



Yanagawa, Japan.  
Photo: W.Y. Chiau

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# *Marine Resources and the Wealth of Nations*

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for the environment.

## **Fisheries**

Everyone seems to know that fisheries in the world ocean have been depleted in recent years. But to what extent? How serious has been the effect on food and the welfare of fishermen? And what should be done about this very valuable marine resource? It has been estimated that the total potential of the world fish catch could be 100 million tons. In fact, the catch from the mid-1990s to the present the total capture of fish has hovered around 80 to 85 million tons, with no real increase. But these figures fail to reveal the true state of the fisheries in the world ocean, for they include not only food fish, but fish used for fishmeal and for feed in aquaculture. About 30% of the fish captured is not available for human consumption. Moreover, the depletion of high valued fish has been declining since the 1980s. Some stocks have been reduced to a tenth of their original population since the 1950s.

The Food and Agriculture Organization estimates that 47% of the world fisheries are fully fished and that any additional strain upon them will cause serious depletion. Meanwhile 27% are already over fished or depleted, meaning that they are not reproducing their stocks and will increasingly be exhausted of any worthwhile catch. Only one-quarter of the world's fisheries can be described as moderately fished, allowing some modest exploitation, but not much. Another way of regarding the importance of fish is to compare the size of the catch and its production as human food to the population of the earth. Some regions of the world, like Africa, and particularly developing

The people of earth live on a watery planet. From outer space the astronauts could observe the blueness of the earth, for 71 percent of its surface is covered by water --salt water. Only three percent of earth's water is fresh, a scarce commodity since two percent is locked up in the glaciers of Antarctica and Greenland. Beyond the exploitation of the land inhabited by six billion people, it is the vast world ocean that can enhance the wealth of nations.

The development of marine resources has a long history beginning with fisheries for food and navigation for trade. From ancient times, fishing was a natural resource of food that could be taken freely from the seas. From the 15<sup>th</sup> century onward, sailing ships piloted by great mariners like Cheng Ho from China, Christopher Columbus from Spain, Vasco da Gama and Ferdinand Magellen from Portugal linked the world into one community for trade for the first time in history.

In the twenty-first century all nations, especially those bordering the Pacific Ocean, face new opportunities to develop the resources of the world ocean, not only in fishing and trade, but also in mineral resources and recreation. But every opportunity bears some responsibility-- and today no one can escape the duty to develop resources with due regard



### **The Fourth APEC Roundtable Meeting on the Involvement of The Business/Private Sector in the Sustainability of the Marine Environment**

The Fourth APEC Roundtable Meeting on the Involvement of the Business/Private Sector in the Sustainability of the Marine Environment will be held from **15-16 December 2003**, in **Taipei**.

For more information, please contact with Dr. Wen-Yan CHIAU

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nations depend heavily upon fish as a food, which is nutritious and should be relatively cheap. Yet the world per capita production of food fish has been declining for several years.

How did this abuse of this resource of the world ocean happen? Why did Newfoundland in Canada, whose seas long provided what seemed an inexhaustible fishery lately declare a moratorium on fishing? Every State of the world has been allowed to declare a 200-mile exclusive economic zone by the 1972 Law of the Sea Convention. In this area, coastal States have full jurisdiction over fish, covering an enormous area of the world ocean. Yet fisheries have declined and have been depleted, even where the coastal State could have prevented it.

It is understandable that governments want to protect their fishing industry. They are influenced by fishermen whose jobs are important to the economy and whose catch may provide not only food for their people, but also a commodity for foreign exchange. In consequence governments have provided an increased capacity for fishing by subsidizing new vessels and their equipment while providing other marketing incentives to fishermen to expand their effort. The result has been more effort directed at the same stocks with overfishing and depletion.

Added to this problem have been the illegal catches of fishermen in defiance of conservation measures taken by States. Not all fishermen report their catches honestly and avoid the regulations for conservation or else sell their catch where no real supervision is available. Another concern has been for straddling stocks that cross the 200-mile coastal boundary and may be freely taken with no regard for quotas or fishing season or gear. The UN Fish Stocks Agreement of 1995 could go a long way in controlling that loss by

establishing regional fisheries organizations that allow the parties to board any member vessels suspected of illegal fishing and report them to the flag State for legal action. Two organizations have already been established with that formula and others should follow to conserve straddling stocks.

To maintain a viable fishery industry with ample resources is not hopeless. It will require national determination to enforce conservation measures over its own citizens and to join international arrangements to prevent illegal fishing. Not only can total catch be increased but shares of the catch can be rationally apportioned through international agreements.

A very positive development of fisheries resources has been the pursuit of aquaculture. This is not new to the peoples of Asia, especially in China and India, where for centuries people have had fish ponds. But the extent of aquaculture in size and the application of modern technology is new. The extended use of inland waters and coastal seas is new. Aquaculture production now exceeds 38 million tons per year, worth about \$ 56 billion. That is double its value ten years ago, which represents an annual growth of 7.2 percent Including crustaceans, mollusks, fin fish, and some plants, aquaculture provides for many countries an economic opportunity. It can be, moreover, a partial substitute for the decline in captured fish while conservation measures are implemented and provide additional food for the world. Modern aquaculture offers a very promising development of marine resources in coastal waters.

#### **Trade and Shipping**

In the ancient world the island of Rhodes was known as the "metropolis of trade", the place in the Mediterranean Sea to which the goods of Egypt, Greece,

and Lebanon could be shipped, exchanged, and reshipped by merchants and by fleets of sailing vessels. Today cities like Rotterdam, Singapore, Hong Kong, or Kaohsiung, no larger than Rhodes, depend on trade that circles the world in giant ships. A marine resource that keeps growing in size and value is shipping. Trade is the motor that starts economic development. An efficient exchange of commodities between two States can benefit b worldwide exchange, largely made possible by the merchant fleets, can raise the standards of living of both developed and developing States

The world merchant fleet now consists of 826 million deadweight tons, comprising liquid and dry bulk carriers, tankers, and container vessels. Despite the economic recession in 2001, the tonnage increased by two percent in 2002. Put another way, 45 million tons of new shipping was built in 2002 while 28 million tons were broken up, which made a gain of 17 million tons in that year. Not all types of ships increased their number. The number of tankers held steady, but container vessels increased by 11 percent.

No designated container vessel

*Photo: W.Y. Chiau*



existed in any country 55 years ago. Today there are 2,755 container ships able to carry 5.35 million twenty-foot equivalent containers (TEUs). A dramatic illustration of the development of marine resources has been the container industry, carrying all kinds of cargo to all parts of the world, at reduced costs for fuel, crew, and stevedores, making profits for entrepreneurs and cheaper goods for consumers. Moreover, the containers have constantly increased in size, so that now vessels carrying over 3000 TEUs provide 70% of the world trade.

