Development of Next Generation Sustainable Aquaculture System

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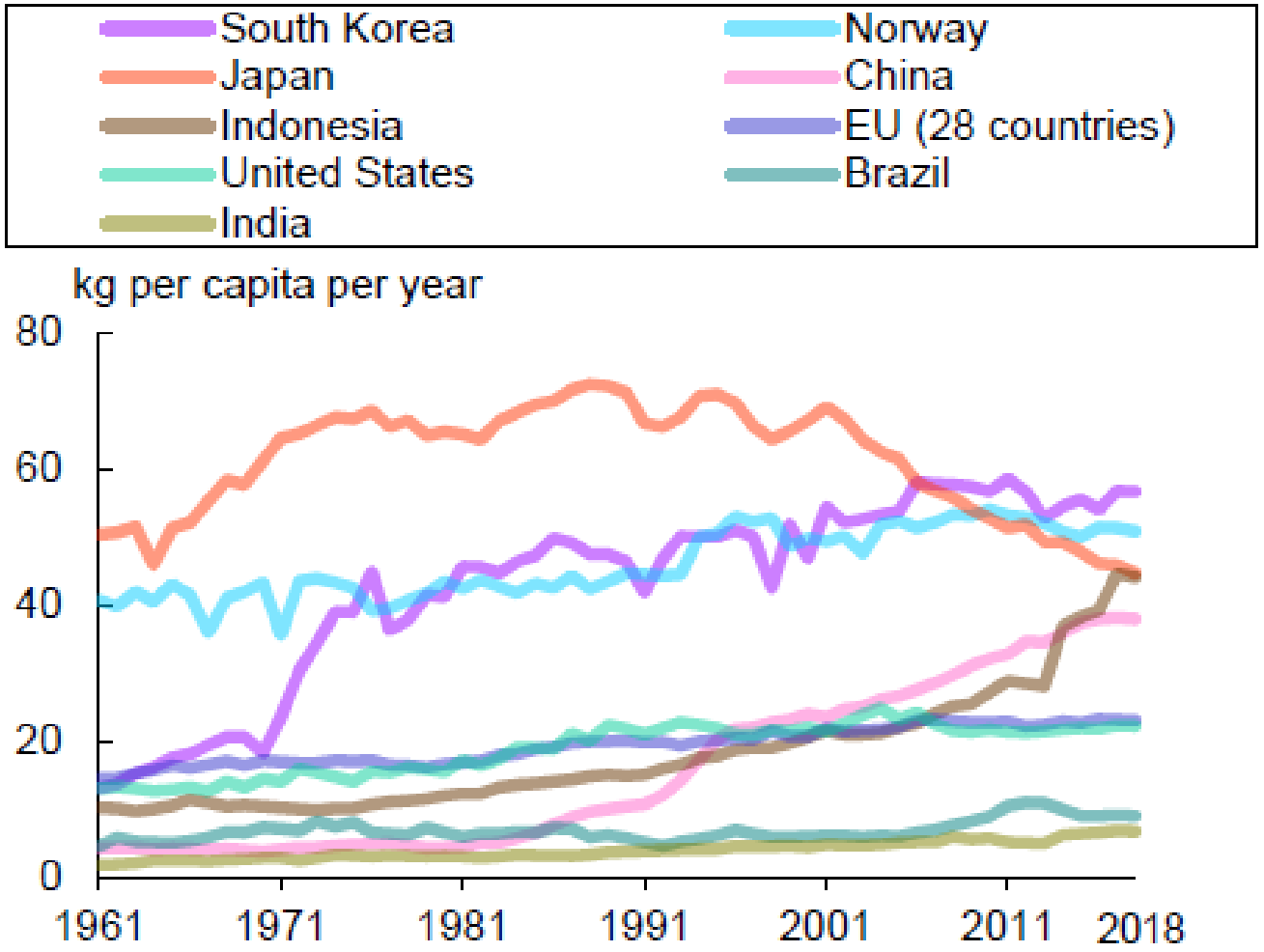
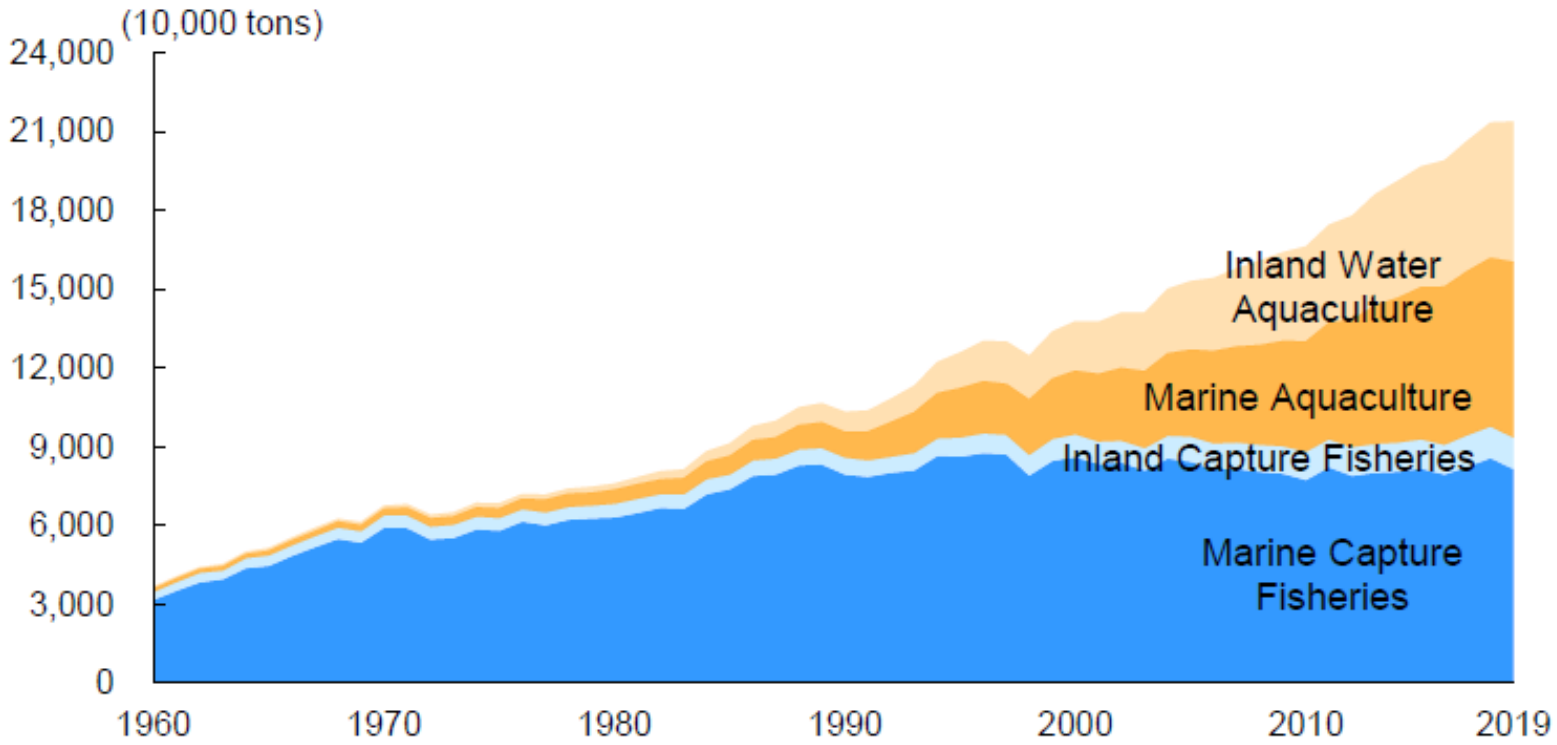
<By country and region>



