

### 3.3 STATUS OF CORAL REEFS OF TAIWAN

Chang-feng Dai, Keryea Soong, Chaolun Allen Chen, Tung-yung Fan, Henyi Justin Hsieh, Ming-Shiou Jeng, Chien-hsun Chen and Sharon Horng

#### Abstract

Coral reefs are found in all the waters around Taiwan except in the sandy area on the west coast. Coral reefs are the most important marine ecosystems in Taiwan since they support local fishery resources, tourism industry, and coastline protection. A total of 32 sites in 8 major reef regions around Taiwan were monitored yearly using the Reef Check protocol from 1997 to 2004. In addition, 4 sites at Dongsha Island were surveyed every two to four years. The percentage of hard coral cover showed a wide range of variation among the 32 sites. Both increasing and decreasing trends in coral cover were observed during the survey years, resulting in no significant changes among years. However, more increasing trends at reef slope and more decreasing trends at reef flat were found, suggesting that the reef flat biota was more frequently influenced by anthropogenic disturbances than that of the reef slope. Among sites showing decreasing trends of coral cover, 88% of the cases were coupled with increasing in the proportion of other substrates such as dead coral and algae. The abundances of fish and invertebrate indicators at most sites were at low levels suggesting that most reefs were under the heavy stress of overfishing. In general, only coral reefs at Lutao (Green Island) and the inner bay of Penghu Islands, both with high coral cover, were in favorable conditions. The reefs of Kenting National Park in southern Taiwan showed a trend of stable or increasing in coral cover but under stressed indicating that the reef management practices were needed to be improved. Most coral reefs in Taiwan are within national parks, national scenic areas or coastal conservation zones and these areas are protected by the National Park Law and the Coastal Environmental Protection Plan. However, the current laws are inadequate to protect coral reefs. The revision of laws and the planning of MPAs with effective management are currently processing by governmental administrations. The enforcement of laws and pollution control, particularly sedimentation from terrestrial runoff, are major needs for protection of coral reefs in Taiwan. Besides, effective management of marine recreation activities and raising public awareness are also needed.

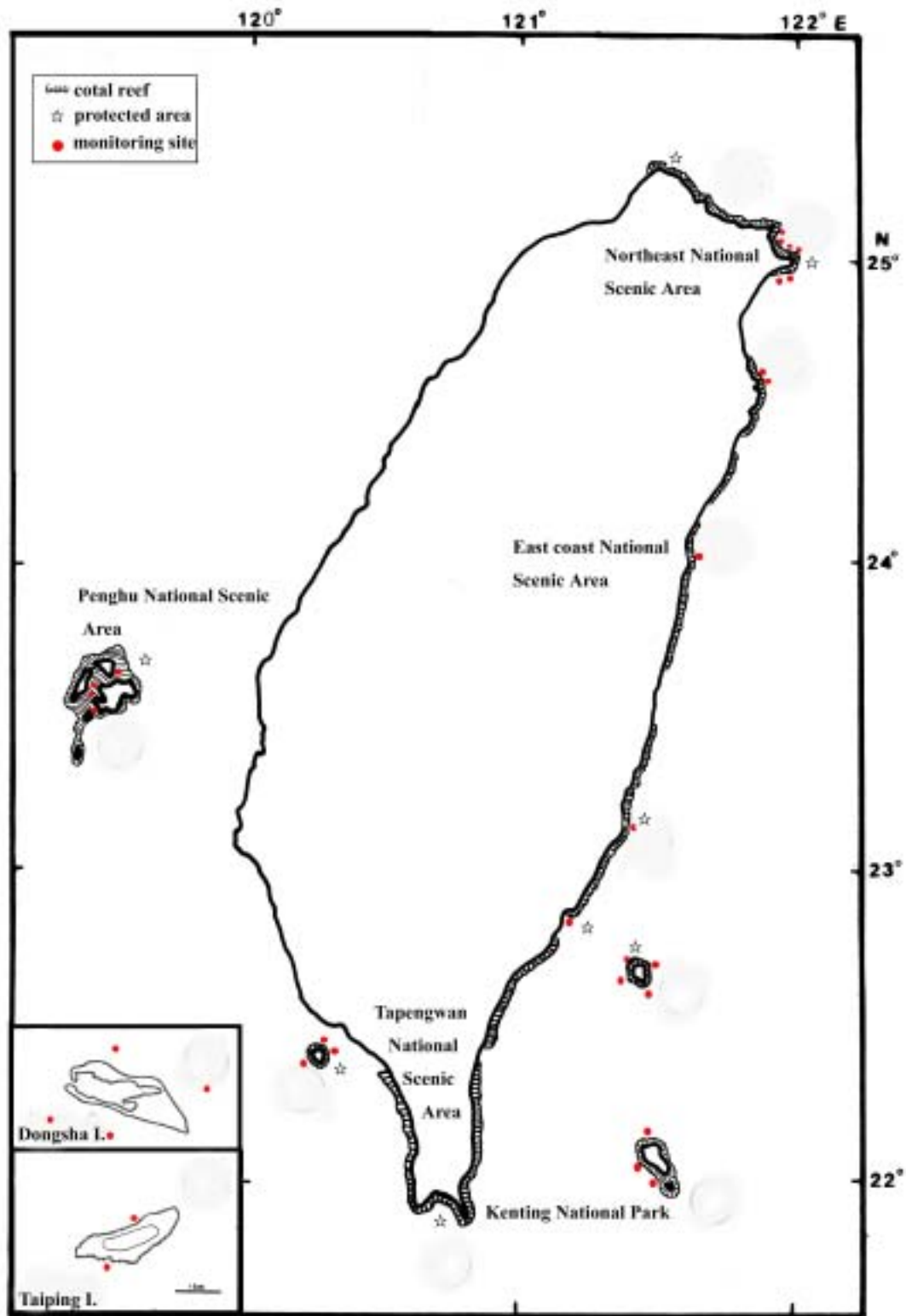
Table 1: Summary of coral reef status in Taiwan

