Socio-cultural and ecological indicators of Canterbury estuaries

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Estuaries support a wide range of human activities and values, but are one of the most anthropogenically impacted ecosystems in the world. Ki uta ki tai (mountain to sea) is a holistic view of waterways, that is embodied within Ngāi Tahu whakapapa (genealogy) and environmental management practices. While ecosystem connectivity is well-recognised, current policies and management do not effectively account for this philosophy, or Ngāi Tahu environmental values and concepts. Identifying and understanding the risks to socio-cultural values is integral to the effective management and accountability of anthropogenic activities in our estuaries. This study evaluates the socio-cultural and ecological values of shellfish across four estuaries in Waitaha Canterbury (Figure 1).

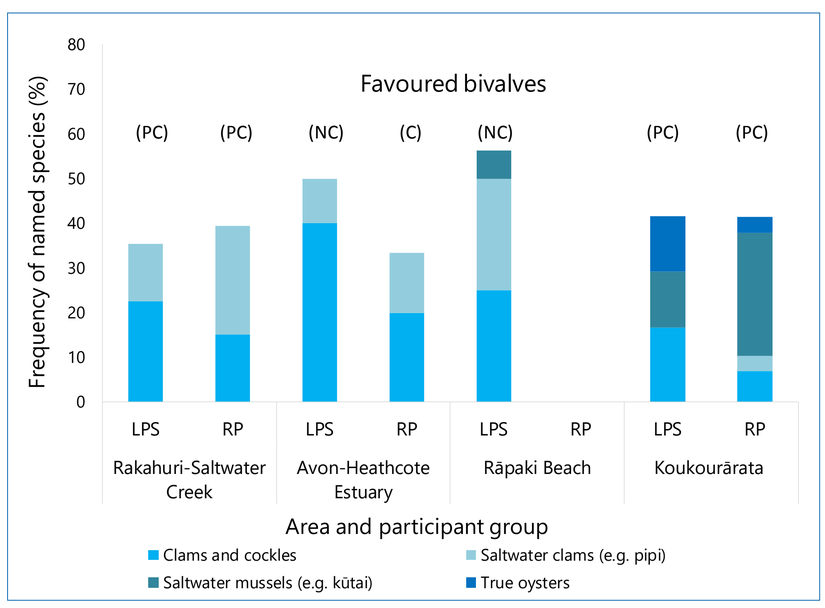

Figure 2: Percent frequency of favoured estuarine species named by participant groups. Cockles and pipi were periodically consumed (PC), not consumed (N), and consumed by participants (C).

Cultural affiliation: Ngāi Tahu scores – group comparison results

Scores	NZ European		NZ Māori		Visitors	
Area	v^2	p-value	v^2	p-value	v^2	p-value
Rakahuri-Saltwater Creek Estuary						
Site	32.73	<0.0001	10.77	0.0015	no value	no value
Catchment	64.84	<0.0001	22.83	<0.0001	no value	no value
Avon-Heathcote Estuary						
Site	27.02	<0.0001	33.00	<0.001	33.00	<0.001
Catchment	27.02	<0.0001	25.00	<0.001	25.00	<0.001
Rāpaki						
Site	23.54	<0.0001	50.02	<0.0001	21.78	0.0001
Catchment	15.12	0.0001	45.89	<0.0001	18.24	0.0003
Koukourārata						
Site	48.22	<0.0001	3.80	0.0789	43.44	<0.0001
Catchment	94.97	<0.0001	1.72	<0.0001	36.22	<0.0001

Table 1: Fisher results of the environmental score given by Ngāi Tahu participants in comparison to New Zealand European, Maori or visitors.

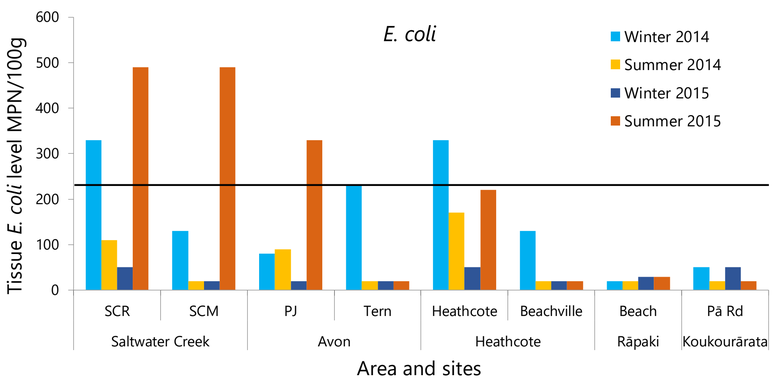

Figure 4: Cockle tissue *E. coli* concentrations at each site, except for Rāpaki Beach where pipi were used, with the human consumption guideline level (230 MPN/100 g) marked by the black line.

