

## Marine and Coastal Management in Taiwan from the Perspective of ICZM Principles

Wen-Hong LIU\*    Jui-Chung KAO\* \*

**Abstract:** Surrounded by sea waters, Taiwan is a densely populated island with only a few flat lands. Due to the scarcity and high value of available land, the coastal zone seems to provide potential sites to meet various needs of further development and to attract both public and private developers. However, coastal zones in Taiwan have not been well planned and used, resulting in problems such as loss of natural coastline, destruction of natural habitats and decline of living marine resources. The coastal zones in Taiwan are under heavy pressures of rapid development and incompatible uses, leading the Taiwan authorities to have to devote efforts to improve coastal zone management. However, a few problems still remain to be solved. Therefore, this study analyses the background and evolution of marine and coastal management in Taiwan to figure out the thread of coastal management. Next, the ICZM principles are used to examine the coastal management framework in Taiwan. The progress, performance and problems of coastal management are also analyzed to find drivers/triggers, obstacles, future opportunities, and future threats. Finally, suggestions are proposed according to principles and practices from Europe.

**Key Words:** ICZM; Marine and Coastal Management; Taiwan

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\* Wen-Hong LIU, Associate Professor, Department of Fisheries Production and Management, National Kaohsiung Marine University, Taiwan. E-mail: andersonliu@mail.nkmu.edu.tw. This research was made possible with the financial support of the "National Science Council" (Grant No. NSC 962415H022003).

\* \* Jui-Chung KAO, Assistant Professor, Department of Logistics Management, National Kaohsiung Marine University, Taiwan.

## I . Introduction

After several years' marine and coastal management in Taiwan, now it is time to review its performance and problems. Marine and coastal management is guided by the principles contained in the Rio Declaration on Environment and Development with special emphasis on the principle of intergenerational equity, the precautionary principle, and the "polluter pays" principle. Several guidelines for integrated coastal zone management (ICZM) are listed in the following pages.<sup>①</sup> Firstly, this paper describes international principles of coastal management, from which some key principles are pinpointed. Reference will be made to these key principles when discussing the background and evolution of marine and coastal management in Taiwan in order to ascertain the progress of such management practice. Secondly, the key principles, i. e. the EU ICZM principles, are used to examine the coastal management framework in Taiwan. The performance and problems of coastal management are also analyzed vis-à-vis cases of fisheries and marine environmental protection to identify drivers, obstacles, future opportunities and future threats. Finally, recommendations are proposed based on coastal zone management practices around the world.

## II . International Guidelines/Principles of ICZM

Marine and coastal management is guided by principles on environment and development that have been endorsed by the international community at the 1992 United Nations Conference on Environment and Development (UNCED) and in subsequent international agreements. These principles include the right to develop, intergenerational equity, obligation to perform environmental assessments, precautionary approach, the polluter-pays principle, and openness and transparency in the decision-making process.<sup>②</sup> In turn, the international principles of ICZM have been drawn from international conventions, guidelines and experience in other fields. Such principles include the precautionary principle, intergenerational equity, the polluter-pays principle, par-

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① Cicin-Sain B. and Robert W. Knecht ed., *Integrated Coastal and Ocean Management: Concepts and Practices*, Washington D. C.: Island Press, 1998.

② Research, Development, and Evaluation Commission ed., *Ocean Policy White Book*, Taipei: Research, Development, and Evaluation Commission, 2006. (in Chinese)

ticipatory approach, stakeholder involvement, long-term perspective and trans-boundary responsibility. There are also methodological principles that can be applied in management and planning, for example, holism, collaboration, ecosystem approach, adaptive management, and the iterative and focused approaches.<sup>①②</sup> All these principles can be classified according to scale, dynamic process/uncertainty, system approach/interconnectivity, societal/governance and resources management (Fig. 1).

At the same time, some principles to be followed have been drawn from international experience demonstration programmes, most notably, the eight principles of holistic approach, working with natural processes, long-term perspective, participatory principle, adaptive approach, address of local issues, support and involvement of relevant administrative bodies and combination of instruments to ensure good coastal zone management, which were distilled from 35 projects of the EU Commission's demonstration programme on ICZM from 1996 to 1999.<sup>③④⑤</sup> The eight principles cover a range of perspectives on ICZM.<sup>⑥</sup> Some principles not mainly focused on ICZM are excluded from EU ICZM principles, such as the precautionary and the polluter-pays principles. EU principles are based on practical experience of application assessment and a significant amount of developmental works. Therefore, this study will examine the progress of Taiwan ICZM in the light of the eight principles of EU ICZM.

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① Stephen Olsen, James Tobey and Meg Kerr, A Common Framework for Learning from ICM Experience, *Ocean & Coastal Management*, Vol. 37, No. 2, 1997, pp. 155~174.

② Robert Kay and Jacqueline Alder ed., *Coastal Planning and Management*, London: Routledge Press, 2000.

③ European Commission ed., *Better Management of Coastal Resources: A European Programme for Integrated Coastal Management*, Luxembourg: Office for Official Publications of the European Communities, 1997.

④ European Commission ed., *Towards a European Integrated Coastal Zone Management (ICZM) Strategy: General Principles and Policy Options*, Luxembourg: European Commission, 1999.

⑤ European Commission ed., *EU Focus on Coastal Zones: Turning the Tide for Europe's Coastal Zones*, Luxembourg: Office for Official Publications of the European Communities, 2001.

⑥ John McKenna, Andrew Cooper and Anne M. O'Hagan, Managing by Principle: a Critical Analysis of the European Principles of Integrated Coastal Zone Management (ICZM), *Marine Policy*, Vol. 32, 2008, pp. 941~955.

