An Overview of the US/Japan Natural Resource's Panel on Aquaculture: Past, Present and Future.

James P. McVey*

Background: The United States Japan Cooperative Program in Natural Resources (UJNR) was initiated by a proposal made during the Third Cabinet-Level Meeting of the Joint United States-Japan Committee on Trade and Economic Affairs in January 1964. An aquaculture panel was formed in 1969 and was charged with exploring and developing bilateral cooperation. In addition to the aquaculture panel, their were other programs on desalination of seawater, toxic microorganisms, air pollution, energy, forage crops, national/park management, mycoplasmosis, wind and seismic effects, protein resources, forestry and several joint panels in marine research, development and utilization.

The First Joint Meeting of the U.S.-Japan Cooperative Program in Natural Resource's Panel on Aquaculture was held in Tokyo, Japan, on October 18-19 and 29, 1971

Dr. Atsushi Furukawa and Mr. William N. Shaw, were elected co-chairmen for the Meeting and were accompanied by Robert Hiatt, Robert Wildman Harvey Willoughby, A. Crosby Longwell, John Glude and Cornelius Mock on the US side and Yoshio Hasegawa, Yukimasa Kuwatani, Shunzo Suto, Hiroshi Kan-no, Tomoo Hayashi and Masaru Fujiya on the Japan side. This meeting included presentations by both sides and a week long field trip to see aquaculture site in Japan. The Japan presentations were on marine cultivation in Hokkaido, seaweed mariculture, freshwater culture, shellfish culture, finfish culture in Japan. The US presentations were on Penaeid shrimp larval culture, Sea Grant research, mollusc culture in S. Atlantic, Gulf and Pacific NW, genetics of American oyster, and freshwater fish culture.

A second meeting of the Aquaculture Panel was held in the United States in Washington, DC and Seattle, Washington in 1972. Dr. Furukawa and William Shaw remained the Chairs and they identified Nutrition and Pathology as issue of mutual concerns and scientific exchanges were planed on these topics.

These early meetings established the general format for conduct of the UJNR technical exchange that we have followed throughout the 35 year history of the program. Meetings are alternated between the two countries on an annual basis with a two day symposium and then a field trip for the delegations to view the research facilities and observe the industry. During this time there is adequate opportunity for individual scientists to talk with one another regarding topics of mutual interest and to identify joint research projects. These projects can be supported in a formal way under the UJNR structure or arranged between cooperating institutions, both Federal and academic.

Since that time 35 years ago there have been annual meetings alternating between our two countries on a broad range of topics:

- 71 Overview papers of Japan and US
- 72/73 Pathology and Nutrition
- 74 Pathology
- 75 Nutrition
- 76 General Discussion FAO meeting
- 77 Marine Algae
- 78 Marine Fish
- 79 Freshwater and Marine overviews
- 80 Crustaceans

2009年8月10日受理（Received. August 10. 2009）

* US Panel Emeritus Chair, National Sea Grant College Program Office of Oceanic and Atmospheric Research, NOAA 1315, East-West Highway, SSMC-3, Rm# 11838 Silver Spring, MD 20910-3282, USA

- 81 Molluscan Aquaculture
- 82 Salmon Enhancement
- 83 Reproduction, maturation and seed production
- 84 Environmental Quality
- 85 Innovative Advances Bio/Engineering
- 86 Marine farming and Enhancement
- 87 Genetics
- 88 Marine Ranching
- 89 Reproductive Physiology
- 90 Disease
- 91 Nutrition
- 92 Environmental Management
- 93 Interactions of Cultured and Natural Species
- 94 Biological Control of Salmon and Advanced Tech
- 95 Water Effluent & Quality, Fish and Shrimp
- 96 Biodiversity and Aquaculture
- 97 Nutrition and Technology Development
- 98 Goals and Strategies for Breeding
- 99 Spawning and Maturation
- 00 Pathogenic Organisms/Stock Enhancement
- 01 Ecology of Aqua species/stock enhancement
- 02 Aquaculture and Stock Enhancement Algae/Filter feeders
- 03 Pathology of Crustaceans
- 04 Ecosystem Carrying Capacity/Sustainable Development
- 05 Aquaculture Stock Enhancement

These topics were identified in a series of five year plans and we have just completed the sixth five year plan with this, the 35th meeting of the UJNR Aquaculture Panel. Studying the flow of topics over time there are trends that follow the development of the industry in both Japan and the US.

