

Biosecurity awareness of ferry passengers travelling to islands in the Hauraki Gulf, New Zealand



Photo: D. Fraser, 2012

A report for Auckland Council Environmental Sciences (Biosecurity)
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Abstract

Protection of the islands of the Hauraki Gulf Marine Park, particularly those that are 'Pest Free', from the impacts of invasive organisms is vital for the ongoing management of New Zealand native species. It is well known that the rate and extent of spread of invasive species has primarily been due to human-mediated transport, be this intentional or unintentional. Due to the high residential/commercial/visitor attraction of these islands, there is significant opportunity for the transport of invasive species via private or commercial sea and air craft. This project aims to increase and celebrate passenger awareness of biosecurity risk, increase the understanding of the types of materials transported on ferries and identify some of the commercial sources of these products. Passengers travelling on ferries to primarily Great Barrier and Rakino islands were engaged in conversation to gain an indication of the level of biosecurity awareness of passengers. The results will assist Auckland Council in the strategic management of risk pathways to the islands of the Hauraki Gulf Marine Park.

Introduction

The Hauraki Gulf islands

The Hauraki Gulf Marine Park (Figure 1) is made up of more than 50 islands, covering 1.2 million hectares of ocean found east of Auckland and includes numerous marine and terrestrial reserves (Department of Conservation, (DoC), n.d.a). The Hauraki Gulf provides an area for public recreation and relaxation, while also creating an environment that we can protect for some of our most precious endangered species (DoC, n.d.a). The islands range in size, accessibility and pest free status and are important habitats for New Zealand's unique range of seabirds, plants, terrestrial birds, reptiles and invertebrates (Diamond & Veitch, 1981; Gaskin & Rayner, 2013; Towns et al.2016).

Great Barrier Island (GBI) (Figure 2) is located approximately 90km north-east of Auckland (Jobberns, 2016). Despite the loss of extensive kauri forest of the past, GBI is a significant island for native New Zealand flora and fauna conservation, including endangered plants such as the Great Barrier Island daisy, 13 lizard species, including the unique chevron skink, and a rich selection of New Zealand terrestrial and marine birdlife. However, these treasures have been under threat by invasive vertebrate species; ship rats (*Rattus rattus*), cats and dogs. GBI is fortunate that it has not been invaded by other pest species such as possums, deer, wallabies, ferrets, stoats, weasels, hedgehogs and Norway rats (*Rattus norvegicus*) (Department of Conservation (DoC), n.d.b). In 2013 GBI had a resident population of 852 people

(Statistics New Zealand, 2013a) and is accessed via ports at Port Fitzroy and Tryphena and two airfields (Claris and Okiwi).

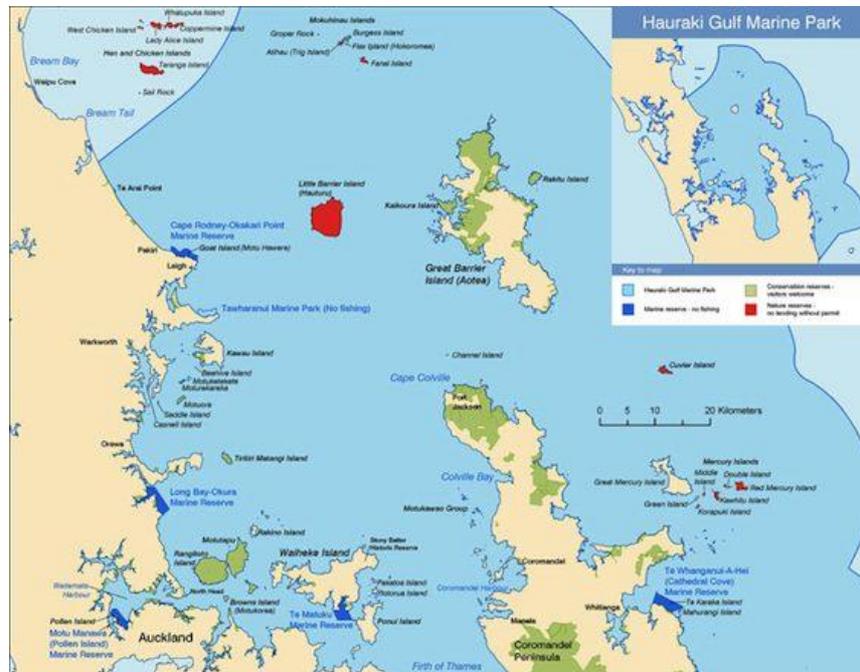


Figure 1: Hauraki Gulf Marine park. Source: Department of Conservation: Hauraki Gulf Marine Park area and map.



Figure 2: Great Barrier Island, Hauraki Gulf (Great Barrier Local Board/Auckland Council, <http://www.aucklandnz.com/discover/great-barrier-island>)

Rakino Island is a 1.5km² island situated off the north eastern side of Motutapu in the Hauraki Gulf (Figure 1). Originally owned by Governor Sir George Grey, it is now mainly privately owned (Rakino Ratepayers Association, (RRA), 2015). The island has a passenger wharf at Sand Bay and a freight wharf at Home Bay (RRA, 2015). A total of 60 people are resident in the combined islands of Rakino, Rangitoto and Motutapu (Statistics New Zealand, 2013b).

Rangitoto

Declared Pest-Free in 2011 (DOC n.d.c), Rangitoto, New Zealand's newest volcanic island provide 3,800 hectares of conservation land for the support of NZ endangered species and the world's largest pohutukawa forest. Due to being situated very close to Auckland, it is easily accessible island by ferry from Auckland.

Invasive Species

Due to New Zealand's geographic isolation, temperate climate and lack of predators, the country has been highly susceptible to the impacts of invasive species (Zavaleta, et al., 2001). Since the arrival of such species, the populations of endemic species have dramatically decreased, due to the ongoing competition of the better adapted invasive species (Mooney & Hobbs, 2000). Examples of more recent invasive species in New Zealand are the plague (previously named "rainbow") skink (*Lampropholis delicata*) and the Argentine ant (*Linepithema humile*).

Plague skinks, which were first detected in New Zealand (Auckland) in the 1960s, have a reproduce rate almost five times as fast as most of the New Zealand native skinks and appears to outcompete native skinks for habitat and resources (Peace, 2004). This species was first detected on GBI in April 2013 at Tryphena Wharf, Shoal Bay (Wairepo, 2013). All other sites on the islands that were surveyed were free of plague skinks in the 2015 survey (M. Wilson, Personal Communication 26 August, 2015). Control of these skinks has proven to be very difficult (J. Wairepo, Personal Communication 26 August 2015).

