Before	**the Independent Hearing Panel appointed by the Northland Regional Council**
UNDER	the Resource Management Act 1991 (RMA)
And	
IN THE MATTER OF	an application for coastal permits to: Place, use and occupy space in the coastal marine area with a wharf facility inclusive of a wharf, a building, a gangway, pontoon and piles (APP.040213.01.01); and Disturb the foreshore in the coastal marine area during the construction of the wharf facility (APP.040213.02.01).
BY	**THE MANGAWHAI HISTORIC WHARF TRUST** Applicant

STATEMENT OF EVIDENCE OF

DR ANTONY JULIAN BEAUCHAMP

On behalf of the DIRECTOR-GENERAL OF CONSERVATION / TE TUMUAKI AHUREI

(Submitter No: 176)

(EFFECTS ON WADING BIRDS INCLUDING THE NZ FAIRY TERN)

Dated: 11 September 2020

Department of Conservation

P O Box 10 420, WELLINGTON 6011

Counsel acting: Shona Bradley; Lisa Sutherland (Legal adviser)

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1. INTRODUCTION

1.1 My name is Antony Julian Beauchamp. I hold the qualification of Ph.D in Zoology, and a post graduate diploma in Environmental Health. I have worked for the Department of Conservation ("the Department") in Northland since 2001, firstly as Conservancy Advisory Scientist until 2008, and then as the Technical Support Officer Ecology and Environment and currently as a Technical Advisor Threats.

1.2 I have been in Northland since 1991 first as a Health Protection Officer that handled the quality control for the National Shellfish Sanitation Programme for the shellfish industry throughout Northland. I undertook yearly sanitary surveys and inspections of most Northland Harbour including assessing the impacts of birds and other bacteria sources on shellfish water quality. I also dug shellfish in most harbours and other sites for marine biotoxin assessment.

1.3 As a Technical Support Officer in the Department of Conservation, I have provided support for the fairy tern programme since 2006 and have been a member of the Fairy Tern Recovery Group. I was an expert witness for the Department on the impacts of the mangrove removal at Mangawhai in 2012. I undertook assessments of the impact of mangrove removal on birds at 6 of the proposed sites in Northland in 2010, and at Tairua, Coromandel in 2013.

1.4 I have been a member of the Ornithological Society of New Zealand (Birds New Zealand) since 1979, and the Regional Recorder of the birds in the region for the Whangarei branch since 2010.

1.5 I have published 32 papers on birds, one on bird use of reclaimed areas near Port Whangarei[1] one of wader use of roosts in Whangarei Harbour and Ruakaka[2], one on fairy tern feeding at Mangawhai[3].

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[1] Beauchamp, A. J., & Parrish, G. R.. (1999).Bird use of the sediment settlement ponds and roost areas at Port Whangarei. *Notornis*, *46*(4), 470-483

[2] Beauchamp, A. J., & Parrish, G. R.. (2007).Wader (Charadriiformes) and royal spoonbill (Platalea regia) use of roosts in Whangarei Harbour and Ruakaka Estuary, Northland, 1973-2000. *Notornis*, *54*(2), 83-91.

[3] Ismar, S.M.H.; Trinski, T.; Beauchamp, T.; Bury, S.J.; Wilson, D.; Kannemyer, R.; Bellingham, M. Baird, K. 2014. *Foraging ecology and choice of feeding habitat in the New Zealand Fairy Tern Sternula nereis davisae. Bird Conservation International, 24*: 72-87. DOI 10.1017/S0959270913000312

2. CODE OF CONDUCT

2.1 I confirm that I have read the Code of Conduct for expert witnesses as contained in the Environment Court's Practice Note 2014. I have complied with the Code when preparing my written statement of evidence and will do so when I give oral evidence before the Court.

2.2 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence to follow.

2.3 Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

3. SCOPE

3.1 The purpose of my evidence is to assist the Panel to consider the resource consent application for the construction and use of the proposed Mangawhai Historic Wharf, in particular in respect of the potential effects on wading birds such as the New Zealand Fairy Tern.

3.2 My evidence covers the following matters:

- The importance of the Mangawhai Harbour to threatened birds including fairy terns;
- Fairy tern (Tara-iti, *Sternula nereis davisae*) population;
- The importance of the Mangawhai Harbour – for foraging;
- Development of the Mangawhai Harbour environment;
- Responses to the Applicant's experts' reports and evidence, the Council planner's Staff Report and the supporting ecological report, and their conclusions on the risks to fairy tern; and
- Conclusions.

4. SUMMARY

4.1 The Mangawhai Harbour is arguably the most important site in the country to New Zealand's rarest breeding bird the fairy tern (tara-iti, *Sternula nereis davisae*).

4.2 The fairy tern current population is only around 40 birds. These include 9 laying pairs, 6 of which nested at Mangawhai in the 2019/20 breeding season.

4.3 The survival of New Zealand fairy tern is highly dependent on Mangawhai Harbour being suitable for their breeding, including providing enough food for egg production and to ensure chicks are fed post fledging at defended sites around the harbour. Added disturbance at these critical times could lead to the fairy tern's extinction.

4.4 Fairy terns defend exclusive foraging territories (sole use areas) which occupy most of Mangawhai Harbour. If any fairy tern pair is disturbed it can only relocate within that foraging territory.

4.5 Frequent or constant human presence is very likely to displace pairs and potentially impact the number of eggs laid and/or the number of young fledged.

4.6 Given the critically small numbers, the factors impacting the lives of individual birds can affect species survival. Any reduction in numbers of breeding birds, or their productivity in critically threatened populations, could increase the probability of extinction.

4.7 Fairy terns' use of the Mangawhai Harbour has already been impacted by humans, including the removal of mangroves to increase human recreational activity (including with pets), and changes in the amount of shelter during foraging.

4.8 Human recreational use of the harbour also disturbs the birds. The most concerning existing disturbance is people walking with unleashed dogs at low tide. This activity overlaps with the exact time fairy terns and waders feed on the channel margins of the harbour.

4.9 Any new or additional impacts caused by the provision of further recreation based at the proposed wharf recreational hub would add to the challenges the fairy tern already faces.

4.10 If recreation is encouraged in the upper and middle harbour through the development of infrastructure such as the proposed wharf, this will threaten the fairy tern population. Any facility that encourages water-craft movement is likely to result in more disturbance, through wake resuspension of sediment and because people tend to use boats for access.

4.11 My expert opinion is that the proposed wharf would result in effects on fairy terns (including cumulative effects) that are likely to be significant, and more that minor. The proposal could potentially tip the balance for the fairy terns. A precautionary approach is therefore needed.

5. THE IMPORTANCE OF THE MANGAWHAI HARBOUR TO THREATENED BIRDS INCLUDING FAIRY TERNS

5.1 Mangawhai Harbour is the home for six threatened birds and four "at-risk" species[4]. Many of these species use open habitats in the harbour to forage when breeding, or when stopping in New Zealand over summer to re-condition in preparation for returning to the northern hemisphere[5]. Many of these species spread over the upper, lower and middle Mangawhai Harbour at low tide.

