

IYOR 2008

Singapore celebrates our reefs

THE SINGAPORE BLUE PLAN 2009

A proposal by civil society
for
integrated and balanced conservation of
Singapore's Marine Heritage



Respectfully submitted by the
International Year of the Reef (2008) Organising Committee and
the Singapore Blue Plan 2009 Committee to:

Mr Mah Bow Tan, Minister for National Development
Co-Chair of the Inter-Ministerial Committee on Sustainable
Development
&

Dr Yaacob Ibrahim, Minister for the Environment and Water Resources,
Co-Chair of the Inter-Ministerial Committee on Sustainable Development

23May 2009

THE SINGAPORE BLUE PLAN 2009

(INTERNATIONAL YEAR OF THE REEF 2008)

EXECUTIVE SUMMARY

INTRODUCTION

1. The Blue Plan is a proposal to the Government and people of Singapore from the members and organizations that form the “International Year of the Reef (IYOR) 2008 Singapore” – interested members of civil society concerned about the conservation and rehabilitation of Singapore’s coastal and marine heritage. Contributions and advice from the leading marine biologists and concerned citizens in Singapore have been incorporated. The Draft Blue Plan 2009 was launched on 23 April 2009 and made accessible to members of the public for comments and feedback via various websites. Their comments have been incorporated into this Final Blue Plan 2009.

2. In addition to it being a proposal to the Government and people of Singapore, the Blue Plan will also be actively used by the Marine Conservation Community to plan and coordinate its efforts and programmes. Based on the Blue Plan, baseline targets will be set, objectives prioritized and resources more efficiently deployed.

3. The Blue Plan recognizes that the Government has indicated a commitment to find a pragmatic balance between infrastructure development and the conservation of the inter-tidal habitats and biodiversity including coral reefs. Since 2004, Environmental Impact Assessments (EIAs) are required for development projects in the coastal and marine areas. Projects that cause damage to the natural environment are required to include mitigation, repair and compensation for damages and the Environmental Monitoring and Management Programme (EMMP) currently provides a framework for managing ongoing development activities to ensure that impacts do not exceed predetermined threshold limits and this provides a mechanism for management agencies to take immediate action when threshold limits are violated.

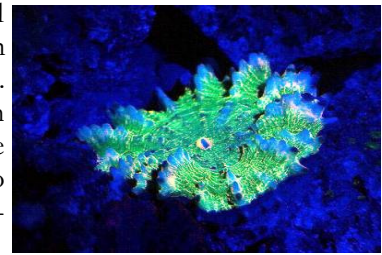
4. Over 3,500 Singaporeans volunteer in conservation efforts and in public education as nature guides to shore and reef areas. Over 100,000 people attend these guided walks and conservation/education events annually. In addition, thousands of SCUBA divers visit our reefs. Although large areas of original reefs were lost over the last 40 years through foreshore reclamation, many reefs and shores still exist today. The recent management approach that encourages best practices for coastal development activities reflects the government’s commitment to balancing development with conservation and management of natural coastal habitats. Some of the examples in the area of shore and reef conservation include:

- a. **The Semakau Landfill** – *mitigation measures employed during construction to protect adjacent coral reefs and conserve part of the island’s inter-tidal habitats include mangrove restoration and silt curtains to minimize sediment damage of sea grass, reefs and sandy shores. Mangrove restoration and management is another example of proactive conservation undertaken by the government. The Semakau Landfill is touted internationally as a showcase for “building with nature” and is used recreationally by the public in a collaborative partnership between government and civil society (Bland 2007; Chou & Tun 2007;).*
- b. **Chek Jawa** – *a landmark deferment of reclamation as a result of collaboration between the Government and civil society in 2001 (Soh & Yuen 2006). The events surrounding this development have stimulated youth interest and participation in various civil society activities. The collaboration lasted five years after deferment until the official launch of the boardwalk and visitor facilities in 2008. To this day, Chek Jawa attracts a continuous stream of local and international visitors.*



- c. **Cyrene Reef** – *a paradise of inter-tidal marine biodiversity within 30 minutes reach from the main-island of Singapore. Cyrene Reef lies in the middle of our world class port and petrochemical facilities. This piece of jewel of marine biodiversity still thrives, in part, due to stringent pollution controls and adherence to International Maritime Organization (IMO) Conventions.*

5. Singapore's inter-tidal and coral reef habitats are an important natural heritage. We still have living reefs and shores that are easily accessible. Even the furthest offshore coral reefs can be reached by a 20-40 minutes boat ride. These ecosystems support excellent biodiversity, providing a living classroom for a quick introduction to tropical marine biodiversity. Opportunities for the residents and citizens of Singapore abound and are concurrently extended to our community of international tourists, scientists, business executives, conference delegates, students and expatriates.



PART OF SINGAPORE'S "SUSTAINABILITY BRANDING"

6. Building on Singapore's existing track record of balancing terrestrial conservation with development, Singapore can, with additional effort, position herself to become a global example of sustainable development in the coastal and marine environment. We can provide a model to the global community by demonstrating how marine conservation and coastal development are not necessarily mutually exclusive. The principles and technology involved in sustainable coastal development can be exported in the same way Singapore has exported the technologies, policies and processes for dealing with limited water and other natural resources.

7. An example of this is "Port of Singapore Authority International" and other Singapore icons such as "Surbana" which currently tenders for jobs to build and operate port facilities throughout the world. Countries increasingly want to conserve their own shores and reefs for tourism, fisheries and other ecological goods and services. With a robust and integrated local marine conservation policy and implementation success, Singapore can, in future, tender for overseas projects to build and operate sustainable world class coastal and marine facilities that incorporate habitat conservation and management. Singapore's competitive edge increases with the ability to build and operate world class facilities without impacting shores and reefs.

BIODIVERSITY

8. Singapore is already a signatory to nine (9) different multilateral environmental agreements (MEA) including the Convention on Biological Diversity, the Montreal Protocol on Substances that Deplete the Ozone Layer, the CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora, and the Basel Convention On The Control Of Transboundary Movements Of Hazardous Wastes And Their Disposal. We have a robust terrestrial management and conservation strategy that includes the Singapore Green Plan 2012, the Parks and Waterbodies Plan 2003 (NParks/URA), Draft Masterplan 2008 (URA) and the Sustainable Development Blueprint (2009). What we can improve upon, however, is an integrated coastal and marine conservation and management plan. Thus, a comprehensive approach to conserving our marine heritage will enhance our standing as a country which is able to balance development with conservation of natural heritage. The individuals and organisations who authored the Blue Plan 2009 would like to continue to partner and complement the government in working together in the future – to take advantage of the opportunities and to tackle the challenges that face our nation in the conservation of biodiversity: terrestrial, wetlands and marine.

9. In the face of climate change, global warming and rising sea levels, conserving our reefs is a valuable and responsible action to ensure the continued provisions of goods and services such as shoreline protection and biodiversity conservation. There is much we can learn from these resources, but only if we conserve them. For example, a recent study by Cooper *et al.*, 2008 showed that the estimated economic benefit of coral reefs and mangroves in providing coastline protection in Belize, a small nation in Central America, was between US\$231 to US\$347 million, which is between 1/5 and 1/4 of its GDP for the assessment year 2007.



IT IS NOT TOO LATE TO SAVE OUR CORAL REEFS – OUR NATIONAL HERITAGE

10. Over the years, development in Singapore has come at a price – we have lost 60% of our coral reefs and much of our natural shoreline (Todd & Chou 2005, Chou, 2006). However, we have been fortunate that the biodiversity has persisted despite this impact. We are in a unique position to maintain and possibly even reverse this trend. [The remaining coral reefs in Singapore contain:](#)

- a. More than 250 species of hard corals from 55 genera (a 2008 reassessment indicated that only one species is locally extinct (Huang *et al.*, in press))
- b. More than 120 reef fish species from 30 families, and still counting
- c. 12 out of the 23 seagrass species that can be found in the Indo-Pacific region



11. Contrary to the belief that our reefs have been permanently devastated, they still support rich marine life. Given the size of the reefs and conditions present here, Singapore coral reefs compare favorably with coral species richness in the more extensive reefs of the region (Huang *et al.*, in press).

RECOMMENDATIONS

12. Singapore should, in its overall conservation strategy, **aim to conserve the best and most representative of our natural coastal and marine heritage/ecosystems.**

13. As Singapore is a signatory to the Convention on Biological Diversity (CBD), with high species diversity in our coral reefs, the Blue Plan [advocates the principle of: “conserving 10% of our original, natural and unmodified coastline”](#). Although we have high biodiversity, the remaining reef area is small, and will require careful management to survive and thrive. As previous and ongoing shoreline modifications have possibly altered more than 90% of Singapore’s natural coastlines, it is imperative therefore that we strive to conserve, as far as possible, **all our remaining natural coastline, including the small stretch along Labrador beach, and all remaining natural coastlines along our southern islands including Sentosa, St John’s Island, Sister’s island, Pulau Semakau, Pulau Jong, Pulau Salu, Pulau Biola and Pulau Pawai.**

14. In general, this Blue Plan recommends that the Government, works together with civil society and research institutions, and build on its good track record by establishing more comprehensive and integrated policies for mitigation of reclamation and development works. This would include:

- a. The formation of a central coordinating agency, comprising representatives from government agencies, NGOs, academia and public interest group tasked to:
 - i. Review EIAs and EMMPs for coastal development projects
 - ii. Engage in active public consultation, and to incorporate multi-sectoral feedback into any development projects



- b. A review of existing laws and regulations that relate to the coastal and marine environment, including:
 - i. Fisheries laws and regulations, especially relating to recreational fishing using unsustainable and damaging fishing devices such as drift nets and bubus
 - ii. Laws and regulations related to anchorage of sea-going vessels near sensitive marine receptors to prevent physical grazing or scraping of shallow-water coastal and reef habitats
- c. An ecosystem-based approach to conservation in Singapore where multiple internal and external influences are considered including the need to balance diverse biological, social and economic objectives
- d. Raising awareness and respect for Singapore's marine biodiversity in a similar way as the ABC programme for freshwater resources