During the first five years of our cooperation there was an emphasis on understanding the issues in each country and formulating a plan for the best areas of cooperation. The first two meetings were spent on providing overviews of national research activities and identifying two research topics: nutrition and pathology, that were important to both parties. These themes were discussed in the next two meetings and then, in 1976, Japan hosted the strategic United Nations Food and Agriculture Organization (FAO) meeting on world aquaculture that served to focus world attention on the issue of aquaculture and set the course of research for the next decade. The UJNR met as part of the FAO meeting and I had the honor of attending that meeting as a young scientist just starting his career.

During the next five year period the UJNR symposiums tended to focus on culture of different phyla and species, i.e. marine fish, algae, crustaceans, mollusks, salmon. These discussions allowed us to look at the life histories of these groups as well as the technical and husbandry aspects of their culture.

During the next ten year period we continued to discuss the basic disciplines underlying the industry needs and we saw the appearance of marine biotechnology as applied to aquaculture. This advanced technology used for diagnosis of pathogenic organisms, control of endocrine processes for reproduction, and genetic manipulation of marine species has been an important part of our technical exchange. It was during this period that serious questions about environmental issues related to aquaculture started to be asked and the 1984 meeting focused on this topic.

Starting in 1992 we held a series of meetings related to environmental issues:

- 92 Environmental Management
- 93 Interactions of Cultured and Natural Species
- 94 Biological Control of Salmon and Advanced Tech
- 95 Water Effluent & Quality, Fish and Shrimp
- 96 Biodiversity and Aquaculture

These meetings helped define the key issues relative to environmental concerns about aquaculture. These issues were being discussed by scientists around the world and by the media and the press. It was during this time period that the rise of Non Government Organizations (NGO's) concerned about environmental matters turned their attention to aquaculture issues. The UJNR Aquaculture Panel helped to bring science to these issues and I believe helped both countries to define the research needed to provide solutions. It is

very important to have the view of more than one country when looking at broad issues as individual countries have different public views of any developmental technology. This will become more apparent during the discussion that comes later in this paper.

From 1997 to 2003 we see the topics turning back towards the disciplinary subjects of genetics, pathology, nutrition, endocrinology and biotechnology. This time period corresponded to a leveling off of aquaculture production in both countries as well as a sharp decline in wild fishery production. Increased imports were needed in both Japan and the US to meet public demand. Supply of seafood shifted to more imports than domestic production and the economics associated with seafood changed accordingly. Prices fell.

The most recent meetings, 2004 and 2005, as well as this meeting entitled "Building Sustainable Food Supplies through Aquaculture, Wild Stock Enhancement and Habitat Management", are adjusting to the shift of world opinion about the need to manage coastal resources in a more holistic manner. Many are attempting to move towards ecosystem-based management or integrated coastal management and away from single species management for seafood and living resources. In 2005 Japan and the US participated in a meeting with China, Korea, Viet Nam, Canada and representatives from Chile, European Union, Taiwan and Malaysia to discuss the role of aquaculture in ecosystem based management. This will be discussed later in this paper.

Significant Accomplishments:

- Approximately 530 oral presentations at Symposia evenly distributed between both countries as determined through 32 published Proceedings.
- Thousands of scientists and students attending symposia and meetings.
- Exchanges of scientists, students and scientific information between Federal, Provincial, and academic institutions. A perusal of UJNR documents indicates that the US sent a minimum of 104 scientists to Japan and Japan sent 327 scientists to the US during our cooperation to date.
- Aquaculture is being integrated into the new paradigm of ecosystem-based management for seafood supplies in several countries.
- Creation of UJNR websites in both countries that are updated periodically to provide information on the science and accomplishments of UJNR

This list of accomplishments does not take into account the increased cultural understanding between our two countries, the formulation of long term friendships between scientists, the broadening of understanding of world issues, the establishment of career lines or focus for young scientists.

