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THREATENED PLANT SURVEY OF TWO SPECIES, EAST CAPE, GISBORNE



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THREATENED PLANT SURVEY OF TWO SPECIES, EAST CAPE, GISBORNE



Swamp musk (*Mazus novaezeelandiae* subsp. *impolitus* f. *hirtus*) with hairy margins visible, growing in a damp riparian margin at Rangiata Station, East Cape. 11 June 2019.

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1. INTRODUCTION

As part of the ongoing management of rare plant populations, the Department of Conservation North Island East Coast office commissioned Wildland Consultants to undertake population surveys for three threatened indigenous plant species:

1. Cranwell's iris (*Libertia cranwelliae*).
2. Swamp fern (*Thelypteris confluens*).
3. Swamp musk (*Mazus novaezeelandiae* subsp. *impolitus* f. *hirtus*).

Cranwell's iris (Threatened-Nationally Critical), an endemic monocotyledonous herb, is currently known from two sites in East Cape. Swamp fern (Threatened-Nationally Vulnerable) is an indigenous fern that occurs in the North Island (NZPCN 2019). Swamp musk, classified as Threatened-Nationally Critical by de Lange *et al.* (2018), is an endemic dicotyledonous herb that is only known to occur at three sites in the North Island (NZPCN 2019).

This report describes the survey methods, population sizes, suggested management, and potential monitoring that could be undertaken at each population of swamp fern and swamp musk. At the time of writing, a survey for Cranwell's iris had not yet been undertaken due to delays in gaining access to survey sites. Therefore, the results of the survey for Cranwell's iris will be provided in a separate report.

2. TAXONOMY AND DISTRIBUTION OF SWAMP FERN AND SWAMP MUSK

Swamp fern

Swamp fern is an indigenous species that is only found in New Zealand in the North Island from Te Pahi in Northland to the Waitakere Ranges and east to East Cape (NZPCN 2019). The species also occurs inland within wetlands that contain geothermal features (NZPCN 2019). Swamp fern is also indigenous to parts of Africa, India and Australia, where it is threatened (NZPCN 2019).

In New Zealand, swamp fern grows in coastal, lowland, and geothermally influenced wetlands, and often occurs along the margins of lakes and streams (NZPCN 2019).

Swamp musk

Mazus novaezeelandiae subsp. *impolitus* was distinguished from *M. novaezeelandiae* in 1998 (Heenan 1998). The subpopulation of this subspecies that has distinctly hairy leaf margins (forma *hirtus*), which is the subject of this report, was also described by Heenan (1998).

Swamp musk was previously found between Northland and East Cape. The taxon is now only known from three localities: One at Awanui near Kaitaia and at two sites in the East Cape (Hautai Beach and Rangiatea Station). Swamp musk occurs in kahikatea forest and coastal wetlands that have low levels of competing plant cover (NZPCN 2019). Within these sites, disturbance from flooding and cattle grazing reduces

competition from surrounding vegetation (NZPCN 2019). This disturbance may also provide bare ground for the plants to colonise.

Additional information and photographs of these species, and other species found in the 2019 surveys, are available on the species' fact sheets on the NZPCN website (www.nzpcn.org.nz), in the Flora of New Zealand Volumes 1, 2, and 3 (Allan 1961; Moore and Edgar 1976; Healy and Edgar 1980), and in de Lange *et al.* (2010) "Threatened Plants of New Zealand" (for swamp musk).

3. METHODS

A total of three days of field survey were undertaken at sites where each of the two threatened plant species have been previously recorded. The survey for swamp musk and swamp fern were carried out at Rangiata Station, Lighthouse, and Hautai Beach in East Cape on 11 (accompanied by Graeme Atkins from the Department of Conservation), 12, and 26 June 2019 (see Table 1 for locations surveyed on each day).

The survey was undertaken on foot in suitable habitat for each species. Where subpopulations (i.e. more than two plants within two meters of each other and at least five metres from the next plant) of each species were located, GPS coordinates and an estimation of the subpopulation sizes were recorded and notes on habitat type and associated species collected (Table 1). Photographs were taken at each site. GPS points and population sizes were also recorded for any additional indigenous threatened plant species encountered during the survey.

