

3. Ecological character

3.1 TOPOGRAPHY/GEOLOGY

The salient geographical features of the ED are the broad Northern Wairoa River (comprising the upper arm of the Kaipara Harbour) in the east, the narrow, shallow Kaihu River valley in the northeast, the substantial Ruawai Plains ('Ruawai Flats') in the southeast, the long, narrow, hilly Pouto Peninsula in the south, and the long sandy coastline in the west. The massifs of Maunganui Bluff (459 m asl) and Mt Tutamoe (at 774 m, the second highest peak in Northland) overshadow the northern part of the ED but lie outside it. Elsewhere, topography is predominantly rolling low hills (highest points Puketi Hill 282 m asl in the north, Muarangi Hill 214 m in the south) with intervening shallow basins and valleys. Dune lakes are a feature of the western side of the ED, particularly in the north at Kai Iwi (largest, Lake Taharoa), west of Dargaville and south at Pouto (largest, Lake Mokeno), and have been augmented in recent decades by farm ponds. The larger Kai Iwi lakes, Taharoa and Waikere, are the deepest (37 m, 30 m respectively) dune lakes in New Zealand (Tanner et al. 1986).

With a shoreline of 3500 km, the Kaipara Harbour is the largest in New Zealand. The north and south Kaipara barriers forming the seaward boundary to the harbour comprise Quaternary dune sand. Consolidated and leached early Pleistocene sands outcropping along the western sides of both barriers are dissected by steep-sided eastwards-draining valleys floored by Holocene alluvial, swamp and estuarine deposits. Younger Pleistocene consolidated sands with partly eroded dune morphology outcrop west of the older sands at up to 214 m elevation. They extend to the west coast forming an eroding, cliffed coastline along the northern part of the north Kaipara barrier, but further south are mantled to seawards by unconsolidated Holocene dunefields with common interdune wetlands. There are also extensive flats of Holocene alluvial swamp and estuarine deposits in the Dargaville and Ruawai areas.

3.2 CLIMATE OF KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

Like much of Northland, Kaipara ED (Northland) has a mild climate because of its northern latitude, proximity to the sea (no part of the ED is more than 8 km from the coast), and low relief (maximum elevation is less than 300 m asl and most of the ED is much lower). Summers are warm and humid and winters mild (New Zealand Meteorological Service 1985). Although mean annual temperature is mapped as 12.5 to 15°C (Wards 1976), the mean annual temperature at Pouto of 17.2°C between 1993 and 2004 (Pearce et al. 2005) was significantly warmer.

Mean annual rainfall is somewhat variable, averaging 800–1200 mm on the Pouto Peninsula and 1200–1600 mm in the northern third of the ED, spread over 120–150 days per year and with a winter maximum. The ED is moderately windy, with winds of all speeds having a slight sou'westerly predominance (Wards 1976; New Zealand Meteorological Service 1985).

3.3 SOILS OF KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

Soils of the Pouto Peninsula and its northern extension to Maunganui Buff fall into two broad categories: sands on the rolling hills and organic soils in the intervening shallow basins. Sandy soils are recent (Holocene) sands at three stages of development and fertility (Taylor & Pohlen 1954; Burridge 1964; Cox 1977). The youngest and most fertile type is Pinaki Sand, well drained and nearly neutral; the oldest and least fertile is Te Kopuru Sand, a poorly drained, acidic soil with a peaty subsoil. Intermediate between them is Red Hill Sand, well drained and mildly acidic. Organic soils (poorly drained acidic peats) occur locally in low-lying basins. Recent soils from alluvium occupy the floor of the Kaihu River valley, while lower flats of the Pouto Peninsula and the Ruawai Plains are characterised by Kaipara Soils, gley soils with heavy clay textures derived from estuarine alluvium (Taylor & Pohlen 1954).

3.4 HISTORY OF KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

Before human settlement of New Zealand 800 years BP (McGlone & Wilmshurst 1999), most of Kaipara ED (Northland) would have supported dense rain forest. Pollen and charcoal analyses from Northland show that fire and fire-tolerant heathland was abundant during the last Ice Age (14 000–10 000 years BP), decreased during most of the Holocene (began 10 000 years BP), and then increased dramatically after the arrival of humans (Dodson et al. 1988). During the Polynesian period (800–200 years BP), about half of New Zealand was cleared by fire, mostly in the lowlands (McGlone 1983).

There are several recent local histories of the region (e.g., Bradley 1982; Forrest 1984; Ryburn 1999; Byrne 2002) as well as more general texts (e.g., McKinnon 1997). Like most of the coastal north, parts of Kaipara ED such as Pouto (settled by the 15th century but probably earlier, and the centre of the Ngati Whatua subtribe Te Uri o Hau from the late 17th/early 18th century) and the Kaihu valley supported substantial Maori populations in the past. There was extensive gardening on the older, consolidated sands of the ED, and it is likely to have had a long fire history, facilitated by seasonal (summer) droughts and the drought-prone nature of most of the (sandy) soils. Although largely depopulated by internecine warfare in the 1820s, much of the ED remained in Te Uri o Hau ownership until at least the 1860s. As in much of Northland, there

was early missionary activity among Maori, with a Wesleyan church, for example, in existence at least between 1838 and 1854 at now deserted Okaro Creek (Buller 1878).

From the 1870s to the 1920s, the Northern Wairoa was a major centre of the kauri timber industry, and the first substantial European settlements were associated with it. Although some of the largest sawmills ever to operate in New Zealand were located on the river at Aoroa, Aratapu, and Te Kopuru, the timber that fed them mostly came from outside the ED; the adjacent Tutamoe, Tangihua, Tokatoka, and Otamatea EDs to the north and east were major strongholds of kauri, and the Northern Wairoa River was used extensively for transporting logs to the mills. Despite a notorious bar that claimed many ships and lives, the Port of Kaipara (1854-1947) at Pouto was for a time one of the most important in the country; the former custom house (1874) and lighthouse (1884) survive, though the wharf itself was eventually demolished. In common with much of Northland, the district was long dependent on water transport, and rail and road links were slow to develop. The Kaihu Valley railway (1882-1959), built to transport kauri timber from the north to the Port of Dargaville, was only completed in 1923 when the timber boom was ending, Pouto was only connected by road with Dargaville in 1931, and Dargaville by rail with rest of the country in 1940.

In the late nineteenth and early twentieth centuries, Dargaville (founded 1872) was a major centre of the kauri gum industry, with vast quantities extracted from kanuka/manuka shrublands and wetlands throughout the district, but particularly the eastern side of the Pouto Peninsula; colourful locality names like Babylon and Scotty's Camp bear witness to numerous onetime gumdiggers' camps. Dune stabilisation was undertaken in the 1930s on the western coast between Dargaville and Pouto (Cutten 1934; Harrison-Smith 1939), and is likely to be the origin of the scattered marram stands there.

The old-growth kahikatea forests scattered through the wetlands, especially on the Ruawai Plains, were milled for butter boxes early in the twentieth century, replacing to some extent the rapidly dwindling supplies of kauri. As throughout the country, the fertile river flats were subsequently cleared for dairying and the extant kahikatea stands comprise secondary forest that has developed since clearfelling of earlier old-growth stands. Since the Second World War, further extensive land development for agriculture has taken place, much of it on poorer soils and sponsored by the Government (e.g., the large Department of Lands and Survey schemes at Omamari and Pouto). Most remaining shrublands have been cleared and wetlands drained, and the ED is now a centre for dairying. The Ruawai Plains are also an important horticultural area, being the centre of the national kumara industry. Substantial tracts of unconsolidated sands on southern Pouto Peninsula were afforested by the Government (Pouto State Forest) and Maori landowners (Pouto Forest Farms) with radiata pine from the late 1960s onward to control eastward sand drift onto neighbouring farms.

3.6 BOTANICAL EXPLORATION OF KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

With the exception of the two best-known Pouto forest remnants (Tapu Bush and Pretty Bush) and the well-known dune lakes at Kai Iwi and Pouto, Kaipara ED (Northland) seems largely to have escaped the attention of botanists until quite recently (e.g., Andersen 1975). Pioneer missionary-botanist William Colenso visited the ED briefly in the 1880s, and described a new species of sun orchid, *Thelymitra cornuta*, from North Kaipara (Colenso 1888), later reduced to synonymy with *T. pauciflora*. Even the now well-known old-growth forest remnants at Pouto have been described only since the late 1970s. Unlike some other parts of New Zealand, there appear to have been no amateur botanists of note resident in the area. Notable recent professional collectors have been the late Dr R.C. Cooper, L.J. Forester, A.E. Wright, and E.K. Cameron. The dune lakes were first studied by Cunningham et al. (1953) as part of a much wider survey, and later by Tanner et al. (1986) and others, e.g., Wells et al. (2007). Tapu Bush was first described in some detail by Reid (1977). An Auckland Botanical Society field trip visited in 1991, leading to listing of mosses (including Pretty Bush) by Beever (1991), lichens by Hayward and Hayward (1991), and vascular plants by Wright and Young (1991). The most comprehensive survey is that of the second Auckland Botanical Society visit in 2001 (Cameron et al. 2001), whose focus naturally was on individual species rather than plant communities as a whole.

3.6 VEGETATION OF KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

3.6.1 Pre-human vegetation pattern

By the time of European settlement (1850s onward), the ED was essentially deforested, the predominant vegetation being kanuka/manuka shrubland and wetland. The Kaihu valley on the northeastern boundary supported kauri-podocarp-broadleaved forest associations typical of Northland on a variety of sedimentary and volcanic substrates; elsewhere, almost the only old-growth forest surviving was kahikatea forest on valley floors.

Forests

Old-growth forest is now extremely scarce in the ED. Nevertheless, a handful of surviving remnants of old-growth forest (Tapu Bush, Pretty Bush, Upper Okaro Bush, and Lake Humuhumu island) provides a tantalising glimpse of the pre-human forests. Kauri/broadleaved forest similar to that in much of Northland would have been widespread except on the youngest, unconsolidated sands, the oldest, poorest consolidated sands, and the organic soils of the wetlands. Kauri would have been concentrated on upper slopes and ridges. Canopies elsewhere would have been dominated by taraire and kohekohe, with puriri, titoki, and mangeao common. Totara and narrow-leaved maire would also have

been common, as emergent and canopy tree respectively, on drier sites. On sites sheltered from the prevailing drying westerlies, rimu would have been present as an emergent and towai in the canopy. Sheltered coastal valley sides would have supported coastal forest dominated by pohutukawa (absent today from most of the west coast) and karaka, along with a variety of other species now rare (e.g., whau, wharangi) or apparently absent (e.g., tawapou). Subcanopies everywhere would have been dominated by mahoe.

Swamp and semi-swamp forests would have been dominated by kahikatea, with pukatea subdominant. Kanuka forest with divaricating shrub (e.g., *Coprosma crassifolia*, korokio) understories on drier sites and sedge (*Baumea juncea*) ground layers on damper areas would have occupied unconsolidated sands in the west, as they still do at Pouto.

Shrublands

Shrub heaths dominated by scattered shrubs (manuka, *Dracophyllum*), sedges (*Baumea*, *Lepidosperma*, *Schoenus*, *Tetraria*), and ferns (*Gleichenia*) would have occupied the oldest, poorest sandy soils, and other areas laid bare by infrequent natural fires. Some relatively intact examples (albeit with some woody weed invasion) survive in the north of the ED, at Kai Iwi and Maitahi. Shrub-flaxland on the western coastal faces - too exposed to support tall forest - would have been dominated by coastal toetoe, harakeke, knobby clubrush, and mingimingi, as it is today, except that now-widespread adventive megagrass pampas would have been absent.

Wetlands

Saline and semi-saline wetlands dominated variously by mangrove shrublands or reedlands of sea rush, oioi, and *Baumea juncea* are probably the least modified plant community of the ED; they would have been much as they are today. The notable exceptions are the stands of the notorious adventive Manchurian wild rice that fringe the Northern Wairoa River and its major tributaries.

Freshwater swamps and fens would have been common on poorly drained flats, basins, and dune swales throughout the ED. High-fertility surface and groundwater-fed swamps were probably the most common type of wetland, dominated by mosaics of varying scales dominated variously by raupo, *Baumea articulata*, *Eleocharis sphacelata*, *Baumea juncea*, and *Carex secta*. Less common would have been lower fertility fens, with less through-flow of water and characterised by less fertility-demanding species such as *Baumea teretifolia*, *Schoenus brevifolius*, manuka, tangle fern, and wire rush. Adventive species like lotus that are now widespread, even ubiquitous, in intimate mixture with the still predominant native species would have been absent.

Sand dune communities

Mobile sands on frontal dunes would have supported transient plant communities very similar to those dominated by spinifex and to a limited extent, pingao, today. More consolidated rear dunes would also have

supported mixtures of megagrasses (e.g., coastal toetoe), grasses (e.g., sand wind grass), sedges (e.g., knobby clubrush), subshrubs (e.g., sand coprosma), and shrubs (e.g., tauhinu) in communities similar to those of today, with the notable exception of widespread adventive grasses like pampas and haretail and dicotyledonous herbs like iceplant and catsear, which would have been absent.

