



Cover: Spring in Kaohsiung, Taiwan.
Photo: W.Y. Chiau

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Action Strategies and Work Programs: Engaging the Private Sector in Sustainable Management of Marine Resources in the APEC Region

***Building on the 1999 APEC MRC Conference on the Private Sector
held in Kaohsiung, Chinese Taipei.
Endorsed by the 13th APEC MRC Working Group Meeting***

Introduction

Oceans and coasts are of large importance to business and industry, either directly through benefits that accrue from the exploitation of marine resources, or indirectly through impacts or influence on the marine environment due to their business activities. Therefore, the private sector ought to be an important player in shaping ocean and coastal management. Its role and function should be directed to sharing more responsibility with the public in marine affairs. To actively involve the private sector in the sustainable management of the marine environment has been a clear policy of the Asia-Pacific Economic Cooperation (APEC). The Declaration of the APEC Ministerial Meeting on Sustainable Development, held in Manila in July 1996, stated, "...ministers agreed that APEC action to promote sustainable development should be conducted in accordance with guidelines, including the promotion of public-private partnership." The APEC Economic Leaders' Declaration of November 1998 in Kuala Lumpur also proclaimed that, "...ministers encouraged greater interaction with the business/private sector in APEC activities." In response to those policies, the *APEC Conference on the Sustainability of the Marine Environment - What Can the Private*

Sector Do?, was held September 1 - 3, 1999 in Kaohsiung, Chinese Taipei, and was attended by delegates from Canada; the People's Republic of China, Hong Kong, China; the Republic of Korea; Singapore; Chinese Taipei; Thailand; the United States of America; and Vietnam.

The conference included representatives from governments, business enterprises, non-governmental organizations and universities. It was the first time the Marine Resource Conservation Working Group (MRC WG) has organized an event such as this with the specific intention of responding to APEC's initiative to integrate the private sector with the work program of APEC. The conference was designed to further the APEC Action Plan on the Sustainability of the Marine Environment through examining how best to develop and promote the public and private sectors' participation and partnership in advancing APEC Member Economies' objectives of sustainable use of the marine environment.

The recommendations of this conference to the Marine Resource Conservation Working Group (MRC WG) are attached (Annex 1). In order to achieve mutual benefits in the APEC region, the MRC Lead Shepherd, Dr. Chea-Yuan Young, and the Environmental Protection Administration (EPA) of Chinese Taipei held several local meetings to explore further actions on the related issues. Six task teams were

convened with experts from the private sector, government agencies and universities. The Task Teams focused on six concerns: 1) role and function and the private sector; 2) conservation of marine resource conservation and community participation; 3) coastal recreation and ecotourism; 4) marine aquaculture; 5) coastal engineering and pollution control; and 6) ocean industries and network.

The conclusions of each of the six task teams were adopted as the basis of a discussion document on private sector engagement in the MRC WG. The discussion document was reviewed at a Round Table held in Chinese Taipei, from 11-12 April, 2000. The objectives of the Round Table were to review and refine the draft discussion paper. This resulting paper will be circulated to APEC member economies and to other APEC fora for comment, before being brought before the MRC WG as a program for action.

Role and Function of the Private Sector

The private sector ought to play a more active role in the development of ocean and coastal management and its function should take the form of assuming more responsibility with the public in marine affairs. The wide range of private sector activities, coupled with the diversity among APEC economies in their approaches to ocean and coastal management requires a flexible approach to this. As stated above, to promote a more active participation on the part of the private sector in the conservation of marine ecosystems and in the sustainable management of the marine environment has been one of the fundamental policies of APEC. However, several institutional barriers impede the involvement of the private sector. For instance, the constraints of both money and time involved in R&D often hinder the development, application and testing of new

technology. In addition, the traditionally strong role of the private sector in ocean and coastal management often meant the private sector lacked enough incentive or opportunity to get involved. The situation was also aggravated by the lack of solid political support for private participation in coastal affairs.

In order to better promote engagement of the private sector in marine resource conservation within APEC, three strategies and associated work programs are recommended.

General Strategies:

- Develop communication channels and the information base to allow the private sector to be an important part of the decision-making process for policies and regulatory development for ocean and coastal management.
- Consider economic incentives, such as tax credits, to encourage the participation of the private sector to protect the marine environment.
- Highlight case studies illustrating the prudent use of marine resources and encourage the private sector to participate in developing innovative institutional

mechanisms to ensure effective partnership for the sustainability of the marine environment.

Work Programs:

- Conduct an analysis of the roles and functions the private sector may play in unison with various groups (administrative agencies; legislative bodies; businesses and industries which are directly or indirectly associated with marine resources; academic and research institutions; mass media; non-governmental organizations; and the general public) and develop local and regional dialogues.
- Assemble a portfolio of examples of the application of economic incentives in APEC economies, to encourage the participation of the private sector to protect the marine environment.
- Assemble a portfolio of case studies of the private sector's involvement in ocean and coastal management in the APEC Region, including innovative institutional mechanisms to illustrate partnership between the private and public sectors



Fishing port, Kaohsiung, Taiwan.
Photo: W.Y. Chiau

Marine Resource Conservation and Community Participation

Marine resource conservation has been a fundamental theme for APEC because of its close relationship with the sustainable development of mankind. More specifically, coastal communities are heavily dependent on the state of well being of the marine environment and the sustainable yield of marine resources. As urged by many forums, the conservation of marine resources should not be separated from the involvement of local communities. Both grass-root involvement in and community-based management of marine resource conservation deserve to come to the forefront of the APEC agenda. Among APEC economies there is a diversity of cultural and institutional approaches to the involvement of coastal communities in resource management and conservation. The careful consideration of local lifestyles, the cultural heritage and traditional practices, including the role of women, of a society can effectively shed light on the history of local coastal resources and enhance the performance of any current steps taken toward the conservation and protection of that local marine environment. Therefore, the productivity of various resources as well as their conservation can be assured.

In order to better promote marine resource conservation and the participation of local communities, two strategies and associated work programs are recommended.

General Strategies:

- Develop tools to combine traditional knowledge with new approaches to strengthen the capacity of people in communities, including local authorities and women, to participate in the management of marine resources. Focus



Royal Poinciana (*Delonix regia*) by the harbor.
Photo: W.Y. Chiau

on harmonizing the compatible uses of marine resources in coastal communities to improve their living standard and increase opportunities for employment.

- Develop tools to assist communities in establishing management-oriented data and information bases relevant to local management of marine resources.

Work Programs:

- Identify and share successful initiatives in training and education programs in APEC economies, focusing on marine resource conservation for communities that reflect characteristics of local environments. These should be geared toward local authorities (including law enforcement officials), women, fishermen, tourism developers and the public at large.
- Assemble a portfolio of case studies of the community involvement in ocean and coastal regulation and management in the APEC Region, including innovative institutional mechanisms to illustrate partnership between the communities, the private sector and other levels of government.

