Enabling *Check, Clean, Dry* Compliance: A Freshwater Biosecurity Behaviour Change Case Study

Kathryn Ovenden and Belinda Studholme

October 2021 Technical Report 2021/18

Research and Evaluation Unit | RIMU

Auckland Council
Te Kaunihera o Tāmaki Makaurau

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ISSN 2230-4525 (Print)
ISSN 2230-4533 (Online)

ISBN 978-1-99-100290-7 (Print)
ISBN 978-1-99-100291-4 (PDF)

This report has been peer reviewed by the Peer Review Panel.
Review completed on 14 October 2021 Reviewed by two reviewers.
Approved for Auckland Council publication by: Name: Malcolm Harrison Position: Team Manager, Regional Delivery, Environmental Services
Name: Phil Brown Position: Head of Natural Environment Delivery, Environmental Services
Date: 14 October 2021

Recommended citation
Ovenden, K and B Studholme (2021). Enabling check, clean, dry compliance: a freshwater biosecurity behaviour change case study. Auckland Council technical report, TR2021/18

Acknowledgements:
Survey by Gravitas Research and Strategy.

This project would not have been possible without:
Luzie Schmid, Research Assistant
Ben Mana, Research Assistant
Henry Powell, Research Assistant
Mikaera Gray, Research Assistant
Shaun Lee, Graphic Designer
Alison MacVeigh, Photoshoot Talent
Sophie Journee, Experiencing Marine Reserves

This report has greatly benefited from detailed reviews from Dr Jane Groom and Anton Griffith.

Executive summary

Lake Tomorātā[1] and Lake Rototoa are identified as priority sites to protect freshwater biodiversity values in Tāmaki Makaurau within the Regional Pest Management Plan (2020). Freshwater habitats can be disrupted by a range of pest plant and animal species that threaten our native species and diminish recreational enjoyment. Pests can be unintentionally spread between waterbodies by contaminated gear and vessels used by recreational freshwater visitors. A behaviour change workstream was initiated within the Auckland Council Environmental Services Unit to protect these lakes from the accidental introduction of pests. This workstream is part of Auckland Council's contribution to the national Freshwater Biosecurity Partnership Programme which delivers the Check, Clean, Dry campaign. This campaign aims to enable recreational freshwater visitors to reduce the accidental spread of pests by removing pests from their gear and vessels.

The Environmental Services Unit's approach to behaviour change aims to be evidence-based. On initiation of this behaviour change workstream very little was known about visitors to the lakes. A mixed-methods survey of lake visitors (n=314) was undertaken in the summer of 2020 (January to March) to understand who was visiting the lake, the recreational activities undertaken, awareness of freshwater pests, and self-reported compliance with Check, Clean, Dry procedures. This survey found most visitors come to swim in family groups, close to half live locally, awareness of freshwater pests is low, half are aware of Check, Clean, Dry but, only a quarter claim to 'always' follow the procedures. The gear used for swimming is deemed unlikely to be contaminated with freshwater pests by the project team. The second most common activity at Lake Rototoa was kayaking (37%) followed by paddle boarding (10%). The second most common activity at Lake Tomorātā was motorboating (25%) followed by jet skiing (23%). The gear used in these activities are seen to pose a higher risk of spreading pests. These results were used to identify target audiences (kayakers and motorboaters) and behaviours at each lake for the development of behavioural interventions.

A suite of behavioural interventions was devised and five of these developed into prototypes through an iterative design process. The prototyped interventions include instructional signs, directional signs, commitment boards, a boat cleaning kit, and a kayak pest checking station. Over the summer of 2021 (February to April) these prototypes were tested at each lake through behavioural observations and intercept interviews. Observations recorded visitor engagement with interventions and interviews focused on visitors' interpretation and perceptions of interventions. The instructional signs and boat cleaning kit are promising interventions. Improvements to these interventions are recommended before delivery in the

[1] The spelling of Lake Tomorātā used in this report is based on guidance from Ngāti Manuhiri and is different to the official spelling (Lake Tomarata) recorded by LINZ.

summer of 2022. Only one person visited the lake with a kayak during the testing period preventing a comprehensive evaluation. It appears kayaking is an activity undertaken earlier in the year and testing of the station could be repeated next summer. The commitment boards had little engagement with lake visitors and are not recommended to be pursued.

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1.0 Introduction

This report describes the progress to date of the freshwater biosecurity behaviour change workstream at Lake Tomorātā and Lake Rototoa. The purpose of this workstream is to reduce the accidental spread of freshwater pests from and to these prioritised lakes by recreational visitors. The first section has a brief background on freshwater biosecurity in Tāmaki Makaurau and is followed by a section on Auckland Council's Environmental Services Unit's approach to behavioural change. This is the process followed by this workstream and provides structure for the remainder of the report. The next section describes a baseline survey conducted of lake visitors to understand who is visiting the lakes, for what purposes, their awareness of freshwater biosecurity, and self-reported performance of Check, Clean, Dry procedures. Section five describes the process of developing behavioural interventions based on the findings of the survey. The final section explains the process of testing interventions in-situ before discussing the results of testing and recommendations for improvements.

2.0 Background on Freshwater Biosecurity

Freshwater habitats (lakes, rivers, streams, and wetlands) can be invaded by a range of pest plants and animals. Freshwater pests can have substantial impacts including on native freshwater biodiversity, water quality, infrastructure, and the recreational and economic uses of freshwater systems.

The legacy Regional Pest Management Strategy includes several freshwater species as declared pests, but Auckland Council has historically allocated little resource for active management of freshwater pests. Consultation through the Regional Pest Management Plan (2020) review has highlighted that some sectors of the public are concerned about the lack of freshwater biosecurity management within the region. Mana whenua have signalled a desire to see more active protection of wai Māori.

As a highly urbanised region, most of Auckland's freshwater systems have already been invaded by some pest species, particularly on the mainland, and at many sites this has contributed to severe degradation of ecological values. Some freshwater ecosystem types may be at imminent risk of regional extinction unless active management is urgently undertaken. The Regional Pest Management Plan (2020) contains a site-led programme for management of invasive fish and submerged aquatic pest plants at two mainland lakes, Rototoa and Tomorātā, which have been identified as priority lakes for protection due to a combination of retaining relatively higher biodiversity values than many other mainland waterbodies, as well as existing community and council restoration activity around the outside of the lakes. Lake Tomorātā supports several regionally rare emergent plants and contains native charophyte meadows. It is also adjacent to wetlands containing the at-risk native species waikaka / black mudfish. Lake Rototoa is ranked as one of Auckland's highest biodiversity value lakes due to its diverse native plant communities with widespread native charophyte meadows growing to depth with a low invasive impact index. It has seen a recent decline in water quality and submerged vegetation.

Lake Tomorātā currently has no pest plants and has rudd and tench present. Lake Rototoa has hornwort, koi, perch, rudd, tench, goldfish and *Gambusia*. Lake Tomorātā is located at the northern edge of the Auckland region with Wellsford the closest large town (see Figure 1). Lake Rototoa is on South Head by the Woodhill forest and Kaipara Harbour.

Figure 1: Locations of Lake Rototoa and Lake Tomorātā.

Most freshwater pests are spread from one site to another by humans, either accidentally (e.g., as a contaminant on gear such as boats or fishing nets) or deliberately (e.g., through dumping of unwanted pets or by releases intended to stock lakes for recreational fishing). The Freshwater Biosecurity project funded by the Natural Environment Targeted Rate and delivered by the Environmental Services Unit represents an opportunity to actively reduce the risk of both accidental and deliberate human-mediated pest spread. Under the Regional Pest Management Plan (2020) it is a priority to keep Aotea/Great Barrier Island, and Lakes Tomorātā and Rototoa free of any further spread of aquatic pests through pathway management, behaviour change, and enforcement. This workstream described in this report is focused on reducing the

probability of recreational users transporting aquatic pests to or from Lakes Tomorātā and Rototoa through the development of non-regulatory behavioural interventions[2].

This workstream forms a component of Auckland Council's contribution to the national Freshwater Biosecurity Partnership Programme. Other organisations involved in the Partnership include Ministry for Primary Industries (MPI), Department of Conservation (DOC), Fish and Game, Land Information New Zealand (LINZ), iwi, energy companies, and other regional councils. The Partnership delivers the Check, Clean, Dry campaign among other initiatives. This campaign encourages recreational freshwater users to check, clean, and dry their gear and vessels when moving between waterbodies to reduce the accidental spread of freshwater pests. Check, Clean, Dry began in 2007 with a focus on Dydimo (an invasive freshwater algae) in the South Island. Overtime, the focus has expanded to cover all freshwater pests nationwide. The behavioural objectives and the Check, Clean, Dry campaign look and feel have been adopted by this workstream.

[2] Non-regulatory interventions may include communications, services, and infrastructure.

3.0 Approach to Behaviour Change

The Environmental Services Unit's approach to behaviour change is inspired by design thinking, embraces evidence-based decision-making, applies behavioural insights, and utilises the COM-B model (Michie et al., 2011). The COM-B model states that an individual will perform a behaviour (B) when they have the capabilities (C), opportunity (O), and motivation (M). The end-to-end approach is illustrated in the roadmap below (see Figure 2). This workstream began in September 2019 and by April 2021 had come to the end of the 'innovation' phase. Close to a year was spent understanding the situation going through the 'knowledge' phase (the 'empathise' or 'discover' phase in a design thinking process[3]). In practice, this period overlapped with the 'define' phase in a design thinking process as answers and information *defined* some components while also generated new questions to explore. The 'knowledge' phase indicated in Figure 2 came to an end at the completion of a recreational lake visitor survey. At this point the project moved into the 'innovation' phase.

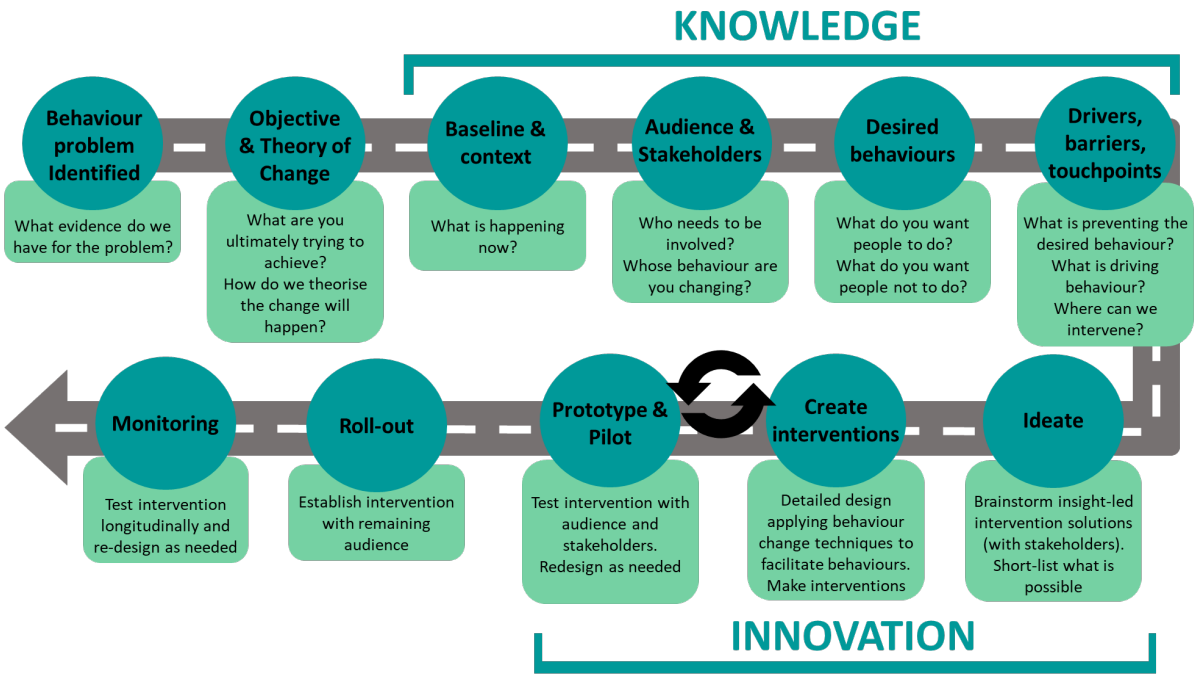
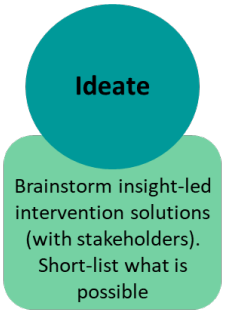


