The 1st International Oyster Symposium Proceedings

Roles of oyster aquaculture in food supply and protection of environment

Kunio Shirasu

Oita Marine Technology Center, Nissui

Mission and philosophy of Nissui as a world class seafood company

Mission

Nissui is determined to create products for customers mainly using aquatic resources. The mission of Nissui was set by Mr. Kosuke Kunishi, a founder of Nissui, as follows: "to obtain aquatic resources from all around the world, and sell the products at fair prices to meet market demand". In other words, Nissui commits itself to build up a distribution network across the world through which its products can reach every consumer in the same way that water is distributed to each household through a city water piping system.

Philosophy

The philosophy of Nissui is reflected by the following commitments, so called "Genes of Nissui".

1. To establish a global supply chain of products
2. To prioritize efforts on cost, quality of R&D
3. To conduct business fairly and lawfully as a company and as individuals

The philosophy guides the daily activity of Nissui in creating seafood products for the comsumers all around the world.

The current status of world oyster aquaculture and trading

Reasons to further promote aquaculture business

Figure 1 shows the trend of the world population in 1950-2050. According to the FAO, the world population will reach 8 billions by 2030. On the other hand, since 1989 there has been no significant increase in the capture fisheries production (Figure 2). The world capture fisheries production is likely to decline in the future. On contrary, the world aquaculture production has grown significantly since 1985, the aquaculture production was tripled from 16.7 million tons in 1990 to 51 million tons in 2002, the annual growth rate was 17%, In 2002, aquaculture production accounted for 35% of total world seafood production (Figure 3).

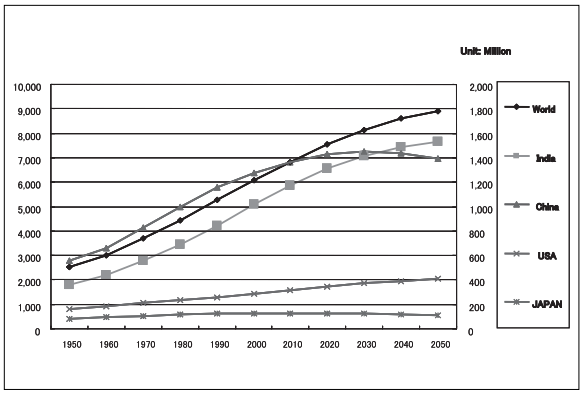


Figure 1 . World Dynamics of Population

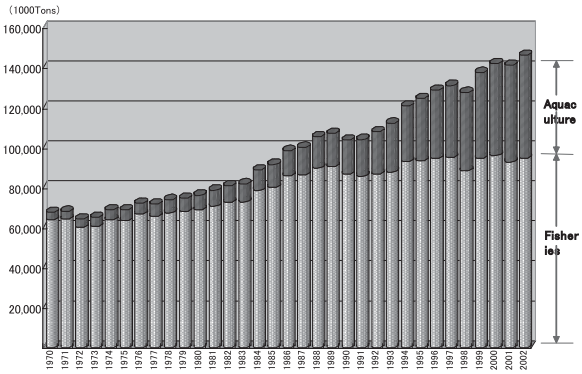


Figure 2. World Fishery Production 1970-2000

It is known that one billion people already rely on seafood as an important source of protein. Globally, an average of 16 kg of seafood is consumed per person per year, and the FAO projects this is to increase to 19-20 kg per person per year by 2030, equivalent to the total world seafood consumption of about 180 million tons. This suggests that the additional 34 million tons seafood needs to be produced from now on if the demand can be satisfied by 2030.With the capture fisheries on the decline, there is no doubt that aquaculture will play an increasing and key role in providing protein for

a significant fraction of the world's population in this century.

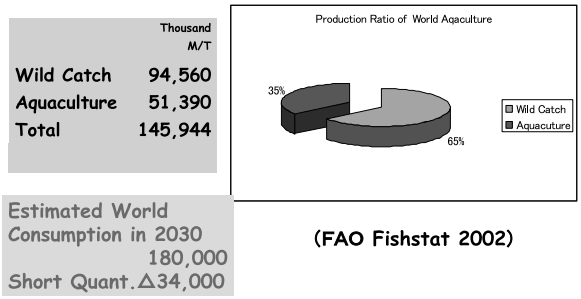


Figure 3. World Aquaculture Production 2002

Why does Nissui stick to aquaculture business?

