Submitter No: 797

Submitter Name: TRONT

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Dr Jane Kitson on behalf of Ngā Rūnanga (Waihopai Rūnaka, Te Te Rūnanga o Ōraka Aparima and Hokonui Rūnaka) and Te Rūnanga o Ngāi Tahu
Summary of Evidence, 27 September 2017
Presented at hearing on Proposed Southland Water and Land Plan

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1. I have provided evidence and rebuttal evidence on behalf of Waihopai Rūnaka, Te Rūnanga o Awarua, Te Rūnanga o Oraka Aparima, and Hokonui Rūnaka (**Papatipu Rūnanga**) and Te Rūnanga o Ngāi Tahu (collectively referred to as **Ngāi Tahu**). My evidence relates to scientific matters.

2. My evidence links Ngā Rūnanga aspirations, associations, values and uses[1] of Southland waterways to the condition of these waterbodies. Statutory mechanisms have been put in place across Southland waterways that recognise the importance and associations with Ngāi Tahu whānui.[2]

3. Water and Mahinga kai are crucial to the cultural identity of Ngāi Tahu, as demonstrated by the video evidence and written evidence of Ailsa Cain and Dean Whaanga.

4. Mahinga kai encompasses the resource harvested, the ability to access the resource, the site where gathering occurs, the act of gathering and using the resource, and the good health of the resource.[3] Mahinga kai resources can include plant, animal and mineral resources.

SLIDE 1: MAHINGA KAI (EXAMPLE)

5. Mahinga kai has many environmental and water related dependencies.

6. These dependencies can be categorised into those that are related to: a) **mahinga kai species** and b) **mahinga kai activities**.

7. There are no national or regional guidelines or standards developed that adequately describe or monitor the state of mahinga kai.

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1 These are documented in the video evidence and the written evidence of Cain and Whaanga, and Dr Tipa and Dr Kitson. Additional material on this was provided in the following appendices: Cain & Whaanga: Appendices 2, 3, 4, 5; Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017, Attachments B, D, E.

2 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017 at paragraphs 4.6 to 4.11, Attachment B. Table 2: Mechanisms that recognise the importance and associations with Ngāi Tahu within Southland Freshwater Management Units, Attachment E: Map 1 Statutory Recognised Ngai Tahu sites in Each Freshwater Management Unit. (Mataura, Oreti, Aparima, Waiau).

3 Tipa G. 2011. Our Uses: Cultural Use in Murihiku. Report Prepared for Environment Southland.

SLIDE 2: ATTRIBUTES FOR MAHINGA KAI SPECIES

8. There are many environmental dependencies upon which mahinga kai species depend. These include: water (quality and quantity) attributes such as sediment, nutrients, dissolved oxygen, water temperature, habitat condition and habitat condition of prey/associated species, toxicants and flow regime.

9. Some of these variables are monitored and reported on by Environment Southland as part of the State of the Environment network. These include water clarity, trophic state (Nitrogen and Phosphorus), toxicity and invertebrates.

10. The majority of mahinga kai species have complex life cycles that require access to marine, estuarine and freshwater environments (for example, lakes, large rivers, small streams, wetlands etc). This requires the state and health of these connected environments within a catchment to be in good condition.

11. Slide 3 demonstrates that the majority of the freshwater mahinga kai/taonga species have a life stage that migrates through, and/or resides for a period of time in, estuarine ecosystems. This requires a healthy estuary with good fish passage to and from the sea.

12. Slide 4 provides examples of the complex life cycles of two important mahinga kai fish: Tuna/eels and Kanakana/Lamprey. Examples of other mahinga kai species have been provided in my written evidence in Figures 9 and 10.[4]

13. Impacts on the abundance and condition of mahinga kai populations include: sedimentation; reduction in habitat quality/quantity (e.g. land-use change, water abstraction, drain clearance), river modifications (e.g. channelisation, flood control), water quality deterioration and eutrophication; removal of vegetation providing shade and shelter, barriers to fish passage, pollution events, parasites and disease, pest fish/plants, and harvest.[5]

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4 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017, Attachment D.