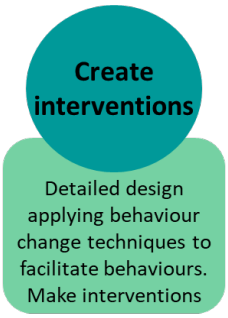
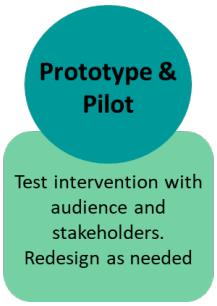
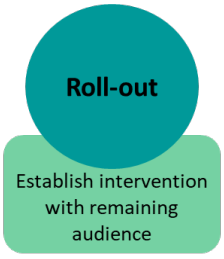
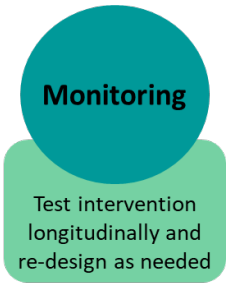
Figure 2: Behaviour change roadmap.

A brief description of the actions undertaken in each of the roadmap stages is described below.

[3] See Design Council (2019) for details on the Double Diamond process developed in 2005, the influence of consulting firm IDEO, and Rowe (1986) for more details on design thinking.

Behaviour problem Identified What evidence do we have for the problem?	Quantitatively evidencing the impact of behaviours performed in private on biodiversity outcomes is challenging. In practice we are, therefore, forced to rely on theory and evidence from other contexts. Plant material can contaminate gear and vessels used in freshwater. We know that: • freshwater plant material can contain fish eggs • Didymo and *Lindavia* (both species of freshwater algae) can survive out of water for up to 48 hours in damp conditions • freshwater plants can be killed with a 5% detergent solution (Burton, 2017) • brown bullhead catfish have been reportedly transported contained within boat trailers (Matthew Bloxham, personal comm). This information forms the basis of the Check, Clean, Dry procedures.
Objective & Theory of Change What are you ultimately trying to achieve? How do we theorise the change will happen?	This workstream is aiming for visitors to the lakes to: 1. CHECK their gear for freshwater pests 2. CLEAN their gear before and after their visit and / or 3. Ensure their gear is DRY to touch for at least 48 hours. So that freshwater pests are prevented from being spread between freshwater bodies, the lakes can continue to be enjoyed by visitors, and have improved biodiversity. It is theorised that these behaviours can be achieved when lake users have the capabilities, opportunities, and motivations to perform the behaviour (COM-B model).
Baseline & context What is happening now?	An intercept survey of recreational lake visitors was commissioned to understand the recreational activities undertaken, current awareness of freshwater pests, and self-reported compliance with Check, Clean, Dry procedures. Site visits to both lakes were undertaken to understand the physical environmental context.

	A detailed stakeholder list was compiled including conservation community groups, mana whenua, and organisations such as MPI and Fish and Game. The intercept survey collected data on who is visiting the lakes to understand the target audience including demographics, visiting group, and where they usually live.
	The intercept survey identified different likelihoods of biosecurity risk at each lake because of different recreational activities occurring. Swimming was the most common activity undertaken at both lakes, however, the gear used for swimming as a low probability of contamination with pests. Motorboating was the second most common activity at Lake Tomorātā and kayaking was the second most common at Lake Rototoa. Facilitates are not available at Lake Tomorātā or Lake Rototoa to enable visitors to check, clean, and dry their boats or kayaks on-site. The key behaviour for Lake Tomorātā was, therefore, for visitors with motorboats to 'make a plan' to clean their boat when they got home. The key behaviour for Lake Rototoa was for visitors to check their kayaks for pests (and remove any pests found by hand) before they went in the water.
	To identify drivers, barriers, and touchpoints the intercept survey asked: • why participants did not 'always' follow the Check, Clean, Dry procedures • what would help participants to check, clean, and dry their gear • through what communication channels they hear about the lake and engaged with on-route to the lake.
	A day-long ideation session was held to develop behavioural intervention ideas informed by survey results and behavioural insights. A short list of interventions was selected and taken into the next phase.

	Intervention prototypes mock-ups were first created by the workstream team and behaviour insights applied before further development to a final prototype in collaboration with a graphic designer.
	Intervention prototypes were tested in-situ at the lakes with a team of research assistants. Data collected provides direction for intervention improvements. Modified interventions and alternative interventions could be tested in the summer of 2022.
	The next step for this workstream will be to refine the most successful tested interventions and deliver them in the summer of 2022.
	A repeat of the intercept survey may be conducted in 2023 to monitor the impact of interventions delivered on self-reported compliance with Check, Clean, Dry procedures.

4.0 Baseline Survey

4.1 Purpose

In late 2019 Gravitas Research and Strategy was commissioned to undertake a survey of lake visitors. The purpose of this survey was to gather baseline information about lake visitors. More specifically this survey aimed to understand participants':

- Frequency of visiting lakes and other freshwater bodies.
- Reasons for visiting lakes.
- Group composition and demographics of visitors.
- Awareness of freshwater pests and their impact.
- Awareness of the Check, Clean, Dry campaign.
- Adherence with the Check, Clean, Dry procedures.

4.2 Method

The survey was primarily conducted through intercepts at the lakes. Visitors invited to participate were given the option of participating with the surveyor on a tablet, by completing a paper questionnaire independently, or completing the survey online through providing an email address (see Appendix **Error! Reference source not found.** for questionnaire). 78 properties surrounding the lakes were invited to participate by being posted a mail-back paper questionnaire and the option to participate online.

Fieldwork was conducted between 11th January and 22nd March 2020. Surveyors were scheduled across different days of the week and times of day to achieve a representative sample of lake visitors. Late evening and overnight visitors to the lakes were excluded to ensure surveyor safety and access to Lake Tomorātā closes overnight.

The intercept survey achieved a good response rate of 42% and 28 responses were received from letters delivered to surrounding properties. A total of 314 responses were achieved (148 at Lake Rototoa and 166 at Lake Tomorātā).

Analysis was undertaken by Gravitas Research and Strategy and a detailed research report delivered in October 2020. The delay between completing fieldwork and receiving the report was due to COVID-19 restrictions.

4.3 Results summary

The survey found similarities and differences at the two lakes. Both lakes were mainly visited by family groups who came to swim. Swimming is considered a low-risk activity as the gear involved in this activity has a low probability of being contaminated by pests. Recreational visitors who have been to another freshwater body within the past fortnight are at a high risk of spreading pests as their gear could remain damp and contaminated with pests. Small proportions (less than 20%) of visitors had been to another freshwater body in the last fortnight producing a low risk of pests being spread overall.

Awareness of freshwater pests was low (less than a quarter were aware freshwater pests exist). Of those aware, about half had previously had their enjoyment of freshwater bodies negatively impacted by pests. Even though there was low awareness of the existence of freshwater pests, 82% of participants were aware pests can spread between freshwater bodies and 83% were aware that people can reduce the spread of pests.

A little under half of participants were aware of the Check, Clean, Dry campaign. Close to half reported they ‘always’ check, clean, and dry their gear when moving between freshwater bodies. Those that did not ‘always’ check, clean, and dry reported this was due to being unaware of the need, only using one freshwater body (and therefore the actions are not relevant to them), not understanding the actions, or perceiving it to be not applicable to them. These findings suggest the campaign has previously not reached a proportion of lake visitors or has not reached them in a way that made freshwater biosecurity relevant to them.

Participants were asked what would help them to check, clean, dry their gear if they did not ‘always’ follow the procedures. Four in ten (42%) said they did not know what would help. Forty-one per cent suggested reminder signs at the lakes, 10% suggested information on the procedures, and 6% said providing cleaning stations.

Close to three quarters (78% at Lake Tomorātā and 70% at Lake Rototoa) of participants first heard about the lake from friends or family. Two in ten (18% at Lake Tomorātā and 20% at Lake Rototoa) first heard about the lake from living or working nearby. This suggests there are few formal communication channels through which lake visitors are hearing about the lakes posing a complication for the Check, Clean, Dry campaign.

Participants looked at online weather reports and social media, and made stops at petrol stations, supermarkets, and cafes on-route to the lakes. These locations and

advertising on online weather reports and social media are channels through which a reminder of the need to check, clean, dry could be delivered.

Key findings from the survey at each lake are described below.

	Lake Tomorātā (n=166)	**Lake Rototoa (n=148)**
	70% families Half locals: 28% Rodney district, 22% Northland	51% families Half locals: 49% Rodney district
	81% come to swim 25% motorboat, 23% jet ski 	84% come to swim 37% kayak, 10% paddleboard 
	Lake liked because it is quiet (30%), close by (23%), child friendly (21%), and good for swimming (20%).	Lake liked because it is quiet (41%), clean (40%), and beautiful (19%).
	16% visited another freshwater body in last fortnight.	18% visited another freshwater body in last fortnight.
	19% aware of freshwater pests.	23% aware of freshwater pests.
	Of those aware, 48% had their enjoyment impacted by pests.	Of those aware, 50% have had enjoyment impacted by pests.
	82% aware pests can spread between freshwater bodies. 81% aware people can reduce the spread.	82% aware pests can spread between freshwater bodies. 87% aware people can reduce the spread.
	48% aware of CCD 27% ‘always’ follow CCD 14% ‘never’ follow CCD	46% aware of CCD 26% ‘always’ follow CCD 7% ‘never’ follow CCD

4.3.1 Audience segmentation

An audience segmentation was commissioned by MPI from The Navigators in 2019 on behalf of the Freshwater Biosecurity Partnership Programme. The segmentation is to be used to enable a refresh of the Check, Clean, Dry campaign to be targeted. This research involved a series of focus groups followed by a nation-wide survey of recreational freshwater users. Six segments were identified and personas for each segment delivered describing their demographic characteristics, recreational activities, values, and current rates of behavioural compliance, motivation, knowledge, and barriers to compliance. The segmentation only includes 'high risk' recreational users defined as those who have travelled between freshwater bodies in the past fortnight.

The questions in the survey used to identify the segment of participants were included in the survey of lake visitors. This enabled the segmentation to be applied to lake visitors and, therefore, for the relevant components of a future national campaign to be delivered. The segmentation was found to only be applicable to a small number (n=23) of participants because few were travelling between freshwater bodies. The Auckland region, in contrast to other areas of New Zealand, has few freshwater bodies frequently used for recreation. The utility of this segmentation for these freshwater lakes is unfortunately low. The visitors chosen to target for interventions were instead based on activities and associated gear.