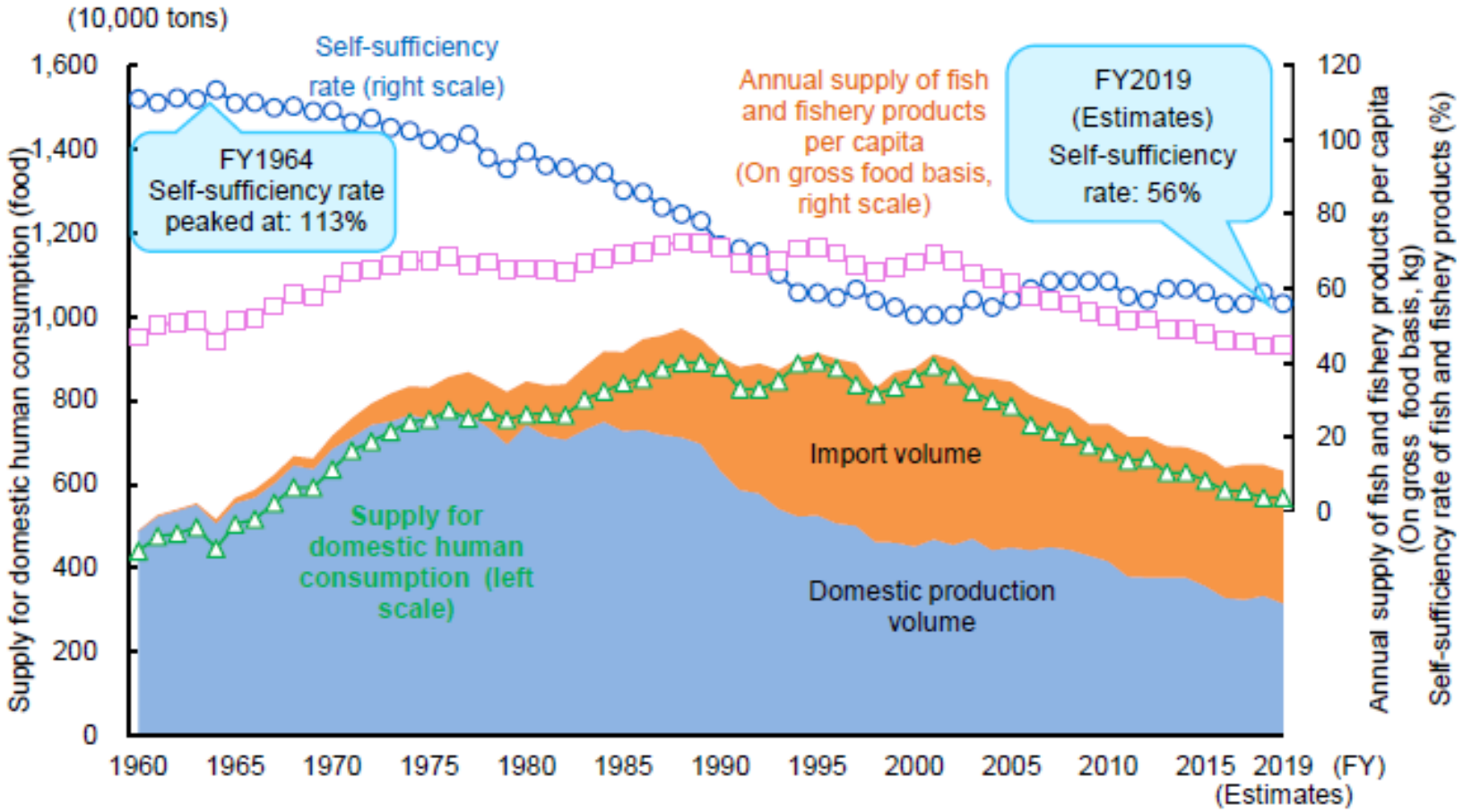
Sources: "FAOSTAT (Food Balance Sheets)" (FAO) and "Food Balance Sheet" (The Ministry of Agriculture, Forestry and Fisheries)
Note: "Gross food" refers to the quantity of seafood including disposal volume.