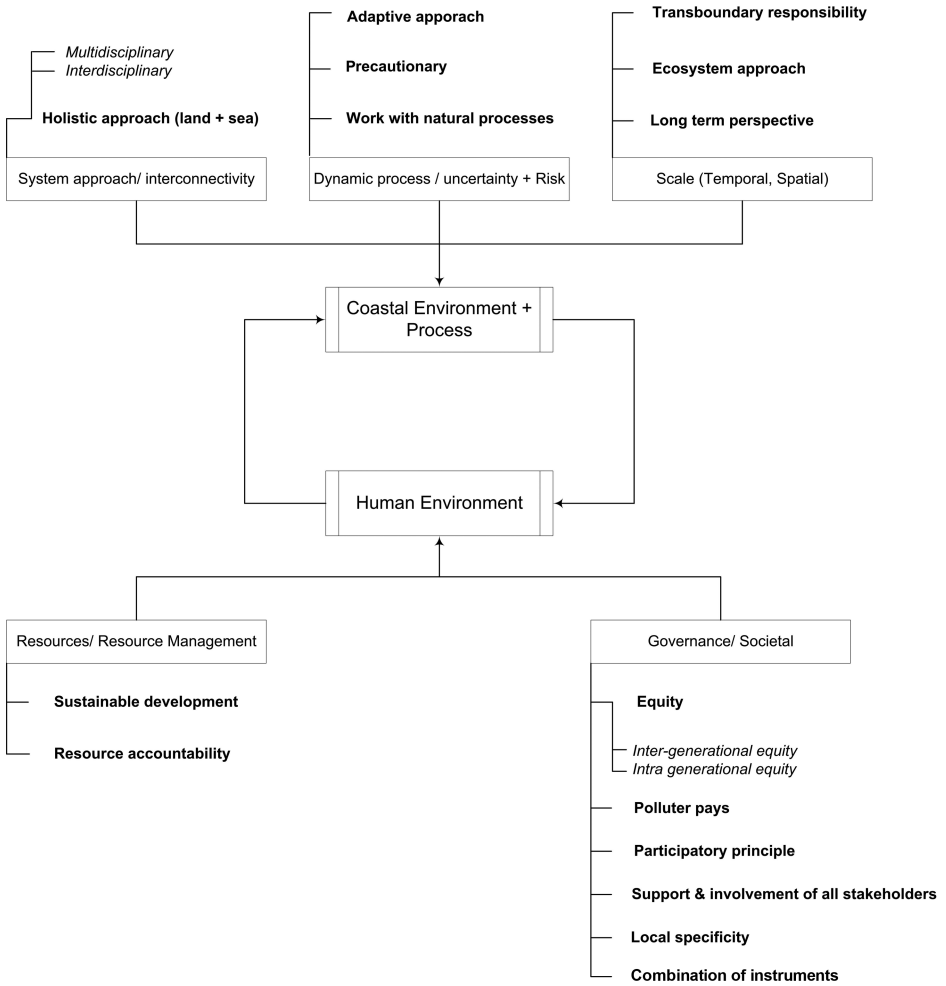


Fig. 1 The Principles of Coastal Management

### III. Taiwan Geography and Coastal Management

The island's coastline is approximately 1,139.2 kilometres and its total land area is 35,879.3 square kilometres (Fig. 2). To the west of Taiwan there is a continental shelf, whose average depth is 60 metres. Along the western coast we find beaches, sand dunes, lagoons, estuaries, wetlands and extensive tidelands. To the east of Taiwan is the Pacific Ocean, whose seabed and ocean trench are very deep. The depth of the water from the coast to a distance of six

nautical miles can reach 3,000 metres. Gravel beaches, rocks, bays and cliffs can be found on the eastern coast.<sup>①</sup> The continental coastal current flows southward from mainland China in the winter. There are several upwellings on both sides of Taiwan. Likewise, owing to the mild climate and special marine environment, natural reefs abound in the marine environment, making it an excellent fishing environment. As a consequence, there are over 2,000 fish species, comprising one-tenth of global bio-species. In addition to fishing, other activities in the marine environment include marine transportation, marine tourism, and the extraction of living and non-living marine resources.

Currently, the population of Taiwan is more than 23 million people. With an area of only 36,000 square kilometres and more than two-thirds of the island covered by rugged mountains, the urban population in the coastal zone is 4.4 million. Due to the scarcity and high value of available land, the coastal zone offers potential sites to meet various development needs and has attracted the interest of both public and private developers.<sup>②</sup>

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① Research, Development, and Evaluation Commission ed., *Ocean Policy White Book*, Taipei: Research, Development, and Evaluation Commission, 2006. (in Chinese)

② Chiau W. Yen, *Background Information-Coastal Zone Management in Taiwan: A Review*, Keelung: International Workshop on Coastal Planning and Management, 2006, pp. 77~90.

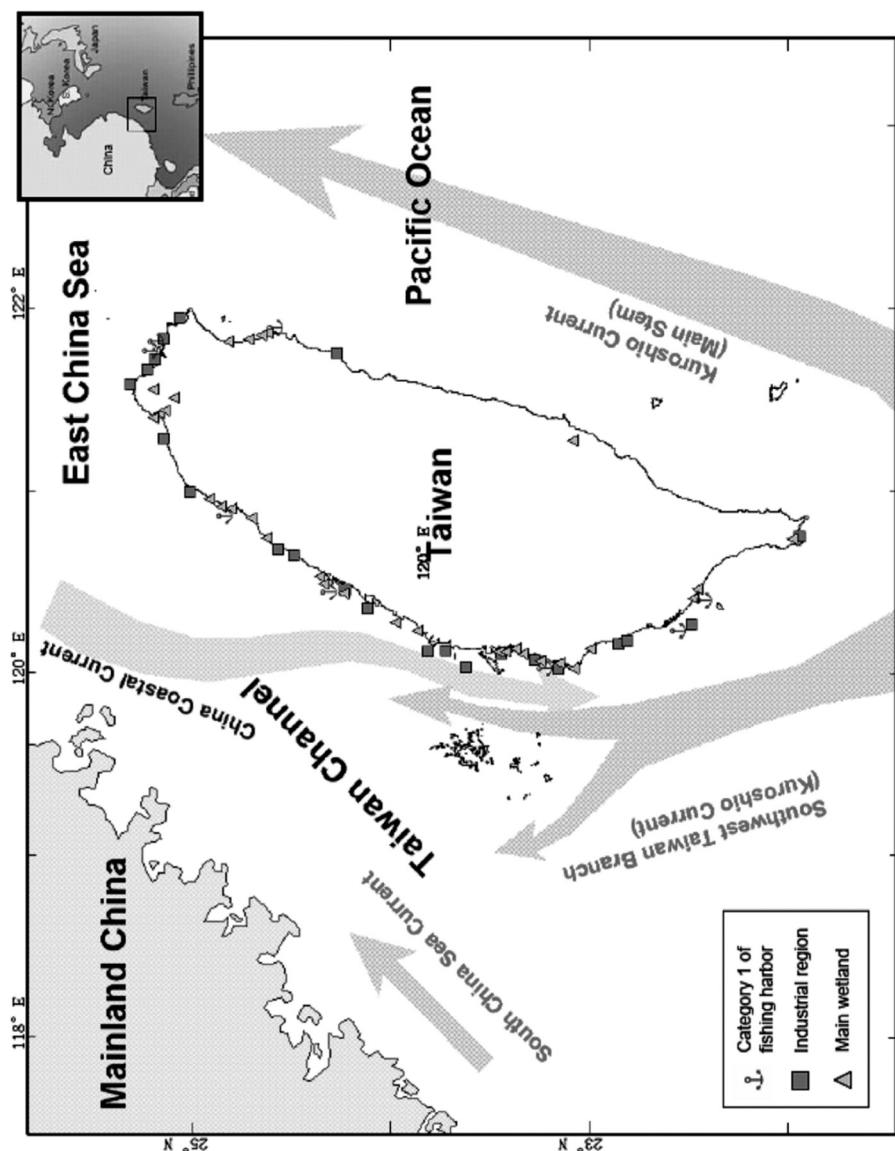


Fig.2 The Geography of Taiwan Coast

## A. Issues

In the course of coastal management evolution, obstacles to its effectiveness have been identified in/as appears in Table 1. In the past two decades, several sources of pollution to the marine environment have become common, including river pollution, waste yards in river basins, other waste pollution, flotsam and jetsam, nuclear power plant discharge, warm water emission from desalination plants, pollution from vessels in ports and bays, oil spills, sea-water bathing activities, coastal engineering, etc.,<sup>①</sup> especially in the western and southern parts of the island. The most serious problems, however, have resulted from river pollution, industrial waste, heavy metals, coastal engineering and oil spills. Recent examples of such problems are the “green oysters” in Erhjin estuary in 1986 and Hisangsan and Anpin Mariculture Areas during 1991 – 1998, and the “Amorgos oil spill” in 2001. <sup>②③④⑤⑥</sup>

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① Control Yuan ed., *The Symposium of Reports of Marine and its Relative Issues Investigation*, Taipei, Taiwan: The Control Yuan, 2004. (in Chinese)

② Control Yuan ed., *The Symposium of Reports of Marine and its Relative Issues Investigation*, Taipei, Taiwan: The Control Yuan, 2004. (in Chinese)

③ Han B. C. Cheng and Tsu C. Hung, Green Oysters Caused by Copper Pollution on the Taiwan Coast, *Environmental Pollution*, Vol. 65, No. 4, 1990, pp. 347~362.

