

Estuarine Vegetation Survey – Tairua Harbour

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1 Introduction

A 1997 pilot study of Whangamata, Wharekawa, and Otahu estuaries determined that it is feasible to map vascular estuarine vegetation from aerial photography together with field surveys. The success of this work encouraged Environment Waikato to continue with this method. The estuarine vegetation of Tairua, Coromandel, Te Kouma, Manaia, Whitianga Port Waikato, Raglan, Aotea, Kawhia harbours and the inner Firth of Thames have since been surveyed and mapped. Of these harbours, Whangamata, Otahu, Wharekawa and Manaia have recently been re-surveyed to determine if there have been any changes in the vegetation communities over time.

The mapped vegetation is in the Coastal Marine Area (CMA) and includes the spatial cover of mangrove, seagrass, sea meadow, and saltmarsh communities. The results of the estuarine surveys are included in Environment Waikato's Global Information System (GIS) database, and are used for State of the Environment investigations and assessing consent applications that may affect estuarine vegetation.

This report details the results from a re-survey of estuarine vegetation in the Tairua Harbour (first surveyed in 1998). Comments are included on the threats to estuarine vegetation, and other field notes of interest. This report is accompanied by digitised aerial maps of the survey site with vegetation community overlays.

2 Methodology

The field survey was undertaken over 4 days between the 17th and 21st April 2008. The survey was undertaken using a combination of boating and walking. The same methodology for mapping saltmarsh, mangrove, seagrass and weed communities was followed as that previously used to map earlier surveyed estuaries (see Graeme, 1997, 1998a, 1998b, 1999) except that a personal digital assistant (PDA) loaded with 2006 aerial maps of the survey site was used as the primary mapping device. The PDA replaced notations on hard copy aerial maps, although hard copy aerials were used as a backup for if the PDA battery ran out or lighting made it too difficult to see the PDA screen clearly in the field. Colour-coded lines were drawn directly onto the PDA aerials to define the spatial extent of wetland vegetation types as they were ground-truthed in the field.

The upper saltwater influence is usually indicated by the upstream limit of oioi. In Tairua Harbour, saltwater paspalum and saltmarsh ribbonwood were also common indicators of the upper saltwater influence.

Areas where there is clear evidence of mangrove clearance were also mapped; However this does not indicate the full extent of mangrove clearance that has occurred over the last 10 years.

Field notes were made of estuarine wetland characteristics and their vulnerability to particular threats.

2.1 Wetland vegetation classification

Estuarine wetland vegetation of the Waikato region is split into four groups: saltmarsh, mangrove, seagrass and weed communities.

1 **Saltmarsh** - a multi-species community in which three sub-communities are distinguishable. They are:

- a) **'Rush/sedge community'** – This is generally sea rush (*Juncus maritimus* var. *australiensis*), oioi (*Apodasmia similis*), and on the West Coast, three-square

sedge (*Schoenoplectus pungens*). Marsh clubrush (*Bolboschoenus fluviatilis*) is commonly found up streams and rivers at the upper estuarine limit in some harbours, although it is not mapped within this survey as it is a species of brackish-freshwater.

- b) **'Saltmarsh ribbonwood community'** - Saltmarsh ribbonwood (*Plagianthus divaricatus*) dominates this zone, although rushes are often common giving a patchy appearance compared with the uniformity of the 'rush/sedge community'. Small areas of sea primrose (*Samolus repens*), remuremu (*Selliera radicans*), the coast spear grass (*Austrostipa stipoides*), and glasswort (*Sarcocornia quinqueflora*) can also be present.
- c) **'Sea meadow community'** - This is devoid of tall plants such as rushes and saltmarsh ribbonwood, with the exception of coast spear grass. The sea meadow community can include sea primrose, remuremu, glasswort, and in more brackish areas bachelor's button (*Cotula coronopifolia*), leptinella (*Leptinella doica*), sharp spike-sedge (*Eleocharis acuta*), slender clubrush (*Isolepis cernua*), and arrow grass (*Triglochin striata*).
- 2 **Mangrove** (*Avicennia marina* subsp. *australasica*) – This is usually a monospecific community although seagrass, spartina, saltwater paspalum and sea meadow beds can sometimes be found below mature mangrove stands.
- 3 **Seagrass** (*Zostera capricorni*) – This is usually a monospecific community.
- 4 **'Weed community'** - In the Waikato region the most significant estuarine weeds are saltwater paspalum (*Paspalum vaginatum*) and cord grass (*Spartina* spp.). Both of these grasses generally grow in the open estuary and trap sediment, greatly increasing the harbour's infilling rate. These weeds also compete with the native wetland communities, particularly saltwater paspalum which vigorously competes with all vegetation types except seagrass.