4. SURVEY RESULTS

4.1 Location and size of threatened plant populations located

Swamp musk was located at Rangiata Station and Hautai Beach. In total, an estimated 1,500 plants in 11 populations were seen at Rangiata Station and approximately 500 plants in one population at Hautai Beach (Table 1). Two sites where swamp musk had been previously recorded were revisited on June 11. These were the vegetated swales adjacent to the stairs up to the lighthouse, and the damp pasture area just east of the Hautai Beach wetland. No plants were detected at either of these sites.

One population of swamp fern, containing approximately ten plants, was seen at Hautai Beach (Table 1).

In addition, populations of two other threatened plant species, *Mazus novaezeelandiae* subsp. *impolitus* f. *impolitus* (Threatened-Nationally Endangered) and *Jovellana sinclairii* (At Risk-Declining), were located during the survey (Table 1). Nine populations of *Mazus novaezeelandiae* subsp. *impolitus* f. *impolitus* were located at Rangiata Station, totalling approximately 300 individual plants. One population containing ten plants of *Jovellana sinclairii* was located at Rangiata Station.

Table 1: Locations of indigenous threatened plant species observed in the East Cape area on 11, 12 and 26 June 2019.

| Species | Common Name | Threat Status | Date | Location | Habitats Recorded | GPS Coordinates | No. of Plants and Notes |
|---|--------------------------|----------------------------------|--------------|--|--|---|--|
| <i>Mazus novaezeelandiae</i> subsp. <i>impolitus</i> f. <i>hirtus</i> , | Swamp musk | Threatened-Nationally Critical | 11 June 2019 | Rangiata station - gully and riparian margin west of homestead (one population) | Damp, shaded riparian margin beneath kānuka. Subject to light grazing. | E2088350 N5814992 | >1000 |
| | | | 12 June 2019 | Hautai Beach - edge of wetland, 100 metres north of Nohomanga Stream (several populations around the margins of the wetland) | Sparsely-vegetated coastal wetland regularly browsed by cattle. | E2084199 N5818870 E2084166 N5818915 E2084171 N5818947 E2084182 N5818947 E2084255 N5818752 | >500 |
| | | | | | | | |
| | | | 26 June 2019 | Rangiata station - throughout shaded gullies and riparian margins west of homestead (ten new populations) | Riparian areas with moderate levels of shading. Also on the base of east and south facing slopes, often beneath a sparse kānuka canopy. Between 10 and 200 plants at each location | E2088339 N5814927 | >300 plants on banks below kānuka across three closely located sub-populations |
| | | | | | | E2088327 N5814978 | |
| | | | | | | E2088321 N5814982 | |
| | | | | | | E2088313 N5814927 | 50 (bottom of bank) |
| | | | | | | E2088303 N5814936 | 60 plants growing like a flattened mat on recently disturbed ground |
| | | | | | | E2088260 N5814965 E2088297 N5814941 | 10 + plants on bank under kānuka at each location |
| E2088392 N5814937 | >100 (under pūriri) | | | | | | |
| E2088499 N5814957 | >50 (under kānuka) | | | | | | |
| E2088327 N5814974 | >60 (bottom of toeslope) | | | | | | |
| <i>Mazus novaezeelandiae</i> subsp. <i>impolitus</i> | N/A | Threatened-Nationally Endangered | 11 June 2019 | Rangiata station - gully and damp riparian margin west of homestead (one population) | As for <i>Mazus novaezeelandiae</i> subsp. <i>impolitus</i> f. <i>hirtus</i> (above). | E2088350 N5814992 | >300 |
| | | | 26 June 2019 | Rangiata station - throughout shaded gullies and riparian | As for <i>Mazus novaezeelandiae</i> subsp. <i>impolitus</i> f. | Found growing alongside subsp. <i>impolitus</i> f. <i>hirtus</i> , | |

