Setting Ecological Flows in Takaka FMU

Trevor James
For Takaka FLAG
26 June, 2015

tasman lifestyle district council

Assessing Level of Ecological Significance For Native Fish

1. Index of Biological Integrity – 'IBI'
2. River Values Assessment System – 'RiVAS'

Assessing Ecological Significance for Native Fish – cont.

IBI

- Number of species
- Number of guilds
  - Riffle
  - benthic pool
  - pelagic pool
- Number of tolerant species
- Proportion of invasive species

Assessing Ecological Significance for Native Fish – cont.

IBI

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- Number of guilds
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Assessing Ecological Significance for Native Fish – cont.

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Assessing Ecological Significance for Native Fish – cont.

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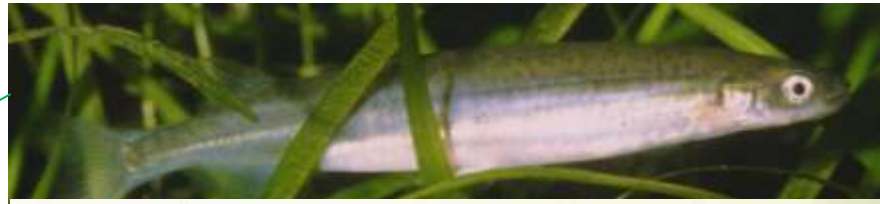


Assessing Ecological Significance for Native Fish – cont.

IBI

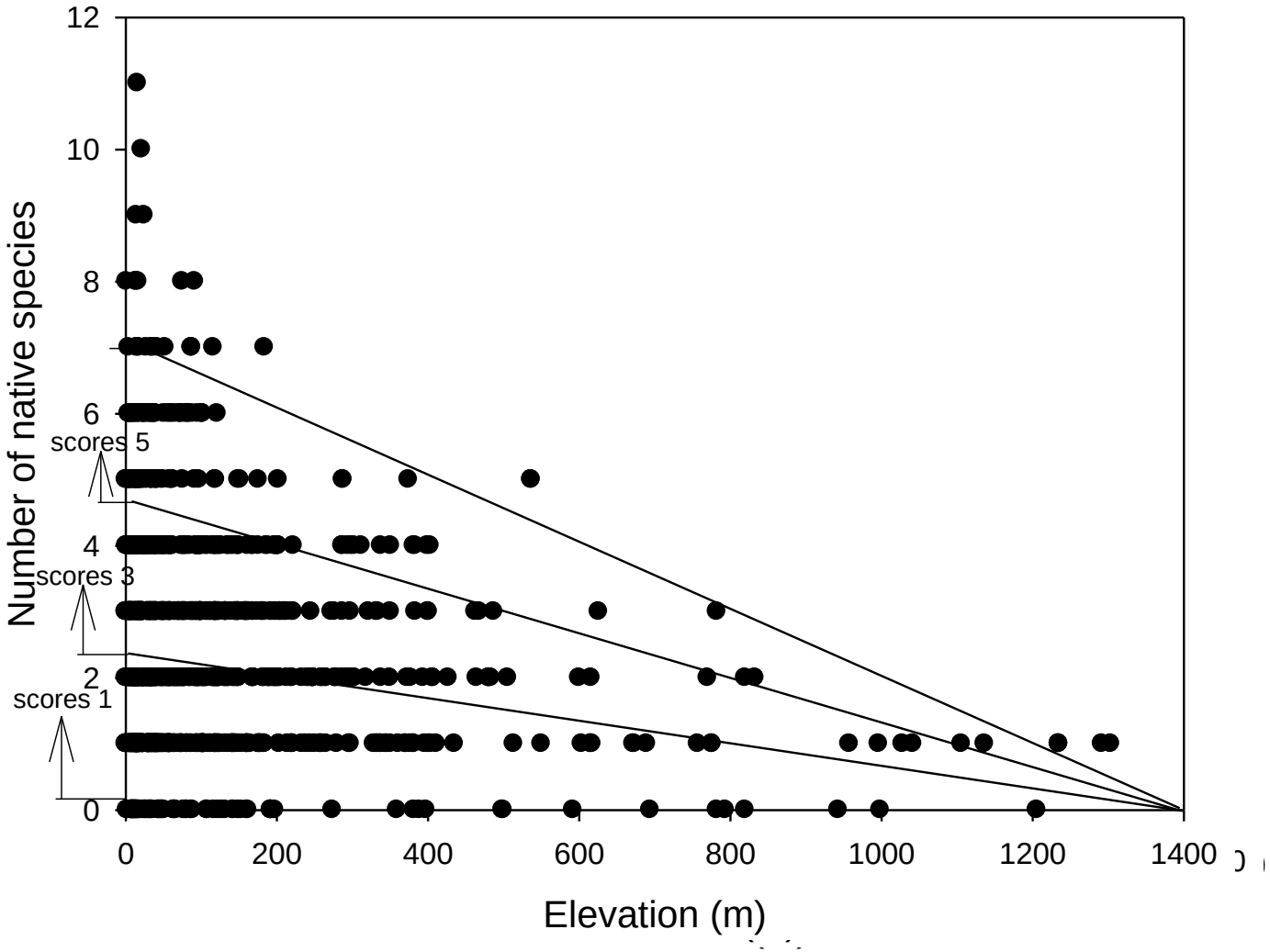
Number of species and guilds dictated by:

