



TAWHARANUI OPEN SANCTUARY SOCIETY INC.  
Newsletter No. 57 June 2016



A pied fantail keeps an eye on passer's by who might stir up insects in Ecology Bush.



Park visitors enjoy warm autumn days at Anchor Bay.

## Coming Events

Sun 3 July 9.15am. Sunday in the Park. Planting followed by BBQ.

Sun 7 August 9.15am. Sunday in the Park. Planting followed by a BBQ.

Sun 4 September 9.15 am. Sunday in the Park. A range of tasks followed by a BBQ and AGM.

## Volunteer Days

Tuesdays 9am The nursery team meets at the Tawharanui nursery. If you would like to join this dedicated team  
Contact: Ray Blackburn 425 4995 [magsandray@gmail.com](mailto:magsandray@gmail.com)

Thursdays 9am A small group of volunteers meet at the Vol Hole for interesting track and maintenance work.  
Contact: Roger Williams 425 9127 [port.williams@clear.net.nz](mailto:port.williams@clear.net.nz)

Volunteer checking (to be done in your own time) See inside of the back page.

## Chair's Report



As advised in the previous newsletter, the Committee recently sat around a table to ponder on what TOSSI does and how we do it. Thank you to the members who contributed to our discussion by forwarding their own thoughts.

This is the beginning of a process not the end; we talked and laughed and disagreed and all-in-all I have to say it was a pleasure to spend an afternoon with such thoughtful, dedicated, like-minded people, who also happened to bring awesome food to share afterwards.

We came up with various ideas, all aimed at ensuring TOSSI remains a vibrant, fully functioning organisation. The key to this is seen as looking after our existing membership, and at the same time aiming to grow both absolute numbers of members, and the level of active participation by people who desire to do so. We also acknowledged that, especially on planting days, there are many supporters of

the Open Sanctuary that are not TOSSI members, and that is OK too.

You can expect to see upgrades to our website, and progress of the development of our social media presence rolling out over the next few months.

We do not work in a vacuum; there are lots of other organisations that intersect in various ways with TOSSI, and we aim to improve our relationships with these groups.

We agreed it is important to have a scientific assessment of the results of the previous 14 years of TOSSI work, and so aim to fund a baseline survey to gauge progress to date, and inform future habitat development and species reintroductions.

We formally agreed to include the Tawharanui Marine Reserve in our Memorandum of Understanding by adding 'and surrounding water and territory' to our place of work. We concluded the constitution allows it as 'incidental or conducive' to the development of the Open Sanctuary.

We aim to improve our facilities for hosting educational visits by upgrading the Sanctuary Hut at Anchor Bay.

All this while continuing to grow 20,000 plants a year, maintain our vigilance with fence checking and baitlines, and host monthly workdays and the weekly building team and so on. No small task.

Most of the committee, and a few other members, are either completing or renewing first aid qualifications to assist in keeping you physically safe on the park. After two days of first aid training I indulged in a few Writers Festival events. The following quote has stuck in my head:

*"It is not only a wild nature that we need as human beings; it is the untamed open space of our imaginations."*  
Jeanette Winterson 'Why be Happy When You Can be Normal'.

Without the untamed imagination of our committee, both past and present, we would be struggling to further develop the wild nature of the Tawharanui Open Sanctuary.

The AGM will be held in September, before the next newsletter is published. I encourage you to make the effort to attend. The Annual General Meeting is the main forum for you to share your own ideas that have formed deep in the untamed open space of your imagination. And if you haven't got any, come and say thanks to those that are doing their best on your behalf. Ngaire Wallen [wallen03@gmail.com](mailto:wallen03@gmail.com)

## Open Sanctuary Senior Ranger update



"Thank goodness for mice and rabbits!" is not a phrase you'd expect to hear a sanctuary manager say out loud very often, but it certainly rings true for me at the moment. Why would that be? We have a stoat (or other member of the mustelid family) at large within Tāwharanui Open Sanctuary at present and as best as we can tell it is subsisting on mice and rabbits as its primary prey. We can only guess this but our guesswork is backed up by the continued presence of many of our predator vulnerable species such as pateke, saddleback, kiwi and takahē.

We have a proud track record to date of detecting and removing pest incursions before they result in biological harm. Typically we will see something like six rats, a bit more than one possum and around one mustelid per year enter the sanctuary. Of the 15 mustelids (7 stoat, 8 weasels) detected since pest eradication in 2004, all but three have been first detected as found dead in a trap. The remaining three were trapped successfully soon after detection. Our current stoat is unwilling to engage with any of

our 'standard' surveillance and protection tools such as tracking tunnels and trap boxes. So, if it won't come to us, then we must go to it.