| Species | Common Name | Threat Status | Date | Location | Habitats Recorded | GPS Coordinates | No. of Plants and Notes |
|------------------------------|-------------|-----------------------------|--------------|---|--|-------------------------|---------------------------------|
| | | | | margins west of homestead (eight new populations) | <i>hirtus</i> (above). | see above for locations | |
| <i>Jovellana sinclarii</i> | N/A | At Risk - Declining | 26 June 2019 | Rangiata station - gully west of homestead (one population) | Growing adjacent to stream on steep south facing bank in partial shade. | E2088246 N5815000 | 10 (on north bank of stream) |
| <i>Thelypteris confluens</i> | Swamp fern | At Risk- Naturally Uncommon | 11 June 2019 | Hautai Beach - edge of wetland 100 metres north of Nohomanga stream | Fringes of sparsely vegetated coastal wetland. I growing amongst slender spike sedge, swamp kiokio, swamp millet, and scattered soft rush. | E2084217 N5818868 | <10 (on east margin of wetland) |

The locations, habitats, and population sizes for each threatened plant species that was located during the survey are summarised in Table 1. Figures 1 and 2 illustrate the locations of each of these species. Additional sites where the target threatened plant species were surveyed for but not found, and other threatened plant species that were located at these sites, will be provided in the final draft of the report.

4.2 Habitats where threatened plants were located

Swamp fern

At Hautai Beach, swamp fern was found alongside populations of swamp musk in the fringes of a sparsely vegetated coastal wetland. Here there were several individual plants spread across a few square metres, growing amongst *Machaerina juncea*, slender spike sedge (*Eleocharis gracilis*), swamp kiokio (*Blechnum minus*), swamp millet (*Isachne globosa*), and scattered soft rush (*Juncus conglomeratus*)*¹.

Swamp musk

At Hautai Beach, swamp musk was found in a sparsely-vegetated coastal wetland that is regularly browsed by cattle, which are reducing competition from exotic plant species. Swamp musk was usually found growing alongside swamp millet. Other associated plant species include lotus (*Lotus pedunculatus*)*, spike sedge, swamp kiokio, as well as moss and liverwort species. The surrounding area contained globe sedge (*Cyperus brevifolius*)*, sparsely distributed areas of *Machaerina articulata*, and raupō (*Typha orientalis*).

At Rangiata Station, swamp musk was found in riparian areas with moderate shading, presumably where they are subject to occasional disturbance by seasonal flooding. At these sites it was growing with clover (*Trifolium repens*)*, creeping buttercup (*Ranunculus repens*)* and rye grass (*Lolium perenne*)*. It was also found colonising the base of east and south facing slopes, often beneath a sparse kānuka (*Kunzea robusta*) canopy and growing alongside bush rice grass (*Microlaena avenacea*), dandelion (*Taraxacum officinale*)*, maidenhair fern (*Adiantum cunninghamii*), *Oplismenus hirtellus* subsp. *imbecillis*, and rye grass. Cattle have access to all of the populations seen at Rangiata Station and browsing of the swamp musk was evident. Plants were growing in areas previously pugged by cattle; often colonising the footprints themselves. Plants were also commonly found around the base of the kānuka trees, and in one case on the trunk of a kānuka itself.

At Rangiata station, swamp musk was almost always interspersed with *Mazus novaezeelandiae* subsp. *impolitus* f. *impolitus*. This is not unexpected as these subspecies are commonly found growing together (Peter Heenan, Wildland Consultants, pers. comm.)

¹ Naturalised (introduced) species are indicated by an asterisk* throughout the report.



