Marine Biodiversity Conservation in Singapore

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Singapore’s Evolving Coastline

Singapore Today

- No hinterland
- Land area: 710 km²
- Territorial sea: >600 km²
- Population: ~5 million
- Population density: ~7000/km²
A young but developed nation, highly urbanised

One of the busiest ports in the world

One of the largest oil refinery clusters in the world
But with Still a Lot to Conserve
Singapore’s Coastal & Marine Habitats are Diverse.....
.....and her Biodiversity, Rich
Managing Singapore’s Coastal & Marine Environment.....

- .... is about balancing priorities
  - Industry and port development
  - Housing and recreation
  - Environment and habitat protection

- Key challenges facing the nation
  - Limited land and sea space
  - Increasing population
  - Meeting competing land-use and development needs within the limited land and sea resources
NParks (NBC) is the Lead Technical Agency.....

- For marine biodiversity conservation
- For nature and biodiversity related issues
- For providing scientific input for habitat management, conservation and sustainability
- For spearheading Integrated Coastal Management (ICM) processes within government
- For profiling Singapore’s coastal and marine management efforts to the international community
5 Key Approaches

Mainstreaming
Safeguarding & Enhancement
Survey, Monitoring & Research
Knowledge Management & Synthesis
International Participation
1. Mainstreaming - IUCM

Integrated URBAN Coastal Management - enhancing the coordination of governmental stakeholders, and coherence in governance, policies and processes

Concept Plan - Longer term strategic planning (30-50 yrs)

Master Plan – Shorter-term implementation planning (10-15 yrs)


http://www.ura.gov.sg/maps/
Mainstreaming - TCCME

Inter-Agency Technical Committee for the C&M Environment (TCCME)
1. Mainstreaming – Outreach

Stakeholder (NGO/interest group & community) engagement
Coastal protection & restoration of mangroves

2. Safeguarding & Enhancement

PROTECTION – Rock Revetment

RESTORATION – Multi-species Planting
2. Safeguarding & Enhancement

Safeguarding corals-of-opportunity

*In-situ* fixed and floating coral nurseries
2. Safeguarding & Enhancement

Habitat enhancement/restoration efforts

- BioBOSS for intertidal biodiversity enhancement
- Reef Enhancement Units (REUs) as mobile enhancement/restoration modules
- Substrate enhancement along coastline revetments
Species recovery programs

- Giant clam culture
- Sexually reproduced hard corals
- Neptune’s Cup sponge recovery
Establishment of Singapore’s first marine park

• Announced on 12 July 2014
• Objectives:
  • Outreach
  • Education
  • Conservation
  • Research
Establishment of Singapore’s first marine park

- The Sisters’ Islands Marine Park was chosen for:
  - Its diverse marine biodiversity
  - The variety of habitats, including intertidal flats, mangrove and seagrass stands and coral reefs within the Sisters’ Islands Marine Park and the surrounding islands
  - The good hydrodynamic connectivity with other coastal and marine areas
3. Survey, Monitoring & Research

Comprehensive Marine Biodiversity Survey

Reef surveys
Seagrass/intertidal surveys
Epi-benthic/benthic/fish Surveys

Marine Biodiversity in Singapore’s Marinas

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INTRODUCTION

Marine biodiversity research in Singapore during the 20th century revealed the high biodiversity of marine habitats. The survey area was divided into four distinct marine environments: coastal, estuarine, coral, and pelagic. The coastal zone encompasses the shallow waters of the Singapore Strait and the straits of Malacca, which are characterized by high levels of primary production. The estuarine zone includes the mouths of the major rivers, which are characterized by low levels of primary production. The coral zone is characterized by a high diversity of coral species, including the scleractinian corals. The pelagic zone is characterized by a high diversity of planktonic species, including the ctenophores, which are responsible for the high levels of primary production in the coastal zone.

METHODS

A. Sampling Techniques

1. Reef surveys: The reef surveys were conducted using a team of trained divers, who collected samples from the reef using a combination ofmanual and automated sampling methods. The samples were collected at regular intervals throughout the day, and the data were recorded using a digital database. The data were then analyzed using a combination of statistical and graphical methods.

2. Seagrass/intertidal surveys: The seagrass/intertidal surveys were conducted using a combination of manual and automated sampling methods. The samples were collected at regular intervals throughout the day, and the data were recorded using a digital database. The data were then analyzed using a combination of statistical and graphical methods.

3. Epi-benthic/benthic/fish surveys: The epi-benthic/benthic/fish surveys were conducted using a combination of manual and automated sampling methods. The samples were collected at regular intervals throughout the day, and the data were recorded using a digital database. The data were then analyzed using a combination of statistical and graphical methods.

RESULTS

A. Reef surveys

1. Coral diversity: The coral diversity was high, with a high diversity of coral species, including the scleractinian corals. The data were analyzed using a combination of statistical and graphical methods.

2. Fish diversity: The fish diversity was high, with a high diversity of fish species, including the ctenophores, which are responsible for the high levels of primary production in the coastal zone. The data were analyzed using a combination of statistical and graphical methods.

B. Seagrass/intertidal surveys

1. Seagrass diversity: The seagrass diversity was high, with a high diversity of seagrass species. The data were analyzed using a combination of statistical and graphical methods.

2. Intertidal diversity: The intertidal diversity was high, with a high diversity of intertidal species. The data were analyzed using a combination of statistical and graphical methods.

C. Epi-benthic/benthic/fish surveys

1. Epi-benthic diversity: The epi-benthic diversity was high, with a high diversity of epi-benthic species. The data were analyzed using a combination of statistical and graphical methods.

2. Benthic diversity: The benthic diversity was high, with a high diversity of benthic species. The data were analyzed using a combination of statistical and graphical methods.

3. Fish diversity: The fish diversity was high, with a high diversity of fish species. The data were analyzed using a combination of statistical and graphical methods.

CONCLUSIONS

The marine biodiversity in Singapore’s marinas is high, with a high diversity of marine habitats. The surveys revealed the high biodiversity of marine habitats, and the data were analyzed using a combination of statistical and graphical methods. The results of the surveys revealed the high biodiversity of marine habitats, and the data were analyzed using a combination of statistical and graphical methods.
3. Survey, Monitoring & Research

Coastal habitat mapping

Pulau Semakau

Chek Jawa
3. Survey, Monitoring & Research

Habitat and species connectivity

[Map showing dispersal of an April 2012 broadcast spawning event at seven select reefs using ABM Lab (MIKE by DHI).]
4. Knowledge Management & Synthesis

- National Biodiversity Strategic Action Plan (NBSAP)
- Flora & Fauna Web / BIOME
- GIS / DSS
5. International Participation

- International – IMO/MPEC, UNGA, UNCBD, UNFCCC, ICRI, etc.
- Regional - AWGCME, PEMSEA/EAS Congress, ASEAN, APEC, ICRI EA, etc.
THANK YOU!