The NZ conservation and sanctuary industry is a fairly close knit family where there is a wonderful culture of camaraderie and support. I have felt very blessed and extremely well supported by going to my network, who in turn contacts their contacts, and before you know it you have many hundreds of years of pest and wildlife management experience and many sharp and determined minds scheming up how best to catch that stoat. Everyone knows exactly what is at stake.

Pest detection dogs are one of our best tools to locate where the animal is or has been, particularly if it leaves no other sign. Park Ranger Lois Clayton has been part of the national Conservation Dog programme for a decade and recently her mustelid dog Gecko has joined our Ranger team. Stoats can range very far and wide, often travelling 10-15km or more in 24 hours, so picking up 'last known whereabouts' can really help target our efforts.

Understanding animal behaviour is important in any attempt to catch or observe them. In a location such as Tāwharanui Open Sanctuary it is hard to imagine any stoat would be very hungry for very long due to an abundance of mice and rabbits as well as a range of native wildlife as prey items. What it does lack though is social interaction with mates, competitors etc. To this end we are attempting to lure this animal to us using scented bedding material from captive stoats and prey species such as rats. We're also attempting to broadcast sound lures of other stoats or again prey species without 'training' the invader to look at wildlife such as saddleback as potential prey.

New Zealand has a great record of conservation management based on science and applied management. The network I refer to above can readily access data and studies relating to what we know and what we don't, or have not yet tested. To this end I can make informed decisions about what to use in the field to best attract this animal. This includes information such as ranging, breeding biology, responses to sounds and scents, relative attractiveness of various baits and how this changes as baits weather and degrade in traps over time. At the same time I must be mindful that science learning is derived from aggregated results and how 'most' animals respond. So it is incumbent to also look to the margins for techniques that may not appeal to most stoats but may be attractive to ours.

Maintaining the pest free status of Tāwharanui Open Sanctuary is our highest priority. Along with fence checkers we have regular surveillance trappers, tracking tunnel runners, weedbusters, rabbit shooters, poisoners and burrow fumigators; all of whom play in an important role in protecting the regionally and nationally significant conservation gains achieved to date. If you'd like to be part of this please get in touch, we have tasks suited to all abilities and skills. The rewards are there everyday on park in the wildlife that surrounds you and the thousands of visitors enjoying their heritage that you protect.

With kind regards, Matt Maitland. I can be contacted at [matt.maitland@aucklandcouncil.govt.nz](mailto:matt.maitland@aucklandcouncil.govt.nz) or 09 426 1200



## TOSSI visit to SOSSI Nursery

A group of TOSSI nursery volunteers recently visited Shakespear Regional Park to see how another volunteer managed regional park nursery was run. Nursery manager Margaret Chappell explained how she runs the nursery, and showed us the various stages of raising the plants to the stage where they will tolerate the exposed conditions experienced once planted out on the park, a peninsula very similar to Tawharanui.

The SOSSI group have a Tuesday " park " day, where Margaret uses some members to do nursery activities and the Auckland Council ranger staff use others to assist in various activities around the park, similar to Tawharanui's " Sunday in the Park " day.

We had a barbecue lunch laid on for us by the volunteers, all resplendent in their SOSSI logo shirts, and we came away impressed by their facilities. Our thanks to Matt Maitland for organising the Auckland Council van for our use. Kerry McGee TOSSI



Margaret Chappell (right) SOSSI shows TOSSI visitors the Shakespear nursery.



Margaret shows a cage for growing kowhai. This is to protect them from a pair of native pigeons who learnt to work together and climb over fenced barriers and gobble the new shoots.



An excellent barbecue lunch was provided in very functional surroundings.



In error I missed a postponement notice of the visit and went a week early. Margaret gave me a special tour but on route a volunteer with a cheeky grin called me a "spy"! Had I been quicker I could have replied with "deserter". It was Les Cave an ex Tawharanui chairperson who now volunteers for SOSSI. Alison Stanes Editor

## Step Lightly

TOSSI has recently joined the world of *malacologists* (snail researchers).

