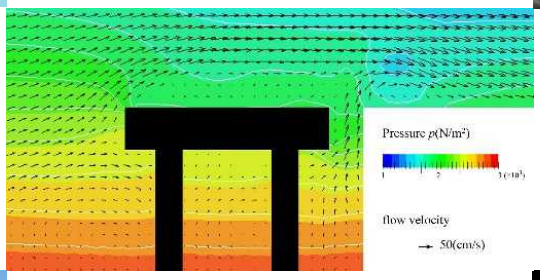
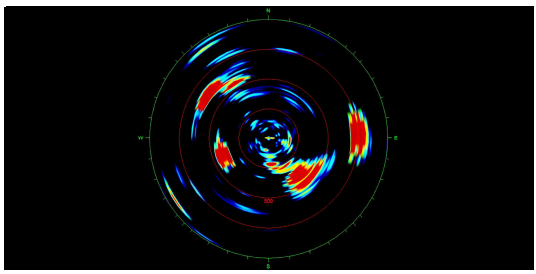
Kamisu Field Station and Tateyama Mooring





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

FRA

Kamisu Field Station

The former National Research Institute of Fisheries Engineering (NRIFE), which has conducted research and development for over 40 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 and development of facility structures, materials, and hydraulics for fishing ports and grounds. The group also studies suitable habitats for aquatic organisms and develops innovative solutions for aquaculture farms.

The Fisheries Production Engineering Group focuses on research and development of fishing vessel gear and methods. This includes applying electronics and ergonomics to fisheries and developing fisheries systems for the efficient implementation of these technologies.

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.

