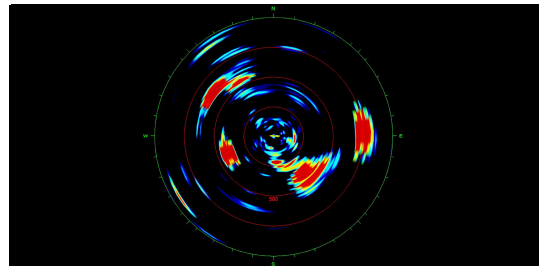
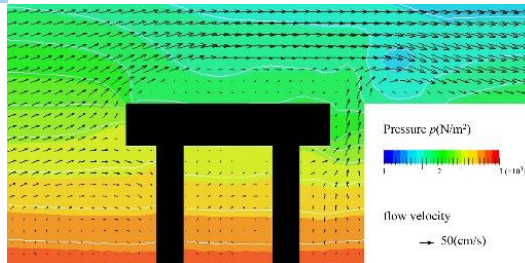
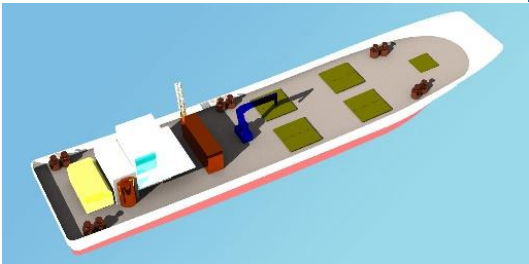


Kamisu Field Station and Tateyama Mooring



Fisheries Engineering,
Kamisu Branch and Taka-maru,
Japan Fisheries Research and Education Agency



Kamisu Field Station

The former National Research Institute of Fisheries Engineering (NRIFE), which has conducted research and development for over 45 years in Hasaki (Kamisu City, Ibaraki Prefecture), has been renamed the Fisheries Engineering Division under the Fisheries Technology Institute. This change occurred during the 2020 organizational restructuring of the Japan Fisheries Research and Education Agency (FRA). At our Kamisu Field Station, we continue to promote engineering research and technological development to secure a stable supply of marine products and develop healthy fishery industries.

The Fisheries Infrastructure Group focuses on research on advanced design and maintenance methods for fishing port facilities to protect lives and livelihoods from natural disasters, and support for fishing ground development through studies of ecosystem structures formed around artificial reefs and other marine structures.

The Ecological Engineering Group focuses on development of technologies for monitoring organisms and marine environments in seagrass beds and tidal flats using emerging technologies such as environmental DNA (eDNA), and for conserving and restoring fishing grounds to create highly productive habitats

The Fisheries Technology Group focuses on research and development of next-generation fishing vessels and fishery production systems using robotics, renewable energy, and related technologies, together with fisheries systems research to identify effective combinations of these technologies.

The Advanced Survey Technologies Group focuses on research on fisheries resource surveys targeting not only fish but also their prey, such as zooplankton; development of measurement methods using advanced acoustic technologies and survey techniques using omnidirectional sonar; and related research on fishing gear and fishing methods.

We will continue to contribute to the sustainable development of Japanese fisheries and strengthen Japan's position as a leading fishing nation through our engineering research approaches.



Main office of Kamisu Field Station

Fisheries Research Vessel “Taka-maru”

The research vessel Taka-maru serves the Fisheries Engineering Division by conducting studies in the coastal waters and adjacent areas of the Kanto region. The vessel supports research activities, including experiments for enhancing fishing vessel safety and operational efficiency, marine environmental studies, testing of fisheries acoustic devices, evaluation of trawl gear performance, monitoring of bivalve planktonic larvae, and assessment of radionuclide contamination.



