
**‘INANGA SPAWNING GROUNDS
ENHANCEMENT AND RESTORATION
PROJECT’**

RONGOWHAKAATA IWI TRUST
PILOT PLANTING PLAN

2016

CONTENTS

Table of Contents

Introduction	3
OUR SITES	4
Planting & Restoration:	6
APPENDIX 1	13
KUAWA Schoenoplectus tabernaemontani	APPENDIX 218
WIWI Juncus edgariae and Juncus gregiflorus	20
KUTA Eleocharis sphacelata	21
Inanga Background Resources	Appendix 3 23
Plan / Source /	25
Quote	25
Engage / Implement	25
Milestone /	25
Completion	25
Trial Planting Calendar, 2016	Appendix 4 25

Introduction

Background

Rongowhakaata Iwi Trust has received funding from Te Wai Maori for the identification and restoration of inanga spawning sites within the region.

Purpose

We have 2 main objectives for this project:

1. The successful planting of native species and stock proof fencing to enhance and protect Inanga Spawning Sites from predation and stock invasion; providing 'safe harbour to rear as per their life cycle, monitored by iwi, and;
2. An innovative engagement approach with Te Ahi Kaa for this project, with a clear and supportive Maori specific framework that can be adopted by others.

Our project team

A mix of our Trust, iwi and regional expertise:

Alayna Watene (CEO)
Staci Hare (Trustee)
Te Rina Whaanga (Trust Employee)

Sarah Pohatu (Iwi member)
Dean Hawkins (Iwi member)
Teina Pohatu (Iwi member)
Soraya Pohatu (Iwi member, EIT)

Murray Palmer (Director, Nga Mahi Te Taiao)
Kurt Ridling (Gisborne District Council)
Harriet Roil (Gisborne District Council)

OUR SITES

Opportunities

For different groups, hapu and whanau to understand and get to know some of the stories about Rongowhakaata, in relation to awa, and with a direct application to the science and practical solutions that are a part of Inanga Spawning site enhancement and restoration. In this sense, we have identified 5 potential sites, which are listed with images and initial considerations for restoration and immediate / intermediate assistance to Inanga spawning.

These 5 sites are a cross section of spawning habitats of varying quality. We have some where vegetation is intact, (though degraded) and fish spawning had occurred in the recent past and sites degraded to the point where riparian vegetation is severely compromised by stock access / livestock grazing, flood gates and where there had ben little to no spawning recently.

Due to the varied nature of this project, we have (alongside GDC) prepared planting planning for a trial site, outlined in the following section 'planting & Restoration' (pg. 10).

All sites

Note:

1. Appear to have water quality suitable for juvenile to adult inanga
2. Have numbers of the damaging pest mosquito fish (*Gambusia affinis*)
3. Have ecological restoration potential
4. Require engagement with landowners and GDC

Considerations

We studied various projects of a smiliar nature, across varying sites to better inform our planning (See Appendix 3, Bibliography). This included a research article on artificial spawning habitats for *Galaxias maculatas* by Michael J. H. Hickford and David R. Schiel in 2013. Titled 'Artificial Spawning Habitats Improve Egg Production of a Declining Diadromous Fish, *Galaxias Maculatus* (Jenyns, 1842)', the research article led our Project Lead to apply Hickfords recommendations to our sites (See Appendix 1), for additional insight into intermediate spawning enhancement measures / techniques.

Engaging with our iwi via wananga led to several key questions being asked

of attendees, with the goal of defining their priority sites, key cultural aspirations and painting a clear picture of what the site/s looked and felt like for our people in the past.

Example of the questions used to prompt korero, and guide our restoration planning / process:

What are our thoughts as whanau, hapu, iwi?

- **Which sites** from our list **are most important to you, your whanau and marae or hapu?** Can you pick 2, numbering your preferences 1 or 2?
- As Kaitiaki / Kaitieki, which do you think might **suit this project** the **most?**
- What can you remember the stream / river looking like when you were young?
- What plants, aquatic life and activities do you remember from these sites? E.g. gathering kai / fishing for certain ika or particular plants growing in abundance.
- Are there any **stories**, or **korero** you would like to share about these places?