Argentine ants, which were first detected in Auckland in 1990 (Ward & Toft, 2011) and are now widespread in the north of North Island (Ward, 2011). They can cause significant impact on horticulture and apicultural production, risk of disease transmission, potential chick mortality in commercial and native bird species, destruction of native invertebrate species and cascade effects of ecosystem function (Landcare Research, 2015). They were first detected on GBI in several sites (Mulberry Grove, Medlands-properties at Southern end of Sandhills Road including the DoC campground, Ocean View Road, Rivendell Nurseries on Masons Road and Barrier Builders, Omanawa Lane) early in 2006 (J. Warden, Personal Communication, 4 July 2016). Towards the end of 2006 it was deemed feasible that these incursions could be

eradicated. This was implemented using a DOC/Auckland Regional Council partnership that relied heavily on volunteers. Due to the extent of the area, 'Envirokiwi' (Environmental Contractors, GBI) were contracted to support this work in the 2007/2008 season. By the 2012/2013 season, significant headway had been made with no Argentine ants detected at the Medlans Beach/Sandhill Road site and reduction and fragmentation of colonies elsewhere. Unfortunately, a new site was detected at Blind Bay Road, while substantially more ants were found at the Ocean View Road in January 2014. The 2014 monitoring of the Mulberry Grove incursion has shown that the colony has moved from one hotspot to another and then back again. In 2014, the Medlands Beach/Sandhills Road sites were found to be clear for the second year. No ants were detected at the Rivendell Nursery and Masons Road sites during this year's (2015/2016) monitoring (J. Warden, Personal Communication 4 July 2016).

Pathway management

To protect the islands in the Hauraki Gulf, such as GBI, it is critical to prevent the introduction, re-introduction and spread of invasive species, such as vertebrate pests and Argentine ants (*Linepithema humile*) and rainbow or plague skinks (*Lampropholis delicata*) (Bassett, et. al., 2016). As the eradication of an established invasive species is a very time consuming, resource heavy and often expensive job, the most cost effective strategy is the prevention of spread of these invasive organisms. As the spread of invasive species is often via human-mediated processes (Wilson, et al., 2009; Bassett et al., 2016), the public (residents, contractors and visitors), traveling to these islands risk transporting invasive species as stowaways in or on their luggage, supplies, materials and vehicles. Therefore, the management of human transport pathways; boats and planes, to the islands, such as those in of the Hauraki Gulf, is seen to be the most efficient mechanism for minimising invasive species spread (Wilson, et al., 2009; Bassett, et al., 2016).

An integral part of the management strategy implemented by Auckland Council is the assessment and education of passengers travelling to the islands of the Hauraki Gulf in relation to biosecurity risk to these highly valued islands and the actions that can be taken by individuals/businesses to reduce the risk of spread of invasive species. Auckland Council implements an Advocacy programme during summer under the Treasure Islands initiative with the aim of raising awareness of biosecurity issues within the Hauraki Gulf and how passengers might help to protect the unique islands. The desired outcome of this role is to initiate changes in behaviours of people travelling to these islands whereby implementation of actions to reduce biosecurity risk become routine behaviours. Representatives interact with passengers to assess the current awareness of passengers and provide information on current issues. The following report is a record of this advocacy role undertaken in the summer of 2015/2016.

Aims

- Promotion of the intrinsic values of the islands in the Hauraki Gulf through the Treasure Island campaign, raise awareness of biosecurity goals for the islands and provide information on the actions that can be taken to reduce the biosecurity risk to these islands.
- To determine the characteristics and biosecurity awareness of a sample of passengers travelling to GBI.

Approach

Passengers on (SeaLink: GBI, Belaire: Rakino, Fullers: Rangitoto) ferries to Great Barrier, Rakino and Rangitoto islands, Hauraki Gulf, were approached and engaged in conversation. Information was provided on the importance and values of the islands of the Hauraki Gulf and the importance of ongoing protection of these habitats, such as the prevention of invasive species incursion. An overview of these interactions will be provided.

During this conversation some basic data was collected on the demographics of the passengers, awareness of pest-free islands in the Hauraki Gulf, the biosecurity issues and actions that can be taken to reduce this risk for those travelling to GBI and Rakino islands (Appendix 1). Passengers travelling to GBI for work were also noted. The data was entered into an Excel spreadsheet and the resulting frequencies of answers to each question were described.

Findings

Advocacy Role

360 Discovery ferries were found to be outstanding in their biosecurity education of passengers. Staff were highly knowledgeable and highly motivated to communicate this information. 360 Discovery has a biosecurity focus, whereas Fullers has more of a commuter/commercial focus given the difference in islands that they service i.e. Fullers services Devonport, Waiheke, Coromandel vs. 360 Discovery has more of a tourist focus.

In general ferry passengers travelling to Rakino and Great Barrier island were open to discussion of biosecurity issues and appeared to be knowledgeable about the pest-free status of some of the islands of the Hauraki Gulf and actions that can be taken to

reduce the biosecurity risk to the islands. However, when flying to Great Barrier Island there is no biosecurity information available for passengers.

It was found that passengers travelling to Rangitoto were less open to conversation about biosecurity and were quite defensive even though the approach was tailored to be even more passive than our approach with passengers to Rakino and Great Barrier islands.

The short questionnaire proved to be a useful tool for opening dialogue between the Auckland Council representatives and passengers. It was completed in a conversational manner and tailored to different passengers in order to maintain valuable relationships between passengers and the Treasure Islands brand.

Questionnaire: Passengers travelling to Great Barrier Island:

A total of 96 surveys were completed with passengers travelling to Great Barrier Island between December 2015 and March 2016. It is important to note that this data is not without bias, therefore, is provided as description only as an indication of the situation under study.

GBI Passenger Demographics:

The data for the origin of all the passengers, the number of visits to GBI, the purpose of travel and the time on the island is shown in Figures 1-4 respectively.

12.5% of passengers were GBI residents, 52% were resident in the Auckland area, 15.5% were from New Zealand but outside the Auckland area and 19% were from outside of New Zealand (Figure 1). 34% of passengers had never been to GBI before, 15.5% had been once or twice, 11.5% had been three to five times and 39% had been more than 5 times (Figure 2).