Global aquaculture business of Nissui

Nissui has been involved in aquaculture business in several countries (Figure 4). Atlantic salmon and rainbow trout have been farmed in Chile over a decade. Currently, annual production is about 30,000 tons.

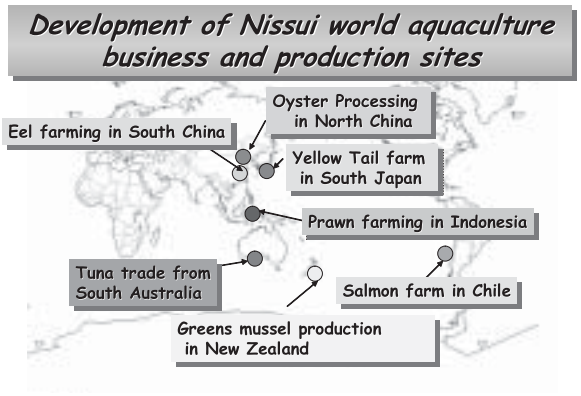


Figure 4. World Aquaculture Business of Nissui

Last year, we started shrimp culture in Serum Island, Indonesia and Buri (Yellowtail) culture in Miyazaki Prefecture, Japan, and eel farming in Fujian Province, China. In addition, we have been conducting collaborative research on oyster safety and quality with the Ocean University of China, and collaborative study on hatchery technology of groper with National Institute of Water & Atmospheric Research Ltd (NIWA) in New Zealand. Nissui endeavors to pursue sustainable and environmental-friendly aquaculture business in the world.

Existing infrastructure of Nissui in seafood business

As Nissui has a long history of capture fisheries business across the world, and recently moved towards the globalization of business, now Nissui has a large number of seafood processing sites in Japan, the USA, China, Chile, New Zealand, Indonesia, Vietnam, and other regions. The existing infrastructure and the supply network of products can be utilized for the farmed products in the future.

Aquaculture is a knowledge intensive industry, therefore, Nissui has established its own research institute for aquaculture in 1993. This institute is known as Oita Marine Biological Technology Center, and located in Oita, Japan. The center has focused on four main research fields, including selective breeding, fish pathology, nutrition and larval rearing. In addition to research activities, the center is providing technical supports to the farming operations.

World production and trading of oyster

World production of oyster

Mollusks production was 23% of world aquaculture production, second to freshwater fish (Figure 5). Total amount of the farmed and seed-enhanced

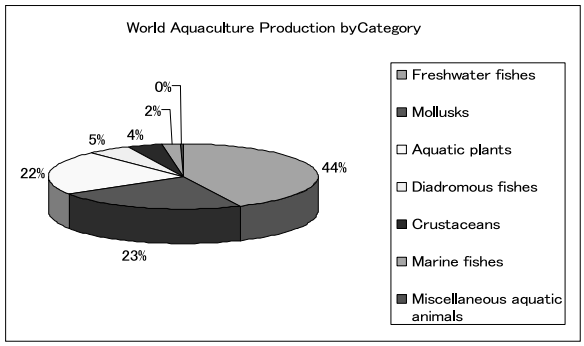


Figure 5. World Aquaculture Production by Category

oyster production is 4,696,000 tons in 2003, dominant production countries are China, Japan, Korea, USA, France and Mexico. China is by far the largest oyster production country, producing over 2 million tons per annum. In China, half of oyster production is used to make oyster source. Recently, oyster production in the USA and France has been affected by disease and costal water pollution (Figure 6).