Fill out the attached form

Korero with us

Your thinking will inform our mahi

PLANTING & RESTORATION:

Our Goal

To restore and include cultural heritage of sites in the form of sensitive and informed plant lists and sourcing.

Additionally, these plants need to be supported (and in turn support) our projects intention: *The restoration and enhancement of inanga habitats / spawning zones.*

However it is acknowledged that while this may be the primary reason for restoring our sites, there are several other benefits to restoration of this area to native vegetation. These are;

- Erosion control
- Sediment reduction to river
- Provision of terrestrial habitat to other native species
- Improved water quality
- Provision of in stream habitat for other native species.

As previously discussed, due to the 5 sites Rongowhakaata Iwi Trust and Gisborne District Council have narrowed down a trial restoration / planting to one site. This aligns with Gisborne District Councils existing Inanga spawning site project (in partnership with MfE), and also aligns with our initial iwi feedback, which highlighted Te Arai as a strong cultural influence (4 out of 5 of our Marae identify Te Arai as their awa).

Species Selection

Project lead Murray Palmer has considered various additions to our littoral zone-planting list. These are his additions (for a 2017 planting schedule, following a nursery source being confirmed) (See Appendix 2)

- Kuawa
- WiWi
- Kuta

Inanga spawning

Monitoring

As this is intended as a pilot study, it is required that our monitoring programme record details on timing and location of eggs deposited and the plant species where they were found. This may indicate a preference of habitat and would be useful for further site restoration.

**Management issues
of Te Arai Site****1. Erosion and sedimentation**

The river arises in native forest, then flows through steep erosive pastoral land to an extensive lowland plain, recently developed for horticulture. This highly eroded land and current agricultural / horticultural landuse results in regular flood events, causing further erosion of the Te Arai site leading to a changes in the river bank profile and 'dumping' of new sediment and logs. This has major effects on the site in terms of;

- Increase in bank slope
- Decrease in bank stability
- Deposition of sediment
- Vegetation burial or complete removal resulting from increased flow
- Potential destruction of site as inanga spawning habitat

2. Pest plant species

GDC at the Te Arai site has cleared an area of Willow approximately 100m x 12m (up to 15 m in the widest space), stumps are however resprouting.

3. Pest animal species

The sites are on predominantly private land in a rural setting. Rats and mice particularly are known predators of inanga eggs.

Restoration plan: Considering the challenges, and diverse values associated with Te Arai existing planting planning / restoration mapping can be considered a trial / pilot study to strengthen this project in the comign 2 years. Given the land-use activities in the catchment and the on-site challenges such as site profile, substrate, pest plants and animals, there is no guarantee that a restoration will be successful as many of these influences are unpredictable. However, if the planting controls are well managed and flood/erosion events are limited, then the restoration may be successful. Regular monitoring of different variables at the site is also recommended to help inform any future work.

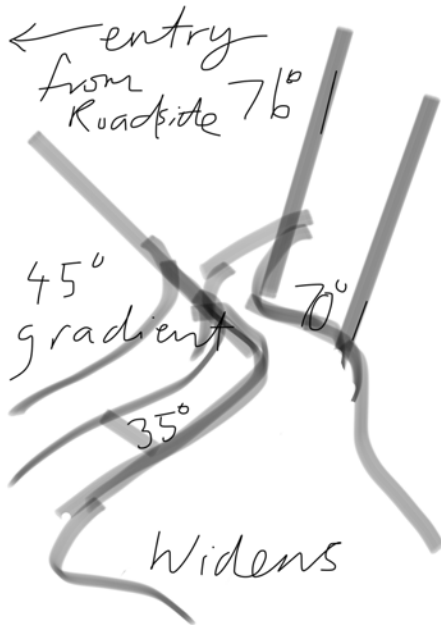
Rongowhakaata Iwi Trust also consider Te Arai to be a highly suitable pilot site, as our project further bolsters existing restoration, fish passage enhancement, and freshwater planning work undertaken by GDC, (also supported by the Tairawhiti Environment Center). For further context, see a recent LAWA video illustrating the diverse values of Te Arai, and highlighting initiatives to assist inanga:

