Asia-Pacific
Economic Cooperation

DERELICT FISHING GEAR AND RELATED MARINE DEBRIS:

AN EDUCATIONAL OUTREACH SEMINAR AMONG APEC PARTNERS

APEC Fisheries Working Group

January 2004

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By East-West Center – University of Hawaii, Manoa
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ASIA PACIFIC ECONOMIC COOPERATION • JANUARY 13-16, 2004
EAST-WEST CENTER • HONOLULU, HAWAI'I

A Way Forward

Derelict fishing gear and related debris are responsible for broad degradation of the Pacific region's economic and ecological resources. Floating derelict fishing gear is a hazard to vessel navigation and poses a threat to life and property when encountered at sea, it can continue to function as designed catching target commercial species without economic benefit but with economic cost, and derelict fishing gear also regularly entangles protected and threatened marine species and destroys habitats of these and other species.

The problem of derelict fishing gear in the Pacific is exacerbated by oceanographic surface currents which ultimately concentrate much of the debris from the greater North Pacific Ocean in ecologically sensitive regions. For the United States, this problem is particularly acute in the Main and Northwestern Hawaiian Islands, which are fragile and remote islands and atolls with endemic coral reef ecosystems and endangered and threatened marine species. A broad-based coalition of organizations has worked to document and remove 330 metric tons of debris from these islands since 1998. Hawaii is also home to commercial and recreational fishermen, shipping interests, the tourism industry and many other sectors that make their living working with the sea.

These problems are not unique to the United States, however. APEC Economies like Australia, Japan, Taiwan, Korea, and Mexico are experiencing the impacts of derelict fishing gear and related marine debris in their coastal zones, ports, and waterways, which have not only damaged sensitive areas and valuable marine resources, but have also resulted in the tragic loss of human life.

In August 2000, the International Marine Debris Conference was held in Honolulu, Hawaii, which, among other things, examined the problem of derelict fishing gear from an international perspective and made recommendations for action. The international community responded by taking note of the problem of plastic debris and derelict fishing gear and the results of the Conference in the United Nations Secretary General's Reports on Oceans and the Law of the Sea, which led directly to the problem being highlighted by the United Nations General Assembly in its resolution 55/8 of 30 October 2000. The need for international coordination and enhanced education and outreach about derelict fishing gear and related marine debris, including through FAO, IMO, regional and sub regional fisheries organizations and arrangements and other appropriate inter-governmental organizations, was identified as a priority.

Recognizing that this problem is a regional one that requires cooperation to solve, APEC approved a project proposal by the United States for an educational and outreach seminar on derelict fishing gear and related debris at its annual Fisheries Working Group in Lima, Peru in 2002. Our reason for choosing APEC as a potential venue for international discussion of this issue is the regional scale and multi-national scope of the problem and the linkages to sustainable development, business practices, and other issues that cross-cut the APEC mandate and its sub-bodies (i.e., the Marine Resource, Tourism, and Transportation Working Groups). We've also been impressed with the utility of APEC as a forum to promote dialogue between business and government interests, develop creative voluntary solutions to problems such as derelict fishing gear that can negatively impact trade, and provide capacity building for APEC economies in best practices.

The Seminar was held in January 2004 with representatives from ten Economies and five global, regional, or sub regional organizations participating, in addition to a broad range of industry leaders, fishermen, resource managers, and researchers and scientists. Through detailed panel presentations, case studies, and the ensuing discussions, derelict fishing gear and related marine debris was recognized as a critical problem in the marine environment and for living marine resources. The Seminar called upon APEC Economies to take action at the national, regional, and global levels, and to secure adequate

funding to do so. The participants in the Seminar recommended a series of specific actions or activities APEC Economies, regional fisheries management organizations, regional bodies, inter-governmental and non-governmental organizations, and individuals should pursue in order to make progress on this issue, including the need for a standing body of people from concerned Economies to dedicate time to addressing this issue.

Two other themes emerged from the Seminar. The first was that although the global problem of marine debris is not unique to any of the participants, the local and regional solutions can be and are. A variety of arrangements and organizations are available to address the problem, and cooperation should be sought from industry, fishers, non-governmental organizations, and Economy representatives. The second was that addressing this issue takes time. It is hoped that participants returned home committed to continuing to work on this issue in new and different ways. We who were involved in the development of this project hope that the reader finds the Seminar report and presentations useful in continuing to advance the international debate on this important topic. For sustainable development to truly be sustainable, all stakeholders need to recognize and respond to the interconnectivity of issues, including ones as seemingly diverse as fisheries management and derelict fishing gear.

Mr. Colin L. McIff
Project Overseer
April 2004

ASIA PACIFIC ECONOMIC COOPERATION • JANUARY 13-16, 2004
EAST-WEST CENTER • HONOLULU, HAWAI'I

Derelict Fishing Gear and Related Marine Debris: An Educational Outreach Seminar Among APEC Partners

Tuesday – January 13

8:00-9:00 AM Registration

9:00 – 9:30 AM Opening Ceremony

Welcome – Ms. Kitty Simonds, Executive Director, Western Pacific Regional Fishery Management Council

Chairman's Address – Mr. Stetson Tinkham, Lead Shepherd, APEC Fisheries Working Group

9:30 – 12:30 PM Plenary Session

9:30 – 10:00 AM "Marine Debris - An Overview of a Critical Issue for Our Oceans"
Ms. Seba Sheavly
The Ocean Conservancy

Regional Case Studies

Derelict fishing gear and related marine debris is a costly and destructive problem facing many APEC economies. This session will focus on the experiences of four economies in the APEC region to address the derelict fishing gear and related marine debris problem. The case studies will cover issues such as damage caused by derelict fishing gear and related marine debris, research efforts to prevent or alleviate accumulation, and pertinent national policies or programs, including public and private activities.

10:00 - 10:30 AM Case Study – Hawaiian Islands

Mr. Gregory Schorr
NOAA Fisheries – Coral Reef Ecosystem Investigation
U.S. Department of Commerce

Dr. Mary Donohue
University of Hawaii Sea Grant College Program
School of Ocean and Earth Science and Technology

10:30 – 11:00 AM Morning Tea

11:00 – 11:30 AM Case Study – Korea

Dr. Dong-Oh Cho
Director of Marine Environment & Safety Division
Korea Maritime Institute

11:30 – 12:00 PM Case Study – Australia

Dr. Ilse Kiessling
Oceans Liaison Officer
National Oceans Office

12:00 – 12:30 PM Case Study – Chinese Taipei

Dr. Don-Chung Liu
Chief Secretary
Fisheries Research Institute, Council of Agriculture

12:30 – 2:00 PM Lunch

2:00 – 2:30 PM Case Study – Japan

Mr. Toshihiro Watanabe
Fishing Methods Section,
National Research Institute of Fisheries Engineering
Government of Japan

2:30-4:00 PM Panel 1 – Science and Policy

The Pacific Ocean is characterized by unique circulation and flow patterns that can exacerbate the problem of derelict fishing gear and other marine debris. This panel will focus on defining the oceanographic conditions and physical environment of the Pacific Ocean and include an overview of ongoing research efforts in the region. The Panel will also discuss where and to what extent the physical environment is a factor in damage caused by derelict fishing gear and related marine debris in the APEC region.

Moderator: Dr. Tatsuro Matsuoka

Panelists:

1. Dr. Murray Gregory
   University of Auckland
   New Zealand

2. Mr. Jeff June
   NW Straits Survey
   Natural Resources Consultants, Inc.
   Seattle, WA

3. Dr. Tatsuro Matsuoka
   Faculty of Fisheries
   Kagoshima University
   Japan

4. Dr. Mary Donohue
   University of Hawaii Sea Grant

5. Dr. Anthony L. Andrady
   Research Triangle Institute
   North Carolina

4:00 – 4:15 PM Afternoon tea

4:15 – 6:00 PM Panel 1 continued

6:30 PM Opening Reception
East-West Center
Garden Level
Aloha casual dress

<u>Wednesday, January 14</u>

9:00 – 10:30 AM Panel 2 – Fishing Gear and Practices

Fishing nets and gear are susceptible to loss at sea during storms, normal fishing operations and entanglement due to their size and unwieldy nature. This panel will explore the types of derelict gear and related debris most often encountered, identify practices employed by fishermen to retain their gear and discuss new technologies that may increase gear retention.

Moderator:
Dr. Don-Chung Liu

Panelists:

1. Mr. Brent Paine
   Executive Director
   United Catchers Boats
   Seattle, WA

2. Mr. Philip MacMullen
Marine Technology Manager
Seafish Authority
United Kingdom

3. Mr. Jim Cook
Pacific Ocean Producers
Honolulu, Hawaii

4. Mr. Ernesto Altamirano
Associate Scientist
Inter-American Tropical Tuna Commission (IATTC)

5. Mr. Kiyokazu Inoue
Deputy Director
Ecosystem Conservation Office Resources and Environment
Research Division
Fisheries Agency, Government of Japan

10:30 – 11:00 AM Morning tea

11:00 – 12:30 PM Panel 2 continued

12:30 – 1:30 PM Lunch

1:30-2:00 PM Photo

2:00 – 4:00 PM Panel 3 – Recovery, Ports and Disposal

Once fishing nets and gear have deteriorated or been too damaged to be repaired, disposing of them properly can be a challenge due to cost and a lack of readily available facilities. This Panel will discuss the challenges economies face to promote proper and safe disposal of fishing nets and gear and what technologies may be available to help alleviate the costs associated with disposal. The Panel will also examine disposal problems unique to islands and developing economies. It will explore possible ways to overcome the challenges associated with disposal, including technological solutions, with particular reference to island and developing economies.

Moderator: Mr. Howard Wiig

Panelists:

1. Mr. Howard Wiig
Institutional Energy Analyst
Department of Business, Economic Development and Tourism
State of Hawaii

2. Mr. Sefania Nawadra
   Marine Pollution Advisor
   PACPOL Program
   South Pacific Regional Environment Program (SPREP)
   Samoa

3. Ms. Fran Recht
   Pacific States Marine Fisheries Commission
   Depoe Bay, Oregon

4. Mr. Joe Schmitt
   Chair, Clallam County
   Marine Resources Committee
   Joyce, WA 98343

5. Mr. James Banigan
   President
   Hawaii Metals Recycling Inc
   Honolulu, HI

6. Video of GENSCO Inc. cutting machine:
   Mr. Eric Kingma (Western Pacific Regional Fishery Management Council)
   Ms. Seba Sheavly (The Ocean Conservancy)

4:00 – 4:15 PM Afternoon tea

4:15 – 5:30 PM Panel 3 continued

Thursday, January 15

9:00 – 10:30 AM Panel 4 – Domestic and International Regulatory Structures

A variety of national regulatory and infrastructure mechanisms pertinent to gear loss**,** disposal**,** and removal of derelict gear are in place. There may also be international legal and policy frameworks, as well as institutional mechanisms that may provide opportunities to address such issues. This Panel will discuss national measures taken and the possibilities for addressing derelict fishing gear and related marine debris nationally, regionally and internationally.

Moderator: Ms. Holly Koehler

Panelists:

1. Ms. Lindy Johnson
   NOAA General Counsel
   Washington, DC

2. Mr. Eric Appleyard
Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
Australia

3. Mr. Sefania Nawadra (on behalf of IMO)
Marine Pollution Advisor
PACPOL Program
South Pacific Regional Environment Program (SPREP)
Samoa

4. LCDR Chris Curatilo
United States Coast Guard, District 14
Honolulu, Hawaii

6. Mr. Ed Araki
Honolulu Agency, Inc.
Honolulu, Hawaii

7. Mr. Rick Steiner
Marine Advisory Program
University of Alaska
Anchorage, Alaska

10:30 – 11:00 AM	Morning tea
11:00 – 12:30 PM	Panel 4 continued
12:30 – 2:00 PM	Lunch
2:00 – 5:45 PM	Plenary Session resumes Chairman: Mr. Stetson Tinkham
	Summary of panel discussions and seminar report and recommendations
5:45– 6:00 PM	Capstone speaker
	Ms. Holly Koehler Office of Marine Conservation U.S. Department of State
6:00 PM	Traditional Closing Ceremony

Friday, January 16 – Excursion

Technical Tour: Hawaii Metals Recycling (HMR) and City and County of Honolulu's H-Power

Participants will be able to tour the HMR operation with a guide and observe from a safe distance the processing of debris in a large whirling chamber. In addition, participants will have the opportunity to inspect the blades and watch the heavy equipment operator pull nets out of a large bin and chop them up into small pieces. The operation is awesome and the time it takes for the chopping operation depends on the net resistance. The chopped nets are then loaded into a bin for transport to Hawaii-Power. Participants will then tour the H-Power facility.

The tour will depart from the Ala Moana Hotel at approximately 8:30 am and will return in the afternoon at approximately 1 pm.

Cameras welcome. Lunch on own.

6:00 – 9:00pm	Closing Luau Dinner Waikiki Aquarium 2777 Kalakaua Ave. Honolulu, Hawaii Aloha casual attire

Opening Remarks by Kitty M. Simonds

Executive Director
Western Pacific Regional Fishery Management Council
January 13, 2004

Aloha and good morning! It's encouraging to see so many of you here at this seminar on derelict fishing gear and related marine debris.

Marine debris continues to be a world problem, a challenge that will continue to require international cooperation and multilateral agreements. We commend the APEC Fisheries Working Group for convening this seminar.

A colleague of ours once said that Hawaii is the cradle of the marine debris movement. We're glad to share that distinction with those of you who have worked with us in recognizing the serious nature of this problem, and thank those who have shared in our efforts to find solutions.

Hawaii has hosted several gatherings on marine debris, including the International Marine Debris Conferences held here in 1984, 1989, and 2000, in addition to the Pacific Rim Fishermen's Conference on Marine Debris in 1987.

Our unique location in the North Pacific leaves us vulnerable to marine debris carried by ocean currents from points north of the islands. Debris originating from thousands of miles north tangle in fishing gear, snag on coral reefs, clutter inshore areas, and wash up on Hawaii's beaches and endanger its wildlife. Marine debris is a serious threat to Hawaii's tourism economy, which depends on maintaining the health and beauty of its natural resources.

From a fisheries management perspective, derelict fishing gear hurts us. Fisheries resources are reduced when ghost nets trap fish, and old nets and line can foul vessel propellers and fishing gear. Derelict fishing gear also impedes population recovery of protected species, such as sea turtles and monk seals.

This past year, NOAA Fisheries removed 122 tons of marine debris from the Northwestern Hawaiian Islands. Most was derelict fishing gear. The Ocean Conservancy, with

the help of federal agency partners including the EPA, NOAA, NPS, and the USCG, continued its National Marine Debris Monitoring Program assessing and cataloguing marine debris washing ashore on U.S. beaches. Elsewhere, World Wildlife Fund-Australia recently produced a net identification kit. This provides interested groups or individuals with means to identify types of derelict nets found in Australia's inshore areas. Other initiatives and programs are focussing attention on the marine debris challenge, and we hope this seminar will allow you to share the news of these efforts from your respective areas.

The International Marine Debris Conference held here in the year 2000 addressed derelict fishing gear issues. A compact disc of the proceedings and recommendations of that conference is included in your seminar materials.

In the more than three years since that conference, we have seen incremental progress in reducing the amount of fishing gear lost or discarded in our oceans. Most of the work has dealt with cleaning up the results of the problem. The real challenge is tackling the source and minimizing the amount of derelict gear lost or abandoned at sea. This will require an effort in international teamwork, a spirit we hope is reflected at this week's seminar.

Marine debris is a problem for all of us who are touched by oceans and care about their resources and their future. We welcome you this seminar and to our beautiful islands. Best of luck in your deliberations. Mahalo!

APEC Marine Debris Seminar
January 13-15, 2004, Honolulu, Hawai'i

Seba B. Sheavly
Director, Office of Pollution Prevention & Monitoring
The Ocean Conservancy
ssheavly@oceanconservancyva.org

"Marine Debris — an Overview of a Critical Issue for Our Oceans"

What is Marine Debris?
Scientists generally define marine debris as any manufactured or processed solid waste material (typically inert) that enters the marine environment from any source (Coe & Rogers, 1997). Debris is more than an unsightly inconvenience for beach-bound vacationers or pleasure boaters; it's one of the world's most pervasive pollution problems affecting our oceans and inland waterways. It affects the economies and inhabitants of coastal and waterside communities worldwide. By the simple process of moving from ship to sea, storm sewer to surf, or hand to sand, any manufactured material can become marine debris. Cigarette filters and cigar tips, fishing line, rope and gear, baby diapers and nappies, six-pack rings, beverage bottles and cans, disposable syringes, tires – the litany of litter is as varied as the products available in the global marketplace, but it all shares a common origin. At a critical decision point, someone, somewhere, mishandled it – either thoughtlessly or deliberately.

Ocean dumping is not a new phenomenon. It has been a practice for centuries. While our habits haven't necessarily changed, the nature of marine debris has – dramatically. Over the past 30 to 40 years, organic materials (once the most common forms of debris) have yielded to synthetic elements, like plastics, as the primary material in solid waste. Durable and slow to degrade, items like beverage bottles, packing straps, tarps, and synthetic fishing line create a debris source with staying power. In addition, many of these items are highly buoyant, allowing them to travel in currents for thousands of miles, endangering marine ecosystems and wildlife along the way.

According to the United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), land-based sources account for up to 80 percent of the world's marine pollution (GESAMP, 1991). Much of the debris reaches the ocean by beach-going activities, being blown into the water, or is carried by creeks, rivers, and storm drains/sewers to ocean areas. Other debris comes from activities on the water, including vessels (from small sailboats to large ships), offshore drilling rigs and platforms, and fishing piers.

While there are laws regulating the dumping of trash at sea and on shore, the global nature of debris, its inability to be confined within territorial boundaries, and the complexity of identifying debris sources have made effective laws difficult to draft and even harder to enforce.