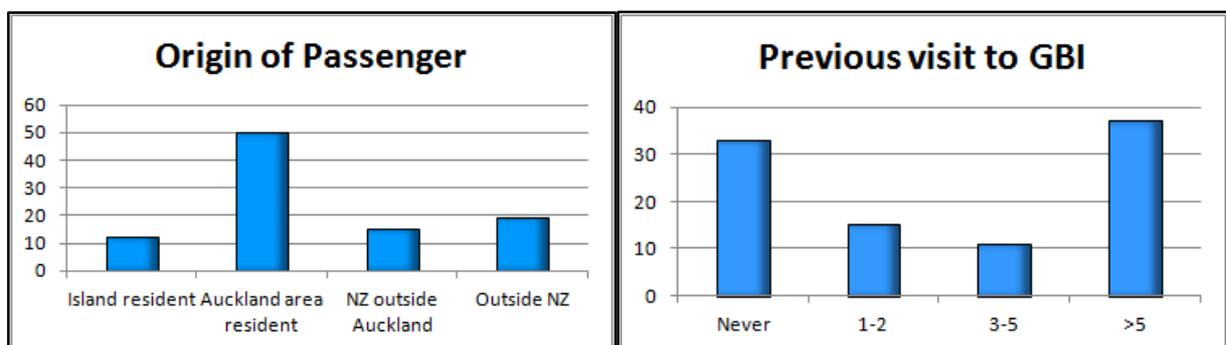


Figure 1: The origin of the 96 passengers surveyed on ferries to Great Barrier Island (GBI)

Figure 2: The number of previous visits made to GBI by the 96 passengers surveyed.

13.5% of passengers were island residents, 1% were day visitors, 8.5% were working and 77% were holidaying on GBI (Figure 3). 25% of passengers were staying for 1-3 days, 46% for 4-10 days, 8% for 11-21 days, 5% for greater than 3 weeks and 16% did not state how long they were staying on GBI (Figure 4).

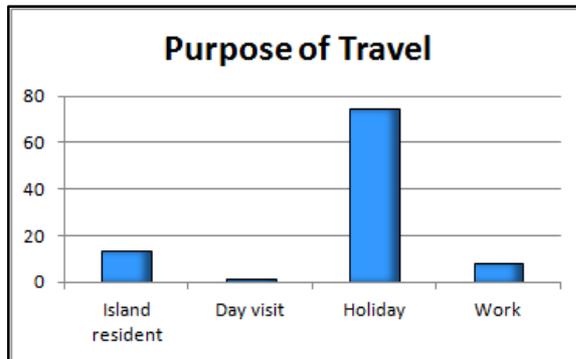


Figure 3: Purpose of visit to GBI of the 96 passenger surveyed.

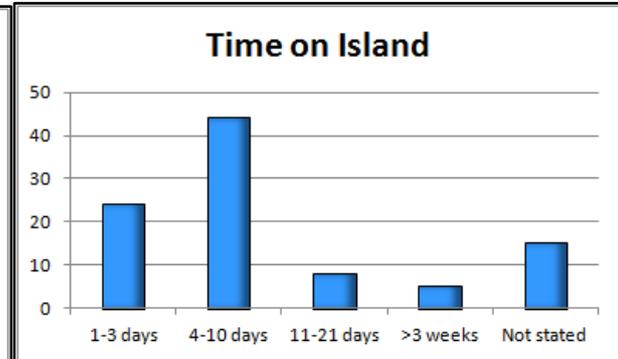


Figure 4: Length of expected stay on GBI by the 96 passengers surveyed.

GBI passenger biosecurity awareness:

92% of passengers were aware that some of the islands of the Hauraki Gulf are 'Pest-free', 16% of passengers said they took risk items to GBI and 84% knew that actions could be taken to reduce biosecurity risk (Figure 5).

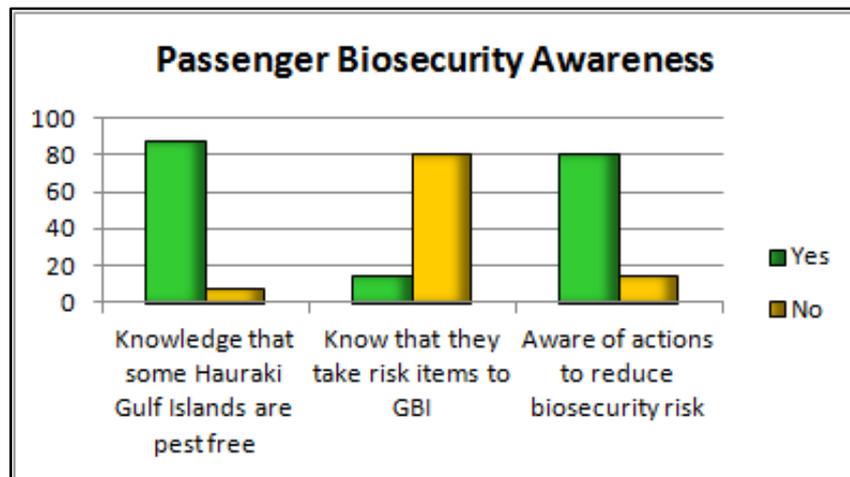


Figure 5: The number of passengers who knew that some islands of the Hauraki Gulf are 'Pest-free', who said they took risk items to GBI and who knew that actions could be taken to reduce biosecurity risk to GBI.

Of the 96 passengers surveyed, 15% were unaware of any actions to reduce biosecurity risk, 41% knew of one action, 35% knew of two actions, 9% knew three actions and 1% knew 4 actions (Figure 6).

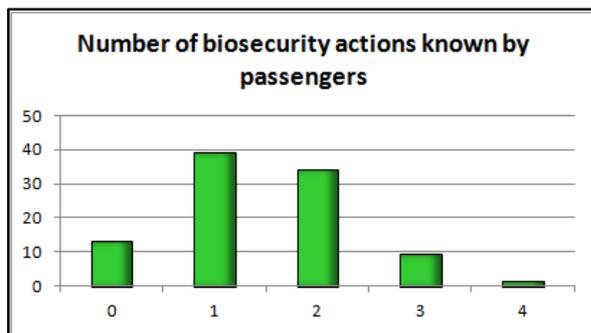


Figure 6: The number of passengers surveyed who knew zero to four actions that could be taken to reduce the biosecurity risk to GBI.