5.0 Behavioural Intervention Design

The information collected in the baseline survey enabled targeted interventions to be developed for each lake. Over a day-long ideation workshop the survey results were reviewed, target behaviours refined, and interventions derived using behavioural insight principle cards (see Allpress and Dosmukhambetova (2020) and The Behavioural Insights Team (2019) for cards). Lake Tomorātā interventions focused on visitors with motorboats or jet skis and Lake Rototoa interventions focused on visitors with kayaks or paddleboards.

Clearly defining the desired behaviours for these groups proved a challenge. Check, Clean, Dry procedures ask freshwater users to perform several behaviours: to check all gear for any sign of pests, to clean all gear with 5% detergent solution, and/or for all gear to be dry to the touch for at least 48 hours when moving between freshwater bodies. The details involved and the 'and / or' nature of cleaning / drying is complicated to convey especially to an audience with low awareness of freshwater biosecurity.

The ideal behaviours for Lake Tomorātā were chosen to be for visitors to arrive with a clean motorboat / jet ski by (1) checking it for pests before leaving the lake, (2) cleaning the vessel at home, and (3) checking again for pests before travelling to the lake. In effort to simplify the behavioural requirements the one behaviour of cleaning the vessel at home was the target behaviour for interventions. Lake visitors were asked to 'make a plan' to clean their vessel to enable this.

The ideal behaviour for Lake Rototoa was to arrive with a clean kayak / paddleboard by checking for pests before putting the vessel in the water. Visitors are also asked to clean their vessels when they return home.

5.1 Intervention development

A long list of interventions was first created and then a selection of interventions were short listed. Mock-ups of interventions were designed before engaging a graphic designer to transform these into testable prototypes. The table below outlines the long list of interventions and indicates which were taken through to be tested. Resourcing constraints prevented all the interventions being tested.

Table 1: Long list of interventions resulting from ideation workshop.

Intervention	Purpose	Lake location	Status
Commitment board	People are more likely to perform a behaviour when they have made a public commitment (Moriarty, 1975).	Lake Tomorātā Lake Rototoa	Tested intervention
Boat cleaning kit containing prompt	Timely prompts can provide helpful reminders for what people need to do, when they need to do it (Catt and Northcote, 2009).	Lake Tomorātā	Tested intervention
Instructional signs asking to 'make a plan'	Enabling people to make a plan can reduce the impact of the 'intention-behaviour gap' and increase their ability to follow through (Bamberg, 2002).	Lake Tomorātā	Tested intervention
Instructional signs	Attractive simple signage accompanied with pest checking station with instruction of where to check kayaks for pests.	Lake Rototoa	Tested intervention
Directional signs	The attention of visitors with kayaks or paddleboards was grabbed with attractive simple signage that directed them to the kayak pest checking station.	Lake Rototoa	Tested intervention
Kayak / paddleboard pest checking station	The station provides a physical opportunity to check and remove pests.	Lake Rototoa	Tested intervention

Intervention	Purpose	Lake location	Status
Community engagement event	Creating positive social experiences associated with the desired behaviours is hypothesised to enable behaviour adoption.	Lake Rototoa	Delivered intervention (with feedback survey)
Geotagged communications campaign	Geographically targeted campaign appealing to locals hypothesised to influence a large proportion of lake visitors.	Lake Tomorātā Lake Rototoa	Not delivered
Weed cordon	Nets surrounding a boat ramp can capture any pests washed from vessels in a small area of the lake.	Lake Tomorātā	Not delivered
Schools and community influencer outreach	Utilising influential messengers to disseminate the message through the local community is more likely to impact behaviour (Christiano and Neimand, 2018).	Lake Tomorātā Lake Rototoa	Not delivered

The intervention ideas described in Table 1 went through many iterations before the final version was manufactured. Mock-up versions were first created to capture the components of each intervention and apply behavioural insights (see examples in

Figure 3).

Figure 3: Mock-up for Lake Rototoa Instructional Sign (top), Lake Rototoa Commitment board (bottom left), and Lake Tomorātā boat cleaning kit (bottom right).

A graphic designer was engaged to design the graphic components of interventions. The look and feel of signs were inspired by the Check, Clean, Dry campaign including the yellow colour and white and yellow 'caution' stripe (see Figure 4 for example Check, Clean, Dry campaign signs). The Check, Clean, Dry campaign is delivered by the Freshwater Biosecurity Partnership Programme with MPI leading the brand management. Consistency in look and feel, and messaging is critical for campaigns to be recognised and bring about behavioural change. The Check, Clean, Dry campaign

is lacking a documented style guide even though the campaign has been in market for many years. The lack of a style guide makes creating a consistent national campaign delivered by the programme partners, who are each independently creating collateral, challenging. There is an added complication of legacy signage creating additional variation. A campaign refresh is planned to address consistency.

Figure 4: Examples of Check, Clean, Dry signage: Maling Pass 2009 sign (left (Wikipedia Commons, 2009)); Tongariro 2014 (centre (Wilson, 2014)); Thames 2018 (right (Morrison, 2018)).

In addition to the expertise of a graphic designer, the copy was revised by a copyeditor, te reo Māori translations of headings were incorporated, and photoshoots (including sourcing talent) were required to create content. Drafts of the signs were shared with workstream partners for feedback and endorsement including MPI, Ngāti Whātua o Kaipara, and Ngāti Manuhiri. The signs' development was an iterative process of many revisions balancing the feedback of partners with the behavioural objectives of these interventions.

Figure 5: Six versions of Lake Rototoa Instructional Sign (first version top left, read across to near final version in bottom right).

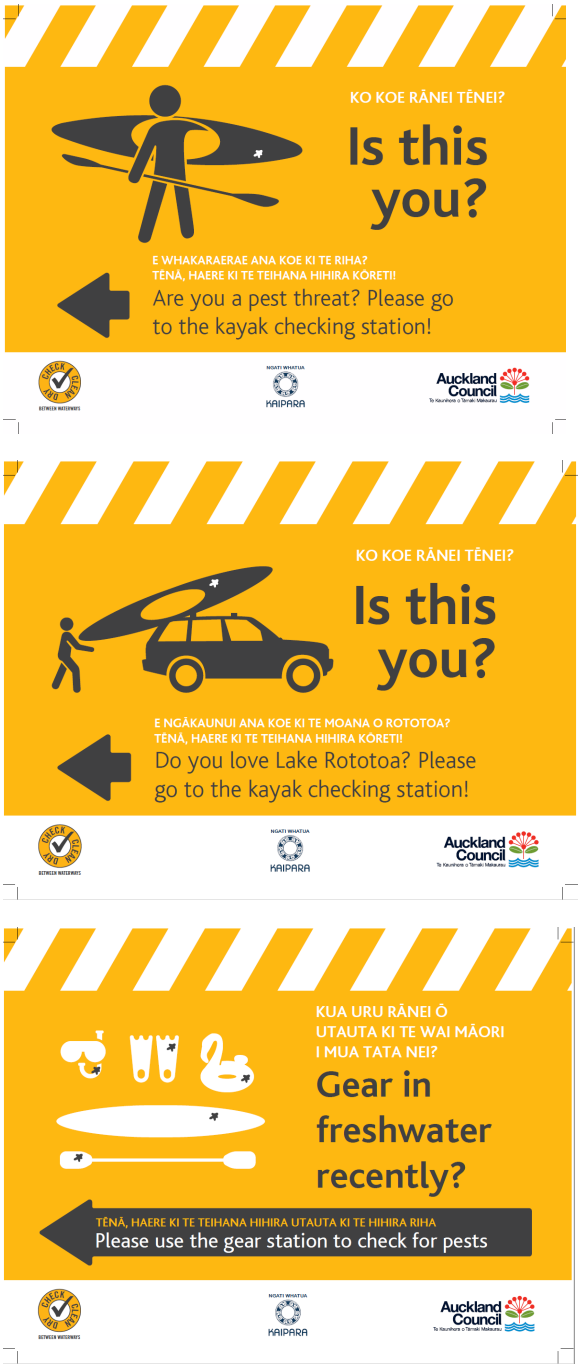
Interventions to enable behaviours were developed in addition to information signage. The boat cleaning kits with prompts and kayak pest checking station were inspired by kauri dieback cleaning stations and boat cleaning stations (see Figure 6). Both lake locations lack facilities (such as running water and concrete pads) to install comprehensive cleaning stations such as those delivered by the Clean, Drain, Dry programme in the USA (Brough, 2018; Cimino and Strecker, 2018)). The original idea of a boat cleaning station was reduced to a boat cleaning kit comprising of a bucket with a Check, Clean, Dry branded sticker demonstrating where on a boat to check for pests, a brush, a spray bottle with detergent, and a Check, Clean, Dry branded prop cover. Timing and budget constraints restricted the prototype cleaning kit to only contain a bucket with Check, Clean, Dry branded sticker demonstrating where on a boat to check for pests, a spray bottle with detergent, and a Check, Clean, Dry branded key ring.

Figure 6: Clean, Drain, Dry CD3 watercraft cleaning station in USA (Brough, 2018).

Comprehensive design of the kayak pest checking station was limited by a lack of industrial design expertise in the project team. The idea was to create a dedicated space in which kayakers could place and check their kayaks for pests, provide tools to remove pests, and a rubbish bin for disposal. The checking station also needed to be temporary, easily transported, and simple to set-up for the purpose of testing. The station comprised of a camp stretcher on which visitors could place their kayaks, a scrubbing brush to aid removal of plant material, and a rubbish bin to dispose of any plant material.

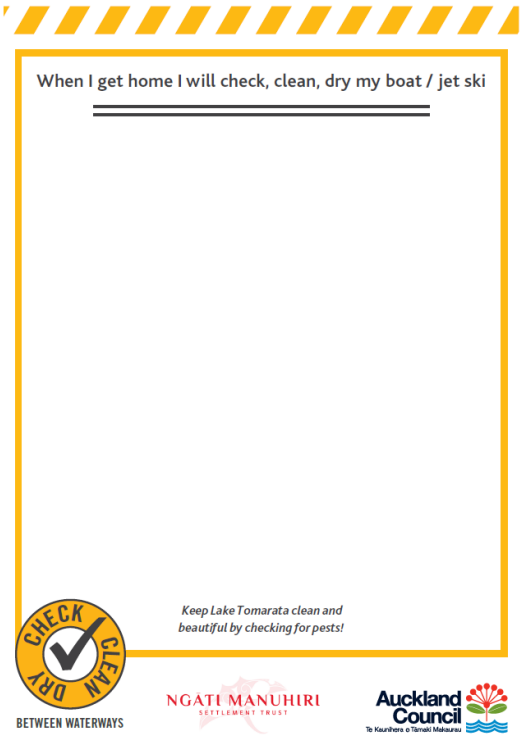
5.2 Interventions tested

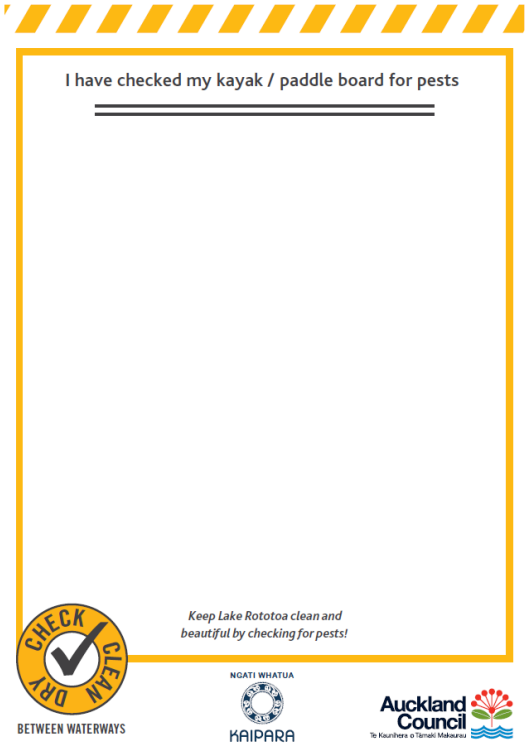
A total of 10 intervention prototypes were tested. The final designs of these prototypes incorporated a range of behavioural insights, design principles, and interpretation techniques to encourage visitor engagement. These design considerations are noted alongside the tested interventions illustrated below.