5 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017, paragraphs 5.7 to 5.10.

SLIDE 5: ATTRIBUTES FOR MAHINGA KAI ACTIVITY

14. Mahinga kai activity is heavily dependent on many environmental attributes including: on whether desired harvested species is present, abundant, in good condition, physically accessible and desirable to harvest. Species must also be safe to consume and gather, and physical and legal conditions must enable access and the ability to use preferred sites and methods.

15. However only a few of these environmental attributes are monitored by Environment Southland. Those attributes monitored are: Human Health (*E. coli*) and cyanobacteria.

16. Impacts on mahinga kai activities include high pathogen load in the waterways and/or toxic algae (which makes it unsafe for harvesters), bank stability and excess sediment (which can impact the ability to use a preferred harvest method safely, e.g. netting or spearing), and excessive pest plants and algae (e.g., fouls nets, makes rocks slippery, decreases visibility).

SLIDE 4: ASSESSMENT OF WHETHER CONDITION OF WATERWAYS IS MEETING NGAI TAHU EXPECTATIONS AND ASPIRATIONS

17. The current monitoring conducted by Environment Southland does not cover the range of sites nor the breadth of measures (including cultural indicators, as described in the evidence of Dr Tipa) that would be required for a comprehensive and culturally relevant assessment of environmental state.

18. However, the existing datasets show that the current state of Southland waterways is not meeting the expectations or aspirations of Ngāi Tahu ki Murihiku [this is summarised in Table 1 below and Slide 4, and will be discussed in the presentation].

Table 1: Summary of environmental state and trends in Southland waterways (See Slide 6)

Attributes	State	Trend (17yr)[6]
Mahinga kai species (Slide 2)		
Toxicants (chronic and acute) (Nitrate, Ammonia)		
Nitrate (toxicity)[7]	In the Waiau FMU all sites are within the A band (No observed effect on any species tested). In the Mataura, Oreti and Aparima FMUs there are sites within the B & C bands (where growth effects are observed on up to 5% and 20% respectively on the most sensitive species such as fish). In the Mataura FMU 50% of the sites are within the A band, and 50% within the B & C bands. In the Oreti, and Aparima, FMUs 37.5% of sites are within the A band and 62.5% are within the B & C bands.	The trend direction for the majority of sites is deterioration (48%). For 45% of sites, trend direction was unable to be confidently determined (henceforth indeterminate), and 8% showed improvement.
Ammonia (toxicity)[8]	The majority of sites are within the A band (~60%). There are sites within the B band within each FMU. The C band sites are found exclusively in the Mataura FMU. Within B bands 5% and C band 20% of the most sensitive species can be impacted. At the C band there is also reduced survival of most sensitive species.	47% of sites showed improvement and 47% of sites showed indeterminate trends. One site was deteriorating.
Trophic state (Nitrogen and Phosphorus) -Rivers		
Total Nitrogen[9]	75% of sites do not comply with ANZECC trigger values. 49% of sites are over twice the trigger value. 10% of sites are over 5 times the trigger value.	The trend direction for the majority of sites (53%) was indeterminate. 40% of sites are deteriorating and 8% of sites showed improvement.
Total Phosphorus[10]	40% of sites do not comply with ANZECC trigger	The trend direction for the majority of sites (64%)

6 River trends are for the 17-year period between Jan 2000 and Dec 2016 as reported within Environment Southland (2017) Water Quality in Southland: Current State and Trends. Other trends are reported within the Section 42A hearing report.

7 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.26; Table 3 Attachment C; Map 4 Attachment E.

8 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.26; Table 3 Attachment C; Map 5 Attachment E.