④ Lee C. Lin, Huei Y. Chen, and May Y. Chuang, Use of Oyster, *Crassostrea Gigas*, and Ambient Water to Assess Metal Pollution Status of the Charting Coastal Area, Taiwan, after the 1986 Green Oyster Incident, *Chemosphere*, Vol. 33, No. 12, 1996, pp. 2505~2532.

⑤ Han Bor-Cheng, Woei L. Jeng, Tsu C. Hung, Yong C. Ling, Ming J. Shieh and Ling C. Chien, Estimation of Metal and Organochlorine Pesticide Exposures and Potential Health Threat by Consumption of Oysters in Taiwan. *Environmental Pollution*, Vol. 109, 2000, pp. 147~156.

⑥ Chiau W. Yen, Changes in Marine Pollution System in Response to the Amorgos Oil Spills in Taiwan, *Marine Pollution Bulletin*, Vol. 51, No. 8~12, 2005, pp. 1041~1047.

**Table 1 Key Issues of Marine and Coastal Management in Taiwan**

Issues	Main idea
<p>Inadequate coastal environmental protection</p>	<p>Marine pollution prevention</p> <ul style="list-style-type: none"> <li>■ Several common sources of pollution to the marine environment</li> <li>■ Most serious problems being from river pollution, industrial waste, heavy metals, coastal engineering and oil spills</li> </ul> <p>Coastal defence</p> <ul style="list-style-type: none"> <li>■ Many rapid changes in land use and increased erosion of the coastline</li> <li>■ Land subsidence, depredation lagoons and estuaries</li> <li>■ Disappearance of the natural shoreline and wetlands on the west coast</li> </ul>
<p>Inadequate coastal resource conservation</p>	<ul style="list-style-type: none"> <li>■ Declined fishery resources and changed catch composition</li> <li>■ Over-exploitation or pollution of most of the coral reefs, wetlands and lagoons leading to biodiversity reduction</li> </ul>
<p>Conflict between industrial development and fishery production</p>	<ul style="list-style-type: none"> <li>■ Critical tideland reclamation for industrial and residential sites</li> <li>■ Conflict between marine tourism and fishing ports' usage</li> </ul>
<p>Failure to establish institution overseeing coastal management practice</p>	<ul style="list-style-type: none"> <li>■ Lack of an organisation in charge of marine and coastal management</li> <li>■ Inadequate legislation to protect the coastal environment</li> </ul>
<p>Insufficient marine scientific research and lack of marine education</p>	<p>Marine scientific research</p> <ul style="list-style-type: none"> <li>■ Dispersed marine environmental science research</li> <li>■ Differences in investigating method, terminology, and research scope</li> <li>■ Ignorance of marine scientific research</li> </ul> <p>Marine education</p> <ul style="list-style-type: none"> <li>■ Lower level of marine scientific research compared with other countries</li> <li>■ Few teachers involved and lack of funding</li> </ul>



There have been many rapid changes in land use and increased erosion of the coastline due to sand mining, the establishment of reservoirs, tideland reclamation, and port, harbour and artificial reef constructions along stretches of the coastline. For instance, the shoreline of Pali in the North-west of Taiwan has retreated 500 metres in the past twenty years.<sup>①</sup> Mangroves have also been cut down, heavy extraction of groundwater has led to subsidence, and lagoons and estuaries have suffered depredation.<sup>②③</sup> Land subsidence area is four times greater in Taipei City than anywhere else in Taiwan. The maximum subsidence amount was 3.22 metres in Pingtung County in 2002, the fastest subsidence rate was 23.6 cm/year in Changhua County in 1997, and the largest area of subsidence was 610 square kilometres in Yunlin County in 2002.<sup>④</sup> Further, and more importantly, the natural shoreline and wetlands on the west coast will disappear if the 80 or more projects that have been proposed here are carried out.<sup>⑤</sup> The natural coastline has decreased dramatically in the past few decades as a result of the creation of artificial jetties, in some cases as long as 557 kilometres, and industrial areas covering over one-third of the Taiwan's coastline.<sup>⑥</sup>

Coastal fishery production has decreased from the highest production of 56,700 tonnes in 1986 to 49,700 in 2003. Moreover, offshore fishery production has decreased, from 370,900 tonnes in 1980 to 185,900 in 2003.<sup>⑦</sup> As catches have decreased, catch composition has also changed in the past fifteen to

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① Chiau W. Yen, *Background Information-Coastal Zone Management in Taiwan: A Review*, Keelung: International Workshop on Coastal Planning and Management, 2006, pp. 77~90.

② Control Yuan ed., *The Symposium of Reports of Marine and its Relative Issues Investigation*, Taipei, Taiwan: The Control Yuan, 2004. (in Chinese)

③ Li C. Pan, Shian P. Tang, Rung Jung Hsu, Shian W. Shyue, Wen Y. Chiau, Jau C. Wang, and Kuang C. Yang, *The Strategies and Principles of Coast Protection—Sustainable Marine Operation*, Taipei: Hu's Books Publishing Co., 2005, pp. 69~86. (in Chinese)

④ Land Subsidence Prevention and Reclamation Corporos Website, at <http://www.lsprc.ncku.edu.tw/now00.htm>, 24 February 2005.

⑤ Chiau W. Yen, *Background Information-Coastal Zone Management in Taiwan: A Review*, Keelung: International Workshop on Coastal Planning and Management, 2006, pp. 77~90.

⑥ Tsai H. Min and Jin F. Jiang, The sustainability of coast management policy, at [http://www.initiate.com.tw/demo/sdi/section02\\_3.htm](http://www.initiate.com.tw/demo/sdi/section02_3.htm), 14 February 2005.

⑦ Ou C. Hsien and Wen H. Liu, Developing a Sustainable Indicator System Based on the Pressure-State-Response Framework for Local Fisheries: A Case Study of Gungliau, Taiwan, *Ocean & Coastal Management*, Vol. 53, 2010, pp. 289~300.

thirty years.<sup>①</sup> Although several kinds of marine protected areas have been established in past decades,<sup>②</sup> most of the coral reefs, wetlands and lagoons have been over-exploited or polluted, which has caused marine biodiversity reduction.<sup>③④⑤</sup>

As a result of an improvement in living standards, usage of the coastal zone has diversified to include agriculture and fisheries, industrial development, coastal engineering, technological development, and marine transportation and tourism, among others.<sup>⑥</sup> Tideland reclamation for industrial and residential sites has therefore become critical. Almost all the sea around Taiwan has been an exclusive fishing right zone since 1920; therefore, as industries have developed in the coastal zone, conflict has emerged between industrial development and fisheries' production. An example of this was the dispute between those who supported the development of the Pinnan Industrial Area and those engaged in fishery production at Chiku lagoon in 1994.<sup>⑦</sup> Moreover, marine tourism is becoming increasingly popular, leading to conflict over fishing ports' usage.

The administrative authority concerned with ICZM is dispersed among a number of "central government" agencies (Fig. 3). Unfortunately, due to political infighting the "Ministry of Marine Affairs" has not been established. On the other hand, the draft of the Coastal Act has not been reviewed since 1990.

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① Shao K. Chao, Sustainable Fisheries in Taiwan Need Biodiversity Protection, Sino-French Symposium on Sustainable Coastal Development: Marine Environmental Protection & Resources Sustainability, Nankang, Taipei, Taiwan R. O. C.; Institute of Zoology, Academia Sinica, 2003, pp. 121~126.

② Shao K. Chao, *The Study on the Establishment and Management Strategies of Marine Protected Area System*, Taipei; Fisheries Agency, Council of Agriculture, 2005. (in Chinese)

③ Chiau W. Yen, Lagoon Management and Black-Faced Spoonbill Conservation; Issues and Challenges in the Chiku Area, Taiwan, *Journal of Coastal Research*, Special Issue 39, 2006, pp. 912~914.