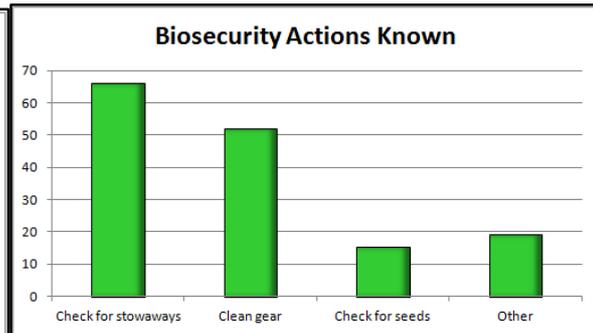


Figure 7: The number of passengers that stated biosecurity actions for reducing risk to GBI as 'Check for stowaways', 'Clean gear', 'Check for seeds' or another action.

Of the 81 passengers who knew of one or more actions that could be taken to reduce biosecurity risk, 81% stated 'Check for stowaways', 64% stated 'Clean gear', 19% stated 'Check for seeds' and 23% knew other actions to reduce biosecurity risk (Figure 7). The other actions that were mentioned by 17 individuals, 3 people stated 'proper storage of food and equipment', 'soaking of plants before transport' and 'care when buying plants and use certified nurseries' (or nurseries outside of major pest areas as technically, plant nurseries cannot become certified pest-free) was each stated three times, 'reading signs' and 'knowledge of pest/weed control programmes' was stated twice and 'minimising pets and rubbish', 'clean kayak at wharf', 'alert DOC to pests' and 'disinfect footwear for kauri dieback' were all mentioned once.

Passengers visiting GBI for work

Type of business

Of the 12 out of 96 passengers who were travelling to GBI for work purposes, 2 passengers were involved in each of 'Nursery/Gardening', 'Building' and 'Equipment amenities maintenance' business types (Figure 8). Other business types included an office worker, an environmental company employee, a trucker, a job seeker and a ferry worker (Figure 8). The assessed category of risk of materials being transported to GBI were 6/12 low risk, 4/12 moderate risk and 2/12 high risk goods.

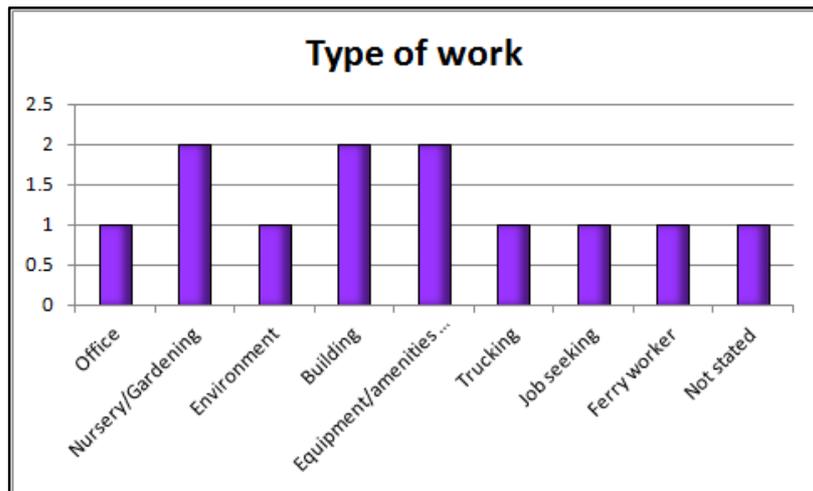


Figure 8: The types of business of passengers who were travelling to GBI for work purposes.

GBI Passenger Biosecurity awareness in relation to origin, including those travelling for work

A comparison was made of the biosecurity awareness of all passengers in relation to their origin as well as the awareness of those travelling to GBI for work (Appendix 2). GBI residents were shown to have a highest level of knowledge of pest-free islands (100%), risk goods (25%) and awareness of actions that could be taken (100%) compared with passengers from other origins (Figure 9). Knowledge of pest-free islands was also high for Auckland Area residents (90%), NZ residents outside of Auckland (93%), visitors from overseas (89%) and those travelling for work (83%). Awareness of actions that can be taken to reducing biosecurity risk was high in Auckland residents (84%) and NZ residents (93%) and relatively high for visitors from overseas (68%) and those traveling for work (75%) (Figure 9). However, awareness of carrying risk items was low in all categories (25%, 10%, 17%, 16% and 25% for island, Auckland, NZ residents, overseas visitors and those traveling for work respectively).

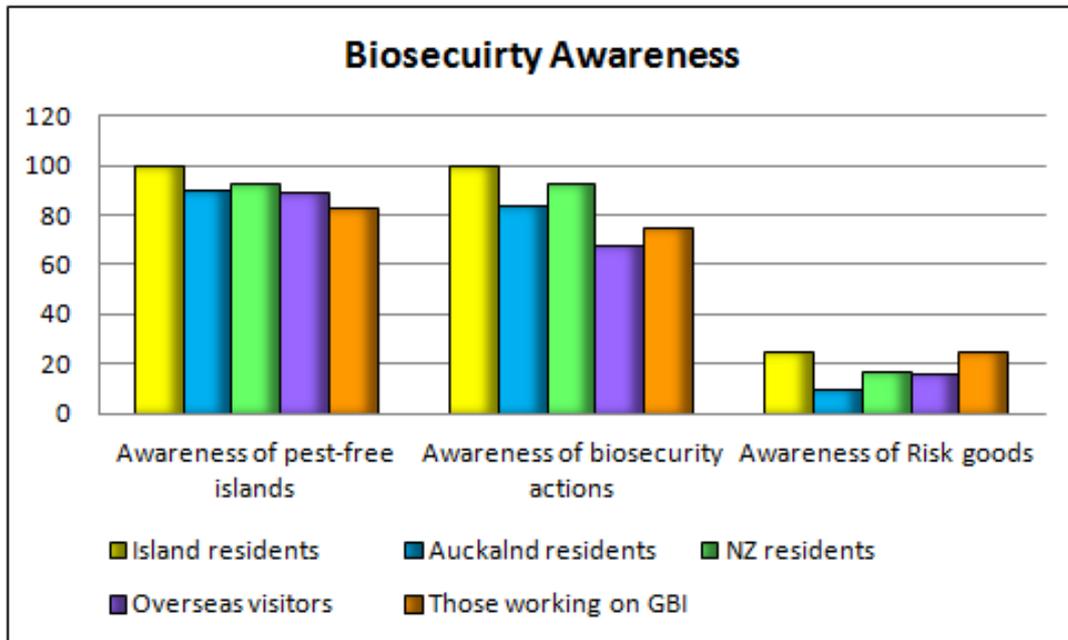


Figure 9: Percentage of passengers travelling to Great Barrier Island from different origins (Island residents, Auckland area residents, NZ residents outside of Auckland, Overseas visitors and those travelling for work) who were of pest-free islands, risk items and biosecurity actions.

