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Economic Cooperation

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Main Measures on the Protection of Resources for a Sustainable Fisheries in Malaysia

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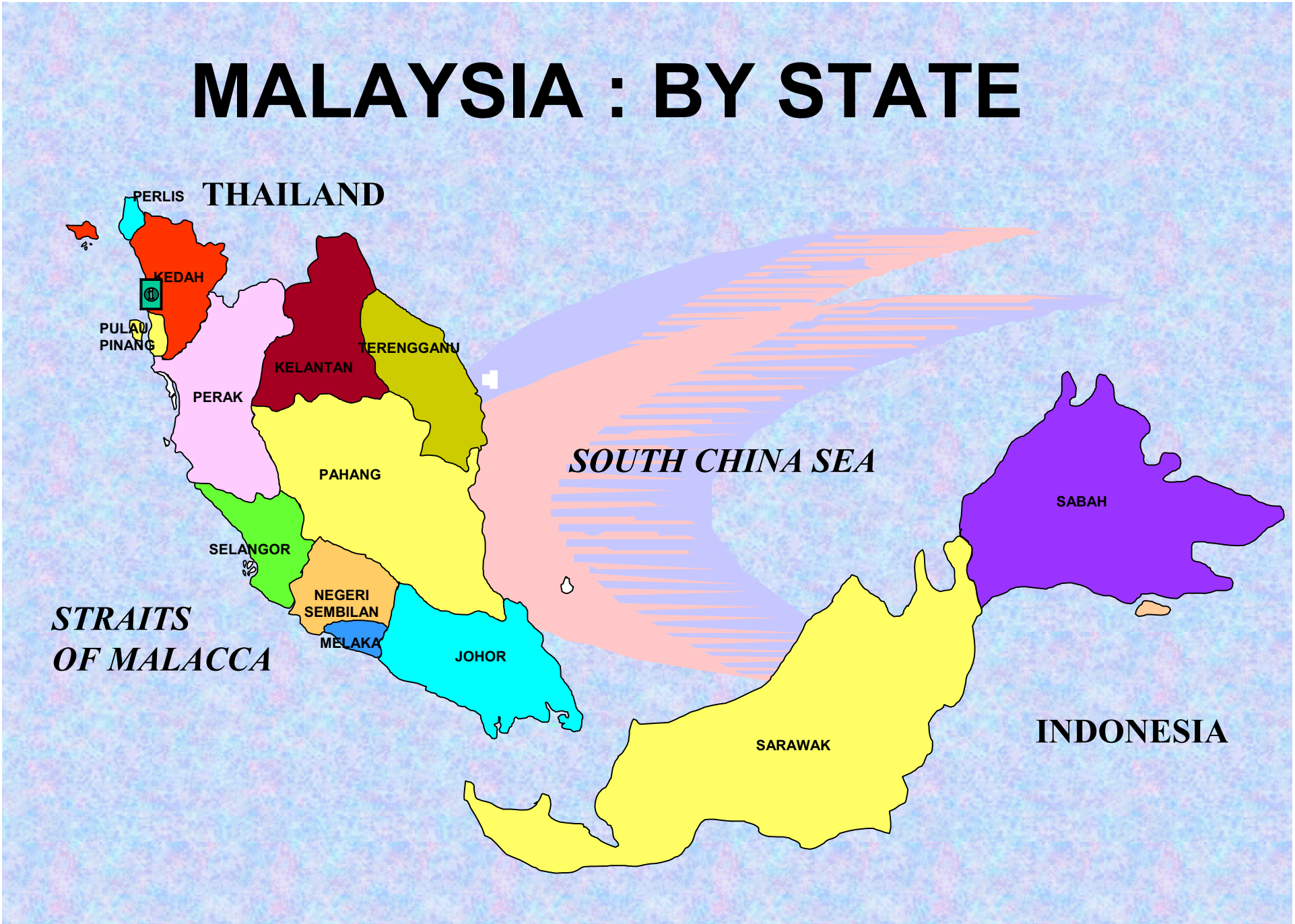
Department of Fisheries Malaysia


Rangoon
THAILAND
LAOS
Da Nang
BURMA
VIETNAM
Bangkok
CAMBODIA
Phnom Penh
Nha Trang
Ho Chi Minh City
Andaman Sea
Gulf of Thailand
South China Sea
SPRATLY ISLANDS
Palawan
Luzon
Manila
PHILIPPINES
Mindoro
Samar
Panay
Cebu
Negros
Philippine Sea
Sulu Sea
Mindanao
Nicobar Islands (INDIA)
Banda Aceh
George Town
MALAYSIA
Kuala Lumpur
ACEH
Medan
Pulau Simeulue
SUMATERA UTARA
Pulau Nias
Pekanbaru
SINGAPORE
Singapore
RIAU
Natuna Besar
Bandar Seri Begawan
BRUNEI
MALAYSIA
Borneo
Celebes Sea
Pontianak
KALIMANTAN BARAT
Kalimantan
KALIMANTAN TIMUR
Samarinda
KALIMANTAN TENGAH
Palangkaraya
KALIMANTAN SELATAN
Banjarmasin
Manado
SULAWESI UTARA
Molucca Sea
Halmahera
Palu
SULAWESI TENGAH
Kepulauan Sula
Sulawesi (Celebes)
SULAWESI SELATAN
Kendari
SULAWESI TENGGARA
Ceram Sea
Buru
Ceram
Ambon
MALUKU
Banda Sea
Pulau Siberut
Padang
SUMATERA BARAT
Jambi
JAMBI
Pulau Bengkalis
Pulau Belitung
Palembang
Sumatra
SUMATERA SELATAN
Bengkulu
BENGKULU
Tanjungkarang-Telukbetung
LAMPUNG
Selat Sunda
GREATER SUNDA ISLANDS
Java Sea
JAKARTA RAYA
JAWA TENGAH
Ujungpandang
Jakarta
Semarang
Bandung
Madura
Surabaya
Java
JAWA BARAT
JAWA TIMUR
BALI
Yogyakarta
YOGYAKARTA
Denpasar
Mataram
Lombok
Sumbawa
Flores
NUSA
Dili
TIMOR
INDIAN OCEAN

MALAYSIA : BY STATE



Background - Malaysia

Area

Total Area: 329,750 km^2

Terrestrial: 328,550 km^2

Coastline: 4,384 km

Peninsular 1,823 km

East Malaysia 2,561 km

Maritime

Continental Shelf: 200 m depth at South China Sea

Territorial Waters: 12 nautical miles

EEZ: 200 nautical miles

East Coast Peninsular - 117,892 km^2
West Coast Peninsular -31,597 km^2
Sabah & Sarawak - 303,697 km^2

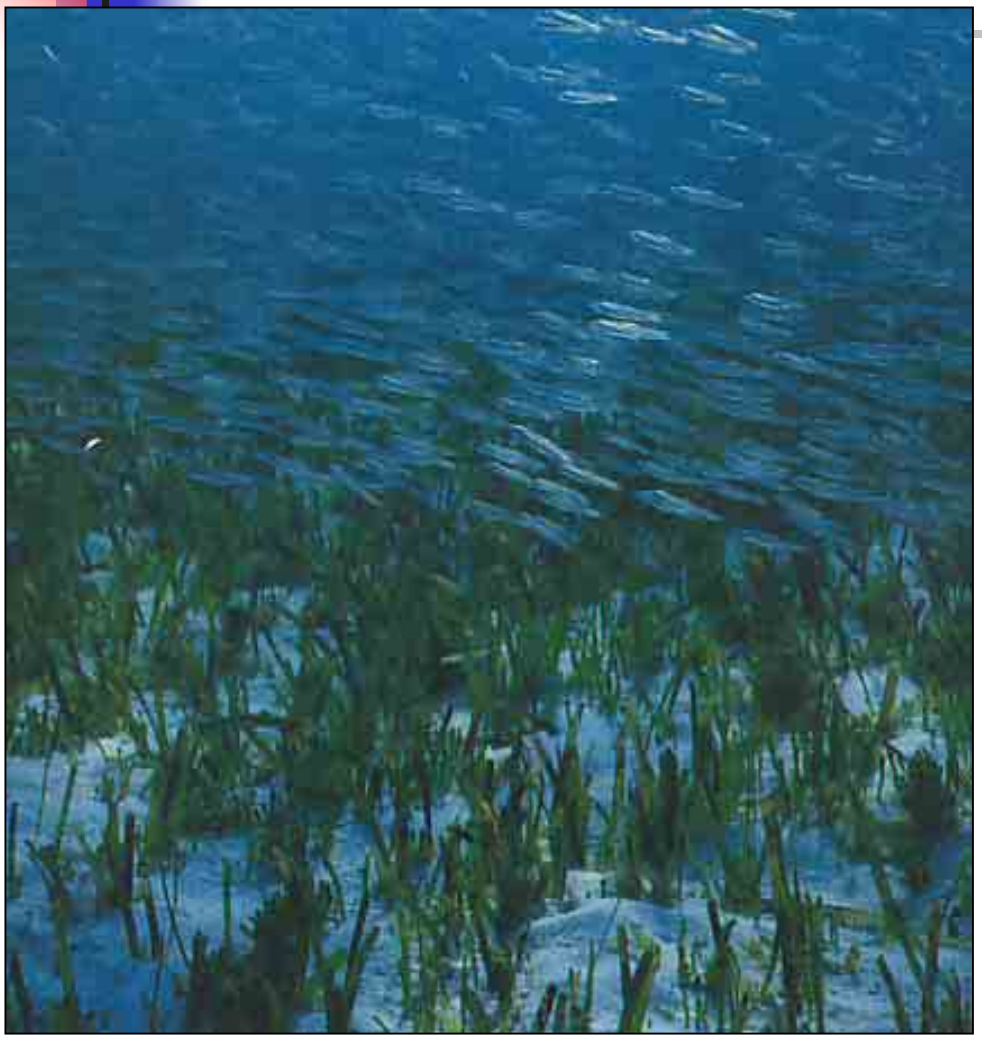
FAO Fisheries Statistic Area: 71

Marine Ecosystem
(Beaches)

Marine Ecosystem
(Mangroves)

Marine Ecosystem

(Seagrasses)



Marine Ecosystem

(Coral Reefs)

Definition – Resources (FAO, 1994)

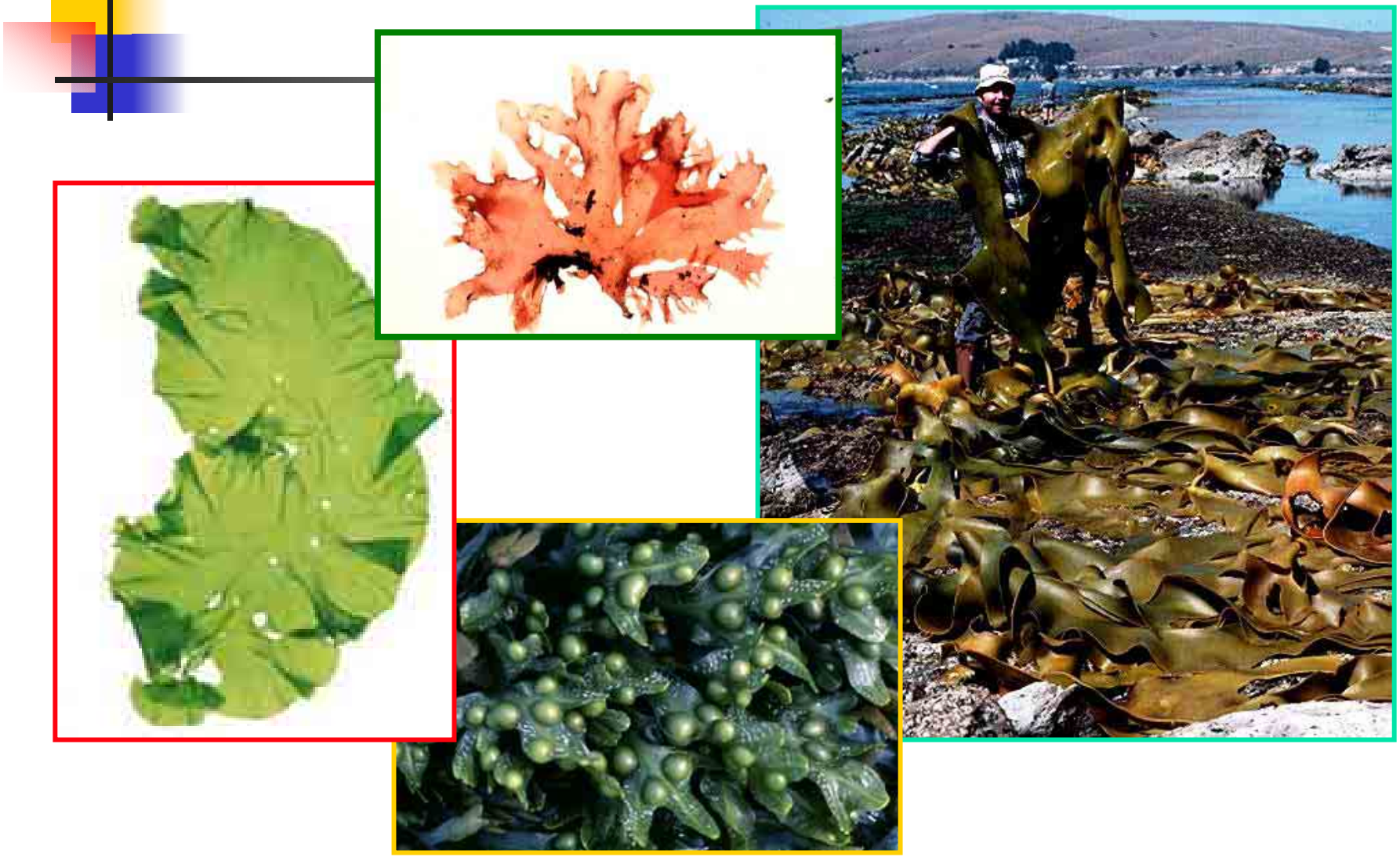
- the term **resources** will, hereafter, be generally used to refer to the **living marine species** potentially or presently subject to exploitation by man for food, feed, fertilizer or the production of other products of value or use, it being understood that a living marine resource cannot be dissociated from its environment. Moreover, the term **fish** will be generally used to cover fish proper, as well as shellfish and all other groups of marine organisms exploited for human use or consumption.

Definition

Fish – Fisheries Act 1985

- Any aquatic animal or plant life, sedentary or not, and includes all species of finfish, crustacean, mollusk, aquatic mammals, or their eggs or spawn, fry, fingerling, spat or young, but does not include any species of otters, turtles or their eggs.

Aquatic Plants



SPONGES

MOLLUSKS

MOLLUSKS

CRUSTACEANS






Fishes

Sharks & Rays

Biggest Fish in the World

Marine mammals

INTRODUCTION

- In 2004 fish production 1.54 m. t. (culture + capture) and valued at RM 5.51 billion (USD1.49b)
- Contributes 1.73% to national GDP and 16.61% to agriculture sector GDP
- Production of capture fisheries - 1.33 m. t. (87.00% of total fish production)
- With value of RM 4.24 b)

INTRODUCTION

- Fish provides important source of food and protein.
- Current Malaysian consumption of fish is **57.9 kg.** per capita
- Projection for 2010, consumption is **63 kg** per capita

INTRODUCTION – cont..

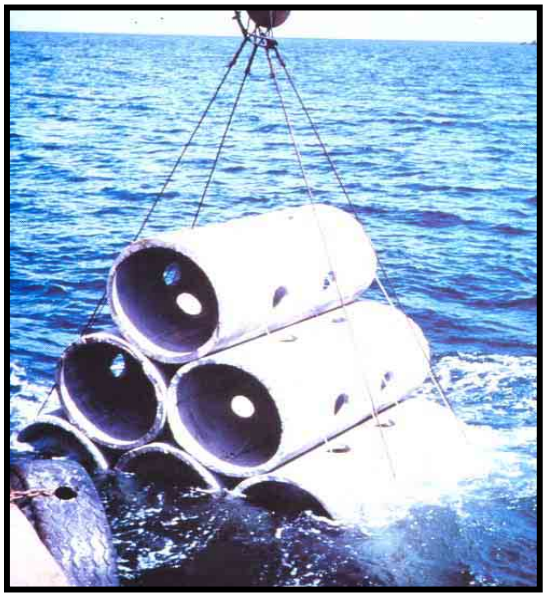
- Fisheries provides job to 89,453 fishermen
- Commercial fishermen 41,443
- Traditional fishermen 48,010

FISHERIES LEGISLATIONS

- Fishery management was started since 1894 under The Colonial Fisheries Unit (1894 – 1950)
  - regulating fisheries activities
  - economic performance
  - equity or social needs
- Fisheries Ordinance 1909 was replaced by Fisheries Rules 1951 and Fisheries Act 1963
  - provide more comprehensive legal framework to manage the fisheries in Malaysian waters

FISHERIES LEGISLATIONS – cont..

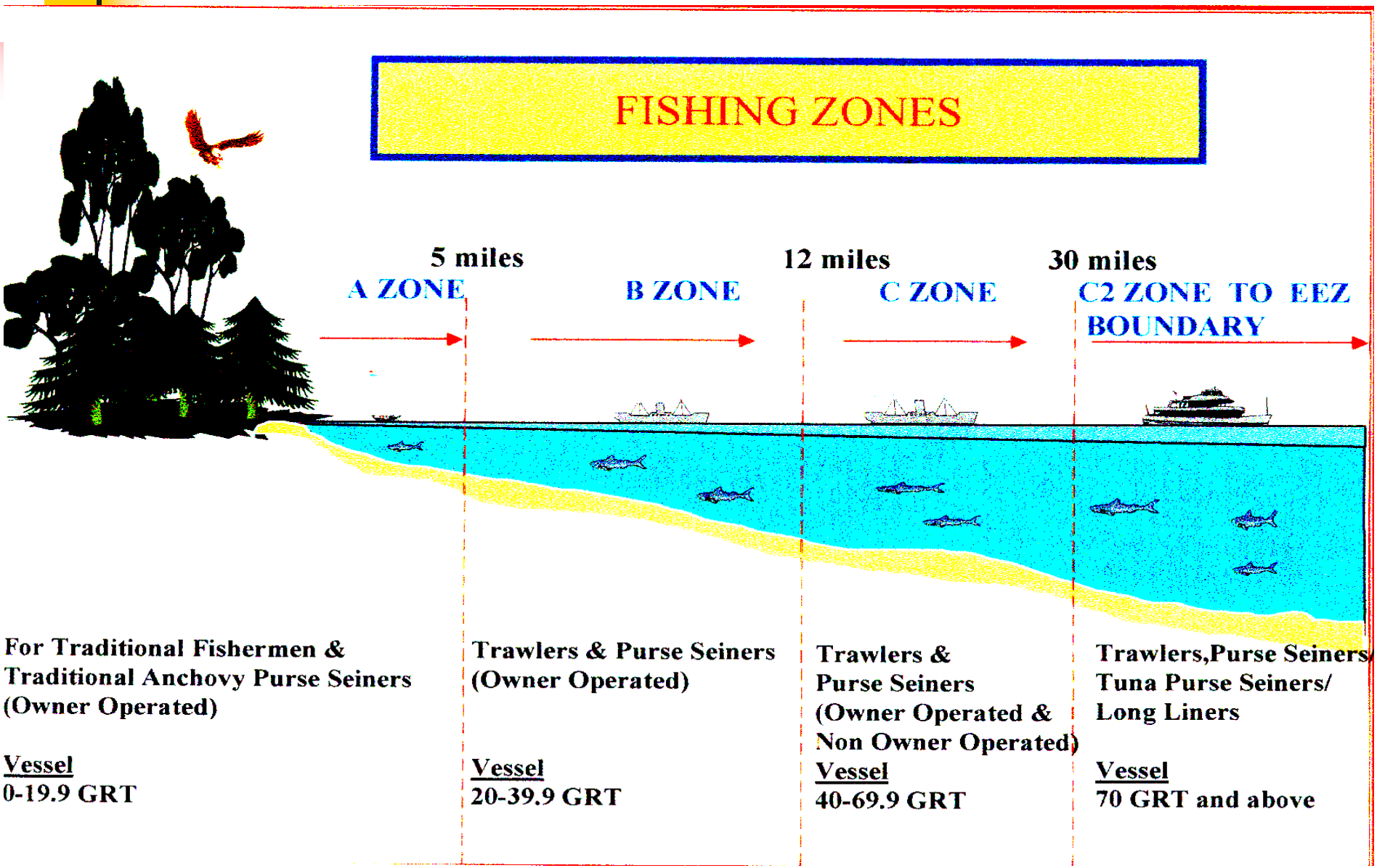
- Fisheries Act 1963 was repealed and replaced by Fisheries Act 1985
  - an act relating to fisheries, including the conservation, management and development of maritime and estuarine fishing and fisheries



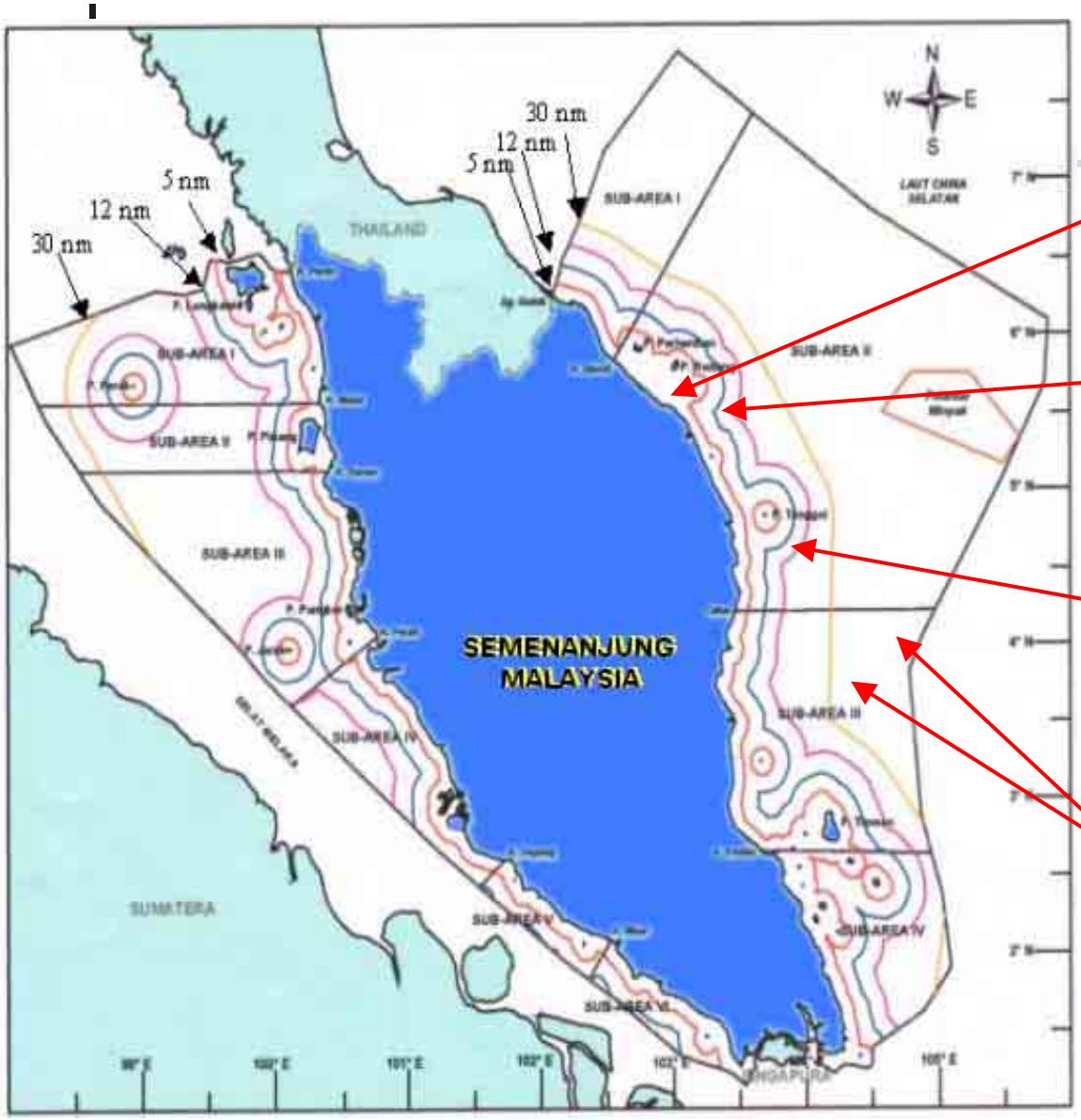
FISHERIES LEGISLATIONS – cont..