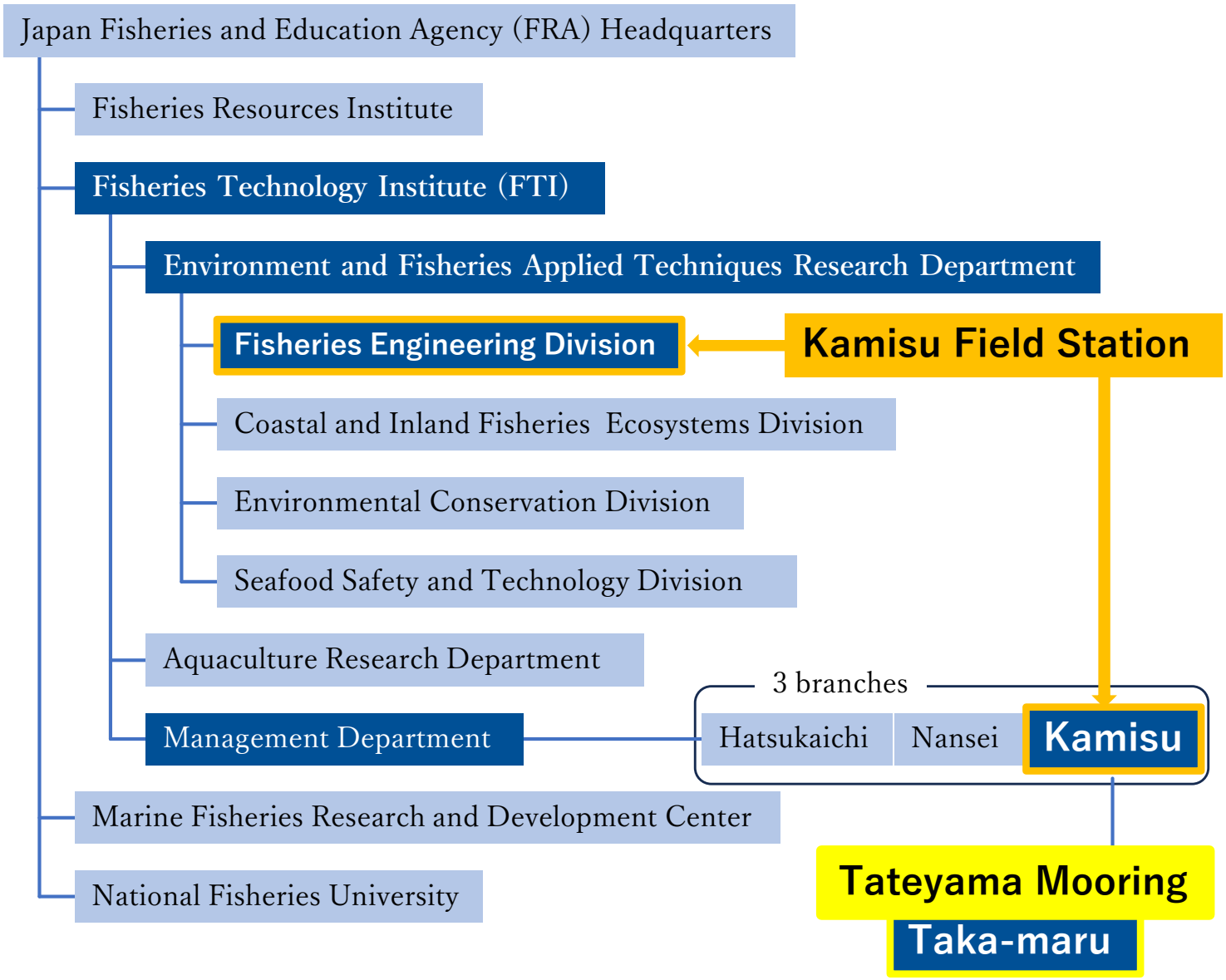
Tateyama Mooring

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)

1984 **The Research Planning and Coordination Division** was established and later merged with the **General Affairs Section** to form the **Project Management Division** in 2006)

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

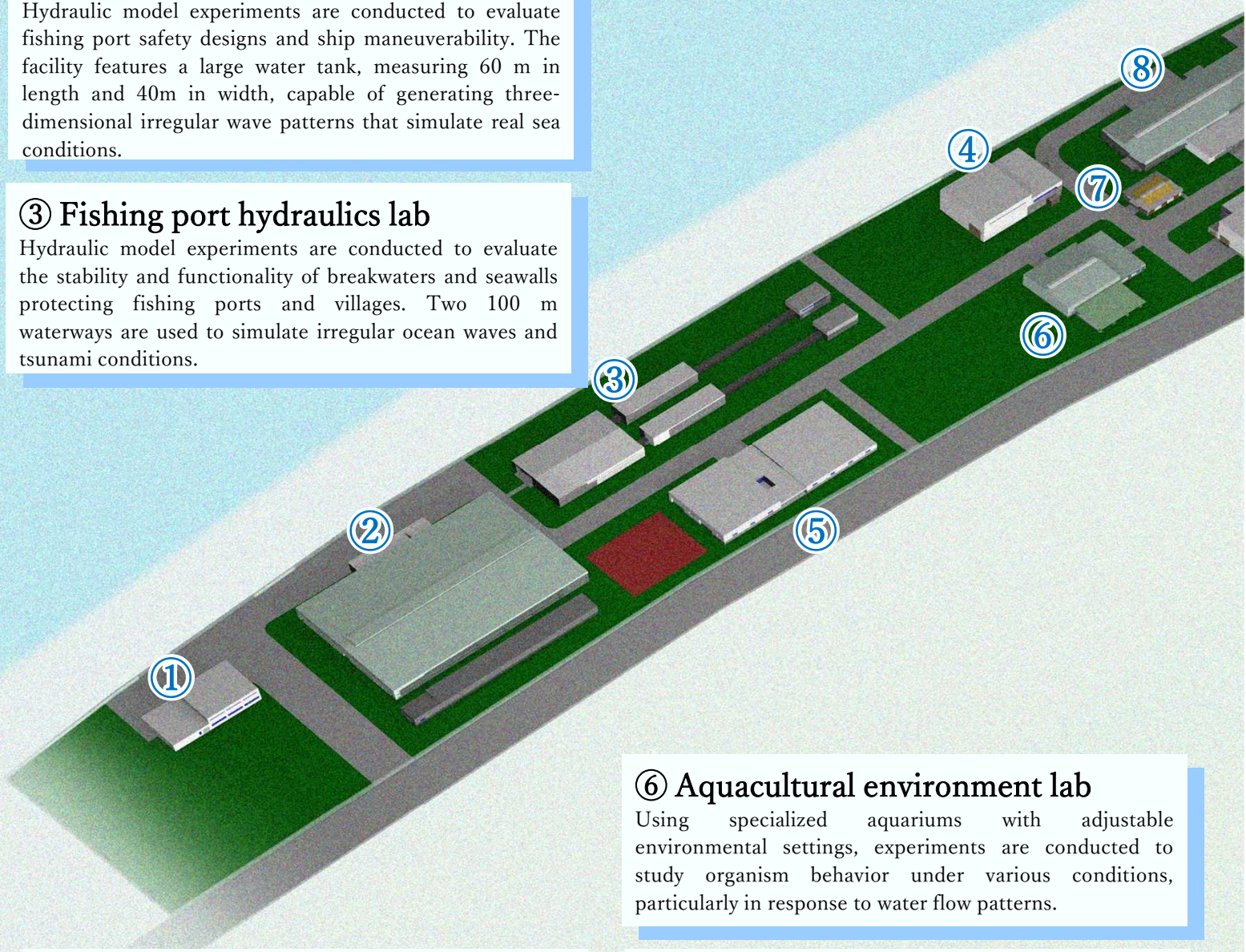
Hydraulic model experiments are conducted to evaluate fishing port safety designs and ship maneuverability. The facility features a large water tank, measuring 60 m in length and 40m in width, capable of generating three-dimensional irregular wave patterns that simulate real sea conditions.