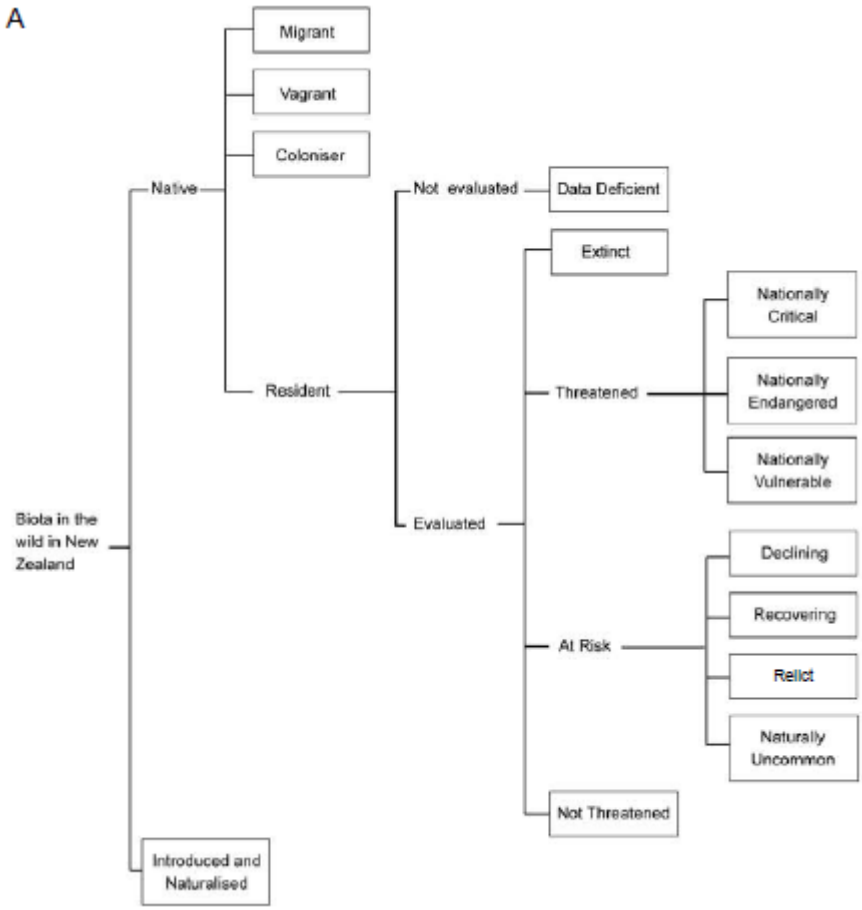
5.2 When I refer to the "upper harbour", I mean the part of the harbour furthest from the sea, i.e. the part where the site of the proposed wharf is. When I refer to the "lower harbour", I mean the part of the harbour closest to the sea, which includes the area adjacent to the sandspit. The "Middle harbour" is the area between the two.

5.3 The Mangawhai sandspit and harbour hold about 10% of the New Zealand dotterel population (c. 270-300 birds) every winter and those birds come from the coastline between Poutawa Stream and Langs Beach[6]. At least one threatened bird species will be found within middle Mangawhai Harbour at low tide all year.

Fairy tern (Tara-iti, *Sternula nereis davisae*) *population*

5.4 The most threatened and "Mangawhai-dependent" seabird is the fairy tern (Tara-iti, *Sternula nereis davisae*) (Table 1 end of document). Fairy terns are classified as "nationally critical" in the NZ Threat Classification System, which is the highest ranking and the highest risk of extinction, as can be seen in the following diagram[7]

[4] DOC submission on this application
[5] Woodley, K. 2012. Shorebirds of New Zealand. Sharing the margins. Penguin, Auckland.
[6] Dowding, J. 2001. Natal and breeding dispersal of northern New Zealand dotterels. *Conservation Advisory Science Notes No 338.* Department of Conservation, Wellington.
[7] Townsend, A.J.; de Lange, P.J.; Duffy, C.A.J.; Miskelly, C.M.; Molloy, J.; Norton, D.A. 2008: New Zealand Threat Classification System manual. Department of Conservation, Wellington. Pg 11.



5.5 The e current fairy tern population numbers c.40 birds. This is down from 45 in 2018.

5.6 The Mangawhai Sandspit and Harbour is one of only four regularly used breeding sites for fairy terns, and is the most important with currently 66% of the breeding pairs present (Fig 1). The regularly used sites are Mangawhai, Waipu, Pakiri, and Papakanui. However, Te Arai has been used four times during the past eight seasons. Six pairs nested on the Mangawhai sandspit in the 2019-20 breeding season, and one pair each at Te Arai, Waipu and Pakiri. No pairs laid at Papakanui because the only female attracted to the site was too young to breed.

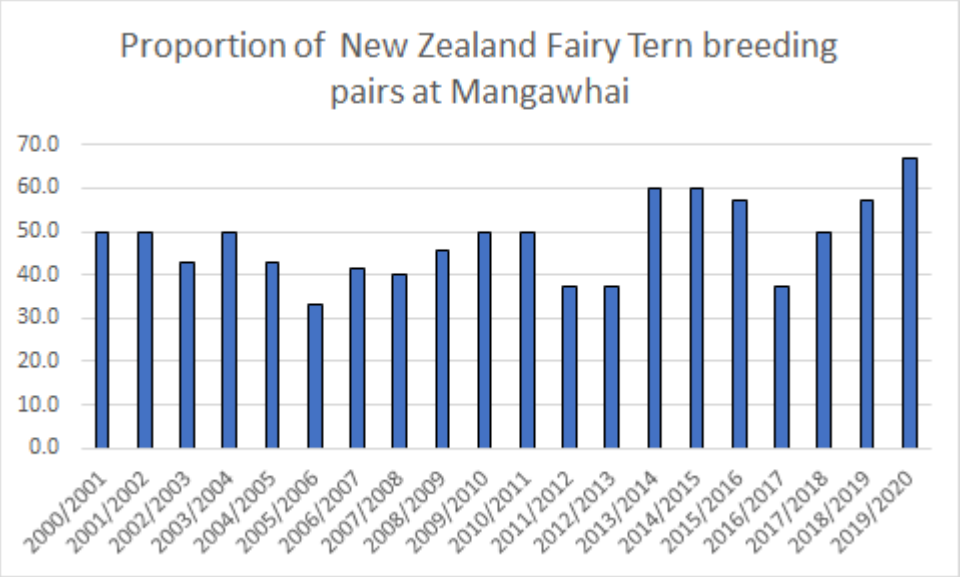


Fig. 1 – Proportion (%) of laying pairs that have been present and using Mangawhai (note this does not include Te Arai where fishing is known to include Mangawhai).

5.7 Fairy terns spend much of the winter on the Kaipara Harbour and then are present on their breeding grounds including Mangawhai from August to February/March. The productivity at Mangawhai affects the potential breeding performance of the entire population because such a high proportion of the birds breed there.

5.8 There are 9 to 10 breeding age females in the fairy tern population. However, the population suffers from genetic issues as the result of inbreeding, that reduce the number of fertile eggs.

5.9 All of the pairs that lay eggs are protected by predator control and monitored throughout the breeding season at all nesting sites. DOC takes various management actions, including fencing protection of breeding sites, manipulation of eggs between nests *in situ* or between breeding sites, and when required, supplementary feeding of chicks *in situ*.

5.10 Fairy terns can raise only one brood a year and lay only either one or two egg clutches. In order to maximise breeding, recruitment is managed by transferring a fertile egg, or eggs, to the nests of infertile pairs. In some situations, fertile pairs are released to lay a second clutch. However, that does not always happen. If the first clutch is only one egg, even with movement of eggs into the breeding site, it is frequently not possible to produce one fledgling per pair (Fig.