There are other weed species (such as tall fescue) which can tolerate a degree of salt influence but for clarity of mapping they have not been included in the surveys due to their presence above the spring high tide mark.

3 Field notes

3.1 Summary

The following observations give a general overview of estuarine vegetation in the Tairua Harbour following the recent field visit.

- The geomorphology of Tairua Harbour is defined by the Tairua River channel which forms a single river estuary except for the two small Pepe Stream and Grahams Creek side arms.
- The middle third of the open intertidal flats is densely covered with seagrass.
- Large oioi and sea rush beds are limited to protected embayments usually associated with streams.
- Extensive mangals dominate seaward of the saltmarsh community in the Oxley Gully embayment, cemetery point, Oturu Stream embayment and Duck Creek.
- Sea meadow communities of any significant size are virtually non-existent except for on the outwash plain at Pepe Stream mouth and in the lower Grahams Stream wetland. Sea primrose and glasswort are the common sea meadow species.

- Saltmarsh ribbonwood communities are not extensive in Tairua Harbour. The largest areas of saltmarsh ribbonwood are found at the mouths of the Pepe and Grahams Streams, along the Oturu and Gumdiggers stream banks, and the land edges of the Gumdiggers and Oxley embayments.
- *Spartina* was limited to the Swampy and Oturu Stream embayments and half way between Duck Creek and Gumdiggers Gully. Of the three *Spartina* sites, only the relatively large new site found up the northern mangrove waterway of the Otahu Stream embayment had not been controlled. The other two sites had been sprayed but still had the occasional live plant present.
- Saltwater paspalum is ubiquitous around the harbour. Dense infestations dominate near the Grahams Creek causeway, at the mouth of the Pepe Stream, and upstream of a point from Swampy and Gumdiggers embayments. Elsewhere saltwater paspalum is present as a narrower band lining the landward edge of most of the harbour and often extending along vegetation community boundaries (e.g. between rush and saltmarsh ribbonwood boundaries).
- The sea meadow and rushland vegetation communities are the most threatened by the further expansion of saltwater paspalum.
- The clearance of mangroves has occurred in several places: the frontage of Waterways Parade either side of the main canal; below the school; and in the small embayment opposite Ailsa Place off Pepe Road.
- There is either roading or housing abutting the mid-lower harbour vegetation.
- Grazed farmland abuts the harbour margin upstream of Swampy Stream on the true left bank (TLB) and Duck Creek on the true right bank (TRB). Farming activities have degraded or eliminated harbour edge vegetation.

Table 1 lists common plant species found during the surveys. The 'estuarine vegetation community' category for the estuarine species corresponds to the colour-coded vegetation boundaries of the aerial map.

See Figure 1 for a map showing the site names and figure numbers mentioned below.

Table 1: Check list of common estuarine plant species found in Tairua Harbour.

Common/Maori name	Scientific name	Estuarine Vegetation Community
coastal shrub daisy	<i>Olearia solandri</i>	saltmarsh ribbonwood
glasswort	<i>Sarcocornia quinqueflora</i>	sea meadow
mangrove	<i>Avicennia marina</i> subsp. <i>australasica</i>	mangrove
oioi	<i>Apodasmia similis</i>	rush/sedge
remuremu	<i>Selliera radicans</i>	sea meadow
saltmarsh ribbonwood	<i>Plagianthus divaricatus</i>	saltmarsh ribbonwood
saltwater paspalum *	<i>Paspalum vaginatum</i>	weed
sea primrose	<i>Samolus repens</i>	sea meadow
sea rush	<i>Juncus krausii</i> subsp. <i>australiensis</i>	rush/sedge
seagrass	<i>Zostera capricorni</i>	seagrass
spartina/cord grass *	<i>Spartina</i> spp.	weed

* denotes an exotic species



Figure 1a: Lower Tairua Harbour site localities mentioned in this report. The numbers refer to the location of the following figures.



Figure 1b: Upper Tairua Harbour site localities mentioned in this report. The numbers refer to the location of the following figures.

3.2 Site descriptions

Tairua Harbour is described anticlockwise from the harbour mouth. The **Grahams Stream** bay is enclosed by sand dunes connecting Paku Hill to the mainland, which provides a sheltered environment for estuarine vegetation. This arm of the harbour is affected by a causeway at its mouth and drainage and reclamation along the western and upper edges. However, a significant mosaic of estuarine vegetation communities still flourishes within the arm. A banded rail was seen running amongst mangroves upstream of the causeway. Saltwater paspalum is prevalent. Figure 2 is a repeat of the 1998 photo [37] showing a view over the upper reaches of the Grahams Stream arm. Figure 3 shows spoil pushed into the rushland near the beginning of the footpath. Fernbird are present in the nearby ribbonwood. Acacia is a problem beside the wetland here.