15. The Blue Plan also attempts to list threats to our coral reefs and makes recommendations on their conservation and rehabilitation. These recommendations include:

- a. **Formally Establishing “MARINE BIODIVERSITY AREAS” for the following areas of high marine biodiversity:**
 - i. Pulau Hantu and adjacent submerged reefs
 - ii. Pulau Subar Darat & Pulau Subar Laut (Sister's Island)
 - iii. Pulau Satumu
 - iv. Pulau Biola and adjacent submerged reefs
 - v. Pulau Semakau and adjacent submerged reefs
 - vi. Cyrene Reef
 - vii. Pulau Ubin (Chek Jawa)
 - viii. Pulau Tekong (Benting Bronok)
 - ix. Kusu Island
 - x. Pulau Jong
- b. **Enhancing policy for mitigation of reclamation & development works through the:**
 - i. Establishment of a comprehensive baseline data intertidal and coral reef biodiversity survey that is included in a continuously updated and publicly accessible national archive
 - ii. Establishment of a central coordinating government agency for reviewing marine development project plans
 - iii. Review of existing laws and legislations on recreational fisheries and anchorage near shallow sensitive marine habitats



- iv. Establishment of an independent, joint coordinating committee to oversee implementation of coral reef protection programmes
- v. Improvement of the siltation mitigation measures that are already in place
- vi. Continued effective prevention, containment and mopping up measures for marine pollution
- vii. Mandatory environmental impact assessments (EIAs)
- viii. Integrated monitoring of marine nature & protected areas
- ix. Research into the regeneration, renewal and connectivity of marine habitats
- x. Adoption of an ecosystem-based approach to conservation



CONCLUSION

16. The IYOR 2008 Committee and the Marine Conservation Community that supports it are ready to work with the Singapore Government, its agencies, the private sector, civil society organizations & the citizens of Singapore in negotiating the challenges and taking all available opportunities to make this passionate and sincere dream come true. The Blue Plan and the IYOR 2008 Committee are apolitical. We see the Blue Plan is a national initiative, interdisciplinary in its approach and overview. It is hoped that the recommendations in the Blue Plan will be implemented (and further enhanced) when the next International Year of the Reef is celebrated again in 2018. The Blue Plan is a plea.....a vision....a dream....a hope....of the people, by the people and for the people of this Nation.

Yours Sincerely,

Francis Lee

*Chairman
IYOR 2008*

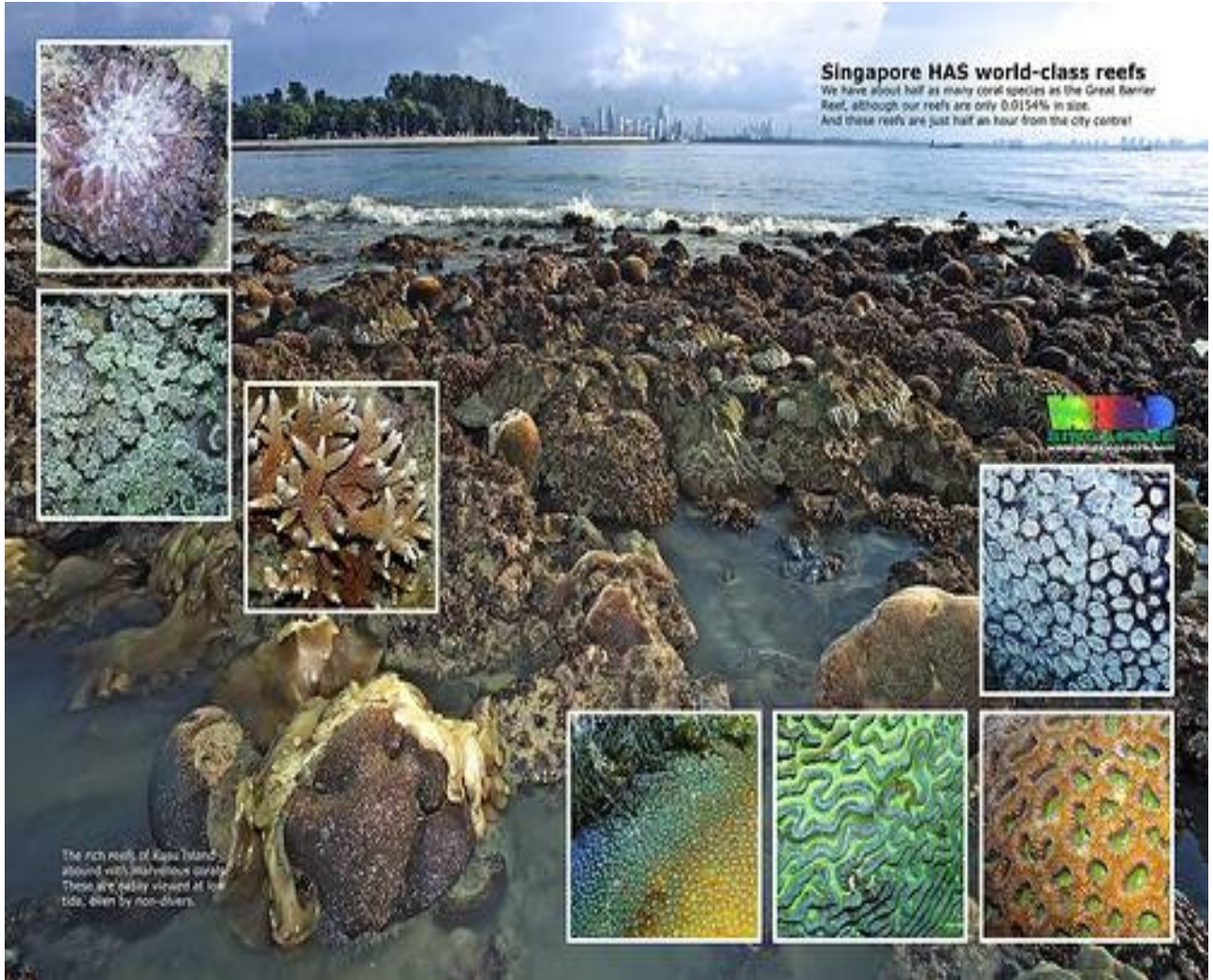
Farid Abdul Hamid

*Chairman
Singapore Blue Plan 2009 Committee*

On behalf of the IYOR 2008 Organising Committee and The Singapore Blue Plan 2009 Committee

Singapore, 23 May 2009

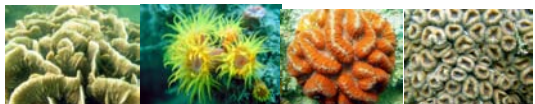




Singapore HAS world-class reefs

We have about half as many coral species as the Great Barrier Reef, although our reefs are only 0.0154% in size. And these reefs are just half an hour from the city centre!

The rich reefs of Kusu Island, abound with astonishing diversity. These are easily viewed at low tide, even by non-divers.



THE SINGAPORE BLUE PLAN 2008

INTRODUCTION TO THE BLUE PLAN

1. The Blue Plan is a proposal to the Government and People of Singapore from the members and organizations that form International Year of the Reef (IYOR) 2008 Singapore – interested members of civil society concerned about the conservation and rehabilitation of Singapore’s coral reef heritage. The Blue Plan was drafted by the Singapore Blue Plan 2009 Committee with inputs and endorsement from IYOR 2008 Singapore. Advice and inputs from the leading Singapore academics in the field of marine biology has been sought and incorporated.

2. Members and organizations endorsing the Blue Plan represent a diverse segment of Singapore’s vibrant and active civil society. Support for the Blue Plan has also come from the corporate sector – providing invaluable financial, material, logistical, and human resource support for IYOR 2008 Singapore in general, and this Blue Plan in particular.

3. Many more organizations and Singaporeans have participated in the numerous IYOR 2008 Singapore’s events and programmes (as listed in the Annex) but they have not formally endorsed the Blue Plan. Organisations such as NParks, being a Government agency, would not be appropriate endorsers or signatories to the Blue Plan, even though it has provided invaluable support and encouragement to IYOR 2008 Singapore.

4. The Blue Plan recognizes that the Government has done excellent work to find a pragmatic balance between infrastructure development and conservation of the marine & coral reef ecosystems and their biodiversity. It hasn’t been easy. IYOR 2008 Singapore and the Blue Plan Team firmly believes that the issues involved in building and improving on this ‘balance’ is both an opportunity as well a challenge.

5. We, at IYOR 2008 Singapore, strongly feel that the views contained in this document address those issues in a practical and balanced way. Singapore has matured tremendously over the years. Government, civil society and citizens of this Republic will continue to work together and influence each other for the benefit of the Nation. **The sincere intent of this document and the people who contributed to its creation, is for the conservation and rehabilitation of our Rich, Natural Marine Heritage – a National Heritage with all its biodiversity - not only for us, but also for future generations of Singaporeans to enjoy.**



CORAL REEFS

6. Coral reefs are undoubtedly one of the wonders of nature, with their shapes and colours, multitudes of brightly coloured fish and exotic plants. Tourists flock from around the world to admire them. But the real value of reefs lie beyond more than just their beauty.

7. Without the coral reefs, coasts would have no protection against the constant assault of waves and storms. Without the coral, there would be no white sand. Without the coral reefs, one of the planet's richest ecosystems, up to 29% of commercialized local fishery will not exist (Salvat, 1992), and tens of millions of people in more than 100 countries who depend on reef fish for part of their livelihood or protein intake (Moberg & Folke, 1999) would lose a significant source of food and protein. Coral reefs are also a source for the discovery of new medicines. Finally, in many parts of the world, coral reefs underpin the viability of local economies that are based largely on tourism.