④ Hsieh H. Lian, Chang P. Chen and Yaw Y. Lin, Strategic Planning for Wetlands Conservation Greenway along the West Coast of Taiwan, *Ocean & Coastal Management*, Vol. 47, 2004, pp. 252~272.

⑤ Taiwanese Coral Reef Society ed., *Investigation of Status Quo of Coral Reef In Taiwan*, Taipei; Council of Agriculture, Executive Yuan, 2005, p. 67. (in Chinese)

⑥ Kuo C. Dung ed., *The Impact of Coast Development Engineering against Coast and its Mitigating Strategies*, Taipei; Morning Star Publishing Co., 1998, pp. 144~161. (in Chinese)

⑦ Lin M. Nan ed., *The News Report about Crisis Resulted from Pinnan Industry Area in the Chiku Lagoon; from the Fishery Law*. Taipei; Morning Star Publishing Co., 1998, pp. 162~194. (in Chinese)

In the past, marine scientific research was ignored in Taiwan. It had decreased from 0.59% of total scientific research in 1989 to 0.52% in 1991.<sup>①</sup> Indeed, the level of marine scientific research has been much lower than in other countries. Marine environmental science research is dispersed in several institutions in Taiwan, for example, the “Central Weather Bureau”, National Taiwan University, the “National Science Council”, etc., and therefore, gaining access to the complete body of scientific findings presents a challenge. Further, it is difficult to integrate all databases due to differences in investigating method, terminology, and research scope (Control Yuan, 2004; CPA, 2007).<sup>②③</sup> However, in the past decade, awareness of the importance of educational programmes in coastal management practice has grown in Taiwan, though the number of teachers involved and the funding level continue to be low.

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① Control Yuan ed., *The Symposium of Reports of Marine and its Relative Issues Investigation*, Taipei, Taiwan: The Control Yuan, 2004. (in Chinese)

② Control Yuan ed., *The Symposium of Reports of Marine and its Relative Issues Investigation*, Taipei, Taiwan: The Control Yuan, 2004. (in Chinese)

③ Construction and Planning Agency, Ministry of the Interior website, at <http://www.cpa-mi.gov.tw/>, 14 May 2007.

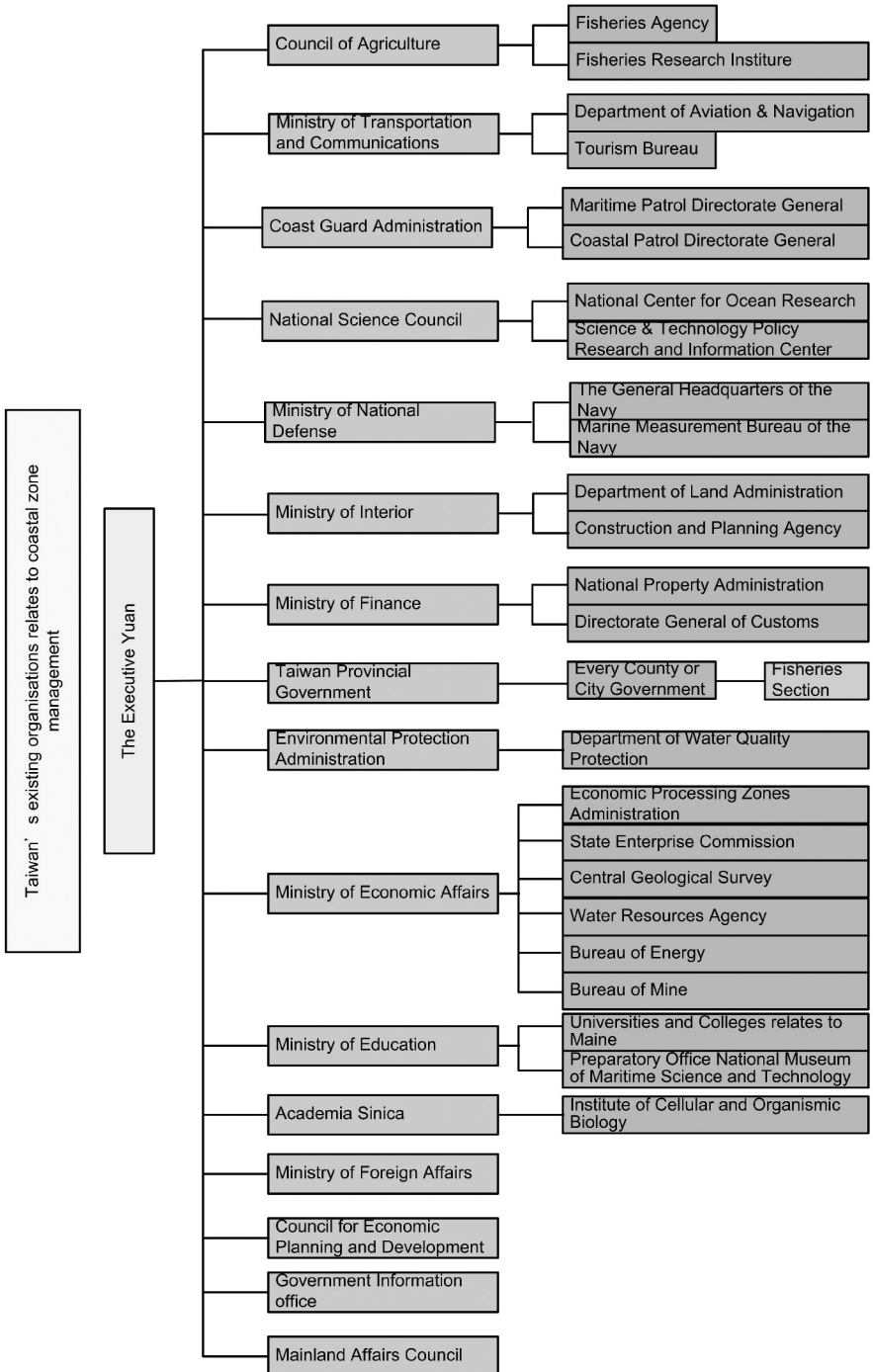


Fig.3 Taiwan's Existing Organisations Relates to Coastal Zone Management

## B. Development of Coastal Management

Development of coastal management in Taiwan has changed from marine control (restricting access to the coast) and marine use (highlighting land development but ignoring marine development), to marine protection (coastal protection).<sup>①</sup> In order to have a good management of the coastal zone, it is necessary to understand how coastal management practice has evolved from its inception to the present day, and to identify those obstacles which hinder its further development in Taiwan (Table 2).