Marine vessel transportation depends upon trade between nations. Assuming no great civil war or world war and no outbreak of disease that could decimate our populations, a further increase of trade across borders seems very likely. To repeat, trade is the motor that starts economic development. The peoples of Asia and the Middle East, and the peoples of Africa have scarcely begun to reach their potential for development. With increased incomes at their disposal, people seek better and more diversified housing, clothing, and food, with more choice of the luxuries of life. Clearly the Evergreen Group in Taiwan has faith in the growth of trade. The third largest shipping

company plans to spend almost three billion dollars in the next ten years to upgrade its fleet. Between now and 2013 the company expects to take a delivery of 49 new containers. Moreover, to show the remarkable change in the dimensions of container ships, of the 49 new vessels, 24 of them would be able to load 6,000 TEUs.

Bear in mind the wonders of economic growth seen in Japan, Korea, and China. At the beginning of the twentieth century, Japan had virtually no ocean-going merchant ships. Its remarkable development of a navy was eclipsed by World War II and the country was devastated. Yet in the 1960s its average annual economic growth rate was 10 percent and in the 1970s four percent. It shipbuilding industry led the world. And despite a slowdown in the 1990s, Japan is still the third largest economy, an economy that depends almost entirely on international trade.

Korea, once known as the hermit kingdom, isolated from the world, was largely an agrarian economy until 1960. In thirty years its gross domestic product (GDP) soared from about \$2 billion dollars to almost \$300 billion. Ten years later the GDP was \$400 billion. This means that the per capita GDP rose from less than

\$80 in 1960 to over \$8,500 per capita in 2000.

The international trade of China has been a miracle of growth. In 1991 Chinese foreign trade was valued at \$135 billion; in 2001 Chinese foreign trade was valued at \$509. The world GDP growth rate from 1991 to 2001 averaged three percent. The Chinese growth rate over the same period averaged more than eight percent. Today China is the sixth leading trading partner in the world. Some Chinese statistics may be exaggerated, but there can be no doubt of the enterprise and energy that the Chinese people have devoted to their transformation from an agrarian society to a modern industrial society. Unless there is political strife, the future looks very bright in the development of marine resources.

The point of this story is that many less developed countries can learn lessons about the uses of trade and the ability of ships to transcend all national boundaries.

### **Marine Minerals**

The bottom of the seas was once thought to be a vast wasteland. Until the twentieth century man obtained little of value from the coastal zone, sand and gravel, a little tin and coal, thin deposits of gold and diamonds, and pearls in shallow seas. The first drilling for oil on land in the United States in August 1859 was followed by almost eighty years of exploiting gas and oil located under the dry earth. In 1937 the first truly offshore production of oil occurred in the Gulf of Mexico in fourteen feet of water. Since then offshore drilling for hydrocarbons has increased a thousand-fold. Today in the United States, about 29% of all the oil recovered comes from offshore wells and 23% of all the gas recovered comes from drilling into the seabed. The rest of the world has followed, so that drilling for hydrocarbon occurs



Photo: W.Y. Chiau

off the coasts of South America, Europe, Asia, and Africa in waters that are ever deeper, even in places where the seabed is more than a mile below the surface of the sea.

East Asia has been a particular zone of exploration with 598 wells drilled in 2001 and 756 wells drilled in 2002. Despite the high hopes for solar power and wind power as sources of energy, while fear restricts the growth of nuclear power, most experts agree that hydrocarbons will remain the main source of fuel for many years to come. It is significant that most of the oil and gas comes from sedentary rock, but the seabed as whole has been little explored. Perhaps as little as five percent of the earth's seabed has been systematically explored.

Oil has been the lifeblood of the Middle East. It has offered developing countries like Indonesia, Nigeria, and Venezuela opportunities to escape poverty by making use of both their land and their seabed resources. Exploration continues in many areas of the world which once were thought to have no hydrocarbon resources. In the early 1930s geologists believed that the rocks of Saudi Arabia were barren. After the discovery of oil in the North Sea, Norway, once dependent on fish and shipping, became the richest per capita country in the world.

Hydrocarbons offer a splendid opportunity to develop marine resources everywhere. But there are other resources of the seabed hardly exploited. Only recently the energy industry has begun to examine the potential of methyl hydrates, essentially natural gas and water frozen solid, that lie on the basins of continental margins. As with petroleum many years ago, no one can predict the value of such commodities, but such marine resources need to be explored. Polymetallic nodules and ferromanganese crusts have proven mineral content but are as yet

unexploited. The nodules seem to be located in concentrations on the seabed below two to four miles of deep water and contain copper, cobalt, nickel, and manganese. These areas tend to be within the jurisdiction of the International Seabed Authority, which has been setting rules for their exploration and ultimate exploitation. At the moment the investment of States into this enterprise has been minimal, for the resources are available on land and the costs of exploitation far exceed any immediate revenues. But there is a future for this resource, considering our limited knowledge about them and the changes in economy that future decades may bring. The ferromanganese crusts lie in more shallow waters from about 1,200 to 12,000 feet, in crusts up to two feet thick, generally on top of volcanic seamounts. In the future their minerals could be of great value.

To prove how little we know about the seabed, only in 1979 did oceanographers discover the sulfide deposits located on hot springs of the sea floor. From the fiercely hot magma of the earth's bowels, water is expelled with traces of various minerals, building up deposits that could someday be exploited. Moreover, to the amazement of the oceanographers, invertebrates were found on the floor of sea, created from bacteria, life arising without the benefit of any sunlight.

Finally, an entirely new potential marine resource found in coastal zones has been gaining attention. Fifty-percent of all the drugs marketed today come from either natural or synthesized natural sources. Marine organism may

contain many natural products that could be used by the drug industry. The marine environment is exceedingly rich in marine plants, animals, and microbes that might be used for pharmaceutical and industrial purposes. Within the 200-mile continental shelf, all States have jurisdiction over these resources and should be aware of their potential value. Developing States could make contracts with developed States whose laboratories could synthesize the chemistry of these organisms. Mutual benefits would follow for both States and provide great benefits to world health.

### Recreation and Tourism

Two mass movements of people have occurred in the twentieth century. Everywhere people have been moving from the countryside into cities and almost everywhere people have been moving closer to the seas. The reason is easy to explain: As agriculture improves with modern technology fewer people are needed to till and harvest the soil, so they migrate to towns and cities for industry and commerce. At the opening of the twentieth century almost 50 percent of the population of the United States was engaged in the direct production of food; today that number is less than three percent. Moreover, in the developed countries more and more leisure time is available as machines increase productivity, raise standards of living, and require less manual work.

At one time only the rich could afford the time and money for a luxury crossing of the Atlantic Ocean aboard such ships as the *Mauritania*, the *Ile de France*, the *Liberte*, or *Queen*



Photo: W. Y. Chiau



Photo: W. Y. Chiau

Mary and Queen Elizabeth. The airlines killed that trade. But to the great profit of some ship owners, the cruising industry was born – not for transportation but for pure enjoyment of the seas and tours of far-off places. A major marine resource today is the use of ports and ships to provide recreation and entertainment to increasing numbers of people at moderate prices. Around the world there are now about 30 cruise lines. Nineteen major cruise lines employ about 115 ships that carry people across all the oceans of the world. In 2002 there were 11 million bookings on cruise ships. Until recently mostly Americans and Europeans were customers of cruise lines, but now other peoples of the world have found the joy of sailing comfortably with fine food and entertainment to visit foreign ports. Singapore, for example, has developed a vibrant cruise industry in Southeast Asia.