Research published in 1981 stated New Zealand has at least 520 species of native land snails and slugs (Solem, 1981). An article in the QEII National Trust Open Space magazine (October 2015) that sparked our interest in this subject states there are at least 1,300 micro (1-9mm) snail species in New Zealand, of which over 600 are listed by DOC as being of 'conservation concern'. Written by Dr. Karin Mahlfeld, DOC's Honorary Land Snail Ranger based in Wellington, it encouraged owners of native forest areas to contact her regarding collection of samples to see just what was living in all that leaf litter.

Leaf litter 'grabs' show that "an essentially sympatric (originating in or occupying the same area) community of about 72 native species is a probable reality, whereas in most areas of the world the sympatric existence of more than 15 land snail species is highly unusual." (Solem, 1981). Even the rainforests of Australia are way behind us on diversity – coming in at 20 - 30 snail species per sample. Something to drop into conversation after exhausting the latest rugby and cricket results.

The authors of the 1981 research paper attribute the high number of species to the leaf litter of our forests staying within an even moisture level; they suggest stress periods where there are one or two months with no rain would result in mass snail mortality, while much of our remnant forest is not particularly prone to flooding.

Snail diversity is highest in northern New Zealand, with populations also affected by land management – comparisons between reserve land, fenced bush and unfenced remnant forest showed that reserves had 40% more species, fenced bush 30% more than unfenced, and unfenced had 75% fewer individuals than reserves (Open Space, QEII N.T., Oct. 2015).

After obtaining approval from Matt Maitland, Open Sanctuary Senior Ranger for Auckland Councils Northern Parks, TOSSI's Kerry McGee rose to the invitation to help with research data by collecting leaf litter samples from Tawharanui and sending them in for analysis. Our first results from three samples showed 27 different species, and a total of 510 individual micro-snails. Sample collection is on-going and is being taken from a variety of habitats throughout the park. Currently we have recorded 62 different species of micro-snail within the park.

If you are interested in participating, contact Dr Karin Mahlfeld [kmahlfeld@gmail.com](mailto:kmahlfeld@gmail.com) for instructions.

When walking on leaf litter at Tawharanui or in any other native bush you may well be trampling a community of tiny snails that no one knows exists. Any caution you may exercise with this in mind in no way applies to the common (introduced) garden snail that remains fair game, particularly in the veg. garden.

Tawharanui is host to a variety of research projects, many of which continue over a number of years. We continue to monitor seabird and shorebird populations, a number of different reptiles and the endangered species that have been introduced to the park. These research opportunities are a direct result of the benefits of a protected sanctuary and the thousands of volunteer hours that keep it safe. Kerry McGee TOSSI

### References:

Solem, 1981 – Solem, Climo, Roscoe <http://dx.doi.org/10.1080/03014223.1981.10427971>  
QE II 2015 – Queen Elizabeth II National Trust, Open Space, Issue 89, October 2015



## The Season's Planting is under way



5000 plants leave the nursery heading for the plant site beside the West End Road. In the photo Jim McGlashan and Ray Blackburn had a very big day shifting plants out of the nursery while Maggie Cornish checked plants off the list.



Auckland Council staff from the Planning Office had a day out helping rangers and volunteers get the plants on to the site. We grateful for groups such as these to help get the plants out.



Stalwart nursery volunteers Ngaio and Liz take a well deserved time out from the strenuous task of placing out plants.



Kim and Roger Grove sporting the new TOSSI tee shirts return down the slope after putting out plants.



Sunday 5 June planting gets underway. 120 volunteers arrive to plant out 5000 trees beside linking plant sites together forming a corridor of vegetation.



## Planting beside West End Road



Two families each with three generations worked together on the warm sunny slope.



With these new TOSSI high viz jackets it is not so easy to sneak off and have a nap behind a bush anymore!!

Pulling back the dead kikuyu may have slowed us down but it did not stop the determination and by lunch time all the plants were in the ground.

## Kiwi Monitoring

Four kiwi monitoring sessions were successfully completed recently. Volunteers listened from 6pm till 8pm in six designated sites and noted down details of each kiwi call that is heard. While there is a need for lots of warm clothing, everyone seemed to enjoy the experience and a total of 264 calls were heard, a result that shows a steady increase of kiwi in the park. Sally Richardson TOSSI Committee

After kiwi listening counts I walked out to Takatu point and saw more than 10 kiwi, however most of the sightings were in the wetland. The only one who wanted to have her photo taken was in Ecology Bush. I did not know they snorted and snuffled so much - so cute! I left at 3am with a big smile.