- Under the New Fisheries Policy 1982 -1983, the restricted areas were expanded and clearly defined to 4 fishing zones
- Each fishing vessel is licensed to operate one fishing gear
- No new license has been issued since 1982 for commercial fishing
- Mesh size not less than 38.0 mm is allowed in the code-end of a trawl net
- Mesh size not less than 24.5 mm is allowed in the the gill net

FISHERIES MANAGEMENT



FISHERIES RESOURCE MANAGEMENT



Under the New Fisheries Policy 1982 -1983, the restricted areas were expanded and clearly defined to 4 fishing zones;

- Zone A
  - Traditional Vessel < 20 GRT
- Zone B
  - Traditional Vessel & Commercial 20 – 39.9 GRT
- Zone C
  - Commercial Vessels 40– 69.9 GRT
- Zone C2
  - Commercial Vessels Deep Sea > 70 GRT

FISHERIES MANAGEMENT

Fishing Vessel

INTRODUCTION – cont..

No. of licensed vessels 36,136 (2004)

Fishing Vessel Type	Number of Vessel
Non Powered Vessels	2697
Outboard Powered vessel	15651
Inboard Powered Vessels < 10 GRT	8557
Inboard Powered Vessels 10 – 69.9 GRT	8434
Inboard Powered Vessels > 70 GRT	833

FISHING APPLIANCES

- TRADITIONAL
- COMMERCIAL

TRADITIONAL FISHING APPLIANCE

THE FISHERIES ACT 1985 INTERPRETS:

TRADITIONAL APPLIANCE:

ANY FISHING APPLIANCE ENUMERATED HEREUNDER OPERATED WITH THE USE OF A NON-MOTORISED FISHING VESSEL OR MOTORISED FISHING VESSEL OF NOT MORE THAN FORTY (<40) GROSS REGISTERED TONNAGE (GRT)

TRADITIONAL APPLIANCES

1. Trap
2. hook-and-line
3. drift net/gill net
4. seine net
5. hand lift net
6. bag net or stow net
7. barrier net

COMMERCIAL APPLIANCES

1. TRAWL NETS
2. PURSE-SEINE NETS

Fishing Gears (2004)

Type of Fishing Gear	Total
Trawl Nets	6,055
Purse Seines	1,030
Gill Nets	18,477
Hook & Lines	4,731
Traps	836
Others*	1,730
TOTAL	32,859

*Lift nets, scoop nets, bag nets, etc.

BANNED APPLIANCES

1. PUSH NET (USING MOTORISED VESSEL)
2. PAIR TRAWL
3. EXPLOSIVES
4. APPARATUS USING ELECTRIC CURRENT
5. GILL NET WITH MESH SIZE OF ≥ 24.5 cm (10 inches)

FISHERIES MANAGEMENT

MONITORING, CONTROL & SURVEILLANCE

- Monitoring : collection of information on the fishing industry
- Control : the issuance of fishing license is regulated to avoid excessive fishing effort but ensuring sustainable fishing
- Surveillance – to enforce Fisheries Act 1985 and its regulations especially on I.U.U. fishing through collaboration with other maritime agencies

FISHERIES MANAGEMENT

MONITORING, CONTROL & SURVEILLANCE

RESOURCE CONSERVATION

- **Marine fish resources have declined over the past decades;**
  - **C.P.U.E 180 kg/hr (1994)**
  - **C.P.U.E 60.2 kg/hr (2001)**

- **Steps taken to alleviate the problem of declining marine resources;**
  - **artificial reefs**
  - **marine protected area**
  - **sea turtle conservation**

Artificial Reefs

- Artificial reefs and fish aggregating devices (FAD) are popular for fisheries resource enhancement and management
- FADs were practiced since early 1900's
  - sinking derelict wooden boats
  - bundle of tree branches and twigs
  - rocks
- Marine fish resources have declined due to the increased intensity of fishing activity
- Depletion of fish resources had been indicated by high composition of trash fish e.g.. 32.9% in 1987 and 55.0% in 1994

Artificial Reefs…. cont.

- AR development was initiated by DoFM in 1975 by deploying tyre reefs
- Principal objectives in the construction of ARs;
  - to mitigate impacts and loss of the habitats due to destructions
  - to increase the marine resources
- Fishing in AR sites are prohibited
- A total of 99 artificial reef sites were established
- Various type of materials are utilised for AR constructions e.g. discarded tyres, derelict boats, fabricated concrete structures, and PVC pipes
- Since 1986, a total budget of RM 23.16 millions had spent by Malaysian Government

ARTIFICIAL REEFS (cont…)

Materials

ARTIFICIAL REEFS…cont.

Success Stories

- ARs have rehabilitated the destructed habitats
- Prevent coastal encroachments
- Increase the fish resources as indicated by the better CPUE of 9 – 21 kg h^{-1}

Artificial Reefs…cont.
another story

- Main objective in the construction of ARs;
  - to increase the marine resources
  - provide fishing ground for traditional fishermen
  - improving catches and incomes
- AR development was also deployed by Fisheries Development Authority (LKIM) in 1975 by deploying tire reefs
- Fishing in AR sites are allowed
- A total of 221 artificial reef sites were established
- Various type of materials are utilized for AR constructions e.g. discarded tyres, and fabricated concrete structures
- Since 1983, a total budget of RM 96 millions had spent

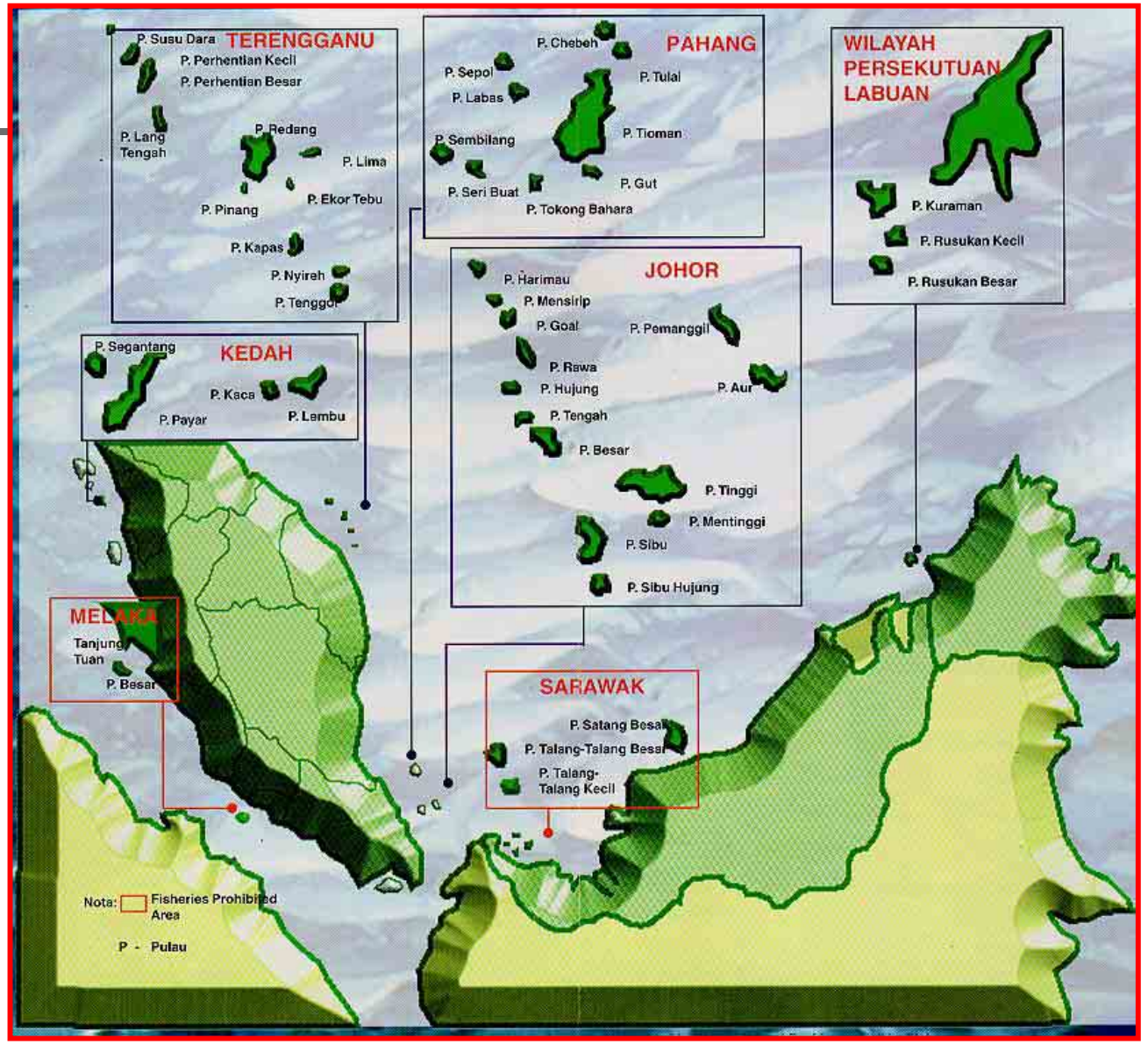
Establishment of Marine Protected Areas

- Realizing the need to enhance marine resources, steps to establish marine protected areas were taken seriously as one of management tool
- The potential identified water bodies were gazetted as Marine Protected of Malaysia in 1994 under the Fisheries Act 1985
- Administered by DoFM under the Fisheries Act 1985 Part IX – Marine Parks and Marine Reserve (Section 41 – 45)
- the statute of no take zone in marine parks and no commercial fishing is allowed in Fishing Prohibited Areas
- The administration of transport and shipping remains with MoT

Marine Protected Areas

Where are the MPAs in Malaysia?

- 40 offshore islands have been established for marine parks
- 7 areas are gazzeted as Fishing Prohibited Areas
- 7 islands are gazzeted as Turtle Protected Islands



Objectives of Marine Protected Areas

- Conservation and protection of coral reefs to sustain fisheries resources
- Upgrading and conserving the natural habitat of aquatic life
- Establishment of management zone for the conservation of aquatic flora and fauna
- Establishment of zones for recreational use consistent with the carrying capacity of the area

Conservation of Sea Turtles

- Conservation strategy for marine turtles had been introduced in early 1950's – Turtle Enactment 1951 of Terengganu
- Late 1980's had shown awakening of awareness and concern for sea turtles by several important events e.g. establishment of Rantau Abang Turtle Santuary, ban on the possession of leatherbacks egg etc.
- In the Malaysian Constitution, sea turtles are under the jurisdiction of the 13 individual states
- Fisheries Act 1985 is in providing for objectives of conservation, management and development of marine resources at federal level
- Fisheries Act 1985 provides a comprehensive frame for subsidiary legislation to be enacted by state governments

Sea Turtles Conservation

Leatherback

Green Turtle

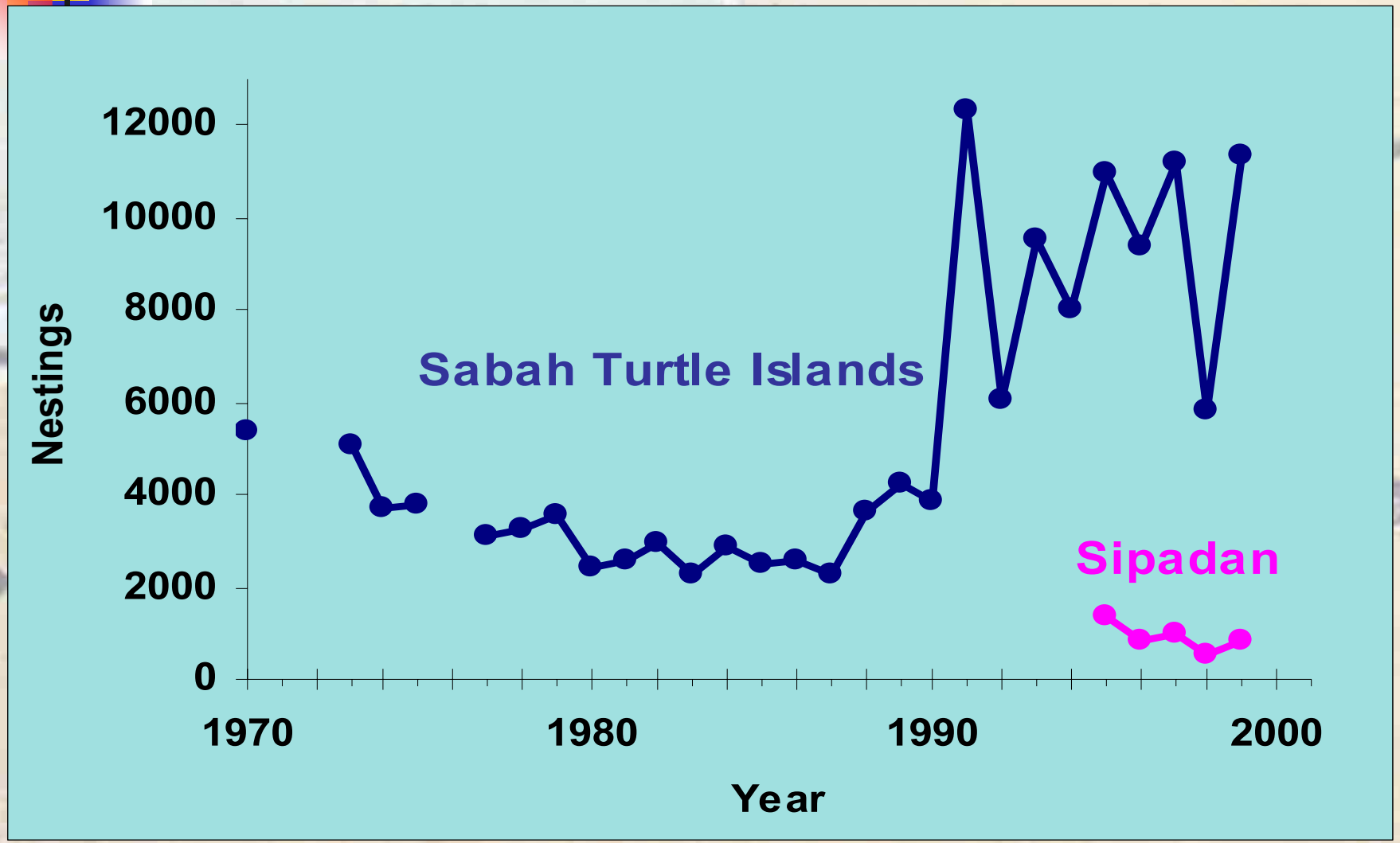
Hawksbill

Olive Ridley

TURTLE LANDING AREAS BY SPECIES IN MALAYSIA

Marine Turtle Nestings

Sabah



Conservations

International & Regional Convention/Agreement

- Malaysia became a party of CITES effectively on 18 Jan. 1978
  - import and export of sea turtles, their products and parts are prohibited
- Malaysia and the Philippines had established the Turtle Islands Heritage Protected Area (TIPHA) to collaborate efforts on trans-boundary conservation, management and research (May 31, 1996)
- September 12, 1997, MOU on ASEAN Sea Turtle Conservation & Protection was signed by all ASEAN member countries
  - to promote the protection, conservation, replenishing and recovery of sea turtles and its habitats
- Transboundary cooperation for management, utilization and conservation of marine resources under Sulu-Sulawesi Marine Ecoregion; Indonesia-Malaysia-the Philippines
- ASEAN Regional Action Plan on Trade in Wild Fauna and Flora 2005 – 2010 to control illegal international trade on wildlife effectively

Management

Hatchery Programme

- First hatchery was established in 1949, off Sarawak

Sarawak	**-**	**1949**
Terengganu	**-**	**1951**
Kelantan	**-**	**1951**
Sabah	**-**	**1966**
Pahang	**-**	**1977**
Melaka	**-**	**1988**
Perak	**-**	**1988**
Pulau Pinang	**-**	**1988**

- Artificial hatcheries are established at almost all nesting beaches
- 15 hatcheries are operational for the whole country
- DoF are purchasing eggs from licensees
- All leatherbacks, hawksbill and olive ridley eggs are buried for hatching
- Since 1965, about 262 millions hatchlings were released

Hatchery Practices

Management

Santuaries

1. Turtle Islands Sabah
2. Turtle Islands Sarawak
3. Rantau Abang Santuary
4. Marine Parks (40 islands)
5. Pulau Redang
6. Ma'Daerah
7. Pantai Aceh

Proposed

1. Pulau Upeh, Melaka
2. Pantai Segari, Perak

FAO Fisheries Experts Say:

'To assure that maximum benefits accrue from the fisheries, the objectives must change from increasing landings to assuring sustainable exploitation' (Gillett, 1996)

'it may be high time to switch attention [from finding new resources] to management of existing fisheries, in order to prevent over-fishing' (Venema, 1996)

Conclusion

The Government of Malaysia through The Department of Fisheries aims to create fisheries resources that are not only economically viable but also profitable and sustainable in the long term while protecting and conserving the environment

Sustainable Marine Fisheries Management and Development in Vietnam

Dr. Chu Tien Vinh

Introduction

Fishing is an important activity throughout the Southeast Asian Region, especially in Vietnam. Due to long coastline of about 3,200 km and its EEZ extending over more than 1 million square kilometer and rapid growth and demand for fish production as the main animal protein sources, the capture marine fishery in Vietnam is undergoing rapid changes both in relation to new fishing boats entering the fisheries and towards bigger and more modern boats operating off-shore.

The Fisheries sector is one of the most dynamic and fastest growing sectors of the Vietnamese economy. In 2005, total production from capture fisheries has been reached more than 1.8 million tonnes and export value gained at 2.7 billion US $.

However, the majority of the Vietnamese marine fisheries can still be characterized as Small scale, Multi-gears and Multi-species.

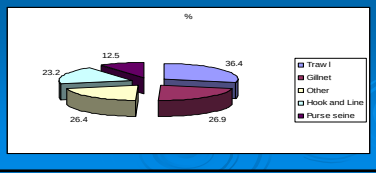
Current status of marine fisheries

+ Fishing fleet

-There are more than 84,000 fishing vessels with the total engine power (Hp) more than 4 million Hp. Fishing vessels having engine power capacity < 45 Hp consists of about 75.8 % of the total number of fishing fleet, from 45-90 Hp- 14.3 % and >90 Hp-9.9 %.

-The fishing gears include active gears like trawls, purse seines and passive gears like gillnets, hook and line, pots and traps and other ones. The percentage of different fishing gears and methods used in coastal and offshore areas is shown in Figure 1. The Trawl fishery is dominant consisting of 36.4 % then followed by gillnet (26.9 %), etc.

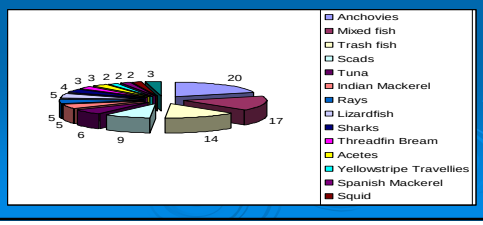
Fig. 1: The percentage of fishing gears and methods



+ Total catch and species composition of the catch

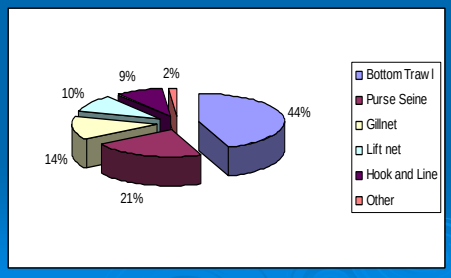
- The total catch of marine fisheries production has nearly tripled from 0,7 million tonnes in 1990 to 1,8 million tonnes in 2005. The species composition of catch depends on the fishing gears used, fishing areas and fishing year.
- In total catch production , anchovy, different mixed fish species and trash fish are dominant then followed by scads, tunas, mackerels, etc. The species/ group of species composition consisting of more than 1 % of total catch are shown in figure 2.

Figure 2. Species/group of species composition in total catch



-Total catch by fishing gears and methods is shown in figure 3. The trawl fishery contributed about 44 % of total catch, then followed by Purse seine (21%), Gillnet 14%), Lift net (10%), etc.

Fig. 3: Catch by fishing gears



+ Fisheries resources

- The total standing biomass is estimated to be around 3.6-4.0 million tonnes, and the Maximum Sustainable Yield (MSY) is 1.4 – 1.6 million tones.
-The total number of marine fish species are reported exceeds 2,030 belonging to over 700 genera and nearly 200 families.

+ Fisheries infrastructure

-There are 150 fishing ports and harbours with total berth length of 4,146 m. Most are small and medium ports serving for unloading of catch, loading fuel, fresh water, ice, repair services and storm shelters.

- The fishing ports almost all lack modern working facilities such as landing equipment, cranes and cool storage warehouses. The place for sorting and grading fish is generally small and the transportation systems in ports are not convenient.

- There are 702 shipyards for fishing vessels providing total building capacity of 8,000 fishing vessels per year. Apart from these, there are many small local shipyards building small fishing boats.

- There are 8 manufacturers producing net fibers, packing bags and other fishery materials. They produce a total volume of 200 tonnes fibers and 7,500 tonnes fishery related material every year.

-The number of specialized fish markets is limited. There are 126 frozen-storage warehouses providing total storage capacity of about 20,000 tonnes, and 120 ice-making enterprises throughout the country supplying ice for the whole fishing fleet , and 405 processing plans .

Problem issues in marine fisheries

+Legal and Institutional framework weaknes

-There are a lot of documents have been published regarding to marine fisheries management , but some of them still are overlapping and not so clear. There are still lack of appropriate, detailed guidelines for implementation of those legislative documents.
-Monitoring and Enforcement are week at both central and local levels.
-Strategy for sustainable marine fisheries development and management are still not in places.

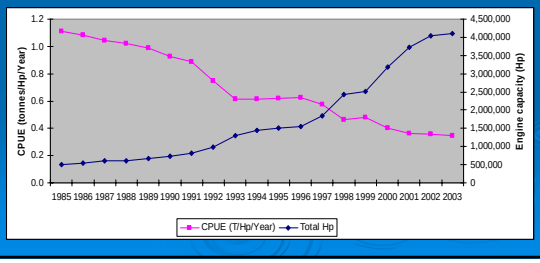
+ "OPEN Access" fishery is in practice

-Open access fishery caused overcapitalization in marine fisheries. All people living along coastline have tried to exploit the fisheries resources, that resulted on resources decline and environment degradation.
-Failure to control right dimensions for fleet size to enter to fishing in accordance with the current capacity of stocks.

- Fisheries resources in near shore water have been being declined, number of fishing boats has been increasing, the earning per fishing boat has been falling down, the competition is getting harder and the resources are getting more and more exhausted.