Status of Marine Aquaculture in the US and Japan:

It is important to put this flow of research and discussion into context with the status of the aquaculture industry in our two countries. Attached are graphs showing the growth of production of marine aquaculture in our respective countries during 1970 to the present. I have not included freshwater aquaculture statistics in order to simplify the analysis and reflect the primary focus of US/Japan cooperation.

In 1970 Japan had marine aquaculture production of approximately 550,000 tons compared to the US production of about 130,000 metric tons (Figure 1)(FAO statistics 2006). Japan had a fairly broad range of species that they were producing including mollusks, finfish, crustaceans and algae while the US production was mainly in mollusks. Over the course of the 70's decade Japan's production increased dramatically to nearly 900,000 tons while US production of mollusks actually declined to about 100,000 metric tons. This decline was probably due to loss of habitat and increases in disease in molluscan stocks.

In the 1980's Japan's marine aquaculture production increased to nearly 1,300,000 tons and US production rose slightly back to pre-1970 levels of about 130,000 (Figure 2). The rise of US production corresponds to increased shellfish production resulting from improvements in hatchery supply of commercial mollusks and the

initiation of coastal shrimp and salmon farms in some states.

During the 1990's (Figure 3) both the Japan and US marine aquaculture production leveled out at the levels realized at the end of the 1980's. There appeared to be a slight decline in Japan's production by the end of the decade and the US remained essentially level around 130,000 metric tons.

During the last four years of the statistics available from FAO, Japan has again declined slightly in its marine aquaculture production while the US, for the first time, has moved up from 130,000 metric tons of production to over 200,000 metric tons in 2004(Figures 4 and Table 1). During this time period the value of marine aquaculture production in Japan was a little under $4 billion while the US production moved from $94 million

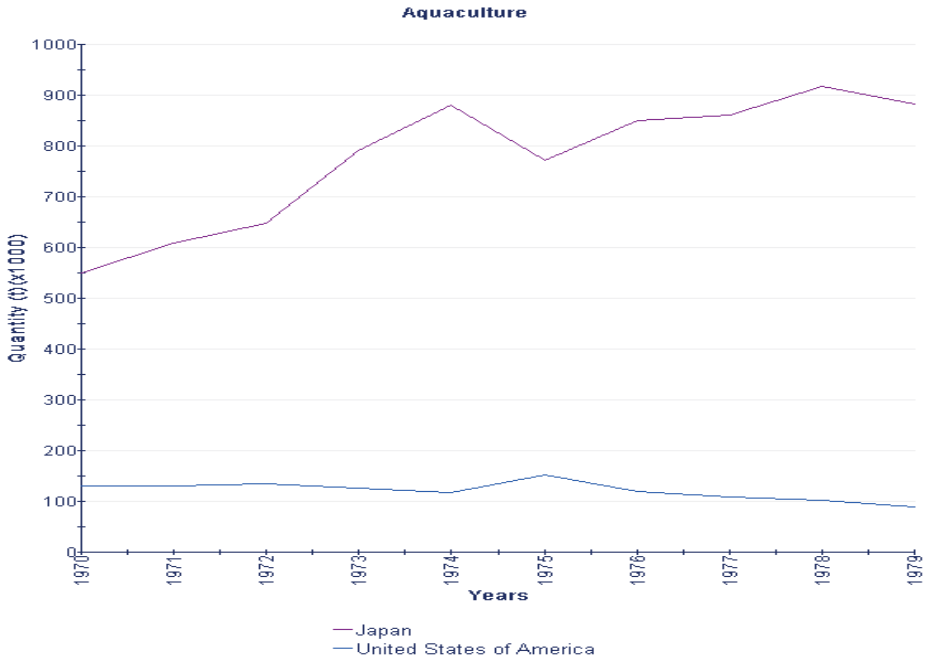

Fig. 1. 1970's Marine Aquaculture Production.