**Table 2 Timeline of Key Coastal Zone Management Progress in Taiwan**

time	Important events
1983	<ul style="list-style-type: none"> <li>■ The “Executive Yuan” published the Regulation on Development and Management of Tideland Reclamation</li> </ul>
1984	<ul style="list-style-type: none"> <li>■ The Kenting National Park covering sea area was established</li> <li>■ The “Executive Yuan” ratified and implemented the Nature Reserve Plan of Coastal Zone in Taiwan</li> <li>■ The “Executive Yuan” published the Taiwan Natural Environment Protection Solution</li> </ul>
1987	<ul style="list-style-type: none"> <li>■ Lift of martial law and open access to coastal zones</li> <li>■ The “Executive Yuan” drew up the Guidelines for Environmental Protection Policy, ROC</li> <li>■ The “Executive Yuan” ratified the second part of the Nature Reserve Plan of Coastal Zone in Taiwan</li> <li>■ Heavy metal pollution resulting from burning waste wires in the Erhjen estuary of South Taiwan destroyed all cultured oyster fields</li> </ul>
1989	<ul style="list-style-type: none"> <li>■ The Wildlife Conservation Act was published</li> </ul>
1990	<ul style="list-style-type: none"> <li>■ The “Ministry of the Interior” drew up the Coastal Act (draft)</li> </ul>
1991	<ul style="list-style-type: none"> <li>■ The “Ministry of Economic Affairs” drove to establish the Chang Hua Coastal Industry Park</li> </ul>

① Council of Marine Affairs Advancement ed., *Manual of Marine Affair Conference in 2004*, Taipei, Taiwan: Council of Marine Affairs Advancement, 2004. (in Chinese)

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time	Important events
1992	<ul style="list-style-type: none"> <li>■ The former provincial government promoted the Taiwan Tidal Lands Exploitation Promotion Plan</li> <li>■ The former provincial government prepared the Tidal Lands Exploitation Plan for Hsian-shan, Hsinchu</li> </ul>
1994	<ul style="list-style-type: none"> <li>■ The “Ministry of the Interior” drew up the 2<sup>nd</sup> version of the Coastal Act (draft)</li> <li>■ The Environment Impact Assessment Act was published</li> <li>■ “Council of Agriculture, Executive Yuan” established “Wushihbi Coastal Natural Reserves” and “Kenting Uplifted Coral Reef Natural Reserves”</li> </ul>
1996	<ul style="list-style-type: none"> <li>■ The Hualien Station Line 11 Widening Project of the MOTC affected coastal landscape, giving rise to conflict</li> </ul>
1997	<ul style="list-style-type: none"> <li>■ The “Executive Yuan” submitted the draft of the Coastal Act to the Legislative Yuan for deliberation</li> </ul>
1998	<ul style="list-style-type: none"> <li>■ The “Executive Yuan” published the National Environmental Protection Plan</li> </ul>
1999	<ul style="list-style-type: none"> <li>■ Regulations on Sea Wall Management in Taiwan Province were published by the former Taiwan Provincial Government</li> <li>■ The “Ministry of the Interior” drew up the Coastal Management Plan in Taiwan Area (draft)</li> </ul>
2000	<ul style="list-style-type: none"> <li>■ The “Coast Guard Administration, Executive Yuan” was established</li> <li>■ The Guidelines for the “National” Sustainable Development Strategy of Taiwan, ROC was passed</li> <li>■ The Regulations Governing Government Policies on Environmental Impact Assessment was passed</li> <li>■ The Marine Pollution Control Act was passed</li> </ul>
2001	<ul style="list-style-type: none"> <li>■ The Marine White Book was published by the “Executive Yuan”</li> <li>■ The Amorgos oil spill accident happened</li> <li>■ The “Environmental Protection Administration” published the Standard of Marine Environmental Classification and Quality</li> <li>■ The Program of Bio-diversity promotion was promulgated</li> <li>■ The Second Implementation Program of Land Subsidence Prevention was implemented from 2001 to 2008</li> </ul>

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time	Important events
2002	<ul style="list-style-type: none"> <li>■ The “Ministry of the Interior” implemented the Natural Protection Plan of Coastal Zone in Taiwan</li> <li>■ The “Executive Yuan” reviewed the revised Coastal Act (draft) again.</li> <li>■ The Marine Environment Pollution Cleanup and Disposal Regulations was published</li> <li>■ Stipulated the Measures for Coordination between the “Coast Guard Administration, Executive Yuan” and the “Council of Agriculture, Executive Yuan”</li> <li>■ The Reviewing Regulation of Management Plan Coastal Reclaimed Land in Industrial Park was published</li> <li>■ The Cultural Heritage Preservation Act was published</li> <li>■ The Environmental Basic Act was published</li> <li>■ The Sustainable Development Action Plan including the Action Plan of Bio-diversity was carried out from 2002 to 2011</li> </ul>
2004	<ul style="list-style-type: none"> <li>■ The “Marine Affairs Advancement Council” was established</li> <li>■ “National” Ocean Policy Guidelines was passed</li> </ul>
2005	<ul style="list-style-type: none"> <li>■ The Proposal on the Development of Marine Affairs and Policies was carried out from 2005 to 2011</li> <li>■ The National Land Recovery Strategies and Action Plan was promulgated</li> </ul>
2006	<ul style="list-style-type: none"> <li>■ The Marine Policy White Paper was published</li> <li>■ The National Land Recovery Strategies and Action Plan was revised</li> </ul>
2007	<ul style="list-style-type: none"> <li>■ The Proposal on the Development of a Sustainable Coast is implemented from 2007 to 2011</li> <li>■ The “Ministry of the Interior” established the Dongsha Marine National Park and also the Marine National Park Headquarters in charge of affairs of the marine national park in 2007</li> </ul>

The Taiwanese restricted access to coastal areas during the Martial Law Period (1949–1987). Tideland reclamation and industrial development were main issues of concern at that time. However, towards the end of the period (1983–1987), protection of the marine environment became an increasingly important issue, several protected areas were established and the “Executive Yuan” drew up the Environmental Protection Policy Guidelines in 1987. The Wildlife Conservation Act was subsequently promulgated and the Coastal Act (in draft form) was drawn up in 1990. Accompanying growing awakening of

the need to protect the marine environment in the latter part of the Martial Law Period was increasing recognition of the importance of effective coastal zone management. Several large industrial parks and extensive developments were planned in the coastal zone from 1990 to 1993.

In order to protect the marine environment and due to growing international recognition of the importance of conserving marine resources, several important acts, regulations and plans were promulgated or drawn up; for example, the Environmental Impact Assessment Act, the Coast Guard Act, the Marine Pollution Control Act, the Natural Environmental Programme for Protecting the Coastal Zone, and the Marine Environment Pollution Cleanup and Disposal Regulations.<sup>①</sup> The “Coast Guard Administration” was established to enforce protection of the marine environment in 2000 and the “Government Reorganisation Committee” advocated establishing the “Ministry of Marine Affairs” to address marine management in 2002.<sup>②</sup>

Marine policies have been substantially developed in recent years. The Guidelines for the “National” Sustainable Development Strategy of Taiwan and the Marine White Book were drawn up in 2000 and 2001. The Sustainable Development Action Plan (SDAP) was carried out from 2002 to 2011 by the “National Council for Sustainable Development”. The “Council of Marine Affairs Advancement (CMAA)” approved the “National” Oceans Policy Guidelines in 2004 and established six groups to carry out the Proposal on the Development of Marine Affairs and Policies (PDMAP) in an attempt to improve coastal management practice and solve marine problems in Taiwan.<sup>③④</sup> “The Construction and Planning Agency” (CPA) promulgated the Integrated Development Programme for Sustainable Coastal Development to respond to the delay in the Coastal Act’s enactment; to prevent further loss of the natural coastline; to reduce coastal engineering installations and their negative impact on the environment; to promote sustainable coastal zone development; and to restore the coastline’s original landscape.

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① Control Yuan ed., *The Symposium of Reports of Marine and its Relative Issues Investigation*, Taipei, Taiwan: The Control Yuan, 2004. (in Chinese)

② Chiau W. Yen ed., *Marine and Coastal Management System: Sustainable Marine Operation*, Taipei: Hu’s Books Publishing Co., 2005a, pp. 21~60.

③ Council of Marine Affairs Advancement ed., *Manual of Marine Affairs Conference in 2004*, Taipei, Taiwan: Council of Marine Affairs Advancement, 2004. (in Chinese)

④ Council of Marine Affairs Advancement, *The National Ocean Policy Guidelines*, at <http://140.117.200.53/doc/1.pdf>, 24 February 2005.