- Catch per Unit Effort (CPUE) in terms of tonnes per Engine power capacity (Hp) per Year has been decreasing (Figure 4), from 1.12 T/Hp/Year in 1985 to 0. 35 T/Hp/Year in 2003.

Fig. 4 : Decline of CPUE (T/Hp/Year/Boat)



+ Destructive fishing is still in practice

- Explosive and cyanide, strong light and electrical impulse, small mesh size of fishing net still are common in almost areas.

+Weakness in vessel registration and fisheries statistics systems

- It caused difficulty in estimation of total catch, catch by fishing fleets, gears, catch by species by time, spaces.

+ Shortage of linkage of fishing and logistic and service activities

- The quality of the post-harvest fishery production is reduced, which caused waste and loss in economy for fishermen.
- The fishing days at sea are reduced, which caused loss in catch/day/boat and total catch.

+ Non-synchronized investment

-There have been non-synchronized investment in infrastructure, manpowers, research capabilities, technology, marketing,etc.

+ Shortage of periodic (routine) researches and surveys

-Not regular research on marine fisheries resources caused lack of information on fisheries resources status and difficulty in fishing grounds forecasting for fishermen.

+ Socio-economic issues

- Educational level in every fishery community is low. 68% percent of them have not finished primary school, 20% finished primary school and nearly 10% finished secondary school. Less than one percent of the fishers have a certificate or diploma from a vocational school or university (VN Statistic 1995).

-The majority of fishers are poor. Their capital investment capacity is very limited. Obviously, the majority of new entrants to fisheries every year will be condensed into coastal fishing activities using small fishing vessels. This situation is continuously increasing competition in coastal fishing and causes deterioration in the state of coastal fisheries resources.

- With low educational level, fishers cannot afford advanced technology, especially offshore fishing technology. Similarly, a change by small scale fishers to alternative employment in other sectors in order to reduce fishing pressure is difficult due to limited allocation of fund.

+ Shortage of capital

+ Regional and International cooperation

- Exchange of scientists or information in marine fisheries are still limmited.

Strategy for marine fisheries development and management

+ The principles

- Development of marine fisheries should be harmonized with the strategies of Government for socio-economic development of the whole country and other strategies of the fisheries sector.

- All resources including governmental and private sector should be mobilized to gradually develop marine fisheries become industrialized and modernized.

- Marine fisheries are managed for long term sustainability of the resources, their ecosystems and the livelihood of coastal communities that depend on them. Fisheries management is based on the principles of the FAO Code of Conduct for Responsible Fisheries and seeks to ensure profitable fisheries.

- The Ministry of Fisheries is responsible for overall policy objectives, monitoring the status of resources and implementing management actions through provincial and local fisheries management agencies and others as appropriate.

- Fisheries policy objectives should be based on biological, economic and social information.

DEVELOPMENT GOALS OF FISHERIES MANAGEMENT AND DEVELOPMENT

+Coastal Fisheries

- To regulate fishing in coastal area sustainable , at the same time rehabilitate and conserve coastal fisheries resources and their ecosystems.

- To enhance the living standards of fishing communities that depend on coastal fisheries resources, to contribute to poverty alleviation within those communities and to assure food security.

+ Offshore fisheries

- To ensure sustainable and efficient offshore fisheries, while maintaining both marine ecosystem functions and harmonious relationships with coastal fisheries.

- To enhance income, create new occupations and improve the living standards of fishing communities that depend on offshore fisheries.

Strategic Orientation

+To renovate institutional framework and policies

-Based upon the sustainable marine capture fishery in order to exploit and protect fisheries resources, ecosystems environment and biodiversity in accordance with the governmental policies on development of other marine economic sectors.

-To develop and adapt responsible fisheries accordingly to the FAO Code of Conduct for Responsible Fisheries, Vietnam Fisheries Law and other related international and national regulations.

-To transfer gradually from “Open access fishery “ to “ Limited fisheries” and adapt the approach of “Participatory management”, “Co-management” / “Community based management”. To intensify enforcement activities.

+ To develop models for effective exploitation and protection of resources

- To recover fishery resource in the coastal areas by decreasing pressure on nearshore exploitation basing on gradual decrement of number of small boats;

- To develop offshore fisheries reasonably and suitably with resource capacity.

-To ensure a harmony of exploitation and resources protection; to establish marine protected areas, prohibited or restricted fishing areas; to minimize the use of harmful fishing gears and exploitation methods. To apply and modify of advanced foreign technology.

-To plan number of fishing boats needed to be developed in every waters so as to be suitable to the resource capacity. To adjust occupation structure.

-To develop systems of new cooperatives. To develop systems of logistic supply and fisheries services at see.

-+ To develop human resources
-To increase awareness and skill for fishermen in order to implement responsible fishing operations and sustainable fishery development.

-To improve ability of scientists in scientific study.
+ To strengthen science-technology and fisheries extension activities
- To conduct routine research and survey on fisheries resources and ecosystems.
-To transfer immediately results of research and survey to fishermen.

+ To strengthen and extend international cooperation
- To cooperate with regional and international organizations, NGOs,etc.

Projects suggested by FAO, MOFi, RIMF supporting to achieve the goals of Sustainable Marine Fisheries Development and Management in Vietnam to year 2015

1. CORE PROJECTS

1.1: Vessel Registry Project
1.2: Institutionilizing & implementing and strengthening statistics system
1.3: Preparation of a fisheries management plan for offshore fisheries
1.4: Feasibility study for the introduction of a Vessel Monitoring System (VMS) in offshore fisheries

2. PROJECTS TO SUPPORT COASTAL FISHERIES

2.1.Establishing a coastal fisheries management approach
2.2.Coastal fish resource assessments
2.3. Assessing coastal coral reefs, seagrass, etc
2.4.Complete a system of resources protection
2.5. Socio-economic survey of coastal fisheries
2.6. New co-operative approaches to coastal fisheries
2.7. Methodology to transfer coastal manpower/vessels to other sectors
2.8. Establish a system of Marine Protected Areas
2.9.Construct and evaluate artificial reefs
2.10.Establish a limited exploitation area.
2.11.Establish a Fisheries Extension
2.12.Service Building fisheries vocational training centres
2.13. Occupational consultation, education and training for fishermen
2.14.On board safety system for fishing vessels.

3. PROJECTS TO SUPPORT OFFSHORE FISHERIES

3.1. Assessment of economic performance of offshore fisheries
3.2. Restructuring plan for offshore fisheries
3.3. Improve fishing technology and gear for offshore fisheries
3.4. Human resource development for offshore fisheries
3.5. Improve post-harvest quality of fish
3.6. Improve fisheries management capabilities.

Thank You !

FACTORS TO CONSIDER FOR THE SUSTAINABLE DEVELOPMENT OF AQUACULTURE INDUSTRY – A CASE STUDY IN TAIWAN

Yew-Hu Chien

Department of Aquaculture,
National Taiwan Ocean University

Importance & Background

Present Status

Sustainability

IMPORTANCE OF AQUACULTURE IN TAIWAN

WITHIN AGRICULTURE

* Provide food resources
*Animal protein
*High quality and nutrition
* Secure employment
* Earn foreign currency

WITHIN FISHERY

* Premier seafood supply
* No constraints from international fishing regulations
* Require less capital than capture fishery

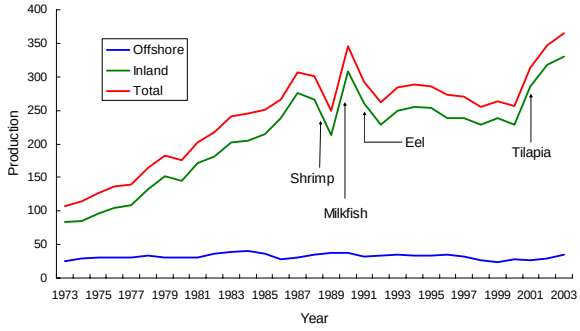
BACKGROUND & HISTORY OF AQUACULTURE IN TAIWAN

* Vast demand for seafood
  - a deeply rooted seafood-loving custom.
  - heavily reliance on seafood for animal protein.
* Increasing demand for seafood
  - depletion of coastal and offshore fishery resources.
  - commodities for export-oriented economy.
* Around 300 years' aquaculture history.
* Continue exploration of new species for culture.
  - 44 in 1978, 55 in 1987, 71 in 1991, and >100 now.

* Four major development stages.

THE DEVELOPMENT OF AQUACULTURE INDUSTRY IN TAIWAN

DORMANT STAGE (1945-1962)
ADVANCING AND PROSPEROUS STAGE (1963-1987)
STRUGGLING AND TRANSITIONAL STAGE (1988-1992)
EMIGRATION AND ADJUSTMENT STAGE (1993-)



EMIGRATION AND ADJUSTMENT STAGE (1993-)

- Production: 1993, 285,275 ton; 2003, 365,069 ton; annual growth rate: 2.8%.
- Seek business opportunities abroad: Mainland China, Southeast Asia, Latin America, Australia.
- Explore technologies to reduce production cost, conserve natural resources, and renovate culturing environment, culture non-Japanese eel.
- Main directions: offshore cage culture, recirculation superintensive culture, and sea ranching.
- Adjust strategies to enhance domestic products' competing ability against imports by advocating good aquaculture practice (GAP), certification, and product traceability.

TRENDS OF AQUACULTURE INDUSTRY IN TAIWAN

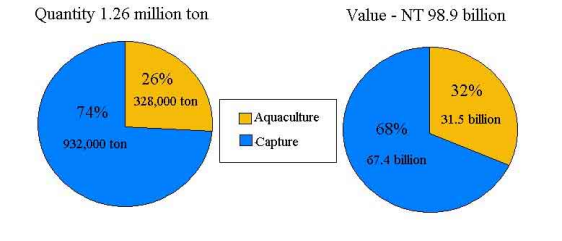
SOCIOECONOMIC DEVELOPMENT	*TECHNICAL DEVELOPMENT*
For food and employment	For high productivity
- rural social security	- natural productivity
	- seed source
For economy	- formulated feed
- foreign currency	- aquaculture engineering
	- disease prevention
For harmony	For sustainable development
- socioecological balance	- conservation of natural resources

Importance & Background

Present Status

Sustainability

Shares of Production of Capture Fishery and Aquaculture in Taiwan in 2004



Aquaculture	328
Capture	932
Total	1,260
	(1,000 ton)

Aquaculture	31.5
Capture	67.4
Total	98.9
	(billion NT)

Top Ten Aquaculture Species in Taiwan in 2004

Rank	Species	Quantity (1000 ton)	Rank	Species	Value (million NT)
1	Tilapia	89,307	1	Eel	8609
2	Milkfish	56,853	2	Milkfish	3100
3	Eel	33,480	3	Freshwater Prawn	3046
4	Hard clam	26,255	4	Grouper	2603
5	Oyster	20,750	5	Tilapia	2479
6	Grouper	13,219	6	Oyster	2076
7	Freshwater clam	12,295	7	White shrimp	1886
8	White shrimp	10,918	8	Hard clam	971
9	Freshwater Prawn	10,039	9	Taiwan abalone	859
10	Gracilaria	9,085	10	Soft shell turtle	625

Production of Various Types of Aquaculture in Taiwan in 2004

Type	Quantity (t ton)	%	Value (m NT)	%
Offshore	28,388	8.7	3,346	10.6
Shallow sea	22,353	6.8	2,161	6.8
Cage	5,417	1.7	1,017	3.2
Others	617	0.2	168	0.6
Inland	299,125	91.3	28,245	89.5
Saline ponds	103,258	31.5	9,194	29.1
Freshwater ponds	190,697	58.2	18,797	59.6
Others	5,170	1.6	254	0.8
Total	327,513	100	31,591	100

Top Ten Export of Aquaculture Product in 2004

Rank	Species	Value (million NT)	Quantity (MT)
1	Eel	7,614	22,981
2	Tilapia	1,778	40,570
3	Milkfish	454	433
4	Taiwan abalone	168	925
5	Frog	65	475
6	Grouper	34	409
7	Sea bass	21	297
8	Cobia	19	52
9	Catfish	16	555
10	Ayu , Mud skipper	15, 15	95, 26
(5)	Ornamental fish	75	100

Importance & Background

Present Status

Sustainability

Major Issues in Sustaining Aquaculture in the World

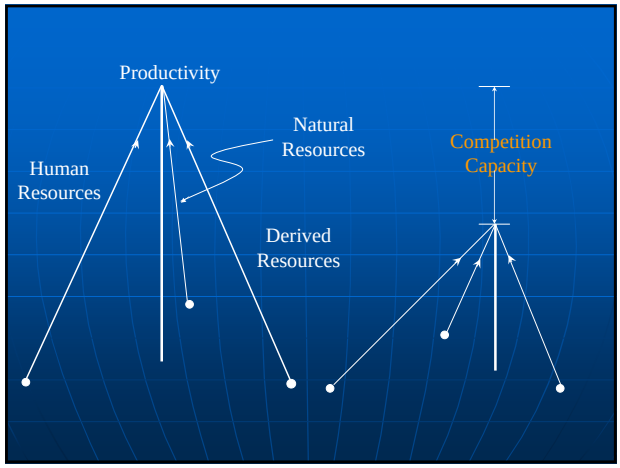
- Sustainable development-Production
  Stable and sufficient seafood supply
- Fulfill consumers' demand

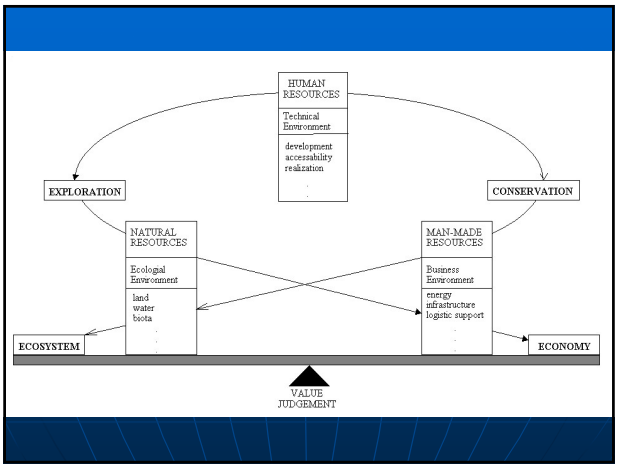
SUSTAINABLE DEVELOPMENT

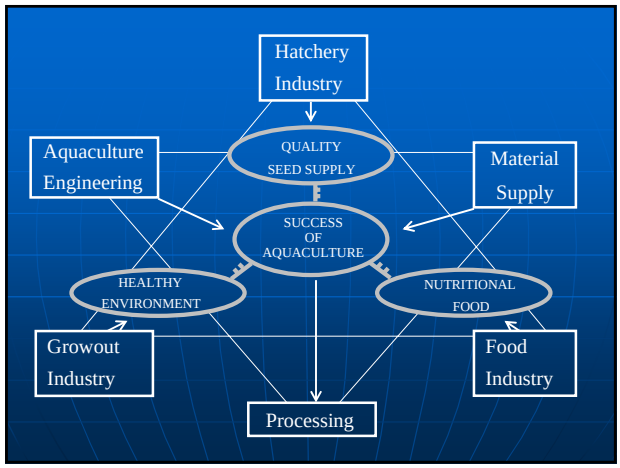
- Development that meets the needs of the present without compromising the ability of future generations to meet their own need (WCED, 1987).
- World Commission on Environment and Development (WCED), 1987. Our common future. Oxford UK, Oxford University Press, 383 pp.

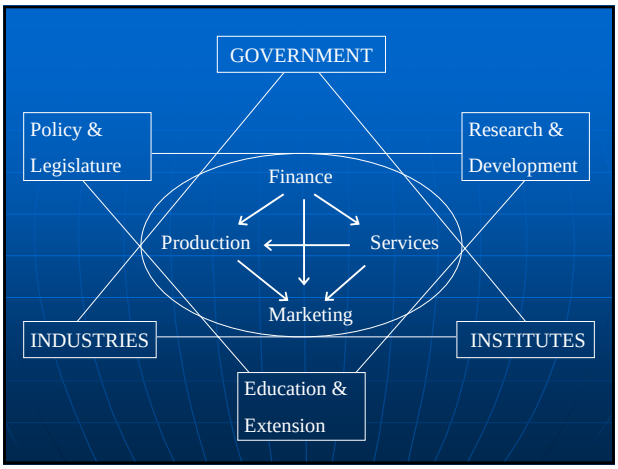
Capability to achieve sustainability in primary industry:

- Economic feasibility:
  Goal-
  stable and predictable profit,
  Approach-
  improve productivity and capability to compete, depending on resource supply;
- Integrity and harmony with other business sectors;
- Eco-friendly production.









Production Sustainability

1. Improvement of productivity is a must for sustainable development of any industry. Efficient use of natural resources, human resources, and derived resources and maintenance of harmony between exploration and ecosystem conservation is essential to sustain the capability for competition in aquaculture industry.

Major Issues in Sustaining Aquaculture in the World

- Sustainable development
- Fulfill consumers' demand

Increasing Demand on Quality Standard from Consumers

Eco-conformity in Production

↑

Safety in Processing (HACCP)

↑

Quality by Analysis

↑

Quality by Sensation

↑

Good Deal

Major Issues in Sustaining Aquaculture in the World

- Sustainable development
- Fulfill consumers' demand→
  - Food safety
  - Food quality
  - Environment and conservation concern

Food Safety

- Meet HACCP
  No antibiotics, carcinogen
- Restrict labeling
  Constituents, sources, GMO, etc.
- Back-trace system
  Retail<-shipping<-processing<-production <-material

Seafood Quality

- Freshness
- Health improving elements
- Diversity (species)

Environmental Concern

- Environmental friendly
  -- Effective use of water, land, and nutrient resource.
- Wildlife conservation
  -- No exploration on mangrove forest, eel grass bed, and nursery ground.
  -- Reduce fishmeal use

Overlook

- Develop offshore cage culture industry.
- Rational use of land and water resources to prevent further deterioration of environment.
- Expand sea-ranching fishery.
- Establish streamline production and marketing system.
- Implement health management system: good management practice, code of conduct, certification of good producers, traceability system, and HACCP.

CONCLUSION

The sustainability of aquaculture industry in Taiwan is attributed to vast and increasing demand for seafood, highly skilled and motivated family-run aquafarmers, strong support from research and extension service, thoroughly integrated peripheral industries, and high diversity and availability of culture species, however, further development of the industry must take integral approach on culturing technologies, socioeconomics, natural resources, and environment so that the sustainability can be obtained.

Asia-Pacific
Economic Cooperation

FWG 02/2004/013

Sustainable Aquaculture in Asia-Pacific: Concepts, Experiences and Prospects

Submitted by: Viet Nam

FWG 02/2004

Ha Noi, Viet Nam
15-17 February 2006

Sustainable Aquaculture in Asia-Pacific: Concepts, Experiences and Prospects[1]

Pedro B. Bueno[2]

1. Introduction

The simplest expression of sustainability is that an activity perpetuates itself. If fish farmers, on their own free will, wish to keep on farming, what they are doing must be sustainable. At the social level, conflicts are the clearest indication that practices, management arrangements and governance are not supporting sustainable aquaculture. Conflicts arise because of the negative impacts of aquaculture on people. The negative impacts of aquaculture in a social or livelihood context are generally of two types and may arise from the third that is related to the larger environment within which aquaculture operates:

(i) Conflicts among people or social groups that stem from competition for common resources and denial to some groups of access to resources.

(ii) Social inequities that are caused when benefits from aquaculture are not equitably shared or when some people or groups reap the benefits while others bear the cost.

(iii) Impacts or conflict arising from the damage caused to the ecosystem by aquaculture and the cost of mitigating the damage or restoring the ecosystem. In the short term, it is society that usually bears the cost of abatement or restoration although in the long term the benefit accrues to everyone, including the exploiters of the ecosystem.

Based on the above, the fundamental purpose of governing the aquaculture sector and therefore the goal of sustainability is to ensure harmonious development and deliver the benefits of such development equitably. (The Brundlant definition includes intergenerational equity: simply, that responsible practice today would leave enough resources available for tomorrow).

2. Governance

A brief review of the concepts of governance to achieve the objective of sustainability points to the importance of a balance of Command and Control mechanisms and stakeholder participation, including the State, in policy decisions, planning and implementation. The review also draws attention to the trend towards self regulation and co-management. The concepts and mechanisms are illustrated in the following reviews:

(i) Role of public administration. Policy making, planning, and public administration for aquaculture development and management in any country should promote an economic and social environment that is optimal to the fish farmer while ensuring that her/his activities do not cause undue costs for others. Thus the public sector intervenes to

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promote efficient production, protect the environment including ensuring biodiversity, and ensure that the evolution of the sector is socially acceptable (Ulf Wijkstrom. 2001. “Policy making and planning in aquaculture development and management”).

(ii) The roles of government. Government can effectively foster sustainable development by playing three important implementation roles, namely, *cheerleader* or promoting particular developments, *gatekeeper,* or regulating and enforcing to require sustainability, and facilitator, or actively intervening to encourage sustainability (John S. Corbin. 1997. “Government as cheerleader, gatekeeper and facilitator for sustainable aquaculture development.” Aquaculture Asia II (2)).

(iii) Sustainable aquaculture and the law. Although the moral force of the principle of sustainable development is readily apparent, morality by itself is not always sufficient to compel individuals to act wisely. Individual, corporate, national, or international competitiveness may provide an incentive for short-term gains to be secured at a longer-term cost. The imperative needs to be given the broadest possible force of law to prevent “free riders” from benefiting at the expense of others who are prepared to behave responsibly towards the environment. (TVR Pillay. 1992. Aquaculture and the Environment).

The need for sustainable development to be provided for as a legal requirement should not be interpreted as an assertion that law is the only mechanism for realizing the objective of sustainability. Technical improvement and expansion of knowledge about good environmental practice are equally as important as law. Likewise, markets and fiscal systems could function to reflect environmental preferences and policy objectives. Nevertheless, given the character of human nature it is difficult to conceive of the range of approaches to sustainable development being pursued voluntarily without some basis in law for the obligation to undertake aquaculture in an environmentally sustainable manner. (W. Howarth. 1998. “Sustainable Aquaculture and the Law,” Aquaculture Asia III (4)).

(iv) Legal and institutional domains of aquaculture management. Aquaculture interacts with the environment as it is dependent on land, water and aquatic species and causing environmental changes. It also must produce a product safe for human consumption by domestic and foreign consumers. Therefore its development and management is likely to fall within the scope of various pieces of legislation and the expertise of various institutions. (Annick Van Houtte. 2001. “Establishing legal, institutional and regulatory framework for aquaculture development and management”. In RP Subasinghe et al).

(v) Market incentives. A market incentive works by the producer bearing the cost of polluting or not polluting the environment: in the first instance, a tax is imposed on pollution with the collected tax to be used to either clean up the pollution or compensate society for the damage caused by the pollution; in the second instance the farmer pays for the cost of abatement of pollution so that no pollution is imposed on society. This underlies the polluter pays principle. As it affects private cost and benefits, its purpose is to induce individuals or firms to change their behavior to more socially desirable alternatives. (D. Bailly and R. Willmann. 2001. “Promoting sustainable aquaculture through economic incentives.” In R.P. Subasinghe et.al).

Another market instrument is eco-labeling (Bailly and Willmann op. cit.) Their common feature of eco-labeling schemes is to take into account attributes of the products other than price, quality and safety. These other attributes relate to economic and social objectives such as fair trade, support to small farmers, discouragement of child labor, health-related properties such as being organic, and environmental and ecological-related

attributes. The purpose of eco-labeling is to provide the consumer the opportunity to express her/his environmental and ecological concerns through the choice of products. Such preference is expected to result in price differential or market share differential between eco-labeled products and those products that do not qualify for eco-labeling or whose producers chose not to seek an eco-label. The label is obtained through a certification process based on a set of criteria that define the desired standard. It is the potentially better price or increased market share, or both, that provide the incentive to seek certification for eco-label.