Trends in the Production of World Fisheries and Aquaculture



Source: Prepared by the Fisheries Agency, based on the Fishstat (Capture Production, Aquaculture Production) (FAO) (without Japan), Fisheries and Aquaculture Production Statistics (the Ministry of Agriculture, Forestry and Fisheries) (Japan)

Trends in self-sufficiency Rates of Fish and Fishery Products for Human Consumption



Source: Food Balance Sheet (the Ministry of Agriculture, Forestry and Fisheries)

Creation of innovative food production technologies in response to environmental changes in the future

Development of Next Generation Sustainable Aquaculture System

Project Leader : Ichiro NAKAYAMA, Research fellow, Institute of Industrial Science, The University of Tokyo

R&D Team : Kyoto University, Tokyo University of Marine Science and Technology, The University of Tokyo, Riken, Nagasaki Prefectural Institute of Fisheries, Nippon Suisan Kaisha Ltd.

Summary :

Purpose: Japan is a country surrounded by wide variety of ocean environments and fish species.

The project aims to develop a next-generation aquaculture system to establish a sustainable aquaculture industry and to protect Japanese fish food culture.

Research summary: We develop a next-generation aquaculture system that integrates novel "food" "seeds" and "places" research.

We conduct researches on novel "feed", "seed", and "place" for sustainable aquaculture; fish-free feed, short-term seed development, and aquaculture system with environment adaptability. We integrate the outputs of research to a new aquaculture system applicable to various environments and fish species in Japan to support Japan's rich food culture.

The research will lead to the sustainable supply of the world's high-quality protein sources and the maintenance and conservation of marine resources.

Japanese Style Sustainable Aquaculture System

Developing Novel Japanese Sustainable Aquaculture System To Protect Japanese Food Culture

Creation of innovative food production technologies in response to environmental changes in the future

R&D Project Title : Development of resources-recycling aquaculture feeds inspired from features of the ecosystem

Project Leader : Jun Ogawa, Professor, Div. Appl. Life Sci., Grad. Sch. Agric., Kyoto Univ.

R&D Team : Nippon Suisan Kaisha, Ltd, Keio University, Riken

Purposes : Switch the current aquaculture system with high environmental load to a sustainable system trough driving the food chain from recyclable plant resources to fishes by utilizing functions of microoragisms, and accomplish natural circulation for future fish cultivation.

Current problems

· Supplying essential nutrients for fishes by fishes themselves.

· Functional metabolites derived from essential nutrients of fish have not been identified.

· The digestive tract research of fishes is extremely few and the investigation and utilization of intestinal bacterial function is not achieved.

Goal : Establish aquaculture food chain from plankton, small fish, to large fish, by using fermented feeds containing essential nutrients and by applying symbiotic microorganism function.

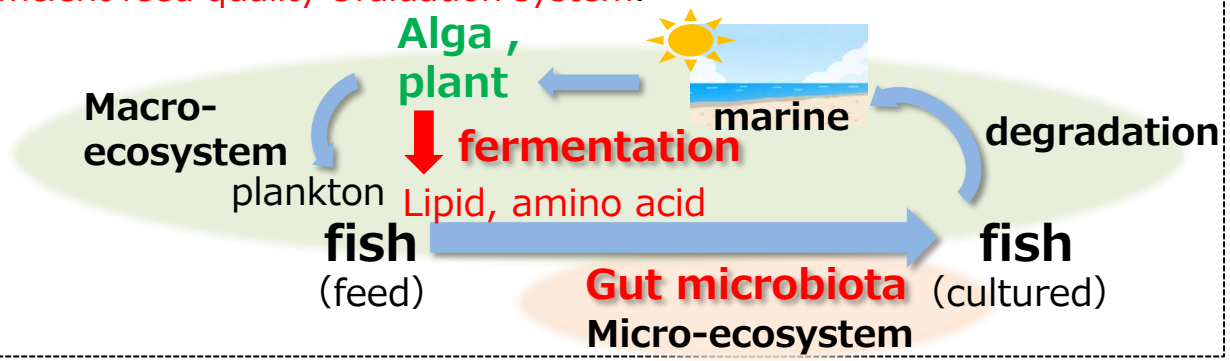
Solution

·Identify metabolites derived from essential nutrients and verify their physiological functions, and supply the metabolites as feeds by fermentation.

·Isolate intestinal bacteria that produce essential nutrients, and verify its probiotic function.

·Produce fermented feeds containing sufficient amounts of essential nutrients (fatty acids · amino acids) from plant materials.

·Develop markers found from omics analysis of aquaculture fish to construct an efficient feed quality evaluation system.

