"Next Step to a Greener Earth" JUNBA2009 Technology Fair Session B-2: Bio Tech. Jan 13, 09

GERM CELL TRANSPLANTATION IN FISH

Mitsuru IZUMI Executive Director for Research Tokyo University of Marine Science and Technology



Fish in the world

 Rapid expansion of fish consumption from 30 million ton (1993) to 100 million ton(2003) in the world Overharvesting Abnormal weather over the earth > Valid for health (no BSE, no bird flu) Wiped out at 2048 ! Boris Worm et al, Science, 3 Nov. 2006 Food security is an urgent matter

Marine Farming is proposed !

Creation of innovation with a fusion of fisheries and engineering technologies

Task 1 Seed production system with surrogate broodstock technology Bear a big fish from a small fish Task 2 Onshore aquaculture system with advanced engineering technology Controlled closed system

Task 3 Offshore aquaculture system using Autonomous Underwater Vehicles Marine Farm with a Biointeractive robot

Research Period : 2007 – 2009 Fund : Japan Science and Technology Agency

Innovative Fisheries and Engineering Fusion Project



The stable supply of a safe fish

Task 1 : Seed production system withsurrogate broodstock technology

Possible to bear a big fish from a small fish

 A small fish is easy to breed early to become a spawning age Tuna •••••7 or 8 years Mackerel •••only half a year
A small fish is easy to raise Enable to raise fish in the small onshore raising facility

Work up to now :

We succeeded to get rainbow trout from surrogate yamame by using the germ cell of rainbow trout. --Goro Yoshizaki et al., *Nature*, No.430, pp 629-630 (2004)--

Leading Tech.: Seed production system with surrogate broodstock technology





Germ Cell Transplantation in Fish

Goro Yoshizaki Tokyo University of Marine Science and Technology, SORST/JST

0

0

0

	Tuna	Mackerel
Body weight	300 kg	300 g
Body length	300 cm	30 cm





Aquaculture of tuna *Conventional aquaculture is capture-base...





Maintain adult tuna in cages





Production of bluefin tuna using mackerel as surrogated broodstock



Egg taking in small tanks *save a lot of space, labor, and cost



Procedure of Gonogenesis



Surrogate Broodstock Technology



How can we transplant Primordial Germ Cells into recipients?







Transplanted primordial germ cells proliferated and started meiosis in gonads of recipients

Rainbow trout juveniles produced by surrogated masu salmon

Nature (2004)

Donor-derived offspring from inter-species germ-cell transplantation were successfully produced.

Making salmon that produces only trout gametes





2N 3N

Employ a Sterile Triploid (3N) recipient salmon













We can discharge them into the environment.



