A REVIEW OF MANAGEMENT ISSUES AND OPTIONS FOR COASTAL BIRDS IN THE TASMAN DISTRICT

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Cover Image: A mixed flock of Red-billed Gulls (*Chroicocephalus novaehollandiae*), South Island Pied Oystercatchers (*Haematopus finschi*) and Variable Oystercatchers (*H. unicolor*) roosting at high tide at Pakawau, Golden Bay / Mohua. The driftwood structures in the background provide evidence of recent recreational activity which has the potential to disturb or displace roosting shorebirds, and the very high tide and limited area available to the roosting birds illustrates the risk posed by human-induced climate change and sea level rise to the region's coastal birds.

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Executive Summary

The coastline of the Tasman District provides vital habitats for important populations of indigenous coastal birds. A total of 55 resident and migratory coastal bird species are included in this review, but seabirds (e.g., albatrosses and petrels) and vagrant bird species are excluded. Of the 55 bird species considered in this review, 32 species (58%) are ranked as either Nationally Threatened or At Risk under the New Zealand Threat Classification System.

Tasman District Council (TDC) is one of several agencies that have statutory responsibilities relating to the sustainable management of the natural character of the Tasman District's coastline, including its indigenous birds. To discharge these responsibilities as efficiently and effectively as possible, TDC needs to maintain a detailed and up-to-date understanding of the distribution of coastal bird values along the Tasman District coastline, and the threats that are adversely impacting those values.

In Part One of this review, we summarise published and unpublished information describing the distribution and abundance of coastal birds in the Tasman District to identify 36 sites in the Tasman District that are of international, national and regional importance to coastal birds according to existing criteria. We have identified five of these 36 sites as having a higher level of importance than that currently listed in Schedule 25D of the Tasman Resource Management Plan (TRMP) and a further 11 of these sites as having a lower level of importance than that listed in the TRMP. Given these changes, we recommend that TDC updates Schedule 25D of the TRMP to include the sites identified in this review. This network of sites provides TDC and its partner agencies and stakeholders with prioritisation framework to help guide where along the Tasman District coastline these groups and agencies should prioritise the investment of time and resources aimed at managing coastal bird values in the Tasman District. By prioritising time and resources towards these 36 sites, resources will be directed towards sustainably managing a network of sites containing the highest coastal bird values in the district.

In Part Two of this review, we review published and unpublished literature and consult local subject-matter experts to identify threats that are known, or considered likely, to be adversely impacting coastal birds in the Tasman District and to describe how each of these threats is adversely impacting coastal bird populations. We also provide a review of available management tools to create a 'toolbox' of 48 potential management actions that could be implemented to eliminate, minimise or mitigate each of the threats identified in this review.

In Part Three of this review, site-specific threats that are known, or likely to be occurring, at each of the 36 internationally, nationally and regionally important sites are identified, and recommended management actions are provided to eliminate, minimise or mitigate each of these threats. While we have very little information quantifying the impacts that each of these threats is having on the local survival and productivity of coastal birds at each of these sites, data collected from similar habitats elsewhere in New Zealand shows that, in general, where hedgehogs, cats and mustelids exist, they are the major threat to ground-nesting coastal birds. This review has identified opportunities for TDC to link in with pest control activities being carried out by Predator Free Onetahua, TET, DOC and other groups to improve predator control at a number of these 36 sites. Stricter measures controlling the use of motorised off-road vehicles and dog walking are recommended for a number of sites where the use of these restrictions is considered proportionate to the coastal bird values that are present. However, experience elsewhere in new Zealand has shown that passing bylaws to regulate these activities in the absence of compliance monitoring or enforcement measures is often unlikely to lead

to significant behavioural change. For this reason, for the majority of these 36 sites, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to reduce the adverse impacts of various activities including motorised off-road vehicle use and dog walking in the first instance. Predicted sea level rise caused by human-induced climate change has been identified as a key threat affecting all 36 coastal bird sites, and it is recommended that a comprehensive sea level response plan be developed for the entire network of sites, including the construction of artificial structures such as sand islands, sand banks and or floating platforms to replace key nesting and roosting sites lost to sea level rise. Pest plants such as willow, lupins and gorse are a new threat to some important riverbed sites for coastal birds, such as the Matakitaki River upstream of Horse Terrace. There is a big opportunity to control these weeds before they invade key nesting habitats on unvegetated riverbed gravels.

The results of this review will allow TDC and its partner agencies and stakeholders to prioritise the future delivery of coastal management actions towards those sites that support the most important populations of coastal birds in the Tasman District, and those sites that are being most severely impacted by one or more threats. The delivery of these management actions will in turn contribute towards the implementation of a number of policies in the Tasman Natural Resources Plan, and a number of the actions outlined in both the Tasman Biodiversity Strategy - Te Mana o te Taiao ki te Tai o Aorere and the Waimea Inlet Action Plan.

Keywords: Coastal birds, management actions, shorebirds, Tasman Biodiversity Strategy - Te Mana o te Taiao ki te Tai o Aorere Tasman District, Tasman Natural Resources Plan, threats, Waimea Inlet Action Plan

Introduction

The coastline of the Tasman District provides vital habitat for internationally and nationally important populations of indigenous coastal birds, many of which are ranked as either Nationally Threatened or At Risk under the New Zealand Threat Classification System (Schuckard & Melville 2013; Schuckard & Melville 2019; McArthur *et al.* 2022). These habitats form part of the East Asian-Australasian Flyway, one of the world's nine great migratory bird flyways, which stretches from the Russian far east and Alaska, through East Asia and Australia to the southernmost parts of New Zealand (Bamford *et al.* 2008; Hansen *et al.* 2016). Spanning 23 countries and 120 degrees of latitude, 54 bird species totalling eight million individual birds move along this flyway twice each year, migrating between breeding and wintering habitats that can be separated by as many as 13,000 km (Bamford *et al.* 2008; Hansen *et al.* 2016). Along the Tasman District coastline, species that breed each year in the Russian far east and western Alaska mingle with birds that nest on the South Island's braided rivers as well as those nesting along the Tasman District coastline itself (Schuckard & Melville 2013; Schuckard & Melville 2019; Schuckard & Melville 2022). Each of these species is heavily reliant on habitats within the Tasman District's coastal marine area for foraging, roosting and/or breeding during key times in their annual lifecycles. Furthermore, many of these species are particularly vulnerable to a range of human activities that result in the disturbance, degradation or destruction of these habitats, the consequences of which would likely ripple far beyond the Tasman District coastline, impacting the wildlife values of habitats stretching the entire length of the East Asian-Australasian Flyway (Schuckard & Melville 2013; Schuckard & Melville 2019).

Tasman District Council (TDC) is one of several agencies that have statutory responsibilities relating to the sustainable management of the natural character of the Tasman District's coastline, including its indigenous birds. In order to discharge these responsibilities as efficiently and effectively as possible, TDC needs to maintain a detailed and up-to-date picture of the spatial distribution of indigenous bird values along the Tasman District coastline; an up-to-date understanding of threats to those bird values, and a detailed and carefully prioritised strategy for managing those threats.

Much of our current knowledge of the coastal bird values of the Tasman District coastline is based on over 60 years of shorebird surveys that have been carried out by members of Birds New Zealand (the Ornithological Society of New Zealand). Organised shorebird counts in the Tasman District began at Farewell Spit in 1961, and in 1983 geographical coverage was further expanded to include several additional sites in Golden Bay / Mohua and Tasman Bay / Te Tai-o-Aorere. These counts have been used to describe long-term trends in non-breeding populations of indigenous shorebirds present in the Tasman District, including both Arctic-breeding and internal New Zealand migrant species (Sagar *et al.* 1999; Schuckard & Melville 2013; Riegen & Sagar 2020; Schuckard *et al.* 2020; Schuckard & Melville 2022). Schuckard & Melville (2019) have also used data sourced from Birds New Zealand's *Atlas of bird distribution in New Zealand* scheme to describe broad-scale patterns in the distribution of a wider set of coastal bird species along the Tasman District's coastline. This work was further supplemented by a comprehensive 'snapshot' survey of the summer distribution of coastal birds that was carried out along 288 kilometres of the Tasman District coastline between Port Pūponga and Richmond in December 2020. This survey included large stretches of coastline that had not previously been surveyed as part of Birds New Zealand's national wader count programme, filling some major gaps in our understanding of the population size and distribution of a number of locally-breeding coastal bird species (McArthur *et al.* 2022).

Another key piece of work that has been carried out recently is a review by Melville and Schuckard (2013) of existing threats to shorebird populations in the Tasman District and which provides comprehensive lists of site-specific management actions designed to mitigate these threats. This review was based on Birds New Zealand wader survey data, so focused heavily on a number of internationally important shorebird roost sites that currently form part of Birds New Zealand's national wader count programme (Melville & Schuckard 2013). Recent discussions among Tasman District Council staff and representatives from Birds New Zealand and the Department of Conservation have identified a need to build on this work, given both the ongoing pressures that human activities are placing on the district's coastline, and the additional bird survey work that has filled some significant information gaps in recent years. These stakeholder discussions have identified the following pieces of work which form the three aims of this report:

1. Combine pre-existing summaries[1] of the coastal bird values of the Tasman District with data obtained from additional sources to identify coastal sites that are of international, national and regional importance according to existing criteria

2. To update existing knowledge of the threats acting on the Tasman District's coastal birds and their habitat, and the suite of management tools that are available to eliminate, minimise or mitigate these threats with the aim maintaining and improving habitat quality for the Tasman District's coastal birds

3. To identify those threats that are present at each of the internationally, nationally and regionally important sites for coastal birds in the Tasman District and provide recommended management actions to be implemented at each site to eliminate, minimise or mitigate those threats

The results of this work will provide an information resource to enable statutory agencies, NGOs and community-led conservation groups across the Tasman District to prioritise their collective management actions aimed at maintaining and improving habitat quality of the Tasman District's coastal birds towards those sites that possess the highest bird values, and towards the threats likely to be having the greatest impact on the coastal bird values at each of these sites.

To achieve these aims, this report has been divided into three parts:

Part One of this report combines summaries of the coastal bird values of the Tasman District provided by Schuckard & Melville (2013); Schuckard & Melville (2019); Schuckard & Melville (2022) and McArthur *et al*. (2022) with data obtained from additional sources to identify sites in the Tasman District that are of international, national and regional importance to coastal birds according to existing criteria. Additional data sources used include both published and unpublished papers and reports, data sourced from the New Zealand eBird citizen science database, and unpublished datasets provided by local community-based conservation groups. These data have been summarised on a site-by-site basis and then applied to existing criteria that have been designed to identify bird habitats of international, national and regional importance to create an up-to-date list of sites along Tasman District coastline to be considered high priority sites at which to invest resources aimed at maintaining and improving habitat quality of coastal birds. By doing so, this part of the report will contribute towards the delivery of Policy 9.1 of the Tasman Regional Policy Statement, namely:

[1] Including the summaries found in Schuckard & Melville (2013); Schuckard & Melville (2019) and McArthur *et al.* (2022).

"Council will promote the development of an adequate information base for sustainable coastal management decision-making" (TDC 2001)

This part of the report will also contribute towards the delivery of Method (i)a of Policy 9.6 of the Tasman Resource Management Plan, namely:

"The Council will investigate and collect information on habitats…ecosystems and natural processes that support the natural character of the coastal environment of the District" (TDC 2011).

Part Two of this report reviews both published and unpublished literature and information provided by local subject matter experts from Tasman District Council, the Department of Conservation, Nelson City Council, Birds New Zealand, Forest & Bird, the Tasman Environmental Trust, the Kotahitanga mō te Taiao Alliance, and key community-led conservation groups to identify and summarise the existing threats to shorebird populations that occur along the Tasman District coastline, and to summarise available management tools that could be implemented to eliminate, minimise or mitigate each of these identified threats. The suite of management tools identified includes both statutory tools (i.e., laws, bylaws, policies and rules) and habitat or species management tools (e.g., predator control, fencing, signage, nest minding or relocating) that could be deployed to address each of the threats identified by this review.

Part Three of this report combines the results of Parts One and Two with information provided by local subject matter experts to summarise the threats that occur at each of the internationally, nationally and regionally important coastal bird habitats identified in Part One, and to provide site-specific lists of recommended priority management actions to implement at each site in order to eliminate, minimise or mitigate each of the identified threats.

Parts Two and Three of this report will contribute towards the delivery of Policy 9.6 of the Tasman Resource Management Plan, namely:

"*The Council will preserve the natural character of the coastal environment by protecting:*

c) Ecosystems, especially those including rare or endangered species or communities, or migratory species

Having regard to the:

i) Rarity or representativeness;
ii) Vulnerability or resistance;

…

iv) Interdependence
v) Scientific, cultural, historic or amenity values" (TDC, 2011).

These parts of the report will also contribute towards the delivery of Methods (i)b and (i)c of Policy 9.6 of the Tasman Resource Management Plan, namely:

Method (i)b: "*The Council will assess the extent, location, significance and risks to such areas…and the options available for protection and enhancement"*

Method (i)c: *"The Council will formally establish relative priorities and sequences for the appropriate actions to protect or enhance coastal natural character"* (TDC, 2011).

Definitions

The terms “coastal bird”, “shorebird” and “wader” have considerable overlap in their meanings and are often used somewhat interchangeably in both published and unpublished literature. For the purpose of this review, we define a **coastal bird** as any native bird species that is an obligate or facultative inhabitant of foreshore, intertidal and inshore marine habitats within the coastal marine area during at least one key life stage (e.g., breeding, non-breeding, migration). For the purpose of this review, we have excluded any coastal birds that are ranked as Vagrant under the New Zealand Threat Classification System (Robertson *et al.* 2021). We have also excluded all Procellariiformes (albatrosses, petrels, prions and shearwaters) from this review, as they typically occur in both offshore marine and terrestrial habitats, rather than foreshore, intertidal and inshore habitats. Appendix One contains a list of the resident and migrant coastal bird species that occur in the Tasman District and are therefore covered in this review.

For the purpose of this review, we use the terms **shorebird** and **wader** interchangeably and have adopted the definition provided in Schuckard & Melville (2013), namely that shorebirds or waders are defined as oystercatchers (Haematopodidae), stilts (Recurvirostridae), dotterels and plovers (Charadriidae), and godwits and sandpipers (Scolopacidae). Shorebirds and waders are therefore a subset of the group of birds that we have defined as coastal birds. Again, for the purpose of this review we have excluded any shorebirds / waders that are ranked as Vagrant under the New Zealand Threat Classification System (Robertson *et al.* 2021) or are vagrant to the Tasman District.

Exclusions and limitations

This review identifies and prioritises the management of threats to coastal birds at 36 sites that are of international, national or regional importance for coastal birds in the Tasman District, and as such it only addresses threats and management actions occurring along a relatively small proportion of the Tasman District’s coastline and rivers. The exclusion of the remainder of the coastal marine area and the beds of rivers does not imply that these habitats are of no importance to coastal birds. Rather, this report recommends that management actions be prioritised towards the 36 sites identified in this review as having the highest coastal bird values in the district.

Part One: A review of internationally, nationally and regionally important sites for coastal birds in the Tasman District

1.1 Introduction

Regional Councils in New Zealand have a statutory responsibility under the Resource Management Act (1991) to sustainably manage coastal environments in New Zealand. Under the Resource Management Act, all regional councils and unitary authorities are required to prepare a Regional Coastal Plan that gives effect to the New Zealand Coastal Policy Statement (NZCPS) (DOC 2010). The purpose of these plans is to assist councils in achieving the sustainable management of their coastal environments, by outlining objectives, policies and rules that govern which activities councils will allow, control or prohibit in the coastal environment.

Section 6(c) of the Resource Management Act provides a mechanism that contributes to the sustainable management of coastal sites with high natural values, by directing the Tasman Resource Management Plan (TRMP) to "identify ecosystems and habitats with significant biodiversity values". To meet this requirement, Policy 9.6 of the Tasman Regional Policy Statement (TDC 2001) directs TDC to "preserve the natural character of the coastal environment by protecting:

- Natural features and landscapes, such as headlands and cliffs, coastal plains, estuaries, tidal flats, dunes and sand beaches
- Habitats such as estuaries and wetlands
- Ecosystems, especially those including rare or endangered species or communities, or migratory species"

To achieve this, Policy 9.6 states that TDC will "investigate and collect information on habitats, features, sites, landscapes or seascapes, ecosystems and natural processes that support the natural character of the coastal environment of the District [and will] assess the extent, location, significance and risks to such areas, features, ecosystems or values and the options available for protection or enhancement." Schedule 25D of the TRMP partially implements Policy 9.6 of the Tasman Regional Policy Statement by including a list of 22 sites within the Tasman District coastal marine area that possess "nationally or internationally important natural ecosystem values" that had been identified by the Department of Conservation in 1993 (Davidson *et al.* 1993; TDC 2008).

At least two other strategies guide Tasman District Council's efforts to sustainably manage habitats for coastal birds in the Tasman District. The Te Mana o te Taiao ki te Tai o Aorere Tasman Biodiversity Strategy (TBS) aims to ensure that "the full range of indigenous species and ecosystems natural to Tasman are thriving" and that "people live in harmony with nature". (TDC 2022). Key objectives of the TBS include:

- Native species, especially found nowhere else, are thriving
- Naturally functioning ecosystems are restored and maintained
- Pest plants and animals, and harmful microorganisms are no longer threatening indigenous biodiversity

- Everyone has the support, knowledge and networks they need to take effective action and make informed decisions that protect and restore biodiversity (TDC 2022)

Tasman District Council is also a co-signatory to the Waimea Inlet Management Strategy, which seeks to sustainably manage the natural and ecological values of the South Island's largest enclosed estuary and an internationally important habitat for migratory shorebirds (Anonymous 2010; Davidson 1993; Melville & Schuckard 2013). To implement this strategy, a Waimea Inlet Action Plan has been prepared, which sets out an agreed-upon list of objectives, outcomes, actions and targets to be worked upon by members of the Waimea Inlet Coordination Group, including:

- **Action 5.1.2:** Actively manage all threatened species in the Inlet and its surrounds

- **Action 5.2.1:** Manage human disturbance of wildlife

- **Action 5.2.2:** Reduce the impacts of cats and dogs around the estuary as population pressures increase

- **Action 5.2.3:** Give formal protection to, and manage human activities in, important wildlife areas

- **Action 5.2.4:** Follow recommended actions from *Effects of selected activities on shorebirds in Tasman District - Management issues and options for site of International Importance* David S. Melville and Rob Schuckard (November 2013)

- **Action 5.2.5:** Continue monitoring of populations and site conditions (roosting, nesting, feeding) as part of State of the Environment monitoring to determine the effectiveness of coastal management actions and RMA compliance (Anonymous 2019)

A key theme running through these documents is a need to prioritise biodiversity management activities towards sites that support the best remaining examples of indigenous ecosystems and/or those sites supporting key populations of indigenous species, particularly those that are either endemic to the Tasman District or are ranked as Nationally Threatened or At Risk under the New Zealand Threat Classification System. Doing so will ensure that TDC and its partner organisations and stakeholders will focus their collective resources towards maintaining the biodiversity values of the best remaining habitats for indigenous species and the most important populations of indigenous species in the Tasman District, thereby maximising the biodiversity gains that are achieved.

To effectively prioritise biodiversity management resources in such a manner, TDC and its partner organisations and stakeholders need to maintain a detailed, up-to-date and highly spatially explicit understanding of the distribution of biodiversity values across the region, including identifying the most important habitats for coastal birds in the Tasman District. A number of previous efforts have been made to identify both internationally and nationally important coastal sites for indigenous birds in the Tasman District. For example, the 22 sites with "nationally or internationally important natural ecosystem values" listed in Schedule 25D of the TRMP were identified by Davidson (1993) using the draft criteria for the identification of areas of important conservation value listed in Schedule Two of the (then) draft New Zealand Coastal Policy Statement. These criteria consisted of qualitative descriptions of ecosystem values and lacked quantitative thresholds, therefore "allowing a wide degree of latitude" when using them to identify sites of important conservation value (Davidson 1993).

The ecosystem values data on which this assessment was carried out are now almost 30 years old, so this network of 22 sites may no longer reflect the current distribution of coastal bird values along the Tasman District Coastline (McArthur *et al.* 2022).

More recently, Schuckard & Melville (2013), Schuckard & Melville (2019) and Schuckard & Melville (2022) have sought to update this work by re-assessing sites of international and national importance for coastal birds using data sourced from both the Birds New Zealand national wader survey dataset, and the *Atlas of Bird Distribution in New Zealand 1999-2004* dataset. Crucially, these reports have used quantitative rather than qualitative criteria to identify sites of international and national importance from these two datasets, creating a much more objective and repeatable process for identifying important coastal bird sites along the Tasman District coastline.

Part One of this action plan seeks to update and expand on the work of Schuckard & Melville (2013), Schuckard & Melville (2019) and Schuckard & Melville (2022) by applying a set of quantitative criteria to available bird occurrence data to identify internationally, nationally and regionally important sites for coastal birds in the Tasman District. Since 2019, a great deal of additional, highly spatially-explicit data has been collected describing the distribution and abundance of coastal birds in the Tasman District, including data collected during TDC's December 2020 summer 'snapshot' survey of coastal birds along the Tasman District Coastline (McArthur *et al.* 2022); TDC's 2020-2021 river bird surveys (TDC, *unpublished data*) and a pool of over 109,000 bird occurrence records that have been submitted to the New Zealand eBird database in recent years. These additional datasets, together with the collection of an additional decade of Birds New Zealand national wader survey data, creates a timely opportunity to update our network of previously identified sites of international and national importance for coastal birds in the Tasman District, to ensure that it continues to accurately reflect the current distribution of coastal bird values.

In addition to updating this work, our review seeks to expand on the work carried out by Davidson (1993), Schuckard & Melville (2013), Schuckard & Melville (2019) and Schuckard & Melville (2022) by using quantitative criteria to identify sites of *regional* importance for coastal birds in the Tasman District, in addition to sites of both international and national importance. In recent years, quantitative ecological criteria have been used by a number of regional authorities in New Zealand to identify areas of regionally important indigenous vegetation and important habitats of indigenous fauna. For example, Greater Wellington Regional Council has developed criteria to identify sites possessing indigenous avifauna values that meet thresholds of regional importance for ecological rarity, diversity and ecological context which have been used to identify a network of 51 coastal and freshwater habitats of significance for indigenous birds in the Wellington region for including in Wellington's Proposed Resource Management Plan (GWRC 2015; McArthur 2020). This approach provides a blueprint for undertaking a similar review of sites of regional significance for coastal birds in the Tasman District.

The list of sites produced by this review will provide Tasman District Council, along with other local agencies, NGOs and community conservation groups with a decision-making tool to determine at which sites these groups and agencies should prioritise the investment of time and resources aimed at managing coastal bird values in the Tasman District. By prioritising time and resources towards sites identified as being internationally, nationally or regionally important for coastal bird species, these resources will be directed towards sustainably managing a network of sites containing the highest coastal bird values in the district. In addition, Tasman District Council will also be able to use this list of important sites as evidence underpinning advice provided to other statutory agencies, NGOs and local communities regarding appropriate priority sites for their own management activities.

1.2 Methods

1.2.1 Information sources and threat rankings used for this review

Bird occurrence data describing the distribution, local abundance and regional populations sizes of coastal birds in the Tasman District were collated from the following sources:

- A search of published and unpublished literature
- The Birds New Zealand national wader survey dataset
- The 2020 Tasman District coastal bird survey dataset
- The 2020 – 2021 Tasman District river bird survey dataset
- The New Zealand eBird database (https://ebird.org/newzealand/home)

Among the published and unpublished literature reviewed, a small number of publications were found to be particularly important sources of information describing the local and regional abundance, and local diversity, of coastal birds in the Tasman District. This review builds on three earlier reviews of the coastal bird values of the Tasman District coastline carried out by Schuckard & Melville (2013), Schuckard & Melville (2019) and Schuckard & Melville (2022) and incorporates much of the information describing site-specific bird values contained within these three reports. This review also draws heavily on the results of the 2020 Tasman District coastal bird survey which are summarised in McArthur *et al.* (2022). Information summarising coastal bird values found on the Tasman District's rivers was sourced from Hughey *et al.* (2010) and from the 2020-2021 Tasman District river bird survey dataset (TDC, unpublished data). Hutzler (2015) provides useful information summarising the distribution of a number of cryptic wetland bird species along the Tasman District coastline, and Mohua (Golden Bay) Blue Penguin Trust (2019) was a key source of information describing the distribution of little penguins along the Tasman District coastline.

Four unpublished datasets were of critical importance to this review. The Birds New Zealand national wader count dataset contains shorebird count data from sites along the Tasman District coastline dating back to 1961. These counts have been used to describe long-term trends in non-breeding populations of indigenous shorebirds present in the Tasman District, including both Arctic-breeding and internal New Zealand migrant species, summaries of which have been published in Sagar *et al.* (1999), Schuckard & Melville (2013), Riegen & Sagar (2020), Schuckard *et al.* (2020) and Schuckard & Melville (2022). The 2020 Tasman District coastal bird survey dataset contains bird occurrence data collected during a 'snapshot' survey of the summer distribution of coastal birds carried out along 288 km of the Tasman District coastline in December 2020. Commissioned by Tasman District Council, this survey mapped the summer distribution and abundance of 67 bird species and 25,200 individual birds along the coastlines of Golden Bay / Mohua and Tasman Bay / Te Tai-o-Aorere, the results of which are summarised in McArthur *et al.* (2022). The 2020 – 2021 Tasman District river bird survey contains bird occurrence data for selected river reaches in the Tasman District collected during the summers of 2020 and 2021. Lastly, The New Zealand eBird database[2], which in turn hosts the New Zealand Bird Atlas dataset, is run by the Cornell Lab of Ornithology in partnership with Birds New Zealand. It

[2] http://ebird.org/content/newzealand/

provides a facility for recreational birdwatchers and professional ornithologists to permanently record their bird observations in a standard format and in one centralised location and makes these observations available to researchers, conservation managers and environmental policy makers (Scofield *et al.* 2012). Globally, the eBird database is now the largest and fastest growing biodiversity database in the world, with over 723,000 unique users having so far contributed over 1.1 billion bird records describing the distribution of 98% of the world's bird species (Sullivan *et al.* 2014; https://ebird.org/news/2021-year-in-review, accessed 21/04/2022) and it now includes over 109,400 bird records submitted for the Tasman District (eBird, 2022).

Data describing the presence, local abundance and regional population size of any of the coastal bird species listed in Appendix One of this report were extracted from these sources and summarised on a site-by-site basis in a Microsoft Excel™ spreadsheet. The species threat rankings used in this review are the New Zealand Threat Classification System rankings listed in Robertson *et al.* (2021).

1.2.1 International, national and regional importance criteria used for this review

Sites of international importance for coastal birds in the Tasman District were identified using relevant criteria from the Ramsar Convention on Wetlands, an international treaty for the conservation and sustainable use of wetlands to which New Zealand is a signatory (Ramsar Convention Secretariat 2016). Since coming into force in 1975, over 2,400 sites around the world have been identified as wetlands of international importance using one or more of the nine criteria listed in the convention, including seven sites in New Zealand (Ramsar Convention Secretariat 2021). The use of Ramsar Convention criteria to identify internationally important shorebird habitats has become a widely accepted and applied approach throughout the world (Weller *et al.* 2020).

Two of the nine criteria in the Convention are specific to identifying internationally important sites for waterbirds, and it is these two criteria that we have adopted for use in this review:

- **Criterion 5:** A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds

- **Criterion 6:** A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird. (Ramsar Convention Secretariat 2016)

Sites of national importance for coastal birds in the Tasman District were identified using similar criteria to those used to identify sites of international importance but with the criteria scaled appropriately to be applied on a national scale. This same approach was used previously by Schuckard (2002), Schuckard & Melville (2013) and Schuckard & Melville (2022) to identify sites of national importance to shorebirds in the Tasman District, using criteria first developed by Watkins (1993), namely:

- A site should be considered nationally important if it regularly supports 10,000 or more coastal birds

- A site should be considered nationally important if it regularly supports 1% of the national population of a coastal bird species

Sites of regional importance for coastal birds in the Tasman District were identified using a modified set of criteria originally developed by Greater Wellington Regional Council to identify coastal and freshwater habitats of significance in the Wellington Region (McArthur *et al.* 2015; McArthur 2020). The original purpose of these criteria was to give effect to Section 6(c) of the Resource Management Act (1991) by implementing Policy 23 of the Wellington Region's Regional Policy Statement, namely to "identify ecosystems and habitats with significant indigenous biodiversity values" that meet criteria identifying sites with significant levels of ecosystem representativeness, rarity or ecological diversity (McArthur *et al.* 2015). These criteria were developed by an expert panel of Wellington-based ornithologists and representatives from the Department of Conservation, Greater Wellington Regional Council and Birds New Zealand. The panel used an iterative approach to develop these criteria, testing draft criteria by applying them to a long list of 166 coastal and freshwater sites for which bird values had been summarised, then re-drafting and re-testing criteria until the panel was satisfied that all regionally important coastal and freshwater sites had been identified, based on their collective expert knowledge of the bird values of the Wellington region (McArthur *et al.* 2015). We adopted this iterative approach to adapt these criteria for use in the Tasman District by applying the existing GWRC criteria described in McArthur *et al.* (2015) to the 2020 Tasman District coastal bird survey dataset. The Rarity and Ecological Context criteria both performed well, with each criterion identifying <10% of the 315 individual survey sections as being 'regionally important'. The Diversity criterion however identified >40% of the 315 individual survey sections as being "regionally important", which we considered much too inclusive to be fit-for-purpose in the Tasman District. To meet this criterion, a site must provide seasonal or year-round habitat for four or more Nationally Threatened or At Risk bird species, so we revised this threshold upwards to seven or more Nationally Threatened or At Risk bird species, then re-applied this revised criterion to the 2020 Tasman District coastal bird survey dataset. This revised Diversity criterion performed much better, identifying <10% of the 315 individual survey sections as being "regionally important". The modified criteria used to identify sites of regional importance for coastal birds in the Tasman District in this review were therefore as follows:

- **Rarity**: A site supports ≥5% of the regional population of a Nationally Threatened or At Risk coastal bird species

- **Diversity**: A site provides year-round or seasonal habitat for seven or more Nationally Threatened or At Risk coastal bird species

- **Ecological Context**: A site supports ≥33% of the regional population of a protected[3] (but not Nationally Threatened or At Risk) coastal bird species

1.3.1 Identifying important habitats for coastal birds in the Tasman District

The criteria listed in Section 1.2.1 above were then applied to the coastal bird occurrence data that we had summarised on a site-by-site basis for the Tasman District to identify those sites that meet criteria for being identified as being internationally, nationally and regionally important sites for coastal birds. Summary information for each of the sites identified is provided in Appendix Two of this report. This summary information includes:

[3] The term 'protected' refers to any species granted absolute protection under the Wildlife Act (1953).