Shaun Lee TOSSI Volunteer



If you plan a very late night adventure looking for kiwi please check the signage at the park entry first as there are occasional night operations including pest control. You are there at your own risk. Please keep to the tracks and don't attempt to follow any kiwi you might see. Kiwi do not see colour. They only see tones of light so please do not use a flash for photography as their eyes are very light sensitive and can be easily damaged. It is best to use a red torch light or cover the torch with red cellophane and then the kiwi hardly notice that you are there. Alison Stanes Committee

## Volunteers from Simpson College Iowa

We recently had a visit from twenty students and three faculty members from Simpson College In Iowa, who were supported by two Pacific Discovery Leaders. Pacific Discovery is a New Zealand company that runs experiential education programmes for North American University students. An important component of these programmes is volunteer work. All the students were from the Sports Science Faculty and were very fit, unfailingly positive in their attitude and eager to help.

Over two days the students tackled a huge range of tasks including maintenance on the Pest Proof fence, planting grasses in M16 wetland, clearing tracks, mulching planting beds and the installation of storm petrel nest boxes at Marine Triangle.

The group had lunches at Anchor Bay and Marine Triangle, explored the beach and rocks at Anchor Bay, walked in the Ecology Bush and generally saw quite a bit of the Park. I hope that they all gained an understanding of the complexity of nature conservation in New Zealand and saw some good bush, birds and beaches. Most of the group also managed to spot takahe at Mangatawhiri Wetland.

I was very grateful for the help of Roger, Karyn, Ray and Keith in taking charge of groups of students. Thanks also to AC Rangers Maurice, Ngaio and Lois for chipping in and providing great back-up.

A big thank you to Simpson College and Pacific Discovery for all their help. You can see pictures of their efforts. James Ross TOSSI Committee

### Nursery Report --- May 2016

Finally we've finished bagging the last of our plants for the impending planting season, about 15,500 for bulk plantings and another 2,500 for infill and special purposes. We're a month or so behind where we would feel comfortable but as long as the growing conditions remain good we should be okay.

A few highlights from the nursery shed. We've managed to raise a lovely crop of little kauris, a first for us. Kerry and his team have done the impossible by raising some forest Ghania. Even the Botanical Gardens had difficulty with them! We've always had problems raising pomaderris, but Keith found by etching the seeds in battery acid and planting them in clay our results improved dramatically.

The planting season has already begun with 1,500 grasses and 200 mixed trees and shrubs put into the last remaining bit of M16. The first scheduled public planting day is on June 5<sup>th</sup> followed by July 3<sup>rd</sup> and then August 7<sup>th</sup>. See you on a hillside sometime soon! Please remember to make sure your boots and spades are clean, every year we come across strange garden plants emerging in the newly plantings. Ray Blackburn TOSSI Committee

### New Moon Rituals

During the long dark nights of autumn and winter, once a month, as close to the new moon as possible, there is a gathering at Tokatu Point. Using strange incantations they lure ghostly seabirds where they are caught, measured and banded - then released.

The seabirds - grey-faced petrels - have been increasing in numbers around Tawharanui for several years but just how many there are is still unknown. The survey nights help us work that out the population by comparing the number of unbanded birds caught with the number of banded birds. Last year we caught 113 unbanded birds and had 23 recaptures. So far this year we have already caught 50 birds in total with 13 of these previously banded. In fact, the May session was so busy that we ran out of bands!

Almost all of the re-captures are birds that have been banded at Tawharanui over the past seven years - some have been re-caught several times now. There have been three exceptions: a bird that was translocated as a chick to Limestone Island near Whangarei in 2006, a second that was banded as a chick at Bethells Beach in 2008 and the third from Moutohora Island in the Bay of Plenty as a chick in 1996 - that's twenty years ago!

It already looks like being a busy season at Tawharanui with large numbers of birds and lots of activity around nest-boxes and natural burrows. In the next month the breeding grey-faced petrel will head out to sea to feed-up before laying a single egg in July. James Ross TOSSI Committee

Grey-faced petrel. The white stripe of twink on its head is to show that it has been already caught and processed that night.





## Simpson College Volunteers



The Simpson College students completed numerous tasks. Here they relax at Tokatu Point after a morning of track trimming.



"Ray of sunshine and his three conservation angels" was the caption given for this image! Three Simpson College students with Ray Blackburn, TOSSI.