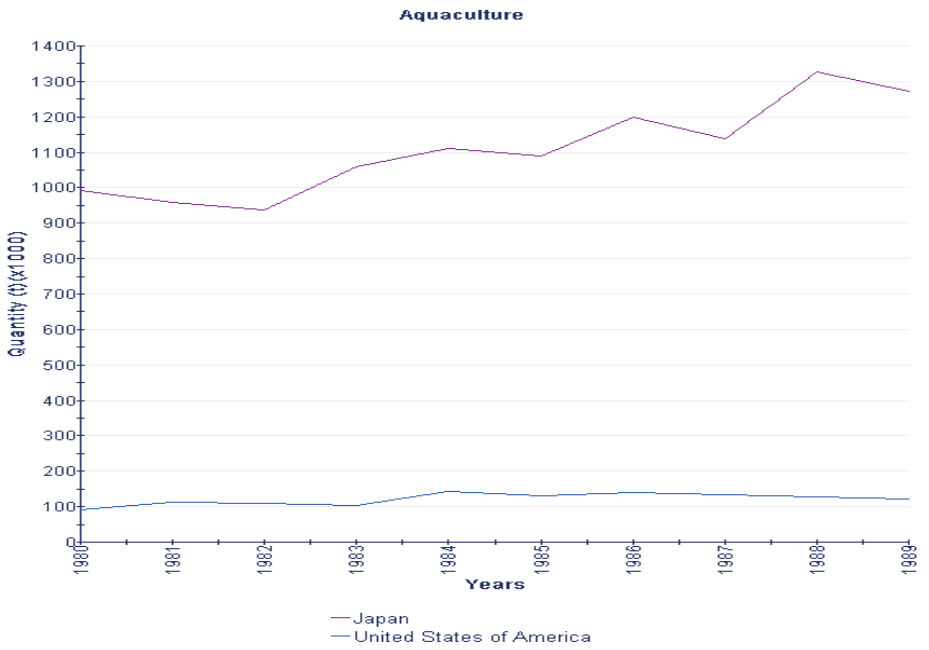

Fig. 2. 1980's Marine Aquaculture Production.

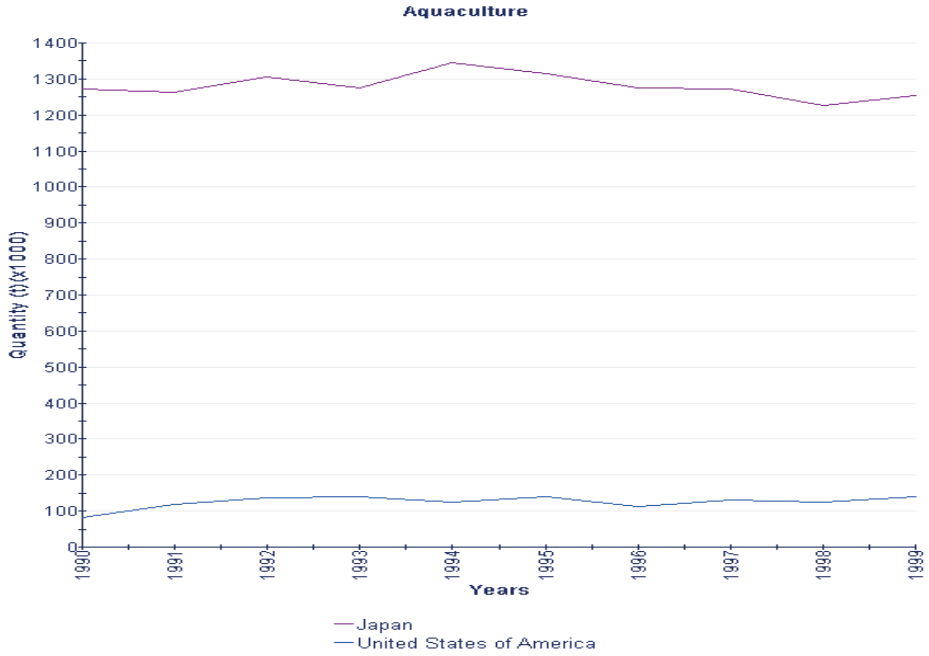

Fig. 3. 1990's Marine Aquaculture Production.