- **Site Name:** Identical names are used in Appendix Two and in the associated shapefile delimiting the boundaries of each site, to facilitate cross-referencing

- **Site Location:** Expressed as the NZTM coordinates for the approximate centroid, or geographic centre, of the site

- **Bird Values:** A description of the relevant coastal bird values that meet one or more of the criteria used in this review

- **Importance level:** Specifies whether a site has been identified as internationally, nationally or regionally important for each relevant coastal bird value

- **Age of data:** the year or years during which the bird occurrence data used to assess relevant bird values at each site were collected

- **Data source(s):** A summary of where relevant bird occurrence data have been sourced from

Each of the sites identified as being internationally, nationally or regionally important in this review and listed in Appendix Two below have also been mapped using ArcMap 10.7.1, and a shapefile containing the polygons delimiting the extent and boundaries of each habitat has been provided to Tasman District Council. In this shapefile, the geographic boundaries of these sites were defined using either the geographic boundaries of the bird survey datasets from which the relevant bird data was sourced, or by manually digitising either natural or artificial habitat boundaries between adjacent habitat types, identified using aerial or satellite photographs. For example, the true left and true right boundaries of important habitats in rivers were typically defined as the boundary between terrestrial woody or herbaceous riparian vegetation (typically willows *Salix* spp. or pasture) and the dry gravels or flowing water of the active riverbed. In the case of important habitats in the coastal marine area, Mean High Water Springs (hereafter referred to as MHWS) was used as the default inland boundary, although this was frequently relaxed to include any habitats above MHWS utilised by any bird species included in the bird values description for that site (e.g., high tide roosts or nesting areas situated above MHWS that are likely being used by indigenous birds using adjacent coastal habitats situated below MHWS).

1.2 Results

This review has identified a total of 36 sites of international, national or regional importance for coastal birds in the Tasman District (Table 1.1; Figures 1.1, 1.2 and 1.3; Appendix Two). Thirty-one of these sites are situated in Tasman District's coastal marine area (CMA) and the remaining five sites are situated in the beds of rivers. Eight of these sites (22%) possess bird values assessed as internationally important, five of these sites (14%) possess bird values assessed as nationally important, and 35 of these sites (97%) possess bird values assessed as regionally important. Appendix Two provides a comprehensive summary of the importance level of each of the relevant bird values identified for each site, whereas Table 1.1 lists the 'highest' importance level identified for each site, prioritising bird values of international importance over those of national importance, and prioritising values of national importance over those of regional importance.

The eight sites possessing internationally important coastal bird values identified in this review includes all seven of the internationally important sites identified by Schuckard & Melville (2022), including Farewell Spit which is the sole site in the Tasman District that is recognised as a wetland of international importance under the Ramsar Convention on Wetlands (Ramsar Convention Secretariat 2021). In addition to these seven sites, we have also identified the Abel Tasman National Park coastline as being internationally important, as this site is estimated to support at least 2.8% of the global population of Kawau Tikitiki / Spotted Shags (*Stictocarbo punctatus*). One internationally important site that we identified as part of our review (East Waimea inlet, Bell Island) effectively appears on our list twice, as it is also nested within the larger East Waimea Inlet site identified both in this review, and in the Schuckard & Melville (2022) review. Several of the sites identified as part of this review are nested within larger sites of importance, to ensure that the descriptions of important bird values provided in Appendix Two are as location specific as possible.

All five of the sites possessing nationally important coastal bird values identified in this review also possess one or more internationally important bird values, so all five sites appear as internationally important sites in Table 1.1 to emphasise the 'highest' importance level identified for each site. Similarly, eight of the 34 sites possessing regionally important coastal bird values identified in this review also possess one or more internationally or nationally important bird values, so these eight sites also appear as internationally important sites in Table 1.1.

Table 1.1: List of 36 sites of international, national or regional importance for coastal birds in the Tasman District identified in this review.

Site Number	Site Name	Habitat	Importance Level
1	Abel Tasman National Park coastline	CMA	International
2	Abel Tasman National Park coastline, Awaroa Bay	CMA	Regional
3	Abel Tasman National Park coastline, Bark Bay	CMA	Regional
4	Abel Tasman National Park coastline, Separation Point	CMA	Regional
5	Abel Tasman National Park coastline, Wainui Inlet	CMA	Regional
6	Buller River, Hinemoatū / Howard River confluence to Murchison township	River	Regional
7	Collingwood foreshore	CMA	Regional
8	East Waimea Inlet	CMA	International
9	East Waimea Inlet, Bell Island	CMA	International
10	East Waimea Inlet, Rabbit Island east	CMA	Regional
11	Farewell Spit	CMA	International
12	Kina Beach, Moutere Inlet	CMA	Regional
13	Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	River	Regional
14	Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	CMA	Regional
15	Matakitaki River below Mole Stream confluence	River	Regional
16	Motueka River, lower reach from river mouth to Anderson Rd	River	Regional
17	Motueka River mouth	CMA	Regional
18	Motueka Sandspit	CMA	International
19	Motupipi River mouth	CMA	Regional

Site Number	Site Name	Habitat	Importance Level
20	Pakawau foreshore, Tomatea Point	CMA	International
21	Parapara coastline, Minthorpe to Onekaka Estuary	CMA	Regional
22	Pariwhakaoho River mouth to 2 km north	CMA	Regional
23	Port Pūponga	CMA	Regional
24	Port Tarakohe to Motu Island	CMA	Regional
25	Pūponga coastline, 1 km north to 1 km south of Taupata Stream	CMA	Regional
26	Rangihaeata Spit	CMA	Regional
27	Riuwaka River mouth	CMA	Regional
28	Rototai coastline and adjacent sand islands	CMA	International
29	Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	CMA	International
30	Ruataniwha Inlet sand islands	CMA	Regional
31	Tākaka River mouth and Rangihaeata Head	CMA	Regional
32	Torlesse Rock, Kaiteretere	CMA	Regional
33	Waimea River, plains reach - SH6 to Lower Queen Street	River	Regional
34	West Waimea Inlet	CMA	Regional
35	West Waimea Inlet, O'Connor Creek	CMA	Regional
36	Whanganui Inlet	CMA	Regional

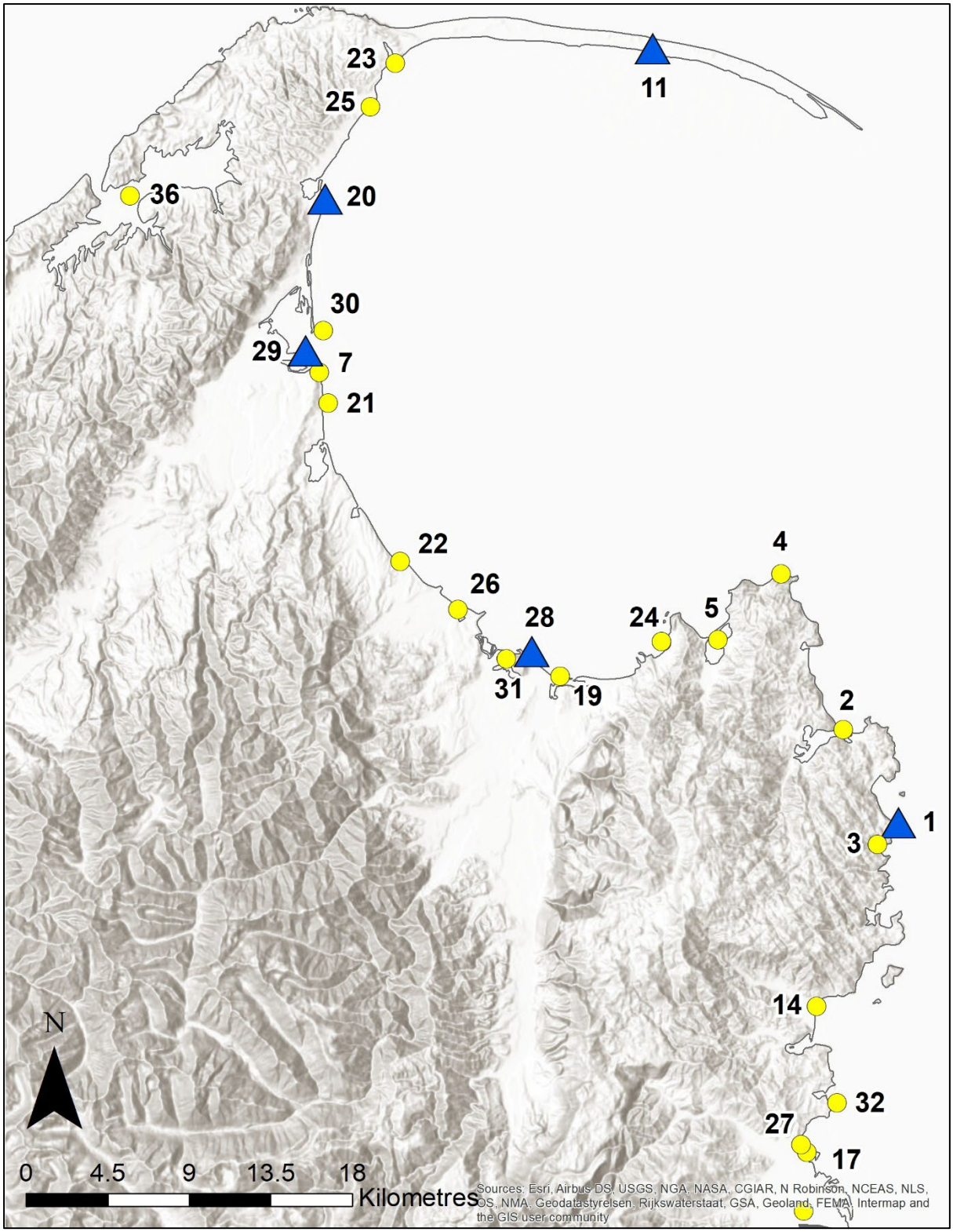


Figure 1.1: Map of sites of international, national and regional importance for coastal birds along the Golden Bay / Mohua and Abel Tasman National Park coastlines, identified in this review. Blue triangles mark the locations of sites of international importance and yellow circles mark the locations of sites of regional importance. Site numbers correspond to those listed in Table 1.1.

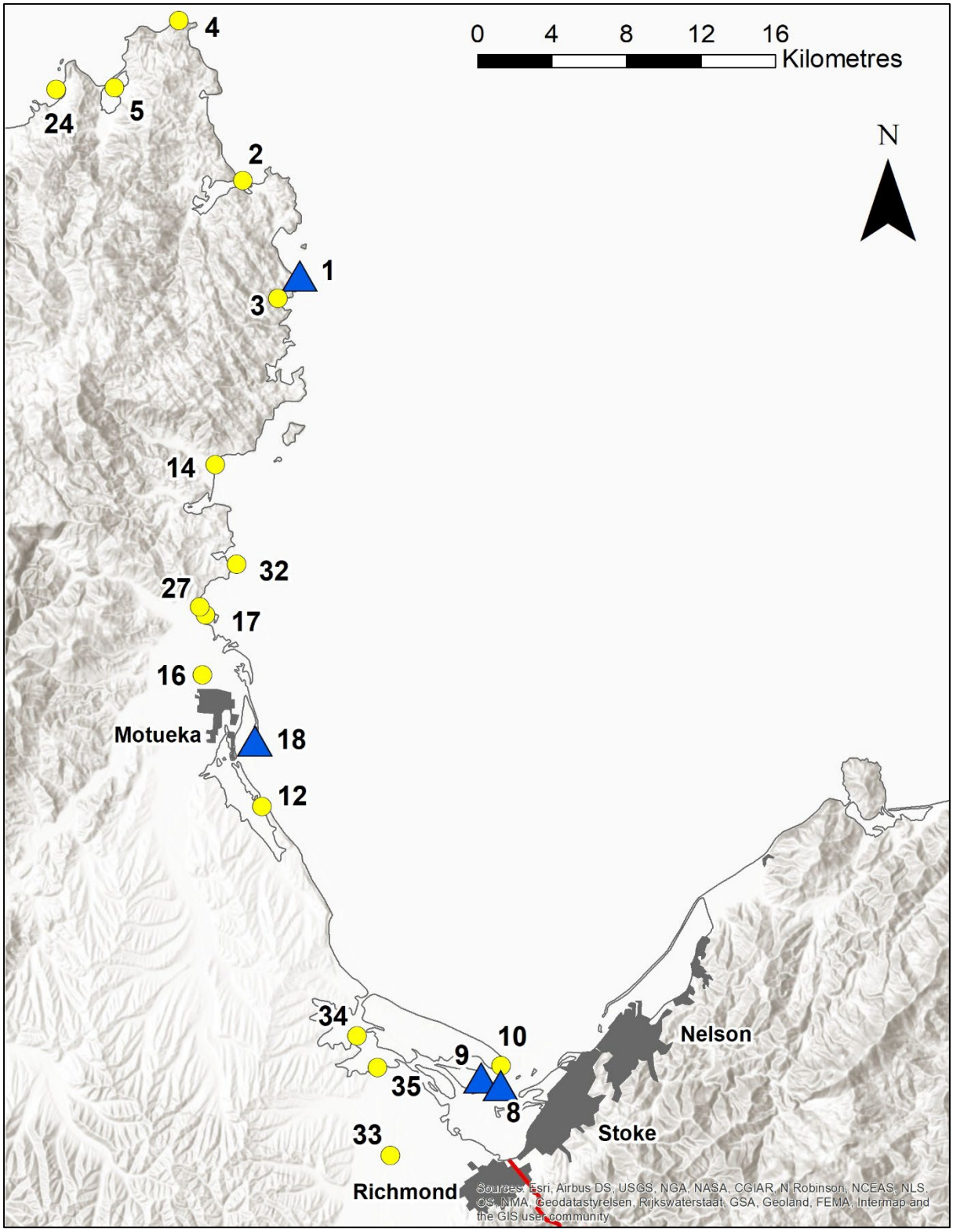


Figure 1.2: Map of sites of international and regional importance for coastal birds along the Tasman Bay coastline, identified in this review. Blue triangles mark the locations of sites of international importance and yellow circles mark the locations of sites of regional importance. Site numbers correspond to those listed in Table 1.1.

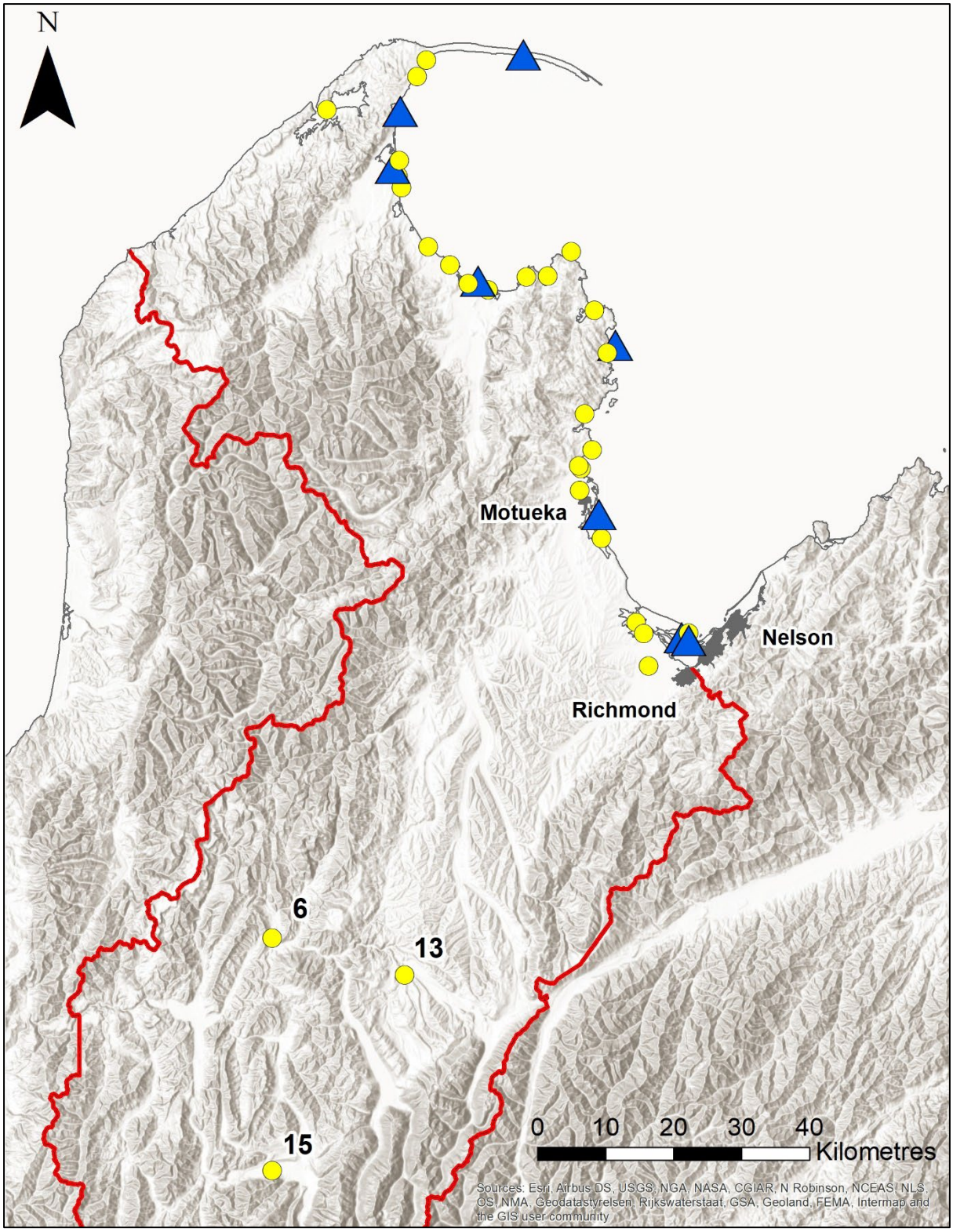


Figure 1.3: Map of sites of international and regional importance for coastal birds in the Tasman District, including the three southernmost sites situated on the beds of rivers. Blue triangles mark the locations of sites of international importance and yellow circles mark the locations of sites of regional importance. Site numbers correspond to those listed in Table 1.1.

Four previous assessments have identified internationally and nationally important sites for coastal birds in the Tasman District since 1993. Davidson (1993) identified 22 internationally and nationally important sites, which are listed in Schedule 25D of the TRMP (TDC, 2008). This assessment has been updated on three occasions by David Melville and Rob Schuckard, who applied Birds New Zealand National Wader survey data to pre-existing quantitative criteria to identify between seven and eight internationally and nationally important sites for coastal birds (Schuckard 2002; Melville and Schuckard 2013; Schuckard and Melville 2022). This review combines the results of Schuckard and Melville (2022) with the first assessment of regionally significant sites for coastal birds in the Tasman District. In comparison to the existing list of sites listed in Schedule 25D of the TRMP, we have assessed five sites as having a higher importance level than is listed in Schedule 25D (East Waimea Inlet, the Motueka Sandspit, Pakawau Inlet, the Rototai coastline and the Ruataniwha Inlet) and eleven sites as having a lower importance level than is listed in Schedule 25D (Mārahau coastline, Moutere Inlet, Onekaka, Parapara Inlet, Port Pūponga, Rangihaeata Spit, Tākāka River mouth, Tata Beach, Wainui Inlet, and West Waimea Inlet and Whanganui Inlet (Table 1.2). Of these eleven sites, three no longer qualify for inclusion in Schedule 25D based on their coastal bird values (Moutere Inlet, Onekaka and Tata Beach). The importance level of one site (Whanganui Inlet) has fallen dramatically from being assessed as being internationally important by Melville and Schuckard (2013) to regionally important in this review. This dramatic change has been driven by a local decline in the number of Kuaka / Bar tailed Godwits using the inlet since 2013. This godwit decline has coincided with a 74% loss of seagrass cover (a loss of 591 ha of seagrass meadows) in the inlet since 2013, although it has not been established whether the two events are linked (Stevens *et al.* 2022). This review also identifies 18 regionally important sites for coastal birds in the Tasman District that aren't listed in Schedule 25D and haven't been identified in any of the previous assessments carried out since 1993.

Table 1.2: Changes in the importance levels of sites of importance for coastal birds in the Tasman District since 1993. Blank cells in the table below signify that either the site was not assessed as part of the relevant review, or that the site had been assessed and did not meet criteria for being of international or national importance. Note, all assessments prior to this review were limited to identifying sites of international and national importance. This review is the first assessment undertaken to identify sites of regional importance for coastal birds in the Tasman District, and the first to include non-coastal sites on the beds of rivers.

Site Name[4]	Importance level					
	Davidson *et al.* (1993)	Schedule 25D, TRMP (TDC 2008)	Schuckard (2002)	Melville & Schuckard (2013)	Schuckard & Melville (2022)	This review
Abel Tasman National Park coastline	International	International				International
Abel Tasman National Park coastline, Awaroa Bay						Regional
Abel Tasman National Park coastline, Bark Bay						Regional
Abel Tasman National Park coastline, Separation Point						Regional
Abel Tasman National Park coastline, Wainui Inlet	National	National				Regional
Buller River, Hinemoatū / Howard River confluence to Murchison township						Regional
Collingwood foreshore						Regional
East Waimea Inlet	National	National	International	International	International	International
East Waimea Inlet, Bell Island	Included in East Waimea Inlet	Included in East Waimea Inlet	International	International	International	International

[4] Note: some site names vary between assessments. Where discrepancies exist, we have adopted the site names used in this review.

Site Name[4]	Importance level					
	Davidson *et al.* (1993)	**Schedule 25D, TRMP (TDC 2008)**	**Schuckard (2002)**	**Melville & Schuckard (2013)**	**Schuckard & Melville (2022)**	**This review**
East Waimea Inlet, Rabbit Island east	Included in East Waimea Inlet	Included in East Waimea Inlet	Included in East Waimea Inlet	Included in East Waimea Inlet	Included in East Waimea Inlet	Regional
Farewell Spit	International	International	International	International	International	International
Kina Beach, Moutere Inlet						Regional
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)						Regional
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	National	National				Regional
Matakitaki River below Mole Stream confluence						Regional
Motueka River, lower reach from river mouth to Anderson Rd						Regional
Motueka River mouth						Regional
Motueka Sandspit	National	National	International	International	International	International
Motupipi River mouth						Regional
Moutere Inlet	National	National				
Onekaka	National	National				
Pakawau foreshore, Tomatea Point	National	National		International	International	International
Parapara coastline, Minthorpe to Onekaka Estuary	National	National				Regional
Pariwhakaoho River mouth to 2 km north						Regional

Site Name[4]	Importance level					
	Davidson *et al.* (1993)	Schedule 25D, TRMP (TDC 2008)	Schuckard (2002)	Melville & Schuckard (2013)	Schuckard & Melville (2022)	This review
Port Pūponga	National	National				Regional
Port Tarakohe to Motu Island						Regional
Pūponga coastline, 1 km north to 1 km south of Taupata Stream						Regional
Rangihaeata Spit	National	National				Regional
Riuwaka River mouth						Regional
Rototai coastline and adjacent sand islands	National	National	International	International	International	International
Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	National	National	International	International	International	International
Ruataniwha Inlet sand islands	Included in Ruataniwha Inlet	Included in Ruataniwha Inlet	Included in Ruataniwha Inlet	Included in Ruataniwha Inlet	Included in Ruataniwha Inlet	Regional
Tākaka River mouth and Rangihaeata Head	National	National				Regional
Tata Beach Estuary	National	National				
Torlesse Rock, Kaiteretere						Regional
Waimea River, plains reach - SH6 to Lower Queen Street						Regional
West Waimea Inlet	National	National				Regional
West Waimea Inlet, O'Connor Creek						Regional
Whanganui Inlet	National	National	National	International		Regional

1.3 Discussion

This review has identified a network of 36 sites along the Tasman District coastline that provides internationally, nationally or regionally important habitat for coastal birds. This network of sites provides Tasman District Council, along with other local agencies, NGOs and community conservation groups with a decision-making tool to determine where along the Tasman District coastline these groups and agencies should prioritise the investment of time and resources aimed at managing coastal bird values in the Tasman District. By prioritising time and resources towards these sites, resources will be directed towards sustainably managing a network of sites containing the highest coastal bird values in the district. In addition, Tasman District Council will also be able to use this list of important sites as evidence underpinning advice provided to other statutory agencies, NGOs and local communities regarding appropriate priority sites for their own management activities.

Many of the sites identified in this review already fall entirely within the network of 22 sites listed in Schedule 25D of the TRMP, but the summaries of the known values of these sites don't always accurately describe their current avifauna values. For example, the summary of values for the Ruataniwha Inlet in Schedule 25D site makes no mention of the fact that the sand island near the mouth of the Ruataniwha Inlet provides breeding habitat for regionally important numbers of gulls and terns, with 50% of the regional breeding population of Tarāpunga / Red-billed Gulls (*Chroicocephalus novaehollandiae*) and 90% of the regional breeding population of Tara / White-fronted Terns (*Sterna striata*) found to be nesting on this shellbank during our survey. Similarly, the summary of values for the Abel Tasman National Park coastline in Schedule 25D omits to mention that this stretch of coastline provides nesting and roosting habitat for internationally important numbers of Kawau Tikitiki / Spotted Shags, with a minimum of 2.8% of the global breeding population of this species recorded along this stretch of coastline during this survey. Given that the list of sites and site summaries included in Schedule 25D of the TRMP no longer accurately reflects the distribution of coastal bird values along the Tasman District coastline, we recommend that the Schedule be updated with the results of this review, to improve TDC's ability to regulate activities along the Tasman District coastline in order to maintain its existing biodiversity values.

A key feature of this review has been the use of both pre-existing quantitative criteria and up-to-date bird occurrence data to identify internationally, nationally and regionally important sites for coastal birds in the Tasman District. This approach provides both an objective method for identifying important habitats for coastal birds and to create an evidential record justifying the identification of each site. Furthermore, this approach is highly repeatable, allowing the network of sites identified in this review to be updated in the future in response to changes to the national NZTCS rankings for the Tasman District's coastal birds, and to the collection of additional bird occurrence datasets. Given the quantity of coastal bird occurrence data being collected by both Birds New Zealand and TDC, and the fact that national NZTCS rankings for New Zealand's birds are currently updated every five years, we recommend that this review also be repeated on a five-year cycle, to ensure that this network of important habitats for coastal birds in the Tasman District remains up to date. This being the case, we recommend that the next review be scheduled to be carried out in mid-2027.

Part Two: A review of threats to coastal birds in the Tasman District and available management tools to address each threat

2.1 Introduction

Part One of this review has identified a network of sites along the Tasman District coastline and along the district's rivers that provides habitat for internationally, nationally and regionally important populations and communities of coastal bird species. In the second part of this review, we summarise information sourced from both published and unpublished literature and from local subject matter experts to list and describe the threats that are known or are considered likely to be impacting coastal bird populations along the Tasman District coastline, and to summarise the available management tools that could be implemented to eliminate, minimise or mitigate each of these identified threats.

All of the Tasman District's large towns are located on the coast or are adjacent to one of the districts larger rivers, placing considerable demand on these habitats for residential and commercial development and for recreation. Key pieces of infrastructure are also located within or adjacent to these coastal and riverine habitats, including major roads, ports, marinas, airports, water treatment plants and flood and coastal protection infrastructure. Furthermore, these habitats are occupied by a range of pest plants and animals and are habitats that are highly vulnerable to the predicted impacts of human-induced climate change.

As a result of these pressures, a high proportion of the coastal bird species that inhabit coastal and riverine habitats in the Tasman District are considered to be at risk of extinction. For example, 39% of the coastal bird species that were recorded during the 2020 Tasman District coastal bird survey are ranked as either Nationally Threatened or At Risk under the New Zealand Threat Classification System (McArthur *et al.* 2022). This situation is by no means unique to the Tasman District however, with similar pressures on coastal habitats and their bird values occurring around the majority of New Zealand's coastline, with similar proportions of Nationally Threatened and At Risk coastal bird species having been recorded during regional coastal surveys that have been carried out in the Wellington and Hawke's Bay regions, and in Nelson City since 2017 (McArthur *et al.* 2019; McArthur *et al.* 2021a; McArthur *et al.* 2021b).

Many of the coastal bird species present in the Tasman District are highly mobile and include both 'internal migrants' which migrate to habitats elsewhere in New Zealand, as well as international migrants which migrate to one or more of 23 other countries along the East Asian - Australasian Flyway for either the breeding or non-breeding season. Given the highly mobile nature of this group of birds, the effective sustainable management of coastal and riverine habitats within the Tasman District will not only help to maintain biodiversity values within the Tasman District, but will also influence the biodiversity values of coastal, riverine and wetlands sites elsewhere in New Zealand, and at sites along the entire length of the East Asian – Australasian Flyway.

A key first step towards maintaining the coastal bird values of the Tasman District is to develop a thorough understanding of all of the threats that are adversely impacting coastal bird populations and to evaluate alternative management actions that could be used to eliminate, minimise or mitigate the threats identified (Lawler *et al.* 2002). Ideally, threats should be identified by monitoring individual local bird populations and by quantifying the degree to which each threat impacts each population's intrinsic rate of growth by reducing either adult survival or reproductive success (e.g., Saunders *et al.*

2018). This approach tends to be very expensive and labour-intensive however, and typically requires several years of work to collect the necessary quantitative data for a given local population. For example, it took four years of intensive nest-success monitoring to quantify the impacts of 14 threats that were adversely impacting the viability of a single breeding population of Pohowera / Banded Dotterels (*Charadrius bicinctus*) on the Eastbourne – Wainuiomata coastline near Wellington (McArthur *et al.* 2021). Carrying out this level of monitoring across all of the local populations of Nationally Threatened or At Risk bird species present in the Tasman District is clearly not feasible, so an alternative approach is required to identify threats impacting coastal bird populations along the entire Tasman District coastline. The purpose of Part Two of this review therefore is to undertake a desktop exercise, reviewing both published and unpublished literature and consulting local subject-matter experts to identify and summarise the existing threats to coastal bird populations in the Tasman District, and to review the suite of available management tools that could be used to eliminate, minimise or mitigate each of these identified threats.