Tateyama Mooring

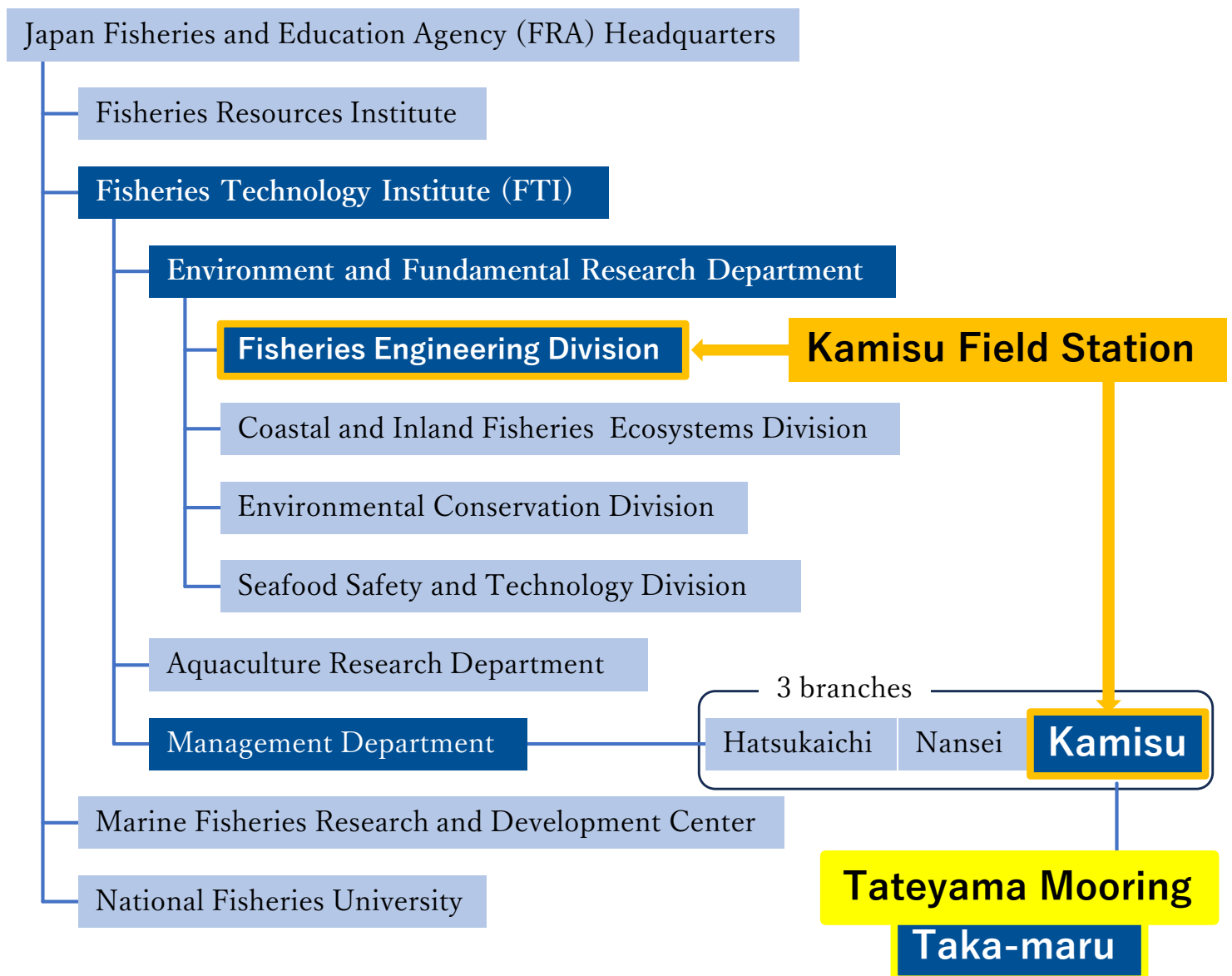


Principal specifications of Taka-maru

Built:	March 22, 1995	Speed, cruising:	12 knots
Length:	29.5 m	Accommodation:	10 persons
Beam:	5.2 m		
Gross tonnage:	61 tons		

Organization

FRA consists of four institutes, including the Fisheries Technology Institute (FTI). The FTI is divided into three departments. The **Kamisu Field Station** houses the **Fisheries Engineering division**, a part of the Environment and Fisheries Applied Techniques Research Department, which includes a director, deputy director, and researchers. Additionally, the **Kamisu branch** of the FTI Management Department is established at the **Kamisu Field Station**. This branch oversees both the fisheries research vessel “**Taka-maru**” and the **Tateyama mooring facility**.