- Elevation
- Distance to sea

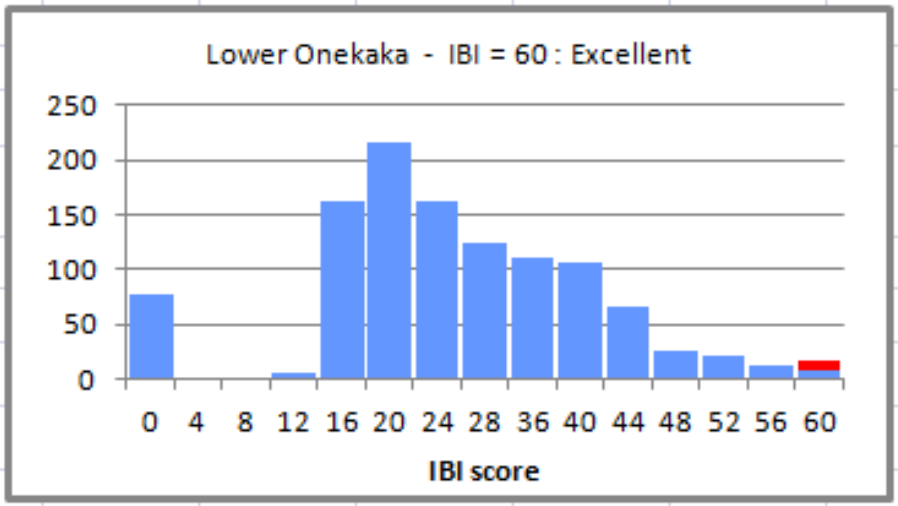
Other factors not used:

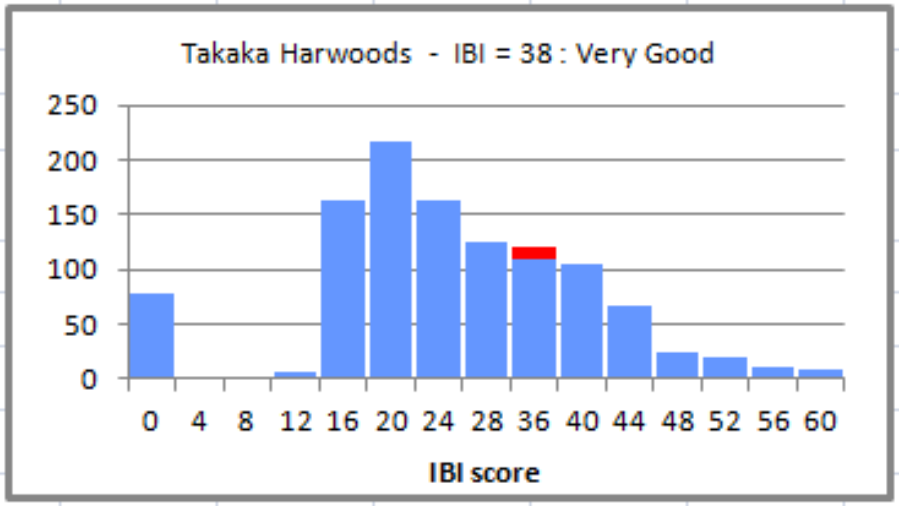
- Stream size
- Summer water temperature
- Catchment-scale drivers of variation in stream flow
- Habitat diversity

