

An Introduction to Two Exotic Mangrove Species in Hong Kong: *Sonneratia caseolaris* and *S. apetala*

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Introduction

In early 2000, AFCD staff found some extra-ordinary mangrove plants on the exposed mudflat close to the mouth of Shenzhen River in the Deep Bay area. They were later identified as an exotic mangrove species belonging to the genus *Sonneratia*.

In 2001, *Sonneratia* individuals were also found among the native mangrove species including *Aegiceras corniculatum*, *Kandelia obovata* and *Acanthus ilicifolius* along the embankment of the downstream section of the Kam Tin Main Drainage Channel (MDC) (Fig. 25). The 13 ha mangroves along the MDC were planted in 1998 as a mitigation measure for the mangrove lost due to the MDC project. Being faster growing, *Sonneratia* could be easily recognized among other planted mangroves by their height. As *Sonneratia* usually grow in the outermost region of the seashore, their occurrence among native mangrove suggests that they were planted mistakenly with the native species. In April 2002, the then Territory Development Department (now renamed as Civil Engineering and Development Department) which commissioned the original planting cleared *Sonneratia* found along the MDC.

The two subcommittees of the Wetland Advisory Committee discussed the occurrence of *Sonneratia* in Hong Kong in May 2001. Although the potential impact of this exotic species on the native mangrove communities was still unknown, both subcommittees agreed to the precautionary measure to remove the exotic mangrove from the Ramsar site. Since then, AFCD has conducted *Sonneratia* removal exercises regularly.

Classification of *Sonneratia*

Sonneratia are evergreen trees with open spreading crown which can grow up to 20 m high. Although they do not have buttress or prop roots, they have thick, cone-shaped and upright densely congregated pneumatophores which originate from the underground cable roots similar to the native *Avicennia marina*. Flowers are solitary with numerous stamens and vestigial (or no) petals. Fruits are fleshy and globule (Hogarth, 1999). *Sonneratia* spp. mainly distribute in the tropical and subtropical area, from East Africa through Indo-Malaya to tropical Australia, Micronesia and Melanesia including the Hainan Island of Mainland China.









The *Sonneratia* specimens found in the Deep Bay area in 2000 were formerly misidentified as *Sonneratia alba* (杯萼海桑). Based on the key published by Hogarth (1999), AFCD suggests that there are two species of *Sonneratia* in Hong Kong – *Sonneratia caseolaris* (海桑) (L.) Engl and *Sonneratia apetala* (無瓣海桑) Buch.-Ham (Table 4). In 2005, the Royal Botanic Gardens of Kew in Britain confirmed the specimens sent to them as *Sonneratia caseolaris*.

Both *S. caseolaris* and *S. apetala* belong to the Family Sonneratiaceae (海桑科) which consists of two genera: *Sonneratia* L. f. (海桑屬) and *Duabanga* (八寶樹屬) which accounts to 12 species (Wang and Chen, 2002). The genus *Sonneratia* can be divided into two Sections: Section *Sonneratia* with capitate stigmas and Section *Pseudosonneratia* with peltate stigmas. There are six species and three varieties in the genus.



Fig 25. *Sonneratia* in Kam Tin Main Drainage Channel.

Table 4. The morphological characteristics of *S. caseolaris* and *S. apetala*.

Species	<i>Sonneratia caseolaris</i> (L.) Engl	<i>Sonneratia apetala</i> Buch. -Ham
Chinese Name	海桑 	無瓣海桑 
Section	<i>Sonneratia</i>	<i>Pseudosonneratia</i>
Height	up to 15 m	up to 20 m
Natural Distribution	South East Asia to the northern Australia. Native to China where they are naturally found on Hainan Island.	South Asia such as India, Bangladesh and Malaysia.
Leaves	Broad, ovate, opposite leaf, incompletely unrolled to show venation. Apex acute in young plants which becomes round at later stage. Length to width ratio is less than two. Petiole short (0.5 cm) and red. 	Narrow, elliptical, opposite, gradually taper toward the apex. Petiole is longer (~1 cm). 
Flowers	Relatively larger (~5 cm). Bisexual. Stamens red and white distally, standing erect. Style greenish and long, twice the length of stamens, topped with capitate stigma. Usually have 6 sepals. Petals red and oblong. Flowers appear all year round. 	Flower small (1.5-2 cm) and stalked, single or clustered at branch ends. 4 green calyx lobes. Bisexual. Stamens white, standing erect. Style yellow topped with mushroom-shaped or peltate stigma. Flowers appear from May to December. 
Fruits	Compressed and edible fleshy. Large (up to 8.5 cm). Green when young and turns yellowish green and aromatic when mature. Produces 800-1,300 seeds per fruit. Fruits appear all year round. 	Oval berry. Distinctively smaller (1.5-2.5 cm) than <i>S. caseolaris</i> . 4-5 calyx lobes. Green when young and becomes grayish when mature. Each fruit produces 100-130 seeds. Fruits appear from August to early Spring. 

Sonneratia in Afforestation

Because of their fast growing nature and the occurrence in the low intertidal level, *Sonneratia* are often used to stabilize coastline or mudflat (Zan *et al.*, 2003). In the ninety centuries, *Sonneratia* have been widely adopted for afforestation in South China including eastern and western Guangdong Province and Fujian Province (Chen *et al.*, 2003).

In 1993, *S. caseolaris* and *S. apetala* were introduced to the Futian Mangrove Nature Reserve (福田紅樹林自然保護區) from Dongzhaigang Mangrove Nature Reserve (東寨港紅樹林區) of Hainan Island as part of a national key project to afforest Shenzhen Bay. While *S. caseolaris* is native to Hainan Island, *S. apetala* was originally introduced from Sundarban in the southwest of Bangladesh to Hainan Island in 1985 (Liao *et al.*, 2004; Zan *et al.*, 2003).