2.2 Methods

We carried out a review of both published and unpublished literature to identify threats to coastal birds in New Zealand, to summarise existing knowledge of the actual or predicted impacts of these threats on New Zealand's coastal birds. We searched for relevant publications by inputting a range of search terms[5] into Google Scholar and the search bars of the *New Zealand Journal of Ecology* and *Notornis.* We also searched the online publications archives of the Department of Conservation and Tasman District Council.

We also contacted local subject-matter experts from Tasman District Council, the Department of Conservation, Nelson City Council, Birds New Zealand, Forest & Bird and the Tasman Environmental Trust to summarise examples of threats known or predicted to be occurring in the Tasman District, and to gain an understanding of the spatial distribution of those threats.

In addition to sourcing information describing threats to coastal birds in the Tasman District, we also summarised information describing available management tools that have been developed to address the threats identified in this review. Information on these management tools was sourced both from our review of the literature and correspondence with subject-matter experts, and includes both statutory tools (e.g., bylaws and resource consent conditions) and habitat or species management tools (e.g., predator control, fencing, signage, nest minding or relocating) that could be deployed to address each of the threats identified in this review.

[5] Search terms used included "coast", "coastal bird", "coastal ecosystem", "coastal and threat", "coastal and values", "river", "river bird", "river and values" and "shorebird".

2.3 Results

This review has identified sixteen threats that are known, likely or predicted to have an adverse impact on coastal bird populations in the Tasman District. These have been categorised into pest animal threats (six threats identified), pest plant threats (two threats identified) and human activity threats (eight threats identified). Each of these threats is summarised below, together with brief descriptions of the suite of management actions that have been developed to eliminate, minimise or mitigate each of these threats.

2.3.1 Pest animals

European hedgehogs

Threat description

European hedgehogs (*Erinaceus europaeus*) are a serious predator of ground-nesting birds in New Zealand, with high rates of nest losses having been recorded in bird populations nesting in both coastal and riverbed habitats throughout the country. For example, trail camera monitoring of Pohowera / Banded Dotterel nests along the Eastbourne – Wainuiomata coastline between 2011 and 2021 has established that hedgehogs are currently the most serious threat limiting Pohowera / Banded Dotterel hatching success along this stretch of coastline. Between 2011 and 2013, 10 out of 15 Pohowera / Banded Dotterel nests (67%) filmed at Lake Kohangapiripiri and Baring Head / Ōrua-pouanui were preyed upon by mammalian predators, and nine of these ten depredated nests (90%) were preyed upon by hedgehogs. Trail camera footage filmed at these nests indicated that hedgehogs were highly effective at locating Pohowera / Banded Dotterel nests, with individual hedgehogs being responsible for multiple nest failures (Figure 2.1; McArthur *et al.* 2021). Similarly, trail camera monitoring of almost 400 Pohowera / Banded Dotterel and Ngutu Pare / Wrybill (*Anarhynchus frontalis*) nests on riverbeds in the MacKenzie Basin in Canterbury in 2016 and 2017 showed that hedgehog depredation accounted for up to 73% of nests that were lost to mammalian predators (Norbury *et al.* 2021).

Although no hedgehog depredation figures are available for any breeding populations of coastal birds in the Tasman District, hedgehogs are both abundant and ubiquitous in coastal and riverine habitats in the Tasman District and are likely to be occurring at similarly high densities to those found in other parts of lowland New Zealand (King 1998). This being the case, we consider it highly likely that ground-nesting coastal birds in the Tasman District will be experiencing similarly high hedgehog nest depredation rates to those observed elsewhere in the country at any site where hedgehogs can gain physical access to their nests. Bird species that are likely to be at particularly high risk to hedgehogs include solitary (rather than colonial) ground-nesters such as Tōrea Pango / Variable Oystercatcher (*Haematopus unicolor*), Pohowera / Banded Dotterel, Poaka / Pied Stilt (*Himantopus himantopus*) and Pīhoihoi / New Zealand Pipit (*Anthus novaeseelandiae*).

Figure 2.1: A Pohowera / Banded Dotterel nest being preyed upon by a European Hedgehog at Pencarrow Head near Wellington. This particular hedgehog had plastic band caught around its neck and was filmed depredating several Pohowera / Banded Dotterel nests at this site over the course of several weeks.

Management options

1. Kill trapping

The primary method used to control hedgehogs in New Zealand is kill trapping. All three sizes of the DOC series predator traps (DOC150, DOC200, and DOC250) have been tested and have passed the National Animal Welfare Advisory Committee (NAWAC) standards for humane kill traps on hedgehogs (Poutu & Warburton 2005). Trapping operations specifically targeting hedgehogs use a variety of baits and lures including canned cat food, peanut butter, dog biscuits soaked in fish oil, liquid fish fertilizer, and rabbit meat (Kavermann *et al.* 2003; Griffiths *et al*. 2015).

A minimum spacing of 100 m between traps is generally recommended for hedgehog control. During the successful eradication of hedgehogs from Rangitoto and Motutapu Islands near Auckland it was found that the original spacing of DOC200 traps set on a 400 x 100 m grid was too sparse to catch all hedgehogs in areas of un-grazed pasture and in thick ground cover. A tighter grid of traps was subsequently established at 100 x 100 m spacing in the un-grazed pasture which was considered adequate to expose all hedgehogs to traps (Griffiths *et al*. 2015).

2. Live cage trapping

Live cage trapping has occasionally been used to catch hedgehogs (Bowie *et al.* 2011) but this method is both labour intensive and expensive due to the requirement to check cages every day when set.

3. Physical barriers

Fences designed to exclude hedgehogs have been used to successfully reduce rates of depredation of shorebird nests (Jackson 2001) and threatened lizards (Reardon *et al*. 2012). Hedgehogs can be excluded by a relatively low (0.4 m high) fence design (Clapperton & Day 2001; Innes *et al*. 2012). However, the value of a cheap, low fence that only excludes hedgehogs is debatable given that such a fence would not exclude other more agile mammalian predators such as cats and mustelids.

Modifying the width and depth of river channels separating gravel islands in riverbeds from the adjacent riverbank has been shown to be effective at excluding hedgehogs from riverine gravel islands and improving the hatching success of shorebird nests (Bell & Connor-McClean 2020). This method is particularly cost-effective when attempting to manage the impacts of hedgehogs on colony-nesting species such as Tarapirohe / Black-fronted Terns (*Chlidonias albostriatus*).

4. Night shooting

Night shooting using a spotlight or thermal imaging scope has occasionally been used to remove hedgehogs on relatively small scales, or to remove neophobic individuals (those reluctant to enter traps). Night shooting was particularly effective at removing the last few hedgehogs on Rangitoto and Motutapu Islands during the recent successful eradication operation (Griffiths *et al*. 2015).

5. Manual removal using hedgehog detector dogs

The Department of Conservation's Te Manuhuna Aoraki project has recently completed a hedgehog removal trail comparing the cost-effectiveness of three control tools (traps, thermal hunting and detection dogs) at removing hedgehogs at Paterson's Terrace tussock drylands site. The results of the trial found that detection dogs were the most cost-effective tool for locating and removing hedgehogs at low densities, whereas trapping had a similar level of cost-effectiveness when hedgehogs occurred at higher densities (DOC, unpublished data). New Zealand currently only has one DOC-certified hedgehog detector dog at present however, so additional dogs will need to be trained and certified before the use of a detector dog becomes a realistic option to control hedgehogs at coastal sites in the Tasman District.

6. Poisoning

No product is currently registered for use to poison hedgehogs in New Zealand. Hedgehogs can potentially be exposed to secondary poisoning or sub-lethal doses of directly consumed bait, however (Dowding *et al.* 2010). Some hedgehogs die during poisoning operations targeting rats (Moss & Sanders 2001), but many survive rodent eradication operations using second generation anticoagulant baits, so follow-up trapping is sometimes required to remove survivors. During the successful multi-species eradication programme on Rangitoto and Motutapu Islands, an estimated 96% of hedgehogs were killed by primary or secondary poisoning following the aerial application of Pestoff 20R bait (0.02% brodifacoum). The remaining hedgehogs were removed with a combination of kill trapping and night hunting using indicator dogs and spotlighting (Griffiths *et al.* 2015).

Box 1: Creating safe nesting islands to reduce hedgehog depredation rates on riverbed-nesting shorebirds

In recent years the Department of Conservation and Environment Canterbury have developed expertise in creating or enhancing gravel islands in braided rivers by excavating artificial channels to separate them from the adjacent riverbank.

Photos of a section of the Waiau Toa / Clarence River before (top) and after (bottom) the creation of an artificial gravel island for nesting Tarapirohe / Black-fronted Terns (Image credit: Baylee Connor-McLean/WMIL).

These islands have been shown to support significantly lower densities of hedgehogs and other mammalian predators, due to the difficulty these animals have in crossing the adjacent river channels. As a result, shorebirds such as Tarapirohe / Black-fronted Terns nesting on these islands experience significantly lower rates of nest depredation by mammalian predators than birds that nest on the adjacent riverbank. The creation of artificial gravel islands could therefore increase the local productivity of shorebird populations and provides an opportunity for commercial gravel extractors to work with local government to improve habitat quality for riverbed-nesting shorebirds by reducing losses caused by mammalian predators.

For more information: Schlesselmann, A-K. V.; O'Donnell, C.F.J.; Monks, J.M. and Robertson, B.C. 2018. Clearing islands as refugia for black-fronted tern (*Chlidonias albostriatus*) breeding colonies on braided rivers. *New Zealand Journal of Ecology 42:* 137-148.

Domestic cats

Threat description

There is a growing awareness in New Zealand that domestic cats (*Felis catus*) are a major threat to a range of indigenous wildlife, wherever important habitats for indigenous wildlife occur in close proximity to residential areas. Domestic cats are emerging as a major challenge for the many projects now underway to restore native biodiversity to New Zealand towns and cities (Kikillus *et al.* 2016). For example, there is a growing body of evidence to suggest that depredation by domestic cats is strongly limiting the ability of a number of indigenous native forest birds, including Pōpokotea / Whitehead (*Mohoua albicilla*), Toutouwai / North Island Robin (*Petroica longipes*) and Tīeke / North Island Saddleback (*Philesturnus rufusater*) to re-colonise forested parks and reserves in Wellington City, following their successful re-introduction to predator-free Zealandia (McArthur *et al.* 2022). Given that many New Zealand towns and cities occur in close proximity to the coast, domestic cats are likely to be major predators of ground-nesting coastal birds in many locations. For example, depredation by domestic cats has been responsible for high rates of Pohowera / Banded Dotterel nest failure at Eastbourne (near Wellington) for several years. During the 2018 - 2019 breeding season, 80% of Pohowera / Banded Dotterel nests were depredated by domestic cats and at least one adult Pohowera / Banded Dotterel was also killed (McArthur *et al.* 2021). Depredation by domestic cats has also caused similarly heavy losses of eggs, chicks and adult Pohowera / Banded Dotterels at a breeding colony at South Bay, Kaikōura over the past eight years (Ailsa Howard, *personal communication*).

Although no domestic cat depredation figures are available for any breeding populations of coastal birds in the Tasman District, domestic cats are likely to be present in both coastal and riverine habitats throughout the Tasman District, with particularly high densities occurring in coastal and riverine habitats adjacent to residential areas. This being the case, we consider it highly likely that ground-nesting coastal birds in these areas will be experiencing similarly high domestic cat depredation rates to those observed at similar sites elsewhere in the country. Both solitary and colonial ground-nesting coastal bird species are likely to be equally at risk of depredation by domestic cats.

Management options

1. Live trapping

Live-capture cage traps can be used to capture, identify and remove domestic cats from the habitats of ground-nesting coastal birds, but the use of these traps is highly labour intensive due to the fact that they need to be checked at least once a day. Cage traps baited with fresh or dried rabbit meat, cat food or fish can be used to catch domestic cats without harming them and the usage and effectiveness of live-capture cage traps may increase over time as more and more domestic cats become microchipped, aiding their identification in the field. Any live-capture cage trapping done in proximity to residential areas should be carried out in consultation with the local community to ensure the operator has the 'social licence' to undertake this activity.

2. Community advocacy

A community education and advocacy campaign can potentially reduce domestic cat depredation rates at sites, either in conjunction with, or instead of, a live-capture cage trapping programme. Community education and advocacy initiatives could include leaflet drops at key times of the year (See Box 2 below), public presentations and workshops and a campaign to encourage local cat owners to microchip their pets, and/or to keep them indoors during key times of the year such as the shorebird nesting season. Encouraging cat owners to microchip their cats or keeping a photographic register of domestic cats that live within 1-2 km of a site at which live-capture cage trapping is being carried out could provide an effective means of identifying captured cats and returning them unharmed to their owners.

3. Bylaws

Local authorities have powers under Sections 145 and 146 of the Local Government Act (2002) and Section 64 of the Health Act (1956) to make bylaws regulating the ownership of domestic cats, including requiring cats to be microchipped, imposing a cap on the number of cats that can be owned and implementing cat curfews. Such bylaws have the potential to reduce the impacts that domestic cats have on coastal birds by reducing the opportunities for cats to roam into the habitats of coastal birds and creating improved opportunities to eliminate the risk of domestic cat by-kill when attempting to trap feral cats.

A number of local authorities have attempted to pass proposed bylaws to regulate the ownership of domestic cats, with mixed results. Proposed bylaws frequently meet strong opposition from both elected councillors and the ratepayers that they represent. For example, in 2021, Tasman District Council prepared a proposed cat management bylaw for consultation requiring that domestic cats in the Tasman District be microchipped. This bylaw was produced in response to submissions to the *Tasman-Nelson Pest Management Plan 2019-29* requesting that TDC does more to manage cat trespass, cat-transferred diseases, domestic-feral cat interactions and threats to native birds. In December 2021, a majority of TDC councillors voted against the proposed bylaw proceeding to consultation however, with councillors instead favouring a “non-regulatory” approach to responsible cat management via education and advocacy. In contrast, in early 2018 Wellington City became the first city in New Zealand to pass a bylaw to make microchipping compulsory for cats, following an intensive consultation process. The new bylaw requires that all domestic cats over the age of 12 weeks must be microchipped, and that the cat's microchip be registered with New Zealand Companion Animal Register.

Box 2: Managing the threat of domestic cats to nesting Pohowera / Banded Dotterels along the Eastbourne Foreshore

For more information: McArthur, N.; Jones, P. and Lees, D. 2021. *Eastbourne - Wainuiomata coastline tūturiwhatu / banded dotterel management strategy 2021-2026.* Unpublished report, Mainland Island Restoration Organisation, Eastbourne.

For the past eleven years, the Eastbourne-based community conservation group MIRO has been managing a small breeding population of Pohowera / Banded Dotterels on the Eastbourne foreshore. During the 2018/2019 breeding season, 80% of monitored nests were depredated by domestic cats, leading MIRO to collaborate with Hutt City Council (HCC) to design and launch an annual domestic cat advocacy and management programme. Each year, a leaflet (see image to left) is distributed to households within a 1 km radius of the dotterel nesting area, providing local cat owners with advice on how they can reduce the risk that their cat will depredate local Pohowera / Banded Dotterel nests. Pohowera / Banded Dotterel nests on the Eastbourne foreshore are monitored using motion-activated trail cameras and any instances of cat predation are followed up by an effort to live-trap the cat involved. Whenever a cat is caught, it is scanned for a microchip and the identity of any microchipped cat is passed on to HCC and the cat's owner is notified. Any captured domestic cats are subsequently released unharmed some distance from the nesting area.

Feral cats

Threat description

Feral cats are known to prey on a wide variety of New Zealand native species including threatened birds and lizards (Gillies, 2001; Wills *et al.* 2003; Reardon *et al.* 2012). Feral cats are a particularly serious predator for ground-nesting birds and have been filmed depredating the nests of a range of ground-nesting bird species inhabiting freshwater wetlands (O'Donnell *et al.* 2015), riverbeds (Sanders & Maloney, 2002; Norbury *et al.* 2021) and coastal habitats (Dowding & Murphy 2001; McArthur *et al.* 2021). For example, nest camera monitoring of riverbed-nesting shorebirds in the Waitaki Basin revealed that feral cats were responsible for 43% of 77 lethal events recorded at 114 Pohowera / Banded Dotterel, 23 Kakī / Black Stilt (*Himantopus novaezelandiae*) and 35 Tarapirohe / Black-fronted Tern nests (Sanders & Maloney, 2002). Similarly, 10% of Pohowera / Banded Dotterel nests monitored at Pencarrow Head near Wellington between 2011 and 2013 were preyed upon by feral cats (Figure 2.2; McArthur *et al.* 2021).

Although no feral cat depredation figures are available for any breeding populations of coastal birds in the Tasman District, feral cats are ubiquitous in both coastal and riverine habitats in the Tasman District (King 1998). This being the case, we consider it highly likely that ground-nesting coastal birds in the Tasman District will be experiencing similarly high feral cat depredation rates to those observed in similar habitats elsewhere in the country. Both solitary and colonial ground-nesting coastal bird species are likely to be equally at risk of depredation by feral cats.

Figure 2.2: Pohowera / Banded Dotterel nest being preyed upon by a feral cat at Pencarrow Head near Wellington.

1. Kill trapping

Kill trapping is the most commonly used method to control feral cats in New Zealand. Four types of kill traps have been tested and passed the National Animal Welfare Advisory Committee (NAWAC) standards for use on feral cats (DOC, 2021), namely:

- Steve Allen conibear traps set in raised wooden cubbies
- Steve Allen conibear traps set under plastic Philproof covers
- Belisle Super-X 220 traps set in a submarine tunnel
- Timms trap set on a raised platform with access ramp

Cat trapping operations sometimes use a variety of kill traps rather than relying on one single design to counteract any avoidance of a particular design by individual cats. Kill traps targeting cats are most often baited with whole or minced rabbit meat, cat pet food, fish or fish oil. The conibear and Belisle style traps require the cat to push or pull the trap trigger while reaching for the bait, while the Timms trap needs the cat to pull on the bait itself to activate the trap. Current DOC best practice for cat trapping recommends that kill traps be positioned 100 - 200 m apart in areas of high cat density.

2. Live trapping

Live capture traps can be very effective for feral cat control but are highly labour intensive due to the fact that these traps need to be checked at least once a day. For this reason, live trapping is often not cost-effective for controlling feral cats over large or remote areas.

Cage traps baited with fresh or dried rabbit meat, cat food or fish are occasionally used to catch feral cats in areas where there is a significant risk of domestic cat by-catch, enabling the operator to selectively remove feral cats and to release domestic cats unharmed. The usage and effectiveness of live-capture cage traps may increase over time as more and more domestic cats become microchipped, aiding their identification in the field.

Live-capture leg-hold traps are frequently used to capture feral cats in more remote locations where there is no risk of domestic cat bycatch. Catch rates using leg-hold traps usually exceed those from kill traps (e.g., Bell & McArthur 2016), possibly because leg-hold traps are more effective at catching neophobic or trap-shy individuals. Leg-hold trapping was the most common method used in successful island cat eradications reviewed by Campbell *et al.* (2011), closely followed by hunting. Leg-hold trapping is labour-intensive, and the operator needs to be skilled in trap placement and the humane euthanasia of trapped animals. Traps need to be checked daily when set, and this requirement limits the number of traps an operator can check in a day. Leg-hold trapping is a good option for pulsed control at key times of the year (e.g., during peak laying or hatching) in combination with ongoing kill trapping. Traps set along linear features such as roads, tracks, fence lines, tree lanes, and waterways reportedly catch well, as do those set against obvious landscape features such as rock outcrops or along established animal trails.

3. Hunting

Night shooting using spotlights or thermal imaging scopes is regularly used to control feral cats at key sites or at key times of the year. Night shooting using a spotlight has been used to reduce densities of feral cats on Ōnoke Spit in Palliser Bay to protect nesting Pohowera / Banded Dotterels and Taranui / Caspian Terns (*Hydroprogne caspia*) (McArthur 2020), and night shooting using thermal imaging scopes has been used at Pencarrow Head to protect nesting Pohowera / Banded Dotterels (McArthur *et al.* 2021). Night shooting can be particularly effective at removing neophobic or trap-shy animals, therefore could usefully supplement an established kill-trapping regime.

4. Poisoning

A best practise method for controlling feral cats using the blood toxicant p-aminopropiophenone (PAPP) has been developed and the toxin has been registered under the trade name of PredaSTOP For Cats (Eason *et al.* 2010; Murphy *et al.* 2011; Eason *et al.* 2014). Registration trials have shown that a high proportion of cats can be killed by placing minced rabbit meat balls laced with PAPP paste into tunnel bait stations. Control using PAPP baits is a tool that delivers a one-off knockdown of feral cats as it does not achieve a long term suppression of cat numbers, however it could be particularly useful for removing trap shy animals. The method is labour intensive as baits have to be made fresh and stations have to be visited at least three times: first to install non-toxic pre-feed; second to install toxic meat balls; and third to remove and dispose of the remaining toxic bait at the end of the operation. Any staff or contractors handling PAPP bait must hold a Controlled Substances Licence with a PAPP endorsement or be working under direct supervision of someone who holds this licence.

Cats have been targeted for many years at Table Hill on Stewart Island in an attempt to protect nesting Tūturiwhatu / Southern New Zealand Dotterels (*Charadrius obscurus obscurus*). Cat control has mainly consisted of a ring of bait station sites circling the breeding area containing fish based polymer baits laced with 0.10% 1080 (Jacques 2012). Rats are also targeted with rodent blocks containing the second generation anticoagulant bromadiolone in the same stations to reduce rat bait take of the cat baits. While cats are primarily targeted with the fish-based bait on Table Hill there is also likely to be some secondary poisoning of cats that have eaten rats or possums that have consumed sufficient quantities of the 1080 or bromadiolone baits. The Pestoff Feral Cat Bait has been used to help eradicate cats from Mayor and Raoul islands, but its use on the mainland of New Zealand has been limited. Any staff or contractors handling 1080 bait must hold a Controlled Substances Licence with a 1080 endorsement or be working under direct supervision of someone who holds this licence.

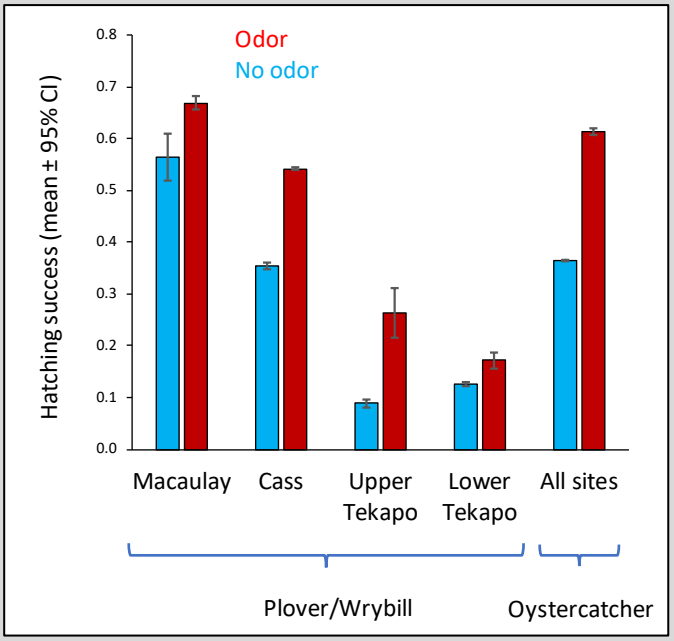
5. Using ‘misinformation’ to alter feral cat foraging behaviour

A recent field experiment carried out by Manaaki Whenua Landcare Research has demonstrated that it is possible to reduce feral cat depredation rates on ground-nesting shorebirds by altering the predators’ foraging behaviour rather than by using more conventional lethal control techniques (see Box 3 below). The approach involves distributing an artificial bird odour across the nesting area of the target shorebird species for several weeks prior to the commencement of nesting. Feral cats foraging in the area learn that the artificial bird odour is not associated with any food resource, so that by the time the target shorebird species begins nesting, cats have

learned to ignore bird odour as a foraging cue and are therefore much less effective at locating shorebird nests. Norbury *et al.* (2021) found that early-season shorebird nests in areas that had been treated with bird odour were 2-3 times more likely to hatch than those situated in areas that hadn't been treated with odour. This method may be particularly useful to protect relatively small shorebird nesting sites (e.g., shingle or sandspits) at which lethal control options are not feasible due to the risk of domestic cat bycatch.

Box 3: Using chemical camouflage to protect shorebird nests from mammalian predators

In New Zealand, reducing the rates at which mammalian predators depredate the nest of threatened shorebirds typically involves the lethal control of those predators using trapping, poisoning or shooting. In recent years, experiments have shown that the foraging behaviour of predators can be modified by presenting them with misleading sensory information, raising the possibility that it may be possible to reduce depredation rates on prey species without needing to resort to the lethal control of their predators. Between 2016 and 2017 researchers from Manaaki Whenua Landcare Research carried out a large-scale experiment deploying an artificial bird odour across riverbed habitats in the MacKenzie Basin to 'camouflage' the nests of Pohowera / Banded Dotterels, Ngutu Pare / Wrybills and Tōrea / SI Pied Oystercatchers (*Haematopus finschi*) from mammalian predators. Artificial bird odour was deployed for several weeks prior to the shorebird nesting season in an attempt to 'train' predators to associate the odour with an absence of any food reward, so that when shorebirds began nesting the predators would ignore bird odour as a foraging cue once the birds began nesting. During the first 25-35 days of the 2016 and 2017 nesting seasons, overall hatching success of early season nests at four treatment sites at which artificial bird odour was deployed was double and triple that of four non-treatment sites, due largely to a reduction in depredation rates by ferrets and feral cats. These results suggest that using artificial and unrewarding bird odour to chemically camouflage shorebird nests can substantially improve shorebird hatching success without the need to lethally control predators. This tool could be particularly useful at sites at which cat depredation is a problem to shorebirds, but where the risk of catching domestic cats is too high to allow the use of lethal control methods such as kill-trapping.



Graph showing the proportion of early season shorebird nests that hatched on riverbed sites with and without artificial bird odour in the MacKenzie Basin during 2016 and 2017. "Plover/wrybill" nests are Pohowera / Banded Dotterel and Ngutu Pare / Wrybill nests; "Oystercatcher" nests are South Island Pied Oystercatcher nests. Graph reproduced from Norbury *et al.* (2021).

For more information: Norbury, G.L.; Price, C.J.; Latham, M.C.; Brown, S.J.; Latham, A.D.M.; Brownstein, G.E.; Ricardo, H.C.; McArthur, N.J.; Banks, P.B. 2021. Misinformation tactics protect rare birds from problem predators. *Science Advances 7*: eabe4164.

Mustelids

Threat description

Mustelids, namely ferrets (*Mustela fero*), stoats (*M. erminea*) and weasels (*M. nivalis*) are known to prey on a wide variety of New Zealand native species and are a major cause of decline in a number of threatened bird species (e.g., O'Donnell *et al.* 1996; McLennan *et al.* 1996; Moorhouse *et al.* 2003; Whitehead *et al.* 2008). Mustelids, particularly ferrets and stoats, are a particularly serious predator for ground-nesting birds and have been filmed depredating the nests of a range of bird species inhabiting freshwater wetlands (O'Donnell *et al.* 2015), riverbeds (Norbury 2002; Norbury *et al.* 2021) and coastal habitats (Dowding & Murphy 2001). For example, depredation by ferrets was responsible for between 15% and 55% of Tarapirohe / Black-fronted Tern nest failures on the Waiau Toa / Clarence River each year between 2012 and 2016 and stoats accounted for a further 1% - 11% of nest failures annually over the same time period (Bell & McArthur 2016). Similarly, out of a sample of almost 400 Pohowera / Banded Dotterel, Ngutu Pare / Wrybill and Tōrea / SI Pied Oystercatcher nests monitored at four sites in the MacKenzie Basin during 2016-2017, 63% of nest depredation events at nests on the Cass and Macaulay Rivers and 18% of depredation events at nests on the Tekapo River were caused by ferrets (Norbury *et al.* 2021).

Mustelid impacts can vary considerably from year to year in response to fluctuations in prey abundance. For example, Norbury *et al.* (2002) found that mustelid depredation rates of Pohowera / Banded Dotterel nests in the Mackenzie Basin increased significantly in the year following crashes in local rabbit populations caused by outbreaks of RHD (Rabbit Haemorrhagic Disease), suggesting that mustelids readily prey-switch when primary prey species become scarce. This result has important implications for the timing of rabbit and rodent control operations and suggests that control operations carried out in the absence of effective mustelid control may have temporary adverse effects on local bird populations.

Although no mustelid depredation figures are available for any breeding populations of coastal birds in the Tasman District, both ferrets and stoats are widespread in both coastal and riverine habitats in the Tasman District, although ferrets may be less common or absent in western parts of the district (King 1998). This being the case, we consider it highly likely that ground-nesting coastal birds in the Tasman District will be experiencing similarly mustelid depredation rates to those observed in similar habitats elsewhere in the country. Both solitary and colonial ground-nesting coastal bird species are likely to be equally at risk of depredation by mustelids.

Management options

1. Kill trapping

The primary method used to control mustelids in New Zealand is kill trapping and a range of kill traps have been tested and have passed the National Animal Welfare Advisory Committee (NAWAC) standards for humane kill traps for ferrets and stoats (Table 2.1; Poutu & Warburton 2005; DOC 2021).

Table 2.1: List of traps that have passed NAWAC standards for humane use on ferrets and stoats ("yes" = passed, "no" = not passed).

Trap name	Ferrets	Stoats
DOC150 in wooden tunnel box	No	Yes
DOC200 in wooden tunnel box	No	Yes
DOC250 in wooden tunnel box	Yes	Yes
BT 200 in wooden tunnel box	No	Yes
Goodnature A24	No	Yes
Victor Professional PCR model	No	Yes
PodiTrap	Yes	No

Kill traps set to catch mustelids can be baited with a range of lures. Fresh rabbit or hare meat are preferred lures used by many professional trappers, followed by salted or dried rabbit meat (Ragg 2010). To target ferrets, a trap density of approximately one trap per 10 ha (or 10 per km^2) is recommended for intermittent annual ferret control operations (Ragg 2010), though many control operations aiming to continually supress ferret and/or stoat numbers use a trap spacing of 100 – 200 m (e.g., see Bell & McArthur 2016).

