45 Ciliophora Oligohymenophorea Peritrichida*

Theory and Technology Development of Freshwater Aquaculture in China



① ② ③

④ ⑤ ⑥

① The paper "Progress and Achievements in Artificial Reproduction of Four Major Domestic Carps in China", written by Prof. WU Xianwen from IHB and Professor ZHONG Lin from Chinese Academy of Fishery Sciences, was published in the *Chinese Science Bulletin* ('Ke Xue Tong Bao' in Chinese) in April, 1964
② *Cultivation of the Chinese Freshwater Fishes*
③ *Aquaculture in China: Success Stories and Modern Trends*
④ Wuchang fish (*Megalobrama amblycephala*)
⑤ Allogynogenetic gibel carp "CAS III"
⑥ Allogynogenetic gibel carp "CAS V"

Since the 1950s, IHB scientists and engineers have devoted to the theoretic and technological studies of freshwater aquaculture. A series of theories and technologies on the genetic breeding of aquaculture species, artificial propagation, high-yield technology used in ponds and lakes, disease control, healthy and high efficient aquaculture patterns, integrated rice-fish farming systems, and modern ecological fishery have been developed.

Collaborating with a bunch of domestic scientists in China, IHB researchers made significant theoretic and technological breakthroughs in the artificial reproduction of "four major domestic carps" in China. They systematically conducted biological research on Wuchang fish (*Megalobrama amblycephala*), and successfully realized their artificial reproduction and aquaculture.

IHB researchers successively bred several novel allogynogenetic gibel carp varieties, including the allogynogenetic gibel carp, high dorsal allogynogenetic gibel carp, allogynogenetic gibel carp "CAS III" and "CAS V". In 1985, IHB's project "Applied research of allogynogenetic gibel carp" was awarded the second prize of National S&T Progress Award. In 1995, the project "Developmental mechanism of natural gynogenesis in gibel carps" was awarded the second prize of National Natural Science Award. In 2011, the project "Studies on genetic basis of unique dual modes of unisexual and sexual reproduction in polyploid *Carassius auratus* gibelio", was granted with the second prize of National Natural Science Award.

In 1961, the book *Cultivation of the Chinese Freshwater Fishes, written by* IHB scientists, was published. This book is the bible of freshwater aquaculture in China. The second and third editions of the book were published in 1973 and 1992, respectively.

China is the world's largest aquaculture country. Its output of aquaculture, most of which is freshwater aquaculture, accounts for 63% of the world total. IHB's project "Study on the mechanism of fish bioenergetics" was awarded the third prize of the 1998 National Natural Science Award. The project "The comprehensive technical research of high fishery production in small macrophyte lakes" and the project "Fisheries resource management and profitable fisheries models in mid-lower Yangtze lakes" were awarded the second prizes of the 1997 and 2005 National S&T Progress Award, respectively.

In 2018, IHB led the compilation of the book *Aquaculture in China: Success Stories and Modern Trends* which was published by the world famous publisher Wiley Blackwell in English. This is the first comprehensive book that systematically introduces the theory and technology of aquaculture in China, and leads the world's technology and practice of freshwater aquaculture.

Tibetan Plateau Scientific Expedition and Research

In 1974, IHB researchers participated in the scientific expedition of the Yarlung Zangbo Grand Canyon in Tibet

IHB researchers have participated in the Tibetan Plateau Scientific Expedition and Research for multiple times.

The *Triplophysa stoliczkae*, captured by IHB researchers at an altitude of 5,200 meters, is the fish species with the world's highest distribution and has been widely cited in ichthyology textbooks.

IHB researchers also proposed the innovative assumption that the Qinghai-Tibetan Plateau had undergone three major rise phases with alternation between violent uplift and relatively stable stage since the late Tertiary.

This assumption, based on the origin and evolution of Schizothoracine fishes, was proposed when there was still a lack of in-depth knowledge on the rise history of the Qinghai-Tibetan Plateau. It was subsequently verified by the findings from geologists.

IHB's relevant achievements were awarded with the special prize of the 1986 CAS S&T Progress Award, and first prize of the 1989 Natural Science Award presented by the State Scientific and Technological Commission (predecessor of the Ministry of Science and Technology).

Prof. CAO Wenxuan (right) and Prof. CHEN Yiyu discussed the origin and evolution of Schizothoracinae in relation to the uplift of the Qinghai-Tibetan Plateau

Ecology and Protection of Yangtze River Basin

Since the 1950s, IHB has conducted systematic and in-depth studies on the ecology of the Yangtze River Basin, the effects of water conservancy projects on watershed ecological environment, and the conservation of rare and endemic aquatic biological resources. Their relevant achievements provide important scientific support for the state pivotal decision making.