What are the Sources of Marine Debris?
Determining where all of the debris originates is no easy task since trash and litter can travel long distances before being deposited on our shorelines or submerging to the bottom of the ocean, bay or riverbed. Marine debris researchers traditionally classify debris source as either *land-* or *ocean/waterway-based*, depending on where it enters the water. Other factors such as ocean current patterns, climate and tides, and proximity to urban centers, industrial and recreational areas, shipping lanes, and commercial fishing grounds influence the type and amount of debris that is found in open ocean areas or collected along beaches and waterways – including underwater areas.

Land-based debris blows, washes, or is discharged into the water from land areas. Sources include

recreational beach-goers and fishers; materials manufacturers, processors and transporters; shore-based solid waste disposal and processing facilities; sewage treatment and combined sewer overflows; inappropriate or illegal dumping; and public littering. How these materials are transported is characterized with the following:

- *Sewer overflows & sewage treatment plants* – public wastewater treatment facilities are prohibited from discharging plastics into the marine environment. Under normal "dry weather" conditions, most wastes are screened out of sewage. Materials can bypass treatment systems and enter waterways during times when runoff from seasonal precipitation exceeds the handling capacity of the sewage treatment facility. Typical debris from these discharges includes tampon applicators, condoms, and syringes.

- *Shore-based Solid Waste Management Practices* – both legal and illegal waste handling practices contribute to the presence of marine debris. The inadvertent release of debris from coastal landfills and garbage from water transports; recreational beach and roadside litter; and the illegal dumping of domestic and industrial garbage into coastal and marine waters are practices contributing to the marine debris problem.

- *Indiscriminate Litter* – every piece of litter has a person's face behind it. How people handle the packaging from convenience items, food wrappings, beverage containers, and a host of other materials, constitutes the foundation for one of the most pervasive pollution problems plaguing the world's oceans and waterways.

People also generate marine debris at sea. ***Ocean/waterway-based*** identified contributors are commercial fishing vessels; merchant, military, and research vessels; recreational boats and cruise ships; and offshore petroleum platforms and associated supply vessels. Debris can end up in the water due to accidental loss or system failure; historical waste management practices; or illegal disposal and indiscriminant littering. How these materials are transported is characterized with the following:

- *Commercial Fishing* – commercial fishing activities introduce marine debris into the ocean and waterways through intentional disposal by discarding ship-generated trash overboard and by not retrieving excess gear; and through unintentional loss when gear wears out and is lost while deployed or the equipment operator makes a mistake and the gear breaks loose. Commercial fishing is associated with debris items such as nets and ropes, salt treatment bags, bait boxes and bags, fish baskets or totes, fish and lobster tags, and gill-net or trawl floats.

- *Recreational Boaters* – some boaters discard trash overboard containing food wrappers, beverage containers, various bags and monofilament fishing line and other related fishing gear.

- *Merchant, Military, and Research Vessels* – large vessels with extensive crew typically carry supplies for several months resulting in the daily production of solid wastes related to galley and operational activities and materials used to cover containers and supplies and unsecured materials on deck can get loose and be blown overboard into the water. The maritime and waste management industries have conducted research to develop ways to handle and store wastes aboard ships for long voyages between port calls.

- *Offshore Petroleum Platforms and Supply Vessels* – maritime activities related to undersea exploration and resource extraction contribute to the marine debris problem. Similar to galley- and operational-type wastes associated with large vessels, activities on an oil/gas platform can result in the improper handling of trash generated from daily operations such as hard hats, sheeting, computer supplies, survey materials, as well as typical human-related trash produced by platform and supply vessel crews.

What are the Impacts of Marine Debris?

Aesthetically, marine debris looks terrible and can have a major effect on the tourist industry in coastal communities. Marine debris can pose human health and safety concerns. Serious injury can occur by stepping on a sharp piece of glass or metal, or worse yet, a discarded syringe. More importantly, thousands of marine animals die each year from becoming entangled in debris or from consuming it, thinking that it is food. When marine debris gets caught in propellers, motors, and other machinery of commercial and recreational boats and ships, consumers pay more for products and services at the marketplace. Many debris items such as syringes, condoms, and tampon applicators are visual indicators of more serious water quality issues of sewage contamination.

- *Human Health and Safety*

Items such as broken glass, medical waste, rope, and fishing line pose immediate risks to human safety. Discarded syringes, condoms, and tampon applicators can indicate more serious water quality concerns that affect human health. Swimmers, divers and snorkelers can become entangled in submerged or floating debris. Medical and personal hygiene debris often enters the waste stream through direct sewage outflows or inadequate sewage treatment systems. These items can indicate the presence of invisible pathogenic pollutants such as streptococci, fecal coliform, and other bacterial contamination. Consumption or contact with water polluted with these pathogens could result in infectious hepatitis, diarrhea, bacillary dysentery, skin rashes, and even typhoid and cholera.

- *Aesthetic and Economic Impacts*

Litter makes shorelines unattractive and hazardous, and can inhibit tourism. Marine debris is not only ugly and dangerous; it can also deplete a coastal community's finances, with increased beach maintenance costs. The indirect costs, though, are perhaps even greater. Its presence discourages people from partaking in coastal activities, such as recreational fishing, boating, swimming, or beach going. It even repels tourists from visiting coastal areas. Most coastal communities rely on seaside businesses, and the clientele that support them, for their economic survival. Clean and safe beaches promote tourism and economic health. Dirty, hazardous beaches do just the opposite.

- *Wildlife Entanglement and Ingestion*

Many forms of marine debris – including derelict fishing gear – pose numerous threats to wildlife. Debris that entangles a living creature can hamper its mobility, prevent it from eating, or suffocate it. Some types of debris can inflict lethal cuts and wounds. Monofilament line, fishing nets and ropes, six-pack rings, and packing strapping bands are some of the more harmful culprits related to entanglements. Birds, for example, often become entangled in trash they have selected for nesting. According to the U.S. Marine Mammal Commission, 136 marine species have been reported in entanglement incidents, including six species of sea turtles, 51 species of seabirds, and 32 species of marine mammals (Marine Mammal Commission, 1996). Debris that has wrapped around limbs, and fins can cause circulation loss and amputation, especially as the animal grows. Animals slowed down by trailing debris are more vulnerable to predators. Heavy, large plastic sheets and other large debris smother or trap benthic-dwelling animals and drown those that must rise to the surface to breathe.

Ingested, debris can lead to strangulation or digestive problems. The Marine Mammal Commission also reports that ingestion incidents have been documented in six of seven species of sea turtles, 111 out of the world's 312 species of seabirds and 26 species of marine mammals. Sea turtles confuse floating trash and food bags with jellyfish, one of their favorite treats. Seabirds, too, are vulnerable to the unintentional ingestion of debris because of their indiscriminant eating habits. Many animals cannot regurgitate an item once it has been swallowed, and it often becomes lodged in their throats and digestive tracts. Debris that will not pass out of the stomach gives a false sense of cessation, causing some animals to stop eating, and slowly starve to death.

Derelict Gear and Animal Entanglement

Derelict fishing gear also plays another role in animal entanglement in the phenomenon known as ghostfishing. Various forms of derelict gear and nets can unfortunately continue to perform their original function in the water, even if fishermen are no longer handling them. Once these materials are out of the control of the fishermen, they can inflict serious damage to unsuspecting fish, turtles, marine mammals, and sea birds as they float freely within the water column, are carried by the currents, or get caught up on coral reefs.

Though there is increasing recognition of the problem of "ghost fishing" few studies have been conducted since 1994 (Laist and Liffmann, 2000). The biological impacts of marine debris on coral reefs may be considerable resulting in long-term impacts to the biota and unknown degrees of recovery (Chiappone, White and Miller, *In Press*). Limited evidence from studies conducted in Atlantic areas suggests that discarded gear may be responsible for significant losses of some commercially valuable fish and crab species (Laist, 1997). Ghost nets are perpetual "killing machines" that never stop fishing (Esteban, 2002). Worldwide, this phenomenon is having an impact on the sustainability of already stressed fisheries. Lost fishing gear costs money to replace and can take a hefty toll on the marine environment and its inhabitants.

- *Habitat Destruction & Alien Species Introduction*

Debris affects the water quality of aquatic habitats and causes physical damage such as covering coral reefs and smothering sea grass beds. Derelict fishing gear in the form of nylon ropes, nets, and fishing line once entangled in coral reefs and other benthic communities can cause significant damage, with effects that can last for many years. Ropes and nets, twisting and moving by currents and tides, abrade, scour, break and destroy living corals once entangled in the benthic habitat. Ensnared debris may also cause increased siltation and turbidity blocking essential sunlight or smothering sea grasses.

Additionally, marine debris floating for great distances may be a transportation source for invasive species. Marine debris drifting on ocean currents eventually become home to entire communities of encrusting and attached organisms. Drifting debris become living rafts capable of carrying potentially harmful, non-native specials of animals and plants to the far corners of the ocean.

- *Vessel Damage*

Derelict fishing gear in the form of nets and ropes, invisibly floating just below the water's surface, can cause significant risks to vessel operations. Nets, ropes and other derelict gear have been documented to entangle vessel propellers and rudders resulting in costly repairs, significant loss of operational time, and endangering boater and crew safety. One of the most common causes of burned-out water pumps in recreational boats is the result of plastic bags clogging and blocking water intakes. A burned-out water pump in a recreational boat results in costly engine repairs and disablement of the vessel if the problem occurs at sea. The true scope and frequency of damaging encounters between debris and commercial/ recreational vessels is difficult to calculate as most incidents go unreported.

Can Marine Debris be Prevented, Reduced, and Controlled?

Marine debris is one of the most pervasive and *solvable* pollution problem plaguing the world's oceans and waterways. Successful management of a pollution problem requires that there is a comprehensive understanding of the nature of the pollution form. Strategies for identifying the types, sources, amounts, interactions, and key user-groups form the foundation of a pollution prevention initiative. Strategies for assessment (local and regional monitoring efforts and networks) and public education and outreach programs must be developed. Relevant laws and policies for pollution control, as well as government and private regulation and enforcement strategies are required. The management of marine debris requires additional considerations related to geographic and ecological indices including wind and current patterns

and special habitats (e.g. sea grass beds and coral reef systems) in coastal areas; population densities, cultural and social issues, access to and interactions with various government, business and industry constituents, and solid waste management entities.

- *Monitoring and Education/Outreach Programs*

On December 31, 1987, the United States ratified Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). Annex V prohibits the at-sea disposal of plastic wastes and regulates the distance from shore that ships may dump all other solid waste materials. Annex V became effective on December 31, 1988. The Marine Plastic Pollution Research and Control Act (MPPRCA) of 1987 (Public Law 100-220, Title II) is the U.S. implementing the legislation for Annex V and extends the dumping regulations to vessels in all navigable waterways of the United States.

Recognizing the need for public education and involvement in solving the marine debris problem, Section 2204 of the MPPRCA, requires the Administrator of the U.S. Environmental Protection Agency (EPA), the Administrator of the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Coast Guard to conduct a public education program in the marine environment. Section 2204 also directs the Administrator of the EPA, along with the Secretary of Commerce, and the U.S. Coast Guard to conduct a program to encourage the formation of volunteer groups to assist in the monitoring, reporting, cleanup, and prevention of ocean and shoreline pollution. These policies form the base of the primary marine debris programs being conducted by The Ocean Conservancy domestically and globally.

The Ocean Conservancy has evolved into an authority on marine debris following its initial efforts in the early 1980's in the tracking of incidental takes of marine mammals, sea turtles, and birds in fishing gear and a 1985 study of plastic marine garbage. The resulting report, *Plastics in the Ocean: More Than a Litter Problem*, was the first to identify plastics as a significant marine debris hazard. Congress has enacted laws to limit the dumping of garbage from boats and to help control land-based sources of marine debris, such as stormwater systems and combined sewer systems. Citizens have also made great efforts in fighting this problem through beach cleanups and debris monitoring activities across the country and all over the world.

<u>International Coastal Cleanup (Global)</u>

Since its first beach cleanup in 1986 in Texas, The Ocean Conservancy and its international and domestic partners have grown the International Coastal Cleanup (ICC) into a global effort devoted to the marine environment. The first campaign brought out 2,800 volunteers who filled 7,900 trash bags with 124 tons of debris from 122 miles of Texas shoreline. Cumulatively, since the ICC began, it has included all 55 U.S. states and territories and 127 countries bordering every major body of water on the planet. In developing and developed nations; in frigid, temperate, and tropical climes; and in time zones that span the globe, six million people have collected more than 103 million pounds of debris from over 114,000 miles of shoreline!

One of the primary goals of the International Coastal Cleanup is to trace pollution to its source and work to prevent it from occurring. To this end, volunteers record debris information using a standardized data card first developed in 1986 by The Ocean Conservancy. Data compiled from annual beach cleanups have been used to identify the types, sources and activities that produce the debris found worldwide along beaches and waterways. The Ocean Conservancy revised and updated the cleanup data card in 2000 to reflect a revised approach for accessing marine debris.

The ICC data card now includes 42-specific debris items and groupings targeting the dominant debris-producing activities and sources. Information is grouped by the behavior associated to its debris presence, be it recreational, beach-going activities, smoking-related activities, ocean and waterway activities, activities associated with legal or illegal dumping, or activities resulting from improper disposal or handling of medical or personal hygiene materials. The new data cards allow for the recording of

specific debris items that are indicative of the activities and sources producing the debris. The result is a unique continuing global database of information collected at every cleanup around the world. Data from the cleanup provides the framework for action at all levels of government to limit marine debris and to educate the public about litter and pollution prevention. Information on the ICC, including data and contacts for local cleanup activities are posted on a special website www.coastalcleanup.org managed by The Ocean Conservancy.

National Marine Debris Monitoring Program (U.S.)

The Ocean Conservancy, through a multi-year cooperative agreement with the U.S. Environmental Protection Agency, developed and field-tested a scientific, marine debris monitoring program for the United States with the objective of assessing the effectiveness of current marine debris legislation as mandated by the Marine Plastic Pollution Research and Control Act (MPPRCA) of 1987 (Public Law 100-220, Title II, section 2204). The development of the research protocol was based initially on data from the International Coastal Cleanup and other marine debris research conducted to assess the accumulation rates, types and amounts of debris dependent on their geographical location, oceanographic and meteorological conditions, and proximity to land-based or ocean-based sources. As a result, nine regional designations were developed for the monitoring program based on prevailing current patterns, marine debris information, and logistics.

The National Marine Debris Monitoring Program (NMDMP) has been successfully developed and field-tested utilizing a national network of 700 trained volunteers, monitoring 130 sites in 21 coastal U.S. states and two territories (Puerto Rico and U.S. Virgin Islands). The results of this five-year study will provide the required data needed to scientifically assess the status of marine debris trends and sources in the United States. Data collected through the National Marine Debris Monitoring Program is posted with an interactive, ArcView GIS-compatible database for public access through The Ocean Conservancy's website (www.oceanconservancy.org/nmdmp).

- *Engage Relevant Stakeholders*

To effectively manage the reduction and control of marine debris and its impacts on the environment, key stakeholders must be engaged. This list of potential "players" is long and wide as it encompasses a true cross section of society – public and private. A sample listing would include: local citizens; governments, agencies and authorities (national, regional, and municipal); organizations (international/ national, civic, religious, nongovernmental, and consumer); institutions (research, education, and medical); businesses (hotels and restaurants, outdoor recreation, manufacturers, and vendors); and industries (fisheries, tourism, waste management, and dive) form a significant part of the coalition needed to tackle the marine debris issue.

There are key audiences related to commercial fishing and derelict gear issues. The core of this group consists of fishers ranging from single, subsistence individuals who may or may not own their own boats to crews on large trawlers. Business and industry associated with equipment and boat manufacturing and marketing are part of this audience as they are responsible for the production and sales of the materials used by fishers. Individuals who are part of the fish processing industry including marketing are also part of this group. And last, but not least, are the governmental regulatory and resource management entities, which are needed to complete the overall framework of this issue.

- *Implement Legislation and Enforce Regulations*

Laws exist on land and at sea related to litter and debris, as well as other pollution forms. The problems exist and continue due to human-influenced activities that result in pollution being introduced into the environment. Additional regulations may indeed help to reduce the problem, if these rules are abided by – this is often not the case. Environmental stewardship as well as penalties and enforcement are all essential to any pollution prevention effort. The current laws relevant to the marine debris issue are:

1972 London Dumping Convention (LCD)

The Convention of the Prevention of Marine Pollution by Dumping of Wastes and other Matter, also known as the London Dumping Convention (LCD), entered into effect in 1975 and is administered under the United Nations by the International Maritime Organization (IMO). This treaty established permitting requirements for the disposal of wastes into the sea and functions as the global instrument to control marine pollution from dumping dredge spoils, sewage sludge and other types of land-based wastes. Under international law, waste materials carried out to sea for disposal are distinguished from those generated during ship operations.

MARPOL 73/78

The IMO also manages the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which provides a comprehensive approach to dealing with ocean dumping by creating international guidelines to prevent ship pollution. MARPOL has six annexes, covering oil discharge (I), hazardous liquid control (II), hazardous material transport (III), sewage discharge (IV), plastic and garbage disposal (V), and air pollution (VI).

Annex V is of particular importance to the maritime community (shippers, oil platforms, fishers, boaters, and cruise lines), because it prohibits disposal of plastic at sea and regulates disposal of other garbage at sea. Under Annex V, garbage includes food and domestic and operational waste – excluding fresh fish – generated during normal vessel operations and liable to the disposed of continuously or periodically. Annex V also requires ports and terminals to provide garbage reception facilities for boats/ships. Ships of signatory nations must abide by Annex V regulations at all times, in all waters; ships from non-signatory nations must abide by Annex V while in a signatory's waters. To cite a vessel for illegally discharging garbage or plastics into the sea, an individual must see the event and report, or provide sound evidence, that such a discharge occurred. As a result, many pollution violations go unreported or are never fully pursued due to lack of evidence. As of October 31, 2003, 118 countries have ratified Annex V. MARPOL has hopefully helped to reduce the amount of trash on the beaches and oceans of the world.