https://www.youtube.com/watch?v=0h_LUSBBTd4



1. Planting

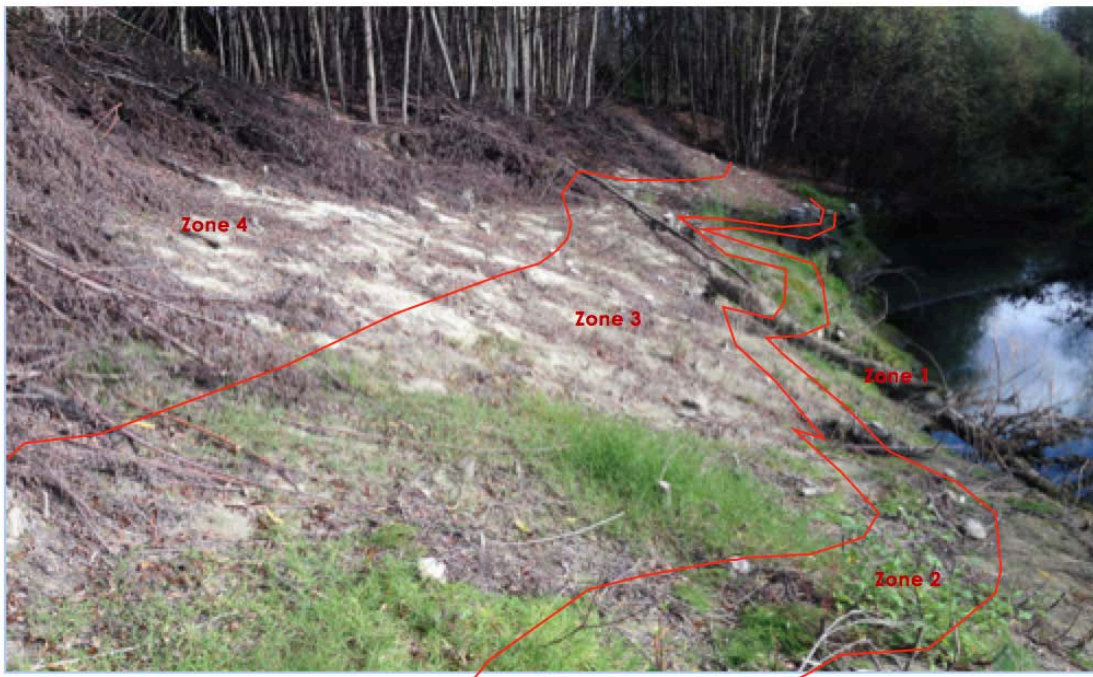
The current profile of the Te Arai site is of a relatively steep (approx. 30-40° in some places), actively slumping slope. During our June monitoring we noted the following on our smart tech to illustrate the varying gradients:



The collapsed earth forms toes into the river which are alternated with steep undercuts in the bank, revealed at low tide.

The planting area can be divided into four basic areas although these are just a guide. The brackish water zone (1) which is subject to tidal fluctuation. The spawning zone (2) which is the narrow strip where inanga will lay their eggs on a spring high tide. The lower terrestrial zone (3) which is above the high tide line but may still be subject to some flooding at spring tides. And Zone 4 which is the upper dry terrestrial slopes. Plant species will generally differ between these three zones although there will be some overlap, particularly between the bottom three zones. See mapping of planting 'Zones' based on these mixed

gradients (Gisborne District Council, 2016):





Planting proposed by Rongowhakaata Iwi Trust (Images Appendix 2)

Littoral Zone:

Zone 1 – Brackish water/Semi submerged

Species for this zone will need to tolerate changes in water levels and salinity. They will also need to provide erosion control and be robust enough to outcompete invasive weeds with little management. They should also provide habitat for inanga spawning.

Species	Habitat	Customary Uses:
Kuawa	Coastal to montane (up to 300 m a.s.l.). Mostly in standing water, growing in brackish or freshwater systems such as lakes, ponds, lagoons, river and stream margins. Also found well inland around geothermal systems. http://www.nzpcn.org.nz/	The culms were occasionally used by Maori along with the korari of the flax (<i>Phormium tenax</i>) to make rafts, and at a flooring in waka. http://www.nzpcn.org.nz/
WiWi	<i>Juncus gregiflorus</i> or wiwi (common name) is a rush of swampy areas throughout New Zealand. It grows into a tight clump 1-2m tall with bright green stems. It is ideal for revegetation of wetlands and riparian areas and is useful for damp landscaping areas. (www.kauriparknurseries.co.nz/plants/juncus-gregiflorus-wiwi/) Wiwi is the name for several species of	None yet identified.