Directional Signs

- Attract attention by asking a question, using a bright yellow colour, and caution stripe.
- Aim to be relevant to target visitor audience by including gear they have and representing their sentiment towards the lake: ‘love Lake Rototoa’.
- Single instruction to ‘go to kayak checking station’.
- Spots on gear intended to demonstrate that pests are potentially present, but hidden.





Commitment Boards

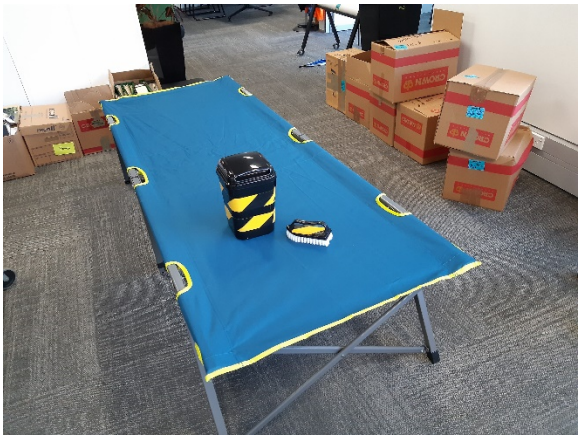
- Ask visitors for a commitment to undertake the key behaviour.
- Aim to be relevant to target visitor audience by representing their values of the lakes ‘clean and beautiful’ as identified in survey.

Instructional Signs

- Attract attention through use of flaps, bright yellow colour, and caution stripe.
- Inspire curiosity by encouraging visitors to look closer for pests through use of flaps with zoomed in images of a kayak.
- Deliver a simple instruction to ‘make a plan’ with the use of icons.
- Aim to be relevant to target visitor audience by reflecting the value they place on the lakes being ‘clean and beautiful’ as identified in survey, targeting families with children, and illustrating the impact of pests on swimming (the most common recreational activity).

Boat Cleaning Kit

- Attract attention by using a bright yellow colour and caution stripe.
- Deliver a prompt to check for pests at the right time (i.e., when visitors are cleaning their boats).



Kayak Pest Checking Station

- Attract attention through use of caution stripes.
- Provide a physical opportunity for kayakers to stop and check their kayaks.

5.3 Lakeside context

The lakesides at Lake Tomorātā and Lake Rototoa are very different. Lake Tomorātā is accessed via a gravel road that loops down to the boat ramp and around back to the main road. Cars are parked on grass areas close to the gravel road under the shade of trees where possible. Lake visitors picnic and play on the grass and sandy beach area (pictured in Figure 7Figure 8). Interventions were installed next to the boat ramp on the side where vehicles with boats pause before and after using the boat ramp (see Figure 8).

Figure 7: Lake Tomorātā, two existing signs (left, see below for details), interventions being tested with lake visitors to the right of the boat ramp (centre), vehicles with boats (right).

Figure 8: Lake Tomorātā interventions next to boat ramp, note location of beach and fenced swimming area.

There are two existing signs at Lake Tomorātā. One sign describes pest species present in the lake instructing visitors to 'check, clean, and dry all gear before and after entering the lake' (see Figure 9). This sign was produced by DOC and Auckland Regional Council (prior to amalgamation into Auckland Council) and follows the DOC brand style guidelines. The other sign outlines the boat safety rules for the lake with a map indicating safe swimming and boating zones. This sign was produced by Auckland Council.

Figure 9: Lake Tomorātā existing signs located to the right of boat ramp. Legacy Check, Clean, Dry sign demonstrating pest species (left, this sign is also present at Lake Rototoa) and safety rules sign (right).

Lake Rototoa has a small car park on the main road. Lake visitors walk through a ‘tunnel’ containing interpretive signage about the lake and species to reach a grass area (see Figure 10 and Figure 11). Visitors then travel through the grass area and following forested area to reach the water’s edge (see Figure 12).

Figure 10: Lake Rototoa carpark and 'tunnel' leading to grass area pictured in Figure 12.

Figure 11: Interpretive sign within 'tunnel’ at Lake Rototoa.

Figure 12: Lake Rototoa grass area leading to forest and water’s edge. Kayak pest checking station and directional sign (right) and directional sign (left).

6.0 Behavioural Intervention Testing

The behavioural interventions described in the previous section were tested in-situ. Testing aimed to evaluate if the elements of the interventions had the desired behavioural effect. The arrow element on the directional signs, for example, indicating the location of the kayak pest checking station, was intended to encourage visitors to notice and travel towards the checking station. The impact of interventions on visitors' likelihood to perform all the Check, Clean, Dry procedures is difficult to quantify as cleaning and drying behaviours are performed at home preventing observational data collection. Intentions to perform procedures and self-reported behaviour are used as an indicator and this is acknowledged as a limitation of this study.

This section describes the method for testing, the results and discussion, and finally a summary of recommendations.

6.1 Method

Fieldwork was undertaken from 12th February through to 5th April 2021. A mixture of weekdays, weekends, and public holidays were scheduled with more weekend fieldwork undertaken to correspond with popular visitation times.

Interventions were tested by research assistants first observing lake visitors engaging with interventions from a short distance away and then approaching them to invite their participation in an interview to provide structured feedback. The presence of research assistants may have influenced visitors engagement with the interventions. The impact of research assistants was mitigated by them being positioned a short distance (5-10m) away from the interventions. Lake visitors were approached by Research Assistants as soon as they stopped engaging with interventions and started to move away. If visitors walked past and did not obviously engage with the intervention they were still approached and invited to participate. Lake visitation was low enough to enable every visitor to be invited to participate. Groups of visitors were invited to participate as a group and treated as a single response.

Research assistants worked in pairs for health and safety reasons. This allowed one research assistant to converse with the participant and the other to act as a note taker. Data were collected on paper forms with bespoke questions for each intervention. Research assistants typed up their handwritten data into spreadsheets.

At Lake Rototoa a total of 66 lake visitors/visitor groups participated in an interview and at Lake Tomorātā a total of 68 lake visitors/visitor groups participated. Only visitors who agreed to participate were included as participants. Any visitors who were observed and did not agree to participate were excluded and any observational data

immediately destroyed. Participants were invited to be interviewed about only the first intervention they engaged with even if they engaged with multiple interventions.

Table 2: Number of participants/groups of participants interviewed for each intervention at each lake location.

Intervention	Lake Rototoa	Lake Tomorātā
Instructional sign	29	41
Commitment board	1	4
Boat cleaning kit	NA	23
Kayak pest checking station	1	NA
Directional sign	35	NA
Total	66	68

Research assistants set up and packed down the interventions at the start and end of each data collection shift. At Lake Tomorātā the instructional sign and commitment board were placed approximately two metres to the right of the boat ramp (Figure 13). At Lake Rototoa visitors walk through a grassy area from the carpark to the water's edge. The directional sign was placed in the visitor's path through the grass (Figure 14). The arrow on this sign pointed to the kayak pest checking station with instructional sign and commitment board (Figure 15).

Figure 13: Instructional sign and commitment board at Lake Tomorātā.

Figure 14: Directional sign at Lake Rototoa.

Figure 15: Instructional sign, commitment board and kayak pest checking station at Lake Rototoa.

When all data was collected it was analysed thematically to identify recurring themes across individual responses. A half-day workshop with research assistants reviewed themes and explored observations not captured in data collection sheets.

6.2 Results and discussion

This section first discusses results shared across the different interventions including the look and feel, organisational logos, and understanding of 'pests' and freshwater biosecurity. Each intervention is then discussed in turn with recommendations throughout.

6.2.1 Findings shared across interventions

Overall participants said the colours 'stood out' and 'catches the eye'. The yellow and white colour scheme was not recognised to indicate 'biosecurity' and instead was frequently associated with COVID-19 collateral (see Figure 16). This association grabbed some participants' attention and encouraged their engagement with the signs. For others, however, the association with COVID-19 decreased their willingness to engage as they were experiencing 'COVID-19 fatigue'. It remains to be seen how long this association will endure and change in sentiment over time.

Figure 16: Examples of COVID-19 collateral (source: https://covid19.govt.nz/posters/).

Continuing use of the colour scheme with a different stripe pattern or a flat yellow could enable maintaining a biosecurity aesthetic and overcoming the overt association with COVID-19. A yellow and grey stripe used by Northland Regional Council on kauri dieback collateral (Option B in Figure 17) or yellow and black stripe like that used by MPI and Auckland Council on kauri dieback collateral (Option C in Figure 17). Using stripped arrows or much finer stripes keeping the white and yellow colours are other options.

This bar indicates a section on the: colour scheme

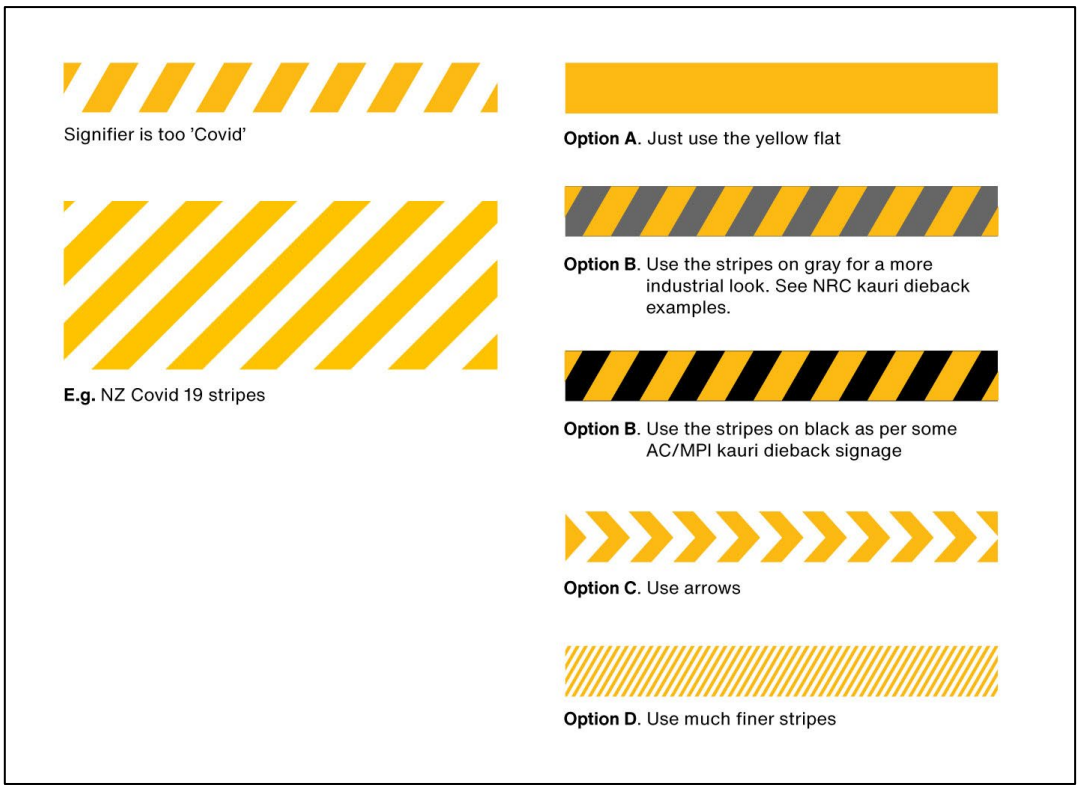


Figure 17: Options for future direction of Check, Clean, Dry look at feel.