Cruising has also given a lift to the shipbuilding industry. None of the cruise ships have been built in the United States so that both Europeans and Asian countries have benefited from the many sailings from American ports. In 2002 the shipbuilders provided 22 new cruise ships and 9 more are scheduled to be launched in 2003. Moreover, the cruise ships have grown larger and larger to accommodate more and more passengers who have found cruising a great recreation. The *Voyager of the Seas* is a vessel of 142,000 gross registered tons, which can hold 3,200 passengers and a crew of 1,800 sailors, stewards, cooks, entertainers, and others who contribute to the voyage. Of particular interest in the development of these marine resources has been the trend in the composition of passengers. More young people are taking cruises, and in 2002 about 41 percent of the passengers were taking their first

cruise.

Tourism has become a major source of income for many countries of the world, not just Italy with its major art treasures, but countries that have good, clean beaches and beautiful resort hotels. Any State that has a beach front has been endowed with valuable resources that can be developed for its accessibility, its sand, its clean water, and the comforts of a safe and secure beach resort. Developing States in the Caribbean Sea or the Indian Ocean have found imaginative ways to attract tourism to their shores, exploiting a marine resource with profit.

### Conclusion

Many opportunities exist for States in the development of marine resources. Although fisheries have been in some areas and with some species overfished and depleted, a national determination to reduce catch and international agreements to fix quotas while preventing illegal and unreported harvests will go far in preserving fisheries for all to enjoy. In addition the opportunities for aquaculture offer promise to almost every coastal State to increase its fishery resources.

Oceanic trade and shipping have a bright future. The volume and value of trade worldwide has been growing, offering higher standards of living to the people of all continents. Nations have been transformed by their ability to shape their national economies to provide commodities for sale overseas followed by an increased gross domestic product for the benefit of their citizens. Coupled with overseas trade has been the shipbuilding industry with contracts for larger and more specialized ships, especially opportune for some States

since the United States is not a great builder of commercial oceangoing ships.

With a vast seabed virtually unexplored to this day, marine minerals, oil and gas offshore production have not reached their full potential. New drilling, close to the shore of Asia and South America and Africa may reveal exceedingly valuable resources. In the future, waiting to be discovered and developed, lie polymetallic nodules, ferromanganese slabs, methyl hydrates, and sulfide deposits on the hot springs of the ocean floor. Few States yet realize the value of the many organisms that lie within their Exclusive Economic Zone, which contain properties for the manufacture of drugs. Such resources are completely under the jurisdiction of the coastal State and offer great promise for sharing benefits with entrepreneurs capable of transforming those resources into drugs.

A rising standard of living everywhere means more time for leisure and recreation. Cruising on the seas for pleasure has been one of the most remarkable uses of the world ocean in recent decades. Not only has it led to a plethora of ships designed for luxury, with employment for thousands of people engaged in navigation and services, but also to a stimulation of the port economies where the cruise ships stop for recreation. Tourism has become one of the most important sources for revenue for many States. A government that can develop beaches for cleanliness and safety will gain greatly from the ever-increasing number of people who can afford vacations.

# *Minister Thibault Announces Canada's First Marine Protected Area*

*MARCH 7, 2003*

**VANCOUVER** -- The Honourable Robert G. Thibault, Minister of Fisheries and Oceans, today announced the establishment of Canada's first Marine Protected Area (MPA), the Endeavour Hydrothermal Vents Area, southwest of Vancouver Island, British Columbia. Canada's oceans are home to an astounding diversity of plant and animal life. Canadians depend on this rich diversity in many ways. Canada's Oceans Act makes it possible to define marine areas that require special status to protect and conserve the plants and animals that live in those areas.

The Endeavour Marine Protected Area hosts rich, diverse ecosystems unlike anywhere else on earth. In fact, the Endeavour Hydrothermal Vents, which lie deep below the surface of the Pacific Ocean, are home to 12 species of marine life that do not exist anywhere else in the world, and 60 species unique to the Juan de Fuca Ridge system.

"The designation of the Endeavour Hydrothermal Vents as Canada's first Marine Protected Area enables us to preserve and protect an ecosystem

of unique importance for the world," said Minister Thibault.

Establishing MPAs is a key activity of Canada's Oceans Strategy, which was released last year by Minister Thibault. An MPA is an area of the ocean that is designated for special management measures under the Oceans Act. This designation puts in place enforceable regulations to protect the area and its marine organisms, while encouraging continued scientific study and research of this unique eco-system.

"The Endeavour Vents is an important area for scientific researchers around the world," stated Dr. Kim Juniper, Associate Professor at University of Quebec in Montreal and member of the Endeavour research team. "This is a unique biological area where new species have been recently discovered. It was great to be part of a process that involved expertise from such reputable institutes across North America."

"The designation of the Endeavour Hydrothermal Vents as a Marine Protected Area is an important step towards the creation of a national system of Marine Protected Areas which will enable Canada to take its place on the world stage as a

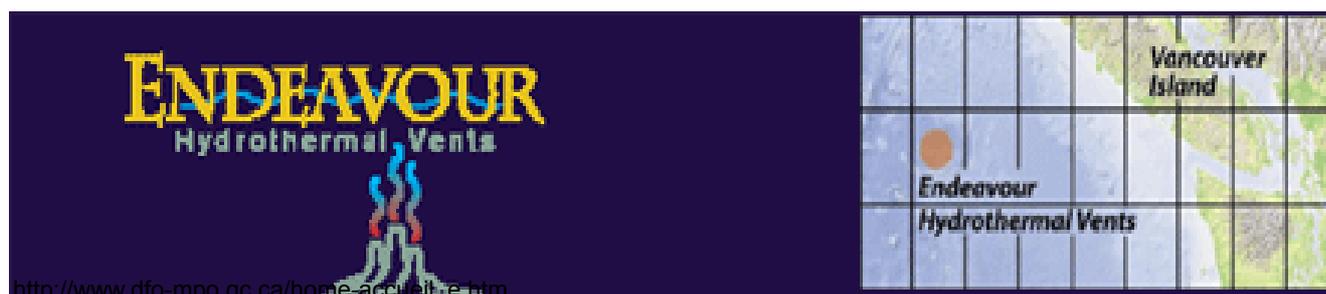
protector of marine ecosystems for the benefit of Canadians and other nations," Minister Thibault added. There are currently 13 areas being considered for designation as Marine Protected Areas on Canada's three coasts, including the Gully, one of the deepest submarine canyons in the western North Atlantic, located approximately 200 kilometres from Nova Scotia. In the southern Beaufort Sea, DFO, the Inuvialuit, and industry are assessing an MPA for critical beluga whale habitats.