	<p>native plant which grow in stiff, rush-like clumps with tall, shiny, unjointed, wire-like stems with a brownish, tiny, ball-like cluster of seeds near the top of the stem. They are found on moist lands, the sea rush being mostly in coastal marsh and salty sand-flats. (http://maoridictionary.co.nz/)</p>	
Kuta	<p>Coastal to lower montane (but mainly in lowland areas). Preferring sunny situations where it usually grows in still deep water such as along lake and pond margins often amongst Raupo (<i>Typha orientalis</i> C.B.Presl) and <i>Baumea articulata</i> (R.Br. Blake). Rarely bordering slowly flowing streams and rivers, or in burn pools and damp depressions within peat bogs. (Plant conservation network http://www.nzpcn.org.nz/).</p>	<ol style="list-style-type: none"> 1. (noun) tall spike sedge, great spike rush, bamboo spike-sedge, <i>Eleocharis sphacelata</i> - a rush growing to about 1 m which spreads from a creeping rhizome and has thick hollow stems of bright green. Found throughout Aotearoa/New Zealand in swamps and on lake edges and is often partially submerged. The soft, flattened, hollow stalks (culms) of kuta are a popular resource for weavers. The long culms are harvested, placed under matting for about 3 days to flatten, then woven into soft hats, mats, and kete. Kuta dries to an attractive golden-brown shade. 2. (noun) maro made of the kuta rush - worn by women. Ko ngā wāhine moe tāne he pakimaero te kaka, he kuta, te whatu he mea herehere, ā, he harakeke toetoe ai kia pēnei te whara o ngā tuwhara nei te rarahi, ka mea ai he aka kāi, he aka mangemange, he aka tororaro rānei ka nati ai ki runga, ka rite ki te hope o te wahine, ki te ponaturi ka mutu (JPS 1928:177). / The married women wore a kilt fashioned from kuta, made by tying them together, also from flax split into strips about as wide as those used in making course floor mats, and these were fastened onto a kāi [<i>Podocarpus spicatus</i>] branch, bushman's mattress vine [<i>Lygodium articulatum</i>], or wire vine [<i>Muehlenbeckia complexa</i>] and made to fit the waist of the woman, and it extended down to her knees. 3. (noun) The soft, flattened, hollow stalks (culms) of kuta are a popular resource for weavers. The long culms are harvested, placed under matting for about 3 days to flatten, then woven into soft hats, mats, and kete. Kuta dries to an attractive golden-brown shade. (Maori Dictionary, http://maoridictionary.co.nz/)

		The long culms, when dried, were sometimes used by Maori for their tukutuku panels. (Plant conservation network http://www.nzpcn.org.nz/).
--	--	--

Planting proposed by Gisborne District Council:

Zone 1 – Brackish water/Semi submerged

Species for this zone will need to tolerate changes in water levels and salinity. They will also need to provide erosion control and be robust enough to outcompete invasive weeds with little management. They should also provide habitat for inanga spawning.

Species	Habitat and characteristics	Where to plant	density
<i>Juncus edgariae</i>	Native rush, establishes easily, tolerates wet feet, habitat for inanga spawning	Plant in clumps on bare soil or within invasive grasses	30cm spacings, in clumps. 30%
<i>Carex geminata</i>	Native sedge, likes wet feet, forms dense clumps Has rhizomatous roots which will hold bank together and provide thick matted bases. Known habitat for inanga spawning.	Plant densely in clumps on bare soil or invasive grasses	30cm spacings in clumps. 60-90%
<i>Bolboschoenus fluviatilis</i>	Marsh clubrush. Found in wetlands, estuaries and river margins. Spreads easily once established.	Plant at water margin. Does best with continuous wet feet and will tolerate occasional submersion.	Plant at low tide above and below tide mark. Plant generously at 30cm.