Coastal Recreation and Marine Ecotourism

Recently, marine ecotourism has enjoyed considerable attention in the major recreation and tourism forums owing to its unique position to maintain a balance between the protection of marine resources and the rights to access for all people. In some APEC economies, marine ecotourism has been thriving and has even been the keystone of some local economies. In particular, coastal activities, such as diving, snorkeling, sailing and nature watching (e.g., reef appreciation, whale watching), have made marine ecotourism more appealing and profitable. Thus, marine ecotourism has been looked upon as an industry with one of the best potentials in the world.

Due to the frequent lack of understanding about the marine ecosystem as well as the absence of thorough research and practical principles, the rapid development of marine ecosystems may result in serious threats to their healthy existence. Without appropriate management measures in the form of laws, guidelines and institutions, or even without sound models for development, marine ecotourism may damage the entire marine environment.

Marine ecotourism is a concern to all members of APEC MRC and the Tourism Working Groups. The purpose of the sustainable management of marine tourism is to harmonize the needs of tourism and the measures for the protection of marine resources. Some member economies have positive experience in responsible marine tourism. They are encouraged to lead a task team to explore further avenues for APEC.

In order to better promote marine resource conservation and support sustainable coastal recreation and ecotourism, three strategies and

associated work programs are recommended.

General Strategies:

- Develop a collaborative approach to marine recreation and ecotourism between the APEC Marine Resource Conservation Working Group and Tourism Working Group.
- Share effective management frameworks related to marine recreation ecotourism that include effective monitoring and control systems and reflect ecological characteristics of the native and/or local marine environment.
- Identify mechanisms that encourage private sector investment in responsible approaches to marine recreation and ecotourism.

Work Programs:

- Organize a workshop of the Marine Resource Conservation and Tourism Working Groups to develop mechanisms for responsible marine recreation and ecotourism in the APEC Region.
- Assemble a portfolio of case studies of effective management frameworks related to marine recreation ecotourism, which include effective monitoring and control systems and reflect ecological characteristics of the native and/or local marine environment.
- Work with the private sector to develop a market-based mechanism to classify and disseminate relevant market opportunity that will facilitate investment in responsible

marine recreation and ecotourism in the APEC Region.

Marine Aquaculture

Although cage aquaculture has existed for centuries, until recently it has not been widely practiced; nor has it been recognized for its potential in culturing a large variety of finfish and crustaceans in such diverse environments as ponds, rivers, lakes, reservoirs, estuaries and the open sea. Today, advanced techniques are now being applied in the open sea, making marine aquaculture one of the most prosperous and profitable industries both in the APEC region and elsewhere. Some of these projects have gained significant acclaim. The fast growth of marine cage aquaculture is attributed to the suitability of the marine environment, well established breeding techniques, availability of peripheral and the strong R&D from research institutions in agencies, universities and the private sector.

Frequently, however, inadequate management frameworks for the marine aquaculture industry have contributed to local degradation of the marine environment, as well as the impacts of introducing exotic species. The high risk its operation

presents in the open seas may necessitate the establishment of an insurance system for the industry. A marketing mechanism is also essential for the sound development of marine aquaculture.

In order to better promote marine resource conservation and sustainable aquaculture, three strategies and associated work programs are recommended.

General Strategies:

- Share information on management frameworks in the APEC Region for marine aquaculture, including policies, legislative and regulatory systems, monitoring and review, in order to assist APEC members in adopting processes to ensure the health of the marine environment and economic benefits.
- Explore innovative approaches to comprehensive marine farming that maximize long term economic benefits through more efficient and sustainable culture practices
- Facilitate the exchange of information on marine aquaculture issues, including market opportunities, species

*Kaohsiung Harbor, Taiwan
Photo: Y. C. Shih*





Ocean View at National Sun Yat-sen University,
Kaohsiung, Taiwan
Photo: W.Y. Chiau

with high potential and culture technologies for sustainable aquaculture.

Work Programs:

- Develop an inventory of management frameworks in the APEC Region for marine aquaculture that include policies, legislative and regulatory systems, monitoring and review.
- Establish a task team to identify and assist in establishing “model sites” for marine aquaculture in suitable areas of the APEC region.
- Recommend that each member economy designate a single contact point on marine aquaculture to facilitate the exchange of market and culture technology information. This may be linked to the relevant APEC websites.

Coastal Engineering and Pollution Control

A sound and tight management mechanism on coastal engineering is an integral component in management systems to mitigate the negative impact of marine pollution on the marine environment. The substantial involvement and participation on the part of the private sector can contribute to the formation of an effective co-management partnership with public agencies. Although the coastal areas are important to each economy along the Asia-Pacific rim, the problems of coastal zone management, like illegal dumping, serious erosion, saltwater intrusion and land subsidence, persist in many areas. Some member economies have developed effective policy guidelines and/or management systems to solve such problems in the coastal areas. Alternative technologies (e.g., eco-engineering) have also been

adopted and applied in some coastal zones to replace the more traditional ways to minimize coastal hazards and damage to marine ecosystems. Nevertheless, more advanced technology and management policies need to be continuously developed, modified and implemented. For these reasons, the sharing by APEC economies of both successful and failed experiences in coastal engineering, marine pollution control and coastal zone management is considered very valuable.

In order to better promote marine resource conservation through effective coastal engineering and pollution control, three strategies and associated work programs are recommended.

General Strategies:

- Develop an approach for effective sharing of comprehensive, geographically referenced data and information on the marine environment in Southeast Asia. The focus should be applications of GIS for management and include chemical, biological, ecological, and physical information.
- Share guidelines, measures, procedures, economic incentive and handbooks for coastal development and coastal engineering in APEC economies, incorporate marine resource conservation concerns.
- Share information on useful models for innovative, effective coastal engineering that are sensitive to marine resource conservation, including responsible approaches for the decommissioning of offshore oil and gas rigs

Work Programs:

- Convene a task team to recommend data types, sources, protocols and mechanisms for effective sharing of comprehensive, geographically referenced data and information on the marine environment in Southeast Asia.
- Compile an inventory of guidelines, measures, procedures, economic incentives and handbooks for coastal development and coastal engineering in APEC economies, incorporate marine resource conservation concerns.
- Identify two to three case study sites that demonstrate innovative, effective coastal engineering and balance conservation and economic development. One of these could include the decommissioning of offshore oil and gas rigs.