Background materials, photos and the Minister's speech are available on the Department of Fisheries and Oceans website at [www.dfo-mpo.gc.ca/home-accueil\\_e.htm](http://www.dfo-mpo.gc.ca/home-accueil_e.htm)

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# *Canada's Marine Protected Area --- Endeavour Hydrothermal Vents*

## *Management Objectives and Actions*



Photo: V. Tunnicliffe

**Management Objective 1: Conserve and protect the ecological integrity.**  
**Current and Potential Activities that could effect ecological integrity:**

- Research activities, including sampling
- Potential non-renewable resource harvesting

**Current Management:**

- Interim management based on voluntary compliance by stakeholders.

**Management Actions:**

- Regulatory designation of the area under the *Oceans Act*, section 35(1), will achieve this management objective.

**Evaluation of Management Actions:**

- The number of access authorisation requests (Management Objective 2) processed will be reviewed, including the number of requests deemed consistent/inconsistent with the management, and the number of requests granted/refused.

- Refer to Management Objective 7.

**Management Objective 2: Monitor and co-ordinate activities through an Access Authorisation Process. Current and Potential Activities that may require monitoring and co-ordination effort:**

- Currently, the majority of activities in the Endeavour area are conducted by foreign research vessels
- Canadian Coast Guard Ships visiting the area to conduct scientific research
- Domestic vessels may carry out operations in the area
- Occasional HMC naval vessel transit through the area, however, this activity is not deemed to compromise the objectives of the MPA

**Current Management:**

- The Department of Foreign Affairs and International Trade (DFAIT) currently administers a foreign vessel clearance request process for vessels planning to carry out activities within Canadian waters:

- Requests from foreign vessels are routed through diplomatic channels to DFAIT.
- DFAIT requests comments from relevant government departments/agencies in the appropriate region(s), i.e. whether the request should be granted or not (Fisheries and Oceans Canada is included on all requests).
- The foreign vessel request process is general to all of Canada's waters (EEZ) and covers foreign vessels only.
- Should the request be granted, foreign vessels conducting work in Canadian waters are required to reserve a berth for a Canadian observer and must submit a post-cruise report.
- As an interim management measure, foreign vessel clearance requests received by DFO for the Endeavour area are currently vetted through the Oceans Directorate and the Endeavour Planning Team to review the requests for consistency with the management plan.
- Fisheries Act
  - The Fisheries Act provides for prosecution of offences involving damage to fish and fish habitat. Although there are no known cases involving prosecution under the Fisheries Act at Endeavour area, it is enforceable as Endeavour lies within Canada's Exclusive Economic Zone.
  - The Fisheries Act also

contains provisions for issuing scientific permits.

Again, these provisions are not currently used in the area, however, it is an available option.

*Management Actions:*

All parties wishing to undertake activities within the Marine Protected Area (with the exception of routine shipping, fishing for highly transient surface species such as tuna, and transient surface and shallow subsurface military operations) will be required to obtain permission, through existing processes, to conduct activities in the MPA. Foreign vessels are and will continue to be required to obtain permission through the Department of Foreign Affairs and International Trade foreign vessel clearance request process under the Coasting Trade Act. The Fisheries Act provision for issuing scientific permits can be used to manage domestic vessel activities in the MPA. Access authorisation requests will be vetted through the Management Committee.

Authorisation is required for all parties (government and non-government) both from within Canada and from outside. The authorisation process will be built into existing regulatory processes and will involve the Endeavour management committee in the review process. The Management Committee will review proposals submitted by parties who wish to carry out activities in the Area. Fisheries and Oceans Canada will review advice from the Management Committee in order to determine whether or not access will be granted. Proposals must include, at minimum, the following information:

- Principal Investigator or Program Operator (if non-research)
- Funding sources
- Rationale for the cruise
- Kinds of activities planned

(including anticipated number and type of samples to be collected; equipment to be left in the area, etc.)

- Specific location of activities
- Duration and approximate dates of the program
- Name of the vessel (if available)
- Number of cruise participants
- Names of any Canadian participants
- Planned dissemination of results

Beyond ensuring compliance with the regulations and objectives of the Area, this process will enable Fisheries and Oceans Canada and the Management Committee to better coordinate activities in the area thus maximising benefits while minimising deleterious impacts to the ecosystem. Currently, this authorisation process is largely accomplished in conjunction with the foreign vessel clearance request process through the Department of Foreign Affairs and International Trade. Review of these requests by Fisheries and Oceans Canada will continue. These foreign vessel clearance requests will also be vetted through the Endeavour Hydrothermal Vents MPA Management Committee. See section 6, Governance Structure. Should access to the Area be authorised, parties carrying out activities in the Area are asked to comply with the Marine

Environmental Quality protocols as described in Management Objective 7.

*Evaluation of Management Actions:*

- The number of access authorisation requests processed will be reviewed, including the number of requests deemed consistent/inconsistent with the management, and the number of requests granted/refused.
- A process for identifying the extent of domestic vessels carrying out activities in the area not captured within the foreign vessel clearance request process will be developed and implemented to continually assess the adequacy of this management action.

- Also, refer to Management Objective 7.

**Management Objective 3: Manage the Salty Dawg vent field to reserve it as an observational research site – deterring intrusive activities.**

*Current and Potential Activities that may effect the Salty Dawg vent field:*

- Few activities currently take place in the Salty Dawg vent field, leaving it a relatively pristine portion of the Endeavour area.
- The relatively unspoilt nature of this vent field provides tremendous potential for examining the effects of human activities in hydrothermal vent ecosystems.



[http://www.dfo-mpo.gc.ca/home-accueil\\_e.htm](http://www.dfo-mpo.gc.ca/home-accueil_e.htm)

- There is potential for intrusive research and mineral exploration and extraction.

*Current Management:*

- As an interim management measure, Fisheries and Oceans Canada – Oceans Directorate reviews foreign vessel clearance requests for the area and vets them with the Endeavour Planning Team to ensure consistency with the management plan.

- Refer to Management Objective 2 for further details.

*Management Actions:*

Management of the Salty Dawg Field will prioritise activities using observation-based or other less intrusive study techniques. All other activities proposed for the Area will be redirected to one of the other three vent fields, as deemed appropriate according to the nature of the proposed activities. Management of the Area will encourage activities in the Salty Dawg Field including:

- infrequent water sampling (no more than once per year), and visits to a single monitoring instrument (maximum once per year) would be the only activities permitted on or near the seafloor;
- acoustic imaging of the field, particularly repetitive mapping would be permitted to document changes in the area;
- water column investigations that have no impact on the seafloor or benthic/near- bottom ecosystems, would be permitted; and
- activities in the area that otherwise contribute to the knowledge and understanding of environmental impacts of human activities on hydrothermal vent ecosystems.

*Evaluation of Management Actions:*

- The number of access authorisation requests (Management Objective 2) processed for the Salty Dawg field will be reviewed, including the number of requests deemed consistent/inconsistent with the management, and the number of requests granted/refused.

- Refer to Management Objective 7.

**Management Objective 4: Manage the High Rise vent field to reserve it for projects focused on education/outreach– deterring more intrusive activities.**

*Current and Potential Activities that may effect the High Rise vent field:*

- The High Rise Field has only been of moderate interest to research activities, resulting in a more

pristine environment as compared to other fields in the area.