Area	Reef type	Management	Long-term monitoring sites	status
Southern Taiwan	Fringing reef	Kenting National Park	6	Stressed
Eastern Taiwan	Patch reefs	East Coast National Scenic Area	3	Fair
Ilan County	Patch reefs	None	4	Poor
Northeastern Coast	Patch reefs or coral community	Northeastern Coast National Scenic Area	4	Poor
Hsiaoliuchiu	Fringing reef	Tapengwan National Scenic Area	4	Poor
Penghu Islands	Fringing reefs or patch reefs	Penghu National Scenic Area	4	Poor
Lutao (Green Island)	Fringing reefs	Eastern Coast National Scenic Area	4	Fair
Lanyu (Orchid I.)	Fringing reefs	None	3	Fair
Dongsha (Pratas) I.	Atoll	Dongsha National Park	None	Poor
Taiping (Itu Aba) I.	Atoll	Coast guard	None	Fair

#### Introduction

##### *Coral Reefs*

Coral reefs are found in all the waters around Taiwan except in the sandy area on the west coast. The main reef area is around the southern tip of the island, the Hengchun Peninsula where well-developed fringing reefs are found. These reefs are characterized by diverse and abundant scleractinians and alcyonaceans with living coral cover ranged from 30 to 60% (Dai, 1991). The northern, northeastern and eastern rocky coasts have flourishing or patchy coral communities with scattered reef development. These coral communities are dominated by scleractinians with living coral cover ranged from 15 to 40%.



Map 1. Distribution of coral reefs, monitoring sites, and MPAs in Taiwan.

Coral reefs are also found on the shallow waters surrounding offshore islands including Lutao (Green Island), Lanyu (Orchid Island), Hsiaoliuchiu and Penghu Islands (the Pescadores). The coral reefs at Lutao and Lanyu, located off southeastern Taiwan, are densely covered with abundant scleractinians and alcyonaceans and living coral cover 40 to 70% of the bottom. Hsiaoliuchiu, off the southwestern Taiwan, is an uplifted reef island. The coral fauna of this island is dominated by scleractinians with living coral cover ranged from 20 to 50% (Yang et al. 1975). Penghu Archipelago is composed of 64 islands located about 50 km west off Taiwan in the Taiwan Strait. Corals are widely distributed in the shallow subtidal areas of these islands and coral communities in these islands are dominated by scleractinians with living coral cover ranged from 20 to 60%. Dongsha (Pratas) Island and Taiping (Itu Aba) Island are atolls in the South China Sea (Dai et al. 1995; Dai and Fan 1996). These reefs are formerly inhabited by rich scleractinians and alcyonaceans. However, coral cover at Dongsha Island declined to a very low level (<10%) following intensive overfishing, destructive fishing, and the coral bleaching event in 1998 (Soong et al. 2002, Dai 2005).

Most coral reefs in Taiwan are within National Parks or National Scenic Areas. These include the Kenting National Park in South Taiwan, the Northeast Coast National Scenic Area, the East Coast National Scenic Area, Tapengwan National Scenic Area, Penghu National Scenic Area, and Dongsha National Park. The status of coral reefs in eight regions including NE coast, Ilan County, East Taiwan, South Taiwan, Lutao, Lanyu, Hsiaoliuchiu and Penghu Islands, have been monitored by the Reef Check surveys from 1997 to the present.

