Mangroves—allies or invaders?

Conventional wisdom has it that mangrove swamps are invaluable nursery areas for marine species and that they merit our respect and protection. André and Robin LaBonté, ocean engineers who specialise in harbour, dune and beach restoration, ask whether these plants are quite the ecological "good guys" we have been led to believe they are.

IN NEW ZEALAND, it seems almost an article of faith that mangroves are tremendously valuable plants. For the past 30 years, biology students have been taught that mangroves are a keystone species in a complex estuarine ecosystem that serves as habitat, nursery and breeding area for many terrestrial and marine organisms. In addition, these wonder plants are said to filter out sediment, nutrients and contaminants and inhibit erosion. Is all this true? Is *Avicennia marina* var. *resinifera* really a backbone species on which other species, such as snapper, depend for successful recruitment?

Having immigrated to New Zealand 18 years ago from Florida, we are familiar with tropical "mangals," as the plant communities associated with mangrove swamps are usually termed. However, tropical mangrove communities differ somewhat from our local New Zealand version. Tropical mangals can be thought of as rainforests growing in the marine environment, containing as many as 30 species of mangrove; the more tropical the area, the more species present. Associated with these plants are many marine, avian and terrestrial species that have evolved obligatory relationships with them, requiring that part of their life cycle be spent within the mangal.

In contrast, the New Zealand mangrove forest is a monoculture, and pollen in sediment cores indicates that the species (which is also present in south Australia) arrived here a mere 14,000 years ago—nothing compared with the 20 million years over which tropical mangrove forests have existed.

From reading, we quickl gained the impression that New Zealand's mangrove trees had been decimated by stock grazing causeway construction and reclamation. We were saddened that New Zealanc had supposedly lost so muc of an important ecosystem. However, in 1994, we had an epiphany while researching and collecting data for a restoration projec in Mangawhai Harbour. Review of a series of histori aerial photographs revealed an almost complete absence

Aerial photos of Mangawhai Harbour taken 55 years apart show that mangroves are spreading. A similar increase is visible in many estuaries in northern New Zealand.

of mangroves in the upper Mangawhai Harbour in 1946—a dramatic difference from today, where the same area is almost completely occupied by the plants. Residents who had grown up in Mangawhai in the 1930s told us that as children they had swum in the upper harbour and caught flounder and collected pipi from a sandy harbour bed. This caused us to wonder about the rate at which the harbour was being infilled by mangroves and mangrove mud.

When a species expands rapidly, it can be an indication of an environmental imbalance or a changed environment. Imbalances often lead to the displacement of some species by others and to habitat alterations that result in reduced biodiversity. One example is the internationally significant site near Miranda, in the Firth of Thames, which functions as a migratory wading-bird foraging site. Here, the expansion of mangroves has altered the habitat to the point where construction of artificial land-based foraging areas is being considered.

When we investigated further, we found that Mangawhai Harbour was not an isolated case. From 1942 to 1981, other harbours and estuaries between Auckland and Mangawhai experienced a 30 to 40 per cent infilling with mangroves. Indeed, most, if not all, of the northern North Island's harbours and estuaries have experienced, or are experiencing, similar rapid expansion of mangroves. In Tauranga Harbour mangrove coverage has increased 117 per cent over the same 40-year period, including in the Waimapu, Waikareao, Matua and Welcome Bay estuaries.