Photo: W.Y. Chiau

- The impressive natural features of this vent field, combined with the field’s relatively unspoiled nature, provides excellent opportunities for public education and outreach.

- There is potential for intrusive research and mineral exploration and extraction.

*Current Management:*

- As an interim management measure, Fisheries and Oceans Canada – Oceans Directorate reviews foreign vessel clearance requests for the area and vets them with the Endeavour Planning Team to ensure consistency with the management plan.

- Refer to Management Objective 2 for further details.

*Management Actions:*

The primary management focus in the High Rise Field will be to accomplish objectives of the Education and Outreach Strategy for the Area (Management Objective 8). In particular, a single long-term monitoring site would be encouraged both as a research tool and as an important component of the education/outreach strategy of the Marine Protected Area. Other activities proposed for the area will be redirected to one of the other three vent fields, as deemed appropriate according to the nature of the proposed activities.

*Evaluation of Management Actions:*

- The number of access authorisation requests (Management Objective 2) processed for the High Rise field will be reviewed, including the number of requests deemed consistent/inconsistent with the management, and the number of requests granted/refused.

- Refer to Management Objectiv

**Management Objective 5: Manage the Mothra and Main Endeavour vent fields to reserve them for research projects, including those involving moderate sampling.**

*Current and Potential Activities that may effect the Mothra and Main Endeavour vent fields:*

- The Mothra and Main Endeavour Vent Fields are the most intensively studied venting fields within the area.
- Activity in the area has included a wide spectrum of research activities (observational to intensive sampling operations).
- There is potential for highly intrusive research and mineral exploration and extraction.

*Current Management:*

- As an interim management measure, Fisheries and Oceans Canada – Oceans Directorate reviews foreign vessel clearance requests for the area and vets them with the Endeavour Planning Team to ensure consistency with the management plan.
- Refer to Management Objective 2 for further details.

*Management Actions:*

Research will continue to be the primary management focus for the Mothra Field. Research activities, provided they are consistent with regulations for the Area, will be encouraged.

*Evaluation of Management Actions:*

- The number of access authorisation requests (Management Objective 2) processed for the Mothra and Main Endeavour fields will be reviewed, including the number of requests deemed consistent/inconsistent with the management, and the number of requests granted/refused.

- Refer to Management Objective



Photo: W.Y. Chiau

7.

**Management Objective 6: Develop and Maintain an Information Centre.**

*Current and Potential Activities that effect the availability of information pertaining to Endeavour:*

- A variety of informative resources are available in hard-copy and electronic (on disk and online) formats at disassociated locations.
- Most resources available on Endeavour are maintained in isolation of others.

*Management Actions:*

Many resources are currently available, however, the locations of resources are not currently connected and typically contain resources on subjects more broad than that relevant to the Endeavour Hydrothermal Vents MPA. To be usable, a coordinated resource centre, virtual or physical, is recommended containing information relevant to the Endeavour area. For example, resources available on the InterRidge1 web site include searchable databases of literature references. This resource is extremely valuable on its own, but coordinated along with information on the MPA program and other resources would provide added value to the Endeavour Hydrothermal Vents MPA. Depending upon funding

availability and the development of partnerships with agencies holding various resources on the Endeavour area, Fisheries and Oceans Canada, with guidance from the Management Committee, will strive towards the development of a co-ordinated information centre for the Endeavour Hydrothermal Vents MPA.

The Information Centre would be intended to:

- inform researchers planning to or carrying out activities in the MPA;
- provide resources for education and outreach initiatives;
- provide complete and detailed descriptions of marine resources including their condition and trends over time;
- allow for the advancement of research in the area through information sharing, cooperation, and reduce of duplication of research;
- identify research gaps, providing guidance for further research in the area; and
- provide a repository for confidential information submitted by researchers as part of the authorisation and cruise reporting process (see Management Objectives 2 and 7).

*Evaluation of Management Actions:*

- The success of an Information Centre would be measured both in terms of the amount of information obtained (number of hard-copy documents/disks, and the number of web sites bookmarked) and the extent to which the centre is used. Develop and implement a survey to assess the value and usability of the Information Centre.

**Management Objective 7: Monitor**

## Marine Environmental Quality.

*Current and Potential Activities that requires monitoring of Marine Environmental Quality:*

- . Research takes place in the area, largely driven by individual projects.
- . Few studies have been carried out to examine Marine Environmental Quality (MEQ) of the area.
- There is great potential for implementing MEQ projects to examine anthropogenic effects on the ecosystem.

*Current Management:*

- Submission of a cruise report and data access for cruises in Canadian waters by foreign vessels is a requirement of the DFAIT foreign vessel clearance request process. However, specific MEQ documentation requirements have not been developed for the foreign vessel clearance request process.
- The management plan has been implemented on an interim basis.

Photo: W.Y. Chiau



However, interim management has primarily focused on the implementation of Management Objective 2.

*Management Actions:*

Marine Environmental Quality protocols and indicators will be developed and implemented to prevent and minimise anthropogenic impacts, especially in the High Rise and Salty Dawg areas. The following approaches will be implemented:

- All sampling activities will require before-and-after images of a sample site, properly documented and submitted with cruise reports.
- Submersible and dive operations (be they for research, education or tourism), will be required to record and document complete, continuous videotapes of the entire period on the seafloor, to be archived and remain available should Fisheries and Oceans deem it necessary to obtain copies for auditing purposes.
- All persons/organisations conducting activities in the area will be required to submit cruise reports which clearly account for all time spent at sea and which describe the activities and procedures undertaken must be submitted within two months of all programs. This protocol is consistent with current provisions under the foreign vessel clearance request process administered by the Department of Foreign Affairs and International Trade (DFAIT).
- Vessels carrying out activities in the area will be required to reserve a berth for an observer, which is consistent with current provisions under the foreign vessel clearance request process administered by the DFAIT.

*Evaluation of Management Actions:*

- . The number of access authorisation requests submitted and the number of MEQ documentation/cruise reports submitted, as well as their completeness, will be monitored and tracked.

**Management Objective 8: Develop and implement an education and outreach strategy.**

*Current and Potential Activities that indicates a potential for education and outreach activities:*

- . REVEL (Research and Education: Volcanoes, Exploration, and Life), University of Washington
- MaGIC (Marine Geology Interactive Cruise), University of Washington
- . Dive and Discover: Expeditions to the Seafloor, Woods Hole Oceanographic Institute.
- . Potential exists for more involvement of Canadian participants in education and outreach programs (both for existing and new programs).
- . There is potential for a wider cross-sector outreach effort generating awareness of the Endeavour MPA and hydrothermal ecosystems.

*Current Management:*

- Involvement of the public is mainly managed by US research institutes/universities, the most engaged of which is the University of Washington REVEL project.

- Awareness of the Endeavour MPA within the broadest international scientific community has been reached only by those already interested in the conservation and protection of hydrothermal vents and researchers who have conducted studies in the Endeavour area recently.