3.6.2 Current vegetation pattern

PATN cluster analysis allowed the identification of 19 major vegetation types in Kaipara ED (Northland). These comprise 5 forest types, 1 forest shrubland type, 2 shrubland types, 1 flaxland type, 5 freshwater wetland types, 2 estuarine wetland types, 1 grassland type, and 2 sandfield types.

The LENZ environmental classification was used at Level II (Table 2) to provide the underlying framework within which sites were classified. Seven environments occur in Kaipara ED (Northland), with four dominant environments. Environment A ('Northern lowlands', mostly A5) accounts for virtually three-quarters of the ED and Environment G (mostly G1 'Coastal dunes') for the remaining one-quarter. Environments A5, A6, A7, and G1 together account for some 97% of the ED.

LENZ classification at Level IV (Tables 3, 4) revealed that just over one-quarter of the area of Kaipara ED (Northland) is within 'Acutely Threatened' land environments of MfE (2007), but only 7% of the remaining natural areas surveyed are within those environments. Another quarter of the ED is within 'Chronically Threatened' land environments, but only 4% of the remaining natural areas surveyed fall within them. Nearly half the ED is 'At Risk', and most surveyed areas (89%) fall within this category. Protection of natural areas remaining in the two most threatened environments (Acutely and Chronically Threatened) is inadequate, with no more than 2% of the natural area of individual environments protected.

The 19 major vegetation types in Kaipara ED (Northland) are described below, and their respective areas by LENZ classes are included in Table 5. In summary, the key features of the current vegetation pattern of the Kaipara ED (Northland) are

- its overwhelmingly secondary nature;
- its fragmented character;
- the importance of coastal habitats (sandfield on dunes, flaxland on coastal faces, and estuarine habitats in saltmarshes); and
- the minimal amount of old-growth forest.

The large tracts of old-growth forest that are so characteristic of the adjacent Tutamoe ED are completely absent - in fact, old-growth forest scarcely exists in the ED now. Unlike more remote parts of Northland, where secondary succession back to predominantly native plant communities on abandoned marginal land has led to the re-connecting of fragments, land clearance for agriculture and consequently, fragmentation; have continued to the present day in Kaipara ED (Northland).

**TABLE 2: LAND ENVIRONMENTS OF KAIPARA ECOLOGICAL DISTRICT
(NORTHLAND CONSERVANCY)**

LENZ LEVEL II	CLIMATE	LANDFORM	SOILS	PERCENTAGE OF KAIPARA ED (NORTHLAND)
Northern lowlands				
A4	Very warm, very sunny, slightly drought-prone	Gently rolling hills	Poorly drained fertile saline soils	< 1
A5	Very warm, sunny, slightly drought-prone	Gently rolling hills	Poorly drained infertile peat and alluvium	42
A6	Warm, very sunny, slightly drought-prone	Rolling hills	Imperfectly drained infertile sedimentary soils	22
A7	Warm, very sunny, slightly drought-prone	Gently rolling hills	Well drained, fertile volcanic soils	10
Northern hill country				
D1	Warm, very sunny, slightly drought-prone	Strongly rolling hills	Well drained, fertile volcanic soils	<1
Northern recent soils				
G1	Very warm, very sunny, moderately drought-prone	Gently rolling coastal dunes	Well drained infertile sils from dune sands.	23
G3	Very warm, sunny, moderately drought-prone	Flood plains	Imperfectly drained infertile alluvial soils	2

TABLE 3: THREAT CATEGORIES AND PROTECTION STATUS OF LAND ENVIRONMENTS IN KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

Categories from MFE (2007). Acutely Threatened: < 10% of indigenous vegetation left. Chronically Threatened: 10-20% of indigenous vegetation left. At Risk: 20-30% of indigenous vegetation left.

THREAT CLASSIFICATION	LENZ LEVEL IV	TOTAL AREA IN KAIPARA ED (NORTHLAND) (HA)	TOTAL NATURAL AREA SURVEYED IN KAIPARA ED (NORTHLAND) (HA)	TOTAL PROTECTED AREA IN KAIPARA ED (NORTHLAND) (HA)	PERCENTAGE OF THE SURVEYED NATURAL AREA ALREADY PROTECTED IN KAIPARA ED (NORTHLAND)
Acutely Threatened	A5.1b	23 460	731	226	1
	A5.1c	654	3	0	0
	G3.1a	271	0	0	0
Chronically Threatened	A5.2a	12 621	306	100	< 1
	A6.1d	348	7	7	2
	A7.1a	49	3	0	0
	A7.3a	8755	98	31	< 1
At Risk	A4.1a	368	117	65	18
	A6.1b	17 017	1145	442	3
	A6.1c	2257	110	17	<1
	G1.1c	20 311	7692	5098	25
	G3.1b	1346	111	0	0
Less reduced and better protected	D1.1a	94	13	0	0

TABLE 4: AREA OF THREATENED LAND ENVIRONMENTS (LENZ LEVEL IV) AT PNAP SITES IN KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

Acutely Threatened: < 10% of indigenous vegetation left; Chronically Threatened: 10-20% of indigenous vegetation left; At Risk: 20-30% of indigenous vegetation left.

SITE	THREATENED ENVIRONMENT	LENZ Level IV	AREA (HA)
O07/011	Chronically Threatened	A7.3a	0.2
	At Risk	G1.1c	4.6
O07/011	Acutely Threatened	A5.1b	46.4
	Chronically Threatened	A7.1a	3.6
		A7.3a	3.4
	At Risk	A6.1b	7.0
		A6.1c	18.2
O07/012	Chronically Threatened	A5.1b	30.5
		A7.3a	3
	At Risk	A6.1b	0.6
O07/014	At Risk	A6.1b	3.0
		A6.1c	6.7
O07/015	Acutely Threatened	A5.1b	2.2
	Chronically Threatened	A5.2a	4.3
	At Risk	A6.1b	2.3
		A6.1c	13.2
O07/016	Chronically Threatened	A7.3a	2.4
	At Risk	A6.1b	5.8
		A6.1c	0.2
		G1.1c	60.6
O07/017	At Risk	A6.1b	1.6
		A6.1c	0.7
O07/018	Chronically Threatened	A5.2a	8.5
	At Risk	A6.1c	10.3
O07/022	Chronically Threatened	A5.2a	30.8
	At Risk	A6.1b	0.4
		A6.1c	0.6
O07/024	Chronically Threatened	A5.2a	6.4
	At Risk	A6.1b	0.2
		A6.1c	2.3
O07/025	At Risk	A6.1b	0.1
		G1.1c	2.9
O07/026	Acutely Threatened	A5.1b	2.4
	At Risk	A6.1b	0.9
		A6.1c	1.1
		G1.1c	3.8
O07/027	Chronically Threatened	A5.2a	36
	At Risk	A6.1b	0.9
		A6.1c	14.6

SITE	THREATENED ENVIRONMENT	LENZ Level IV	AREA (HA)
P07/025	At Risk	A6.1b	6.9
		A6.1c	0.8
P07/061	Acutely Threatened	A5.1b	3.1
	Chronically Threatened	A5.2a	1.8
		A7.3a	3.3
	At Risk	G1.1c	297.7
P07/120a	At Risk	A6.1c	2.1
	Chronically Threatened	A5.2a	1.4
P07/120b	Chronically Threatened	A5.2a	1
P07/121	Chronically Threatened	A5.2a	1.4
P07/121a	Chronically Threatened	A5.2a	0.3
	At Risk	A6.1c	0.3
P07/124a	Chronically Threatened	A7.3a	2
P07/125	Acutely Threatened	A5.1b	0.8
	At Risk	A6.1b	9.9
		A6.1c	10.4
P07/127	Acutely Threatened	A5.1b	59.1
	Chronically Threatened	A5.2a	16.4
		A7.3a	4.7
	At Risk	A6.1b	94.4
		A6.1c	2.3
P07/130	Acutely Threatened	A5.1b	2.4
	Chronically Threatened	A7.3a	2.1
	At Risk	G1.1c	111.3
P07/131	Chronically Threatened	A5.2a	5.7
	At Risk	A6.1b	0.2
P07/132	Acutely Threatened	A5.1b	5.3
	Chronically Threatened	A5.2a	4.6
	At Risk	A6.1b	5.6
P07/133	Acutely Threatened	A5.1b	130.1
	Chronically Threatened	A5.2a	126.6
	At Risk	A6.1b	92.8
P07/134	Acutely Threatened	A5.1c	0.8
	At Risk	G3.1b	10.8
P07/135	Chronically Threatened	A5.2a	
	At Risk	G3.1b	39.9
P07/136a	Chronically Threatened	A5.2a	6.8
P07/138	Chronically Threatened	A7.3a	0.9
	At Risk	G1.1c	0.8
P07/140	Acutely Threatened	A5.1b	5.7
	Chronically Threatened	A5.2a	0.8
P07/141	At Risk	G3.1b	10.3
P07/141a	Acutely Threatened	A5.1b	0.6
P07/142	Acutely Threatened	A5.1b	1.3
	At Risk	G3.1b	7.8

SITE	THREATENED ENVIRONMENT	LENZ Level IV	AREA (HA)
P07/145	Acutely Threatened	A5.1b	3.2
	Chronically Threatened	A7.3a	2.3
P07/148	At Risk	G3.1b	2
P07/149	At Risk	G3.1b	3.8
P07/150	Acutely Threatened	A5.1b	0.9
	Acutely Threatened	A5.1c	2.6
	At Risk	A6.1b	0.1
		G3.1b	2.9
P07/153	Acutely Threatened	A5.1b	14.7
	Chronically Threatened	A5.2a	22.4
P07/154	Chronically Threatened	A5.2a	1.6
	At Risk	A6.1b	0.4
		A6.1c	0.6
P07/157	Chronically Threatened	A5.2a	1.5
P07/157a	Acutely Threatened	A5.1b	4.3
	Chronically Threatened	A5.2a	0.4
P07/158	Acutely Threatened	A5.1b	3.9
	At Risk	A6.1b	5.4
P07/160	Chronically Threatened	A5.2a	7.8
P07/161	Chronically Threatened	A5.2a	10.3
	At Risk	A6.1b	0.1
P07/162	Acutely Threatened	A5.1b	5.3
P07/164	At Risk	A6.1b	0.9
P07/165	Acutely Threatened	A5.1b	2.1
		A5.1c	0.1
	At Risk	A6.1b	4.9
		A6.1c	1
P07/167	Acutely Threatened	A5.1b	21.9
	Chronically Threatened	A5.2a	2.1
	At Risk	A6.1b	1.3
P07/169	Acutely Threatened	A5.1b	5.8
P07/169a	Acutely Threatened	A5.1b	8.5
	At Risk	A6.1b	0.9
P07/171	Chronically Threatened	A7.3a	4.8
P07/171a	Acutely Threatened	A5.1b	2.1
	Chronically Threatened	A5.2a	6.8
	At Risk	A6.1b	2.6
P07/171b	Acutely Threatened	A5.1b	1.3
	Chronically Threatened	A7.3a	6.7
P07/172	Acutely Threatened	A5.1b	2.1
	Chronically Threatened	A5.2a	0.3
	At Risk	A6.1b	0.8
P07/173	Acutely Threatened	A5.1b	1.8
P07/174a	Acutely Threatened	A5.1b	3.1
	At Risk	G1.1c	1.8
P07/177	Acutely Threatened	A5.1b	2.9

SITE	THREATENED ENVIRONMENT	LENZ Level IV	AREA (HA)
P07/182	Acutely Threatened	A5.1b	2.9
P07/185	Acutely Threatened	A5.1b	2.2
P07/206	Chronically Threatened	A7.3a	0.9
P08/029	At Risk	G1.1c	1.1
P08/056	Acutely Threatened	A5.1b	2.2
P08/060	Acutely Threatened	A5.1b	7.6
P08/061	At Risk	G1.1c	248.3
P08/062	Acutely Threatened	A5.1b	2
	Chronically Threatened	A7.3a	7.5
	At Risk	A6.1b	33.9
P08/063	Acutely Threatened	A5.1b	2
P08/067a	Acutely Threatened	A5.1b	1.4
P08/067b	Acutely Threatened	A5.1b	2.5
P08/068a	Acutely Threatened	A5.1b	2.8
P08/068b	Acutely Threatened	A5.1b	6.1
P08/068c	Acutely Threatened	A5.1b	0.9
P08/072	At Risk	G1.1c	758.4
P08/073	Chronically Threatened	A7.3a	0.1
	At Risk	G1.1c	7.3
P08/080	Chronically Threatened	A7.3a	1
P08/081	Acutely Threatened	A5.1b	9
	At Risk	A6.1b	91.1
P08/087	Acutely Threatened	A5.1b	4.4
	At Risk	A6.1b	8.8
P08/088	Acutely Threatened	A5.1b	0.3
	At Risk	A6.1b	9.3
P08/092	Acutely Threatened	A5.1b	8.4
	Chronically Threatened	A7.3a	0.1
	At Risk	A6.1b	0.8
P08/094a	Acutely Threatened	A5.1b	6.3
P08/095	Acutely Threatened	A5.1b	5.5
	At Risk	A6.1b	7.6
P08/096	Acutely Threatened	A5.1b	7.2
	At Risk	A6.1b	1
P08/096a	Acutely Threatened	A5.1b	11.9
	At Risk	A6.1b	2.2
P08/099	Acutely Threatened	A5.1b	14.7
	At Risk	A6.1b	3
P08/101	Acutely Threatened	A5.1b	25.1
	At Risk	A6.1b	6
P08/200	Acutely Threatened	A5.1b	64.7
	Chronically Threatened	A5.2a	0.9
		A6.1d	2.7
	At Risk	A4.1a	89.3
		A6.1b	3.5
P08/207	At Risk	G1.1c	0.8