Fluctuating water levels can flood or wash away traps in riverbeds and coastal wetlands, so this can be a challenge when it comes to installing an effective network of kill traps. Where possible, traps should be positioned on higher or drier ground where they are unlikely to be inundated. In coastal wetlands with little or no water movement, floating trap platforms can be used to prevent traps from becoming inundated with silty water and debris (Figure 2.3; Hill & Antoniak 2007).

Figure 2.3: A floating platform (consisting of a sheet of closed cell foam enclosed by plywood), supporting a double set DOC150 trap tunnel installed in a flood prone site in the Arthur Valley, Fiordland. The platform is tethered by a rope and is designed to float up when the site is inundated, preventing the tunnel filling with silt and mud. The platform settles back down on the ground once flood waters recede with the traps still set and ready to catch (Image credit: DOC).

2. Live trapping

Live capture traps can be very effective for ferret control but are highly labour intensive due to the fact that these traps need to be checked at least once a day. For this reason, live trapping is often not cost-effective for controlling ferrets over large or remote areas.

Live-capture leg-hold traps are regularly used to control ferrets in areas where there is no risk of bycatch. Catch rates using leg-hold traps usually exceed those from kill traps (e.g., Bell & McArthur 2016), possibly because leg-hold traps are more effective at catching neophobic or trap-shy individuals. Leg-hold trapping is labour-intensive, and the operator needs to be skilled in trap placement and the humane euthanasia of trapped animals. Traps need to be checked daily when set, and this requirement limits the number of traps that an operator can check in a day. Leg-hold trapping is a good option for pulsed control at key times of the year (e.g., during peak laying or hatching) in combination with ongoing kill trapping. Traps set along linear features such as roads, tracks, fence lines, tree lanes, and waterways reportedly catch well, as do those set against obvious landscape features such as rock outcrops or along established animal trails.

3. Poisoning

A best practise method for controlling stoats using the blood toxicant p-aminopropiophenone (PAPP) has been developed and the toxin has been registered under the trade name of PredaSTOP For Stoats (Dilks *et al.* 2011; Eason *et al.* 2014). Registration trials have shown that a high proportion of stoats can be killed by placing minced rabbit meat balls laced with PAPP paste into tunnel bait stations. Control using PAPP baits is a tool that delivers a one-off knockdown of stoats as it does not achieve a long term suppression of stoat numbers, however it could be particularly useful for removing trap shy animals. The method is labour intensive as baits have to be made fresh and stations have to be visited at least three times: first to install non-toxic pre-feed; second to install toxic meat balls; and third to remove and dispose of the remaining toxic bait at the end of the operation. Any staff or contractors handling PAPP bait must hold a Controlled Substances Licence with a PAPP endorsement or be working under direct supervision of someone who holds this licence.

Studies have shown that mustelids can be killed through secondary poisoning during aerial 1080 operations (Alterio 1996; Heyward & Norbury 1999; Gillies & Pierce 1999), delivering a timely knock-down of these apex predators at a time when densities of their primary prey species (rabbits or rodents) are also low. However, this secondary poisoning cannot be relied upon to provide ongoing predator suppression as new animals will quickly reinvade the treatment area.

4. Using 'misinformation' to alter mustelid foraging behaviour

A recent field experiment carried out by Manaaki Whenua Landcare Research has demonstrated that it is possible to reduce mustelid depredation rates on ground-nesting shorebirds by altering the predators' foraging behaviour rather than by using more conventional lethal control techniques (see Box 3 above). The approach involves distributing an artificial bird odour across the nesting area of the target shorebird species for several weeks prior to the commencement of nesting. Mustelids foraging in the area learn that the artificial bird odour is not associated with any food resource, so that by the time the target shorebird species begins nesting, mustelids have learned to ignore bird odour as a foraging cue and are therefore much less effective at locating shorebird nests. Norbury *et al.* (2021) found that early-season shorebird nests in areas that had been treated with bird odour were 2-3 times more likely to hatch than those situated in areas that hadn't been treated with odour. This method may be useful to protect relatively small shorebird nesting sites (e.g., shingle or sand spits) at which lethal mustelid control options are not feasible due to the risk of bycatch.

Rabbits

Threat description

Rabbits (*Oryctolagus cuniculus*) can have both direct and indirect impacts on ground-nesting coastal birds. Rabbits can directly impact ground-nesting coastal birds by disturbing and trampling nests. For example, during trail camera monitoring of Pohowera / Banded Dotterel nests along the Eastbourne – Wainuiomata coastline near Wellington rabbits have frequently been filmed disturbing incubating Pohowera / Banded Dotterels from their nests at night and have been filmed almost trampling dotterel eggs on several occasions (McArthur *et al.* 2021). The indirect impacts of rabbits are likely to be even more severe however, with high rabbit densities tending to support higher densities of mammalian predators including feral cats and mustelids. Furthermore, any sudden decreases in the abundance of rabbits can lead to substantial increases in nest depredation rates for ground-nesting shorebirds as a result of feral cats and mustelids pre-switching from rabbits to shorebirds (Norbury & Heyward 2008).

Management options

1. **Night shooting**

Night shooting can be highly effective at quickly reducing rabbit populations at relatively small sites; for mopping up the survivors of poisoning operations or to hold rabbit populations at low levels following a poisoning operation, to extend the interval between operations.

2. **Burrow fumigation**

Fumigation is a relatively labour-intensive method for controlling rabbits, so is best used to control rabbits at relatively small sites, or to mop up the survivors of a poisoning operation. Fumigation is also a very effective method of controlling young rabbits which don't wander far from their burrows. When a fumigant such as Magtoxin is introduced to a burrow system, it produces toxic fumes which are inhaled by the rabbits, causing death by absorption through the lungs. To effectively fumigate a rabbit warren, you need to be able to identify and seal off all burrow entrances. Fumigation can be carried out at any time of the year, but it has the greatest long-term effect if done shortly before the commencement of the rabbit breeding season (i.e., late winter to early summer).

3. **Poisoning**

A poisoning operation is generally the best option for controlling rabbits over large areas (>2000 ha), or in areas which are difficult to access. Autumn-winter is usually considered the optimum time to do rabbit control using poison baiting as this is the time of year that rabbit populations are at their lowest prior to breeding, and food is less abundant (NPCA 2012). Poison options typically involve carrying out 1 – 2 pre-feeding operations broadcasting non-toxic baits consisting of chopped carrot, oats, or cereal pellets across the control area, followed by a poison operation

broadcasting the same baits which have been laced with either 1080 or pindone (NPCA 2011). A pre-fed 1080 or pindone cereal pellet operation targeting rabbits would also have the added benefit of controlling some possums and rats through primary poisoning and reducing numbers of mammalian predators such as feral cats and mustelids through secondary poisoning (McIlroy & Gifford 1992; Gillies & Pierce 1999; Heyward & Norbury 1999).

Southern Black-backed Gulls

Threat description

There is a growing body of evidence demonstrating that Karoro / Southern Black-backed Gulls (*Larus dominicanus*) can be significant predators of other coastal bird species, including Tarāpuka / Black-billed Gulls (*Chroicocephalus bulleri*) and Tarapirohe / Black-fronted Terns (Figure 2.4; Steffens *et al.* 2012; Thierry *et al.* 2016; Schlesselmann 2018) . For example, recent trail camera monitoring of Tarapirohe / Black-fronted Tern nests on the lower Waitaki River found that Karoro / Southern Black-backed Gulls were responsible for 62.5% of filmed depredation events (Schlesselmann 2018). The impacts of Karoro / Southern Black-backed Gull depredation can be very severe and can lead to total nesting failure at colonies of other coastal bird species. For example, in the late 1980s, Karoro / Southern Black-backed Gulls were observed depredating eggs from a Tara / White-fronted Tern colony situated on shellbanks near Bowentown in the Bay of Plenty and causing the failure of all 180 nests in the colony (Biswell 2005). Karoro / Southern Black-backed Gull impacts are likely to be highest when the nesting colonies of Karoro / Southern Black-backed Gulls and those of other ground-nesting coastal bird species are situated in close proximity (Mischler & Bell 2016). Although Karoro / Southern Black-backed Gulls are a native species, they have benefited substantially from the human settlement of New Zealand, and their numbers are now substantially higher than at any time prior to European settlement (Heather & Robertson 2015). As a result, Karoro / Southern Black-backed Gulls are one of the few native bird species that is not afforded any level of protection under the Wildlife Act (Miskelly 2014).

Karoro / Southern Black-backed Gulls are abundant and widespread in coastal and riverine habitats in the Tasman District (eBird, 2022; Tasman District Council, unpublished data) and do nest in close proximity to other colony-nesting coastal birds. For example, a large Karoro / Southern Black-backed Gull nesting colony situated on a sand island near Rototai is positioned in close proximity to regionally important nesting colonies of Tarāpuka / Black-billed Gull, Tarāpunga / Red-billed Gull, Taranui / Caspian Tern and Tara / White-fronted Tern colonies (McArthur *et al.* 2022; TDC, unpublished data). Given the abundance of Karoro / Southern Black-backed Gulls in the Tasman District, and the presence of a number of coastal bird species known to be vulnerable to Karoro / Southern Black-backed Gull depredation, we that there is a risk that ground-nesting coastal birds in the Tasman District could be experiencing similarly high Karoro / Southern Black-backed Gull depredation rates to those observed in similar habitats elsewhere in the country.

Figure 2.4: Karoro / Southern Black-backed Gull depredating a Tarapirohe / Black-fronted Tern nest on the lower Waitaki River. Image reproduced from Schlesselmann (2018).

Management options

1. Poisoning

Karoro / Southern Black-backed Gulls are regularly controlled by poisoning adult birds at nesting colonies using Alpha Chloralose, a narcotic which is widely used in neuroscience and veterinary medicine as an anaesthetic and sedative (Silverman & Muir 1993). Prior to a poisoning operation being carried out, operators first do a reconnaissance of the nesting colony to determine the area, size and distribution of the colony; assess surrounding land use, and to estimate the timing of peak incubation. Poisoning operations are ideally carried out during peak incubation when the maximum number of gulls are sitting on eggs and are strongly anchored to their nests, thus helping to reduce the dispersal of gulls after poisoning. Performing a poisoning operation during peak incubation will also reduce the number of chicks needing to be humanely euthanised and reduces the risk of by-kill (non-target bird species are less likely to enter Karoro / Southern Black-backed Gull colonies during incubation. To achieve the best results when using Alpha Chloralose, pre-feeding the birds with non-toxic bread baits is crucial to condition the gulls to the same type of bait that is going to be used to carry the toxin. Pre-feeding should be carried out for 3-5 consecutive days prior to the Alpha Chloralose baits being laid out, so that the gulls become accustomed to human presence and readily eat the toxic baits when they are laid out. After a period of pre-feeding, bread baits 'buttered' with Alpha Chloralose paste should be laid throughout the colony during calm weather, as windy conditions may blow poisoned gulls away

from the colony before dying, making the recovery of carcasses laborious. As Alpha Chloralose is more effective at lower temperatures, toxic baits should ideally be laid out as close to dawn or dusk as possible. Prior to carrying out an Alpha Chloralose poisoning operation, the appropriate permissions and Approved Handler Test Certificates are needed for the operation and poison handling. Adjacent landowners to the control site should be notified prior to the control operation, in case any poisoned gulls stray onto adjacent properties. Appropriate warning signage should also be installed at all public access points prior to the Alpha Chloralose operation and should remain in place until all toxic baits and poisoned gulls are retrieved.

2. Shooting

Karoro / Southern Black-backed Gulls have also commonly been controlled by shooting. Shooting has two advantages over poisoning, namely that shooting is not as weather-dependent as poisoning, nor is it reliant on a large number of workers to carry out a successful control operation. Prior to a shooting operation, monitoring needs to be carried out within the operational area to assess Karoro / Southern Black-backed Gull activity (i.e., identify feeding zones, nest sites, roost sites etc.), to determine the stage of breeding, and to estimate the number of gulls present. Shooting operations should be timed to be carried out during peak incubation, when the maximum number of gulls are sitting on eggs and when the first chicks are hatching. During this period the parent gulls are most protective, their instincts keeping them in close proximity to the nest site, making for the most productive shooting. Carrying out a shooting operation before large numbers of chicks are present also reduces the number of chicks that need to be humanely euthanised. Several methods can be used during a shooting operation to draw gulls to the shooter, especially when nests are scattered over a large area. One approach can be to pre-feed at the site beforehand to habituate the gulls into being attracted to a known feeding site. Another approach is to repeatedly leave and re-enter the operational area, to trigger new outbreaks of activity giving additional opportunities to target gulls. Shooting has less potential risk to non-target species, as the shooter identifies each gull shot. Further, shooting requires no specific permissions or consents, other than operators having a valid firearms licence.

3. Egg sterilisation

Long-term control of Karoro / Southern Black-backed Gull populations can also be achieved by sterilising eggs to reduce productivity. While this method will eventually lead to long-term population declines, many years of effort may need to be invested before a significant population reduction is achieved. When sterilising eggs, considerable care needs to be taken to keep eggs and nests intact, as this will help prevent the incubating gulls from recognising that their eggs are no longer viable and laying replacement clutches. Although this method is labour intensive, requiring frequent visits to a breeding colony over a period of years, it is often viewed by the public as a more humane, and therefore preferable approach to poisoning or shooting adult birds.

Eggs can be sterilised either by puncturing, shaking, pricking or oiling them. Egg puncturing is carried out by using a heavy-gauge needle to puncture the eggshell and membrane. Egg shaking involves vigorously shaking eggs to displace and rupture the internal membranes. Egg pricking is done by using a hypodermic needle to inject eggs with a preservative such as formalin which both kills the embryo and preserves the egg. Egg oiling involves completely coating the egg in a thin

film of non-toxic mineral oil (e.g., paraffin oil) or vegetable oil, preventing gas exchange through the eggshell and suffocating the embryo.

2.3.2 Pest plants

Pest plants in coastal habitats

Threat description

Environmental weeds including Marram (*Ammophila arenaria*), Horned Poppy (*Glaucium flavum*) and Boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*) invade sparsely vegetated sandy and gravel beaches and can reduce the total area and quality of habitat available for ground-nesting shorebirds such as Tōrea Pango / Variable Oystercatchers and Pohowera / Banded Dotterels. Furthermore, dense stands of woody weeds provide shelter and cover for mammalian predators, so likely contribute to higher depredation rates on breeding shorebirds (O'Donnell & Moore 1983; Robertson *et al.* 1984; O'Donnell 1992; Hughey & Warren 1997 and Rebergen *et al.* 1998).

At Pencarrow Head near Wellington for example, a dense infestation of Hare's Foot Trefoil (*Trifolium arvense*) which established on raised gravel beaches used by nesting Pohowera / Banded Dotterels rapidly spread to occupy almost 10,000 square metres of gravel beach habitat, reducing the total area of available Pohowera / Banded Dotterel nesting habitat by almost 20% (Figure 2.5; McArthur & Lees 2019).

Figure 2.5: A dense infestation of Hare's Foot Trefoil covering a raised gravel beach at Pencarrow Head near Wellington.

Management options

1. Herbicide treatment

Treatment with herbicide is usually the most cost-effective option for controlling large infestations of environmental weeds in coastal areas, however a number of issues need to be taken into consideration. Firstly, although the proper application of an appropriate herbicide will be highly effective at killing large weed infestations, the standing crop of dead vegetation may take some time to break down, and in the meantime will continue to reduce habitat quality for ground-nesting shorebirds. For this reason, treatment of weed infestations with herbicide may not deliver rapid improvements in habitat quality for shorebirds. Secondly, herbicide application should ideally be carried out prior to the shorebird nesting season to avoid disturbing nesting shorebirds or exposing them to toxic herbicides. Should it be necessary to treat weed infestations with herbicide during the shorebird nesting season, the treatment area should first be surveyed to locate active nests or broods of chicks and an application method should be chosen that gives the operator a high level of control over where herbicide is broadcasted (e.g., knapsack or gun-and-hose spraying). If using a gun-and-hose rig, extreme care needs to be taken to ensure that the trailing hose is not accidentally dragged across active nests, or through any areas occupied by young chicks.

2. Mechanical removal

Environmental weeds can physically uprooted or ploughed into the surface gravels using machinery. Although this is a relatively expensive option, it is effective at a range of spatial scales and has the major advantage of achieving an immediate reduction in total weed cover. Because the mechanical removal of weeds causes such an immediate reduction in weed cover, careful consideration needs to be given to whether or not the removal of this weed cover will exacerbate rates of coastal erosion. If so, weed infestations may need to be removed in a series of stages, with each successive treatment area being re-planted with appropriately eco-sourced indigenous species before the next stage of weed removal commences.

3. Hand-weeding

Hand-weeding infestations of environmental weeds is usually too labour intensive to be attempted on anything other than a small scale, however it may be a useful option for quickly weeding very small areas (for example to clear small shingle or sandspits used by colonial nesters such as Tarāpuka / Black-billed Gulls), or for selectively weeding larger areas in which mechanical removal or herbicide use is not an option due to the presence of native vegetation or active shorebird nests. Hand-weeding should ideally be carried out prior to the shorebird nesting season to avoid disturbing nesting shorebirds. If hand-weeding needs to be carried out during the breeding season, the area should first be surveyed to locate any shorebird nests or broods of chicks, and hand-weeding should then be carried out in a series of short sessions to minimise disturbance to nesting shorebirds.

Pest plants in riverbed habitats

Threat description

Environmental weeds such as Broom (*Cytisus scoparius*), Gorse (*Ulex europaeus*), Tree Lupin (*Lupinus arboreus*) and Willow (*Salix* spp.) are particularly invasive in braided river habitats and pose a significant threat to shorebird populations (O'Donnell & Moore 1983; Brown 1999). Environmental weeds reduce the total area of open gravel habitats available to nesting shorebirds and are also likely to increase the channelisation of the river, leading to the loss of minor braids and gravel islands which provide particularly high quality shorebird foraging and nesting habitat. Furthermore, dense stands of woody weeds provide shelter and cover for mammalian predators, so likely contribute to higher depredation rates on breeding shorebirds (O'Donnell & Moore 1983; Robertson *et al.* 1984; O'Donnell 1992; Hughey & Warren 1997 and Rebergen *et al.* 1998).

On the lower reaches of the Ashburton River/Hakatere for example, weed encroachment has been steadily worsening since the early 1980s (Figure 2.6). O'Donnell (1992) observed that there had been a "considerable increase in the extent and encroachment of introduced shrubs, particularly broom, gorse and…willows" on the river between 1981 and 1990. Since the early 1980s, shorebird numbers have steadily declined on the river as weed encroachment has worsened, although shorebird numbers temporarily bounce back following major flood events that clear woody vegetation from large areas of riverbed (O'Donnell 1992).

Figure 2.6: Extensive Tree Lupin infestation and prospecting Tarāpuka / Black-billed Gulls on the Ashburton River/Hakatere near the SH1 Bridge in late September 2015. Image credit: Edith Smith/Forest & Bird.

Management options

1. Herbicide treatment

Treatment with herbicide is usually the most cost-effective option for controlling large infestations of environmental weeds on the beds of rivers, however a number of issues need to be taken into consideration. Firstly, although the proper application of an appropriate herbicide will be highly effective at killing large weed infestations, the standing crop of dead vegetation may take some time to break down, and in the meantime will continue to reduce habitat quality for riverbed-nesting shorebirds. For this reason, treatment of weed infestations with herbicide may not deliver rapid improvements in habitat quality for shorebirds. Secondly, herbicide application should ideally be carried out prior to the shorebird nesting season to avoid disturbing nesting shorebirds or exposing them to toxic herbicides. Should it be necessary to treat weed infestations with herbicide during the shorebird nesting season, the treatment area should first be surveyed to locate active nests or broods of chicks and an application method should be chosen that gives the operator a high level of control over where herbicide is broadcasted (e.g., knapsack or gun-and-hose spraying). If using a gun-and-hose rig, extreme care needs to be taken to ensure that the trailing hose is not accidentally dragged across active nests, or through any areas occupied by young chicks.

2. Mechanical removal

Environmental weeds can physically uprooted or ploughed into the surface gravels using machinery. Although this is a relatively expensive option, it is effective at a range of spatial scales and has the major advantage of achieving an immediate reduction in total weed cover. To reduce costs, mechanical weed control can be combined with other river management activities such as commercial gravel extraction or flood mitigation activities (see Box 5 below), or island engineering work (see Box 1 above).

3. Hand-weeding

Hand-weeding infestations of environmental weeds is usually too labour intensive to be attempted on anything other than a small scale, however it may be a useful option for quickly weeding very small areas (for example to clear small gravel islands used by colonial nesters such as Tarāpuka / Black-billed Gulls), or for selectively weeding larger areas in which mechanical removal or herbicide use is not an option due to the presence of native vegetation or active shorebird nests. Hand-weeding should ideally be carried out prior to the shorebird nesting season to avoid disturbing nesting shorebirds. If hand-weeding needs to be carried out during the breeding season, the area should first be surveyed to locate any shorebird nests or broods of chicks, and hand-weeding should then be carried out in a series of short sessions to minimise disturbance to nesting shorebirds.

Box 4: Flood mitigation activities and weed suppression on riverbeds

Regional Councils and unitary authorities have statutory responsibilities for flood and erosion mitigation under Section 30 of the Resource Management Act (1991) and Sections 10 and 126 of the Soil Conservation and Rivers Control Act (1941). To meet these responsibilities, councils carry out a range of flood mitigation activities on rivers such as building stopbanks, planting willow and managing gravel volumes within active river channels. Some of these activities, notably gravel extraction and gravel "ripping" or "raking" (using machinery to breaking up the armoured surface of dry gravel beaches and islands to mobilise gravels during floods and freshes) involve turning over large areas of the surface gravels on the beds of rivers. This mechanical disturbance of surface gravels can substantially reduce woody weed cover, greatly improving habitat quality for riverbed-nesting shorebirds. Provided the risks that these activities pose to nesting shorebirds are adequately managed (most regional councils either concentrate these activities during the non-breeding season, or carry out pre-works surveys to locate shorebird nests prior to gravel extraction or beach raking activities), these activities could therefore result in a net improvement in habitat quality for riverbed-nesting shorebirds.

For example, annual shorebird surveys carried out along 290 km of braided rivers in Hawke's Bay between 2018 and 2021 found that there was a negative relationship between Pohowera / Banded Dotterel densities and woody weed cover, and that sections of riverbed that had been subjected to beach raking within five months of the survey being carried out had significantly lower woody weed cover and significantly higher Pohowera / Banded Dotterel densities compared to section of riverbed that had not been subjected to beach raking.

This result shows that there is an opportunity for regional councils to work with commercial gravel extractors and contractors engaged to carry out flood mitigation works on the beds of rivers to work together to suppress woody weeds and to improve habitat quality for riverbed-nesting shorebirds.

Gravel extraction site on the Waipawa River, Hawke's Bay, showing the complete removal of environmental weeds within the extraction area.

For more information: McArthur, N. 2020. *A pilot analysis of the impacts of beach raking on riverbed vegetation and banded dotterel densities on Hawke's Bay rivers*. Client report prepared for Hawke's Bay Regional Council, Napier.

2.3.3 Human activities

Human-induced climate change

Threat description

A high proportion of the Nationally Threatened and At Risk coastal bird species present in the Tasman District have been assigned the new "Climate Impacts" qualifier recently added to the New Zealand Threat Classification System (McArthur *et al.* 2022; Robertson *et al.* 2021; Rolfe *et al.* 2021). This new qualifier is designed to identify taxa that are, or are predicted to be, adversely affected by long-term human-induced climate trends and/or extreme climatic events, including extended periods of abnormal rainfall or sunshine hours, short-duration extreme weather events, and gradual changes to sea level and average temperatures. The assignment of the Climate Impact qualifier to a taxon indicates a need for more in-depth research, ongoing monitoring of climate impacts, and potentially a climate change adaptation plan for the taxon (Rolfe *et al.* 2021). The fact that so many of the coastal bird species present in the Tasman District have been assigned this qualifier highlights the high degree of vulnerability that many of the Tasman District's coastal bird species have to the impacts of human-induced climate change. One conspicuous impact of human-induced climate change is that sea levels are predicted to rise significantly over the next century. The Intergovernmental Panel on Climate Change Fifth Assessment Report estimates that global mean sea levels will rise by up to 0.98 m above current levels by the year 2100, assuming unmitigated growth in carbon emissions over that time (Church *et al.* 2013). However, a more recent survey of climate scientists has estimated that global mean sea levels could rise by up to 1.32 m over the same period (Horton *et al.* 2020). Even more recent modelling carried out by the NZ SeaRise project[6] has shown that rates of sea level rise along the Tasman District coastline may be twice as high as previously thought when vertical land movement is also taken into account. The sea level along parts of the Tasman District coastline is now predicted to rise by 30 cm within the next 10-20 years, and in excess of 1 metre over the next century, assuming that Paris Agreement goals are met. The potential effects of this sea level rise on the Tasman District's coastal birds will likely include reductions in the total area of breeding, foraging and roosting habitats for coastal birds and increasing losses of eggs and chicks due to flooding. The combined effects of these impacts have the potential to be sufficiently severe to negate any efforts that have been made in the meantime to reduce the adverse impacts of other threats such as mammalian predators, weeds, recreational activities and land-use changes. These effects are also likely to be compounded in the coming decades as predicted increases in the frequency of extreme storm-tide and skew-surge events and increasing rates of coastal erosion places pressure on local authorities to 'harden' coastlines seawalls and other coastal defences, further reducing habitat quality and quantity for coastal birds. (Stephens *et al.* 2020).

The impacts of climate change will not be limited to sea-level rise and an increase in coastal flooding, however. Increases in storm and rainfall intensity are predicted to increase the risk and severity of flooding on rivers, and parts of New Zealand with decreasing rainfall will increase the risk and severity of wildfires (Lundquist *et al.* 2011). A warming climate is also driving rapid changes in predator-prey dynamics, plant and animal breeding phenology and plant and animal distributions, including speeding

[6] https://www.searise.nz/; accessed 15th May 2022.

up the range expansions of invasive plants, animals and disease-causing pathogens (McGlone & Walker 2011).

Management options

The predicted impacts of human-induced climate change on the coastal birds of the Tasman District are too numerous and too imperfectly understood for a comprehensive suite of management options to be developed as part of this review. For example, human-induced climate change is likely to interact with other environmental factors such as socio-economic processes, human behaviour and rapid adaptations by plants and animals to deliver a range of as yet poorly understood impacts on the Tasman District's coastal birds. Due to the complexities and uncertainties regarding the potential impacts of human-induced climate change, we have limited our view to a consideration of management options aimed to mitigate the impacts of sea-level rise on the district's coastal birds.

1. Managed retreat

The concept of 'managed retreat' is increasingly being discussed as a response to the risks posed by predicted sea level rise. Managed retreat refers to the planned, strategic and gradual relocation of property and infrastructure away from low-lying coastal areas as sea levels rise. Such a concept can also be used to manage the impacts of sea-level rise on the Tasman District's coastal bird fauna. For example, as sea levels rise, coastal habitats and the indigenous species that use those habitats will begin to shift inland so there will be a need to develop the regulatory frameworks necessary to accommodate this inland shift. In Australia for instance, consideration is being given to the use of "rolling covenants" to balance coastal land use requirements with a need to accommodate the inland shift of indigenous ecosystems and species (Bell-James *et al.* 2021). Rolling covenants are potential alternatives to completely prohibiting shoreline development in the short term while allowing the shoreline to encroach landward in the longer term (O'Donnell & Gates 2013). They represent a legally enforceable expectation that the shore, or human access along the shore, can migrate inland instead of being squeezed between an advancing sea and a fixed property line or physical structure (Titus 2011). A rolling easement doesn't necessarily restrict land use, but rather prevents shoreline armouring to allow for natural coastal processes to occur. The purpose of a rolling easement is to allow flexibility in land use, so that land can be used productively until such time as it is threatened by the sea. This flexibility is an advantage over other approaches such as the acquisition of land, which could be both expensive and could deprive a landholder of productive use of land in the short to medium term (Bell-James *et al.* 2021).

2. Creation of artificial habitats

A number of the Tasman District's coastal bird species will readily make use of artificial structures such as breakwaters, jetties and wharf piles for roosting and nesting (Heather & Robertson 2015; eBird 2022). Although the relative importance of artificial structures versus natural habitats for coastal birds hasn't been examined in detail in New Zealand, work carried out in Australia has shown that some coastal bird species exhibit consistent and widespread use of artificial habitats,

with large aggregations of birds using artificial structures as high-tide roosts or for nesting (Jackson *et al.* 2019).

Artificial structures have the potential to be used as a management tool to minimise the impact of future sea-level rise on coastal bird populations, by providing artificial roosting and nesting habitats to either temporarily or permanently replace natural habitats that have become more flood prone due to rising flood levels. Artificial structures built for other purposes (e.g., breakwaters, seawalls, wharves and jetties) can be engineered to also provide roosting or nesting habitat for coastal birds. For example, Lower Hutt City council is currently applying for a resource consent to construct a shared cycle and walkway and an upgraded seawall along several kilometres of the Eastbourne coastline. As part of this project, the council is proposing to construct four "bird protection areas" consisting of artificially constructed nesting and roosting habitats for Kororā / Little Penguins (*Eudyptula minor*) and Tōrea Pango / Variable Oystercatchers that have increased resilience to future sea level rise (McArthur & Thorpe 2021). Alternatively, artificial structures that no longer fulfil their intended uses (e.g., decommissioned bridges or abandoned wharves) could be re-purposed to provide roosting or nesting habitat for coastal birds (see Box 5 below), or structures can be designed and built for the primary purpose of providing habitat for coastal bird species, in response to the observed or predicted loss of key natural habitats.