**Management Actions:**

To achieve full realisation of the Management Plan, an outreach strategy will be developed and implemented focusing towards financial granting agencies (e.g. Natural Science and Engineering Research Council of Canada, 'NSERC', and the US National Science Foundation, 'NSF', program) and researchers who may or do conduct studies in the Endeavour area. The strategy will be directed towards building co-operation with researchers and funding agencies involved in the Endeavour area.

Consistent with the objectives for Marine Protected Areas prescribed in the Oceans Act, education and outreach will be maintained as a priority throughout the management of the Area. To this end, projects will be encouraged to engage Canadian schools, educators, and the general public in activities taking place in the Area. This may include first hand and virtual involvement by people from a broad variety of backgrounds. Some potential projects are listed below:

- Development of lesson modules for delivery by educators formally in the classroom environment. E.g. Integration with the US REVEL (Research and Education: Volcanoes, Exploration, and Life), which involves school teachers in research cruises to gain a better understanding of current science and technology being applied to research, then apply their experience to classroom activities.

- Development of interactive online information sources with material pertaining to the Area.

- Development of display materials, videos, or other information resources of an education and outreach nature.

**Evaluation of Management Actions:**

- The number of people/organisations reached with the education and outreach program will be tracked.

- Involvement of Canadian participants in hands on outreach programs (e.g. REVEL) will also be tracked.

- In terms of education and outreach directed at researchers and funding agencies, the number of access authorisation requests (Management Objective 2) processed will be reviewed, including the number of requests deemed consistent/inconsistent with the management, and the number of requests granted/refused.

**Principles for the Management of the Endeavour Hydrothermal Vents Marine Protected Area.**

The federal-provincial "Marine Protected Areas: A Strategy for Canada's Pacific Coast" outlined guiding principles for MPA development. Those principles as they relate to the Endeavour Hydrothermal Vents area are discussed below.

**Working Together:**

While Fisheries and Oceans Canada (DFO) has jurisdictional responsibility,

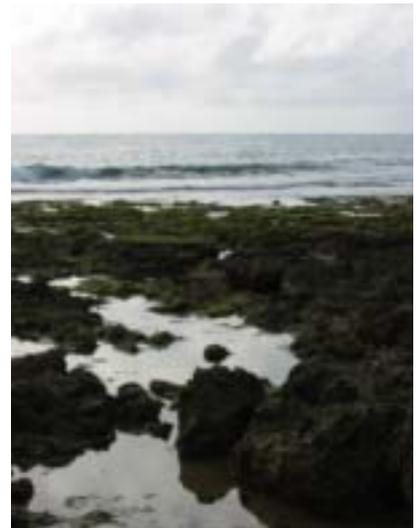


Photo: W.Y. Chiau

achieving the vision, goals and objectives for the Endeavour Hydrothermal Vents area can only be achieved through the co-ordination, co-operation, and partnership with a range of other government agencies, non-government organisations, and individuals. DFO will provide the leadership that fosters this co-ordination, co-operation and partnership.

**Co-operation and Co-ordination:**

Due to the overlaps and limits to the authority of the lead management agencies, accountability is a particularly important issue. The co-operation and co-ordination between DFO, Planning Team member organisations, Advisory Team member organisations, and other stakeholders, is essential to assure the shared accountability for the protection of the resource.

**Precautionary Principle:**

All management actions, including the regulation of appropriate uses, will be based on the precautionary principle. The precautionary principle means, "Erring on the side of caution." This principle puts the burden of proof on any individual, organisation or government agency conducting activities within Endeavour Hydrothermal Vents MPA to demonstrate that there will be no damage to the marine ecosystem from proposed activity.

***Adaptive Planning and Management:***

The natural values protected within Endeavour Hydrothermal Vents MPA will be subject to external influences, and change over time. As such, the management plans for the area, and the ongoing management actions must be adaptive and responsive to the changing social, environmental and economic conditions.

***Open, Informed and Inclusive Decision-Making:***

Effective protection of Endeavour Hydrothermal Vents' values depends on open and informed decision-making. The management planning must be both inclusive and transparent, and supported, to the greatest extent possible, by all

affected organizations and individuals.

***Fostering Ecosystem-Based Management/Stewardship:***

An ecosystem-based approach will be used to manage Endeavour Hydrothermal Vents MPA. This means that management upholds the integrity of the natural ecosystem and its key components, structure, and functions. This approach means that certain human activities may need to be managed or curtailed in order to protect the natural environment.

***Managing for Sustainability:***

Effective management of the Endeavour Hydrothermal Vents area requires focusing on the sustainability of the unique ecosystem. Emphasis will be placed on maintaining viable populations of all species and on the conservation of ecosystem

functions and processes while managing a variety of human activities in the area. The most current scientific knowledge will provide the basis for management decisions.

***Learning by Doing:***

Flexibility has been and will continue to be maintained in the management process to incorporate information relevant to the management of the Endeavour Hydrothermal Vents as it becomes available. This has been facilitated through the participation and cooperation of scientists from government and universities, which will be further encouraged in the development and implementation of a management plan.



Photo: W.Y. Chiau

# Rare Shallow Hydrothermal Vents off Northeastern Taiwan

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Photo: W.Y. Chiau

## Abstract

Kueishantao islet (121°55'E, 24°51'N), about 15 km off northeastern Taiwan, is situated near the southernmost part of the Okinawa Trough which extends westward through the development of an E-W trending graben. Subduction of the Philippine Sea plate beneath the Eurasia plate along Ryukyu trench causes many earthquakes, including one that killed several thousand people on Taiwan on 21 Sept. 1999. Many volcanic islands dot the region and Kueishantao islet is one of the youngest, with the last major explosion occurring about 7,000 yr. ago, followed by four eruptions since then. Today, the islet enjoys warm, humid weather with year-round rain which nurture an abundance of well preserved flora. The Kueishantao islet, which literally means Turtle islet, indeed looks like a real turtle when seen from the coast of Ilan County.

The western tip of the islet is the tail which is covered with gravel and pebbles, and most visitors land there. A Kuanyin temple overlooks a tranquil lake.

The body of the hilly islet reaches the height of 398m. A two-story high observation tower sitting on the summit offers a panoramic view. The eastern tip of the islet is the rounded head which is marked by steep cliffs. This may be the reason why some of the first Westerners to land on Taiwan named the islet Steep Island. A cluster of several dozen vents at about 10~20m water depth off the head of the islet (Figure 1) font emits reduced gases such as hydrogen, methane and hydrogen sulfide. The sulfurous discharge turns the blue waters white and leaves yellowish sulfur particles trailing in its wake. During the northeast monsoon, rotten egg smell of hydrogen sulfide can be detected even in the nearby villages on Taiwan.

Most of the venting mounds have a height of 2m and a diameter of 3~4m

at the base. However, one large chimney sitting at a water depth of 20m, found in August 2000, is about 6m high and 4 m wide at the base (Photo 1). It is the largest shallow-water chimney ever reported. The chimney and these mounds are mainly composed of almost pure elemental sulfur (>99%). Initial attempts to obtain long-term temperature records in a fumarole were unsuccessful because the deployed thermocouples with stainless steel casting were either corroded away or lost. The authors then chose to record the temperature from a vent that is lower in temperature with less corrosive discharge. It is clear that the temperature shows diurnal and fortnightly cycles. The emitted hot fluids have the characteristics of high temperature (40~116°C, Photo 2), strong acidity (pH<2), high metal contents but low dissolved oxygen. The acidity is the highest among underwater vents in the world (Photo 3). In addition, the major ion composition is somewhat different from normal seawater, suggesting water-rock alterations under high temperature under the sea bed.

