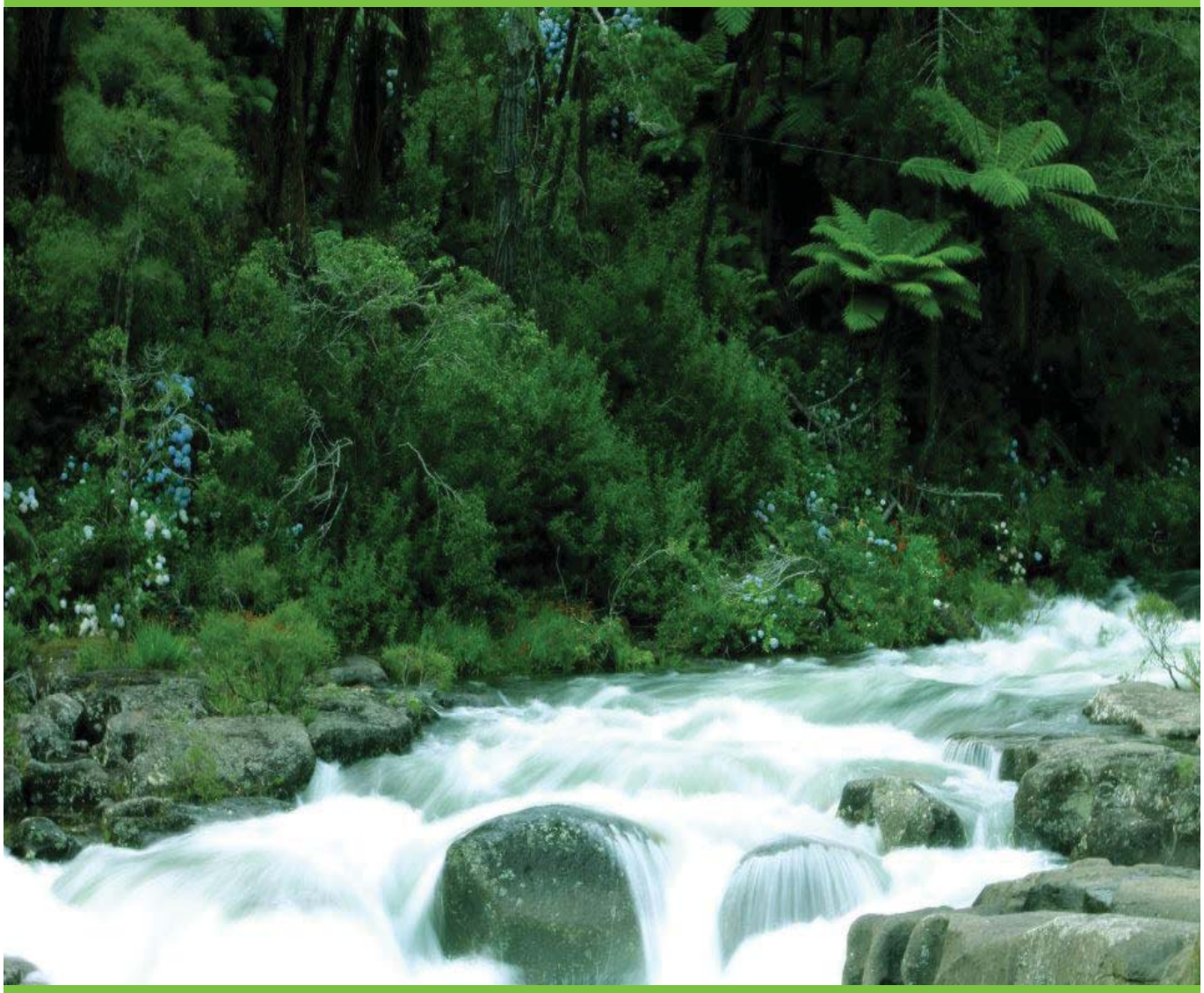
Aquatic Pest Survey 2013



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Photographer: Tracey Bates

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Executive summary

For both the Bay of Plenty region and New Zealand, the Rotorua Lakes are a significant asset. Their health and native biodiversity are therefore worth protecting. The number, popularity and close proximity of the lakes to each other and the Waikato fresh-waterways make them extremely susceptible to invasive species.

Invasive aquatic weeds such as hornwort, egeria, lagarosiphon and elodea have been identified as the main invasive species that have established in the lakes and contribute to water degradation. Human recreational activities are the principal means through which weed fragments spread between lakes, with vessels, trailers and equipment identified as the main vectors. Eggs of pest fish species such as brown bullhead catfish and koi carp 'hitchhike' on weed fragments and are a concern, as is the invasive freshwater alga didymo. First identified in a South Island river catchment in 2004, it is now widespread, though is not yet known to be present in the North Island.

Aquatic pest summer awareness programmes aim to identify levels of public awareness, as well as educate recreational users of the threats pest weeds, fish and didymo present, and how to prevent their spread. This was conducted via surveys at boat ramps and on the rivers, during which a promotional pack containing merchandise and educational information were offered for free. Awareness and decontamination stations at sporting events and the distribution of educational material to retail outlets, information centres and tourist accommodation these surveys.

A total of 806 individuals were surveyed on lake boat ramps and rivers throughout the Bay of Plenty during the 2012/2013 programme. Of those at lakes, 41.6% checked and cleaned vessels between waterways, a 3% decrease from the previous year, indicating a declining trend following last summers' 19% decrease. In addition, eight people were seen to have weed fragments attached to vessels, trailers or equipment, and a significant amount of hornwort and egeria was found floating in the cordon at Lake Rotomā. Such incidents pose a significant risk to many of the lakes, specifically the ones that are currently hornwort free such as Rotomā and Tikitapu. A greater proportion of river users (74.6%) checked and cleaned their vessels/equipment between waterways, however. Most lake users were from Rotorua (36.1%) or Tauranga (24.9%) whereas most river users were from Rotorua (27%) or the South Island (27%). The majority of lake users (76%) used vessels with outboard motors with the most popular recreational activity being fishing (29.6%). However, on rivers, kayaks (73%) were the most heavily used due to the popularity of the Wairoa and Kaituna Rivers. A concerning statistic was that 28.6% of river users had last used their gear in the South Island, posing a significant threat due to didymo's dominant presence in that part of the country. The region of fresh waterways the majority of river users had last been in was the Bay of Plenty, making up 63.5%. In total, 68.1% of vessels at lakes had last been used on the Bay of Plenty region's waterways, an increase of 3.7% from last year.

It was perceived that a high proportion (75.9%) of those surveyed at the lakes had a good level of interest in aquatic pest issues, a decrease of 8.4% compared to last year, with 85.7% of river users perceived to have a good level of interest. This summer, however, new survey methods allowed greater insight into individual awareness. Results found only 29% lake users spoken to have heard of hornwort, and 7.6% had never heard of didymo. In comparison, 50% of river users had heard of hornwort although 8.1% were unaware of didymo. In terms of overall awareness of aquatic pest issues, the majority of lake users (31.6%) were found to have a medium level of awareness, answering two topic questions correctly. Nineteen percent of lake users had a high awareness. With regards to didymo, 45.5% of lake users had high awareness and were able to answer all questions about its presence and habitat. Surveys conducted on the rivers found 87.3% had high didymo awareness, with most people having heard of it and being aware of its current distribution.

Contents

Part 1: Introduction

1.1 Background on Bay of Plenty lakes and rivers

The Lakes District in the Bay of Plenty, consisting of sixteen lakes of varying size and depth, was created through volcanic activity over 140,000 years ago. Considered by the people of Te Arawa and New Zealand alike as taonga, and as natural assets of great beauty, the lakes provide a large source of economic, recreational and cultural benefits to the country (RotoruaNZ).

Of these 16 lakes, 12 are referred to as the "Te Arawa," or "Rotorua Lakes," and are managed through the Rotorua Lakes Protection and Restoration Action Programme (Bay of Plenty Regional Council, 2013). The geothermal nature of the region means the lakes were created in close proximity to each other and although many have no surface outlets, they are thought to be interconnected via groundwater and subsurface flows. The number, popularity and closeness of the lakes make them extremely susceptible to invasion by pest species, the biggest medium through which weeds invade the lakes being human activities such as fishing, water tourism and recreational activities. In many of the lakes, high nutrient levels from sources such as runoff and sewage output have also contributed to greater abundance of aquatic weeds, particularly in Rotorua, Rotoiti, and Rotoehu.

In addition to the lakes there are a number of rivers in the Bay of Plenty region which are famous for their white water kayaking and rafting appeal. The Wairoa River and Kaituna River are known worldwide for their amazing kayaking experience. Both the rivers and lakes contribute to the appeal of the region as a summer destination, domestically and internationally.

Regional tourism for 2010, including domestic and international tourists, contributed $491 million to the Rotorua economy (Ministry of Economic Development, 2010). The lakes are therefore a vital asset to the region's growth and stability and their health and biosecurity is worth protecting.

Figure 1 Lake Rotoiti

1.2 Invasive weed species

Since colonisation of New Zealand, introductions of foreign animals and plants have contributed significantly to the loss of native flora and fauna. In some cases, the introduction of foreign species has contributed to the local and regional economy through aquaculture, the aquarium industry and pharmaceuticals. In a lot of situations, however, the effects of these species on the native environment can be catastrophic. Of all anthropogenic impacts that affect global biodiversity, the impact of invasive species is considered second only to habitat destruction in terms of loss of biodiversity (Groves, Panetta, & Virtue, 2001).

In the Rotorua region, there are four main invasive weed species established in the lakes that contribute to degradation of water quality and loss of native biodiversity. These weeds include: hornwort *(Ceratophyllum demersum),* Canadian pondweed (*Elodea canadensis*)*,* lagarosiphon *(Lagarosiphon major),* and egeria *(Egeria densa).*

Invasive weed species possess a similar set of characteristics that enable them to spread rapidly and survive in New Zealand's aquatic environments. These include the ability to grow rapidly, often by asexual means such as fragmentation. They grow in thick blankets, altering habitats for native species, smothering native aquatic plants, clogging intakes on jet boats, fouling propellers and preventing recreational activities (DOC, 2012a). In most cases only one sex of the species has been introduced, meaning they are constrained by lack of natural dispersal methods. Human activities are therefore the most common means of dispersal from one water body to another, and the close proximity of all our lakes place them at risk of incursion from these invasive weeds (Champion & Clayton, 2000).

An Aquatic Weed Risk Assessment Model (AWRAM) is a useful tool developed to compare the success of one aquatic species with another (Table 1). Attributes of the ecology, biology, weediness and management of each species is assessed based on their behaviour in new habitats. Each trait is ranked on a scale of 0-10 and combined to give a total score.

Table 1 Submerged aquatic plant species present in Rotorua Lakes ranked according to weed risk. Higher score reflects greater impact (Champion & Clayton, 2000)

Common name	Scientific name	AWRAM score
Hornwort	*Ceratophyllum demersum*	67
Egeria	*Egeria densa*	64
Lagarosiphon	*Lagarosiphon major*	60
Canadian pondweed	*Elodea canadensis*	46

1.2.1 **Hornwort**

Native to most landmasses except New Zealand and Antarctica, hornwort is an invasive weed that is mainly submerged, and found within littoral zones of still and flowing fresh water (Popay *et al*., 2010). Considered New Zealand's worst aquatic weed, hornwort has no roots and can either be free-floating, or anchor itself in sediments via modified leaves (Popay *et al*., 2010). In clear lakes hornwort can be found to depths of 16 metres and its dense beds can reach up to 10 metres in height, inhibiting light penetration to native species and causing blockages of hydro dams (Biosecurity New Zealand, 2009).

Figure 1 Hornwort found in Lake Matahina

The appearance of the plant is feathery, with bright green, finely divided leaves that have minute teeth, making it feel rough to the touch. New plants can form easily via vegetative growth of broken stems. Readily snapped and dislodged by waves, currents or boats, hornwort is a particularly rapid invader in water of varying clarity, temperature, light and nutrient levels (DOC, 2003).

Hornwort was first found in the region in Rotoiti, and has since established in Rotorua, Tarawera, Rotoehu, Rotomahana and more recently, Ōkataina and Ōkāreka.

1.2.2 Lagarosiphon

Native to South Africa, lagarosiphon is a wholly submerged, freshwater perennial that has been present in New Zealand since the 1950s. It was first discovered blocking hydro dams, and has spread throughout the world via the aquarium trade. Lagarosiphon has since established in many waterways throughout the country, and is present in all the Rotorua Lakes except for Rotomahana, Ōkaro and Rotokakahi (DOC, 2012).

Figure 2 Lagarosiphon bed in Awahou River, Rotorua

It differs in appearance to other aquatic weeds in that the leaves are arranged in an alternate spiral rather than in a whorl and have tapered tips curving downwards along the stem. Only female plants occur in New Zealand, therefore spread to other lakes is facilitated primarily by human activities (Popay et al., 2010).

This invasive oxygen weed prospers in clear, shallow water of depths up to 6.5 metres. It can form dense monospecific stands that block light penetration, eliminating growth of native plants and smothering benthic invertebrate populations. In addition to this, lagarosiphon can restrict the passage of boats and limit recreational activities such as swimming and fishing (ISSG, 2006c).

1.2.3 Egeria

Native to South America, this species thrives in turbid, slow-flowing waters, forming dense monospecific beds that clog water bodies and cause fluctuations in water quality. Its dense growth creates anoxic conditions that smother benthic communities and restrict light to surrounding native plants. Egeria is often used as an indicator of regime change from clear, macrophyte dominated lakes to turbid, algae dominated lakes (ISSG, 2006a).

Egeria is dark green, with short internodes which give the plant a leafy appearance and stems that can grow up to several metres in length. Individual leaves are minutely serrated, linear and arranged in whorls of four to six (Popay *et al.*, 2010).

Egeria was first found in Lake Rotorua in 1977, and since then has established in Rotoiti, Ōkāreka, Tarawera, Rotomahana and Rerewhakaaitu.

1.2.4 Elodea

Canadian pondweed is a submerged aquatic plant that has the ability to grow and multiply rapidly in a diverse range of environments and conditions. This species forms dense mats over substrate, often reaching heights of up to six metres (Popay *et al.*, 2010). It is a major threat to waterways due to habitat modification and its competitive ability against other plant species for light and space (ISSG, 2006b).

Elodea is similar in appearance to the other oxygen weeds, egeria and lagarosiphon, however, it can be identified as having three leaves arranged in whorls around the stem. This species also has flowers which are carried to the surface by long, slender stalks for pollination via the wind and water (ISSG, 2006b).

Elodea is thought to have established in New Zealand over a century ago and is currently found in all but one of the Rotorua Lakes.

The transferral of invasive weeds can also heighten the risk of unknowingly introducing other invasive specimens to the Rotorua Lakes. A discovery last summer of *Pomacea diffusa* (Apple snails) on hornwort taken from Lake Tarawera, confirms the dispersal of this aquarium species from the Waikato River to the Bay of Plenty region. The impacts of this species are not yet well documented; however, this case heightens the importance for further public awareness and understanding of the biosecurity risks surrounding our freshwater ecosystems (Collier *et al*., 2011).

1.3 Pest fish species

The introduction of invasive pest fish species poses a further threat to the quality and health of the Rotorua Lakes. Currently the lakes are inhabited by mosquito fish (*Gambusia affinis*), a highly predatory species that preys on invertebrates and the eggs of trout and native fish (ISSG, 2010b).

High numbers of invasive pest fish in neighbouring regions increase the risk of their transfer into local waterways. In the Waikato freshwater ways there are currently two such species which, if found in our lakes, would seriously reduce the water quality and habitat for native flora and fauna. These species include koi carp (*Cyprinus carpio*) and brown bullhead catfish (*Ameiurus nebulosus*). The importance of checking trailers and equipment for aquatic weed fragments is especially important in the case of pest fish, as fertile eggs can be attached and therefore introduced to new water bodies (Clements, 2005).

Koi carp are similar in appearance to goldfish and are often irregular in colour, with blotching of red, black, gold or white. They are distinguishable from other fish by the presence of two pairs of barbels at the base of their mouth and can grow up to 600 mm in length. Koi carp pose a serious threat as they reduce the health of the lakes as a result of their opportunistic feeding habits. As they grub through bottom sediments they increase water turbidity, impacting on plant habitat, insects and water fowl through competition for food and reduced water quality (Clements, 2005). Feral goldfish have been present in the Rotorua lakes since the late 1800s where they can reach considerable sizes, often causing people to mistake them for koi carp.

Figure 3 Koi carp

Koi carp are similar in appearance to goldfish and are often irregular in colour, with blotching of red, black, gold or white. They are distinguishable from other fish by the presence of two pairs of barbels at the base of their mouth and can grow up to 600 mm in length. Koi carp pose a serious threat as they reduce the health of the lakes as a result of their opportunistic feeding habits. As they grub through bottom sediments they increase water turbidity, impacting on plant habitat, insects and water fowl through competition for food and reduced water quality (Clements, 2005). Feral goldfish have been present in the Rotorua lakes since the late 1800s where they can reach considerable sizes, often causing people to mistake them for koi carp.

Brown bullhead catfish are a scale-less, dark brown species with pale sides and belly. They are a distinctive fish due to their large, flat mouth surrounded by eight barbels and the presence of a sharp toxic spine on the leading edge of their dorsal fin. Native to North America, brown bullhead catfish are extremely hardy and can invade a wide range of habitats as well as survive long periods of time out of water. They can rapidly build up to large numbers and out-compete trout and native species by stirring up sediment and preying on eggs and juveniles (Clements, 2005).

Other pest fish include tench (*Tinca tinca*) and rudd (*Scardinius erythrophthalmus*), which are found in both islands of New Zealand but are commonly found in the northern half of the North Island. Both pose a threat to indigenous species and it is considered an offence to be in possession of any of these pest fish.

Tench are a large species typically found in slow waters of varying levels of turbidity. They have fleshy, downturned mouths with a small barble on each side, bright red eyes and are typically olive green in colour. Little is known about their ecology; however they are blamed for reduction in benthic invertebrate densities in overseas lakes (Rowe, 2004). In addition there is good evidence that high-density populations can reduce lake water clarity by disturbing sediments and increasing nutrient recycling in shallow lakes (BOPRC, 2012). Indirect negative effects on native fish are also possible through reduced food supply; changes in water quality and reduced macrophyte cover. Tench were introduced to New Zealand in 1868 and are now found in Oamaru, Christchurch, Nelson, Northland and Tauranga (Rowe, 2004).

Rudd are stocky, deep-bellied fish with distinctive red fins and scales that range from silver on juvenile fish, to pale orange on adults. Adult rudd feed preferentially on native macrophytes, while juveniles feed primarily on zooplankton. These feeding habits endanger native plant, invertebrate and fish species by reducing water quality and altering indigenous habitats. A recent discovery of rudd in Lake Ianthe highlights the importance of educating the public about the detrimental effects coarse fish can have on aquatic ecosystems (DOC, 2012b).