8. It is estimated that the total net benefit per year of the world's coral reefs is US\$29.8 billion, with tourism and recreation accounting for US\$9.6 billion of this amount, coastal protection US\$9.0 billion, fisheries US\$5.7 billion, and biodiversity US\$5.5 billion (Cesar *et al.*, 2003).

WHAT ARE CORAL REEFS?

9. Coral reefs are impressive three-dimensional structures built up over many centuries by small, simple animals called coral. Each coral animal, called a coral polyp, live in a mutually beneficial relationship with microscopic algae (called zooxanthellae), and together, they use the calcium carbonate from seawater to build their limestone skeleton as they bud and grow. Over time, individual corals grow to form massive coral reef structures that support a multitude of marine life. Corals supply food and shelter to an incredible variety of plants and animals. They are the architects of this magnificent living sculpture. A work created over millions of years.



10. However, coral reefs are delicate and sensitive systems that are easily damaged and destroyed. Although coral reefs can form large and impressive structures, only the thin outer surfaces are alive.

DISTRIBUTION

11. Corals are found both in temperate and tropical waters, but reefs are formed only in a zone extending at most from 30°N to 30°S of the equator. Coral reefs are estimated to cover 284,300 square kilometers, with the Indo-Pacific region (including the Red Sea, Indian Ocean, Southeast Asia and the Pacific) accounting for 91.9% of the total. Southeast Asia accounts for 32.3% of that figure, while the Pacific including Australia accounts for 40.8%. Atlantic and Caribbean coral reefs only account for 7.6% of the world total.

WHAT CORALS NEED

12. Reef-building corals require specific conditions if they are to survive and to grow: clean, clear water, low in nutrients and sediment, with constant temperature and salinity and a great deal of light. If any one of



these conditions is not met, the corals can become stressed (just like human beings!). Coral reefs exhibit stress through extreme reactions: they expel their partner, the zooxanthellae, they turn white and they may eventually die. The main threats to coral reefs are linked to worldwide factors such as global warming caused by the greenhouse effect. Danger may also stem from marine or land based activities, particularly coastal development, which causes the run-off of fresh water and mud, as well as all sorts of pollution and excessive consumption of natural resources. Excessive consumption of natural resources and over-fishing is also deleterious to coral reef ecosystems, and careless tourist practices can cause further damage.

BIODIVERSITY

13. Coral reefs support an extraordinary biodiversity, being home to over 4000 species of tropical or reef fish, such as colorful parrotfishes, angelfishes, damselfishes, butterflyfishes, groupers, snappers, grunts and wrasses.

14. Reefs are also home to a large variety of other organisms, including sponges, cnidarians (which includes some types of corals and jellyfish), worms, crustaceans (including shrimp, spiny lobsters and crabs), molluscs (including snails, clams, squids and octopus), echinoderms (including starfish, sea urchins and sea cucumbers), sea squirts, sea turtles and sea snakes. Aside from humans, mammals are rare on coral reefs, with visiting cetaceans such as dolphins being the main group. A few of these varied species feed directly on corals, while others graze on algae on the reef and participate in complex food webs.

15. A number of invertebrates, collectively called cryptofauna, inhabit the coral rock substrate itself, either boring into the limestone surface or living in pre-existing voids and crevices. Those animals boring into the rock include sponges, bivalve molluscs, and sipunculid worms. Those settling on the reef include many other species, particularly crustaceans and polychaete worms

16. Due to their tremendous biodiversity, many governments world-wide take measures to protect their coral reefs. In Australia, the Great Barrier Reef is protected by the Great Barrier Reef Marine Park Authority, and is the subject of many plans and pieces of legislation, including a Biodiversity Action Plan.



CORAL REEFS IN SINGAPORE

17. At one time, there were over 60 offshore islands and patch reefs around Singapore, most of which were situated south of mainland Singapore. However, since the mid 1970s, major land reclamation was undertaken on the mainland as well as the offshore southern islands. Most of the southern islands were reclaimed, adding 1695 ha to Singapore's total land area. Some islands were merged as a result. The reef flats of many islands e.g. Pulau Sudong, Pulau Hantu and Kusu Island were reclaimed right up to the reef slope. Many of the coral reef organisms were smothered by the reclamation, while others were severely affected by the resulting increase in water turbidity. Since 1986, most coral reefs in Singapore have lost up to 60-65% of their live coral cover (Chou 2006; 2008).

18. The high turbidity of our waters restrict light penetration and coral life ends at a depth of only 8m below the water surface, Sedimentation rates ranged from 3-6mg/cm²/day in 1979. In 1994, these increased to 5



45mg/cm²/day (the higher value obtained from localised areas close to reclamation projects). This reduced visibility from 10m in the 1960s to 2m or less today. As a consequence, the reef is very compact, as opposed to reefs in clear waters, which can be found at depths of 20m and more.

19. Development in Singapore has come at a price – the decimation of Singapore reefs. We have lost over 60% of our coral reefs. However, we have been fortunate that the reefs associated biodiversity has not been affected much. We are in a unique position to maintain and even possibly reverse this trend. For instance, the remaining coral reefs in Singapore contain:

- a. More than 250 species of hard corals from 55 genera
- b. More than 120 reef fish species from 30 families, and still counting
- c. 12 out of the 23 seagrass species that can be found in the Indo-Pacific region

20. Contrary to the belief that our reefs have been permanently devastated, they still support rich marine life. Given the size of the reefs and conditions present here, Singapore coral reefs compare favourably with coral species richness in the more extensive reefs of the region (Huang *et al.*, in press). A list of new species and new records of species found in Singapore over recent years is listed out at Annex D.

21. In addition to the astounding biodiversity that exists on our reefs, they are also easy to get to. In Singapore, one can quickly go from a high-level business meeting at a world class hotel, to visit a living reef in under half an hour! It only takes 15 minutes to reach the nearest reef by fast boat.

EXPERIENCING OUR MARINE HERITAGE

22. Many who live in Singapore visit our coral reefs. For scuba divers, the “Reef Xplore programme”, organised by the Hantu Blog, offers a guided tour of the underwater diversity of Pulau Hantu.

23. Many volunteer groups organise “No need to swim, no need to dive!” guided walks of our shores. Some of these NGOs & civil society groups include “Naked Hermit Crabs” (Sentosa, Che Jawa Broadwalk), “Blue Water Volunteers” (Kusu Island), “Team Seagrass” (Chek Jawa, Tuas, Labrador, Sentosa, Pulau Semakau, Cyrene Reef) “Nature Society (Singapore)”, “Raffles Museum of Biodiversity Research” (Pulau Semakau) and volunteers under “NParks” (Chek Jawa, Pulau Ubin; Sungei Buloh Wetland Reserve, and Pasir Ris Park).



24. Dolphins and sea turtles are regularly spotted by boaters and divers. Dolphins are usually seen around the Sisters/St John's islands and also off Pulau Satumu (Raffles Lighthouse). Adult sea turtles are regularly seen around Pulau Hantu and Pulau Satumu, and newly hatched baby turtles have been encountered on a regular basis (about 4 sightings a year, at East Coast Park Beach, Sentosa and West Coast Park Beach).

THREATS TO SINGAPORE REEFS

Sedimentation and Suspended Sediments

25. The most significant causes of reef degradation in Singapore result from sediment related processes like sedimentation and turbidity due to suspended sediments. Land reclamation, dredging of shipping channels and dumping of earth spoils, have increased the sedimentation and sediment load. Loss of coral reefs to land reclamation occurred along the southwest coast of the mainland and on some of the offshore southern islands. Increased sedimentation and suspended sediments affect the remaining reefs in the following ways:

- a. Smothering live corals and thereby increasing their energy expenditure to remove overlying sediments
- b. Reducing light penetration due to increased turbidity
- c. Reducing the amount of hard surface available for coral larvae to settle on.
- d. Reducing the strength and structural integrity of coral reef framework

26. The combined impacts from sedimentation and suspended sediments degrade coral reefs over time, resulting in a slow but steady reduction in live coral cover and a reduction in the lower depth limit of coral growth on reef slopes.

27. Surveys since 1986 indicate that live coral cover has decreased by up to 60-65% on some reefs. The reduction in sunlight penetration reduced the lower depth limit of coral growth. In the 1970s, coral growth extended to 10m down the reef slope. Today, growth is restricted to 6m although some coral species still occur at the 8m depth.

28. Sedimentation studies in 1979 and 1994, show sedimentation rates ranging from 3-6mg/cm²/day in 1979 to 5-45mg/cm²/day in 1994 (the higher value obtained from localised areas close to reclamation projects) (Low & Chou, 1994). Visibility has reduced from 10m in the 1960s to 2m or less today. As a consequence, coral growth is restricted to the shallow depths, as opposed to reefs in clear waters, where coral may be found at depths of 20m and more.

Oil Spills

29. Accidental oil spills remain as an ever-present threat. However the 1997 Evoikos oil spill (27,000 tonnes) did not seriously affect coral reefs, although oil contaminated the upper parts of some reef flats.

Recreation Related Damage

30. Other activities that have an impact on the reefs include recreational and tourist-related use. Negligent or inexperienced divers without proper buoyancy control, leave a trail of broken corals. Indiscriminately deployed anchors can cause extensive damage to coral reef. At Pulau Hantu, a popular dive location with as many as 10-15 boats visiting during weekends, courtesy mooring buoys were installed previously by the marine conservation community to prevent anchor damage. However, the buoys have since been removed by the authorities due to security concerns following 9/11. Indiscriminate reef gleaning and collection of marine life on our shores depletes already strained plant and animal stocks. Drift nets and abandoned fish cages kill reef fish needlessly with their continued 'ghost fishing', while groundings, intentional or accidental, by barges on reefs (a more recent observation) smash huge tracts of reefs into unstable rubble fields devoid of life.