### ***Biodiversity***

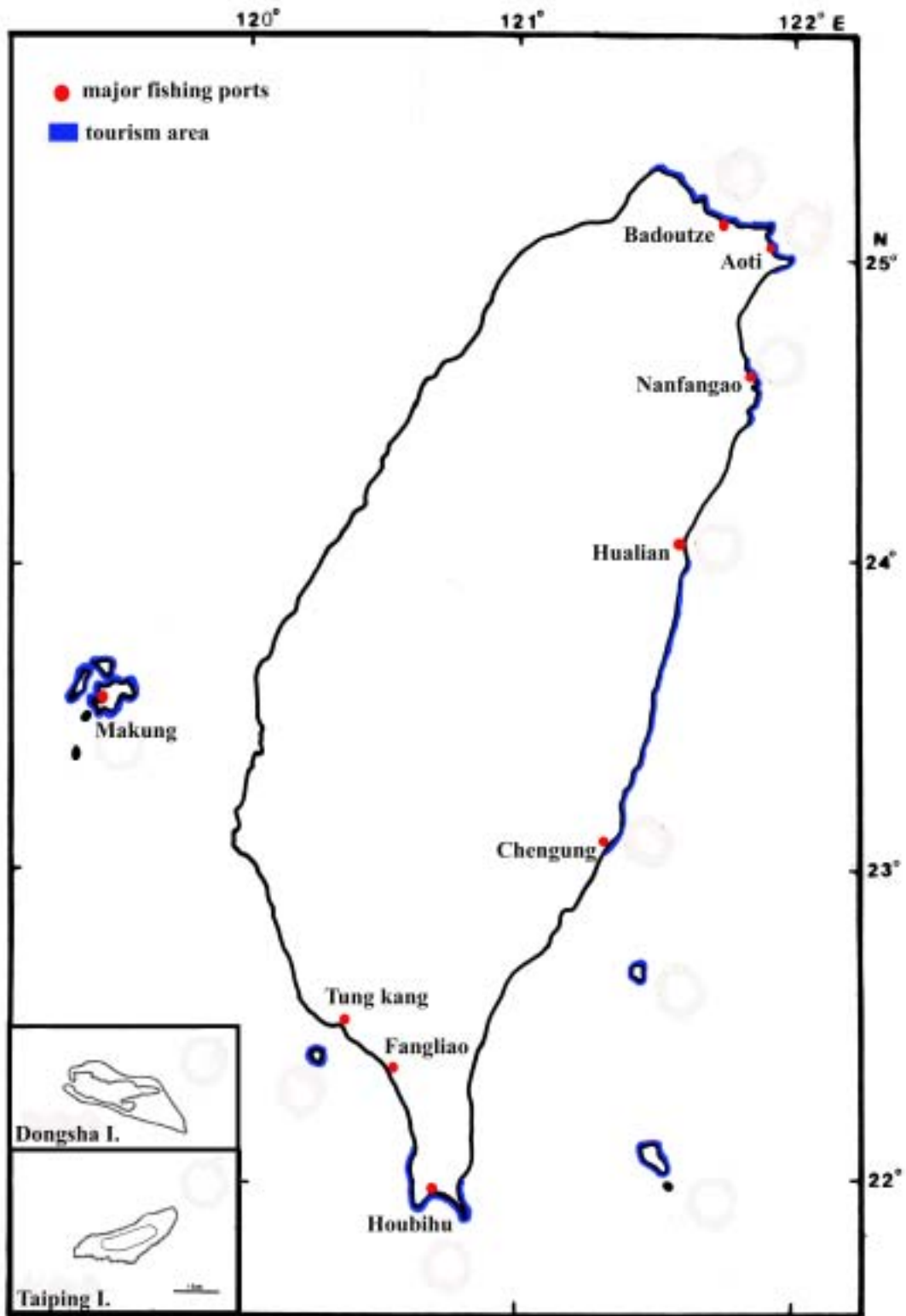
Species diversity of reef organisms on the coral reefs around Taiwan area is relatively high. Approximately 300 species of scleractinian corals, 50 species of alcyonaceans, 20 species of gorgonians, 130 species of decapod crustaceans, 90 species of echinoderms, 1200 species of reef fishes and 150 species of algae have been recorded from coral reefs in southern Taiwan, Lutao and Lanyu (Shao 1994). About 200 species of scleractinian corals and 1000 species of fishes have been reported from Hsiaoliuchiu and Penghu islands (Chen et al. 1992, Shao et al. 1994). Approximately 100 species of scleractinian corals and 800 species of fishes have been reported from the coastal areas in the north and northeast coast of Taiwan. A total of 101 species of scleractinians in 34 genera, 28 species of alcyonaceans in four genera, three species of gorgonaceans and three species of hydrocorals have been recorded from Dongsha Island (Dai et al. 1995). A total of 163 species of scleractinians, 15 species of alcyonaceans, 6 species of gorgonaceans and 421 species of reef fishes have been recorded from Taiping Island in the Spratlys of the South China Sea (Dai and Fan, 1996; Chen et al. 1997). Since only few surveys have been conducted on most reefs, far more species have not been reported and the estimated species diversity is possibly much higher than the number currently known.

Table 2: Estimated number of species of reef biota in Taiwan

Area	Scleractinians	Octocorals	Fish	Molluscs	Crustaceans	Macroalgae
Southern Taiwan	300	100	1200	600	300	200
Eastern Taiwan	200	50	800	500	300	250
Ilan County	120	50	800	500	200	200
Northeastern Coast	100	50	800	400	250	300
Hsiaoliuchiu	200	50	1000	400	250	200
Penghu Islands	200	50	1000	500	300	250
Lutao	300	100	1200	600	300	200
Lanyu	300	100	1200	600	300	200
Dongsha I.	300	100	1200	600	300	200
Taiping I.	300	100	1200	600	300	150

### ***Resource Use***

Coral reefs in Taiwan are important for both fisheries and tourism. Fish and invertebrates collected from waters adjacent to coral reefs comprise considerable portion of the total catch of near shore fisheries. In addition, coral reefs are major attractions for tourists and are popular for recreational fishing. Currently, most coral reefs in Taiwan are within National Parks or National Scenic Areas. These include the Kenting National Park in south tip of Taiwan, the Northeast Coast National Scenic Area, the East Coast National Scenic Area, Tapengwan National Scenic Area and Penghu National Scenic Area. Various marine recreation activities including scuba diving, snorkeling, glass bottom boat trips and recreational fishing depend upon coral reefs. Approximately 150,000 people rely on coral reefs, at least in part, for livelihood.



Map 2: Major Fishing Ports and tourism use areas in Taiwan.

*i. Reef Fish and Fisheries*

Reef fish, mollusks (abalones, squids and octopus), crustaceans (spiny lobsters and crabs), fleshy algae are the target of near shore fishery in Taiwan. Fishing ports are distributed around the coast of Taiwan and offshore islands. Principal fishing ports includes Badoutze on the northern coast, Aoti on the northeastern coast, Nanfanao in Ilan county, Chengung on the eastern coast, Houbihu on the southern coast, Fangliao and Tungkang on the southwestern coast, and Makung in Penghu Islands. Reef fish are caught by a variety of gears including long line, purse seines, gill nets, and spearing. Aquarium fish collection are common on most reef areas. Abalones are mainly harvested on the eastern and northeastern coastal areas. Squids and octopus are mainly harvested on the northern and southwestern coasts and Penghu Islands. Spiny lobsters are collected on most reefs and fleshy macroalgae are harvested by local fisherman on the northeastern coast and Penghu Islands. Reef fisheries in Taiwan have a long history for more than 300 years. However, most of the fishery resources have been depleted during the past two or three decades.

*ii. Tourism*

Reef tourism in Taiwan started to flourish in 1990. Scuba diving, snorkeling, and glass-bottom boats are the major recreation activities on most reefs. Main resorts and diving centers are located at Kenting in southern Taiwan, Longdong on northeastern coast and Lutao. Since most reefs are readily accessible from the shore, cruise and boat diving are not as common in Taiwan.