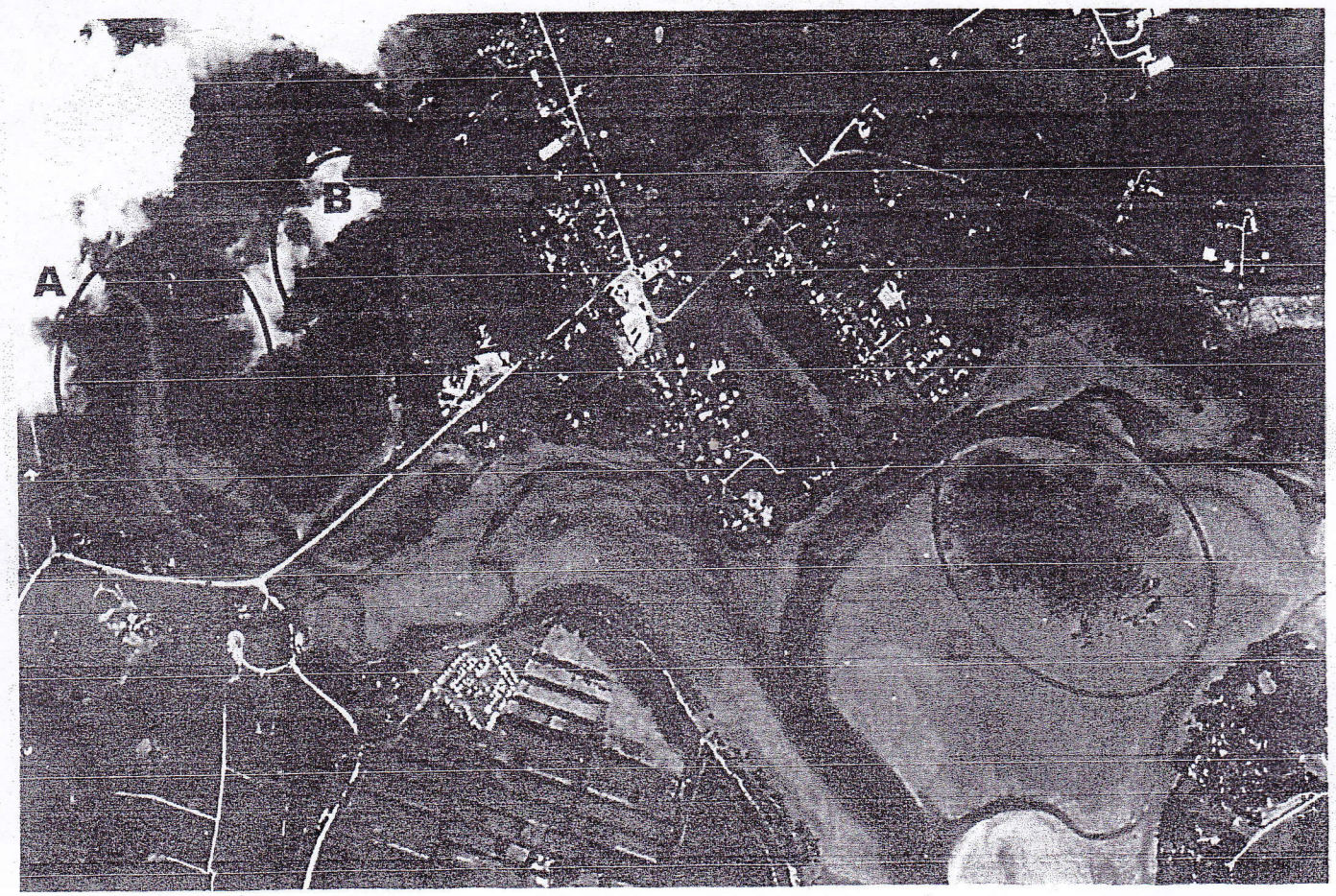
A time series of aerial photographs shows that at Welcome Bay and Waimapu new mangrove growth advances on average up to 20 m per year from an established front, and that infilling to a dense stand occurs within two years.

Other areas where concern has heightened over the rapid expansion of mangroves include Whangamata, Opoutere, Waiuku, Papakura Inlet, Raglan, Thames, Coromandel, Matapouri, Pataua, Whananaki and the upper reaches of Kaipara and Hokianga Harbours.