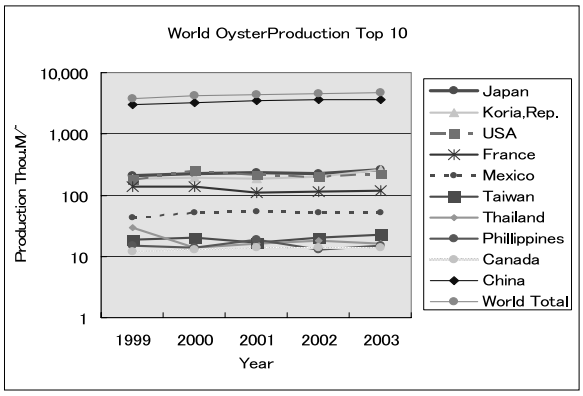


Figure 6. World Cultured Oyster Production 1999-2003

World trading of oyster

Dominant trading countries for oyster are China, Korea, Japan, USA and Canada (Figure 7). Total trading volume of oyster without shell in these countries was about 60000 MT tons in 2003, valued 20 million US dollars, the average price was about 3.5 US dollars per kg. In China, the total trading volume was 18000 tons, valued 25 million US dollars, and the average price is about 0.35 US dollar per kg.

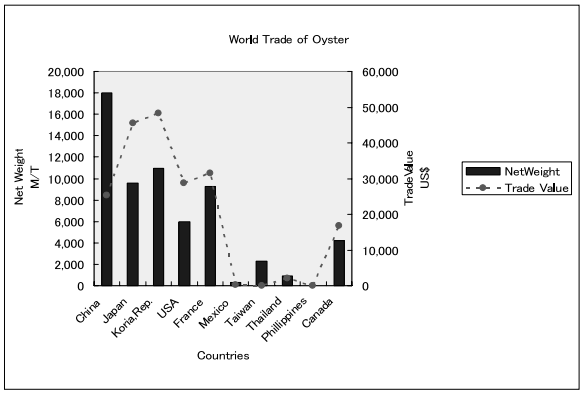


Figure 7. World Trade of Oyster 2003

Oyster aquaculture serves to purify environment

Oyster works for nitrogen absorption from sea water

Oysters like other mollusks play an important role to purify sea water. Oysters are plankton feeders, therefore they indirectly take out of nitrogen and phosphorus from sea water through phytoplankton and zooplankton.

The annual amount of nitrogen absorbed by the farmed oysters is estimated in Table 1. It was believed that 19,000 ton of nitrogen was removed from seawater by oysters every year, equivalent to the purification capacity of 109,000 km^2 forest.

Table 1. Oyster Contributes to Prevent Green House Effect

Oyster works for nitrogen absorption from sea water

		Facter	Thou.M/T
A	Oyster World Production Amount 2003		4696
B	Oyster Meat	25%	1174
C	Amount of Protein in Oyster	10%	117
D	Amount of Nitrogen in Oyster Protein	16%	19

Farmed oyster absorbs 1230 tons CO_2 per year

Meanwhile, oysters also contribute to absorb the dissolved CO_2 from seawater. The amount of CO_2 used by oysters was estimated in Table 2. Thus, oysters and other mollusks contribute to alleviate green house effect.

Table2. Oyster Shell Works for CO2 Gas Absorption from Earth

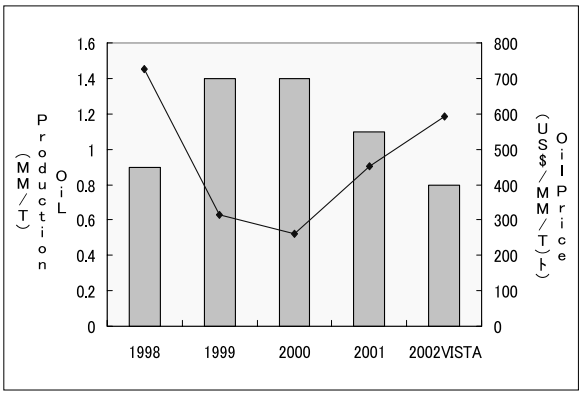
	Factor	Thou.M/T
Oyster World Production Amount	2003	4696
Oyster Meat	25%	1174
Shell Amount	75%	3522
CaCO3 Amount	81.6%	2874
CO2 %	42.8%	1230

Significance of non-feeding aquaculture

Anchovy fishery catch in Peru and horse mackerel fishery catch in Chile have long been used to produce fish meal and oil, but recently the both fish species stocks become unstable due to EL NINO and green house effect.