SITE	THREATENED ENVIRONMENT	LENZ Level IV	AREA (HA)
P08/208	Chronically Threatened	A7.3a	1.1
P08/210	At Risk	G1.1c	2.4
P08/211	At Risk	G1.1c	1.6
P08/212	At Risk	G1.1c	3.7
P08/213	Acutely Threatened	A5.1b	24.7
	At Risk	A6.1b	7.5
P09/001	At Risk	G1.1c	5265.1
P09/002	At Risk	A6.1b	1.3
	At Risk	G1.1c	3
P09/003	Acutely Threatened	A5.1b	64.2
	Chronically Threatened	A7.3a	1.9
	At Risk	A6.1b	334.7
P09/008	Acutely Threatened	A5.1b	2.9
	Chronically Threatened	A7.3a	1.6
	At Risk	A6.1b	29.4
P09/011	Chronically Threatened	A7.3a	1.1
	At Risk	G1.1c	208.1
P09/011a	At Risk	G1.1c	1
P09/014	Chronically Threatened	A7.3a	4.5
	At Risk	G1.1c	40.1
P09/020	Acutely Threatened	A5.1b	25.4
	Chronically Threatened	A7.3a	13.4
	At Risk	G1.1c	0.8
P09/025	Chronically Threatened	A7.3a	1.3
Q09/051	Acutely Threatened	A5.1b	47.6
	Chronically Threatened	A7.3a	8.2
	At Risk	A4.1a	35.8
	At Risk	A6.1b	250.9
Q09/051	Chronically Threatened	A7.3a	0.2
	At Risk	G1.1c	19.3
Q09/054	Chronically Threatened	A7.3a	6.8
	At Risk	G1.1c	125
Q09/055	Chronically Threatened	A7.3a	7.2
	Chronically Threatened	A7.3a	0.7
Q09/056	At Risk	A4.1a	7.4
		A6.1b	25.7
Q09/057	Chronically Threatened	A7.3a	9.1
Q09/058	Chronically Threatened	A7.3a	5.9
	At Risk	G1.1c	117.4
Q09/060	Chronically Threatened	A7.3a	2
	At Risk	G1.1c	43.2
Q09/061	At Risk	G1.1c	62
Q09/063	Chronically Threatened	A7.3a	3.3
	At Risk	G1.1c	88.2
Q09/150	Acutely Threatened	A5.1b	39.3
	At Risk	A6.1b	64.5

SITE	THREATENED ENVIRONMENT	LENZ Level IV	AREA (HA)
Q09/201	Chronically Threatened	A7.3a	1.8
	At Risk	G1.1c	0.1
Q09/202	Chronically Threatened	A7.3a	4.3
Q09/203	Chronically Threatened	A7.3a	1.9
Q09/204	Chronically Threatened	A7.3a	4.1

TABLE 5: CLASSIFICATION OF VEGETATION AND RELATED LAND ENVIRONMENTS IN KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

VEGETATION CLASS	LENZ LEVEL II ENVIRONMENTS (PREDOMINANT IN BOLD)	VEGETATION TYPE (N=19)	AREA, % OF TOTAL ¹
Forest (324 ha, 2%)	A6, G1	Pohutukawa forest	7 ha, < 0.1%
	A5, A6, A7, D1, G3	Totara forest	78 ha, 0.7%
	A5, G3	Kahikatea forest	76 ha, 0.6%
	A5, A6, G3	Ti kouka-kahikatea forest	25 ha, 0.2%
	A5, A7, G1	Puriri forest	138 ha, 1%
Forest/shrubland (4037 ha, 34%)	A4, A5, A6, A7, G1, G3	Kanuka forest/shrubland	4037 ha 34%
Shrubland (901 ha, 8%)	A4, A5, A6, A7, G1	Kanuka/manuka shrubland	133 ha, 1%
	A4, A5, A6, A7, D1, G1, G3	Manuka shrubland	768 ha, 6%
Flaxland (687 ha, 6%)	A5, A6, A7, D1, G1	Harakeke-knobby clubrush flaxland	687 ha, 6%
	A5, A6, A7, D1, G1	Raupo reedland	312 ha, 3%
Freshwater wetland (857 ha, 7%)	A5, A6, A7, G1	Raupo- <i>Baumea articulata</i> reedland	323 ha, 3%
	A5, A6, A7, D1, G1	<i>Baumea arthrophylla</i> sedgeland	199 ha, 1.7%
	A5, A6, A7, G1	<i>Eleocharis sphaelata</i> reedland	17 ha, 0.2%
	A5, A6, A7	<i>Baumea articulata</i> reedland	6.3 ha, <0.1%
Estuarine wetland (927 ha, 8%)	A4, A5, A6, A7	Mangrove shrubland	426 ha, 4%
	A4, A5, A6, D1, G3	Oioi rushland	501 ha, 4%
Grassland (197 ha, 2%)	A5, A6, A7, D1, G1	Pampas grassland	197 ha, 2%
Sandfield (3818 ha, 29%)	A4, A5, A6, G1	Spinifex sandfield	625 ha, 5%
	A4, A5, A6, G1	Sandfield	3193 ha, 26%

¹Excluding fresh and estuarine waters.

Forest

1. Pohutukawa forest was recorded from five coastal sites, all small or very small stands, on rolling sedimentary hills (A6) or dunes sands (G1) mostly in the northwest of the ED. Several have been planted (B. Searle, pers. comm.). Karaka and hangehange are present occasionally in the canopy and harakeke and coastal toetoe in canopy gaps. Ground cover consists of New Zealand spinach and introduced grasses.
2. Totara forest occurs mostly on poorly drained peaty or alluvial soils (A5) and imperfectly drained sedimentary soils (A6) in the northeast of the ED. It is entirely secondary forest containing abundant or frequent totara in the canopy and range of other coniferous (kahikatea, kauri, tanekaha, matai) and broadleaved (puriri, taraire, titoki) canopy tree species, as well as some relictual kanuka from the earlier seral stage.
3. Kahikatea-dominant forest occurs mostly on poorly drained peaty and alluvial soils (A5). It is entirely secondary forest on alluvium and colluvial footslopes, mostly in the northeast of the ED, and has developed after previous old-growth kahikatea forest was milled late in the 19th or early 20th centuries. Of a small range of other species rarely present in the canopy, only ti kouka, pukatea, and nikau are consistently present. Where stands have been protected for some time from grazing by domestic stock, dense subcanopy, understorey, and ground layer tiers dominated by characteristic kahikatea associates (e.g., mahoe, small-leaved mahoe, *Coprosma areolata*), have developed.
4. Ti kouka-kahikatea forest, again mostly on poorly or imperfectly drained peat and alluvium (A5), has ti kouka and kahikatea sharing canopy dominance. A range of other tree species is present, but none consistently. This vegetation type occurs solely in the northeast of the ED.
5. Puriri forest is the most common forest type of the ED, occurring on alluvium (A5), volcanic substrates (A7), and old consolidated sands (G1). It covers a diverse assemblage of forest stands dominated by broadleaved tree species, some with conifers (kauri, kahikatea, totara) present in small numbers. Apart from puriri, the only tree species consistently present are karaka, mahoe, and rewarewa. Other quite widespread species are kauri, totara, kohekohe, taraire, pukatea, towai, narrow-leaved maire, and mapau. Puriri forest occurs in diverse locations throughout the ED on sites with diverse lithologies, and includes the three outstanding forest remnants at Pouto (Tapu Bush, Pretty Bush, and Upper Okaro Bush).

Forest/shrubland

6. Kanuka forest/shrubland is the most common vegetation type in the ED, occurring across a wide range of environments, and comprises extensive shrublands, much smaller areas of forest, and many seamless intermediate stages between them. It is secondary

vegetation almost exclusively dominated by kanuka; a large suite of other canopy tree species is present but only six (radiata pine, pampas, ti kouka, rewarewa, mapau, hangehange) with any frequency. It includes some quite extensive tracts and occurs mostly on older consolidated sands in the south of the Pouto Peninsula, where a long fire history has greatly reduced or eliminated altogether seed sources of other secondary and later successional tree species. Where protected from domestic stock grazing, understories dominated by small-leaved *Coprosma* species have developed. The total area is somewhat smaller than the figure given, because small unmappable areas of manuka shrubland on the Pouto dune system are included within it.

Shrubland

7. Kanuka/manuka shrubland occurs widely in the ED in a range of environments. Kanuka is dominant and manuka subdominant. Of the wide range of associated species, only two, radiata pine and mamaku, are present with any frequency. Kanuka/manuka shrubland has the widest range of adventive species in the canopy of any vegetation type in the ED, but at very low frequencies. The total area is somewhat larger than the figure given, because small unmappable areas of kanuka/manuka shrubland are included within other vegetation types.
8. Manuka shrubland occurs throughout the ED in a range of environments. Manuka is overwhelmingly dominant; a wide range of mostly shrubby native and adventive species (e.g., pampas, ti kouka, mamaku, harakeke, bracken, raupo) can also be present but none of them consistently. The total area is somewhat larger than the figure given, because small unmappable areas of manuka shrubland on the Pouto dune system are excluded.

Flaxland

9. Coastal flaxland is widespread along the coastal faces between Aranga Beach in the north and Glinks Gully south of Dargaville, and also extends a short distance inland along the sides of some larger gully systems. It occurs in a wide variety of environments. Harakeke, knobby clubrush, pohuehue, and coastal toetoe form the bulk of the vegetative cover, with a range of other shrubs (mingimingi, tauhinu, and hangehange), dicotyledonous herbs (adventive iceplant), and grasses (pampas and marram) present. A high proportion of the flora is adventive. Degraded variants occur south of Glinks Gully towards Pouto, where domestic stock has access to long stretches of the coastline. *Schoenus* sedgeland, a gumland vegetation type dominated by *Schoenus brevifolius* and with frequent harakeke, occurs at Maitahi Wetland SR.

Freshwater wetland

10. Raupo reedland is widespread in Kaipara, occurring throughout the ED as lacustrine fringes of natural lakes and man-made farm

ponds and in the wetter parts of freshwater wetlands, including the upper reaches of Omamari GPWMR and the Kaipara Harbour estuaries at Pouto. It is overwhelmingly dominated by raupo, but the other reedland species widespread in the ED, *Eleocharis sphacelata*, *Baumea articulata*, and kuta are locally present, as well as harakeke and pampas. A wide range of other native and adventive wetland species is rarely present. The abundance of this eutrophic wetland community in a landscape dominated by relatively infertile soils on old consolidated sands may in part reflect the widespread use of fertilisers for agriculture in the ED.

11. Raupo-*Baumea articulata* reedland is also widespread and occurs across a similar range of environments as raupo reedland. Other species consistently present are ti kouka, kuta, manuka, harakeke, pampas, native willow weed, and *Eleocharis sphacelata*.
12. *Baumea arthropophylla* sedgeland is the third major wetland type in the ED, occurring in a wide range of environments. As well as *B. arthropophylla*, substantial components are *B. juncea*, raupo, lotus, oioi, and swamp millet.
13. *Eleocharis sphacelata* reedland occurs throughout the ED, as lacustrine fringes around dune lakes and farm ponds in wide range of environments. It is overwhelmingly dominated by *E. sphacelata*, but a small range of other wetland species is occasionally present.
14. *Baumea articulata* reedland occurs throughout the ED, as lacustrine fringes around dune lakes and farm ponds in a wide range of environments.

Estuarine wetland

15. Mangrove communities are dispersed over long stretches of the Kaipara Harbour coastline, including the lower and middle reaches of the larger Pouto estuaries, mostly in environments A5 and A6. They are totally dominated by mangrove but include frequent enclaves of salt meadow characterised by herbaceous species such as sea primrose and the adventive saltwater paspalum. Mangroves are taller on the edges of channels, where water movement controls salinity and provides fresh nutrient inputs, and shorter in upper tidal areas, bordering saltmarsh habitats.
16. Oioi rushland occurs mostly in environments A5 and A6 in several distinct locations: as freshwater wetlands around the Kai Iwi dune lakes (especially Taharoa) in the north, and as semi-saline and saline wetlands of the larger gully systems on the central west coast, in the Kaipara Harbour estuaries at Pouto, and in dune slacks of the Pouto dune system. Oioi is the overwhelming canopy dominant; the very wide range of occasional associated woody and herbaceous species reflects the diversity of the habitats occupied by the dominant species. The total area is somewhat larger than the figure given, because numerous small dune slacks dominated by oioi on the Pouto dune system could not be mapped separately.