Ocean Industries and Network

Ocean industries are defined as those businesses that are closely dependent on the oceans. Although the marine environment offers numerous benefits and functions to mankind as well as to the ecosystem, the development of ocean industries must not come at the expense of the sustainable productivity of the marine environment. In order to promote the development of ocean industries, facilitate the exchange of information among them and pursue the common goals and benefits of the region, there is a necessity to establish an inventory system and/or a website network for APEC ocean industries. As per the consensus at the Ninth Meeting of the APEC MRC WG (27-29 September 1996, Phuket, Thailand), each member economy was requested to compile an

inventory of ocean industries. However, the successful compilation of information relevant to ocean industries was hampered due to the broad range of those businesses. Many member economies were also not clear about the definition and/or activities of the ocean industries. Thus, only a few economies and areas established their inventories or database. More involvement from other economies needs to be encouraged.

In order to better promote marine resource conservation through better exchange of information on ocean industries, two strategies and associated work programs are recommended.

General Strategies:

- Explore approaches for effective networking of ocean industries in APEC economies to share and exchange information on opportunities and capabilities among ocean industries
- Develop an approach for creating a database on ocean industries in the APEC region through a central or distributed network, to assist in identifying capabilities and market opportunities for the benefit of the private and public sectors in APEC member economies.

Work Programs:

- Convene a workshop to share and exchange information on opportunities and capabilities among ocean industries of the APEC member economies (consider an APEC Ocean Industry trade fair)
- Establish a task team to assess and implement the best approach for creating a database on ocean industries in the APEC region.

Implementation and Review

The work programs proposed above, which aim at the common benefits of all member economies, need to be further developed and fine-tuned. It is suggested that the individual projects may be led by any experienced member economy provided that member is agreed upon by all members and is in a position to encourage more participation from the private sectors within the APEC region.

The MRC WG Project Review Team should review progress on implementation and outcomes of the overall set of projects after one and two years, with recommendations on changes or further programs that may be needed to follow up.

Concluding Remarks

The overall set of work programs will contribute to more effective implementation of the APEC Action Plan on Sustainability of the Marine Environment. The MRC WG is currently developing a process for more effective implementation of the Action Plan. The process that led to the work program development may serve as an example for how to develop programs for other components of the plan.

Marine resources are closely associated with the long-term benefits of every APEC member. As called for by APEC leaders and other delegates at ministerial meetings, both the public and private sectors need to collaborate and cooperate with each other as well as develop concrete partnerships on the sustainable management of marine resources. It is believed that the prosperous future of the region depends on thorough planning,



Sunset at Hsin-Tze Bay, Kaohsiung, Taiwan.
Photo: W.Y. Chiau

enforceable management and close cooperation of all member economies of APEC.

The outcome from both the conference and roundtable discussions should be of considerable value in helping to achieve the goal of sustainable management of marine resources as well as the mutual economic benefits of Asian Pacific Economic Cooperation.

Annex 1

Recommendations of the APEC Conference on Sustainability of the Marine Environment:

What can the Private Sector Do?

September 1 - 3, 1999
Kaohsiung, Chinese Taipei

The APEC Conference on Sustainability of the Marine Environment - What Can the Private Sector Do, was held September 1 - 3, 1999 in Kaohsiung, Chinese Taipei, and was attended by delegates from Canada; People's Republic of China; Hong Kong, China; Republic of Korea; Singapore; Chinese Taipei; Thailand; United States of America and Vietnam.

The conference included representatives of governments, business enterprises, non-governmental organizations and universities. It was the first event organized by the Marine Resource Conservation Working Group specifically intended to respond to APEC objective of integration of the private sector with the work program of APEC. The conference was designed to further the APEC Action Plan on Sustainability of the Marine

Environment through examining how best to develop and promote public and private sector participation and partnership in advancing APEC Member Economies' objectives of sustainable use of the *marine environment*.

The APEC Conference on Sustainability of the Marine Environment - What Can the Private Sector Do, recommends to the Marine Resource Conservation Working Group that:

- it undertake to describe the roles and relationships between governments, the private sector, communities and academia with respect to the marine environment;
- recognizing the heterogeneous nature of the private sector, it undertake to assist the private sector in identifying with which APEC fora it should interact;
- it identify types of incentives that can be successful in gaining private sector involvement in sustainability of the marine environment;
- recognizing that some types of industry, while not dependent on the marine environment, nevertheless have an impact on it, it describe and promote approaches to engaging them in efforts to ensure the sustainability of the marine environment;
- it identify and promote success stories of public-private partnerships or private industry in enhancing the marine environment, and that it promote these as demonstration models on the potential for APEC to work with the private sector. [The Workshop on

Decommissioning of Oil and Gas Platforms held in Indonesia in 1998 might serve as one such model];

- it promote the use of the internet to advance successes in public-private partnerships in enhancing the marine environment, alert the business community of opportunities in APEC member economies related to sustainability of the marine environment, and to provide a resource on relevant services and products available;
- it work with the Tourism Working Group to identify new opportunities for ecotourism, promote private coastal ecotourism within APEC, and define guidelines or best practices for coastal ecotourism;
- recognizing that conflicts arise among users of coastal environments, it identify and promote various approaches that have been successful in the resolution of such conflicts;
- it work with the private sector to develop a basis to improve communication between APEC member economies and the private sector, so as to strengthen their relationship and promote partnerships in sustainability of the marine environment. [The development of a business plan as part of the upcoming Partnership Market Meeting is one such approach.]; and
- it use the proceedings of this conference as a resource to further promote public-private partnerships. Areas could include defining new marine food resources and culture methods, raising public

awareness on rehabilitation of impacted coastal habitats, harbour redevelopment and planning, promoting ecotourism and the use of artificial reefs.

The Conference considers that, through undertaking the steps outlined above, the APEC Action Plan on Sustainability of the Marine Environment can be implemented with the full support and participation of the private sector.

Islands in Halong bay are really heavenly palaces in the world. But Halong is not only beautiful within range of traveller's vision but also within their profound mind win respect to the far-off past and changes of nature and cultural history.

Halong is also the ideal object for scientific research in geology, geography, biology, oceanography, biodiversity studies...etc.

Departure from Hanoi is scheduled for Friday, June 13th by 6.00 am and return to Hanoi at 7.00 pm.

Fisheries Working Group Business Roundtable

As part of the FWG meeting agenda, the FWG business roundtable will be organised in Ho Chi Minh City on 15 June, 2003 with the theme of "Seafood Safety". This business roundtable will take place at the same time as Vietnam Fisheries International Exhibition 2003 (VIETFISH 2003). The participants from FWG and MRC will be welcomed to join this important event.

For economical purpose, the participants are advised to book in advance the air-tickets with the route as departing city - Hanoi - Ho Chi Minh city (on 14 June) - departing city.