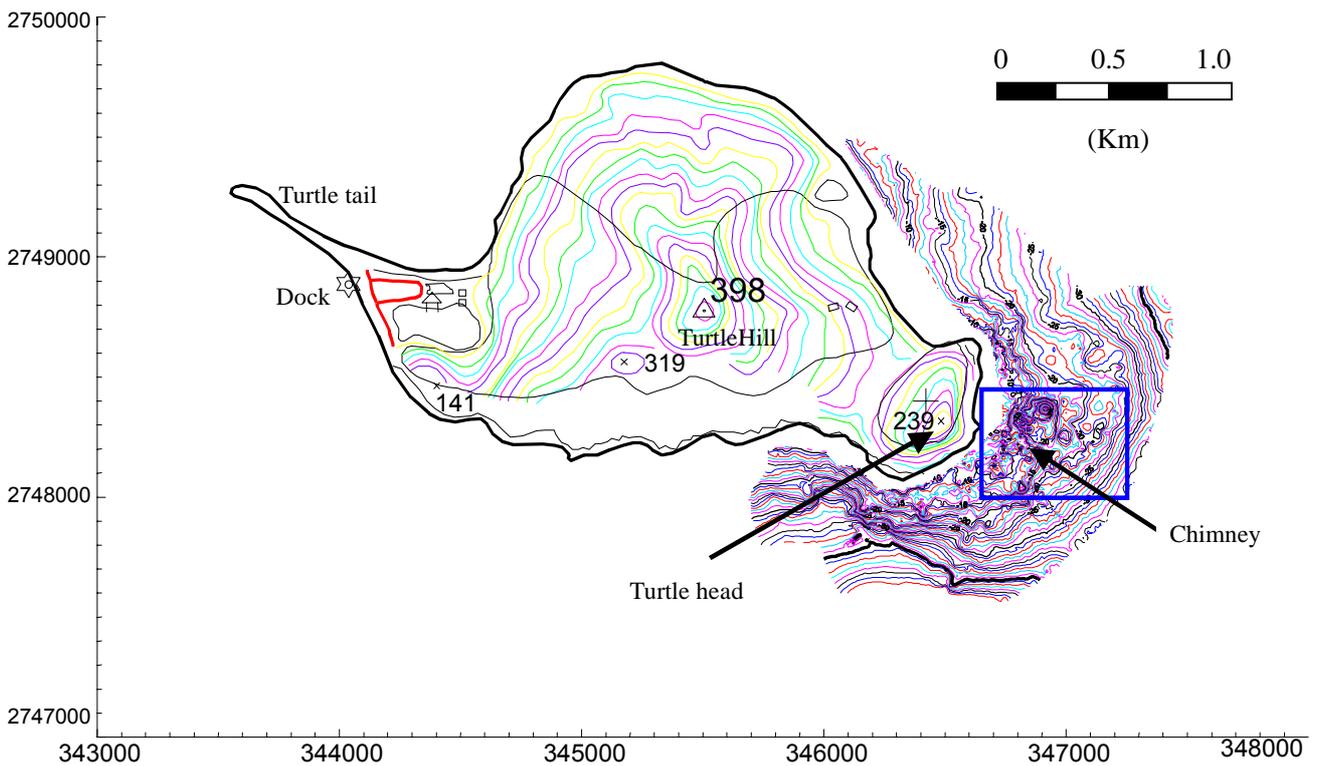


Figure 1. Topography and bathymetry of Kueishantao islet and the thermal field.

Left-up. A massive chimney among dozens of undersea spouts.

Right-up. The thermometer recording 110°C.

Right. A scuba diver in action—Sampling the boiling, highly corrosive hydrothermal fluid.



# *Formation of a Sustainable Coastal Margins Program (SCMP) at Texas A&M University*

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"Coastal margins" are holistically defined as the watersheds (rivers, tributaries and drainage basins) that interface with coastal areas; the bays, lagoons, and estuaries seaward of the coast; the barrier islands and that portion of the continental shelf that influences processes in coastal waters; and the human population, infrastructure and industries that reside within these areas. Coastal margins are one of the greatest natural resources and economic assets in Texas and the U. S. Yet coastal margins are arguably placed at the greatest risk. Migration into the coastal margin is already occurring, with over 80% of the American population expected to be living within 50 miles of the coast by 2010. Presently fewer Texans are living in coastal margins than this projection. The Texas coastal margin is anticipated to experience significant development pressures as its population increases and these projections are realized. Texas A&M University is poised to play a central role in this emerging issue for the State.

The Sustainable Coastal Margins Program (SCMP) was formed in November of 2000 by the action of the Provost and Vice President for Research of Texas A&M University. SCMP was chartered with a commitment to hire 14 new faculties and fund 10 Graduate Assistantships, on a permanent basis, in the general area of sustainable development of coastal margins.

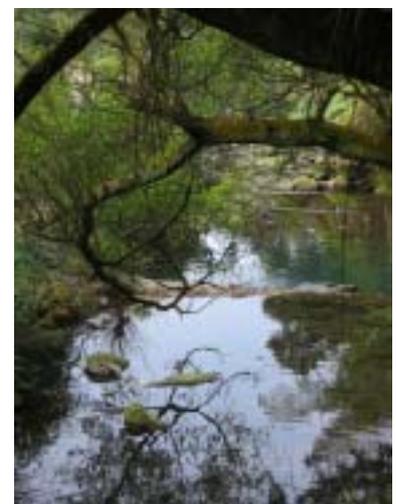
There are five topical focus areas included under SCMP. A team of faculty, researchers and staff will provide leadership to foster collaboration, partnering, and coordination to develop interdisciplinary research, offer joint degrees, share faculty appointments, create majors in environmental studies/sciences, develop highly competitive research proposals for state, federal, and private sector research dollars, and promote linkages to external organizations and programs with complimentary missions. The Team is committed to establishing Texas A&M University as a leader in research, education, service and outreach in support of the sustainable utilization of natural resources in coastal margins worldwide.

The Sustainable Coastal Margins Program was formed to:

- Enhance fundamental scientific understanding of the structure and functioning of coastal margins;
- Promote a more complete understanding of the interconnectivity of the physical, biological, geological, chemical, ecological, social, behavioral and public policy components of coastal margins;
- Create a program to produce educated and informed scientists, technicians, resource managers, government officials, and lay public; and

- Develop mechanisms to coordinate access to the human and economic resources that must be brought to bear on these important issues.

The sustainable development of coastal margins can only be accomplished by interdisciplinary education and research. Due to its uniqueness, its importance to the economy of the Texas, and the extensive natural resources that it contains, it is expected that most of the Team's efforts will be focused along the Texas coastal margin. However, the lessons learned in Texas will be applicable worldwide. The SCMP will catalyze synergy among the diverse talents and elements of Texas A&M University and elevate the University to national prominence in all matters related to coastal margins.