*iii. Other Uses*

Research and education facilities using coral reef resources include National Aquarium and Museum of Marine Biology in southern Taiwan, several research stations of Taiwan Fisheries Research Institute in northern, eastern, southwestern Taiwan and Penghu Islands. Besides, many institutes collect soft corals, reef sponges and macroalgae for pharmacological studies.

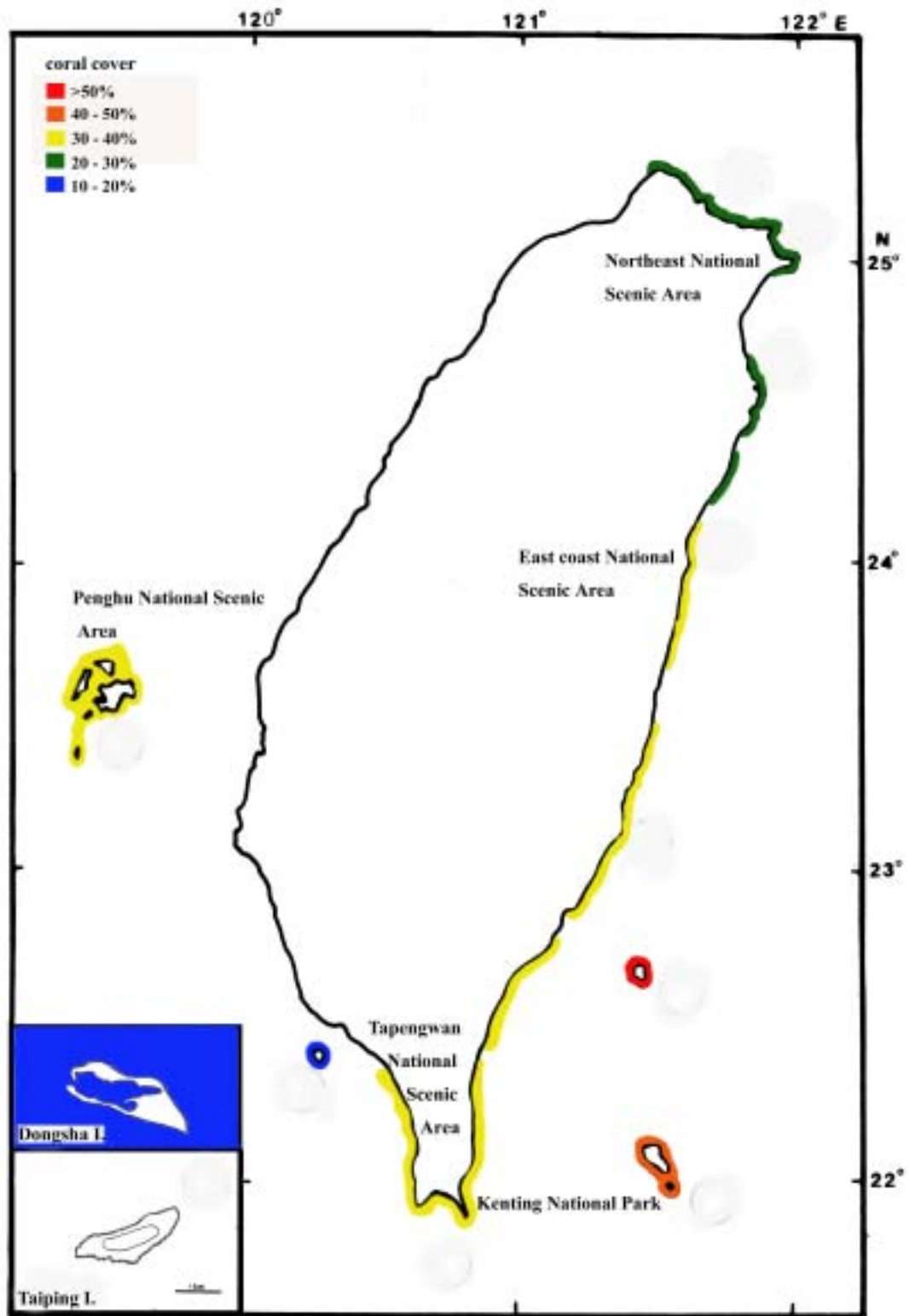
## **Status of Coral Reefs**

*a. Status of Reef Benthos (especially corals)*

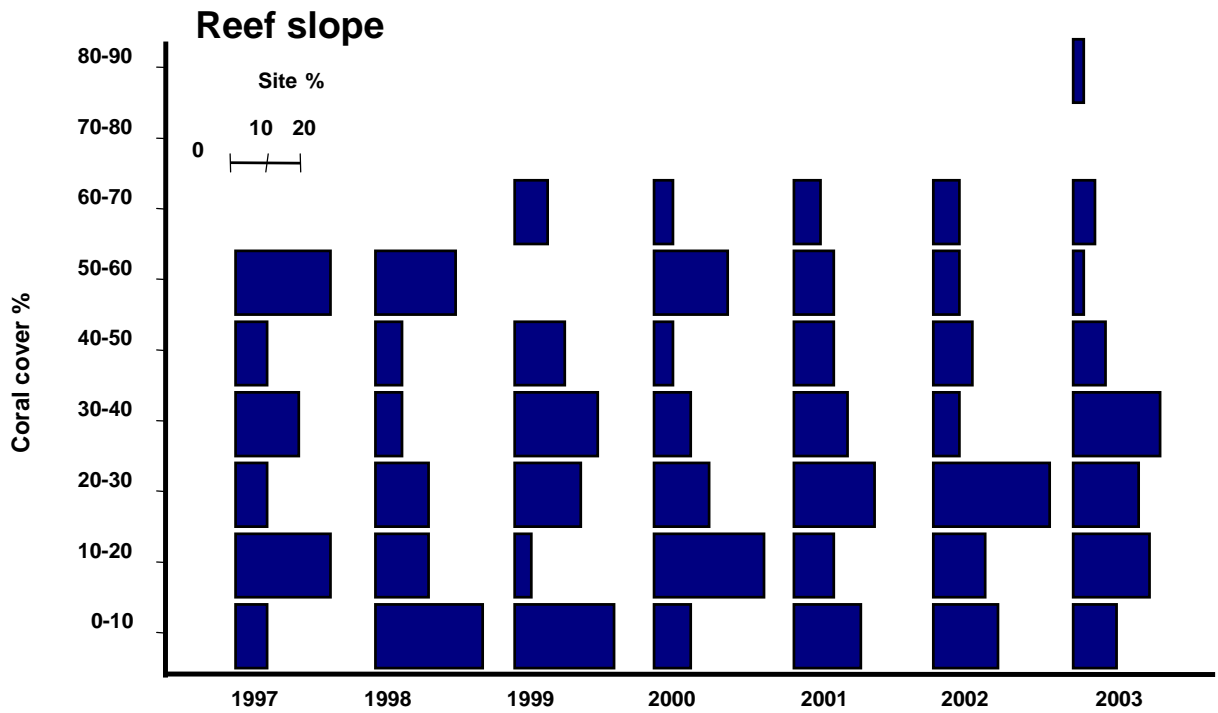
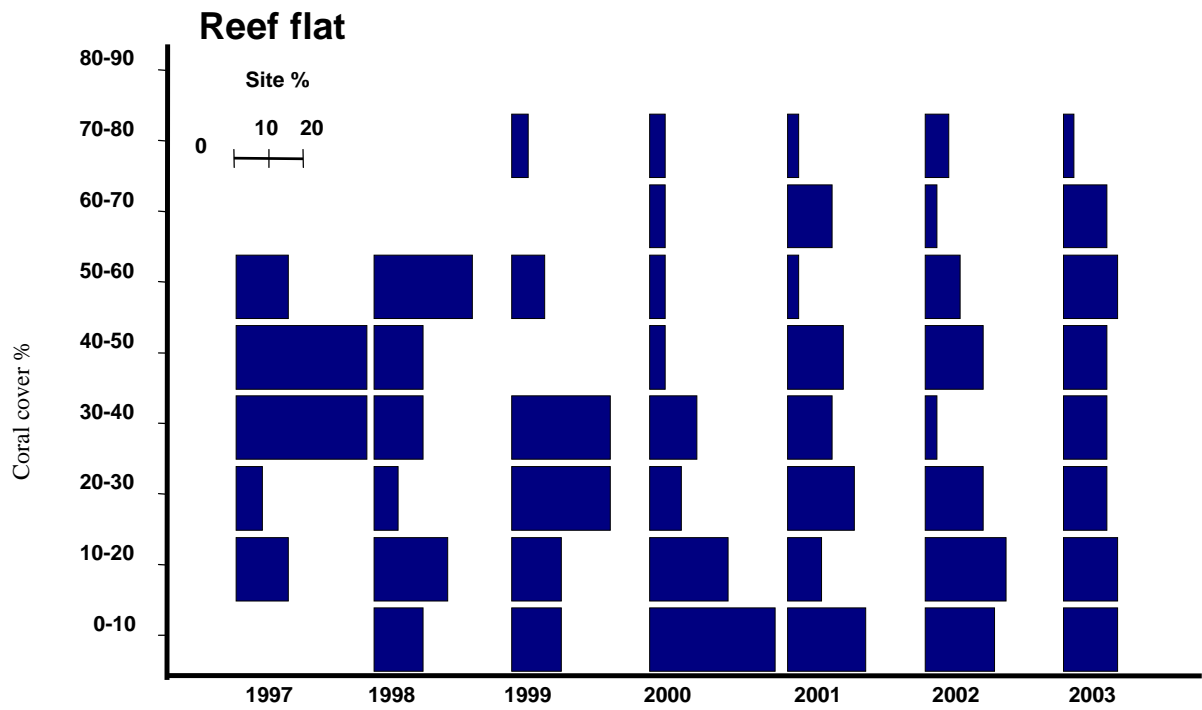
Coral reefs at 32 sites in 8 regions have been monitored using Reef Check surveys from 1997 to 2004. These monitoring are conducted by members of the Taiwanese Coral Reef Society and volunteers of local diving clubs.

The percentage of hard coral cover on 32 sites showed a wide range of variation. The highest coral cover was found at the Inner Bay of Chinwan (65%), Penghu Is., Hsiangjiaowan (65%) in southern Taiwan, and Kunguan (59%) at Lutao, representing sites with reefs in "good conditions". Living coral cover at more than half (18/32) of the sites was lower than 30%. Coral cover at reef sites on the northeastern coast and Ilan County was generally below 30%, indicating the marginal environment for coral growth. In tropical environment of southern Taiwan, living cover of hard corals at five in six sites was higher than 30%. Results also show a general trend of stable or increasing in coral cover on Taiwanese coral reefs especially after 2001, but some of these reefs were still under stress. Since both increasing and decreasing trends were observed at different sites, overall, no significant changes in coral cover among years from 1997 to 2004 were detectable using trend analysis.

Hard corals were the dominant benthic organisms at most sites, although soft corals were relatively abundant at four sites. The percentage of dead corals and coral skeletons covered by macroalgae were very high at Dongsha Island reflecting severe reef damage caused by destructive fishing and rising sea temperatures in recent years. Similar phenomenon also occurred at several sites in eastern Taiwan. Bare rocks occupy a large percent of the substrate at many sites, especially in southern Taiwan, Hsiaoliuchiu, northeastern coast and Ilan County, suggesting that reef destruction in these areas occurred several years ago. Approximately 30% of the sites showed a higher cover of fleshy and coralline algae, mostly in northeastern coast and Lanyu suggesting a phase-shift from coral-dominated to algal-dominated reefs. Low density of herbivores and nutrient enrichment are the possible factors responsible for the increasing of macroalgae on reefs.