Legend

Threatened plants

- Swamp musk original population
- Swamp musk new population
- Swamp fern
- Search route

Data Acknowledgment
 "Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0"

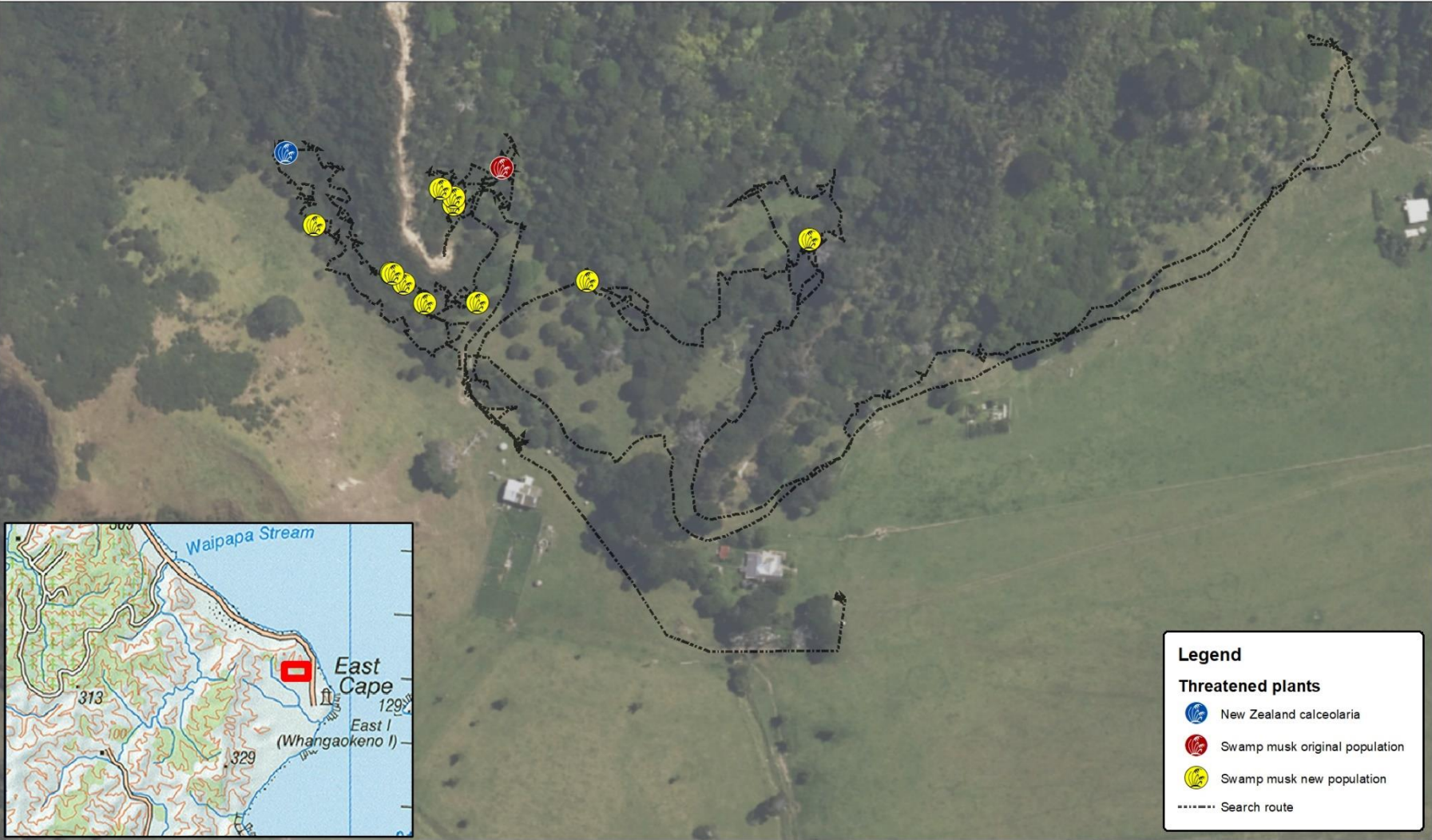
Report: 5087
 Client: Department of Conservation
 Ref: 10 0013
 Path: E:\gis\EastCape\mxd\
 File: Figure2_Threatened Plants.mxd

Figure 1: Threatened plant locations, East Cape Road, East Cape, June 2019



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Scale: 1:10,000
 Date: 31/10/2019
 Cartographer: LD
 Format: A4R



Legend

Threatened plants

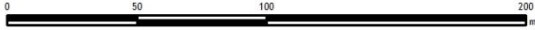
- New Zealand calceolaria
- Swamp musk original population
- Swamp musk new population
- Search route