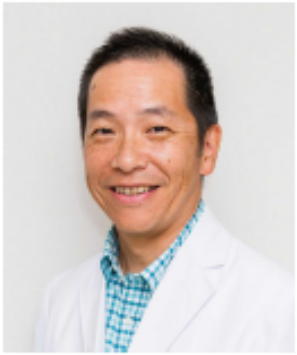


Creation of innovative food production technologies in response to environmental changes in the future

Next-generation fish breeding by combination of developmental biotechnology and genomic selection

Project Leader : Goro YOSHIZAKI
Professor, Tokyo University of Marine Science and Technology

R&D Team : The university of Tokyo, Nagasaki Prefectural Institute of Fisheries

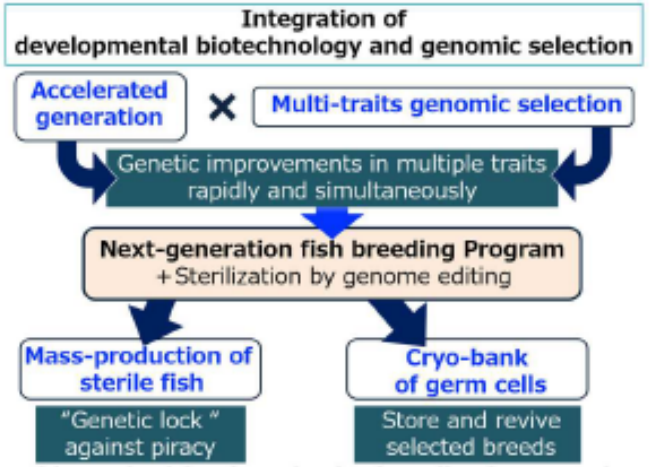


Summary :

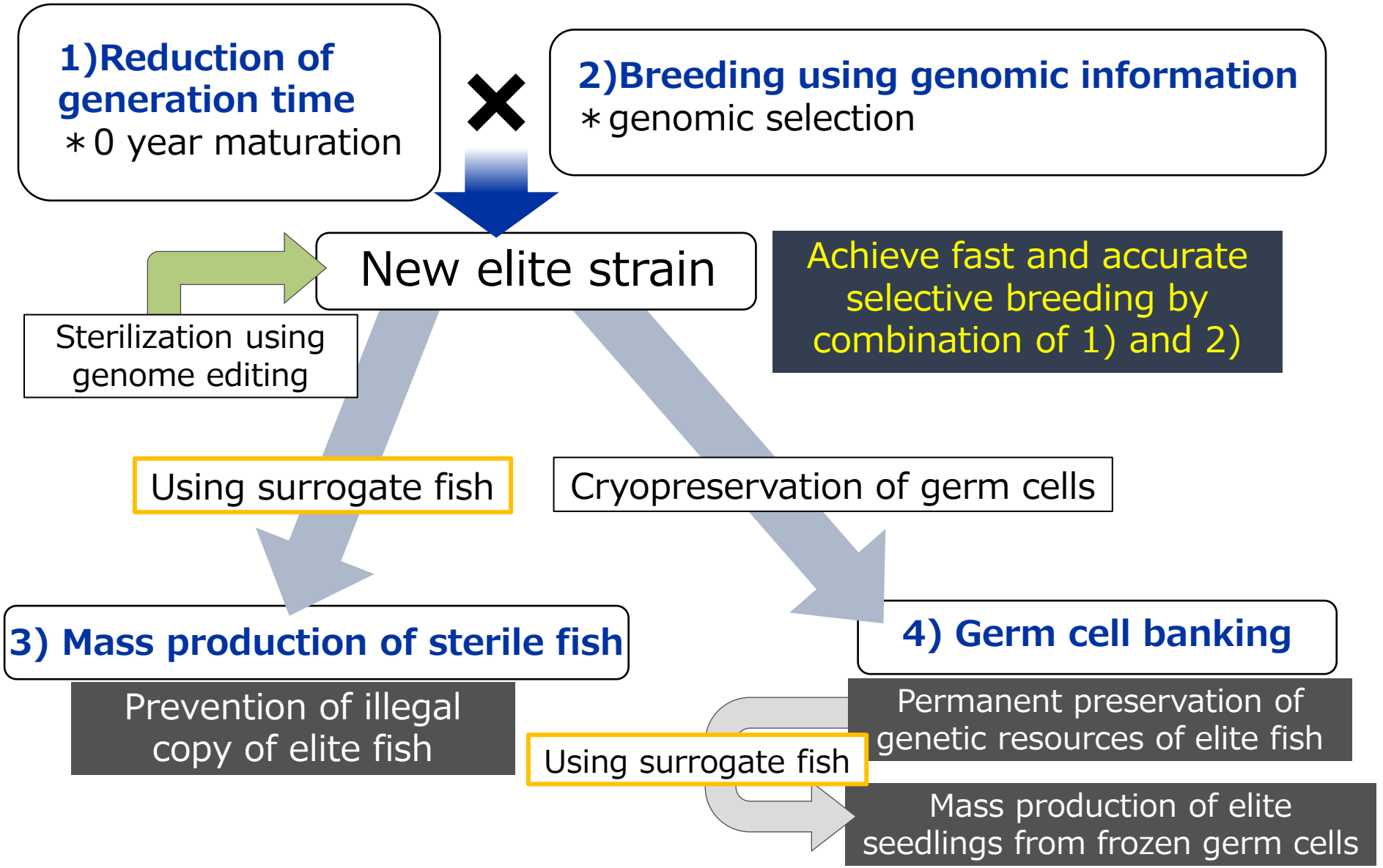
Selective breeding is a key technology used for producing high-quality aquaculture fish. However, relatively long intervals between generations in aquaculture species limit rates of genetic improvements. To overcome this challenge, we will develop a novel generation time acceleration technique comprising two remarkable technologies; that is, surrogate broodstock technology and advanced puberty onset. Integration of the generation time acceleration techniques and multi-trait genomic selection would facilitate the establishment of a unique fish breeding scheme where genetic improvements can be obtained in multiple traits rapidly and simultaneously.

