

STATUS OF MANGROVES IN SINGAPORE: CONSERVATION BEYOND THE YEAR 2000

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ABSTRACT

Only about 600 hectares of mangrove forests are now left in Singapore, mostly in the northern area. A large part of this however, will probably be lost to development in the coming years. Some areas have been designated 'green areas' by the government, while some mangroves are retained in currently protected parks and bird sanctuaries. The absence of a significant economic rationale for conserving mangroves, coupled with the land needs of a rapidly growing and industrialising country, mean that probably only token mangrove areas will be conserved for aesthetic and educational purposes in the future.

INTRODUCTION

Mangroves have been on a serious decline in Singapore, especially in the last two decades, with less than one percent remaining today. Small areas survive mainly in the northern parts, with a few remnants on the offshore islands of Pulau Ubin and Pulau Tekong in the north, and Pulau Semakau and Pulau Pawai in the south (Chou *et al.* 1980; Chou 1991). Development of the southern islands over the next decade, however, will destroy much of these mangroves. Conservation of this rich and diverse ecosystem has never been a more critical issue.

Mangrove forests covered 10 to 13% of Singapore's coastline in 1819 (Corlett 1986; Rao 1987). Soon after colonisation by the British, mangrove forests were cleared for port facilities, and subsequently for industries, housing estates and other development projects (Chia 1989). Today, only about 0.5% or 600 hectares of mangrove forests remain (Corlett 1986; Chou *et al.* 1980; Chou 1991). This is however, an optimistic estimate, as this figure includes disused prawn ponds as well as fragmented and degraded mangrove patches.

Recent interest in the mangrove ecosystem has led to numerous studies of Singapore mangroves. A general summary of the state of Singapore mangroves was done by Chou *et al.* (1980). The various abiotic conditions in mangroves were discussed by Johnson (1973). The natural history and history of the forest was summarised by Wee & Corlett (1986), Corlett (1986) and Rao (1987). Diversity and related studies of selected groups (e.g. Tan & Ng 1988; Murphy 1992; Sivasothi *et al.* 1993; Low & Chou 1993; Tan & Ng 1994; Low & Chou 1994) have been done. The hydrobiology of the northern mangrove forests were studied by Quek & Chua (1990) and Goh & Chou (1993) at Sungei Buloh and that of Pulau Tekong by Chung & Goh (1990). Faunal zonation at Pandan was studied by Berry (1963), and recently, Murphy (1981) and Murphy & Lee (1991) have attempted to elucidate zonation patterns from stem count data and measurement of tidal ranges in the Mandai mangroves. Murphy and Sigurdsson (1990) discussed the situation with the Sungei Buloh mangrove reserve, and also provided an historical account of previous studies of mangroves in Singapore.

USES OF MANGROVES IN SINGAPORE

Traditionally, mangrove trees were harvested for firewood, charcoal, poles and Nibong trunks for fishing kelongs etc., *Nypa* palm (for sugar and seeds) and many kinds of seafood have also been harvested. In modern

Singapore however, none of these uses are important any more. With increased urbanisation and demands of a growing affluent population, mangrove forests were extensively redeveloped for industries and housing. Much of the development took place in the 1970s (Chia *et al.* 1989) by the Jurong Town Corporation, the Urban Redevelopment Authority and the Port of Singapore Authority.

Artisanal fisheries still exist in Singapore but are declining. Gear used include gill and trammel nets, fish traps, crab nets, long lines and kelongs. Green mussel (*Perna viridis*) culture is practiced on a small scale. Much of the catch consists of groupers and snappers (*Epinephalus*, *Cephalopholis* and *Lutjanus*), shrimps (*Penaeus* and *Metapenaeus* spp.) and crabs (*Scylla serrata* and *Portunus pelagicus*). Various kinds of molluscs (*Glaucanome*, *Cerithidea*, *Telescopium*, *Geloina*) are also collected in small numbers by hand for local consumption. Small numbers of the horseshoe crab (*Carcinoscorpius rotundicauda*) are also occasionally collected for their eggs.

CONSERVATION LAWS IN SINGAPORE

Details of conservation laws in Singapore are beyond the scope of this paper, but a good account of wildlife legislation was done by Lye (1991). There are no specific laws for the protection of the mangrove forests, but all wild animals (with the exception of domestic and farm animals) are protected under the Wild Animals and Birds Act of 1974. Parks in Singapore are governed by the Parks and Trees Act of 1975 under the purview of the Commissioner of Parks and Recreation, which includes the protection of the natural habitat.

CONSERVATION AND DESTRUCTION

Concern over the mangrove forests goes back to 1884, when mangrove areas were included in 5000 hectares of forest reserves (Wee & Corlett 1986). The largest reserve was at Pandan, to the south of the mainland. This reserve, has dwindled drastically over the years, and the remnants of the original 1012 hectares of forest will be soon be cleared for development. Kranji mangroves, adjacent to the Mandai system, were originally 306 hectares, but was mostly destroyed when the Kranji Reservoir was developed.