APEC ACTION PLAN ON SEVERE ACUTE RESPIRATORY SYNDROME (SARS)

***MEETING OF APEC MINISTERS RESPONSIBLE FOR TRADE
KHON KAEN, THAILAND
2-3 JUNE 2003***



Photo: W.Y. Chiau

The APEC region has borne the full brunt of the Severe Acute Respiratory Syndrome (SARS) epidemic. This contagious disease, which has already taken a number of human lives, has also caused a severe economic downturn in many member economies. Diminished business confidence, reduced business travel, and increased transaction costs because of health measures have all affected trade and investment flows. Reduced travel has had an especially severe effect on the airline, travel, tourism, and hospitality sectors. If left unchecked,

SARS could affect the well-being of our peoples and further undermine economic growth and prosperity.

APEC must therefore respond quickly and effectively to this challenge. Our coordinated response to combat SARS must be transparent and add value to both national and international initiatives. The fact that some member economies have effectively controlled and contained SARS makes us more confident that, with proper coordinated measures, we can win the battle against SARS and mitigate its impacts on trade and investment.

In its response to SARS, APEC is conscious that its actions must acknowledge fully and complement the excellent work of the WHO in responding to and containing the spread of SARS.

The APEC Emerging Infectious Information Network (EiNet), established to facilitate information sharing on emerging infectious diseases, can contribute to the early detection and prevention of new infectious diseases, such as SARS. All APEC member economies are therefore encouraged to provide to the APEC EiNet information of their experiences which have proved to be

effective and helpful in containing and treating SARS. However, as SARS has proven to be beyond the ability of any single economy to contain and control, APEC member economies are determined to strengthen regional cooperation to win the battle with SARS. On 26 April 2003, Health Ministers of ASEAN, China, Japan and Korea met in Kuala Lumpur and agreed to adopt cooperation measures to prevent and control the spread of SARS. Three days later, the Leaders of ASEAN and China met in Bangkok and reaffirmed their commitment to full and speedy implementation of measures to restore the security, safety and confidence of people throughout the East Asian region. The cooperative framework agreed during those meetings could be enhanced and, where appropriate, adopted by APEC.

It is important that APEC member economies agree to confront this common threat by adopting a multi-faceted approach to dealing with SARS, utilizing all necessary means and resources within the APEC community, and working closely with the World Health Organization (WHO), to ensure that SARS is contained. To this end, we have proposed an APEC Action Plan

for Severe Acute Respiratory Syndrome (SARS) which aims to build public confidence through:

- a common set of guiding principles for health screening procedures for travelers;
- encouraging cooperation towards prevention and treatment of SARS along with other emerging diseases;
- exchanging accurate and timely information and best practices, including a credible communications strategy that addresses the consequences of SARS on travel.

Within APEC, all APEC's committees, Working Groups and Fora have been tasked to assess the impact of SARS in areas relevant to their work. They have been asked to assist in containing the spread of SARS as soon as possible and minimize its impact on APEC. The strategy to win the battle of SARS contains several measures that shall be implemented immediately and in the medium to longer terms. The agreed measures are:

Information sharing



Photo: W.Y. Chiau

Giving full, accurate and timely information is an essential part of building public awareness of the infectious disease and facilitating early detection and prevention of the spread of disease. We endorse the APEC Secretariat's webpage on "APEC Response to SARS" as a focal point for information sharing among APEC member economies. The webpage provides the following information:

- SARS situation in APEC economies

A contact point on SARS in each economy is given to facilitate instant information exchange and cooperation. Each economy will be hyperlinked to its Ministry of Health or equivalent agency responsible for SARS. APEC member economies have undertaken to update the information on a regular basis. The webpage would also include hyperlinks to other relevant agencies, and also up-to-date information for travelers such as travel advisories and regulations for both incoming and outgoing travelers, including any relevant visa or entry restrictions and airport health screening procedures. This will facilitate the exchange of best practices and increase transparency.

- Hyperlink to the APEC Infectious Information Network (EiNet)

This provides information for health officials and researchers on SARS and other emerging infectious diseases.

- Other useful information

Links to other relevant international organizations such as the WHO and

ASEAN SARS Containment Information Network.

In addition, member economies shall endeavor to inform the public and officials on the nature of SARS and its prevention to reduce unnecessary fear. The business community, through the APEC Business Advisory Council (ABAC), local Chambers of Commerce and Business Associations, should also be briefed regularly to assure uninterrupted business activity. The tourism and airline sectors should also be informed of the best practices, including good ethics, in dealing with clients suspected of SARS infection and/or other emerging diseases. As appropriate, the APEC Secretariat could work with APEC fora to develop communications products for an APEC-wide audience. This may be particularly useful in the case of the Tourism Working Group. The APEC Secretariat, the Committee on Trade and Investment (CTI) and ABAC could also cooperatively develop communications products aimed at the business community.

Strengthening a credible Infectious Diseases Strategy for APEC

We ask the Industrial Science and Technology Working Group (ISTWG) to provide feedback to SOM as soon as possible on how the APEC Infectious Diseases Strategy and its associated network can add value to the work of other organizations fighting the SARS epidemic. In doing this, the ISTWG should seek input from the WHO on how the APEC Infectious Diseases Strategy can best be used to support international and national efforts to combat SARS.



Photo: W.Y. Chiau

In addition, the ISTWG proposals on Pandemic Influenza Preparedness shall be given a fast-track approach to build capacity for response and information sharing for all infectious outbreaks, including SARS, to allow the project to begin in August or September 2003.

Promoting Common Guiding Principles on Health Screening at Borders for Air travelers

The fear of SARS is more harmful than SARS itself. The unwarranted fear of SARS has deterred people from traveling, depressed the tourism and transport sectors, and eroded confidence in regional trade and investment. Rather than a blanket ban on travel, a measured approach that focuses on isolation and containment should be used for health screening at borders.

The coordinated measures on health screening at borders adopted by the Special Meeting of ASEAN + 3 Ministers of Health on SARS in Kuala Lumpur on 26 April 2003 could be endorsed by APEC economies as the starting point for developing a common and transparent set of guiding principles to assure the safety of all travelers. These measures include:

- Pre-departure screening of all passengers from SARS affected areas to prevent the spread of SARS to other economies and boost the

confidence of the international community in the APEC region. ASEAN members have already adopted health screening for outbound flights from ASEAN airports. This has been applied by other APEC economies declared by the WHO as SARS affected areas. Pre-departure screening will be conducted in conformance with WHO guidelines and may involve the completion of a standardized health declaration card and a temperature check before boarding the vessel. APEC health and border control officials should expedite agreement on standard information that should be provided on health declaration cards.

- Screening of all arriving passengers from areas with recent transmission of SARS shall also be conducted to ensure effective control of SARS transmission. No passenger shall be refused entry due to suspected SARS infection. The host economy shall allow any individual suspected of having contracted SARS to seek medical treatment within the host economy. Health Ministers and all relevant Ministers in charge of border controls will be asked to work together to develop a common set of protocols for air travel.
- APEC member economies shall inform each other in a timely manner of SARS cases that have traveled between members. This will allow contact tracing to be carried out to identify persons with possible infections, thus arresting any potential spread of SARS. Economies should use existing communications

channels, including the WHO, to share this information.