9 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.25, Table 3 Attachment C.

	values. 8% of sites are over twice the trigger value.	was indeterminate. 36% of sites had improving trends.
Dissolve Reactive Phosphorus [11]	52% of sites do not comply with ANZECC trigger values. 21% of sites are over twice the trigger value.	The trend direction for the majority of sites (52%) with sufficient data was indeterminate. 44% of sites are improving and 4% are deteriorating.
Clarity[12]	11% of sites do not comply with ANZECC trigger values.	The trend direction for the majority of sites (72%) was indeterminate. 14% of sites are improving and 14% are deteriorating.
Invertebrates[13]	56% of ES monitored sites are within the excellent and good MCI water quality categories and 44% are within the fair and poor categories. 72% of ES monitored sites comply with the Water Plan MCI standards.	The trend direction for the majority of sites (72%) with sufficient data was indeterminate. 28% of sites showed deterioration and no sites are improving.
Connections and health of other ecosystems – which support different life stages		
Lakes – Te Anau and Manapouri [14]	In A Band for NPS-FM ecosystem health and human health (swimming)	
Lakes – Coastal[15]	Waituna is below the bottom-line for Total Nitrogen (closed) and human health (swimming). Uruwera/Lake George is in C band for Total Nitrogen, Total Phosphorus and human health (swimming).	
Wetlands[16]	From historic (circa 1840) and current data (2010), it has been reported that 90% of wetlands have been lost within Southland (excluding the public conservation lands of Fiordland National Park and Stewart Island/Rakiura).	Wetland loss is still occurring

10 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.28; Table 3 Attachment C.
11 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.28; Table 3 Attachment C.
12 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: Table 3 Attachment C.
13 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.29, 6.30, 6.31; Maps 6 & 7 Attachment E.
14 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.33; Table 4 Attachment F.
15 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.34; Table 4 Attachment F.
16 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraphs 6.42 and 6.43; Fitzgerald et al (2010) and Clarkson et al (2011); Ewans (2014).

Estuaries[17]	New River Estuary and Jacobs River Estuary are in poor ecological health. Fortrose (Toetoes) Estuary is in moderate state of ecological health. Parts of Waikawa Estuary are in moderate ecological health. Nutrient enrichment has been linked to all these estuaries as a main driver of decline.	There has been rapid decline in NRE and JRE. Blackness increasing with NRE (Cultural evidence) In Fortrose (Toetoes) Estuary macro-algae coverage has been expanding since 2004. For Waikawa Estuary Townsend and Lohrer (2015) expressed concern over possible macro-algae expansion.
Mahinga kai activity (Slide 3)		
Safe & Desirable to harvest		
Human pathogens (*E. Coli*)[18]	80% of ES monitored sites are above the minimum acceptable state for primary recreation (immersion/swimming). 74% of sites are twice the minimum acceptable state for swimming. 35% of monitored sites are 10 times above times the minimum acceptable state for swimming. Magnitude of exceedance ranges from 0 to 76 times above the minimum acceptable state for immersion/swimming. *E. coli* levels near the two freshwater Mātaitai are over 20 times minimum acceptable state for immersion/swimming.	The trend direction for the majority of sites (83%) was indeterminate. 10% of sites are deteriorating and 7% are improving. *E. coli* trends near Mataura River Mātaitai are deteriorating.
Cyanobacteria[19]	All the Ngāi Tahu Statutory Acknowledgment Rivers in the Southland region have had one or more sites experience benthic cyanobacteria (blue-green algae/*Phormidium*) proliferations on one or more occasion since 2009.	

17 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.37 to 6.41; Townsend and Lohrer (2015).
18 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.24, Attachment C Table 3, Attachment E Maps 3 and 8.
19 Replacement statement of evidence of Dr Jane Catherine Kitson (Including Attachment E), 29 May 2017: paragraph 6.32, McAllister et al. 2016.

REBUTTAL EVIDENCE IN RELATION TO THE EVIDENCE OF MR HELLER (ON BEHALF OF FEDERATED FARMERS OF NEW ZEALAND INCORPORATED (SOUTHLAND PROVINCIAL DISTRICT)

19. My rebuttal evidence focusses on the aspect that Mr Heller has presented opinions in his evidence based on inaccurate facts and assumptions. In this summary I have chosen to focus specifically on two main aspects that form the foundation for Mr Heller's conclusions. These are specifically:

(a) Inaccurate and inappropriate use of the terms 'stable' and 'no change' in relation to trends; and

(b) Unclear analysis of nutrient limitation and reliance on N:P ratios.