## IV. Methodology

In this research, many techniques/tools are applied in many different cases in order to understand where it is necessary to utilize them. Based on these lessons, Environmental Impact Assessment (EIA), Geographic Information System (GIS), Monitoring, and Strategic Environmental Assessment (SEA) are chosen to examine the current situation. Decision makers in many coastal States have drawn up policies and laws addressing coastal problems, whose implementation has been given a high priority. The Taiwan government has also announced many ocean-related policies and acts in managing coastal areas, but some problems/obstacles still persist. In order to find out the crux of the problems, the paper examines the evolution of policy/legislation also including programmes. Governments can assist in improving the management of coastal areas in a variety of ways; by encouragement, through force or through the use of research and information. In order to achieve sound planning and management at the coast, capacity building is also used by the government.<sup>①</sup> In this article, we will focus on activities concerning training of managers and education of people.

This section assesses the performance of the two integrated policies (i. e. SDAP and PDMAP) contained in the four approaches mentioned above, on how well they achieve each EU ICZM principle. Three qualitative options are available (Table 3). In terms of policy and legislation, a partial circle stands for the presence of ICZM principles in the policy and legislation (or either of them), or in the process of involving ICZM principles, while a hollow circle stands for the absence of ICZM principles in the policy and legislation (or either of them). Regarding the aspect of government/administration, a full circle means that all related organisations and levels are involved in coastal management, while a partial circle stands for some related organisations and levels involved in management, and a hollow circle means that none of the related organisations and levels is involved in management. In the aspect of capacity building, a full circle stands for sufficient and effective capacity building, while a partial circle means the presence of only some capacity building, and a hollow circle refers to the absence of capacity building. Finally, in the aspect of techniques/tools/im-

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① Robert Kay and Jacqueline Alder ed., *Coastal Planning and Management*, London: Routledge Press, 2000.

plementation, a full circle stands for sufficient and effective techniques/tools/implementation in application, while a partial circle means the presence of some techniques/tools in application or ineffective implementation, and a hollow circle refers to the absence of any techniques/tools/implementation in application. For the corresponding results, see Table 3.

## **V. Application of ICZM Principles in Taiwan**

### *A. Holistic Approach*

The PDMAP conducts sea use management from an integration viewpoint, and presents the results to the “Ministry of the Interior”, which is its sponsor. Related organisations of marine affairs assist in developing marine function zones and drafting related legislation about sea use management. The “Ministry of the Interior” carried out the Study on Marine Function Zoning in 2007, and has already set up a GIS regional planning and database of cooperating management in the coastal areas. The “Council of Agriculture” also actively propagates the limits of authority of exclusive fishing right so that related industries can use sea areas together and utilise unnecessary fishing ports gradually for tourism or other purposes.

In addition, in order to prevent the impact of land pollution on the ecological environment in sea areas, the PDMAP has also drawn up the River Pollution Improvement Plan, which is carried out under the sponsorship of the “Environmental Protection Administration” and with the assistance of the “Council of Agriculture”, as well as the “Ministry of the Interior”. The “Environmental Protection Administration” also maintains 250 patrol teams (5,000 members) for all rivers throughout the Province, and holds related publicity activities, meetings of outcome review, forum, and education as well as training at the same time. Focusing on ecological rehabilitation, the “Environmental Protection Administration” has so far established 71 water quality improvement facilities, which can treat over 488,000 tonnes of water every day, reducing BOD pollution by 9,000 kilograms. In 2007, the “Environmental Protection Administration” also created a website on water quality improvement, which has enabled inspection of water quality of all these facilities at any time.

In order to integrate the information obtained from scientific research, the PDMAP also pushes for increasing the budget of marine scientific research year



by year, to set up the “National Marine Research Center” and the “Marine Data Center”, and establish the basic data and information on marine and coastal topography. The above endeavours are sponsored by the “National Science Council” and the “Ministry of the Interior”, and related organisations assist in carrying them out. The “National Marine Research Center” has been established in Kaohsiung. The “Ministry of the Interior” is also in the process of gathering the basic data and information on marine and coastal topography.

Concerning marine education, the PDMAP successfully increased student quota in National Taiwan University for relevant specialties in 2005, and planned and designed integrated marine higher education courses to train talents for marine integration and marine management. Four marine institutes have been established in Taiwan, and some teachers been employed so far. At present, the “Ministry of Education” is sponsoring the establishment of “marine education offices” to provide people with marine guide, while assisting in the development of ocean-related courses. The “Ministry of Education” also subsidizes local governments to design resource centers of marine education, and to provide courses, teaching materials and teaching media of marine education in high schools and primary schools, as well as set up share platforms of marine teaching resource network.

## *B. Work with Natural Processes*

The SDAP aims to increase components of bio-diversity and promote its sustainable utilisation. It also requests local governments to practice the Wildlife Conservation Act and the Cultural Heritage Preservation Act, draft the Marine Resource Management Act, and promote legislation of the Coastal Act. Involved in the above endeavours are also the “Council of Agriculture”, the “Ministry of the Interior”, the “Ministry of Transportation and Communication”, the “Ministry of Economic Affairs” and the “National Science Council”. In addition, the “Ministry of the Interior” has also established the Dongsha National Marine Park and the Marine National Park headquarter which is in charge of affairs of the national marine park. The SDAP has set up teacher seminars on Taiwan’s marine bio-diversity in primary schools so as to enhance conservation of fisheries resources, marine ecological protection, and operating management for the protection of bio-diversity.

The SDAP has proposed to create marine protected areas comprising 5% of the sea area of 12 nautical miles off the coast, especially in the coral reef are-

as, and to delimit the coastal conservation axis. Meanwhile, under this plan, a bio-diversity information exchange mechanism has been established; every organisation is equipped with a database, and all databases are integrated, establishing an information management system to handle bio-diversity monitoring data. The marine protected areas that the government is actively planning at present are, however, akin to conservation areas of fisheries resources. Due to lack of manpower and finance, it is difficult for these conservation plans to be effective, which are more of a notion than a reality.

Furthermore, the SDAP has also proposed to enhance conservation, management and investigation in the coastal and the sea areas. It has drafted concrete conservation utilisation and management tactics, and used eco-engineering on river and sea construction in order to avoid destroying the natural ecology of the coastline.<sup>①</sup> At the same time, the PDMAP has actively investigated coastal areas, and proceeded with integration and planning in first class conservation of such areas. It has requested the relevant coastal management authority to establish a mechanism to mitigate the reduction of bio-diversity in accordance with the purpose of the Coastal Act. The “Construction and Planning Agency” has decided that important natural protected areas be brought into regional planning so as to furnish coastal management with a legislation basis. In addition, in 2007 the “Ministry of the Interior” resolved to include 75 important wetlands across the Province into the coastal protected areas, for the reference of subsequent delimitation of marine protected areas. In this way, we can prevent large-scale development cases from destroying the coast and implement the monitoring coast utilisation plan across the Province, thus establishing an investigation management system, planning land utilization, and bringing the natural coast under continuous monitoring.