Map 3: Average coral cover on reefs in Taiwan.



Graph 1: Trends in coral cover at 32 monitoring sites in eight areas around Taiwan from 1997 to 2003.

Table 3: Area summaries for percent cover of major benthic groups on reefs in Taiwan in 2004

Area	Hard coral	Soft coral	Macroalgae	Dead coral	Bare rock	Sand & mud	Others
South Taiwan	41.76	6.30	6.55	0.22	36.40	7.27	1.55
East Taiwan	33.30	9.90	34.40	0.35	13.45	5.35	3.25
Ilan County	21.30	7.80	25.23	0.15	40.40	5.15	0
NE Coast	22.55	1.63	39.88	1.88	22.28	10.93	0.85
Hsiaoliuchiu	14.60	0	24.87	11.07	20.93	27.87	0.66
Penghu Islands	32.30	0.45	25.90	27.55	0.25	12.45	1.10
Lutao	52.75	13.80	3.90	3.95	17.00	6.60	2.00
Lanyu	41.13	15.93	5.60	3.87	24.80	7.33	1.34
Dongsha I.	11.50	7.62	31.30	38.20	6.27	3.46	1.65

#### ***b. Status of Reef Fish***

The abundance of fish indicators remained very low at most sites from 1997 to 2004. Humphead wrasse, bumphead parrotfish, and reef barracuda were absent at all of the 32 reef sites monitored. None grouper was recorded at 78% of the reef sites. Grouper were relatively common in Penghu islands where they were recorded at five among seven sites, although the population density was very low and their body sizes were small. Grouper are heavily fished by a variety of methods in the waters around Taiwan due to their high commercial values. The abundance of snappers was also very low, none was recorded at 63% of the sites and only one or two individuals were found in a belt transect of 500 m<sup>2</sup> at 26% of the sites. The extremely low densities of grouper, sweetlips and snappers indicate that most reef sites have been heavily influenced by overfishing.

The abundance of butterfly fish was relatively higher than other indicator organisms. The density of butterfly fish at most sites predominantly fall in the >2-4 fish per 100 m<sup>2</sup> class. This is much lower than most Indo-Pacific reef sites where the majority were in the >6-8 fish per 100 m<sup>2</sup> class. The low density of butterfly fish indicates that the reefs are under the stress of aquarium fish collection.

#### ***c. Status of Resource Use***

All of reef areas in Taiwan have been overfished and fishery resources have been depleted at least ten years ago. As apparently seen in the results of Reef Check surveys from 1997 to 2004, the abundance of all fish indicators were very low and very few commercially valuable fishes existed on the reefs in Taiwan. Most reefs also suffered from intensive aquarium fish collections. Marine recreation activities, mainly scuba diving and snorkeling, were flourishing during the past ten years. Reefs on the northeastern coast, southern Taiwan, Lutao, Lanyu, and Penghu Islands have been frequently visited by tremendous amount of tourists every year. The trend for tourism development is accelerating due to the growing demand for marine recreations, putting even more pressure on these reef sites.

#### ***d. Physical Environment***

Coral reefs in Taiwan are frequently influenced by typhoons. Sedimentation from terrestrial runoff has been one of the major impacts on coral reefs particularly for those around Taiwan and Penghu Islands. SST has been constantly monitored at major port areas but the trend of variation during the past 20 years is still obscured. Salinity and turbidity have only been measured occasionally, although the increase in turbidity, which could be detected by satellites images, has been brought up recurrently. The existing data of our physical environment are not sufficient to unveil the long-term trend of environmental changes.

### **Stress and Damage to Coral Reefs**

#### **a. Sediments and Nutrients (land-based)**

Coastal areas around Taiwan have been intensively exploited for various uses including aquaculture, road construction, resort building, and agriculture. Soil erosion and landslides repeatedly occur in coastal areas, especially after storms. These runoffs have carried large amounts of sediment and nutrients to the reef areas. In addition, sewage from most human-inhabited coastal areas is often discharged into the ocean without proper wastewater treatment. This induces serious nutrient enrichment to reef ecosystems especially in northeastern and southern Taiwan, and Hsiaoliuchiu.

**b. Destructive Fishing Methods**

Although blast and poison fishing methods have been officially banned, there are still sporadic reports on these illegal fishing methods. These fishing practices mainly occur in southern Taiwan and several offshore islands including Hsiaoliuchiu, Lutaο, Lanyu, Penghu Islands and Dongsha Island. Gill nets have been commonly used for fishing in most reef areas and discarded fishing gears are often found entangled on the reefs. Preventive measures to reduce illegal fishing practices include intensive inspections and patrols by coast guards, although the effective strength of law enforcement varies in different areas.

**c. Anchor and Trawler Damage, Other Kinds of Damage (divers, trampling, etc)**

Damages caused by anchoring were found every once in a while on most reefs. Bottom-trawlers, with their heavy gears sweeping across reef surface, have caused severe damage to coral reefs in Penghu Islands. Trampling and mechanical breakage of coral skeleton by divers and tourists have always been a serious problem at diving hotspots in Lutaο, Penghu and southern Taiwan.

**d. Development Damage to Coral Reefs (ports, airports, dredging, etc)**

The construction of the Fourth Nuclear Power Plant in Yenliao, northeastern Taiwan, could be responsible for the deterioration of coral reefs in that area. Thus, the reefs are being monitored regularly in recent years. In other areas of northeastern and eastern Taiwan, damages on coral reefs occurred as a consequence of the construction of fishing ports and coastal highway.