History

- 1979 NRIFE was established as an affiliated institute of the Fisheries Agency of Japan with the following organizational structure:
- | | |
|---|-------------------------------------|
| The General Affairs Section: | Hasaki (Current location) |
| Aquaculture and Fishing Port Engineering Division: | Hiratsuka (moved to Hasaki at 1980) |
| Fishing Boat and Instrument Division: | Tokyo (moved to Hasaki at 1993) |
| Fishing Gear and Methods Division: | Tokyo (moved to Hasaki at 1993) |
| Fisheries research vessel “Taka-maru”: | Tokyo (moved to Tateyama at 1993) |
- 1992 Tateyama Seaside Facility was established as the operation base of **“Taka-maru”**
- 1998 **Fishing Boat and Instrument Division** and **Fishing Gear and Methods Division** were reorganized into two divisions: **Fishing Technology Division** and **Fisheries Information Science Division**
- 2001 NRIFE was incorporated into the Japan Fisheries Research Agency (FRA)
- 2009 **Fishing Technology Division** and **Fisheries Information Science Division** were merged to form the **Fishing Technology and Information Science Division**, and the **Research Center for Fisheries System Engineering** was established
- 2011 **Fishing Technology and Information Science Division** was reorganized to become the **Fisheries Technology Division**
- 2016 FRA was incorporated into the Japan Fisheries Research and Education Agency, retaining its original abbreviation, FRA
- 2020 Reorganization of FRA
- The research activities of the NRIFE were transferred to the **Fisheries Engineering Division** of the Fisheries Technology Institute (FTI).
- Responsibilities of the **Project Management Division** were assumed by the **Kamisu branch of FTI’s Management Department**, which now oversees both the and research vessel **“Taka-maru”** and Tateyama Mooring Facility.

Facilities

The Fisheries Engineering Division conducts various experiments using advanced research facilities in the Kamisu Field Station of the Japan Fisheries Research and Education Agency to support the sound development of the fisheries industry in Japan.

① Soils and foundations lab

This laboratory conducts experiments to investigate ground bearing forces and the strength of soils and rubble materials, supporting the development of new fishing port structures.

② Coastal wave test basin

Hydraulic model experiments are conducted to evaluate fishing port safety designs and ship maneuverability. The facility features a large water tank, measuring 60 m in length and 40m in width, capable of generating three-dimensional irregular wave patterns that simulate real sea conditions.

③ Fishing port hydraulics lab

Hydraulic model experiments are conducted to evaluate the stability and functionality of breakwaters and seawalls protecting fishing ports and villages. Two 100 m waterways are used to simulate irregular ocean waves and tsunami conditions.

④ Acoustic experiment tank

Acoustic scattering properties of fish and zooplankton can be measured in a spherical wave tank and an anechoic tank, respectively. Calibrations of acoustic instruments and preliminary tests before surveys can be performed in these tanks.