MARPOL "Special Area" Designations

MARPOL has designated "Special Areas" as locations where, due to the site's unique oceanographic, ecological, all overboard discharges of garbage (except ground-up food wastes) are prohibited. Food wastes may not be discharged within 12 nautical miles of the nearest land in Special Areas. To date, MARPOL has designated nine Special Areas – Mediterranean Sea; Baltic Sea; Black Sea; Red Sea; Persian Gulf; Gulf of Aden; North Sea; Antarctic area; and the Wider Caribbean (including the Gulf of Mexico). However, for the designation to take effect, an "Area" needs to prove it has adequate waste reception facilities at ports to handle the increased volume of trash from ships now prohibited from dumping in the area. So despite their status, many "Special Areas" are not yet treated as such.

Cartagena Convention

The 1987 Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region – known as the Cartagena Convention – is the only legally binding environmental treaty for governing marine debris in the Wider Caribbean. The Convention and its Protocols constitute a legal commitment by participating governments to protect, develop, and manage their common waters individually or jointly. It requires adopting measures to prevent, reduce, and control pollution from ships, dumping, seabed activities, land-based activities, and airborne pollution. Ratified by 20 countries, the Convention governs the marine environments of the Gulf of Mexico, the Caribbean Sea, and certain areas of the Atlantic Ocean.

- *Business/Industry Involvement*

A review of the available data and other information on the debris found worldwide indicates that the

dominate types and sources of debris are related to the indiscriminate littering of convenience food and beverage packaging (cans, bottles, food wrappers, plates and eating utensils), and the remnants of smoking activities (cigarette filters, cigar tips, product packaging, and disposable lighters). Another significant source of debris has also been identified with the presence derelict gear – nets, rope, fishing line, floats, buoys, and various traps. Much of the debris found worldwide is attributable to what we consume related to food, beverages, smoke, and what we use in transporting ourselves over the sea and what materials we harvest from the sea. Businesses and industries affiliated with the aforementioned products and services have a critical role in debris management and abatement. Without their involvement and support in this issue, the long-term prognosis will be bleak (The Ocean Conservancy, 2002).

So why is marine debris still an issue?

The reason why marine debris is still an issue is because we continue doing the things that produce marine debris. Even though we know where debris comes from and how it gets into the environment, we continue to facilitate its reoccurrence. There are alternatives to some of the materials and products that have been developed that are less invasive to the environment, but not all have been successfully integrated them into the economic mainstream. There are laws and regulations that have been implemented, but frequently enforcement and compliance are inadequate. We do need to further develop strategies and opportunities for adopting behaviors and activities that will help to reduce marine debris from identified sources. Ongoing efforts to abate this problem through governments and the public and private sectors must continue, targeting those behaviors and activities that have been shown to result in the deposition of debris into the environment. Reducing and controlling the presence of marine debris is a significant, but doable challenge that must be accomplished if we are to conserve ocean resources.

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Derelict fishing gear and related debris: a Hawaii case study

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Abstract

As a result of oceanic circulation patterns, the Hawaiian Archipelago is the repository for significant amounts of exogenous marine pollution, including derelict fishing gear from North Pacific Ocean fisheries. Derelict fishing gear is threatening Hawaiian coral reef ecosystems by abrading and scouring living coral polyps and altering reef structure through large-scale destruction of the reefs' coral skeleton foundation. Derelict fishing gear also entangles marine mammals, turtles, sharks, other fishes, lobsters, and crabs. Entanglement in derelict fishing gear is hampering the United States federal government's efforts to recover the endangered and protected species such as the Hawaiian monk seal. Management responsibility for these islands, and associated natural resources, consists of a complex amalgam of government authorities. Non-government organizations (NGOs) and private industry also have regional interests.

The Hawaiian Archipelago's marine debris problem's magnitude prevented effective mitigation by any single organization or agency. In addition, the scope of debris impacts overlapped management boundaries. In response to these circumstances, a multi-agency marine debris working group was established in 1997 that partnered stakeholders to improve Hawaiian Islands' marine debris mitigation. To date, 16 federal, state, local, industry, and NGO partners have removed over 286 metric tons of derelict fishing gear and other debris from the Northwestern Hawaiian Islands. This effort, led by the National Marine Fisheries Service, also conducts scientific studies on debris accumulation and sources. In addition, working group partners have removed derelict fishing gear from Main Hawaiian Island beaches as well as conducted activities as part of the Ocean Conservancy's International Coastal Cleanup. This review details the evolution of this partnership, notes the challenges and rewards of such arrangements, and advocates for the use of this paradigm for more effective resource management.

Marine Debris Management
: Case of Korea

Dong-Oh Cho

KMI 한국해양수산개발원
KOREA MARITIME INSTITUTE

Contents

I. Case Study : Damage Caused by Marine Debris

❑ Accident of Passenger Ship M/V Seo-Hae Ferry

➢ Vessel Particular

110G/T, Eng : 500HP, Age : 4 years,

Max. onboard persons ; 221(passenger : 207, crew : 14)

➢ Accident details

- 10/10/1993, just off West coast of Korea, 362 onboard (passenger 141 overload)
- wind 5.5m/sec, wave 2m, current 0.46knots
- Capsized and sunken
- 292 death toll, 70 saved

❑ Accident of Passenger Ship M/V Seo-Hae Ferry

➢ Cause of the accident

- News reports before refloatation : overload
- MAIA report after refloatation : overload & derelict fishing ropes
- Nylon rope(10㎜ diameter) coiled both shafts and right side propeller, vessel suddenly turned right side and capsized

❑ Maritime Accident Caused by Marine Debris

➢ Marine accidents (Jung. 1999)

	eng.trouble	disaster	opearation delay	propeller damage	sub total	total accident	ratio(%)
1996	7	1	41	18	67	661	10.1
1997	6	12	33	18	69	840	8.2
1998	2	9	37	20	68	772	8.8
total	15	22	111	56	204	2,273	9.0

➢ Loss of fishery production (Questionnaire & interview by KRISO, 1999)

- Loss of the production : 10~30%

(fishes : 10~20%)

(shellfish & seaweed : 20~30%)

- **Ghost Fishing**
  - **Where : Ool-Jin, East Coast**

    Depth : 350m
  - **Problems : Derelict fishing gears make another derelict fishing gear**
  - **Pic. 1, 2, 3, 4, : 10/8/2003, Ooljin**




II. Marine Debris Management Policy at a Local Level
- Case of Incheon City -

- **Marine Debris Statistics Surveyed**
  - **Period : 4/23/2001-12/26/2001**
  - **Geographical Scope : Incheon Coastal Area, 500,000ha**
  - **Purpose**
    - **How much from River Han?**
    - **How much budget needed to collect deposited marine debris?**
  - **Deposited Marine Debris :**
    - **194,000㎥ or 97,000ton**
    - **Most : derelict fishing gear**
    - **Part : land based marine debris**

❑ Marine Debris Statistics Surveyed

➢ from River Han per year :

	TTL	vinyl& plastic	net	bottle	rubber	styrofoam	woods	etc
input (㎥)	191,273	52,059	16,971	3,375	6,633	8,001	96,135	8,099
ratio (%)	100	27.2	8.9	1.8	3.5	4.2	50.3	4.2

❑ MOU for Fund Raising between Incheon, Seoul, Kyungki Province

➢ Budget allocation by Population & Q'ty of Marine Debris

Incheon	Seoul	Kyungki	total
50.2%	22.8%	27.0%	100%

1st phase	('01-'02)	3.5biWon	USD 2.9mi
2nd phase	('02)	5.0biWon	USD 4.2mi
	('03)	5.0biWon	USD 4.2mi
	('04)	5.0biWon	USD 4.2mi
	('05)	5.0biWon	USD 4.2mi
	('06)	5.0biWon	USD 4.2mi
total		28.5biWon	USD 23.9mi

❑ Subsidy for Marine Debris Management

➢ Coastal Cleanup Subsidy

- Reciver: Local Government
- Year 2002 : 0.8biWon
- Year 2003 : 1.3biWon

➢ Incentive Program

- Fishermen who collect marine debris during fishing operation
- Objects : Derelict Fishing Gear including other ship based marine debris
- Purchasing Subsidy : 6,000Won/40ℓ(bag)

- 2002 : 380㎥(212ton)

(unit : milWon)

- 2003 : 882㎥(264ton)

(unit : milWon)

- Cost reduction effects : 9.8~17.6 times

  Subdy : 6,000Won/40ℓ

  Gov't Collection : 58,000~105,800/40 ℓ

- Pic. 1, 2, 3, 4, 5, 6

❑ Collection by Floating Fence in Rainy Seasons

- Where : mouth of River Han
- Fleet : 1 barge, 1 tugboat, 1 assistant vessel, 2 cleaning vessels, 1 crane
- 2002 : 162 tons, 743miWon
- 2003 : 284 tons, 1,485miWon
- Pic 1. 2, 3, 4, 5, 6


인천 933

❑ Collection by Deposited Marine Debris

- Quantity estimated : 190,000㎥(97,000ton)
- Fleet : 1 barge, 1 tugboat, 1 crane, 3 fishing vessels, 1 cleaning vessel, 1 assistant vessel

year	cost	area	collection
2002	1,561miWon	3,646㎥	1,713ton
2003	1,600miWon	1,734㎥	867ton

- Pic 1, 2, 3, 4, 5, 6

III. Marine Debris Management Policy at the National Level

❑ Collection of Marine Debris

➢ Allocation of the Budget for Marine Debris Management

project	allocation	Implementing organization	remark
collection of deposited marine debris	central govt 100%	private company	
R&D	central govt 100%	reaseach institute	
multi-purpose vessel operation	central govt 100%		owned & operated by central govt
styrofoam volume reduction system	central govt 80%	local governments	
collection of deposit derelict fishing gear	central govt 80% local govt 20%	local governments	

- **Survey of Deposited Marine Debris**
  - 1999~2000
  - 146 areas : ports, fishing ports, etc
- **Scheduled surveys**
  - 2003~2007
  - Major fishing area and ares within EEZ

❑ Collection of Deposited Marine Debris

- ➢ Where : commerical ports and major fishing ports(1999~).
  from 2002:
  - Major fishing grounds(Yellow Sea : blue crab fishing ground, East Sea : king crab fishing ground)
  - Derelict fishing gear
- ➢ Commercial ports and major fishing ports will be completed by 2005
  from 2004 : EEZ will be included
- ➢ Results :

	total	1999	2000	2001	2002
quantity(ton)	34,735	1,135	12,687	10,798	10,112
cost(biWon)	28.5	0.5	10.0	9.0	9.0

- **Collection of Floating Marine Debris**
  - Where : commercial ports and fishing ports
  - By 28 cleaning vessels
- **Dredging of Aquaculture Areas**
  - When : 1986~2001
  - How much : 140,628miWon, 272,349 tons of sediments

❑ Incentive Program

- ➢ Fishermen who collect Marine Debris during Fishing Operation
- ➢ Where : beyond 12miles from coastal line

  ’03 : Vessels registered in Busan, Yeosoo, Mokpo→’04: 12 ports

  ’03 : beyond 12miles from coast→’04: within/beyond 12miles
- ➢ Objects : Derelict Fishing Gear including other ship based marine debris except food
- ➢ Purchasing Subsidy : 4,000W/40ℓ(bag) = 13~14kg
- ➢ Fund rasing
  - MOMAF : 80%, Local Govt : 20%

IV. Public Outreach Programs

- **Training workshops**
  - Eight workshops from 2001 to 2003
  - 30~50 NGO leaders, volunteers, government officials and researchers
  - Topics covered
    - Scientific understanding of marine environment and pollutants
    - International trend in marine environmental management
    - National policies and strategies for marine environmental conservation

❑ Training workshops

- Education and public information program to raise public awareness
- Results of monitoring marine debris and their policy implications
- Establishment of a partnership organizations among local stakeholders, governments, and researches
- International Coastal Cleanup site captains training

❑ National Monitoring on Marine Debris

- ➢ Twenty three NGOs participated
- ➢ Monthly monitoring from Aug. 2000 to Dec. 2001;

  Monthly or seasonal since 2002 at twenty coastal sites
- ➢ Identification of and measurement of quantity

  collected in weight and number

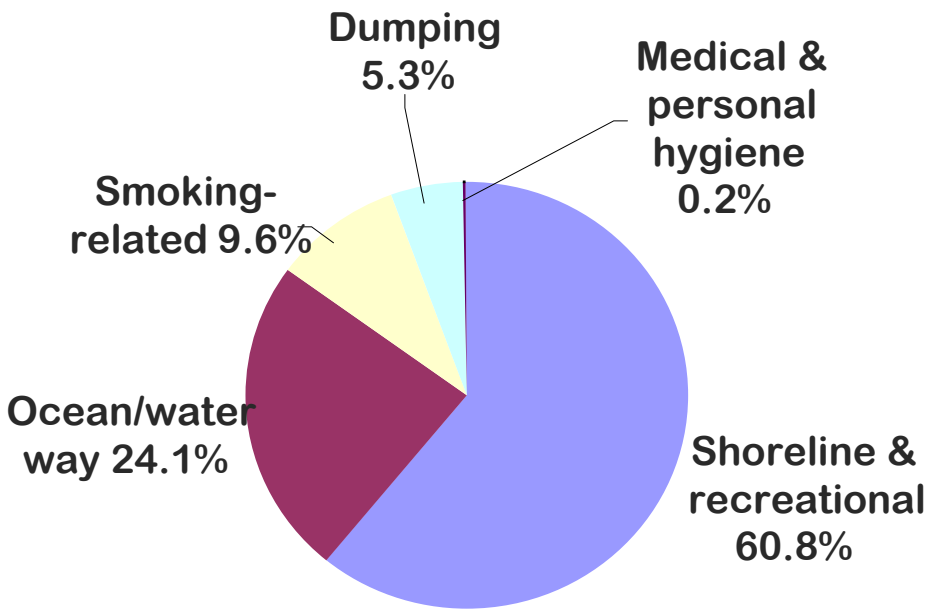
❑ National Marine Debris Monitoring

- ➢ Site location and beach marks
- ➢ Standardized amount of debris cleaned at twenty sites
  - 91ton/㎢/yr

❑ Result of National Monitoring on Marine Debris

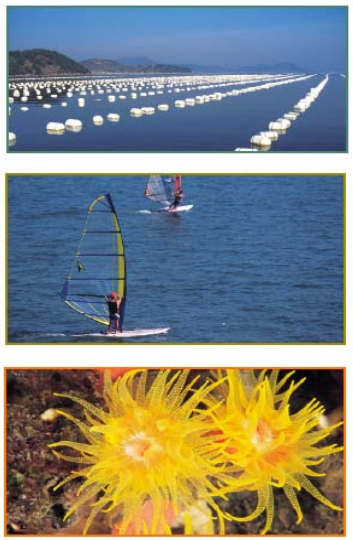
➢ Source of Marine Debris in Korea

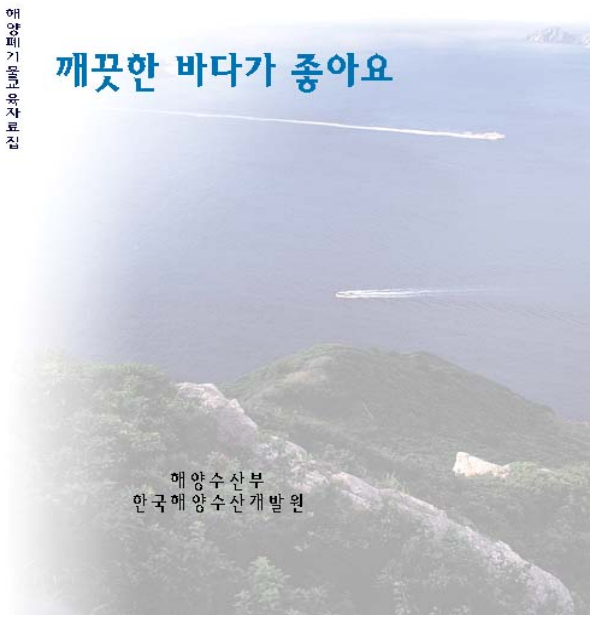
(2002 International Coastal Cleanup Result)

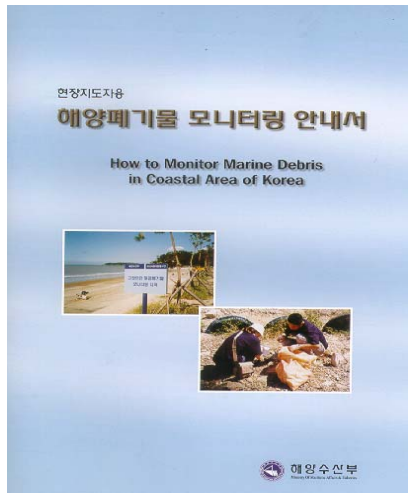


❑ Development of Education and Public Relations Materials

- ➢ Booklet, posters, and leaflets on marine debris
- ➢ Manual on marine debris monitoring

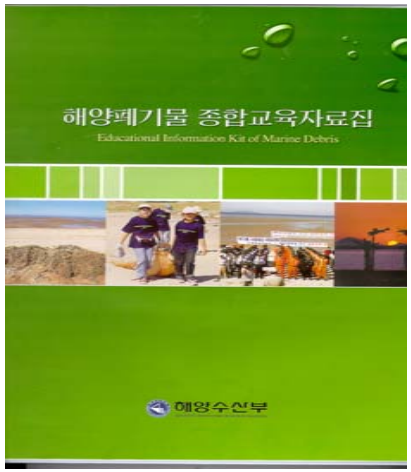






❑ Development of Education and Public Relations Materials

- ➢ ‘Educational Kit on Marine Debris’ with VCR tape and VCD
- ➢ Educator’s Guidebook for Marine Environmental Education for K 3~6 grades