Grassland

17. Pampas grassland, mostly in environments A5 and A6, comprises a diverse range of modified communities dominated by pampas. They are mostly partially drained shrubby wetlands, with a wide range of other wetland and mesophytic species present but only four of them (manuka, harakeke, mamaku, raupo) consistently. Because pampas grassland is dominated by adventives and scarcely meets PNAP criteria, it is not considered further in this study.

Sandfield

18. Spinifex sandfield occurs in one long, virtually continuous belt on the inland side of unconsolidated frontal dunes on the coastline between Aranga Beach and Pouto Point, mostly in environment G1. Apart from spinifex, a wide range of other native and adventive species is present, but only six of them (knobby clubrush, tauhinu, tree lupin, sand coprosma, adventive iceplant, coastal toetoe) occur consistently. About half the flora is adventive.
19. Sandfield occurs in one long, virtually continuous belt on the seaward side of unconsolidated frontal dunes on the coastline between Aranga Beach and Pouto Point, again mostly in G1. Much smaller dispersed areas occur in the littoral zone around some of the Kai Iwi dune lakes, and at the mouths of some of the Kaipara Harbour estuaries at Pouto. Vegetative cover is minimal, consisting of a similar range of species as spinifex sandfield. Only spinifex is consistently present.

3.6.3 Species of botanical interest

Observations made during the survey suggest that some plant species that are relatively common in other parts of Northland are uncommon (e.g. taraire, tawa, towai, mangeao, northern rata, miro, swamp maire, and *Alseuosmia* spp.) or apparently absent (e.g., manatu/lowland ribbonwood) from Kaipara ED (Northland). Their rarity may be either natural or caused by human intervention. Some have been recognised as 'Regionally Significant' by Northland Conservancy (W.R. Holland, DOC, pers. comm.), and are discussed below (3.5.5).

3.6.4 Threatened plant species in Kaipara Ecological District (Northland Conservancy)

The current threat status of species listed below follows Hitchmough et al. (2007). Appendix 3 gives the definitions of threat categories as set out in Molloy et al. (2002). Records have been compiled from herbaria, DOC Bioweb, SSBI, unpublished reports, and field observations made during this survey.

A checklist of flora in Kaipara ED (Northland) is listed in Appendix 5. Qualifiers: CD—Conservation Dependent; DP—Data Poor; EF—Extreme Fluctuations; HI—Human Induced; RF—Recruitment Failure; SO—Secure Overseas.

ACUTELY THREATENED

***Calochilus* aff. *herbaceus* Copper bearded orchid**

(Nationally Critical, EF, SO) Endemic

One of the attractive tall bearded orchids that grow in open places with very depauperate soils. Recorded from Maitahi Wetland SR (P07/133) in 1999 (AK 241957).

***Centipeda minima* ssp. *minima* Sneezeweed**

(Nationally Critical, EF, SO) Indigenous

A small, prostrate, annual herb; typically grows in ephemeral wetlands. Recorded from the Kai Iwi lakes (Forester & Townsend 2004). There is also a 1981 record from Lake Taharoa (O07/022) (DOC Bioweb).

***Juncus boloschoenus* var. *boloschoenus* Angled rush**

(Nationally Endangered) Endemic

A small rush. Collected from Dargaville by D. Petrie in 1896 (DOC Bioweb).

***Kunzea ericoides* var. *linearis* Sand kanuka**

(Serious Decline, HI) Endemic

A small tree with silky hairy branchlets and leaves that grows on coastal sands and podzols in northern New Zealand. Recorded from Sail Pt near Clark's Bay in 1995 (AK 288776).

Phylloglossum drummondii

(Nationally Endangered, HI, SO) Indigenous

A small wintergreen lycopod that typically colonises burnt areas on very infertile soils. Recorded from Maitahi Wetland SR (P07/133) (AK 286617).

***Pomaderris phyllicifolia* Tauhinu**

(Nationally Endangered, HI, SO) Indigenous

A small shrub of poor soils in coastal places in northern New Zealand. Recorded from Maitahi Wetland SR (P07/133) in 1999 (AK 286611).

Sebaea ovata

(Nationally Critical, CD, SO, HI, EF) Indigenous

An erect yellow-flowered herb in the gentian family that grows on seasonally damp sand flats. Translocations to the Pouto dunes (P09/001), where it had previously been recorded (Forester & Townsend 2004), have been attempted recently but proved unsuccessful. The sites chosen for planting appear to be too dynamic for the species to establish successfully (A. Townsend, pers. comm.).

***Utricularia australis* Yellow bladderwort**

(Nationally Endangered, HI) Indigenous

A submerged, carnivorous aquatic herb with deep yellow flowers that grows in peaty wetlands. Recorded from Omamari GPWMR (P07/127) in 2000 (AK 248055) and Maitahi Wetland SR (P07/133) in 1999 (AK

292387). One shoot was found at Freidrich's Lake (P07/171) in 2005 (Wells et al. 2007).

CHRONICALLY THREATENED

Cyclosorus interruptus

(Gradual Decline, SO) Indigenous

A large creeping fern that occurs in New Zealand in geothermal areas as well as northern wetlands. Recorded from Omamari GPWMR (P07/127) in 2000 (AK 248058).

***Desmoschoenus spiralis* Pingao/Golden sand sedge**

(Gradual Decline, CD, EF) Endemic

A large, strikingly handsome sedge that grows only on mobile foredunes. Occurs in scattered populations on frontal sand dunes between Aranga Beach and Pouto Point (recorded during this survey at O07/011, O07/026, P08/061, P09/001, and Q09/063), and also on small dune systems at some of the Kaipara Harbour estuaries, e.g., Okaro Creek (part Q09/051) (SSBI Q08/H047*1).

Dianella baemata

(Serious Decline, DP) Endemic

Recently segregated from *Dianella nigra*. It is larger, with reddish leaf sheaths, and grows in peaty soils such as those of gumlands. Recorded as *Dianella* aff. *nigra* (b) and Taxonomically Indeterminate in Hitchmough et al. (2007). Recorded during the present survey from Maitahi Wetland SR (P07/133).

Drosera pygmaea

(Gradual Decline, SO) Indigenous

A diminutive sundew of open places on very infertile, peaty soils. Recorded from Lake Kai Iwi in 2003 (AK 288711).

***Eleocharis neozelandica* Sand spike-sedge**

(Gradual Decline, EF) Endemic

A small rhizomatous sedge that grows on damp sand flats.

The Pouto dune system (P09/001) is its national stronghold (Forester & Townsend 2004). Records include AK 284635 (2003).

Fimbristylis velata

(Sparse, SO) Indigenous

A small, spreading sedge that grows in ephemerally wet places. Recorded from Lake Parawanui (P08/212) in 2005 (AK 254137), and Lakes Wainui (P08/211) in 2007 and Kapoai (P08/210) in 2001 (Wells et al. 2007).

Hydatella inconspicua

(Serious Decline, EF) Endemic

An aquatic, rush-like monocot that grows in water of shallow to medium depth. Recorded from Kai Iwi lakes: Kai Iwi (O07/024) in 2001 (AK 256186), and Waikere (O07/018) and Taharoa (O07/022) by Wells et

al. (2007). Also recorded from the Pouto lakes: Humuhumu (Q09/054), Rotootuauru (Q09/055), Rotokawau (Q09/057), which apparently has the largest population in Northland, and formerly Waingata (Q09/204) by Wells et al. (2007).

***Mida salicifolia* Willow-leaved maire**

(Gradual Decline, RF) Endemic

A small, hemiparasitic subcanopy tree that is a favoured food of the introduced possum. Recorded during this survey from Opanake Road Reserve (P07/148), and from Lake Humuhumu Wetland and Forest (Q09/054) (SSBI Q09/H004).

Pimelea tomentosa

(Serious Decline, EF) Endemic

A white-flowered shrub that characteristically occurs in short secondary vegetation. Recorded on this survey in shrubland beside Okaro Creek (part Q09/051) and also at Lake Kahuparere (Q09/060) in 1999 (SSBI Q09/H015); possibly more widespread. Also recorded from Pouto Point (part Q09/063) in 1999 (DOC Bioweb) and Lake Humuhumu Wetland and Forest (Q09/054) in 1999 (DOC Bioweb).

Schoenus carsei

(Gradual Decline, SO, HI) Indigenous

A tall sedge that grows in moderately acidic to highly acidic peat bogs and mires. Previously thought extinct in Northland (P.J. de Lange, DOC, pers. comm.), it was recorded from Maitahi Wetland SR (P07/133) in 1999 (AK 246919).

***Stuckenia pectinata* Fennel-leaved pondweed**

(Gradual Decline) Indigenous

A cosmopolitan rhizomatous aquatic herb of slow-moving waters, usually coastal. Recorded from Lake Rototuna (P09/205) by NIWA in 2005 but not in a later survey in 2007 (Wells et al. 2007).

***Thelypteris confluens* Marsh fern**

(Gradual Decline, CD, SO) Indigenous

A large tufted fern that typically grows on 'floating suds' in northern wetlands and geothermal areas. Locally common in wetlands around the Pouto dune lakes (part P09/001) (including AK 252344, AK 220594, AK 202660), the major population in New Zealand (Forester & Townsend 2004). Also recorded from Omamari GPWMR (P07/127) in 2000 (AK 248057), Maitahi Wetland SR (P07/133) in 2000 (AK 287536), Punahaere Creek (Q08/H047*4) in 1985, and Mosquito Gully (P08/099) in 1996 (SSBI P08/H021). Recorded during this survey at Lake Rotopouua (P09/014) and Lake Humuhumu (Q09/054).

Utricularia delicatula

(Gradual Decline, HI) Endemic

A tiny bladderwort of damp, poor soils such as peats and restiad bogs throughout New Zealand. Recorded from Maitahi Wetland SR (P07/133) in 1999 (AK 292388).

AT RISK

Doodia mollis

(Sparse) Endemic

A small tufted fern of fertile soils, usually under alluvial forest. Recorded on this survey at one site, Rotu Stream (P07/141), in the Kaihu valley, and also at Tatariki in NRC Creamery Road Reserve (P07/068b) in 1998 (AK 235015).

***Pseudopanax ferox* Fierce lancewood**

(Sparse, CD, RF) Endemic

An uncommon small tree with a striking juvenile form with deeply lobed leaves. Recorded at Pretty Bush (Q09/061) in 1990 (AK 203129), Pouto Point WR (Q09/063) in 2001 (AK 252746), and Lake Kahuparere (Q09/060) in 1999 (AK 300268). Previously recorded from Tapu Bush (P09/001) in 1977, but not in subsequent surveys (Cameron et al. 2001).

Sticherus flabellatus

(Sparse, SO) Indigenous

A large, handsome fern with creeping rhizomes and pale-green forked fronds that grows in well-lit places in scrub and forest in the north of both main islands. Recorded during this survey from a roadside batter on Maitahi Road beside Maitahi Wetland SR (P07/133).

***Tbelymitra tholiformis* Domed sun orchid**

(Sparse, EF) Endemic

A stout mauve-flowered orchid that grows on infertile soils that have formerly supported kauri forest. Recorded from Maitahi Wetland SR (P07/133) in 1999 (SSBI P07/H056).

DATA DEFICIENT

Centipeda aotearoana

Endemic

A small creeping herb that forms circular patches on damp ground. Recorded from Q09/201 in 2007 (AK 299835) and Lake Kapoai (P08/201) by Wells et al. (2007).

***Spiranthes aff. novae-zelandiae* Ladies tresses**

Endemic

A wetland orchid notable for its pink spiralled inflorescences, usually found on acidic peats. Recorded from the Kai Iwi lakes in 1992 (DOC Bioweb), Maitahi Wetland SR (P07/133) in 1999 (SSBI P07/H056), and the Pouto dune system (P09/001) in 2001 (AK 252671).

3.6.5 Regionally Significant plant species in Kaipara Ecological District (Northland Conservancy)

The following species are provisionally listed as 'Regionally Significant' by DOC Northland Conservancy (W.R. Holland, DOC, pers. comm.). Unless otherwise specified, records are from this survey.

***Adiantum aethiopicum* True maidenhair**

Indigenous

A small, delicate fern that occurs locally under scrub or light forest in northern New Zealand. Recorded at Pouto Point WR (Q09/063) in 2000 (AK 252590) and P09/001 (Reid 1977).

Alternanthera aff. sessilis

Possibly endemic

A semi-aquatic herb of uncertain taxonomic status. Recorded near Lake Kanono (Q09/058) in 2003 (AK 299836) and Lake Kapoai (P08/201) (Wells et al. 2001).

Asplenium bookerianum

Indigenous

A small spleenwort of semi-shaded places in drier forests. Recorded in Tapu Bush (P09/011) in 1991 (AK 205258).

***Astelia grandis* Swamp lily**

Endemic

A tufted megaherb of semi-shaded damp places. Recorded at Maitahi Wetland SR (P07/133) in 2006 (AK 297736).