- APEC member economies shall promote best practices and good ethics among officials to enable others to learn and benefit from such practices. Medically advanced APEC members could also provide technical assistance and capacity building to other APEC members to facilitate prompt responses to the epidemic.

Promoting Common Guiding Principles on Health Screening at Borders for Land and Sea Travelers

In the case of land and sea travel, economies which share common land borders and/or which have regular point-to-point sea-links may establish, as appropriate, a common set of protocols in order to contain and prevent the spread of SARS at land and sea checkpoints.

Medium and long-term Steps

Impact on Tourism

The Tourism Working Group has been tasked to prepare a paper on an APEC Strategy to address the impact of SARS in the tourism and airline sectors. A communications strategy, including travel advice and best practices for tour operators and relevant agencies, will be developed and disseminated. APEC, through the APEC Secretariat's website, will play a role in promoting these best practices so that we facilitate the containment of the disease while, at the same time, not unduly hindering the flow of people.

Trade Facilitation

The CTI has prepared a plan of action dealing with the impact of SARS on trade, investment and business mobility. This plan focuses on promoting overall transparency in the implementation of measures in response to SARS. CTI sub-fora have been tasked to provide an early assessment of the effect of SARS in areas such as business mobility, trade in services and how their work could mitigate the adverse effects of the SARS epidemic. This includes promoting mutual recognition of screening procedures to minimize inconvenience for travelers. We encourage the CTI to continue to identify measures in dealing with SARS which will help restore the business confidence in the region.

Economic impact

The Economic Committee (EC) has prepared a preliminary report on the economic impact of SARS. The report includes details of economies' experiences in developing economic packages to assist those adversely affected by SARS.

ABAC

In its second meeting during 13-16 May 2003 in Tokyo, ABAC held a



Photo: W.Y. Chiau

workshop on SARS to assess the impact of SARS on business in the Asia Pacific region and to discuss ABAC's response to this issue. ABAC's conclusions stressed the need for scientifically based, timely, and transparent information both within the business community and the general public on SARS. ABAC also emphasised the need to streamline border controls to ensure that screening procedures and appropriate health safeguards are implemented in a manner which does not unduly restrict business mobility. ABAC members also urged that SARS control measures do not become a non-tariff barrier to trade and that regional disease control capacity be strengthened to respond to future crises.

ABAC's response to SARS will be incorporated in ABAC's 2003 Interim Report to APEC Economic Leaders. In addition to presenting the Interim Report to the meeting of APEC Trade Ministers in Khon Kaen, Thailand, during 1-3 June 2003, the ABAC Chair will report to SOM on the outcomes of their discussion on SARS during the SOM Retreat

session on 28 May 2003. Feedback from ABAC would be helpful to guide APEC's response to the SARS crisis. In addition, ABAC is urged to make use of its business network to

disseminate accurate and timely information on SARS to the region's business community.

Science and Technology

The Industrial Science and Technology Working Group (ISTWG) has been tasked to strengthen cooperation in developing common standards for the monitoring and reporting of infectious diseases, as well as other public health issues.

Networks among medical institutions of member economies should be set up to provide prompt information on emerging infectious diseases. The ISTWG should Review its ability to develop a capacity building plan for health related emergency preparedness and report back to SOM before SOM III.

Given the urgency of this matter, the APEC Ministers Responsible for Trade (MRT) will be asked to endorse the preceding trade and investment facilitation measures in response to SARS to ensure that the fear of SARS will not be used as a pretext to protectionism or raising non-tariff barriers that restrict the movement of people and goods. As a follow up to the call by the Leaders of ASEAN during its Special Meeting on SARS in Bangkok on 29 April 2003, APEC member economies have agreed to hold a Special Meeting of APEC Health Ministers in Bangkok on 28 June 2003. We ask colleagues from the Health Ministry to discuss as soon as possible the agenda of the meeting as well as the development of a strategy to combat SARS.

Introduction

Coastal development has increased extensively throughout Southeast Asia in the last three decades (although temporarily arrested by the 1998 economic

Improving the Aquatic Environment in Semi-closed Areas through Biological Applications

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crisis). Human-engineered construction in coastal areas interferes with coastal physical processes, leading to deterioration of water quality within created enclosures (1). Apart from harmful components such as heavy metals, tributyl tin, petroleum hydrocarbons and untreated sewage, which accumulate in these waters, excessive build-up of nutrients pose a major problem. Within these enclosed or semi-enclosed systems, nutrient-driven algal blooms can affect the aesthetic qualities of the waters, causing fish kills and general deterioration of the system.

The abundance of natural habitats such as coral reefs, and the tropical climate make Southeast Asia an attractive destination for marine recreation and leisure. This is evident from the fast-developing network of modern coastal marinas and yacht clubs across the region. Marinas and yacht clubs require sheltered conditions, commonly achieved through engineering where solid seawalls are constructed to produce the desired effect. The enclosed or semi-enclosed (depending on engineering design) body of water is deprived of adequate natural flushing. This interference with natural coastal processes often leads to deterioration of water quality within the marina.

Environmental quality changes influence the community structure of marine life by favouring the more tolerant species. Populations of these species may, however, be depressed by the lack of habitat availability. At the same time, the presence of other species that could grow in such

waters may be restricted by the availability of specific niches. Whichever the case, there are species that can perform effective "cleansing" roles. For example, macro-algae can be used as biological filters for the uptake of excessive nutrients within semi-enclosed systems. Their presence needs to be enhanced as a biological solution to improving the environmental quality of semi-enclosed waters. There is currently little information on the improvement of water quality in semi-enclosed marine systems using macro species bio-manipulation.

Investigations have recently been initiated, focusing on the use of plant and animal species to improve water quality in semi-enclosed marine systems by capitalising on their ecological roles and by exploring whether their abundance is restricted by availability of appropriate ecological niches. The project, in collaboration with a local marina, Raffles Marina, includes a detailed survey of marine species present within its semi-enclosed system and aims to establish whether their populations can be enhanced (if restricted by niche availability). Species that are efficient in "fixing" nutrients and other pollutants can then be identified and techniques developed to facilitate their growth within the marina will. Experiments were conducted to assess the effectiveness of the green mussel, *Perna viridis*, as a pollution management agent.