1.4 The threat posed by didymo (*Didymosphenia geminata*) to New Zealand

Didymo (*Didymosphenia geminata*), or 'Rock Snot' as it is known colloquially due to its unpleasant manifestation, is an organism posing a biosecurity threat to the Bay of Plenty's freshwater ecosystems. A species of freshwater diatom, didymo are single celled algal micro-organisms that can be spread in just a single drop of water (Bowden, 2010). Although microscopic, they can accumulate in dense colonies called algal blooms. Didymo attaches to substrates with thick polysaccharide stalks and forms impenetrable mats that cover rocks and suffocate plants on the substratum of rivers, streams and lake edges (BNZ, 2011). It is brown, beige or white in colour and though it appears to be slimy, it is in fact rough, feeling like wet cotton wool (ISSG, 2010a). Kilroy and Bothwell (2012) conclude that cell division slows when phosphorus concentrations in the water are low, at which time stalk production increases. A prolonged period - at least two weeks - of low phosphorus is required for elevated stalk production to establish bloom conditions (Kilroy & Bothwell 2011, Kilroy & Bothwell 2012). Didymo's preference for lower nutrient environments to attain higher biomass is not characteristic of similar species (Kirkwood et al., 2007).

Figure 4 Ministry for Primary Industries pest awareness sign

The native distribution of didymo includes cold forest and alpine environments across the northern latitudes of North America, Asia and Europe and is typically located in cool, oligotrophic waters and grows through vegetative cell division (ISSG, 2010a). It has a preference for stable substrates and flows and favours conditions that are high in light (Kilroy, 2004).

New Zealand became the first Southern Hemisphere country to have didymo following the positive identification of the diatom in a South Island river during October 2004. Employees of Southland Fish and Game and the National Institute for Water and Atmospheric Research (NIWA) discovered a strange algal growth covering the substrate of the lower Waiau River and this was later confirmed to be didymo (Kilroy, 2004). Early attempts to contain didymo through public education and awareness initiatives proved to be difficult and the alga is now widespread in South Island rivers but has not yet been identified in New Zealand's North Island (BNZ, 2011). The South Island has been made a controlled area in its entirety and under the Biosecurity Act (1993), didymo has been classified as an unwanted organism (BNZ, 2011).

Kilroy *et al.,* (2006) highlight different characteristics that facilitate didymo invasiveness: large amounts of didymo cells can suspend in flowing water which acts as a vector; cells can flourish in a wide range of water velocities; it has a wide tolerance compared to specific limits of native algae and with a relatively stable substrate it can grow anywhere along the course of a river. These characteristics have resulted in didymo growing profusely and becoming widespread over a comparatively brief period of time. It is possible for didymo cells to survive for up to fifty days in damp conditions in which the water is cool, that is 12°C or less (Kilroy *et al.,* 2007).

Freshwater species and ecosystems, recreational activities and the aesthetic appearance of our waterways have been adversely affected. This has impacted upon government finances, social and commercial interests and the spiritual and cultural values of Maori (Deloitte, 2011). Branson (2006), reports that didymo blooms can have a negative effect on fisheries, tourism, hydro-electric power and irrigation schemes. The adverse impacts of didymo for 2006-2011 have been estimated to have cost New Zealand $127.8 million, with an increased projection estimated at between $210.6 and $854.8 million for the period 2011-2020 (Deloitte, 2011). In general, densities of benthic invertebrate species in lotic environments have been found to increase but changes in community composition are usually restricted to greater densities of Cladocera, Chironomidae, Nematoda and particularly Oligochaeta (Kilroy et al., 2009).

The inadvertent spread of invisible didymo cells is of great concern should this invasive alga species be transferred to the North Island. Rivers that are popular with recreational users such as fishermen and kayakers are often those most suitable for didymo growth. Therefore, these activities have been identified as the most likely vectors of didymo proliferation within and between different waterways and catchments. Kilroy and Unwin (2011) reported that of 47 new didymo incursions it was believed 28 and 13 could be attributed to anglers and kayakers as vectors, respectively. The eradication of microscopic organisms that have established in natural fresh waterways is practically impossible and therefore not a viable option (Bothwell & Spaulding, 2008). The 'check, clean, dry' campaign, currently overseen by the Ministry for Primary Industries (MPI), is a proactive attempt at slowing the spread of didymo and containing it within the South Island. This awareness campaign is directed towards the public and educates as to the best methods of cleaning vessels, clothing and equipment if moving between bodies of freshwater (Bowden, 2010).

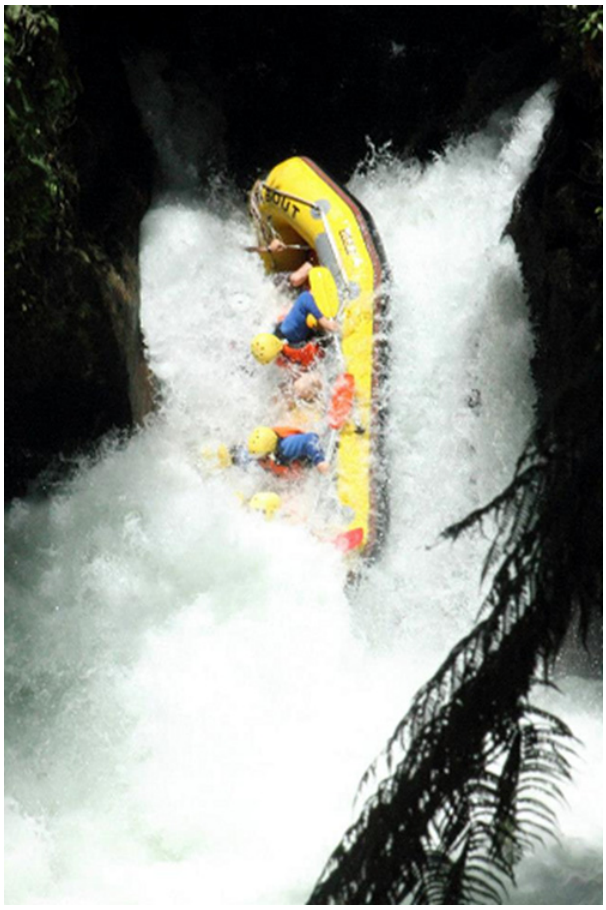

Figure 5 Rafters on the Kaituna River, Rotorua

1.5 Awareness programme and survey background

The Bay of Plenty region's rivers and lakes are used by people living locally as well as both domestic and international travellers undertaking a wide variety of recreational activities. Equipment, clothing, vessels and trailers associated with these activities have been identified as the primary vectors capable of transferring invasive weed and pest fish species, as well as live didymo cells, between waterways. Invasive pest weed species spread via vegetative fragmentation and weed fragments can harbour the eggs of pest fish. Didymo cells are microscopic, can survive in moist conditions and may therefore be spread unwittingly. Weeds can form dense mats which out-compete native freshwater plants such as charophytes and milfoils, degrade water quality, encourage stagnation and adversely affect irrigation and hydroelectric schemes.

The Aquatic Pest Coordination Group (APCG) (formerly Aquatic Pest Technical Advisory Group) was established in August 2004. This multi-agency initiative comprises of representatives from the Bay of Plenty Regional Council (formerly EBOP), the Department of Conservation (DOC), the Te Arawa Lakes Trust, Eastern Fish and Game, Rotorua District Council (RDC), and Land Information New Zealand (LINZ). These organisations work in partnership to ascertain and improve public awareness relating to aquatic pest plant dispersal between waterways.

The Bay of Plenty Regional Council has employed two students each summer since 2004 to assist with their Aquatic Pest Advocacy Programme. This programme has since evolved into a more direct programme in terms of its education and awareness strategies. Included in this programme is a survey created by APCG (Appendix 2) directed at users of lake boat ramps and the region's rivers. Packs containing merchandise and educational material provided by the Ministry for Primary Industries (MPI) and Bay of Plenty Regional Council are distributed free of charge to participants of these surveys.

1.5.1 Aims and objectives

The main aim of the annual Aquatic Pest Advocacy Programme is to both determine awareness of aquatic pests and educate recreational users of the lakes and rivers in the region about how pest fish, weeds and didymo are dispersed between waterways. In addition it educates water users on how to best minimise the risk of this happening. The distribution of educational material to retail outlets, iSites and tourist accommodations provides an additional approach to promoting awareness. This method also ensures the target audience can access information throughout the year, not just during the three months of the programme. This report initially highlights the methodologies used to disseminate information and the locations at which surveys were undertaken. Analysis and discussion of results from surveys follows. Finally, conclusions and recommendations will be documented to facilitate those conducting subsequent awareness programmes.

1.5.2 Methods

The Aquatic Pest Advocacy Programme aims to disseminate the 'Check, Clean, Dry' message to as many individuals and organisations as possible to help stop, or slow, the spread of aquatic weed, fish and algal pests between waterways. To accomplish this aim, boat ramps, river access points, tourism outlets and local businesses were visited to ensure the message was widely received.

Between 24 November 2012 and 9 February 2013, a total of 806 surveys were conducted with individuals or groups spoken to on boat ramps and river banks by Adam Brown and Tracey Bates, employees of the Bay of Plenty Regional Council. In addition, Manu Rangiheuea from the Department of Conservation undertook a similar role in the region and incorporated some locations within the Waikato region. Surveys were undertaken every weekend and for three days during the week between 8:00 am and 4:30 pm. However, on certain weekends, over the Christmas period and on statutory holidays, later starts were often required so we could speak with individuals returning from fishing trips or those staying out into the evening.

Relevant retail outlets, information sites, tourist accommodations and organisers of aquatic sporting events were contacted and provided with educational material and merchandise. This ensured a wide audience was spoken to and educated with regards to freshwater biosecurity issues.

1.5.3 **Boat ramp surveys**

Figure 6 Aquatic pest advocate surveying lake users at Lake Rotorua

The boat ramps at several lakes within the Bay of Plenty region were repeatedly visited over the busy summer period. For each survey conducted, the lake, boat ramp and weather conditions were noted. It was determined that amendments to the survey form (Appendix 2) used in previous years should be made. Using a standardised set of survey questions over many years helps to establish trends. However, it was decided that the section aimed to determine public awareness about aquatic pest issues and didymo was too subjective. The perception of awareness between not only two individuals working together, but also surveyors from one year to the next, can vary enormously. To ascertain a more accurate indication of awareness that could be used and compared statistically over the long term, it was decided to incorporate three questions on aquatic pests and three questions on didymo. The aquatic pest questions aimed to establish if the individual had heard of hornwort, knew that koi carp and brown bullhead catfish were not currently in the Rotorua Lakes and that pest weeds spread via fragmentation. Didymo awareness was established by asking the individual if they had heard of didymo and whether they knew it was restricted to the South Island and was predominantly found in rivers. Overall awareness was determined according to the following scores:

0 = none
1 = low
2 = medium
3 = high

A further new addition to this year's survey asked lake users if they knew how to clean their vessels/equipment to prevent the spread of aquatic pests.

The other information gathered during surveys was the same as in previous years. This included the origin of those surveyed, the last water body they visited, the kind of vessel or equipment being used, their recreational purpose or activity, whether any pest fish had been seen and an estimation of their level of interest regarding aquatic pest issues. It was also asked whether the vessel or equipment had been checked or cleaned prior to launching. If any obvious weed fragments were evident, the species and their location were recorded.

At the site, the vehicle was parked out of the way of turning trailers and vehicles but close enough to the ramp to see vessels launching and retrieving. On quieter ramps it was possible to speak to people while they were on the ramp as they were in no immediate rush and no one was waiting to access the water. On busier ramps, it was often better to speak to individuals either waiting to use the ramp, fixing their vessel up to leave, or those people waiting for the skipper on the jetty. This ensured that no congestion occurred on the ramp as a result of our surveying.

The majority of people were observed briefly to see if they checked their vessels for weed fragments, however it was difficult to determine whether their vessels had been cleaned at home or not. The topic was therefore brought up during discussion, during which many people stated whether they had or had not cleaned their gear. Lake users were approached, engaged in conversation and asked whether they were happy to talk for a few minutes. Answers relating to the survey were then ascertained. A promotional pack comprising educational material and free merchandise (keyring, lollipop, spray bottle, detergent and either a propeller flag, bucket hat, T-shirt or singlet) (Appendix 3) was not usually handed over until the end of the discussion. This ensured interest remained high, those surveyed were not distracted looking at pack contents and all the necessary information could be acquired prior to the discussion ending. Pack contents were contained within a fisherman's trout bag. All users were educated on the importance of checking and cleaning their vessels and equipment, and the risks associated with aquatic weeds, didymo and pest fish. In the case of didymo, more information was given if they were perceived to be a greater risk to the region, i.e. kayakers, fishermen and foreigners.

Figure 7 Surface reaching hornwort in Lake Rotoehu, 2009

A 2009 photo of Lake Rotoehu, in which aquatic weeds including hornwort are shown to be covering the entire surface of the lake, was used to highlight the effect that invasive weeds can have on lakes (Figure 7). The photo was an extremely effective prop to use with people, as they could understand the impact it would have on their recreational activities if it spread to cleaner lakes. Another useful prop was a display case containing models of koi carp and brown bullhead catfish, as it allowed people to see what pest fish looked like and if possible, identify them if found within the Rotorua Lakes in the future.

Once all the relevant information had been gathered, survey sheets were filled in away from the ramp in the vehicle. This decreased any bias achieved by surveying people directly, in which dishonest answers might be given in regards to whether they check and clean their gear.

The following list comprises all boat ramps visited over the summer period, the locations of which are displayed on maps in Appendix 7 and 8:

- **Lake Rotorua**
  Hannah's Bay
  Ngongotahā Mouth
  Hamurana
  Hamurana Springs Mouth
  Sulphur Point
  Lake Front

- **Lake Rotoehu**
  Kennedy Bay
  Ōtautū Bay

- **Lake Ōkāreka**
  Boyes Beach
  Acacia Point Reserve

- **Lake Rotomā**
  Merge Lodge
  Matahī Spit

- **Lake Ōkataina**

- **Lake Rotoiti**
  Otaramarae
  Delta Ramp
  Gisborne Point
  Hinehopu
  Okawa Bay
  Rotoiti Holiday Park

- **Lake Tikitapu (Blue Lake)**

- **Lake Rerewhakaaitu**

- **Lake Rotokakahi (Green Lake)**

- **Lake Aniwhenua**
  Camp ground and ramp

- **Lake Matahina**

Of these boat ramps, all but four were visited on a weekly basis. Lakes Rerewhakaaitu, Aniwhenua and Matahina are further out than the other lakes, and therefore require more driving and time. Aniwhenua and Matahina were visited three times over the summer during the Christmas/New Year period and Anniversary weekend as a lot of people camp at Aniwhenua with boats and kayaks. Guy Roe Reserve at Rerewhakaaitu is another popular camping spot, with a lot of people mooring boats along the lake edge. Lake Rotokakahi was checked every time we drove past the ramp to Lake Tarawera, but as it is privately owned with no public access we never encountered boats or trailers.

Figure 8 Lake Matahina

At the completion of the survey period the origins of water users were combined into regional categories to allow for comparisons to be drawn between results. The origins of lake users were as follows:

- **Rotorua region**
  Rotorua
  Tarawera
  Ōkāreka
  Ngongotahā
  Rotomā
  Tarawera
  Rerewhakaaitu
  Rotoehu
  Hamurana
  Rotoiti
- **Whakatāne region**
  Whakatāne
  Awakeri
  Kawerau
  Te Teko
  Matatā
  Paengaroa
  Galatea
  Edgecumbe
  Ohope
  Ōpōtiki

- **Tauranga region**
  Tauranga
  Te Puke
  Pāpāmoa
  Pukehina
  Maketu
  Katikati
  Mount Maunganui
  Pongakawa
  Ōmokoroa
- **Waikato region**
  Tokoroa
  Hamilton
  Cambridge
  Te Awamutu
  Reporoa
  Morrinsville
  Mangakino
  Taupo
  Whangapoua
  Thames
- **Wellington region**
  Wellington
  Upper Hutt
  Otaki
  Paraparaumu
- **Hawke's Bay region**
  Hastings
  Napier
  Waipawa
  Waipukurau
- **Northland**
  Whangarei
  Hellensville
- **Gisborne**
- **New Plymouth**
- **Auckland**
- **Horizons region**
  Palmerston North
  Foxton
  Masterton
  Ohakune
  Taumarunui
- **South Island**
  Christchurch
  Alexandra
  Nelson

- **Overseas**
  UK
  Czech Republic
  Abu Dhabi
  Sweden
  Switzerland
  Australia

1.6 River user surveys

Surveying recreational users of rivers within the Bay of Plenty region, in addition to boat ramp users, ensured a more comprehensive demographic of the population were addressed. Rivers within the Rotorua District were usually visited on at least two occasions each week whereas rivers within the Whakatāne and Ōpōtiki Districts were visited only once over the entire duration of the programme. This was primarily due to recommendations made by previous students of the awareness programme, stating that in comparison few people use these rivers. Time constraints due to long distances required for travel also restricted our opportunities to visit these locations. However, the Wairoa River in the Western Bay of Plenty District was visited on three occasions over the survey period. This river gets utilised heavily on Sundays over the summer by kayakers and rafters taking advantage of the Wairoa release, which is carried out to generate hydro-electric power. McLaren Falls, the Ruahihi Power Station take out and the Canoe Club put in and play wave all proved popular with kayakers and provide good opportunities for educating and surveying different users.

- **Rotorua District (Appendix 7)**
  Ngongotahā River access points
  Awahou River mouth
  Kaituna River
  Waitetī River mouth

- **Whakatāne District (Appendix 8)**
  Rangitāiki River
  Tarawera River
  Waimana River
  Whakatāne River

- **Western Bay of Plenty District (Appendix 9)**
  Wairoa River

- **Ōpōtiki District (Appendix 10)**
  Waioeka River

Popular fishing sites were visited in an attempt to find river users. Blue and white angler access point signs were located at known fishing spots by Fish and Game. These were useful indications of where anglers may be found, as were vehicles parked adjacent to these signs. Access points were especially useful on the Waioeka River, on which good fishing spots would otherwise be very hard to access without prior knowledge. Ngongotahā and Waioeka River access points are shown respectively as N1, N2 etc. (Appendix 7) and W1, W2, etc. (Appendix 10).