2 A & B).

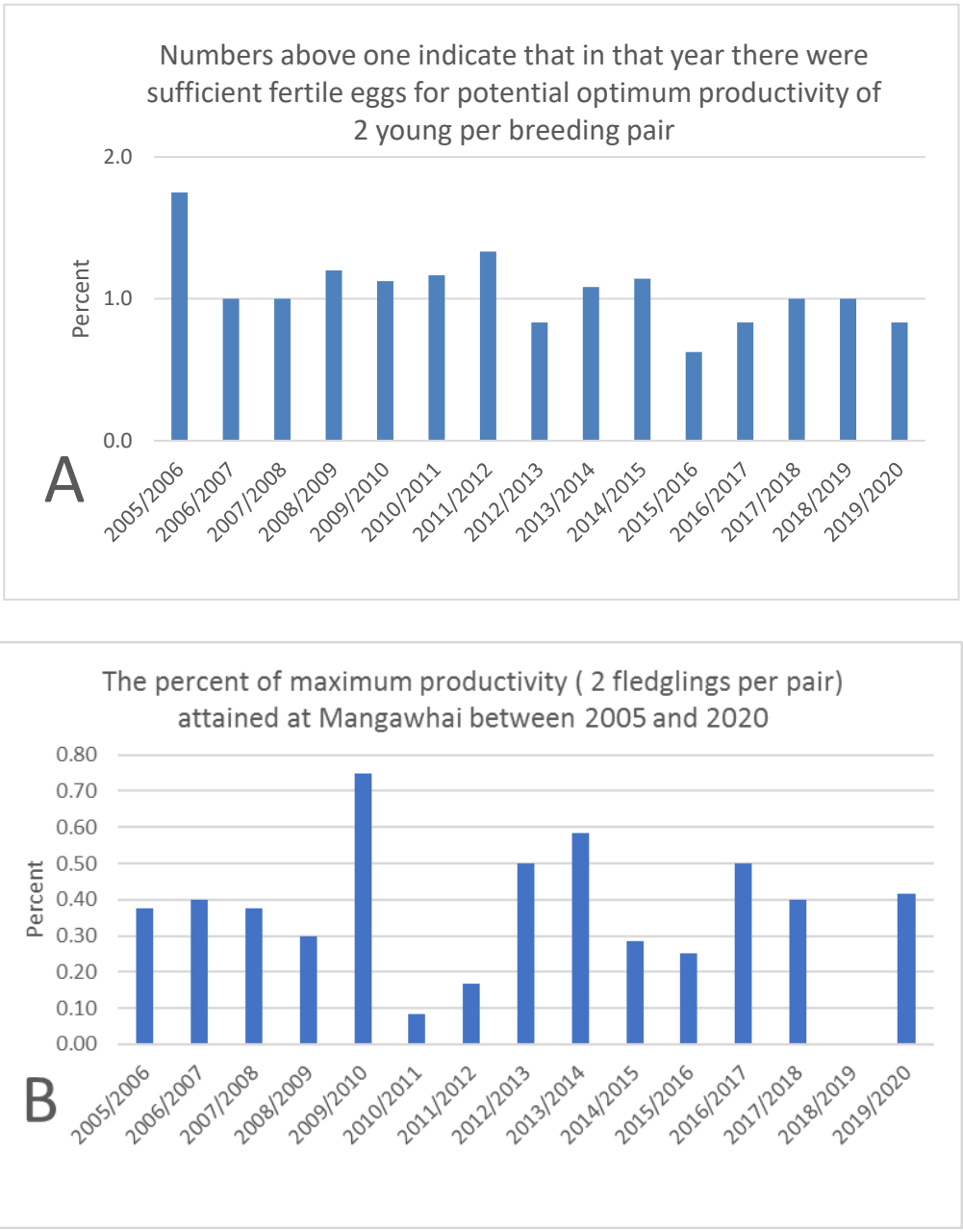


Fig. 2 – Fairy term management and productivity. **A** Potential optimum productivity from eggs laid and transferred into Mangawhai. **B** Percent of maximum productivity attained at Mangawhai.

5.11 Figure 2 includes two graphs. Graph A shows that the potential for optimum productivity, based on the actual number of fertile eggs laid at Mangawhai and/or transferred to nests there, during the past 15 years. During 8 of those years there were only just enough eggs or less than enough eggs for optimum productivity of 2 chicks per nest. Graph B in Figure 2 shows that in only four

seasons did the number of chicks raised equal or exceed one chick per breeding pair fledged (≥50%).

5.12 Female fairy terns are provisioned (fed) to put on condition in preparation for laying by their male in protected feeding territories in the harbour and estuaries adjacent to breeding sites[8]. The number of first clutch eggs laid by stable pairs is indicative of the foraging environment before laying. Most stable pairs will lay 2 egg clutches where conditions permit.

5.13 The pre-breeding environment in Mangawhai Harbour has not been as productive for fairy terns as in the immediate past. At Mangawhai, between 2005 and 2014 there were three one-egg-clutches laid by experienced pairs (existing breeding pairs), and since 2015 there have been eight first one-egg clutches. That coincides with the substantial disturbance and modification of the harbour by machine removal of mangroves, and the increased pitch of waves and ongoing resuspension of sediment in the harbour and increased erosion caused by persistent strong wind conditions in 2017-18 and 2018-19 that were sufficiently strong to cause foraging problems and increase delivery times for foraging parents (Fig. 3).

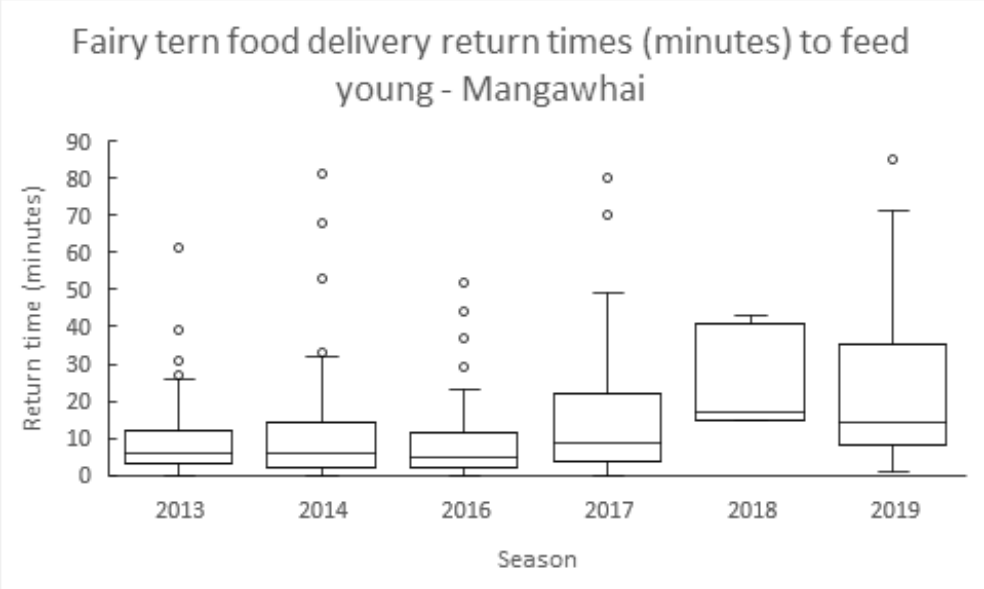


Fig 3 - Box and whisker plots of the return time taken for fairy tern parents to return with fish for dependent young at Mangawhai. NOTE most recording times were less than 70 minutes. There is no distinction between the sex of the foraging bird. The median (middle value) is indicated as the line inside the boxes. The lower line and upper line on the boxes are the 25% and 75% values respectively. The whiskers (line above and below the boxes are the 3rd quartiles (c.

[8] Southey evidence

95% confidence limits) and the circles are values well outside the distribution represented by the box and whiskers.

The importance of the Mangawhai Harbour – for foraging

Where fairy terns feed in the harbour

5.14 Fairy terns use all of Mangawhai Harbour except the Molesworth arm for feeding from the pre-breeding season (August-September) to the time young are fledged (January-March). Males and pairs defend sites which are used most critically when females are putting on condition for laying eggs and when the young first leave the nest site. The closer the female or young bird is, the more food can be supplied during the limited optimal foraging times. This feeding rate can be 5 to 10 times greater when a bird is at the foraging site, than if the birds must fly and return to the nest site.

5.15 During the time when chicks cannot fly the adults forage at sea and in the harbour. When accessing harbour foraging site, they can search for food on the way.

5.16 In 2010/2011 breeding season the fairy terns' foraging ecology and choice of feeding habitat at Mangawhai Harbour was studied by Forest and Bird volunteers. The diet was also assessed using feathers collected from term chicks at banding (19-21 days old).[9] That study documented 405 foraging dives and found that:

- the frequented foraging sites were along the water edges and shallow channels, and the oxbow lagoons on the sand spit;
- less frequented site included some tidal pools on sandflats in the middle and lower harbour and the shallow margins and the dredged main channel in the lower harbour were used; and
- the coastal shallows were also used for foraging.

5.17 The middle harbour and lagoons on the sandspit were found to be the core areas for foraging, with 34% of the fairy tern dives recorded occurring in the middle harbour.