The current government has decided that no less than 5% of the land area of Singapore will be devoted to the conservation of natural green areas (Urban Redevelopment Authority 1991; Ministry on the Environment 1993). These areas include the remaining mangrove forests at the Mandai-Kranji-Buloh area, and parts of Pulau Ubin and Pulau Tekong. These mudflats are vital to the survival of the mangrove birds, many of which feed there (Murphy & Sigurdsson 1990). In addition to this, there are park areas which include mangroves (e.g. Pasir Ris Park).

The mangrove forests surrounding Sungei Buloh have been gazetted as a Nature Park and bird sanctuary which is currently managed by the Jurong Bird Park. The Nature Park is open to the public, and has relatively good mangroves, with a raised walkway and educational facilities. In its opening month some 10,000 visitors passed through its gates. The Parks and Recreation Department has also incorporated a mangroves swamp habitat into the planning of the Pasir Ris Park (northeastern Singapore), and has initiated a mangrove reforestation project (Nathan 1993a) at Sungei Api-Api.

Reconciliation between development and conservation will not be easy. Consider Pulau Semakau, an offshore island south of Singapore. The western half of the island has been designated a nature area, but development of the eastern side as a land-fill for waste disposal has already begun. The necessity of an offshore dumping ground is perhaps not in dispute due to the large quantities of waste produced in Singapore daily. The area covers 350 hectares, and the land-fill will have a 'lifespan' of 47 years. While the marine environment will be protected by 7 km of rock bunds surrounding the dump site (Nathan 1993b), the mangrove forest presently occupying the site will be lost. The survival of the other small patches is also in doubt.

BEYOND 2000

In its plan for Singapore, the Urban Redevelopment Authority of Singapore has allocated 5% of its land (including reclaimed land) as 'green areas' (Urban Redevelopment Authority 1991; Ministry on the Environment 1993). While the bulk of this 5% is centred in the Central Catchment Area under the National Parks Board, there are however, provisions for the conservation of some mangrove areas. Besides the Sungei Buloh Nature Park, portions of Sungei Khatib Bongsu, Mandai, Kranji and Pasir Ris will be conserved. The problem with conservation in Singapore is that laws and 'masterplans' change very rapidly (Ng 1991), and that mangrove areas are conserved in the 1990s does not at all mean that there will be extant mangroves in the year 2000. In Singapore, the value of mangroves for fishery or forestry purposes is virtually negligible. Ecotourism is still in its infancy and unlikely to develop into a significant money-earner. In fact, the only reasons for conserving mangroves are mainly aesthetic, heritage or educational purposes. With these perspectives in mind, Singapore would be lucky to keep even a small part of the 0.5% of the original mangroves it now retains over the next 50 years.

REFERENCES

- Berry, A.J. 1963. Faunal zonation in mangrove swamps. **Bulletin of the National Museum, Singapore**, 32:90-98.
- Chia, L.S., Khan, H. & Chou, L.M. 1988. **The Coastal Environmental Profile of Singapore**. Technical Reports 21. International Center for Living Aquatic Resources Management, Manila. 92 pp.
- Chou, L.M. 1991. Contributions of the ASEAN-Australia Coastal Living Resources Project to coastal living resource assessments in Singapore. In: Alcalá, A.C.(ed.) **Proceedings of the Regional Symposium on Living Resources in Coastal Areas**, University of the Philippines, Manila. pp. 569-572.
- Chou, L.M., Ho., S.H., Khoo, H.W., Lam, T.J., Murphy, D.H. & Tan, W.H. 1980. **The present state of mangrove ecosystems in Southeast Asia and the impact of pollution: Singapore**. FAO/UNEP report SCS/80/WP/94d. South China Sea Fisheries Development and Coordinating Programme, Manila, Philippines. 97pp.
- Chung, D.S.L. & Goh, B.P.L. 1990. A survey of the soft-bottom benthic fauna of Pulau Tekong. In: Chou, L.M. (ed.) **Living Coastal Resources of Singapore**. Proceedings of a Symposium on the Assessment of Living Resources in the Coastal Areas of Singapore, 3 April 1989, National University of Singapore, Singapore, pp. 53-62.
- Corlett, R. 1986. Singapore. In: Umali, R.M.(ed.) **Mangroves of Asia and the Pacific: Status and Management**. Technical report of the UNDP/UNESCO research and training pilot programme on mangrove ecosystems in Asia and the Pacific (RAS/79/002), Manila, Philippines. pp.211-218.
- Ministry on the Environment 1993. **The Singapore Green Plan - Action Programmes**. Ministry of the Environment, Singapore. 80pp.
- Goh, B.P.L. & Chou, L.M. 1993. The riverine community of Sungei Buloh, Singapore, based on the surveys of 1990 and 1991. **ASEAN Journal of Science & Technology for Development** 10(1): 1-13.
- Johnson, D.S. 1973. Bird Life. In: Chuang, S.H.(ed.) **Animal Life and Nature in Singapore**. pp. 85-102.
- Lee, C.S.C. & Murphy, D.H. 1990. Some attempts at cluster analysis of stem count data from transects in a Singapore mangrove site. In: Chou, L.M.(ed.) **Living Coastal Resources of Singapore**. Proceedings of a Symposium on the Assessment of Living Resources in the Coastal Areas of Singapore, 3 April 1989, National University of Singapore, Singapore. p. 81-100.

