Issues of sustainable aquacultural seedlings in Japan

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ABSTRACT

The Japanese archipelago, extending from north to south, is home to a variety of ocean regions ranging from subarctic to temperate to subtropical, with complex coastlines, and is interrupted by ocean currents such as the Kuroshio Current and Oyashio Current, making it one of the world's richest fishing ground and suitable habitat for a rich variety of fish and shellfish species. Since ancient times, the Japanese people have fished and used various types of fish and shellfish inhabiting each ocean region as food, and the current fishing industry and fish-eating culture have become well developed. In addition, in order to secure stable supplies of marine products and the sustainable development of the fishing industry, the release of young fish and the cultivation of fish, bivalves, crustaceans, and seaweeds are being conducted in many areas to maintain and increase resources. Currently, yellowtail, red seabream and scallop account for more than 50% of domestic production. Even the less abundant grouper species such as longtooth grouper and seven-band grouper, yellowtail amberjack, Japanese jack mackerel, chub mackerel, thread-sail filefish, filefish, Japanese sea perch, chicken grunt, striped beakfish, marbled rockfish etc. are also now available and highly valued in the Japanese markets. Although slightly different from aquaculture, capture-based aquaculture (short-term aquaculture) of Japanese spiny lobster, Japanese blue crab, common octopus, horned turban, Manila clam etc. has also been underway for quite some time.

For sustainable development of aquaculture, it is important to secure a large and stable supply of artificial seeds rather than natural seeds. Currently, there are ongoing researches to achieve 100% artificial seedling production of yellowtail, eel and tuna, which are representative species for Japanese aquaculture. Similarly, technology to produce artificial seedlings is needed for new cultivated species. Fortunately, Japan has a number of seedling production technologies that have been developed through sea farming. Over the past 60 years, a total of 150 seedling production technologies for 73 species of fish, 23 species of crustaceans, 38 species of shellfish and 16 species of other marine seafoods have been developed so far. In recent years, new technologies such as closed recirculating aquaculture systems and LED lighting have been introduced, making it possible to produce seedlings of various fish species that were previously considered difficult to breed. In this symposium, we will introduce the technologies for producing seedlings of spotted halibut, common octopus, pen shell and hiziki, which are being researched and developed as new target species for release of seedlings and aquaculture.

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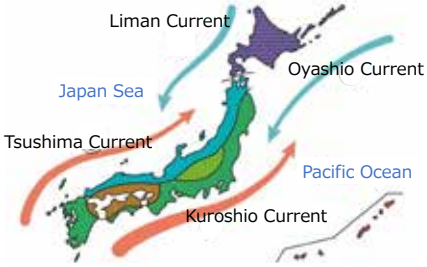
Japan Fisheries Research and Education Agency
KAZUTAKA SAKIYAMA

Marine Environment of the Japanese Islands



- Climate
  - Subarctic
  - Temperate
  - Subtropical
- Warm and cold currents
- Complex coastline
- Many islands

Abundant variety of marine amimals

Stable supply of seafood and regional development

Fish living in the seas around Japan⇒ More than 3000 species
Edible fish⇒ About 500 species

- Important local fishery resource
- Important source of income for fishermen
- Local food culture

Stable supply of seafood and regional development

Many species in aquaculture

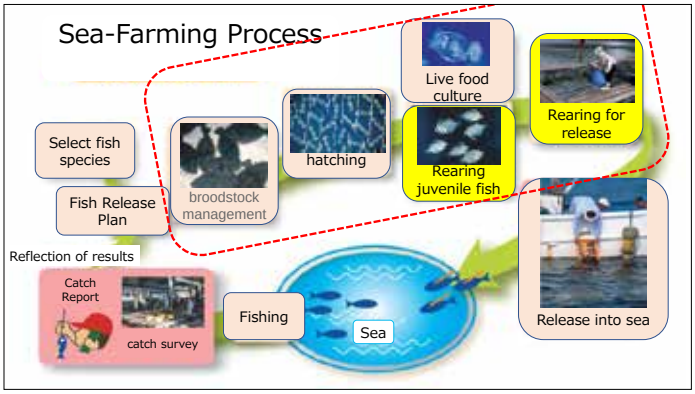
Aquaculture and sea-farming require a lot of fry

Overfishing of natural juveniles
Impacts on fishery resources

Rearing many fry by human hands
(seedling production technology)

Japan has the technology to breed many kinds of fish.