### TOSSI volunteers remove calstegia from kahikatea plantings



Calstegia a native convolvulus is an annual that consumes slow growing kahikatea plants in Mangatawhiri Wetlands. TOSSI volunteers have been very dedicated in removing it each season. However, help is on the way in the form of carpet squares to go around the base of each tree which hopefully will slow the calstegia down.

### TOSSI volunteers repairing the feathered ends of the Pest Proof Fence



TOSSI Volunteers uncover the feathered ends of the pest proof fence, that guide critters into traps, after a storm buried them.

## Radio-tracking young robins at Tawharanui

North Island robins were reintroduced to Tawharanui from Tiritiri Matangi Island and Puhoi in 2007. As part of ongoing annual monitoring, robin nests are located and chicks are banded on the nest. The robins have been breeding well with a large number of chicks being banded on the nest each year. However a recurring puzzle has been low annual recruitment. This means that only a few of the chicks born each year have stayed within the park to breed the next season. The 2014-15 breeding season data showed that of the 135 chicks banded, only 14 stayed in the park! The main theory behind this low recruitment has been that they disperse inland.

During the 2015/2016 breeding season I have been working with Tim Lovegrove, Kevin Parker and Richard Chambers monitoring the robins at Tawharanui. My work has been focused on monitoring pre- and post-independent juveniles. I have been collecting resighting data for the first 4 weeks after the chicks fledge and leave the nest, as this enables an estimate of juvenile probability of survival until independence. I have also been collecting radio telemetry data for post independent juveniles. We started with 16 transmitters, each with a battery life of 6 weeks. The transmitters were attached when the juveniles were between 40 and 60 days old.

There have been a few challenges. We had 3 birds drop their transmitters. Practice makes perfect and it took a few attempts to get the elastic on the transmitters to the correct tension so that they didn't fall off, but also weren't too tight, as tight harnesses could potentially harm the birds. Unfortunately there were some fatalities, and four juveniles with transmitters were found dead. These birds have been sent to Massey University for post mortem and further testing. These losses might not be attributable to the radio-tagging and could explain why such a small proportion of the young robins that fledge at Tawharanui are recruited the following year. Despite these losses, I gained some very valuable data on robin movements within the sanctuary. The tracking data shows that they move freely between Ecology, Takatu, Possum Gully and the South Coast areas of bush. Interestingly, no juveniles were tracked out of the sanctuary! A summary of the 20 birds that were radio-tagged is provided in the accompanying table.

### Summary of young robins radio-tagged at Tawharanui during the 2015-16 summer

Note: Of those that 'stayed within the park' not all of them were tracked for the full 6 weeks as some were carrying transmitters that were re-used with partial battery life.

Number	Robin Band Combinations	Fate
1	RM-PO	Tx dropped after 18 days
2	RM-OP	Tx dropped after 15 days
3	RM-PG	Bird dead 14 days after tx attached
4	RM-RO	Stayed within Park
5	RM-OB	Stayed within park
6	RM-WB	Tx dropped after 19 days
7	RM-WG	Tx lost up tree after 4 days (non- moving signal)
8	RM-PR	Stayed within park
9	RM-GR	Bird dead 3 days after tx attached
10	RM-GP	Stayed within park
11	RM-GN	Stayed within park
12	RM-BR	Stayed within park
13	RM-BG	Stayed within park
14	OR-RM	Tx lost up tree after 1 day (non-moving signal)
15	OO-RM	Stayed within park
16	RM-GB	Stayed within park
17	OW-RM	Stayed within park
18	YW-RM	Bird dead 9 days after tx attached
19	WG-RM	Bird dead 17 days after tx attached
20	RP-RM	Stayed within park



Two robins each with a transmitter. The package weighs only 0.5 g and is worn on the lower back. It is attached with two loops of fine shirring elastic around the upper thighs. Note the aerials projecting out of the back of the birds.



## Keeping our threatened species safe

### Fence Monitors Wanted

The fence monitoring team would love to hear from anyone interested in joining the fence checking team. We work in teams of two, one walking each side the length of the fence, a distance of approximately 6 kms. The purpose is to check the integrity of the fence for the safekeeping of our endangered introduced birds. Full training is offered and initially new volunteers will be on standby to fill in for teams unable to do their turn. Teams are on an 11 week roster and have a week, Wednesday to Wednesday to complete the fence check and to enjoy a walk in the park. For more information

Contact: Jenni McGlashan 09 422 3733

### Trapline Volunteers Needed

Trapline volunteers help maintain the network of traps and bait stations throughout the park. They serve a crucial role in detecting and eliminating pest predators that have somehow managed to get into the sanctuary. Volunteers adopt a line which they usually service once a month. You can do this alone or with a friend to help share the load. The lines vary in length and difficulty: some are physically demanding, others are literally a walk in the park! If you are interested please contact:

James Ross [jamesross@paradise.net.nz](mailto:jamesross@paradise.net.nz).  
Full training and advice will be provided.