[9] See footnote 3

5.18 However, after this study was completed, the oxbow lagoons, which had already been cut off from inundation by spring tides by sand fences, over-heated and all the fish in them died. Since then the lagoons have not provided food for fairy terns.

5.19 Both pelagic and bottom dwelling fish are taken (Fig 4), but observations and isotope work have shown that gobies are the most important food for fairy tern chick rearing. These are of estuarine, rather than oceanic origin.

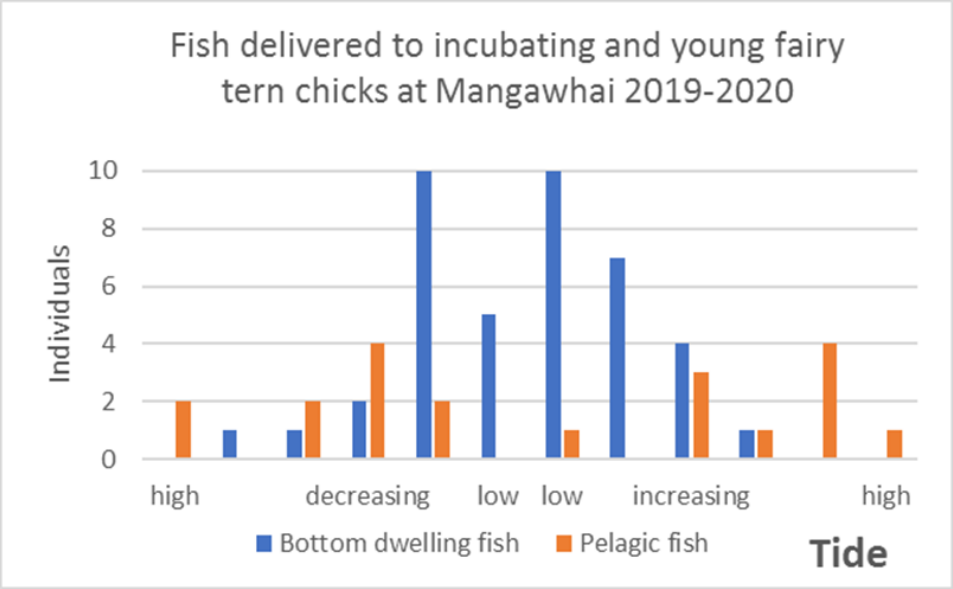


Fig. 4 - Presentation of fish to incubating mates and young chicks (<5 days old) over 12 time periods covering the tide from high decreasing to high after an increasing tide at Mangawhai. Bottom dwelling fish were gobies and flounder and pelagic fish, were mullet, inunga, glass eels

When fairy terns feed

5.20 Foraging takes place throughout the tide cycle when young are at the natal breeding sites (Fig. 5).

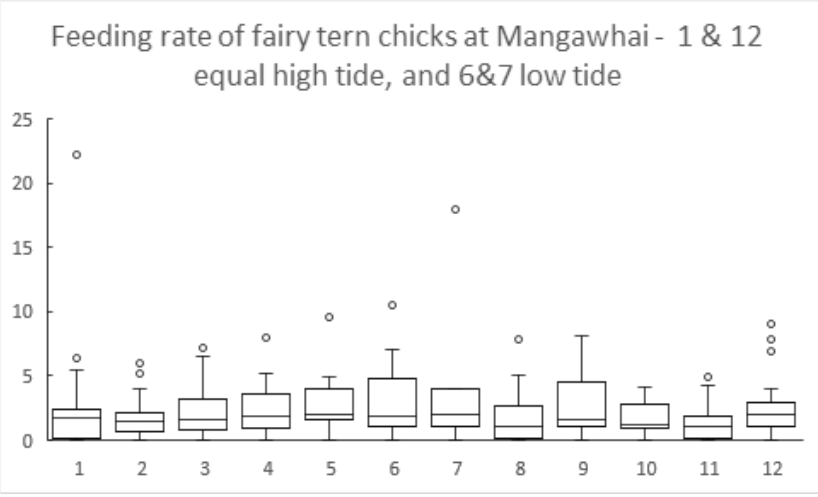


Fig 5 - Box and whisker plots of the food delivery rates by adult fairy terns throughout the tidal cycle to dependent young at nest sites on Mangawhai Spit The Y access if the number of feeds per hour and X is the high to low tidal cycle split evenly into 12ths

5.21 Low tide is the peak period for foraging at middle Mangawhai Harbour and that coincides with the current peak in human walking use of the same sites, which is not surprising given the harbour is relatively easy to cross by foot at low tide when the tidal flats and foreshore are not covered in water, and the water in the channels is shallow enough to cross.

5.22 Figure 6 shows that on one day of my study when people were present along the edge and middle of the harbour, there were no foraging birds present as they were all displaced (i.e. abandoned the part of the harbour they were in).

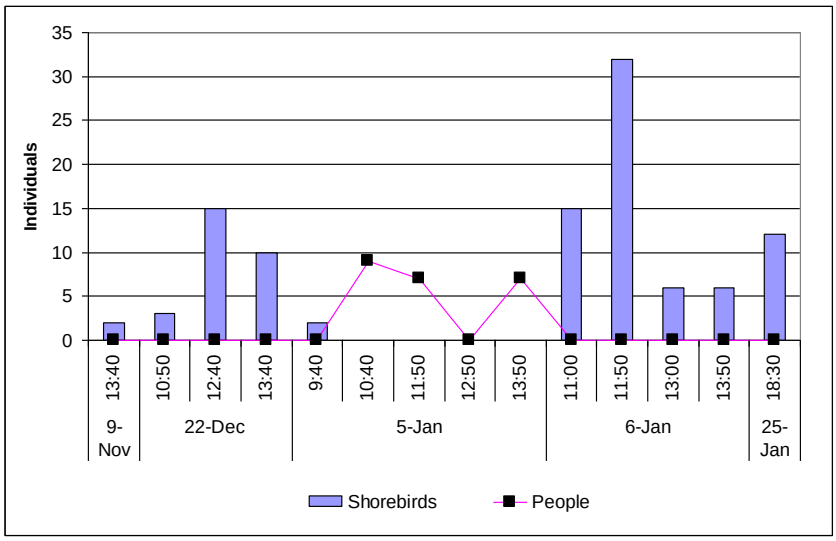


Fig. 6 – Bird presence and human activity at low tide along the south western edge of middle Mangawhai harbour, and the displacement of birds on 5 January 2012 when it was fine verses other days where human impact was not present.

Proximity between foraging sites and breeding sites is critical

5.23 Reproductive success in small terns has been shown to depend heavily on the proximity of productive foraging areas and availability of high-quality prey for chick provisioning. Without productive feeding grounds close to nesting locations, breeding is not possible.

5.24 New Zealand fairy tern males and pairs defend areas of the harbour for their own exclusive foraging use. Fairy tern females rest on the immediate margin of the harbour channels and are fed during pre-breeding by their male mate.

5.25 Newly fledged young also rest on the margins and are fed by parents. Their defended sites are also used to teach young to forage, and what they catch is supplemented by the parents until young can feed independently.

5.26 More food can be delivered if the male/parents are close, and do not need to move young from areas where they are being disturbed.

5.27 Fairy terns often desert the middle harbour as the tide covers the sand flats so their feeding time there is limited. However, pre-laying they are present from the time that the sand flats emerge, and it is critical that the female and male remain close together and the female can rest (rather than using high energy flight) and form the reserves for eggs.

5.28 In Australia studies of the congeneric Little Tern (a close relative of the fairy tern), a direct linkage has been established between local foraging success near the breeding site and reproductive outputs[10]. Studies have also shown that Australian fairy terns rarely travel beyond 2 km during the breeding season and generally forage within 100 m of nests and young[11]. At Mangawhai distances to defended foraging sites are up to 4.5 km away, so the foraging return times at Mangawhai are likely to be longer than in Australia.

5.29 At Mangawhai, minimum return times to natal chick sites show that food can be caught less than 100 metres away, but that the median time taken to fly, catch and return with a fish in 2013-2016 was 6.5 minutes. At a flight speed of 40 km per hour this could mean that the foraging territory is used for food capture throughout the tidal cycle. In the past two breeding seasons the amount of time has become substantially longer than the previous 4 seasons with a median of 15 minutes (range 1-84 minutes; Fig. 3).