Zone 2 – Inanga spawning band. some tidal influence at spring tide

Planting is the same as in zone 1 but without the *Machaerina* and planting should avoid any already existing suitable spawning habitat e.g. areas of creeping bent.

<i>Juncus edgariae</i>	Native rush, establishes easily, tolerates wet feet, habitat for inanga spawning	plant in clumps on bare soil or invasive grasses	30cm spacings, in clumps. 35%
<i>Carex geminata</i>	Native sedge, likes wet feet, forms dense clumps. Has rhizomatous roots which will hold bank together and provide thick matted bases. Known habitat for inanga spawning.	Plant densely in clumps on bare soil or within invasive grasses	30cm spacings in clumps. 65%

Zone 3 – Lower terrestrial slopes. No/little tidal influence

Plants here should be mostly terrestrial but be able to tolerate the occasional tidal or flood event. Plant densely to hold bank together and shade out weeds.

<i>Cyprus ustulatus</i>	Native giant umbrella sedge. Likes wet feet, common to streamsides and wetlands. Large size so good for ground cover and erosion control.	Plant densely in clumps towards bottom area of this zone.	0.5m spacings. 40%
<i>Austroderia fulvida</i>	Native grass. Very hardy and	Plant densely	0.5m spacings. 30%

<i>(toetoe)</i>	fast growing. Common to streamsides and coastal areas. Provides ground cover fast – “living mulch” for secondary native tree species.	throughout.	
<i>Coprosma repens</i>	Taupata. Coastal/streamside, fast growing shrub, hardy. Fruit for birds.	Plant scattered throughout.	0.5m spacings. 10%
<i>Phormium tenax/cookianum (subsp. Hookeri)</i>	Native flax/coastal flax. Hardy and fast growing. Both common throughout NZ. Cookianum common in coastal and lowland habitat.	Plant towards top of zone.	0.5m spacings. 20%
Zone 4 - Terrestrial slopes			
Plant flax and other species densely to help prevent reinvasion of willows and other weeds			
<i>Phormium tenax/cookianum (subsp. Hookeri)</i>	Native flax/coastal flax. Hardy and fast growing. Both common throughout NZ. Cookianum common in coastal and lowland habitat.	Not good in flood events as thick fan shaped base impedes flow and can rip bank away. Plant towards top of slope as barrier to weeds.	Plant at 0.5m spacing. 50%
<i>Cordyline australis</i>	Native cabbage tree.	Deep tap root helps to hold bank together.	Plant at 0.5m interspaced with other species. 10%
<i>Coprosma repens</i>	Taupata. Coastal/streamside, fast growing shrub, hardy. Fruit for birds.		Plant at 0.5m interspaced with other species. 10%
<i>Leptospermum scoparium</i>	Manuka. Fast growing coloniser, good for erosion control.		Plant at 0.5m interspaced with other species. 10%
<i>Carpodetus serratus</i>	Putaputaweta. Small native tree common to streamsides.	Need shelter from other plants so plant in between other species such as coprosma or cabbage tree.	Plant at 1m interspaced with other species. Several scattered throughout.
<i>Podocarpus totara</i>	Totara. Large native tree, often found on drier riparian banks. Hardy. Tolerates light and shade.	Will grow in either full light or partial shade. Suitable for upper slopes of this zone	Plant at 1m interspaced with other species. Several scattered throughout. Towards top if slopes
<i>Dacrycarpus dacridoides</i>	Kahikatea. Large native tree, usually found in streamsides, wetlands and swamps. Provides fruit for birds.	Need shelter from other plants so plant in between other species such as coprosma or cabbage tree.	Plant at 1m interspaced with other species. Several scattered throughout. Towards top if slopes

Te Arai:



CONSIDERATIONS: *Ensure good spawning substrate (grasses, sedges) and higher up the bank harakeke, ti, etc; stock exclusion; control willows etc; artificial spawning substrate (e.g. straw mat rolls) to minimise sediment impacts. Potential to utilise/enhance small side tributaries of Te Arai as spawning zones, possibly subject to less sedimentation issues.*