Box 5: Improving artificial nesting habitat for Tara / White-fronted Terns in Tauranga Harbour

Tara / White-fronted Terns are known to occasionally nest on artificial substrates such as breakwaters and wharf piles (Higgins & Davies 1996), which have the potential to provide better protection against disturbance by humans and dogs than more natural nesting sites on beaches and coastal rocks. Since 2008, a small colony of Tara / White-fronted Terns has been nesting on some disused concrete bridge supports in inner Tauranga Harbour. Prior to 2013, a number of nests were lost each season due to being either washed away during high tides or being flooded when cavities in the upper surfaces of the concrete bridge supports filled with water. In 2013, two researchers with assistance from the New Zealand Transport Agency modified the existing concrete bridge supports by installing recycled wooden beams to the upper surfaces of some of the low-lying bridge supports to create raised wooden surfaces on which the terns could nest, and by cutting a series of drainage channels across the upper concrete surfaces of other bridge supports, to reduce the risk of flooding. The birds readily accepted these modifications (which were carried out prior to the birds arriving for the 2013/2014 nesting season) and the colony experienced its highest level of hatching success in the year following these modifications being carried out. This case study demonstrates that Tara / White-fronted Terns will tolerate modifications to artificial nesting habitats and that modifications designed to reduce the impacts of threats such as flooding can result in substantially higher nesting success.

Tara / White-fronted Terns nesting on re-cycled wooden beams (left) and on a concrete bridge support with a drainage channel cut through a flood-prone cavity in the concrete surface (right). Images reproduced from McLean & Fleming (2018)

For more information: McLean, I.G.; Fleming, A. 2018. Successful restoration of an unnatural breeding habitat for white-fronted terns (*Sterna striata*). *Notornis 65:* 54-58.

Gravel and sand mining, flood mitigation and erosion control activities

Threat description

Gravel and sand mining on the foreshore or on the beds of rivers has the potential to have both negative and positive impacts on ground-nesting coastal bird species. Gravel extraction and flood mitigation and erosion control activities including the construction of stop banks, rock groynes, rock rip rap, gravel beach ripping and recontouring and the planting or riparian willows on the beds of rivers can cause substantial disturbance to dry, unvegetated gravel habitats and can lead to a reduction in the number of braids and islands in the bed of the river (e.g., Figure 2.7). If works are carried out during the shorebird breeding season this can lead to the local destruction of nests and chicks, and these losses, combined with longer-term reductions in riverbed habitat quality and quantity, can reduce the local population size and productivity of riverbed-nesting shorebirds (McArthur *et al.* 2015; McArthur *et al.* 2018). Conversely, some of these activities can also have positive impacts on locally-breeding shorebirds provided that local losses of nests, eggs and chicks can be avoided, by reducing woody weed encroachment and maintaining open habitats for shorebirds (see Box 4 above; McArthur 2020).

Figure 2.7: The construction of a 200m long rock wall on the Matakitaki River downstream of Mole Stream in 2020 has the potential to reduce the number of active river braids and gravel islands within this regionally important site for coastal birds. The red circle in the aerial photograph shows the location of the rock wall, demonstrating how it acts to confine the majority of the river flow to the main channel and prevents water from travelling through a series of braids on the true right of the channel. Image Credit: Trevor James/Tasman District Council.

Management options

1. Pre-works shorebird surveys and maintenance of exclusion zones around nests

The mining of commercial quantities of gravel, the removal of gravel, and the construction of flood mitigation and erosion control structures on the beds of rivers are activities that are regulated by the Resource Management Act (1991) and typically require either a resource consent or a gravel extraction authorisation from the relevant regional council or unitary authority (McArthur *et al.* 2018). Gravel extraction resource consents and authorisation usually include several conditions aimed at avoiding or minimising the adverse impacts of gravel extraction activities on riverbed-nesting shorebirds. Conditions typically require gravel extractors to engage a suitably qualified ornithologist to carry out a survey for nesting shorebirds prior to carrying out gravel extraction during the shorebird breeding season. Should any nests or chicks be found during this pre-works survey, additional conditions specify exclusion zones that need to be maintained around nests, or the area(s) in which chicks are observed, to minimise the risk of disturbing breeding birds. In cases where the creation of exclusion zones renders it impractical for gravel extraction to take place, extractors typically work with their consultant ornithologist and the regulator to decide on a course of action, which usually involves either agreeing to delay extraction until after breeding has concluded at the site, or to extract gravel from an alternative site at which breeding birds are not present (McArthur *et al.* 2018; McArthur 2020).

2. Development of a code of practice to balance flood mitigation and erosion control activities against the natural and recreational values of rivers

Regional Councils and Unitary Authorities are increasingly being expected to balance flood mitigation and erosion control responsibilities with the need to maintain the natural, cultural and recreational values of rivers subject to flood management. Councils are striking this balance through policy documents such as natural resources plans, and in more detailed codes of practice that outline in detail how flood mitigation and erosion control activities should be carried out to avoid or minimise adverse impacts on natural, cultural and recreational river values. Greater Wellington Regional Council (GWRC) for example, has prepared a Code of Practice (CoP) to guide and monitor how all flood protection and erosion control activities are undertaken across the Wellington region. The Code is specifically designed to support the vision "that Flood Protection activities restore and enhance the natural and cultural values associated with [Wellington's] rivers" (GWRC 2018). One of the key ecological values of the rivers that are subject to GWRC's flood and erosion mitigation activities is the relatively high number and diversity of bird species that use the river corridors as foraging, roosting or breeding habitat, including four shorebird species that breed on the open riverbed gravels. To address the risk that flood mitigation and erosion control activities pose to these birds, the CoP includes a commitment by GWRC to carry out regular monitoring of the bird populations found on rivers that are subject to flood and erosion mitigation activities and includes a set of bird monitoring triggers which activate a management response if a substantial population decline is detected (GWRC 2018).

Recreational walkers, fishers, surfers, swimmers and picnickers

Threat description

Recreational walkers, fishers, surfers, swimmers and picnickers can be a considerable source of disturbance for coastal birds, disrupting key activities such as nesting, roosting and foraging. Human foot traffic on beaches and riverbeds can cause the local losses of eggs and chicks due to people accidentally trampling on nests or chicks, by causing incubating birds to abandon their nests, or by causing young chicks to become separated from their parents. For example, trail camera monitoring of Pohowera / Banded Dotterel nests carried out along both the Eastern Foreshore and at South Bay, Kaikōura since 2011 has recorded several instances of walkers accidentally treading on nests (Figure 2.8; McArthur *et al.* 2021; Ailsa Howard *personal observation*). Several instances of bonfires being lit close to nests, or driftwood sculptures being built on Pohowera / Banded Dotterel breeding territories have also been observed to have caused nest failures at both sites (Figure 2.9; McArthur *et al.* 2021; Ailsa Howard *personal observation*).

Although the impact of human foot traffic on the breeding success of coastal birds in the Tasman District hasn't been quantified, it is almost certain to be causing the local losses of eggs and chicks. For example, human foot traffic has been observed causing high rates of disturbance to nesting Tōrea Pango / Variable Oystercatchers on beaches on Rabbit Island (Nikki McArthur *personal observation*) and at several sites in Golden Bay / Mohua including Pakawau, Collingwood, Rototai (Melville & Schuckard 2013), the Pariwhakaoho River mouth (Peter Fullerton *personal communication*) and at Rangihaeata Beach (Cynthia McConville *personal communication*). Human foot traffic, along with dogs and horses has been observed causing considerable disturbance to both roosting and nesting birds on the Motueka Sandspit (Melville & Schuckard 2013).

Figure 2.8: Trail camera images of recreational walkers passing in close proximity to a Pohowera / Banded Dotterel nest (see incubating bird in the top left image) on the Eastbourne foreshore near Wellington. The nest was disturbed on numerous occasions over several days before the eggs were eventually trampled by the walker in the bottom left image (Images courtesy of Parker Jones/MIRO).

Figure 2.9: Driftwood sculptures and shelters constructed on a Pohowera / Banded Dotterel nesting area at Pencarrow Head near Wellington.

Management options

1. Rāhui

The placement of a rāhui (temporary access ban) on sensitive sections of the coastline or riverbed can be used as an approach to reducing levels of disturbance caused by human foot traffic at key times of the year. To our knowledge, there is only one example of a rāhui being used to reduce rates of human disturbance on coastal birds. Since 2013, Taranaki Whānui ki Te Upoko o Te Ika has placed an annual rāhui on several sections on the Eastbourne-Wainuiomata coastline between August and January each year to reduce levels of human disturbance to several small populations of nesting Pohowera / Banded Dotterels. The placement of this rāhui has coincided with a substantial increase in Pohowera / Banded Dotterel nesting success since 2013, and a noticeable decline in human foot traffic within the areas subject to the rāhui (see Box 6 below).

2. Seeking voluntary compliance

The erection of signage and/or visual barriers such as temporary single-strand fencing in combination with sustained community education and advocacy efforts has commonly been used to reduce levels of disturbance caused by human foot traffic within the nesting areas of coastal bird species such as Tūturiwhatu / Northern New Zealand Dotterels (*Charadrius obscurus aquilonius*) and colony-nesters such as Tarāpuka / Black-billed Gulls and Tara / White-fronted Terns. It should be noted that the installation of signage and temporary fencing alone tends to be ineffective at sites where walking access is particularly well established, or foot traffic is heavy. Instead, signs and fences at such sites frequently become the target of vandals which can send a counter-productive message that a site is not being regularly monitored for compliance.

Combining the use of signage and visual barriers with sustained efforts to engage and educate the local community, and to advocate for voluntary compliance with restrictions aimed at protecting coastal birds can be enormously successful however and have been instrumental in the population recovery of Tūturiwhatu / Northern New Zealand dotterels in the northern half of the North Island (Dowding & Davis 2007; Dowding 2020). Involving members of the local community, including schools and local iwi should be considered particularly important elements of any community engagement campaign (Figure 2.3; Box 7).

Box 6: The use of rāhui to reduce rates of human disturbance on nesting Pohowera / Banded Dotterels along the Eastbourne-Wainuiomata coastline.

Since 2011, the Eastbourne-based community conservation group MIRO has been collaborating with local government agencies, local iwi and Birds New Zealand to manage several breeding populations of Pohowera / Banded Dotterels along the Eastbourne – Wainuiomata coastline (see also Box 2). Early monitoring of these populations identified human disturbance (walkers, fishers, divers, surfers, cyclists and off-road vehicle users) to be a key threat contributing to low rates of hatching success. In an effort to reduce levels of disturbance on nesting birds, Taranaki Whānui ki Te Upoko o Te Ika kaumātua have placed a rāhui (temporary access ban) on the Pohowera / Banded Dotterel nesting areas between August and January each year since 2013. Each August a ceremony is held to place the rāhui, temporary signage is installed by local goverment agencies and notification of the rāhui is communicated to the local community via media and social media channels. The implementation of this rāhui together with a suite of additional management actions has increased annual hatching success from a low of 3% of nests hatching chicks during 2011 and 2012 to a high of 74% of nests hatching chicks during 2020 and 2021 (McArthur & Jones 2022), and has been accompanied by a substantial reduction in vehicle and foot tracks within the nesting areas during the Pohowera / Banded Dotterel nesting season.

Taranaki Whānui ki Te Upoko o Te Ika kaumātua Sam and June Jackson placing a rāhui on Pohowera / Banded Dotterel nesting area at Pencarrow Head, Eastbourne, while representatives from Taranaki Whānui ki Te Upoko o Te Ika and Greater Wellington Regional Council watch on.

For further information: McArthur, N.; Jones, P. and Lees, D. 2021. *Eastbourne - Wainuiomata coastline tūturiwhatu / banded dotterel management strategy 2021-2026.* Unpublished report, Mainland Island Restoration Organisation, Eastbourne.

Dog walking

Threat description

Domestic dogs are known to be a considerable source of disturbance for coastal birds, disrupting key activities such as nesting, roosting and foraging. In recent years a considerable amount of research effort has been invested in quantifying the disturbance impacts of domestic dogs on coastal-breeding birds. For example, a recent study carried out on four beaches in Spain found that free-roaming dogs caused Kentish Plovers (*Charadrius alexandrius*) to flush from their nests during 100% of encounters, and that dogs walked on-leash by their owners caused the plovers to flush from their nests on 94% of encounters. In comparison, people walking on the beach without a dog caused plovers to flush during 47% of encounters (Gomez-Serrano 2021). Similarly, Taylor *et al.* (2005) found that dog walkers tend to provoke a bird disturbance response at greater distances and for longer periods than stimuli from other recreational activities, including people without dogs, and similar results have been found by many other studies. Disturbance from dogs can also adversely impact the ability of birds to forage for food. For example, a study quantifying the impacts of human activities on the foraging behaviour of Sanderlings (*Calidris alba*) on California beaches found that disturbance from free-roaming dogs caused a significant reduction in the amount of time that Sanderlings spent foraging (Thomas *et al.* 2003).

Although the impact of dog walking on the breeding success of coastal birds in the Tasman District hasn't been quantified, it is almost certain to be causing the local losses of eggs and chicks. For example, off-leash dogs have been observed causing significant and frequent disturbance to roosting and nesting birds at several sites in Golden Bay / Mohua including Pakawau, Collingwood, Rototai (Melville & Schuckard 2013; Grant Williams, *personal communication*), the Pariwhakaoho River mouth (Peter Fullerton, *personal communication*), Rangihaeata Beach (Cynthia McConville, *personal communication*) and at Parapara (David Costar, *personal communication*). Dog walking, along with human foot traffic and horses has been observed causing considerable disturbance to both roosting and nesting birds on the Motueka Sandspit (Melville & Schuckard 2013).

Management options

1. Bylaws

Local authorities have powers under Sections 145 and 146 of the Local Government Act (2002) and Section 64 of the Health Act (1956) to make bylaws regulating the ownership of domestic dogs. Such bylaws have the potential to reduce the impacts that dog walking has on coastal birds by designating particular areas along the coastline or on the beds of rivers where dog walking is either permitted or prohibited and whether dogs should be on or off-leash within designated dog walking areas.

Under the Tasman District Council Dog Control Bylaw (2014) dogs are already prohibited from a number of the internationally, nationally and regionally important sites for coastal birds identified in Part One of this review, including Rabbit Island and the Bell Island shellbank in Waimea Inlet,

Kaiteretere Beach, the Motueka Sandspit and a number of beaches and estuaries in Golden Bay[7]. A number of regionally important sites for coastal birds identified in Part One of this review fall within controlled (off-leash) dog exercise areas including the Collingwood foreshore, the Pariwhakaoho River mouth and Kina beach, however the bylaw states that "on any occasion a dog is likely to injure, endanger or cause stress to any…protected wildlife it shall be kept under continuous leash control." Evidence collected as part of this review indicates a poor level of compliance with this rule within these controlled dog exercise areas, suggesting a need for either a) greater compliance monitoring and enforcement within these exercise areas, or b) a review of the dog control bylaw to consider whether some of these controlled dog exercise areas that have been identified as important sites for coastal birds need to be re-scheduled as either leash control areas or dog prohibited areas.

2. Rāhui

The placement of a rāhui (temporary access ban) on sensitive sections of the coastline or riverbed provides can be used as an approach to reducing levels of disturbance caused by dog walkers at key times of the year. To our knowledge, there is only one example of a rāhui being used to reduce rates of disturbance caused by dog walkers on coastal birds. Since 2013, Taranaki Whānui ki Te Upoko o Te Ika has placed an annual rāhui on several sections on the Eastbourne-Wainuiomata coastline between August and January each year to reduce levels of disturbance caused by dogs to several small populations of nesting Pohowera / Banded Dotterels. The placement of this rāhui has coincided with a substantial increase in Pohowera / Banded Dotterel nesting success since 2013, and a noticeable decline in the number of dogs entering the areas subject to the rāhui (see Box 6 below).

3. Seeking voluntary compliance

The erection of signage and/or visual barriers such as temporary single-strand fencing in combination with sustained community education and advocacy efforts has commonly been used to reduce levels of disturbance caused by dog walkers within the nesting areas of coastal bird species such as Tūturiwhatu / Northern New Zealand Dotterels and colony-nesters such as Tarāpuka / Black-billed Gulls and Tara / White-fronted Terns. It should be noted that the installation of signage and temporary fencing alone tends to be ineffective at sites where the use of an area for dog walking is particularly ingrained or heavy. Instead, signs and fences at such sites frequently become the target of vandals which can send a counter-productive message that a site is not being regularly monitored for compliance. Combining the use of signage and visual barriers with sustained efforts to engage and educate the local community, and to advocate for voluntary compliance with restrictions aimed at protecting coastal birds can be enormously successful however and have been instrumental in the population recovery of Tūturiwhatu / Northern New Zealand Dotterels in the northern half of the North Island (Dowding & Davis 2007; Dowding 2020). Involving members of the local community, including schools and local iwi should be considered particularly important elements of any community engagement campaign (Figure 2.3; Box 7).

[7] https://www.tasman.govt.nz/my-property/animal-control/dog-control/exercising-your-dog/; accessed 25th June 2022.

Horse riding

Threat description

Little work has been done to quantify the direct impacts of the recreational use of horses on coastal bird species, however there is some evidence that the long-term recreational use of horses on sandy beaches in New Zealand could lead to substantial declines in the abundance of burrowing bivalves which are preyed upon by both Tōrea / South Island Pied Oystercatchers and Tōrea Pango / Variable Oystercatchers (Taylor *et al.* 2012).

Although the impact of horse riding on the breeding success of coastal birds in the Tasman District hasn't been quantified, it is almost certain to be causing the occasional losses of eggs and chicks at sites where this activity occurs. For example, horse riders have been observed causing disturbance to both roosting and nesting birds at Rototai and on the Motueka Sandspit (Melville & Schuckard 2013), at the Pariwhakaoho River mouth (Peter Fullerton, *personal communication*) and on Rabbit Island (Nikki McArthur, *personal observation*).

Management options

1. Rāhui

The placement of a rāhui (temporary access ban) on sensitive sections of the coastline or riverbed provides can be used as an approach to reducing levels of disturbance caused by horse riding at key times of the year. To our knowledge, there is only one example of a rāhui being used to reduce rates of disturbance on coastal birds caused by recreational activities. Since 2013, Taranaki Whānui ki Te Upoko o Te Ika has placed an annual rāhui on several sections on the Eastbourne-Wainuiomata coastline between August and January each year to reduce levels of disturbance caused to several small populations of nesting Pohowera / Banded Dotterels. Although these sites are not used for horse riding, the placement of this rāhui has coincided with a substantial increase in Pohowera / Banded Dotterel nesting success since 2013, and a noticeable decline in the recreational use of the areas subject to the rāhui during the months in which the rāhui is in force (see Box 6 above).

2. Seeking voluntary compliance

The erection of signage and/or visual barriers such as temporary single-strand fencing in combination with sustained community education and advocacy efforts have been used to reduce levels of disturbance caused by recreational beach users within the nesting areas of coastal bird species such as Tūturiwhatu / Northern New Zealand Dotterels and colony-nesters such as Tarāpuka / Black-billed Gulls and Tara / White-fronted Terns. It should be noted that the installation of signage and temporary fencing alone tends to be ineffective at sites where the use of an area for horse riding is particularly ingrained or heavy. Instead, signs and fences at such sites frequently become the target of vandals which can send a counter-productive message that a site is not being regularly monitored for compliance. Combining the use of signage and visual barriers with sustained efforts to engage and educate the local community,

and to advocate for voluntary compliance with restrictions aimed at protecting coastal birds can be enormously successful however and have been instrumental in the population recovery of Tūturiwhatu / Northern New Zealand Dotterels in the northern half of the North Island (Dowding & Davis 2007; Dowding 2020).

Motorised off-road vehicles

Threat description

The use of motorised off-road vehicles along the coastline and on the beds of rivers can have several adverse impacts on coastal bird species. Motorised off-road vehicles can disturb or destroy the nests of ground-nesting birds, leading to the localised losses of eggs, chicks and adult birds during the breeding season (O'Donnell & Moore 1983; Robertson *et al.* 1984; Figure 2.10). Losses can be particularly severe for colony-nesting species such as Tarāpuka / Black-billed Gulls and Tarapirohe / Black-fronted Terns, which can lose dozens of nests or chicks in a single disturbance event. Furthermore, the prolonged or repeated disturbance of roosting birds by motorised vehicles can cause them to abandon preferred roosting and foraging habitats, increasing competition for remaining disturbance-free, but more distant and/or sub-optimal roost sites or foraging areas (Kim & Yoo 2007; Tarr *et al.* 2010; Woodley 2012). The effects of prolonged or repeated disturbance of birds are difficult to quantify, however by increasing energy expenditure and/or reducing the amount of time available to be spent roosting and foraging, higher rates of disturbance may reduce the survival and productivity of affected birds, potentially contributing to population declines (Pfister *et al.* 1992; Lord *et al.* 1997). The use of motorised off-road vehicles on beaches can also have a number of indirect impacts on coastal bird species by modifying the physical environment on sandy or shingle beaches. Heavy off-road vehicle use can lead to heavy surface rutting and the mobilization of sand and gravel substrates (Schlacher & Thompson 2008) which may increase the risk of nests being buried by wind-blown sand or gravel. Heavy off-road vehicle use can also cause substantial declines in the diversity and abundance of sub-surface invertebrates on sandy beaches (Schlacher *et al.* 2007; Schlacher *et al.* 2008), reducing food availability for coastal bird species that feed on burrowing invertebrates such as crabs, molluscs and Polychaete worms.

No studies have been carried out to quantify the impacts that motorised off-road vehicle use is having on coastal birds in coastal or riverbed habitats in the Tasman District however there have been a number of instances of off-road vehicles causing localised losses of shorebird nests. For example, in January 2022 a group of ATV quadbike riders driving their vehicles on Onahau Sandspit near Rangihaeata caused four pairs of Tōrea Pango / Variable Oystercatchers to abandon their nests[8]. Regular ATV quadbike use at the Pariwhakaoho River mouth has also caused disturbance to locally-breeding Pohowera / Banded Dotterels and Tōrea Pango / Variable Oystercatchers (Peter Fullerton, *personal communication*). The Collingwood foreshore, the Rototai coastline and the Motueka Sandspit have also had a history of disturbance caused by off-road vehicle use (Grant Williams, *personal communication;* Trevor James, *personal communication*). Both the Onahau Sandspit and Pariwhakaoho River mouth have been identified as a regionally important sites for coastal birds in the Tasman District in Part One of this review, and both Rototai and the Motueka Sandspit have been

[8] https://www.stuff.co.nz/environment/127463659/nests-abandoned-after-quad-bikers-rip-up-protected-beach?cid=app-android; accessed 28/04/2022.

identified as internationally important sites (Table 1.1; Figure 1.1 and Appendix Two; note the Onahau Sandspit is named Rangihaeata Spit in this review). Schuckard & Melville (2013) have reported that off-road vehicle impacts aren't limited to the occassional localised incident however, but that "vehicle damage is significant around much of [Tasman District's] coastline".

Figure 2.10: Four-wheel drive vehicle tracks passing in close proximity to a pohowera / banded dotterel nest (three olive green eggs inside red circle) on a beach at Pencarrow Head near Wellington.

Management options

1. Bylaws

The use of motorised off-road vehicles on the foreshore is a permitted activity under Section 25.2.2.1 of the Tasman Resource Management Plan (TDC 2011), provided that the following conditions are met:

(a) The activity does not contravene any other applicable rule of Chapter 25 of this Plan.

(b) In relation to the launching and retrieval of any craft, the most direct route is taken between any launching ramp and water.

(c) In relation to any craft or vehicle, including any motorcycle, land yacht, or hovercraft:

(i) there is no damage to the foreshore or seabed or to animal or plant habitats;

(ii) there is no mooring, beaching, or other continued occupation of the foreshore or seabed by the craft or vehicle.

(d) There is no vehicle or craft passage across any foreshore within any estuary at all times that that foreshore is exposed to the air, except where the passage is for or in connection with:

(i) any lawful structure, occupation or disturbance; or

(ii) any scientific research or coastal management activity (TDC, 2011)

Given the impacts that motorised off-road vehicles are observed to be having on coastal birds at individual sites along the Tasman District coastline, it appears that at least some of the off-road vehicle activity occurring along the coast is not meeting all of the conditions set out in Section 25.2.2.1 of the TRMP and is therefore not a permitted activity. This indicates that there is a clear need for increased education and enforcement of motorised off-road vehicle users to improve compliance with this section of the TRMP.

Another statutory mechanism regularly used by territorial authorities to regulate the use of motorised off-road vehicles in coastal areas is the making of bylaws. Regional and district councils have powers under the Land Transport Act (1998) and Local Government Act (2002) to make bylaws regulating the use of vehicles on beaches, which are defined as roads under the Land Transport Act (1998). Bylaws regulating the use of vehicles on beaches are used by many regional and district councils to address the risks that vehicles pose to public safety, to protect ecological values including shellfish beds, native vegetation and coastal bird habitats, and to protect wāhi tapu sites. Bylaws can either prohibit or restrict the use of vehicles along defined sections of the coastline, provide exemptions and set penalties for infringement. Bylaws may be a useful tool for TDC to use to prohibit or restrict the use of motorised off-road vehicles at beaches or estuaries that fall within regionally, nationally or internationally important sites for coastal birds in the Tasman District in order to improve levels of compliance with Section 25.2.2.1 of the TRMP. Given current levels of non-compliance with section 25.2.2.1 of the TRMP, the passing of any additional bylaws will likely need to be accompanied by a programme of compliance monitoring and enforcement in order to be effective at reducing damage to the habitats of coastal birds.

2. Physical barriers

Controlling access to coastal areas or riverbeds by blocking or removing access routes from nearby public roads can also be used to reduce motorised off-road vehicle use in sensitive areas, either as an alternative to, or to complement other measures such as the passing of bylaws or the erection of signage. Wooden bollards have been successfully used at the Manawatū Estuary to exclude motorised vehicles from a shorebird high-tide roost and have also been used at Baring Head / Ōrua-pouanui to reduce motorised vehicle traffic on a shingle sandspit being used by nesting Pohowera / Banded Dotterels. Similarly, large concrete blocks have been installed on the

southern side of the Tukituki Estuary in Hawke's Bay to prevent vehicle access to a shingle spit used by nesting Tara / White-fronted Terns and Tarāpuka / Black-billed Gulls; and a combination of concrete blocks, forestry gates and piles of hard-fill have been used to strategically block vehicle access points to the lower Ashburton / Hakatere River in Canterbury. It should be noted that physical barriers are sometimes ineffective at sites with a long history of off-road vehicle use and can become the target of vandalism. At such sites, physical barriers may be more effective when used in combination with other management options such as bylaws or a rāhui (see below) or is combined with a sustained community engagement and education campaign.

3. Rāhui

The placement of a rāhui (temporary access ban) on sensitive sections of the coastline or riverbed provides an alternative approach to reducing the impacts of motorised off-road vehicles on coastal birds without the need to pass bylaws. To our knowledge, there is only one example of a rāhui being used to reduce rates of human disturbance on coastal birds. Since 2013, Taranaki Whānui ki Te Upoko o Te Ika has placed an annual rāhui on several sections on the Eastbourne-Wainuiomata coastline between August and January each year to reduce levels of human disturbance to several small populations of nesting Pohowera / Banded Dotterels. The placement of this rāhui has coincided with a substantial increase in Pohowera / Banded Dotterel nesting success since 2013, and a noticeable decline in spring and summer off-road vehicle use within the areas subject to the rāhui (see Box 6 above).

4. Seeking voluntary compliance

The erection of signage and/or visual barriers such as temporary single-strand fencing in combination with sustained community education and advocacy efforts has commonly been used to reduce levels of human disturbance within the nesting areas of coastal bird species such as Tūturiwhatu / Northern New Zealand Dotterels and colony-nesters such as Tarāpuka / Black-billed Gulls and Tara / White-fronted Terns. It should be noted that the installation of signage and temporary fencing alone tends to be ineffective at sites where the use of off-road vehicles is particularly ingrained or heavy. Instead, signs and fences at such sites frequently become the target of vandals which can send a counter-productive message that a site is not being regularly monitored for compliance. Combining the use of signage and visual barriers with sustained efforts to engage and educate the local community, and to advocate for voluntary compliance with restrictions aimed at protecting coastal birds can be enormously successful however and have been instrumental in the population recovery of Tūturiwhatu / Northern New Zealand Dotterels in the northern half of the North Island (Dowding & Davis 2007; Dowding 2020). Involving the members of the local community, including schools and local iwi should be considered particularly important elements of any community engagement campaign (Figure 2.11; Box 5).

Figure 2.11: Ashburton Borough School pupil Emma Moodie standing beside a Tarāpuka / Black-billed Gull warning sign on the Ashburton River featuring her artwork. Image credit: Forest & Bird.

Box 7: Empowering and resourcing local iwi to restore the mauri of coastal ecosystems: the Hem of Remutaka project.

Taranaki Whānui ki te Upoko o te Ika in partnership with Conservation Volunteers New Zealand, DOC, and Greater Wellington Regional Council have recently received $1.56 million from the Jobs for Nature fund to launch the 3-year Hem of Remutaka project. This project is focussed on restoring the mauri of coastal ecosystems between Eastbourne and Turakirae Head near Wellington, by restoring vegetation, trapping predators and engaging with the local community. Uri (descendents) of Taranaki Whānui and local residents from both Wainuiomata and Lower Hutt are being employed over the next three years to deliver these kaitiakitanga services, a key element of which is to engage with the local community to ensure that visitors to the local coastline are complying with relevant regulations including fisheries regulations and relevant bylaws and restrictions on off-road vehicle use designed to reduce adverse impacts on ground-nesting birds and fragile coastal vegetation. This project provides a useful model demonstrating how central and local government and local iwi can work together, with the former passing bylaws and other regulations designed to manage threats to coastal ecosystem values, and the latter playing a lead role in monitoring and encouraging compliance among members of the wider community.

Hem of Remutaka trapper Mason Pope holds a captured stoat on the Remutaka coastline (Image credit: Brian McDonald/DOC).

Aircraft and UAVs

Threat description

Both aircraft and UAVs (unmanned aerial vehicles) have the potential to cause disturbance to both roosting and nesting coastal birds. A number of recent studies have demonstrated that the improper use of UAVs can disturb coastal birds and cause them to flush from roost sites or nests (e.g., Lyons *et al.* 2017; Weston *et al.* 2020), however the level of disturbance is very dependent on how the vehicle is operated (e.g., Bevan *et al.* 2018). Operating UAVs at higher altitudes, using constant speeds and predictable flight paths can reduce the potential for UAVs to cause disturbance to coastal birds (Bell

& Harborne 2019; Stone & Parker 2022). Indeed, UAVs are increasingly being used to survey and monitor coastal bird populations as they can cause less disturbance than ground-based survey techniques (Borrelle & Fletcher 2017).