Sea-Farming Process



Fish rearing techniques developed by Sea-Farming

Fish	73
Crustacean	23
Shellfish	38
Other	16

Total 150 species

Some fish species are used as seedlings for aquaculture

Important in the development of new fish seed production technology

Observation of larval ecology
Improve existing technologies to rearing techniques appropriate for each species

Introduction of new technologies
Important to appropriately improve on techniques developed for other fish species

Examples of ecological observations


Common octopus


Pen shell

Examples of introducing new techniques


Spotted halibut


Hiziki

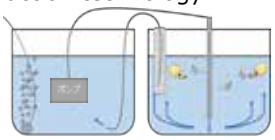
Common octopus seed production technology

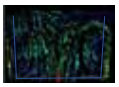

hatching larvae


Octopus larvae (reaching the bottom)

Stable supply of food and rearing conditions unknown
One of the most difficult fish species to keep

Expected to be a future aquaculture species, but the major problem is cannibalism




Elucidation of water flow suitable for larval rearing


Swimming crab larvae "just after hatching" are effective as a food source

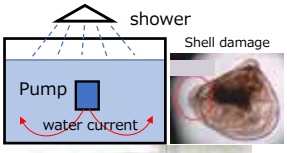
Survival rate of more than 90%

Pen shell seed production technology


Pen shell
Atrina pectinata


D-type larvae
100-150μm


Mass mortality due to agglomeration and flotation

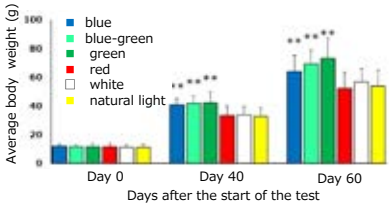


Rearing techniques using showers and water flow
Currently improving the technology to make it even better for stable production

Rearing techniques for spotted halibut juveniles


Spotted halibut (*Verasper variegatus*)


Breeding fry with various colors of light

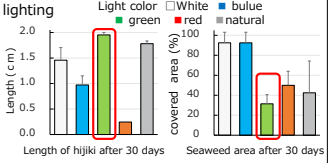


- Green lighting is effective in promoting growth of spotted halibut
- Growth promotion effect by promoting feeding
- Conducted demonstration test of land-based aquaculture

"Hijiki" seed production technology

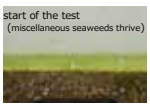

Hijiki *Hizikia fusiformis*

Breeding test with LED lighting



Suppression and removal of miscellaneous seaweeds

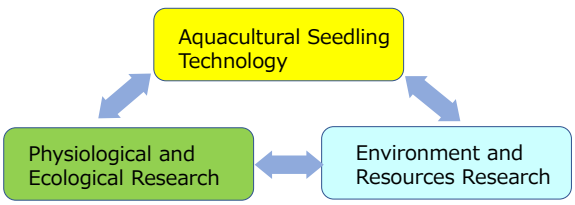
Removal of miscellaneous seaweed by fish



Reared with green LED lighting until the size of hijiki is 2 mm.

After 2mm, we devised a method to remove miscellaneous seaweeds with fish

Sustainable and appropriate development of seed production technology



Sustainable seed production technology requires collaboration with physiological ecology research and resource and environment research


Vision for the future
Increase and stabilize fishermen's income
Regional revitalization and creation of new industries
Stable supply of local fish
Food for tourism
Development of local aquaculture and sea-farming
Seed production technology for local specialty species