We also focus on developing a novel "genetic lock" method, which facilitates the mass production of genetically sterile fish from surrogate broodstock to preclude the piracy of improved breeds. In addition, we will establish a germ cell bank of the improved breeds by means of germ cell cryopreservation to store the genetic resources permanently. The germ cells could be revived using the surrogate broodstock technology, and seedlings of the targeted breeds could be reproduced anytime without any genetic deterioration.

Through the above technologies, we present "next-generation selective breeding," which is heralded as a gold standard for selective breeding in aquaculture.



Genetic Breeding（TUMSAT・U. Tokyo・Nagasaki Pref. Res. Station）



Establishment of gold standard for fish breeding

Prof. Kitazawa at IIS　The University of Tokyo

Daisuke KITAZAWA

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Institute of Industrial Science, The University of Tokyo

Targets of Aquaculture System

Target 1　Optimal design of aquaculture facilities for mackerel

We will study the optimal aquaculture system that takes advantage of the physiological and ecological characteristics of mackerel.

Target 2　Development of aquaculture system packages for wide variety of environment and fish species

Japan has a long and diverse environment from north to south, and a vast sea surface. These features enable us to cultivate a wide variety of fish.

Packages of Aquaculture System

Packages of aquaculture system for wide variety of fish species, environment, the amount of production, etc. will be developed.

Species	Area	Production	Feed	Seed	Frame	Net	Feeding system	Energy supply	・・
Mackerel	Coastal	500 tons							
	Offshore	1,000 tons							
Yellowtail									
・・									

Various technologies for aquaculture are being reviewed.

- Cage (submergible cage etc.)
- Netting (monitoring, cleaning, copper net, etc.)
- Feeding system (underwater feeding, etc.)
- Predator (Kikko net, K-Grid, Metal net, etc.)
- Live fish transportation
- Environmental monitoring (water, benthic quality)
- Disease (distance between cages, density, diagnose, health monitoring, etc.)
- Light utilization (growth enhancement)
- Renewable energy
- Removal of dead fish
- Harvesting system (floating net, pump, etc.)
- Escape (sterilization, semi-closed system)
- Remote control (wireless communication, theft prevention)
- Environmental preservation (oxygen, IMTA)
- Monitoring of fish growth and the number of fish
- Monitoring using underwater drones.

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