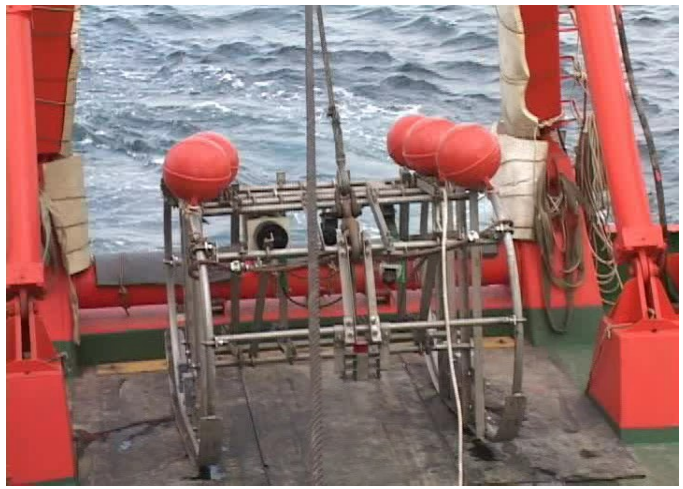


- Development of Education and Public Relations Materials
  - NGOs in coastal areas
  - Local agencies of MOMAF and MOE(Ministry of Education & Human Resources Development)
  - Organizations related to marine and fisheries
  - School teachers

- **Participation in the ICC since 2001**
  - **Twenty two NGOs, 1,750 people in 2001**
  - **Twenty NGOs, 1,600 people in 2002**
  - **Sixteen NGOs, 1,260 people in 2003**
  - **Participatory program to raise public awareness in cooperation with NGOs, the national government, and a research institute**
  - **NGOs monitoring beach debris - Key role in carrying out the event**

V. R&D for Marine Debris Management

- Search & Collection of Derelict Fishing Gear in Deep Sea
  - Developed photographing system in deep sea
    - Nov. 2002, tested in 250m
    - pic. 1. Photographing System, 2002
    - pic. 2. Photographing System, 2003



❑ Search & Collection of Derelict Fishing Gear in Deep Sea

- Aug. 2003, surveyed in 100m, Jejoo Island Sea
- Oct. 2003, surveyed in 500m, East Sea
- pic. 1, 2, 3, 4 : 10/8/2003, Ooljin, 350m




➢ Developed Collection Equipement of Delrelict Fishing Gear in Deep Sea

- pic. 1. Collection Equipment
- Pic. 2. Collection of Derelict Fishing Gea


- **Styrofoam Volume Reduction System(SVRS)**
  - **Ruduction of styrofoam wastes**
  - **Reuse or fuel for incinerators**
  - **Capacity : 100kg/hr**

- 2002 : 1 site(Nam Hae)

  2003 : 4 site(Tong Yong, Geo Jae, Yeo Soo)

  2004 : 6 site(Plan)

  2005 : 9 site (Plan)

  2006 : 10 site (Plan), pic. 1, 2, 3, 4, 5

- Many local governments want to operate SVRS in their coastal region



Marine Debris in Australia
The International Dimension

13 January 2004
APEC marine debris seminar, Hawaii

Ilse Kiessling - National Oceans Office

Healthy oceans: cared for, understood and used wisely for the benefit of all, now and in the future

Australian Government
National Oceans Office

National Oceans Office

- Commonwealth Government agency
- Responsible for implementation of *Australia's Oceans Policy*
- Regional marine planning is the principal tool for implementing Australia's Oceans Policy
- Marine debris has emerged as a key theme through the regional marine planning process for northern Australia

Australian Government
National Oceans Office

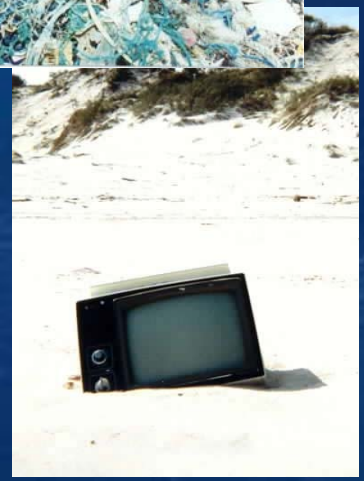
Origins of marine debris around Australia

Across Australian waters:

- 13 800 tonnes of waste is generated aboard ships per year
- 2 400 tonnes of fishing gear is lost or discarded
- only 9 800 tonnes of debris are recovered over berths and disposal to landfills
- so that up to 6 500 tonnes of waste per year is lost or discarded overboard (ANZECC, 1996)

Origins of marine debris around Australia

- In general, approx. 80% of marine debris around Australia is terrestrial in origin
- In northern Australia most debris (up to 99%) is likely to be from marine activities




Papua New Guinea
Indonesia
East Timor
Arafura Sea
Indian Ocean
Pacific Ocean
Australia
New Zealand

Origins of marine debris in northern Australia

In northern Australia

- the fishing industry is likely to be responsible for the majority of debris

Origins of marine debris in northern Australia

- coastal and offshore shipping are also significant sources of debris
- most debris is likely to originate beyond Australian waters

Impacts of marine debris around Australia

Many people share a concern about the impacts of debris on:

- public safety
- navigation
- tourism and fishing industries
- marine habitats and wildlife

Impacts of marine debris in northern Australia

Indigenous people are particularly concerned about the impacts of debris on animals and environments

"We are the ones on the ground looking out and seeing all this marine debris coming in. We are the ones who are affected. We and our marine species as well" (Nanikiya Munungurritj)

Impacts of marine debris around Australia

- Derelict fishing gear is the most hazardous type of debris to marine species
- In southern Australia, approx. 1500 Australian sea lions and New Zealand fur seals are being entangled each year

Impacts of marine debris in northern Australia

- In northern Australia, more than 700 marine turtles have been entangled since 1996

Australian responses to marine debris

Domestic initiatives

- research and non-government activities including:
  - seal entanglement studies (eg. Page *et al.*, in press)
  - turtle entanglement studies (eg. Roeger, 2002)
  - *A Fishing Net Identification Kit for Northern Australia* (WWF, 2002)

Australian Government
National Oceans Office

Australian responses to marine debris

- Natural Heritage Trust
- Reviews and reports, including,

  '*Finding Solutions to Derelict Fishing Gear and other Marine Debris in Northern Australia*' (Kiessling, 2003)
- 'Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris' listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*

Australian responses to marine debris

Australian domestic responses to the issue of marine debris have been driven by:

- High quantities of debris
- Increasing impacts of debris
- Strong community concern and involvement
- Clear identification of common areas of concern
- Collaboration between multiple groups

Australian responses to marine debris

International initiatives

- …

Australian Government
National Oceans Office

Options to address marine debris in the APEC region

Science and policy

- mapping of wind and drift patterns
- mapping of fishing operations
- analysis of socio-economic drivers of polluting behaviour
- collaboration between gear experts and surveillance operations to verify source of derelict fishing gear
- ‘tagging’ or other permanent identification marking of fishing gear

Options to address marine debris in the APEC region

Fishing gear and practices

- financial incentives to encourage retrieval, return and recycling of vessel sourced waste
- market-based incentives

Options to address marine debris in the APEC region

Ports and disposal

- analysis of the need for port facilities throughout the APEC region for efficient disposal of vessel-sourced waste
- fishing gear repair, re-use and recycling initiatives at key ports

Australian Government
National Oceans Office

Options to address marine debris in the APEC region

Domestic and international regulatory structures

- analysis of the effectiveness of existing legal, regulatory and management regimes
- identify opportunities for more effective implementation of MARPOL Annex V in the APEC region
- joint activity between APEC working groups

Sustaining Our Vital Oceans

Chinese Taipei's Visions

Don-Chung Liu

Fisheries Research Institute
Council of Agriculture

Contents

- The status of marine capture fisheries in 2002
- Administrative framework for marine fisheries affairs
- Derelict fishing gear and marine debris
- Coastal cleanup activities in 2002
- Future perspective

The status of marine capture fisheries in 2002

The status of marine capture fisheries in 2002

- Category
  - Far sea fisheries
  - Offshore fisheries
  - Coastal fisheries
- Production
- Number of fishers

Far sea fisheries

- **Otter trawling (4.7%)**
- **Bull trawling (3.3%)**
- **Purse seine for tuna (31.4%)**
- **Tuna longline (38.5%)**
- **Squid jigging (13.5%)**
- **Torch light net for saury (6.2%)**

Offshore fisheries

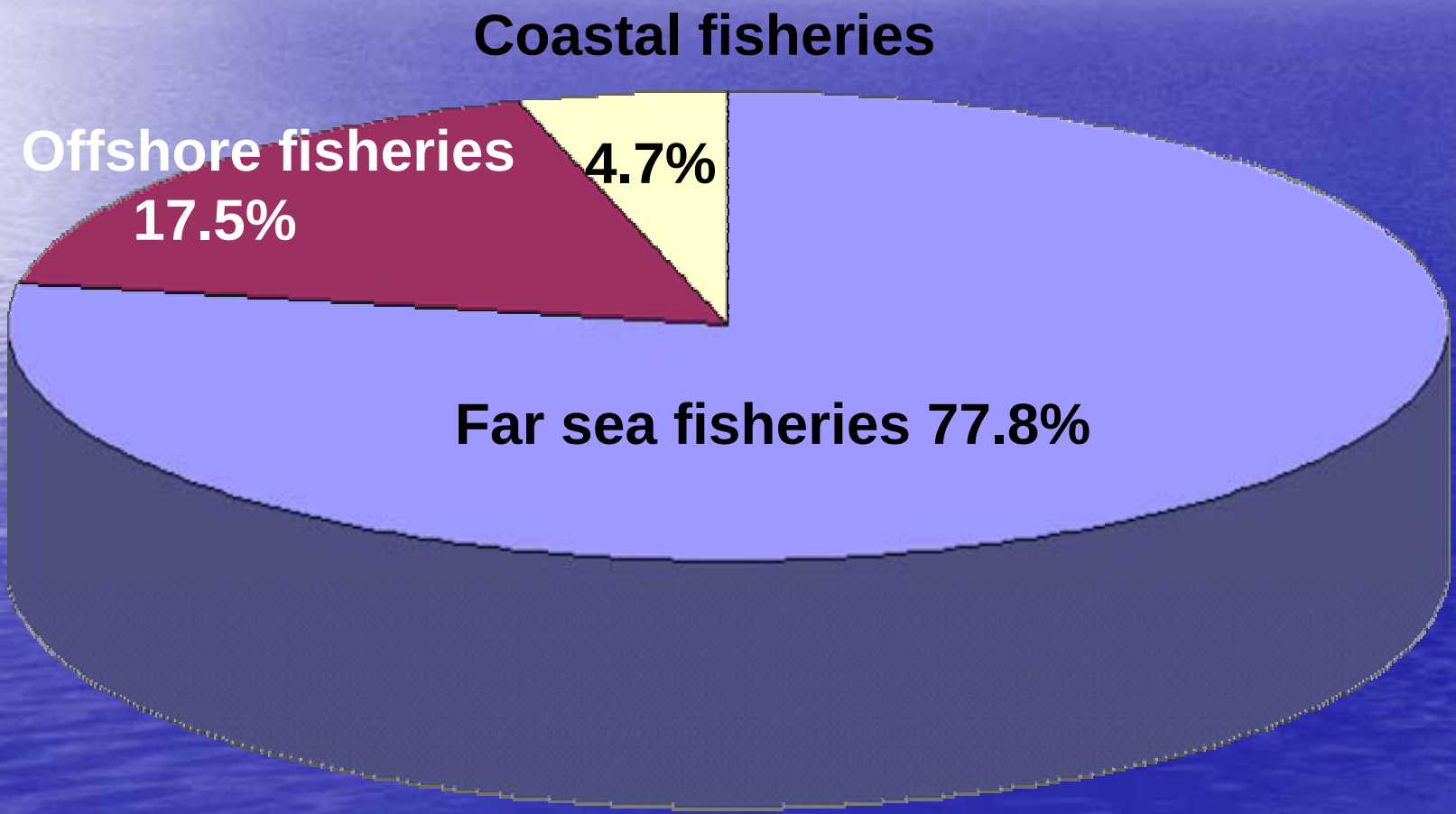
- Purse seine (1.4%)
- Purse seine for mackerel (18.3%)
- Torch light net (13.0%)
- Drag net (32.5%)
- Gill net (11.3%)
- Tuna longline (11.8%)
- Misc. fish longline (6.4%)
- Pole and lines boote (1.0%)

Coastal fisheries

- Set net (16.8%)
- Beach seine (1.7%)
- Torch light net (13.7%)
- Gill net (26.7%)
- Pole and lines boote (10.2%)
- Longline (15.9%)
- Spear fishing (1.0%)

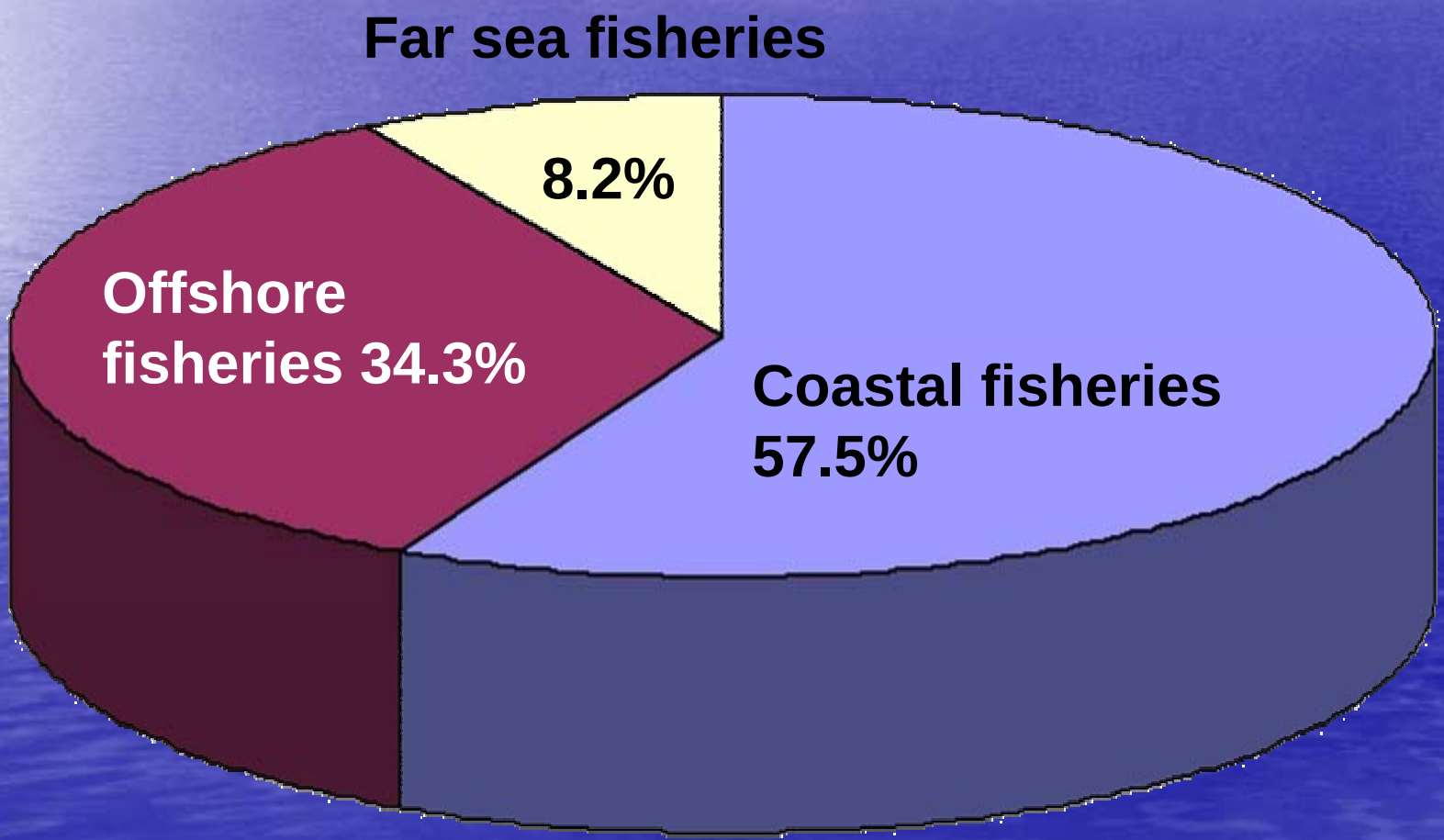
Production

Total: 1,059,142 tonnes



Number of fishers

Total: 237,114 persons



Production per capita in different fisheries

Category	Production (Tonnes; A)	Fishers (Persons; B)	A/B (Tonnes/Person)
Far sea fisheries	823,534	19,338	42.6
Offshore fisheries	185,939	81,404	2.3
Coastal fisheries	49,669	136,372	0.4

Administrative framework for marine fisheries affairs

Organizations and main functions (1/4)

➢ Council of Agriculture (COA)

- Highest fisheries policy making body
- Competent authority of the Fisheries Law

➢ Fisheries Agency (FA), COA

- Highest fisheries administrative agency
- Supervision for the fisheries policy, laws and regulation
- Management and monitoring for the vessel and crewman
- Making plan, promote, monitor and coordinate on the fisheries resource conservation
- Planning, supervision and training for the fisher

Organizations and main functions (2/4)

➢ Fisheries Research Institute, COA

- Fishery resources, fishing technology, ocean environment monitoring
- Technical training and services to domesticate and international fisheries communities

➢ Environmental protection administration (EPA)

- Marine environment classification and monitoring
- Marine pollution control
- Sea dumping
- Beach cleanup plan

Organizations and main functions (3/4)

➢ Coast Guard Administration

- Search and rescue at sea
- Fishing harbour control
- Patrol and inspect on fishing activities
- Conservation on marine environment and fisheries resources

➢ National park administration, Ministry of Interior

- Conserving all fisheries resources in park area

Organizations and main functions (4/4)

- **National Coastal Scenic Area Administration, Tourism Bureau, Ministry of Transportation and Communications**
  - Conserving all fisheries resources in scenic area

- **Local governments (County/city)**
  - Management on coastal fisheries, fishing harbour