(vi) Self regulation and co-management. Faced with increasing difficulty with regulating aquaculture activity, increasing importance is given to voluntary arrangements and co management practices. Their practical application is in the adoption of best management practices, codes of conduct and codes of practices by farmers and industry. Self regulation and co-management imply divesting the government of some responsibilities. Usually these are in the operational and maintenance of systems in favor of the industry, although certain features of voluntary and co-management arrangements automatically remove the need for such usual government functions as monitoring of compliance with rules and regulations and imposition of penalties to violations (A. van Houtte. op cit).

3. Trends in promoting sustainable aquaculture development

Some of the more significant developments in recent years include the promulgation of policies and programmes that are pro-poor, the development or strengthening legal and institutional support for environmentally and socially responsible aquaculture, implementations of strategies that engender wider participation in policy formulations, development planning and research, integration of aquaculture in rural development, and support or encouragement to farmer associations. The latter has been accompanied by the development and encouragement to adopt voluntary codes of conduct, self-regulatory practices, and development of standards and certification schemes based on these standards.

Globalization has made trade and market access increasingly the driver to aquaculture development. Its impact has been the strengthening of national, inter-provincial or inter-state, as well regional and international measures on biosafety and food quality and safety, strengthening of the ability through legislation, codes of practices, certification, and traceability schemes of governments and producers to comply with trade and market access requirements. Countries are collectively harmonizing import and export standards and protocols. And direct subsidies are giving way to more market friendly modes of technical assistance to the production sector.

The role of civil society and farmer associations in managing the sector is increasing. The development and promotion of codes of practices, certification systems, and standards have required the strengthening of farmers, through their being associated and thus better empowered, for their role in carrying out sustainable aquaculture. The desired status is that the various stakeholders participate and have co-ownership in the development of policies and R and D programs to attain such objectives as equitable access to resources and share of the returns from aquaculture, environmentally friendly and socially responsible farming, harmony, and cooperation.

Banks and micro-finance providers have widened their portfolio to include providing working capital to small-scale aquaculture ventures. Responsible aquaculture practice is increasingly considered as one of the criteria used in loan approval.

3.1. The Role of Government

Some examples of government's support to promote as well as ensure orderly aquaculture development with policy and institutional support are found in Asia:

Governments in Asia have the common role of promoting technology through any combination of the following activities:

- Establishment of a hatchery and making seed stock available,
- Establishment of a demonstration and training farm,
- Training of farmers,
- Selecting and giving full assistance to a key farmer to apply and showcase a specific culture system,
- Fielding of extension workers,
- Provision of special loan program and sometimes marketing assistance, and
- Financial incentives for large-scale development

While maintaining policies to encourage the development or further develop the aquaculture industry through liberal land use policies with long-term and low-cost lease options, liberal financing, technology development, and other incentives, most of the countries in Asia, are also trying to mitigate the negative consequences of runaway development by instituting rules and regulations on the following:

- Environmental impact assessment.
- Ban on further clearing of mangrove forests for aquaculture development.
- Imposition of a green belt along the shoreline and river banks.
- Licensing of all aquaculture operations including hatcheries with the license often required by banks for loan applications
- Allowable size of fish cages and spacing between such cages.
- Banning the use of a specific list of chemicals and therapeutants.
- Inspection of and imposition of quarantine procedures on movements of live fish.

To jumpstart development in an orderly and rational manner some governments have set aside public lands for managed aquaculture development. The government through the existing institutions or a quasi-governmental corporation undertakes the physical planning and development before distributing farm lots or ready to operate farms to smallholders. (In some cases, this may be left to a private investor under specific development guidelines). A common central facility to produce seed stock, feeds as well as to process and market the harvest often, but not always, comes with such development

In Indonesia the government allows large-scale development only if allowance is made for the participation of small-scale holders through a nucleus-estate type of development. Individuals or companies going into brackishwater aquaculture are limited to 30 hectares within Java and 50 hectares in the outer island. Beyond such size the development has to follow the nucleus-estate concept wherein the excess area is developed into viable farm units for distribution to qualified smallholders. This concept was applied in the development of tens of thousands of hectares of swamplands into shrimp farms in southern Sumatra. Upon development, half-hectare farms were transferred to qualified farmers. The companies operated hatcheries to supply shrimp post larvae, feed mills to produce feed, and bought back the shrimps for processing in their own processing plants and eventual export.

Zoning and the establishment of mariculture parks are tools for encouraging investment, and promoting orderly development of aquaculture. Malaysia set up Aquaculture Investment Zones. Investors locating in the AIZ are entitled to many financial incentives offered to large-scale agriculture development and production including to seed and feed

production. These incentives include the following: Pioneer Status, Investment Tax Allowance (ITA), Reinvestment Allowance (RA), Agricultural Allowance, Deduction For Capital Expenditure on approved projects, Export Credit Refinancing (ECR) Scheme, Double Deduction For Export Credit Insurance Premium, Double Deduction For Expenses On Promotion Of Export, Industrial Building Allowance (IBA), and Incentives For Research And Development

In the Philippines the government has taken the planned development concept to the open waters through the mariculture parks. Marine waters are identified and set aside for mariculture park development. Development consists of provision of mooring facilities at pre-set distances for sea cages. This has three purposes: to limit mariculture activity to a pre-identified area; the mooring system pre-sets the distances between cages as well as the number and size of cages; it reduces the start up cost for fish cage operators since the mooring can take up even more than half of the capital cost in setting up the sea cages. Fish cage operators pay a yearly user fee part of which goes to upkeep, security and technical assistance. For those who lack the capital to put up their own cages, pre-installed cage frames are provided for a yearly fee so that the farmer need to invest only on the net-cages, fingerlings and feed.

Among Asia-Pacific governments, and especially the APEC economies, import risk assessment has been increasingly promoted as part of a broader program on responsible movement of animals (APEC/NACA 2004). Along with quarantine regulations and reporting of diseases, health certification, and overall capacity building in health management, prevention of the entry of pathogens (that have caused damages in the millions of dollars due to epidemics, as well as continuing costs from mitigating endemic occurrences once they have established in a locality), has considerably minimized losses from diseases

Weakness in implementation. While most Asian countries already have adequate laws for the routine administration of aquaculture, they usually lack well designed programs to propel development towards a specific vision. Or, where there is a specific vision and program, actual implementation is hobbled by lack of funding support at the institutional and farm levels. This is exacerbated by the lack of trained field personnel. The lack of personnel is particularly true in extension work. In practically all of the Southeast Asian countries it is the field technicians of feed companies who become the surrogate extension agents, and are generally seen as more knowledgeable and better experienced (as well as motivated) than government personnel. Part of the blame may lie in attempts to streamline the bureaucracy as conditions to structural loan packages. This has impacted on the fisheries extension systems. For example, in Indonesia and the Philippines the extension service under their respective fisheries agency were integrated with agricultural extension with the idea of having one extension officer to take care of fisheries, crops, livestock, forestry etc. Agricultural technicians were given training in aquaculture and fishing and fisheries technicians were given training in crops or livestock. A fair conclusion about the effect of this is that the expertise becomes shallow and focus of service greatly diffused. Add the generally low remuneration level for extension workers and you have a greatly diminished effectiveness of the entire service.

Well-defined policies for the poor are blunted by many factors. In the Philippines, for instance, official policies for freshwater aquaculture are markedly pro-poor with numerous provisions that favor small-scale operations and community welfare. But implementation of these policies is hindered by vested interests and by complex and confusing legislation. The Fisheries Code of 1998 is the main legal framework and the basis of all Fisheries Administrative Orders. The Code gives to municipal or city Local Government Units, in consultation with local farmers and subject to review by the appropriate provincial council,

the authority to make ordinances and decisions and to appropriate funds for general welfare and for environmental protection. The results have been mixed. At the municipal level, there have been more than 20 legislative instruments of relevance to fishing and aquaculture in the Lake Taal (a 15,000 ha freshwater lake near Manila with a volcano at the centre and where thousands of fish cage farms have been operating). Fishers and farmers are not fully aware of these and many have not been effectively implemented. More legal instruments have been prepared under the Fisheries Code, but it is hard to envisage that compliance with these will be swift or widespread (ADB.2004. "Tilapia cage farming in Taal Lake, Batangas, Philippines, Case Study 6." Special Evaluation Study of Small Scale Freshwater Aquaculture Development).

In another fishfarming area in the Philippines, the ADB noted that fish farmers (in Central Luzon) are aware of only the few administrative orders that relate to illegal fishing practices. Awareness of other regulations is limited and compliance poor. For instance, farmers with fishponds larger than 300 m2 are required to secure an environmental compliance certificate from the Department of Environment and Natural Resources. Very few farmers are aware of this. Limited budgets, the voluntary nature of a code of practice for aquaculture, and weak enforcement capabilities of national and local governments constrain enforcement of environment-friendly regulations (ADB.2004. "Farming tilapia in ponds in Central Luzon, Philippines, Case Study 5." Special Evaluation Study of Small Scale Freshwater Aquaculture Development).

Chile's modifications of its 1991 Fishing and Aquaculture law provide a good case of improving the legal framework to address abuses in acquisition of aquaculture space. It also encourages farmers by simplifying the red tape and paperwork. More specifically, it establishes new reasons for canceling licenses together with stiffer regulations and fines for violation. The former regulations by which aquaculture concessions were issued free of charge allowed for unscrupulous agents requesting large areas of sea concessions with the intention of transferring them to real aquaculturists for a very large sum of money. This was possible because there was no legal limit for the transfer of concessions or aquaculture licenses.

To provide a legal remedy, the Government created two kinds of regimes for aquaculture concessions and licenses: the first occurs with the issue of the concession and its license for which the holder pays 42 taxable units (2500 US$) per hectare or fraction of, with a maximum of 210 taxable units (7,600US$). In the second regime it is not necessary to deposit cash for processing a concession request but the rights of the holder are limited. The cost of license is proportional to the surface area of water occupied. These modifications are aimed at ending the speculations while improving sanitary and environmental aspects of fish farming. It also allows a longer period to begin operations and therefore time to recover.

As to seaweed farming, the law is favorable to individual farmers with less than one hectare of total concession surface (and who are native persons), because their license debts are condoned (Fish Farming International. January 2006).

3.2. The Participation of Civil Society and the Private Sector

In most Latin American countries, the participation of the private sector in governing and promoting aquaculture is achieved through National Consultative Commissions. These commissions work with government authorities in searching for solutions that benefit this sector. Among others, the commissions mitigate the effect of too many agencies involved in overlapping regulatory and implementing functions.

Civil society groups i.e. NGOs and People's Organizations have been playing a greater role in sector management. In most cases, their advocacy role has been focused on environmental and social responsibility directly addressed at government, communities, and the farming sector. But it is now also expressed in consumer movements where awareness has been promoted among consumers on the attributes of products so that they can express their preference towards those that are reasonably priced, safe and wholesome but also towards how and under what conditions they were produced. Another important role of civil society groups has been their highlighting of inequitable arrangements in communities. This brought these, otherwise ignored or tolerated, into public scrutiny, debate, study and in many cases, being addressed in policy, regulations and stakeholder negotiations. A case in point is the ban on coastal shrimp culture imposed by India.

Several NGOs have also chosen to exercise their advocacy roles in the context of partnership with governments. This is exemplified by PADEK in Cambodia, which is a civil society organization that among other roles, worked with the government to improve national research and extension capacities, promoted the role of women in fisheries, in Cambodia and the greater Indo China region, and directly worked with farmers to improve technical efficiency and environmental sustainability of fish farming.

3.3. The Increasing Role of Farmer Associations

The need to develop aquaculture has to be accompanied by the production sector assuming the responsibilities expected of it. To assure sustainable aquaculture, the production sector has to be organized efficiently for the implementation of or compliance with the requirements now in place or that are anticipated. The debate on the sustainability of aquaculture has broadened from technical and environmental questions to the inclusion of economic, marketing, and social responsibility issues. To these purposes, the use of Associations, at the National and Regional levels, provides the basis and the practical means of communicating with the sector that will lead to improvements in the management of resources and the sector.

There has been a significant increase in the requirement for consultation with the professional aquaculture sector in recent years, reflecting changes in government policies where the higher involvement of stakeholders and the move towards self-regulation are important issues. When issues such as international trade and market stability, sustainability, development of standards (including organic farming and eco-labeling issues), governance and self-regulation have to be debated, with the professional point of view in mind, this cannot be done in a vacuum. Strong and active as well as independent farmer associations could provide non-political positions, based on science and/or good sense, which support the sector and its development.

The role of farmers Associations can vary but is generally one of uniting the views and actions of a profession for the common good (Hough and Bueno, 2000). In fisheries or agriculture in general they provide support to the sustainable development and management of the sector. A survey of 13 associations of farmers (12 in Asia, 1 in Latin America) showed a number of motivations for organizing that relate to self regulation, as follows:

(i). To be *competitive*. The common pathway for attaining competitiveness was basically similar: "unifying the industry players to address common problems cohesively,

strengthening bargaining power with suppliers of materials and credit and buyers, improving production efficiency with better technology, and cooperating with government in conducting promotional activities, technology trials, shaping of regulations and policy, developing and promoting codes of conducts or good aquaculture practices, and improving access to export markets."

As an example, the Thai Shrimp Farmers, Producers and Exporters Association were formed to rationalize and synchronize the efforts of the various sub-sectors of the industry. Individual players in the Thai shrimp industry, namely, hatchery operators, growers, cold storage operators and exporters each had their own agenda and invariably disparate activities to address the common industry problems of safety and quality of product, especially the antibiotic residue problem, removal of GSP status resulting in higher tariffs (although it has been returned recently), price fluctuations, and lack of raw materials for the processors, and the anti-dumping charges. The association was meant to unify and direct these separate efforts.

(ii) To *cope with threats to viability and improve the industry's image*, also leads to the associations adopting on their own measures to cope with three major threats to the industry: diseases, low prices and a bad image. The first and the last are linked, and found common solution in better water and effluent management. The Thai national shrimp association (that grew from a provincial Shrimp Farmers Association) enhanced its image further with successful and visible efforts at planting mangroves or rehabilitating them.

(iii) To *promote a unified governance of the sector exemplified by* the Vietnamese Fishery Society. The Society unifies the Vietnamese Aquaculture and Vietnamese Fishery associations, although it focuses largely on coastal communities. It is part of the government's overall structure and program of poverty alleviation. As such its structure parallels that of the national administrative system and involves not only farmers and fishermen but also companies, local and national government units, government agencies and R and D institutes, and other interested members. Two of their aquaculture products are major export items: shrimp and catfish. As such, while the society's activities do not include exporting, it does have a great interest in having the products and their farming and processing practices adhere to safety, quality and environmental requirements.

As with Vietnam, the Ecuadorian association, which is in fact a national " chamber," consists of the entire range of industry stakeholders, but unlike in Vietnam, does not include government services. Its membership of nearly one thousand indicates the broad scope of representation in the association.

(iv) To *have a voice in policy and development planning*. At the local level this is exemplified by the formation of Indian associations of poor tribal farmers and scheduled castes, which was initiated by development agencies, government, and an NGO in three Eastern states to provide the environment and institutional support for poor farmers and aquatic resource users to be able to demand the institutional support they need and recommend policies and approaches needed to bring it about. To be even stronger, the small village associations have formed a network among themselves, albeit with assistance from the state governments and a non-governmental organization.

Farmers associations in developed economies. Two farmers associations, in Australia and Canada, illustrate the purposes, services to members, and the role of the associations in the advancement of the aquaculture industry, in developed economies. The emphasis

on *scientific and manpower development* is strong, and the focus on having a *stronger representation in government policy-making* is evident.

(i) Aquaculture Association of Canada (Association Aquacole du Canada (**www.aquacultureassociation.ca**). The AAC's objectives are to: a) foster an aquaculture industry in Canada, to promote the study of aquaculture and related science in Canada, to gather and disseminate information relating to aquaculture, and to create public awareness and understanding of aquaculture; b) promote, support, and encourage educational, scientific, and technological development and advancement of aquaculture in Canada; c) gather and disseminate technical and scientific information on aquaculture development in Canada and throughout the world; d) conduct seminars for the presentation, exchange, and discussion of information, findings, and experiences on all subject and techniques related to aquaculture; e) encourage the teaching of all phases of aquaculture and the training of aquaculture and the training of aquaculturists in accredited colleges and universities in the field of aquaculture; and f) encourage private industry and government agencies, both provincial and federal, to support education, research and development.

AAC carries out these objectives primarily through their annual meeting "Aquaculture Canada" where it holds workshops, seminars, contributed papers and posters and discussions. (Its 2005 meeting carried the theme: "Navigating Forward: New Directions in Food Safety, Quality and Social Diversification.")

(ii) The Australian Prawn Farmer's Association (www.apfa.comau) represents the interests and fosters the development of the Australian prawn farming industry. The Association is a key contact for investors, new farmers and firms wishing to do business with the Australian prawn farming sector. Membership of the Association is voluntary. The Association has close to 100% coverage of growers across Australia, which means it has a strong voice at all levels of government. Benefits to members include having lobbying power, being able to exchange ideas and discuss products and methods with each other and other related sectors to improve performance. The service sectors are encouraged to join the Association to strengthen their links and networks with the industry. The Association provides the link for communications between grower's and related sectors including infrastructure suppliers, the finance sector, retailers and exporters, technologists, researchers and all levels of government.

The Association, in collaboration with Fisheries Research & Development Corporation, helps direct funding to a number of core areas described in the APFA Research & Development Plan 2000-2005. A major challenge for industry has been a shortage of data relating to all aspects of prawn farming and also inter-relationships with the environment. Accordingly the APFA has prepared a Five Year Research & Development Plan. The APFA R&D Plan is administered by the APFA Research & Development Committee. Research and Development priorities are determined annually by members in a series of workshops and surveys.

Regional and global associations. The activities and purposes that relate to promoting sustainable aquaculture and better management of the sector, of two kinds of associations, namely a federation and an alliance, are provided by the Federation of European Aquaculture Producers (FEAP) and the more loosely organized Global Aquaculture Alliance (GAA).

i. FEAP. The Federation had 34 Associations from 24 countries in 2005.

Its primary goal (www.feap.info) is to provide a forum for the debate of issues (concerning European aquaculture primarily) common to its members and to communicate the results of such discussion to the appropriate authorities. Providing this possibility for fair debate to sectoral representatives gave the basis for the initial development of the Federation, reinforcing the potential for efficient communication between the Member Associations and developing clear opinions and arguments on matters of importance to the profession. One of the key objectives is the effective communication of these opinions to the authorities, which vary, depending on the topic, and cover all aspects of aquaculture operation. In Europe, many countries that are neighbors to those which are Member States of the European Union have adopted much of the harmonized legislation, a factor that reinforces the position and the reason for being of the Federation.

FEAP and the Global Aquaculture Alliance have been active in promoting Codes of Conduct and Good Practice and, since each has direct access to producers, this activity has been quite successful in transposing the desires of government into practical actions at farm level. The development of internationally-acceptable standards may also be seen as an activity that could be developed through regional cooperation between such bodies.

ii. Global Aquaculture Alliance (www.gaalliance.org). The Global Aquaculture Alliance focuses on tropical shrimp production and its membership covers Associations, private production companies and product importers. Its goal is to advocate aquaculture as an answer to global food needs and to educate producers, consumers and the media in regard of this, while furthering environmentally responsible aquaculture.

Its has four purposes: (a) develop and encourage the use of aquaculture system designs, installations and operations sensitive to and compatible with environmental and community needs; (b) improve production and marketing efficiencies to provide aquaculture products to larger segments of the world's population; (c) promote effective and coordinated government regulatory and international trade policies; and (d) articulate the importance of aquaculture as a source of food and employment and its compatibility with community needs and environmental protection.

Under its Responsible Aquaculture Program it has initiated the development of standards of good practice or codes of conduct for the aquaculture industry. It also provides advice for monitoring and certifying adherence to standards or codes and has initiated the development and use of marks or logos designating adherence to codes or standards

4. Mechanisms for sector governance other than C and C

4.1 Self regulation

Promotion of aquaculture has largely met little problem in most parts of Asia. On the other hand, if a certain aquaculture venture turns out to be profitable, governments had often found it difficult to control or stop runaway development until a catastrophic mass mortality and other related problems occur. Viewed in this light, industry growth is self-limiting. The problem is not so much promotion as management. Beyond issuance of permits and licenses governments in Asia-Pacific are increasingly realizing the need to protect the environment and manage aquaculture resources in a sustainable manner. In New Caledonia for instance a rigid system of self-regulation applying to all prawn farmers (*P. stylirostris*) has been put in place in order for the industry to meet the high quality standards demanded of its niche markets in Japan and France.

In Latin America, Codes of Conduct for Responsible Fishing and Good Practices in Shrimp Culture are adopted as in Brazil, good practices in aquaculture production in Colombia, qualification in good practices on handling and quality assurance of aquatic products in Costa Rica and Nicaragua, and Environmental Regulation for Aquaculture (RAMA) in Chile.

In some countries, governments have introduced quality betterment systems and better practices for aquaculture and have supported the implementation of Hazard Analysis and Critical Control Points (HACCP), qualification and training of Good Aquaculture Production Practices (BPPA), ISO 9 000 certification (quality), ISO 14 000 certification (environment), rules and regulations, and product chains schemes. Similarly, in other cases, independent companies and producers associations have established standards and regulations or codes of conduct under Clean Production Agreements (APL) for salmon, shrimp and tilapia production, post larvae production, processing, etc. Steps are being taken to set up traceability systems for fisheries and aquaculture products.

3.2. Best management practices

One of the arguments for BMPs is that they pay for themselves. They would also benefit the environment, especially BMPs that include effluent treatment, less use of drugs, less use of trash fish, or less use of seed caught from the wild.

A research-extension pilot project in India on developing and promoting best health management practices among small shrimp farmers organized into self-help groups also highlights the importance of farmers being organized to be able to adopt cost-effectively best practices that improve their yield and the quality of their produce. The results are described in more detail in Section 6 (NACA Annual Report, 2005).

3.3. Co-management

Co management is an emerging trend and the concept has mostly been described through its application in the management of common resources and mostly at the community level. A review of co-management is included here to shed some light into the existing and potential ways by which it is applied to the aquaculture sector. This review is from L. Carlsson and F. Berkes. 2005.

What is co-management? In relation to natural resources, the term management can be understood as the ‘right to regulate internal use patterns and transform the resource by making improvement . These activities can be preformed by single actors or jointly by groups of individuals or as a result of cooperation among different groups. Collaborative management, or co-management, has been defined as ‘the sharing of power and responsibility between the government and local resource users.

Co-management is ‘the term given to governance systems that combine state control with local, decentralized decision making and accountability and which, ideally, combine the strengths and mitigate the weaknesses of each.

The World Bank has defined co-management as ‘the sharing of responsibilities, rights and duties between the primary stakeholders, in particular, local communities and the nation state; a decentralized approach to decision making that involves the local users in the decision making process as equals with the nation-state. The same definition was adopted by the World Conservation Congress: ‘a partnership in which government agencies, local communities and resource users, nongovernmental organizations and other

stakeholders negotiate, as appropriate to each context, the authority and responsibility for the management of a specific area or set of resources'. This latter regards the State as only one among a set of stakeholders.