to $191 million or a doubling over the four year period (Figures 5 and Table 2). This increase for the US appears to be a result in a dramatic increase in mollucan production as well as the initiation of a marine finfish industry.

Significance of FAO statistics:

- Marine Aquaculture is a significant part of Japan's seafood supply and economic well being but has not expanded in last decade.
- Marine Aquaculture is a very small part of US seafood supply and is just starting to expand.
- The ten fold difference in production and value in marine aquaculture between the US and Japan may be attributed to differences in public perceptions and traditions, regulatory and policy structures, and timing relative to environmental issues among other factors.
- Possible factors influencing the stagnation of Japanese marine aquaculture production and the prolonged low production of US may be: response to competition from cheap seafood imports making the economics of aquaculture difficult, competition over limited space and resources in coastal zones, and concern over environmental impacts,
- The shift from self sufficiency in seafoods to importation of cheap seafoods has had a profound effect on both countries production and value of seafood. These observations, which represent my personal opinions, help set the stage for this years UJNR symposium.

UJNR 2006 Symposium Topic: Building Sustainable Food Supplies through Aquaculture, Wild Stock Enhancement and Habitat Management

This topic implies a holistic look at seafood production that includes aquaculture, fisheries, habitats and the coastal communities that depend upon these resources. We have a range of presentations from both US and Japanese scientists that will examine these issues and hopefully add to our understanding of these critical relationships.

This years UJNR meeting will build upon a multi-lateral meeting held with several key countries, mentioned earlier, that was attended by UJNR leadership last year in Hawaii entitled: The Role of Aquaculture in Ecosystem Based Management, This meeting came up with several products that add to this overall discussion, these are:

- Guiding Principles for Marine Aquaculture
- Coastal Managers' Considerations for Aquaculture and Integrated Coastal Management

- Requirements for Models used in Managing Coastal Aquaculture
- Country Scenarios for Ecosystem Based Coastal Aquaculture

We expect the publication of these products in book form in the next year and they can be added to the publication of the Proceedings of this meeting as we continue to look at aquaculture in coastal environments.

Questions for the Future:

Looking at the past 35 years of the United States and Japan Aquaculture Panel activities in combination with the analysis of aquaculture production in our respective countries as well as recent meetings and discussions on this year's topic I would like to offer several questions that might guide some of our discussions:

- ➢How do developed countries develop their own aquaculture industry in the face of cheaper imports?
- ➢How does large scale aquaculture integrate with fisheries and coastal communities in the coastal zone of developed countries?
- ➢How do environmental concerns limit aquaculture development?
- ➢What regulatory and financial changes need to be made to develop the aquaculture industry