The impact of aircraft and UAVs on the coastal birds in the Tasman District hasn't been quantified however aircraft have been observed causing disturbance to roosting birds in Waimea Inlet, on the Motueka Sandspit and at the Riuwaka River mouth (Melville & Schuckard, 2013; Trevor James, *personal communication*).

Management options

1. Rāhui

The placement of a rāhui (temporary access ban) on sensitive sections of the coastline or riverbed provides can be used as an approach to reducing levels of disturbance caused by the use of UAVs at key times of the year. To our knowledge, there is only one example of a rāhui being used to reduce rates of disturbance on coastal birds caused by recreational activities. Since 2013, Taranaki Whānui ki Te Upoko o Te Ika has placed an annual rāhui on several sections on the Eastbourne-Wainuiomata coastline between August and January each year to reduce levels of disturbance caused to several small populations of nesting Pohowera / Banded Dotterels. Although UAV use has been low at these sites up to the present time, the placement of this rāhui has coincided with a substantial increase in Pohowera / Banded Dotterel nesting success since 2013, and a noticeable decline in the recreational use of the areas subject to the rāhui during the months in which the rāhui is in force (see Box 6 above).

2. Seeking voluntary compliance

The erection of signage in combination with sustained community education and advocacy efforts have been used to reduce levels of disturbance caused by recreational beach users within the nesting areas of coastal bird species such as Tūturiwhatu / Northern New Zealand Dotterels and colony-nesters such as Tarāpuka / Black-billed Gulls and Tara / White-fronted Terns. It should be noted that the installation of signage and temporary fencing alone tends to be ineffective at sites where the use of UAVs or aircraft is particularly ingrained or heavy. Instead, signs and fences at such sites frequently become the target of vandals which can send a counter-productive message that a site is not being regularly monitored for compliance. Combining the use of signage with sustained efforts to engage and educate the local community, and to advocate for voluntary compliance with restrictions aimed at protecting coastal birds can be enormously successful however and have been instrumental in the population recovery of Tūturiwhatu / Northern New Zealand Dotterels in the northern half of the North Island (Dowding & Davis 2007; Dowding 2020).

Watercraft

Threat description

The improper use of watercraft including motorised and sailing boats, hovercraft, kayaks, jet skis, wind surfers and kite surfers can cause considerable disturbance to both roosting and nesting coastal birds. Kite surfing in particular appears to cause high levels of disturbance by displacing large numbers of shorebirds from preferred roost sites (Krüger 2016). Both jet skis and motorised boats have been shown to be major sources of disturbance to roosting birds and to colony-nesting species such as gulls and terns (e.g., Burger 1998).

The impact of watercraft on the coastal birds in the Tasman District has not been quantified, however watercraft have been observed causing disturbance to roosting birds both in Waimea Inlet and on the Motueka Sandspit (Melville & Schuckard, 2013). High rates of recreational activity on the sandy beaches of Abel Tasman National Park including the recreational use of sea kayaks is also believed to be influencing local habitat use by coastal birds, as noticeable changes in local habitat use by several coastal bird species occurred during the first 12 months of the global Covid-19 pandemic when New Zealand's borders were closed to international tourists (Trevor James, *personal observation*).

Management options

1. Rāhui

The placement of a rāhui (temporary access ban) on sensitive sections of the coastline or riverbed provides can be used as an approach to reducing levels of disturbance caused by watercraft users at key times of the year. To our knowledge, there is only one example of a rāhui being used to reduce rates of disturbance on coastal birds caused by recreational activities. Since 2013, Taranaki Whānui ki Te Upoko o Te Ika has placed an annual rāhui on several sections on the Eastbourne-Wainuiomata coastline between August and January each year to reduce levels of disturbance caused to several small populations of nesting Pohowera / Banded Dotterels. Although these sites have not been prone to disturbance by watercraft up until the present time, the placement of this rāhui has coincided with a substantial increase in Pohowera / Banded Dotterel nesting success since 2013, and a noticeable decline in the recreational use of the areas subject to the rāhui during the months in which the rāhui is in force (see Box 6 above).

2. Seeking voluntary compliance

The erection of signage in combination with sustained community education and advocacy efforts have been used to reduce levels of disturbance caused by recreational beach users within the nesting areas of coastal bird species such as Tūturiwhatu / Northern New Zealand dotterels and colony-nesters such as Tarāpuka / Black-billed Gulls and Tara / White-fronted Terns. It should be noted that the installation of signage alone tends to be ineffective at sites where the recreational use of an area is particularly ingrained or heavy. Instead, signs and fences at such sites frequently become the target of vandals which can send a counter-

productive message that a site is not being regularly monitored for compliance. Combining the use of signage and visual barriers with sustained efforts to engage and educate the local community, and to advocate for voluntary compliance with restrictions aimed at protecting coastal birds can be enormously successful however and have been instrumental in the population recovery of Tūturiwhatu / Northern New Zealand Dotterels in the northern half of the North Island (Dowding & Davis 2007; Dowding 2020).

Part Three: A site-specific summary of threats and recommended management actions at internationally, nationally and regionally important sites for coastal birds in the Tasman District

3.1 Introduction

Part One of this review identified a network of 36 sites along the Tasman District coastline and along the district's rivers that provides habitat for internationally, nationally and regionally important populations and communities of coastal bird species. In Part Two of this review, we reviewed the threats that are known, or are considered likely, to be impacting coastal bird populations along the Tasman District coastline and summarised the impacts that each of these threats is known, or likely, to be having on coastal bird populations. We also reviewed and summarised the available management tools that can be used to eliminate, minimise or mitigate each of these identified threats.

In the third part of this review, we have synthesised the results of Parts One and Two with information provided by local subject matter experts to identify the threats that are occurring at each of the regionally, nationally and internationally important coastal bird habitats identified in Part One, and to provide a list of recommended management actions to implement at each site in order to eliminate, minimise or mitigate each of the identified threats. These lists of identified threats and recommended management actions will serve to provide Tasman District Council and its partner agencies and stakeholders with an evidence-based and regional-scale framework for prioritising management actions aimed at maintaining and improving the Tasman District's coastal bird values towards those sites that support the most important coastal bird populations and towards those threats that are most likely to be having an adverse impact on these coastal bird populations.

3.2 Methods

We carried out a review of both the published and unpublished literature to identify site-specific threats to coastal birds along the Tasman District coastline. We searched for relevant publications by inputting a range of search terms[9] into Google Scholar and into the search bars of the *New Zealand Journal of Ecology* and *Notornis*. We also searched the online publications archives of the Department of Conservation, Nelson City Council and Tasman District Council.

We also contacted local subject-matter experts from Tasman District Council, the Department of Conservation, Birds New Zealand, Forest & Bird, the Tasman Environmental Trust, the Mohua (Golden Bay) Blue Penguin Trust and private individuals to solicit evidence for site-specific threats occurring or suspected to occur within each of the network of 36 internationally, nationally and regionally important sites identified in Part One of this report.

We also collated threats to coastal birds observed occurring along the Tasman District coastline by fieldworkers carrying out the 2020 Tasman District coastal bird survey (McArthur *et al.* 2022). During

[9] Search terms used included "coastal bird and Tasman", "coastal ecosystem and Tasman", "coastal and threat and Tasman", "river and Tasman", "river and threat and Tasman" and "shorebird and Tasman".

this survey, fieldworkers were asked to note any observations of predators, environmental weeds or human activities observed or suspected to be adversely impacting coastal birds along the Tasman District coastline. Although this assessment was confined to a small window of time during one month of the year (December) and is also likely to be biased towards detecting the more conspicuous threats such as off-road vehicles or dogs, these fieldworkers were successful in collecting several dozen direct observations of threats that either corroborated or complemented information obtained from other sources.

Once we had compiled a comprehensive list of the threats that are known or considered likely to be operating at each of the 36 high-value sites, we combined the results of our review of available management actions identified in Part Two of this review with feedback received from the local subject-matter experts that we consulted to identify a set of recommended management actions to be implemented at each site in order to eliminate, minimise or mitigate each of the identified threats.

3.3 Results

We identified a total of 240 threats that are known, or likely to be, adversely impacting coastal bird populations at each of the 36 internationally, nationally or regionally important sites identified in Part One of this review. Appendix Three provides a list of these threats, with the sites listed in alphabetical order, and the threats listed in the order in which they appear in Part Two of this review. For the majority of these threats, we provide a recommended management action designed to eliminate, minimise or mitigate the threat, selected from the 'toolbox' of management actions outlined in Part Two of this review. For a minority of the threats identified, we found that management actions are already being implemented by TDC, DOC or community-led conservations groups and we have briefly described these in Appendix Three. In several cases, we consider that the evidence that a particular threat is impacting coastal bird populations is either too weak, or that the available management actions are either too costly or controversial to recommend a specific management action. In these cases, we instead recommend additional monitoring or investigation work required to build a stronger case for a management response, and/or to identify the most effective management action required to address these threats.

There is a substantial variation in the proportion of sites affected by each of the threats identified in Part Two of this review. One threat, human-induced climate change, is known or predicted to adversely impact the coastal bird values of all of the 36 sites identified in Part One of the review, while three further threats (feral cats, mustelids and European hedgehogs) are known or predicted to occur at >90% of sites. Of the human activities identified, recreational walkers, fishers, surfers, swimmers and picnickers are likely to be adversely impacting the coastal bird values of 64% of sites, and dog walking has been identified as an issue at 39% of sites. Gravel and sand mining and flood protection and erosion control activities have only been identified as an issue at 17% of sites, however these include all five of the internationally, nationally or regionally important sites identified on the beds of rivers. Similarly, pest plants on riverbeds have only been identified as an issue at 6% of sites, however this likely reflects the fact that only a relatively low proportion of sites are situated on the beds of rivers (Table 3.1).

Table 3.1: Proportions of internationally, nationally or regionally important coastal bird sites known or predicted to be adversely impacted by each of the threats identified in this review.

Threat	Percentage of sites at which threat has been identified
Human-induced climate change	100%
Feral cats	97%
Mustelids	97%
European hedgehogs	94%
Recreational walkers, fishers, surfers, swimmers and picnickers	64%
Domestic cats	53%
Dog walking	39%
Watercraft	33%
Motorised off-road vehicles	25%
Gravel and sand mining, flood mitigation and erosion control activities	17%
Horse riding	17%
Aircraft and UAVs	14%
Pest plants on riverbeds	6%

3.4 Discussion

Having identified 240 site-specific threats occurring at these 36 high-value sites, and over 200 recommended management actions designed to eliminate, minimise or mitigate these threats, we acknowledge that it will not be possible to implement all of these management actions in the immediate future. For this reason, we discuss below a number of priorities and opportunities for consolidation that may assist TDC in prioritising the implementation of the recommended management actions in this report.

One obvious means of prioritising these management actions is to focus on improving the management of those sites that support the highest coastal bird values in the Tasman District in the first instance, before moving on to those sites with lower coastal bird values. Among the 36 high-value sites for coastal birds that we identified in Part One of this report, eight sites support internationally important populations of coastal birds (Table 1.1; Appendix Two). Four of these sites (Farewell Spit, Abel Tasman National Park and two sites in East Waimea Inlet) are already the subject of flagship ecosystem restoration projects which are addressing a proportion of the threats that we have identified are occurring at these sites. Farewell Spit falls within the project area of Pest Free Onetahua, an ambitious predator eradication project being funded by Predator Free 2050 and run by the Tasman Environmental Trust and Manawhenua Ki Mohua. With an aim of eradicating stoats, rats, possums and feral pigs from Farewell Spit by 2025, the successful completion of this project should result in substantial increases in the local nesting success of a range of coastal bird species breeding on the spit. Similarly, Abel Tasman National Park has been the subject of a major ecological restoration effort being spearheaded by Project Janzoon in partnership with Ngāti Tama, Ngāti Rārua, Te Ātiawa, DOC and the Abel Tasman Birdsong Trust. Restoration activities within the park include extensive multi-species mammalian predator control, weed control and native species reintroductions, all of which is likely to lead to improvements in the diversity, abundance and distribution of coastal birds within the park. In the East Waimea Inlet, ecological restoration efforts are guided by the Waimea Inlet Management Strategy and Waimea Inlet Action Plan, and a range of management actions including mammalian predator control, restoration planting and weed control are being carried out by groups including the Tasman Environmental Trust, Tasman District Council, Nelson City Council and the Department of Conservation. Two further internationally important sites identified in this review (the Pakawau foreshore and Ruataniwha Inlet) also fall within the operational area subject to predator control activities being carried out by Pest Free Onetahua project and are benefitting from mustelid and hedgehog control. At these six sites therefore, we recommend that TDC engages with the relevant agencies and community groups to explore opportunities for managing the remaining threats identified in this review that aren't currently being managed at these sites. These threats include the control of feral cats (if feasible) and the management of various forms of disturbance caused by human activities including recreational walkers, dogs, motorised off-road vehicles and watercraft.

The two remaining internationally important coastal bird sites (Rototai and the Motueka Sandspit) are not currently the subject of flagship ecosystem restoration projects, and a much larger proportion of the threats to coastal birds that we have identified occurring at these sites are not currently being managed. The Motueka Sandspit is the second-most important habitat for shorebirds in the Tasman District coastline, supporting internationally important concentrations of non-breeding migrant shorebirds during both summer and winter, and providing important breeding habitat for species such as Pohowera / Banded Dotterel and Tōrea Pango / Variable Oystercatcher. The Rototai coastline supports internationally important numbers of non-breeding Tōrea / SI Pied Oystercatchers, and provides breeding habitat for nationally- and regionally-signficant numbers of Taranui / Caspian Terns,

Pohowera / Banded Dotterels, Tara / White-fronted Terns, and Tarapunga / Red-billed Gulls. Given the important coastal bird values at these two sites, we recommend that TDC prioritises the implementation of the management actions identified in this review for these two sites, as a matter of urgency.

Opportunities also exist to consolidate several individual managment actions into single projects or programmes of work. For example, we recommend that TDC engages with the Motueka community to develop a community-led predator trapping project to control both hedgehogs and mustelids along the Motueka coastline between the Riuwaka River mouth and Port Motueka, and along the lower Motueka River as far upstream as Anderson Road. By doing so, this single predator-trapping project will reduce predator densities at four of the 36 important coastal bird sites identified in this review, including the internationally important Motueka Sandspit. Similarly, we recommend that TDC engages with the Pohara and Rototai communities to develop another community-led predator trapping project along the Rototai coastline between Rangihaeata Spit and the Onahau Estuary and the western end of Pohara Beach. Targetting hedgehogs, mustelids and feral cats (if feasible) this project will reduce predator densities at another four of the 36 important coastal bird sites identified in this review, including the internationally important Rototai coastline and sand islands. Taken together, these two projects would deliver multi-species mammalian predator control to 20% of the important coastal bird sites identified in this review.

At a large proportion of these important coastal bird sites, we have identified a need to improve the managment of various recreational activities that are causing disturbance to both roosting and nesting birds, and in some cases have caused the losses of the active nests of absolutely protected and threatened species. These activities include recreational walking, swimming, surfing, picnicking; dog walking, horse-trekking and the use of recreational watercraft. In the majority of these cases, we have recommend that TDC engages with the local community and recreational user groups to educate and encourage beach-goers to implement a range of voluntary actions to reduce the risk that their activities pose to coastal birds. Evidence from other parts of New Zealand has shown that a sustained and coordinated education campaign, including the use of rangers or voluntary rangers to engage directly with the public and monitor compliance at shorebird nesting or roosting sites, can lead to substantial reductions in levels of disturbance. An alternative approach is to use statutory tools such as bylaws to regulate these activities, however experience from other regions has shown that the use of bylaws in the absence of associated compliance monitoring and enforcement often fails to improve rates of compliance, particularly at sites with a long-ingrained history of unregulated recreational activity. Given that we are recommending that education, advocacy and compliance campaigns be rolled out across a number of coastal sites in the Tasman District, designing a single coordinated campaign to be rolled out across the entire network of sites identified in this review simultaneously will be significantly more efficient in the long run than implementing these managment actions at individual sites in a more piecmeal fashion. Such a campaign is likley to be resource-intensive in the short to medium term, however costs to TDC could possibly be reduced by partnering up with local communities and engaging iwi and community-led conservation groups to assist with the delivery of education and activity activities on the ground.

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Appendix One

This appendix contains a list of resident and migratory bird species present in the Tasman District that meet the definition of "coastal bird" used in this review. A coastal bird species is any native bird species that is an obligate or facultative inhabitant of foreshore, intertidal and inshore marine habitats within the coastal marine area during at least one key life stage (e.g., breeding, non-breeding, migration). For the purpose of this review, we have excluded any coastal birds that are ranked as Vagrant under the New Zealand Threat Classification System (Robertson *et al.* 2021). We have also excluded all Procellariiformes (albatrosses, petrels, prions and shearwaters) from this review, as they typically occur in both offshore marine and terrestrial habitats rather than foreshore, intertidal and inshore habitats. This list follows the taxonomy and English and Māori naming conventions of the Checklist Committee (OSNZ) (2022) and uses the New Zealand Threat Classification System (NZTCS) rankings listed in Robertson *et al.* (2021).

Scientific Name	English Name	Māori Name	NZTCS ranking
Cygnus atratus	Black Swan	Kakīānau	Not Threatened
Tadorna variegata	Paradise Shelduck	Pūtangitangi	Not Threatened
Chenonetta jubata	Australian Wood Duck		Coloniser
Anas gracilis	Grey Teal	Tētē Moroiti	Not Threatened
Anas chlorotis	Brown Teal	Pāteke	At Risk, Recovering
Anas superciliosa	Grey Duck	Pārera	Nationally Vulnerable
Anas rhynchotis	Australasian Shoveler	Kuruwhengi	Not Threatened
Gallirallus philippensis	Banded Rail	Moho Pererū	At Risk, Declining
Zapornia tabuensis	Spotless Crake	Pūweto	At Risk, Declining
Zapornia pusilla	Marsh Crake	Kotoreke	At Risk, Declining
Porphyrio melanotus	Pukeko	Pūkeko	Not Threatened
Haematopus unicolor	Variable Oystercatcher	Tōrea Pango	At Risk, Recovering
Haematopus finschi	South Island Pied Oystercatcher	Tōrea	At Risk, Declining
Himantopus himantopus	Pied Stilt	Poaka	Not Threatened
Pluvialis fulva	Pacific Golden Plover	Kuriri	Migrant

Scientific Name	English Name	Māori Name	NZTCS ranking
Charadrius obscurus obscurus	Southern New Zealand Dotterel	Tūturiwhatu	Nationally Critical
Charadrius bicinctus	Banded Dotterel	Pohowera	At Risk, Declining
Anarhynchus frontalis	Wrybill	Ngutu Pare	Nationally Vulnerable
Elseyornis melanops	Black-fronted Dotterel		At Risk, Naturally Uncommon
Vanellus miles	Spur-winged Plover		Not Threatened
Numenius phaeopus	Eurasian Whimbrel		Migrant
Limosa lapponica	Bar-tailed Godwit	Kuaka	At Risk, Declining
Arenaria interpres	Ruddy Turnstone		Migrant
Calidris canutus	Red Knot	Huahou	At Risk, Declining
Calidris acuminata	Sharp-tailed Sandpiper	Kohutapu	Migrant
Calidris ruficollis	Red-necked Stint		Migrant
Coprotheres pomarinus	Pomarine Skua		Migrant
Stercorarius parasiticus	Arctic Skua		Migrant
Chroicocephalus novaehollandiae	Red-billed Gull	Tarāpunga	At Risk, Declining
Chroicocephalus bulleri	Black-billed gull	Tarāpuka	At Risk, Declining
Larus dominicanus	Black-backed Gull	Karoro	Not Threatened
Sternula albifrons	Little Tern		Migrant
Gelochelidon nilotica	Australian Gull-billed Tern		Coloniser
Hydroprogne caspia	Caspian Tern	Taranui	Nationally Vulnerable
Chlidonias leucopterus	White-winged Black Tern		Migrant
Chlidonias albostriatus	Black-fronted Tern	Tarapirohe	Nationally Endangered
Sterna striata	White-fronted Tern	Tara	At Risk, Declining
Eudyptula minor	Little Penguin	Kororā	At Risk, Declining

Scientific Name	English Name	Māori Name	NZTCS ranking
Morus serrator	Australasian Gannet	Tākapu	Not Threatened
Microcarbo melanoleucos	Little Shag	Kawaupaka	At Risk, Relict
Phalacrocorax carbo	Black Shag	Māpunga	At Risk, Relict
Phalacrocorax varius	Pied Shag	Kāruhiruhi	At Risk, Recovering
Phalacrocorax sulcirostris	Little Black Shag	Kawau Tūī	At Risk, Naturally Uncommon
Phalacrocorax punctatus	Spotted Shag	Kawau Tikitiki	Nationally Vulnerable
Leucocarbo carunculatus	New Zealand King Shag	Kawau Pāteketeke	Nationally Endangered
Bubulcus ibis	Cattle Egret		Migrant
Ardea alba	White Heron	Kōtuku	Nationally Critical
Egretta novaeholladiae	White-faced Heron	Matuku Moana	Not Threatened
Egretta sacra	Reef Heron	Matuku Moana	Nationally Endangered
Botaurus poiciloptilus	Australasian Bittern	Matuku-hūrepo	Nationally Critical
Platalea regia	Royal Spoonbill	Kotuku Ngutupapa	At Risk, Naturally Uncommon
Todiramphus sanctus	Sacred Kingfisher	Kōtare	Not Threatened
Poodytes punctatus	Fernbird	Mātātā	At Risk, Declining
Hirundo neoxena	Welcome Swallow	Warou	Not Threatened
Anthus novaeseelandiae	New Zealand Pipit	Pīhoihoi	At Risk, Declining

Appendix Two

This appendix contains a list of internationally, nationally or regionally important habitats for coastal birds in the Tasman District, identified using the criteria outlined in Part One of this report. The NZTM coordinates for each site represent the approximate location of the centroid (geographical centre) of each site. It should be noted that the table below only includes those site-specific avifauna values for which we have the data to demonstrate that they meet one or more of the criteria used to identify these sites as important habitats for coastal birds. This table does not provide a complete description of all of the indigenous bird values present at these sites.

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Abel Tasman National Park coastline	E1605483 N5471889	This site provides nesting, roosting and foraging habitat for a minimum of 2.8% of the global population of Spotted Shags This site provides nesting, roosting and foraging habitat for 58% of the Tasman District population of Reef Herons	Yes		Yes	2020	McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Abel Tasman National Park coastline, Awaroa Bay	E1602440 N5477005	This site provides nesting, roosting and foraging habitat for 6% of the Tasman District population of Variable Oystercatchers Eleven Nationally Threatened or At Risk bird species are resident or regular visitors to this site: Banded Rail, Black-billed Gull, Caspian Tern, Fernbird, Little Shag, Pied Shag, Red-billed Gull, SI Pied Oystercatcher, Spotted Shag, Variable Oystercatcher, White-fronted Tern			Yes	2019-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)
Abel Tasman National Park coastline, Bark Bay	E1604333 N5470669	This site provides nesting, roosting and foraging habitat for 11% of the Tasman District breeding population of Red-Billed Gulls			Yes	2020	McArthur *et al.* (2022)
Abel Tasman National Park coastline, Separation Point	E1599013 N5485589	Seven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Caspian Tern, Little Shag, Pied Shag, Red-billed Gull, Spotted Shag, Variable Oystercatcher and White-fronted Tern			Yes	2020-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Abel Tasman National Park coastline, Wainui Inlet	E1595536 N5481976	Eleven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Banded Rail, Black-billed Gull, Brown Teal, Caspian Tern, Fernbird, Little Shag, Pied Shag, Red-billed Gull, SI Pied Oystercatcher, Variable Oystercatcher			Yes	2017-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)
Buller River, Hinemoatū /Howard River confluence to Murchison township	E1555036 N5384632	This site provides nesting, foraging and roosting habitat for >5% of the Tasman District breeding population of Black-billed Gulls Seven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Black-billed Gull, Black-fronted Tern, Black Shag, Little Shag, Pied Stilt, SI Pied Oystercatcher			Yes	2010-2020	Hughey *et al.* (2010); Mischler (2018); 2020-2021 Tasman District river bird survey dataset (TDC, unpublished data); eBird (2022); McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Collingwood foreshore	E1573524 N5496721	This site provides breeding, roosting and foraging habitat for 12% of the Tasman District breeding population of Banded Dotterels This site provides roosting and foraging habitat for 6% of the Tasman District population of SI Pied Oystercatchers Eight Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Little Shag, Pied Shag, Red-billed Gull, SI Pied Oystercatcher, Variable Oystercatcher, White-fronted Tern			Yes	2020	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
East Waimea Inlet	E1608569 N5431099	This site provides breeding, roosting and foraging habitat for 1.9% of the global population of Variable Oystercatchers This site provides roosting and foraging habitat for 4.6% of the global population of SI Pied Oystercatchers This site provides roosting and foraging habitat for 1.4% of the global population of Wrybills This site provides roosting and foraging habitat for 1.6% of the global population of Bar-tailed Godwits This site provides roosting and foraging habitat for 1.8% of the national population of Red Knots	Yes	Yes		2001-2020	Schuckard & Melville (2013); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
East Waimea Inlet, Bell island	E1615210 N5428860	This site provides roosting and foraging habitat for 1.2% of the global population of Black-fronted Terns This site provides breeding, roosting and foraging habitat for 3% of the national breeding population of Caspian Terns Seventeen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Black-billed Gull, Black-fronted Dotterel, Black Shag, Caspian Tern, Little Shag, Little Black Shag, Pied Stilt, Pied Shag, Red-billed Gull, Red Knot, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher, White-fronted Tern, Wrybill	Yes	Yes	Yes	2000-2020	Schuckard & Melville (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022); McArthur *et al.* (2022)
East Waimea Inlet, Rabbit Island east	E1616302 N5429502	Twelve Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Black-billed Gull, Caspian Tern, Little Shag, Pied Shag, Red-billed Gull, Red Knot, SI Pied Oystercatcher, Variable Oystercatcher and White-fronted Tern, Wrybill			Yes	2020	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Farewell Spit	E1591926 N5514583	This site supports a mean of 29,000 shorebirds in summer and a mean of 20,000 shorebirds in spring This site provides roosting and foraging habitat for up to 9% of the global population of Bar-tailed Godwits This site provides roosting and foraging habitat for 8% of the global population of Red Knots This site provides roosting and foraging habitat for up to 9% of the global population of SI Pied Oystercatchers This site provides roosting and foraging habitat for 1.4% of the global population of Ruddy Turnstones This site provides nesting, roosting and foraging habitat for 2% of the global population of Variable Oystercatchers This site provides roosting and foraging habitat for up to 3% of the global population of Banded Dotterels	Yes	Yes	Yes	1998-2022	Bell & Bell (2008); Schuckard *et al.* (2012); Schuckard & Melville (2013); Schuckard & Melville (2019); Schuckard *et al.* (2020); Eagles (2021); Schuckard & Melville (2022); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
		This site provides winter roosing habitat for 1.5% of the global population of Black-fronted Terns This site provides nesting habitat for 7% of the national breeding population of Australasian Gannets This site provides nesting and roosting habitat for 4% of the national breeding population of Caspian Terns Nineteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Australasian Bittern, Banded Dotterel, Bar-tailed Godwit, Black-fronted Tern, Black Shag, Caspian Tern, Fernbird, Little Penguin, Little Shag, NZ Pipit, Pied Shag, Pied Stilt, Red-billed Gull, Red Knot, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher, White-fronted Tern, White Heron					