Two different models try to conceptualize co-management between "folk-managed" systems and state managed systems. On the one hand there is a 'horizontal continuum from nearly total self-management to nearly total state management'. On the other there is a 'vertical contracting out model of state management' power, which is characterized by devolution of rights. Although these models are not mutually exclusive, they are based on a dichotomy comprised by something called the State and local resource users. Co-management can be looked upon as a continuum from the simple exchange of information to formal partnership

The above definitions and conceptualizations of co-management have some common underpinnings: (i) they associate the concept of co-management with natural resources management; (ii) they regard co-management as some kind of partnership between public and private actors; (iii) they stress that co-management is not a fixed state but a process that takes place along a continuum.

What is co-management good for?

1. Allocation of tasks. Many existing management systems need to operate at both the small-scale and at the large-scale, and there are different kinds of skills and knowledge that are necessary to do so. This is possible because co-management brings together a variety of different capacities and comparative advantages. For example, marginalized producer groups in remote areas of the world need external markets for the realization of the value of the goods they produce. But they need links to the market through persons who know the structure of the demand, or have access to different types of commercial networks. This is only one example of allocation of tasks, but the principle permeates all types of co-management systems. Division of labor enables specialization to increase efficiency.

2. Exchange of resources. Local groups may have a need for certain types of resources that they are themselves unable to provide, such as technology, scientific expertise, and a diversity of information. But, they may possess resources needed at the center, such as information about harvesting volumes or status of the resource. A basic assumption about network relations is that one party is dependent on resources controlled by another, and that there are gains to be had by pooling of resources.

3. Linking different types and levels of organization. Co-management is a means of linking different types of organization. In a bureaucracy, different layers of organization are linked to one another within in a framework of coherent hierarchy. Co-management, by contrast, is a process by which representatives from different levels of organizations and types of organizations coordinate their activities in relation to a specific area or resource system. In practice it means that, for instance, state employed experts might work in concert with the board of a local community of resource users. In comparison with hierarchic ways of organizing management, the latter is more responsive to local circumstances. It is also likely that the flow of information is faster and more effective and that problems are addressed at a more appropriate level within the organization. In short, co-management agreements serve the purpose of constituting linkages among organizational groups that might not be otherwise connected.

4. Reduction of transaction costs. Transaction costs are the costs of measuring what is being changed and enforcing of agreements. These costs can be divided into long-term and short-term costs, although it is not easy to distinguish between activities aimed at a long-term reduction of transactions costs or for more immediate purposes. If, as a result of an agreement, representatives of State authorities are entrusted the right to monitor the access to or appropriation of a resource, this will reduce conflict among members of the community. Consequently, users do not have to dedicate time and resources for solving these conflicts, thus reducing transaction costs.

5. Risk sharing. Agriculture based communities tend to diversify their crops. If one crop fails, they still have a resource base for their subsistence living. In short, they do not put 'all eggs in one basket'. The same type of reasoning can be applied to institutions and governance systems. Systems that are composed by single administrative units and practice monolithic decision systems are more vulnerable than are polycentric arrangements and redundancy. This logic can also be applied to co-management networks. Webs of relations that have evolved over time make up diversified management arrangements. These webs serve the purpose of spreading the risk among involved parties. For example, it is less risky to share some management tasks among a number of actors, as compared to relying on one actor for their accomplishment.

6. Conflict resolution mechanisms, power sharing. The establishment of co-management systems may function as a means of conflict resolution between communities of local resource users and the State. The processes of negotiation, bargaining and setting up co-management agreements that codify the rights and responsibilities of involved parties (local groups, the State, commercial actors, etc) reduce conflicts and might even function as a more long-term problem solving mechanism. Successful reduction of conflicts is essential for long-term planning and for the willingness among individuals to invest in creating appropriate institutions.

An example is provided by the community-based aquaculture programme in Northeast Thailand. The review des not describe the arrangements and processes but only the reasons for both good and unsuccessful outcomes (ADB, 2004. Evaluation of small-scale freshwater aquaculture in Bangladesh, the Philippines, and Thailand) The evaluation found that the programme had contributed to the development of self-help initiatives, local ownership, and decision making in the communities. The main factors that have influenced the success of community-based aquaculture were (i) the demand for and the extent of interest in fish farming; (ii) social capital, including organizational arrangements that contribute to strong community participation, sharing access to resources, and conflict resolution; and (iii) government assistance and partnerships with the communities.

On the other hand, constraints to rural aquaculture have included water shortages, unfavorable biophysical conditions, low natural productivity, and such farm management issues as stocking density, pond management, access to feed, and harvesting methods. Fish farming has also been affected by environmental degradation, limited financial and human resources, inappropriate links between extension and research, and external shocks (such as the effects of the Asian financial crisis of 1997).

5. Abatement of Social and Environmental Impacts

Addressing the negative impacts of aquaculture essentially means promoting its responsible practice. The various measures are described below:

5.1. Internalizing costs.

It has been argued that if blame must be assigned for the adverse impacts of aquaculture, it should be placed not on aquaculture itself but on the way it is undertaken (T.A. Anderson and Sena De Silva. 1998. "Strategies for low pollution feed." Aquaculture Asia III (1)). This implies, rightly, that better and more responsible management practices would avoid or mitigate the impacts. Such practices are enforced by legislation or adopted on a voluntary basis, they should have to be based on acceptable science-based standards, and subject to monitoring. Compliance with regulations and adoption of better management practices would necessarily entail cost to aquaculture. Having the aquaculturist shoulder the cost of preventing the farm effluent from polluting the environment does essentially not have to pass on that cost to society. Furthermore, authorities have averred that adopting such measures as better management practices also pays for itself (Jason Clay. 2004, World Aquaculture and the Environment).

5 2. Adoption of better management practices

The results from a shrimp health management project in India of NACA and the Marine Export Development Authority of the Ministry of Commerce, in which better health management practices were adopted by organized farmer groups, give support to Clay's statement. It is described in more detail under Section 6.

Essentially, shrimp farmers that adopted BMPs in 2004 increased their yield by 33%, harvested shrimp that were 1.5 times larger, and were visited 20% less frequently by diseases than surrounding non-adopting farmers. With more farmers covered, a subsequent evaluation, of the 2005 crop, showed an increase in production by two-fold, 34% increase in size of shrimp, and 65% reduction in disease prevalence compared to surrounding non-adopting ponds..

Better yields and profitability apart, and contrary to a number of reservations (C. Bene. 2005), the projects are providing indications that BMP adoption is not a problem for small-scale farmers that are well-organized. Being organized has enabled them to attain economy of scale to be able to adhere to best practices. Technical assistance from government is increasing their awareness, and organizational capacity and, if not yet marketing skills, the growing awareness that in being organized and responsible, they are in a stronger position to transact with suppliers and buyers. They are not yet participating in a certification and labeling scheme, but that is the next step envisioned for the project, and which the farmers themselves have asked to be initiated.

BMPs have been argued as a technical solution and, as such, ignore the political and social issues related to shrimp farming. Apart from the fact that the BMPs (in the Indian shrimp health management project) do not focus only on technical solutions, the projects have engendered harmony and cooperation among players in the market chain.

Clay says BMPs can pay for themselves, although he still advocates support for small farmers to make the transition into better management practices, rather than leaving this to the market alone. He thinks government subsidies in the short term would provide incentives for their adoption, adding that regulatory and permitting systems can also encourage the identification and adoption of these practices.

In the context of commercial or corporate aquaculture, Clay (2004.op cit) advocates promoting social- and equity-based BMPS. Research evidence suggests that social- and

equity-based better agricultural practices are not only important for reducing the impacts of producers around the world but for making profits as well. He lists as examples worker incentives, bonuses, equity positions, employee stock option plans, and benefits, which he said result in increased productivity and reduced cost as well as better product quality, less input use and maintenance of the resource base. Extending benefit packages such as education to the nearby community would create more worker pools and avoid for the company costly mistakes that arise from illiteracy.

5. 3. Integrating aquaculture in rural development plans

There are negative consequences from aquaculture that are not the result of bad practices but are associated with power structures in the community and the capacities of institutions. Among these are the exclusion of the poor from taking part or in being physically removed from aquaculture, resource appropriation by elites and the politically powerful sectors, and conflicts and violence. The negative consequences associated with a weak institutional context include poor linkages, coordination, and coherence between sectors, unclear or overlapping mandates, unclear public/private sector responsibilities, uncertainties in tenure, property and user rights, weak regulatory regimes and enforcement capacity, rent seeking, ineffective communication, and little involvement of primary stakeholders in policy and programme formulation concerning the sector. Without some form of intervention short term financial perspectives tend to dominate environmental and social issues (Graham Haylor and Simon Bland. 2001. "Integrating Aquaculture into Rural Development." In R.P. Subasinghe et.al. Technical Proceedings of the Conference on Aquaculture in the Third Millennium. NACA Bangkok and FAO Rome)

In this regard, Haylor and Bland argue for such interventions to be strategically planned. A generic recommendation is to integrate aquaculture in rural development planning which should come with sound governance, strengthening of institutions including farmer associations, provisions for multi-stakeholder participation, be people-oriented, and with a multi-sectoral agenda.

5.4. Creating opportunities for the participation of the poor

Few aquaculture development initiatives reach the *poorest*. Aquaculture, the argument goes, requires resources such as land, ponds, water, credit, and other inputs, by definition those involved in aquaculture are not the very poor. In this regard, an FAO/NACA consultation in 2002 collated experiences that clearly demonstrate that if aquaculture is properly planned there are considerable opportunities for poor people's entry (Friend, R. F. & Funge-Smith, S. J., 2002. Focusing Small-scale Aquaculture and Aquatic Resource Management on Poverty Alleviation. FAO RAP, Bangkok Thailand.). Experiences showed that aquaculture offers significant advantages over other activities such as livestock and crop farming for the entry of poor people because it entails low cost technologies using available on farm inputs, is a low investment and low-risk activity, requires low labor inputs that fit with household divisions of labor, is easily integrated into other livelihood and farm activities, and low levels of production provide important sources of household nutrition and buffers against shocks.

When aimed at poverty reduction, development assistance should be targeted carefully by clearly defining the intended beneficiaries and devising appropriate strategies to help them benefit. The assistance needs to recognize specific and prevalent features of poverty among the intended beneficiaries, including the means of overcoming key barriers for entry into aquaculture and adoption of technologies, and to mitigate risks to which the

poor are particularly vulnerable. The ADB (2004) studies of small-scale freshwater aquaculture in Bangladesh, Philippines and Thailand yielded strategies for targeting the small and poor households, as follows:

- **Access to land and water.** Direct beneficiaries of aquaculture development have largely been pond owners among small- (0.5–1.0 ha) and medium-scale landholders (1–2 ha). Access to land and water is the key requisite for fish farming. Conventional aquaculture development initiatives that emphasize the promotion of technology and provision of targeted extension services are unlikely to reach the functionally landless and the extremely poor. Without access to land and water, the poorest are unlikely to engage in fish farming directly.

- **Access to other livelihood assets.** Fish farming requires human capital and skills, social capital, financial capital, and a vital operating environment that includes support infrastructure, facilities, and access to markets. Access to financial and human capital assets is necessary for households to benefit from aquaculture. The ability to pay for pond development and fish farming, including seed and feed, requires financial capital, access to credit or both. Human capital, in terms of basic education and capacity to learn, is required for people to gain from training and extension services.

- **Leasing a pond.** When the landless gain access to water bodies or ponds through lease or other access arrangements for fish farming, secure access rights are critical. Without binding and long-term agreements on access rights, fish farmers are vulnerable. Eviction is common when access is not secure, and interrupted operation can result in loss of investment that the poor cannot recover. Demonstrated profitability of fish farming may also increase the price of pond leasing because of an increasing demand for fishponds by entrepreneurs. With annual pond leases going very high, the financial barrier for entry into aquaculture by the landless is significant. Further, the profitability of fish farming may entice landowners to operate fishponds on their own or through caretaker arrangements, and this affects the possibility of renewal of pond leases for landless people without long-term and secure tenure rights.

- **Pond Sharing.** With the growing rural population and large number of dependents per family (typically, a family has 5–8 members), land inheritance leads to a multiple ownership of fishponds, presenting an array of issues related to co-ownership and collective action among shareholders. Arguably, many of the issues related to underutilized or derelict fishponds stem from the social dimensions of multiple ownership, when cost sharing, benefit distribution, and assignment of responsibilities and accountabilities for pond management become difficult.

- **Living marginally with risks.** Marginal farmers or the marginally poor with access to limited amounts of land can still benefit from small-scale aquaculture but they have significant constraints in accessing resources. Most direct beneficiaries of fish seed and grow out technologies in Bangladesh are not the poorest people. Small-scale landholders with fishponds may have limited assets and may not be categorized as marginally poor or the poorest, but most small-scale landholders are only precariously above the poverty line.

- **Labor and cash inputs.** Although fish farming technologies can offer potential solutions for the landless poor who can secure access to water bodies, there may be socioeconomic constraints: feeding fish in small cages may require several hours of daily labor for food gathering, preparation, and feeding; and returns from fish farming are often highly seasonal. When the scale of operations increases, feed requirements

cannot be always met by pond fertilization and collection of feed from the immediate vicinity. Supplementary feed may require cash outlays, which the poorest cannot easily afford. Lack of cash and difficulties in accessing credit are major barriers for the poor to undertaking aquaculture on their own. Although labor may be shared and minimized through collective action among farmers, organizational arrangements are not easy to meet. Different interests in the use of the water bodies may result in social conflicts; the poor frequently lose out under such circumstances.

- **Theft.** Fishpond owners and cage operators often face the threat of poaching. Theft risks increase when fishponds or cages are far from farmers' households. Surveillance requires labor inputs for which the returns are not immediate. These constraints have limited the feasibility of fish farming to some extent, especially among households headed by females, who, on their own, are unable to protect their assets against an unfavorable social environment.

5.5. Stakeholders' involvement in governance

In the ultimate, preventing conflict is the most effective way of addressing social impacts. This brings into focus the concept and practice of stakeholder involvement in policy making, planning and management (Sevaly Sen.2001. "Involving stakeholders in aquaculture policy-making, planning and management". In: RP Subasinghe, et al Technical Proceedings of the Conference on Aquaculture in the Third Millennium). Stakeholder involvement has arisen out of a new general development model that seeks a different role for the state, which is based on pluralistic structures, political legitimacy and consensus. In aquaculture it is expected to lead to more realistic and effective policies and plans as well as improve their implementation. It is based on the assumption that greater information and broader experiences make it easier to develop and implement realistic policies and plans, new initiatives can be embedded into existing legitimate local institutions, there is less opposition and greater political support, local capacities are developed, and political interference is minimized.

Enabling the small and poor farmers and aquatic users to have a voice in policy and planning mitigates the inadvertent effect of policies and programmes of marginalizing the poor and weak. This has been a keystone of the STREAM Initiative (established in 2001as a NACA primary programme element by a multi-agency collaboration that includes FAO, DFID, NACA and VSO, an international NGO). A growing body of lessons is providing useful guidelines to governments and development organizations for building capacity to support aquaculture and living aquatic resources for rural livelihoods of poor people in the region. The lessons have included effective ways to organize and strengthen organizations or groups of poor people so that they become partners to government, development agencies and civil society in identifying potentials and developing solutions to improve aquaculture and aquatic resources management.

Approaches include rural organization, establishment of one-stop-aqua shops for farmers, application of livelihoods approaches in rural development planning and implementation, improving the capacity of institutions to work towards poverty alleviation, developing local level institutional models to better serve the objectives of rural farmers and fishers, and sharing of better practices appropriate to poor people in rural areas (NACA.2006. Annual Report to the Governing Council, 2005)

5.6. Well defined rights

Finally, while the above refers to a stakeholder role of the State, it also highlights a fundamental role of governance, which is to ensure that basic rights of individuals and the welfare of the public take precedence over that of interest groups. Defining basic rules to impartially arbitrate among potentially conflicting interests may prevent many of the conflicts from arising in the first place. (Denis Bailly and Rolf Willmann. "Promoting Sustainable Aquaculture through Economic and other Incentives." In: RP Subasinghe, et al Technical Proceedings of the Conference on Aquaculture in the Third Millennium. NACA Bangkok and FAO Rome).

Legislation on integrated coastal area management, defining access rights and limitations to various types of activities, and recognizing basic individual rights such as access to shore or water with specific properties would help private and public promoters of aquaculture development plan their activities with more security and more informed basis for decisions. Well-defined individual or collective rights act as incentive where those who have rights, either on the side of the aquaculture promoter or on the part of another interested party, can use them for persuasion or can claim them in front of jurisdiction capable of enforcement.

6. Focus on the Farmer

I would like to end this review by re-focusing on the Farmer: what does all the above mean to his staying in farming? Development plans invariably stress that the farmer is both the reason for and the key player in rural development. At the risk of putting theory before evidence, but also to see how the elements of the work program are supporting the farmers, let us consider what a farmer's basic goals could be. These are, as one:

- Higher yield
- Lower costs
- Better economic returns
- Less risk

In addition, s/he must satisfy the basic demand of the consumer for a product that is safe, at a price that is affordable, and supplied in enough quantities at a time that they are needed in the form and state that are wanted. On top of these, society requires that s/he produces without polluting the surroundings, without exploiting farm workers, if any, and as much as possible without tampering with other living things in the wild. Other conditions are in the horizon that include keeping the fish in comfort.

To achieve his four objectives in the light of market access requirements, the entire range of practical concerns of a farmer would now include:

- reducing the risk of losing a crop from pest and disease and other reasons
- reducing the risk of losing money from ill-informed choices of what to farm, how to farm and how and when to sell, in what form and at what volume
- assurance of a reliable supply of preferably hatchery-bred viable and healthy seed
- information on other ways of farming that offer the prospect of raising a better crop, and potentially earning more money from it
- knowledge in producing and selling fish that is wholesome and safe to eat, and leaves the surroundings clean
- opportunities to work with other farmers and other workers to better comply with safety requirements on his fish and the manner in which they are farmed
- options for him and fellow farmers in the development of better ways of managing their farms, and harvesting and marketing their products

- opportunity to work with others in identifying his production problems and the ability to look for or work out solutions for them
- skills to do all the above, and further opportunities to improve those skills
- collective ability to deal with suppliers of farm inputs and buyers of their product
- skills and tools to determine what is the best option for him and his family to earn a living
- opportunity to express his views in policy and development planning

These 12 concerns would be addressed and the needs satisfied by a combination of essential and enabling support. It may be argued that all are essential since the absence of one would preclude the attainment of one or more of the basic goals. For instance there is no point investing more to increase yield if the market cannot give a fair price, or in investing money and effort on farming if there is no assurance that the investment is protected by law. The State would need to assure and protect access to land and water. On the other hand it cannot directly assure a fair price without intervening in the market mechanisms. The enabling support is what creates the conditions for attaining the basic goals. It would be the enabling support that gives the farmer a better capacity to deal with biological, technical and marketing constraints.

Satisfying these would keep the farmer in business.

6.1. Staying in business

Society's interest in keeping the farmer in business is to continuously enjoy the supply of his produce. Reciprocally, it is in the farmer's interest to satisfy what society requires. In this light, helping the farmer stay in the farming business is a social responsibility.

But apprehension has been expressed, at the Aquaculture Trade and Market Access Workshop (Manila 2003), that the increasing number and stringency of market requirements could drive the poor, small farmers – unable to comply with all these requirements -- out of farming. And studies have shown that difficult access to capital and the high capital requirements for certain technologies and farming systems either make it difficult for the poor to enter or could eventually marginalize the poor farmers (Ahmed, M. et.al. 1994).

These two factors – high capital needed to adopt technologies and high cost of compliance with market requirements -- raise the specter in Asia (where more than 80% of fish farmers are small) of hundreds of thousands of displaced and unemployed farmers, or farmers turned laborers in what used to be their farms now consolidated by some corporate giant.

6.2. Sustainability and making a profit

To reiterate what is said at the beginning of the review, the simplest expression of sustainability is that the activity perpetuates itself without or after the withdrawal of external assistance. Farming can only be sustainable if the farmer wants to keep on farming. There is no plausible reason, in a democratic environment, for any farmer to want to keep on farming other than to benefit from it. Making a profit is nothing to make excuses about. To paraphrase management guru Peter Drucker, a farmer who succeeds in business, who earns a profit to pay for production costs, for his family's living, and for their future security is a responsible farmer. It is the one who fails to make a profit and

fails in faming or makes profit by taking short cuts whose costs society end up paying, who is not.

6.3. Empowerment and reward

In this regard, a sustainable aquaculture program should emphasize and strengthen the system of support that enables the farmer to play a stronger and active role in the social and economic processes that impact on his livelihood, which simply means to empower him, and to assure that for staying in business, he is justifiably rewarded.

6.4. From the rural development arena to the global market place

Competitiveness. There is another issue: competitiveness. Between satisfying the farmer's objectives and meeting the demands of the consumer and the rest of society, stands an economic mechanism called the market. Its basic function is to make compatible the goals of the producer on one hand, and the needs of the consumer and requirements of society, on the other. Globalization however has raised the question as to whether the market mechanism alone can enable this compatibility, without distorting its mechanism to favor the farmer, as with a subsidy. As market distorting gratuities are discouraged, the acceptable way to go is for farmers to have a better capacity to comply. Better capacity suggests collective and democratic action, a condition that can be attained by being organized and having the ability and opportunity to take part, as a major stakeholder, in planning and decision-making processes in the community or the country. It basically means acquiring the skills and tools to foresee problems and work out solutions to deal with them.

Placing the farmer in the context of the market place means more than helping him stay in business. He must be competitive. Basic competitiveness comes from technical efficiency that gives higher yield and productivity; economic efficiency that results in better economic returns; greater ability to avoid or manage nature-spawned and economic risks; and a stronger capacity to comply with regulations, adopt codes of practices and address market access requirements and barriers to trade. These – again -- underline the importance of farmers being organized. Being organized to attain economy of scale and acquire a stronger power to transact with suppliers and buyers is now seen as essential to the survival of small and poor producers in developing countries where the market chain is usually fragmented. It is also considered necessary for large producers in both developing and developed economies.

Limited resources. Another reality facing farmers is having to do more with less. At the FAO workshop in Iran in September 2005 to review aquaculture development in Asia, one of the trends identified by the meeting was the continuing intensification of aquaculture. This is a short simple statement that embodies a complex train of events and linked factors. What it simply indicates is that farmers and the sector, to reach their basic goals of producing and earning more will now have to do with a lot less: less land, less freshwater, less or inferior biological resources, probably less financial resources. This too needs technical and economic efficiency and attaining economy of scale, thus, for small farmers, being organized.

To sum up, for farmers, and users and gatherers of aquatic resources, being organized into a formal association or a self-help group is to collectively achieve a strong capacity to enter and stay in aquaculture, effectively demand and absorb institutional services and technical assistance, cope with natural hazards and economic risks, address barriers to

property and financial access, and acquire and effectively use capital and operating assets (ADB, 2005).

These are some hard evidence of the advantages of being organized and adopting better management practices from NACA-assisted projects, in India and Vietnam:

Case No. 1. The small shrimp farmers in India are, like other shrimp farmers in the region, repeatedly hard hit by virus diseases. They are the most vulnerable to shocks and least able to rebound from adversities. Yet, other then providing 70% of the total volume of exported shrimp, they also comprise more than 80% of the shrimp farmers in India. This led to MPEDA requesting NACA assistance in developing and providing technical assistance to a shrimp health management project. The project eventually evolved into a community development pilot with health management as the core technology. A project evaluation in 2004 found that the shrimp farmers that formed aquaclubs and adopted BMPs have increased yield by 33%, harvested shrimp that were 1.5 times larger, and were visited 20% less frequently by diseases than surrounding non-adopting farmers. Moreover, their produce became more attractive to buyers because the shrimp had no antibiotic residues as the farm management practices they adopted excludes the use of banned drugs and chemicals.