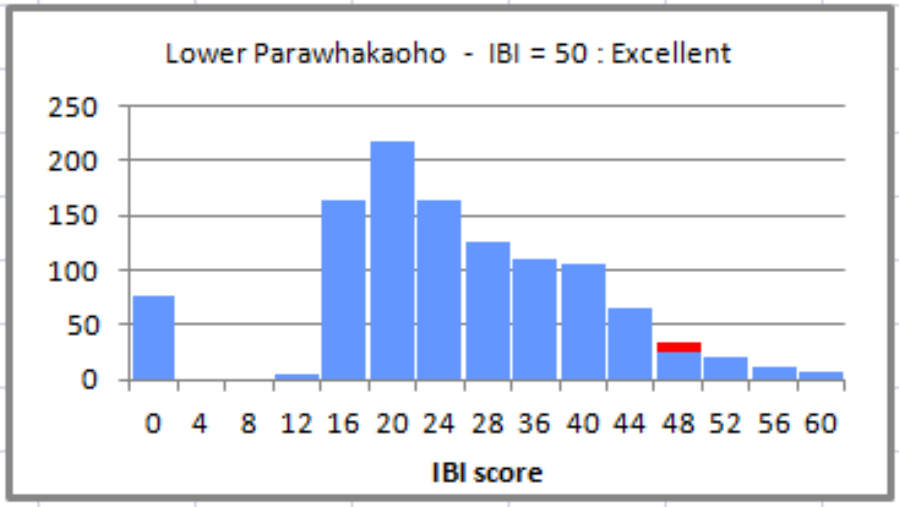
fish species in Tasman plotted against elevation