Warming of Sea Surface Temperature

31. As with coral reefs around the world, Singapore reefs suffered a mass bleaching event in June 1998. Sea temperatures around Pulau Hantu and St John's were elevated by 2-4°C (to 32-34°C) from March to June 1998. 50-90% of all reef organisms in Singapore were affected, particularly the hard corals, soft corals and anemones. The bleaching effect extended down to 6m, the lower growth depth limit for coral growth locally. Sea temperatures returned to normal in August 1998. A study of the stressed colonies was undertaken during this period and showed that 10 out of 35 coral colonies died. Other colonies showed other signs of impact, such as growth of turf algae and silt accumulation, leading to partial mortality.

Vessel Related Damage

32. Groundings by barges and all kinds of sea-going vessels including the damage caused by indiscriminate and improper use of anchors, are a continuous hazard to coral reefs, especially those anchored off shallow reefs.



Lifestyle for High-Net Worth Individuals

33. In Singapore's current effort to attract global clients of high net-worth, offering a full spectrum of natural attractions in close proximity to world class living conditions would be uniquely Singapore. Should Singapore succeed in further developing urban living in a sustainable manner with sensitivity to existing ecosystems – offering a range of 'close to nature' optional lifestyles, this will increase Singapore's attractiveness to these high net-worth individuals.

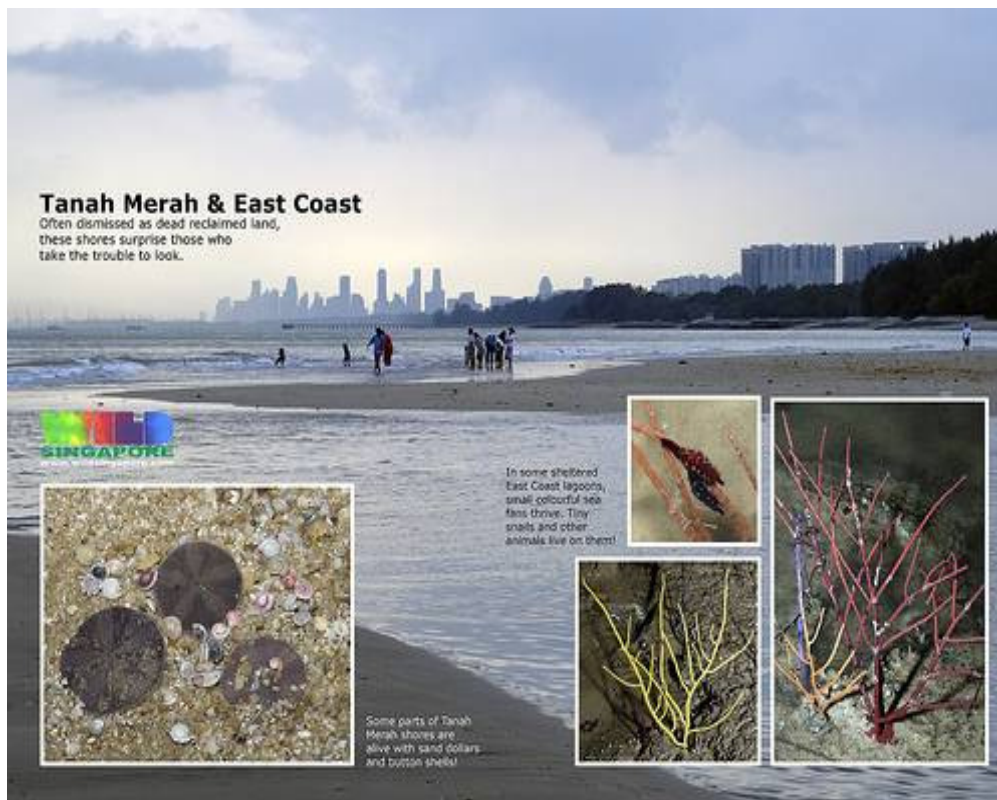
Shore Protection

34. Our coral reefs also help provide vital ecosystems services, including shoreline protection. Healthy reefs can reduce the need for expensive seawalls and artificial coastal defenses.



Excellence in Sustainable Development

35. The Semakau Landfill, Singapore's only existing landfill, has been developed and operated in such a way that half of the original Pulau Semakau remained relatively undisturbed (Chou & Tun, 2007). The coastal habitats on the western side of the island are still intact, and nature walks there offer rare opportunities to discover wild mangroves, vast seagrass meadows and amazing coral reefs!



36. Another outstanding example is the existence of the inter-tidal habitats at Cyrene Reef – this stunning haven of biodiversity, in the middle of our world class port and petrochemical industries is an example of sustainable conservation and development, and reflects favourable water conditions resulting from stringent pollution controls that are currently in place.

37. This know-how will be much sought after as other countries seek to manage the disposal of solid wastes and develop with minimal impact to their large natural reefs and coastal habitats, for tourism or other purposes. Sustainable coastal development can be exported in the same way Singapore has exported other technologies, policies and processes, eg, for dealing with limited water and other natural resources. Successful experience in sustainable development, habitat restoration and enhancement will be expertise that can be exported.

38. Every development near the shore should be seen as an opportunity for Singapore to prove that it has the know-how to develop and operate first-world facilities without wiping our natural habitats.

39. Singapore can excel in sustainable development by continuing to develop a vibrant, cosmopolitan city that exists in harmony with nature. Our natural surroundings can be conserved and rehabilitated to offer this balance. Our net carbon emissions can be steadily reduced to a more sustainable level. It is within Singapore's reach to be a global sustainable metropolitan city of excellence-becoming not only a green, but also a blue city. We are in a position to take global leadership in environmental studies, research and best practices.



Transferability & Expansion of Expertise

40. Our living reefs can validate our sustainable approaches to development when Singapore bids for overseas projects for offshore landfills, ports and petrochemical developments near reefs that are also important for tourism or fisheries.

41. In addition, the knowledge, expertise and databases accrued by the research, planning and other institutions in Singapore in working together to make Singapore an “Environmentally Sustainable Global Metropolis”, can potentially be applied to other areas of scientific, engineering, architectural, urban and industrial planning domains, generating revenue and attaining a reputation for global excellence & leadership in environmentally friendly and “sustainable development” policies, technology & expertise.

Our Responsibility to Future Generations of Singaporeans Yet to be Born

42. We owe it to generations of Singaporeans yet to be born and those who are young and youthful today, to hand over a piece of our precious natural heritage for them to appreciate, learn to live, work and play in, and in turn, ensure that they hand it over to their descendants. It is not morally right to deprive future generations of Singaporeans something that has been handed down to us by our forefathers (albeit in a reduced state – it is then our responsibility to rehabilitate and conserve). The coral reefs, like our other natural, cultural and national heritage – has to be kept alive. They can be enhanced and conserved, as an essential part of what makes us Singaporeans.



OUR PROPOSAL

Establishing “MARINE BIODIVERSITY AREAS” (MBA)

43. It is proposed that the following islands/areas be given some form of recognition of their high marine biodiversity status. Stepped up protection to minimize damage to, as well as the rehabilitation of the coral reefs found there is strongly recommended.

- a. Pulau Hantu and adjacent submerged reefs
 - i. High coral reef diversity and moderate hard coral cover
 - ii. Extremely diverse reef intertidal reef flat community
 - iii. Only publicly accessible island
 - iv. Extensive research conducted within the surrounding waters
- b. Pulau Subar Darat & Pulau Subar Laut (Sister’s Island)
 - i. High coral reef diversity and moderate hard coral cover
 - ii. One of the major source reefs in Singapore
- c. Pulau Satumu (Raffles Lighthouse)
 - i. Extremely high coral reef diversity and high hard coral cover
 - ii. Only reef where the hard coral *Stylophora pistillata* is found in Singapore
 - iii. One of the major sink reefs in Singapore
- d. Pulau Semakau and adjacent submerged reefs
 - i. High coral reef diversity and moderate hard coral cover
 - ii. Extremely diverse reef intertidal reef flat community
 - iii. Integral part of the Semakau Eco-Island initiative
 - iv. Extensive research conducted within the surrounding waters
- e. Pulau Biola
 - i. Only reef where the fire coral (*Millepora* sp.) has been observed in recent times (since 2006)
- f. Cyrene Reef
 - i. Extremely diverse reef intertidal reef flat community



- g. Pulau Ubin (Chek Jawa)
 - i. Extremely diverse reef intertidal reef flat community
- h. Pulau Tekong (Benting Bronok)
 - i. Extremely diverse reef intertidal reef flat community
- i. Kusu Island
 - i. Extremely high coral reef diversity and high hard coral cover
 - ii. One of the major source reefs in Singapore
- j. Pulau Jong
 - i. Extremely diverse reef intertidal reef flat community

44. In addition, the southern military islands managed by SAF for operational/training purposes – namely, Pulau Salu, Pulau Senang, Pulau Pawai and Pulau Sudong – should be retained as it is believed to be some of the most diverse and healthy coral reefs in Singapore.. Should the islands cease to be used by the SAF for such purposes, it is strongly recommended that they be considered for similar “MBA” classification as those islands identified in paragraph 43.

Building a More Comprehensive & Integrated System & Policies for Mitigation of Reclamation & Development Works

45. More comprehensive and integrated policies for mitigation of reclamation and development works. The plan supports the following recommendations put forward by the Nature Society Singapore (NSS) in 2003:

Biodiversity Survey:

46. A comprehensive biodiversity survey be carried out within and on the periphery and adjacent to the proposed MBAs (paragraph 43). Development or land-use plans on the periphery or adjacent to the nature areas should be temporarily put on hold to enable a proper and expedited ecological survey to be conducted. Until this step is completed, the size and boundary of the nature areas cannot be ecologically determined and should not be officially finalized.

47. Like its terrestrial counterpart, the NParks department for marine ecosystems (within the larger framework of enhancing and conserving biodiversity) should be given the responsibility to focus on species and its biodiversity enhancement.