5.30 The reasons for these changes are unclear as it is not possible to unbundle complex cumulative effects. However, there is a known association between poor foraging conditions due to persistent higher winds during the breeding seasons, and turbidity due to the resuspension of sediment. This resuspension may have been exacerbated by the extra energy of waves with longer pitches in the harbour, re-suspension of material from machine removed mangrove

[10] Perrow et al. Effects of the construction of Scroby Sands offshore windfarm on the pray base of Little Tern Sternula albifrons at its most important UK colony. *Mar.Pollution Bull*. 62:1661-1670.
[11] Paton DC; Rodgers, DJ. 2009. Ecology of breeding fairy terns in the Coorong. Final Report of the Wildlife Conservation Fund.

sites, and the associated increased erosion of material from the harbour margin (including the margin or the Insley Causeway).

5.31 At Insley Causeway on 13 November 2018 during the day before laying, I observed a resident pair from two hours after high tide during windy conditions and when the water was turbid with sediment from easterly wind re-suspension. Over 30 minutes on falling tide, the female only received one fish from the male while resting on the water (2 fish/hr) despite the male undertaking more than 20 foraging attempts. However, at low tide, when she rested on the margin of the channel she was fed five fish over 30 minutes from18 foraging dives (10 fish/hr).

5.32 Other data shows that when parents and chicks are close, delivery rates can exceed 22 fish/hr. This is far higher than the median feeding rates at nests (mean 2.34. *SD* = 2.34, *n* = 299). Consequently, it is imperative that parents be near young to optimise delivery rates.

Consequences of disturbance

5.33 Fairy terns defend exclusive foraging territories (sole use areas) which occupy most of Mangawhai Harbour. If any fairy tern pair is disturbed it can only relocate within that site.

5.34 Flight is also a high energy activity in birds and can affect the bird's ability to put on pre-breeding condition.

5.35 Frequent or constant human presence is very likely to displace pairs and potentially impact the number of eggs laid and/or the number of young fledged.

6. DEVELOPMENT OF THE MANGAWHAI HARBOUR ENVIRONMENT

6.1 Mangawhai has seen considerable development over the past 20 years, and this development has resulted in most of the northern central harbour being converted from a shrubland and Sydney golden wattle vegetated landscape into dense residential housing. This intensive housing also includes most of the flat area behind the Mangawhai Tavern.

6.2 Associated with these developments are people using the harbour margins and moving into the limited remaining natural areas of the harbour. Significant

areas of mangrove habitat were also cleared in 2014 and 2015, improving public access to and within the harbour.

6.3 There are two motor camps on the edge of the middle harbour, and both motor camps are configured to provide access to the water.

My observations of human activity and disturbance in the Mangawhai Harbour

6.4 I undertook bird counts at Mangawhai from the end of Pearson Street, the Insley Causeway and Molesworth Causeway between November and January 2011-12, 2016-17 and 2018-19. This work covered the rising or falling tide to or from low water, and covered 4 common dates each year and some other dates between 11 November and 25 January.

6.5 I recorded the waders and other birds present at these sites and the people interacting with the harbour and what they were doing. During this time there were 114 anthropomorphic events (events involving people) on the middle harbour that could cause disturbance (Table 2 end of document)[12] The maximum number of people seen during any day was 61. Even with moderate presence of people all waders, gulls and terms were absent from the area between the Tern Point entrance and the Riverside Motor Camp on 5 January 2012 (Fig. 6).

6.6 Historically, human access and use of the middle harbour was generally associated with the motor camps and their immediate surrounds, with use spilling over into the wider harbour at low tide. The Sand Island mangroves used to provide a barrier from human disturbance for waders, however those were removed in 2015.

6.7 On 5 January 2012, I observed 35 people in three groups who displaced birds from the exposed sand flats, resulting in the birds flying over the mangroves to the sand channel. However, since 2015, the birds do not have this barrier, so they now fly much further away or to the opposite side of tidal channels to avoid people.

6.8 The major activity both before and after mangrove removal was walking, with and without dogs (Table 2), and most of that activity was at low tide in the Christmas-New Year holiday period.

[12] However the way this work was designed (rotating counts at multiple sites per hour) precluded the collection of disturbance rate data.

6.9 Before mangrove removal, 61% (n = 19) of the records were of groups of walkers, and 42% (*n* = 8) of these people had dogs with them. After mangrove removal, 64% (*n* = 54) were groups of walkers and 42.5% (*n* = 23) of these people had dogs with them. In all but one case the dogs were off-leash. These dogs varied between those fully under control to those out of control and chasing birds. The increase in potential disturbance events was lower that the change in residents/development and visitor numbers would have predicted, and the number of events were not significantly different between the time periods, when the number of surveys was taken into account ($X^2 = 3.69$, 1*df*. *P*<0.05).

6.10 However, during the principal holiday period and when fledgling terns could be present at the site there was some periods of disturbance to the fairy terns at low tide. A case in point is that on 30 December 2017 and 1 January 2018, when I was attempting to locate a male fairy tern with a potential colour-band issue at his foraging grounds at low tide near Moirs Point.

6.11 During 3.2 hours at the site I recorded more than one disturbance event for each hour I was present and each time he relocated within his foraging area:

- the wake of a boat moving up the main channel generated waves that swamped the side channel where the fairy tern was roosting,
- a horse being ridden along the margins or the channel displaced the tern,
- a helicopter flew low and straight over the top of the site prompting all the birds close by to fly off, and
- if I had not been present there also would have been an additional three walkers and an off-leash dog displace the bird as well (that is, 1.25 disturbance events per hour).

6.12 Overseas research shows that people with dogs have significantly greater impact on birds that those without dogs[13], and changing behaviours of people to leash dogs on beaches is difficult even when the impacts chasing birds are known to the dog owners[14].

[13] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2391219/

[14] Williams, Kathryn J. H., Weston, Michael A., Henry, Stacey and Maguire, Grainne S.(2009). Birds and Beaches, Dogs and Leashes: Dog Owners' Sense of Obligation to Leash Dogs on Beaches in Victoria, Australia',Human Dimensions of Wildlife,14:2, 89—101

6.13 Other harbour associated activities at Mangawhai I observed during my surveys were kayaking, swimming, jet ski and boat use (Table 2).

6.14 Work I have done at Ruakaka Estuary has shown that these activities can also cause disturbance and displacement of birds. During 29 survey days between 18 October 2009 and 1 March 2010 at Ruakaka Estuary human disturbance events averaged 1.04 h^{-1}, and 210 of 813 anthropomorphic events caused disturbance. The anthropomorphic disturbance rates exceeded natural rates significantly more frequently in 5 of the 6 zones. This included the boat launch zone and the camp-ground zone. The only zone that was not affected by people (the northern beach) was protected by the water channel. However, event there, pied shags roosting beside the channels were displaced by the wakes of powered boats entering and existing the estuary (68%, *n* = 22). Long distance movements by birds from the estuary were caused by (boats (*n* = 14), dogs (*n* = 2), kayak (*n* = 1), swimmers (*n* = 1), vehicles (*n* = 1), walkers (*n* = 7). People using kayaks were less of a problem, however, when people exited them (*n* = 5) they always caused disturbance when near birds.

6.15 I acknowledge that the anthropomorphic events detected in middle harbour at Mangawhai are likely to be still lower overall than at sites like Ruakaka due to the size difference between the harbours. However, much of the sand flats at the Ruakaka Estuary are part of a wildlife refuge, and dog presence is illegal, so dog presence was low. This is not the case at Mangawhai where only the sandspit is a wildlife refuge, and dog presence around the harbour is high and not subject to controls.

6.16 Like at Ruakaka, one of the reasons why human impact on the middle Mangawhai harbour is currently limited, is the lack of desire of people to access it through the water, especially in areas where the channels are 0.5-1.2 m deep at low tide, and visibility often precludes people seeing their feet.