Figure 9 Kayakers on the Tarawera River canoe slalom course

The same survey sheets were used as those at lake boat ramps. The only differences being that fishing equipment was recorded as opposed to type of vessel and river users were asked if they knew how to reduce the risk of spreading didymo rather than weeds. Fishermen were approached and informed that we were working for the Bay of Plenty Regional Council. Conversation was initiated and answers to questions in the survey ascertained. Packs were handed out to those surveyed and survey forms filled in back at the vehicle. Many fishermen were surveyed during early evening at fishing spots close to Rotorua. This was not possible at the more remote rivers visited on day trips further out of the region due to time constraints.

1.7 Retail and tourism awareness

Prior to and during the Christmas holiday period, a number of retail outlets and local businesses in the Bay of Plenty region were visited to distribute material and provide information about the invasive pest species that threaten the lakes and rivers. Organisations targeted were those that frequently used the waterways as part of their businesses; had people staying who would be using the waterways; or who had customers that may lack understanding of the biosecurity issues in and around our waterways. In particular, businesses such as rafting companies, boat and kayak shops, and retail outlets selling fishing and tramping gear were targeted. In addition, motels, hotels and backpackers were provided with information that foreigners and first time visitors to the region might not be aware of when using the water. Retail outlets targeted (for a full list see Appendix 1):

Tourist accommodation (motels/hotels/backpackers/campgrounds):

- Retail outlets selling boating and fishing gear.
- Retail outlets selling fishing licences.
- Local businesses frequently using the water i.e. white water rafting, Tarawera Water Taxi.

- Information centres and libraries
- Stores and petrol stations that were frequently used by lake users i.e. Rotomā Trading Post.
- Fish and Game.

At each business, the owners were educated about the risks associated with water users and why it was so important that their customers were aware of these. The threat of didymo to our waterways, especially when people from the South Island were travelling to the North Island, was emphasised and the means of how to stop its spread outlined. In cases where owners were uninterested or unresponsive, we reiterated the damage these invasive species would cause to the local economy and in turn, their own businesses.

Merchandise supplied from the Ministry for Primary Industries and Bay of Plenty Regional Council included A4 and A3 posters, brochures ("Protect our waterways", those targeting trampers and foreign language versions) and z-booklets. For businesses that were more actively using the water, we provided keyrings, "stop the spread" branded clothing and occasionally 20 litre containers of Simple Green decontamination detergent.

1.8 Event awareness and decontamination stations

Attendance at sporting events on Bay of Plenty waterways during the summer was viewed as an opportunity to increase awareness of aquatic pest issues to a wider cross section of society. These events catered to groups with a diverse range of interests, many of which may not otherwise have spent much time on the region's waterways. In addition, events provide a chance to distribute information to organisers, friends and family of competitors and other spectators.

During November 2012 the events were researched, with information provided by organisers passed through a matrix to determine their risk to lake health. Correspondence with organisers helped determine whether it was possible to speak at briefings, whether decontamination stations would be necessary and what merchandise would be most appropriate for distribution. The following events were attended during the programme:

- Annual International Trout Fishing Tournament.
- Rotorua Lakes High School (RLHS) Blue Lake Fun Day.
- Waka Ama Regatta- Blue Lake.
- Stand-Up Paddle Board (SUP) event. Paddle Board Tours race series – Lake Rotoiti.
- Blue Lake Sprint Regatta - canoes.
- Check, Clean, Dry (CCD) advocacy North Island training day (MPI).
- Lake Rotoiti swim - Okawa Bay (Swim Rotorua and Rotary Club of Rotomā).
- Contact Tri-Series Triathlon.
- Blue Lake Half and Quarter Ironman.
- 'Kaituna Enduro' kayaking event.
- 'Christmas at Kaituna' kayaking event.
- Stoney Point Fish and Game Boat Fishing Seminar - Lake Tarawera.

- Water Ski Racing: North Island series - Rotomā (NZ Water Ski Racing Association [NZSRA]).
- North Island PWC Summer Tour - Lake Rotoma (Hawkes's Bay Jet Sport Club Inc.).
- Dewar Shield Blue Lake Regatta (Tikitapu).
- Canoe Slalom NZ Training Camp.
- Canoe Slalom NZ Selection Races- 2013 (Tarawera River-Kawerau).
- Eves Blue Lake Multi Sport Festival 2013.
- Kiwanis Club of Whakatāne- Rotomā Waitangi Day Open Water Swim 2013.
- Lake Rotoiti Wooden Boat Parade 2013.

Figure 10 Lead waka of the Lake Rotoiti Wooden Boat Parade

During the '2012/2013 Summer Awareness Programme' the Lake Rotomā Waitangi Day swim was the only event at which a decontamination station, manned by Regional Council summer students, was set up. A 5% 'Simple Green' detergent solution was used at the station to reduce the risk of spreading aquatic pests like didymo and pest fish eggs. A further decontamination station set up for cleaning kayaks at the NZ Canoe Slalom Training Camp in Kawerau, was left to be manned by instructors. In addition, Tracey Bates and Ross Powell of the Regional Council decontaminated jet skis and trolleys at the PWC Summer Tour event.

The Blue Lake Half Ironman, Contact Tri Series and Blue Lake Multi Sport Festival event organisers, all made the decontamination of wetsuits a requirement of race entry. The necessary equipment and decontamination solution was provided by the Regional Council.

Event organisers were provided with a Biosecurity New Zealand "Check, Clean, Dry" ring binder containing information on decontamination processes, aquatic pest educational material and free merchandise relevant to the event activity, to use as either spot prizes or for event officials.

Further information about decontaminating vessels and equipment and a "Stop the Spread" DVD are sent to event organisers after application for a lake closure has been approved.

1.9 Results

1.9.1 Distribution of surveys conducted at boat ramps

Over the summer period a total of 746 surveys were conducted in the Bay of Plenty region at boat ramps and camp sites. The distribution of surveys conducted at all the boat ramps was analysed to show where the majority of users were surveyed (Figure 11). Merge Lodge and Matahī Spit remain two of the busiest boat ramps in the region following results of 2011-2012. Otarmarae and Boat Shed Bay are also heavily used ramps over the summer period.

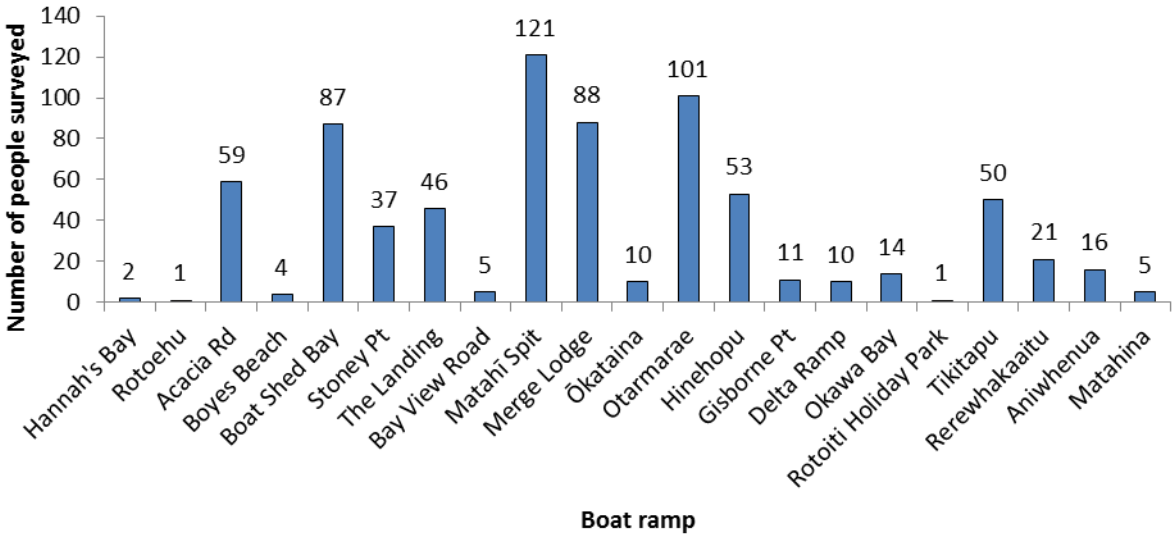

Figure 11 Number of users surveyed at each boat ramp during summer 2012/2013

Was the vessel checked/cleaned before launching?

Of all lake users surveyed it was found 41.6% confirmed they cleaned their vessels before launching. In addition, 7.8% told us directly they had not cleaned or checked their vessel before using it in the lake. Just over 50% of all people surveyed already had their vessels in the water (AIW).

On two separate occasions this summer, lake users were observed spraying their boats and checking for weed fragments before launching. These people were given extra “Stop the Spread” merchandise such as hoodies and T-shirts.

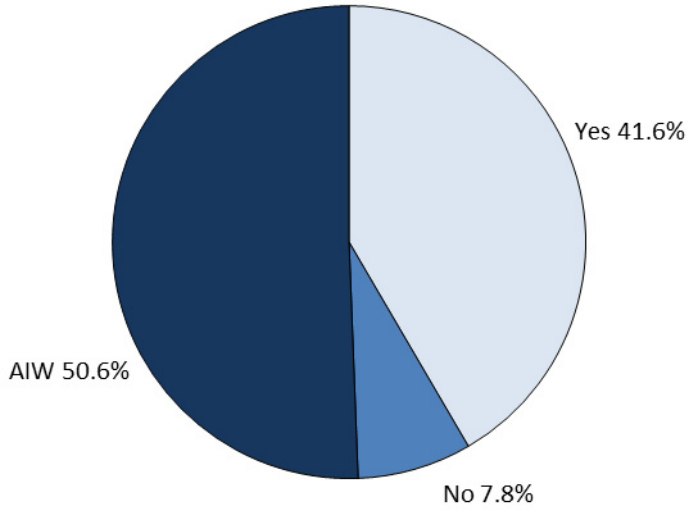

Figure 12 Percentages of vessels checked for weed prior to launching

Over the duration of the summer period, eight individuals were spoken to who had weed on their trailer, one of which had two different weeds present. Of these nine weed specimens found on equipment, six samples were hornwort, two were egeria and one was lagarosiphon. The lakes where these people were spoken to were Rotoiti, Tarawera, Aniwhenua and Matahina.

In one incident over summer clumps of weed were observed floating in the weed cordon on Lake Rotomā. On closer inspection the species in this sample were determined to be hornwort, egeria, lagarosiphon, elodea and native aquatic plants.

Types of vessels and recreational purpose

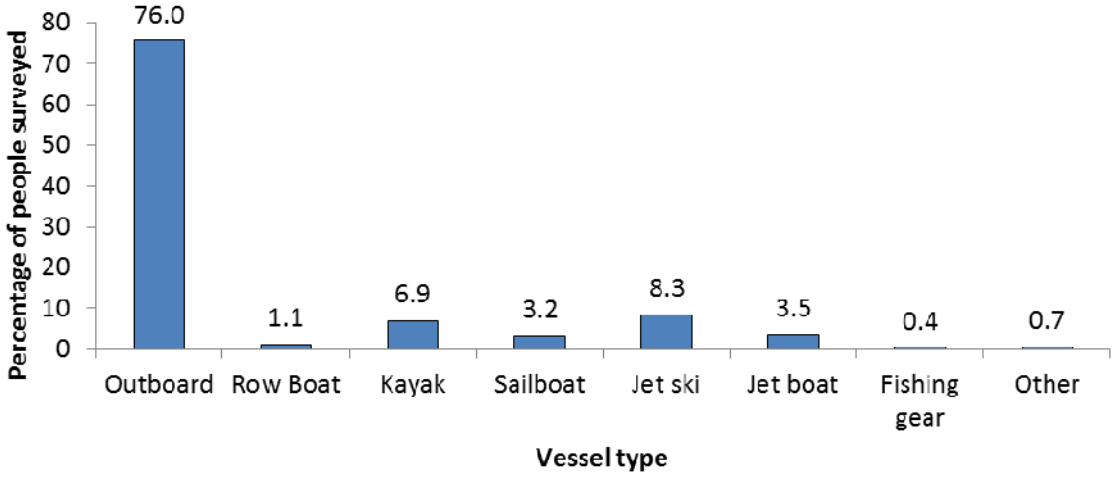

Figure 13 Vessel types surveyed at boat ramps

Figure 13 shows that the majority of people surveyed at the boat ramps had boats with outboard motors, with a result of 76%. Jet skis made up the second largest group, with 8.3%, followed by kayaks at 6.9%.

In 2012/2013 fishing represented the greatest percentage of recreational purposes, with 29.6%, followed by "other," in which we placed camping, general boating and sailing (Figure 15). Skiing and biscuiting were the second largest recreational activities with 17% of people surveyed carrying out these activities.

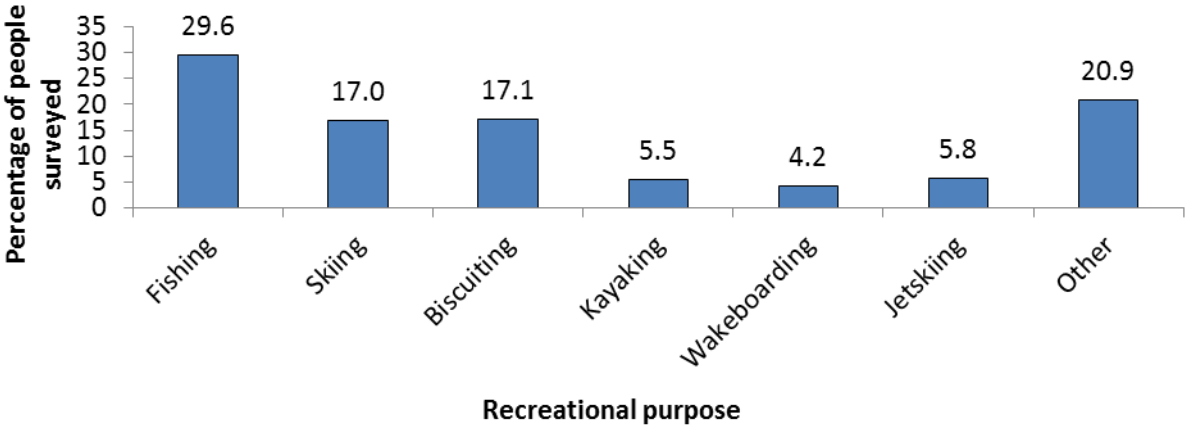

Figure 14 Recreational purposes of lake users

Origin of owner and vessel

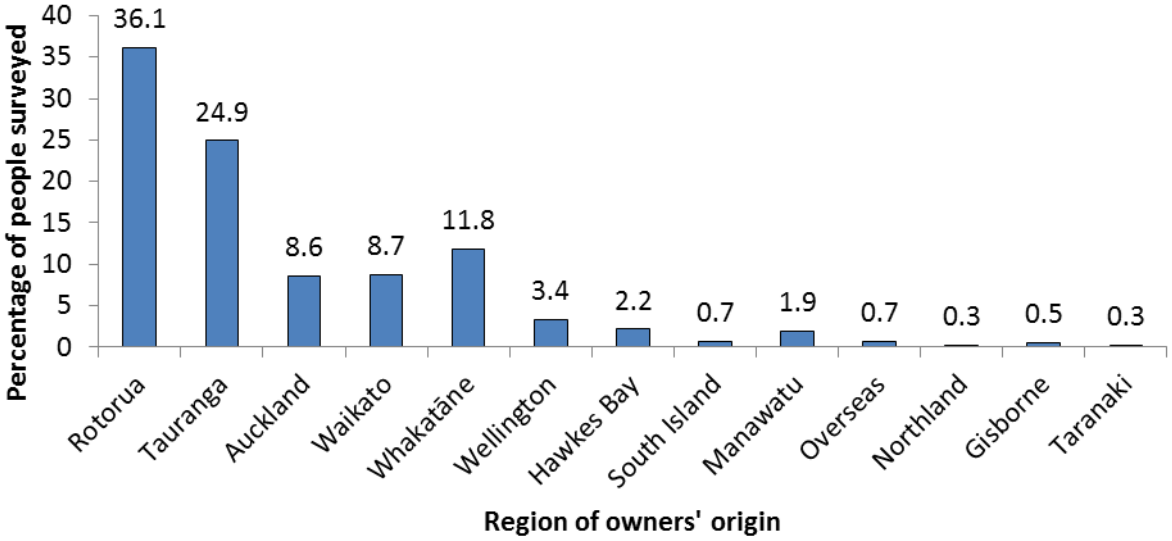

Figure 16 Percentage of boat owners surveyed from each region

Figure 16 highlights the place of origin of recreational users at the lakes this summer. The highest number of users was the Rotorua District with 36% of people surveyed. Tauranga and Whakatane represented the next largest places of origin with 25% and 12% respectively. Individuals from Auckland and Waikato also represented a large group with 8.6% and 8.7% of people originating from these regions.

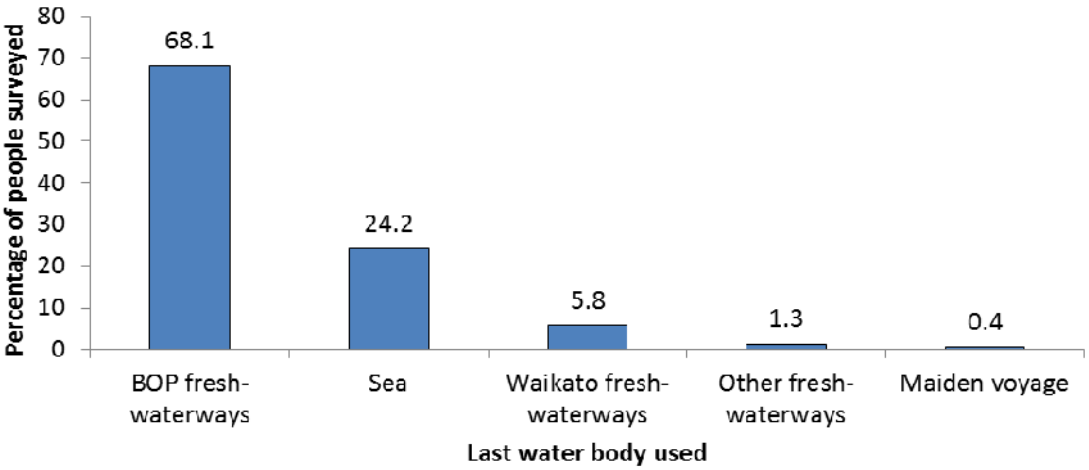

Figure 17 Region of water body last visited

Of all individuals surveyed, 68% had last used their vessels in Bay of Plenty lakes or rivers (Figure 17). Vessels originating from the sea or Waikato waterways were the next largest categories with 24% and 5.8% respectively.