⑥ Aquacultural environment lab

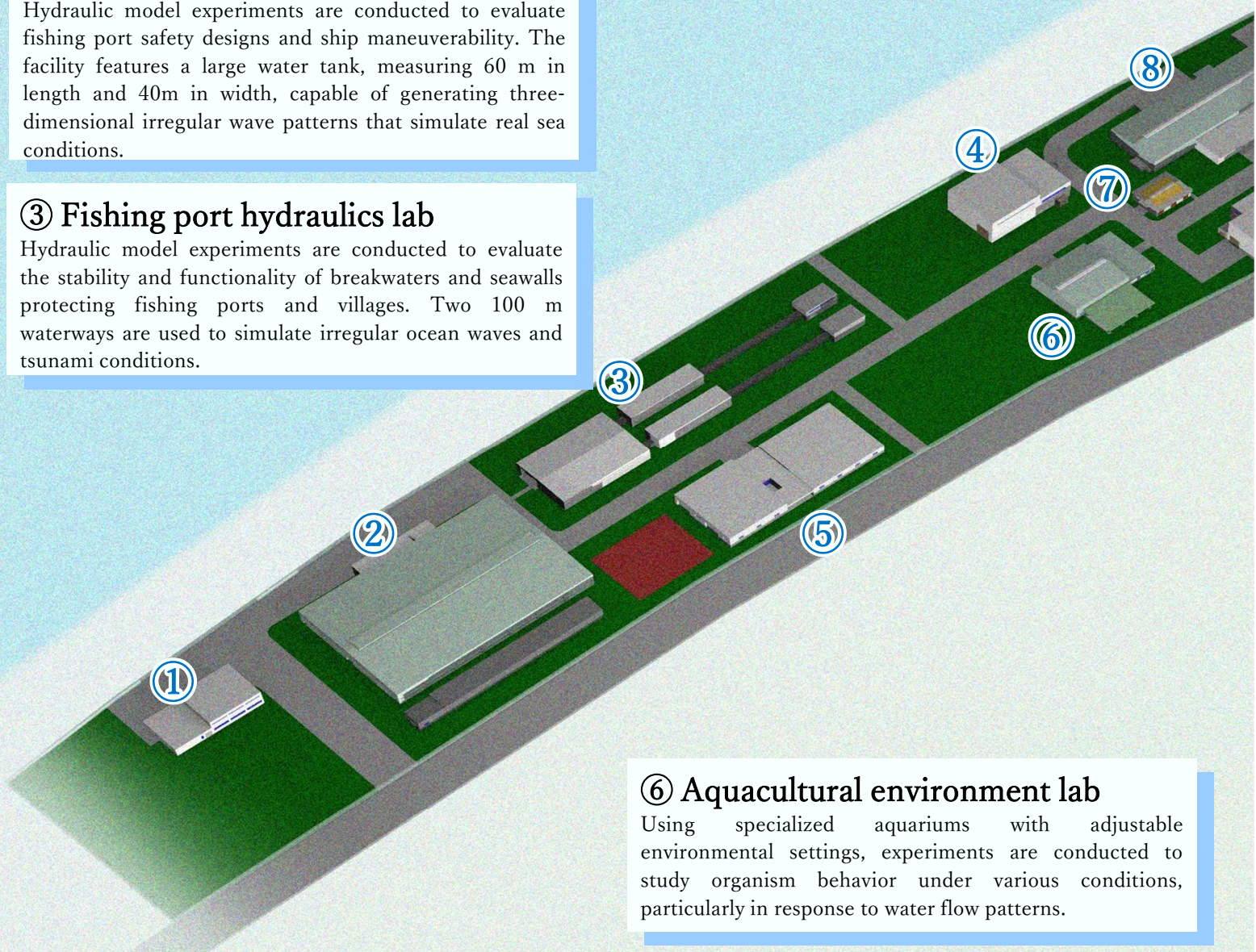
Using specialized aquariums with adjustable environmental settings, experiments are conducted to study organism behavior under various conditions, particularly in response to water flow patterns.