Methods

Socio-cultural values were evaluated using interviews and on-site questionnaires with Local Practitioners and Specialists (LPS), e.g., scientist, kaitiaki and Recreational Participants (RP), e.g., 'beach-goers'.

Participants were asked about their estuarine-based activities, the environmental condition, the indicators they used to guide their activities, and their opinions about management.

Ecological values were investigated using tuangi/cockle (*Austrovenus stutchburyi*) and pipi (*Paphies australis*) at Rāpaki site with both low and high salinity areas. The indices examined the shellfish condition index (CI) and density, and sediment and tissue contaminants (metals and *E. coli*).

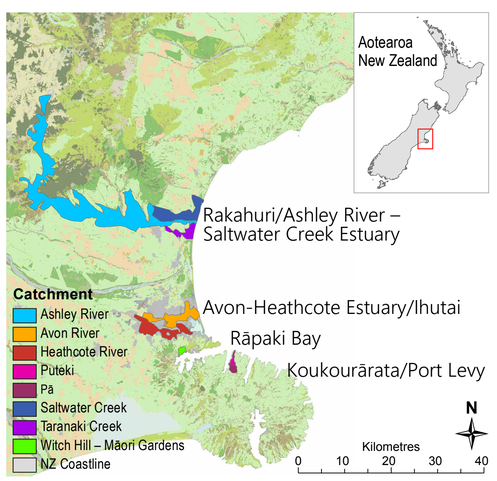

Figure 1: Location of study catchments in Waitaha, Canterbury. Maps: LINZ (2015) and LRIS (2012).

Results summary

Shellfish were favoured resources but consumption was restricted to certain sites.

- Shellfish made up 33–56% of favoured estuarine species (Figure 2).
- Consumption was varied across the participant groups and was restricted by rāhui bylaws (Rāpaki and Koukourārata) or perceived poor environmental condition. For example, the Avon-Heathcote Estuary no longer supports Ngāi Tahu shellfish harvest values, but the less experienced (<20 years) RP (non-Ngāi Tahu) are consuming shellfish from this estuary.

Participants' environmental indices highlighted local concerns.

- Sediment, water indices (e.g., water quality/clarity), fish and shellfish indices, and contamination (including food and wading risks) were common concerns (Figure 3).
- These indices, including salinity, were associated with harvest practice by more experienced (>20 years) participants who identified as Ngāi Tahu and NZ European.
- Ngāi Tahu participants had perceived environmental condition significantly lower than NZ Europeans and Māori participants at each site, except Koukourārata (Table 1).

Food safety indicators was site specific and were negatively associated with shellfish condition.

- Cockle tissue *E. coli* exceeded food safety guidelines at low-salinity sites of agricultural and urban catchments (SCR, PJ, Heathcote), including the site downstream from SCR (SCM).
- Cockle tissue inorganic arsenic also once exceeded food safety guidelines (>1.0 ppm) at SCR (Figure 4).
- The following indices were negatively associated with each other:
  - condition index (CI) with tissue *E. coli* ($p<0.0001$)
  - CI with tissue trace metal score (Marine Pollution Index (MPI) $p<0.0001$)
  - density with tissue MPI ($p<0.0001$).

Conclusions

1. The identification and evaluation of socio-cultural and ecological values highlighted local (site-specific) and shared (across sites) shellfish concerns.
   - Sites that no longer provide for safe socio-cultural interactions and exceeded food safety guidelines require further investigation and management interventions.
   - Scientific values do not necessarily provide for Ngāi Tahu values: ***"The food standard doesn't provide an indigenous perspective of health standard"*** (Ngāi Tahu LPS interviewee).
2. Given the identified impacts on mana whenua values at multiple sites, estuarine management requires a more participatory approach to better reflect the ethic of ki uta ki tai.

Figure 3: Habitat sediment condition is a concern for cockles at Saltwater Creek.

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