***Blechnum fluviatile* Kiwakiwa**

Indigenous

A tufted fern of shady places on damp, fertile soils. Recorded from the Lake Humuhumu island (Q09/054) in 2001 (AK 252702).

Callitriche petriei* ssp. *petriei

Endemic

A tiny, creeping herb of damp, peaty places. Recorded from Lake Kapoai (P08/210) by Wells et al. (2007).

Centrolepis strigosa

Endemic

A delicate, tufted, rush-like annual that grows in damp, open places. Recorded from Lake Kai Iwi (O07/024) in 1980 (CHR 319045) and on the west coast near Dargaville (CHR 214231).

***Coprosma acerosa* Sand coprosma**

Endemic

A sprawling subshrub with yellow stems that is characteristic of semi-consolidated sand dunes. Widespread on the extensive western dune system and some distance inland on consolidated sands between Aranga Beach and Pouto Point. Recorded during this survey from O07/011, O07/014, O07/025, O07/026, P07/130, P08/061, and P09/001.

***Coprosma crassifolia* Thick-leaved coprosma**

Endemic

A divaricating shrub typical of dry shrubland habitats distinguished by its thick leaves with whitish undersides. Locally common in the understorey of hillslope kanuka forest at Pouto (P09/001, Q09/063).

Coprosma parviflora

Endemic

A large understorey shrub characterised by its flattened branching habit and grey-green leaves that is endemic to Northland.

Recorded in forest, shrubland, and wetland from Dargaville north (P07/135, P07/141, P07/150, P07/157a, P07/169a), and at Pouto (P09/001, P09/008).

Coprosma rigida

Endemic

A large understorey shrub of fertile soils characterised by orange bark and twinned drupes.

Occurs locally in secondary kahikatea forest on alluvium in the north. Recorded during this survey from P07/135, P07/141, P07/157, P07/169, and P08/068b.

***Coprosma rotundifolia* Round-leaved coprosma**

Endemic

A tall understorey shrub of damp, fertile soils with distinctive soft, red-blotched leaves. Recorded during this survey at two sites (P07/135 and P07/142) in secondary kahikatea forest on alluvium in the north.

***Coprosma tenuicaulis* Swamp coprosma**

Endemic

A large erect shrub with distinctly veined leaves that grows mostly in open fertile wetlands but also in the understorey of open-canopied alluvial forest. Occurs locally in the understorey of secondary kahikatea forest on alluvium in the north. Recorded during this survey from P07/135, P07/140, P07/142, and P07/157.

***Corokia cotoneaster* Korokio**

Endemic

An attractive yellow-flowered divaricating shrub with tomentose on the undersides of the leaves. Locally common in the understorey of secondary forest at Pouto. Recorded from Lake Kahuparere (Q09/060) in 1991 (AK 205024), Tapu Bush (P09/011) in 1991 (AK 205262), Pretty Bush (Q09/061) in 1987 (AK 180236), and on this survey at Lake Rotopouua (P09/014).

Dracophyllum sinclairii

Endemic

A large heathland shrub of northern New Zealand. Recorded from the edge of Lake Taharoa (O07/022) in 1999 (SSBI O07/H007).

***Drosera binata* Forked sundew**

Indigenous

A small carnivorous herb of peaty wetlands distinguished by its characteristically forked leaves. Recorded during this survey from wetlands at Omamari GPWMR (P07/133), Lake Taharoa (O07/022), Russell Wetland (P08/096), and Lake Humuhumu (Q09/054).

***Empodisma minus* Wire rush**

Indigenous

A rush-like plant that forms extensive patches, this is one of the most important peat-forming plants in New Zealand bogs. Recorded during this survey at Omamari GPWMR (P07/133), Maitahi Wetland SR (P07/133) and a wetland east of Lake Rotopouua (Q09/053), the latter the only record from the Pouto Peninsula. Recorded earlier from Maitahi Wetland SR (P07/133) in 2000 (AK 248062).

***Epacris pauciflora* var. *pauciflora* Tamingi**

Endemic

A slender, fine-leaved shrub with conspicuous white flowers that grows on infertile, often peaty soils.

Recorded in manuka heath in Maitahi Wetland SR (P07/133) (SSBI P07/H056).

Glossostigma elatinoides

Indigenous

A small mat-forming herb that grows in ephemerally wet places or shallow permanent water. Occurs on the shores of several lakes in the ED: Shag Lake (O07/014) (SSBI O07/H005), Lake Rototuna (P09/205), Lake Waingata (Q09/204), Lake Humuhumu (Q09/054), Lake Kanono (Q09/058) and Lake Mokeno (part P09/001) by Wells et al. (2007), and Lake Kahuparere (Q09/060) by Champion et al. (2002).

Gratiola sexdentata

Endemic

Erect, patch-forming herb of ephemerally wet places or shallow water with conspicuous white flowers. Recorded from Lake Rotootuauru (Q09/055) by Wells et al. (2007).

Gunnera dentata

Endemic

A patch-forming herb of ephemerally wet places. Recorded from wetlands on the Pouto dune system (P09/001) by Cameron et al. (2001).

Gunnera prorepens

Endemic

A patch-forming herb with bronze leaves and conspicuous clusters of red berries that grows in ephemerally wet places. Recorded from wetlands south of Lake Matthews (Stick Lake) on the Pouto dune system (P09/001) in 2000 (AK 248035).

Hebe diosmifolia

Endemic

A widely-grown ornamental shrub with conspicuous white to purple inflorescences in either spring or autumn. Recorded from the understorey of Tapu Bush (P09/011) in 1991 (AK 205265) and Pretty Bush (Q09/061) in 1991 (AK 205275), and at North Kaipara Head (part P09/001) in 1987 (AK 180253).

Lagenifera stipitata

Indigenous

A small, tufted, composite herb occurring in scattered locations in northern New Zealand. Recorded from Pouto Point (Q09/063) in 2001 (AK 252734).

***Lophomyrtus obcordata* Rohutu**

Endemic

An attractive myrtle that grows in well-lit places on fertile sites.

Recorded from P09/001 in 1987 (AK 180267) and Pretty Bush (Q09/061) in 1990 (AK 203113).

***Metrosideros robusta* Northern rata**

Endemic

A massive emergent forest tree that often begins life as an epiphyte, eventually forming a trunk coalescing around that of the host tree. Now much reduced in many localities by possum browsing. Recorded during this survey in one forest remnant, Te Kawa Stream forest (P07/121a), in the north. There is also an earlier record from Tapu Bush (P09/011) by Reid (1977).

Myriophyllum votschii

Endemic

A sprawling or erect emergent aquatic herb of shallow waters. Recorded from the Pouto dune system (P09/001) (including AK 252641), and from Lake Humuhumu (Q09/054), Lake Rotootuauro (Q09/055), and Lake Rotokawau (Q09/057) by Wells et al. (2007). Also recorded from Lake Kai Iwi (O07/024) in 2001, where it occurs in association with *Hydatella inconspicua*.

Olearia albida

Endemic

A tall shrub of forest margins that has distinctive yellow-green leaves with wavy margins. Occurs in the understorey of Tapu Bush (P09/011) (Wright & Young 1991) and Pretty Bush (Q09/061) (SSBI Q09/H016) at Pouto (Cameron et al. 2001).

Olearia solandri

Endemic

A tall shrub with sticky yellow branches and fine rolled leaves that typically grows at the edges of saltmarshes, in Northland found only in the Hokianga and Kaipara Harbours. Recorded at Tauhara Creek (part Q09/056) in 2001 (AK 252693).

***Pennantia corymbosa* Kaikomako**

Endemic

A small subcanopy or forest margin tree of fertile soils with a very distinctive juvenile habit. Recorded during this survey in the subcanopy of secondary kahikatea forest on alluvium at several sites in the northeast, including P07/135, P07/141, and P07/142.

Psilotum nudum

Indigenous

A fern-ally that lacks true leaves and roots, and has distinctive forked stems and yellow sporangia. Recorded near Lake Mokeno (P09/001) in 1996 (AK 228957).

Ranunculus urvilleanus

Indigenous

A tall buttercup of swamps and wet places. Recorded from Maitahi Wetland SR (P07/133) in 2000 (SSBI P07/H056).

***Sparganium subglobosum* Burr-reed/maru**

Indigenous

A tall, rhizomatous herb with tufts of grassy leaves that usually grows in shallow water. Recorded during this survey from in freshwater wetlands at P07/131, P07/145, and Q09/054. Also recorded from P07/133 (SSBI P07/H056) and P09/001 (2001, AK 252720).

***Triglochin striata* Arrow grass**

Endemic

A tufted grass-like monocot herb; occurs in a wide variety of damp places. Recorded during this survey from a number of freshwater-Kernot Farm Wetland (P08/081), Lake Rotopouua (P09/014), Lake Humuhumu (Q09/054)-and semi-saline-Punahaere Creek (part P09/003), Kaipara Harbour (P09/200), Tauhara Creek (Q09/056), Ongange Creek (Q09/150)-wetlands. Also recorded from Lake Taharoa (O07/022) by Wells et al. (2007).

Utricularia dichotoma

Indigenous

A small bladderwort of damp places. Recorded by DOC from Maitahi Wetland SR (P07/133) (SSBI P07/H056).

Viola lyallii

Endemic

A small forest herb of damp and shady places with conspicuous white flowers. Recorded during this survey from two sites (P07/135 and P07/141) in the Kaihu valley.

3.6.6 Threatened and Regionally Significant plant species not recorded recently in Kaipara Ecological District (Northland Conservancy)

CHRONICALLY THREATENED

***Myriophyllum robustum* Stout water milfoil**

(Gradual Decline, CD) Endemic

A sprawling or erect emergent aquatic herb of shallow waters. Historic records only from Lake Kahuparere (Q09/060) in 1928 (WELT SP44985) and Lake Rotootuaauaru in 1950 (DOC Bioweb).

***Pimelea arenaria* Sand pimelea**

(Serious Decline, HI, RF) Endemic

A sprawling, low-growing shrub with small, fragrant white flowers that grows on sand dunes. There are old records of this species from Lake Humuhumu (Q09/054) by Matthews in 1920 (AK 101198 and 101199).

REGIONALLY SIGNIFICANT

***Dicksonia fibrosa* Wheki-ponga**

Endemic

A very distinctive tree fern with a massive fibrous caudex that typically grows in cool, moist sites. There is an unvouchered record of a single specimen from Lake Rototuna (P09/205) in the 1990s that had disappeared by the time of a subsequent visit (P. Anderson, pers. comm.).

***Myrsine divaricata* Weeping mapou**

Endemic

A large understorey shrub with very distinctive weeping branches and small heart-shaped leaves. Recorded in the past from the understorey of Tapu Bush (P09/011) (Reid 1977).

3.7 FAUNAOF KAIPARA ECOLOGICAL DISTRICT (NORTHLAND CONSERVANCY)

3.7.1 Overview of indigenous fauna

Information on indigenous fauna in this report has been compiled from the following sources:

- Unpublished OSNZ survey records 1972-1995 held at Northland Conservancy, Department of Conservation in the SSBI system.
- Unpublished SSBI survey records (NZWS 1977-1987, DOC 1987-2005) held at Northland Conservancy, Department of Conservation.
- The Bioweb Herpetofauna database (DOC Bioweb).
- The NZ Freshwater Fish Database (NIWA 2007).
- Incidental field observations during November/December 2006 and January 2007 during the current study.

The freshwater and estuarine wetlands, shrublands, and dunelands of Kaipara ED (Northland) and adjacent Kaipara Harbour with its 3500 km shoreline provide significant habitat for birds (McKenzie 1972). The dune lakes of the ED, especially those of the Pouto Peninsula, are well known for grebes and waterfowl. They are a national stronghold of New Zealand dabchick and Australasian little grebe, and are also noted for New Zealand scaup and Australasian shoveler. Wetlands throughout the ED support populations of Australasian bittern and banded rail, the latter especially in estuarine mangrove shrublands. North Island fernbird are widespread in shrublands and wetlands. The Pouto dunes support northern New Zealand dotterel, banded dotterel, and New Zealand pipit. Some of the larger harbour estuaries, e.g., Okaro and Tauhara Creeks, provide limited roosts

for waders such as variable oystercatcher and migratory species such as bar-tailed godwit, while the rocky coastline at the southern end of Pouto Peninsula affords refuge for reef heron. Four species of shag/cormorant, black, pied, little, and little black, are widespread.

The Kaipara Harbour is the largest enclosed harbour and estuarine system in New Zealand, with a total surface area of 947 km² (Cromarty & Scott 1996). It is predominantly shallow, with 409 km² of the total surface area exposed as mudflats at low tide (Heath 1975). The shallow intertidal areas of the harbour are vital non-breeding sites for New Zealand-breeding waders such as South Island pied oystercatcher, variable oystercatcher, Australasian pied stilt, black stilt, banded dotterel, northern New Zealand dotterel, and wrybill (Dowding & Moore 2006), some of which are threatened (see below). Even greater numbers of waders and other waterbirds are present in the Kaipara Harbour in summer when transequatorial migrants, such as bar-tailed godwit, lesser knot and turnstone, flock to the harbour to feed. Year-round seabirds or waterbirds that are common or regularly encountered in the ED include white-faced heron, royal spoonbill, black-backed gull, red-billed gull, pied shag, and Australasian gannet. Arctic skua are seasonal visitors, while white heron and little egret are irregular visitors. The harbour waters are also feeding grounds for four threatened tern species, at least three of which, Caspian tern, white-fronted tern and New Zealand fairy tern, occur in Kaipara ED (Northland).