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.



⑤ Fishery material lab

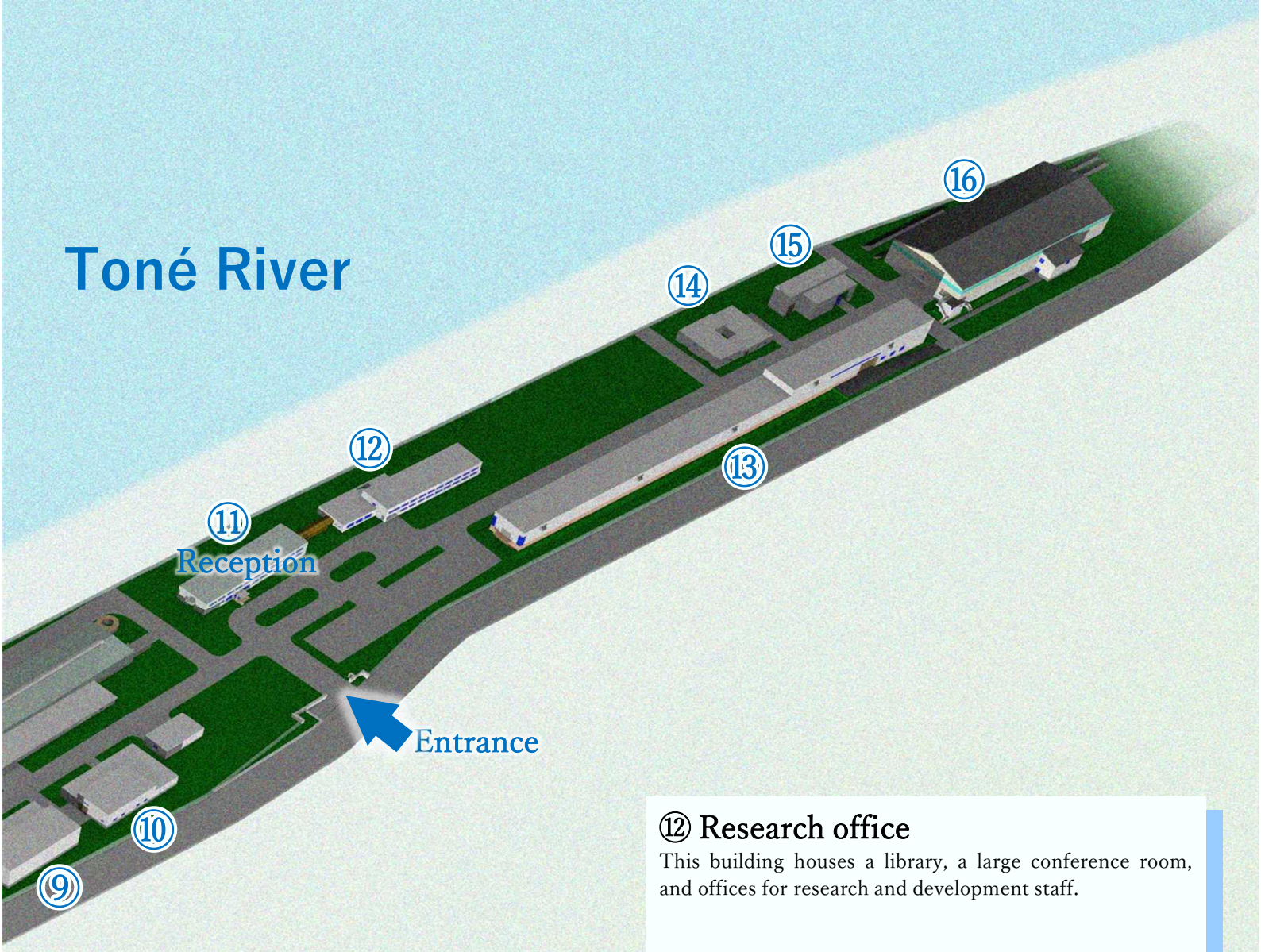
This facility supports the development of prototype fishing gear for research use and handles the adjustment and preparation of various research equipment.