All GBI residents stated knowledge of one or more biosecurity actions to reduce the biosecurity risk while 58% knew 2 or more actions (Figure 10). Although a % of passengers in other categories were not aware of any biosecurity; Auckland area 14%, other NZ residents 8%, overseas visitors 32% and those travelling for work 25%, substantial numbers of passengers knew of multiple (2 or more) actions that could be taken (48%, 26%, 47% and 67% respectively for Auckland area, NZ residents, overseas visitors and those traveling for work) (Figure 10). In all categories, checking for stowaways and cleaning gear was the most frequently stated actions to be taken with checking for seeds being relatively low (Figure 11).

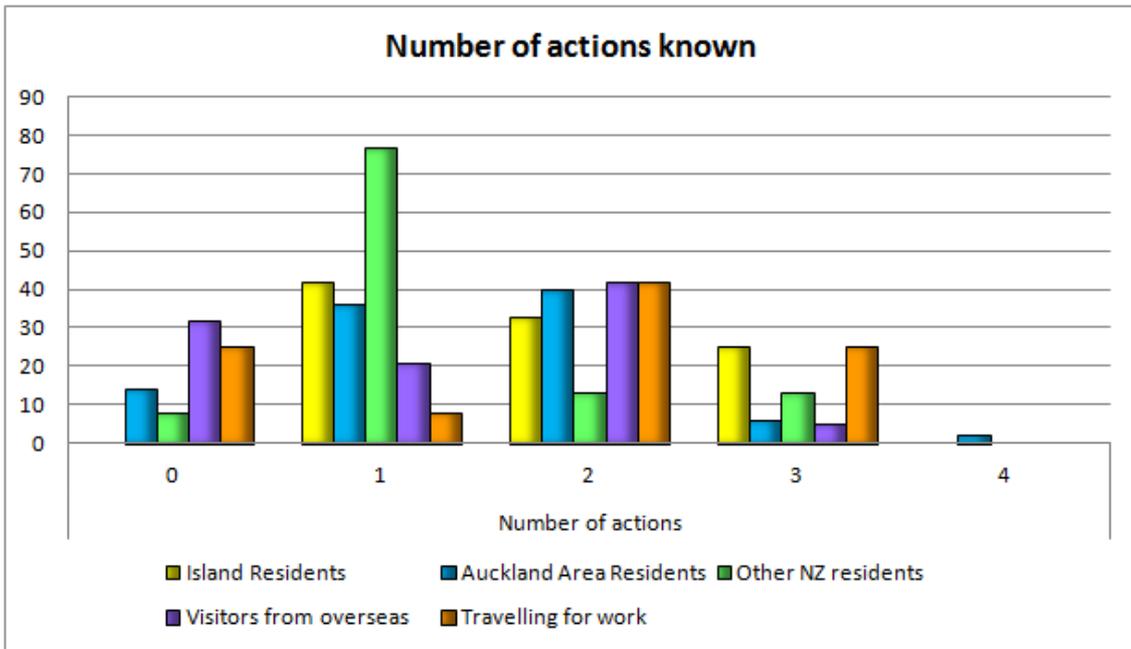


Figure 10: Number of actions to reduce biosecurity risk known by passengers travelling to Great barrier island from different origins (Island residents, Auckland area residents, NZ residents outside of Auckland, and Overseas visitors)

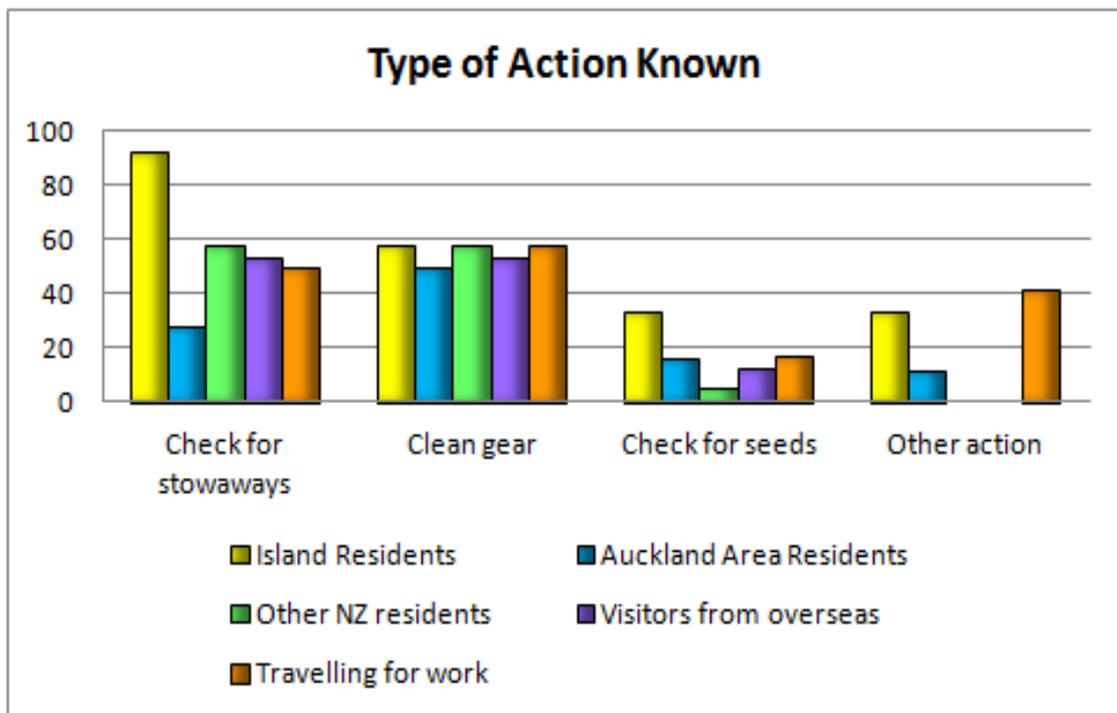


Figure 11: Type of action known to reduce biosecurity risk known by passengers travelling to Great barrier island from different origins (Island residents, Auckland area residents, NZ residents outside of Auckland, and Overseas visitors)

Questionnaire: Passengers travelling to Rakino island:

A total of 13 surveys were completed with passengers travelling to Rakino between December 2015 and February 2016. Due to bias in sampling, this data is only presented as a description as an indication of the situation.