Central Coordinating Government Agency:

48. A legal and regulatory framework with an identified central or coordinating government agency should be created. At present, there is no singular or coordinating government agency that looks after marine habitats - with different zones under different authorities, some of the islands being under the jurisdiction of the Sentosa Development Corporation (SDC), surface water under Maritime and Port Authority (MPA) and underwater seabed under the Land Office. National Parks has been consulted from time to time on major development initiatives. Marine habitats beside the body of seawater should include mangrove, coral reefs, rocky coast and sandy mudflats.

Review of Existing Laws and Regulations:

49. Implement a review of existing laws and regulations affecting the coral reefs should be made with a view to improving these areas of legislation.

Coordinating Committee:

50. In conjunction with the above, there is a need to form an independent coordinating committee to oversee the implementation of the action programmes for the proposed MBAs. This committee should comprise representatives from the various stakeholders - relevant government bodies, non-governmental organisations, academic institutions, businesses, etc.

Siltation:

51. Singapore's offshore waters have become turbid with heavy sediment load from reclamation and dredging activities, threatening the remaining coral reef communities. The measures taken against siltation during the construction of Pulau Semakau landfill are highly commendable. Similar measures, such as the erection of silt screens, should also be undertaken for all reclamation activities. When dredging sea channels, silt should not be deposited on the sides of the lanes, but instead carried away by sand barges.

Marine Pollution:

52. The efficient prevention, containment and mopping up measures for oil spills demonstrated by the government are highly commendable. Better enforcement to reduce and manage marine litter and the input of endocrine disrupting chemicals should also be considered.

Mandatory Environmental Impact Assessments:

53. A policy of instituting Environmental Impact Assessments (EIAs) should be made mandatory for all foreshore development projects, including all inland projects with the potential to significantly impact coral reefs through run-offs into drains and rivers which flow into the sea. The transparent implementation of EIA hinges critically on the existence of boundaries for the nature areas. Without proper EIAs, the impact and extent of degrading or destructive impacts cannot be ascertained properly. This plan strongly urges that no development plans should be decided for a designated nature area until an EIA has been implemented and the results put on public exhibition to obtain feedback.



Monitoring:

54. Once the ecological boundaries have been established and a management system set up, a meaningful monitoring programme of all the nature areas should be instituted. The first comprehensive survey would provide the baseline data for this monitoring programme, which, should be conducted on an annual or bi-annual basis. Biodiversity indicators should be identified and measures appropriately taken so that reliable estimates of the health and viability of the nature areas can be ascertained as the years go by. Without these measures it will be extremely difficult to establish the state, and monitor the health, of our biodiversity.



55. As with the EIA proposal in paragraph 53, there is a need for the results of the monitoring to be transparent on the results of the monitoring (eg, the “success” of coral relocation, mitigation measures, etc) – before, during and after development – so that all parties concerned, the government agencies, civil society and academic/research institutions and work shoulder to shoulder to address any issues that might need concerted effort.

56. The Environmental Monitoring and Management Programme (EMMP), while being a good framework, can be improved. It is recommended that the limits of the programme be reviewed and extended. Restoration and relocation should only be a last resort. Preventive measures must be emphasized.

57. Singapore should also have its relevant Government agencies study the impact and assessments prior to development. The monitoring agencies should also be given the powers to enforce and prosecute, like URA and NEA’s pollution control unit.

58. Similarly, through comprehensive education, monitoring and enforcement (encouraging a system of reporting to enhance effective detection and prosecution), the relevant agency/agencies will be able to effectively reduce reef damage caused by barges, poaching, pollution events, etc.

Research into Regeneration, Renewal and Connectivity Issues:

59. More research needs to be carried out to determine source and sink reefs, i.e. reefs that produce larvae (sources) that can supply other reefs (sinks). Understanding these processes of reproduction, renewal, and regeneration are critical to better facilitate the survival of our reefs.

An Ecosystem-Based Approach to Conservation in Singapore:

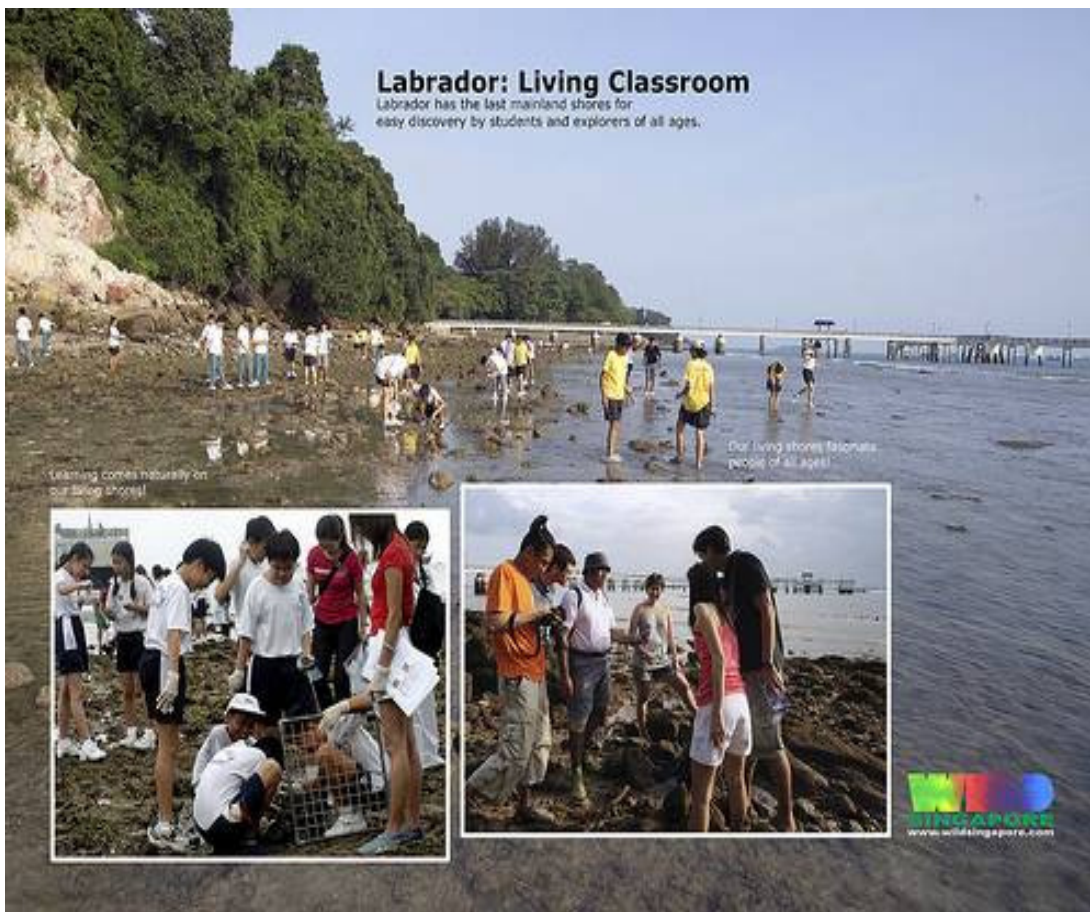
60. It is also proposed that a more “ecosystem-based” management strategy to conservation be used so as to provide a more holistic and balanced approach to protecting our natural heritage in Singapore. Multiple internal and external influences should be considered including the need to balance diverse biological, social and economic objectives. The inter-connectivity and inter-dependency between our wetlands, mangroves, seagrass beds and coral reefs, must be vital components of this strategy.



The Efforts by Singaporeans to Experience, Share and Care for our Coral Reefs

61. An inspiring and not an insignificant number of informally connected but passionately concerned civic minded citizens and residents work hard to conserve our precious heritage. Many, young and old, from all walks of life freely give their time and passion to work together to:

- a. Increase public awareness and appreciation. Many schools have partnered NGOs to organize such coral-reef and shoreline appreciation field trips
- b. Actively gather data to assist researchers, government officers at NParks as well as Singaporean marine-conservation NGOs



62. There are groups, too many to list separately, that actively engage in marine conservation in Singapore. Samples of their work, their passion and their concern can be seen on the websites and blogs listed in the annexes. By no means is the list exhaustive. There is so much good work by too many good people to mention specifically.

63. Approximately 3,500 volunteers work to provide guided walks, guided dives, as well as conduct regular monitoring of seagrasses and reefs and to clean up and collect data on marine debris on our shores. There is also a growing number of Singaporeans who blog and share photos and stories of their education and conservation work.

64. Even larger numbers of Singaporeans, residents and visitors (estimated at around 100,000 annually) join these walks to view our shores and reefs. All regular guided tours on reefs are quickly booked within days of being offered. The wait-list for guided walks at Chek Jawa and Kusu Island remain long.



65. Many Singaporeans express concern about the uncertain future of this beautiful natural heritage of Singapore's – keen for their children, and their children's children, to experience just a tiny part of what was their country's heritage – soon to be lost forever if nothing is done to conserve it. Just some of these views have been shared online and can be seen at the blogs listed in Annex C.

66. There are many concerned citizens that actually monitor the state of our coral reefs, seagrass beds and other marine habitats. The data collected (on their own and in partnership with various Government Agencies as well as Institutes of Higher Learning) by these passionate and experienced citizens (trained to conduct the monitoring) are shared with research, academic, government and relevant local as well as international non-government organizations. Some of the international organisations include:

- a. "REEFBASE" (www.reefbase.org)
- b. "REEFCHECK" (www.reefcheck.org)

67. Leading civil society environmentally focused organizations have also formed the Singapore Reef and Marine Conservation Committee, which has for two decades, been engaging government to conserve our reefs, particularly in the formulation and implementation of Singapore's Green Plan. A short write-up on the International Year of the Reef 2008 is attached at Annex B, including the list of key members and organizations leading it.



CONCLUSION

68. This Blue Plan focuses on the issue of protection and management of coral reef habitats in Singapore. While it does not discuss in detail the other marine ecosystems found in Singapore, it strongly supports an integrated monitoring and conservation approach to these ecosystems, including:

- a. Mangroves
- b. Seagrasses
- c. Rocky shores

69. It is only through such integrated conservation strategies that a healthy and thriving marine environment can be sustained for the benefit of its inhabitants, Singaporeans present and generations to come.