The open sandy edge along the town frontage has a thin band of saltwater paspalum along it. Seagrass beds extend out from the shore and along the sides of the Pepe Stream channel.

The **Pepe Stream** arm has seagrass patches in the mid reaches abutting mangroves and rush beds on the western side and a thin saltwater paspalum-rushland fringe on the eastern side. Further upstream along either side of the stream channel, a mosaic of rushland, saltwater paspalum, sea meadow and saltmarsh ribbonwood covers the outwash plains at the stream mouth. Figure 4 shows saltwater paspalum and sea primrose mats on firm river sediments. On the golf course side of the stream channel there is a large band of mangroves and rushland. The rushland is limited in its landward extent by infilling. Golf course paths intersect rushland and manuka remnants. Figure 5 is a repeat of the 1998 photo [38] from the banks of the old motor camp looking over the Pepe Stream towards the golf course. A large band of saltmarsh ribbonwood dominates the landward edge to the left of Figure 5 but saltwater paspalum tends to dominate the immediate stream banks. Housing and an esplanade reserve has replaced the former Pinelea motor camp (see Figure 6). The main open mud flats are relatively firm in the vicinity of the Pepe Stream channel. Figure 7 shows a view from Pepe Road (between Diamond Drive and Ailsa Place) over seagrass fringing the mangrove band. Mangroves have been removed further up this little side creek. A banded rail was seen running into the mangroves here.

Saltwater paspalum lines the shoreline of the southern part of Tairua town. Mangroves aren't encountered until the small creek below the **Tairua school** grounds (Figure 8). Some mangroves have been chopped down here. The flats out from the school are either dominated by seagrass on soft sediments or *Hormosira* seaweed (Neptunes necklace) on exposed bedrock.

The middle third of Tairua Harbour's open flats are densely covered with seagrass. The upstream limit of seagrass is on the northern side of the Oturu Stream embayment and the southern end of the Tangitarori wetland (Oxley Gully).

Dense mangrove forest (mangal) begins north-east of **cemetery point** and extends up the harbour edge to Green Point. Extensive rush/sedgeland occurs in the embayment south of cemetery point and dominates the Oturu embayment. Saltwater paspalum lines much of the landward edge from cemetery point to the Oturu embayment, and only small scattered areas of saltmarsh ribbonwood are found along this edge.

A more sizable band of saltmarsh ribbonwood lines the banks of the lower **Oturu Stream** channel as it flows out through the rush/sedgeland. Figure 9 shows a view from the re-aligned highway at the northern end of the Oturu embayment. Wattle trees are a problem weed along the road edge here and further north. Figure 10 shows a repeat view of the 1998 photo [41] over the rush/sedgeland from the edge of the re-aligned highway. Note the saltwater paspalum expanding out into the sea rush and

oioi. A patch of healthy spartina was found along the northernmost mangrove-lined channel in the Oturu embayment (Figure 11). Figure 12 shows a band of saltwater paspalum dominating the zone between the mangroves and rush/sedgeland. Figures 13 and 14 show a view of the Oturu Stream from the new road bridge and Figure 15 shows the re-aligned highway around the back of the Oturu embayment. Figure 16 shows a repeat view of the 1998 photo [46] from **Green Point** looking over the southern end of the Oturu embayment wetland. Vehicle tracks were noted coming from State Highway 25 near the TLB of the highway bridge through the sea rush and out to the high land on the TLB of the Oturu Stream mouth.

Figure 17 shows the re-aligned highway extending out into the **Swampy Stream** embayment wetland. Rush/sedgeland generally dominates the vegetated edge of the harbour here except at the southern end where there is a patch of mangroves and saltwater paspalum has invaded. Amongst the saltwater paspalum and rush/sedge patches, are clumps of spartina (Figures 18 and 19). These areas of spartina have been sprayed by DoC with good results. Only one or two more return visits are needed to kill the few scattered live plants remaining (Figure 20). The effects of this spraying show clearly that the herbicide Gallant used to kill the spartina is just as effective on saltwater paspalum (Figure 21). However, to date, saltwater paspalum has been left unsprayed and will most likely expand out to cover the open ground left by the dead spartina, resulting in similar ecological effects.

South of Swampy Stream embayment the Tairua River channel sweeps in close to the TLB and only a thin scattered band of saltwater paspalum and rushes are present. This bank has been re-enforced against erosion using various materials. A large wetland community occurs where the river channel bends upstream towards the TRB. The wetland has formed in the shelter of the river bend and a raised island below the site of the old timber mill (**sawmill point**). A small patch of mangroves at the northern tip of this wetland is the upstream limit of this species. The wetland here is dominated by rush/sedgeland with a thick seaward edge of saltwater paspalum. Fernbird were heard amongst the scattered saltmarsh ribbonwood.