Yangtze finless porpoises

In response to the depleting biological resources and degrading biodiversity in the Yangtze River, IHB researchers proposed, for the first time, that "a long-term fishing ban, preferably 10 years, shall be imposed on the Yangtze River", and actively engaged in the planning of the scientific practice for the fishing moratorium move. The ten-year fishing ban has been launched as one of the major national strategies to protect the ecology of the Yangtze River.

In addition, IHB's suggestion on the establishment of the Chishui River National Natural Reserve was adopted and launched by the state, keeping the river as the only first-order river of the upper Yangtze River that had no dams and still maintained its natural flow. With less human activities, the ecosystem of Chishui River Basin remains intact and healthy, thus providing important habitats and spawning grounds for the rare and endemic fishes living in the upper reaches of the Yangtze River.

The Yangtze River dolphin (also known as *Baiji*) and Yangtze finless porpoise are two endangered aquatic mammals live only in China's Yangtze River.

Since 1978, IHB researchers have been conducting systematic and comprehensive researches on the cetaceans. They established the theory of *ex-situ* conservation of endangered small cetaceans, built the technological systems for survey, *ex-situ* conservation and breeding protection of the Yangtze finless porpoise, thus made the species successfully protected in *ex-situ* reserves.

Yangtze River dolphin

During 1980 and 2002, Qi-Qi, the world's only captive Baiji, had been reared at IHB for over 22 years. Since the 1990s, in collaboration with Tian-e-zhou Baiji National Natural Reserve, IHB has successfully conducted the *ex-situ* conservation of the porpoise. In 2005, the world's first Yangtze finless porpoise was successfully bred in captivity at IHB, indicating a new era for the captive breeding of the porpoise.

The *ex-situ* conservation of the porpoise is now an exemplar for the international conservation of the endangered cetaceans and is being promoted to different areas of the world. The "Action Plan for Saving the Yangtze Finless Porpoise", submitted by IHB in 2016, becomes China's guideline on the conservation of Yangtze finless porpoise for the next decade.

IHB's researches on the rearing of Yangtze River cetaceans, their population status, species conservation and *ex-situ* conservation were respectively awarded the S&T Progress Awards at the academy, provincial and state levels.

World's First Somatic Cell Nuclear Transplant Fish and World's First Transgenic Fish

World's first somatic cell nuclear transplant fish

In the early 1980s, by means of the serial nuclear transplantation technique, IHB scientists transferred a short-term cultured kidney cell nucleus of triploid crucian carp into the enucleated oocytes of diploid crucian carp and obtained the first sexually matured somatic cell nuclear transplant fish. This is the world's first evidence that the differentiated somatic cells of vertebrates retain developmental totipotency and are able to undergo dedifferentiating and reprogramming. This cloned fish, bred by IHB, was born some 10 years earlier than Dolly, the world's first somatic cell cloned sheep that was born in the UK.

In 1985, IHB researchers conducted the world's first successful transgenic study with agronomic traits and reported the first successful gene transfer in fish. A complete theoretical model of transgenic fish was then built up, leading to a new research era of fish gene-engineered breeding. IHB's relevant studies have been at the forefront of the world.

In recent years, IHB researchers generated the champion carp which grows fast and the sterile triploid carp which has a broad potential for breeding promotion. With more experiments conducted and more detailed data collected, IHB's studies on the evaluation of the potential ecological risks posed by the champion fish, and its reproductive containment strategies and aquaculture pattern are more advanced than the United States, and are widely acknowledged by the international peers.

IHB generated the world's first transgenic fish and participated in the generation of nuclear transferred fish led by Prof. TONG Dizhou, one of the founding members of experimental embryology in China. These two achievements were cited *by The Timetables of Science: A Chronology of the Most Important People and Events in the History of Science* (edited by A. Hellemans & B. Bunch, 1991, publisher: Simon & Schuster) as two significant research achievements of China in the 20th century.

Champion carp (all-fish *gh*-transgenic common carp) and control carp (8 months old)

Environmental Management and Ecological Restoration of Lakes

IHB has developed key technologies in ecological restoration and water environmental protections in lakes, such as techniques for the assessment of ecological health status of lakes, relevant skills for the transplantation of submersed macrophytes and the reform of community structure of submersed vegetation, adjustment of fish assemblage with aims to control algal bloom, and equipment for removal of algal scum. These technologies and skills were used in a 10 km^2 area and whole lake in Lake Erhai in Yunnan province and had achieved great successes, where Chinese President XI Jinping had visited in January 2015 and stressed the importance of improving the ecological and environmental quality of the lake.