Inaccurate and inappropriate use of the terms 'stable' and 'no change' in relation to trends

20. Mr Heller has used the terms 'stable' or 'no change' throughout his evidence when referring to the trend results in the Southland Water Quality 2017 report.[20] However the statistical approach followed by Environment Southland was that as described by Larned *et al.* 2015 and McBride *et al.* 2015. This differs from previous trend analysis.

21. In the approach Environment Southland has employed, the trend analysis can only conclude either that the trend direction can be determined with confidence (upward or downward), or it cannot be determined with confidence and thereby 'indeterminant'. No one can infer 'no trend' or 'stable' conditions.

22. I consider that all of Mr Heller's evidence using the premise of 'no trend' or stable trend' should be disregarded.

Unclear analysis of nutrient limitation and reliance on N:P ratios

23. Mr Heller's opinions around managing primarily for Phosphorus are based on analysis that is unclear. He has not described the methodology and assumptions he employed in his analysis. Mr Heller presumably used the DIN:DRP molarity ratio 30:1, however he has not stated whether he converted the data from mass to molarity.[21]

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20 Environment Southland 2017. State and Trend for Southland Water Quality. Environment Southland.

21 Molecular weight is the mass of a molecule. It is calculated as the sum of the atomic weights of each constituent element multiplied by the number of atoms of that element in the molecular formula. The unit used for molar weight is grams/mole.

24. That aside, N:P ratios should only be used as an indicator of nutrient limitation. Measuring N:P in algal biomass and bioassays are considered to provide a more definitive answer and need to be undertaken at different times of the year/different flow conditions)[22].

25. Mr Heller's argument of managing just for P goes against expert opinion and the literature, and has not been shown to be based upon rigorous analysis.

26. The other inaccuracies within Mr Heller's evidence are highlighted within my rebuttal evidence.

22 Death et al. 2007; Francoeur et al., 1999; McDowall and Larned 2008, McDowall et al. 2009; Wilcox et al. 2007.

Visual Evidence

Dr Jane Kitson

Te Runanga o Ngai Tahu


Mahinga Kai example
Ability to fish at preferred sites, ki uta ki tai (catchment scale)
Food for whānau
Manaakitanga - Food for manuhiri
Whakapapa & identity
Ability to trade between whānau
Taonga species
Ability to use preferred harvest & storage methods
Available in sufficient numbers
Fish condition
Safe & desirable to harvest
Ability to support intergenerational knowledge transfer activities
Ecological integrity of habitat
Access
Safe to eat
Slide 1; *(source Williams and Crow 2016)*

Periphyton
(Relevant for invertebrate habitat/abundance /biomass/community composition)

Water clarity/turbidity/suspended fine sediments
(relates to the amount of light in the water needed for aquatic plants to grow, and how much suspended sediment (soil) is in the water. Too much can affect visual feeding of fish, cause abrasions to fish and clog gills)

Nitrogen and phosphorus
(not too high and not too low for supporting primary production e.g., periphyton/algae)

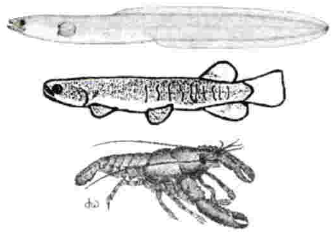
Flow regime*

Fish habitat
(places for fish to live)

Benthic invertebrate habitat
(places for kai species to live)

Fine deposited sediment
(Can degrade feeding and spawning habitat for fish)

Invertebrate habitat and wetted productive area



Invertebrate abundance/biomass and quality
(species and size composition)

Other kai/food species (Slide 5)

Dissolved Oxygen in the water (DO)

Water temperature

pH (acidity)

Toxicity Chronic and acute
eg nitrate, ammonia, heavy metals etc.