Widespread indigenous birds of forests and shrublands are grey warbler, North Island fantail, silvereye, tui, New Zealand kingfisher, morepork, and shining cuckoo. Common birds of open country are Australasian harrier, Pacific swallow, New Zealand pipit, paradise shelduck, pukeko, spur-winged plover, and black-backed gull.

Three endemic species of lizard have been recorded from the ED, the threatened Auckland green gecko, and the copper and shore skink. Four species of turtle, green turtle, hawksbill sea turtle, leatherback turtle, and loggerhead sea turtle, and two species of sea snake, banded sea snake and yellow-bellied sea snake, have been recorded from Kaipara ED (Northland).

At least two threatened insects occur in the ED. Black katipo and an unnamed moth, *Notoreas* sp. 'northern', occur locally on the west coast of the ED.

Threatened endemic landsnails may occur in Kaipara ED (Northland). A snail survey was conducted by DOC in Pretty Bush in 1987 and Tapu Bush in 1988, but no threatened species were recorded. Further investigation is needed.

The New Zealand conservation status of species is derived from Hitchmough et al. (2007) which uses the threat classification system of Molloy et al. (2002) (see Appendix 3). Species classed determined as 'Regionally Significant' by DOC Northland Conservancy were provided by W.R.Holland (DOC). Nomenclature follows Heather and Robertson (2005) for birds, Gill and Whitaker (1996) for reptiles, McDowall (1990) for fishes, and King (ed.) (2005) for mammals.

A checklist of fauna recorded in Kaipara ED (Northland) is presented in Appendix 7.

3.7.2 Threatened bird species in Kaipara Ecological District (Northland Conservancy)

Kaipara ED (Northland) has high numbers of threatened bird species: nine species are currently Acutely Threatened, six species are Chronically Threatened, and a further eight species are At Risk. Unless otherwise specified, records are from this survey.

ACUTELY THREATENED

***Egretta alba modesta* White heron/kotuku**

(Nationally Critical, ST, SO, OL) Indigenous

Recorded from Tikinui (part P08/200) on the Northern Wairoa River in 1973 (OSNZ CSN 1973), and likely to be a regular Kaipara Harbour visitor (P08/200). Also recorded from Pouto Point (Q09/063) (OSNZ CSN 2002).

***Anarhynchus frontalis* Wrybill/ngutuparore**

(Nationally Vulnerable) Endemic

The Kaipara Harbour (P08/200) is the fourth most important non-breeding site in the country for wrybill (Dowding & Moore 2006), with peak numbers between midsummer and midwinter. Also recorded on the west coast north of Glinks Gully (P08/061) (OSNZ CSN 1978), south of Glinks Gully (P08/072), and at Roundhill (P09/001) (OSNZ CSN 1978).

***Anas superciliosa superciliosa* Grey duck/parera**

(Nationally Endangered, SO) Indigenous

Birds which appeared to be predominantly of this species, but in fact some of which are likely to have been hybrids with introduced mallards, have been recorded widely from lakes and wetlands in the district: O07/012 (SSBI O07/H004), O07/014 (OSNZ survey 1986), O07/018 (SSBI O07/H007), O07/022 (SSBI O07/H007), O07/024 (SSBI O07/H007), P07/174a (OSNZ surveys 1977-1994), P07/206 (OSNZ surveys 1979-1982), P08/073 (OSNZ surveys 1977-1992), P08/208 (SSBI P08/H016), P08/209 (SSBI P08/H006), P08/210 (OSNZ surveys 1977-1994), P08/211 (SSBI P08/H015), P08/212 (SSBI P08/H008), P09/001 (SSBI P08/H015), P09/011a (OSNZ surveys 1973-1995), P09/014 (OSNZ surveys 1977-1994), P09/205 (OSNZ surveys 1972-1994), Q09/060 (SSBI Q09/H015), Q09/051 (SSBI Q08/H047*1), Q09/054 (SSBI Q09/H004), Q09/204 (SSBI Q09/H010), Q09/203 (OSNZ surveys 1977-1994), Q09/202 (SSBI Q09/H013),

***Botaurus poiciloptilus* Australasian bittern/matuku**

(Nationally Endangered, TO, HI) Indigenous

Recorded widely in a variety of wetland habitats throughout the ED, which is a stronghold for the species: O07/014 (OSNZ surveys 1977-1991), O07/022 (O07/H007), O07/024 (SSBI O07/H007), P07/127 (SSBI P07/H026), P07/169a (this survey), P07/141 (SSBI P07/H034), P07/145 (SSBI P07/H029), P08/072 (SSBI P08/H029), P08/073 (SSBI P08/H014), P08/081 (SSBI P08/H049), P08/101 (SSBI P08/H020), P08/208 (SSBI P08/016), P09/209 (SSBI P08/H006), P08/211 (SSBI P08/H015), P08/212 (OSNZ surveys 1977-1994), P09/001 (various, including SSBI P09/H003), P09/003 (SSBI Q08/H047), P09/205 (OSNZ surveys 1972-1994), Q09/054 (SSBI Q09/H004), Q09/057 (SSBI Q09/H009), Q09/058 (SSBI Q09/H011), and

Q09/060 (SSBI/H015). Recorded from Okaro Creek (Q09/051) in 2007 (R.J. Pierce, EcoOceania Ltd, pers. comm.) and from Omamari Road Grassland and Wetland (P07/130) in 2008 (A. Booth, DOC, pers. comm.).

***Charadrius obscurus aquilonius* Northern New Zealand dotterel/
tuturiwhatu pukunui**

(Nationally Vulnerable, CD, ST) Endemic

The western coast of the Kaipara ED (Northland) is a stronghold for this race. Encountered at a number of locations in the north (O07/011, O07/016) and on the Pouto dune system (P09/001) and beyond (QQ09/063), and recorded from Okaro Creek (part Q09/051) (SSBI Q08/H047*1) where they breed (R. Parrish, pers. comm.).

***Egretta sacra sacra* Reef heron/matuku-moana**

(Nationally Vulnerable, DP, SO) Indigenous

Reef herons have been recorded from Lake Rototuna (P09/205) (SSBI P09/H002), and were noted during the present survey on the Kaipara Harbour south of Tauhara Creek (Q09/056).

***Himantopus novaeseelandiae* Black stilt/kaki**

(Nationally Critical, CD, ST, HI, OL) Endemic

The Kaipara Harbour (P08/200) is the fifth most important wintering site in the country for this species (Dowding & Moore 2006), and they mostly visit the southern part of the ED (R. Parrish, pers. comm.).

***Sterna nereis davisae* New Zealand fairy tern**

(Nationally Critical, OL, CD, HI) Endemic

Virtually the entire population once overwintered on the Kaipara Harbour (P08/200), but it is uncertain whether they still do (R. Parrish, pers. comm.). They breed at South Kaipara Head and it is likely that some birds feed over the harbour waters of the ED and roost at shellbanks (R.J. Pierce, EcoOceania Ltd, pers. comm.).

***Nestor meridionalis septentrionalis* North Island kaka**

(Nationally Endangered, HI) Endemic

An occasional visitor, e.g., to secondary kahikatea fragments at Turiwiri (P07/182) in 2003 (SSBI P07/H067).

***Sterna caspia* Caspian tern/taranui**

(Nationally Vulnerable, SO) Indigenous

The Kaipara Harbour (P08/200) supports one of the largest breeding colonies of Caspian tern in New Zealand (McKenzie 1972). They were encountered regularly on the present survey on the western coast (O07/011, O07/016, P08/061, P09/001, Q09/063), and on the Kaipara Harbour (P08/200) and two of its estuaries (P09/003, Q09/051). They have also been recorded from other Kaipara estuaries: P08/213 (SSBI Q08/H047*9), Q09/051 (SSBI Q09/H015), and some eastern Pouto lakes: P09/205 (OSNZ surveys 1972-1994), Q09/054 (SSBI Q09/H054), Q09/058 (SSBI Q09/H011), and Q09/060 (SSBI Q09/H015).

CHRONICALLY THREATENED

***Apteryx mantelli* North Island brown kiwi**

(Serious Decline, HI, RF, CD) Endemic

North Island brown kiwi were recorded in Tapu Bush (P09/011) in 1989 (SSBI P09/H007), and at Kai Iwi between Lakes Taharoa (O07/022) and Kai Iwi (O07/024) in 2002 (SSBI O07/H007).

***Larus bulleri* Black-billed gull**

(Serious Decline) Endemic

Recorded recently from the Pouto dune system (P09/001) (Robertson et al. 2007).

***Charadrius bicinctus bicinctus* Banded dotterel/tuturiwhatu**

(Gradual Decline) Endemic

The Kaipara Harbour (P08/200) is the fourth most important wintering site in the country for banded dotterel (Pierce 1999). They were recorded on the present survey on the Pouto dune system (P09/001), and have also been recorded at Kelly's Bay (part P09/003) (SSBI P08/H047*5).

***Eudyptula minor iredalei* Northern little blue penguin/korora**

(Gradual Decline, HI, EF) Endemic

Present in the waters of the Kaipara Harbour (P08/200), and reputed to breed on the shore south of Waikere Creek (part Q09/051) estuary (L. Forrest, pers. comm.).

***Hemiphaga novaeseelandiae novaeseelandiae* New Zealand pigeon/kukupa**

(Gradual Decline, RF) Endemic

Encountered during this survey at one site (P07/141) in the Kaihu valley. Also recorded recently from two sites at Tatariki, P08/068a and P08/068c (SSBI P08/H028), and two at Pouto: the Pouto dune system (P09/001) (Robertson et al. 2007) and upper Okaro Bush (P09/008) (R.J. Pierce, EcoOceania Ltd, pers. comm.), but appear to be very rare on the Pouto Peninsula.

***Larus novaehollandiae scopulinus* Red-billed gull/tarapunga**

(Gradual Decline) Indigenous

Recorded widely from the Kai Iwi lakes, the western coastline, the Kaipara estuaries, and the Pouto lakes: O07/018 (SSBI O07/H007), O07/022 (SSBI O07/H007), O07/024 (SSBI O07/H007), P08/072 (SSBI O07/H029), P08/101 (SSBI O07/H020), P08/200 (SSBI O07/H047*2), P08/213 (SSBI O07/H047*9), P09/003 (SSBI O07/H047*5), 09/054 (SSBI Q09/H004), Q056/056 (SSBI Q08/H047*2), Q09/057 (SSBI Q09/H011), Q09/201 (OSNZ surveys 1978-1994), and Q09/202 (OSNZ surveys 1973-1995).

***Sterna striata striata* White-fronted tern/tara**

(Gradual Decline) Endemic

Encountered regularly on the western coast between Aranga Beach (O07/011) and Pouto Point (Q09/063), and also at some of the eastern Pouto dune lakes. Records include P08/072 (SSBI P08/H029), P08/200 (this

survey), P09/001 (this survey), P09/003 (SSBI Q08/H047), Q09/057 (OSNZ surveys 1972-1995), Q09/058 (OSNZ surveys 1972-1995), and Q09/063 (this survey). Breeds irregularly at South Kaipara Head and on shellbanks elsewhere in the Kaipara Harbour (P08/200) (R. Parrish, pers. comm.).

AT RISK

Bowdleria punctata vealeae North Island fernbird/matata (Sparse) Endemic

Recorded (mostly heard and only occasionally seen) widely in larger tracts of shrubland and wetland throughout the ED. Records include O07/012 (SSBI O07/H004), P07/127 (SSBI P07/H026), P07/133 (SSBI P07/H056), P07/169a (this survey), P07/171b (SSBI P07/H032), P08/099 (SSBI P08/H021), P08/101 (SSBI P08/H020), P08/200 (this survey), P09/001 (this survey), P09/002 (SSBI P09/H003), P09/003 (SSBI Q08/H047), P09/014 (SSBI Q09/H003), P09/020 (SSBI P09/H009), Q09/053 (this survey), Q09/056 (SSBI Q08/H047*2), Q09/058 (OSNZ surveys 1973-1994), and Q09/150 (this survey). Common in most saltmarshes at eastern Pouto, e.g., Kelly's Bay/Punahaere Creek (P09/003), and Okaro Creek (part Q09/051) (R Parrish, pers. comm.)

Gallirallus philippensis assimilis Banded rail/moho-peruru (Sparse) Indigenous

Northland is a stronghold for banded rail, which have been recorded at several Kaipara Harbour estuaries between Tangitiki Bay (P08/101) (SSBI P08/H020) and Okaro Creek (part Q09/051) (SSBI Q08/H047); common at the latter site in mangroves and adjacent saltmarsh in 2007 (R.J. Pierce, EcoOceania Ltd, pers. comm.). Records include P08/200 (Robertson et al. 2007), P08/213 (SSBI Q08/H047), P09/003 (SSBI P09/H005), and Q09/056 (SSBI Q08/H077). Unrecognised bird calls heard at several wetlands on the Pouto dune system (P09/001) during this survey were subsequently identified as those of banded rail.