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Kina Beach, Moutere Inlet	E1603464 N5443413	This site provides nesting, roosting and foraging habitat for 12% of the Tasman District breeding population of Banded Dotterels Eleven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Caspian Tern, Little Shag, Pied Shag, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Spotted Shag, Variable Oystercatcher, White-fronted Tern			Yes	2019-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	E1574530 N5379234	This site provides nesting habitat for >5% of the Tasman District breeding population of black-billed gulls			Yes	2020	2020-2021 Tasman District river bird survey dataset (TDC, unpublished data)
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	E1600964 N5461758	This site provides nesting, roosting and foraging habitat for 5% of the Tasman District breeding population of banded dotterels Twenty-one Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Australasian Bittern, Banded Dotterel, Banded Rail, Bar-tailed Godwit, Black-fronted Tern, Black Shag, Black-billed Gull, Caspian Tern, Fernbird, Little Penguin, Little Shag, Marsh Crake, Pied Shag, Pied Stilt, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Spotless Crake, Spotted Shag, Variable Oystercatcher and White-fronted Tern			Yes	2015-2022	Hutzler (2015); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Matakitaki River below Mole Stream confluence	E1554976 N5350438	This site provides nesting, roosting and foraging habitat for 59% of the regional breeding population of Black-billed Gulls			Yes	2020	McArthur *et al.* (2022)
Motueka River, lower reach from river mouth to Anderson Rd	E1600262 N5450461	Nine Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Black-fronted Tern, Black Shag, Caspian Tern, Little Shag, Pied Shag, Pied Stilt, Red-billed Gull, SI Pied Oystercatcher			Yes	2010-2021	Hughey *et al.* (2010); 2020-2021 Tasman District river bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Motueka River mouth	E1600445 N5453700	Fifteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Black-billed Gull, Black-fronted Tern, Black Shag, Caspian Tern, Little Shag, Little Black Shag, Pied Shag, Pied Stilt, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher, White-fronted Tern			Yes	2016-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Motueka Sandspit	E1603084 N5446936	This site provides roosting habitat for up to 7% of the global population of Black-fronted Terns This site provides nesting, roosting and foraging habitat for up to 2.2% of the global population of Variable Oystercatchers This site provides nesting, roosting and foraging habitat for up to 1.8% of the global population of SI Pied Oystercatchers This site provides roosting and foraging habitat for 1.7% of the global population of Bar-tailed Godwits This site provides roosting and foraging habitat from 1.1% of the national population of Red Knots This site provides roosting and foraging habitat for 5.8% of the national population of Ruddy Turnstones This site provides nesting, roosting and foraging habitat for >5% of the Tasman District breeding population of Black-billed Gulls	Yes	Yes	Yes	2001-2020	Schuckard & Melville (2013); Schuckard & Melville (2019); McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
		This site provides nesting, roosting and foraging habitat for 50% of the Tasman District breeding population of Banded Dotterels					
Motupipi River mouth	E1586814 N5479958	Eleven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded dotterel, Bar-tailed Godwit, Black Shag, Caspian Tern, Little Shag, Pied Shag, Pied Stilt, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher			Yes	2018-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)
Pakawau foreshore, Tomatea Point	E1573850 N5506289	This site provides roosting and foraging habitat for 1.5% of the global population of SI Pied Oystercatchers Thirteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Black-billed Gull, Black Shag, Caspian Tern, Little Penguin, Little Shag, Pied Shag, Red-billed Gull, SI Pied Oystercatcher, Spotted Shag, Variable Oystercatcher, White-fronted Tern	Yes		Yes	2019-2022	Mohua (Golden Bay) Blue Penguin Trust (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); Schuckard & Melville (2022); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Parapara coastline, Milnthorpe to Onekaka Estuary	E1575027 N5495027	Thirteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Bar-tailed Godwit, Black-billed Gull, Black Shag, Caspian Tern, Little Penguin, Little Shag, Pied Shag, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Spotted Shag, Variable Oystercatcher, White-fronted Tern			Yes	2019-2022	Mohua (Golden Bay) Blue Penguin Trust (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)
Pariwhakaoho River mouth to 2km north	E1577983 N5486295	This site provides nesting, roosting and foraging habitat for 5% of the Tasman District breeding population of Banded Dotterels Eight Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Black-billed Gull, Little Penguin, Little Shag, Pied Shag, SI Pied Oystercatcher, Variable Oystercatcher and White-fronted Tern			Yes	2019-2021	Mohua (Golden Bay) Blue Penguin Trust (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Port Pūponga	E1577715 N5513777	Seven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Little Penguin, Pied Shag, Royal Spoonbill, Red-billed Gull, SI Pied Oystercatcher, Spotted Shag, Variable Oystercatcher			Yes	2019-2022	Mohua (Golden Bay) Blue Penguin Trust (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)
Port Tarakohe to Motu Island	E1592418 N5481873	This site provides habitat for 33% of the Tasman District population of Reef Herons This site provides nesting, roosting and foraging habitat for 17% of the Tasman District breeding population of Red-billed Gulls Thirteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Rail, Bar-tailed Godwit, Caspian Tern, Little Penguin, Little Shag, Pied Shag, Pied Stilt, Red-billed Gull, Reef Heron, SI Pied Oystercatcher, Spotted Shag, Variable Oystercatcher, White-fronted Tern			Yes	2009-2022	Mohua (Golden Bay) Blue Penguin Trust (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022); McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Pūponga coastline, 1km north to 1km south of Taupata Stream	E1576340 N5511361	This site provides roosting and foraging habitat for 6% of the Tasman District population of SI Pied Oystercatchers Eleven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Bar-tailed Godwit, Black-billed Gull, Black Shag, Caspian Tern, Little Shag, Pied Shag, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher, White-fronted Tern			Yes	2020-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022); McArthur *et al.* (2022)
Rangihaeata Spit	E1581182 N5483636	Eleven Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Caspian Tern, Fernbird, Little Shag, Pied Stilt, Red-billed Gull, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher, White Heron			Yes	2020-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Riuwaka River mouth	E1600117 N5454113	This site provides habitat for 8% of the regional population of Reef Herons This site provides nesting, roosting and foraging habitat for 7% of the regional breeding population of Banded Dotterels			Yes	2020	McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Rototai coastline and adjacent sand islands	E1585249 N5481321	This site provides roosting and foraging habitat for 1.5% of the global population of SI Pied Oystercatchers This site provides nesting, roosting and foraging habitat for 3% of the national breeding population of Caspian Terns This site provides nesting, roosting and foraging habitat for 9% of the Tasman District breeding population of White-fronted Terns This site provides nesting, roosting and foraging habitat for 7% of the Tasman District breeding population of Banded Dotterels This site provides nesting, roosting and foraging habitat for 6% of the Tasman District breeding population of Red-billed Gulls	Yes	Yes	Yes	2001-2020	2020 Tasman District coastal bird survey dataset (TDC, unpublished data) McArthur *et al.* (2022); Schuckard & Melville (2012)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Ruataniwha Inlet, including Sand Islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	E1572747 N5497902	The Ruataniwha Inlet provides roosting and foraging habitat for 2.5% of the global population of SI Pied Oystercatchers Fifteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Bar-tailed Godwit, Black-billed Gull, Black Shag, Caspian Tern, Little Shag, Little Black Shag, Pied Shag, Pied Stilt, Red-billed Gull, Royal Spoonbill, Spotted Shag, Variable Oystercatcher, White-fronted Tern, White Heron	Yes		Yes	2001-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); Schuckard & Melville (2022); eBird (2022)
Ruataniwha Inlet, Sand Islands	E1573731 N5499006	This site provides nesting, roosting and foraging habitat for 91% of the Tasman District breeding population of White-fronted Terns This site provides nesting, roosting and foraging habitat for 48% of the Tasman District breeding population of Red-billed Gulls This site provides nesting, roosting and foraging habitat for 40% of the Tasman District breeding population of Black-billed Gulls			Yes	2020	McArthur *et al.* (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Tākaka River mouth & Rangihaeata Head	E1583851 N5480904	Fourteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Banded Rail, Bar-tailed Godwit, Black Shag, Caspian Tern, Little Black Shag, Little Shag, Pied Shag, Pied Stilt, Red-billed Gull, Royal Spoonbill, Variable Oystercatcher, White-fronted Tern, White Heron			Yes	2019-2022	Mohua (Golden Bay) Blue Penguin Trust (2019); 2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)
Torlesse Rock, Kaiteretere	E1602096 N5456413	Torlesse Rock provides nesting, roosting and foraging habitat for 18% of the Tasman District breeding population of Red-billed Gulls			Yes	2020	McArthur *et al.* (2022)
Waimea River, plains reach - SH6 to Lower Queen Street	E1610367 N5424686	Nine Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Banded Dotterel, Black-fronted Dotterel, Black-fronted Tern, Black Shag, Caspian Tern, Little Shag, Pied Shag, Pied Silt, SI Pied Oystercatcher			Yes	2010-2021	Hughey *et al.* (2010); 2020-2021 Tasman District river bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
West Waimea Inlet	E1616267 N5428459	The West Waimea Inlet provides nesting, roosting and foraging habitat for 10% of the regional population of Pied Stilts The West Waimea Inlet provides nesting, roosting and foraging habitat for 8.5% of the regional population of Variable Oystercatchers			Yes	2001-2020	2020 Tasman District coastal bird survey dataset (TDC, unpublished data)
West Waimea Inlet, O'Connor Creek	E1609658 N5429421	Eight Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Bar-tailed Godwit, Black Shag, Caspian Tern, Little Shag, Pied Shag, Pied Stilt, Royal Spoonbill, Variable Oystercatcher			Yes	2018-2022	2020 Tasman District coastal bird survey dataset (TDC, unpublished data); eBird (2022)

Site name	Site location (NZTM coordinates)	Bird values that trigger importance criteria	Importance level			Age of Data	Data Source(s)
			International	National	Regional		
Whanganui Inlet	E1563069 N5506442	Fourteen Nationally Threatened or At Risk bird species are known to be resident or regular visitors to this site: Australasian Bittern, Black Shag, Caspian Tern, Fernbird, Little Black Shag, Little Shag, Pied Shag, Pied Stilt, Red-billed Gull, Reef Heron, Royal Spoonbill, SI Pied Oystercatcher, Variable Oystercatcher, White Heron			Yes	2001-2022	eBird (2022)

Appendix Three

This appendix contains a list of identified threats known or likely to be adversely impacting coastal bird populations at each of the 36 internationally, nationally and regionally important sites for coastal birds identified in Part One of this review, and recommended management actions to eliminate, minimise or mitigate each of these identified threats. Each threat identified in the table is hyperlinked to the corresponding section of Part Two, for ease of cross-reference. The information source(s) for each identified threat are also given, along with a brief rationale for each recommended management action.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping hedgehogs throughout Abel Tasman national Park using DOC200 traps.	
Abel Tasman National Park coastline	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	DOC and Project Janzoon are currently controlling feral cats in Awaroa Bay using the toxin PAPP deployed in bait stations.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping mustelids throughout Abel Tasman national Park using DOC200 traps.	
Abel Tasman National Park coastline	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Abel Tasman National Park coastline	Recreational walkers, fishers, surfers, swimmers and picnickers	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline	Watercraft	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	
Abel Tasman National Park coastline, Awaroa Bay	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping hedgehogs throughout Abel Tasman national Park using DOC200 traps.	
Abel Tasman National Park coastline, Awaroa Bay	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	DOC and Project Janzoon are currently controlling feral cats in Awaroa Bay using the toxin PAPP deployed in bait stations.	
Abel Tasman National Park coastline, Awaroa Bay	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping mustelids throughout Abel Tasman national Park using DOC200 traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Awaroa Bay	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Abel Tasman National Park coastline, Awaroa Bay	Recreational walkers, fishers, surfers, swimmers and picnickers	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	
Abel Tasman National Park coastline, Awaroa Bay	Watercraft	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Bark Bay	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping hedgehogs throughout Abel Tasman national Park using DOC200 traps.	
Abel Tasman National Park coastline, Bark Bay	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).		
Abel Tasman National Park coastline, Bark Bay	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping mustelids throughout Abel Tasman national Park using DOC200 traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Bark Bay	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Abel Tasman National Park coastline, Bark Bay	Recreational walkers, fishers, surfers, swimmers and picnickers	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	
Abel Tasman National Park coastline, Bark Bay	Watercraft	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Separation Point	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping hedgehogs throughout Abel Tasman national Park using DOC200 traps.	
Abel Tasman National Park coastline, Separation Point	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).		
Abel Tasman National Park coastline, Separation Point	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping mustelids throughout Abel Tasman national Park using DOC200 traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Separation Point	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Abel Tasman National Park coastline, Separation Point	Watercraft	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	
Abel Tasman National Park coastline, Wainui Inlet	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping hedgehogs throughout Abel Tasman national Park using DOC200 traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Wainui Inlet	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).		
Abel Tasman National Park coastline, Wainui Inlet	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	Project Janzoon, the Abel Tasman Birdsong Trust and DOC are currently trapping mustelids throughout Abel Tasman national Park using DOC200 traps.	
Abel Tasman National Park coastline, Wainui Inlet	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Abel Tasman National Park coastline, Wainui Inlet	Recreational walkers, fishers, surfers, swimmers and picnickers	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	
Abel Tasman National Park coastline, Wainui Inlet	Watercraft	Trevor James (TDC), *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Recreational activities within Abel Tasman National Park are regulated and managed by the Department of Conservation.	
Buller River, Howard River confluence to Murchison township	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021)	We recommend that TDC engages with the Murchison community to establish a community-led predator trapping programme along braided sections of this reach of the Buller River. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Buller River, Howard River confluence to Murchison township	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Buller River, Howard River confluence to Murchison township	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Buller River, Howard River confluence to Murchison township	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Murchison community to establish a community-led predator trapping programme along braided sections of this reach of the Buller River. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Buller River, Howard River confluence to Murchison township	Pest plants in riverbed habitats	Trevor James *personal communication*	We recommend that TDC eradicates key pest plant species such as willows, lupins, gorse where feasible (e.g., in geographically isolated areas).	Controlling the spread of pest plants on the riverbed will maintain the open, unvegetated gravels needed by coastal bird species for nesting.
Buller River, Howard River confluence to Murchison township	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project		

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Buller River, Howard River confluence to Murchison township	Gravel and sand mining, flood mitigation and erosion control activities	TDC, unpublished data	We recommend that TDC reviews, updates and standardises (if needed) gravel and sand mining consent conditions to minimise both short and long-term adverse impacts on coastal bird species. We recommend that TDC develops a code of practice to ensure that flood mitigation and erosion control activities are carried out in a way that maintains the natural, cultural and recreational values of the Tasman Districts rivers and coastline.	This combination of appropriate consent conditions and an overarching code of practice is a proven approach that has been implemented by other regional councils, including Hawke's Bay Regional Council, Greater Wellington Regional Council and Environment Canterbury.
Collingwood foreshore	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids (and presumably also catching hedgehogs) around parts of the northern shore of Ruataniwha Inlet using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network can be extended to include the entire Ruataniwha Inlet shoreline, including the peninsula extending southwards from Totara Avenue and the Collingwood foreshore.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Collingwood foreshore	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Collingwood foreshore	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The lethal control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps. In the meantime, we recommend that TDC investigates the use of chemical camouflage techniques to reduce cat depredation rates on shorebird nests.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Collingwood foreshore	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids around parts of the northern shore of Ruataniwha Inlet using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network can be extended to include the entire Ruataniwha Inlet shoreline, including the peninsula extending southwards from Totara Avenue and the Collingwood foreshore.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.
Collingwood foreshore	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Collingwood foreshore	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013; 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.
Collingwood foreshore	Dog walking	Melville & Schuckard 2013; Grant Williams*, personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	The Collingwood foreshore is currently an off-leash dog exercise area under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to make this site an on-leash dog exercise area to reduce the impacts of this activity on both nesting and roosting shorebirds. We also recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education and compliance monitoring campaign to inform local residents of this change to the bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks, so we consider that requiring dogs to be exercised on-leash is proportionate to the regionally important values of this site.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Collingwood foreshore	Motorised off-road vehicles	Melville & Schuckard 2013; Cynthia McConville, *personal communication;* Grant Williams, *personal communication*	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Collingwood foreshore	Aircraft and UAVs	Grant Williams, *personal communication*	We recommend that TDC engages with local aero clubs and scenic tour operators to request that low-flying aircraft avoid overflying this site to avoid disturbing nesting and roosting shorebirds. We also recommend that TDC updates signage at this site to include a request that UAV operators do not fly their drones at this site at any time of the year.	Seeking voluntary compliance from the public through direct engagement and improved signage is likely to be the least controversial options for reducing levels of aircraft and UAV disturbance to roosting birds.
East Waimea Inlet	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping hedgehogs around the inland shoreline of East Waimea Inlet using DOC200 traps as part of the Battle for the Banded Rail project, and the Moturoa/Rabbit Island Trapping Group is also trapping hedgehogs on the eastern half of Rabbit Island using DOC200 traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
East Waimea Inlet	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with the Tasman Environmental Trust to investigate the feasibility of controlling feral cats in East Waimea Inlet, in addition to the existing trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken in East Waimea Inlet should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping mustelids around the inland shoreline of East Waimea Inlet using DOC200 traps as part of the Battle for the Banded Rail project, and the Moturoa/Rabbit Island Trapping Group is also trapping mustelids on the eastern half of Rabbit Island using DOC200 traps.	
East Waimea Inlet	Southern Black-backed gulls	Threat possibly present due to known distribution of Southern Black-backed Gulls (TDC, unpublished data) and shorebird impacts reported elsewhere (e.g., Biswell 2005; Schlesselmann 2018).	Given the uncertainty regarding the severity of this threat to locally-breeding shorebirds, it is recommended that the severity of this threat be quantified by using trail cameras to quantify causes of local shorebird nest failure to inform whether or not a management action is required.	Given the cost and potential controversy of controlling Southern Black-backed Gulls we recommend that an investigation be carried out to quantify the impacts of black-backed gulls on locally-breeding shorebirds to provide evidence for whether or not a management response is required.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
East Waimea Inlet	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013; 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial options for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet	Dog walking	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Dogs are currently prohibited from both Rabbit Island and the Bell Island shellbank under the Tasman District Council Dog Control Bylaw (2014), however there currently appears to be a poor level of compliance with this bylaw on Rabbit Island. We recommend that TDC works with DOC to review and update signage at Rabbit Island if necessary, and to implement a local education campaign to inform local residents of this changed requirements.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of this site as habitat for nesting gulls and terns, and for roosting shorebirds, we consider the existing bylaw proportionate to the important bird values of this site, however a local education campaign, including an on-site compliance monitoring and enforcement component is needed to improve rates of compliance with this bylaw.
East Waimea Inlet	Horse riding	Nikki McArthur, *personal observation;* Guinevere Coleman*, personal communication*	We recommend that TDC updates signage at this site to provide clear guidance to horse riders to ride their horses below the high-tide mark between the months of Sept – Feb inclusive to avoid trampling shorebird nests. Installation of improved signage should be accompanied by an education campaign targeting local horse riders, encouraging riders to avoid approaching roosting flocks of coastal birds at any time of the year.	Seeking voluntary compliance from the public through improved signage and education is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet	Aircraft and UAVs	Melville & Schuckard 2013	We recommend that TDC engages with local aero clubs, helicopter and scenic tour operators to request that low-flying aircraft avoid overflying Bell Island to avoid disturbing nesting and roosting shorebirds. We also recommend that TDC updates signage at this site to include a request that UAV operators do not fly their drones at this site at any time of the year.	Seeking voluntary compliance from the public through direct engagement and improved signage is likely to be the least controversial options for reducing levels of aircraft and UAV disturbance to roosting birds.
East Waimea Inlet	Watercraft	Melville & Schuckard 2013	We recommend that TDC installs signage requesting that watercraft users not approach within 200m of roosting or nesting shorebirds on Bell Island. Signage should be erected at local boat-launching sites. Installation of this signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to nesting and roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet, Bell Island	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping hedgehogs on Bell Island using DOC200 traps as part of the Battle for the Banded Rail project.	
East Waimea Inlet, Bell Island	Feral cats	Willie Cook, *personal observation*; David Melville, *personal observation.*	We recommend that TDC liaises with the Tasman Environmental Trust to investigate the feasibility of controlling feral cats on Bell Island, in addition to the existing trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken on Bell Island should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
East Waimea Inlet, Bell Island	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping mustelids on Bell Island using DOC200 traps as part of the Battle for the Banded Rail project.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet, Bell Island	Southern Black-backed gulls	Threat possibly present due to known distribution of Southern Black-backed Gulls (TDC, unpublished data) and shorebird impacts reported elsewhere (e.g., Biswell 2005; Schlesselmann 2018).	Given the uncertainty regarding the severity of this threat to locally-breeding shorebirds, it is recommended that the severity of this threat be quantified by using trail cameras to quantify causes of local shorebird nest failure to inform whether or not a management action is required.	Given the cost and potential controversy of controlling Southern Black-backed Gulls we recommend that an investigation be carried out to quantify the impacts of black-backed gulls on locally-breeding shorebirds to provide evidence for whether or not a management response is required.
East Waimea Inlet, Bell Island	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet, Bell Island	Aircraft and UAVs	Melville & Schuckard 2013	We recommend that TDC engages with local aero clubs, helicopter and scenic tour operators to request that low-flying aircraft avoid overflying Bell Island to avoid disturbing nesting and roosting shorebirds. We also recommend that TDC updates signage at this site to include a request that UAV operators do not fly their drones at this site at any time of the year.	Seeking voluntary compliance from the public through direct engagement and improved signage is likely to be the least controversial options for reducing levels of aircraft and UAV disturbance to roosting birds.
East Waimea Inlet, Bell Island	Watercraft	Melville & Schuckard 2013	We recommend that TDC installs signage requesting that watercraft users not approach within 200m of roosting or nesting shorebirds on Bell Island. Signage should be erected at local boat-launching sites. Installation of this signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to nesting and roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet, Rabbit Island east	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Moturoa/Rabbit Island Trapping Group is trapping mustelids on the eastern half of Rabbit Island using DOC200 traps.	
East Waimea Inlet, Rabbit Island east	Feral cats	North 2012	We recommend that TDC liaises with the Moturoa/Rabbit Island Trapping Group to investigate the feasibility of controlling feral cats on Rabbit Island, in addition to the existing trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken on Rabbit Island should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
East Waimea Inlet, Rabbit Island east	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Moturoa/Rabbit Island Trapping Group is trapping mustelids on the eastern half of Rabbit Island using DOC200 traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet, Rabbit Island east	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
East Waimea Inlet, Rabbit Island east	Recreational walkers, fishers, surfers, swimmers and picnickers	North 2012; 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial options for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
East Waimea Inlet, Rabbit Island east	Dog walking	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Dogs are currently prohibited from this site under the Tasman District Council Dog Control Bylaw (2014), however there currently appears to be a poor level of compliance with this bylaw at this site. We recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education campaign to inform local residents of this changed requirements.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of these sand islands as habitat for nesting gulls and terns, and for roosting shorebirds, we consider the existing bylaw proportionate to the important bird values of this site, however a local education campaign, including an on-site compliance monitoring and enforcement component is needed to improve rates of compliance with this bylaw.
East Waimea Inlet, Rabbit Island east	Horse riding	North 2012; Nikki McArthur, *personal observation*	We recommend that TDC updates signage at this site to provide clear guidance to horse riders to ride their horses below the high-tide mark between the months of Sept – Feb inclusive to avoid trampling shorebird nests. Installation of improved signage should be accompanied by an education campaign targeting local horse riders, encouraging riders to avoid approaching roosting flocks of coastal birds at any time of the year.	Seeking voluntary compliance from the public through improved signage and education is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Farewell Spit	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are collaborating to eradicate pigs, rats, mustelids and possums from Farewell Spit by 2025 as part of the Pest Free Onetahua project using a combination of aerial 1080, kill trapping and detector dogs. We recommend that TDC liaises with Pest Free Onetahua and DOC to examine the feasibility to expand eradication efforts to include European hedgehogs, if needed.	
Farewell Spit	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are collaborating to eradicate pigs, rats, mustelids and possums from Farewell Spit by 2025 as part of the Pest Free Onetahua project using a combination of aerial 1080, kill trapping and detector dogs. We recommend that TDC liaises with Pest Free Onetahua and DOC to examine the feasibility to expand eradication efforts to include feral cats, if needed.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Farewell Spit	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are collaborating to eradicate mustelids from Farewell Spit by 2025 as part of the Pest Free Onetahua project using a combination of aerial 1080, kill trapping and detector dogs.	
Farewell Spit	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Farewell Spit	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013	Birds roosting in the 'Gobi Desert' area at the base of Farewell Spit have experienced disturbance from walkers in the past (Melville & Schuckard 2013). We recommend that TDC liaises with DOC and local tour operators to review whether current signage needs to be upgraded and a local education campaign run to reduce levels of disturbance in this area.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial options for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.
Kina Beach, Moutere Inlet	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Kina community to establish a community-led predator trapping programme along Kina Beach. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Kina Beach, Moutere Inlet	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020)	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Kina Beach, Moutere Inlet	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021)	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps. In the meantime, we recommend that TDC investigates the use of chemical camouflage techniques to reduce cat depredation rates on shorebird nests.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Kina Beach, Moutere Inlet	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021)	We recommend that TDC engages with the Kina community to establish a community-led predator trapping programme along Kina Beach. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Kina Beach, Moutere Inlet	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Kina Beach, Moutere Inlet	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC examines the feasibility of installing temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Kina Beach, Moutere Inlet	Dog walking	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Kina Beach is currently designated as an off-leash dog exercise area under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to make this site an on-leash dog exercise area to reduce the impacts of this activity on both nesting and roosting shorebirds using this site. We also recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education and compliance monitoring campaign to inform local residents of this change to the bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks, so we consider that requiring dogs to be exercised on-leash is proportionate to the regionally important values of this site.
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC carries out annual summer checks for nesting Black-billed Gulls at this site. Should a nesting colony be located, we recommend that TDC installs a grid of kill traps around the colony, to control local numbers of hedgehogs, feral cats and mustelids.	Black-billed Gulls may not nest at this site each year, as the locations of nesting colonies tend to change from year to year. For this reason, maintaining and servicing a permanent network of kill traps at this site might not be very cost-effective.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC carries out annual summer checks for nesting Black-billed Gulls at this site. Should a nesting colony be located, we recommend that TDC installs a grid of kill traps around the colony, to control local numbers of hedgehogs, feral cats and mustelids.	Black-billed Gulls may not nest at this site each year, as the locations of nesting colonies tend to change from year to year. For this reason, maintaining and servicing a permanent network of kill traps at this site might not be very cost-effective.
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC carries out annual summer checks for nesting Black-billed Gulls at this site. Should a nesting colony be located, we recommend that TDC installs a grid of kill traps around the colony, to control local numbers of hedgehogs, feral cats and mustelids.	Black-billed Gulls may not nest at this site each year, as the locations of nesting colonies tend to change from year to year. For this reason, maintaining and servicing a permanent network of kill traps at this site might not be very cost-effective.
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project		

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Maggie Creek (airstrip to Hinemoatū / Howard River confluence)	Gravel and sand mining, flood mitigation and erosion control activities	TDC, unpublished data	We recommend that TDC reviews, updates and standardises (if needed) gravel and sand mining consent conditions to minimise both short and long-term adverse impacts on coastal bird species. We recommend that TDC develops a code of practice to ensure that flood mitigation and erosion control activities are carried out in a way that maintains the natural, cultural and recreational values of the Tasman Districts rivers and coastline.	This combination of appropriate consent conditions and an overarching code of practice is a proven approach that has been implemented by other regional councils, including Hawke's Bay Regional Council, Greater Wellington Regional Council and Environment Canterbury.
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	Hedgehogs are currently being trapped at this site by the Abel Tasman Birdsong Trust, the Mārahau Halo Project and Otuwhero Trust.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	Mustelids are currently being trapped at this site by the Abel Tasman Birdsong Trust, the Mārahau Halo Project and Otuwhero Trust.	
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC examines the feasibility of installing temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.
Mārahau coastline, including Otūwhero Inlet and Mārahau Estuary	Watercraft	Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC and DOC engage with local sea kayak and water taxi companies to develop measures to minimise the risks that recreational watercraft use pose to nesting and roosting shorebirds.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Matakitaki River below Mole Stream confluence	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC carries out annual summer checks for nesting Black-billed Gulls at this site. Should a nesting colony be located, we recommend that TDC installs a grid of kill traps around the colony, to control local numbers of hedgehogs, feral cats and mustelids.	Black-billed Gulls may not nest at this site each year, as the locations of nesting colonies tend to change from year to year. For this reason, maintaining and servicing a permanent network of kill traps at this site might not be very cost-effective.
Matakitaki River below Mole Stream confluence	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC carries out annual summer checks for nesting Black-billed Gulls at this site. Should a nesting colony be located, we recommend that TDC installs a grid of kill traps around the colony, to control local numbers of hedgehogs, feral cats and mustelids.	Black-billed Gulls may not nest at this site each year, as the locations of nesting colonies tend to change from year to year. For this reason, maintaining and servicing a permanent network of kill traps at this site might not be very cost-effective.
Matakitaki River below Mole Stream confluence	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC carries out annual summer checks for nesting Black-billed Gulls at this site. Should a nesting colony be located, we recommend that TDC installs a grid of kill traps around the colony, to control local numbers of hedgehogs, feral cats and mustelids.	Black-billed Gulls may not nest at this site each year, as the locations of nesting colonies tend to change from year to year. For this reason, maintaining and servicing a permanent network of kill traps at this site might not be very cost-effective.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Matakitaki River below Mole Stream confluence	Southern Black-backed gulls	Threat possibly present due to known distribution of Southern Black-backed Gulls (TDC, unpublished data) and shorebird impacts reported elsewhere (e.g., Biswell 2005; Schlesselmann 2018).	Given the uncertainty regarding the severity of this threat to locally-breeding shorebirds, it is recommended that the severity of this threat be quantified by using trail cameras to quantify causes of local shorebird nest failure to inform whether or not a management action is required.	Given the cost and potential controversy of controlling Southern Black-backed Gulls we recommend that an investigation be carried out to quantify the impacts of black-backed gulls on locally-breeding shorebirds to provide evidence for whether or not a management response is required.
Matakitaki River below Mole Stream confluence	Pest plants in riverbed habitats	Trevor James *personal communication*	We recommend that TDC eradicates key pest plant species such as willows, lupins, gorse where feasible (e.g., in geographically isolated areas).	Controlling the spread of pest plants on the riverbed will maintain the open, unvegetated gravels needed by coastal bird species for nesting.
Matakitaki River below Mole Stream confluence	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project		

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Matakitaki River below Mole Stream confluence	Gravel and sand mining, flood mitigation and erosion control activities	TDC, unpublished data	We recommend that TDC reviews, updates and standardises (if needed) gravel and sand mining consent conditions to minimise both short and long-term adverse impacts on coastal bird species. We recommend that TDC develops a code of practice to ensure that flood mitigation and erosion control activities are carried out in a way that maintains the natural, cultural and recreational values of the Tasman Districts rivers and coastline.	This combination of appropriate consent conditions and an overarching code of practice is a proven approach that has been implemented by other regional councils, including Hawke's Bay Regional Council, Greater Wellington Regional Council and Environment Canterbury.
Motueka River, lower reach from river mouth to Anderson Rd	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka River, lower reach from river mouth to Anderson Rd	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Motueka River, lower reach from river mouth to Anderson Rd	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka River, lower reach from river mouth to Anderson Rd	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Motueka River, lower reach from river mouth to Anderson Rd	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project		
Motueka River, lower reach from river mouth to Anderson Rd	Gravel and sand mining, flood mitigation and erosion control activities	TDC, unpublished data	We recommend that TDC reviews, updates and standardises (if needed) gravel and sand mining consent conditions to minimise both short and long-term adverse impacts on coastal bird species. We recommend that TDC develops a code of practice to ensure that flood mitigation and erosion control activities are carried out in a way that maintains the natural, cultural and recreational values of the Tasman Districts rivers and coastline.	This combination of appropriate consent conditions and an overarching code of practice is a proven approach that has been implemented by other regional councils, including Hawke's Bay Regional Council, Greater Wellington Regional Council and Environment Canterbury.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka River mouth	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Motueka River mouth	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka River mouth	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	
Motueka River mouth	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka River mouth	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Motueka Sandspit	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka Sandspit	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Motueka Sandspit	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka Sandspit	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Motueka Sandspit	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka Sandspit	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC liaises with DOC to install temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas and to discourage the construction of driftwood structures within nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka Sandspit	Dog walking	Melville & Schuckard 2013; Lionel Solly (DOC), *personal communication*	We recommend that TDC works with DOC to make the boundaries of the Motueka Sandspit Scenic Reserve ambulatory to match the actual location of the spit[10]. Dogs are currently prohibited from the southern half of this site under the Tasman District Council Dog Control Bylaw (2014) however the northern half of the site is designated an off-leash dog exercise area. We recommend that TDC works with DOC to amend the existing bylaw to prohibit dogs from the entire length of the spit, and to review and update signage at this site if necessary, and to implement a local education and compliance monitoring campaign to improve compliance with the new bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the internationally important numbers of shorebirds that use this site for roosting and nesting we consider that prohibiting dogs from Motueka Sandspit to be a measure that is proportionate to the important bird values of this site.