Pathogens, disease

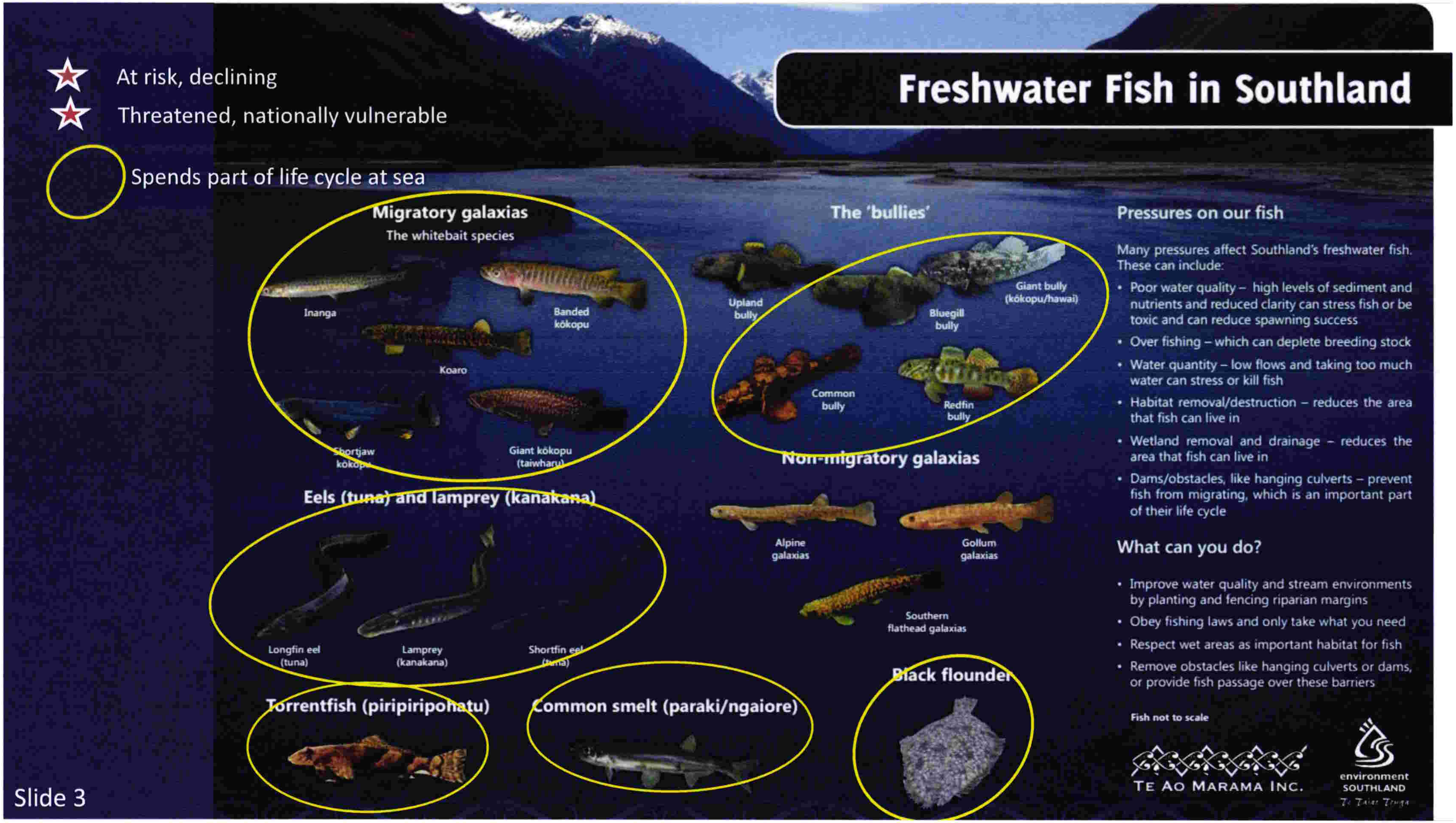
Fish passage

Introduced predators & competitors

Associated species eg kakahi and hosts, and interactions between species & ecosystem