Rakino passenger demographics:

The data for the origin of the passengers, the number of visits to Rakino, the purpose of travel and the time on the island is shown in Figures 12-15 respectively. Of those surveyed, the origins of passengers were similar for Rakino and GBI (Figure 12), although none of the passengers travelling to Rakino were doing so for work. Although the percentage of passengers visiting Rakino for the first time was about half of that of GBI, the majority (54%) had visited Rakino more than 5 times compared with 39% for GBI (Figure 13).

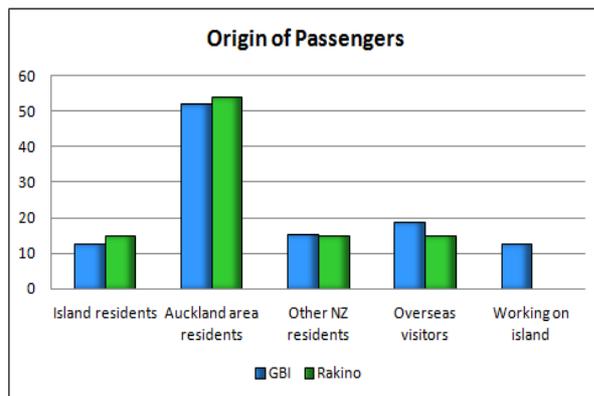


Figure 12: The percentage of passengers from different origins on ferries to GBI & Rakino islands.

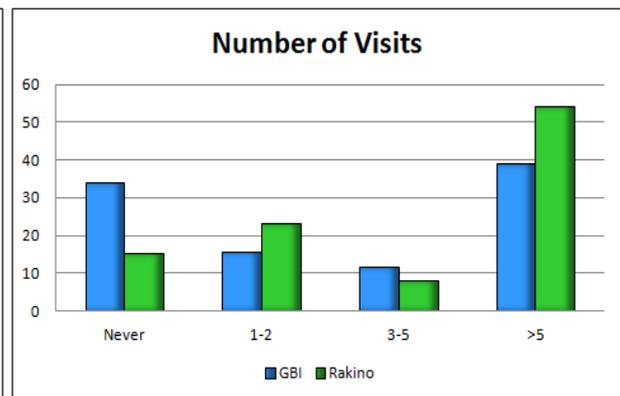


Figure 13: The number of previous visits made to Rakino by ferry passengers surveyed expressed as a percentage of total passengers to each island.

85% of passengers were holidaying on Rakino compared with 77% going to GBI (Figure 14). The length of stay on of passengers travelling to Rakino was 10 days or less and, unlike GBI passengers (Figure 15).

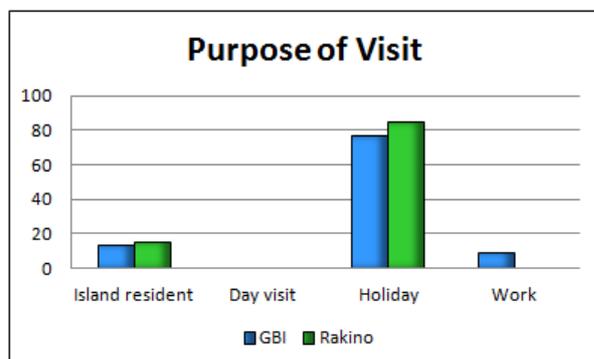


Figure 14: Purpose of visit by passenger to GBI & Rakino.

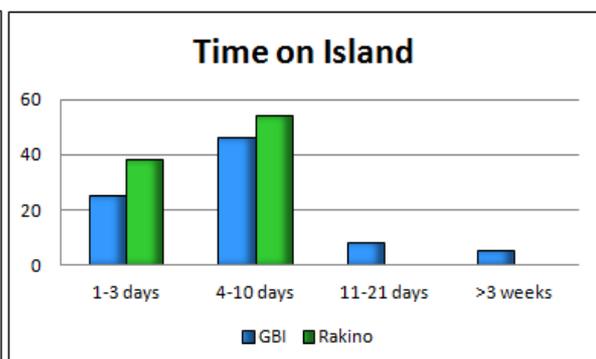


Figure 15: Length of expected stay on GBI or Rakino by passengers.

Rakino passenger biosecurity awareness:

77% of passengers were aware that some of the islands of the Hauraki Gulf are 'Pest-free', 31% of passengers said they took risk items to Rakino and 62% knew that actions could be taken to reduce biosecurity risk (Figure 16).

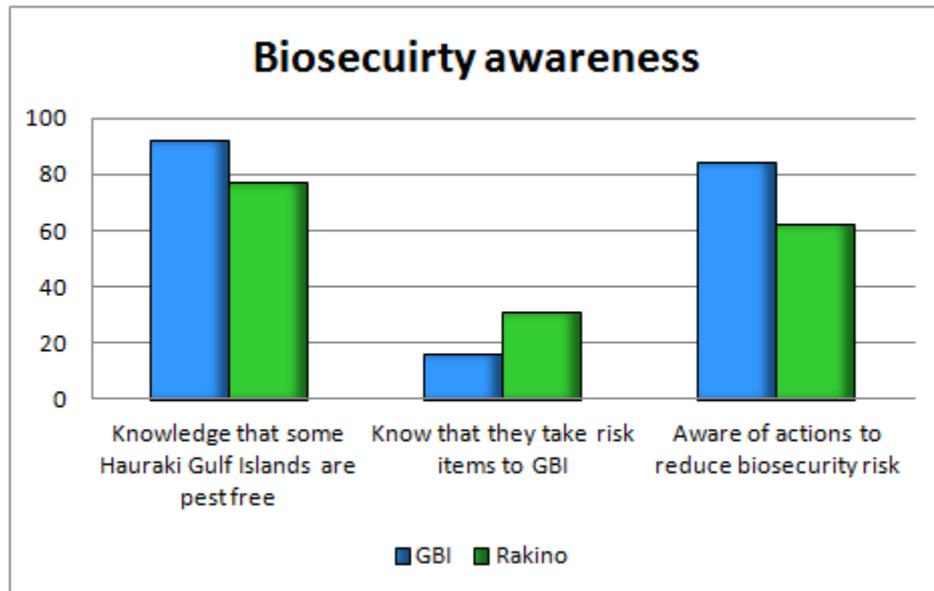


Figure 16: Number of passengers who knew that some islands of the Hauraki Gulf are 'Pest-free', who said they took risk items to GBI and who knew that actions could be taken to reduce biosecurity risk to GBI.