Data Acknowledgment
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Report: 5087
 Client: Department of Conservation
 Ref: 10 0013
 Path: E:\gis\EastCape\mxd
 File: Figure_plants.mxd

Figure 2: Threatened plant locations, Rangiaata Station, East Cape, June 2019



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Scale: 1:2,500
 Date: 5/12/2019
 Cartographer: LD
 Format: A4R

5. THREATS AND POTENTIAL MANAGEMENT ACTIONS

5.1 Overview

Local threats and potential management actions for the populations of swamp fern and swamp musk are outlined below. Threats include vulnerabilities due to small population sizes, weeds, hydrological modification, livestock, climate change, herbicide use, and other human-related activities.

5.2 Swamp musk

Threats

The threats to the populations of swamp musk at Hautai Beach and Rangiata Station are as follows:

- Hydrological modification: The construction of farm drains to lower the water table and allow stock grazing will have a major impact on this species, particularly in wetlands and riparian areas where the plants survival relies on periodic natural flooding. Draining these areas will reduce water flow to wetlands and affect their ability to retain moisture. Swamp musk populations and associated wetland plants that rely on these damp conditions are unlikely to survive these hydrological changes.
- Weeds: Invasive weeds (for example kikuyu grass; *Cenchrus clandestinus*) can smother and/or outcompete swamp musk.
- Livestock: Fluctuations in grazing pressure may negatively impact the swamp musk populations. An increase in livestock density may lead to increased browsing and trampling of habitat. A reduction or exclusion of livestock may lead to an increase in exotic plant growth. It will be important to maintain a grazing regime that allows this species to thrive; as is seen at Rangiata Station.
- Climate change: Short- and long-term decreases in rainfall and increases in average temperature will affect available soil moisture levels.
- Herbicide use: Maintenance of vegetated swales on the lighthouse track are likely to have resulted in the loss of the population at that site.

Potential Management Actions

The persistence of the swamp musk populations at the sites appears to be reliant on low levels of ecological disturbance due to periodic natural fluctuations in water levels, flooding and livestock grazing. Therefore, these disturbance regimes are integral to the persistence of these populations but, in the case of livestock grazing, should be carefully managed. Very low stock numbers will result in the growth of competing palatable plant species (both indigenous and exotic). By contrast, excessive grazing is liable to result in the loss of swamp musk plants and surrounding plant cover and, during high rainfall periods, pugging of the soil surface. A balance in the number of animals and their frequency and duration of grazing needs to be made through well managed trials that assess the impacts on the populations. These trials

can be monitored using the methods outlined in Section 6. It should be noted that the livestock stocking units may need to vary across the year due to seasonal rainfall patterns and the resulting disturbance to the soil surface. If it is found that cattle are having too great an impact, consideration should be given to grazing the areas where swamp musk occurs with sheep, that have lower disturbance impacts, if they are available at the sites.

Pest plants need to be surveyed for and managed on an ongoing basis at each of the swamp musk populations. Kikuyu grass is present at each of the swamp musk populations and should be hand weeded to prevent this invasive grass from affecting the health or persistence of swamp musk at the sites. Weeding should be undertaken annually within a ten metre buffer zone around each population of swamp musk. Cape ivy (*Senecio angulatus*) is present along the lighthouse track and should be controlled to prevent it from potentially impacting the swamp musk population at the site (note that no swamp musk was located during the current survey). Great care should be taken to avoid spray drift impacting the populations of swamp musk if herbicides are to be used near any of the populations and previously known locations for swamp musk. All herbicides should be applied by a qualified applicator (Growsafe and Approved Handler certified) who adheres to the manufacturer's instructions provided on the herbicide label.

If *ex situ* conservation measures have not been undertaken for these populations, consideration should be given to collecting seed from each of the populations to safeguard the taxa from extinction. Seed could be sent to the New Zealand Indigenous Flora Seed Bank¹ for long-term storage. Although the seed bank will be able to guide seed collection protocols, in general, a small amount of seed should be collected from the widest possible number of plants in each population to ensure that the greatest possible genetic diversity is sampled. As far as is known, there is no facility in New Zealand for the storage of fern spores (for swamp fern). Any *ex situ* conservation measures for this species would require that plants are grown from spores collected from the Hautai Beach population.