70. **The Singapore Blue Plan 2009 was drafted by the Blue Plan Team in consultation with the IYOR 2008 Singapore Organising Committee. Together, members of the committees would be more than happy to arrange for presentations and organise guided walks/dives to any of these reefs, so that policy makers and senior civil servants are able to see for themselves, some of the finest natural heritage that Singapore has to offer. The Committee is ready to engage, dialogue and work together with the Singapore Government, its agencies, the private sector, civil society organizations & the citizens of Singapore, in negotiating through the challenges and taking all available opportunities to make this passionate and sincere dream come true. The Blue Plan is a plea.....a vision....a dream....a hope....of the people, by the people and for the people of this Nation.**

71. The Blue Plan Committee would be honoured to meet with the Government and its agencies to elaborate on the Blue Plan and explore collaborative possibilities. Its members may be contacted through:

- a. Chairman (IYOR 2008) : Francis Lee , Tel: 96721336
email : foxtrot@cvg.com.sg
- b. Chairman, Singapore Blue Plan 2009 Team, Farid Abdul Hamid, Tel: 64497133
email: farid@ithaca.sg

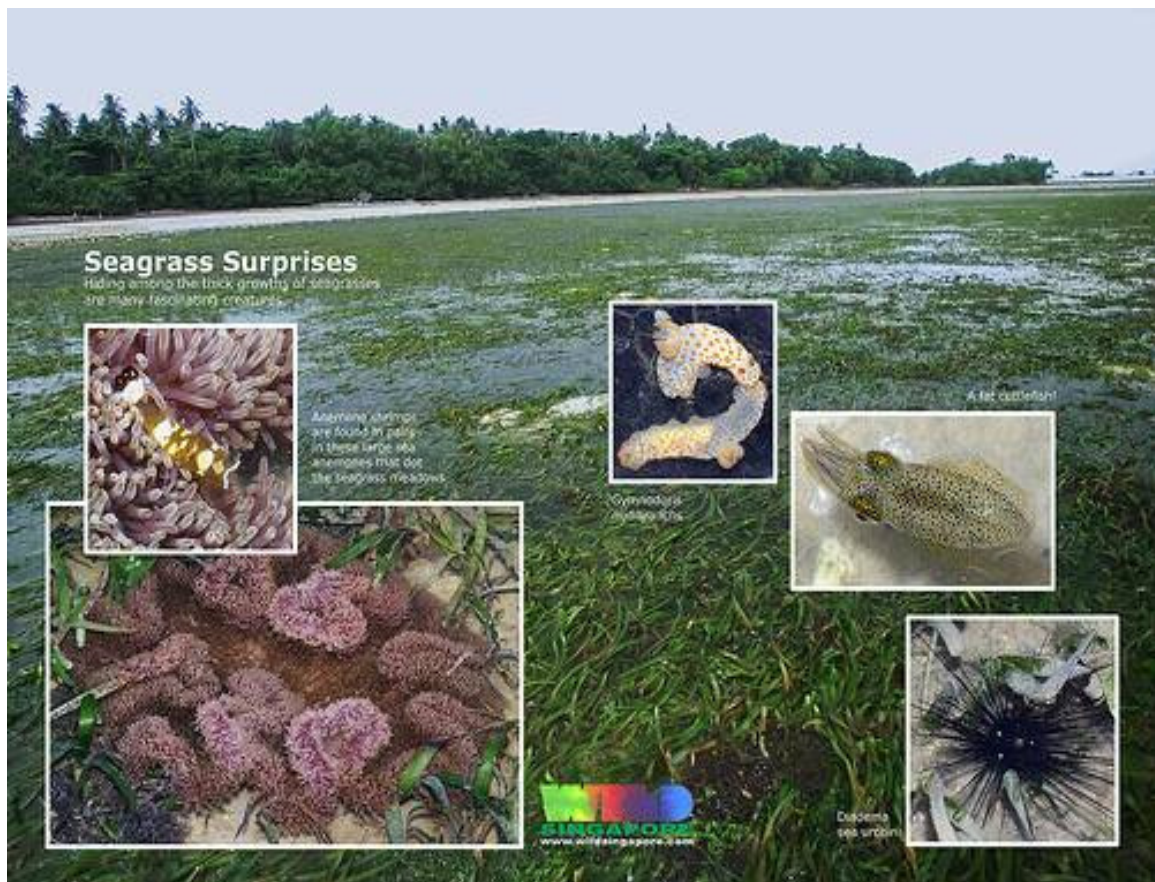


Drafted by: Farid Abdul Hamid – Chairman, Singapore Blue Plan 2009
 Leong Kwok Peng – Vice-Chairman, Singapore Blue Plan 2009
 Chua Sek Chuan - Member
 Ngiam Hui Shin – Member
 Edzra Iskandar - Member

With inputs from: Prof Chou Loke Ming, NUS
 Prof Peter Ng, NUS
 Asst Prof Peter Todd, NUS
 Dr Beverly Goh, Singapore Institute of Biology
 Ms Zeehan Jaafar, NUS
 Mr Huang Danwei, NUS/SCRIPPS Institute of Oceanography
 Mr N Sivasothi, NUS
 Ms Debbie Ng, Hantu Bloggers
 Ms November Tan, NUS
 Dr Shawn Lum, NTU
 Mr Francis Lee, Chairman IYOR 2008
 Mr R Subaraj - Naturalist

NATURE SOCIETY (SINGAPORE)
 WORLDWIDE FUND FOR NATURE (SINGAPORE)
 BLUEWATER VOLUNTEERS

23 May 2009



INTERNATIONAL YEAR OF THE REEF 2008

INTRODUCTION TO INTERNATIONAL YEAR OF THE REEF

1. Initiated by the International Coral Reef Initiative (ICRI), the year 2008 has been designated as the International Year of the Reef (IYOR), celebrated worldwide to raise awareness about the value and importance of coral reefs and threats to their sustainability and to motivate people to take action to protect them.
2. The first IYOR campaign in 1997 was initiated in response to the increasing threats and loss of coral reefs and associated ecosystems, like mangroves and sea grasses. IYOR 97 was a global effort to increase awareness and understanding of coral reefs, and support conservation, research and management efforts. It proved to be very successful, with over 225 organizations in 50 countries and territories participating, over 700 articles in papers and magazines generated, hundreds of scientific surveys undertaken, and catalyzed conservation and policy initiatives, as well as numerous local and global organizations dedicated to coral reef conservation.
3. Recognizing that ten years after IYOR 97 there continues to be an urgent need to increase awareness and understanding of coral reefs, and to further conserve and manage valuable coral reef and associated ecosystems, the International Coral Reef Initiative has designated 2008 as the International Year of the Reef (IYOR 2008).
4. In the year 2008, IYOR aims to:
 - a. Strengthen awareness about the ecological, economic, social and cultural value of coral reefs and associated ecosystems
 - b. Improve understanding of the critical threats to coral reefs and generate both practical and innovative solutions to reduce these threats
 - c. Generate urgent action at all levels to develop and implement effective management strategies for conservation and sustainable use of these ecosystems

IYOR SINGAPORE

5. IYOR 08 Singapore has been initiated by a diverse group of individuals and organizations, active in marine conservation, that come together in recent years as the Marine Round Table. Two consultative sessions were held, one in 2006 and the other in 2007. This Marine Round Table has formed the IYOR 08 Singapore Organising Committee. It is an open and inclusive Committee, serving only to initiate and co-ordinate activities, and will welcome any like-minded volunteer who wishes to join in.
6. IYOR was launched in August 2008 at the Singapore Botanical Gardens. Honorary Advisor, Prof Tommy Koh, Ambassador at Large, was the Guest of Honour for the launch, which was attended by over 200 supporters and guests.



7. The advisors, officers and members of the IYOR 2008 Singapore Organising Committee are:
- a. Honorary Advisors:
 - i. Prof Tommy Koh, Ambassador at large
 - ii. Prof Chou Loke Ming, Professor, NUS
 - iii. Dr Geh Min, President, Past President Nature Society Singapore, Former NMP
 - iv. Dr Isabelle Louis, Director, Worldwide Fund for Nature, Singapore
 - v. Mr Edwin Khiew, Nominated Member of Parliament
 - vi. Prof Leo Tan, Natural Sciences and Sciences Education (NSSE), NIE
 - vii. Mr Balakrishnan, Commodore, Republic of Singapore Yacht Club
 - viii. Mr Bob Ashman, Commodore, Changi Sailing Club
 - ix. Mr Arthur Tay, Chairman, 1°15 Marina
 - x. Ms Wang Look Fung, GM, Keppel Corp Ltd
 - xi. Ms Abigail Alling, Planetary Coral Reef Foundation, USA

 - b. Officers:
 - i. Mr Francis Lee, Chairman
 - ii. Mr Leong Kwok Peng, Dy Chairman
 - iii. Mr Farid Hamid, Vice Chairman
 - iv. Ms Ria Tan, Hon Secretary
 - v. Ms Kok Lai Mun, Member

 - c. Focus Clusters:
 - i. Reef Database Cluster :
 - ii. Blue Plan Cluster – Chairperson: Farid Hamid
 - iii. Awareness & Outreach Cluster : Chairperson: Kok Lai Mun



ORGANIZATIONS PARTICIPATING IN IYOR 2008 SINGAPORE

ORGANIZATIONS

(Participants in alphabetical order, descriptions taken from their websites)

1. **Blue Water Volunteers**

<http://www.bluewatervolunteers.org/>

Contact: Ms Zeehan Jaafar (Chairperson, BWV) reefrelations@bluewatervolunteers.org

A volunteer-based, non-governmental marine conservation organisation that seeks to complement research activities and increase awareness of local marine habitats, such as coral reefs. We strive to achieve our aims for conservation, awareness and education through four main programmes: ReefFriends (coral reef monitoring), ReefWalk (educating the public through intertidal walks), ReefTalk (free public marine related talks) and ReefExhibits (mobile exhibits booth showcasing Singapore's marine life)

2. **Changi Sailing Club**

<http://www.csc.org.sg/>

3. **Cicada Tree Eco-place**

Contact: Dr Vilma D'Rozario vilma.drozario@nie.edu.sg

4. **Eart-h.com**

<http://www.eart-h.com/>

Contact: Mr Joseph Lai (Founder, Eart-h.com) joelaitk@singnet.com.sg

Founded by Joseph Lai, Earth is an outreach seeking to connect People and Nature, hearts and earth.