The project was subsequently expanded and another evaluation, of the 2005 crop results from 930 demonstration ponds spread over 484 hectares of area in 15 villages, showed an increase in production by two-fold, 34% increase in size of shrimp, and 65% reduction in disease prevalence compared to surrounding non-adopting ponds. There was a remarkable improvement in quality of the shrimps due to non-use of any banned chemicals and better practices during harvest and post-harvest handling. Another outcome is the 'contract hatchery seed production system' in which the organized small farmers could procure high quality of seeds at reasonable price, and even offering premium price to hatchery owners for quality and reliable seed supply.

Case No. 2. Viet Nam witnessed an outstanding 3-fold increase in aquaculture production, from 374,000 mt in 1993 to 1,150,000 mt in 2003, and a 2-fold increase only in the 5-year period 1998-2003. Shrimp farming played a major role in this rapid development, with a production that, according to FAO data, over the 5 year period between 1998 and 2003 registered a 4-fold increase reaching over 220,000 mt and that, according to national statistics, grew constantly to reach an estimated 350,000 mt in 2005.

Although continuously higher production could be an indicator of the healthy growth of the sector, the increased production observed in recent years was due more to an increase in the number of farms, than to improved productivity.

This sharp increase in production came at a cost. Escalating environmental deterioration and the associated shrimp health problems, which in 2004 led to an estimated loss of more than 11% of the total shrimp production, began to damage the sector. Farmers usually dealt with these health problems by increasing the use of chemicals, involving sometimes the application of banned substances, which led importing countries to impose restrictions on Vietnamese aquaculture products that in turn most likely resulted in a negative impact on the livelihoods of farming communities.

The government of Vietnam recognized the need for promoting a more sustainable development of the sector and initiated several activities in this direction.

Among these is a project that supported coastal aquaculture, which demonstrates the private and social benefits of adopting BMPs. In this project, support was given to the promotion of responsible development of the shrimp farming sector at all levels and for all links in the production chain. BMPs were developed for broodstock traders, hatcheries, seed traders and farmers. Focus was given on the development of simple and practical BMPs, which addressed the needs of less resourced small-scale farmers. Ten sets of extension material were developed and disseminated in close collaboration with the Ministry of Fisheries. The tangible outcomes include the following:

- Implementation of BMP for hatcheries was supported in six hatcheries and resulted in seed production up to 1.5 times higher and a price per unit seed of about 30-40% higher than non-BMP seed.
- BMP implementation was also supported in 7 pilot farming communities (655 direct beneficiaries). Implementation led to a remarkably lower risk of mortality, higher production and higher probability of making a profit.
- Farming communes that introduced seed testing increased their chances of making a profit of over 7 times.
- BMP application led to average yields that were sometimes more than 4 times higher than in farms where BMP had not been adopted.
- The project BMPs were also incorporated into the draft standards for the production of organic seed.

The project also strengthened the institutions involved with seed health management by conducting training courses and by supporting the development of national and provincial-level legal documents to improve the process of seed screening and certification.

More fundamental than the small farmers and the environment benefiting from BMPs is the social harmony it engenders. The above projects have arguably served to enhance trust and cooperation among the players in the market chain that include hatchery owners, the farmers, and processors/exporters. The basis for this proposition is that the supplier of inputs, the farmer, and the buyer of products stand to gain more from each one behaving responsibly towards one another than by taking advantage of each other.

6.5. A checklist of emphasis

In summary, the concepts and empirical evidences from the review suggests five key support areas for farmers that a sustainable aquaculture development program could emphasize:

1) Enabling real and a strong sense of ownership of development programs and initiatives by the farmers,
2) Promoting associations of farmers and aquatic users, working towards their being more strongly represented in policy-making and, in the long term, operating their own extension and field research teams,
3) More adoption of voluntary codes of conducts and practices, and best management practices, which suggests a program that would lessen the need for more rules and regulatory controls, which aquaculture legal experts describe as “blunt instruments”, as well as restrictive of healthy development if carried to the excess or enforced inefficiently,
4) Direct participation or at least active representation of farmers in regional and global discussions of agreements and policies, and

5) Stronger and wider cooperation among players in the market chain in developing and adopting better practices (for instance, better marketing and manufacturing practices).

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Conservation Aspects of Marine Fisheries

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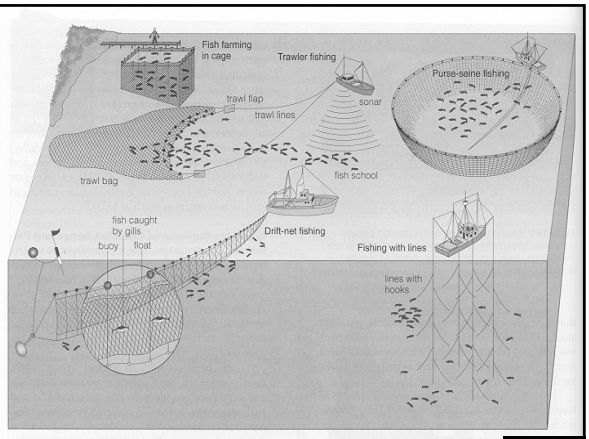


Miller 2001

Impacts of Various Fishing Methods

C. Yau

Ecological friendly

All fishing activities produce some impacts on marine ecosystems

Introduction

All fishing activities have ecological impacts:

- physical structure of the habitat and water quality
- by-catch/incidental-catch of other wildlife species
- genetic diversity or even species extinction
- ecosystem balance

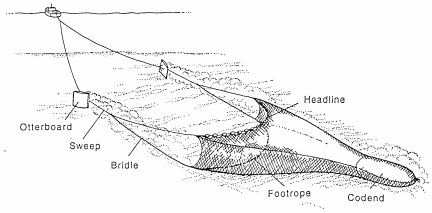
1. Impacts of various Fishing methods

2. Mitigation measures and methods

1. Demersal Trawling

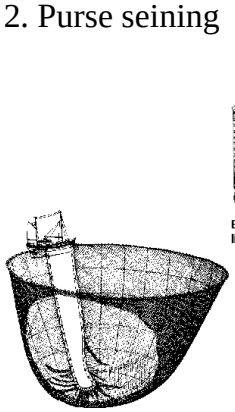
Marine Conservation Biology Institute

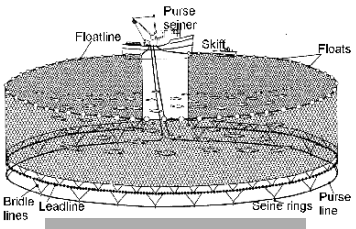
Bottom trawling: *sweeping everything*



- one of most common fishing methods
- heavy gear dragged over the seabeds crushes
- removal of epibenthos e.g. sponges, coral, seagrass
- resuspension of sediments
- low selectivity and high disturbance of habitats

2. Purse seining



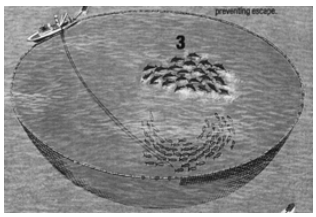


Purse Seining

- Selective fishing: deliberately target one/few species
  - ⇨ upset the balance of ecosystem
- Evolutionary shifting population demographics

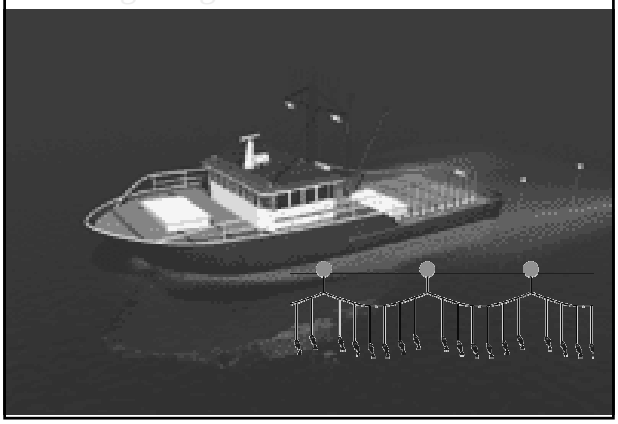
Tsai TP 2003

Purse seining: *killing millions of dolphins*



- dolphins are often in association with tuna
- nets are set around dolphins and therefore tuna
- they become confused in nets, are entangled & drowned
- several millions of dolphins have been killed

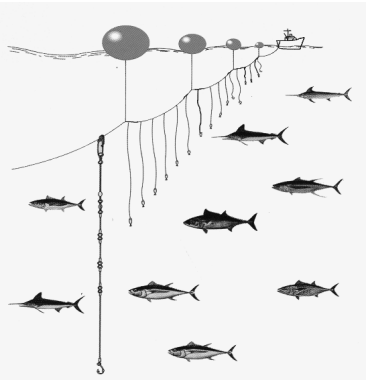
3. Longlining



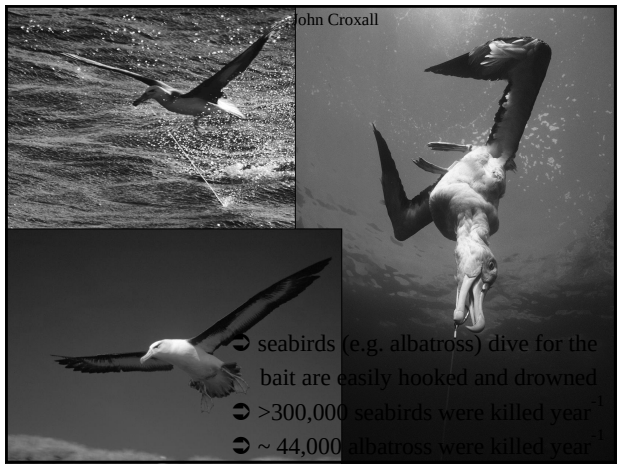
Longliner

Chen CL 2003

Longlining: *44,000 albatross were killed annually*

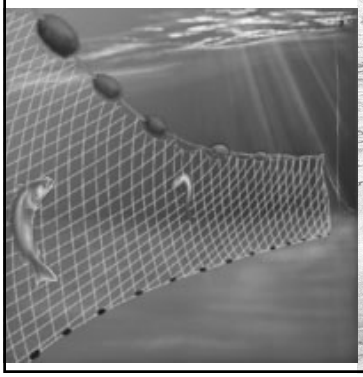


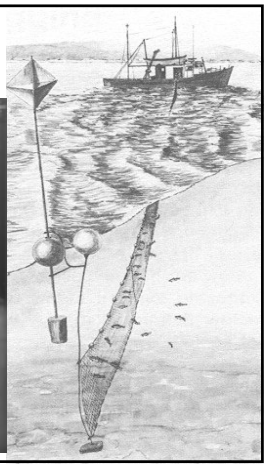
- target large tuna, sharks & billfish
- cause minimum environmental damage
- fairly high species and size selectivity
- Seabirds catch rate @0.08~0.41/1000 hook
- Sea turtle



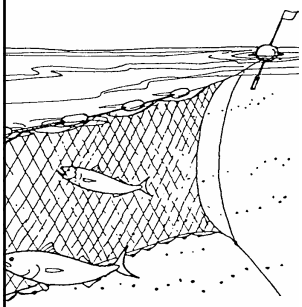
- seabirds (e.g. albatross) dive for the bait are easily hooked and drowned
- >300,000 seabirds were killed year^{-1}
- ~ 44,000 albatross were killed year^{-1}

4. Gill net





Driftnet and some gill net: *Wall of death*

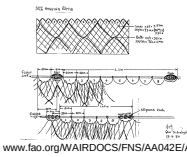


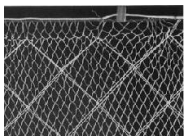
- 2.5 to 60 km length of nylon
- target tuna, squid, & salmon
- less environmental damage
- non-selective for species captured
- wildlife besides fishes were entangled and killed (seals, cetacean, sea turtle, seabird)

- 0000s of cetaceans
  0000s of seals
  000s of sea turtles
  00,000s of seabirds
  were killed each year

Trammel Net – *Catch All !*

- three layers of nets overlaid together
- two large-meshed nets with a small-meshed net webbing in between



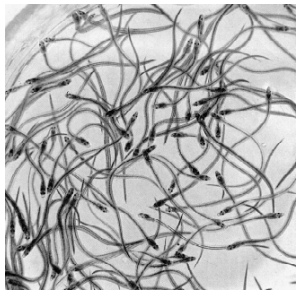


www.fao.org/WAIRDOCS/FNS/AA042E/AA042E05.htm

- Entangle fish in bags or pockets of netting.

http://www.eurocbc.org/page177.html

5. Fry or fingerling capture: *recruitment overfishing*



- Fingerlings of valuable food species, e.g. eel, groupers, etc. are collected from the wild
- Sold to fish farmers

- high demand ⇨ juveniles were depleted
  - ⇨ recruitment overfishing
  - ⇨ depletion of wild fish stocks

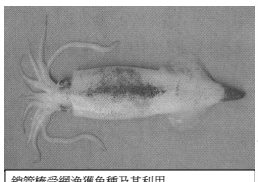
Artificial Light in Purse Seiners

Attracting more small fish?

Effects on fish fry?

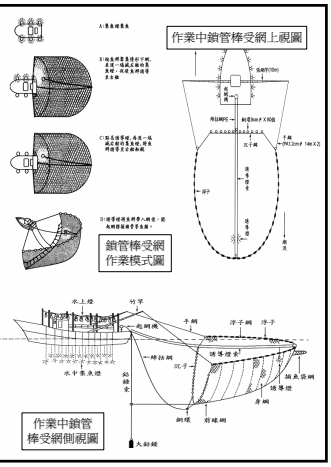
網漁業 – 火誘網 (Su WC 2005)

鎖管棒受網
Squid Netting with Light



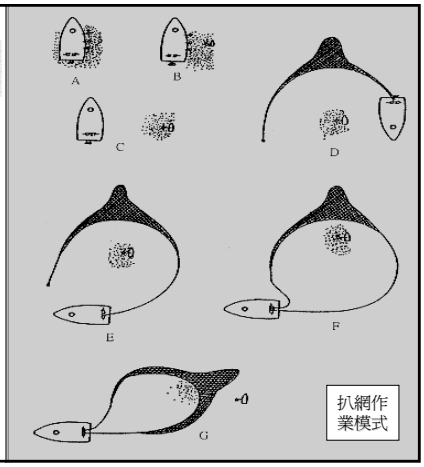
鎖管棒受網漁獲魚種及其利用

學名：***Doryteuthis sibogae***
中名：尖鎖管
俗名：尖仔
利用：鹽漬煮食



網漁業 – 火誘網 (Su WC 2005)

扒 網
Purse seiner with light



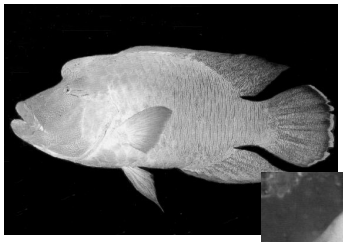
6. Dynamite fishing: *blast to powder*

- ➲ Blast fishing using explosives is indiscriminate
- ➲ Few sticks of dynamite can kill 2 tones of fish
- ➲ Kills targeted fish, plankton, reef invertebrates & corals

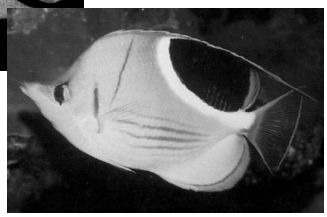
- ➲ Complex coral habitat is destroyed and reduced to barren rubble
- ➲ It may take decades for reef regeneration

Blast fishing
Time 1995

7. Cyanide fishing: *stun the big one, kill the small one*

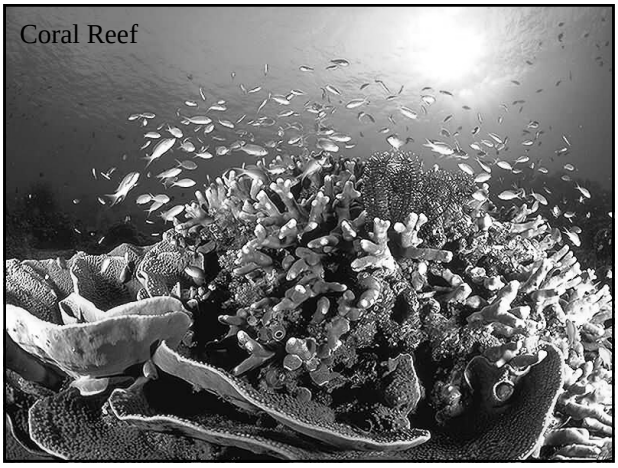


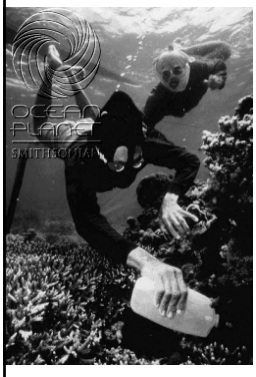
⇦ Food fish
supplies valuable life reef fish trade



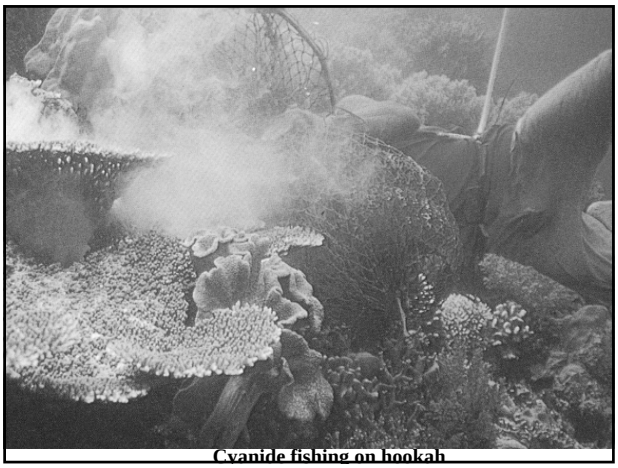
Aquarium fish ⇨
ornamental species

Coral Reef





- ➲Hundreds of tons of cyanide are pumped into coral reefs every year
- ➲Target fish are stunned by the poison and caught
- ➲ Kill smaller fish and invertebrates, especially coral reef
- ➲ In Philippines, ~33 million coral heads are sprayed with cyanide annually



Cyanide fishing on hookah

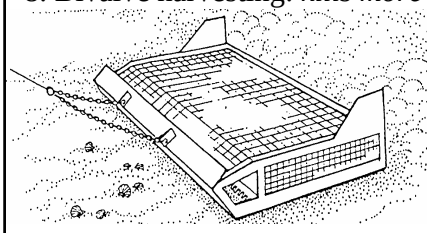
Electric fishing damage the fishery resources

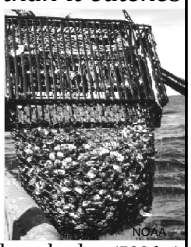
南方日报 NANFANG 要 闻 RIBAO 2000年2月19日

非法电虾肆虐阳江
休渔成果破坏殆尽

该市日前现场销毁一批三无渔船

8. Bivalve harvesting: *kills more than it catches*





NOAA

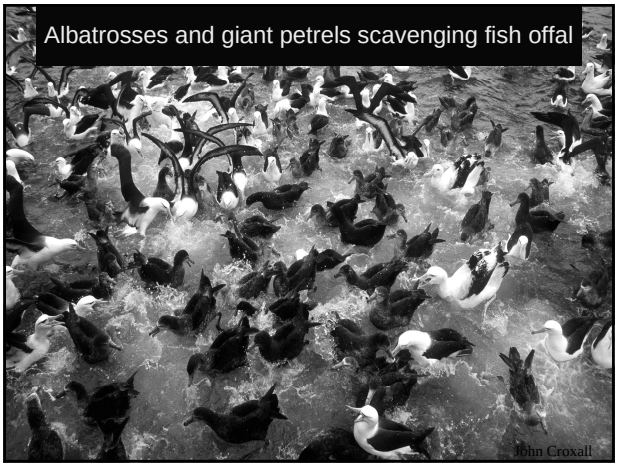
- Scallop are harvested by heavy metal box dredge (500 kg)
- 80% of the scallops are crushed and damaged, subjected to predation and disease infection
- Only 12-22% are landed as catch
- Post fishing mortality rate is **7×** natural mortality
  - ⇨ complete destruction of scallop beds

9. Discrads and Bycatches:

you get something you don't want

Elliot A. Norse

- occurs whenever gear is not 100% selective
- **27 million tones** was discarded every year, = 26% of the total catch
- Induce extra handling, juvenile fish mortality, incidental kills of marine mammals & sea turtles
- May cause ecological shift in benthic communities

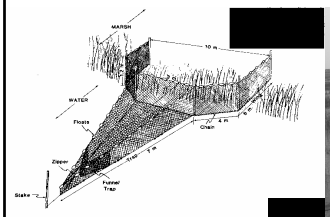


Albatrosses and giant petrels scavenging fish offal

John Croxall

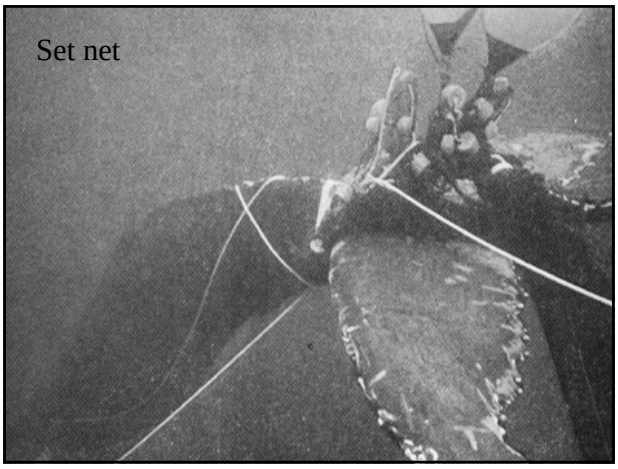
10. Set net, Beach net

Zhong JS 2005



River mouth eel larvae net

Set net



11. Lost Gear – 'Ghost Fishing'

- Lost fishing gear may continue to catch and kill animals for more than 6 years.
- Lost pots tend to retain their catching ability for longer in a re-baiting cycle.
- A grapnel survey of Georges Bank yielded 341 lost trawl nets.