⑤ Fishery material lab

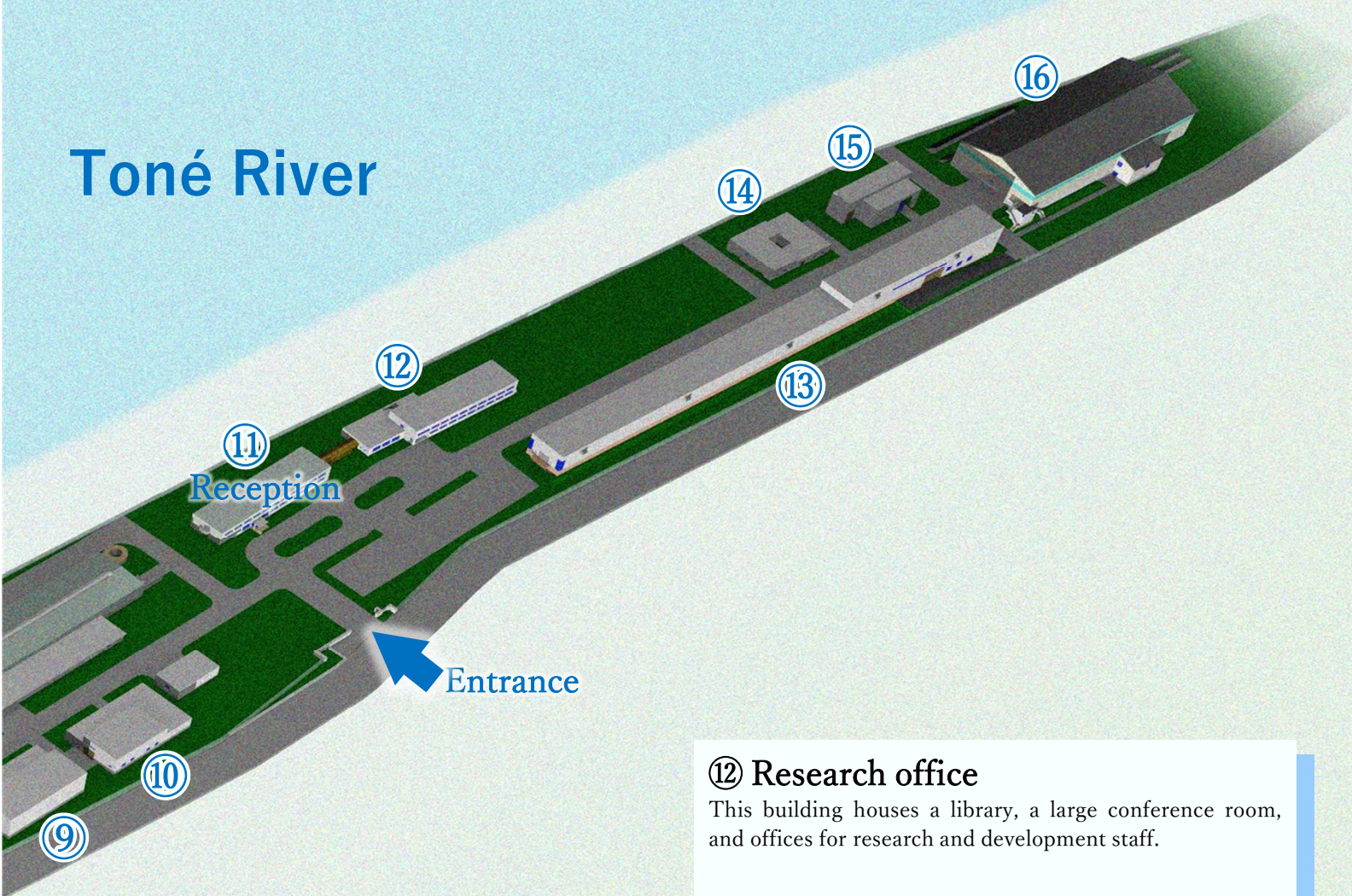
This facility supports the development of prototype fishing gear for research use and handles the adjustment and preparation of various research equipment.

⑦ Sunlight breeding lab

This animal research facility features translucent roof windows that allow natural sunlight to enter, creating natural environment conditions for raising animals and conducting experiments.



Toné River



⑧ Aquacultural hydraulics lab

(Tidal flat environmental experiment facility)

Experiments are conducted to study the relationship between organisms and their environments by simulating waves and currents that affect tidal flats and aquaculture facilities, including artificial fish reefs.

⑨ Fish behavior lab

Fish behavior in response to fishing gear is studied in a large seawater tank. Additionally, a circulating water tank is used to test the swimming capabilities of aquatic organisms.

⑩ Optics and radio wave lab

Fish swim bladder shapes, which are crucial for determining acoustic characteristics used in biomass estimation, are precisely measured using X-ray imaging device.

⑪ Main office

This building, located at the main entrance, houses the Kamisu branch director's office, administrative staff offices, and research and development workspaces. The visitor reception area is also located here.

⑫ Research office

This building houses a library, a large conference room, and offices for research and development staff.

⑬ Towing tank

New fishing vessel designs are developed to minimize hull resistance against various forces while maximizing fuel efficiency. These forces are measured by towing scale models of fishing vessels in a 137m-long water tank.

⑭ Engine and machinery lab

The performance of fishing vessel engines, fishing machinery, and aquaculture facilities is evaluated using test engines and a motion simulation platform that replicates ship movements.

⑮ Circulating water channel

Performance of fishing vessel hull designs and fishing gear is examined. This channel generates stable, uniform water flow, enabling precise measurements of water flow patterns around vessel models.

⑯ Marine dynamics basin

Scale model experiments are conducted to analyze vessel stability and determine conditions that may lead to capsizing. The large water tank features a wave generator capable of simulating realistic ocean wave patterns.