Levels of interest and awareness

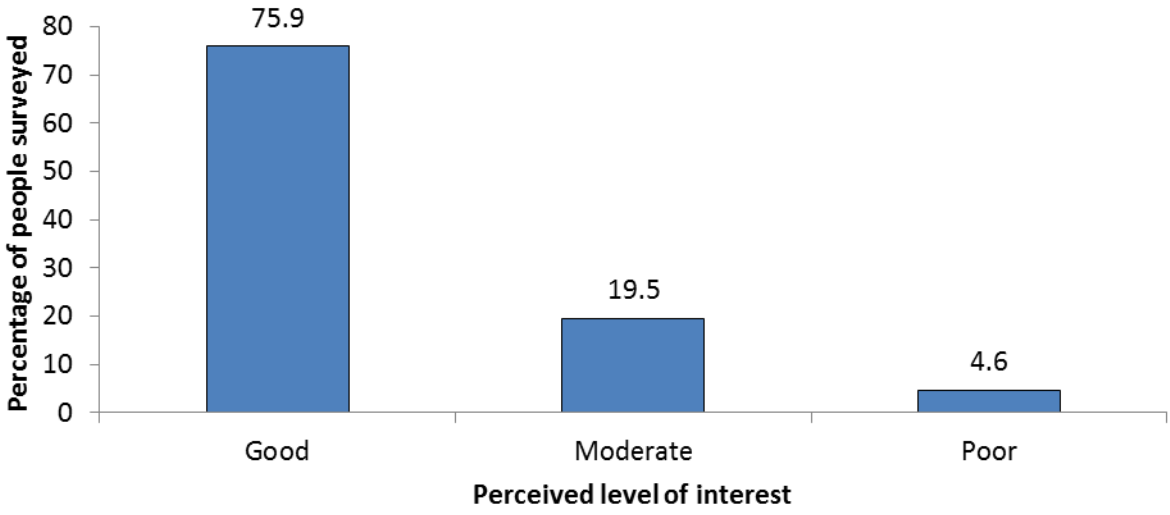

Figure 18 Perceived interest in aquatic pest issues

Perceived levels of interest in aquatic pest issues were high with 76% exhibiting "good" interest and 4.6% receiving "low" interest (Figure 18).

This summer results for awareness of pest issues have altered significantly due to new surveying methods. The majority of individuals (31.6%) received a "medium" level of awareness as they knew the correct answers to two out of three aquatic pest weed and fish questions (Figure 19). Individuals who had no awareness of aquatic pest issues made up 27% of people surveyed, and 19.4% of people could answer all three pest weed/ fish questions correctly.

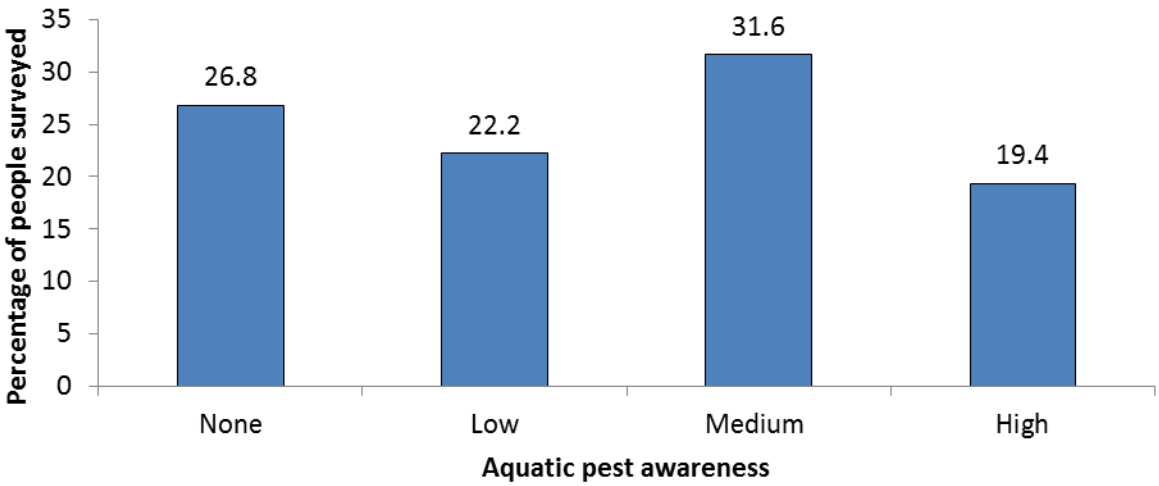

Figure 19 Aquatic pest weed/fish awareness levels of people surveyed

In terms of didymo awareness, 7% of lake users had never heard the alga, and 45.4% had a high awareness, being able to answer all three questions. Those receiving a "low" awareness made up 30.4%, and those with a medium awareness made up 17%.

Over the summer period, 19.5% of people spoken to admitted they did not know the proper procedure to clean their vessels for pest species (Figure 20). The topic that lake users exhibited the lowest awareness of was the threat posed by hornwort, with 70.8% of everyone spoken to having never heard of this invasive weed. Individuals showed the greatest awareness surrounding pest fish issues, with 56.4% knowing koi carp and catfish were not yet present in the Rotorua lakes. Awareness of how weeds spread was only slightly lower with 55.2% revealing they knew about fragmentation.

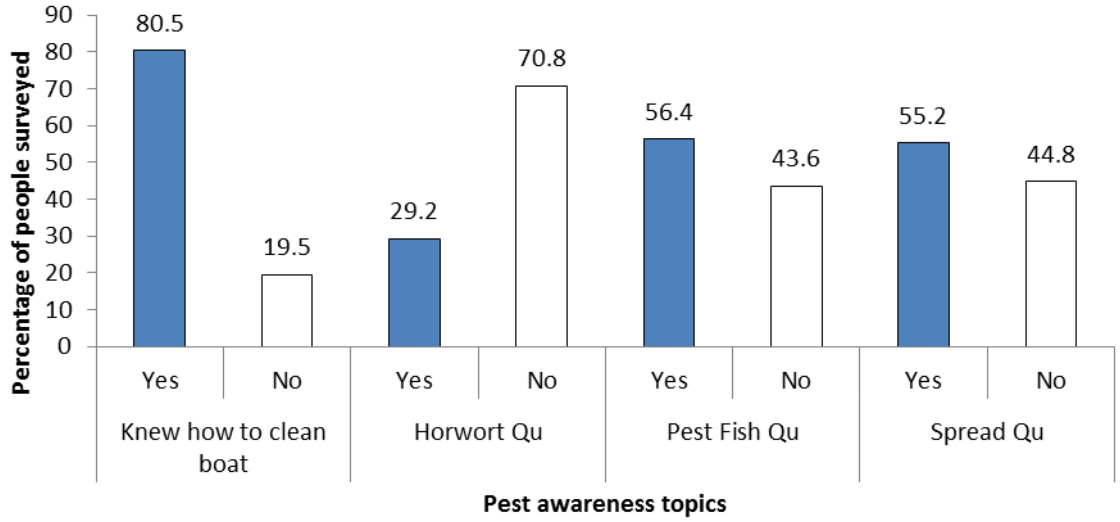

Figure 20 Pest weed/fish awareness topics (Yes= knew correct answer; no = gave incorrect answer)

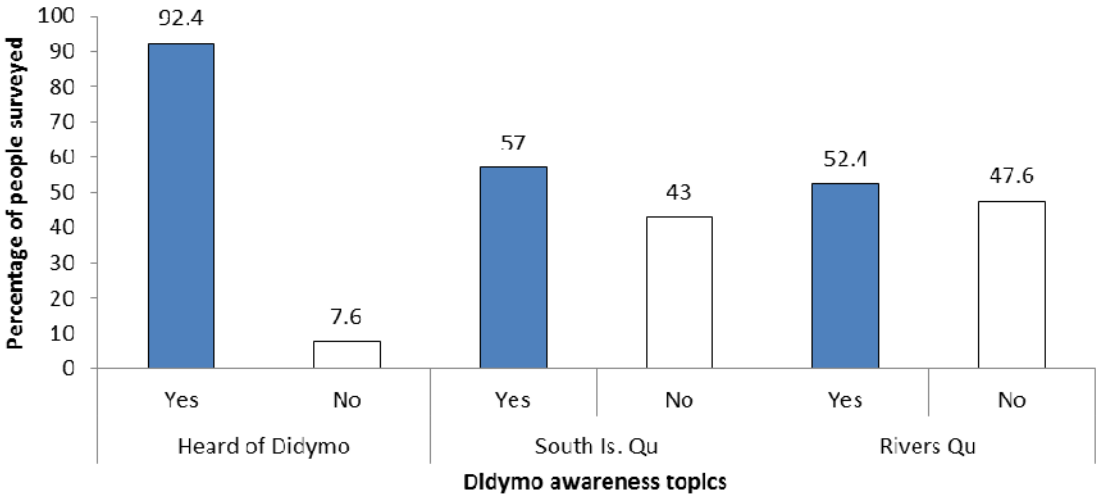

Figure 21 *Didymo awareness topics (Lake users). (Yes= knew correct answer; no = gave incorrect answer)*

Awareness of didymo among lake users was higher than pest weed and fish awareness, with 92% of everyone spoken to having heard of didymo (Figure 21). Awareness of its distribution and ecology was significantly lower, however, with only 57% aware it was still in the South Island, and 52% knowing didymo was found mainly in rivers.

Origin of vessel - Rotomā and Tikitapu

For some of the region's cleaner lakes such as Rotomā and Tikitapu, the last waterway vessels were used in were analysed to determine whether these lakes were at great risk of pest fish or hornwort incursion.

For both lakes the majority of boat owners had last launched in Bay of Plenty waterways, with 63% on Lake Rotomā (Figure 22), and 60% on Lake Tikitapu (Figure 23). Following this category the sea was the second largest water body that vessels were used in, with 26% on Rotomā and 31% on Tikitapu. For both lakes, a considerable number of boat owners said they had last used their boat in Lake Taupō, the Waikato River or Waikato lakes, with 8% on Rotomā and 6% on Tikitapu.

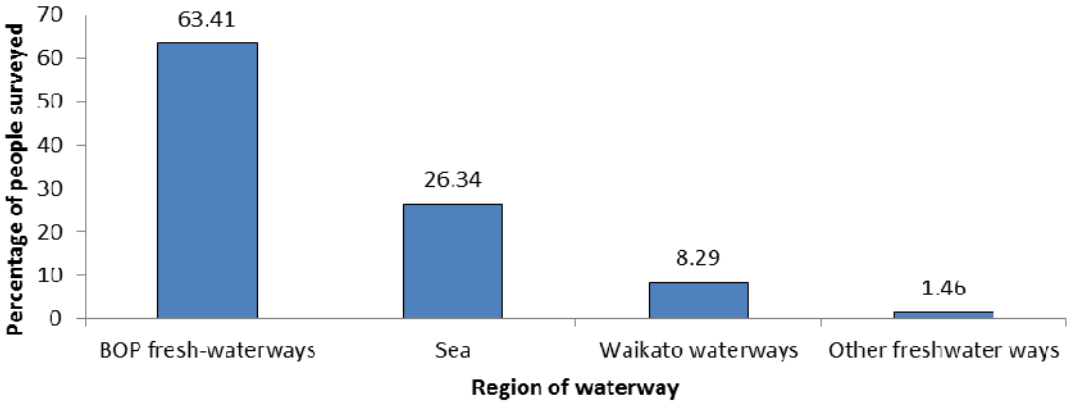

Figure 22 *Region of water body vessels were last in before launching in Lake Rotoma*

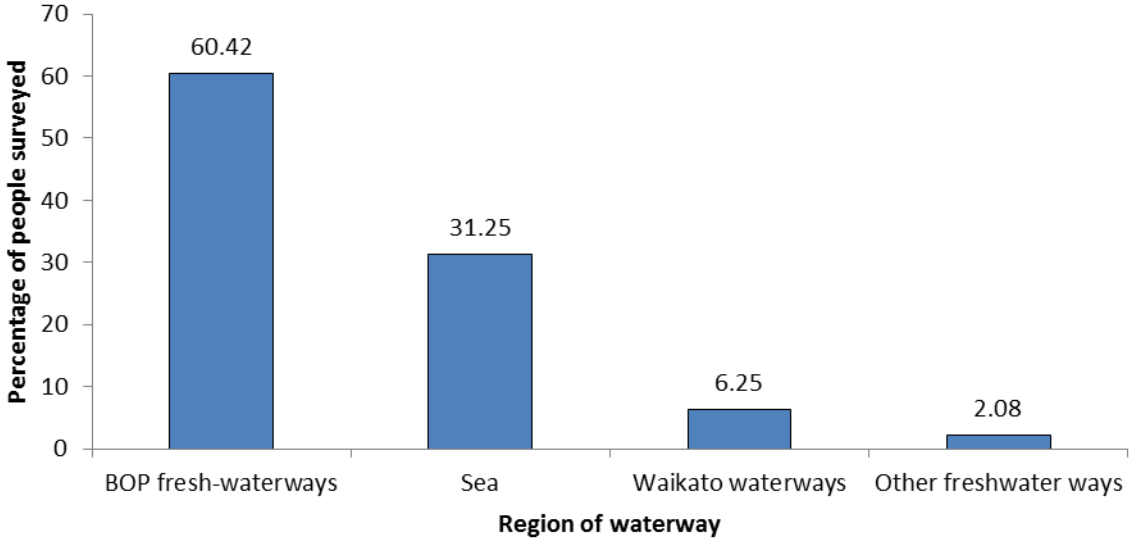

Figure 23 Region of water body vessels were last in before launching in Lake Tikitapu

In terms of pest weed and fish awareness, it was found that those surveyed at Lake Tikitapu had noticeably lower awareness than the overall results and those surveyed at Lake Rotomā. People who had heard of hornwort made up only 17% of individuals, as opposed to Lake Rotomā where 27% were aware of this species. In addition, most people (55%) at Tikitapu admitted they did not know pest fish were absent from the Rotorua Lakes, or how weeds dispersed (57%). In contrast 59% of individuals at Rotomā knew pest fish were absent, and 51% knew how weeds spread around the region.

River surveys

Sixty-three surveys were conducted this summer at the Bay of Plenty Rivers. As this was a large enough sample to do analyses on, results were not amalgamated into lake users' surveys. The majority of surveys were collected at the Wairoa River, Tauranga, where a lot of kayakers go to take advantage of the higher water levels generated by the weekly release (Figure 24). At the Mclaren Falls put-in kayakers are very relaxed and easy to talk to. In Rotorua, the Hamurana and Waitetī Streams are also popular spots with fishermen, however, after frequent visits the surveyors begin to find the same people.

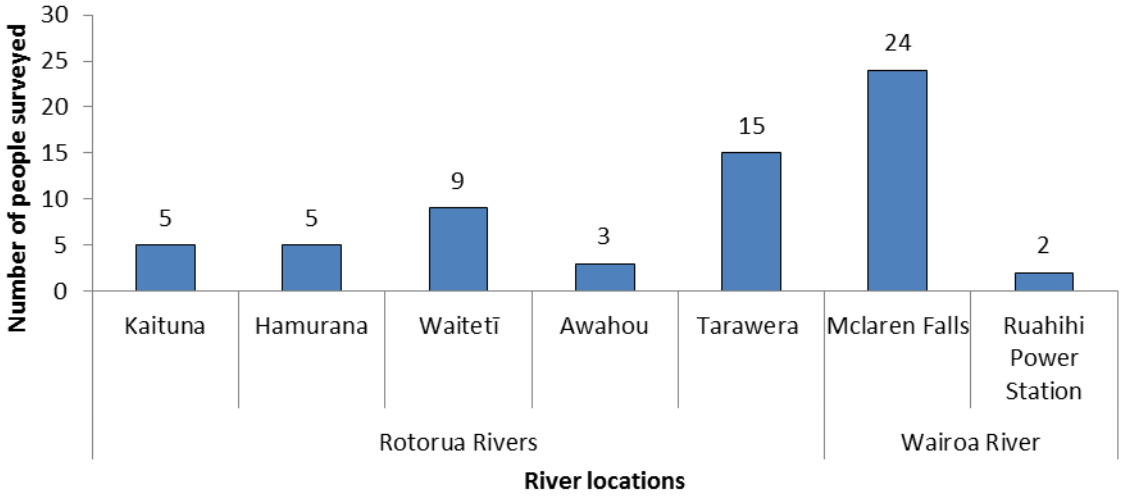

Figure 24 *Number of surveys gathered at different river locations in the Bay of Plenty region*

Was the equipment checked/cleaned before launching?

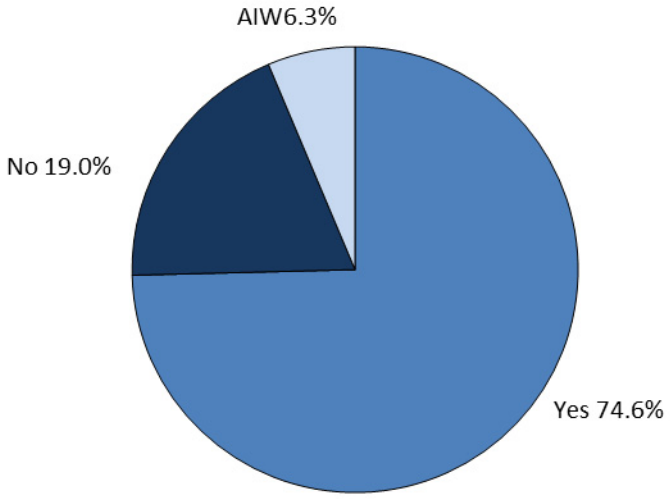

Figure 25 *Percentage of river users who checked/cleaned their gear before using in a river*

In the river surveys 74.6% of individuals had checked or cleaned their gear before entering the water (Figure 25). Most kayakers were very aware of the threat posed by didymo to North Island rivers; however, 19% admitted they did not clean between waterways.

Types of equipment and recreational purpose

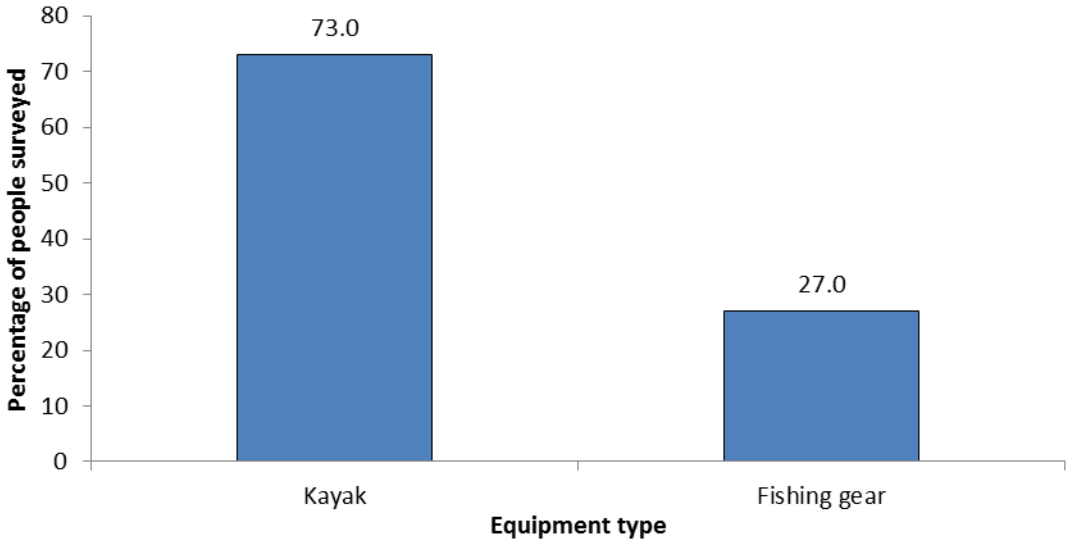

Figure 26 Type of equipment used by people surveyed at river sites

The majority of users surveyed at river sites were kayakers due to the popularity of the Wairoa release and Tarawera slalom course. They made up 73% of the types of equipment being used on the rivers, and correspondingly, the recreational purpose of the people spoken to (Figure 26). This summer the only other activity observed on the Bay of Plenty rivers was trout fishing, with 27% of users having fishing equipment.