Derelict fishing gear and marine debris

Derelict fishing gear and marine debris: in case of gillnet and longline

- Gear lost assessment
- Possible solutions
- Marine debris

Gear lost assessment

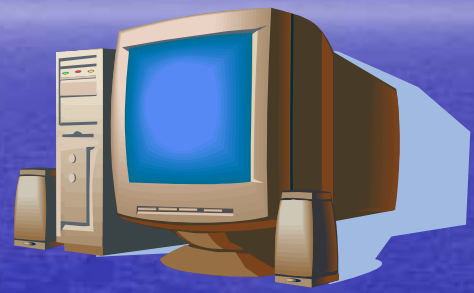
- Inclement weather
- Over-harvesting
- Gears fouled
- Sea disaster
- Defective equipment

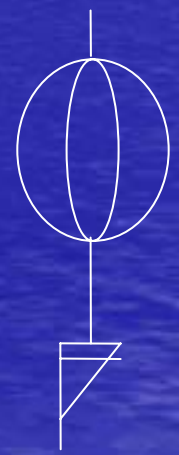
Possible solutions (1/4)

- Buy back licenses
- GPS radio buoy
- Oceanographic survey

Possible solutions (2/4)

GPS radio buoy



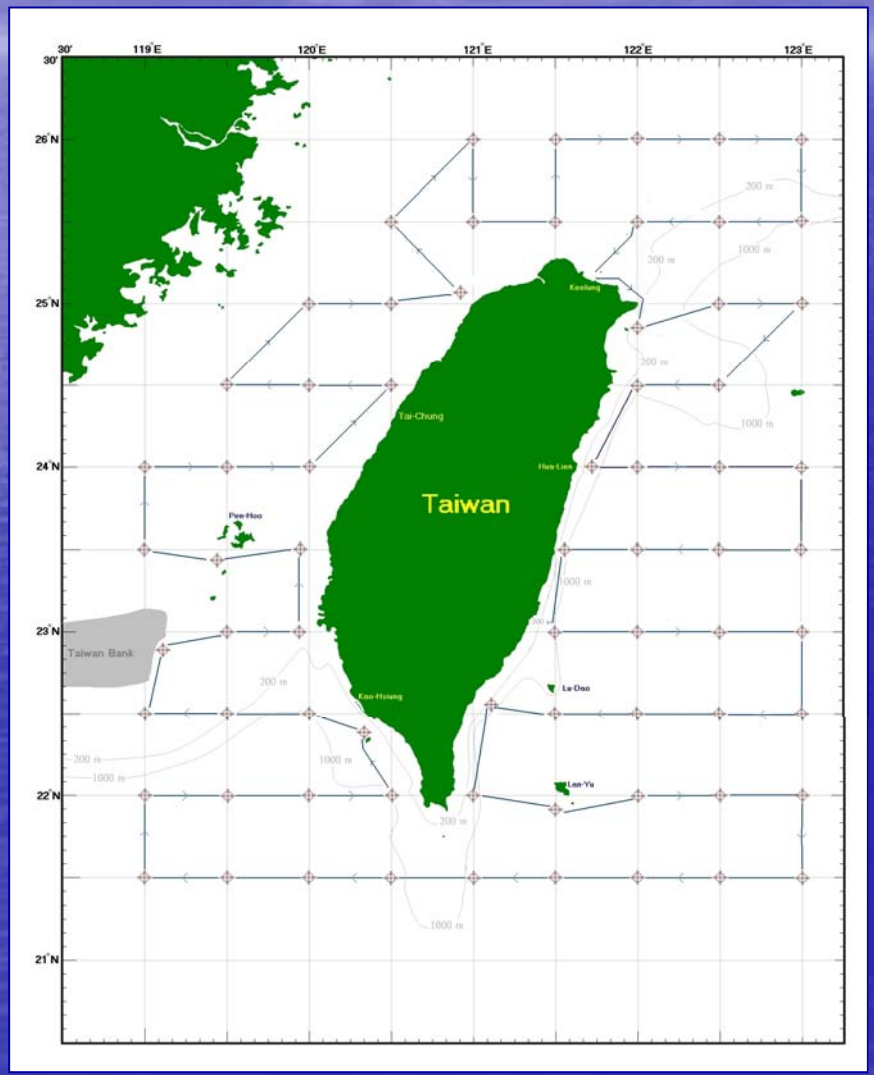


Possible solutions (3/4)

GPS radio buoy

Possible solutions (4/4)

Oceanographic survey



Marine debris-Items

Marine debris-Reuse

Marine debris-Recycling (1/2)

Marine debris-Recycling (2/2)

Coastal cleanup activities in 2002

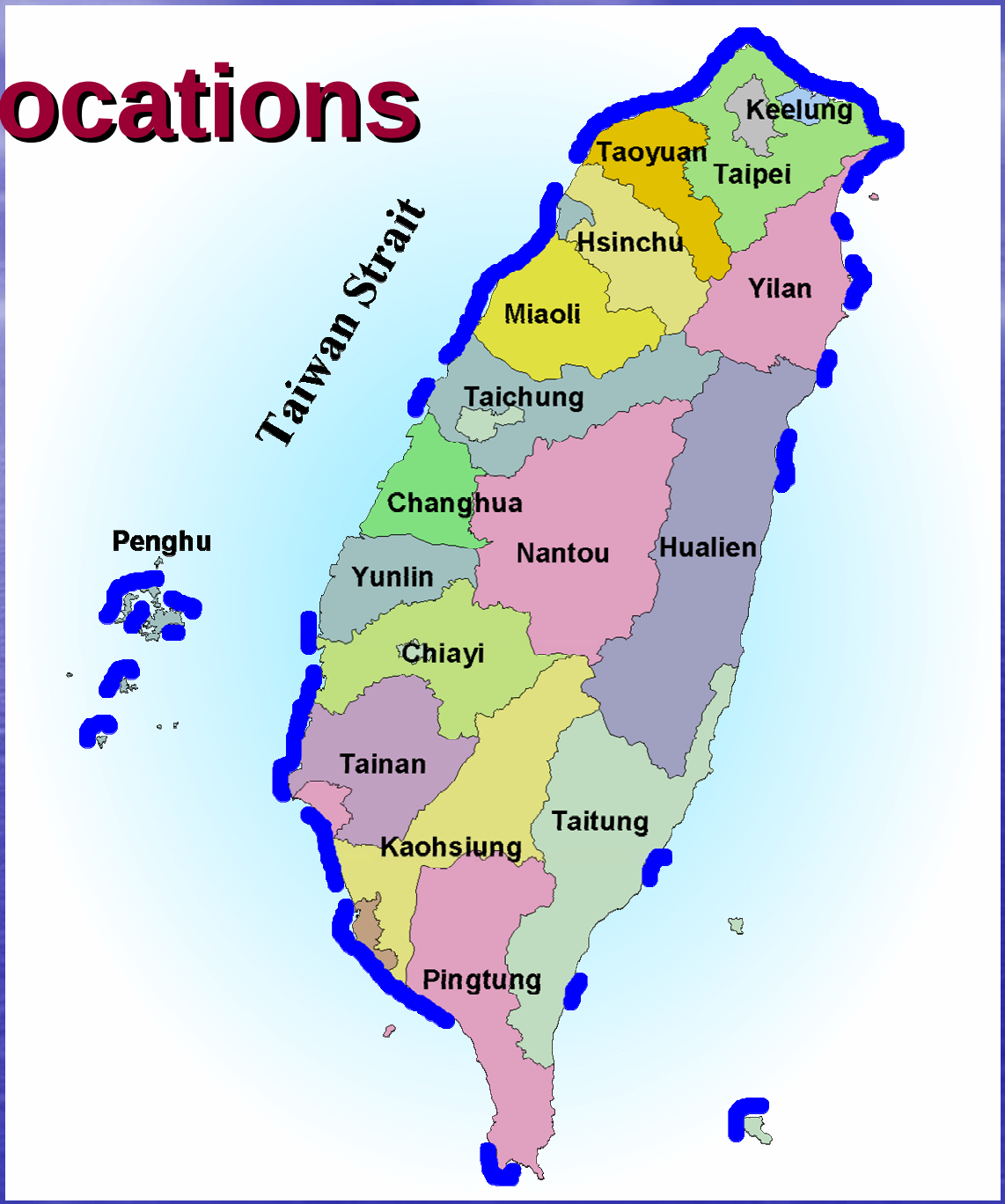
Coastal cleanup activities in 2002

- EPA
  - Issues
  - Locations
  - Achievements
  - Volunteers
- FA
  - Locations
  - Achievements

EPA-Issues

- **Recreational fisheries**
  - Boat fishing
  - Dolphin & whale watching
- **Blue highway tourism**
- **Sea sports**

EPA-Locations



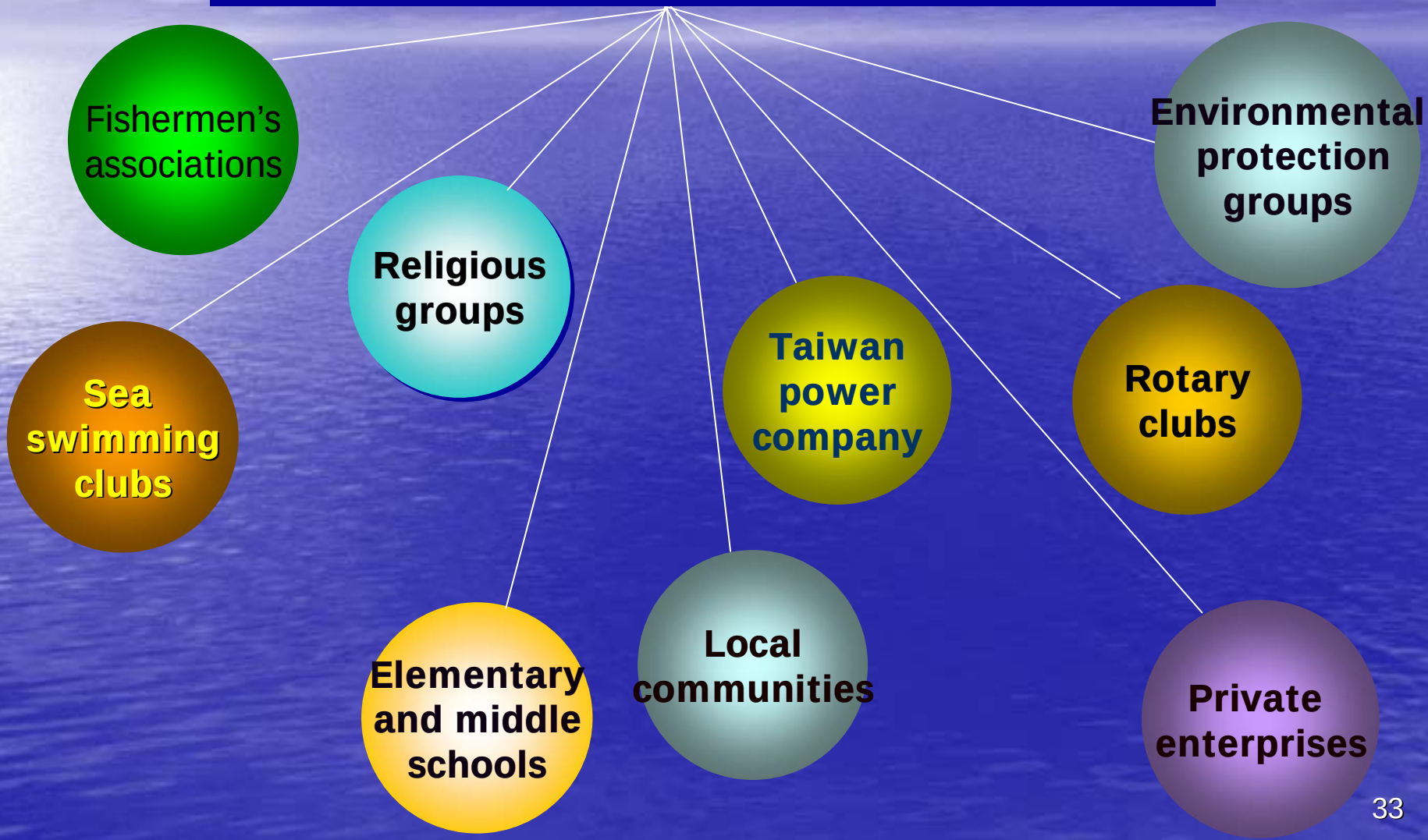
EPA-Achievements (1/2)

Cleanup coastline	1,000 Km
Participants	131,670 persons
Garbage weight	689,598 tonnes
Frequency	6 times/year
Budget	100 million NT dollars

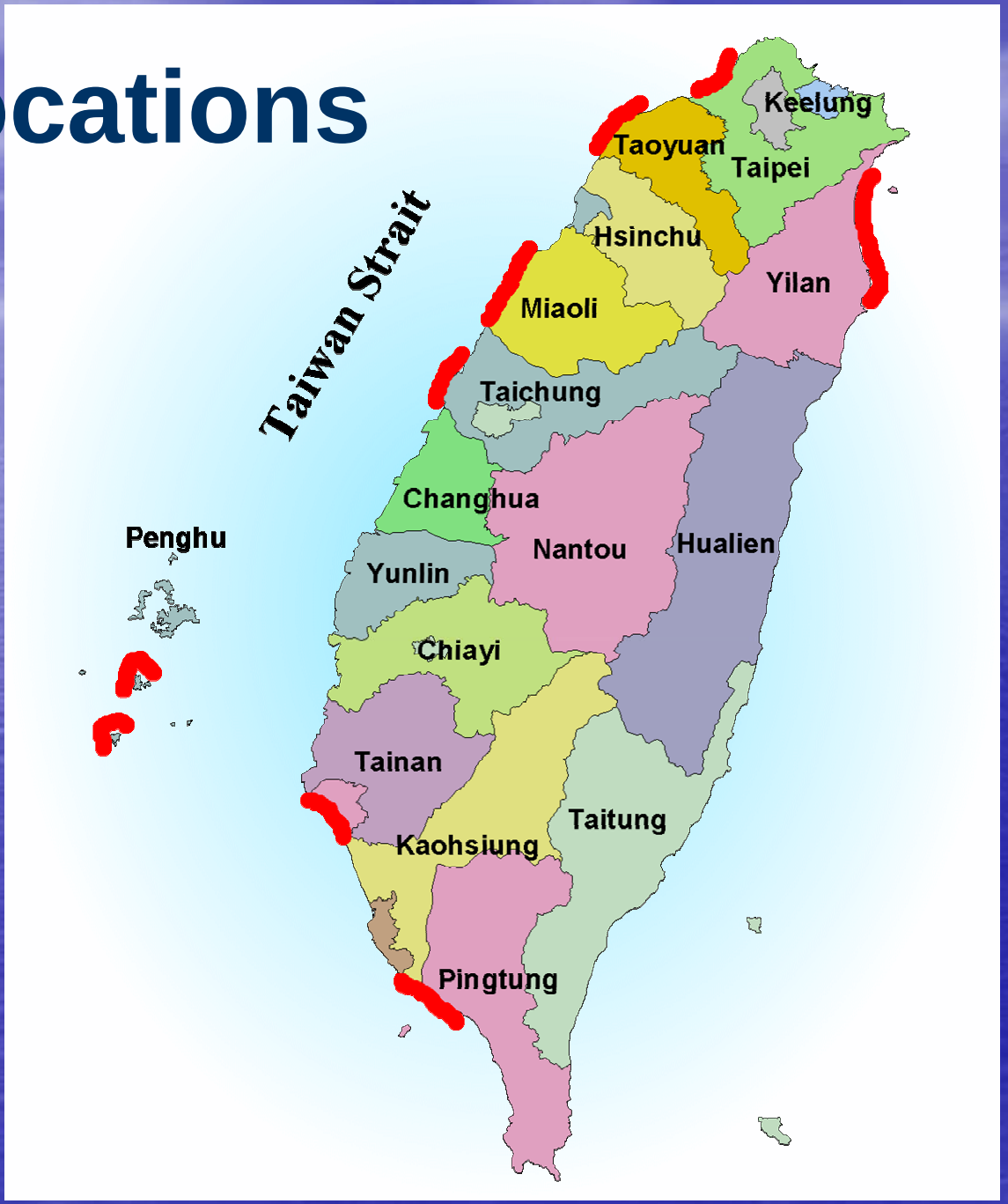
EPA-Achievements (2/2)

EPA

Volunteers: 35, 192 persons



FA-Locations



FA-Achievements (1/2)

Cleanup artificial reef	15 sites
Diving team	8 persons
Working day	64 days
Waste net	> 5.2 tonnes
Budget	6.5 million NT dollars