Logos

Nine in ten participants recognised the Auckland Council logo and most expected to see a sign like this from Auckland Council. Some expected signs on biosecurity to be delivered by the Department of Conservation (DOC) or the Ministry for Primary Industries (MPI). This suggests that there is capacity for Auckland Council to communicate the role of local government in biosecurity and contribution towards broader biodiversity outcomes alongside central government bodies.

One in five participants recognised the Check, Clean, Dry logo (compared with 47% of those surveyed in 2020). Those that were aware of Check, Clean, Dry described this as, for example, “stopping the spread of pests like Didymo”, “being for lakes around New Zealand”, and about “checking vessels before entering water and when you are at home”. There is opportunity to normalise and increase awareness of Check, Clean, Dry procedures, and freshwater biosecurity in Tāmaki Makaurau.

Participants' interpretations of the signs suggest low understanding of biosecurity in general and especially freshwater biosecurity. The terms 'pests' and 'cleanliness' are misunderstood with some interpreting the signs to be about terrestrial pests (such as possums) and litter. Some participants were curious about the current pest status of the lake and what implications this had for their recreational activities (for example, one participant asked if it was safe for swimming). Interested participants requested more information about which pests were present at the lake, to see images of pest species, to hear about their impact, and how pests can spread. This suggests that there is appetite and opportunity to communicate the relationship between biosecurity, biodiversity, and implications for recreation. Signs with a large quantity of information, in practice, tend to have low engagement even though participants expressed this interest. Providing detailed information on signs should be done with caution as it may distract from the critical biosecurity message and instead consider delivering detailed content through in-person engagement or on a webpage linked to with a QR code on signs. Such a webpage could be hosted on Tiaki Tāmaki Makaurau (https://www.tiakitamakimakaurau.nz/) with content similar to that on the DOC webpage (https://www.doc.govt.nz/stopthespread) relevant to Auckland lake visitors (i.e., describe Auckland pests at Auckland locations). The benefits of QR codes on single interpretive signs in public spaces is lacking evidence. QR codes have been somewhat successful within museum interpretive signage (Dressler and Kan, 2018) and educational walking trail interpretive signage (Lake, 2020). These circumstances, unlike biosecurity interpretive signage targeting recreational lake visitors, are delivering an experience for an audience that has already committed to engaging in educational content by choosing to visit a museum or completing an educational walking trail. Recreational lake visitors may not have the same interest in educational content.

Lake visitors who live locally tended to have greater awareness of biosecurity and environmental issues relative to non-local or infrequent lake visitors. Local visitors also tended to perceive the issue of pests as more relevant to them relative to non-local lake visitors. Local visitors tended to live in more rural communities relative to non-locals living in more urban communities. This implies that there are two distinct audiences with which the issues of pests and biosecurity need communicating. Overcoming the challenge of multiple audiences and communicating a complex issue may benefit from the expertise of a science communicator.

6.2.2 Instructional signs

Both lakes had instructional signs that contained some shared elements and some elements unique to each lake. The Lake Tomorātā sign was focused on boats and the Lake Rototoa sign was focused on kayaks.

Figure 18: Lake Tomorātā instructional sign.

Figure 19: Lake Rototoa instructional sign.

The signs at each lake asked visitors to perform different behaviours. At Lake Rototoa the sign instructed visitors with a kayak to check it now and to check, clean, and dry their kayak when they returned home. Four in ten participants understood visitors with kayaks were being asked to check their kayak 'now'. The remaining participants seemed to confuse the behaviours to do 'now' and those to do 'at home' with some saying to "clean with water" and "wash and leave it overnight" 'now' (see Figure 20 for at home instructions). Simplifying the instruction to ask visitors to just 'clean now' may overcome this confusion. This solution, however, may be limited by an ability to maintain a cleaning station (see Section 6.2.6).

Participants were asked how they will check their kayak for pests now. The sign reads: 'remove all plant matter from your gear and dispose of it in the rubbish bin'. Participants offered a mixture of techniques to 'check' their kayaks including "looking thoroughly", "scrubbing it all over even if it looks okay", and "hose down on grass and leave to dry". This suggests the action of 'checking' is ambiguous and asking lake visitors to 'clean' their kayaks may be more straightforward.

Some participants were unsure if they were meant to check for pests before and/or after using their kayak in the lake. One participant, for example, said they will check for pests when loading the kayak onto their car. Placing the kayak pest checking station, directional sign and instructional sign in the pathway lake visitors use to travel from the carpark to the lakeside was intended to signal that 'now' means 'before using kayak in the lake'. Greater clarity in the instruction to 'check for pests before using kayak in the lake' is required.

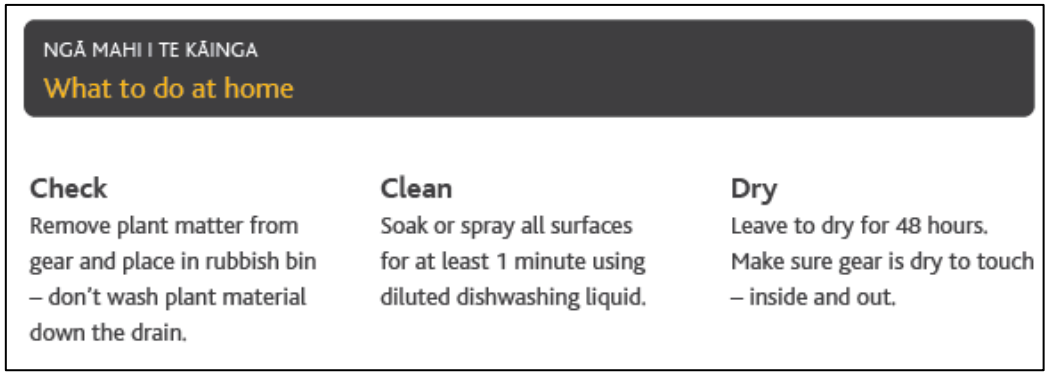


Figure 20: Instructions for checking, cleaning, and drying kayaks at home on Lake Rototoa sign.

At Lake Tomorātā visitors were asked to 'make a plan' for cleaning their vessel now (see Figure 21). This was poorly received by participants who all except two interpreted the sign to be asking them to check, clean, dry their vessels 'now'. One of the two participants who did recognise the action for 'now' was to 'make a plan' commented that it was "not very clear". The original intention for the commitment board

was for lake visitors to write out their cleaning plan and attach this to the board. This finding could suggest a specific mechanism through which lake visitors are enabled to 'make a plan' is required (if the target behaviour of 'making a plan' is still desired). Changing the key behaviour to 'check' their vessel for pests before entering the water or to 'clean' now may be better understood.

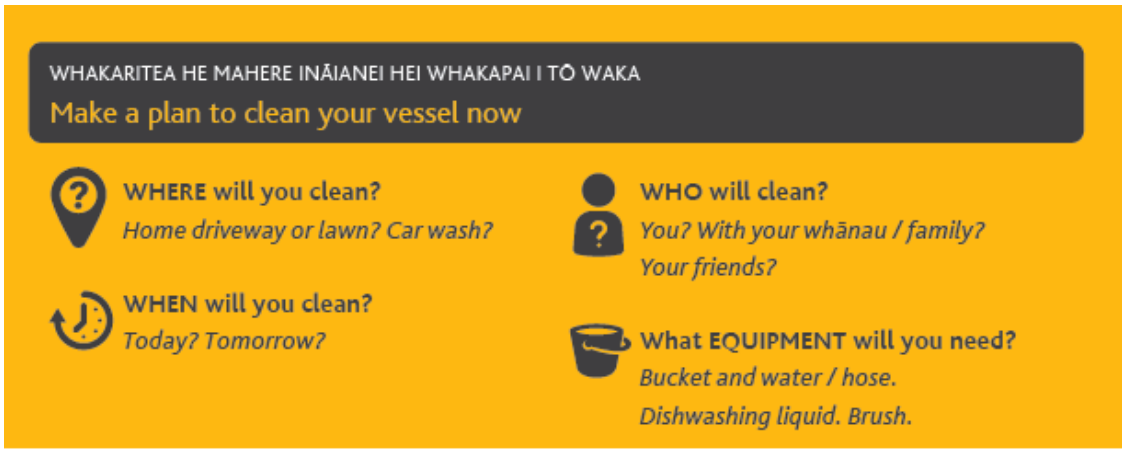


Figure 21: 'Make a plan to clean your vessel now' instruction on Lake Tomorātā sign.

When asked how participants would clean their vessel most described cleaning it at home with a hose/water and carwash/detergent. It is encouraging that almost all participants felt it was achievable for them to check, clean, dry their vessels. A few mentioned being on tank water at home and consequently facing water restrictions. This context suggests a cleaning station may not be fundamental in enabling lake visitors to clean their vessels. Many participants, however, asked for cleaning facilitates to be provided at the lake or nearby.

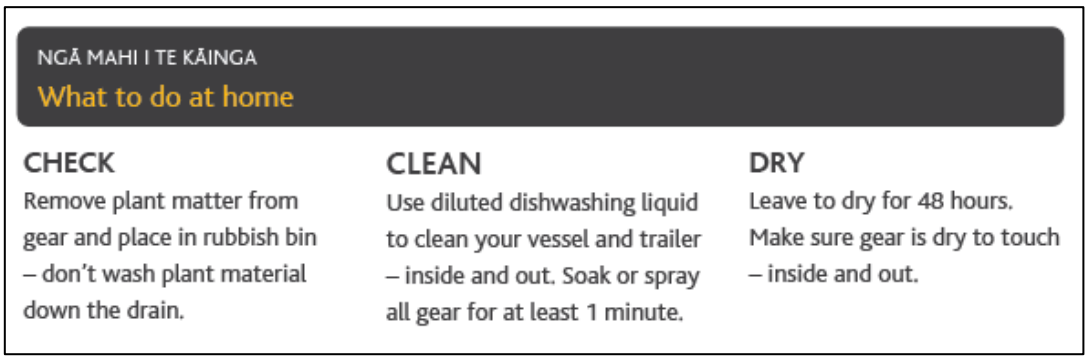


Figure 22: Instructions for checking, cleaning, and drying at home on Lake Tomorātā sign.

Headline

The headline ‘Keep Lake Rototoa/Tomorātā clean and beautiful by checking for pests!’ and the images were the elements that were initially drawing visitors’ attention. The headline was informed by the 2020 survey which found that being clean and beautiful were characteristics of the lakes which visitors liked best. Using these terms in the headlines were intended to motivate visitor engagement and align the biosecurity message with the values of lake visitors. Overall visitors responded positively to the headline. Some suggested shortening the headline and some expressed confusion in their interpretation of ‘pests’ and ‘clean’ as previously discussed. Some participants responded by saying it was their first time to the lake when asked about the headline suggesting the headline may not be resonating with new visitors. Greater consideration of the terms used to describe the preferred state of the lake (i.e., ‘clean and beautiful’) and the threat (i.e., ‘pests’) should be given.

Interpretive copy and images

Interpretive copy was included on the instructional sign to explain why lake visitors should comply with the Check, Clean, Dry procedures. The questions visitors asked about pests and freshwater biosecurity (see ‘Biosecurity understanding’ in Section 6.2.1) suggest this copy can be improved. The whimsical phrasing (e.g., ‘pests squeeze the life out of our country’s precious rivers and lakes’) may be creating ambiguity and a more explicit writing style may be required.