The estuarine wetland vegetation then thins out upstream of the old mill site, with a narrow band of saltwater paspalum and rush/sedgeland fringing the river bank (See Figures 22 and 23). Figure 24 shows a developed floodplain abutting the rivers edge. The upstream representation of estuarine vegetation on the TLB is saltmarsh ribbonwood found around the vicinity of **Woody Stream** (Figures 25 and 26).

A lovely remnant of freshwater cabbage tree swamp is found upstream of the saltwater influence along the TLB of the Tairua River.

Over on the **TRB**, the main vegetation present at the upper limit of saltwater is saltwater paspalum (see Figure 27). The river bank here and further downstream is grazed. Figure 28 shows a grazed paddock with scattered manuka standing amongst saltwater paspalum and sea rush. Bittern and fernbird are present here. Further downstream, riverside floodplain has been developed into 'canal' real estate (Figure 29) with the irreversible loss of wetland habitat.

Figures 30 and 31 show eroding banks and saltwater paspalum at the mouth of **Duck Creek**. A bittern was disturbed at the stream mouth and further investigation found uprooted saltwater paspalum suggesting the bittern could have been feeding in/on this grass (Figure 32). Stock tracks are common in the saltmarsh on the TRB of Duck Creek. There is only a thin band of saltmarsh ribbonwood and oioi scattered amongst freshwater vegetation along the banks above the road bridge. Above the saltwater influence, manuka, freshwater rushes and flax dominate. Duck Creek is recognised as a highly significant freshwater wetland with a large fernbird population and other wetland bird species. Saltwater paspalum, reclamation and stock access are degrading the lower estuarine vegetation of this significant wetland sequence.

Figure 33 shows an un-natural coastal edge north of Duck Creek with *Eleagnus* dominating the landward bank and saltwater *Paspalum* dominating the tidal edge. The only native estuarine plants visible here are saltmarsh ribbonwood. Banded rail footprints were seen further north. Further north again, the saltwater *Paspalum* mats expand out to dominate the tidal flats immediately south of **Gumdigger Gully** stream mouth. A patch of sprayed *Spartina* was found along a *Paspalum*-lined creek (Figure 34). A few individual *Spartina* plants remain green. The saltwater *Paspalum* was generally over knee deep at this site. There were some small areas where sea primrose survives amongst lower-statured saltwater *Paspalum*. Saltwater *Paspalum* dominates at the stream mouth of Gumdigger Gully (Figure 35) while extensive rush/sedgeland is found further upstream. Saltwater *Paspalum* lines the creek edge and is backed by thick saltmarsh ribbonwood (Figure 36). Saltmarsh ribbonwood is also found in thin bands between the rush community and the forestry. Fernbird and banded rail are present in this wetland.

Figure 37 shows a view of the estuarine edge below the horticultural peninsula north of Gumdigger Gully. A dense zone of saltwater *Paspalum* has established behind the mangroves. Sea rush and oioi are limited to a thin band along the land edge. The saltwater *Paspalum* zone stops towards the northern end of the mangal (Figure 38). A banded rail was seen here running into the mangroves.

The upstream limit of the main seagrass beds occurs at the southern end of the **Tangitarori wetland**. *Remuremu* and sea primrose are present amongst saltwater *Paspalum* near the boat ramp at end of Tangitarori Lane. At the south-western end of the wetland boardwalk there is an extensive saltwater *Paspalum* sward, some of which is mown in the recreation reserve. Figures 39 and 40 show the estuarine vegetation immediately upstream and downstream of the north-eastern end of the boardwalk. Tangitarori wetland has fernbirds and banded rail present. The main weeds on higher ground are pampas, wattle and pine. Saltwater *Paspalum* at the back of the wetland is often knee to thigh deep. It is creeping over and through rushland. Saltwater *Paspalum* is generally found along disturbed or open edges such as drains or creeks.

North of the Tangitarori wetland mangroves have been removed (see Figures 41 and 42). Estuarine vegetation along the western **Waterways Parade** is restricted to saltwater *Paspalum* and sea grass. Figures 43 and 44 show saltwater *Paspalum* already well established within the newer Waterways canals. The saltwater *Paspalum* sward visible in Figure 44 could be aged from when the canal earthworks were completed.

North of the Waterways entrance channel there are reserve plantings that incorporate Indian hawthorn (*Rhaphiolepis* sp.). This introduced coastal tree is of concern as it seeds prolifically (see Figures 45 and 49). In front of the northern end of Waterways Parade is a small wetland with mangroves, saltwater *Paspalum* and saltmarsh including sea rush, oioi and saltmarsh ribbonwood (Figure 46). Further north, the landward zone of the wetland has a thin band of saltmarsh ribbonwood intermingled with coastal shrub daisy, manuka and flax which have survived the effects of residential development (Figure 47). Figure 48 shows the northern edge of this wetland, which is the downstream limit of the saltmarsh and mangrove community on the eastern side of the Tairua Harbour. A banded rail was seen amongst the mangroves. Some of the seaward mangroves have been cut down.