Raffles Marina's concern for marine environmental conservation is

evident from the design of its berthing facility. The protective outer seawall is not a solid wall and does permit restricted movement of tidal currents. This ensures that the waters within can support some marine life. Although the design of the outer seawall permits flow of seawater through it, water movement is nevertheless restricted. While creating a sheltered environment for the berths, it also becomes a trap for nutrients, sediment and other pollutants. Any sheltered body of water will favour accumulation of these inputs, which are not swept away or diluted by full tidal flushing. Past monitoring of water quality parameters indicated elevated nutrient levels within the marina compared to the surrounding sea. Since storm drains did not flow directly into the marina, the obvious source of nutrients is from the flushing of boat toilets while berthed.

Water quality can be improved by enhancing growth of biological species that perform specific "environmental cleansing" roles. For example, filter-feeding species are effective in removing suspended sediment from the water column. They can help to improve water clarity, and if harvested and removed regularly, can lower sediment load of the enclosed waters. Similarly, macro-algae are effective nutrient scrubbers and can lower nutrient levels. What is required is a menu of different species that can "fix" certain pollutants.

If these species can perform such roles, why are they not present in an environment where the high

availability of nutrients and/or pollutants obviously favours their growth? There are many reasons why these species do not appear naturally in the marina. One of these could be the lack of proper settlement space. Macroalgae for example need some structure to hold on to and also require abundant sunlight. To promote growth of macroalgae, such habitat opportunities have to be made available. The challenge is to provide these settlement spaces within the confines of the marina without them interfering with boat movements and other marina operations.

Biological solutions are environmentally most acceptable (notwithstanding alien species introductions, and genetically-modified interventions, both of which require greater and more careful prior planning and investigation). The results, particularly the protocols and techniques for promoting active growth of desired species, will be useful for application to any coastal water body that is similarly semi-enclosed. With the improvement of water quality, marinas can serve as special habitats to a diversity of marine life. It can eventually use its waters to support species for the aquarium trade and also participate in the culture of threatened species for seeding and ranching purposes.

Materials and Method

A survey of marine biodiversity was first carried out to provide an indication of which species are naturally available, and where and how they were distributed within the semi-enclosed marina. This survey will establish whether present populations in the marina are restricted by the lack of niche availability and provide a list of naturally-occurring candidate species that can be exploited for their environmental cleansing abilities.

The survey covered species attached to fixed structures such as the seawall and pilings, floating structures such as pontoons and floats, the water column, and the sea floor. Specimens from the fixed and floating structures were easily collected by hand. Nekton was sampled using nets while the benthic community was sampled using an Eckman grab.

Experiments were carried out with filter-feeding green mussels (*Perna viridis*). Mussel spats grown on ropes were introduced to an experimental berth. They were brought in from a farm close to the causeway in the Johore Strait where salinity is lower than at the marina. These mussels grow naturally on the outer seawall but are not abundant. In all, 80 ropes of mussels were used, 10 of which contained 3-month old mussels while the remaining 70 contained mussels that were over a year old. Each rope was 2m in length. Mussel samples were collected fortnightly, sealed in containers and transported in ice to the laboratory. The tissues were extracted, dried, weighed and acid digested prior to heavy metal analysis by a Perkin Elmer AA600 graphite furnace atomic adsorption spectrophotometer. Water samples were collected for nutrient analysis and physical data such as salinity and dissolved oxygen



Lagoon Entrance of Dongsha(Pratas) Island, Taiwan.
Photo: W.Y. Chiau

measured in situ.

Results

A general survey of marine life within the marina completed in 2000 year showed a healthy diversity of 72 pelagic species and 63 benthic species. In addition, the epibiotic community attached to the seawalls, pontoons and pilings was diverse. The pelagic species were dominated by fish (63 species) and included 3 species of jellyfish, 3 of crabs and 1 each of a swimming polychaete, a squid and a sea-snake (Table 1). Sixteen of the 63 fish species were bottom dwellers (such as the catfishes *Plotosus lineatus* and *Arius venosus*) while 8 were those that generally inhabit reefs (such as *Chelmon rostratus* and *Platax teira*). The fish community included species from a variety of trophic levels and niche specialisations. Of interest is the presence of the seahorse, *Hippocampus kuda*, puffers, archer fish and food fishes.

The benthic community (Fig. 1) was dominated by polychaetes, represented by 51 species (Table 2), most abundant of which were *Polydora* sp., *Drilonereis filum* and *Sthenolepis japonica*. Most abundant polychaete families were Spionidae, Cirratulidae and Orbiniidae.

The epibiota on the seawalls and pilings was dominated by crustacea (barnacles) and gastropoda (limpets), which form about 99% of the community. Crabs included *Myomenippe hardwicki* (which was most common), *Lauridromia indica*, *Selatium brockii*, *Metopograpsus* sp. and *Schizophrys aspera*. The gastropod families Neritidae and Littorinidae were well represented. Other fauna included gorgonians and ascidians. The epibiotic community of the pontoons showed a greater diversity of 10 phyla from 2 kingdoms (Table 3). Common were the calcareous tube polychaetes, sponges, ascidians and stinging

hydroids. Less common were soft corals (5 species), zooanthids, seafans and seawhips.

Water transparency, determined by Secchi readings, improved significantly (ANOVA, $p < 0.05$) within the mussel experimental berth compared to locations beyond it (Fig 2).

The levels of ammonia, nitrite, nitrate and phosphate did not show significant differences between the waters within and beyond the mussel berth. Evident is the accumulation of heavy metals within the young mussels in the short span of time of their introduction. Copper and nickel content rose after the second week of mussel introduction. Copper level increased from 33.65 to 58.76ppm while nickel increased from 2.54 to 5.96 within a month of introduction.

Discussion

Literature on the improvement of semi-enclosed marine waters by physical, chemical and biological means is not extensive. These interventions can be used singly (2) or in combination (3). Biological remediation has a potential in reforming impacted environments (4,5) and more investigations are needed.

A study of heavy metal levels in marine sediments of Singapore indicated varying levels of copper, zinc, lead and cadmium (6). These levels were influenced by sediment particle-size and types of human activity. An earlier but brief investigation showed that heavy metal and nutrient loads within the marina were twice the concentration of the surrounding waters. Untreated sewage discharged from the boats berthed in marinas has a profound effect on the biological communities (7,8). Current investigations of another marina, Punggol Marina, showed high eutrophication (high primary productivity and Chlorophyll a)