Connections and health of other ecosystems – which support different life stages eg wetlands, estuaries, springs, ponds, rivers, streams, coast, ocean

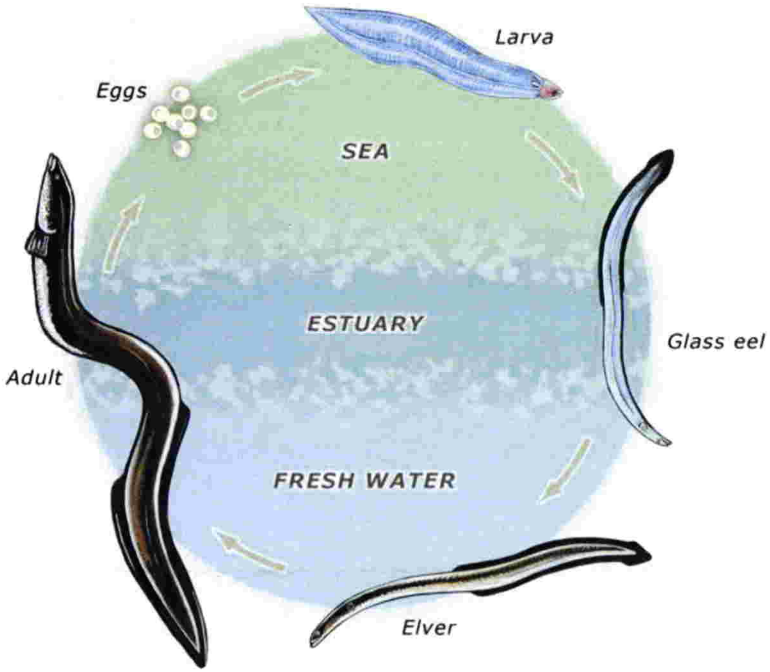
Attributes for mahinga kai/taonga species