- Low, J.K.Y. & Chou, L.M. 1993. Fish Fauna of some Singapore mangrove and near-shore habitats. In: Sasekumar, A. (ed.) **Mangrove Fisheries and Connections**, 26-30 August 1991, Perak, Malaysia. University of Malaysia, Kuala Lumpur, Malaysia. pp. 94-113.
- Low, J.K.Y. & Chou, L.M. 1994. Fish diversity of Singapore mangroves and the effect of habitat management. In: Sudara, S., Wilkinson, C.R. & Chou, L.M. (eds.) **Proceedings Third ASEAN-Australia Symposium on Living Coastal Resources, Vol: 2, Research Papers**, Chulalongkorn University, Bangkok Thailand, May 1994 (in press).
- Lye, L.H. 1991. Wildlife protection laws in Singapore. **Singapore Journal of Legal Studies** (1991). Pp. 287-319.
- Murphy, D.H. 1992. The natural history of insect herbivory on mangrove trees in and near Singapore. **Raffles Bulletin of Zoology** 38(2):117-203.
- Murphy, D.H. & Lee, C. 1991. Preliminary interpretation of topography and vegetation at a Singapore mangrove site. In: Alcala, A.C. (ed.) **Proceedings of the Regional Symposium on Living Resources in Coastal Areas**, University of the Philippines, Manila. pp. 419-432.
- Murphy, D.H. & Sigurdsson, J.B. 1990. Birds, mangroves and man: Prospects and promise of the new Sungei Buloh Bird Reserve. **Essays in Zoology**. Department of Zoology, National University of Singapore. pp. 233-243.
- Nathan, D. 1993a. Mangrove saplings taking root along banks of Sungei Api-api. **The Straits Times**, Friday, November 5, 1993. pp. 33.
- Nathan, D. 1993b. Measures in place to prevent pollution at landfill site: ENV. **The Straits Times**, November 1, 1993.
- Ng, P.K.L. 1991. Conservation in Singapore: prospects, limitations and challenges. **Wallaceana** 64:7-9.
- Quek, S.T. & Chua, C.Y.Y. 1990. A study of the benthic soft-bottom and pelagic communities of Sungei Buloh. In: Chou, L.M. (ed.) **Living Coastal Resources of Singapore**. Proceedings of a Symposium on the Assessment of Living Resources in the Coastal Areas of Singapore, 3 April 1989, National University of Singapore, Singapore. Pp. 1-8.
- Rao, A.N. 1987. Land regeneration and reduced mangrove areas in Singapore. In: Field, C.D. and Dartnall, A.J. (eds.) **Mangrove ecosystems of Asia and the Pacific: Status, exploitation and management**. pp. 199-207.
- Sivasothi, N., Murphy, D.H. & Ng, P.K.L. 1993. Tree-climbing and herbivory of crabs in the Singapore mangroves. In: Sasekumar, A. (ed.) **Mangrove Fisheries and Connections**, 26-30 August 1991, Perak, Malaysia. University of Malaysia, Kuala Lumpur, Malaysia. pp. 220-237.
- Tan, L.W.H. & Ng, P.K.L. 1988. **A Guide to Seashore Life**. Singapore Science Centre, Singapore. 160pp.
- Tan, C.G.S. & Ng, P.K.L. 1994. An annotated checklist of mangrove brachyuran crabs in Malaysia and Singapore. In: Sasekumar, A., Marshall, N. & Macintosh, D.J. (eds.) **Hydrobiologia: The Ecology and Conservation of Southeast Asian Marine and Freshwater Environments including Wetlands**. In press.
- Urban Redevelopment Authority 1991. **Living the Next Lap: Towards a Tropical City of Excellence**. Urban Redevelopment Authority, Singapore. 40pp.
- Wee, Y.C. & Corlett, R. 1986. **The City and the Forest: Plant Life in Urban Singapore**. Singapore University Press, National University of Singapore, Singapore. 186pp.