Downstream of this last saltmarsh and mangrove community, the estuarine vegetation is limited to a thin band of saltwater *Paspalum* that extends along almost the entire foreshore, past **Pleasant Point** and almost out to **Royal Billy Point** at the harbour mouth (see Figures 48, 49 and 50). This thin band of saltwater *Paspalum* generally grades abruptly inland into kikuyu grass.



Figure 2: Coastal wetland scrub still exists along the sand dune edge of the eastern side of Grahams Stream and along the upper edges of the stream. Sea rush and small patches of oioi dominate the tidal flats with saltwater paspalum present along the stream banks. This is a repeat of the 1998 photo [37].



Figure 3: Infilling for housing has encroached on the Grahams Stream wetland in places. In this photo spoil is being dumped along the north-eastern side of the wetland (next to the beginning of the boardwalk path).



Figure 4: Saltwater paspalum and sea primrose beds (darker green) intermingle along a side creek near the mouth of the Pepe Stream.



Figure 5: This photo is taken from the old motor camp looking over Pepe Stream towards the golf course, in the vicinity of the 1998 photo [38]. Saltwater paspalum dominates the edges of the stream with sea rush beds behind (and saltmarsh ribbonwood out of the picture to the left).



Figure 6: The former Pinelea motor camp has been subdivided for housing. An esplanade reserve now extends in front of the new housing out to the spit with the pines (Pepe Stream behind). A patch of saltwater paspalum edges the saltmarsh and a few scattered small mangroves are present on the mudflats.



Figure 7: A view over the Pepe embayment showing seagrass fringing mangroves. This photo was taken from a Pepe Road park seat.



Figure 8: There is a variety of estuarine vegetation below the Tairua School. Mangroves fringe the stream mouth and foreshore (although some large trees have been cut down). *Hormosira* seaweed grows on exposed bedrock and seagrass dominates the soft mud.



Figure 9: This view over the saltmarsh and outer mangrove band is taken from the newly-aligned edge of SH 25 (a near repeat of 1998 photo [40]).



Figure 10: This photo is a repeat of the 1998 photo [41] showing the alignment of the new road and expanding patch of saltwater paspalum. The undisturbed saltmarsh remains unchanged.



Figure 11: A healthy patch of spartina found growing along a mangrove creek immediately north of Oturu Stream (NZMG 2762419.0, 6459713.4).



Figure 12: Saltwater paspalum forms a band between the landward edge of mangroves and seaward sea rush community in the Oturu Stream embayment. Sparse oioi can be seen scattered amongst the saltwater paspalum.



Figure 13: A view of Oturu stream from the realigned SH25. The old road was further inland and constructed over freshwater manuka/tangle fern wetland at the time of the 1998 photo [42].



Figure 14: Another view looking down Oturu Stream from the realigned SH25 bridge.



Figure 15: A view of the realigned SH25 and neighbouring saltmarsh. The new road line has resulted in the loss of large areas of manuka/tangle fern wetland that formed part of a natural sequence of estuarine to freshwater wetland communities as was pictured in the 1998 photo [44].



Figure 16: This photo is a repeat view of the 1998 photo [46] overlooking the Oturu embayment from Green Point.



Figure 17: A repeat of 1998 photo [47] showing the newly aligned SH25 that has encroached out into the saltmarsh. The roading disturbance has also allowed a band of weeds to establish out from the road earthworks.



Figure 18: Spartina has been sprayed in the Swamy Stream embayment (dead patches in green mat and scattered stalks on open flats) but the saltwater paspalum has been left to continue encroaching over the open mud flats.



Figure 19: Sprayed spartina amongst saltwater paspalum towards the southern end of the Swamy Stream embayment. The piled up logs in the left background have been purposefully placed to provide bank protection.



Figure 20: Occasional fragments of spartina survive and require follow-up spraying. Live sea primrose and a runner of saltwater paspalum can just be seen amongst the dead spartina root mat.



Figure 21: This sprayed patch of spartina shows that the herbicide Gallant is just as effective in controlling saltwater paspalum.



Figure 22: A view looking downstream from a fence line showing the embankment of the river edge. A thin patchy band of rushes exist along the eroding bank edge. A change in the colour and lushness of the grass indicates the inland boundary of saltwater paspalum with kikuyu grass.



Figure 23: A view looking upstream from the photo point of Figure 22 above.