Why are mangroves on the increase? The onset of the expansion more or less coincided with the post-Second World War introduction of topdressing and more intense farming practices, which led to increased nutrient runoff into harbours. More recently, intensification of housing subdivisions may also be causing more silt and nutrients to enter estuaries. Mangroves probably respond to higher levels of nutrients with increased seed (propagule) production.

Mangrove expansion also needs to be viewed against the great increase in potential habitat that has become available over the past 150 years. When northern New Zealand was under forest, runoff would have contained little silt, and harbours were deep. Once the trees were removed, the land started to slip and topsoil and clay sluiced into the harbours. In consequence, these have silted up, greatly increasing the area suitable for mangrove growth.

Concurrent with the expansion of New Zealand's mangrove forests has been the development of a global protectionist attitude towards tropical mangals. During the



late 1960s and early 1970s, this attitude was adopted here, too. The premise for protection was not based on any New Zealand data, but relied on imbuing New Zealand's single-species mangrove swamps with the properties of complex tropical mangals. Since then, students have been taught that the North Island's mangrove forests and tropical mangals are analogous.

But are they? Consider their role as nurseries. Tropical mangals serve as nurseries for many marine organisms, since certain mangrove species—though not New Zealand's—have prop roots which remain submerged throughout the tidal cycle. These provide juvenile organisms such as fish with hiding places to avoid predators. If New Zealand's juvenile fish depend on mangroves, where do they hide when the tide goes out and the mangroves are exposed?

Tropical mangals and New Zealand's mangrove forests both produce leaf litter which contributes organic material to the sea's food chain. The clear blue waters of tropical seas are often referred to as "deserts" because of their lack of nutrients, so mangrove leaves constitute a significant nutrient source. New Zealand's greenish waters are much richer, hence the contribution of mangrove leaf litter to the food chain is less significant. The question arises: how did our marine organisms fare in earlier times when there were few mangroves?

Furthermore, many of the marine organisms present in the mangrove-populated upper third of the North Island are also present in the waters of the lower two-thirds of the North Island, the South Island and the Chatham Islands. Since these areas are devoid of mangroves, how vital can the contribution of mangrove forests be to the persistence of these species?

Do mangroves protect estuaries and harbours from becoming filled with sediment off the land and sand from adjacent beaches? We do not believe so. Mangrove propagules establish in soft sediments away from waves and currents. Young plants accumulate mangrove mud (which is several times more resistant to erosion than unconsolidated sediment),

but well-established plants trap very little. Instead, channelling occurs, whereby suspended sediment travels past and through a forest. The effect of the trees shifts to the reduction and alteration of water flow, which can result in increased flooding in upper-harbour areas and reduced flushing. Choking of a harbour with sediment can result. This in turn reduces the sediment supply to beaches, potentially accelerating coastal erosion.

New Zealand is the only country in the world where the mangrove is expanding its area of occupation. Is this expansion good for New Zealand's marine environment? We don't believe it is, because it appears to be occurring at the expense of other habitats, such as shellfish beds, sea-grass beds, flounder habitat and wading-bird habitat, as well as recreational areas such as sandy beaches and stretches of open water.

These concerns are shared by an increasing number of northern North Island coastal communities, whose residents have documented the rapid expansion of mangrove forests and the associated loss of other valuable habitats. As a result, a community-based mangrove working party has been formed for the purpose of sharing information on mangrove research and management. Active groups are located in Whangamata, Opoutere, Waiuku, Papakura, Raglan, Welcome Bay, Matua, Waikareao, Waimapu and Mangawhai.

Why manage mangrove expansion? In some instances, if no management action is taken, the ultimate outcome could be complete closure of tidal inlets and total loss of intertidal habitats in harbours, thereby reducing biodiversity. In a few areas there may not be sufficient time to await the results of prolonged research before habitats are irrevocably altered. In these urgent cases, pilot projects which combine research and management activity could satisfy the needs of the community while expanding our knowledge of the New Zealand mangrove's niche in the ecosystem.

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