Lost gear

A moray eel entangled in a torn fishing net (Paxton & Eschmeyer 1994)

12. Recreational fishing: *catch fewer fish?*

- Helps to alleviate the stress caused by human relations in urban life
- Hobby industry - Catch for fun
- Majority recreational fishing are hook and line

- Catch fewer fish and less ecological impact?
- Recreational catch > commercial catch for some species (e.g., Australia – red snapper)
- Targets large, top-level predatory fish ⇒ upset the balance of ecosystem

Significant Increasing Population of Recreational Fisheries

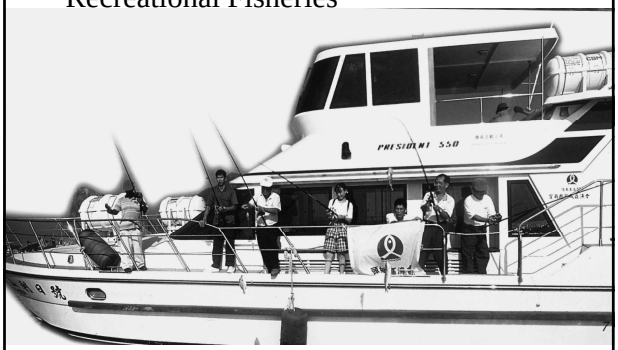


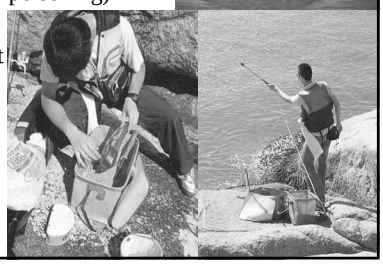
Photo from ***Our Fishery Our Love***, Taiwan Fishery Bureau

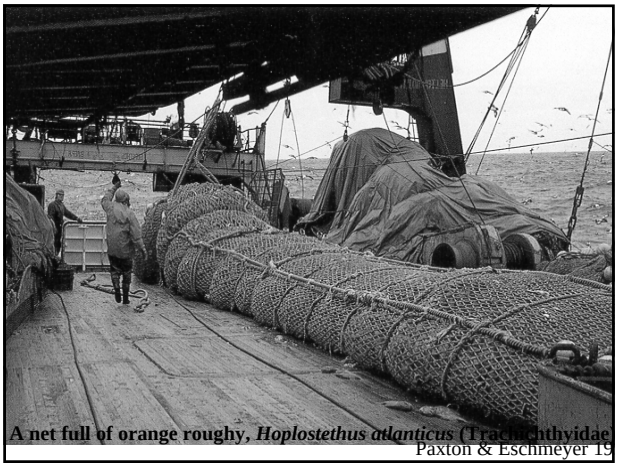
Recreational Fishing: *limited fishing effort?*

www.hattershi.com/fishingreport.html

Other ecological impacts:

- bycatch and discards
- lost gear (unlikely to have ghost fishing problem)
- lead sinker (lead poisoning)
- Littering
- use of chum bait (pollution and eutrophication)

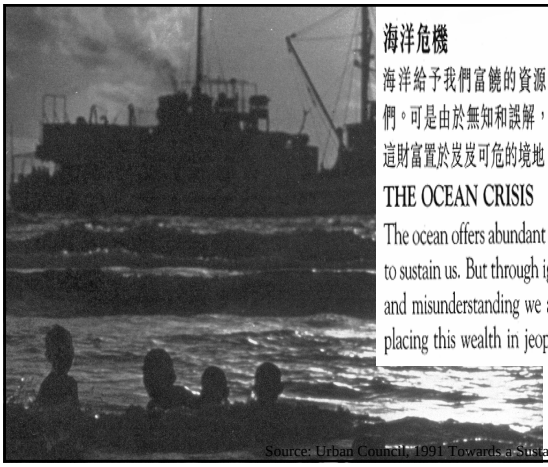




A net full of orange roughy, *Hoplostethus atlanticus* (Trachichthyidae

Paxton & Eschmeyer 19

Many of the world's fish populations are overexploited, and the ecosystems that sustain them are degraded (FAO, 2002)



海洋危機

海洋給予我們富饒的資源，養育我們。可是由於無知和誤解，我們正把這財富置於岌岌可危的境地。

THE OCEAN CRISIS

The ocean offers abundant resources to sustain us. But through ignorance and misunderstanding we are placing this wealth in jeopardy.

Source: Urban Council, 1991 Towards a Sustainable Wo

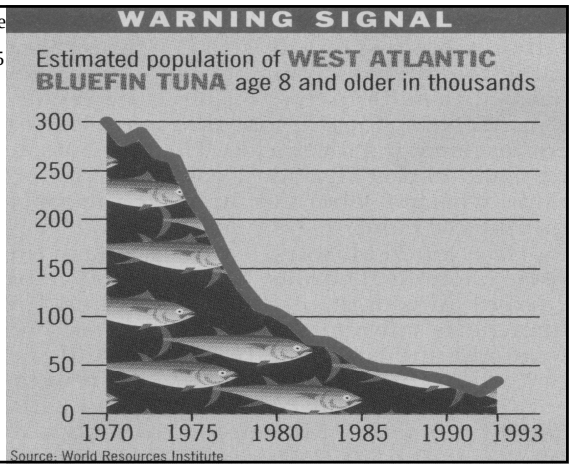
ENVIRONMENT

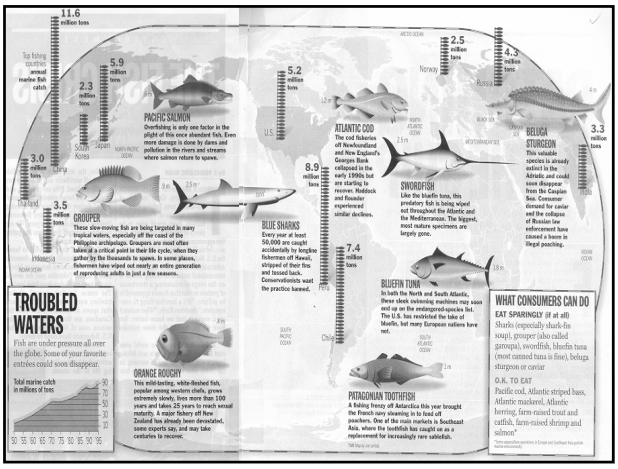
THE FISH CRISIS

The oceans that once seemed a bottomless source of high-protein, low-fat food are rapidly being depleted

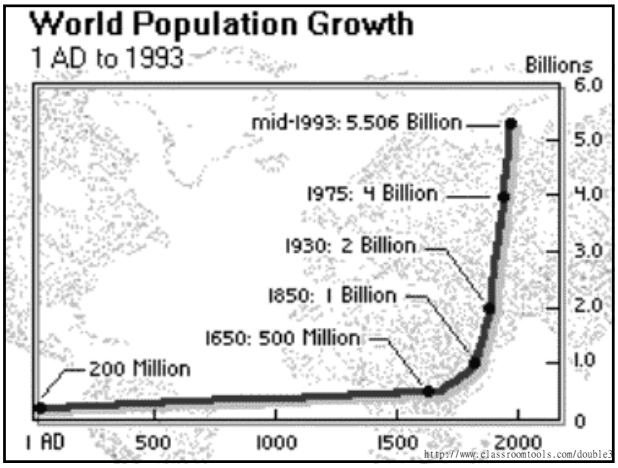
Time

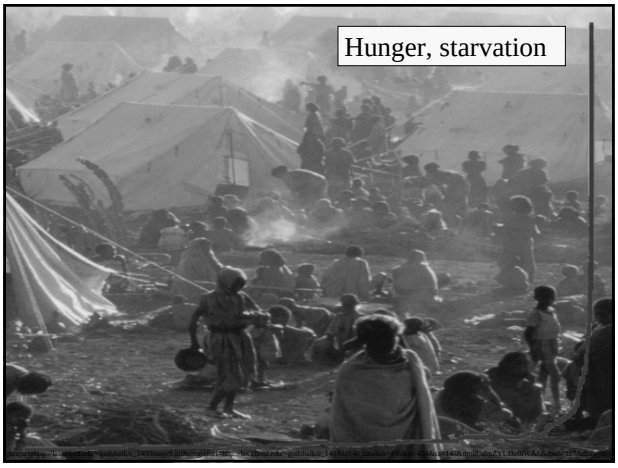
1995





⇨ ***Fishing***
or
not fishing ?





Food: Agriculture

- About 30,000 species of plants are edible, only about 15 crops and 8 animals species supply 90% of our food
- Wheat, rice, corn and potato are more than 50% of world total food production
- 2/3 of the world's people survive on a diet of grains - mostly because they can not afford meat.
- High productivity lead to low stability in the food system. Mad cow disease, pig foot-and-mouth, chicken flu and outbreak of insects are examples.

農業進步的代價
農業工業化，生產力固然高，但長遠來說破壞性也很大。今天，很多農民也在實行這種「殺雞取卵」的耕作方式。

THE COSTS OF ADVANCED AGRICULTURE
Industrial agriculture is highly productive: it can also be highly destructive – in a slow, quiet manner. Many of today's farmers practise a form of 'deficit financing'.

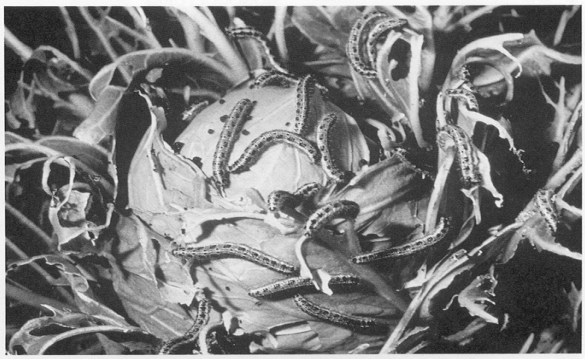
單一耕作
廣泛地單獨種植一種農作物，若遇上蟲害，損失往往慘重，遺傳物質的多元性也會被削減。

MONOCULTURES
All vulnerable to the same pest and all helping to erode genetic diversity.

Source: Urban Council, 1991 Towards a Sustainable Wo

道高一尺……
在控制蟲害方面，害蟲始終佔盡上風。

RACE AGAINST NATURE
Resistant and mutant forms of pests are always one jump ahead.



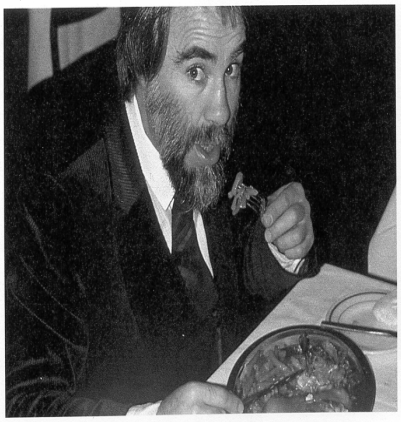
Source: Urban Council, 1991 Towards a Sustainable World

Food: Live Stock

- >50% of the world's cropland (2/3 in USA) is used to produce livestock feed
- Live stock consumes about 37% of the world's grain production (70% in USA).
- About 1/3 of the world annual fish catch is converted into fish meal and fed to livestock.
- Damage to the environment:
  overgrazing, topsoil loss, desertification, biodiversity loss

www.southcn.com/news/hktwma/ twmil/20011213130 8.h

www.oursci.org/magazine/ 200303/030306.htm



暴殄天物
爲了滿足已發展國家對肉食的大量需求，全球出產的穀物差不多有四成被用作飼料以養活禽畜。

WASTEFUL DIETS
Nearly 40% of the world's grain is fed to livestock for the meat-rich diet of the North.

Source: Urban Council, 1991 Towards a Sustainable World

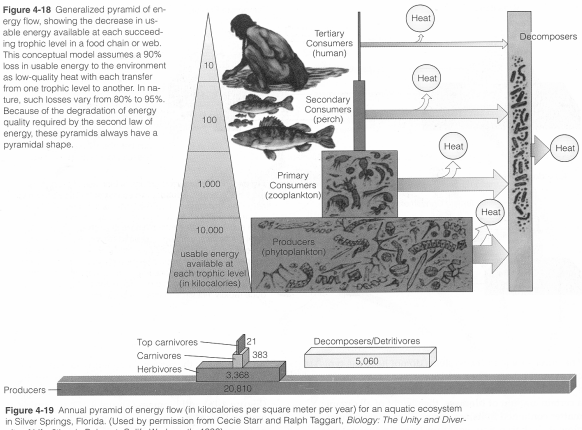
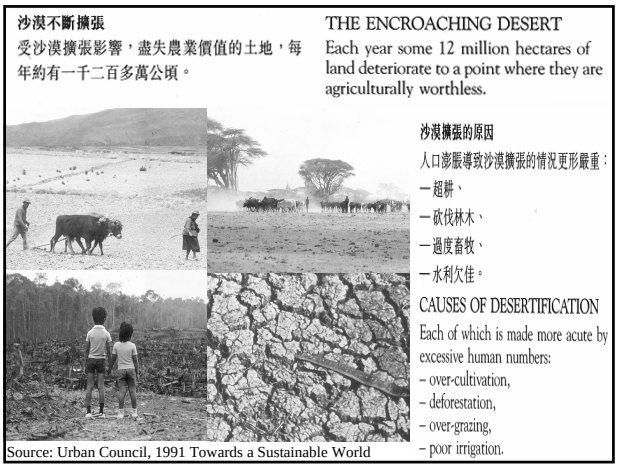


Figure 4-18 Generalized pyramid of energy flow, showing the decrease in usable energy available at each succeeding trophic level in a food chain or web. This conceptual model assumes a 90% loss in usable energy to the environment as low-quality heat with each transfer from one trophic level to another. In nature, such losses vary from 80% to 95%. Because of the degradation of energy quality required by the second law of energy, these pyramids always have a pyramidal shape.

Figure 4-19 Annual pyramid of energy flow (in kilocalories per square meter per year) for an aquatic ecosystem in Silver Springs, Florida. (Used by permission from Cecie Starr and Ralph Taggart, *Biology: The Unity and Diversity of Life*, 6th ed., Belmont, Calif.: Wadsworth, 1992)

Miller 2001 (Fig 4-16 &



Source: Urban Council, 1991 Towards a Sustainable World

Source: Urban Council, 1991 Towards a Sustainable World

Food/Drug from ocean

- Planet Ocean (Earth): covers 70% surface area
- Three dimensional
- Worldwide, people get 20% animal protein directly from fish/shellfish with additional 5% indirectly from fish meal fed to live stocks
- About 87% annual commercial fish/shellfish catch come from ocean

Sustainable Fisheries Resources

- Chinese Philosopher LaoTse

  "Give a man a fish and he will eat for a day. Teach a man to fish and he will eat for a lifetime."

- Alix (1989) Community based resource mgmt:

  "Give a man a fish and he will eat until the resource is depleted. Teach a community to manage its fishery resources and it will prosper for generations to come."

Mitigation measures and methods

1a. International legal instruments:

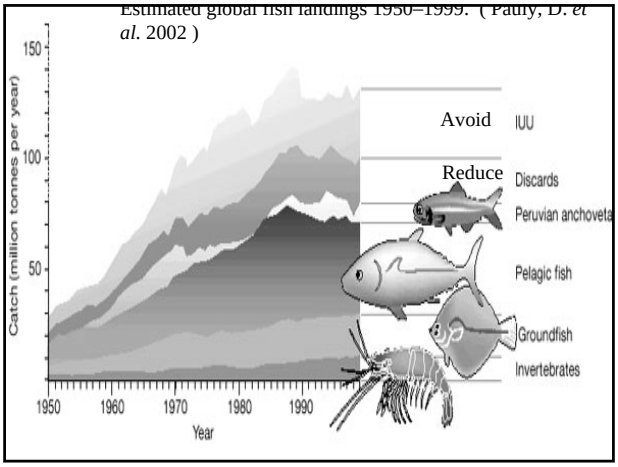
- ✪ UN Convention on the Law of the Sea (1982, effected 1994) - conservation and management of fisheries
- ✪ International Conservation & Management Measures by Fishing Vessels on the High Seas, 1993
- ✪ Convention on Biological Diversity (1992, effected 1993)
- ✪ Conservation and Management of Straddling Fish stocks and Highly Migratory Fish Stocks, 1995 (based upon 1982)
- ✪ UN Framework Convention on Climate Change 1992 & the 1997 Kyoto Protocol

⇨ESD: Ecologically sustainable fisheries development

1b. International instruments on fisheries

- ✪ World wide moratorium on all high seas driftnet fishing, 1991
- ✪ Agenda 21, Chapter 17, Section 46: use selective fishing gear and minimize bycatch 1992
- ✪ Precautionary approach: Principle 15 of Rio Declaration, 1992
- ✪ Code of practice on introduct.& transfer of marine organism, 94
- ✪ Jakarta Mandate on Marine & Coastal Biological Diversity,1995
- ✪ The Rome Consensus on World Fisheries, 1995
- ✪ The Kyoto Declaration and Plan of Action on Sustainable Contribution of Fisheries to Food Security, 1995
- ✪ Rome Implem.of Code of Conduct for Responsible Fishing, 199
- ✪ The IPOA for Management of Fishing Capacity, for reducing Incidental Catch of Seabirds in Longline Fisheries, and for Conservation and Management of Sharks, 1999
- ✪ Prevent, Deter and Eliminate Illegal, Unreported & Unregulated (IUU) fishing, 2001

Estimated global fish landings 1950–1999. (Pauly, *D. et al.* 2002)



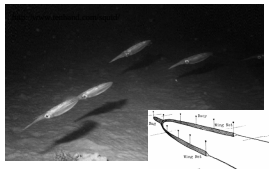
2. Trade instruments

- ✪banned importation of live fish with cyanide residues
- ✪Dolphin bill: illegal to trade non dolphin-safe tuna
- ✪banned the importation of driftnet catches
- ✪"Give Swordfish a Break" campaign (>33 lbs)
- ✪Organization for the Promotion of Responsible Tuna Fisheries (OPRT) - responsible trading system

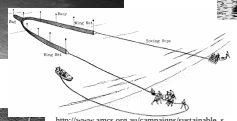
3. Ecological acceptable fishing methods

- ✪use hook and line instead of cyanide and dynamite to catch reef fish
- ✪use hand net and barrier net to collect aquarium fish

Hook and line for fish alone? *We want more!*




http://www.rainbowrest.com.hk


http://www.amcs.org.au/campaigns/sustainable_seafood_guide/ss_fishing_gear_in_focus.html

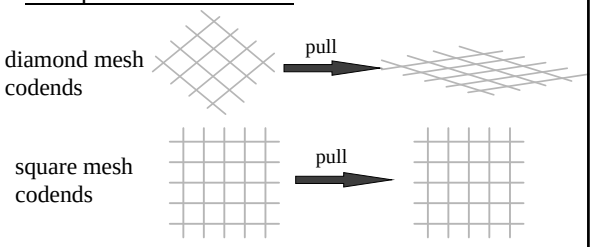

http://www.rainbowrest.com.hk


http://www.rainbowrest.com.hk

Forbidding set net at estuaries Zhong JS 2005

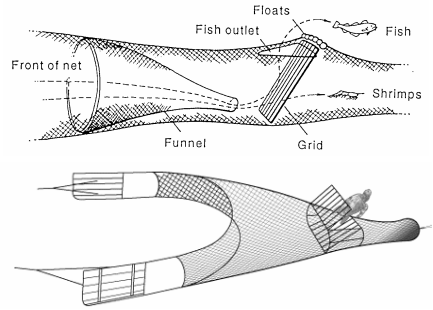
4. Conservation engineering

A. Square mesh codends



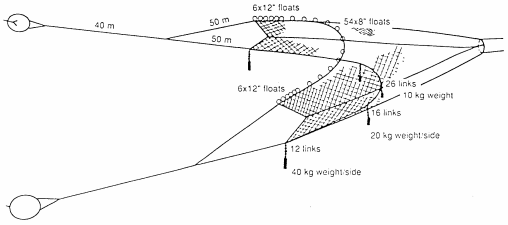
✪ square mesh does not collapse upon pulling
✪ reduce juvenile bycatch and fish bycatch in trawls

B. Trawl efficiency or turtle exclusion devices (TEDs)



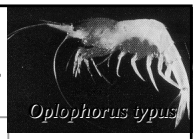
✪ allow unwanted species to exit
✪ can exclude 60 -100% of unwanted species

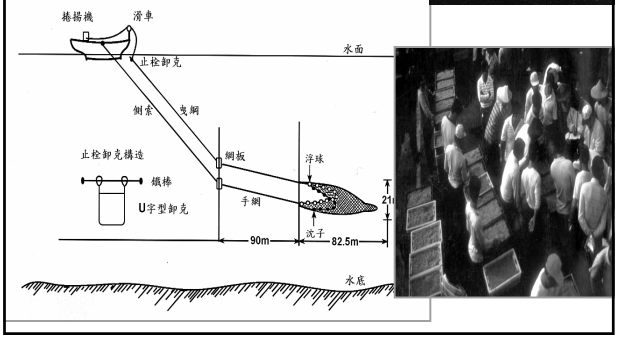
C. Semi-pelagic trawl



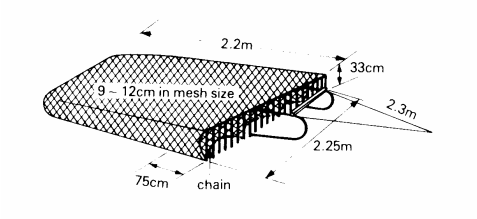
✪ certain demersal fisheries can use semi-pelagic trawl
✪ reduce sea bottom damage and epibenthos removal
∵ groundrope fly above the seabed

正櫻蝦拖網
Sakura shrimp trawler





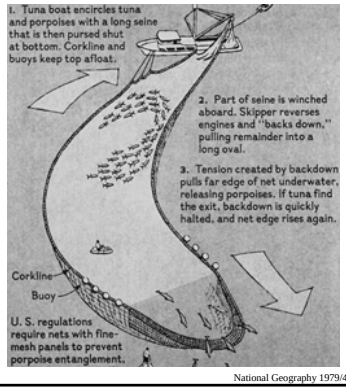
D. Improve scallop dredging



✪ replace rigid steel box with tickler chain and ring mesh
⇨ reduce scallop damage and mortality
⇨ reduce seabed damage and improve efficiency

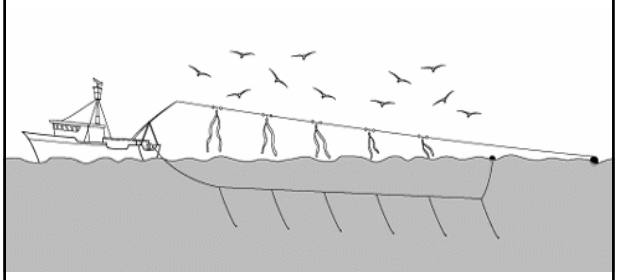
E. Reduce dolphin mortality associated with purse seine

✪ safety panel and 'backing down' technique
✪ reduce 99% of dolphins mortality (1960s to 1994)
✪ HACCP "Dolphin safe" on canned tuna



National Geography 1979/4

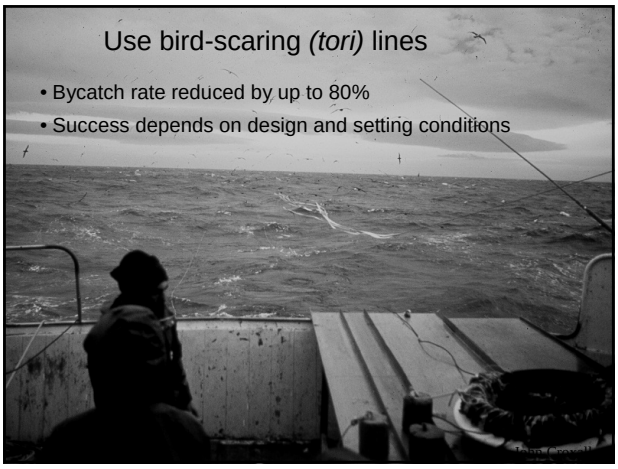
F. Reduce albatross mortality associated with longlining



✪ 1997 CCSBT/FAO
✪bait casting machine + weighted branch line + streamer
✪ setting lines at night time
✪ reduce albatross mortality by over 80%

Use bird-scaring *(tori)* lines

- Bycatch rate reduced by up to 80%
- Success depends on design and setting conditions

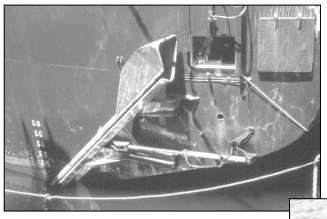


Paired Streamers

ReducedBycatch by 100% (Melvin 2003)

Put enough weights onto line

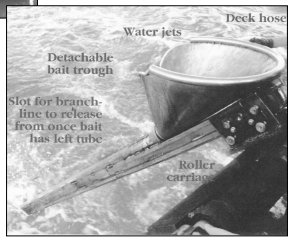
John Croxall



New methods
Underwater setting

Effective for bottom fisheries - can reduce bycatch by 70%

Experiments for pelagic fisheries ongoing



John Croxall

G. Discrads and Bycatches of juvenile fishes:
Protecting fisheries recruitments

- ➲ No fishing at spawning sites
  - ⇨ Marine reserve
  - ⇨ Setting artificial reef
- ➲ No fishing during spawning season
  - ⇨ Suspended fishing season
- ➲ Increasing mesh size at codend
- ➲ Regulate minimum catch size
- ➲ By-catch as part of quota

H. Artisanal Fishing:

- ➲ Employment
- ➲ Less damaging???
- ➲ Catching small fishes

By scale? Lery *et al*., 1999

Mongabay.com

By method?

http://www.oceansatlas.com/world_fisheries_and_aquaculture/html/tech/capture/typesoffi/img/411.jpg

Comparison of commercial fisheries and artisanal fisheries

	Large-scale company-owned	Small-scale artisanal
Number of fishermen employed	Around 450 000	Over 12 000 000
Marine fish caught for human consumption	Around 24 million tonnes annually	Around 20 million tonnes annually
Capital cost of each job on fishing vessel	$10 000 to $100 000	$100 to $1000
Bycatch discarded at sea	Around 20 million tonnes annually	Around 1 million tonnes annually
Marine fish caught for industrial reduction to meal and oil, etc.	Around 19 million tonnes annually	Almost none
Fuel oil consumption	10 to 14 million tonnes annually	1 to 2 million tonnes annually
Fish landed per tonne of fuel consumed	2 to 5 tonnes	10 to 20 tonnes
Fishermen employed for each $1 million invested in fishing vessels	10 to 100	1000 to 10000

Fig. 2.4 Comparison of large-scale commercial fisheries with small-scale artisanal fisheries. (Source: modified from Thomson 1980.)