### *C. Long-term Perspective*

The PDMAP has proposed to construct artificial habitats in sea areas, restore coral reefs for building an excellent environment of fishing ground and conserving the local ecological environment, and cultivate various healthful fish seeds for releasing. The plan is sponsored by the “Council of Agriculture”, and

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① Hsu T. Wen, I F. Tseng, TA Y. Lin, Chih Y. Shin and Shan H. Ou, Review of Countermeasures against Beach Erosion on the Taiwanese Coast, *Coastal Management*, Vol. 36, No. 3, 2008, pp. 274~293.

co-executed by the “National Science Council” and the “Ministry of Education”. Since the 1970s, the “Council of Agriculture” has been promoting the construction of artificial fish reefs, the release of fish seeds, and the establishment of conservation areas of fisheries resources for the purpose of restoring fisheries resources. According to the fisheries development program, a total of 1,350,000 steres of artificial fish reefs have been launched for improving the fishing ground environment, and 69,210,000 fish seeds have been released so far. These plans are still being carried out at present.

#### *D. Participatory Principle*

The Bio-diversity Action Plan (BAP) seeks to promote mutual aid and cooperation among domestic organisations engaged in the BAP, and assist various organisations in terms of capital adjustment as well as technological resources. The “Council of Agriculture” sponsors activities concerning bio-diversity guidelines and relevant exhibitions, and also promotes 40 detailed sub-plans under the Biology Multi-partnership Plan of the “GBIF Committee” established by “Academic Sinica” in 2008 as a communication platform for cross-organisation integration of bio-diversity information and for promoting data integration as well as website update.

The PDMAP must integrate the data of governmental and private departments, arrange local fora and consultancy, and carry out the coastal conservation and restoration plan each year. This plan is carried out under the sponsorship of the “Ministry of the Interior”, with the assistance of the “Ministry of Economic Affairs” and the “Council of Agriculture”. While drafting all public construction and administrative plans for the government, the SDAP should be aware of participants’ perceptions, and improve the quality of people’s discussions on public decisions. Therefore, it is imperative to formulate the Administrative Regulations of Public Participation and Public Policy. The regulations have not been formulated so far as public participation has not been brought into consideration by related organisations in their policy planning.

The plan also requires that the government should assist the development of environmental protection groups, and timely inform them of the decision-making process on any environment-related issue and invite them to participate in discussions. Besides policy making, the government should also offer sufficient funds for environmental protection groups so that they may invite people and media for holding forums, debates, or meetings in an attempt to establish

bilateral communications. The plan is sponsored by the “Environmental Protection Administration”, the “Ministry of Education”, the “Ministry of Economic Affairs”, the “Council of Agriculture”, the “Ministry of the Interior”, and the “Ministry of Foreign Affairs Ministry of Foreign Affairs”. The “Environmental Protection Administration” has allocated \$ NT 9,077,000 to folk communities to hold related activities, and it also encourages people’s participation in environmental protection as well as supervision. These initiatives are still at their inception, though, without much effect.

### *E. Adaptive Approach*

The PDMAP is responsible for advocating conservation methods in off-shore and off-lying sea fisheries, adjusting the scale of both fisheries, and enhancing management and assessment of fisheries resources. It is sponsored by the “Council of Agriculture”, and the “Coast Guard Administration”. In order to restore fisheries resources, the “Fisheries Agency” spent a budget of \$ NT 170,000,000 to buy back 37 offshore and off-lying sea fishing vessels as well as 301 fishing rafts from 2007 to 2009. \$ NT 109,450,000 were paid as reward to buy back 7,726 fishing vessels for voluntary fishing closures, and \$ NT 3,350,000 were paid to buy back 27 fishing vessels of larval fish from fishing grounds designated for closure. Similarly, the “Fisheries Agency” propagates the concept of sustainable resources by holding fisheries educational courses, conferences, and courses on Four-H, domestic economy and fisheries affairs in fishing villages. These initiatives are being continuously implemented, but without obvious effect.

### *F. Local Issue*

The “Ministry of Economic Affairs” has called up the “Council of Agriculture” and the “Ministry of the Interior” to advance the implementation of the Program of Land Subsidence Prevention, but related legislation and high-level guideline plans, e. g. the Coastal Act and the National Land-Use Planning, have not been promulgated and practiced. Consequently, this program cannot be carried out properly, and thus land utilization cannot be improved. Moreover, insistence on carrying out the program may go against the law. The “Water Resource Agency” in the “Ministry of Economic Affairs” has established the stratum sinkage database. Updated data reveal that stratum sinkage in Ilan,

Taoyan, Kaohsiung, and Pingtung has ceased in the past seven years, and reduced to 3.8 and 2.9 centimeters per year in Chiayi and Tainan respectively. Changwa has seen the most obvious improvement, with the stratum sinkage dropping from 17.6 to 8.4 centimeters per year. Meanwhile, the "Council of Agriculture" encouraged fishermen to employ cage culture to reduce the utilisation of groundwater and water of fresh water ponds.

However, the implementation of the Program of Land Subsidence Prevention conflicts with some people's interest, e. g. enforcement of closure of illegal underwater wells. The enforcement meets with such violent resistance from the people that the local government loses the will to enforce the program coercively. As a result, it is difficult to close such illegal wells and as such the problem of land subsidence cannot be properly solved. In addition, water quality degradation resulting from environmental pollution has made it very difficult to find good alternative sources of water, forcing people to rely on groundwater for their subsistence. Currently, the government is actively establishing a groundwater database of Taiwan and an integrated information system. To sum up, the problem of land subsidence has not been effectively addressed due to the following causes: lack of budget for the implementation of the Program of Land Subsidence Prevention, very few people willing to abide by the law, weak crisis awareness on the part of the people, and lack of competent human resources in the local government.

### *G. Support and Involvement of Relevant Administrative Bodies*

The PDMAP has also planned to cooperate with the local community on providing education and training to address marine oil pollution and establish a certification system for personnel of marine oil pollution disposal. The Major Marine Oil Pollution Emergency Response Plan should be reviewed regularly at all levels in order to estimate and improve the precautionary capacity of governmental and private departments on the sea. The government should also maintain its cooperation with petroleum companies for working out the best emergency response and regional cooperation mechanisms. The PDMAP is carried out under the sponsorship of the "Environmental Protection Administration", with the assistance of the "Ministry of the Interior", the "Ministry of Transportation and Communication", the "Ministry of Economic Affairs", the "Coast Guard Administration" and the local governments. In turn, the "Coast Guard Administration" has formulated Coordination Regulations in conjunction



with the “Environmental Protection Administration” in order to timely deal with the serious marine oil pollution. The “Environmental Protection Administration” sponsors education, training and a certification system for personnel of marine oil pollution disposal, with the assistance of the “Ministry of the Interior”, the “Ministry of Transportation and Communication”, the “Ministry of Economic Affairs”, the “Coast Guard Administration” and the local governments. The PDMAP has built various cleaning oil vessels, and addressing issues of marine salvage, rescue, and pollution control; it also recommends facility development and marine construction techniques, while people are sent to receive related education and training for dealing with marine oil pollution. In 2006, the function of the emergency response team worked in the event of the oil spill pollution of Tzini by effectively reducing the impact of such pollution. Additionally, it is an efficient practice to integrate all departments for dealing with present marine and coastal problems under the guidelines of the two integrated policies of PDMAP and SDAP.

#### *H. Combination of Instruments*

The legislative process of the Coastal Act has not been completed by far, but the Taiwan coast cannot do without effective management. To cope with the problem, the “Ministry of the Interior” prepared the Proposal on the Development of a Sustainable Coast (2007—2011) to stop the erosion of the natural coastline in Taiwan, prevent unsuitable coastal construction which may impact the balance of the natural environment, and restore the natural coast landscape. The “Ministry of the Interior” has also highlighted six items, namely fishing port, coastal road, jetty, tourism and leisure, land reclaimed from the sea, and coastal investigation and planning closely related with coastline, as the main shaft of the priority plan. This proposal is carried out under the sponsorship of the “Ministry of the Interior”, and with the assistance of coast-related organisations and local governments. To effectively protect coastal resources, the top priority is to delimit the existing natural coast for preservation, set up a coastal monitoring mechanism with satellite or reconnaissance planes, include the development plan of the coastal areas into the “list of sensitive locations to be examined” calling for deep consideration, set up an examination mechanism of coastal preservation and protection, and promulgate a “national” wetland policy and chart list as well as other related plans. At present, the Proposal on the Development of Sustainable Coast, having been merged with the PDMAP and

the SDAP, is still underway.