(engagement with key landowners and GDC; catchment approach to sediment reduction)

Mike Hickford recommendations:

1. lay ready made grass mat (creeping bent)
2. Trial *Juncus edgariae* (in larger clumps) at intervals along the spawning site. Source and then grow/transfer if required into larger pots – could spread bent seed (with transfer) in the larger pots. Grow for a couple of months then plant at site.
1. Harakeke and Ti Kouka planted further up for bank stabilisation
2. Planting plan for the site

Pakowhai Site:



CONSIDERATIONS: *Extend fencing if possible; planting sedges etc for shade and to enhance spawning habitat*

(engagement with key landowners and GDC; check juvenile to adult habitat)

Mike Hickford recommendations:

1. Coconut mat – lay approximately 2m strip (attach with cable ties) could seed the mat also.

Matokitoki Stream:



CONSIDERATIONS: *Bank gradient lowered at key sites and/or straw mat rolls employed; encourage more in-stream cover*

for juveniles to adults; possible stormwater impacts (engagement with key landowners and GDC)

Mike Hickford recommendations:

1. Bales or tubes – extend into either direction of identified spawning site
2. Ideal site for schools to carry out enhancement and monitoring

Karaua Stream:



CONSIDERATIONS: *Re-plant side stream edges (riparian) with grasses and sedges; main stream banks reformed and in-stream plant growth managed*

(engagement with landowners and GDC to ensure inanga habitat requirements can be understood and provided for; e.g. enough in-stream plant growth for cover, but not too much to choke stream – manual harvesting and removal if necessary)

Mike Hickford recommendations:

1. Bales and tubes with hot wire fencing

Whatatuna Stream:



CONSIDERATIONS: *Fence for stock exclusion and replant with grasses and sedges (harakeke and ti sp. etc. on higher banks); ensure fish access to and from main awa*

(engagement with landowners and GDC to remove stock access; restore connectivity with the main river e.g. trial floodgate removal; replanting)

KUAWA *Schoenoplectus tabernaemontani*

APPENDIX 2

HABITAT

Coastal to montane (up to 300 m a.s.l.). Mostly in standing water, growing in brackish or freshwater systems such as lakes, ponds, lagoons, river and stream margins. Also found well inland around geothermal systems. <http://www.nzpcn.org.nz/>

CUSTOMARY USES

The culms were occasionally used by Maori along with the korari of the flax (*Phormium tenax*) to make rafts, and at a flooring in waka. <http://www.nzpcn.org.nz/>



Above left, looking NW from the Whatatuna spawning site, and above right, at the spawning site, February 2015. Present are extensive beds of Kuawa or Lake Clubrush, *Schoenoplectus tabernaemontani*. This plant at lesser densities may provide a good 'binder' supporting denser swards of grass or similar preferred spawning substrate. Left, a site approximately 400m upstream of the spawning site. Although currently grazed, the stream gradient is suitable for inanga spawning, and a small tributary in the foreground of the streams true left bank may be a good low velocity fish refuge. With alteration of the flood gates, the salt wedge could be expected to extend at least as far as this area.

WIWI *Juncus edgariae* and *Juncus gregiflorus*

HABITAT

Juncus gregiflorus or wiwi (common name) is a rush of swampy areas throughout New Zealand. It grows into a tight clump 1-2m tall with bright green stems. It is ideal for revegetation of wetlands and riparian areas and is useful for damp landscaping areas.

(www.kauriparknursery.co.nz/plants/juncus-gregiflorus-wiwi/)

Wiwi is the name for several species of native plant which grow in stiff, rush-like clumps with tall, shiny, unjointed, wire-like stems with a brownish, tiny, ball-like cluster of seeds near the top of the stem. They are found on moist lands, the sea rush being mostly in coastal marsh and salty sand-flats.

(<http://maoridictionary.co.nz/>)

CUSTOMARY USES

None identified as yet.

INANGA

This particular specie of wiwi has been identified as a plant utilised by inanga to spawn amongst (Richardson and Taylor, 2002).