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.

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.



⑫ Research office

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

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.

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.

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.

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.

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.

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.

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.

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

This group conducts research and development on design methods for breakwaters and seawalls in fishing ports to prevent or reduce tsunami disasters. They also study the stability and performance of these structures during high sea waves caused by typhoons and other unusual weather events. In addition, the group is developing a new method to evaluate the effectiveness of artificial fish reefs and fishing ground improvements using innovative technologies such as underwater drones and environmental DNA analysis.

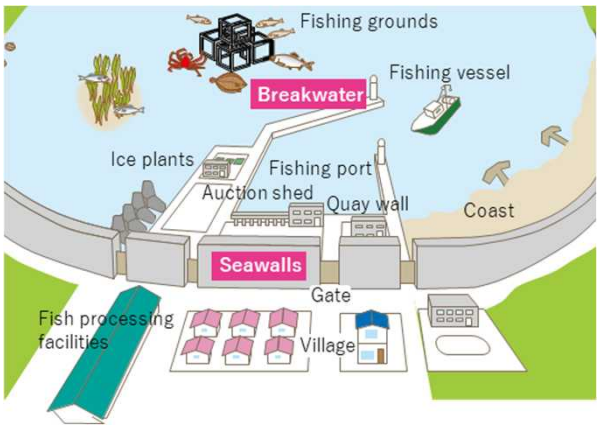
Topics ①

Research to protect fishing ports and villages from disasters

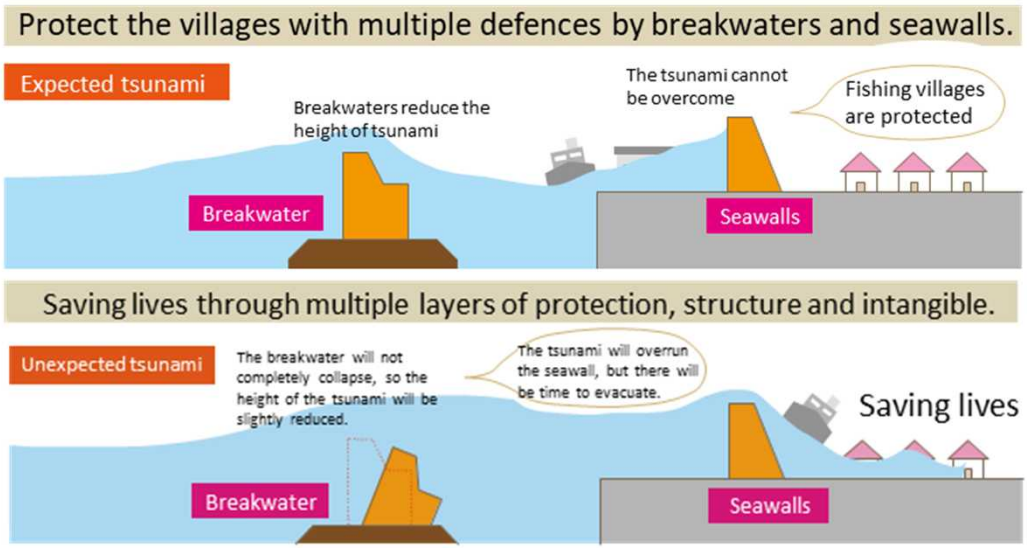
Breakwaters and seawalls at fishing ports and coasts protect human life and property from natural disasters such as earthquakes, tsunamis, and waves.