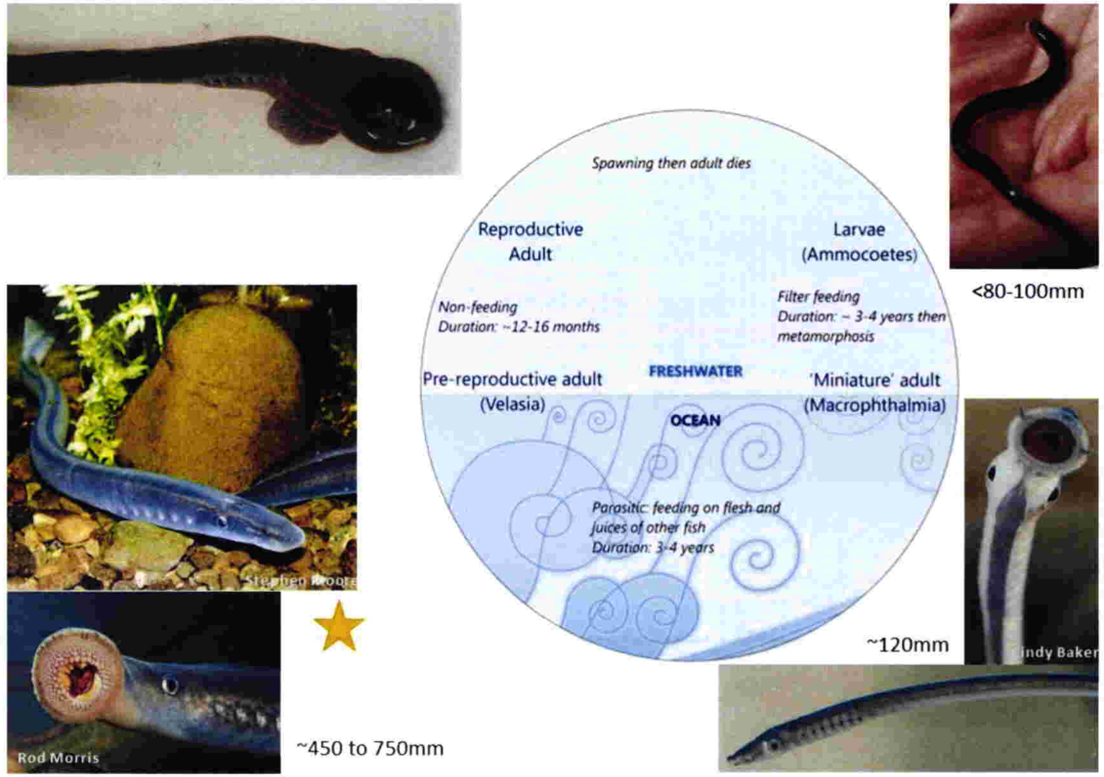
At risk, declining
Threatened, nationally vulnerable
Spends part of life cycle at sea
Freshwater Fish in Southland
Migratory galaxias
The whitebait species
Inanga
Banded kōkopu
Koaro
Shortjaw kōkopu
Giant kōkopu (taiwharu)
The 'bullies'
Upland bully
Bluegill bully
Giant bully (kōkopu/hawai)
Common bully
Redfin bully
Non-migratory galaxias
Alpine galaxias
Gollum galaxias
Southern flathead galaxias
Eels (tuna) and lamprey (kanakana)
Longfin eel (tuna)
Lamprey (kanakana)
Shortfin eel (tuna)
Torrentfish (piripiripohatu)
Common smelt (paraki/ngaiore)
Black flounder
Pressures on our fish
Many pressures affect Southland's freshwater fish. These can include:
• Poor water quality – high levels of sediment and nutrients and reduced clarity can stress fish or be toxic and can reduce spawning success
• Over fishing – which can deplete breeding stock
• Water quantity – low flows and taking too much water can stress or kill fish
• Habitat removal/destruction – reduces the area that fish can live in
• Wetland removal and drainage – reduces the area that fish can live in
• Dams/obstacles, like hanging culverts – prevent fish from migrating, which is an important part of their life cycle
What can you do?
• Improve water quality and stream environments by planting and fencing riparian margins
• Obey fishing laws and only take what you need
• Respect wet areas as important habitat for fish
• Remove obstacles like hanging culverts or dams, or provide fish passage over these barriers
Fish not to scale
Te Ao Marama Inc.
environment SOUTHLAND
Te Taiao Tonga
Slide 3