**e. Coral Bleaching**

Extensive coral bleaching was observed in Penghu Is., and Hsiaoliuchiu reefs following heavy rainfalls associated with typhoons in June and July, 2004. Apparently these bleaching events were related to the significant reduction of light intensity in the water column due to high turbidity.

**f. Coral Diseases**

No coral disease outbreak was observed or reported in the past in Taiwan. However, coral diseases including various kinds of tissue or skeleton abnormality were noticed in northeastern, eastern, and southern Taiwan, also offshore islands such as Hsiaoliuchiu and Penghu Is. It has been noticed that the incidences of coral diseases are rapidly increasing. There is an urgent need for studies on coral diseases in Taiwan.

**g. Outbreaking or Invasive Organisms (COTS, *Drupella*, *Diadema*, etc)**

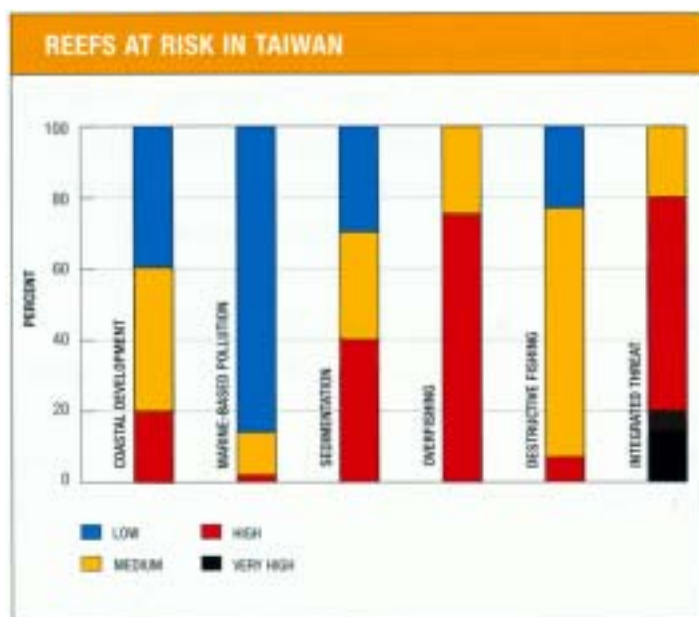
COTs have rarely been observed on the reefs around Taiwan. They can only be found sporadically and occasionally. High densities of *Drupella* were discovered at one site in Penghu Islands. However, it is not an outbreak since this snail is rare on other reefs. Outbreak of a sea anemone, *Condylactis nanwanensis*, was noticed in Nanwan Bay, southern Taiwan. This species has been suggested as an invasive species possibly from the Caribbean through the aquarium trade (Tsai et al. 2002). The outbreak of this sea anemone, which destroyed coral tissue and weakened coral skeleton, resulted in severe damage to coral reefs (Chen and Dai, 2004). However, the abundance of the sea anemone decreased and that of hard corals recovered from 2003 to 2005 (Fan et al. unpubl. data).

**h. Coral Damage from Natural Events**

Coral damages, mainly mechanical breakage and sediment burial, caused by typhoons have been occasionally observed at monitoring sites. These damages caused by typhoon disturbances vary greatly among sites since the impacts are often spatially heterogeneous. Coral communities in protected habitats are particularly vulnerable to typhoon disturbances. For example, coral communities at Chitou, Penghu Is. suffered seriously from Typhoon Chibi in September 2001, with coral mortality up to 90%, and have not recovered since then.

**Potential Threats to Coral Reefs (Reef at Risk Threat Indicators)**

A revision of the five indicators of RRSEA analysis demonstrates that all of Taiwan's reefs are threatened. Overfishing and destructive fishing together threatened 75% of the reefs; sedimentation and coastal development both threatened 50% of the reefs.



Graph 2: Reef at Risk Threat Indicators for reefs in Taiwan in 2004.

## 6. Management

### a. Marine Protected Areas

Most of the reef areas are within national parks or national scenic areas. The management is entrusted in the following Authorities: Kenting National Park in south Taiwan; the Northeastern Coast National Scenic Area; the East Coast National Scenic Area; Tapengwan National Scenic Area; and Penghu National Scenic Area. Unfortunately, the effectiveness of this management is poor, because the lack of adequate laws restricts the power of these authorities to enforce management policies to protect the reefs. The revision of laws and establishment of MPAs with effective management are under planning and discussion by governmental administrations.

### b. Monitoring

Monitoring of coral reefs has been conducted by Taiwanese Coral Reef Society using Reef Check surveys from 1997 to the present. This long-term monitoring is sponsored by the Administration of Fisheries of the Taiwanese government. Another long-term ecological research program was launched in 2001 to study and monitor the changes of coral reefs in southern Taiwan. This program is sponsored by the National Science Council of the Taiwanese government and data are managed by the Research Center for Biodiversity, Academia Sinica (<http://140.117.92.194/iter>).

### c. Legislation

Coastal resources are protected under the National Park Law and the Coastal Environmental Protection Plan which are administered by the National Park Department, Ministry of Interior. Despite this, these laws are not competent to protect coastal areas. The Coastal Area Protection Act, which is focused on conservation and sustainable management, is under revision by legislators. This law may strengthen the legal basis for the management of coastal areas in Taiwan.

## 7. Conclusions and Recommendations

Data from our past surveys indicates that coral reefs of Taiwan are under concomitant, intense pressure of overfishing and destructive fishing, pollution and nutrient enrichment from terrestrial sedimentation, marine recreational activities, and global climate change. Our results show that only one-fifth of the reef sites in Taiwan are in “good conditions”, with coral coverage higher than 50%. About half of the reef sites are in “stressed conditions”, with coral coverage between 30 to 50%. The rest of the sites are in “degraded conditions”, with coral coverage lower than 30%. The assessments of fish and invertebrate indicators revealed that all kinds of marine organisms with commercial values are very rare, further illustrating that coral reefs of Taiwan are in a highly disturbed, overfished situation.