Our current research focuses on developing tsunami-resistant breakwater designs capable of withstanding extreme forces.

We are also investigating the relationship between wave forces and the structural stability of breakwaters and seawalls.



An example of a typical fishing port.



Above image: Multiple layers of protection, such as breakwaters and seawalls, effectively safeguard against tsunamis within expected size parameters.
Bottom image: When tsunami waves exceed expected magnitudes, resilient breakwaters and seawalls help delay wave progression, providing crucial evacuation time for coastal communities.

Topics ②

Study of the development of new assessment methods for artificial reefs.

Traditional artificial reef surveys have largely relied on qualitative assessments. While current survey methods using echo sounders and sonar provide quantitative data, they have limitations in accurate species identification. Given the long-term nature of artificial reef installations, continuous monitoring is essential. This creates a need for accurate, efficient, and quantitative evaluation methods. To address these challenges, we are developing new assessment methodologies that incorporate advanced technologies such as underwater drones and environmental DNA analysis to accurately evaluate artificial reef effectiveness.

Underwater drone

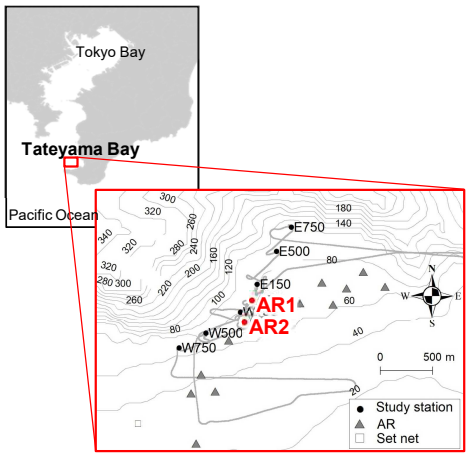
User-friendly underwater drones capture video footage of fish populations around artificial reefs. Analysis of this video data enables us to estimate fish density and quantitatively assess the artificial reef's effectiveness as a marine habitat.

Underwater drone
used in the research activities

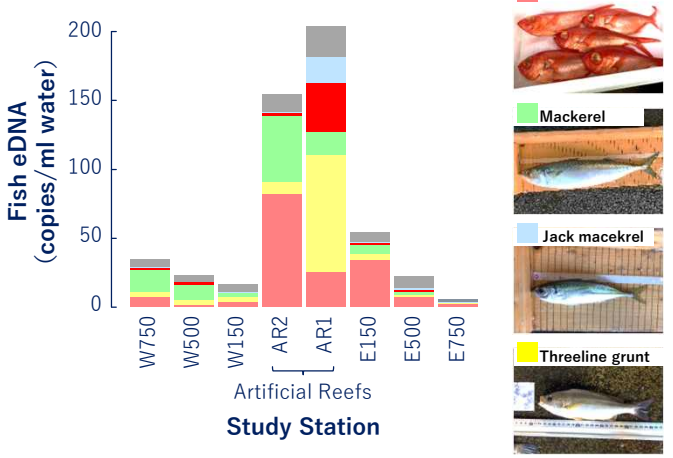
Fish schools around the artificial reef
recorded by an underwater drone in Tateyama Bay

Environmental DNA (eDNA)

eDNA is genetic material found in various environments, such as soil and water, that originates from organisms living there currently or in the past. Our research aims to identify fish species around artificial reefs by collecting seawater samples at designated survey points and analyzing the eDNA present in these samples.



Location of sampling study stations and artificial reefs (AR1, 2) in Tateyama Bay



Analysis of eDNA community compositions at each study station revealed that threeline grunt and red seabream were the predominant fish species around artificial reefs (AR1, 2).