Consideration could also be given to partnering with a botanic garden (or similar institution) to establish *ex situ* living collections of swamp musk. If suitable partners are found, the botanic gardens could grow a representative sample of individuals from each population that could then be used to establish restoration sites in suitable habitat. These *ex situ* collections could also be used to provide plants to conduct field trials to determine the habitat preferences and ideal disturbance regimes for the taxon, which would better inform the management of the remaining natural populations.

Opportunities exist to undertake research projects (likely by university graduate students) with the populations to improve their management. First, determining the genetic diversity within and between the three remaining populations could be undertaken using microsatellite markers (for example, see Shepherd and Perrie 2011). Second, Heenan (1998) provided a brief overview of the reproductive biology of *Mazus novaezeelandiae*. Plants are believed to be self-incompatible, however, there is variation in stigma and anther length between individuals, which likely acts as a

¹ See: https://www.massey.ac.nz/massey/learning/colleges/college-of-sciences/clinics-and-services/new-zealand-indigenous-flora-seed-bank/new-zealand-indigenous-flora-seed-bank_home.cfm

mechanism to avoid selfing in some individuals. Determining the frequency of this mechanism, the pollinators that visit the populations, and the mating systems of the plants in each population would be useful for the management of the swamp musk populations.

Hydrological changes at the Hautai Beach site will affect the swamp musk population that are present the site. Some drivers of hydrological change, such as a variation in climate and sea level, are unable to be managed. However, others, such as wetland drainage, can be managed. Digging, clearing or blocking of drains, removal of adjacent vegetation, and the planting of certain tree species will have an effect on the water table and should be avoided.

The population of swamp musk adjacent to the Lighthouse was not relocated during the field survey. However, due to the short duration of the survey at the site, it is possible that the species may still be present. Therefore, a more thorough search should be undertaken at the site. Future management of the lighthouse site should focus on alternative options for managing weeds in the swale adjacent to the staircase and in any other areas where swamp musk may occur. It should also include the management of several weed species that have colonised the lighthouse area (for example, cape ivy) that pose a threat to the wider site.

For this project, surveys for additional populations of swamp musk predominantly focussed on coastal wetland areas. However, the densest populations of the species occur in damp, forest gullies at Rangiata Station. Future surveys for this species at East Cape should focus on habitat similar to that at Rangiata Station. Ideally, an initial desk top analysis should be undertaken to identify potential survey sites so that landowner permission can be sought and field work planned accordingly.

In the medium term, consideration should be given to the development of a Threatened Species Recovery Plan for both swamp musk taxa. This recovery plan could guide the restoration of the remaining populations of swamp musk taxa as well as identify further research and management requirements.

5.3 Swamp fern

Threats

Swamp fern is primarily found in wetlands and as such is vulnerable to modification of these habitats. These threats include:

- Hydrological modification: The construction of farm drains to lower the water table and allow stock grazing will have an impact on this species as plant survival relies on periodic flooding.
- Weeds: Invasive weeds (for example kikuyu grass) can smother and/or outcompete plants.
- Livestock: Grazing may lead to browsing and trampling of habitat and decreased survival of swamp fern populations. Fencing the entire wetland where this species

occurs will provide the most benefit. However, this will negatively affect the swamp musk populations at the site, which are a higher priority for protection.

- Climate change: For example, the potential for decreases in rainfall.
- Herbicide use: Weed spraying at or near the swamp fern populations could potentially kill plants.

Potential Management Actions

Swamp fern relies on wetland habitat for its survival. Therefore, management actions will be similar to those of swamp musk.

The current survey did not reveal any further populations of this species; there is only one known site for swamp fern on the East Cape. Future surveys should be conducted in similar lowland wetland sites in East Cape. Based on the current survey, the species appears to prefer similar micro-habitats as raupō and swamp millet, and these may act as indicator species for potential swamp fern habitat when conducting future surveys.