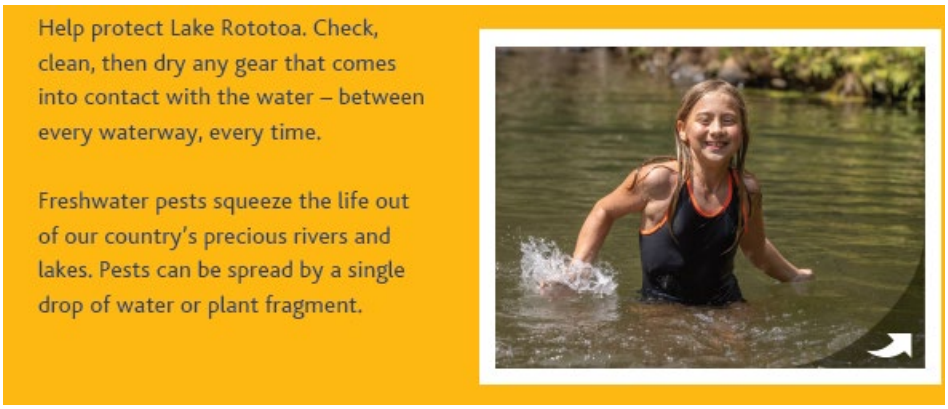


Figure 23: Interpretive copy and image on Lake Rototoa sign (copy duplicated on Lake Tomorātā sign).

The two images of the girl in water were intended to demonstrate the impact of freshwater pests. A clean lake, positive experience image was atop a flap which when lifted showed a pesty lake, negative experience image. Participants generally interpreted these images as intended, for example, “shows the impact pests can have and their severity”, “emphasis of the difference between a clean lake and one with pests: happy vs unhappy”, and “clean lake and then a dirty lake not looked after”. There were a few participants who stated that they didn’t understand the message of the images.

Figure 24: Image of girl in water on signs describing pest-free experience (left, on flap on sign) and pesty experience (right, underneath flap on sign).

Alternative sets of images could be explored to identify which could best resonate with lake visitors. Other images could include people kayaking, a boat on a boat ramp, or underwater images of a lake without people present. This kind of provocative imagery has been used previously by the Check, Clean, Dry campaign in 2009/2010 (see Figure 25). An evaluation of this campaign reported a correlation between viewing the campaign's output and self-reported performance of Check, Clean, Dry procedures (NSMC, 2010).

Figure 25: Creative from 2009/2010 Check, Clean, Dry campaign (NSMC, 2010).

Interpretive copy and images

The use of flaps was intended to inspire curiosity in participants by creating a novel experience as has been achieved with other interpretive signage (see Ballantyne and Hughes (2003)). It was anticipated that the flap would draw participants' attention and encourage their engagement with the instructional content on the sign. Only a third of participants opened the flap unprompted at Lake Rototoa and half at Lake Tomorātā. Those that did not lift the flap said they were unaware that it was a flap to be lifted. The small arrow in the bottom right corner (see Figure 24) and hinge (see Figure 26) were not sufficient affordances[4]. Participants suggested having the flaps in a different colour or writing 'lift here' next to the flap.

Figure 26: Flap image on sign demonstrating hinge and arrow bottom right corner.

Kayak images

The Lake Rototoa sign also had images of plant material hidden in a kayak on flaps. These images were to demonstrate how plant material can 'hide' in the nooks and crannies of kayaks and, therefore, that plant material is likely to be present on all kayaks. Each of these three image pairs had its own hinge so images could be looked at separately. Four in ten participants lifted these flaps unprompted and one participant commented that "it is encouraging me to look a little harder for any teeny tiny pests that I may have missed". The images are generally being interpreted as intended, however, six in ten participants did not recognise the flaps are to be lifted.

Participants suggested these images could be improved by circling the plant material to draw their attention, identifying the kind of pest plant in the images, and ensuring the plant material is easily visible (the top, centre image in Figure 27 has the plant material in shadow).

A similar set of images demonstrating plant material hidden on a boat could be used on the sign at Lake Tomorātā replacing the current instructions to 'make a plan'.

[4] 'Affordances' are the properties of objects that show users the actions they can take (Norman, 2013).

Figure 27: Plant material hidden on a kayak flap images on Lake Rototoa sign.

6.2.3 Directional signs at Lake Rototoa

Three versions of directional signs were tested. One sign was in place during each data collection shift and the two alternative signs were shown to participants to enable comparisons. The purpose of these signs was to direct visitors towards the kayak pest checking station on the left-hand side of the grass area. A revised version of the kayak pest checking station could be positioned in the location of these directional signs making these signs redundant.

Figure 28: Three version of the directional sign, 'carry kayak' (left), 'car kayak' (centre), 'assorted gear' (right).

Two-thirds of lake visitors walked straight towards the sign suggesting its placement was appropriately in visitors' path. Half of participants who saw the sign followed the instruction to proceed to the kayak pest checking station. This is a smaller proportion

than anticipated and may suggest the information on the sign is perceived to have low relevance to lake visitors (only one participant visited with a kayak). Encouraging greater engagement may be achieved through placing the checking station in an unavoidable location.

The two signs with an image of a kayak (carry kayak and car kayak) were generally interpreted as intended with participants understanding the sign to be informing of the kayak pest checking station, instructing visitors with kayaks to go to the station, and being about kayaks. There were two instances of participants misunderstandings: one where the participant thought the sign was inferring kayaking is bad for the environment, and one where the participant thought the sign was demonstrating good kayak lifting technique to secure kayaks to vehicles. The 'assorted gear' sign was interpreted to be about checking the gear pictured for pests or more generally about preventing the spread of pests. This sign (assorted gear) was most appealing to participants overall as it was seen to be more relevant to lake visitors using a diverse range of gear. While this sign was most appealing, this finding must be assessed within the context that the signs and kayak pest checking station are targeting *kayakers* who were infrequently visiting the lake during fieldwork. The image of the person carrying the kayak is, therefore, likely to be the best image to use on a revised sign. An alternative approach of a photograph of a person carrying a kayak rather than an icon should also be considered.

The small spots on the kayak and gear images were intended to represent the pests that needed to be removed at the checking station. These were poorly understood by participants with some thinking the kayaks were damaged, were crosses indicating the gear was not allowed at the lakes, were specific areas to check for pests, or were unsure what they represented. About half the participants thought the spots were bacteria, bugs, plants, bad things, fungi, or pests. This interpretation is closer to what was intended, but still suggests the spots do not clearly communicate what kind of freshwater pests are likely to be present on kayaks. Changing the spots to be a leaf icon or otherwise explicitly represent plant material may improve comprehension.

There were three versions of the instruction to go to the kayak checking station:

1. Are you a pest threat? Please go to the kayak checking station!
2. Do you love Lake Rototoa? Please go to the kayak checking station!
3. Please use the gear checking station to check for pests.

The minimal understanding of biosecurity and 'pests' is likely to explain why few participants resonated with the 'Are you a pest threat?' phrasing. 'Do you love Lake Rototoa?' had appeal as some participants were fond of the lake. The clarifying 'to

check for pests' is beneficial to version 3. A revised version of the sign could read 'Do you love Lake Rototoa? Please use the kayak checking station to check for pests'.

A revised sign could be created using elements from the three tested signs:

- The person holding a kayak icon and 'Is this you?' phrase from the 'carry kayak' sign.
- Changing the spots on the kayak to leaf icons or other icon representing plant material.
- The black arrow from the 'assorted gear' sign reading: 'Do you love Lake Rototoa? Please use the kayak checking station to check for pests'.

6.2.4 Commitment boards

The commitment boards at both lakes saw little lake visitor engagement with only one participant at Lake Rototoa and four participants at Lake Tomorātā. Two participants at Lake Tomorātā signed the board and two did not. No other visitors to the lakes engaged with the commitment boards. The one Lake Rototoa participant signed the board. Those that did sign were motivated to do so as the commitment asked for aligned with their pro-environmental values. Those that did not sign were unaware it was to be signed as they had not seen a similar board previously. The signs may require an explicit instruction to sign the board such as 'by signing this board I commit to checking, cleaning, and drying my boat when I get home'.

The minimal engagement with this intervention suggests it was unsuccessful in achieving a behavioural outcome. Commitment boards have been applied at forest walking tracks to encourage use of kauri dieback hygiene stations. In this context they were successful in increasing correct compliance and decreasing non-compliance particularly at tracks visited by local residents (Aley, 2019). The comparatively high visitation and high visitor turnover at walking tracks relative to the lakes may explain some of the difference in engagement between these two contexts. The commitment board format may be more successful in a different context such as at a local outdoors store or community event.

6.2.5 Boat cleaning kit at Lake Tomorātā

Participants overall were surprised to be gifted the cleaning kit. The kit was intended to act as a prompt to remind lake visitors to check their vessels for pests, however, it may instead be creating a sense of reciprocity where in exchange for the clean kit gift lake visitors feel an obligation to use the kit to clean their vessels. Reciprocity has

been experimentally demonstrated as a driver for behavioural compliance (Regan, 1971).

Participants liked the cleaning kit contents and thought a brush or sponge would be a good addition. Many participants intended to clean their vessels regardless so the impact of the cleaning kit on compliance with Check, Clean, Dry procedures may be minimal. There is potential that the experience of receiving the cleaning kit could result in lake visitors telling others about their experience creating word of mouth and social norm of Check, Clean, Dry compliance.

An equivalent cleaning kit could be delivered to kayakers at Lake Rototoa. The kit could have the same content of a bucket with a sticker demonstrating where to check for pests on a kayak, a spray bottle with detergent, and a cloth or sponge. A cloth could be printed with the Check, Clean, Dry logo and then also act as a prompt.

6.2.6 Kayak pest checking station at Lake Rototoa

The kayak pest checking station was only used by one lake visitor. Research assistants only managed to encounter one visitor with a kayak even though the survey conducted in 2019 found that 37% of visitors came to kayak and 10% came to paddleboard. This difference may be due to the fieldwork occurring slightly later in summer (February through to April 2021 compared with the survey conducted from January through to March 2020) and the comparatively small amount of time research assistants were present at the lake (approximately 60 hours in 2021 compared with 178 hours in 2020).

The one participant was observed to brush the kayak all over and did not find any plant material. They thought the rubbish bin provided was too small. They suggested including a spray bottle or water and therefore transforming the ‘checking station’ into a ‘cleaning station’. When other participants were asked what more could be done to assist them checking, cleaning, and drying their kayaks, the most common suggestions were similar: to provide “a spray bottle with some solution”, “have a hose here and liquid for cleaning”, and “cleaning equipment, spray bottle and hose”. These suggestions may indicate that ‘cleaning’ is perceived to be a more important behaviour than ‘checking’ or one that makes ‘checking’ for pests redundant if being pest-free is the end-state of cleaning.

Further exploration is required to determine the benefit of a kayak pest checking (cleaning) station at Lake Rototoa. It would be ideal to know the actual quantity of kayaks / paddleboards visiting the lake. Quantifying the number of kayaks / paddleboards present could be achieved through motion activated surveillance cameras placed near the carpark. Understanding the true size of the biosecurity risk

posed by contaminated kayaks / paddleboards could better direct the return on investment of interventions targeting these items. If there is a small number of kayaks / paddleboards visiting relative to other gear, there is a small probability of pests being spread by kayaks / paddleboards, and it may be better to invest in pest prevention interventions targeting other gear. If it is found that closer to 37% of visitors have kayaks and 10% have paddleboards (as the 2020 survey found), there is a higher probability of pests being spread by this gear and investing in a kayak pest cleaning station may be worthwhile.