Fisheries Production Engineering Group

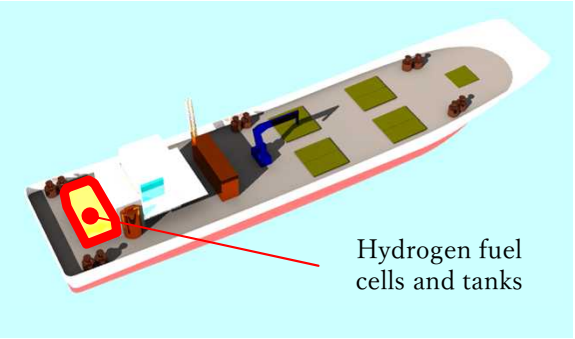
Our group conducts diverse research projects that integrate engineering knowledge to promote sustainable fisheries. Our work includes enhancing fishing vessel safety and operational efficiency, developing selective fishing gear to prevent overfishing, improving resource assessment methods for various marine species, and generating insights for maintaining and advancing the fishing industry. This multidisciplinary approach aims to ensure the long-term viability of fisheries as a sustainable industry.

Topics ①

Research in safe and efficient fishing vessels

Ensuring the safety of fishing vessels is crucial for maintaining sustainable fishing operations. We advance safe and efficient vessel design through experiments conducted in one of the world's most advanced experimental basins, where ship models are tested in simulated rough weather conditions. Additionally, we utilize virtual space simulations of fishing operations to analyze and improve operational safety. In pursuit of environmental sustainability, we are developing a hydrogen fuel cell fishing vessel as next-generation technology, contributing to the industry's goal of carbon neutrality.

Hydrogen fuel cell fishing vessel

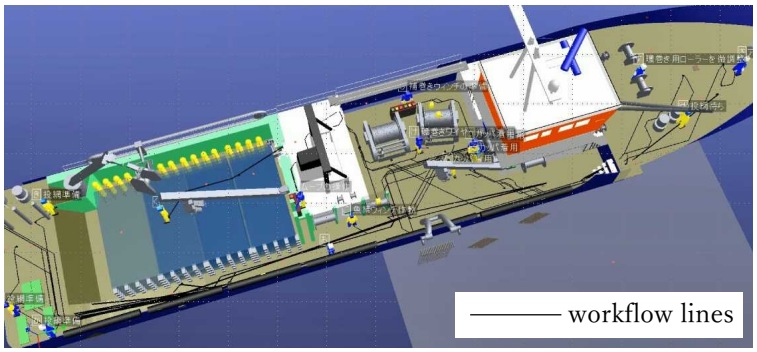


To achieve carbon-neutral fisheries, we are developing a fishing vessel powered by hydrogen fuel cells, and safe and efficient ways to operate the vessel.

Safety of fishing vessels in rough waves

Safety of fishing vessels are examined in a large experimental water tank (L60 x W25 x D3.2m) using computer-controlled scale models.

Virtually simulated workflow line on a purse seine fishing vessel



Modifying existing fishing vessels or constructing vessels with new specifications poses significant risks for fishers. Virtual space technology allows us to explore various vessel structures and arrangements without these physical risks. Through computer simulation technology that recreates onboard workspaces, we analyze workflow patterns and optimize deck arrangements to enhance safety and operational efficiency.

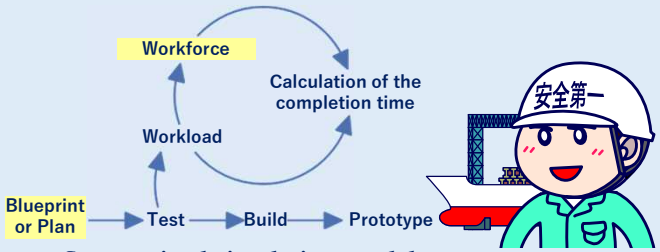
Topics ②

Simulation study for sustainable fishery

Understanding and improving Japan's complex contemporary fishery system presents significant challenges. Our research employs system dynamics methodology to analyze these complex phenomena and generate insights for fishery improvement. This methodology conceptualizes fishery as an interconnected system, represented through diagrams that show elements and their relationships using positive and negative directional arrows. Using computer software, we can calculate and evaluate how the system and its components evolve over time.

Cost simulation of the prototype fishing vessel building

To efficiently build a prototype fishing vessel, a simulation model was developed that considers the vessel-building process as a system, investigating the relationship between labor allocation, time management, and completion time. As a result, we found that shortening the test period while allocating sufficient labor to increase the pass rate leads to a faster completion of the prototype.