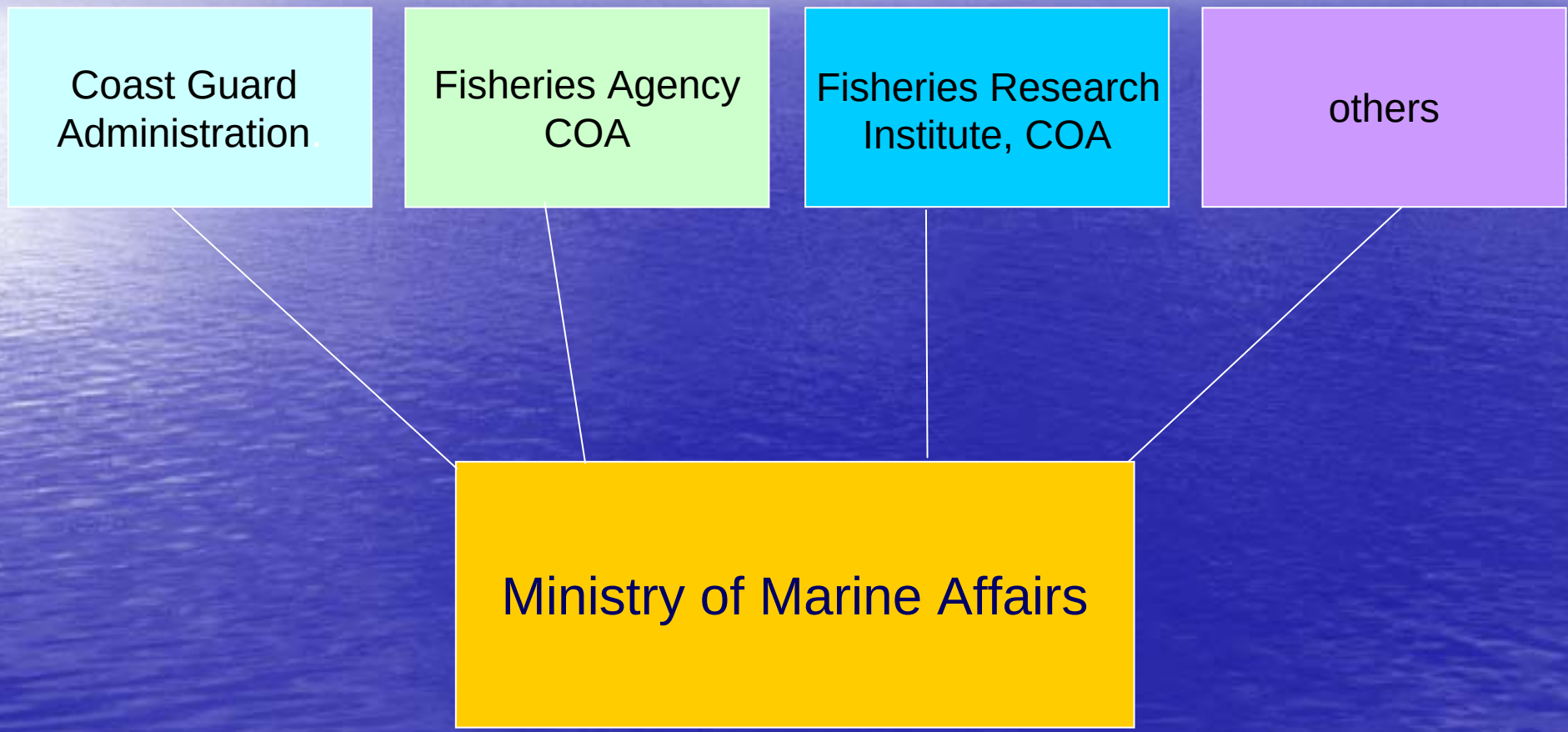
FA-Achievements (2/2)


Future perspective

Future perspective

- Legislation of “Coastal Act”
- Organization unification initiative
- Education and public awareness

Organization unification initiative



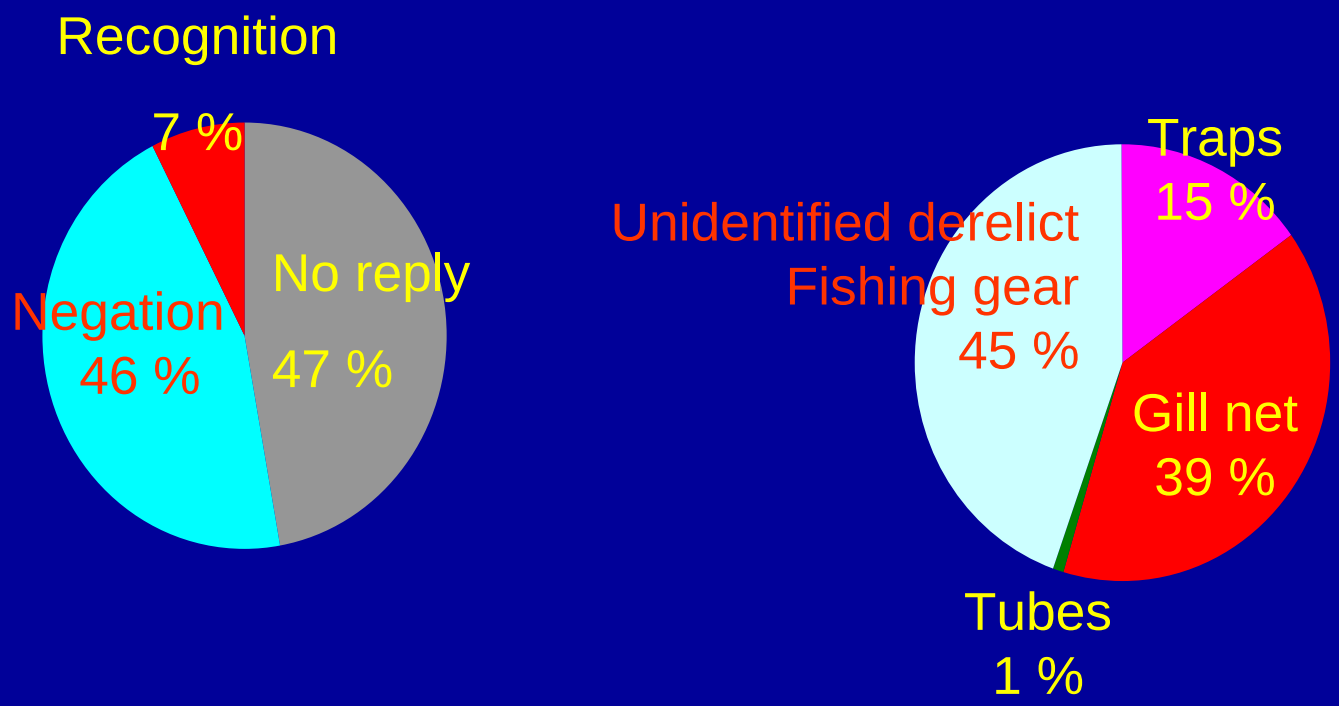
Education and public awareness

- Seminar/Symposium
- Media
- Publication
- Volunteer

Case study on the derelict fishing gear and marine debris problem in Japan

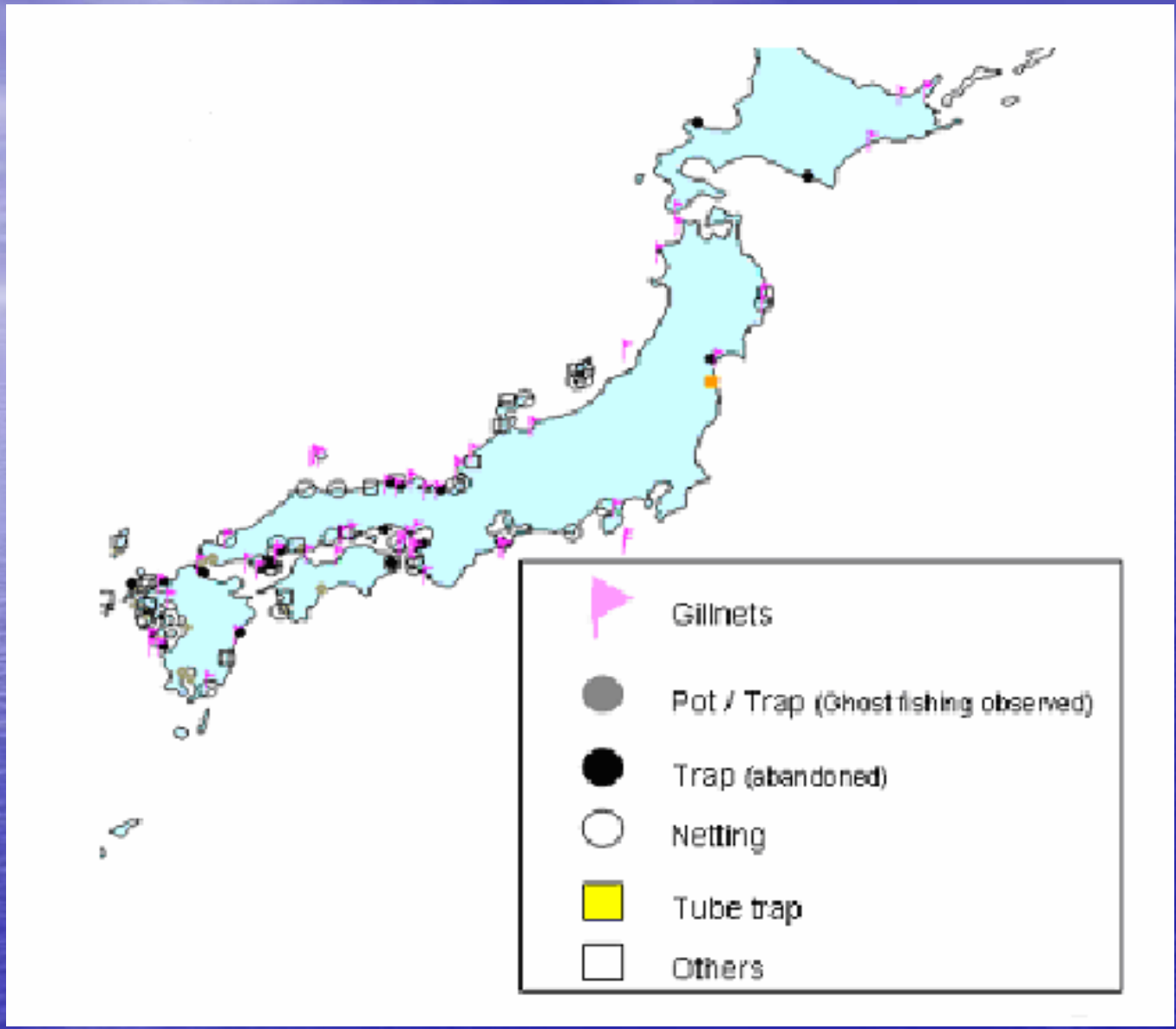
Toshihiro WATANABE [1] , Yoshiki MATSUSHITA [1],
Akihiro SHIOMOTO [2] and Kiyokazu INOUE [3]

[1] National Research Institute of Fisheries Engineering,
[2] National Research Institute of Fisheries Science,
[3] Fisheries Agency

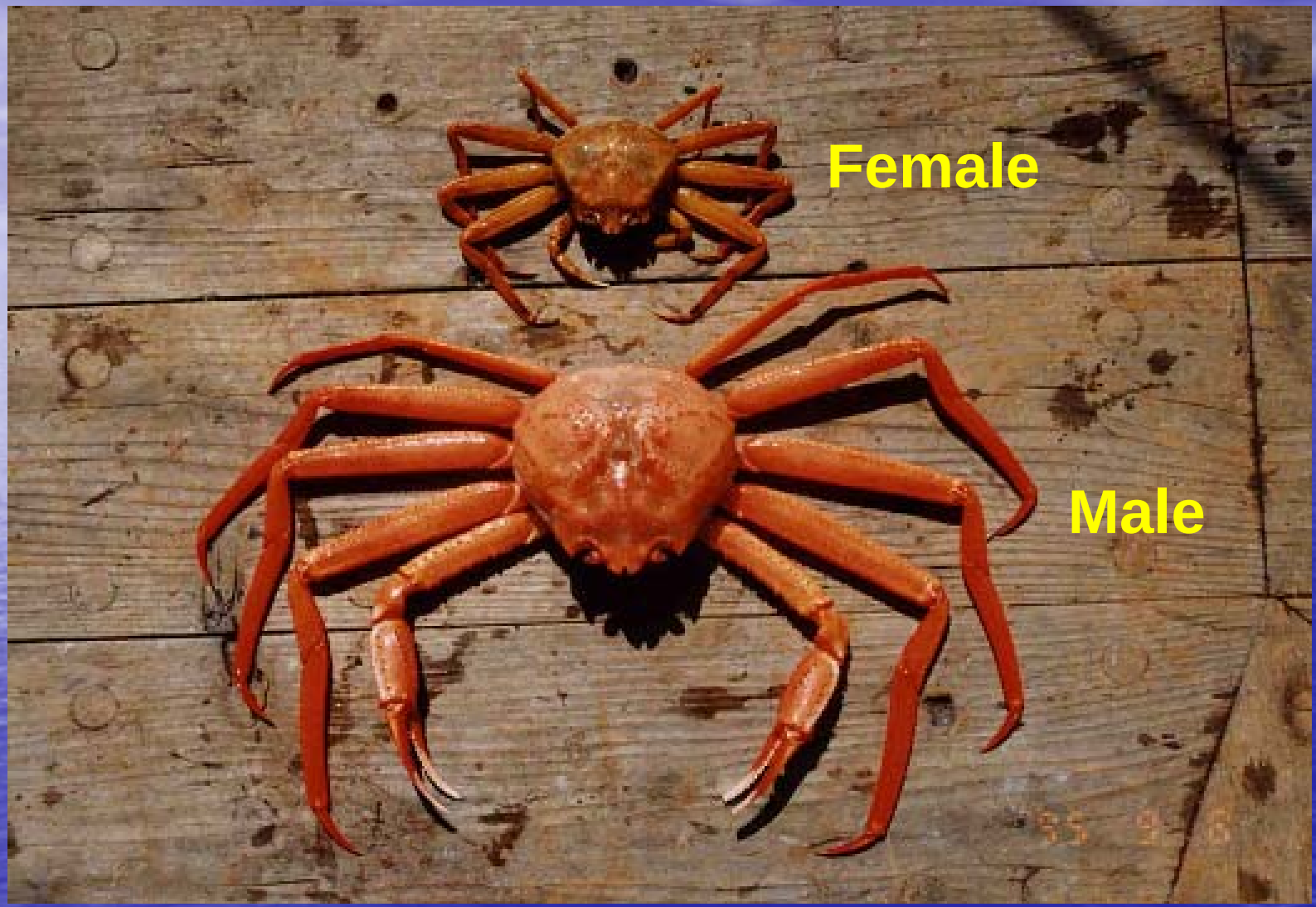


Summarized result of questionnaire survey

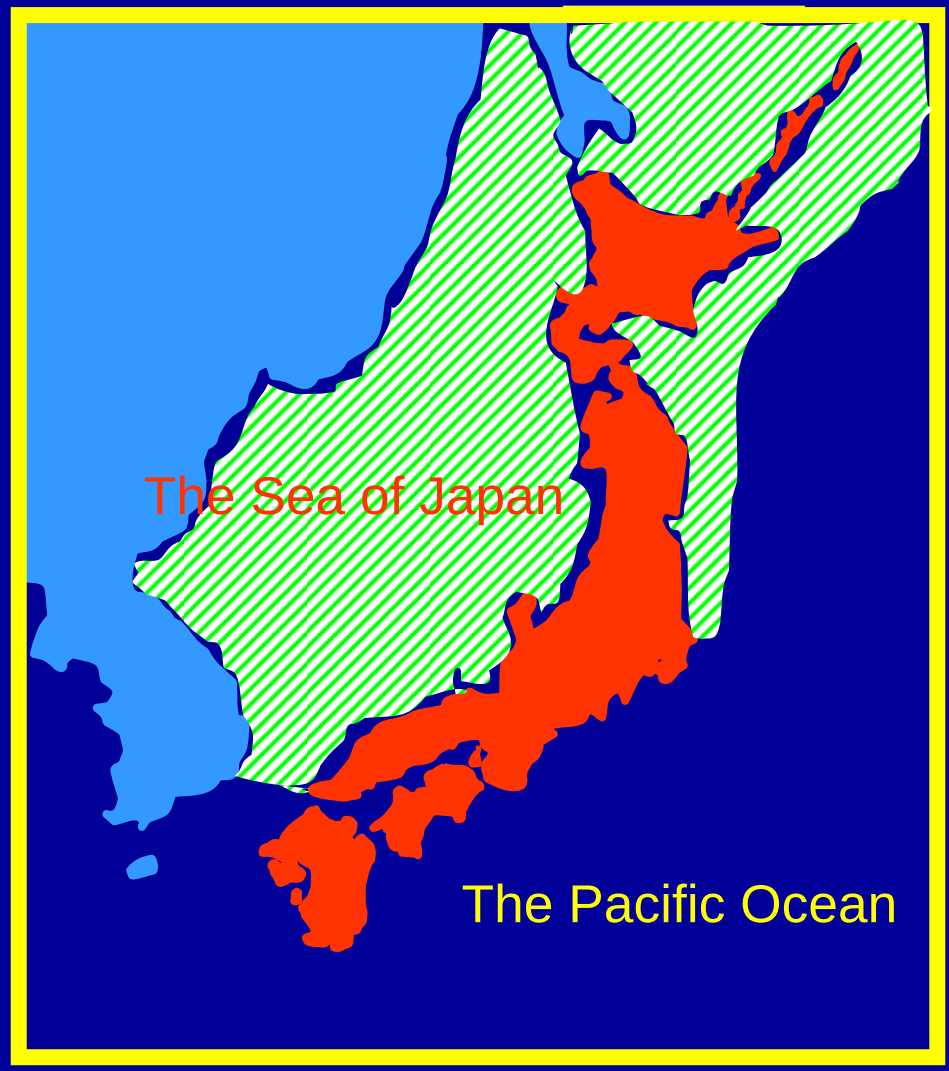
We sent 1781 mails. Of the 941 replies, 132 replies have recognized and have heard say of derelict fishing gear including “ghost fishing” problems. Types of fishing gear recognized were mainly accounted for gillnets and traps