6.2.7 Kayak and snorkelling community event at Lake Rototoa

On Sunday 28th March 2021 a free kayak and snorkelling community event was held at Lake Rototoa. This event was delivered by Experiencing Marine Reserves in collaboration with Aotearoa Lakes, Whitebait Connections, Auckland Sea Kayaks, and South Kaipara Landcare. There were stalls providing information on community trapping projects, Auckland Council lake monitoring, freshwater pest species and colouring activities. The event was marketed to locals in the first instance but there was a mix of local and visitors from further afield.

Attendees registered to either kayak or snorkel in the lake. Kayaking involved small groups being taken on a guided kayak tour of the lake with commentary about the biodiversity and the research being conducted at the lake. Snorkelling involved a guided snorkel from the beach exploring the immediate bay area. The snorkellers were given some instructions on how to duck dive and were shown freshwater mussels, native fish, native submerged plants, and the pest plant hornwort. Attendees could bring their own kayak to use or borrow a kayak supplied by Auckland Sea Kayaks.

Research assistants acted as Biosecurity Champions during the event sharing information about biodiversity and freshwater pests. The kayak pest checking station was set up with a barrel of water with detergent, extra brushes, and spray bottles with detergent (see Figure 29). All attendees who registered for the kayak event were given a brief talk about the risk of pest transfer between waterbodies and the Check, Clean, Dry procedures. Attendees who brought their own kayaks were directed to the station to check their kayaks before going in the water. The kayaks from Auckland Sea Kayaks were clean on arrival. After being in the lake, all kayaks were sprayed down on the grass – the camp stretcher on which to place kayaks for checking was not used.

Attendees of the event were observed to spray their kayaks down with a barrel of water and detergent with a spray hose on the grass. A ‘cleaning station’ with a similar simplistic design could be refined through a testing process at a community event next summer. Ongoing maintenance provides a challenge in delivering a semi-permanent

cleaning station. The water and detergent solution would need to be replaced and it would need to be able to withstand vandalism.

Figure 29: Kayak pest checking station with addition of spray barrel and spray bottles (right), instructional sign (centre), biodiversity information table (left), and biosecurity champion at community event.

Attendees were asked to complete a one-page feedback survey at the end of the event 40 out of 87 attendees completed the survey. The primary purpose of this survey was to provide Experiencing Marine Reserves with feedback to improve their events. Two questions about Check, Clean, Dry were included as well as a question about freshwater conservation knowledge.

One third (n=13) of participants had not previously heard of Check, Clean, Dry and the remaining two thirds (n=24) had heard. This is slightly greater than those who reported being aware of Check, Clean, Dry in the 2020 survey (46% of Lake Rototoa visitors aware). Sixteen per cent (n=6) did not learn about Check, Clean, Dry during the event and the remaining 84% (n=31) did learn about Check, Clean, Dry. All participants said that 'yes' their freshwater conservation knowledge had increased. All participants were satisfied with the event; 90% (n=35) being 'very satisfied' and 10% (n=4) being 'satisfied'.

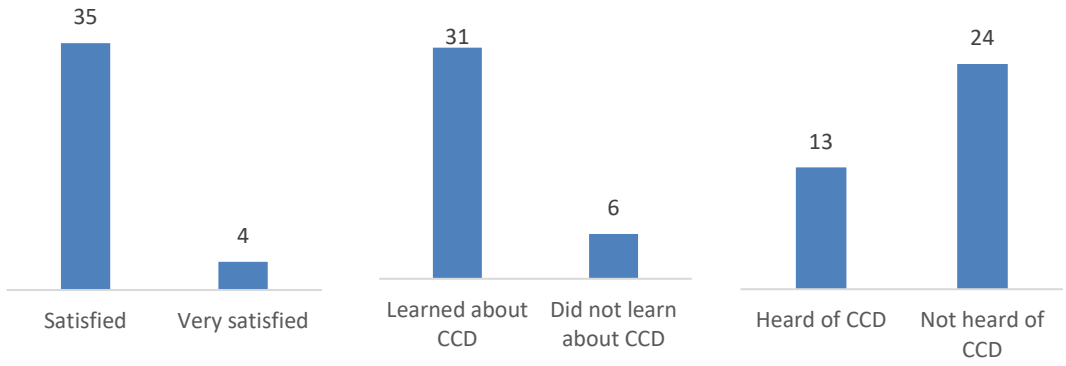


Figure 30: Event attendees awareness of CCD (left), report learning about CCD at the event (centre), and satisfaction with the event (right). All charts display counts of responses.

These results suggest the event was successful in engaging people about Check, Clean, Dry procedures, freshwater conservation, and providing an enjoyable event. The event also provided insight into kayak cleaning behaviours which can inform the development of the kayak pest checking (cleaning) station. It is recommended that the event is repeated in subsequent summers earlier in the season and a more detailed evaluation of the behavioural impacts of the event is considered.

6.3 Recommendations for behavioural interventions

The results of testing interventions inform a series of recommendations. Some findings suggest a need for collaborative initiatives broader than this workstream can deliver alone. Other findings provide very specific direction to improve the tested interventions and deliver revised versions in the summer of 2022.

Broader initiatives

- The optimal way to communicate the impact of freshwater pests for lake visitors and to illustrate why compliance with check, clean, dry matters to them needs to be investigated. The intervention testing found that 'freshwater pest' is not a well understood term and visitors have mixed awareness of, and interest in, the impacts of pests. This is not isolated to freshwater biosecurity. The same challenge exists for marine biosecurity, island biosecurity, plant pathogens, terrestrial pest animals and plants. This may therefore be best addressed from a regional perspective traversing projects and ecosystems.
- Testing found participants expected biosecurity signage to be delivered by central government bodies (DOC and MPI) rather than Auckland Council. This raises a broader question of whether there is a need to further communicate the collaborative nature of biosecurity programmes delivered in partnerships

with local and central government bodies. The existing lakeside signage needs addressing to ensure it complements new signage providing an opportunity to collaborate with DOC, MPI, and mana whenua, to better communicate how we all contribute to achieving biodiversity outcomes.

Lake interventions

- Reconsider the behaviour asked of boat owners at Lake Tomorātā. The request to 'make a plan' was generally unsuccessful. Asking to 'check for pests before putting vessel in water' may be more achievable.
- Continue with instructional signs and boat cleaning kit by making amendments and delivering next summer. Considering changing the location of the instructional sign at Lake Rototoa to be on the right-hand side of the grass area making the directional sign redundant. Develop and deliver kayak cleaning kits with a kayak image on the bucket.

  Instructional sign amendment summary:
  - Shorten headline.
  - Revise copy on what to do 'now' and state checking for pests is to be done before entering the water.
  - Add instruction to lift flap.
  - Pair flap images with explicit description of pest impact.
  - Add circles or otherwise indicate pest plant material on the kayak images.
  - Add images of pest plant material on boats in a similar nature to the kayak images.
  - Revise instruction on Lake Tomorātā sign to ask boat owners to check their vessels (not to 'make a plan' to Check, Clean, Dry at home).
- Commitment boards saw low engagement and pursuing this as a standalone intervention is not recommended. This may be more effective when paired with a biosecurity champion who gifts a cleaning kit and explicitly requests a commitment from lake visitors.
- Deliver a kayak and snorkelling community day earlier in the year during school holidays. Undertake a more thorough evaluation of this event to understand the learning and behavioural outcomes.
- Explore means to more accurately understand the volume of kayakers at Lake Rototoa. Kayaking is suspected to be an activity undertaken in early summer (December-January) more than in later summer (February-March). A decision on pursuing the development of a kayak pest checking/cleaning station should be made with more information on the frequency of kayaking. Repeating the

kayak and snorkelling community day may provide an opportunity to trial a kayak cleaning station.

- Consider trialling two other interventions: (1) biosecurity champions with cleaning kits from December 2021 to intercept kayakers at Lake Rototoa and boat owners at Lake Tomorātā, and (2) a geotagged media campaign targeting local lake visitors. This campaign could be delivered with the Freshwater Biosecurity Partnership Programme targeting locals nationwide with regionally relevant content.

7.0 Summary

This report describes the process undertaken to develop behavioural interventions for Lake Tomorātā and Lake Rototoa to enable lake visitors to reduce their risk of accidentally spreading freshwater pests.

A baseline survey was undertaken to understand who are visiting the lakes, for what purposes, and self-reported performance of Check, Clean, Dry procedures. This information was then used to inform the development of a series of behavioural interventions tested at the lakes to enable compliance with Check, Clean, Dry procedures.

Two interventions are found to be the most successful: instructional signs and the boat cleaning kit. It is recommended that amendments are made to these interventions before they are delivered next summer. More investigation is needed to determine the benefit of a kayak pest checking (cleaning) station before this intervention is developed further as only one kayaker was encountered during testing and cleaning was the required function during the community event. Commitment boards were found to be an unsuccessful intervention due to minimal engagement. Additional interventions could be tested in the future such as Biosecurity Champions and geotagged social media campaigns.

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9.0 Appendix: Questionnaire for Baseline Survey

Frequency of Visit & Group Size

Q1. To start with, how often do you visit this lake in general?

If needed: If it varies or you are unsure, please make your best guess based on a typical year. If you are staying near the lake, please think of each day as a separate visit

Read out. Select one only.

1. This is my first visit ever
2. Once every few years
3. 1 to 5 times a year
4. 6 to 10 times a year
5. More than 10 times a year
6. Don't know

Q2. And how did you first find out about this lake?

If needed: Who told you about this lake or where did you read about it? If you have been visiting for a while, how did you initially hear about it?

Read out if necessary. Select one only.

1. Friends or family
2. Tourism provider
3. Club or organisation ***[Specify]***
4. Car hire company
5. Social media ***[Specify]***
6. Other ***[Specify]***
7. Can't remember/don't know

Q3A. Who is visiting the lake with you today?

Read out if necessary. Select as many as apply.

1. By myself
2. Family
3. Friends
4. Club or organisation ***[Specify]***Other ***[Specify]***

All excluding those by themselves (code 1 at Q3A)

Q3B***.*** Including yourself, how many people in your group today are……

[For each there will either a text box to type in the number for each or a drop down option]

1. Adults (16 years or older)
2. Children (under 16 years old)

Reason(s) for Visit

Q4A. What types of recreational activities have you or will you [or your group] participate in at the lake today? ***[Hide motorized boat codes for Lake Rototoa]***

Probe: What else will you do, or have you done on this visit?

Read out if necessary. Select as many as apply.

1. Picnic
2. Swimming
3. Walking/tramping
4. Kayaking
5. Sailing
6. Windsurfing
7. Boat fishing
8. Fly-fishing/non-boat fishing
9. Jetboating
10. Ski/wake boating
11. Jet skiing
12. Other ***[Specify]***

If multiple activities mentioned at Q4A, show those selected and ask:

Q4B. And which **<u>one</u>** of these activities would you consider your **<u>main activity</u>** or reason for visiting the lake today?

If unsure ask: Which of these activities will you spend the most time doing?

Read out if necessary. Select one only.

[*Show only those selected at Q1A*]

If visit more than once (codes 2-6 at Q1A) ask:

Q5A. Other than the things you have already mentioned you have done or will do today, do you ever participate (or have you ever participated) in other types of recreational activities <u>at this lake</u>?

Don't read out. Select one only.

1. Yes
2. No – no other activities
3. Don't know

If yes at Q5A ask:

Q5B. What other types of recreational activities do you participate in at this lake?