*Photo: W. Y. Chiau*

# *Ocean and Coastal Policies in Taiwan: Recent Initiatives and Issues*

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*CHINESE TAIPEI*



*Photo: W. Y. Chiau*

As documented in much literature, Integrated Coastal Management (ICM) is a continuous and dynamic process by which decisions are made for the sustainable use, development, and protection of oceans, coasts, and islands. ICM should lead to sustainable development of coastal and marine areas, reduction of conflicts and vulnerability, as well as maintenance of natural processes and biological diversity. In this regard, an integrative approach is essential to overcome fragmentation in sectoral management and jurisdiction levels. Dialogue and participation mechanisms should be provided to relevant stakeholders so that coherent ocean and coastal policies can be made.

The environment of islands requires more deliberated planning and management for their sustainable development. This is certainly no less true in Taiwan with its limited land area and resources but highly dense population. With a total

area of only 36,000 square kilometers and a population of more than 23 million, Taiwan is one of the most densely populated areas in the world. Added to this, since two-thirds of the total area is covered by mountains, the seas and coastal areas have been attracting numerous developers seeking space for projects of all types. Frequent conflicts as to the different uses for the limited space are unavoidable and common on the island. Therefore, there is a necessity to strengthen the performance of ocean and coastal management.

Like anywhere else in the world, land-based pollution is one of the most serious issues in Taiwan. Today, two-thirds of all rivers in Taiwan Island and most of its marine environment are polluted. Although several relevant laws on water and marine pollution control have been promulgated, a significant volume of untreated wastewater is still directly discharged into rivers. This has been a serious concern due to decreasing fisheries production and far too frequent cases of astounding pollution in coastal waters. The

seriousness of marine pollution also signifies the necessity for an integrated approach to land and marine management.

In addition to land-based pollution, incidents, such as oil spills, very often pose threats to the marine environment of Taiwan. One incident involving the oil spill from the Greek ship *Amorgos*, grounded on January 14 2001, severely damaged the coast along Kenting National Park in southern Taiwan. Although the "Marine Pollution Control Act" was passed in 2000, this incident made it clear-cut that the response system to that oil spill was much too weak. Marine pollution prevention and contingency planning are definitely important because Taiwan is located on the strategic point of the major shipping and oil transportation routes of East Asia. Due to the lack of experience in Taiwan, it is necessary to strengthen multilateral and/or international cooperation with respect to combating disasters, such as oil spills.

In response to the problems which have negatively impacted the marine environment, Chinese Taipei has been undertaking several programs to better manage its critical, yet so fragile, marine environment. However, administrative authority over ocean and coastal management is widely dispersed among a large number of government agencies at both the central and local levels. Moreover, the marine environment in Taiwan, needless to say, is suffering from environmental degradation,



**The East Asian Seas Congress 2003 features:**

- The Ministerial Forum on the Sustainable Development of the Seas of East Asia (**12 December**)  
Concerned ministers and officials from the host country, Brunei Darussalam, Cambodia, People's Republic of China, Democratic People's Republic Korea, Indonesia, Japan, Malaysia, Philippines, Republic of Korea, Singapore, Thailand and Vietnam will consider to adopt the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA).
- The International Conference on the Sustainable Development of the East Asian Seas: Towards a New Era of Regional Collaboration and Partnerships (**8-11 December**)  
Concerned stakeholders - policy-makers, economists, environmental and natural resources managers, non-government organizations representatives, media practitioners, the academe, civil society and the private sector - will gather to discuss ways to strengthen regional collaboration, promote synergies and linkages among existing regional and global programmes, and work towards achieving sustainable coastal and ocean development in the East Asian Seas region.

habitat loss and growing conflicts among resource users. In addition to all that, a significant portion of the coastal zones has been confronted with the problem of erosion. In response to the above problems, some major new initiatives on ocean and coastal management in Taiwan have been taken. These include:

- The promulgation in March 2001 of the *White Paper on Marine Policy*, which is based on the concept of sustainable development of the marine environment, serves as the fundamental framework and includes guidelines for marine utilization and protection.
- The enactment of the *Major Maritime Laws* including the *Exclusive Economic Zone and Continental Shelf Act* and the *Territorial Sea and Contiguous Zone Act* in 1998 and the *Marine Pollution Control Act* in 2000.
- The drawing up of the *Coastal Management Act* which will soon be given further review by the Legislative Yuan.
- The enforcement of the *Tideland Reclamation Management Regulations* and the establishment of 'the permission to develop' and 'environmental impact assessment' (EIA) systems.
- The development of a new "*Integrated Coastal Zone Management Plan*" and the revisions to the "*Natural Environment Protection Plan for Taiwan's Coastal Areas*" of 1984 and 1987.
- The setting up of the *Leading*

*Agency* for the Ministry of Marine Affairs, which may be in force around 2004.

- The formation of an *Action Plan for Sustainable Development* in response to the *Implementation Plan of the World Summit on Sustainable Development* (WSSD), held in South Africa in August 2002.

It is true that the government of Chinese Taipei has adopted several measures to protect its marine environment, but conflicts of coastal projects on the same site, which lack of integration, are not uncommon. Very often, agencies such as on fisheries, harbor construction and tourism may initiate their own new projects without cooperation and collaboration. Criticism is also raised from the lack of consultation with the environmental organizations and local residents. In addition, difficulties of marine governance with respect to enforcement still prevail. To cite an example, destructive fishing in the Dongsha (Pratas) Islands represents, to say the least, an awkward situation in maritime enforcement. Starting every April, thousands of fishing vessels from mainland China, Hong Kong, Vietnam and Taiwan Area operate around the Dongsha Islands. Being unmonitored, very often they use cyanide and explosives, thus severely damaging the precious reef ecosystem of the Dongsha Reef Atoll. It is, in fact, estimated that more than 90% of the coral reefs in Dongsha are bleached or already dead. Although a marine-protected area (non-fishing zone) in

Dongsha has been delineated by Chinese Taipei, the situation requires further active support and cooperation for marine resource conservation within the region. The protection of fishery resources deserves priority because it is closely related to the mutual benefits not only of Taiwan but also of other countries in the western rim of the Pacific.

Definitely, Chinese Taipei needs to strengthen its ICM policies and relevant mechanisms to lead to a harmonized vision between the marine protection and the human development. It is also believed that the time has come to establish mechanisms for regional cooperation in the sustainable development of the marine environment in the APEC region. For example, a series of conferences and/or workshops to provide useful forums for the sharing of experiences and exchanging information should be encouraged. The exchange of scholars and other programs would also be feasible and invaluable to help all of APEC region achieve our mutual benefits. The establishment of a regional marine and coastal governance association deserves further consideration in the near future. It is believed that greater understanding, peace, health, security and sustainable development within the region can be achieved in the future through consensus on the above mechanisms. In doing this, our mutual benefits and opportunities for sustainable development will be strengthened.