Phalacrocorax carbo novaehollandiae Black shag/kawau (Sparse) Indigenous

Encountered regularly at lakes and wetlands throughout the ED: O07/014 (OSNZ surveys 1977-1991), O07/018 (OSNZ surveys 1977-1991), O07/022 (SSBI O07/H007), O07/024 (SSBI O07/H007), P07/169a (this survey), P07/171 (OSNZ surveys 1979-1991), P07/174a (OSNZ surveys 1977-1994), P07/206 (OSNZ surveys 1979-1982), P08/072 (this survey), P08/087 (this survey), P08/209 (OSNZ surveys 1977-1994), P08/210 (OSNZ surveys 1977-1994), P08/212 (SSBI P08/H008), P08/213 (Q08/H047*9), P09/001 (various records), P09/002 (SSBI P09/H003), P09/011a (OSNZ surveys 1973-1995), P09/014 (OSNZ surveys 1977-1994), P09/205 (SSBI P08/H002), Q09/054 (SSBI Q09/H004), Q09/055 (SSBI Q09/H005), Q09/056 (SSBI Q09/H077*2), Q09/057 (SSBI OSNZ surveys 1973-1995), Q09/058 (OSNZ surveys 1972-1995), Q09/201 (OSNZ surveys 1979-1982), Q09/202 (OSNZ surveys 1873-1995), Q09/203 (OSNZ surveys 1977-1994), and Q09/204 (SSBI Q09/H010).

***Phalacrocorax sulcirostris* Little black shag**

(Sparse) Indigenous

Encountered during this survey on the west coast south of Glinks Gully (P08/072) and at lakes on the Pouto dune system (P09/001). Also reported widely from dune lakes throughout the ED: O07/014 (OSNZ surveys 1977-1991), O07/022 (OSNZ surveys 1977-1992), P07/171 (OSNZ surveys 1979-1991), P08/209 (OSNZ surveys 1977-1994), P08/210 (OSNZ surveys 1977-1994), P08/211 (OSNZ surveys 1977-1994), P08/205 (SSBI P09/H002), P08/212 (OSNZ surveys 1977-1994), Q09/054 (SSBI Q09/H004), Q09/055 (OSNZ surveys 1973-1995), Q09/057 (OSNZ surveys 1973-1995), Q09/058 (OSNZ surveys 1972-1995), Q09/201 (SSBI Q09/H014), Q09/202 (SSBI Q09/H013), and Q09/204 (SSBI Q09/H010).

***Phalacrocorax melanoleucos* Little shag/kawaupaka**

(Sparse) Indigenous

Recorded widely from dune lakes in the ED: O07/014 (OSNZ surveys 1977-1991), O07/018 (SSBI O07/H007), O07/022 (SSBI O07/H007), O07/024 (SSBI O07/H007), P07/127 (SSBI P07127/H026), P07/171 (OSNZ surveys 1979-1991), P07/174a (OSNZ surveys 1977-1994), P08/101 (SSBI P08/H020), P08/208 (SSBI P08/H016), P08/209 (OSNZ surveys 1977-1994), P08/211 (SSBI P08/H015), P08/212 (SSBI P08/H008), P08/213 (Q08/H047*2), P09/001 (various records), P09/011a (OSNZ surveys 1973-1995), P09/014 (OSNZ surveys 1977-1994), Q09/051 (SSBI Q08/H047), Q09/054 (SSBI Q09/H004), Q09/055 (OSNZ surveys 1973-1995), Q09/057 (SSBI Q09/H008), Q09/058 (SSBI Q09/H015), Q09/201 (SSBI Q09/H014), Q09/202 (SSBI Q09/H013), Q09/203 (SSBI Q09/H006), and Q09/204 (SSBI Q09/H010).

***Porzana pusilla affinis* Marsh crake/koitareke**

(Sparse) Indigenous

There is one record from the Pouto dune system (P09/001) (Cromarty & Scott 1996).

***Poliiocephalus rufopectus* New Zealand dabchick/weweia**

(Sparse) Endemic

Recorded widely from dune lakes throughout the ED, which is a national stronghold of the species. Recorded from O07/014 (SSBI O07/H005), O07/018 (SSBI O07/H007), O07/022 (SSBI O07/H007), O07/024 (SSBI O07/H007), P07/171 (OSNZ survey 1979-1991), P07/174a (SSBI (07/H034), P08/072 (this survey), P08/208 (SSBI P08/H016), P08/209 (OSNZ survey 1977-1991), P08/210 (SSBI P08/H07), P08/211 (SSBI P08/H015), P09/001 (various records), P09/002 (SSBI P09/H003), P09/011a (SSBI P09/H008), P09/205 (SSBI P09/H002), Q09/054 (SSBI Q09/H004), Q09/055 (SSBI Q09/H009), Q09/057 (SSBI Q09/H009), Q09/H058 (SSBI Q09/H011), Q09/060 (SSBI Q09/H015), Q09/202 (SSBI Q09/H013), Q09/203 (SSBI Q09/H006), Q09/204 (SSBI Q09/H010).

***Porzana tabuensis plumbea* Spotless crake/puweto**

(Sparse) Indigenous

Recorded from wetlands throughout the ED. Records include O07/018 (OSNZ survey 1977-1991), P07/145 (SSBI P07/H029), P07/171b (SSBI P07/H032), P07/174a (OSNZ surveys 1977-1994), P08/099 (SSBI Q08/H047), P09/001 (OSNZ surveys 1979-1994), P09/014 (OSNZ surveys 1977-1984), P09/020 (SSBI P09/H009), Q09/051 (SSBI Q09/H004), Q09/058 (SSBI Q09/H011), and Q09/060 (SSBI Q09/H015).

NON-RESIDENT NATIVE

***Sterna hirundo* Common tern**

(Migrant) Indigenous

Recorded at Lake Rotokawau (Q09/057) (SSBI Q09/H009, OSNZ survey 1990).

***Limosa lapponica* Bar-tailed godwit/kuaka**

(Migrant) Indigenous

The most common transequatorial migrants arriving at Kaipara ED (Northland) each summer. Recorded from the larger Kaipara estuaries, including P08/101 (SSBI P08/H020), P08/213 (SSBI P08/H047), P09/003 (SSBI Q08/H047), and Q09/051 (this survey), and mouth: Q09/063 (SSBI Q09/H047).

***Calidris canutus* Lesser knot/huahou**

(Migrant) Indigenous

Recorded in 1989 from Kelly's Bay (part P09/003) (SSBI Q08/H047*5). The southern Kaipara Harbour supports major concentrations (R. Parrish, pers. comm.).

***Chlidonias leucopterus* White-winged black tern**

(Migrant) Indigenous

Recorded at Lake Rotokawau (Q09/057) (SSBI Q09/H009) (OSNZ survey 1990).

COLONISER

***Tachybaptus novaehollandiae* Australasian little grebe**

Indigenous

Recorded from Shag Lake (O07/014) (SSBI O07/H005, OSNZ surveys 1977-1991), Lake Rehutai (P07/174a) (SSBI P07/H034, OSNZ surveys 1977-1994), and Lake Kanono (Q09/058) (SSBI Q09/H011, OSNZ surveys 1972-1995).

***Charadrius melanops* Black-fronted dotterel**

Indigenous

Recorded at Lake Taharoa (O07/022) (SSBI O07/H007) (OSNZ survey 1984).

3.7.3 Regionally Significant bird species in Kaipara Ecological District (Northland Conservancy)

The following species are provisionally listed as 'Regionally Significant' by DOC Northland Conservancy. Unless otherwise specified, records are from this survey.

Anas gracilis Grey teal/tete

Indigenous

Widely recorded from the Kai Iwi lakes, the west Dargaville lakes, and the larger Pouto dune lakes. Records include O07/018 (SSBI O07/H007), O07/022 (SSBI O07/H007), O07/024 (SSBI O07/H007), P07/171 (OSNZ surveys 1979-1991), P07/174a (SSBI P07/H034), P09/001 (various records), P09/205 (OSNZ surveys 1973-1995), Q09/055 (SSBI Q09//H005), Q09/057 (OSNZ surveys 1973-1995), Q09/060 (SSBI Q09/H015), Q09/201 (OSNZ surveys 1978-1994), Q09/202 (OSNZ surveys 1973-1995), Q09/203 (SSBI Q09/H006), and Q09/204 (OSNZ surveys 1973-1995).

Anas rhynchos Australasian shoveler/kuruwhengi

Indigenous

Recorded widely in the district: O0/017 (OSNZ surveys 1977-1991), O0/018 (SSBI O07/H007), O0/022 (SSBI O07/H007), O0/024 (SSBI O07/H007), P07/171 (OSNZ surveys 1979-1991), P07/174a (OSNZ surveys 1977-1994), P08/208 (SSBI P08/H016), P08/209 (SSBI P08/H006), P08/212 (SSBI P08/H008), P09/001 (SSBI P09/H001*4), P09/205 (OSNZ surveys 1972-1994), Q09/054 (SSBI Q09/H004), Q09/055 (OSNZ surveys 1973-1995), Q09/057 (SSBI Q09/H009), Q09/058 (SSBI Q09/H011), Q09/060 (SSBI Q09/H015), Q09/201 (SSBI Q09/H014), Q09/202 (OSNZ surveys 1973-1995), Q09/203 (OSNZ surveys 1977-1994), Q09/204 (SSBI Q09/H010).

Aythya novaeseelandiae New Zealand scaup/papango

Endemic

Widely recorded from some of the west Dargaville lakes and the larger Pouto dune lakes.

Records include P07/138 (OSNZ surveys 1977-1984), P08/211 (SSBI P08/H015), P08/212 (SSBI P08/H008), P09/001 (various records), P09/002 (SSBI P09/H003), P09/205 (Q09/H002), Q09/054 (SSBI Q09/H004), Q09/055 (SSBI Q09/H005), Q09/057 (SSBI Q09/H009), Q09/059 (SSBI Q09/H015), Q09/201 (OSNZ surveys 1978-1994), and Q09/202 (SSBI Q09/H010).

Haematopus unicolor Variable oystercatcher/toreapango

Endemic

Recorded from several locations on the western coast including O07/011 (this survey), O07/016 (this survey), P08/072 (SSBI P08/H029), P09/001 (this survey), and Q09/063 (this survey), and also at Kaipara estuaries such as Kelly's Bay (part P09/003) (SSBI Q08/H047*5) and Okaro Creek (Q09/051) (SSBI Q08/H047).

***Pterodroma macroptera gouldi* Grey-faced petrel/oi**

Endemic

Recorded breeding at Pouto Point (Q09/063) as late as 1980 (P. Anderson, pers. comm.), but it is unknown whether this colony still exists. This was one of the four breeding colonies on the Northland mainland (A. Booth, DOC, pers. comm.).

3.7.4 Threatened and Regionally Significant bird species not recorded recently in Kaipara Ecological District (Northland Conservancy).

ACUTELY THREATENED

***Anas aucklandica chlorotis* 'North Island' brown teal/pateke**

(Nationally Endangered, HI, CD) Endemic

Recorded from the Pouto dune system in 1977/1978 (P09/001) (Cromarty & Scott 1996) and from Lake Rototuna (P09/205) in 1977 (P09/H002).

***Gallirallus australis greyi* North Island weka**

(Nationally Vulnerable, HI, EF) Endemic

Last recorded at Dargaville in 1937 (OSNZ CSN 1940).

3.7.5 Threatened mammal species in Kaipara Ecological District (Northland Conservancy)

Both long-tailed bat and lesser short-tailed bat are likely to have occurred in Kaipara ED (Northland) before major habitat loss was induced by humans and introduced mammalian predators became common (Molloy 1995).

3.7.6 Regionally Significant mammals in Kaipara Ecological District (Northland Conservancy)

***Arctocephalus forsteri* New Zealand fur seal**

Indigenous

Fur seals regularly haul out on the western coastline between Aranga Beach (O07/011) and Pouto (P09/001) (R. Parrish, pers. comm.) and were encountered on the present survey.

3.7.7 Threatened reptiles in Kaipara Ecological District (Northland Conservancy)

CHRONICALLY THREATENED

***Naultinus elegans elegans* Auckland green gecko**

(Gradual Decline, HI) Endemic

There are two records from the ED, a live collection from Punahaere Creek (part P09/003) in 1980 (Q08/H047*4), and a 2004 record (SSBI P07/H056) from Maitahi Wetland SR (P07/133).

3.7.8 Threatened invertebrates in Kaipara Ecological District (Northland Conservancy)

ACUTELY THREATENED

***Notoreas* sp. 'northern'**

(Nationally Endangered, HI) Endemic

A small, brightly coloured diurnal moth that lives on *Pimelea prostrata*, a widespread subshrub of consolidated sands on the west coast. It has recently been recorded from three sites (O07/016, P08/061, P08/072) on the west coast, but its habitat is threatened by invasion of weeds such as pines, Spanish heath, berry heath, and pampas (A. Booth, DOC, pers. comm.).