As stock trampling and browsing have a major impact on this species, the most effective way to protect the current population at Hautai Beach would be to fence the wetland area from access by stock. However, this would have a negative effect on the swamp musk population and therefore, in this instance, fencing should be avoided. The wetland has been lightly grazed for some time which appears to have not negatively affected the swamp fern population. Therefore, maintaining grazing at the current levels should be sufficient for populations of this species to persist at the site.

The persistent invasion of the margins of the wetland by kikuyu grass is likely to be an ongoing threat for the populations of swamp fern and swamp musk. The sites where both species occur should be monitored on a regular basis to ensure that they are free of kikuyu grass (see Section 6 below). If kikuyu grass does begin to invade the sites where swamp fern and swamp musk occur, the kikuyu grass should be hand weeded on an annual basis in a ten metre buffer around the perimeter of each subpopulation of each species.

6. MONITORING

The populations of all three species should be revisited at least every two years during the spring or autumn to census the populations and to identify emerging threats (for example, new pest plants) and management requirements. Surveys should be conducted annually if populations of the threatened plant species are at serious threat of decline (for example, by pest plants such as kikuyu grass). Where possible, individual plants should be counted within the populations and the extent of the populations mapped using global positioning systems (GPS) at each visit. This will allow population trends to be assessed over time. This data could be used to guide management decisions regarding grazing intensity.

Photopoints could potentially be established at the sites to monitor changes in the surrounding vegetation over time by recapturing the photographs at the same

permanently marked locations at standardised frequencies (for example, every three or five years). For the swamp musk populations, photo-plots could be used to record plant density and distribution within a defined area (for example, a two metre square area) over time by taking the photograph from above the plot at a permanently marked location (using a metal or wooden peg that is driven into the ground on a corner of the plot). At least one photopoint and five photo-plots (if swamp musk is present at the site) should be established at each population to ensure that there is a sufficient sample size to inform management decisions. Colour print-outs of the photopoints and photo-plots should be carried to the field at each resampling to help locate the points and to ensure the frame of the photograph is the same as previous sampling photographs.

7. CONCLUSION

Population surveys for two threatened plant species, swamp fern (Threatened-Nationally Vulnerable) and Swamp musk (Threatened-Nationally Critical) were undertaken over three days during June 2019. Ten new populations of swamp musk were detected at Rangiatea Station, close to previously known populations of the species. No new populations of swamp fern were detected.

Management recommendations for swamp musk include monitoring all populations, and managing stock grazing regimes, changes in hydrology and potential invasion by pest plants, particularly kikuyu grass. The development of a Threatened Species Recovery Plan for swamp musk would help to focus management actions and future research needs.

Further surveys for swamp fern and swamp musk are needed in the wider East Cape, and should be conducted in similar habitats as those where both species were located in the current survey.

ACKNOWLEDGMENTS

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Plate 1: Several swamp musk plants (indicated by red arrows) growing amongst slender spike sedge, swamp millet and moss at Hautai Beach, East Cape. 11 June 2019.



Plate 2: Hautai Beach wetland, East Cape. Swamp musk plants were located in areas dominated by swamp millet on the edge of raupō stands. 11 June 2019.



Plate 3: Swamp fern among slender spike sedge at Haitai Beach wetland, East Cape. 11 June 2019.



Plate 4: Swamp musk growing at the base of a kānuka, Rangiatea Station site, East Cape. 26 June 2019.



Plate 5: Swamp musk was found colonising dry south facing slopes under kānuka scrub at Rangaita Station, East Cape. 26 June 2019.



Plate 6: More than 100 swamp musk plants of both sub-species colonising a dry, south-facing slope beneath kānuka at Rangaita Station, East Cape. 26 June 2019.



Plate 7: Swamp musk plants colonising an area recently trampled by livestock, Rangiata Station, East Cape. 26 June 2019.



Plate 8: Swamp musk growing on an eroded stream bank amongst *Oplismenus hirtellus* subsp. *imbecillis*, Rangiata Station, East Cape. 26 June 2019.



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