Origin of owners and equipment

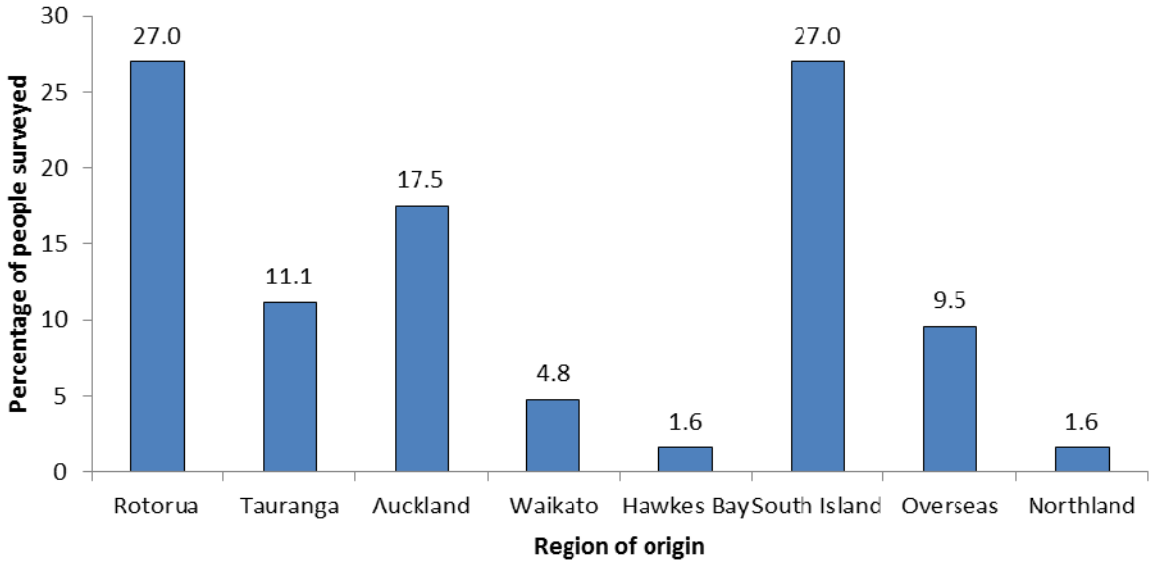

Figure 27 Region of origin of river users

This summer the majority of river users originated from the Bay of Plenty or the South Island, both making up 27% of individuals surveyed (Figure 27). Auckland also represented a large group of users with 17.5% coming from this region.

Of all people spoken to, a large amount had last used their equipment in either the Bay of Plenty waterways, consisting of the Kaituna and Wairoa rivers, (63.5%), or the South Island (28.6%) (Figure 28).

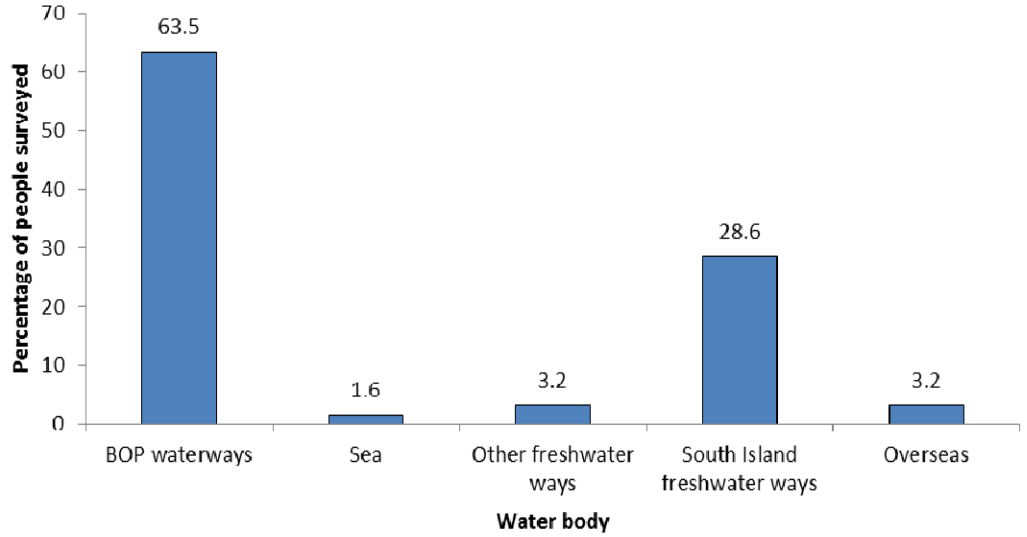

Figure 28 Region of water body equipment was last used in

Perceived level of interest and awareness of didymo

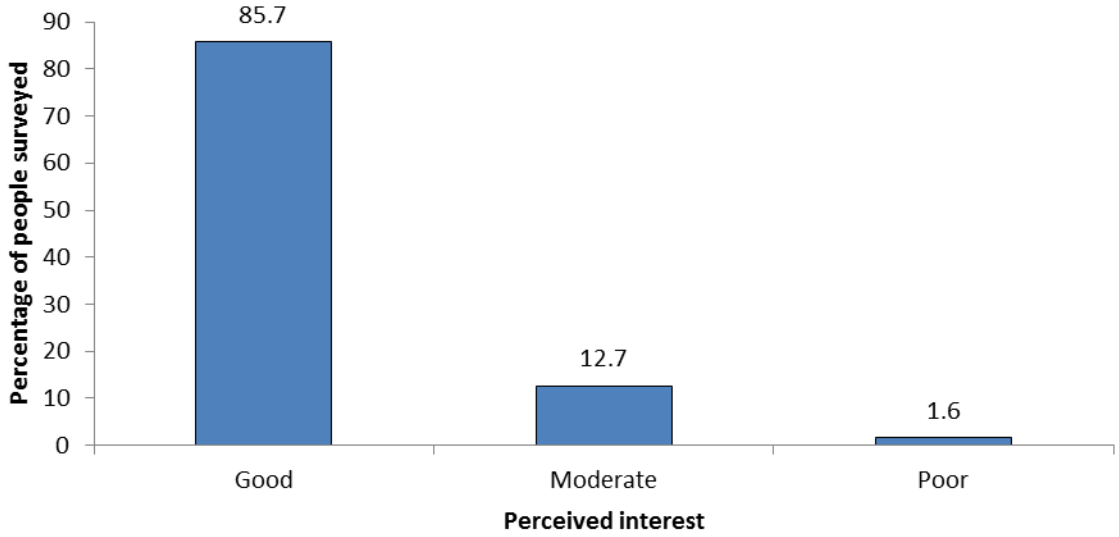

Figure 29 Perceived level of interest in aquatic pest issues among river users

In general, most people spoken to at river sites were happy to be spoken to with 85.7% of individuals falling into the “good” category of interest levels (Figure 29). Users with a “low” level of interest made up a minor proportion of the population with only 1.6%.

As didymo is the main threat to river ecosystems, it was decided that weed awareness would not be presented graphically. It is worth noting, however, that most river users (44%) had no awareness of pest weed or fish issues and 24.4% had high awareness. From the awareness topic results, it was found 50% of those who were asked the weed species questions had heard of hornwort, but only 40% knew about the distribution of koi carp and catfish. Twenty-seven per cent of individuals knew weeds spread by fragmentation. Both of these values were lower than those gained in lake-user surveys, however, hornwort awareness was greater by 21% among river users.

Knowledge of didymo and its distribution was considerably higher among river users than lake users, with 87.3% obtaining a high-awareness (Figure 30). Of the three didymo topics, awareness of the alga was the highest with 92% (Figure 31), followed by awareness of it being absent from the North Island (90.3%). Eight percent of individuals surveyed had never heard of didymo (Figure 30).

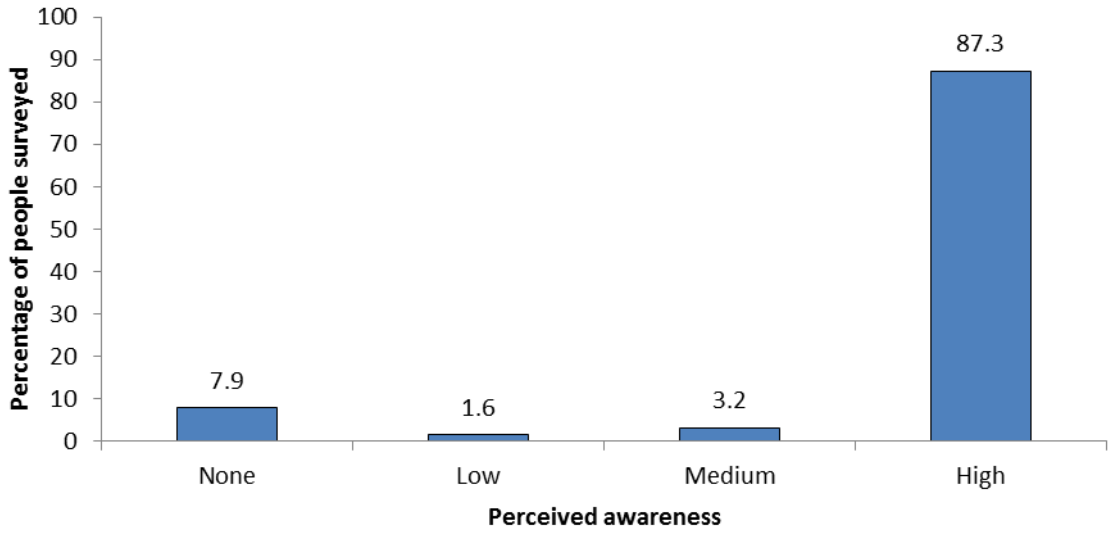

Figure 30 Levels of awareness of didymo among river users

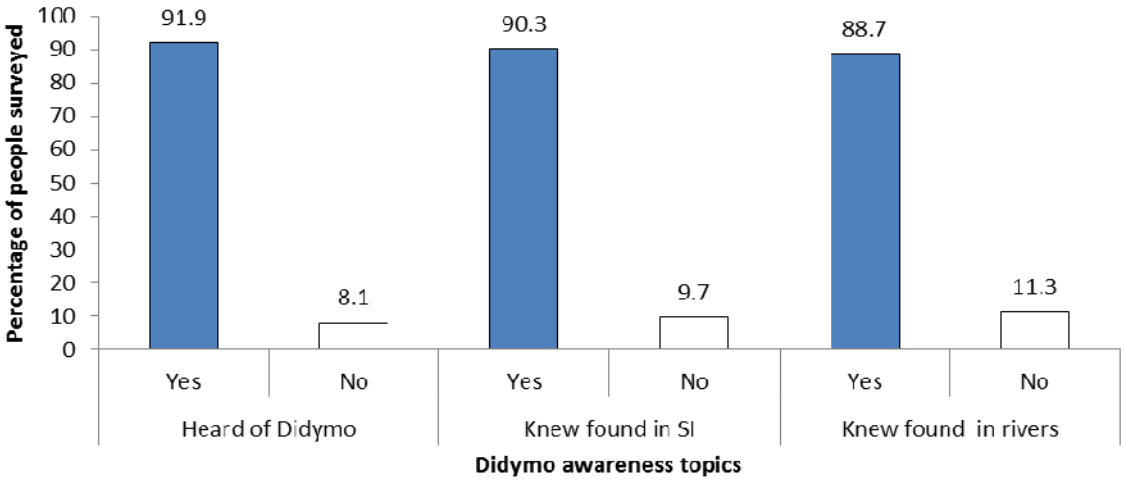

Figure 31 Didymo awareness topics (River users). (Yes= knew correct answer; no = gave incorrect answer).

1.10 Discussion

1.10.1 Distribution of surveys conducted at boat ramps

The two boat ramps on Lake Rotomā again proved to be popular with recreational users and holiday makers. Lake Rotomā is not only renowned for its pristine waters but is also located approximately half way between Rotorua and Whakatāne, therefore attracting users from both towns. Like the previous summer, Matahī Spit was the busiest ramp due to the space it provides for parking and relaxing (Figure 11). The Otarmarae ramp on Lake Rotoiti is popular with those from both Rotorua and Tauranga and was visited far more frequently this year thus explaining the dramatic increase in surveys from the previous summer. Boatshed Bay is the busiest place to launch vessels on Lake Tarawera as it has two ramps, a large turning circle and lots of space for parking cars and trailers.

Figure 32 Matahī Spit (Lake Rotomā) on a busy day

Quieter ramps which yield smaller amounts of surveys should not be ignored and if possible should be visited as frequently as the busier ramps. Some people launch from the quieter ramps or visit the less popular lakes for the simple reason that they do not like the crowds and want a peaceful time. Other individuals visit quieter ramps because they know they are more likely to avoid officials and harbour masters and these people often need targeting when it comes to biosecurity risks. By ignoring these ramps it is possible that a small but potentially high risk group of recreational users are missed for several years.

Ramps at Lake Aniwhenua and Lake Matahina have smaller numbers because they are a substantial distance from major towns and are also visited by summer students less often. However, they do get busy during long weekends so are worth visiting at least twice over the summer period.

1.10.2 Was the vessel checked/cleaned before launching?

Approximately half of all those surveyed on boat ramps over the summer had their vessels already in the water when they were spoken to (Figure 13). It was therefore difficult to determine whether their boat and trailer had been properly cleaned. Some of these people did mention they clean their equipment but there is no way of verifying whether they are all being truthful. Last year's report highlighted a 19% decline in those cleaning their vessels which was a very worrying statistic. The results from this summer's awareness programme have shown a further decline of 3.9%, a trend that needs reversing. Lake users who were seen to have vessels or trailers that had not been cleaned or freely admitted they had not cleaned them have increased by 1.2% on last year's findings. These results show either apathy amongst users, a growing trend of complacency, a lack of education or simply laziness. Those from outside the region may not be as aware as locals of the risks associated with not cleaning their vessel.

On two occasions this summer people were observed spraying equipment with detergent and checking for weeds at the boat ramp. When spoken to these couples were very environmentally minded and proactive and by cleaning their boats at the ramp may encourage other people to become more aware of the importance of such procedures.

Figure 33 Hornwort attached to boat trailer after use on Lake Rotoehu

During last year's survey nine separate vessels were found to have weed attached with eight of these instances being hornwort. This year's finding was similar in that eight trailers had weeds attached and were again unfortunately dominated by hornwort fragments. Most of these were on Lake Rotoiti ramps but Lakes Aniwhenua and Matahina were seen to be full of weed and trailers retrieved from these lakes did remove fragments from the water. As we arrived on our first visit to Lake Aniwhenua, three different vehicles were being driven from the campground with trailers covered in large amounts of weed fragments. This was a very worrying observation as it would only take one such owner to stop off at Rotomā to cause a possible incursion. These observations highlight the importance of future dialogue between the Bay of Plenty Regional Council and the power board regarding what action needs to be undertaken to clean up these two lakes. Users of these two lakes also need to be targeted due to the close proximity to Lake Rotomā.

On one occasion this summer an incidence occurred in which hornwort and egeria fragments were found within the weed cordon at Matahī Spit on Lake Rotomā. A large clump of weeds was seen to be floating by Tracey Bates whilst undertaking surveys near the ramp. On closer inspection by both summer students, several other fragments were found floating in the immediate area. All the fragments were removed from the water and hornwort and egeria were believed to be amongst them. Positive identification of these species was confirmed by Regional Council biosecurity and land management officers. Due to the tightly packed nature of this clump of weeds it is believed they came from a compact space within a vessel. A jet skier had recently been spoken to at the same location and left abruptly after the weeds were seen. It was noted that this individual was revving his engine between when he was spoken to and leaving. However, we expected that the fragments found would be severely chewed up and despite some damage to fragments this was not the case. This incident does highlight the importance of the weed cordon to lake biosecurity on Rotomā.

Figure 34 Hornwort attached to trailer after owner launched in Lake Matahina

A lot of people mentioned that they cleaned their boat by alternating their recreational activities between the lakes and the sea in order to kill pest species harbouring in their vessel. Several people again suggested putting wash down stations at ramps and mentioned that it would make them more likely to clean their vessels should they move between waterways over a short space of time. The importance of cleaning equipment, such as sea-biscuits, as well as boats is not realised by many people. Some people spoken with could understand the reasoning behind removing weed fragments from boats and trailers, but not washing vessels as didymo was a South Island problem and not yet in the North Island. This provided opportunity to explain that didymo cells are initially microscopic and could be spread inadvertently. The “Check, Clean, Dry” message relating to didymo is a proactive measure used to contain and slow the spread of didymo. It is an alternative to being reactive to the arrival of didymo should it be transported to the North Island.

Types of vessel/equipment and recreational purposes

The number of individuals with outboard vessels this year increased by over 12% on last year and now account for just over three quarters of all lake users (Figure 13). In the majority of instances in which weeds are detected during the awareness programme, most are found on trailers used to transport outboard motor vessels. Weed fragments caught on anchor lines and in anchor wells of these vessels are also the most likely explanation for incursions of hornwort found well away from boat ramps on Lake Ōkataina and Lake Ōkāreka in recent years.

Figure 35 Jet skis on Lake Rotoma

In contrast, a lower percentage of people using jet boats and jet skis were found, with reductions of 6.6% and 1.86% respectively. This is a positive turn around on last year when the percentage of those undertaking these activities had risen. Jet boats and jet skis still pose a significant bio-security threat to the health of our lakes and still comprise 3.5% and 8.3% of all users surveyed respectively. These vessels are at a higher risk of incursion than others due to silt traps and jet intakes. Many owners are unaware of the risks associated with jet intakes and do not realise that weed fragments would be likely to survive an extended period of time in damp conditions.