correlated with higher measures of nutrients (nitrate, nitrite, ammonia) and Total Petroleum Hydrocarbons (8). Similar monitoring studies reporting the effect of pollutants on the biota established in marinas have been reported (9,10). They all indicate a need to find biological solutions to improving water quality so that its environmental capacity and integrity can be enhanced. Knowledge of sewage treatment has been applied effectively, employing physical, chemical and biological means for environmental remediation. Bioremediation or biomanipulation is a favoured approach as physical and chemical means of remediation in a marina may trigger other undesirable changes. Unregulated inputs of nutrients cause eutrophication. Aquatic micro- and macrophytes use up nutrients effectively and create conducive conditions for bacterial decomposition of organic matter (11). Their ability to bioaccumulate contaminants like heavy metals is known. Use of aquatic weeds for remediation (phytoremediation) is a more recently evolved branch of bioremediation. Aquatic macrophytes have been widely used in remediation of freshwater ecosystems quality (12). Seaweeds have been used in biological nutrient removal systems to improve coastal water (13). Under conducive conditions like excess nutrients and light, algal blooms are known to establish in closed or semi-enclosed systems. It is an established fact that like artificial reefs, coastal marinas provide extensive and sustainable substrata to a variety of flora and fauna (1). They can be manipulated to serve environmental cleansing functions and help to improve the environmental capacity of the enclosed waters. The species diversity at Raffles Marina presents a wealth of target organisms that can be exploited to remediate the waters. Experiments with the mussels showed potential applications with heavy metal uptake and water clarity

improvement. Further investigations with other species will identify those that are effective in lowering pollution load. Growth of these target species needs to be encouraged as substratum availability may not be present. The introduced mussels on ropes, for example, grew rapidly, while the naturally occurring ones were not abundant and confined to the outer seawall. Once identified, management protocols for the candidate species need to be developed for the frequency of their introduction and removal, including techniques to reduce human effort.

Marine habitat biomanipulation is a promising and developing discipline with immense scope for application. Environmentalists prefer management interventions, which are biological as they are ecological compatible. Most work has been on freshwater systems and only few have been on marine systems.

Acknowledgements

This paper is based on investigations initiated at the Raffles Marina. The results presented are partly from the thesis reports of two Honours students (14,15). The management of Raffles Marina Singapore provided full cooperation and support for the investigations to be carried out including long-term availability of a berth for the experiments to be conducted.

Table1. List of pelagic species sampled within Raffles Marina

(B=bottom dwellers, C= reef-associated).

Class	Order/Family	Status	Species
Scyphozoa	Rhizostomeae		<i>Phyllorhiza</i> sp.
			Rhizostome sp.1 Rhizostome sp.2
Polychaeta	Amphinomidae		<i>Chloea flava</i>
Cephalopoda	Loliginidae		<i>Sepioteuthis</i> sp.
Crustacea	Dorippidae		<i>Neodorippe callida</i>
	Portunidae		<i>Portunus pelagicus</i> <i>Thalamita</i> sp.
Osteichthyes	Clupeidae		<i>Sardinella</i> sp.
	Ariidae	B	<i>Arius venosus</i>
	Plotosidae	B	<i>Plotosus lineatus</i>
	Antennariidae	B	<i>Lophiocharon trisignatus</i>
	Atherinidae		<i>Hypoatherina valenciennesi</i>
	Belontiidae		<i>Strongylura strongylura</i>
	Hemiramphidae		<i>Zenarchopterus buffonis</i>
	Centriscidae		<i>Aeoliscus strigatus</i>
	Syngnathidae	B	<i>Hippocampus kuda</i>
		B	<i>Hippichthys cyanospilos</i>
		B	<i>Hippichthys poenicillus</i>
	Scorpaenidae	B	<i>Synanceja horrida</i>
	Platycephalidae	B	<i>Cymbacephalus nematophthalmus</i>
	Ambassidae		<i>Ambassis kopsii</i>
	Centropomidae		<i>Lates calcarifer</i>
	Serranidae		<i>Cephalopholis boenak</i>
		B	<i>Diploprion bifasciatum</i>
		B	<i>Epinephelus coioides</i>
	Pseudochromidae	BC	<i>Congrogadus subducens</i>
	Terapontidae		<i>Pelates sexlineatus</i> <i>Terapon theraps</i>
	Apogonidae		<i>Apogon amboinensis</i>
			<i>Apogon hyalosoma</i>
			<i>Apogon margaritophorus</i>
			<i>Sphaeramia orbicularis</i>
Haemulidae	C	<i>Plectorhincus chaetodonoides</i>	
Lutjanidae		<i>Lutjanus johnii</i>	
Nemipteridae		<i>Nemipterus peronii</i>	
	C	<i>Scolopsis vosmeri</i>	

	Scatophagidae		<i>Scatophagus argus</i>
	Ephippidae		<i>Platax teira</i>
	Monodactylidae		<i>Monodactylus argenteus</i>
	Silliganidae	B	<i>Sillago sihama</i>
	Lobotidae		<i>Lobotes surinamensis</i>
	Pomacanthidae	C	<i>Pomacanthus annularis</i>
	Chaetodontidae	C	<i>Chelmon rostratus</i>
		C	<i>Coradion chrysozonus</i>
	Chaetodontidae		<i>Parachaetodon ocellatus</i>
	Carangidae		<i>Caranx ignobilis</i> <i>Caranx</i> sp.
	Cichlidae		<i>Etoplus suratensis</i>
Osteichthyes	Pomacentridae	C	<i>Abudefduf bengalensis</i>
		C	<i>Pomacentrus tripunctatus</i>
	Labridae	C	<i>Choerodon anchorago</i> unidentified genus and species
			unidentified genus and species
	Blenniidae	B	<i>Omobranchus ferox</i>
		B	<i>Omobranchus zebra</i>
	Gobiidae	B	<i>Butis butis</i>
		B	<i>Butis koilomatodon</i>
	Siganiidae		<i>Siganus canaliculatus</i>
			<i>Siganus guttatus</i>
	Toxotidae		<i>Toxotes jaculatrix</i>
	Monacanthidae		<i>Acreichthys tomentosum</i>
			<i>Anacanthus barbatus</i>
		<i>Chaetodermis penicilligerus</i>	
		<i>Monacanthus chinensis</i>	
		<i>Paramonacanthus choirocephalus</i>	
Ostraciidae		<i>Rhynchostracion nasus</i>	
Tetraodontidae		<i>Arothron reticularis</i>	
		<i>Tetraodon nigroviridis</i>	
Diodontidae		<i>Diodon liturosus</i>	
Reptilia	Acrochordidae		<i>Acrochordus granulatus</i>

Table 2. List of benthic polychaete species from Raffles Marina.