5. **ECO Singapore**

<http://www.eco-singapore.org/>

Contact: Mr Wilson Ang wilson.ang@eco-singapore.org

ECO Singapore is a non-profit, non-government organization. ECO aims to establish a voluntary environmental movement, thereby creating opportunities for active involvement by Singaporean youths, instilling a sense of commitment and awareness of environmental issues and global hazards. By providing youths a holistic approach towards environmental issues, ECO Singapore's mission is to encourage youths to take initiative and choose to live environmentally sustainable lifestyles.

6. **Flying Manta Project**

<http://www.flyingmantaproject.org/>

Contact: Mr Ivan Choong ivan_choong@flyingmantaproject.org



7. **Green Drinks**
(<http://www.greendrinks.sg/>)

Contact: Ms Olivia Choong olivia.choong@gmail.com

Green Drinks is platform for environmentalists to discuss sustainable living and its related issues in an informal networking session over drinks. Already active in more than 230 cities, Singapore is the latest city to join the movement!

8. **The Hantu Bloggers**
(www.pulauhantu.org)

Contact: Ms Debby Ng hantublog@gmail.com

The Hantu Blog is a non-profit, environmental awareness initiative for Pulau Hantu, an island recognised by most divers as Singapore's most popular Southern Island, known for its sheltered and biologically diverse reefs. It is now described as a new-age NGO that utilises modern, free-media, to enhance the awareness of Singapore's coastal and marine habitat.

9. **International Coastal Cleanup Singapore**
(<http://coastalcleanup.wordpress.com/>)
(<http://coastalcleanup.nus.edu.sg/>)

Contact: Mr N. Sivasothi iccs@rafflesmuseum.net

The International Coastal Cleanup, Singapore (ICCS) is coordinated by volunteers of the Raffles Museum of Biodiversity Research of the National University of Singapore. The programme which was initiated in 1992 now involves some 3,000 volunteers annually and is strongly supported by National Parks Board, Waterways Watch Society and numerous local and international schools, institutions and organisations. The international event coordinated by the US-based agency, The Ocean Conservancy, a non-profit organization that coordinates data submission from more than a million volunteers from 70-100 countries around the globe. Data about debris is collated during the cleanup of the world's lakes, rivers and oceans providing international and local reports which are submitted to governmental and international organizations including the United Nations. These serve to educate the public, initiate debate, support legislation and encourage positive change.

10. **Ithaca (Singapore) Pte Ltd**
(<http://www.ithaca.sg/>)

Contact: Mr Farid Hamid farid@ithaca.sg

Ithaca specializes in experiential learning methodologies for schools, community & grassroots leaders, government agencies, not for profit organizations & corporate organizations, in the field of diversity education (inter-ethnic, inter-faith education), service learning (internationally and within Singapore), leadership development, environmental education, team development, adventure education.

11. **Naked Hermit Crabs**
(<http://nakedhermitcrabs.blogspot.com>)

Contact: Ms Ria Tan wildsingapore@gmail.com

The Naked Hermit Crabs are a motley bunch of volunteer guides who have come together to share our other shores through public walks. Especially those shores which are in danger.



12. **National Parks Board**
(<http://www.nparks.gov.sg>)

Contact: Mr Jeffrey Low Jeffrey_LOW@nparks.gov.sg

As Singapore's scientific authority on nature conservation, NParks monitors and coordinates measures to ensure the health of designated nature areas.

13. **National Biodiversity Centre**
(<http://www.nbrcnparks.org/>)

Contact: Mr Jeffrey Low Jeffrey_LOW@nparks.gov.sg

The NBRC is the focal point for biodiversity conservation in Singapore and one-stop centre for information on indigenous biodiversity of Singapore.

14. **Sungei Buloh Wetland Reserve**
(<http://www.sbwr.org.sg>)

Contact: Ms Shila G Kumari G_Shila_KUMARI@nparks.gov.sg

15. **Pulau Ubin NParks**
(<http://www.nparks.gov.sg/CPage2.aspx?pg=143&prv=Y>)

Contact: Ms Adelle Wang WANG_Shumin@nparks.gov.sg

16. **Pasir Ris Park**
(<http://www.nparks.gov.sg/CsubPage.aspx?prv=Y&pg=195>)

Contact: Chong Wei Teng CHONG_Wei_Teng@nparks.gov.sg

17. **Nature's Niche**
(<http://www.naturesniche.com/>)

Contact: Ng Bee Choo and Morten Strange nniche@singnet.com.sg

Seeing, Knowing, Loving. Nature's Niche specialises in nature books and nature-related merchandise.

18. **Nature Society (Singapore)**
(<http://www.nss.org.sg/>)

Contact: Mr Leong Kwok Peng kwokpeng@pacific.net.sg

Nature Society (Singapore) is a non-government, non-profit organization dedicated to the appreciation, conservation, study and enjoyment of the natural heritage in Singapore and the surrounding regions.

19. **National Institute of Education Green Club**
(<http://niegreenclub.blogspot.com/>)

Contact: Mr July Qi Yue Lin july_lqy81@yahoo.com.sg

A group of nature enthusiasts from the National Institute of Education that have gathered together to discover more about nature.



20. Planetary Coral Reef Foundation

(<http://www.pcrf.org/>)

Contact: Mr Yves De Leeneer yves.de.leeneer@compassenergy.com

PCRF's mission is to preserve and protect coral reefs through pioneering programs in science, technology and education.

21. Raffles Marina

(<http://www.rafflesmarina.com.sg/>)

22. Raffles Museum of Biodiversity Research

(<http://rnbr.nus.edu.sg>)

Contact: Prof Peter Ng peterng@nus.edu.sg

Includes: Semakau Intertidal Walks (non-profit education walk for the public and students) <http://semakau.rafflesmuseum.net/>

Raffles Museum Toddycats (volunteer groups managing several nature and heritage programmes) <http://toddycats.rafflesmuseum.net/>

23. Republic of Singapore Yacht Club

(<http://www.rsyc.org.sg/>)

Contact: Commodore Balakrishnan commodore@rsyc.org.sg

24. Roots and Shoots (Singapore)

(<http://www.rootsandshoots.org/>)

Contact: Mr Belmont Lay belmontlay@gmail.com

Roots & Shoots Youth United, founded in October 2007 by seniors and graduate students at the National University of Singapore, aspires to educate, encourage and empower youths to make informed decisions and take affirmative action to positively impact their environment and social landscape. Roots & Shoots Youth United is part of a growing global network of Roots & Shoots, the Jane Goodall Institute's youth service programme.

25. Simply Green

(<http://www.simplygreen.com.sg/>)

Contact: Dr Chua Ee Kiam simplygreen@gmail.com

Simply Green will encourage the participation of activities that will heighten the consciousness of all humans towards thinking and living green. And the appreciation of nature can be an exhilarating experience.

26. Singapore Environment Council

(<http://www.sec.org.sg/>)

Contact: Mr Howard Shaw howard@sec.org.sg

The mission of the Singapore Environmental Council is to educate, inspire and assist individuals, business organisations and environmental groups to care for and protect the environment.



27. **Sport Fishing Association of Singapore**

(<http://www.sfas.net/>)

The SFAS practice catch and release and among the rules are that anglers must demonstrate proper conduct and practice good fishing ethics and etiquette, and anglers are to use artificial lures or flies for sport fishing and not to use any organic baits (dead or alive) in all fishing activities.

28. **Singapore Underwater Federation**

(<http://www.suf.org.sg/>)

Contact: Mr Stephen Beng (President, SUF) president@suf.org.sg

The vision of the SUF is a sub-aquatic sporting lifestyle for Singapore with a professional Singaporean dive industry with world-class standards, and an environmentally aware Singapore which treasures our natural heritage.

29. **TeamSeagrass**

(<http://teamseagrass.blogspot.com/>)

Contact: Ms Ria Tan wildsingapore@gmail.com

As part of International Seagrass-Watch, we are a team of volunteers from all walks of life who regularly monitor the seagrasses on Singapore's shores, gathering data that will help us better understand and manage our seagrass meadows.

30. **Underwater World Singapore**

(<http://www.underwaterworld.com.sg/>)

Contact: Kok Lai Mun yellowaris@yahoo.com.sg

Underwater World Singapore is a wholly owned subsidiary of Haw Par Corporation. Our mission goes beyond making our guests aware of the fascinating marine life in the oceans. Over the years, UWS has sought to raise public awareness on marine conservation issues via our exhibits, interpretive panels, enriching educational programs, as well as various breeding, rehabilitation, research and conservation projects. We deem it an important responsibility of ours, as an oceanarium, to inspire our visitors to do their part to conserve the fragile marine environment. Our newly launched conservation slogan: *Blue Mission - Inspire, Educate, Conserve*, represents aptly our vision and the work that we strive to do.

31. **WildFilms**

(<http://wildfilms.blogspot.com/>)

Contact: Ms Ria Tan wildsingapore@gmail.com

Volunteers desperately documenting Singapore's fragile shores before they disappear. Shoot first, ask questions later! No budget, no time and often no clue.

32. **WildSingapore**

(<http://www.wildsingapore.com>)

Contact: Ms Ria Tan wildsingapore@gmail.com

A one-stop location for Singaporeans who want to learn about our wild places; and do more for them. One person CAN make a difference! Simply explore, express and ACT!