Figure 24: This photo shows a repeat view of the floodplain in the 1998 photo [48]. Note the recent earthworks to presumably form large ‘hollows’ to concentrate and drain the floodwaters that naturally accumulate on this floodplain. Figures 22 and 23 show the harbour margin of this area.



Figure 25: Vegetation along the stream mouth of Woody Stream includes flax, raupo, swamp coprosma, lake clubrush as well as the estuarine species’ saltwater paspalum and saltmarsh ribbonwood.



Figure 26: A view upstream of Woody Stream from the State Highway 25 bridge. This is a repeat of the 1998 photo [50].



Figure 27: A view from the upper harbour looking over to cattle grazing amongst saltwater paspalum and rushes.



Figure 28: Low-lying floodplain beside the river with grazed saltwater paspalum, sea rush and manuka.



Figure 29: A new canal development formed from floodplain similar to that pictured above. Sea rush and saltwater paspalum line the new canal edges. Remuremu was found amongst the saltwater paspalum.



Figure 30: Slumping saltwater paspalum edge upstream of the mouth to Duck Creek



Figure 31: The stream mouth of Duck Creek is dominated by saltwater paspalum, sea rush and oioi. Saltmarsh ribbonwood is also common.



Figure 32: A number of areas of uprooted saltwater paspalum were found at the mouth of Duck Creek. A bittern was disturbed in the same area.



Figure 33: A repeat of the 1998 photo [53] showing saltwater paspalum still dominating the tidal flats with scattered saltmarsh ribbonwood. Note the eleagnus vine dominating the bank.



Figure 34: A sprayed patch of spartina (either side of creek) amongst dense saltwater paspalum. Sea rush can be seen in the left background and oioi along the landward edge on the right-hand side of the photo.



Figure 35: Saltwater paspalum at the mouth of Gumdiggers Gully stream.



Figure 36: A repeat of the 1998 photo [54] showing dense saltmarsh ribbonwood lining Gumdiggers Creek as well as oioi and saltwater paspalum. Fernbird and banded rail are present in this wetland.



Figure 37: View (along a line of power poles) over a thick band of saltwater paspalum that has colonised between the landward rush edge and the mangroves.



Figure 38: The thick saltwater paspalum band shown above ends in line with the Tangitarori Lane straight. A banded rail was seen running into the mangroves.



Figure 39: This view shows the estuarine vegetation immediately upstream of the north-eastern end of the Tangitarori wetland boardwalk. The light yellow-green grass is saltwater paspalum.



Figure 40: This view is of the estuarine vegetation immediately downstream of the north-eastern end of the Tangitarori wetland boardwalk.



Figure 41: A view looking south over mud flats towards the natural mangrove edge. Mangroves have been cleared from the mud flats in the foreground of this photo. The board-walked Tangitarori wetland (Oxley gully) is in the background.



Figure 42: This is a view north from the photo point of Figure 41 above, looking over scattered mangrove stumps (note the oysters are concentrated around old stumps).



Figure 43: Saltwater paspalum dominates the edge of this new 'undeveloped' canal, with sea rush and raupo scattered amongst it.



Figure 44: Saltwater paspalum has established at the head of this dead-end canal.



Figure 45: Indian hawthorn (*Rhaphiolepis* sp.) has been planted in reserve gardens near the Waterways entrance canal (dark green bush in right background). Birds are freely dispersing the seed of this exotic coastal species as indicated by the proliferation of seedlings in the middle foreground of this photo.



Figure 46: This view shows the estuarine vegetation north of the Waterways entrance channel (note the channel navigation marker in the right background). Species visible here are mangroves, sea rush, oioi and saltwater paspalum.



Figure 47: A thin band of saltmarsh ribbonwood intermingled with scattered coastal shrub daisy, manuka and flax grades down into sea rush and then to mangroves. Some of the seaward mangroves have been cut down. Seagrass is visible on the mud flats.



Figure 48: This view shows the saltwater paspalum edge to the lower harbour. In the background is the downstream limit of the saltmarsh and mangrove communities on the eastern side of the Tairua Harbour. A banded rail was seen amongst the mangroves. Some of the seaward mangroves have been cut down.



Figure 49: Indian hawthorn (*Rhaphiolepis* sp.) in amongst saltwater paspalum, flax and *Baumea juncea*.



Figure 50: A view looking north over intertidal (and some subtidal) seagrass towards Pleasant Point. Saltwater paspalum lines the foreshore.

3.3 Birds

Birds seen or heard during the survey include -

New Zealand dotterel, white-faced heron, variable oystercatcher, pied stilt, black-backed gull, red-billed gull, spur-winged plover, paradise duck, mallard duck, Canada geese kingfisher, little pied shag, fernbird, bittern, pukeko and banded rail.