KUTA *Eleocharis sphacelata*



HABITAT

Coastal to lower montane (but mainly in lowland areas). Preferring sunny situations where it usually grows in still deep water such as along lake and pond margins often amongst Raupo (*Typha orientalis* C.B.Presl) and *Baumea articulata* (R.Br. Blake). Rarely bordering slowly flowing streams and rivers, or in burn pools and damp depressions within peat bogs. (Plant conservation network <http://www.nzpcn.org.nz/>).

CUSTOMARY USES

- 4. (noun)** tall spike sedge, great spike rush, bamboo spike-sedge, *Eleocharis sphacelata* - a rush growing to about 1 m which spreads from a creeping rhizome and has thick hollow stems of bright green. Found throughout Aotearoa/New Zealand in swamps and on lake edges and is often partially submerged. The soft, flattened, hollow stalks (culms) of kuta are a popular resource for weavers. The long culms are harvested, placed under matting for about 3 days to flatten, then woven into soft hats, mats, and kete. Kuta dries to an attractive golden-brown shade.
- 5. (noun)** maro made of the kuta rush - worn by women. Ko ngā wāhine moe tāne he pakimaero te kaka, he kuta, te whatu he mea herehere, ā, he harakeke toetoe ai kia pēnei te whara o ngā tuwhara nei te rarahi, ka mea ai he aka kāi, he aka mangemange, he aka tororaro rānei ka nati ai ki runga, ka rite ki te hope o te wahine, ki te ponaturi ka mutu (JPS 1928:177).

/ The married women wore a kilt fashioned from kuta, made by tying them together, also from flax split into strips about as wide as those used in making course floor mats, and these were fastened onto a kāi [*Podocarpus spicatus*] branch, bushman's mattress vine [*Lygodium articulatum*], or wire vine [*Muehlenbeckia complexa*] and made to fit the waist of the woman, and it extended down to her knees.

6. **(noun)** The soft, flattened, hollow stalks (culms) of kuta are a popular resource for weavers. The long culms are harvested, placed under matting for about 3 days to flatten, then woven into soft hats, mats, and kete. Kuta dries to an attractive golden-brown shade. (Maori Dictionary, <http://maoridictionary.co.nz/>)

The long culms, when dried, were sometimes used by Maori for their tukutuku panels. (Plant conservation network <http://www.nzpcn.org.nz/>).



The Kuta may be a useful addition to low velocity inanga spawning sites where it could help stabilise the littoral margin and provide some shade and shelter for eggs developing amongst grass mats such as creeping bent.

Atkinson, M. (2005). Fish passage in New Zealand rivers: Understanding fish habitat and simple solutions to allow fish passage over weirs, fords, bridge aprons and through culverts. Cawthron Institute, Nelson, New Zealand. Retrieved online from http://www.cawthron.org.nz/media_new/publications/pdf/2013_08/fish-passage.pdf

Australian and New Zealand Environment and Conservation Council. (2000). *Australian and New Zealand guidelines for fresh and marine water quality: The guidelines*. National water quality management strategy, no.4. Chapter 1-7. ISSN 1038 7072. Retrieved online from <https://www.environment.gov.au/system/files/resources/53cda9ea-7ec2-49d4-af29-d1dde09e96ef/files/nwqms-guidelines-4-vol1.pdf>

Bloom, D. D. & Lovejoy, N. R. (2014). *The evolutionary origins of diadromy inferred from a time-calibrated phylogeny for Clupeiformes (herring and allies)*. Proc. R. Soc. B 281: 20132081. Retrieved online from <http://dx.doi.org/10.1098/rspb.2013.2081>

Clapcott, J. E., Young, R. G., Harding, J. S., Matthaei, C. D., Quinn, J. M. and Death, R. G. (2011). *Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values*. Cawthron Institute, Nelson, New Zealand. Retrieved online from http://www.cawthron.org.nz/media_new/publications/pdf/2014_01/SAM_FINAL_LOW.pdf

Hicks, A., Leigh, B., & Dare, J. (2013). *Potential inanga spawning areas in Southland rivers, technical report*. Environment Southland, Te Taiao Tonga. Publication No. 2014-06. Retrieved online from http://www.es.govt.nz/Document%20Library/Research%20and%20reports/Various%20reports/potential_inanga_spawning_areas_in_southland_rivers.pdf