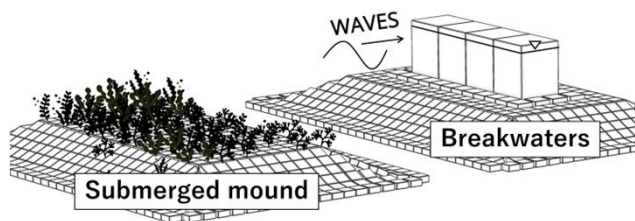
Fisheries Infrastructure Group

We advance design methods for fishing port facilities, including breakwaters and seawalls, to ensure their safety against earthquakes, waves, and tsunamis, and quantitatively evaluate the fishing-ground enhancement functions of artificial reefs and other fishing ground facilities through field observations and laboratory experiments.

Topics

Development of Breakwaters for Climate Change Adaptation

In recent years, rising sea levels and stronger typhoons associated with climate change have increased wave loads on coastal structures, raising concerns about the safety of breakwaters in fishing ports. To address these challenges, we combine hydraulic model experiments, numerical simulations, and field observations to develop innovative breakwater structures and reinforcement methods that enhance their performance. Our goal is to ensure that fishing port facilities remain functional and resilient under increasingly severe ocean conditions in the future.



A breakwater with a submerged mound is an innovative coastal structure that effectively dissipates wave energy by breaking waves over a submerged mound installed offshore of an existing breakwater. Its performance can be flexibly enhanced by adjusting the mound height, making it applicable to the upgrading of existing facilities. In addition, it can contribute to environmental conservation by promoting seaweed growth, offering a promising approach that combines disaster prevention with environmental sustainability.

Evaluation of the Fishing-Ground Enhancement Functions of Artificial Reefs

Artificial reefs have been widely used in Japan to create and enhance fishing grounds. However, conventional survey methods face technical challenges: underwater visual observations require substantial effort, while acoustic surveys have limitations in species identification. To address these issues, we are developing efficient evaluation methods using emerging technologies such as underwater drones and artificial intelligence (AI).

Right image: Fish around an artificial reef captured by an underwater drone. Image analysis and environmental data are used to evaluate reef effects and investigate the mechanisms of fish aggregation.

Upper-left image: Underwater drone used in field surveys.



Ecological Engineering Group

The Ecological Engineering Group uses advanced techniques such as environmental DNA (eDNA) analysis, which detects DNA present in seawater; population genetic analysis, which examines the genetic characteristics of organisms; and gene expression analysis, which investigates the activity of genes involved in biological processes such as digestion and immunity. Using these techniques, we study the mechanisms underlying the formation and maintenance of coastal fishing grounds, including seagrass beds, tidal flats, and rocky reefs. Environmental DNA analysis enables us to efficiently identify the biological communities inhabiting a given marine area. Population genetic analysis helps reveal where fish and shellfish originate, how they migrate, and how populations are connected among different marine areas. Through these studies, we aim to better understand the ecology of coastal organisms and develop methods for assessing coastal fishing grounds.

Topics

Gene expression-based assessment of nutritional status and food availability in Manila clams

In recent years, Manila clam populations have declined throughout Japan. Possible causes include decreases in the abundance of phytoplankton, which serve as food for Manila clams, as well as changes in phytoplankton species composition.

Manila clams are particularly vulnerable to starvation during the early post-settlement and juvenile stages. Even a slight shortage of food may substantially affect their growth and survival. Currently, marine food availability is commonly assessed using chlorophyll *a* concentrations as an indicator of total phytoplankton abundance. However, this approach does not adequately evaluate the species and sizes of phytoplankton suitable as food for Manila clams.

In this study, we examine changes in gene expression in Manila clams under starvation conditions. By clarifying their physiological responses to food shortages, we are developing new indicators for assessing their nutritional status. We ultimately aim to apply these findings to develop a new method for evaluating food availability in marine environments more accurately.



Fisheries Technology Group

To realize sustainable, safe, and profitable fisheries, this group conducts research and development on next-generation fishing vessels and fishery production systems using robotics, AI, model experiments, and renewable energy technologies.

In addition, the group conducts fisheries systems engineering research to identify optimal combinations of related technologies and evaluate the impacts of different implementation approaches.