3.4 Threats

There are four significant threats to the native estuarine vegetation communities of Tairua Harbour.

Stock

Where cattle have access to the estuarine vegetation they damage it directly through trampling and pugging. The trampling and pugging of estuarine vegetation also encourages the establishment of weeds such as saltwater paspalum. Weeds can be spread in the hooves of stock or by fragments being dislodged by stock. Pugging also creates habitat suitable for the Southern saltmarsh mosquito, for which there is currently an eradication programme on the Coromandel Peninsula. Stock increase harbour sedimentation via pugging and stream bank erosion, and they pollute water through faecal contamination.

In Tairua Harbour stock have access to the Coastal Marine Area along the upper harbour/river edges only, as housing or roading dominate the lower and middle harbour reaches. Of note is the degraded farmed wetland upstream of Duck Creek that could be easily restored to a healthy estuarine-freshwater wetland. Such significant but degraded habitat (see Figure 28) is further threatened by potential infilling or canal development such as that shown in Figure 29. Stock access is a problem all along the TRB of Duck Creek up to the road bridge. Stock access is also an issue along the upstream extent of estuarine vegetation on the TRB of Gumdiggers Gully stream.

Drainage/stop-banking

Drainage and stop-banking was often undertaken in the past to maximise the amount of farmable land. This resulted in the large scale lost of coastal freshwater wetlands that would have formed a sequence with the estuarine wetland edge of the harbour.

Saltmarsh ribbonwood communities were also impacted by such 'land improvement' but the more seaward vegetation communities were generally too low and salty to produce productive grazing. Examples of low-lying land that has been previously drained or stop-banked includes the golfcourse edge of the Pepe embayment and the mouth of Graham's Stream. The effects of drainage and stop-banking can however be reversed if the land use allows.

Currently the estuarine edges upstream from Duck Creek are under threat from further drainage and stop-banking. Loss of wetland along the TLB of Duck Creek immediately downstream of the road bridge through bunding and drainage has eliminated the saltwater influence. The farmed edge between Woody and Swampy Streams is stop-banked and generally not fenced from stock. There is no natural riparian vegetation of note along this farmed edge.

Infilling/declamation

The edges of the Tairua River upstream from Duck Creek are also threatened by declamation. Some of this floodplain that would have graded from estuarine to freshwater wetland vegetation communities has already been lost to canal development (see Figure 29). Declamation of land is not a land-use that is easy to reverse.

Weeds _____

Estuarine weeds threaten the ecological integrity of the harbour vegetation communities and can lead to a loss of native plant and animal biodiversity if they are allowed to dominate. Particular weed species of concern in Tairua Harbour are:

- **Saltwater paspalum** – This grass colonises vegetated and non-vegetated estuarine flats. It is extremely efficient at stabilising sediments and building up bed levels. Saltwater paspalum competes for space with native estuarine vegetation, often smothering sea meadow, saltmarsh ribbonwood and rush/sedgeland communities to form a dense mono-specific mat. Observations made in other Coromandel Peninsula harbours indicate that saltwater paspalum may also affect the health of landward mature mangroves. Saltwater paspalum mats on open mudflats may also enhance mangrove seedling settlement. Saltwater paspalum was found throughout the harbour with particularly dense swards around Gumdiggers Gully, the mouth of Duck Creek, opposite Duck Creek, Swampy Stream, and the upper estuarine reaches of the TRB of the Tairua River (see Figures 18, 34, 35 and 37 for examples).
- **Spartina** – The Department of Conservation has been controlling spartina with herbicide in the harbour since the early 2000's. During the current survey, a few surviving plants were found at the sprayed sites (see Figures 18 and 34) and a new uncontrolled site was found within the Oturu Stream embayment (see Figure 11).
- **Coastal edge weeds** – Weeds of concern along the coastal edge (i.e. immediately landward of the estuarine vegetation zone) include wattle, wilding pine and pampas. These species can out-compete native coastal forest species and suppress natural regeneration of the native coastal forest along the harbour edge.

It is also recommended that Indian hawthorn (*Rhaphiolepis* sp.) is removed from TCDC reserve plantings (noted near Waterways) as this exotic coastal species shows clear signs of becoming a serious weed (see Figures 45 and 49).

4 Discussion

The results of this survey will be able to be compared with those from the 1998 survey to report on any large scale changes in the spatial extent of estuarine vegetation in the Tairua Harbour. The historical loss of estuarine wetland extent (e.g. with the

Waterways development) can similarly be estimated from comparison with historical photographs.