Hickford, M. (2016). *Inanga: where do they come from, where do they go and what can we do to help them along the way?* Marine Ecology Research Group, University of Canterbury, New Zealand. Retrieved online <http://www.whitebaitconnection.co.nz/uploads/file/NZFSS%20whitebait%20special%20session%20presentations/4%20Hickford.pdf>

Hickford, M. & Schiel, D. (2013). *Artificial Spawning Habitats Improve Egg Production of a Declining Diadromous Fish, Galaxias maculatus (Jenyns, 1842)*. Society for Ecological Restoration. doi: 10.1111/rec.12008. Restoration Ecology Vol. 21, No. 6, pp. 686–694. Retrieved online <http://onlinelibrary.wiley.com/doi/10.1111/rec.12008/abstract>

Hickford, M. & Schiel, D. (2014). *Experimental Rehabilitation of Degraded Spawning Habitat of a Diadromous Fish, Galaxias maculatus (Jenyns, 1842) in Rural and Urban Streams*. Society for Ecological Restoration. doi: 10.1111/rec.12079. Restoration Ecology. Retrieved online <http://onlinelibrary.wiley.com/doi/10.1111/rec.12079/abstract>

Hickford, M. & Schiel, D. (2016). Otolith microchemistry of the amphidromous *Galaxias maculatus* shows recruitment to coastal rivers from unstructured larval pools. Vol. 548: 197–207, 2016. doi: 10.3354/meps11701. Marine Ecology Research Group, School of

Biological Sciences, University of Canterbury, Christchurch, New Zealand. Retrieved online <http://www.int-res.com/abstracts/meps/v548/p197-207>

New Zealand Department of Conservation. (2008). *Gisborne Region Fish Passage: Barriers to Fish Passage in the Gisborne Region*. ISSN 1175-026 X Technical Support Series No. 27. Retrieved online from <http://www.gdc.govt.nz/assets/Files/Planning-Policy/Regional/Freshwater-Reports/Fish-Passage-DoC-Report.pdf>

Richardson, J. Taylor, M. J. (2002). *A guide to restoring inanga habitat*. NIWA Science and Technology Series No. 50. ISSN 1173-0382. NIWA, Wellington, New Zealand. Retrieved online from https://www.niwa.co.nz/sites/niwa.co.nz/files/a_guide_to_restoring_inanga_habitat.pdf

Stevenson, C. & Baker, C. (2009). *Fish Passage in the Auckland Region – a synthesis of current research*. Prepared by NIWA for Auckland Regional Council. Auckland Regional Council Technical Report 2009/084. Retrieved online from <http://www.doc.govt.nz/Documents/conservation/native-animals/Fish/fish-passage/fish-passage-in-auckland-region.pdf>

The Whitebait Connection. (2004). *Investigating Freshwater: Akoranga Wai Maori, An inquiry resource*. WBC, New Zealand. Retrieved online from http://www.whitebaitconnection.co.nz/uploads/file/resources/IFW_Bklt_Sept_10_FINAL%5B1%5D.pdf

TRIAL PLANTING CALENDAR, 2016

APPENDIX 4

Plan / Draft / Research Engage Complete

Planting Calendar (may change)	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March
Project team sets wananga dates, confirms consultation letter:	Complete	Complete	Complete	Complete	Complete					
Internal:										
Letter of consultation sent to Marae Committee:	Complete									
Social Media:										
Website updated:					Complete					
Schools and networks notified:					Complete					
Planting at Te Arai:										
RIT and Indigenous learners bolster existing planting:						Complete				
GDC begin planting as per their zone mapping:				Complete						
RIT plant near Ohako Marae		Complete								
Wananga to define site values held at Ohako marae:	Complete									
Project introduced via Gisborne Herald / Pīpiwharaurora:	Complete									
Monitoring:										
Resources made, to improve iwi monitoring:	Complete									
Monitoring begins:	Complete	Engage	Engage	Engage	Engage	Engage	Engage	Engage	Engage	Engage
Landowners:										
Contact and on-going consultation	Engage	Engage	Engage	Engage	Engage	Engage	Engage	Engage	Engage	Engage
Comms Team:	Project Leader, Administrator and wiser Project team									