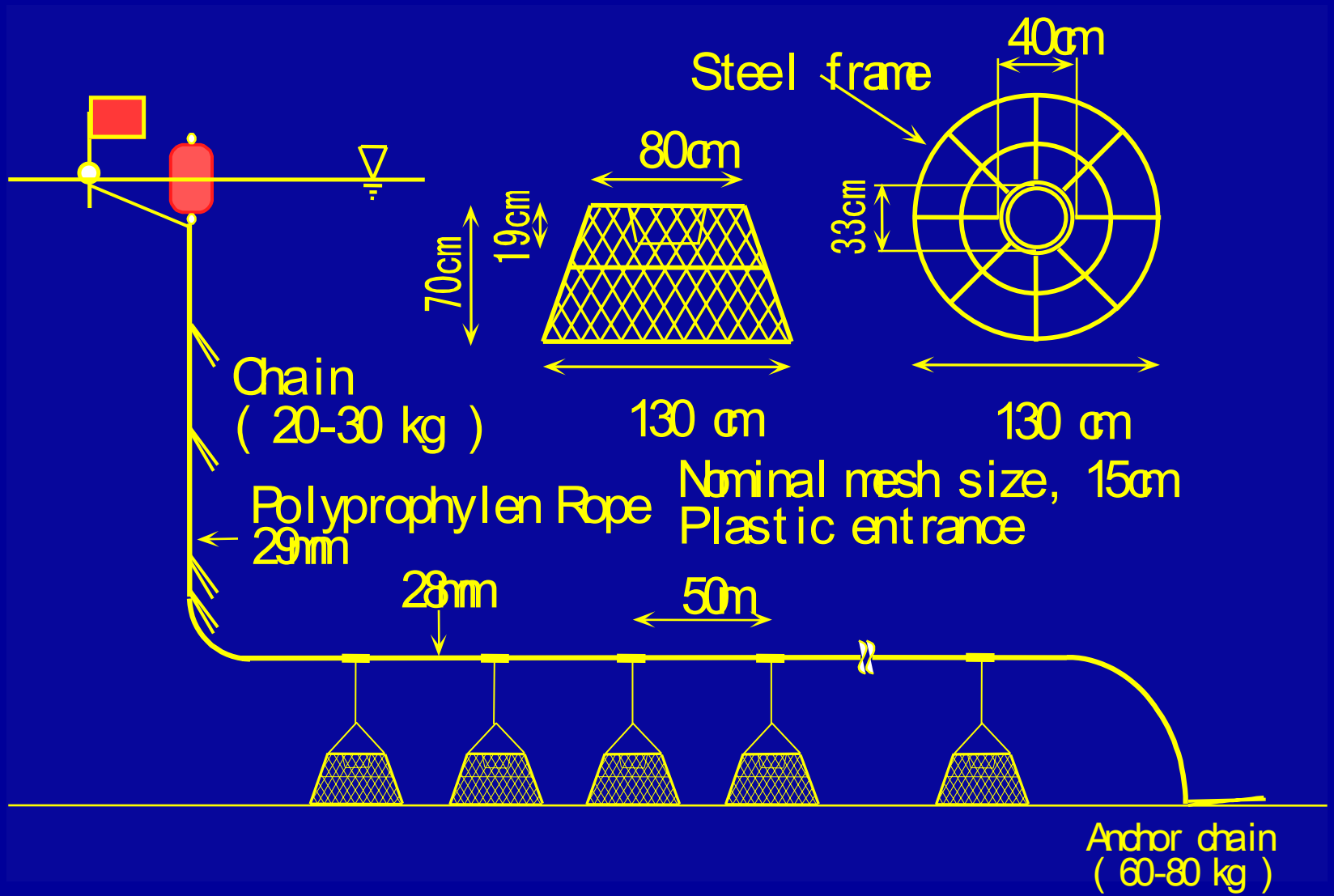
Distribution of derelict fishing gear in Japan coast



Red queen crab *Chionoecetes japonicus*



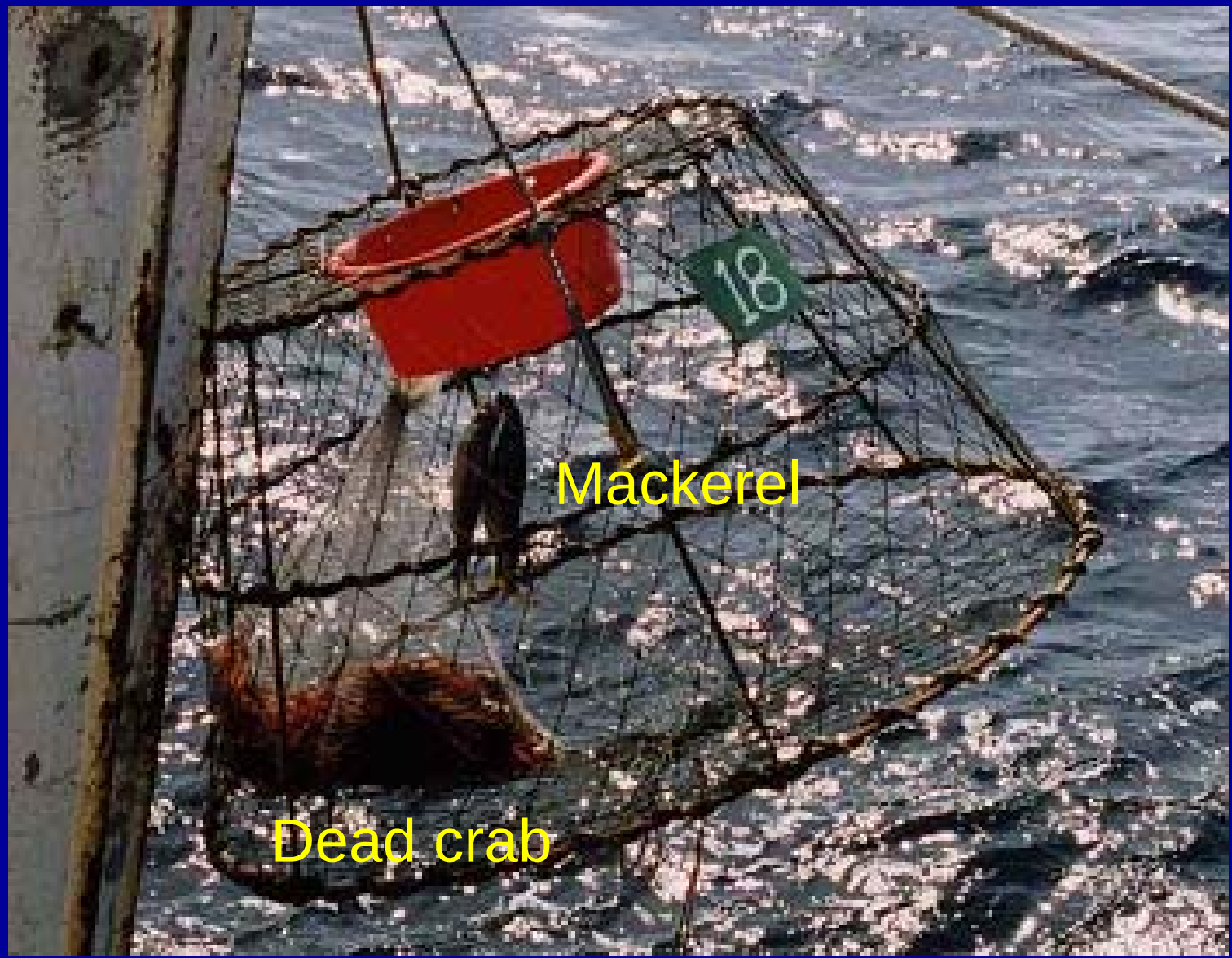
Distribution of red queen crab



Schematic diagram of the conventional commercial trap fishing gear

Investigation procedure to understand the impact of ghost fishing by crab traps

- Attractant effect for crab when the same crab served as trap bait, to investigate whether derelict traps will continue to capture new crabs or not.
- Catch of traps soaked for a long period
- Development of detecting method for derelict traps on the deep seafloor



Trap with normal bait (mackerel) plus dead crabs

Crab Catches in traps baited with and without dead crabs

Op. no.	Bait condition	Number of trap used	Catch number			Catch number per pot		
			Male	Female	Total	Male	Female	Total
1	Mackerel	9	134	69	203	14.9	7.7	22.6
	Mackerel plus Crab	9	18	33	51	2.0	3.7	5.7
2	Mackerel	10	83	195	278	8.3	19.5	27.8
	Mackerel plus Crab	8	5	85	90	0.6	10.6	11.3
3	Mackerel	10	18	192	210	1.8	19.2	21.0
	Mackerel plus Crab	10	4	79	83	0.4	7.9	8.3
4	Mackerel	10	157	50	207	15.7	5.0	20.7
	Mackerel plus Crab	10	13	56	69	1.3	5.6	6.9
5	Mackerel	8	118	86	204	14.8	10.8	25.5
	Mackerel plus Crab	9	8	44	52	0.9	4.9	5.8
6	Mackerel	9	109	67	176	12.1	7.4	19.6
	Mackerel plus Crab	10	33	61	94	3.3	6.1	9.4
Total	Mackerel	56	619	659	1278	11.1	11.8	22.8
	Mackerel plus Crab	56	81	358	439	1.4	6.4	7.8

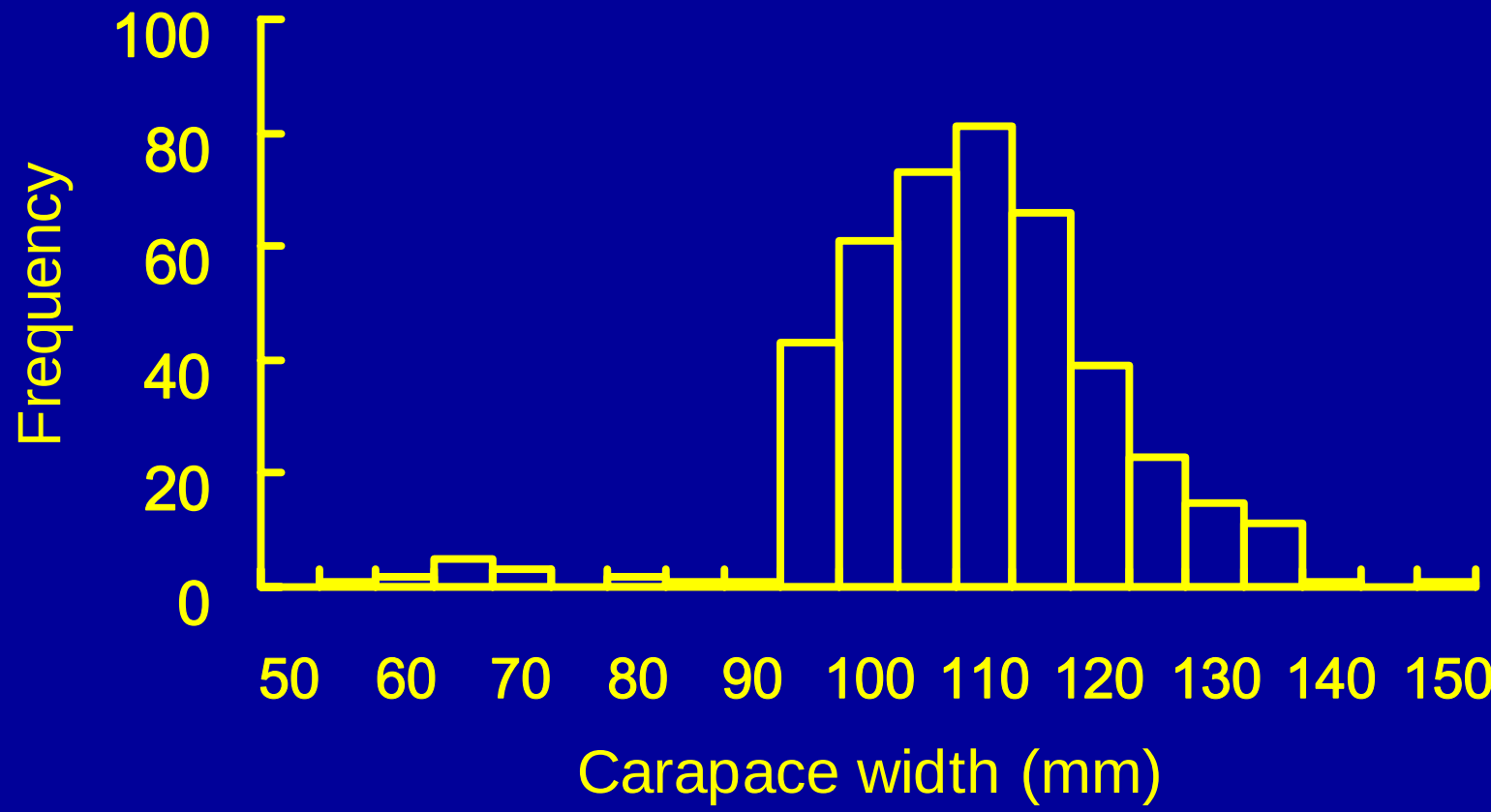
Experimental operations were performed 6 times in total. Catches of male crab decreased significantly in traps with normal bait plus dead crabs in all operations.

Catch number per commercial trap soaked for a long period

Soaking duration		Soaking time	Traps with bait			Traps without bait		
			Catch number per trap			Catch number per trap		
Start	End	(months)	Male	Female	Total	Male	Female	Total
Oct. 14 '94	Apr. 21 '95	6	8.7	0	8.7	1.9	0	1.9
Oct. 15 '94	Aug. 20 '95	10	13.5	0	13.5	4.8	0.2	5.0
Sep. 7 '95	Nov. 4 '96	14	20.7	0	20.7	3.7	0	3.7
Nov. 23 '96	Nov. 3 '97	11	2.3	0.2	2.5	0.5	0.4	0.9

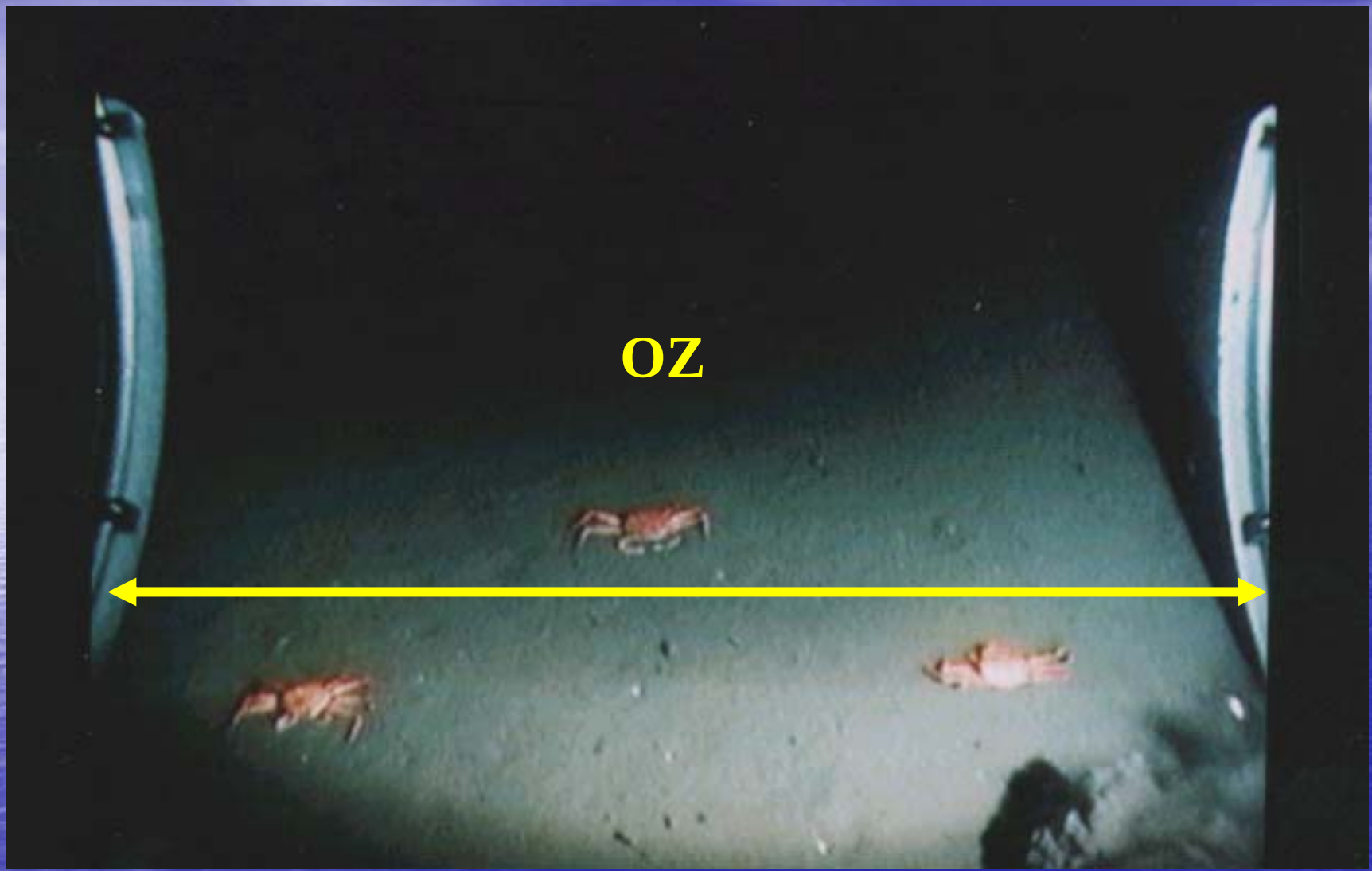
Females were scarcely caught in both baited traps and no baited traps.

Males were caught in both baited traps and no baited traps.