Of the 13 passengers surveyed, 31% were unaware of any actions to reduce biosecurity risk, 15% knew of one action, 15% knew of two actions, 38% knew three actions (Figure 17).

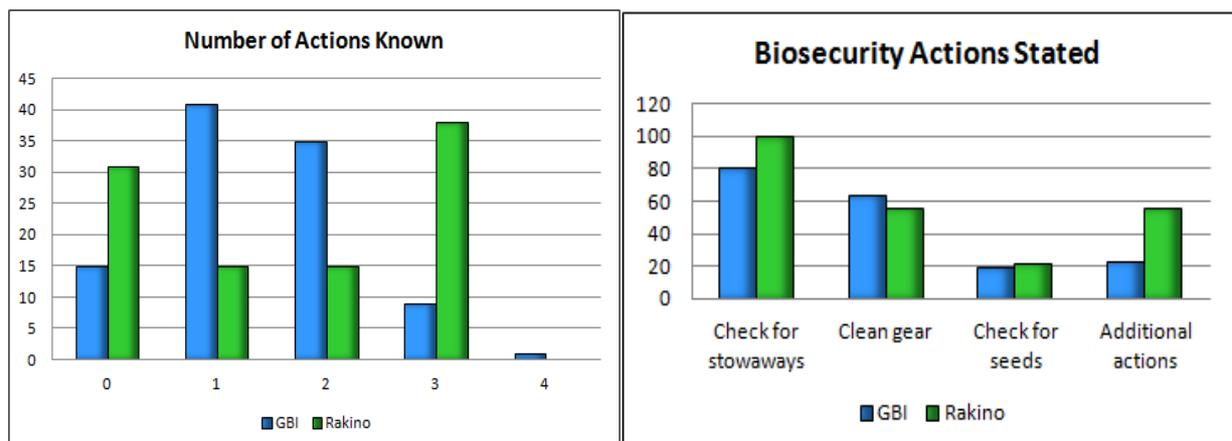


Figure 17: The number of passengers who knew zero to four actions that could be taken to reduce the biosecurity risk to Rakino.

Figure 18: The number of passengers that stated biosecurity actions for reducing risk to Rakino as 'Check for stowaways', 'Clean gear', 'Check for seeds' or another action.

Of the 9 passengers who knew of one or more actions that could be taken to reduce biosecurity risk, 69% stated 'Check for stowaways', 38% stated 'Clean gear', 15% stated 'Check for seeds' and 38% knew other actions to reduce biosecurity risk (Figure 18). The other actions that were mentioned by passengers included 'soak plants before transport', 'plants to be checked by skipper before journey', 'secure storage area for bags before boarding ferry' and 'sourcing plants from the island' by 17 individuals, 3 people stated 'proper storage of food and equipment', 'soaking of plants before transport' and 'care when buying plants and use certified nurseries'.

Comments:

Advocacy Role:

Overall, the Advocacy Role for the 'Treasure Island' initiative would appear to be extremely important for the transfer of knowledge regarding biosecurity and risk mitigation actions in the Hauraki Gulf. It is suggested that the Advocacy Role is vital for the ongoing development of relationships with residents and visitors to the islands, particularly inhabited islands such as GBI and Rakino islands. Saying that, it is extremely difficult to ascertain whether passengers have indeed implemented biosecurity risk mitigation actions rather than just having knowledge of these. Implementing behavioural change is known to be difficult (Bassett, et al., 2016). With the future proposals for GBI to be pest-free (Ogden & Gilbert, 2011), open engagement and communication with residents will be the fundamental issue for the success of this proposal (Bassett, et al, 2016). Bassett et al., (2016) also highlights that the material provided on biosecurity and actions that can be taken must be clear and simple to promote behavioural change.

It was perceived that passengers holidaying on GBI generally were travelling with a lot of luggage and vehicle(s) and but had fairly high levels of biosecurity knowledge while those travelling for work had materials/equipment and vehicle(s), had varying levels of knowledge and were coming from a range of risk level environments, e.g. office to weed covered yards. All passengers, particularly businesses using or coming from high risk industries can be considered high risk pathways. However, company representatives were very much aware of the reputation of the company.

The outstanding biosecurity message delivered by 360 Discovery ferries is highly valuable given the islands that they service. Rangitoto Island and neighbouring Motutapu Island are both pest free and have species requiring higher biosecurity practices than what are currently in place. This is particularly important due to a perceived lack of knowledge of the passengers on the Rangitoto ferry of biosecurity issues when visiting these islands.

The reduced openness of passengers travelling to Rangitoto Island is potentially due to the nature of the journey. Todd & Fraser (2015) reported that “Visitors to Rangitoto were often ‘spur of the moment’ travellers due to the easy access from Auckland.” These passengers were typically young family groups that travelled with open, unchecked, possibly old bags and dirty shoes that could have picked up invasive species such as seeds or harmful microbes. Their understanding of the biosecurity risk appeared to be limited, which supports the impression gained in the 2015/2016 season.

The survey proved to be a useful tool for opening dialogue with passengers. It was able to be completed in a conversational way and tailored to different passengers in order to maintain valuable relationships between passengers and the Treasure Islands brand.

Great Barrier Island Passengers: Biosecurity Awareness

Of the passengers surveyed, Auckland area residents (52%) were the most frequent passengers on the GBI ferries, with just over a third (34.5%) were resident outside of Auckland either within New Zealand or from overseas (Figure 1). Although a substantial number of passengers were repeat visitors to GBI, approximately one third (34%) were visiting the island for the first time (Figure 2). 77% of passengers were travelling to GBI for holidays (Figure 3) with the 71 % of those surveyed stating they would be staying for 1-10 days (Figure 4). In 2006 it was estimated that the total number of visitors to GBI (ferry and air transport and private boat) was 79,651 people (Norgrove and Jordan, 2006). With a total resident population of 939 people and a medium income of \$19,000 in 2013 (median income for New Zealand in 2013 was \$28,500) (GBI Community Health Trust (2016), tourism is an important income source for island residents.

It would appear that GBI residents have a high level of knowledge of pest-free islands in the Hauraki Gulf and actions that can be taken to reduce the biosecurity risk to these islands (Figure 5). In 2003, The Great Barrier Island Charitable Trust (GBICT) advocated that rats and other mammalian pests should be eradicated from the island for the protection of native biodiversity (Ogden & Gilbert, 2011). Although this has yet to gain the approval of the whole community on island, knowledge of residents about the environmental protection is high (Ogden & Gilbert, 2011).