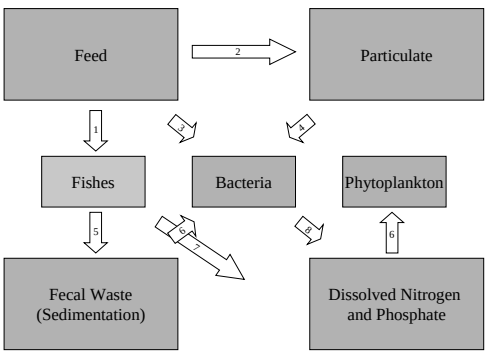
(Misund *et al*., 2002)

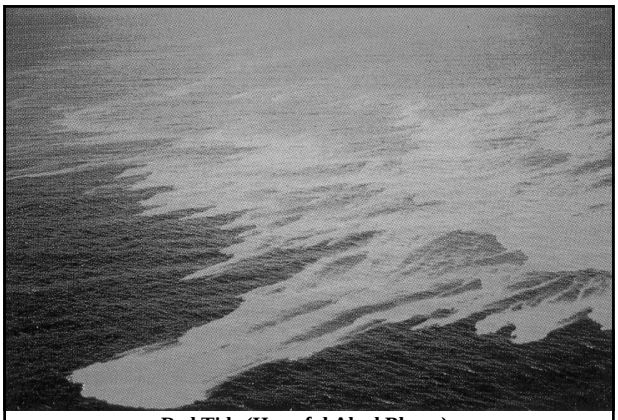
- ➲ Operation 'niche'?
- ➲ Habitats covered?
- ➲ Participants involved?
- ➲ Temporal and spatial flexibility?
- ➲ Any control or management?
- ➲ Selectivity in gears and methods used?

I. Aquaculture – Coastal polluter

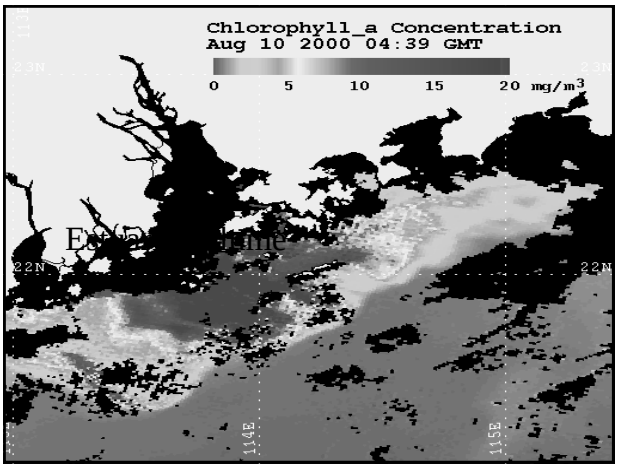
- ✪ Contribute about 19% of world production
- ✪ Can alleviate fishing pressure
- ✪ Can supply source of fingerling for growing out

Nutrient flow in a regular fish farm





Red Tide (Harmful Algal Bloom)
Dinoflagellate - *Noctiluca*



Harmful Algal Bloom in Hong Kong

posed a serious threat to aquaculture and fisheries

with a loss of HK$ 508 (US$ 65) million dollars in fishing industries in March-April 1998

Grouper

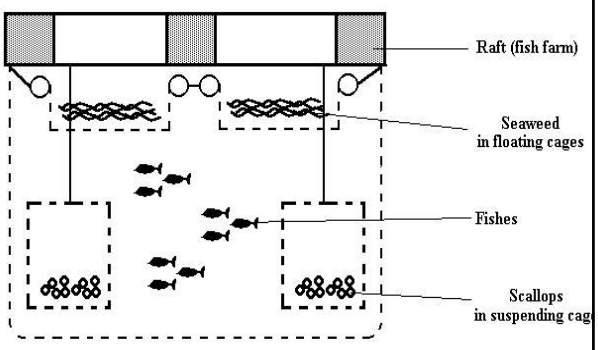
Aquaculture

BUT possible adverse ecological effects:

- Detrimental effluent
- Eutrophication -HAB
- Disease
- Reduction in genetic diversity

⇒ Integrated mariculture

Co-culture Diagram of suggested integrated mariculture



人類社會

「……逆天行道，其妄自招。」

——道家學說

HUMANITY

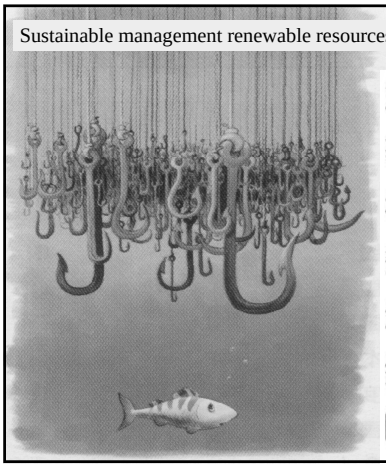
'... The universe is sacred. If you try to change it, you will ruin it.'

– Lao-Tsu, Founder of Taoism.

Source: Urban Council, 1991 Towards a Sustainable World

Sustainable management renewable resources

科學人 2002年五月



加拿大卑詩省溫哥華漁業中心的華森及鮑里用上統計模型程式分析，指出全球漁業危機要比以往想像得還要嚴重。該程式納入了海洋學的因素及過去的漁獲量記錄。有些國家，特別是中國大陸，大幅誇大了漁獲量。

If we keep catching fish without protecting fish recruits,

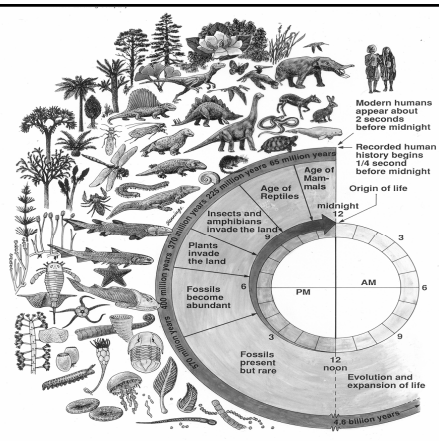
all fish will be extinguished

Protection & preservation of the habitats of marine life

People are forced to eat fish reared in polluted waters

If we don't stop water pollution now.

All fish will be contaminated and will endanger the lives of those who eat them



Simplified history of biological evolution

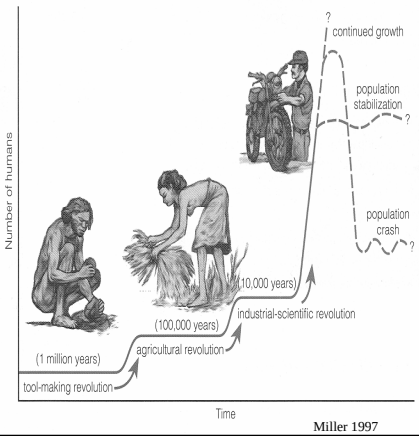


Figure 2-3 Expansion of the earth's carrying capacity for humans. Technological innovation has led to major cultural changes, and we have displaced and depleted numerous species that compete with us for—and provide us with—resources. Dashed lines represent three alternative futures: **(1)** uninhibited human population growth, **(2)** population stabilization, and **(3)** growth followed by a crash and stabilization at a much lower level. The time spans shown represent periods over which a cultural revolution took place.

Miller 1997

全球共識

「地球只得一個，世界卻人人不同。然而，我們賴以爲生的生物圈，還是只得一個。」

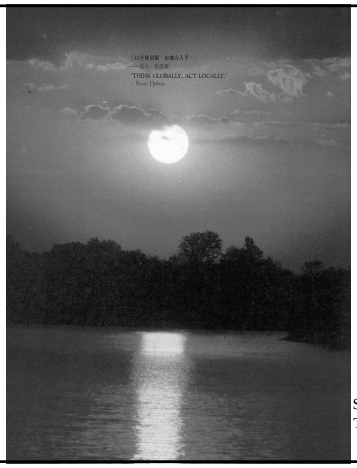
——《我們共同的未來》

GLOBAL CONSCIOUSNESS

'The Earth is one but the world is not. We all depend on one biosphere for sustaining our lives.'

– 'Our Common Future'

Source: Urban Council, 1991 Towards a Sustainable Wo



Think globally

Act locally

Source: Urban Council, 1991
Towards a Sustainable World

Acknowledgment

- ✪ Contributors of all the pictures and sketches
- ✪ Organizing Committee

Technology of fisheries post –harvest preservation and process

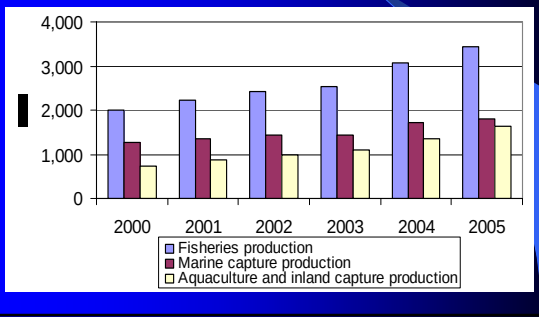
Dr. Pham Van Tho

Contents

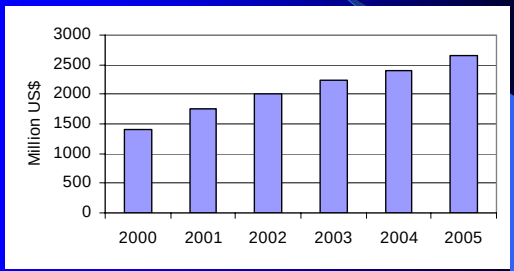
1. Overview of fishery production
2. Status of fisheries post- harvest preserving technology
3. Fish quality and safety management Programs
4. Research in fisheries post – harvest preserving and processing technology (PHPPT)
5. Development plan

Overview of fishery production

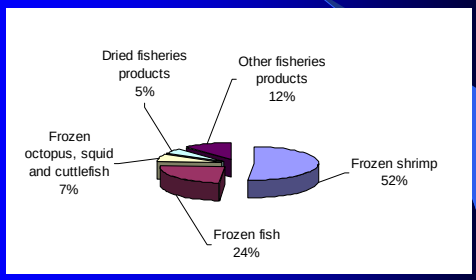
Fishery production



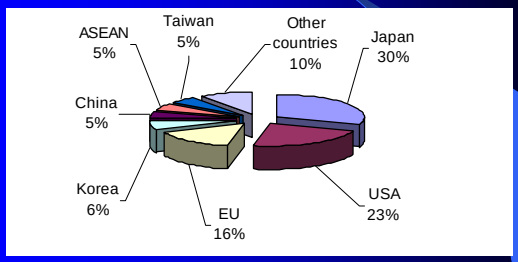
Export turnover



Main exported fisheries products



Main export markets



Status of post harvest preserving technology

- Most of fishing boats have power under 90CV, lack of preservation facilities;
- Fishing time is long duration;
- Capture product is multi-species;
- Fisheries infrastructure including fishing ports, landing sites, fish markets has not yet met the requirement of hygiene;
- Transportation of capture and aquaculture product to the processing plants is indirect, through middlemen. Preservation condition is limited and directly affects to the quality of raw material.

Fisheries preservation technology

- Icing (most popular)
- Alive maintenance
- Salting
- Drying

Fishery logistics

In 2002

- 643 storages with 78,700 MT;
- 240 ice producing establishments
- 63 fishing ports
- 10 fish markets
- 52 landing sites

Fishery processing technology

- Frozen and canned processing: about 400 plants.
- Dry processing: small scale, traditional technology, some plants applying industrial technology
- Fish sauce: household, using traditional technology.

Food quality and safety management program

- For capture product:
  - Apply standards on food safety and hygiene assurance for fishing boat, fishing port fish storage point.
- For aquaculture product:
  - Monitoring hygiene conditions of bivalve mollusc harvesting areas;
  - Monitoring harmful substance residues in aquaculture;
  - Pilot applying Good Aquaculture Practice (GAP)

Food quality and safety management program

- For fishery processing plants: Apply HACCP
  - In 2004 : 264/439 establishments applying HACCP

Research for fishery PHPPT

- Survey and assess of the fishery post harvest preservation status in capture and aquaculture;
- Processing technology for value species including tuna, tilapia, cuttlefish and Gracilaria
- Preservation technology for tiger shrimp and mollusc
- The processing enterprise self-invest for researchs for processing technology of value-added products

Development Plan

- Continue research in preservation and post harvest technology.
- Fulfill technology of preprocess and preserve for capture product, especial for high value species.
- Make guideline of fishery preservation technology for fisherman and farmer.
- Deeply invest facility, technology and human resources for Research Institutes, University and support Extension system in post harvest preservation.

Asia-Pacific
Economic Cooperation

FWG 02/2004/014

Trade issues in sustainable fisheries

Submitted by: Viet Nam

FWG 02/2004

Ha Noi, Viet Nam
15-17 February 2006

Trade issues in sustainable fisheries

Workshop on Sustainable Fisheries Development
Hanoi - Vietnam, 15-17 February 2006

Fish and fish products are among the most highly traded commodities in the world. The UN Food and Agriculture Organization (FAO) reports that nearly 133 million metric tons of fish production (capture plus aquaculture), worth an estimated $63 billion, entered world commerce in 2003, an increase of approximately 45% since 1992. Of this total, wild caught fish production represented about 90 million metric tons in 2003.

While wild caught totals have leveled off aquaculture production continues to expand and exceeded 42 million metric tons in 2003, or about 32% of overall production. In fact, it is aquaculture that is driving growth in total fish supply. As trade in wild caught fish and fish products remains more or less constant, aquaculture production and trade is expected to grow. Just as the profile of production has changed in the last two decades so has the profile of trade flows changed. Developed countries are importing more and more each year and exporting less. To meet increasing demand by consumers in these markets developing countries have expanded their exports. In 2003, developing country exports approximated 50% of total global exports for the first time.

As developing country exports continue to increase, developed countries increase their dependence on imports. Japan is the largest single importer at 18% of world totals by value but the European Union in the aggregate increased its imports to about 40% in 2003. The United States is unusual in that we are the fourth largest exporter **and** the second largest importer. The US trade balance continues to shift to further reliance on imports: In 2005, the US exported $4 billion worth of edible seafood and imported $12.2 billion, or more than three times what we exported. Shrimp imports – predominately farm raised -- have increased rapidly in recent years. In 2005 the United States imported about 90% of its domestic consumption by volume and was the world's largest importer of this increasingly popular commodity. Vietnam exported a total of $1.2 billion of seafood to the United States in 2005 of which shrimp represented almost $400 million, a total that suggests that recent anti-dumping actions have not dramatically affected Vietnamese exports of this commodity. In fact, with per capita seafood consumption increasing in the United States shrimp has eclipsed canned tuna as the most important fish product in the US diet. Perhaps not surprisingly, the expansion of global production of shrimp, the subsequent fall in the world price for shrimp and the effects of disastrous hurricanes in the Gulf of Mexico have combined to increase anxiety in US coastal fishing communities.

As many in this room are aware, developing countries increasingly depend on fish exports for foreign currency generation, as well as for employment and food security. The FAO has estimated that developing countries earned $18.3 billion in export revenues in 2003 – an amount greater than the total of all other traded food commodities.

As an important market for fish and fish products the legitimate use of trade measures by the United States can have an impact on global commerce. The United States uses a variety of trade measures for a range of purposes, some of which have a direct impact on the sustainability of fisheries resources and the communities that depend on these products. Trade measures come in many guises and, in the case of the United States, are sometimes used unilaterally and sometimes multilaterally in common with other economies in Regional Fisheries Management Organizations (RFMOs), or other inter-governmental organizations. Trade measures are considered tools in a tool kit to track trade, fight illegal, unreported or unregulated (IUU) fishing, conserve endangered species, combat non-competitive practices and label seafood to educate consumers, among many other uses.

I will mention a few of the trade measures the US Government endorses and one the US would like to see eliminated.

US Trade Laws

As I have mentioned, the United States is a very important market for seafood exports. It is therefore not surprising that the United States has used its trade laws to ensure that trade with its partners is fair. Like other World Trade Organization Members (and Vietnam will be a Member soon) the United States can use its trade laws to level the playing field when it is determined that government subsides are harming the US industry or that exports of seafood to the United States are unfairly priced. The United States and other WTO Members can also temporarily slow imports if there is a surge in imports of a particular product. These are drastic actions that are not taken lightly by the United States. I would suggest that APEC economies make a special effort to better understand the political and economic environment in export markets to accomplish sustainable trade.
I can imagine there is a difference of opinion on this matter but this category of trade measures does have a sustainable development component for the United States. In the two-part process leading up to a final determination by the US Government on whether to impose punitive tariffs on imports it must be found that imports are harming the US industry involved. In the case of a natural resource sector, such as seafood, unfair trade can and does harm US coastal communities.

Tariffs

Effective management is the key to ensuring the longevity of natural resources for fisheries. Tariffs and non-tariff barriers are not an effective substitute. In fact, trade liberalization, together with sustainable resource management, can stimulate more efficient means of production by opening markets and exposing industries to competition, thus potentially benefiting the environment in the long run.

Tariffs are taxes that countries apply at their borders. After 8 rounds of multilateral negotiations in what is now known as the World Trade Organization tariffs on fish and fish products remain too high. Especially high tariffs on processed products inhibit the development of processing capability in developing countries. The elimination or substantial reduction of tariffs on processed seafood would be an important contribution to

the economic development of developing countries with an export interest – a proportion that has been estimated to be nearly two-thirds of the WTO membership. The United States is a strong supporter of tariff elimination in the seafood sector.

Regional Fisheries Management Organizations

The United States is a member of a number of RFMOs all of which are committed to the conservation of the resources under their respective jurisdictions. In deference to time I will mention only two – the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Both of these RFMOs employ trade measures and trade tracking to meet conservation objectives. Both maintain lists of vessels suspected of having fished illegally or in contravention of RFMO conservation objectives.

ICCAT

This organization has 40 members and covers the Atlantic Ocean and adjacent seas such as the Mediterranean Sea. It is concerned with highly migratory species of tuna and swordfish, as well as by-catch issues associated with these fisheries such as sea turtles and seabirds. To accomplish its mission, ICCAT has recommended to its Members that they block imports from non-Members that were determined to be undermining the conservation goals of ICCAT. With the world's major markets as Members these recommendations are a powerful tool and have been proven effective in bringing non-Members into compliance. A groundbreaking statistical tracking system has helped ICCAT determine the true levels of trade from Atlantic waters and supported the use of trade measures in the region.

CCAMLR

The 1982 Convention established CCAMLR for the purposes of protecting and conserving the marine living resources in the waters surrounding Antarctica. Thirty-one countries have acceded to the Convention which is based upon an ecosystem approach to the conservation of marine living resources and incorporates standards designed to ensure the conservation of species such as Patagonian and Antarctic Toothfish. A major contribution of CCAMLR has been the introduction of a catch documentation scheme to track fish from the point of harvest throughout its traded life. Vessels fishing in the Convention area are required to fill in a catch document with details on place and quantity of the harvest and report that information to the flag-state. Only when a flag state confirms that the vessel was fishing legally can that fish enter a Member country market. There are plans to make this system fully electronic and internet-based.

Labeling

As consumers become more concerned about buying safe and legally caught fish of the highest quality labels have increased in number. Some, such as the US Country of Origin

labels (COOL), require only that fish and shellfish be labeled at retail to indicate country of origin and method of production. This regulation does not apply to seafood that is an ingredient in a processed food item, such as canned tuna. Other schemes are more elaborate and have been called ecolabels.

In 2005, the FAO Committee of Fisheries adopted new Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries. The United States fully supported the negotiations leading to these voluntary Guidelines and hopes that governments or private sector entities use them for certifying and promoting labels for fish and fishery products from well-managed fisheries. The Guidelines have already encouraged the Marine Stewardship Council to alter its popular labeling scheme to bring it into compliance with the FAO framework.

It is inevitable that more labeling requirements will be developed as consumers demand more information about the food they eat. Traceability requirements will also become more common both for purposes of combating illegal fishing and to ensure the conservation of threatened resources. Consumers will be inundated by well-intentioned efforts to produce wallet-sized cards listing what is right and what is wrong to buy. Major importers will put pressure on producers in developed and developing countries to provide quality, chemical free seafood. In a global market where fishermen in developed countries are losing market share pressure will be increasingly applied on their governments to protect them from what they perceive to be unfair trade. In this environment trade measures will continue to play an important role.

Concluding Remarks

A key message for this audience is that present day trends in the market place and global management regimes provide a good idea of what is to come. Rather than argue that labeling schemes or HACCP requirements are too difficult to comply with countries in the region should work with major market representatives to understand the regulations and figure out a way to keep trade flowing. There will be more not fewer requirements in the future. Fish and fisheries products from sustainably managed fisheries or from responsible aquaculture facilities will be preferred and, in some market segments, required. It is in the best interest of regional economies to promote and implement sustainable management practices both from an economic as well as from a conservation point of view.

Asia-Pacific
Economic Cooperation

FWG 02/2004/017

List of participant
Workshop on Sustainable Fisheries Development in the Region

Submitted by: Viet Nam

FWG 02/2004

Ha Noi, Viet Nam
15-17 February 2006

List of participant

The Workshop on Sustainable Fisheries Development in the Region
Hanoi - Vietnam, 15-17 February 2006

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22.	Mr. Pham Van Tho	National Aquaculture Services Company - NASCO	Vietnam Speaker
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24.	Ms. Tran Thi Mieng	Deputy Director of Planning and Accouting Department	
25.	Mr. Duong Long Tri	Deputy Director, Centre for Informatic	
26.	Mr. Do Duc Hanh	Editor , Fisheries Review	
27.	Mr. Nguyen Viet Manh	Deputy Director, International Cooperation Department	
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29.	Mr. Do Duy Con	Deputy Cabinet of MoFI	
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58.	Ms. Nguyen Thu Hue	Director, Centre for Marine Conservation and Community Development - MCD	
59.		The Voice of Vietnam	
60.		Nhandan Newspaper	
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