### Finding pohutukawa



Surprise pohutukawa were struggling under clumps of kikuyu at the top of M16 gully. My twin sister Heather Smith and I took a good part of the day releasing 80 plants. Since kikuyu is not native I was able to spray back the vegetation we pulled off to slow its stronghold. Alison Stanes Editor

### TOSSI Committee

Chair	Ngairé Wallen	09 627 1526
Vice Chair	Alison Stanes	09 524 0291
Secretary	James Ross	09 422 6760
Treasurer	Karyn Hoksbergen	09 5851315

Committee	Ray Blackburn	09 425 4995
	David Stone	09 422 9415
	Sally Richardson	09 425 0161
	Roger Grove	09 422 3459

Newsletter Editor Alison Stanes 09 524 0291

Membership Secretary Janet Barruel

E letter Janet Barruel 09 425 9852

Email: [secretary@tossi.org.nz](mailto:secretary@tossi.org.nz)

Website: [www.TOSSI.org.nz](http://www.TOSSI.org.nz)

Correspondence: Chair or Membership Secretary  
P.O Box 112 Matakana 0948

### Application form for NEW MEMBERS Tawharanui Open Sanctuary Soc. Inc.

Name(s): \_\_\_\_\_

Address: \_\_\_\_\_

Phone No. \_\_\_\_\_

E-Mail \_\_\_\_\_

Occupation \_\_\_\_\_

Please tick how you would like to help:

- |  |   |
|--|---|
| <input type="checkbox"/> Planting/workdays         | <input type="checkbox"/> Bird Counts    |
| <input type="checkbox"/> Fund raising              | <input type="checkbox"/> Administration |
| <input type="checkbox"/> Monitoring Pests          | <input type="checkbox"/> Nursery        |
| <input type="checkbox"/> Predator fence monitoring |   |
| <input type="checkbox"/> Environmental educational |   |
| <input type="checkbox"/> Publicity/promotion       |   |
| <input type="checkbox"/> Other _____               |   |

Membership fee:

\$20 single membership \$ \_\_\_\_\_

\$30 Family membership \$ \_\_\_\_\_

Additional contribution (optional) \$ \_\_\_\_\_

Donations over \$5 are tax deductible

Gift Membership:

Please send membership to

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Amount of Gift membership(as above)\$ \_\_\_\_\_

Total amount enclosed \$ \_\_\_\_\_

Please make cheques payable to Tawharanui Open Sanctuary Society Inc. and return the completed form to:

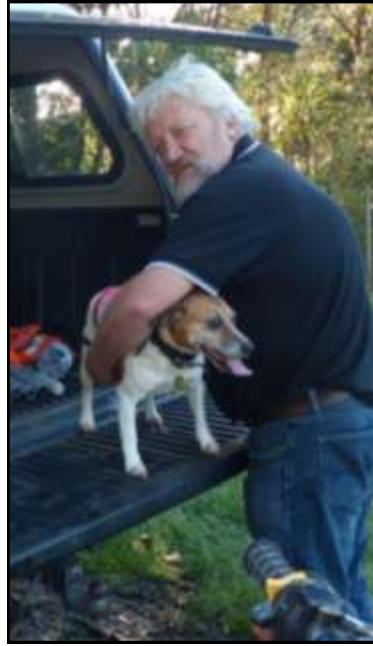
TOSSI Membership Secretary  
P.O.Box 112 Matakana 0948

## Finding and trapping the critters that leak into Tawharanui

Auckland Council staff, dedicated volunteers, and contracted individuals all help keep Tawharanui free of unwanted critters. Here are some of those who do the job.



Liz Maire sets out with a back pack full of eggs to change the eggs in traps.



Brian Shields prepares his certified dog Tui for a search for rats.



John Stephen dispenses baited carrots for rabbits in a takahe proof zone.



Lois Clayton sets out with her certified dog Gecko to sniff out stoats.

Pukeko reflections, early on a still sunny morning, in Mangatawhiri wetland.