Order	Suborder	Family	Species
Orbiniida		Orbiniidae	Haploscoloplos kerguelensis <i>Scoloplos armiger</i> <i>Scoloplos (Leodamas) gracilis</i> <i>Scoloplos (Leodamas) sp.</i>
		Paraonidae	<i>Aedicira sp.</i> <i>Aricidea sp.</i> <i>Aricidea longobranchiata</i>
Spionida	Spioniformia	Spionidae	<i>Aonides oxycephala</i> <i>Aguilaspio sexoculata</i> <i>Paraprionospio pinnata</i> <i>Polydora sp.</i> <i>Prionospio malmgreni</i> <i>Pseudopolydora kempfi</i> <i>Pseudopolydora sp.</i>
		Magelonidae	<i>Magelona cincta</i>
	Cirratuliformia	Cirratulidae	<i>Cirratulus filiformis</i> <i>Cirriformia tentaculata</i> <i>Tharyx marioni</i> <i>Timarete sp.</i>
Capitellida		Capitellidae	<i>Capitella capitata</i> <i>Heteromastus filiformis</i> <i>Mediomastus californiensis</i> <i>Notomastus latericeus</i>
Phyllodocida	Aphroditiformi a	Polynoidae	<i>Polynoidae sp.</i> <i>Lepidonotus sp.</i>

		Sigalionidae	<i>Sthenolepis japonica</i>	
		Chrysopetalidae	<i>Paleanotus debilis</i>	
	Nereidiformia	Hesionidae	<i>Ophiodromus angustifrons</i>	
		Pilargiidae	<i>Otopsis sp.</i> <i>Pilargis sp.</i>	
		Syllidae	<i>Typosyllis sp.</i>	
	Glyceriformia	Glyceridae	<i>Glycera natalensis</i> <i>Glycera rouxi</i> <i>Glycera sp.</i> <i>Glycera tessellata</i>	
		Goniadidae	<i>Glycinde kameruniana</i>	
		Lacydoniidae	<i>Paralacydonia paradoxa</i>	
	Nephtyidae	<i>Aglaophamus dibranchis</i> <i>Aglaophamus lyrochaeta</i> <i>Nephtys sp.</i>		
		Amphinomid a	Amphinomidae	<i>Linopherus hirsuta</i>
		Eunicida	Eunicidae	Eunice antennata <i>Eunice indica</i>
Lumbrineridae	Lumbrineris nagae <i>Lumbrineris sp.</i>			
Arabellidae	<i>Drilonereis filum</i>			
Lysaretidae	<i>Oenone fulgida</i>			
Oweniida		Oweniidae	<i>Myriochele sp.</i>	
Terebellida			<i>Isolda pulchella</i>	
		Terebellidae	<i>Amaeana sp.</i>	
Sabellida		Sabellidae	<i>Laonome sp.</i>	

Table 3. Epibiota of the floating pontoons in Raffles Marina.

Kingdom	Phylum/Division	Class/Order	Family
Plantae	Chlorophyta	Siphonales	Caulerpaceae
			Codiaceae
Animale	Porifera		
	Cnidaria	Hydrozoa	Hydroids
			Soft Corals
		Gorgonacea	
	Zoanthidea	Zoantidae	
	Platyhelminthes	Turbellaria	
Nemertea			
	Annelida	Polychaeta	Nereidae
	Mollusca	Gastropoda	Littorinidae
			Others
		Bivalvia	Mytilidae
			Ostreidae
	Crustacea	Amphipoda	
		Decapoda	Camptandriidae
			Grapsidae
			Majidae
	Echinodermata	Holothuroidea	
Echinoidea			
Ophiuroidea			
Chordata	Ascidiacea		

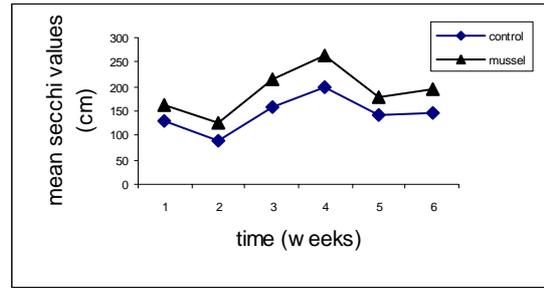


Figure. 2. Transparency of water within and beyond mussel berth.

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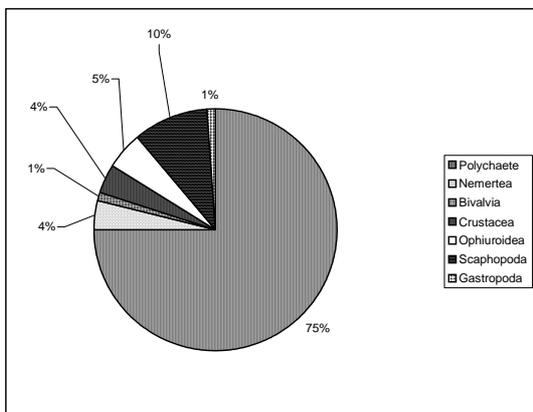


Fig.1. Benthic community composition within Raffles Marina

Important Information about Caulerpa Taxifolia



Caulerpa taxifolia is an invasive marine seaweed that has been found in many parts of the world. If it is not contained, the seaweed presents a serious threat to the environment and associated marine industries in nearby coastal areas. Caulerpa taxifolia is able to over run native seagrasses and is extremely difficult to eradicate. It can grow from small fragments accidentally carried by boat owners, fishers and other water users. Fish can not eat this variety of Caulerpa due to the toxins in the plant and it has the potential to displace fish populations. Therefore, action needs to be taken to protect seafood industry and our important natural marine environment.

While much is known about the weed through its appearance in other parts of the world, very little is known about Caulerpa taxifolia in our climate and in an enclosed marine environment. It is not practical for full eradication of the weed, but may be suitable for small isolated patches. High concentration of salt method has been used extensively in New South Wales of Australia but with little success. The weed will die in fresh water with salinity levels less than 10 parts per thousand. Copper has been shown to be effective in killing the weed but there are

concerns about the potential environmental impact of its use within the entire lake and/ or marine environment. Although Chlorine has also been used, it could not completely kill the Caulerpa at feasible dosage rates due to large volumes, of waters, cost and environmental impact. The other methods such as smothering are currently being tested and may prove to be a suitable management tool for small, isolated patches of the weed. A number of possible options for the eradication of Caulerpa taxifolia are being finalized. Each option will take into account such things as the likely impact on residents, environmental impacts, costs, logistics, time frames, etc. When the assessments are completed, they will be presented to the related government for consideration. Then there are other considerations such as possible environmental impacts of various treatments and obtaining the necessary environmental approvals.

Therefore, it would certainly be inappropriate and short-sighted to embark on an eradication plan without adequate research to ensure that any "solution" now didn't turn out to be a long-term issue impacting on either the community or the environment.

What can you do to help? Many ways are suggested as follows.

- Remain vigilant and if you see Caulerpa growing in beachfront waters or other areas, and call the authority concerned.
- Do not allow dogs to play in the invaded waters during the eradication and clean-up.
- Check home marine aquariums and if you have Caulerpa, remove it, seal it in a plastic bag and put it in the household rubbish.

Source:

<http://fishnews.cool.net.au/modules/news/article.php?storyid=18>

More information is also available on the website:
www.pir.sa.gov.au/weeds