The spatial extent of estuarine vegetation in Tairua Harbour is strongly influenced by the geomorphology which is dominated by the Tairua River channel. Dense seagrass beds occupy the tidal flats of the middle reaches of the harbour. All other estuarine vegetation is restricted to sheltered embayments where small streams enter the harbour or where there are floodplains either side of the Tairua River channel. Mangroves are associated with stream mouths where suspended sediments settle out. Rushland and sedgeland require shelter either from land features or seaward mangroves. Sea meadow communities seem to be associated with active stream outwash plains. Saltwater paspalum is generally associated with open or disturbed areas. This is often along the landward and seawards edges of rushland and sedgeland, or in areas disturbed by grazing, housing or roading. Saltwater paspalum however can also colonise open flats.

The raised board-walk through the lower reaches of the Tangitarori wetland provides an excellent recreational resource that encourages people out into wetlands. It not only provides access but also helps with public education and appreciation of these valuable areas.

While fernbird were not often encountered (probably due to lack of suitable saltmarsh ribbonwood habitat), it was encouraging to note banded rail were present in mangrove and rush/sedgeland habitat throughout much of the harbour, including near some built-up residential areas.

Illegal mangrove destruction has occurred in a few small areas: either side of the Waterways canal entrance and near Ailsa Place in the Pepe Stream embayment. Banded rail are a threatened species (Sparse) which utilise mangroves as habitat and were observed at both of these clearance sites. This highlights the importance of catchment management plans which specifically identify areas where mangrove removal is sanctioned on the ground of ecological priority or public access requirements (e.g. at the interface between mangrove and seagrass beds, or where public access to open water is necessary).

4.1 Recommended action points and restoration projects

- 1 Undertake a feasibility study to control saltwater paspalum. Saltwater paspalum is already well established around the harbour and adversely affecting the native estuarine vegetation and open mudflat communities. A particular concern is the potential loss of sea meadow vegetation communities at the mouth of the Pepe Stream and Grahams Stream.
- 2 Undertake weed control along the golf course wetland walkway that bisects the upper extent of saltmarsh and manuka wetland remnants. The walkway has allowed wattle and pampas to spread along the disturbed high ground.
- 3 Remove all Indian hawthorn where it occurs, as this is a weed which is just beginning to spread.
- 4 Aim to exclude all farming activities from the Coastal Marine Area and river margins. Particular attention should focus on the following farmland:
 - the estuarine edges upstream of Duck Creek (some of this floodplain that would have graded from estuarine to freshwater wetland vegetation communities has already been lost to canal development); and
 - the lower margins of Gumdiggers Gully.
- 5 Potential restoration sites include:

- Oturu Stream and Grahams Stream mouths' - restoring hydrological connections to re-establish estuarine-freshwater vegetation sequences.
- The lower Tairua River between Woody and Swampy streams and Boom Stream and Duck Creek - restore estuarine-freshwater floodplains.
- The cabbage tree swamp immediately upstream of the saltwater influence along the TLB of the Tairua River – enhance remnant freshwater swamp vegetation that would have commonly formed a vegetation sequence with estuarine vegetation communities.

4.2 Notes on survey method

- Google Earth can provide a very clear picture of estuarine vegetation and a useful back-up aerial view to compare with council aerial images and what is being observed on the ground.
- Vegetation communities which have multiple canopies are mapped as separate layers (e.g. seagrass underneath a canopy of mangroves). Therefore the sum of all vegetation communities can equal more than 100% coverage if multiple canopy communities exist. However, mixed communities that occupy a similar niche (i.e groundcover) are better mapped as 'mixed' vegetation. For example a 'rushland/saltwater paspalum' community includes saltwater paspalum mixed in with rushland. While this category does not indicate the density of particular species, over time the category will either increase in spatial extent, indicating that the weed species is expanding; or the mixed category will be replaced by individual vegetation community categories that will indicate, for example, the rush has out-competed the saltwater paspalum, or more likely, the saltwater paspalum has out-competed the rush.
- When comparing the differences in vegetation communities between the 1998 and present survey there are a few differences to note in mapping techniques used and areas which were previously overlooked, including:
 - the 1998 survey did not map the full inland extent of grazed estuarine floodplain and the recently constructed waterways upstream from Duck Creek (Figures 28 and 29).
 - Saltwater paspalum and sea meadow communities were probably over-estimated before the use of a pda due to the difficulty in drawing thin lines to scale.
 - It can be difficult to determine the upstream limit of saltwater paspalum where it grades into the closely related and similar-looking Mercer grass. While this was not a big problem in Tairua Harbour, it was more so in Wharekawa Harbour.
 - This survey has delineated saltmarsh ribbonwood communities from manuka communities more clearly. Earlier mapping surveys often over-estimated the salt saltmarsh ribbonwood communities where there is extensive coastal wetland grading from estuarine into freshwater communities (e.g. manuka swamp). This was particularly the case for Manaia and Tairua harbours.

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