Summarized simulation model

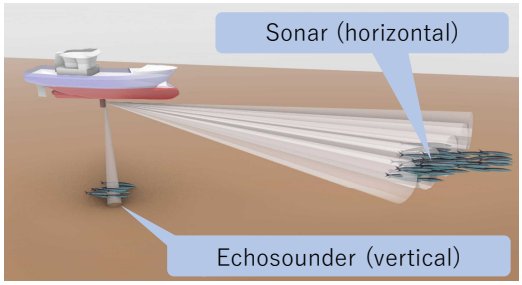
Completion time in three scenarios

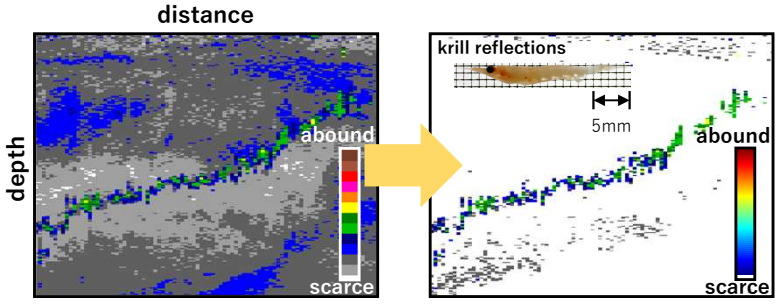
Scenario			Completion time (month)
No.	Test period (month)	Pass rate (%)	
1	3	80	33
2	6	80	45
3	3	40	52

Topics ③

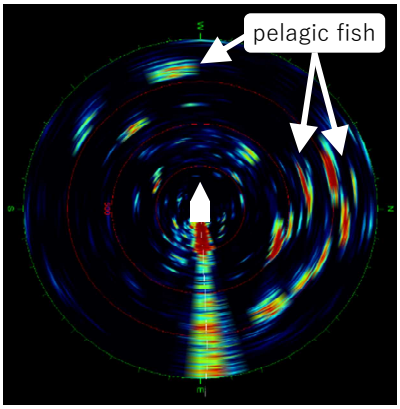
Measuring fisheries resources

Sounds are mainly used in the surveys of fishery resources due to much less attenuation than light in water. Methods are being developed to measure the amount and distribution of zooplankton and fish using sound waves, and these are utilized in fishery resource surveys. We combine various instruments and methods to measure different resources and improve the accuracy of measurements. The instruments includea hull-mounted quantitativeechosounder, a scanning sonar for pelagic fish, and a suspended quantitative echosounder capable of reaching deep-water range.



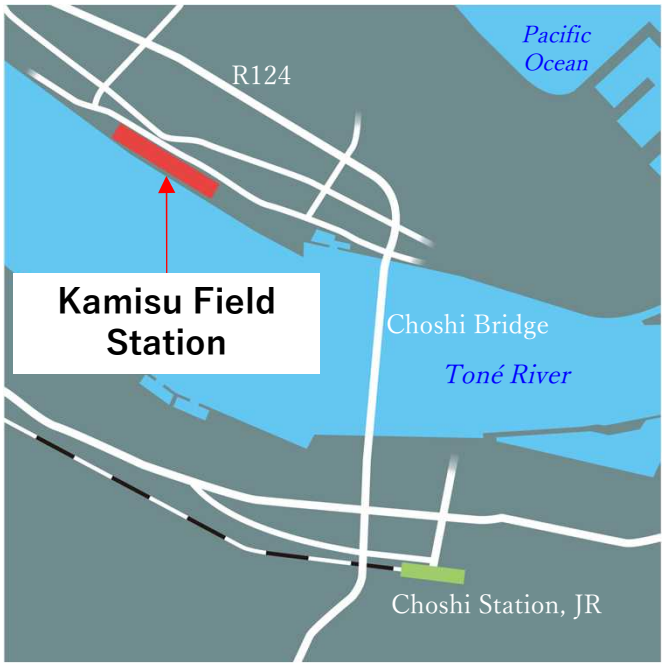


An example of vertical survey using a quantitative echosounder. Krill reflections can be extracted from all the reflected images by analyzing the acoustic characteristics of the krill.



An example of scanning sonar image. Sonar can detect fish schools around the sea surface.

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 seaside facility

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).