World fish oil production and price trend between 1998 to 2002 are shown in Figure 8. Since 2000 fish oil production has decreased and the price has is increased rapidly. In the future, the shortage of fish meal and oil supply imposes constraint to the aquaculture industry based on external feed. But oyster and many other mollusks aquaculture utilize the natural feeds in the water, therefore, mollusks aquaculture as a non-feeding farming practice has a great potential in the future.

In table 3, I calculated how much fish meal and oil material fish harvest we can save, replacing by Oyster aquaculture. Annual World Oyster Production is 4,696 thousand MT tons in 2003, of which 25% is Oyster meat, that is 1,174 thousand MT



CIF US$/MT in Rotterdam Market

Figure 8. World Fish Oil Production and Price Trend

Table 3. Oyster Meat Converted to Fishmeal and Oil.

			Factor	Thou.M/T
A	Oyster World Production Amount 2003			4696
B	Oyster Meat	Yield rate	25.0%	1174
C	Same amount of farmed fin fish		Equal	1174
D	Required amount of Fish Feed	FCR	1.5	1761
E	Required amount of Fish meal and fish oil from D	formulation	40%	700
F	Amount of raw material fish for fish meal & oil	Yield rate	25%	2800

tons. We replace the same amount of farmed fin fish harvest by Oyster meat 1,174 thousand tons. If we culture 1,174 thousand tons farmed fin fish by the index of FCR 1.5, we need 1,761 thousand tons fish feed, of which fish meal and oil total amount is 40%. That is to say, it is required 700 thousand tons fish meal and oil. Finally, raw material fish harvest is cut down 2,800 thousand MT tons, if fish meal and oil production yield ratio is 25%. This figure means about 3% of world wild catch and about half of Japanese annual fishery production.

Oyster aquaculture is a resource saving aquaculture. Non-feeding aquaculture is an environment friendly industry. Oyster is one of most promising species for aquaculture.

Potential of oyster shell as a resource

Oyster shell is also an important natural resource. Possible uses of oyster shellsare summed up in Table 3.

Oyster shells contain a high density of calcium carbonate. Ca^{2+} ion is useful for health food products by mineral. It's bactericidal activity is useful for food additive. Comminuted and refined shell is available as construction materials. Shell itself is available as filter element for purification of waste water.

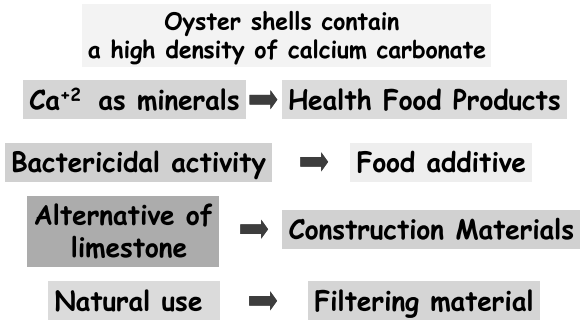


Figure 9. Potential of Oyster Shell as a Resource

Most of about 3,500,000 tons oyster shells in abandoned and wasted on sea shore every year. How to convert this huge natural waste to useful resources for human beings needs to be considered.

Oyster's importance as common Japanese seafood

The annual oyster production of Hiroshima Prefecture is about 22 thousand tons. The amount of various oyster products are shown in Table 4. Oyster's advantage and disadvantage as seafood are shown in Table 5. Oyster is regarded as healthy and versatile food which can be prepared easily. However, oyster fresh meat has a short shelf life time. Food safety as a consequence of toxins and infection by bacteria and virus should be secured.

Table 4. Composition of Hiroshima Oyster Products Usage of Hiroshima Oyster

Annual Production of Out-Shell Oyster
Hiroshima 22,000t

Processed Form	Production	%
Fresh & Live	13,500	61%
Frozen	7,000	32%
Dried & Canned	1,500	7%
TOTAL	22,000	100%

Contents of Frozen	Production	%
Coating	3,500	50%
Individual	3,000	43%
Block	500	7%
TOTAL	7,000	100%

Table 5. Oyster's Advantages and Disadvantages as Seafood

Advantages	Disadvantage
· Can be prepared easily · Healthy · Versatile	·Short shelf life time for fresh meat ·Food safety: toxic planktons, bacteria and virus