CHRONICALLY THREATENED

***Latrodectus atritus* Black katipo**

(Serious Decline, HI) Endemic

A species of coastal dunes in the northern half of the North Island, black katipo have declined because of habitat loss and modification. Recorded from four localities (O07/016, P08/061, P08/072, and P09/001) on the west coast. A survey in January 2008 showed that densities were higher on the Pouto Peninsula than in most other areas surveyed in Northland, indicating the ED is a stronghold of the species in Northland (A. Booth, DOC, pers. comm.).

3.7.9 Regionally Significant reptiles in Kaipara Ecological District (Northland Conservancy)

***Chelonia mydas* Green turtle**

(Migrant) Indigenous

One was recorded live between Bayly's Beach and Glinks Gully (part P08/061) in 1978 (DOC Bioweb).

***Eretmochelys imbricata* Hawksbill sea turtle**

(Vagrant) Indigenous

There are several recent records from the ED. The species was sighted live in the Northern Wairoa River at Dargaville in 1979 and 1996, and on the west coast at Glinks Gully (SSBI P08/H029) in 1996 (DOC Bioweb). Dead specimens were collected at Roundhill (part P09/001) in 1972 (SSBI P09/H001*4), Glinks Gully (SSBI P08/H029) in 1984, and between Aranga Beach and Omamari (P08/061) in 1984 (DOC Bioweb).

3.7.10 Threatened fish, mollusc, and crustacean species in Kaipara Ecological District (Northland Conservancy)

ACUTELY THREATENED

***Galaxias* sp. Dunelakes galaxias**

(Nationally Vulnerable, CD, HI) Endemic

An 'evolutionary species unit' of dwarf inanga, dunelakes galaxias is

currently regarded by DOC as a separate species and is confined to the Kai Iwi lakes. Formerly present in Lake Kai Iwi (O07/024), it is now apparently confined to Lakes Waikere (O07/018) and Taharoa (O07/022) (Pingram 2005). As with dwarf inanga, introduced fish species such as rainbow trout and gambusia have been implicated in its decline (Rowe & Chisnall 1997).

CHRONICALLY THREATENED

***Anguilla dieffenbachii* Longfin eel**

(Gradual Decline, HI) Indigenous

Longfin eels are found throughout New Zealand, but are threatened by over-harvesting (especially of large females) and habitat modification. Recorded from some Kai Iwi (Shag Lake (O07/016), Waikere (O07/018)) and Pouto (Rotootuauru (Q09/055), Karaka (part P09/001)) lakes. Some lakes have been stocked with longfin eels (A. Macdonald, pers. comm.)

***Galaxias argenteus* Giant kokopu**

(Gradual Decline, DP, HI) Endemic

The range of giant kokopu is predominantly coastal and extends around most of New Zealand. Recorded from Lake Karaka in 1977 (part P09/001) and again in 2006 (SSBI P09/H001*2), currently the only known population in Northland.

***Galaxias gracilis* Dwarf inanga**

(Serious Decline, CD, HI) Endemic

Dwarf inanga is endemic to the Pouto dune lakes (Rowe & Chisnall 1997); the Kai Iwi lakes entity is currently regarded by DOC as a separate species, dunelakes galaxias (Pingram 2005). As well as habitat modification caused by changes in land use of surrounding catchments and subsequent declines in water quality, the decline of dwarf inanga appears to be largely a result of predation by introduced fish species such as rainbow trout and gambusia. Recently recorded from nine of the Pouto lakes: Rotopouua (P09/014), Rototuna (P09/205), Humuhumu (Q09/054), Rotokawau (Q09/057), Kanono (Q09/058), Kahuparere (Q09/060), Swan Egg Pond (Q09/203) (NIWA 2007), Rotootuauru (Q09/055), and Waingata (Q09/204) (Wells et al. 2007).

***Hydriella menziesii* Freshwater mussel**

(Gradual Decline) Endemic

Freshwater mussels have been recorded from lakes throughout the ED (Wells et al. 2007), at Kai Iwi: Lake Kai Iwi (O07/024), west Dargaville: Lake Parawanui (P08/212), and Pouto: Lake Rotokawau (Q09/057), Lake Humuhumu (Q09/054), Lake Kauparere (Q09/060), Lake Rotootuauru (Q09/055), and Lake Mokeno (part P09/001).

***Neobanna diversus* Black mudfish**

(Gradual Decline, HI) Endemic

Distinguished from the Northland mudfish (the other northern species) by the number of caudal fin rays, black mudfish occupies a range from the Mokau River catchment in the south to Kaitaia in the north. The main

threats to the species are as a result of land drainage and development. There is also a potential predation threat from the introduced gambusia on black mudfish fry. However, these may be mitigated by the ability of mudfish to survive for long periods in dry habitats, combined with winter breeding when gambusia numbers are low. Recorded from only two wetlands in Kaipara ED (Northland): Maitahi Wetland SR (P07/133) by DOC in 1999, and Tangitiki Estuary (P08/101) in 2001 (NIWA 2007), the only Pouto Peninsula record.

***Parenephrops planifrons* Koura/Freshwater crayfish**
(Gradual Decline) Endemic

Recorded from some of the Kai Iwi (Waikere: O07/018, Taharoa: O07/022) and Pouto (Humuhumu: Q09/054, Kanono: Q09/058, Kahuparere: Q09/060) lakes by Wells et al. (2007).

AT RISK

***Amarinus lacustris* Freshwater crab**
(Sparse, SO) Endemic

Recorded from Lake Waikere (O07/018) by NIWA (2007) and Lake Taharoa (O07/022) by Wells et al. (2007).

3.7.11 Regionally Significant fish species in Kaipara Ecological District (Northland)

***Galaxias fasciatus* Banded kokopu**
Endemic

Banded kokopu were recorded in Waihaupai Stream wetland (O07/012) by the New Zealand Wildlife Service in 1978 (SSBI O07/H004).

3.7.12 Invertebrates

A comprehensive discussion and checklist of fauna, particularly invertebrates, is beyond the scope of the present study. The descriptions for each site detail known threatened fauna, as well as provide some records of non-threatened species. There are very few records of invertebrates, irrespective of their prevalence, and it is recognised that they are a significant facet of indigenous ecosystems which is often overlooked. Indigenous New Zealand insects are our largest fauna group, and are intimately associated with indigenous habitat, carrying out a wide range of roles in ecosystems. In addition to their consumption of live plant material, they are involved in pollination, breakdown of leaves, litter and logs, soil formation, general scavenging, parasitism and predation, as well as providing the main food for birds, lizards, and most freshwater fish (Watt 1975). It is generally acknowledged that although there are many 'generalist' species of insects, the great majority have particular habitat requirements that restrict their populations in both space and time. With the present state of knowledge of these species, the protection of the maximum range of habitat types is considered the most important strategic approach in order to provide a minimum basis on which populations can be maintained.

3.8 Threats

The integrity of natural areas of Kaipara ED (Northland) is threatened by various ongoing and potential threats, most of which apply widely in lowland New Zealand.

3.8.1 Invasive plants

The ground layers of forest on damp alluvium in the Kaipara ED (Northland) have been locally invaded by tradescantia and alligator weed, and subcanopies only very locally by tree and Chinese privet. Shrublands have been widely invaded by a suite of woody weeds, including three species of *Hakea* (prickly hakea, downy hakea, and willow-leaved hakea), three species of wattle (black, brush, and Sydney golden), two species of pine (radiata and maritime), two species of heath (berry and Spanish), and dally pine, but remain predominantly native. Taller invaders like pines and wattles convert shrublands into treeland and eventually forest.

Freshwater wetlands have been widely invaded by a large suite of herbaceous adventives, including the aggressive alligator weed on the wettest sites and pampas on drier ones. As elsewhere in the country, they now largely comprise intimate mixtures of native and adventive species. Although many freshwater lakes have been locally invaded by aggressive aquatic species such as lakeweed, Canadian pondweed, and oxygen weed, virtually all the Pouto dune lakes remain free of them and every effort should be made to ensure that this state continues. Saltmarshes have been widely invaded by a small suite of herbaceous adventives, especially saltwater paspalum, but remain predominantly native. Sharp rush, an aggressive adventive, appears to be actively spreading in damper places on the Kaipara Harbour estuaries and the Pouto dune system and should be controlled now. Sand dunes have been widely invaded by a suite of herbaceous adventives, most conspicuously pampas, but remain for the most part predominantly native. Sydney golden wattle poses a particularly serious threat to coastal dunes in Northland and every effort should be made to keep it out of the nationally important Pouto dune system.

3.8.2 Pest animals

A small suite of mammalian pests is present in Kaipara ED (Northland). Of the larger introduced mammals of obvious significance to vegetation, brush-tailed possums were introduced into lower Northland in 1870 and have been present in Kaipara ED (Northland) at least since 1963, probably much longer (Cowan 1990). Canopies continue to suffer the effects of largely uncontrolled possum browsing; the crowns of many totara in Tapu Bush appear from a distance to be suffering from the effects of possum browsing. Feral pigs were present at Pouto in 1983 (McIlroy 1990) but have undoubtedly been present for very much longer. Sign of both mammals was noted on the present survey. A range of smaller mammals such as feral cats, house mice, rats, and mustelids such as stoats and ferrets, is present in the ED and likely to be having locally significant effects on flora and fauna. Stoats were observed at a number of locations during the present survey. Argentine ants are now present on the west coast at Aranga Beach and Bayly's Beach (A. Booth, DOC, pers. comm.)

and may pose a problem for nesting birds. Although many freshwater lakes have been invaded by pest fish species like gambusia, many, especially those of the Pouto dune system, are still free of them.

3.8.3 Effects of agriculture on natural areas

Unfenced forest remnants in pastoral settings have been widely degraded by domestic stock grazing, which appears to have facilitated the entry and expansion of some aggressive adventives like alligator weed. Shrublands appear less vulnerable to grazing. Although still frequented by a range of native birds, many dune lakes, particularly in the central part of the ED, are now grazed to the water's edge with no significant wetlands remaining around them. Many freshwater wetlands in pastoral settings are still being grazed by stock and drier parts are being seriously degraded by them. The prevalence in many smaller freshwater wetlands of species such as raupo, which are indicative of high fertility, may reflect the widespread use of fertilisers for agriculture on the generally poor soils of the ED. Freshwater lakes with pastoral catchments, many of which remain without any riparian protection at all, are being enriched by nutrient inflows and sediment from intensive agriculture, aggravated as elsewhere in the country by the continuing expansion of dairying. Saltmarshes have been drained in places in the past and are still grazed in places; naturally high fertility may have helped accelerate the spread of the invasive saltwater paspalum. Sand dunes and coastal faces between Glinks Gully and the northern part of the Pouto dune system are largely open to domestic stock and show widespread weed invasion.

3.8.4 Effects of residential dwelling on natural areas

Kaipara ED (Northland) is relatively sparsely populated, with only three significant population centres (Dargaville, Te Kopuru, and Ruawai), so the threat of weed invasion from residential areas, its chief source (Timmins & Williams 1991), and mammalian pests like domestic dogs to wildlife is likely to be lower than in some other parts of the country. However, the ED has been settled for longer than some other parts of the country, and is unlikely to remain immune indefinitely from the generally increasing pressure for coastal subdivision in New Zealand and its attendant risks to the integrity of natural areas.

3.8.5 Ongoing effects of former land clearance

Land clearance has led to severe habitat fragmentation throughout the Kaipara ED (Northland). The ecological effects of fragmentation have been widely studied and are reasonably well understood, and undoubtedly apply to the fragmented natural areas of the ED. They include microclimatic effects:

- altered microclimate within and around fragments (e.g., more extreme edge temperatures),
- more solar radiation, resulting in changed vegetation composition at the edges and numerous faunal effects,
- increased edge windiness, resulting in increased direct and indirect damage, leading to increased windthrow and gaps and thus altered composition,

- increased seed rain from outside, and
- less buffered hydrology.

They also include isolation effects such as species relaxation and enrichment with invasive and edge species, both of which become apparent over time (Saunders et al. 1991). Wetland drainage is evidently still in progress in the ED; several examples were encountered on the present survey.

3.8.6 Legal protection versus conservation management action

Without active conservation measures, even protected areas may lose biodiversity. The following actions need to be undertaken to protect the immediate and long-term viability of the natural areas:

- Fencing to exclude livestock from wetland, forest and shrubland remnants. This includes fencing along the coast so that livestock do not have access to dunes (for example, the coast south of Glinks Gully, including the northern portion of the outstanding Pouto dune system) and estuarine areas (e.g., the Kaipara Harbour estuaries at Pouto).
- Reducing the impact of invasive plants through targetted control programmes.
- Regular control of mammalian pests.

A lack of conservation management action, in the face of all the other pressures enumerated here, is probably the greatest threat to the future viability of the natural areas of Kaipara ED (Northland).