President XI Jinping inspected Lake Erhai

Experimental project of aquatic vegetation restoration in Lake Erhai

IHB developed key technologies in physicochemical-biological-ecological multi-cooperation deep purification, improvement of substrate with ecological base, *in situ* restoration of composite functional materials and submerged plants, and successfully applied the technologies to the ecological restoration project of the West Lake in Hangzhou, Zhejiang province. IHB researchers reconstructed the stable submerged plant complex community which helped form an underwater forest with an average coverage of 32.9% and increased the biodiversity by 67%. These achievements pushed forward the process of the West Lake being inscribed on the World Heritage List, and ensured the water environment safety and embellished the water landscaping of the G20 Summit which was held in Hangzhou in 2016. Media like Xinhua News, People.com, CCTV ran features on the achievements.

Demonstration project of aquatic plant community optimization and water ecological restoration in West Lake, Hangzhou, Zhejiang province.

Mechanism Underlying the Outbreak of Cyanobacterial Blooms and Their Control Theory

① ② ③ ④ ⑤

① "Mechanism Study of Lake Eutrophication Process and the Outbreak of Cyanobacterial Blooms" was awarded the first prize of the National Environmental Protection S&T Award
② Productivity Control on Cyanobacterial Bloom in the Hyper-eutrophic Water Bodies
③ The monograph *A Historical Study of Lake Chaohu*
④ Standard for the determination of microcystins in Aquatic Products
⑤ Standard for the determination of microcystins in water

Based on the strong background in the study of classification, physiology, ecology and molecular biology of cyanobacteria in IHB, researchers took the initiative in conducting the nationwide investigation and studies of cyanobacterial blooms and cyanobacterial toxins since the 1980s.

Subsequently, they coordinated the key projects "Mechanism Study of Lake Eutrophication Process and the Outbreak of Cyanobacterial Blooms" and "Mechanism Study of the outbreak of cyanobacterial blooms in large and medium-sized shallow lakes" supported by the National Basic Research Program of China (973 Program), in which the spatio-temporal pattern of cyanobacterial blooms, as well as the driving forces governing the succession of dominant cyanobacteria in the large and medium-sized lakes has been elucidated.

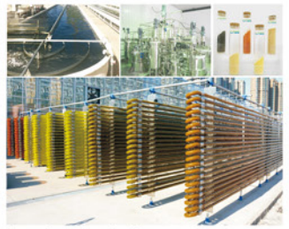
They revealed the mechanism of cyanobacterial bloom occurrence and dominance maintenance in Lake Dianchi and other lakes, thus helped for nutrient threshold determination for lake management and the prediction and early warning of cyanobacterial blooms of major lakes in China.

Both the non-classical bio-manipulation theory of controlling the cyanobacterial blooms and the technological principles of regulating primary productivity, proposed by IHB researchers, have been promoted to the whole nation, and guided the treatment of eutrophicated lakes and reservoirs and the control of cyanobacterial blooms in China.

One of IHB's relevant achievements was awarded the first prize of the National Environmental Protection S&T Award. In addition to over 100 papers published by IHB researchers in this area, three monographs and two national standards that specify requirements for the determination of microcystins in water and aquatic products were also published.

At present, IHB's studies in cyanobacterial blooms and cyanobacterial toxins are at the forefront of the world.

Algal Biotechnology Development and Biological Soil Crusts for Restoration of Desertified Land



A novel tubular photobioreactor for mass culture of microalgae

IHB researchers carried out innovative researches on the fundamental biology of microalgae as well as paradigm-shift technologies development, with the aim to accelerate the commercialization of algal potentials. They developed a series of products, technologies and processes with independent intellectual property and provided technical supports for IP transfer and industrialization. The key R&D areas include molecular and cellular mechanisms of oil and carotenoids biosynthesis, strain development, photobioreactor design, mass cultivation technology, crop protection, products extraction and processing, techno-economic and life cycle analysis.

After large-scale culture of excellent sand-fixing algal species, IHB researchers re-inoculated the species to the surface of drifting sand dunes and they rapidly developed into biological soil crusts composed of algae, bacteria, fungi, lichens, bryophyte and their secretions and soil. This technology has been demonstrated and promoted in about 3,330 ha of different dry lands in N China's Inner Mongolia, and boosted ecological, economic and social benefits.

Before cyanobacteria inoculation

After restoration with BSC