Examples of mahinga kai life cycle

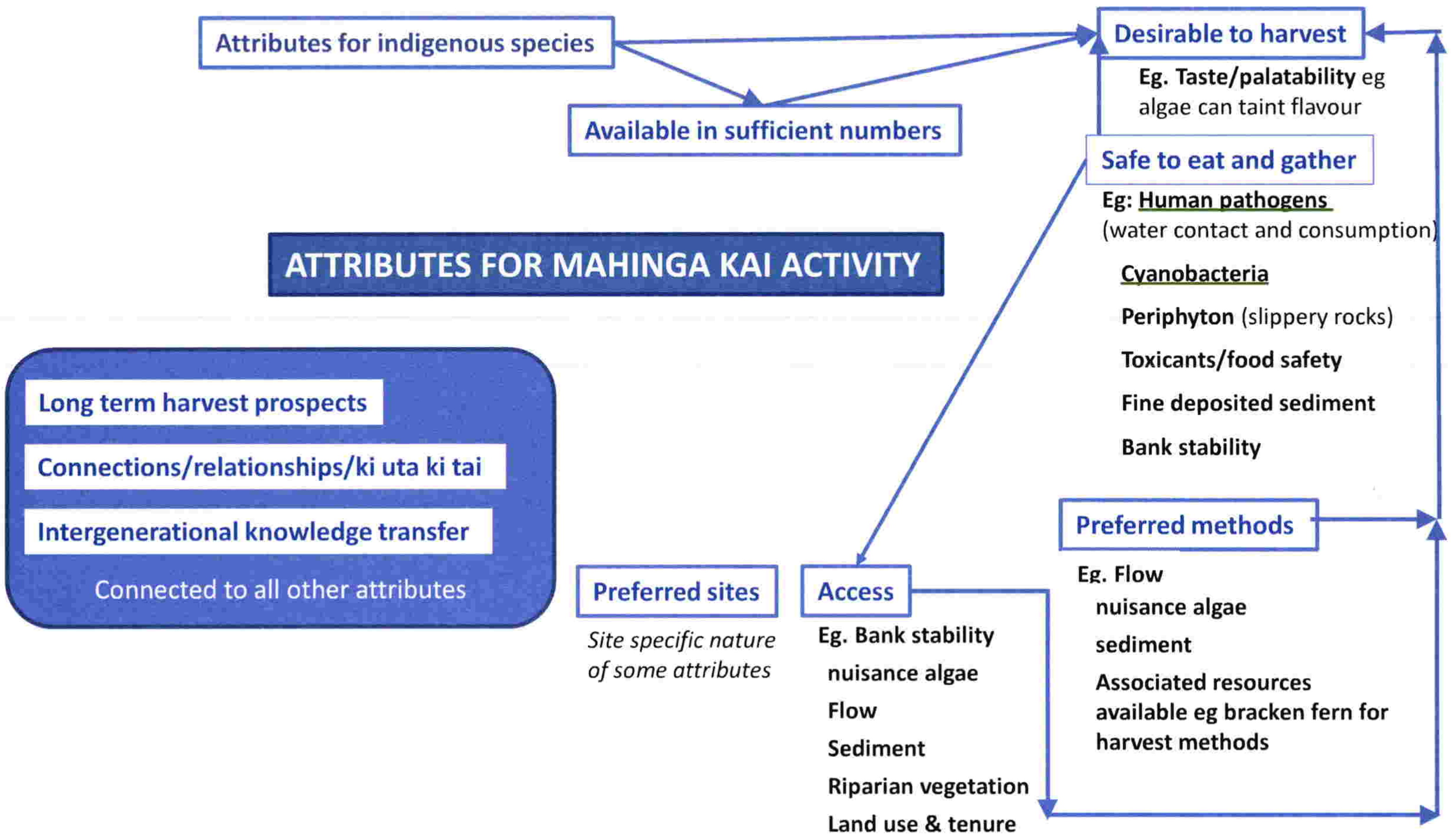
TUNA



KANAKANA



Slide 4


Attributes for indigenous species
Available in sufficient numbers
Desirable to harvest
Eg. Taste/palatability eg algae can taint flavour
Safe to eat and gather
Eg: Human pathogens (water contact and consumption)
Cyanobacteria
Periphyton (slippery rocks)
Toxicants/food safety
Fine deposited sediment
Bank stability
ATTRIBUTES FOR MAHINGA KAI ACTIVITY
Long term harvest prospects
Connections/relationships/ki uta ki tai
Intergenerational knowledge transfer
Connected to all other attributes
Preferred methods
Eg. Flow
nuisance algae
sediment
Associated resources available eg bracken fern for harvest methods
Preferred sites
Site specific nature of some attributes
Access
Eg. Bank stability
nuisance algae
Flow
Sediment
Riparian vegetation
Land use & tenure

Slide 5

Attributes	State	Trend (17 years)
Mahinga kai species		
Toxicants - Rivers		
Nitrate		↘ ? ↗
Ammonia		? ↗ ↘
Trophic State (Nitrogen and Phosphorus) - Rivers		
Total Nitrogen		? ↘ ↗
Total Phosphorus		? ↗
Dissolved Reactive Phosphorus		? ↘ ↗
Clarity		? ↗ ↘
Invertebrates		? ↘
Connections and health of other ecosystems – which support different life stages		
Lakes: Te Anau & Manapouri		
Lakes: Coastal		
Wetlands		↘
Estuaries		↘
Mahinga kai activity : Safe to harvest		
Human pathogens (*E. coli*)		? ↘ ↗
Cyanobacteria		

Mō tātou, ā, mō ngā uri, ā muri ake nei

For all of us and our children after us.