Fishing, biscuiting and water skiing remained the most popular recreational activities on the lakes (Figure 14). Although the percentage of people fishing and water skiing remained almost identical to the previous summer, those biscuiting rose by 3.4%. Sea-biscuits remain damp for a longer period of time than water skis and wakeboards, thus posing a greater threat of transferring aquatic pests. The ‘other’ category constitutes a fifth of all users but does represent a number of different activities.

The origin of owners/vessels

The largest proportion of people surveyed at the Rotorua Lakes this summer, in keeping with recent years, were from Rotorua (36%) and Tauranga (25%) (Figure 16). Although those from Tauranga increased marginally, there was a 10% increase in recreational users from Rotorua. In regards to risk of pest incursions, there has encouragingly been a decrease in the percentage of visitors from Auckland (down 4.1%) and the Waikato (down 1.7%). Despite this decrease, however, visitors from the Waikato (8.7%) and Auckland (8.6) still constitute sizable groups and present a significant risk. This is due to the presence and alarming proliferation of invasive pest fish species, such as brown bullhead catfish and koi carp, in the fresh waterways of these regions. The waterways in Auckland and Waikato also contain high numbers of invasive weeds that are not present in some of our cleaner lakes such as Rotomā and Tikitapu. It was noted that although many users from these regions were aware of pest fish due to their presence in that region, they did not know that their eggs could spread via weed fragments. Many recreational users of the lakes that were spoken with from the Waikato and Auckland, revealed they visit the Rotorua lakes because of the superior water quality and less invaded environment compared to home. It was often commented that vessels were always cleaned properly for this very reason.

Visitors from the South Island and from overseas each accounted for 0.7% of recreational users surveyed, with very small increases for both, compared to last summer. Overseas tourists present a serious risk of transferring didymo between catchments and to the North Island due to the activities they undertake, their movements over short time frames and their lack of awareness about didymo. South Islanders travelling to the North Island have also been identified as a major potential threat to spreading didymo cells, however they are often better informed and take better precautions than many in the North Island.

Over two-thirds (68.1%) of vessels being used at the Rotorua Lakes had previously been used in the fresh waterways of the Bay of Plenty region (Figure 17). However, many people surveyed incorrectly assumed that all the lakes had the same composition of weed communities in them. Although these vessels would not currently pose a threat of introducing koi carp and brown bullhead catfish eggs, they would be just as likely to act as a vector for transporting invasive weed species. Many people whose vessels had previously been used in the sea (24%) were well aware of the fact that saltwater kills freshwater aquatic pests and stated that they used the sea to eliminate the risk of carrying aquatic hitchhikers. Vessels last used in Waikato waterways during summer 2012/2013 were down 2% on last year.

Weed loading on ramps and equipment

As with last summer, the amount of weed found on ramps has not been as noticeable as previous years. In the past, weed loading at Lake Rotoehu accounted for a high percentage of weed being found on trailers. On only one occasion this summer was any weed loading witnessed, at Stoney Bay on Lake Tarawera. This observation may be attributed to the fairly high water levels in lakes resulting from higher than usual amounts of precipitation last summer and winter 2012. The weed cordon at Ōtautū Bay, weed harvesting and herbicide spraying around ramps and bays may also have contributed to Lake Rotoehu again looking in better condition than in the past. Members of the public gave positive feedback about how the lake was improving. Other lake ramps being relatively weed free can be explained by the spraying of Diquat in November/December to control the abundance of weed. Okawa Bay on Lake Rotoiti is one exception and as previously mentioned, Lakes Aniwhenua and Matahina need urgent attention for weed control.

Figure 36 Invasive weeds floating near boat ramp at Okawa Bay, Rotoiti

Perceived levels of interest

Although members of the public that were perceived to have a ‘good’ level of interest in aquatic pest issues was high at 76%, this was in fact a decrease of 8.4% on last year. Those displaying moderate (19.5%) and poor levels of interest (4.6%) had increases of 5.6% and 2.7% respectively. People who claimed to know everything we were talking about or who were simply uninterested or non-supportive of what we were saying made up the “poor” category. Both summer students conducting the surveys remained the same as the previous summer so a degree of consistency on perceptions of interest would be expected in these findings. Throughout the summer we did feel as though there were more people displaying less interest than last year, a couple of which were more interested in discussing completely unrelated matters. Some of these had been surveyed and received packs in previous years and were just going through the motions. Often those people showing very little interest in pest awareness are also displayed very little knowledge. Recreational users of the lakes that have been spoken with over several years can be very knowledgeable and do not wish to be held up. However, on the whole, most people were genuinely interested in what we were discussing and the messages we were relaying. Lots of people asked questions and could later be seen looking at the educational material we had given them. Genuine interest could be seen when members of the public approached us and enquired about biosecurity related issues. Despite signs at boat

ramps informing people about the weed cordons, it was surprising how many people do not know what they are used for. Apart from one gentleman who said that Lake Ōkāreka had more weed in it than at any time over the last 25 years, many people commented that they were very happy with the state of the lakes and cleanliness of the waters.

Figure 37 Weed fragments on a trailer at Lake Aniwhenua

Last year it was perceived that awareness of aquatic pest issues showed a shifting trend towards higher levels of understanding than in the past. The changes to the survey form and methodologies used in this year's report means that no direct comparison should be made between this summer's findings on awareness and those from the 2004-2012 reports. Although this is frustrating, a method of generating statistics about awareness, for comparison, was required rather than one based upon subjective perceptions of different summer students. Thus, the information obtained from asking questions on aquatic pests and didmyo should be used as baseline statistics against which future findings can be compared.

Figure 38 Signage advising people to check their vessels before launching in Lake Rotoiti

In one regard, it was encouraging that almost one fifth of those surveyed had high aquatic pest awareness, that is, they were able to answer all three questions correctly. Conversely, over a quarter had no awareness, in that they were unable to answer any questions correctly. Those people with no or low awareness totalled 49% of respondents. This appears to be extremely low but to gain a high awareness relied upon knowing three very specific pieces of information. One respondent was only given a medium awareness based on his answers to questions but knew an awful lot about weeds to the extent that he could have been a freshwater scientist. This has been identified as a minor criticism of this methodology but deriving information for statistical analysis is imperative. Asking a greater number of questions was discussed to cover a broader knowledge base, but it was felt that this would hold people up for too long at the boat ramp, that they would lose interest or not want to cooperate. We also wanted to acquire the responses through an informal conversation about freshwater pest issues and didymo and this could be accommodated with just the six new pieces of information. Any more questions would actually have required us asking if a formal survey could be conducted.

Figure 39 Acacia Bay, Lake Okareka

Most people (80%) indicated they knew how to properly clean their vessels or that by using their vessel in saltwater they would kill freshwater pests. Over 50% of respondents knew that the Rotorua Lakes are not believed to contain populations of koi carp and brown bullhead catfish. Likewise, over 50% of those surveyed knew that the spread of weeds was by fragmentation. Many more people than this know weeds can be transported on vessels and trailers but this question was asked in such a way as to ascertain how it spread in terms of biomass. Some people, possibly those spoken to in previous years, were able to correctly state that only one small fragment of weed is required to cause an incursion. A far smaller proportion of people surveyed (<30%) had heard of hornwort. Considering the invasiveness of this weed and the incursions of recent years, it is suggested that increases in hornwort advocacy continue.

The vast majority of people had heard of didymo (>92%) which is very encouraging. This suggests that didymo is becoming a commonly heard and used word. However, those answering all three questions correctly and being categorised as having high awareness only stood at 45%. The proportion of people correctly stating that didymo is predominantly found in rivers (52%) and only known to be in the South Island (57%), was lower than we expected. The perception we had from the previous summer was that knowledge about didymo was far more comprehensive.

Of most concern for some of our most pristine lakes, such as Tikitapu and Rotomā, are those recreational users conversed with at such lakes, whose vessel had previously been in the Waikato River, Lake Taupō or another of the Waikato lakes like Karapiro. The results show the proportion of vessels within this category for both lakes to be significant. People moving their vessels between Waikato waterways and 'healthy' lakes, pose a far greater risk of pest fish incursions and an additional possible means of hornwort incursion.

The statistics show that a greater proportion of those surveyed at Lake Rotomā (82%) knew how to clean their vessels correctly than those at Tikitapu (70%). Respondents from Rotoma also had better awareness of aquatic pest issues with a greater proportion of correct answers given for each of the three questions. Only a small proportion of those at both lakes had heard of hornwort and this indicates an area to be focused on in the future. Increasing awareness about pest species to people using these two lakes should be a priority.

Other issues for discussion

In general, regular users of the lakes tended to be better informed about aquatic pests as they had received packs in previous years and had the message repeated to them on several occasions. This was not always the case, however, as information and slogans are often forgotten. Owners of vessels will often say they have received packs in previous years. On these occasions it is always worth asking the waterway user if they mind being updated on recent biosecurity developments. Once these issues have been relayed, a brief reminder on cleaning techniques can then be given.

During the course of this year's awareness programme, a significant number of 'stop the spread' T-shirts, singlets, bucket hats, towels and hoodies have been distributed to event organisers, advocates of the programme and packs for people who were genuinely interested in the awareness programme. The slogans on these products have already been seen to be worn around boat ramps and campgrounds and have thus been seen by others. It is apparent that the awareness campaign is working as comments such as "we only normally go to the sea"; "we've checked our boats and trailers for weeds"; "we only use this lake" and "we always wash our boat between waterways" are often made. Local residents of the lakes were also often well informed as it is in their interests to keep the lakes in a healthy condition for both aesthetic value and for recreational activities.

In the past, those spoken to at Okawa Bay on Lake Rotoiti were restricted to members of the yacht squadron and their vessels were not usually moved from this location. The ramp is now open to the general public and traffic has increased. There is a substantial amount of weed floating at the Okawa Bay boat ramp. Now the ramp is open to the general public, this increases the risk of weeds being transferred to other lakes.

A few people this summer have objected to the fact that Lake Ōkataina is a passive lake. The reasoning behind why this decision was made has been relayed to those complaining. Some of these people have stated there is insufficient signage prior to arriving at the boat ramp. There is in fact signage depicting prohibited activities approximately one kilometre along the road to the lake. This is clear to see and at a location with a turning circle should owners of vehicles wish to change their plans and head for a different lake. On one occasion this signage was discovered to have been unscrewed and turned around and reattached. It was also found to have been used as a target on occasion by someone with a firearm. People visiting Lake Ōkataina value its tranquillity. There are plenty of alternative lakes to use for those with a need for speed.

Figure 40 Lake Okataina

River user's discussion

For summer 2012/2013 the Wairoa River was visited three times at around 10:00 am to coincide with the hydro-release. This is an extremely popular spot for kayakers and rafters and a number could be targeted before or after they use the river. In addition, locations such as the Kaituna River put-in at the Rotoiti control gates and the take-out on Trout Pool Road are high-use areas where we were able to speak to many kayakers. The Rotorua rivers were visited on a weekly basis and were extremely popular spots due to the fine weather experienced this year. Many fishermen congregate at the Hamurana, Awahou and Waitetī stream mouths. The Waioeka, Waimana and Whakatāne River were visited only once over the summer period due to their remote location and the time needed to travel there. This summer no fishermen were encountered but it allowed a visit to Murray Redpath, a resident on the river who has a didymo station set-up for visitors to his farm.

Was the equipment checked/cleaned before launching?

Results from surveys conducted at rivers this summer found the majority (74.6%) of individuals confirmed they cleaned their gear between waterway, an increase of 9.3% from last year (Figure 25). Unlike boats, kayaks and fishing gear don't have as many areas where visible clumps of weed can accumulate, but as the main risk to rivers is didymo, we took people's response saying they wash their equipment with detergent or seawater as honest answers. Despite this increase in those who did clean gear, there was also an increase of 9.5% in river users who admitted they did not wash their kayaks or fishing gear between waterways. The proportion of people surveyed who hadn't washed their gear usually said it wasn't practical or necessary to carry detergent around, as didymo was not yet in the North Island. These people were reminded that it takes just one person to introduce didymo into a new area, and that if it were to come to the North Island, we could be unaware for some time before it manifests in a waterway. These people were also made aware of the fact that kayakers and fishermen are high risk vectors for the spreading of didymo as they can easily move between several different rivers in the space of one day. For example, on a Sunday many visit the Wairoa River for the release and then head to Ōkere Falls for a kayak on the Kaituna River. In some situations we spoke to fishermen when they were already fishing, contributing to the 6.3% of the AIW

section. The percentage of people surveyed who fell into this category was significantly lower than previous years, contributing to the increases in the amount of people who do clean their gear, and those who don't.

Figure 41 Kaituna River

Origin of owners and equipment

The majority of users this summer were again from the Bay of Plenty region, making up 27% of everyone surveyed (Figure 27). However a significant increase was noted in the number of people coming up from the South Island, now making up 27% of the sample, an increase of 22.4% from last year. In addition, the number of vessels that had last been used in the South Island made up 28.6% of everyone surveyed (Figure 28). These numbers pose a significant risk to the didymo-free status of the North Island. Most of these people spoken to, however, were well-informed about didymo and knew all the procedures they need to go through to prevent its spread. A number of individuals were kayakers competing in the Canoe Slalom Selection races and told us they had large bins they submerged all their equipment in, and had once hired a commercial freezer to kill any didymo cells before coming to the North Island. Those that had last used their gear overseas (3.2%) were also part of the kayak training group and were very knowledgeable about didymo. The majority of people spoken to (63.5%) had last used their gear in the Bay of Plenty. In addition, many kayakers said they went to play in the surf in Taraunga if they ever moved between the Wairoa and the Kaituna Rivers.

The amount of people spoken to from overseas decreased by 15.8% from last year, however these individuals still pose a major risk as they are the most likely to have no understanding or awareness of aquatic pests. This result heightens the importance of targeting backpackers and tourism outlets with information and merchandise. Many foreigners spoken to had been told of didymo by their kiwi friends, however some were unaware that it was present in the country and spread by moving from one river to another. In most situations people from overseas exhibited little awareness of didymo.

Perceived level of interest and awareness

Eighty five percent of people spoken to this summer showed a good level of interest, and were very enthusiastic about the programme (Figure 29). In addition there was a decrease of 3.7% in those who showed poor interest in aquatic pest issues. Kayakers from the Auckland University Canoe Club, in particular, were very enthusiastic about keeping didymo out of the North Island, to the point where they asked MPI to provide them with "Check, Clean, Dry" graphics templates to get them placed on a river raft. Following this summers' response from people, it appears the enthusiasm encountered last year has continued and will hopefully ensure other people work hard to keep didymo contained to the South Island.

Due to the different methods for surveying people this year, didymo awareness was significantly different to those perceived in previous programmes. The amount of people receiving a high awareness was at 87.3% this year, 48.4% greater than those achieving a "good" perceived awareness for 2011/2012 (Figure 21). This is most likely due to the strength of the "check, clean, dry" campaign surrounding kayakers and fishermen, making most of them aware of didymo and where it was found. For a lot of people, however, simply knowing where it is found did not make them proactive about cleaning their equipment, as they were not aware it takes just one drop of water to spread it, or that it may be present in a waterway without manifesting. One concerning statistic is that more people were encountered this year who had never heard of didymo, with an increase of 3.7% from last year. Of the didymo awareness topics, the one people were most unaware of was that didymo is mainly found in rivers (Figure 31), however in general knowledge of didymo was high among river users.

The defensive response encountered when speaking to some fishermen last summer was not encountered this year, with many of them remembering the campaign and that in educating people through this programme, we are helping to keep their treasured fishing spots pristine. Despite this, a few fishermen did argue that birds are another vector through which didymo can be spread. On these occasions, we explained that we don't know for sure how didymo arrived but that current research suggests it was unlikely to have been birds. In general, however, many fishermen are great custodians of New Zealand's rivers and realise that if didymo enters the North Island it will affect their recreational interests more than most. Some individuals we spoke to freeze their equipment after use in the South Island and others that regularly fish in both islands have a different set of gear to use in each as it prevents hassle at ferry terminals. People who had seen didymo for themselves in the South Island river catchments were generally a lot more passionate in making sure it does not reach the North Island. As we found last year, after a few visits to the Waitetī Mouth we began to encounter the same people. Several people surveyed stated that they restrict their fishing to a single waterway so they are unlikely to spread didymo to other watersheds.

Retail and tourism awareness

The Bay of Plenty region's retail and tourism sector services a wide variety of people with a diverse range of freshwater recreational interests. During the 2012/2013 awareness programme a total of 90 backpacker hostels, motels, hotels, campgrounds and holiday parks were visited, along with 35 retail and 12 tourism outlets. In general, the awareness programme was very well received by the employees and owners of outdoor retail outlets, accommodation providers and tourism centres.

The majority of retail outlets were enthusiastic about promoting our programme and were generally very supportive. However, certain branches of an outdoor retail chain have a policy where they do not take material that is not sold or used to promote the company. The owner of another outdoor retail store is not keen to display the material in his store.

Figure 42 Some of the merchandise distributed to tourism outlets (brochures) and lake users (prop flag etc.).

As during the previous summer, most hotels and motels were happy to take brochures and posters from us with only a small minority declining. A few owners mentioned their clientele were either not users of the waterways, or those that were tended to book with companies rather than bringing their own vessels or equipment. Brochures were usually taken and displayed despite these comments. Occasionally, motels still had brochures on display and posters on walls in reception areas from the previous year which was encouraging. However, many accommodation providers have large display areas containing lots of different brochures. The issue is whether many visitors actually see them and take the time to read them. As in previous years, the A4 sized posters were far more likely to be taken and displayed than the A3 posters. They were placed in communal areas such as laundries, games rooms, kitchens or the windows of reception areas. The potential impact of didymo upon the tourist industry and accommodation providers was highlighted if owners lacked interest. Camping grounds were also happy to take brochures and posters for communal areas.

Backpackers travel widely and often go tramping in remote but stunningly beautiful areas of wilderness with pristine waterways, so have the potential to become vectors of didymo cell dispersal. Many travellers go from the South Island to the North Island with little knowledge of biosecurity risks and may well transport didymo between islands inadvertently. This highlights the importance of targeting lower budget accommodation that backpackers typically frequent. Recreational users of waterways who visit from overseas, such as kayakers and anglers, also move freely between different catchments and are therefore also categorised as a high risk group.

Event awareness and decontamination stations

Speaking to event organisers and to competitors at briefings offered the chance to not only raise awareness of aquatic pest risks to lake health, but also to provide information on decontaminating vessels and equipment. Most organisers were willing to promote didymo and aquatic pest awareness and cooperated well with requests to decontaminate the vessels and equipment used.

Figure 43 Aquatic pest advocate speaking to water ski racers on Lake Rotomā

Events can bring large captive audiences to a single location, so being granted permission to speak to a crowd of people in a relaxed manner, offers the opportunity to spread awareness that would otherwise have taken a considerable amount of time and effort. Many of the competitors taking part in events over the summer may not usually use the Rotorua Lakes and may thus arrive with very little knowledge of freshwater biosecurity issues.