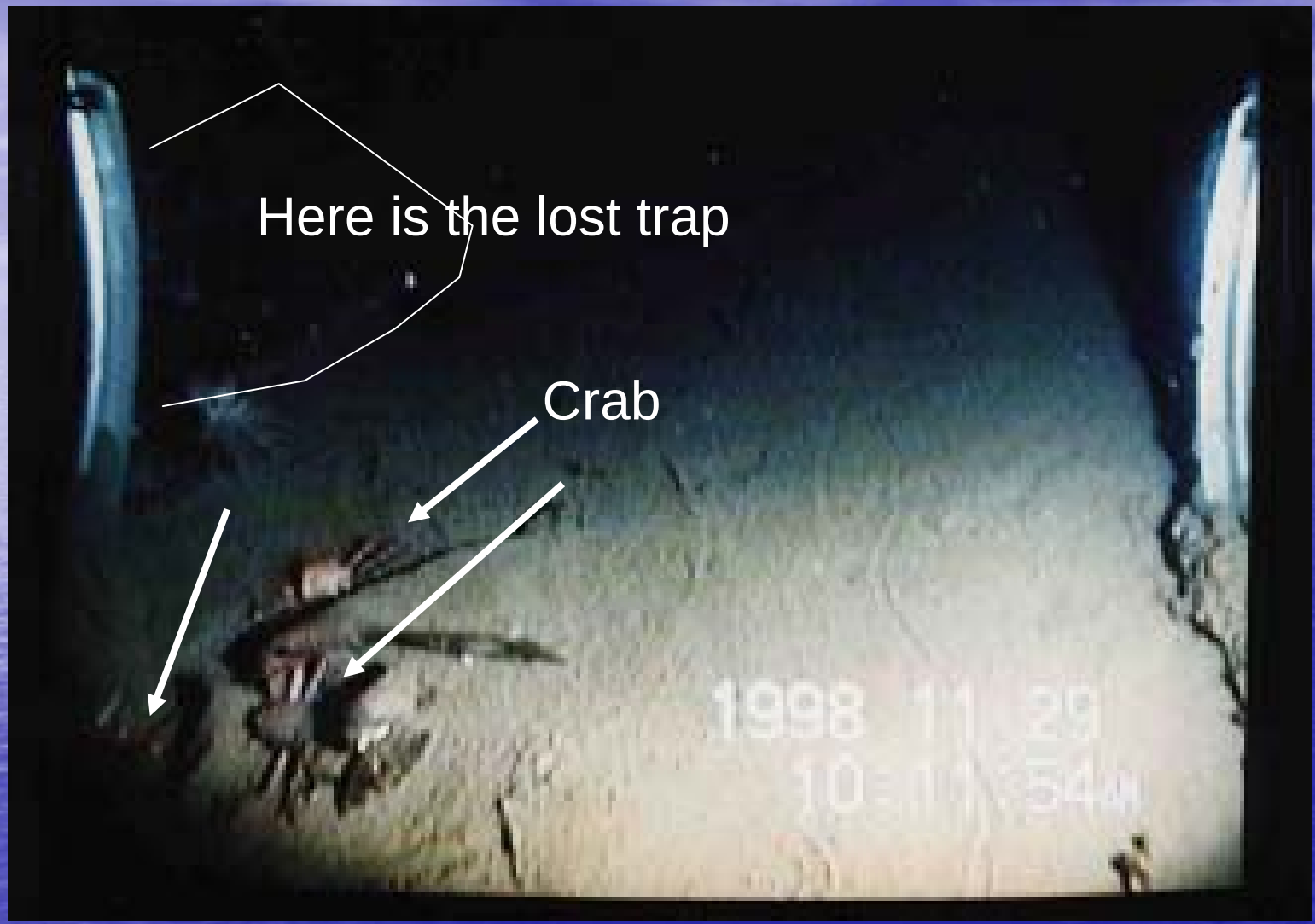
Size composition combined both male and female caught by traps soaked for a long period

Deep-sea Video Monitoring System on a Towed Sledge (DVMSTS)



Example of the video image recorded with the DVMSTS.
OZ : Observation zone (1.66m in width)

Derelict trap observed with DVMSTS



Derelict trap observed with VMSTS

Crabs have a tendency to gather around the derelict traps.

Experimental operation of traps covered with biodegradable plastic netting

Problems in biodegradable plastic to apply for the trap

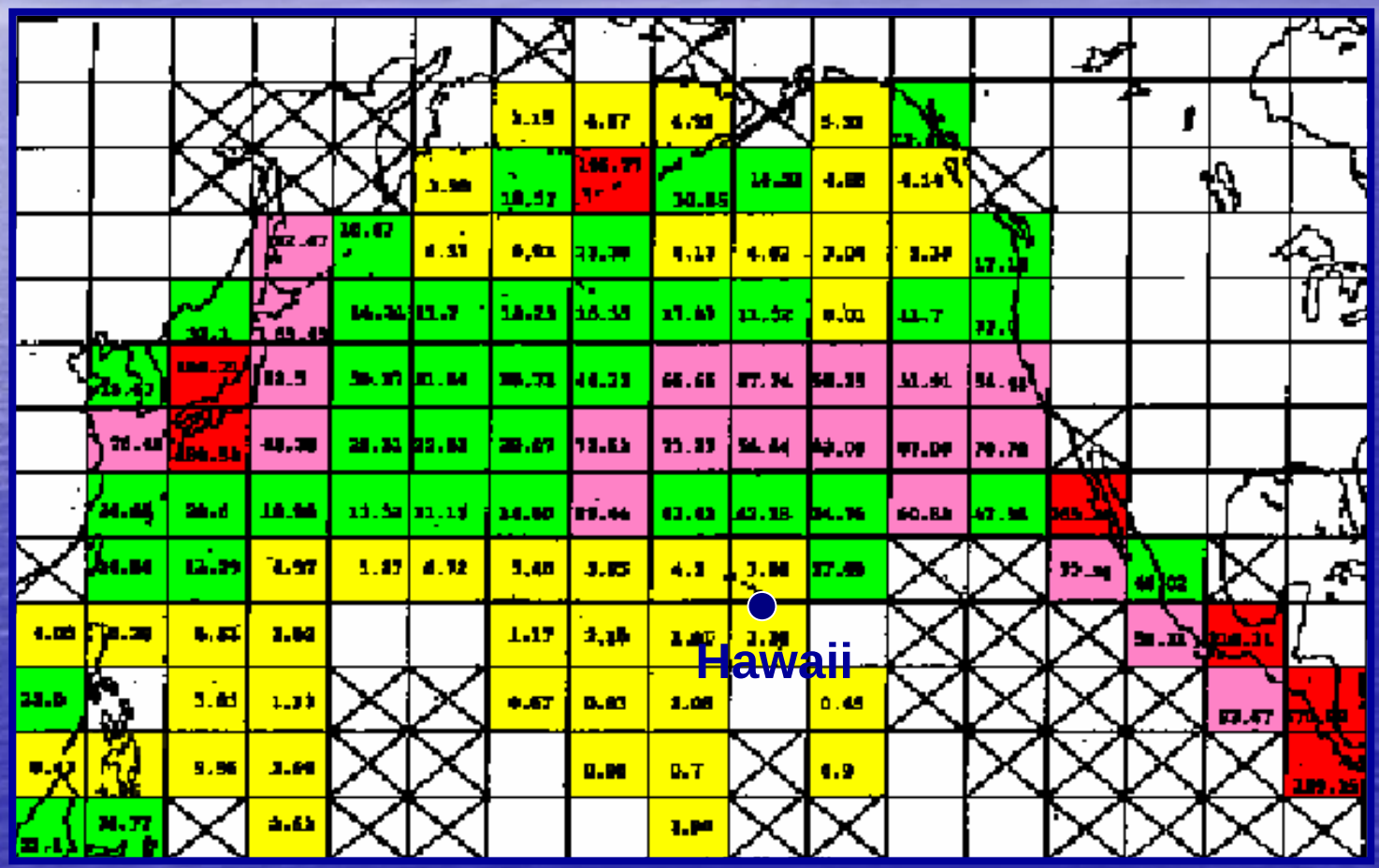
- The breaking strength of biodegradable plastic fiber is very weak, about one-third of nylon fiber.
- Biodegradable plastic fiber is very expensive, not available practical use.
- The deterioration of biodegradable plastic fiber is faster than I expected.

Conclusion

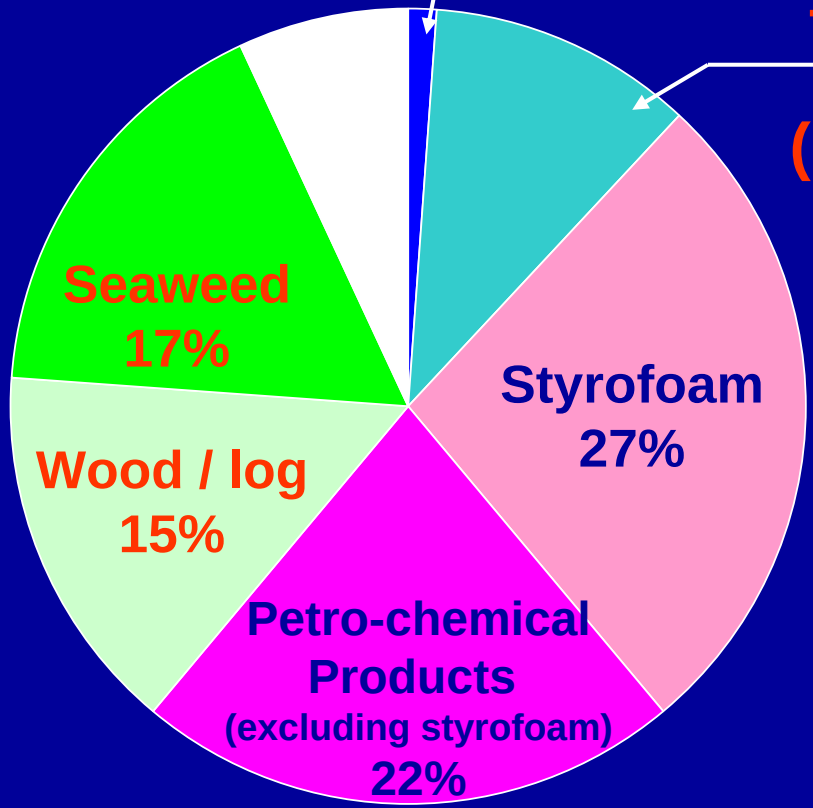
- Lost traps will not continue to capture with dead crabs serving as bait
- Lost traps will capture crabs with a carapace width more than 95 mm.
- Crabs have a tendency to gather around the structures such as boulders and lost traps.
- Lost pot will catch incidentally crabs which occur around the lost traps and this low catch rate after the bait looses its attraction will continue for a long period
- It is not practical to make use of biodegradable plastic netting
- We are testing the deterioration of some kind of the biodegradable plastic fiber (including natural fiber) to make use of a part of a trap.

Coastal cleanup activity : There are a lot of various marine debris in the beach.

Distribution of drifting objects observed in 1988 survey

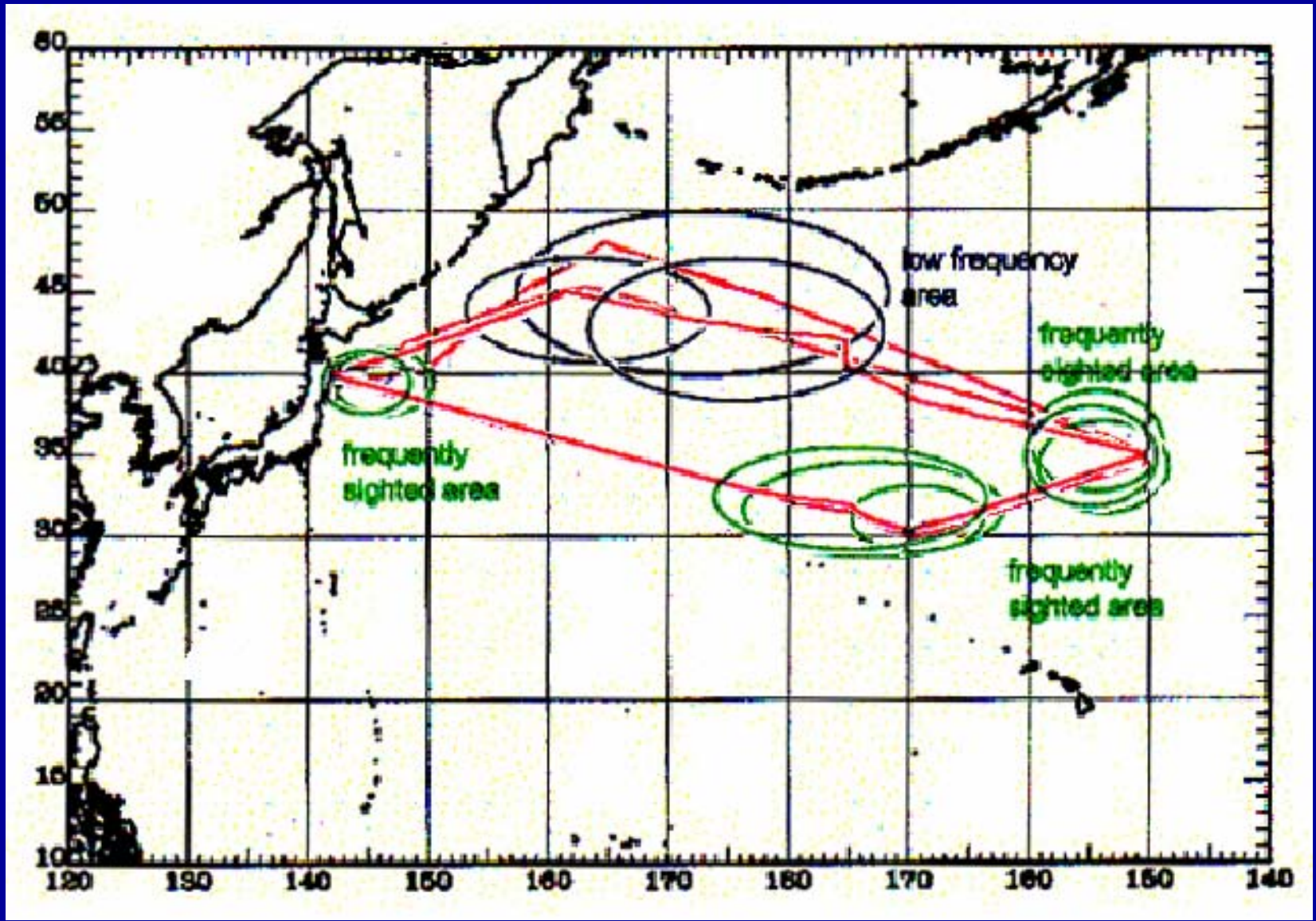


Composition of drifting objects observed in 1988 survey

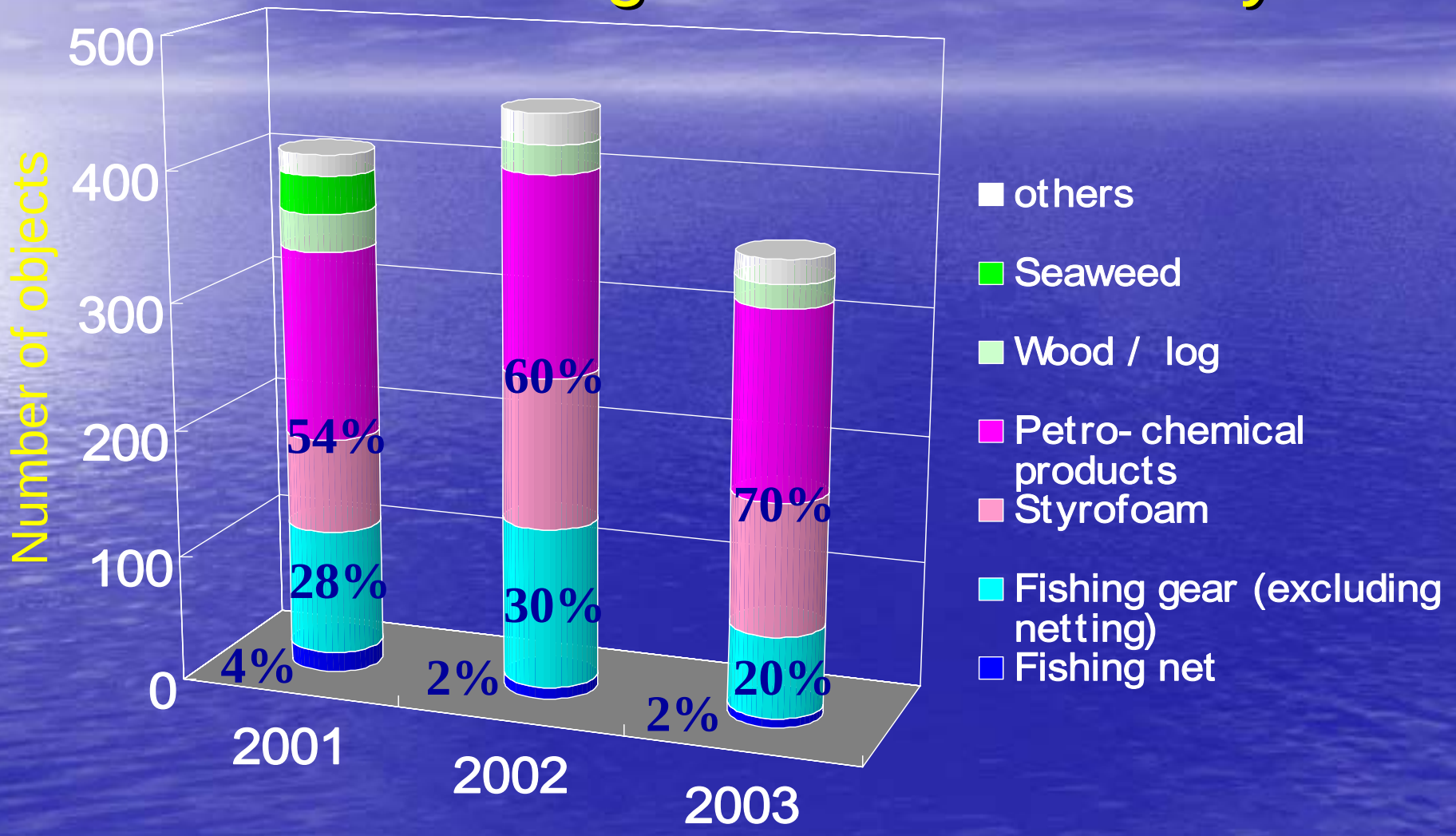


N = 35675

Survey of drifting objects during 2001 - 2003



Composition of drifting objects observed during 2001-2003 surveys



Summary from the sighting surveys in the oceanic area in the North Pacific, 2001-2003

- High density areas of drifting objects were sighted around Japan, and to the northeast and northwest of Hawaii Islands.

- Plastic debris held the majority of the marine debris.

- The share of fishing-related debris was less than 30% of all, especially the share of fishing net was less than 5%.