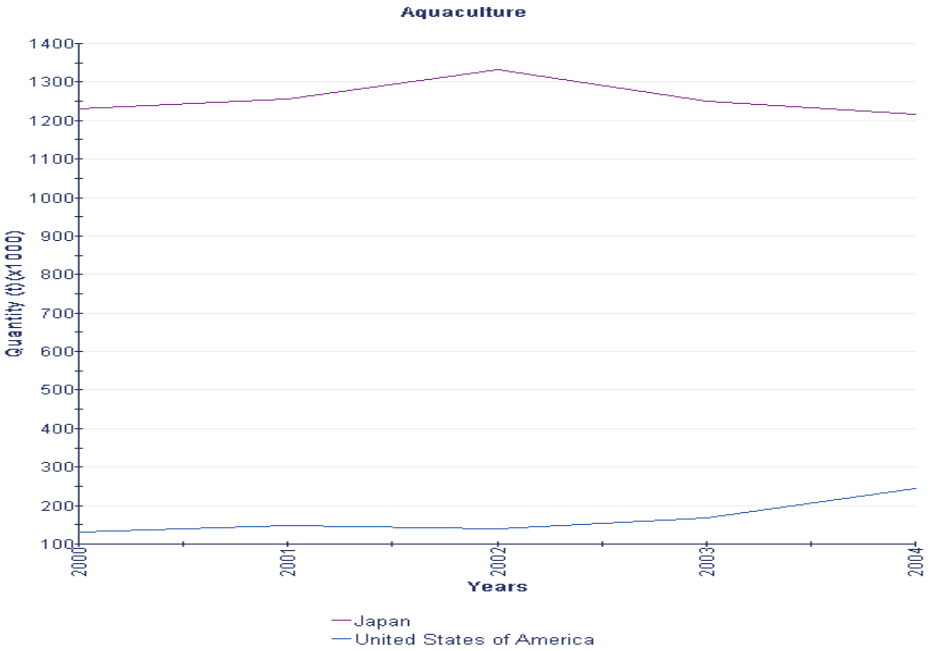

Fig. 4. 2000-2004 Marine Aquaculture Production.

Aquaculture: Quantity (t)

Display Land Area: All ok EXPORT GRAPH

Land Area	Ocean Area	Environment	Species	Scientific name	2000	2001	2002	2003	2004
Japan	Marine waters	Marine	Aquatic plants	Aquatic plants	528 574	511 448	557 951	477 705	484 389
			Marine fishes	Marine fishes	245 566	252 173	260 382	264 710	252 674
			Crustaceans	Crustaceans	2 086	2 004	1 778	1 824	1 818
			Molluscs	Molluscs	433 629	468 851	495 725	485 221	451 223
		Sub-total Marine			1 209 855	1 234 476	1 315 836	1 229 460	1 190 104
	Sub-total Marine waters				1 209 855	1 234 476	1 315 836	1 229 460	1 190 104
Total Japan					1 209 855	1 234 476	1 315 836	1 229 460	1 190 104
United States of America	Marine waters	Marine	Crustaceans	Crustaceans	2 163	3 564	4 026	4 577	4 731
			Marine fishes	Marine fishes	0 .	0 .	0 .	0 .	1 362
			Molluscs	Molluscs	105 689	122 463	121 717	145 979	221 717
		Sub-total Marine			107 852	126 027	125 743	150 556	227 810
	Sub-total Marine waters				107 852	126 027	125 743	150 556	227 810
Total United States of America					107 852	126 027	125 743	150 556	227 810
Grand total					1 317 707	1 360 503	1 441 579	1 380 016	1 417 914