6.17 This low clarity water is often present from the proposed wharf site and down the main channel, which appears to limit the desirability and ability for people to use this part of the harbour.

Potential effects of the proposed wharf on fairy terns

6.18 The proposed new wharf and recreation hub has the potential to substantially change the current situation for the fairy terns. Encouraging water access via

boats and other watercraft there will increase the number of people crossing channels in the middle harbour.

6.19 Substantially higher disturbance of fairy terns using the harbour for foraging as a result of the proposed wharf recreation hub could have a substantial impact on the fairy tern, given the very small population and heavy reliance on the harbour.

6.20 As I have explained in detail above, reliable foraging areas close to nesting sites are vital for breeding and fledging success, disturbance reduces the fairy terns' ability to forage and feed, and reduce the degree by which female fairy terns' can put on condition to prepare for laying. That is, in addition to the effects of disturbance at nesting sites.

7. RESPONSES TO THE APPLICANT'S EXPERTS' REPORTS AND EVIDENCE, THE COUNCIL PLANNER'S STAFF REPORT AND THE SUPPORTING ECOLOGICAL REPORT, AND THEIR CONCLUSIONS ON THE RISKS TO FAIRY TERNS

7.1 There are three experts that cover the impacts on shorebirds and the New Zealand fairy tern in their supporting documents for the applicant (Mr La Bonte, Mr Don and Mr Yusuf, and Dr Craig). Two have provided evidence (Dr Craig and Dr McDermott). In addition, Mr Leach has provided some evidence on disturbance impacts. I respond to particular points in their reports and evidence, below:

La Bonte report

7.2 Mr La Bonte (Appendix 8, page 9) states that some people who expressed views during consultation. He states:

> *Some of these individuals expressed concern that more people recreating in the upper end of the middle harbour area (attracted to use of the wharf) would disturb birds. Fairy tern and other coastal birds are known to breed on the sand spit. The sand spit is over 3km from the site of the proposed wharf. Therefore, the effects of placing the wharf at this location are considered to be no more than minor with regard to fairy tern breeding activity.*

7.3 I do not agree with the opinion of Mr La Bonte that because the nests are 3 km from the breeding site, the placement of the wharf will have a no-more than minor impact on breeding activity. I cover the reasons for this in clause 5.13.

Mr Don and Mr Yusuf's report

7.4 Mr Don and Mr Yusuf record in their report that they only visited the proposed wharf site to assess bird use for one day (7 November 2018), and just prior to high tide to just after low tide, and that they confined their work to 30 m either side of the site of the proposed wharf.

7.5 They indicate that they held more information collected for another client but did not refer to that information. It is not clear to me why that information hasn't been tabled.

7.6 In the day they were there, they observed 3 flights of fairy tern which they considered was significant. They concluded that they were unable to be sure about the severity of impacts of the use of the wharf once constructed on fairy tern foraging from boat wakes, noting:

> *In contrast, the effect of additional vessels using the low tide channel on the feeding activity of fairy tern is unknown and is a significant deficiency in the information available, there is no data that would provide assurance that no adverse effect, either direct or cumulative would result. In our view that issue would require direct observation and data collection.*

7.7 I agree with that opinion, that there is a lack of information on the potential wider impacts from the use of the proposed wharf after construction, and a lack of data to undertake such an assessment. Without such data, the potential effects of the wharf and its use cannot be quantified and are uncertain.

Dr Craig's overview report

7.8 Dr Craig in his overview report makes comments on the lack of identification of the foraging threats posed to fairy tern in the latest Fairy Tern Recovery Plan. That plan was written in 2006 and is out of date.

7.9 Since that time, the Ismar et al study has been published, and information that was lacking on fairy tern foraging and delivery throughout the tidal cycle are also presented above in my statement of evidence (5.19, Fig. 5). There is a peak in delivery of bottom dwelling fish species as foods for fairy tern chicks

over the hour and a half before and after low tide (Fig 4), which as noted earlier, coincides with the highest time of use of the harbour by people.

7.10 Dr Craig in his overview of the wharf effects did not mention that in Mr Don and Mr Yusuf's were unsure about the impacts on fairy terns after the immediate construction phase of the wharf, and instead, concentrated on the impacts of wharf construction:

7.11 He then concluded (final page of report) that:

> *The effects of the wharf on endangered species, including the FT will be temporary and related to feeding in what is a relatively low producing area, some distance from the FT breeding and main roosting areas. The effects can be considered no more than minor. Perhaps more importantly, they are likely to be more than offset by enhanced interpretation and instruction, a major benefit giving the prospect of significant an[d] ongoing increase in harbour use a Mangawhai continues to grow"*

7.12 Dr Craig recommends, in light of his conclusion on effects from construction only, that effects can be avoided by restricting the timing of construction to months outside of the fairy tern breeding season.

7.13 Dr Craig however fails to apply this principal of avoidance to the impacts of disturbance caused by the use of the wharf as a recreation hub long-term, or to the effects resulting from recreation spilling over the entire middle harbour where most of the fairy terns feeding territories are located. The peak period of use is in summer (Christmas to the end of January) where most of the disturbance occurs and coincides with the time many fairy tern young fledge.

7.14 My observations on overall harbour use by people being associated with existing hubs (motor camps) and those of Mr Southey at the wharf site, indicate that the impacts there have the potential to be significant for breeding pairs of terns, and by implication the population as a whole. .

7.15 Dr Craig also states that he considers that the fairy terms are far more at risk from boats using the lower harbour ski lane than disturbance in the middle harbour. However, Ismar et al.[15] showed that there were very limited foraging dives by fairy terns in the ski-lane area (their Fig. 2 b[16]). This suggests that the

[15] See footnote 3

[16] Reproduced in Southey submission Fig 10.

activity in the lower harbour ski lane in 2012 was already being avoided by breeding fairy terns. Currently the ski lane forms only small parts of breeding pairs' foraging areas. In my experience newly fledged terns using the area to the west of the ski lane forage in the large pools on the sand bank, and their parents also forage in the channel to the west of the sand bank which is protected at low tide from the wakes generated by use of the ski lane.

Dr Craig's Statement of Evidence dated 4 September 2020

7.16 Dr Craig (Evidence 2.3, 3.8-3.13) states his opinion that fairy terns will adapt to disturbance and suggests there is no need to be concerned about this. However, as indicated in my evidence above (6.11) when terns do respond to disturbance by moving, they need to remain within their own territories to forage, and too much disturbance can potentially reduce the productivity of the population and feeding of newly fledged terns. I have also described the protections afforded by the wildlife refuge for the northern territories and that of the ski lane which are not present in the lower harbour where the wharf is proposed to be located.

7.17 Dr Craig in Section 3.6 (c) points out that submitters have not proven that the wharf will attract increased boat traffic, or that increased traffic will impact on fairy tern foraging. The proposed conditions for use of the wharf (Appendix 11) indicate that while no commercial use of the wharf will take place, the applicant is not precluding is use as a seasonal taxi service to and form Mangawhai Heads"[17]. As there is no water-taxi service now, any service must include more boat movements. The fact that the wharf is designed to extend into the channel indicates that it is intended to be used by boats.

7.18 In my evidence above (6.11) I have included direct observation of wake associated disturbances which already take place now. Mr Leach has also indicated in his evidence that there is considerable non-compliance with the five-knot rule in the area (12.1).

7.19 Dr Craig (3.11) comments that for other species he has studied, there was no effect on breeding with the presence of people close by. He appears to conclude that fairy terns are not disturbed by rangers putting up fences. Perhaps Dr Craig is not aware that the fences are put up in advance of the

[17] Appendix 11 of the application Advice note proposed condition 2

breeding season because the birds desert nests to investigate people on the margins.

7.20 Fenced areas are also large and most of the observations of fairy terns are done from hides because we have had chicks move from sites on the sight of people over 100 m away. In my opinion, Dr Craig provides no evidence of adaption to disturbance at the breeding grounds.

7.21 Also, Dr Craig indicates here that the number of people in Mangawhai has doubled over the past 10 years and that this has not stopped the fairy tern foraging areas from increasing in number from 5 to 9.