33. **WWF – World Wide Fund for Nature**
(<http://www.wwf.sg/>)

Contact: Amy Ho aho@wwf.sg

WWF is one of the world's largest independent conservation organizations, with a global network active in more than 100 countries, including Singapore. WWF's goal is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature..



EXAMPLES OF BLOGS AND WEBPAGES THAT FEATURE CONTENTS ABOUT MARINE LIFE IN SINGAPORE

This annex lists webpages and blogs with a complete focus or a section of on marine life in Singapore. Dormant personal sites (no updates for more than three months) were largely not included, those that were reflected significant resources and include a terminal date. Blogs with only a partial focus on marine life in Singapore were also not included. An active WildShores Google Reader feed is available for current posts from a wider range that includes infrequent sources : <http://tinyurl.com/singaporeshores>

Categories:

- I. Personal blogs
- II. Volunteer group blogs
- III. Project or event blogs
- IV. Resource blogs and webpages

I - Personal blog (Italicised names are aliases of unknown identity)

1. "Colourful Clouds," by Sonnenblume
Mar 2005 - present.
<http://colorclouds.blogspot.com/>
2. "God's Wonderful Creation," by Loh Kok Sheng
Feb 2005 - present.
<http://wondercreation.blogspot.com/>
3. "Nature Scouter," by Tan Sijie.
Sep 2007 - present.
<http://naturescouter.blogspot.com>
4. "Psychedelic Nature," by Neo Mei Lin
Nov 2008 - present.
<http://psychedelic-nature.blogspot.com/>
5. "Red Dot Beach Bum," by Beachbum.
Oct 2007 - present.
<http://reddotbeachbum.blogspot.com/>
6. "Singapore Beach Bum," by Beachbum.
Feb 2008 - present.
<http://sgbeachbum.blogspot.com/>
7. "The Blue Tempeh," by Jani Thuaibah
Jan 2004 - Jan 2006.
<http://thebluetempeh.blogspot.com/>



8. "The Tide Chaser," by Ron Yeo.
Jan 2007 - present.
<http://tidechaser.blogspot.com/>
9. "Urban Forest," by Teo Siyang
Nov 2006 - present.
<http://uforest.blogspot.com/>
10. "Where discovery begins," by Dreamer July.
Apr 2007 - present.
<http://wherediscoverybegins.blogspot.com/>
11. "Wild Shores of Singapore," by Ria Tan.
Aug 2008 - present.
<http://wildshores.blogspot.com/>
12. "Voices of the Reefs," by Yi Xi & Kathy.
Apr 2007 - Feb 2009.
<http://voicesofthereefs.blogspot.com/>

II - Volunteer group blog

1. "Adventures with Naked Hermit Crabs."
May 2007 - present.
<http://nakedhermitcrabs.blogspot.com/>

Society blog of an informal group of volunteers who lead guided boardwalk trips at Chek Jawa, Pulau Ubin,

2. "BWV Community."
July 2005 - present.
<http://www.bluewatervolunteers.org/bwv-community/>

Society blog of Bluewater Volunteers, a registered, volunteer-based, marine conservation NGO.

3. "Hantu Bloggers," by Debby Ng.
Mar 2004 - present.
<http://www.pulauhantu.org/>

Blog-Webpage of informal group of volunteers who conduct volunteer-led educational dive trips to Pulau Hantu

III - Project or Event Blogs

1. "Chek Jawa Mortality and Recruitment Project," by Loh Kok Sheng.
May 2007 - Oct 2008.
<http://cjproject.blogspot.com/>

2. "Labrador Park."
Mar 2007 - Feb 2009.
<http://labradorpark.wordpress.com/>

Seagrass project by a group of RGS students.



3. "News from the International Coastal Cleanup Singapore," by N.Sivasothi.
Sep 2007 - present.
<http://coastalcleanup.wordpress.com/>

4. "Singapore Celebrates our Reefs: IYOR 2008," by Ria Tan (ed.)
Nov 2007 - Feb 2009.
<http://iyor08singapore.blogspot.com>

5. "Star Trackers" by Chim Chee Kong and Tan Sijie
May 2008 - present
<http://startrackers.blogspot.com/>

Monitoring the body growth, survivorship, habitat utilization and movement patterns of knobbly seastar (Protoreaster nodosus) individuals at marine habitats in Singapore.

6. "TeamSeagrass," by teambloggers
Oct 2006 - present.
<http://teamseagrass.blogspot.com/>

7. "Wildfilms," by teambloggers
Apr 2007 - Aug 2008.
<http://wildfilms.blogspot.com/>

Misadventures of volunteers desperately documenting Singapore's fragile shores.

IV - Resource blogs and webpages

1. "Coral Reefs of Singapore."
2003 - present
<http://coralreef.nus.edu.sg/>

Resource webpage from Reef Ecology Study Team, Department of Biological Sciences, National University of Singapore. Webmaster: Huang Danwei (2007-present). Creator/Webmaster: Loh Tse-Lynn (2003-2007).

2. "Habitatnews," by N. Sivasothi. [Marine news section]
Feb 2004 - present
<http://habitatnews.nus.edu.sg//index.php?phrase=marine>

News about marine life in Singapore, Resource webpage from Reef Ecology Study Team, Department of Biological Sciences, National University of Singapore.

3. "International Coastal Cleanup Singapore."
2001 - present.
<http://coastalcleanup.nus.edu.sg/>

Official webpage of the International Coastal Cleanup with data and educational material on the issues of marine trash.

4. Labrador Park. The fauna and flora at Labrador Park, Singapore.
Jun 2004 - Mar 2008.
<http://habitatnews.nus.edu.sg/news/labrador/blog/>

Group blog by Raffles Museum Toddycats, volunteers with the Raffles Museum of Biodiversity Research, National University of Singapore.



4. "Mangroves of Singapore." By N. Sivasothi
2001 - present.
<http://mangrove.nus.edu.sg/>

Resource webpage about mangroves from the Department of Biological Sciences, National University of Singapore.

5. "Wildfact sheets" on wildsingapore by Ria Tan
2008 - present
<http://www.wildsingapore.com/wildfacts/>

Easy introduction to singapore's common marine life with a special section for nature guides

6. "Wildsingapore flickr" by Ria Tan
2007 - present
<http://www.flickr.com/photos/wildsingapore/>

Free photos for teachers, nature lovers who want to give presentations and others who just enjoy looking at our natural heritage.



NEW SPECIES AND NEW RECORD

1. 3 new fish species, discovered from Singapore

Mugilogobius fasciatus (2001)

Mugilogobius tigrinus (2001)

Cryptocentrus sp. (currently being described by myself)

2. 11 new fish species records for Singapore (since 2000)

Amblygobius phalaena

Calamiana polylepis

Cryptocentrus inexplicatus

Cryptocentrus strigiliceps

Myersina crocatus

Bryaninops tigrinus

Yongeichthys virgatulus

Balistoides viridescens

Doryrhamphus janssi

Cromileptes altivelis

Heniochus varius

3. 30 new hard coral species records for Singapore (since 2005)

Acanthastrea isbigakiensis

Acanthastrea rotundoflora

Acropora florida

Acropora granulose

Acropora loripes

Acropora microclados

Acropora samoensis

Alveopora spongiosa

Alveopora tizardi

Astreopora macrostoma

Caulastrea furcata

Echinopora lamellosa

Echinopora pacificus

Euphyllia cristata

Favia helianthoides

Favia maxima

Favia rotumana

Favites paraflexuosa

Goniastrea minuta

Montastrea colemani

Oulophyllia bennettiae

Oulophyllia crista

Pectinia aylei

Platygyra ryukyuensis

Podabacia kunzmanni

Podabacia motuporensis

Porites deformis

Porites monticulosa

Pseudosiderastrea tayami

Symphyllia agaricia



4. 1 new seagrass species records for Singapore (since 2006)
Halophila decipiens



REFERENCES

- Bland, E. 2007. Garbage of Eden. *New Scientist*, 14 April 2007: 39-41.
- Cesar, H., L. Burke, and L. Pet-Soede. 2003. "The Economics of Worldwide Coral Reef Degradation." Arnhem, The Netherlands: Cesar Environmental Economics Consulting
- Chou, L. M. 2006. Marine habitats in one of the world's busiest harbours. Pages 377-391 *in* E. Wolanski (editor), *The Environment in Asia Pacific Harbours*. Dordrecht: Springer.
- Chou, L. M. and K. P. P. Tun. 2007. Conserving reefs beside a marine landfill in Singapore. *Coral Reefs* **26**:719-719.
- Chou, L. M. 2008. Nature and sustainability of the marine environment. Pages 169-182 *in* T.C. Wong, B. Yuen, C. Goldblum (Editors), *Spatial Planning for a Sustainable Singapore*. Dordrecht: Springer.
- Cooper, E., L. Burke & N. Bood, 2008. Belize's Coastal Capital: The Economic Contribution of Belize's Coral Reefs and Mangroves. 6pp.
- Huang, D., K. P. P. Tun, and L. M. Chou. In press. An inventory of zooxanthellate scleractinian corals in Singapore, including 34 new species records. *Raffles Bulletin of Zoology*.
- Low, J. K. Y. and L. M. Chou. 1994. Sedimentation rates in Singapore waters. Pages 697-701 *in* S. Sudara, C. R. Wilkinson, and L. M. Chou, editors. *Proceedings of the 3rd ASEAN-Australia Symposium on Living Coastal Resources, Vol 2: Research Papers*. Chulalongkorn University, Bangkok.
- Moberg, F. and C. Folke. 1999. Ecological goods and services of coral reef ecosystems. *Ecological Economics* **29**:215-233.
- Salvat, B. 1992. Coral reefs—a challenging ecosystem for human societies. *Global Environmental Change* **2**:12-18.
- Soh, E. Y. and B. Yuen. 2006. Government-aided participation in planning Singapore. *Cities* **23**:30-43.
- Todd, P.A. and L.M. Chou. 2005. A Tale of Survival: Labrador Park, Singapore. *Coral Reefs* **24** (3): 391-391.