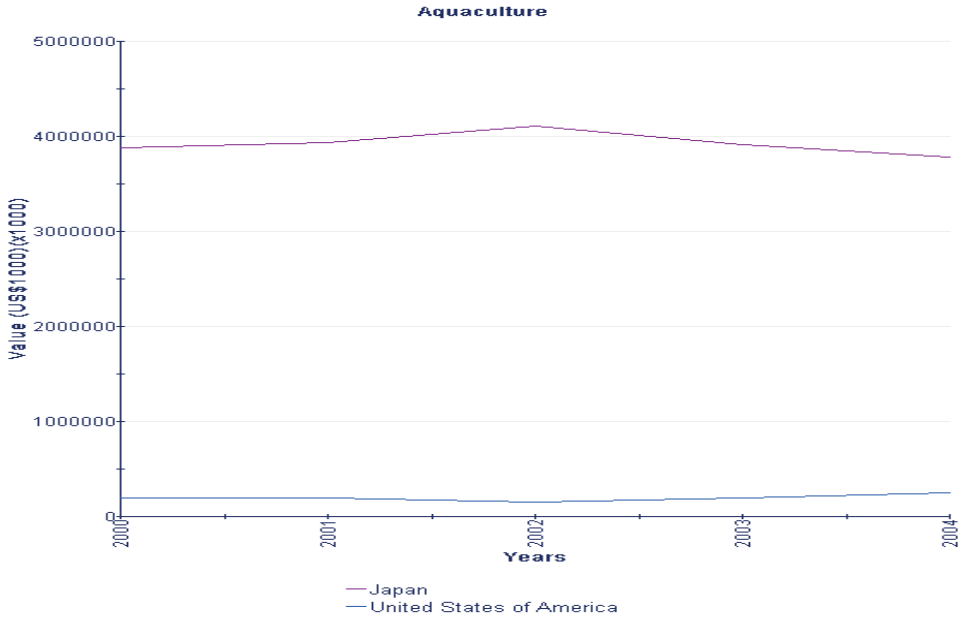

Fig. 5. 2000-2004 Marine Aquaculture Value.

Aquaculture: Value (US$1000)

Display Land Area: All ok EXPORT GRAPH

Land Area	Ocean Area	Environment	Species	Scientific name	2000	2001	2002	2003	2004
Japan	Marine waters	Marine	Aquatic plants	Aquatic plants	1 132 793	1 099 083	1 206 075	1 021 294	1 036 728
			Crustaceans	Crustaceans	13 559	13 026	11 557	11 856	11 817
			Marine fishes	Marine fishes	2 019 604	2 058 042	2 102 470	2 103 228	2 001 269
			Molluscs	Molluscs	652 536	705 368	746 416	730 257	679 077
		Sub-total Marine			3 818 492	3 875 519	4 066 518	3 866 635	3 728 891
	Sub-total Marine waters				3 818 492	3 875 519	4 066 518	3 866 635	3 728 891
Total Japan					3 818 492	3 875 519	4 066 518	3 866 635	3 728 891
United States of America	Marine waters	Marine	Crustaceans	Crustaceans	14 514	27 407	27 095	23 205	20 958
			Marine fishes	Marine fishes	0 .	0 .	0 .	0 .	6 292
			Molluscs	Molluscs	79 984	93 239	98 073	120 929	164 352
		Sub-total Marine			94 498	120 646	125 168	144 135	191 603
	Sub-total Marine waters				94 498	120 646	125 168	144 135	191 603
Total United States of America					94 498	120 646	125 168	144 135	191 603
Grand total					3 912 990	3 996 165	4 191 686	4 010 769	3 920 494

site last updated: Jan 1 1970

sector while protecting the environment?

➢What is the future of offshore technologies?

➢What predictive models and monitoring techniques will be necessary for situating and managing aquaculture in coastal areas

➢What genetic guidelines will be necessary for safe-guarding natural fishery stocks relative to aquaculture

➢How can we capture and recycle marine proteins and obtain alternative proteins and oils from both land and ocean for aquaculture diets

➢What diagnostic tools and disease treatments are appropriate for sustainable aquaculture

In closing, I would like to reflect on some additional FAO information that deals with the needs of the future:

· In 2006, FAO's "The State of World Aquaculture" reported that world aquaculture is now contributing 45.5 million tons (43%) of fish supply. The world will need 40 million tons more by 2030 based on present per capita consumption. Catches in the wild have leveled off and the only hope for meeting future demand is through farming. Imports of seafood by developed nations have reached 33 million tons valued at $62 billion.

These statistics show how far we have come and how far we have have to go! Aquaculture production is now nearly equal to wild fisheries production and the combination of the two equal our seafood supply. The loss of habitat, declining water quality in our coastal areas, the declining fisheries around the world, the limited amount of marine protein available for aquaculture feeds, the limited amount of space available for aquaculture in nearshore environments, presents great challenges to future production.

Working together the US and Japan have made great strides in providing aquaculture science and technology for developing world aquaculture. Technologies developed through our joint efforts are being used throughout the world and have helped lead to the increased production recorded in FAO statistics.

I anticipate that our cooperation will continue for a long time to come and the professional relationships and friendships that have evolved over the past 35 years will form the base of future endeavors.