7.22 Dr Craig goes further to state that if population related disturbance were a current cumulative problem at Mangawhai, that breeding a Papakanui would be more successful than at Mangawhai.

7.23 In my evidence (6.9) I indicate that despite increases in the overall human population I have not detected increased disturbance activities at the same rate.

7.24 The increase in the number of foraging territories at Mangawhai is associated with a surge in males entering breeding age in the population, and other sites not attracting these males. This indicates that relative to other breeding sites, Mangawhai Harbour is still attractive as a breeding area.

7.25 It does not follow that mangrove removal has been good for fairy tern as Dr Craig suggests. The number of one egg first clutches has increased post removal, and pre-laying conditioning in the habrour appears to have been worse since 2015 (5.12).

7.26 I also note that at Papakanui, the Department has considerable difficulties with wind moved sand and tide disrupting breeding, so many eggs are harvested from there for raising young at other sites.

7.27 In paragraphs 3.11-3.12 of his evidence Dr Craig acknowledges that people and dogs may be an issue, but that birds will habituate as long as they do not get chased. He indicates that this is evident from fairy tern territories overlapping with walkers and dogs on the Insley Causeway.

7.28 In my surveys, I only saw one unleashed dog walked along the Insley Causeway and then the dog diverted where it could get to the sandflats. It did

not chase any birds as there were none there at the time. All other dogs (n = 7) were on the sand flats, and I recorded 3 chasing birds.

7.29 Dr Craig suggests that similar habituation would occur if dogs were only walked on the proposed wharf. That may be appropriate at that site, but most of the breeding areas do not have structures and Dr Craig does not present any information on dog use of the sandflats at Mangawhai where the concerns lie, or any information on dog use of the site of the proposed wharf or any personal observations there.

7.30 Dr Craig points out the need to separate cause and effect in science by multivariate assessment (3.16). He rightly observes that there are confounding issues with fairy tern habitat changes and the changes in the population composition around the time of the mangrove removal.

7.31 However, he appears to assume (3.16) that because Baird et al. found that a pair of terns that lost their first nest and went to the Kaipara to re-provision before returning to Mangawhai to renest at Mangawhai, this is "typical" for all pairs. He indicates that renesting cannot therefore be linked with the foraging habitat in Mangawhai Harbour.

7.32 I disagree. In my opinion, by the time fairy tern pairs renest at Mangawhai they have a very good idea of foraging conditions in their natal foraging site, having been assessing them for months, and they would be very aware of their capacity to feed young from it.

7.33 The pair that visited the Kaipara, and re-provisioned for laying there before renesting at Mangawhai had a foraging range just inside the entrance of Mangawhai Harbour, but also used the lagoon for foraging (Ismar, NZFTCT Figure 1). The lagoon was the most used dive site[18] and would have been known to the fairy terns nesting there. Why they moved to the Kaipara is unclear. Where the Department has rangers more closely linked with the foraging grounds at Pakiri and Waipu, I have been informed that those staff never detect pairs leaving the breeding site during re-provisioning.

7.34 In my opinion the terns at Mangawhai are very aware of the status of food and foraging conditions in their breeding areas and alter their renesting accordingly.

[18] Ismar see footnote 3

The low renesting rate at Mangawhai in the past two seasons is associated with longer parent return times to feed young (Fig 3).

7.35 Dr Craig concludes that the presence of the wharf will have little to do with the amount of people walking or having dogs in the middle harbour (5.6). I disagree. My understanding from reading the application documents is that a key intention in proposing a wharf with a pontoon is to allow access to watercraft. Dogs are regularly carried by motorboats and yachts, and in my 27-year experience at Mansion House, Kawau Island, landing dogs is a daily problem there during summer. Watercraft can be used to transport and land people and dogs throughout the area. Dr Craig suggests that this issue can be resolved by council imposing a ban on such activities (people walking dogs) during the fairy tern breeding season, but this is outside the control of the applicant, and does not form part of the resource consent application.

7.36 Dr Craig also concludes that the long-term threats on fairy tern survival are more insidious. These threats include those associated with climate change, “including changing water conditions (warming sea level rise), and the increasing frequency of sever-weather events (turbidity and inundation)”.

7.37 I agree that these threats will be challenging, but it does not diminish the importance of avoiding disturbance of the terns in their foraging areas.

7.38 In Mr Leach’s evidence (section 14.2) he indicates that the proposed recreation hub on the wharf is primarily being designed for educational and human recreational activities, and Dr Craig appears to support this.

7.39 In my opinion, the suggested remedial activities by Dr Craig, including providing information on the wharf, are inadequate and will not avoid disturbance or offset the effects of it. Council bans imply that the council will be available to enforce compliance. Dog enforcement can take hours to reach the Department of conservation rangers at the breeding sites during the Christmas to January period. Consequently, any ban would need the buy-in and peer pressure enforcement by residents. That is not happening for boat speeds now (Leach evidence,12.1).

Dr McDermott’s Statement of Evidence

7.40 Dr McDermottt states in his evidence that the number of permanent residents at Mangawhai has doubled (Evidence 4.4), and by implication, the proportional

impact of that population on the harbour. He presents no information to support that assessment. My data (6.9) does not reflect such an increase in impact.

7.41 Dr McDermott also points to the increase in membership and launching of boats by Mangawhai Fishing Club (Evidence 4.8), and the seasonal increase in the neighbouring campground as an indication of the impacts that fairy terns have adapted to.

7.42 However, virtually all the boat movements are to the sea from the ramp (c. 1 km distant), and the fairy terns using that area have natal areas less than 30 m from the coastline, with access to a part of the sandspit (which is a wildlife refuge) generally lacking human and dog presence.

7.43 Dr McDermott also states that fairy tern foraging disturbance is limited because the few episodes of disturbance or loss are confined to the breeding area, and the lack of reporting of incidents could be due to the Department concentrating on the breeding areas (Evidence 4.11).

7.44 This bias is correct, but it does not mean that disturbance immediately post fledging is not happening. There is increasing evidence of losses in the fledging time and the Department's rangers have had their employment extended to ensure the magnitude of such losses are understood.

7.45 This was triggered in 2008 by the death of a fairy tern chick from human trampling inside a protection fence when it was 20 days old. Since then, at Waipu, we have recorded one young that died of unknown causes during the early fledging period.

7.46 Dr McDermott also appears to conclude that we can protect fairy tern by improving management at the nest sites, alone. However, the activity of protecting nest sites cannot make up for impacts of disturbance of fairy tern at foraging areas that reduce fecundity through reduced egg production or juvenile loss. I strongly disagree with Dr McDermott that just concentrating on nest habitat related activities and ignoring the risks posed by disturbance at forging sites, is the best immediate response.

7.47 Dr McDermott suggests that the population at Mangawhai may have reached a density dependent ceiling at 9 pairs (Evidence 4.13). The Fairy Tern Recovery Group is well aware of the issues surrounding density dependent controls and is actively seeking methods of changing former breeding sites back to nesting

habitat so that if such controls exist and birds chose to move, or if new pairs are formed, they have some other options.

7.48 There is also consideration of potential captive rearing and releasing birds into new habitats that will probably be beyond viable colonisation by the existing tern population. However, fairy tern breeding sites are rare, as most of the former open active dune ecosystems have been taken over by weeds or housing, pine plantations and farmland, and potentially many foraging areas have been destroyed by development, as water has been captured by trees, and swamps have been drained and water extracted from aquifers.

7.49 The number of sites within the known recent (50 years) range is small and less than 10 pairs may be accommodated. Mangawhai Harbour will therefore remain a very important breeding site for fairy tern for the foreseeable future, as males' defence is centred on the same sites over many years and are site-attached to this harbour.