[10] This recommendation also implements one of the management targets of the Tasman Biodiversity Strategy - Te Mana o te Taiao ki te Tai o Aorere (TDC 2021).

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka Sandspit	Horse riding	Melville & Schuckard 2013	We recommend that TDC works with DOC to make the boundaries of the Motueka Sandspit Scenic Reserve ambulatory to match the actual location of the spit[9]. We recommend that TDC and DOC engages with the local horse-riding community to explore options to phase out the use of Motueka Sandspit for horse riding.	Given the internationally important numbers of shorebirds that use this site all year round, we consider the phasing out of horse riding at this site to be a management action proportionate to the important bird values of this site.
Motueka Sandspit	Motorised off-road vehicles	Melville & Schuckard 2013; Trevor James (TDC), *personal communication*	We recommend that TDC works with DOC to make the boundaries of the Motueka Sandspit Scenic Reserve ambulatory to match the actual location of the spit[9]. We recommend that TDC works with DOC to install signage and physical barriers, and to implement an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at the Motueka Sandspit.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motueka Sandspit	Aircraft and UAVs	Melville & Schuckard 2013	We recommend that TDC works with DOC to make the boundaries of the Motueka Sandspit Scenic Reserve ambulatory to match the actual location of the spit[9]. We recommend that TDC and DOC engage with local aero clubs to impose a voluntary 1000 ft minimum altitude limit for aircraft over the Motueka Sandspit.	
Motueka Sandspit	Watercraft	Melville & Schuckard 2013	We recommend that TDC works with DOC to make the boundaries of the Motueka Sandspit Scenic Reserve ambulatory to match the actual location of the spit[9]. We recommend that TDC and DOC work together to improve signage at the spit and at nearby watercraft launching sites, encouraging watercraft users to maintain a minimum distance of 200m from any roosting or nesting shorebirds.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motupipi River mouth	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Motupipi River mouth	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motupipi River mouth	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer. The use of kill traps to control feral cats (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
Motupipi River mouth	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motupipi River mouth	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Motupipi River mouth	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. This should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Motupipi River mouth	Dog walking	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Dogs are currently prohibited from this site under the Tasman District Council Dog Control Bylaw (2014), however there currently appears to be a poor level of compliance with this bylaw at this site. We recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education campaign to inform local residents of this changed requirements.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of these sand islands as habitat for nesting gulls and terns, and for roosting shorebirds, we consider the existing bylaw proportionate to the important bird values of this site, however a local education campaign, including an on-site compliance monitoring and enforcement component is needed to improve rates of compliance with this bylaw.
Pakawau foreshore, Tamatea Point	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are trapping mustelids and hedgehogs at this site using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing hedgehog impacts on coastal birds or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pakawau foreshore, Tomatea Point	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of delivering a local community education campaign designed to encourage local cat owners within 2 km of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Pakawau foreshore, Tomatea Point	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of controlling feral cats on the Pakawau Foreshore, in addition to the mustelid trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken on the Pakawau Foreshore should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pakawau foreshore, Tomatea Point	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids on the Pakawau Foreshore using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing mustelid impacts on coastal birds at this site, or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.
Pakawau foreshore, Tomatea Point	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pakawau foreshore, Tomatea Point	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013	We recommend that TDC updates signage to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pakawau foreshore, Tomatea Point	Dog walking	Melville & Schuckard 2013; 2020 Tasman District coastal bird survey dataset (TDC, unpublished data)	We recommend that the Tasman District Council Dog Control Bylaw (2014) be amended to prohibit dogs from this site between September and February inclusive (the shorebird breeding season) and to require dogs to be exercised on-leash between March and August inclusive[11]. We also recommend that TDC works with DOC to review and update signage at the sites if necessary, and to implement a local education campaign to inform local residents of these changed requirements.	Off-leash dogs are a considerable risk to shorebird eggs and chicks, so we consider prohibiting dogs from this site during the shorebird breeding season is proportionate to the regionally important values of this site. Outside of the shorebird breeding season the site provides roosting habitat for internationally and regionally important concentrations of shorebirds, however the risk that dogs pose to roosting shorebirds can be adequately minimised by requiring dogs to be exercised on-leash at all times and educating beachgoers of the importance of not approaching too close to roosting flocks.

[11] The existing bylaw prohibits dogs from this site from December to February inclusive and requires dogs to be exercised on-leash between March and November inclusive.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pakawau foreshore, Tomatea Point	Motorised off-road vehicles	Melville & Schuckard 2013; Cynthia McConville, *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements. At this particular site we recommend that vehicles continue to be allowed to use the existing boat-launching lane through the dunes, but be discouraged from accessing the remainder of the foreshore.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Parapara coastline, Milnthorpe to Onekaka Estuary	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Milnthorpe and Parapara communities to establish a community-led predator trapping programme at this site. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Parapara coastline, Milnthorpe to Onekaka Estuary	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Parapara coastline, Milnthorpe to Onekaka Estuary	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	
Parapara coastline, Milnthorpe to Onekaka Estuary	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Milnthorpe and Parapara communities to establish a community-led predator trapping programme at this site. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Parapara coastline, Milnthorpe to Onekaka Estuary	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Parapara coastline, Milnthorpe to Onekaka Estuary	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Parapara coastline, Milnthorpe to Onekaka Estuary	Dog walking	Cynthia McConville, *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Dogs are currently prohibited from the Parapara and Onekaka Estuaries all year round, whereas Tukurua Beach is designated as an on-leash dog exercise area under the Tasman District Council Dog Control Bylaw (2014)[12]. There currently appears to be poor levels of compliance with this bylaw at these sites, however. We recommend that the Tasman District Council Dog Control Bylaw (2014) be amended to prohibit dogs from Tukurua Beach between September and February inclusive (i.e., the shorebird breeding season) and to require dogs to be exercised on-leash between March and August inclusive. We also recommend that TDC works with DOC to review and update signage at the sites if necessary, and to implement a local education campaign to inform local residents of these changed requirements, and to improve rates of compliance.	Off-leash dogs are a considerable risk to shorebird eggs and chicks, so we consider prohibiting dogs from this site during the shorebird breeding season is proportionate to the regionally important values of this site. Outside of the shorebird breeding season, the risk that dogs pose to roosting shorebirds on Tukurua Beach can be adequately minimised by requiring dogs to be exercised on-leash at all times on the beach and educating beachgoers of the importance of not approaching too close to roosting flocks.

[12] Dogs are currently prohibited from Tukurua Beach between December to February inclusive, but can be exercised on-leash at this site between March and November inclusive.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Parapara coastline, Milnthorpe to Onekaka Estuary	Motorised off-road vehicles	Cynthia McConville, *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pariwhakaoho River mouth to 2 km north	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC works with local residents to expand existing trapping efforts to control hedgehogs, feral cats and mustelids across this entire site to protect locally breeding banded dotterels and variable oystercatchers. We recommend that both hedgehogs and mustelids be controlled using DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Pariwhakaoho River mouth to 2 km north	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC works with local residents to expand existing trapping efforts to control hedgehogs, feral cats and mustelids across this entire site to protect locally breeding banded dotterels and variable oystercatchers. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken at this site should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pariwhakaoho River mouth to 2 km north	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC works with local residents to expand existing trapping efforts to control hedgehogs, feral cats and mustelids across this entire site to protect locally breeding banded dotterels and variable oystercatchers. We recommend that both hedgehogs and mustelids be controlled using DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Pariwhakaoho River mouth to 2 km north	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pariwhakaoho River mouth to 2 km north	Recreational walkers, fishers, surfers, swimmers and picnickers	Peter Fullerton, *personal communication*	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC examines the feasibility of installing temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pariwhakaoho River mouth to 2 km north	Dog walking	Peter Fullerton, *personal communication;* Cynthia McConville, *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	This site falls within a designated off-leash dog exercise area under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to prohibit dogs from this site between September and February inclusive (i.e., the shorebird breeding season) and to allow on-leash dogs to be exercised between the months of March and August inclusive. We also recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education and compliance monitoring campaign to inform local residents of this change to the bylaw.	Off-leash dogs are a considerable risk to both nesting and roosting shorebirds, so we consider prohibiting dogs from this site during the shorebird breeding season and requiring dogs to be exercised on-leash during the remainder of the year to be proportionate to the regionally important coastal bird values of this site.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pariwhakaoho River mouth to 2 km north	Horse riding	Peter Fullerton, *personal communication*	We recommend that TDC updates signage at this site to provide clear guidance to horse riders to ride their horses below the high-tide mark between the months of Sept – Feb inclusive to avoid trampling shorebird nests. Installation of improved signage should be accompanied by an education campaign targeting local horse riders, encouraging riders to avoid approaching roosting flocks of coastal birds at any time of the year.	Seeking voluntary compliance from the public through improved signage and education is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pariwhakaoho River mouth to 2 km north	Motorised off-road vehicles	Peter Fullerton, *personal communication;* Cynthia McConville, *personal communication;* 2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Pūponga	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids in the vicinity of Port Pūponga using DOC200 traps as part of the Pest Free Onetahua project and these traps are presumably also catching hedgehogs. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing hedgehog impacts on coastal birds or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Pūponga	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Port Pūponga	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of controlling feral cats at this site, in addition to the mustelid trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken at this site should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Pūponga	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids in the vicinity of Port Pūponga using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing mustelid impacts on coastal birds at this site, or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.
Port Pūponga	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Pūponga	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC examines the feasibility of installing temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Tarakohe to Motu Island	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Pohara, Tarakohe and Tata Beach communities to establish a community-led predator trapping programme at this site (note, mustelids are already being trapped on the Tata Islands as part of the Tata Islands Pest Eradication Project). This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Port Tarakohe to Motu Island	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Tarakohe to Motu Island	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	
Port Tarakohe to Motu Island	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Pohara, Tarakohe and Tata Beach communities to establish a community-led predator trapping programme at this site (note, mustelids are already being trapped on the Tata Islands as part of the Tata Islands Pest Eradication Project). This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Tarakohe to Motu Island	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Port Tarakohe to Motu Island	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC updates signage at this site to provide clear guidance to beach goers avoid disturbing nesting shorebirds and little penguins, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Port Tarakohe to Motu Island	Dog walking	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	Both Ligar Bay and Tata Beach are designated as on-leash dog exercise areas under the Tasman District Council Dog Control Bylaw (2014), however there currently appears to be a poor level of compliance with this bylaw at this site. We recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education campaign to improve rates of compliance with the existing bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of this site to both nesting and roosting shorebirds and little penguins, we consider the existing bylaw proportionate to the important bird values of this site, however a local education campaign, including an on-site compliance monitoring and enforcement component is needed to improve rates of compliance with this bylaw.
Port Tarakohe to Motu Island	Watercraft	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC engages with local sea kayak and water taxi companies to develop measures to minimise the risks that recreational watercraft use poses to nesting and roosting shorebirds and little penguins.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pūponga coastline, 1 km north to 1 km south of Taupata Stream	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids along the Pūponga coastline using DOC200 traps as part of the Pest Free Onetahua project and these traps are presumably also catching hedgehogs. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing hedgehog impacts on coastal birds or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.
Pūponga coastline, 1 km north to 1 km south of Taupata Stream	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of controlling feral cats at this site, in addition to the mustelid trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken at this site should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pūponga coastline, 1 km north to 1 km south of Taupata Stream	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids along the Pūponga coastline using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing mustelid impacts on coastal birds at this site, or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.
Pūponga coastline, 1 km north to 1 km south of Taupata Stream	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Pūponga coastline, 1 km north to 1 km south of Taupata Stream	Motorised off-road vehicles	Cynthia McConville, *personal communication*	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rangihaeata Spit	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Rangihaeata Spit	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rangihaeata Spit	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Rangihaeata Spit	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rangihaeata Spit	Recreational walkers, fishers, surfers, swimmers and picnickers	Cynthia McConville, *personal communication*	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC examines the feasibility of installing temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rangihaeata Spit	Dog walking	Cynthia McConville, *personal communication*	This site does not currently have a designation under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to prohibit dogs from this site between the months of September and February inclusive (i.e., the shorebird breeding season) and to allow dogs to be exercised on-leash between the months of March and August inclusive. We also recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education campaign to improve rates of compliance with the existing bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of this site as nesting and roosting habitat for shorebirds , we consider these proposed changes to the bylaw proportionate to the important bird values of this site.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rangihaeata Spit	Motorised off-road vehicles	Cynthia McConville, *personal communication*	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Riuwaka River mouth	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Riuwaka River mouth	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Riuwaka River mouth	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the Motueka community to establish a community-led predator trapping programme along the Motueka coastline, extending from the Riuwaka River mouth to Port Motueka and up the Motueka River as far as Anderson Road. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at four of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Riuwaka River mouth	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Riuwaka River mouth	Recreational walkers, fishers, surfers, swimmers and picnickers	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	We recommend that TDC installs signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education and compliance monitoring campaign to improve rates of compliance with this signage. We also recommend that TDC examines the feasibility of installing temporary fencing and associated signage during the shorebird breeding season to delimit shorebird nesting areas.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Riuwaka River mouth	Dog walking	2020 Tasman District coastal bird survey dataset (TDC, unpublished data).	The Riuwaka River mouth is currently designated as an off-leash dog exercise area under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to make this site an on-leash dog exercise area to reduce the impacts of this activity on both nesting and roosting shorebirds using this site. We also recommend that TDC works with DOC to review and install signage at this site if necessary, and to implement a local education and compliance monitoring campaign to inform local residents of this change to the bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks, so we consider that requiring dogs to be exercised on-leash is proportionate to the regionally important values of this site.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Riuwaka River mouth	Motorised off-road vehicles	David Melville, *personal observation*	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	Experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.
Riuwaka River mouth	Aircraft and UAVs	Trevor James (TDC), *personal communication*	We recommend that TDC engages with local aero clubs, helicopter and scenic tour operators to request that low-flying aircraft avoid overflying this site to avoid disturbing nesting and roosting shorebirds.	Seeking voluntary compliance from the public through direct engagement and improved signage is likely to be the least controversial options for reducing levels of aircraft disturbance to roosting birds.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rototai coastline and adjacent sand islands	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Rototai coastline and adjacent sand islands	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer. The use of kill traps to control feral cats (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rototai coastline and adjacent sand islands	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Rototai coastline and adjacent sand islands	Black-backed gulls	Threat possibly present due to known distribution of black-backed gulls (TDC, unpublished data) and shorebird impacts reported elsewhere (e.g., Biswell 2005; Schlesselmann 2018).	Given the uncertainty regarding the severity of this threat to locally-breeding shorebirds, it is recommended that the severity of this threat be quantified by using trail cameras to quantify causes of local shorebird nest failure to inform whether or not a management action is required.	Given the cost and potential controversy of controlling black-backed gulls we recommend that an investigation be carried out to quantify the impacts of black-backed gulls on locally-breeding shorebirds to provide stronger evidence for whether or not a management response is required.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rototai coastline and adjacent sand islands	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Rototai coastline and adjacent sand islands	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013	We recommend that TDC updates signage at this site to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. The signage should also clearly request that beachgoers refrain from walking out to the sand islands due to the presence of large numbers of nesting and roosting shorebirds. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rototai coastline and adjacent sand islands	Dog walking	Melville & Schuckard 2013; 2020 Tasman District coastal bird survey dataset (TDC, unpublished data)	Dogs are currently prohibited from the majority this site under the Tasman District Council Dog Control Bylaw (2014), however a small, controlled dog exercise area does exist on the foreshore opposite Nees Road, but the boundaries of this area are unmarked so compliance with the bylaw at this site is low. We recommend that the existing bylaw be amended to prohibit dogs from this entire site to reduce the impacts of this activity on both nesting and roosting shorebirds. We also recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education and compliance monitoring campaign to inform local residents of this change to the bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of these sand islands as habitat for nesting gulls and terns, and for roosting shorebirds, we consider that prohibiting dogs from this site to be proportionate to the important bird values of this site, however a local education campaign, including an on-site compliance monitoring and enforcement component will be needed to improve rates of compliance with this amended bylaw.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rototai coastline and adjacent sand islands	Horse riding	Melville & Schuckard 2013	We recommend that TDC updates signage at this site to provide clear guidance to horse riders to ride their horses below the high-tide mark between the months of Sept – Feb inclusive to avoid trampling shorebird nests, and to refrain from riding horses on the sand islands offshore to avoid disturbing nesting gulls and terns. Installation of improved signage should be accompanied by an education campaign targeting local horse riders, encouraging riders to avoid approaching roosting flocks of coastal birds at any time of the year.	Seeking voluntary compliance from the public through improved signage and education is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Rototai coastline and adjacent sand islands	Motorised off-road vehicles	Melville & Schuckard 2013; Cynthia McConville, *personal communication.*	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds, and/or to improve compliance with the relevant conditions in the TNRP. We also recommend that TDC engages with local iwi to investigate the use of rāhui at these sites to further encourage voluntary compliance with these requirements.	We acknowledge Forest & Bird's submission requesting a bylaw be passed to prohibit the use of motorised off-road vehicles at this site and agree that this measure would be proportional to the coastal bird values present. However, experience elsewhere shows that passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids (and presumably also catching hedgehogs) around parts of the northern shore of Ruataniwha Inlet using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network can be extended to include the entire Ruataniwha Inlet shoreline, including the peninsula extending southwards from Totara Avenue.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of controlling feral cats around the shoreline of Ruataniwha Inlet including the peninsula extending southwards from Totara Avenue. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken around Ruataniwha Inlet should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids around parts of the northern shore of Ruataniwha Inlet using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network can be extended to include the entire Ruataniwha Inlet shoreline, including the peninsula extending southwards from Totara Avenue.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.
Ruataniwha Inlet, including sand islands and adjacent coastline north to (and including) Waikato/Totara Ave Peninsula	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Ruataniwha Inlet sand islands	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of controlling feral cats along the peninsula extending southwards from Totara Avenue, to protect shorebirds nesting on the adjacent sand islands. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken around Ruataniwha Inlet should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
Ruataniwha Inlet sand islands	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids around parts of the northern shore of Ruataniwha Inlet using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network can be extended to include the peninsula extending southwards from Totara Avenue, to protect shorebirds nesting on the adjacent sand islands.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Ruataniwha Inlet sand islands	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Ruataniwha Inlet sand islands	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013	We recommend that TDC installs signage requesting that beach goers refrain from walking out onto the sand islands at any time of the year, to prevent disturbance to nesting and roosting shorebirds. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Ruataniwha Inlet sand islands	Dog walking	Melville & Schuckard 2013	Dog walking is currently not regulated at this site under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to prohibit dogs from this area to reduce the impacts of this activity on both nesting and roosting shorebirds using this site. We also recommend that TDC works with DOC to review and install signage at this site if necessary, and to implement a local education and compliance monitoring campaign to inform local residents of this change to the bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of these sand islands as habitat for nesting gulls and terns, and for roosting shorebirds, we consider that amending the bylaw to prohibit dogs from these sand islands to be proportionate to the important bird values of this site. However, a local education campaign, including an on-site compliance monitoring and enforcement component will likely be needed to ensure compliance with any amended bylaw.
Ruataniwha Inlet sand islands	Watercraft	Melville & Schuckard 2013	We recommend that TDC installs signage requesting that watercraft users not approach within 200m of these sand islands to avoid disturbing nesting and roosting shorebirds. Signage should be erected at local boat-launching sites. Installation of this signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to nesting and roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Tākaka River mouth and Rangihaeata Head	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Tākaka River mouth and Rangihaeata Head	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Tākaka River mouth and Rangihaeata Head	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer. The use of kill traps to control feral cats (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
Tākaka River mouth and Rangihaeata Head	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC engages with the local community to establish a community-led predator trapping programme along the Rototai coastline, extending from Rangihaeata Spit and the Onahau Estuary to the western end of Pohara Beach. This trapping programme should be designed to target hedgehogs, mustelids and feral cats, with both hedgehogs and mustelids being controlled using a network of DOC200 traps.	This trapping programme will control mammalian predators at three of the 36 important coastal bird sites identified in this review. Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Tākaka River mouth and Rangihaeata Head	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Torlesse Rock, Kaiteretere	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Waimea River, plains reach - SH6 to Lower Queen Street	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	We recommend that TDC engages with the Richmond community to establish a community-led predator trapping programme along this reach of the Waimea River. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.
Waimea River, plains reach - SH6 to Lower Queen Street	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Waimea River, plains reach - SH6 to Lower Queen Street	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021)	The control of feral cats will probably not be feasible at this site until local domestic cat owners microchip their cats to aid the identification and prevent the accidental by-kill of domestic cats. Should high rates of microchipping be achieved, this will create the opportunity to control feral cats using live-capture cage traps.	
Waimea River, plains reach - SH6 to Lower Queen Street	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021)	We recommend that TDC engages with the Richmond community to establish a community-led predator trapping programme along this reach of the Waimea River. This trapping programme should be designed to target hedgehogs and mustelids, with both species being controlled using a network of DOC200 traps.	Engaging the assistance of the local community to maintain and service traps will reduce the financial cost of this trapping project to the ratepayer.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Waimea River, plains reach - SH6 to Lower Queen Street	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project		
Waimea River, plains reach - SH6 to Lower Queen Street	Gravel and sand mining, flood mitigation and erosion control activities	TDC, unpublished data	We recommend that TDC reviews, updates and standardises (if needed) gravel and sand mining consent conditions to minimise both short and long-term adverse impacts on coastal bird species. We recommend that TDC develops a code of practice to ensure that flood mitigation and erosion control activities are carried out in a way that maintains the natural, cultural and recreational values of the Tasman Districts rivers and coastline.	This combination of appropriate consent conditions and an overarching code of practice is a proven approach that has been implemented by other regional councils, including Hawke's Bay Regional Council, Greater Wellington Regional Council and Environment Canterbury.
Waimea River, plains reach - SH6 to Lower Queen Street	Recreational walkers, fishers, surfers, swimmers and picnickers	TDC 2010	We recommend that TDC updates signage at this site to provide clear guidance to recreational river users on the need to avoid approaching shorebird nests or chicks during the months of September and February inclusive. Installation of improved signage should be accompanied by an education campaign targeting local river users, encouraging riders to avoid approaching roosting flocks of coastal birds at any time of the year.	Seeking voluntary compliance from the public through improved signage and education is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Waimea River, plains reach - SH6 to Lower Queen Street	Dog walking	TDC 2010	This site does not currently have a designation under the Tasman District Council Dog Control Bylaw (2014). We recommend that the bylaw be amended to prohibit dogs from this site between the months of September and February inclusive (i.e., the shorebird breeding season) and to allow dogs to be exercised off-leash between the months of March and August inclusive. We also recommend that TDC works with DOC to review and update signage at this site if necessary, and to implement a local education campaign to improve rates of compliance with the existing bylaw.	Off-leash dogs are a considerable risk to shorebird eggs and chicks and cause significant disturbance to nesting and roosting shorebirds. Given the importance of this site as nesting and roosting habitat for shorebirds , we consider these proposed changes to the bylaw proportionate to the important bird values of this site.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Waimea River, plains reach - SH6 to Lower Queen Street	Horse riding	TDC 2010	We recommend that TDC updates signage at this site to provide clear guidance to horse riders to refrain from riding their horses on bare unvegetated gravels within the active riverbed between the months of September and February inclusive, to avoid disturbing nesting shorebirds. Installation of improved signage should be accompanied by an education campaign targeting local horse riders, encouraging riders to avoid approaching roosting flocks of coastal birds at any time of the year.	Seeking voluntary compliance from the public through improved signage and education is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Waimea River, plains reach - SH6 to Lower Queen Street	Motorised off-road vehicles	TDC 2010	We recommend that TDC installs signage and implements an education, advocacy and voluntary compliance monitoring campaign to discourage the use of motorised off-road vehicles at each of the 36 sites where motorised off-road vehicles have been identified as a threat to coastal birds.	Passing a bylaw in the absence of compliance monitoring or enforcement measures is unlikely to lead to significant behavioural change. For this reason, we have recommended that TDC invests resources into an education and voluntary compliance monitoring campaign to discourage vehicle use at this site in the first instance. Should this campaign be unsuccessful at reducing levels of disturbance caused by motorised off-road vehicles, we would then recommend the passing of a bylaw and the resourcing of a compliance monitoring and enforcement campaign to strengthen TDC's regulation of this activity at this site.
West Waimea Inlet	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping hedgehogs around the shoreline of West Waimea Inlet using DOC200 traps as part of the Battle for the Banded Rail project.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
West Waimea Inlet	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC liaises with the Tasman Environmental Trust to investigate the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.
West Waimea Inlet	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with the Tasman Environmental Trust to investigate the feasibility of controlling feral cats in West Waimea Inlet, in addition to the existing trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken in West Waimea Inlet should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
West Waimea Inlet	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping mustelids around the shoreline of West Waimea Inlet using DOC200 traps as part of the Battle for the Banded Rail project.	
West Waimea Inlet	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
West Waimea Inlet	Recreational walkers, fishers, surfers, swimmers and picnickers	Melville & Schuckard 2013	We recommend that TDC updates signage at public access points to the shoreline of west Rabbit Island, and on the permanent islands in West Waimea Inlet to provide clear guidance to beach goers to walk below the high-tide mark between the months of Sept – Feb inclusive to avoid disturbing nesting shorebirds, and to avoid approaching flocks of roosting birds at all times of the year. Installation of improved signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.
West Waimea Inlet	Watercraft	Melville & Schuckard 2013	We recommend that TDC installs signage requesting that watercraft users not approach within 200m of roosting or nesting shorebirds in West Waimea Inlet. Signage should be erected at local boat-launching sites. Installation of this signage should be accompanied by a local education campaign to improve rates of compliance with this signage.	Seeking voluntary compliance from the public through improved signage is likely to be the least controversial option for reducing levels of disturbance to nesting and roosting birds. Experience from other coastal sites in NZ indicates that improved signage alone is unlikely to reduce rates of disturbance. Instead, any signage upgrade should be accompanied by a local education campaign to increase levels of compliance.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
West Waimea Inlet, O'Connor Creek	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping hedgehogs around the shoreline of West Waimea Inlet using DOC200 traps as part of the Battle for the Banded Rail project.	
West Waimea Inlet, O'Connor Creek	Domestic cats	Threat assumed to be present based on known distribution of domestic cats (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020).	We recommend that TDC investigates the feasibility of delivering a local community education campaign designed to encourage local cat owners within a 2 km radius of this site to keep their cats indoors during the shorebird breeding season and to microchip their cats to aid identification. We recommend that such a campaign be modelled on the similar campaign that has been successfully implemented by MIRO in Eastbourne, Wellington (see Box 2 above).	Engaging the voluntary assistance of cat owners to help reduce the risk of domestic cat predation on local shorebird populations can lead to significant improvements in local nest success rates, without the need to pass potentially controversial bylaws.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
West Waimea Inlet, O'Connor Creek	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with the Tasman Environmental Trust to investigate the feasibility of controlling feral cats in West Waimea Inlet, in addition to the existing trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of both domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken in West Waimea Inlet should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
West Waimea Inlet, O'Connor Creek	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust is currently trapping mustelids around the shoreline of West Waimea Inlet using DOC200 traps as part of the Battle for the Banded Rail project.	

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
West Waimea Inlet, O'Connor Creek	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.
Whanganui Inlet	European hedgehogs	Threat assumed to be present based on known distribution of European hedgehogs (King 1998) and shorebird impacts reported elsewhere (e.g., McArthur 2020; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids around Whanganui Inlet using DOC200 traps as part of the Pest Free Onetahua project and these traps are presumably also catching hedgehogs. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing hedgehog impacts on coastal birds or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Whanganui Inlet	Feral cats	Threat assumed to be present based on known distribution of feral cats (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	We recommend that TDC liaises with Pest Free Onetahua to investigate the feasibility of controlling feral cats around the margins of Whanganui Inlet, in addition to the mustelid trapping regime already underway. We recommend using kill traps to control cats provided the risk of accidental bycatch of domestic cats and Weka can be adequately managed.	Incorporating cat trapping into the existing trapping activities being undertaken around Whanganui Inlet should deliver operational efficiencies. The use of kill traps (provided the risk of accidental by-kill of domestic cats and Weka can be managed) requires less training and fewer qualifications than other methods such as live trapping, hunting or poisoning.
Whanganui Inlet	Mustelids	Threat assumed to be present based on known distribution of mustelids (King 1998) and shorebird impacts reported elsewhere (e.g., Dowding & Murphy 2001; Norbury *et al.* 2021).	The Tasman Environmental Trust and Manawhenua Ki Mohua are currently trapping mustelids around Whanganui Inlet using DOC200 traps as part of the Pest Free Onetahua project. We recommend that TDC liaises with Pest Free Onetahua to review whether the existing trap network is fit-for-purpose for reducing mustelid impacts on coastal birds or whether the network needs to be expanded and/or intensified.	Expanding and/or intensifying the existing trapping network will capitalise on the trapping work that Pest Free Onetahua has carried out to date.

Site name	Identified threat	Information source(s)	Recommended management action	Rationale
Whanganui Inlet	Human-induced climate change	McGlone & Walker 2011; NZ SeaRise project	We recommend that TDC develops a contingency plan examining options to mitigate the impacts of sea-level rise at each of the 36 sites identified in this review, including options to facilitate the managed retreat of the shoreline and intertidal habitats and the construction of artificial habitats to replace the loss of key nesting sites on sand islands and sandspits inundated by rising seas.	Facilitating a managed retreat of the coastline will allow foreshore and intertidal habitats to migrate inland in response to rising sea levels. The construction of artificial habitats such as artificial sand islands and shellbanks or floating platforms may be required to replace key nesting habitats at sites such as Rototai and the Ruataniwha Inlet.