The organisers of events like the Dewar Shield, water ski racing on Rotomā and the Canoe Slalom Training Camp were receptive to having Regional Council workers attend and speak, which we did. An allocated time period, usually five to ten minutes, was given at each event for us to talk about the lakes and the biosecurity risks associated. Many people attending these events were fishermen and are thus supportive and keen to keep the lakes in a healthy state. Mark Sherburn hosted the annual Fish and Game Boat Fishing Seminar, adjacent to the Stoney Point boat ramp, at Lake Tarawera. Time was again allocated for Adam Brown to speak to people attending about aquatic pests and methods for cleaning equipment and vessels. The koi carp and brown bullhead catfish models were taken along to give those new to fishing help with identification of pest fish species.

Tracey Bates and Adam Brown also gave a PowerPoint presentation at the Check, Clean, Dry (CCD) Advocacy North Island training day in Rotorua. This was to enlighten other North Island advocates as to the programme we undertake around Rotorua but also to help those new to advocacy work.

Many of the competitors at events were preoccupied with preparations or competing but on occasion we were able to speak to them in down time between races. The parents, friends and supporters of competitors proved to be an easy audience to speak to during the day and provided a medium through which information would be passed on to competitors.

A recurring theme at events this year, as with the previous summer, was that people don't like putting on damp wetsuits. Competitors will try to avoid having wetsuits decontaminated by saying "it's a brand new wetsuit;" "I last wore it in the sea," and "It's only been in this lake." Determining which people are telling the truth and which are simply providing a convenient excuse is not possible. We therefore related to people that all wetsuits must be dipped with the exception of new ones that still had the tags attached. Last summer some people gave these excuses and were then contradicted by family members during conversation or by children innocently correcting them.

The event organisers of the Blue Lake Multisport Festival were again very proactive in organising decontamination and provided their own volunteers to oversee the station. The Regional Council supplied the RATS club with Simple Green and a bin in which to do their decontamination. The Ministry for Primary Industries and the Bay of Plenty Regional Council are attempting to encourage event organisers to be more proactive about biosecurity and make decontamination at their events compulsory. The decontamination station for the Contact Tri-Series and Rotorua Half Ironman events was this year manned by event organisers rather than Regional Council employees. Full decontamination of equipment and vessels at the Dewar Shield Blue Lake Regatta was again made a condition of participation. Organisers of the Waitangi Day swim were far more receptive to decontamination this year which is very encouraging. Wetsuit dipping prior to the swim was made compulsory rather than voluntary this year.

Figure 44 Vessels participating in the Wooden and Classic Boat Parade, Lake Rotoiti

Events which need stricter biosecurity cleaning procedures are canoe slalom races on the Tarawera River. Responsibility for the cleaning station set up was initially overseen by summer advocates at the N.Z Canoe Slalom training camp at Kawerau, however it was passed to group instructors for the remaining kayakers and those competing in selection races the following weekend. Cleaning procedures and the need to decontaminate every vessel, including those not used in the South Island were explained in full. When the selection races were attended on the weekend however, a blasé attitude was received and none of the senior or international competitors had been required to clean their gear. Such top level athletes may have done so themselves, however, with such a prominent event that includes foreign competitors, a stricter cleaning protocol needs to be enforced.

The majority of event organisers and competitors were friendly and supportive of what we were doing. Numerous people have participated in Rotorua events for many years and are passionate about keeping water quality and lake health high. Many of the vessels used in events are high performance machinery or very expensive and owners usually keep them in immaculate condition and well maintained. These vessels are often comprehensively cleaned each time they are used.

Part 2: Conclusions and recommendations

2.1 Conclusion

The Rotorua/Te Arawa Lakes are a significant asset to both the Bay of Plenty region and the country. The health of the lakes, their water quality and biosecurity are therefore worth protecting for the enjoyment of future generations. The number, close proximity and enormous popularity of the lakes make them extremely susceptible to invasion by pest weed and fish species.

The main invasive weed species to have established in the lakes and that contribute to water degradation are hornwort, egeria, lagarosiphon and elodea. Invasive weeds grow and spread within a waterway via vegetative fragmentation. The activities undertaken by recreational users have been identified as the primary means through which weeds spread between lakes. The main vectors of aquatic pests are acknowledged as being vessels, trailers and equipment associated with these activities. Eggs of pest fish species like brown bullhead catfish and koi carp are also known to be able to 'hitchhike' and remain viable on damp weed fragments. In addition, an invasive freshwater alga called didymo was identified in a Southland river in 2004 and is now widespread over the South Island, though not currently known to be in New Zealand's North Island. Didymo has negative impacts upon river ecology and aesthetics, as well as the interests of commercial endeavours and recreational users.

The 2012/2013 Aquatic Pest Summer Awareness Programme aimed to identify levels of public awareness and educate recreational users about didymo, invasive weeds and pest fish species. In total, 806 individuals or groups were surveyed on lake boat ramps and river access points throughout the Bay of Plenty region during the summer.

Over the previous two years a decline has been found in those cleaning their vessels, trailers and equipment; a trend that needs reversing. A few of our most pristine lakes, such as Rotomā and Tikitapu, are also some of the most visited. Invasive aquatic weed species were found attached to trailers or equipment on eight separate instances, the majority being hornwort but also occasionally comprising egeria and lagarosiphon. For the most part, these finds were at Lake Rotoiti boat ramps but a few were at Lakes Aniwhenua and Matahina, which were observed to have large amounts of weed within them. Vehicles towing trailers covered in weed fragments were seen to be leaving the Lake Aniwhenua domain, indicating that dialogue between the Regional Council and Bay of Plenty Electricity is required. The discovery and removal of hornwort and egeria fragments floating in Lake Rotomā underlines the potential risks to our most pristine waterways. This case highlighted the significance of the Check, Clean, Dry message and also the importance of the weed cordon.

Approximately three quarters of lake users used boats with outboard motors. The recent incursions of hornwort on Lakes Ōkataina and Ōkāreka highlight the importance of checking anchor lines and anchor wells for weed fragments. On a positive note, jet-ski and jet boat usage was down on last summer though jet-ski usage is still considerable. These vessels pose a significant biosecurity threat due to the presence of silt traps and jet intakes, which can harbour invasive species.

Most recreational users of the lakes were from Rotorua and Tauranga. Although visitors from both Auckland and the Waikato declined this year, they still constitute sizable groups that represent a significant risk due to the invasive weeds and pest fish in their waterways. Encouragingly, vessels last used in Waikato waterways were down slightly. The perceived level of interest amongst lake users was down compared to the previous summer. Making comparisons of aquatic pest awareness was not possible this year due to change in the survey design. This year's results should thus be regarded as baseline for comparisons in the future. Although the majority of lake users knew how to clean their vessels or equipment correctly, awareness of aquatic pest issues at Lakes Rotomā and Tikitapu was disappointing.

Almost three quarters of all river users cleaned their vessels/equipment between waterways. The significant decrease of vessels already in the water resulted in an increase of both the proportion of those cleaning and those not cleaning vessels between rivers. A large increase in river users coming from, and last using vessels in, the South Island was alarming and enhances the risk of didymo incursion to the North Island. However, there was a high level of interest and consciousness about didymo amongst river users from the South Island. There is very high awareness of the Check, Clean, Dry campaign with kayakers and fishermen, both demographics being well informed. In addition to these findings, there was a slight decrease in those from overseas.

The Aquatic Pest Awareness Programme is reaching many of those most at risk of causing incursions of invasive species to the Bay of Plenty region. Users of the waterways appreciate the work conducted by the Regional Council around the lakes and rivers and frequently make positive remarks about the work undertaken. A mind-set among recreational users to "Check, Clean and Dry" vessels and equipment will prevent didymo incursions to the North Island, which will be beneficial to New Zealand ecologically, aesthetically and economically.

2.2 General recommendations

- Summer students should contact the Water Administration Officer at the Rotorua office when looking for events to attend. They are responsible for lake closures and have event information and contact details.
- Make contact with event organisers as early as possible. This ensures they have had plenty of notice and sufficient time to contact participants if necessary.
- On days when boat ramps are quiet and people are hard to find it is worth while visiting Otarmarae, a popular ramp with people from both Rotorua and Tauranga.
- Provide event organisers with a didymo information file and some free merchandise (T-shirts, caps, keyrings etc.) to either use as spot prizes for competitors or to use themselves. Organisers are often responsible for several events each year and when they wear or use merchandise the slogans or messages are seen by a large number of people.
- Arrange with organisers the opportunity to speak about aquatic pests and cleaning vessels at event briefings and try to encourage them to be more proactive about doing decontamination themselves. Ask about putting aquatic pest information and didymo brochures in event packs.

- If event registration is the day prior to the event itself, ask that a decontamination station be set up (e.g. if it involves wetsuits) and supervised by members from their organisation. This provides enough time for wetsuits to dry out. Decontamination could be a prerequisite for participation in the event. A visit could be scheduled if there are doubts about compliance.
- Large amounts of merchandise are required for survey packs, event organisers, retail outlets, tourist accommodation and other contacts. Conducting regular stock counts and ordering in stock that is running low ensures enough is available for the weeks ahead. This is especially vital leading up to Christmas and New Year which is the busiest survey period. Ministry for Primary Industries employees are off work so good planning and early ordering is required.
- We spoke to one man who was new to boating; knew nothing about navigation rules; operating his craft or biosecurity issues. It is certainly worth having some navigation brochures in the vehicles as well as those for didymo/pest awareness.
- Distribute brochures to retail outlets and tourist accommodation early in the programme. This ensures they are stocked prior to the busiest time of year.
- Most motel owners are happy to display a pile of brochures in the front office. However, if they show interest encourage them to direct guests known to use waterways towards the brochures. Better still, if a guest is known to be a fisherman or boat owner etc., to place a brochure in their room prior to arrival.
- Backpackers often tramp in the South Island and then the North Island with the possibility of having contact with a large number of waterways in a short period of time. They are therefore a potentially high risk vector for didymo dispersal. Ask backpacker hostel owners for permission to put posters on noticeboards and to take a pile of the didymo brochures directed at those that tramp.
- Encourage motel owners to put posters in communal areas e.g. laundry/games room.
- Ask owners of fishing outlets or boat showrooms to hand out a brochure with every fishing licence/fishing rod/boat sold.
- Likewise, encourage sport shops/camping stores to put posters in changing rooms.
- Occasionally members of the public do not wish to be spoken to and may become negative, argumentative or berate the organisation. You will not be criticised for simply thanking them for their time and walking away rather than getting enticed into an argument.
- If people you approach say they have had packs in previous years, still attempt to engage them if they are receptive. You could ask them if they mind being updated regarding biosecurity issues in the region. These people often have very poor awareness or have forgotten information from previous years despite having the merchandise.
- When conducting river surveys try not to attend the Wairoa River on too many occasions as you will find many repeat users. One visit at the beginning, once in the middle and again towards the end of the survey period would be ideal.
- Wairoa release kayakers at the McLaren Falls put-in are often in more of a rush than when they get out of the river. Although some surveys can be conducted there, it is recommended that more time is spent at the Ruahihi Power Station take-out area or at the play wave. Kayakers' park cars by the roadside and are usually more relaxed.

- Choose busy periods such as public holidays to visit more remote rivers (e.g. Waioeka) and lakes (e.g. Aniwhenua and Matahina). This will increase the chance of meeting people rather than travelling long distances for a few surveys.
- Murray Redpath has a farm (Appendix 10) that the Waioeka River runs through. He has good didymo awareness and has a decontamination station set up for fishermen using the river. We would recommend you visiting him, providing him with 'Simple Green' if necessary and offering him some free merchandise.
- Make an appointment to meet with either Kelley Korau or John Merito at Te Waiariki Purea Trust. They regularly use the lakes for activities with their youth groups. John Merito has also suggested the possibility of spreading awareness and educating people about cleaning procedures over the Māori radio station that they use.

2.3 Awareness programme recommendations

- Encourage organisers to be more proactive with regards to invasive pest awareness at events. The aim is for organisers to contact us about wetsuit decontamination and for them to run the stations, as the Blue Lake Multi Sport organisers have in recent years. We can supply the equipment for this purpose. Some organisers have already included decontamination as a condition for entering their event which is promising.
- Those living in properties with private boat ramps are often not surveyed so a significant number of people are not spoken to about aquatic pest awareness. Future summer students could communicate with the Regional Council's consents officers to get addresses of these properties. The four information sheets used in survey packs could then be sent to these addresses with a covering letter explaining the awareness programme.
- Awareness of pest weed, fish and didymo awareness issues is low at Lake Rotomā and Tikitapu. Particular attention needs to be paid to users of these lakes to ensure they are made aware of the pristine nature of these lakes and the importance of checking equipment, especially if they were last in the Waikato region.

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Appendices

Appendix 1 – Sites visited to promote aquatic pests and didymo awareness

Rotorua sites		
	Name	**Products distributed**
Hotels/Motels	Aaryn Court	Brochures (10)
	Acacia/Sequoia Lodge Motel	Brochures (10), poster
	Accolade Lodge	Brochures (10), poster
	Ace Motor Lodge	Brochures (10)
	Alpin Motel	Brochures (10), poster
	Apollo Hotel (serviced apartments)	Brochures (10), poster
	Arista Lodge	Brochures (10), poster
	Ascot on Fenton	Brochures (10), poster
	Ashleigh Court	Brochures (10), poster
	Aywon	Brochures (10), poster
	B & K's Rotorua Motor Lodge	Brochures (10)
	Baden Lodge	Brochures (10), poster
	Bel Aire Motel	Brochures (10), poster
	Birchwood Spa Motel	Brochures (10), poster
	Boulevard	Brochures (10), poster
	Brylin Motel	Brochures (10), poster
	Capri Court	Brochures (10), poster
	Coachman Comfort Inn	Poster
	Copthorne Hotel	Brochures (10)
	Collingwood Gables	Brochures (10), poster
	Devonwood Resort	Brochures (10), poster
	Distinction Hotel	Brochures (10)
	Emerald Spa Resort	Brochures (10)

	Executive on Fenton	Brochures (10), poster
	Fenton Court Motel	Brochures (10), poster
	Gateway Motel	Brochures (10)
	Geneva Motor Lodge	Brochures (10)
	Golden Glow Motel	Brochures (10)
	Gwendoline Court	Brochures (10), poster
	Holiday Inn	Brochures (10)
	Kerry's Motel	Brochures (10), poster
	La Mirage	Brochures (10), poster
	Malfroy Motor Lodge	Brochures (10)
	Malones Motel	Brochures (10)
	Marama Resort	Brochures (10), poster
	Midway Motel	Nothing - still had items from last year
	Palm Court Motor Inn	Brochures (10), poster
	Paradise Valley Lodge	Brochures (20), poster, keyrings (6)
	Pineland	Brochures (10)
	Pohutu Lodge	Brochures (10)
	Quality Inn Hotel	Brochures (10)
	Regal Palms	Brochures (10), poster
	Rob Roy	Brochures (10), poster
	Rose Court	Brochures (10), poster
	Rotorua Motel	Brochures (10), poster
	Rotorua Mini Suites	Brochures (10)
	Rotorua Motor Lodge	Brochures (10)
	Rotovegas Motel	Nothing - don't get lake/river users
	Rydges	Brochures (10)
	Silver Fern Motor Inn	Brochures (10), poster
	Silver Oaks	Brochures (10)
	Silver Oaks Resort	Brochures (10), poster

	Six on Union	Brochures (10), poster
	Studio Motel	Brochures (10), poster
	Tuscany Villas	Brochures (10)
	Union Victoria Motel Limited	Brochures (10), poster
	Victoria Lodge	Brochures (10)
	Wylie Court	Brochures (10), poster
Camping Grounds	All Seasons Holiday Park - Hannah's Bay	Brochures (10), poster
	Blue Lake Top 10 Holiday Park	Brochures (10), poster
	Cosy Cottage Holiday Park	Brochures (10), poster
	Holdens Bay Top 10 Holiday Park	Brochures (10), poster
	Lake Rotoiti Holiday Park	Nothing - already had items from last year
	Paradise Valley Lodge	Key-rings (10)
	Rotorua Family Holiday Park	Brochures (10), poster
	Rotorua Thermal Holiday Park	Brochures (10), poster
	Waitetī Lakeside Lodge	Brochures (20), Keyring (1)
	Waiteti Trout Stream Holiday Park	Brochures (20), poster, keyrings (8)
	Willow Haven	Brochures (10), poster
Backpackers	Blaney Stone Backpackers	Brochures (10), poster
	Cactus Jacks Backpackers	Brochures (10)
	Crank Backpackers	Brochures (10), poster
	Crash Palace	Brochures (15)
	Downtown Backpackers	Brochures (10)
	Funky Green Voyager	Brochures (10), poster
	Oasis Hostel	Still had brochures, poster
	Rotorua Central Backpackers	Brochures (15), poster
	Spa Lodge Backpackers	Brochures (10)
	X-Base Backpackers	Brochures (10), poster

	YHA Rotorua	Brochures (10), poster
Retail Outlets	Bill Davies Outdoor Sports World	Brochures (15 of each), poster, keyrings (8), spray bottles (6)
	Dive HQ	Brochures (20), keyrings (10), towels (4), T-shirts (4), pink bags (2), CCD folder
	Hamill's	Brochures (10 of each), poster, keyrings (18)
	Hunting and Fishing	Nothing
	Kathmandu	Brochures (10 of each), poster
	Lake Tarawera Water Taxi	Singlet (10), hat (1)
	Mountain Designs	Brochures (10), posters (2)
	O'Keefes	Brochures (15 of each), poster, keyrings (15)
	Outdoorsman Headquarters	Brochure (10), poster, keyrings (10)
	Raft-About	As River Rats - same business
	Redwoods info centre	Brochures (10), poster
	River Rats	20L Simple Green, keyrings (15), already had everything else
	Rotoma's Trading Post	Brochures (20), keyrings (20)
	Rotorua Stand Up Paddleboard	CCD folder, T-shirts (3), towel (1), keyrings (10), hats (2), pink bags (2), hoodie (1)
	Stirling Sports	Brochures (10)
	Telfer marine	Brochures (10)
	Te Waiariki Purea Trust	Singlets (5), keyrings (10), towels (2), pink bags (2), hoodies (2)
	The Happy Angler	Brochures (15)
Schools	Rotorua Lakes High School	CCD folder, hats (3), keyrings (20), pink bag (1)
Tourism	Te Puia	Brochures (10)

Tauranga sites		
Backpackers	Harbourside Backpackers	Brochures (10), poster
	Tauranga Central Backpackers	Brochures (10), poster
	Loft 109	Brochures (10), poster
	YHA	Brochures (10), poster
	Mount Backpackers	Brochures (10), poster
	Pacific Coast Lodge Backpackers	Brochures (10), poster
Tourism	Tauranga Library	Brochures (10)
	iSite Tauranga	Brochures (10)
	Te Puke iSite	Brochures (20 of each), Poster
	Te Puke Library	AS above- same location as iSite
Retail	Camping and Outdoors	Brochures (10), poster
	Te Puke Backpackers	Brochures (15), poster
	Sportsworld Te Puke	Brochures (20)
	Stirling Sports	Brochures (10), poster
	Mountain Designs	Brochures (10), poster
	Bivouac Outdoors	Brochures (10), poster
	Wrights sports	Brochures (10), poster
	Broncos Sports	Nothing- already had items from last year
	Kathmandu	Brochures (20), poster
Whakatane sites		
Hotels/Motels	Tuscany Villas	Brochures (10), poster
	Whakatāne Hotel	Brochures (10)
	Windsor Lodge Backpackers	Brochures (20) , poster
	Karibu Backpackers	Brochures (20)
Retail Outlets	Hunting and Fishing	Brochures (100- wanted lots), poster
	Iceman	Nothing- Store for sea fishing

	Kathmandu	Nothing (store policy)
	Sportsworld	Brochures (10), poster, Keyrings (5)
	Stirling Sports	Brochures (10), poster, Keyrings (5)
	Whakatane Great Outdoors/Kiwi Outdoors	Brochures (10), poster, Keyrings (5)
Tourism Centres	Citizens Advice Bureau	Brochures (10)
	iSite Whakatane	Brochures (20), poster
	Whakatane Library	Brochures (20), poster
	Whale and Dolphin Watching & Diveworks	Brochures (10), Keyrings (5)
	White Island Tours	Brochures (10), poster
Opotiki sites		
Retail Outlets	Hickeys Sports	Brochures (20), poster
	Opotiki Bait & Tackle	Brochures (20), poster, keyrings (6)
Tourism Centres	Department of Conservation	Brochures (10 of each)
	iSite Opotiki	Brochures (10 of each)

Appendix 2 – Boat ramp survey form

Lake/River _____ Boat ramp _____ Date _____

Weather conditions: _____ Weed loading: _____

Checked/cleaned prior to launching today? ☐ **Yes** ☐ **No** ☐ **AIW**

Weed on boat/equipment? ☐ **Yes** ☐ **No**

If yes-species and where on boat (anchor/trailer???)