Topics

Production Systems for Future Fisheries

Our research aims to improve the safety, productivity, and sustainability of fishing vessels and aquaculture systems using AI, digital technologies, and next-generation energy sources. We are working on projects such as hydrogen fuel cell-powered fishing vessels, safe and autonomous navigation technologies, and the advancement of fisheries and aquaculture using digital twin technology, with the goal of realizing innovative production systems for the future fisheries industry.

Development of a Hydrogen Fuel Cell-Powered Fishing Vessel



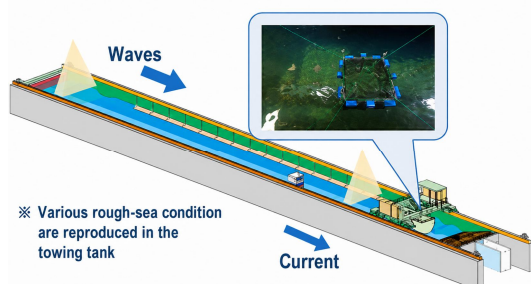
To achieve carbon neutrality, we are demonstrating a hydrogen fuel cell-powered fishing vessel, evaluating safety and operational performance, and developing next-generation fishing systems.

Development of Technologies to Enhance Fishing Vessel Safety



Through model experiments and accident analysis, we are developing design and operational technologies for safety of fishing vessels by incorporating based on Physical AI-based autonomous navigation technologies.

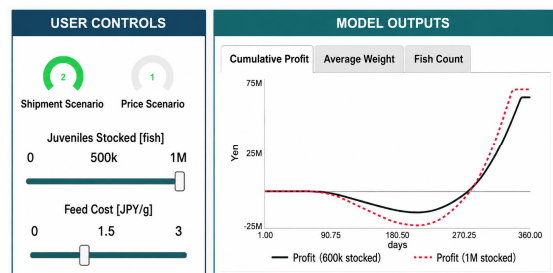
Development of an AI Model for Optimizing Fish Cages Placement



※ Various rough-sea condition are reproduced in the towing tank

We are researching AI models that accurately predict and control cage motion and identify optimal cage locations, thereby reducing the risks of damage caused by waves.

Development of Digital Twin Technology for the Fishing and Aquaculture Industries



By leveraging digital twin technology, we enhance decision-making for shipment strategies and production planning, helping to stabilize the fisheries industry, improve productivity, and encourage new entrants.

Advanced Survey Technologies Group

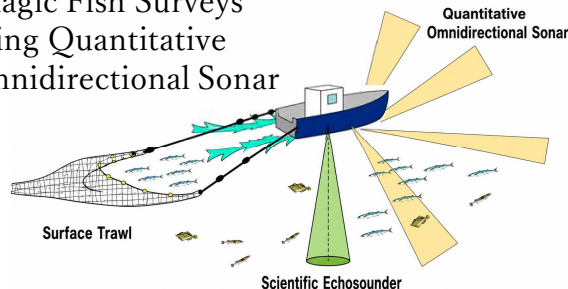
We conduct research to support the sustainable use of fisheries resources, focusing on fish, their prey such as zooplankton, and the broader marine ecosystem. Our work includes developing advanced acoustic survey techniques, applying omnidirectional sonar and broadband acoustic techniques, and conducting research on fishing gear and methods.

Topics

Research on Fisheries Resource Monitoring Using Acoustic Technologies

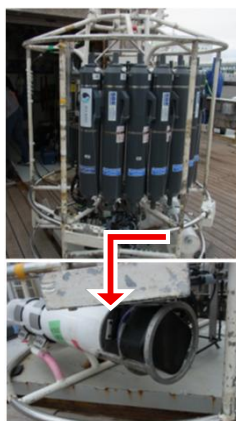
We aim to achieve sustainable fisheries by advancing resource monitoring and aquaculture through acoustic technologies. Research includes quantitative surveys using omnidirectional sonar, measuring organism distribution and abundance with multi-frequency acoustic profilers, and developing real-time aquaculture management using broadband acoustics. These studies support resource assessment and management, aquaculture productivity, marine conservation, and a stable food supply.