Read out if necessary. Select one only.

[*Show only those NOT selected at Q3A*]

Q6. What do you like or value about this lake?

1. Other *(specify)*
2. Don't know

Q7. Which of the following things did you do today either just before your trip to this lake or on your way here?

Read out if necessary. Select As many as apply.

1. Stopped at a Petrol station ***[specify where]***
2. Looked at the weather online ***[specify what site]***
3. Looked at social media ***[specify where]***
4. Stopped at a supermarket ***[specify where]***
5. Stopped at a café ***[specify what/where]***
6. Saw a billboard ***[specify where]***
7. Looked at a newspaper ***[specify which]***

Frequency of Visit to other lakes

Q8A. In the last 2 weeks (14 days), have you visited any other lakes or rivers in New Zealand?

Don't read out. Select one only.

1. Yes
2. No – no other rivers/lakes visited
3. Don't know

If yes at Q8A ask:

Q8B. Thinking about the most recent lake or river you visited (other than this lake), how long ago was your visit? (i.e. when were you there?)

Read out if necessary. Select one only.

1. Earlier today
2. Yesterday (or within the last 24 hours)
3. Two days ago (or within the last 48 hours)
4. 3-5 days ago
5. About a week ago
6. More than a week ago
7. Don't know

If yes at Q8A ask:

Q8C. [Thinking about the most recent lake or river you visited (other than this lake)] , what region was it in? What was the name of the river/lake? How many times did you visit that river/lake in the last two weeks? Did you use any boats or water gear during that visit (including kayaks, fishing gear, etc)? *[record details in drop down list for each question]*

- Region *[drop down list]*
- River/lake name *[drop down list]*
- Number of visits for each *[drop down list – 1, 2, 3, 4, 5-9, 10-14]*
- Water gear *[record yes/no]*

Probe after each: Have you visited any other rivers or lakes in the last 2 weeks?

[if yes, record details for each using the drop down lists]

Q9A. In the past 12 months, have you taken part in the following activities on/in any lakes or rivers in in New Zealand? And for each activity, please say if you have done this on/in different lakes or rivers or in just one lake or river.

Please **EXCLUDE** any activities where:

- you were **not responsible or jointly responsible** for packing up the equipment or gear i.e. someone else did it for you e.g. a tour operator, club, friend or family member.
- you were in sea water.

	No – I have not done this	**Yes – I have done this in the last 12 months…….**			
		….but only on **one lake or river**	**…..** and I have been on **different lakes or rivers**	**…….**and I am unsure if I have been on different lakes but it's **likely** that I have	**…….**and I am unsure if I have been on different lakes but it's **unlikely** that I have
Fishing - in rivers or lakes	1	2	3	4	5
Whitebaiting	1	2	3	4	5
Eeling	1	2	3	4	5
Catching kōura	1	2	3	4	5
Kayaking / Canoeing - in rivers or lakes	1	2	3	4	5
Rafting - in rivers or lakes	1	2	3	4	5
Waka ama - in rivers or lakes	1	2	3	4	5
Motorboating - in rivers or lakes	1	2	3	4	5
Jetboating - in rivers or lakes	1	2	3	4	5
Sailing - in lakes	1	2	3	4	5
Jet Skiing - in rivers or lakes	1	2	3	4	5
Paddleboarding - in rivers or lakes	1	2	3	4	5
Kite Surfing - in lakes	1	2	3	4	5
Mountain biking – with river crossings	1	2	3	4	5
Tramping / Trail running – with river crossings	1	2	3	4	5
Hunting – with river crossings	1	2	3	4	5

For those who have been on different lakes or rivers in New Zealand for any of the above activities, show the following for each done:

[ONLY SHOW ACTIVITIES WHERE Q9A = 3 or 4]

Q9B Thinking about when you have been on/in different lakes or rivers in the last 12 months for each of the activities, how close together have the visits to different lakes been? If you have had multiple visits, please think about the shortest timeframe.

	Not applicable – I have not done this activity or been on different lakes/rives	In the last 12 months, I have neem on/in a different lake or river doing this activity…….				
		…on the **same day or within a few days**	**….about a week apart** but not less	**…..about 2-4 weeks apart** but not less	**…..about a month or more apart** but not less	**Unsure**
Fishing	1	2	3	4	5	6
Whitebaiting	1	2	3	4	5	6
Eeling	1	2	3	4	5	6
Catching kōura	1	2	3	4	5	6
Kayaking / Canoeing	1	2	3	4	5	6
Rafting	1	2	3	4	5	6
Waka ama	1	2	3	4	5	6
Motorboating	1	2	3	4	5	6
Jetboating	1	2	3	4	5	6
Sailing	1	2	3	4	5	6
Jet Skiing	1	2	3	4	5	6
Paddleboarding	1	2	3	4	5	6
Kite Surfing	1	2	3	4	5	6
Mountain biking	1	2	3	4	5	6
Tramping / Trail running	1	2	3	4	5	6
Hunting	1	2	3	4	5	6

Freshwater Pests

Q10A. Do you know of any freshwater pests that are problems in New Zealand lakes and rivers?
Don't read out. Select one only.

1. Yes
2. No
3. Don't know

If yes to Q10A ask:

Q10B. What freshwater pests have you heard of?
If needed: this could include plants, animals, organisms that threaten native freshwater species and ecosystems
Don't read out. Select as many as apply.

1. Didymo/rock snot
2. Hornwort
3. Lagarosiphon/oxygen weed
4. Egeria/oxygen weed
5. Lindavia/lake snow
6. Hydrilla
7. Plants/weed (unsure of name)
8. Gambusia/mosquitofish
9. Tench
10. Goldfish
11. Perch
12. Rudd
13. Catfish
14. Koi carp
15. Fish/exotic fish (unsure of name)
16. Other *(specify)*
17. Don't know/unsure

Q11A. Have freshwater pests, including plants, animals or organisms, impacted your enjoyment of any lakes and rivers in New Zealand?
Don't read out. Select one only.

1. Yes
2. No
3. Don't know

If yes at Q11A ask:

Q11B. And have they impacted your enjoyment of <u>this</u> lake?
Don't read out. Select one only.

1. Yes
2. No
3. Don't know

If yes at Q11B ask:

Q11C. How have they impacted your enjoyment of <u>this lake</u>?

Don't read out. Multiple response

***Probe**:* How else have they impacted your enjoyment of this lake?

3. Other *(specify)*
4. Don't know

Knowledge and Performance of Risk-Preventing Behaviours

Q12. Are you aware that freshwater pests can spread from one lake or river to another?
Don't read out. Select one only.

1. Yes
2. No
3. Don't know/unsure

If yes at Q12 ask Q13a….everyone else skip to 13C:

Q13A. Are you aware of how people using waterways can help reduce the spread of freshwater pests between lakes and rivers?
Don't read out. Select one only.

1. Yes
2. No
3. Don't know/unsure

If yes at Q13A ask:

Q13B. What ways of reducing the spread of freshwater pests are you aware of?
Don't read out. Select all that apply

1. CCD – Check, Clean, Dry
2. Check – Remove any visible plan material from equipment/shoes
3. Clean –boats,
4. Clean – kayaks
5. Clean - windsurfing or paddle boards
6. Clean - fishing nets/equipment
7. Clean – skis/wakeboards
8. Clean – any other equipment that has been used in the water
9. Clean – trailer
10. Dry – any equipment that has been used in the water (including boats, kayaks, windsurfing or paddle boards, fishing nets/equipment, skis, etc)
11. Dry – trailer
12. Flush outboard motor
13. Clean anchor well and anchor
14. Remove bungs

15. Other *(specify)*
16. Don't know/unsure

If yes at Q13A and not mentioned (code 1) at Q13B ask:

Q13C. Are you aware of the "Check, Clean, Dry" campaign to help reduce the spread of freshwater pests?

Don't read out. Select one only.

1. Yes
2. No
3. Unsure – sounds familiar

Show those who say no or are unsure the showcard and ask:

Q13D. These are some images from the "Check, Clean, Dry" campaign, have you seen these before? ***[Show card}***

Don't read out. Select one only.

1. Yes
2. No
3. Unsure – sounds familiar

If yes at Q13C or Q13D ask:

Q13E. Where have you seen or heard information about the "Check, Clean, Dry" campaign?

If unsure: Where do you think you saw or heard it?

Read out if necessary. Select all

1. Posters
2. Brochure or flyer
3. Word of mouth – from Friends or family
4. Club or organisation ***[Specify]***
5. Council or government websites ***[Specify]***
6. Other ***[Specify]***
7. Can't remember/don't know

Ask everyone - even if aware of check, clean, dry campaign

Q14A. To prevent the spread of freshwater pests, the following actions are recommended:

Before you move between different lakes and rivers, ensure your gear and equipment (including any clothing that got wet) has been checked (visible pests removed) and then dried for more than 48 hours OR cleaned thoroughly with a detergent or disinfectant solution for at least a minute.

How often do you follow the Check, Clean, Dry procedures (or take other effective approaches i.e. freeze gear or use different sets of equipment) when moving between lakes and rivers?

Read out. Select one only.

1. Always
2. Mostly
3. Sometimes
4. Never
5. *(Don't read)* Not Applicable – I don't use different lakes and rivers/this is my first time using a lake/river
6. (*Don't read*) Don't know/unsure

If codes 2-4 at Q14A ask:

Q14B. Why do you not always follow the "Check, Clean, Dry" actions when moving between lakes and rivers?

Don't read out. Select all that apply.

1. Was not aware of this
2. I'm not clear on what I'm supposed to do
3. I just forget
4. I don't have the right equipment (no buckets, detergent, facilities, etc)
5. I don't see a sign that prompts me
6. I assume there are no pests in the waterway I'm moving from
7. I didn't think this applied to me (e.g. thought this only applied to boats etc.)
8. Other *(specify)*
9. Don't know/unsure

If codes2-4 at Q14A ask:

Q14C. Is there anything that would help you to undertake or remember to undertake the recommended "Check, Clean, Dry" actions?

Probe: What else could help you to undertake or remember the actions?

Don't read out. Select all that apply.

1. Other *(specify)*
2. Nothing I can think of
3. Not interested/I would not do this
4. Don't know/unsure

Demographics

Finally, just a few questions about you. These are just to make sure we have a good mix of people in the survey.

Q15. Which gender do you identify with? ***]*** (***if online/paper***: Are you….)
Don't read out. Select one only

1. Male
2. Female
3. Gender diverse
4. Prefer not to say

Q16. Which age group do you belong to?

Read out as needed. Single response

1. 15-24 years
2. 25-29 years
3. 30-39 years
4. 40-49 years
5. 50-59 years
6. 60-69 years
7. 70-74 years
8. 75+ years
9. I prefer not to say

Q17**.** Which ethnic group or groups do you identify with?

Probe: Apart from *[insert what they have mentioned]* what other ethnic groups do you identify with?
Read out as needed. Multiple response

1. NZ European/ Pākehā
2. Māori
3. Samoan
4. Cook Island Māori
5. Tongan
6. Niuean
7. Chinese
8. Indian
9. Other *(Please specify)*
   _____
10. I prefer not say

Q18**.** Where do you live?

Read out if needed. Select one only

1. New Zealand – *Specify* region *[drop down list] and* town/city *[drop down list If Auckland Specify NSEWC]*
2. Overseas Visitor – *Specify* Country *[drop down list]*

Find out more: phone 09 301 0101, email rimu@aucklandcouncil.govt.nz or visit aucklandcouncil.govt.nz **and knowledgeauckland.org.nz**

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