Vessel/equipment type? e.g. boat (separate jet boats), jet ski, waders etc.

Origin of vessel/equipment (last water body where used)

Origin of owners? (where vessel users are from/live)

Recreational purpose?	☐ **Fishing**	☐ **Skiing**	☐ **Other**	
Level of awareness of aquatic pest issues?	☐ **0 None**	☐ **2 Low**	☐ **3 Medium**	☐ **High**
Level of awareness of Didymo?	☐ **0 None**	☐ **2 Low**	☐ **3 Medium**	☐ **High**
Level of interest in aquatic pest issues?	☐ **Good**	☐ **Moderate**	☐ **Poor**	
Lake users: Do you know how to reduce the risk of spreading weeds?	☐ Yes	☐ No		
River users: do you know how to reduce the risk of spreading Didymo?	☐ Yes	☐ No		

1	Do you know what hornwort is?	☐ Yes	☐ No		
2	Do you know if there are there any koi carp/catfish in these lakes?	☐ Yes	☐ No		
3	Do you know how aquatic weeds are spread around the lakes?	☐ Yes	☐ No		
1	Have you heard of Didymo?	☐ Yes	☐ No		
2-3	Do you know where Didymo is found in NZ?	☐ (2) Yes- knew it was in south island ☐ (3) Yes- knew it was found mostly in rivers		☐ No	
Have you seen any pest fish?		☐ Yes		☐ No	

Comments (on anything: e.g. didymo, signs, banners etc): .....
.....

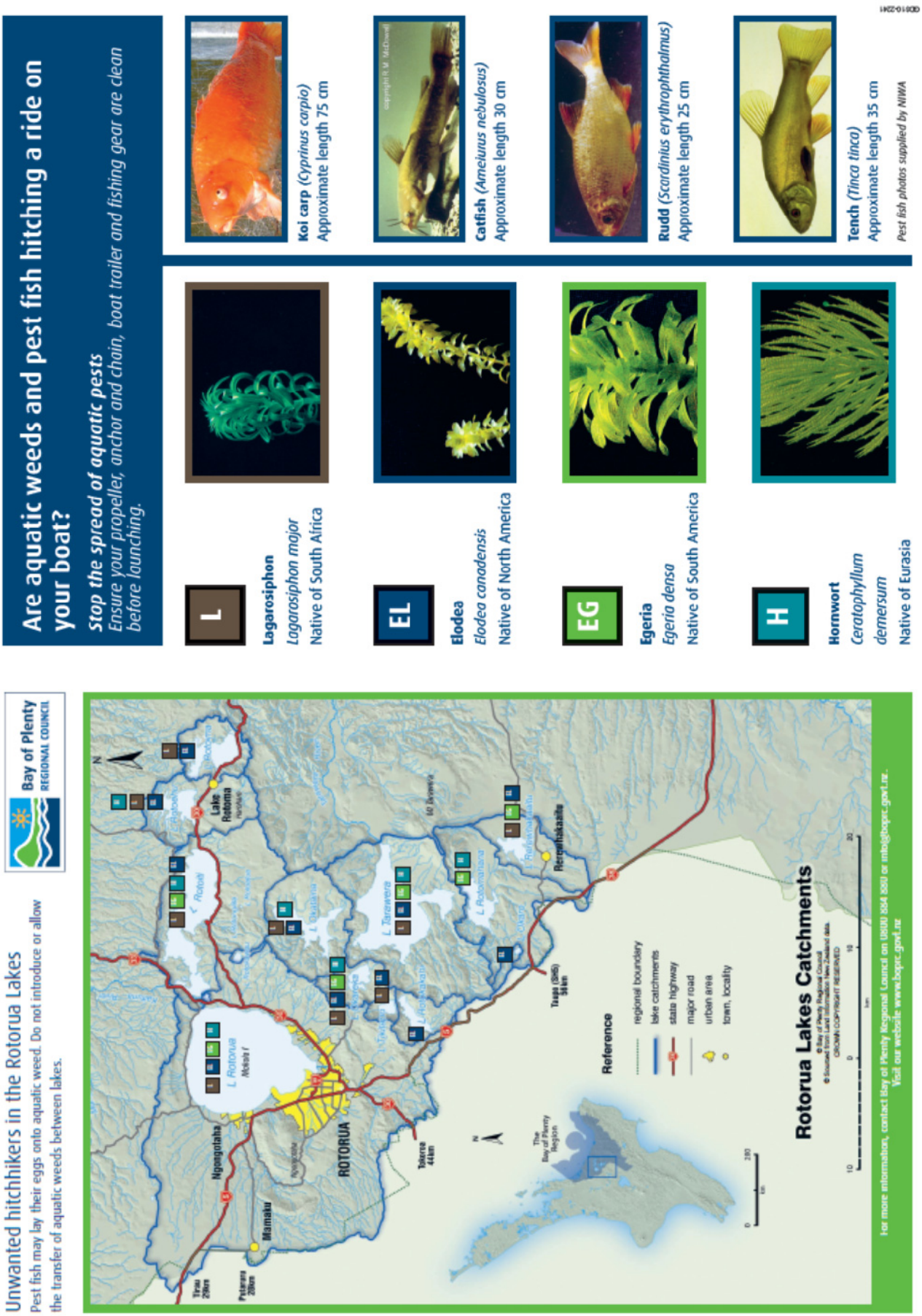
.....

Appendix 3 – List of Ministry for Primary Industries and Bay of Plenty Regional Council products distributed

- Fluorescent “Stop the Spread” propeller flag.
- “Stop the Spread” floating keyrings.
- Lollipops.
- Spray bottles used for cleaning vessels & equipment.
- 20 ml sachets of detergent for decontamination purposes.
- “Stop the Spread” T-shirts.
- “Stop the Spread” long sleeved tops.
- “Stop the Spread” hoodies.
- “Stop the Spread” singlets.
- “Stop the Spread” bucket hats.
- “Stop the Spread” pink draw string swimmers bags.
- “Stop the Spread” towels.
- Z-booklets (pocket brochures).
- Didymo posters - Various designs in A3 and A4 sizes.
- Lakes information sheets showing aquatic plant pests and fish species.
- Boat information sheets showing where to check for aquatic hitchhikers.
- Aquatic pest plants factsheet (Pest plant control 13) – 4 pages.
- Department of Conservation “Wanted” pest fish sheets.
- Trout bags with “Check, Clean, Dry” message.
- Didymo brochures - for trampers, boat owners and brochures about didymo in general.
- Simple Green.
- Check, Clean, Dry temporary tattoos.

Appendix 4 – "Wanted" pest fish flyers

Appendix 5 – Unwanted hitchhikers' flyer



Appendix 6 – Keeping lakes pest free flyer

Keep our lakes pest free this season

The Rotorua Lakes are popular for many forms of recreation and are treasured natural assets of great beauty. We need to look after them so that they remain as beautiful and enjoyable for generations to come.

You can help to stop the spread of pests

When entering the Rotorua Lakes (especially from the Waikato River system including Lake Taupo and the hydro-lakes) and when moving between the Rotorua Lakes, it is important that you:

- Inspect trailers, engine wells, anchors, propellers, fishing gear and other wet equipment such as waders to ensure they are not carrying either weed fragments or pest fish species BEFORE you leave one waterway.
- Ensure you thoroughly clean your boat and all equipment that has been in contact with water before using again.

Threats to our lakes

Threats to the lakes include aquatic weeds, algae, and pest fish.

Aquatic weeds and algae can invade and seriously degrade our lakes, displace native aquatic plants, and reduce suitable habitat for aquatic organisms.

Pest fish can cause many problems, such as causing extensive damage to native plant, fish and waterfowl habitats. They also eat and compete with native fish. Once pest fish have become established in a lake it is practically impossible to eradicate them.

It is your responsibility as a lake user to ensure that you are not contributing to the introduction or spread of aquatic pests.

New rules around pest management

The Bay of Plenty Regional Council 2011-2016 Pest Management Plan has rules regarding spreading pests including Section D(6):

No Person shall move or allow to be moved any machinery, vessel, organism, risk good, or other goods that is contaminated with any containment pest plant.

Under these new rules it is an offence to move or allow to be moved, any machinery, vessel, organism, risk good or others goods contaminated with any contaminant pest plant.

STOP THE SPREAD

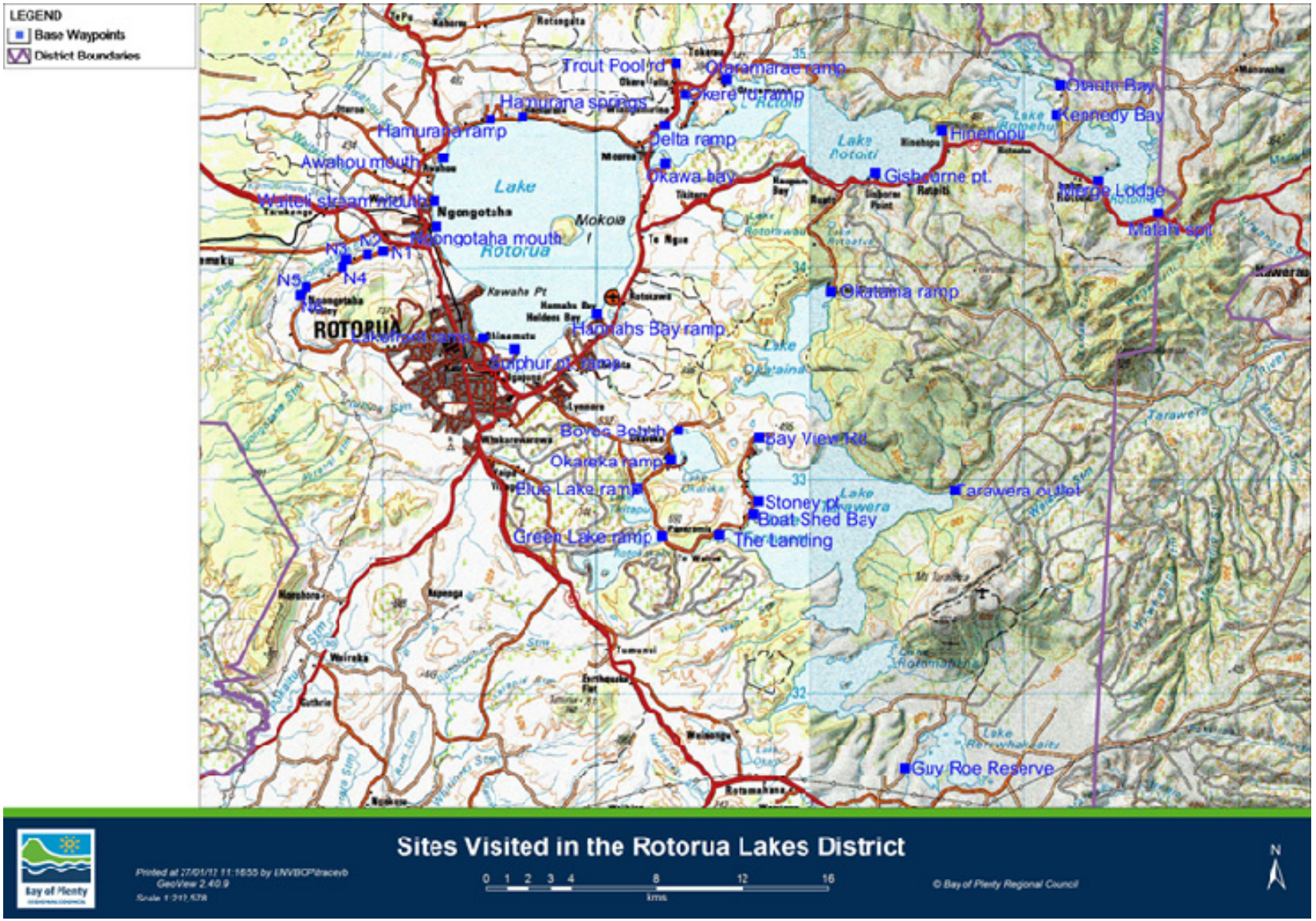
Protect our waters from aquatic hitchhikers
Check, clean and dry all boats and recreational equipment between waterways

Inspect trailers, engine wells, anchors, propellers, fishing gear and other wet equipment such as waders to ensure they are not carrying either weed fragments or pest fish species BEFORE you leave one waterway.

For more information contact a Biosecurity officer at Bay of Plenty Regional Council
0800 884 880 or visit www.boprc.govt.nz

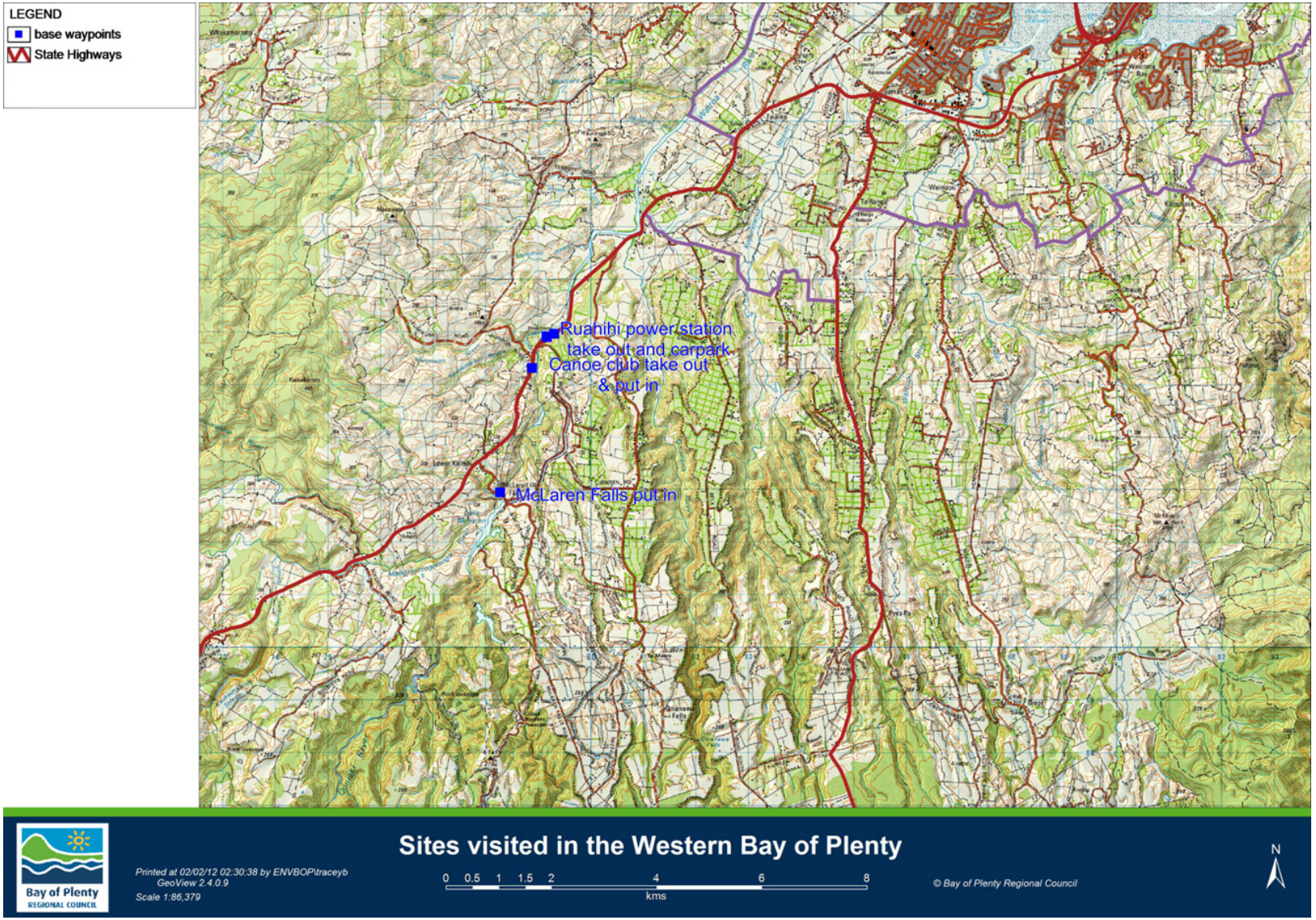
Bay of Plenty
REGIONAL COUNCIL

Appendix 7 – Sites visited in the Rotorua District



Appendix 8 – Sites visited in the Whakatane District

Appendix 9 – Sites visited in the Western Bay of Plenty District



Appendix 10 – Sites visited in the Opotiki District