Pelagic Fish Surveys Using Quantitative Omnidirectional Sonar

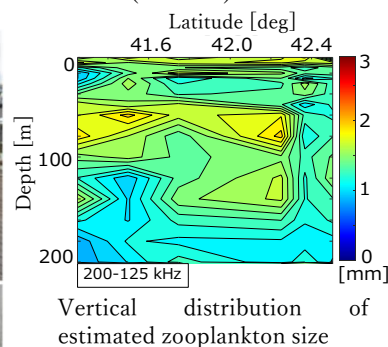


By combining quantitative omnidirectional sonar with a scientific echosounder for wide-area surface observation, we develop and propose survey methods for pelagic fish such as Pacific saury and sardines.

Zooplankton Observation Using an Acoustic Zooplankton Fish Profiler (AZFP)



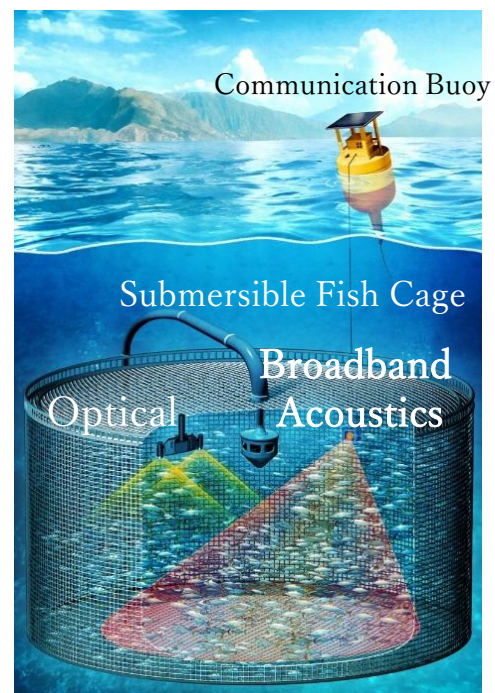
AZFP



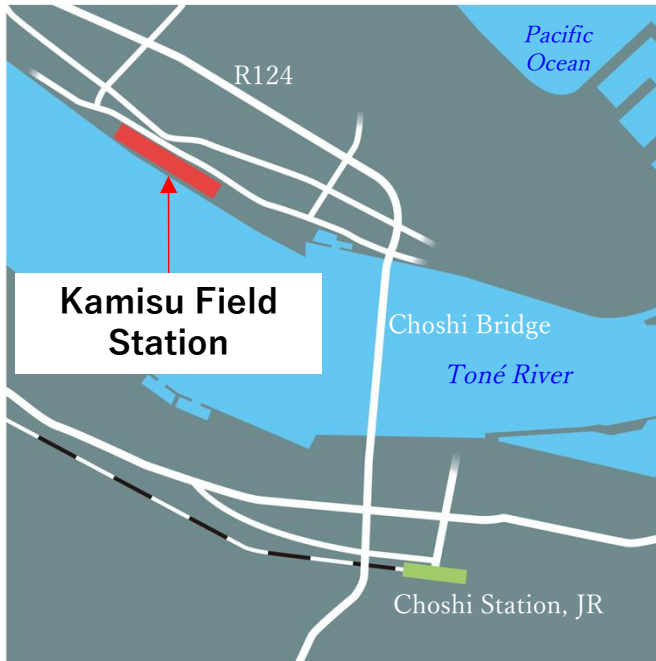
We are developing methods to estimate the horizontal and vertical distribution, abundance, and size of zooplankton using multi-frequency acoustic observations without biological sampling.

Development of a Real-Time Aquaculture Management System

We are developing a real-time aquaculture management system using high-resolution broadband acoustic technology to optimize the productivity of yellowtail farming in large submersible fish cages.



Location



Kamisu field station

7620-7 Hasaki, Kamisu, Ibaraki 314-0408

TEL 0479-44-5929

FAX 0479-44-1875

Approximately 3.5 km from Choshi station, JR.

Cabs are available (about 10-minute).



Tateyama Mooring

848-1, Numa, Tateyama,
Chiba 294-0034

TEL 0470-24-0834

FAX 0470-24-0882

Approximately 2.0 km from Tateyama Station, JR.

Cabs are available (about 5-minute).