The level of awareness also appears to be high in residents visiting GBI and Rakino in the Auckland area and NZ residents outside of Auckland. However, from anecdotal evidence, this would appear to be related to the island being visited as there appeared to be little knowledge of biosecurity issues of passengers traveling to Rangitoto. Surprisingly, knowledge also appeared to be high in the case of visitors from overseas (Figure 9). Activities for visitors to GBI include walking & tramping, bird watching,

fishing, swimming and surfing (Auckland Tourism, Events & Economic Development Limited, n.d). As such, it is suggested that the people visiting GBI are more engaged with the environment and are, therefore, more aware of the issues of island biosecurity.

As the number of previous visits by passengers to the island increases, it may be hoped that the level of biosecurity knowledge is increased. There is substantial amounts of information regarding these islands and island biosecurity available to passengers in many of the steps to reaching the islands. Using Great Barrier Island in this example, there is a link to the Treasure Island's website when booking a ferry trip through SeaLink, on many of the websites found via a simple "Great Barrier Island" Google search, signage at the point of boarding, announcements by crew on ferries and brochures and posters on board the craft. However, there is still the issue of whether this information is implemented as behavioural action to reduce biosecurity risk to the islands.

GBI Passenger Biosecurity Risk

Due to the apparent high level of biosecurity awareness shown by those passengers surveyed, it may be assumed that the level of risk is relatively low. Island residents potentially pose the lowest threat due to their level of awareness which included knowledge of sourcing plants from certified nurseries and soaking them in water before transport. However, it would appear that the knowledge of risk items by all passengers was low (Figure 9). This may indicate that although passengers were aware of issues, they were not aware as to how this transposed into materials and goods being transported to the islands. However, due to the bias in methodology this is only an indication of what might be the case in reality. As such, this may reveals a major gap in the knowledge of passengers and, therefore, a significant potential pathway for the transport of invasive species. This highlights the need for ongoing Advocacy role for biosecurity education. Although all passengers pose a risk of transporting invasive species, high risk items, such as plants and building/construction materials, are still seen to be the most likely vectors for spread of invasive species such as argentine ants, other ant species, plague skinks and Kauri dieback. Therefore, management of the pathway by the assessment of these goods prior to transport would appear to be the most efficient means of controlling further incursions of these species.

Rakino Passenger Demographics and Biosecurity Risk

The large proportion (54%) of passengers to Rakino island were from Auckland, were repeat visitors on holiday who stayed for less than 10 days at a time (Figures 12-15). Although knowledge of Pest free islands was relatively high (77%), only 60% knew of

actions to reduce biosecurity risk (Figure 16). It is suggested that advocacy and education of passengers to Rakino would improve their knowledge and reduce the biosecurity risk to this pest free island.

Suggestions & Comments:

- It is suggested that the management of pathways to the islands of the Hauraki Gulf is increased by the implementation of control measures for the movement of high risk products to these islands (e.g. soil, plants, building materials). This may potentially include approved inspection or treatment before transportation.
- It is recommended that a comprehensive and scientifically robust survey of passengers on Hauraki Gulf ferries is conducted in order to gain a more accurate representation of biosecurity awareness of passengers travelling to the islands in the Hauraki Gulf.
- A comparison of a residential island and a visitor island could be interesting to see if there is a difference in biosecurity awareness between the two passenger categories.
- The lack of biosecurity awareness of passengers to Pest free Rangitoto island is of major concern in the prevention by re-incursion of pests. This urgently needs attention.
- Ongoing education/advocacy of ferry passengers in the Hauraki Gulf is vital for the potential to inform and change behaviours for the protection of these unique islands. This is increasingly important for potential future pest eradication attempts on inhabited islands in the Gulf.
- It is suggested that more biosecurity 'enforcement' from ticketing agents at time of sale to ensure biosecurity gaps are covered by the passengers themselves. This could help to engage and educate, as well as place accountability and responsibility on passengers.
- Language barriers were only encountered with passengers travelling to Rangitoto, however, it is suggested that the biosecurity information pamphlets could be printed in other languages.

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Appendix 1: Biosecurity Summer Student Survey 2016

Auckland Council Biosecurity/Unitec Summer Studentship 2016:

Island: _____

Date: _____

1. Have you been to this island before?

YES NO If yes how many times: _____

2. Where do you live?

Island Resident
Auckland & area resident
NZ outside Auckland
Outside NZ From: _____

3. Travelling group:

On own
Group Family: Friends:
Group size: ____ Ages: Under 5 x ____, 5-12 years x ____, 13-18 years x ____,
19-35 years x ____, 40-60 years x ____, over 60 x ____

4. What is the purpose of your trip today?

Island Resident **Go To: Q7.**
Day visit **Go To: Q7.**
Holiday **Go To: Q6.**
Work **Go To Q5.**

5. If work, what type of work will you be doing? _____

5a. What equipment / materials are you taking with you? _____

5b. Can you please tell us which company you represent and where you are based?

6. How long will you be on the island? Number of days/ weeks: _____

7. Are you aware that some of the islands of the Hauraki Gulf are Pest-free?

YES NO

8. Do you take any risk items to the island?

9. Are you aware of what you can do to reduce the risk of invasive species being spread to the islands

YES NO

Actions: Check for stowaways Clear gear Check for seeds
Use certified nursery for plants

Appendix 2: Responses to knowledge of pest-free islands, the carrying of risk goods, awareness that action can be taken, the number of actions known and the frequency of specific actions (check for stowaways, clean gear, check for seeds and other actions) known by passengers surveyed on ferries to Great Barrier Island (summer 2015/2016).

		Island Residents (n=12)(%)	Auckland area residents (n=50)(%)	NZ residents outside Auckland (n=15)(%)	Visitors from overseas (n=19)(%)	Traveling for work (n= 12)(%)
Know of Pest Free Islands		100	90	93	89	83
Carrying Risk items		25	10	17	16	25
Awareness of actions		100	84	93	68	75
Number of Actions known	0	0	14	8	32	25
	1	42	36	77	21	33
	2	33	40	13	42	33
	3	25	6	13	5	8
	4	0	2	0	0	0
Check for Stowaways		92	28	58	53	50
Clean Gear		58	50	58	53	58
Check for seeds		33	16	5	13	17
Other		33	12	0	0	42