Consequently, when considering strategies for coral reefs conservation, ways to eliminate or alleviate anthropogenic threats to coral reefs are of primary concern. In order to protect coral reef resources, the following measures are recommended: the establishment of MPAs, marine pollution control, development of coral nurseries, changeover to a sustainable exploitation of marine resources, cultivation of endangered species, raise public awareness, and initiate related researches regarding coral reefs and marine ecological conservations. We proposed the MPAs should include reef sites that have had stable, high coral coverage during the past surveys and high biodiversity. These areas include Longdong Bay, Maoao Bay, Tofuchia, Shitiping, Sansientai, Lutao, Lanyu, west of Shiaoliuchiu, and Chinwan, Jiangjunao, Dongyuping, and Xiyuping of Penghu Islands.

## **8. References**

- Chen CA, Dai CF (2004) Local phase shift from *Acropora*-dominant to *Condylastis*-dominant community in the Tiao-shi reef, Kenting National Park, southern Taiwan. *Coral Reefs* 23: 508.
- Chen JP, Jan RQ, Shao KT (1997) Checklist of reef fishes from Taiping Island (Itu Aba Island), Spratlys Islands, South China Sea. *Pacif. Sci.* 51(2): 143-166.
- Chen JP, Shao KT, Ho LT, Chen LS, Kao PH, Wu YY (1992) Fish fauna and their geographical distribution in the coastal waters around the Hsiao-Liuchiu, southwestern Taiwan. *Acta Zool. Taiwanica* 3(2): 105-134.
- Dai CF (1991) Reef environment and coral fauna of southern Taiwan. *Atoll Res. Bull.* 354: 1-28.
- Dai CF (2005) Coral reefs in Dongsha Island: past, present and future. *Proc. 10<sup>th</sup> Coral Reef Symp. Okinawa* (in press).
- Dai CF, Fan TY, Wu CS (1995) Coral fauna of Tungsha Tao (Pratas Islands). *Acta Oceanogr. Taiwanica* 34(3): 1-16.
- Dai CF, Fan TY (1996) Coral fauna of Taiping Island (Itu Aba Island) in the Spratlys of the South China Sea. *Atoll Res. Bull.* 436:1-21
- Dai CF, K. Soong, J.S. Huang, C.A. Chen, T.Y. Fan, H.Y. Hsieh, J.S. Chang (2002) The status of coral reefs in Taiwan and the conservation problems. *Proceedings of IUCN/WCPA-EA4 Taipei Conference*, p. 265-276, Taipei.
- Shao KT (1994) Biodiversity and conservation of marine fishes in Taiwan with emphasis on the coral reef fishes. *Institute of Botany, Academia Sinica, Monograph Series* 14: 307-318.
- Shao KT, Chen CP, Ho LT, Lin CP, Kao PH, Lin PL, Chen LS (1994) Checklist and distribution patterns of the fishes of the Pescadores Islands. *Proc. 4<sup>th</sup> Indo-Pacific Fish Conference*, Kasetart University, Bangkok, Thailand, p. 267-280.
- Tsai WH, Dai CF, Fan TY (2002) Population structure and reproduction of the sea anemone *Condylactis* sp. In Nanwan Bay, southern Taiwan. *Proceedings of IUCN/WCPA-EA4 Taipei Conference*, p. 743-751, Taipei.
- Soong, K., C.F. Dai, C.P. Lee (2002) Status of Pratas Atoll in the South China Sea. *Proceedings of IUCN/WCPA-EA4 Taipei Conference*, p. 739-741, Taipei.
- Yang RT, Chi KS, Hu SC, Chen HT (1975) Corals, fishes, and benthic biota of Hsiao-Liuchiu. *Institute of Oceanography, National Taiwan University, Special publication No. 7*, 53 p.

## **9. Contact Information and Acknowledgements**

Taiwanese Coral Reef Society  
<http://www.tcrs.org.tw>

Chang-feng Dai  
Institute of Oceanography, National Taiwan University  
Taipei, Taiwan  
Tel: (+886)2-23916693

Fax: (+886)2-23916693  
e-mail: corallab@ntu.edu.tw

Keryea Soong  
Institute of Marine Biology, National Sun Yat-sen University  
Kaohsiung, Taiwan  
Tel: (+886)7-5255109  
e-mail: keryea@mail.nsysu.edu.tw

Chaolun A. Chen  
Research Center for Biodiversity, Academia Sinica  
Taipei, Taiwan  
Tel: (+886)2-27899549  
e-mail: cac@gate.sinica.edu.tw

Tung-yung Fan  
National Museum of Marine Biology and Aquarium  
Checheng, Pingtung, Taiwan  
Tel: (+886)8-8825001 ext 2109  
e-mail: tyfan@nmmba.gov.tw

Henry Justin Hsieh  
Penghu Marine Biology Research Center, Taiwan Fisheries Research Institute  
Penghu, Taiwan  
Tel: (+886)6-9931026  
e-mail: hernyi@ms15.hinet.net

Ming-Shiou Jeng  
Research Center for Biodiversity, Academia Sinica  
Taipei, Taiwan  
Tel: (+886)2-27899577  
e-mail: jengms@gate.sinica.edu.tw

Chien-hsun Chen  
Institute of Oceanography, National Taiwan University  
Taipei, Taiwan  
Tel: (+886)2-23916693  
Fax: (+886)2-23916693  
e-mail: d91241002@ntu.edu.tw

Sharon Horng  
Institute of Oceanography, National Taiwan University  
Taipei, Taiwan  
Tel: (+886)2-23916693  
Fax: (+886)2-23916693  
e-mail: dedoluv@yahoo.com