## VI. Discussion

Though all ICZM principles are adopted by some related policies of marine resource conservation or marine environmental protection, none of the drafts of ocean-related policies in Taiwan is completely in conformity with ICZM principles. As a result, coast-related legislation, such as the Coastal Act and the Marine Resource Conservation Law, can hardly be fully put into action. The scale of coastal areas at present involves exclusive fishing right areas. The “Ministry of the Interior”, which is the department in charge of coastal management, will continue to integrate relevant plans after the promulgation of the Coastal Act. As this happens, fishermen will worry about the current scale of exclusive fishing right area becoming smaller and their losing vested rights and interests. This is one of the reasons why the Coastal Act has failed to be put into action.<sup>①</sup> Moreover, the enforcement of the Coastal Act to prevent land subsidence such as putting an end to illegal groundwater wells will also deprive local residents of vested interests, thus giving rise to conflicts. As mentioned before, the enforcement of the Coastal Act has always met with such a violent resistance from the people that the local government has no strong will to implement the Coastal Act. How to strike a balance between integrated benefits and local benefits has now evolved into a political issue.<sup>②</sup>

For their part, local governments have been classified as assistant units when two integrated plans are to be implemented, namely the Plan of Fleet Size Reduction and Fishing Closures and the Marine Oil Pollution Emergency Response Plan, and the Proposal on the Development of Sustainable Coast. Other integrated plans are only related to specific departments. The failure of effective vertical integration of the plans has led to a subsequent failure to implement policies, no matter how good they are. Our government has gone through party change, and both presidents have proposed to establish a special agency in charge of marine affairs. However, as many levels of organisations/depart-

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① Huang I, The Discussion of the Coastal Act, *The Law Monthly*, Vol. 55, No. 4, 2004, pp. 34~40. (in Chinese)

② John McKenna, Andrew Cooper and Anne M. O'Hagan, Managing by Principle: A Critical Analysis of the European Principles of Integrated Coastal Zone Management (ICZM), *Marine Policy*, Vol. 32, 2008, pp. 941~955.

ments are involved, combined with the intervention of political power, no relevant high-level agency is now available to take full responsibility for marine and coastal management. Therefore, the progress of marine and coastal management is still slow at present.

In addition, due to insufficient governmental executive capacity building, education and training, people do not understand government policies and even resist their implementation. For instance, the government would like to achieve the short-term target of setting up marine protected areas, which would include the Dongsha Marine National Park and 5% of the sea area 12 nautical miles off the coast. However, only the Kenting National Park and the Dongsha Marine National Park are managed by the "National Parks Police Corps" and the "Coast Guard Administration", while other marine protected areas do not have effective management due to lack of manpower and budget.<sup>①</sup> Moreover, many local residents in the protected areas do not know they live in a protected area, let alone obeying due rules governing protected areas. In addition, fishermen always oppose the setup of protected areas for the sake of their livelihood. Consequently, how to help fishermen understand the function of marine protected areas and the concept of sustainable resources, and to guide and assist the community for common management through education and propagation are more important issues than the management through the aforesaid two organs itself.

The government has applied extensively EIA, GIS, monitoring, and MPA in environmental protection and resources conservation. Nevertheless, of the existing procedures of environmental impact assessment, only five procedures in the decision making process are open for public participation, including review of the description of environmental impact, public hearing, stage of setting up control limits of environmental assessment, location survey and debate, as well as review of reports on environmental impact assessment. Participants are mostly people from government agencies and scholars, and local residents are seldom involved in these decision-making procedures, a fact that reveals that it is difficult for local residents to have access to have a firsthand of the information in the first stage of development. The communication between local resi-

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① Shao K. Chao, *Sustainable Fisheries in Taiwan Need Biodiversity Protection*, Sino-French Symposium on Sustainable Coastal Development: Marine Environmental Protection & Resources Sustainability, Nankang, Taipei, Taiwan R. O. C. : Institute of Zoology, Academia Sinica, 2003, pp. 121~126.

dents and the government often comes to a deadlock as a result, and the lack of communication may lead to intense conflicts. <sup>①</sup> Finally, relevant policies on implementing environmental impact assessment were issued in 2000, but such policies have not been applied to marine management so far. <sup>②</sup>

From the analysis above, we can see that Taiwan faces the same challenges European countries do, such as unclear distribution of functions between “national” and local levels of government with the provincial government not feeling “in charge” of ICZM, and insufficient time, unqualified manpower and insufficient funds provided to introduce the complex idea of ICZM through awareness, education and demonstration projects (European Commission, 2006). The Taiwan government should overcome these factors causing failure and introduce others conducive to success, such as improving leadership skills or at least spotting a dedicated caretaker role (political will) at the provincial level for such affairs and/or identifying agencies suitable for executing ICZM from agencies implementing coordinated ICZM, and utilizing and strengthening their existing territorial planning or management institutions (e. g. from marine spatial planning). These favorable factors are important for Taiwan to make ICZM more successful.

## VII. Conclusion

The government has applied only some EU ICZM principles to marine and coastal management, such as the principle of holistic approach. The government is in the process of setting up marine multi-function zones, and considers river and marine pollution problems from the perspectives of mountains, rivers and oceans. However, not only has the Coastal Act not been materialized, but also the Administrative Regulations of Public Policy and People Participation, the Marine Resource Conservation Act, and related Acts have not been passed by the government. Also, the government has not established a special high-level unit for marine and coastal management. Nor have local governments actively participated in management plans, or engaged in capacity building plans.

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① Wang H. Jyuhn, Public Participation of Environmental Impact Assessment: Analysis and Mechanism Design, *Quarterly Journal of Chinese Forestry*, Vol. 34, No. 1, 2001, pp. 73 ~84.

② Wang H. Juan, The Harmonizing of Rationality and Philosophy—The DisCuSsion of Practical Approach of Environmental Impact Assessment in Taiwan, *Environmental Protection Source*, Vol. 112, 2007, at <http://www.fengtay.org.tw/>, 10 March 2008.

The aforesaid causes have led to problems in management of marine protected areas, stratum sinkage, coastal development, and conflicts arising from sea use. Therefore, the government should (1) approve the Coastal Act and related Acts; (2) set up a high level competent unit for marine and coastal management; (3) allow local governments to participate in planning and decision making; (4) conduct ongoing marine spatial planning; (5) advocate education and training of marine affairs; (6) have the public participate in and implement the SEA; (7) promote community joint management of the marine protected areas, and (8) incorporate all EU ICZM principles into marine and coastal management related to government marine policy as soon as possible.

The “Executive Yuan” has promulgated a Plan for Sustainable Development of the Coastline, which contains main guiding principles for all public sector tiers when proposing and assessing land use of all kinds in the coastal areas in order to preserve the coastal ecosystem, reduce damage to the natural environment, and promote ecological restoration. Moreover, the Plan clearly defines the characteristics of two types of coastline: natural and artificial. Further, there is a short-term strategy: “zero damage to the natural coastline”, and a long-term strategy: “sustainable coastline action”. The Plan is also in accordance with the “National” Land Recovery Strategies and Action Plan promulgated by the “Executive Yuan” in 2006.