In Futian, *S. apetala* and *S. caseolaris* started producing flowers and fruits successfully in 1996 and 1997 respectively (Zan *et al.*, 2003; Li *et al.*, 1998). Similar to those on Hainan Island, the tallest *S. apetala* reached 12.5 m. As at 2003, there was more than 0.6 ha of artificial forest of these two species in Futian.

Sonneratia are renowned for the ease to proliferate. The buoyancy nature of the seeds allows them to be drifted by the water current and travel a long distance. Germination requirements are not specific and seeds tolerate a relatively wide fluctuation of temperature, pH and salinity (Liao *et al.*, 1997). In view of these characteristics, the close proximity of the Deep Bay area in Hong Kong to the Futian Nature Reserve (Fig. 26), it is likely that the *Sonneratia* in Hong Kong was originated from Futian.

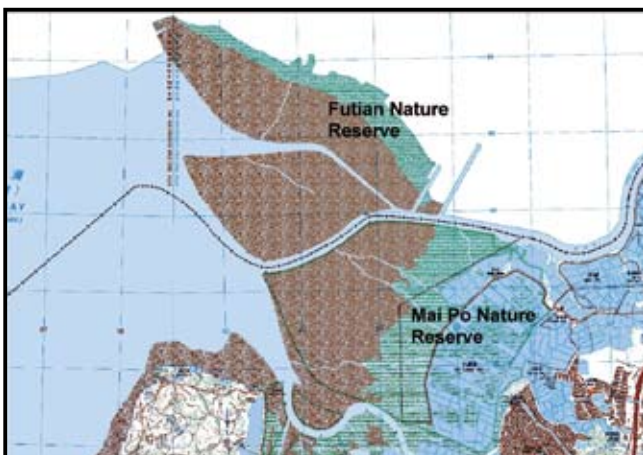


Fig 26. Map showing Mai Po Nature Reserve and Futian Nature Reserve.

Potential “Impact” of *Sonneratia* on Native Mangrove

Field surveys carried out by AFCD in 2005 found that *Sonneratia* are distributed in the intertidal area and channels of the Deep Bay area, Tsim Bei Tsui, Hong Kong Wetland Park, Nam Sang Wai, Sheung Pak Nai and Ha Pak Nai (Fig. 27). There were about 1,600 *Sonneratia* plants in the Deep Bay area (70% *S. caseolaris* and 30% of *S. apetala*). They are mainly distributed in the outlets of stream and channels where salinity is relatively lower. They were also found in the outermost region of the mangrove forests or in isolated ‘gaps’ within the mangrove forests where light penetrates.

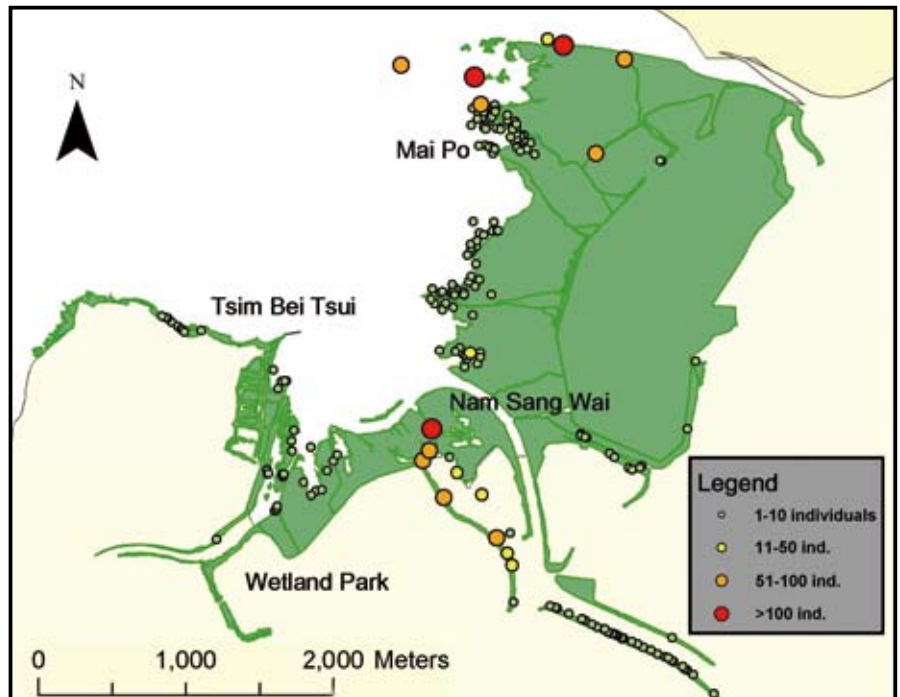


Fig 27. Map showing the distribution of *Sonneratia* in the Ramsar Site.

There are some discussions on the potential impact of *Sonneratia* on the native mangrove flora community. When compared with other terrestrial and riparian habitats, mangrove is relatively resistant to invasion as the instable substratum and saline conditions prevent invasion of most exotic plant species (Teo *et al.*, 2003). Zan *et al.* (2003) suggested that the niche of *Sonneratia* spp. does not overlap with the native mangroves and therefore it was unlikely that the indigenous mangrove species would be replaced. Moreover, Li *et al.* (2003) showed that *Sonneratia* spp. improve soil quality in the mudflat by increasing salinity, organic materials as well as nitrogen, phosphate and potassium concentration and reducing pH, which could promote the growth of native species. In fact, although *Sonneratia* spp. have colonized the Deep Bay area for several years, there is no sign that they have out grown the well established native mangrove species.