7.50 Dr McDermott has indicated that increasing the genetic diversity of NZ fairy tern may be required to save the species (Evidence 4.4). This can only be done by bringing in eggs from populations that behave very differently from the current population of New Zealand fairy tern. These populations are generally colonial, transitory nesters feeding very near food resources[19]. Given the link between genetics and behaviour there is a need for caution as the foraging ecology of the populations may differ. There have been two genetic assessments of the New Zealand and overseas populations [20], including one which is ongoing, to assess the inbreeding infertility or embryo death issues and compare populations. Any move to bring in fairy tern genetic material (eggs) needs to be considered carefully. In my opinion, the conditions associated with the habitat that fairy tern's nest and forage in is still crucially important, regardless of this action.

7.51 Dr McDermott also suggests that we could benefit by working on moving birds to roosting sites at Te Arai and Pakiri[21]. Both areas were already breeding sites in 2019-2020 and held one pair each. They cannot be developed to provide for more, as resident birds defend the entire estuarine foraging areas at both sites.

[19] See footnote 10

[20] Baling, M; Brunton, D. 2005. Conservation genetics of the New Zealand fairy tern (*Sterna nereis davisae*). Auckland UniServices Limited. Department of Conservation.

[21] His attachment, Working paper summary, last paragraph

7.52 Work has been carried out at Papakanui to try to enhance the breeding shell patches there and that may well provide habitat for more pairs if we can get the breeding sites secure from sand and tide inundation. Other work carried out by Forest and Bird with the assistance of the Department has not yet managed to encourage birds to nest at Bird Island, and there may well be changes to foraging areas near the site which were associated with its desertion as a roost site.

7.53 All of Dr McDermott's suggested changes are already underway. Any improvements at these sites will not change the need for management to reduce disturbance of the Mangawhai fairy tern foraging territories.

7.54 Dr McDermott has identified several issues that are being managed by current operations by the Department or are/have been considered by the Fairy Tern Recovery Group. He has not provided any evidence that the fairy terns can deal with impacts on their foraging, and the potential that this can have on reduced egg numbers and risk to newly independent young. In my opinion his recommendation that the evidence provided to the planner is not supported by sound concerns, is based on assumptions about current population impacts on fairy tern, and a lack of understanding of issues of disturbance to critical parts of the fairy tern life cycle.

Mr Leach's Statement of Evidence

7.55 Mr Leach provides some insight into compliance issues with boating rules, which he has observed while walking his dog in the area (Evidence, 12.1 as noted above).

7.56 Mr Leach states that there will not be a rush of boat use from the lower harbour because the wharf will only be able to be accessed either side of high tide, and that it will take about an hour to do a round trip (12.2).

7.57 In my experience at Ruakaka, people driving boats have extreme difficulty travelling at 5 knots for less than 400 m, even with obvious signage. I also have seen boats travelling up the main channel at Mangawhai at low tide, so from my own experience I would not expect the proposed wharf's use to be limited in the way described by Mr Leach.

Northland Regional Council Staff Report.

7.58 The Northland Regional Council Staff Report assesses the issues surrounding the proposal, including the avifauna issues[22]. It concludes, based on the evidence of Ms Hansen that the processes surrounding the construction of the wharf would be manageable for impacts on bird life.[23] I agree with that conclusion.

7.59 I also agree with the assessments in the report and Ms Hansen's evidence that the long- term impacts of the boating and recreational activities undertaken in and around the harbour that will be enabled and encouraged by the presence of the wharf, would potentially be more than minor on New Zealand Fairy Tern.

7.60 I agree with the conclusion in the Staff Report and Ms Hansen's evidence that a precautionary approach is needed to prevent adverse effects on fairy tern.

8. CONCLUSIONS

8.1 In my opinion, the proposed wharf proposal cannot be viewed just as a one-off impact confined to its construction. The potential for disturbance of fairy terns as a result of the use of the wharf and the activities that it will enable and encourage are potentially significant.

8.2 The wharf is proposed as part of a recreation hub and will undoubtedly bring activity into the middle harbour for the duration of its existence.

8.3 Fairy terns use the harbour during critical life cycle phases. The provisioning of female which dictates the number of eggs, the feeding of chicks and the period of immediate post fledging and teaching them to fish.

8.4 There are many factors that currently do or could affect the fairy terns (climate change and more intense storms, increased length of turbid water conditions), that we cannot control. There are some things that we can control, and that includes improved protection at breeding sites, and controls on human activity on Mangawhai Harbour.

8.5 The survival of fairy tern is highly dependent on Mangawhai Harbour being suitable for breeding for the foreseeable future. Added disturbance there at critical times could lead to the extinction of the fairy tern, which is New

[22] Section 6.2.2 paragraphs 23-29
[23] Section 6.2.2 Paragraph 28

Zealand's rarest breeding bird, and which will require conservation dependent action for years to come.

8.6 If Mangawhai Harbour becomes less suitable for fairy terns, they have very limited options to relocate to other safe breeding sites, and in my opinion, there is a high probability that the population would fail.

8.7 Therefore, extreme caution is required when considering development where s is the case here, there is uncertainty around the risk the development poses to fairy tern's survival, but good reason to expect that adverse effects on fairy terns will occur.

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Table 1- Threat status of birds using mangroves at Mangawhai

Common name	**Name**	**Umbrella category current**	**Conservation Status current**
New Zealand fairy tern	*Sternula nereis davisae*	***Threatened***	Nationally Critical
Bittern	*Botaurus poiciloptilus*	***Threatened***	Nationally Endangered
Pied shag	*Phalacrocorax varius varius*	***Threatened***	Nationally Vulnerable
Banded dotterel	*Charadrius bicinctus bicinctus*	***Threatened***	Nationally Vulnerable
Lesser knot	*Calidris canutus rogersi*	***Threatened***	Nationally Vulnerable
Caspian tern	*Hydroprogne caspia*	***Threatened***	Nationally Vulnerable
Banded rail	*Gallirallus philippensis assimilis*	***At Risk***	At risk - Declining
Black Shag	*Phalacrocorax carbo novaehollandia*	***At Risk***	Naturally uncommon
Eastern bar-tailed godwit	*Limosa lapponica baueri*	***At Risk***	At risk - Declining
South Island Pied oystercatcher	*Haematopus finschi*	***At Risk***	At risk - Declining
Variable oystercatcher	*Haematopus unicolor*	***At Risk***	At risk - Recovering
Northern New Zealand dotterel	*Charadrius obscurus aquilonius*	At Risk	At risk- Recovering
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	Not Threatened
White-faced Heron	*Egretta novaehollandiae*	Not Threatened	Not Threatened
Grey warbler	*Gerygone igata*	Not Threatened	Not Threatened
Little shag	*Phalacrocorax melanoleucos brevirostris*	Not Threatened	Not Threatened
North Island fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	Not Threatened
Sacred kingfisher	*Todiramphus sanctus vagans*	Not Threatened	Not Threatened
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Not Threatened	Not Threatened
Grey warbler	*Gerygone igata*	Not Threatened	Not Threatened
Silvereye	*Zostrops lateralis*	Not Threatened	Not Threatened
Mallard	*Anas platyrhynchos*	Not Threatened	Introduced and naturalised
Common starling	*Sturnus vulgaris*	Not Threatened	Introduced and naturalised
Eurasian blackbird	*Turdus merula*	Not Threatened	Introduced and naturalised
Song thrush	*Turdus philomelos*	Not Threatened	Introduced and naturalised
Pukeko	*Porphyrio melanotus melanotus*	Not Threatened	Not Threatened
Royal Spoonbill	*Platalea regia*	Not Threatened	Naturally uncommon
Pacific golden plover	*Pluvialis fulva*	Non-resident Native	Migrant

Table 2 – Groups of people undertaking activities in middle Mangawhai Harbour

Activity	Pre-mangrove removal (2011-12) (n = 9 survey days) *	Post-mangrove removal (2015-2019) (n = 17 survey days)
Walking	8	23
Walking with dog(s)	11	31
Golf driving	2	0
Pulling mangrove seedlings	1	0
Rod fishing	1	0
Kayaking	3	5
Swimming	2	10
Set-net fishing	1	3
Shellfish gathering	1	0
Sitting	0	11
Boat movement	0	2

* The Hideaway motor camp beach was not visible from the count site due to mangrove presence