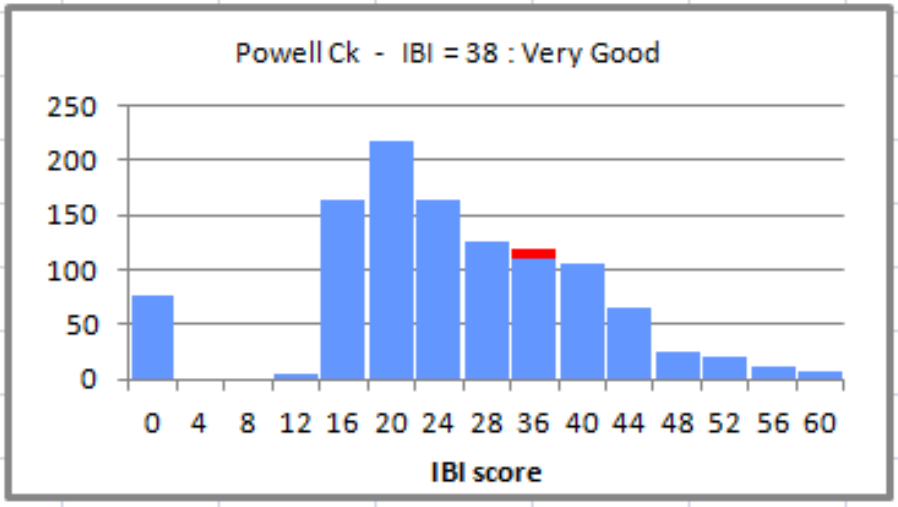


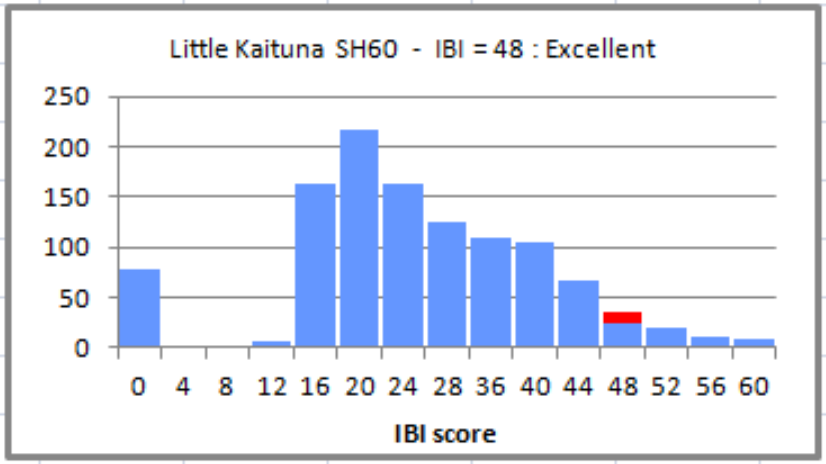
Outputs of relative significance

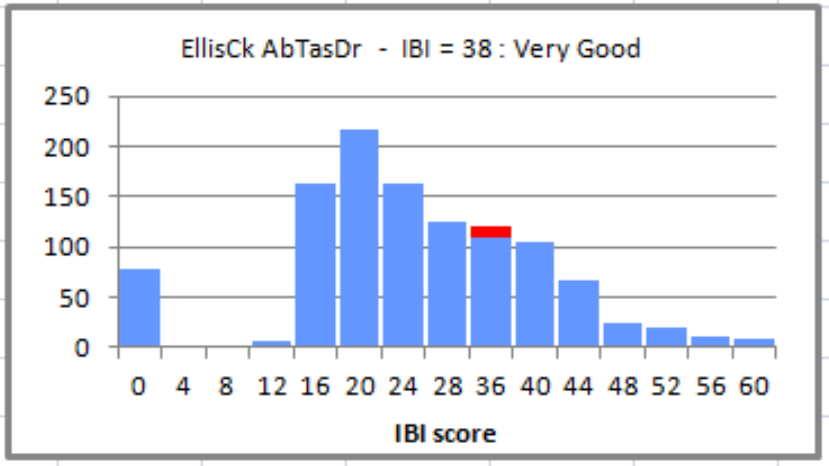


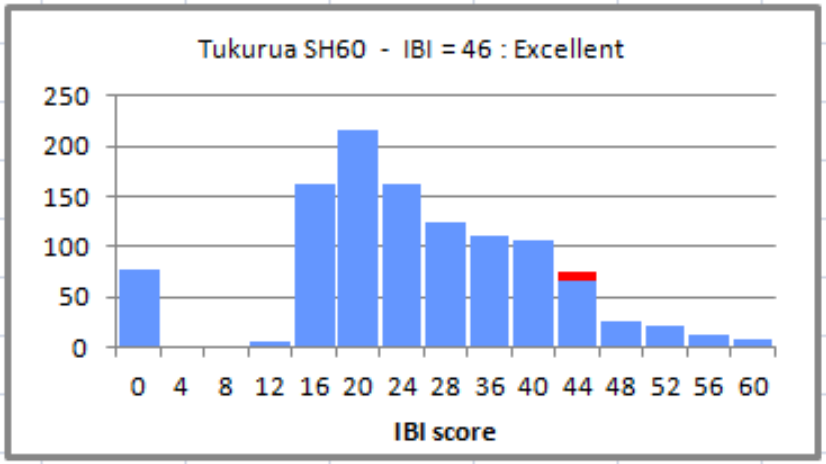


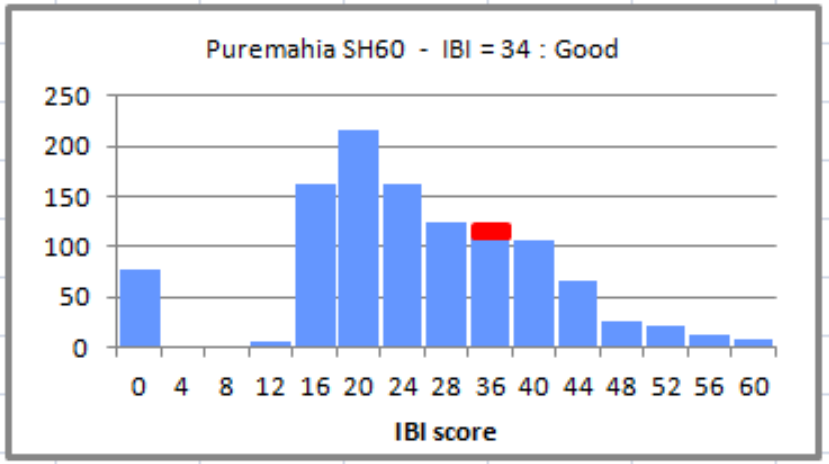


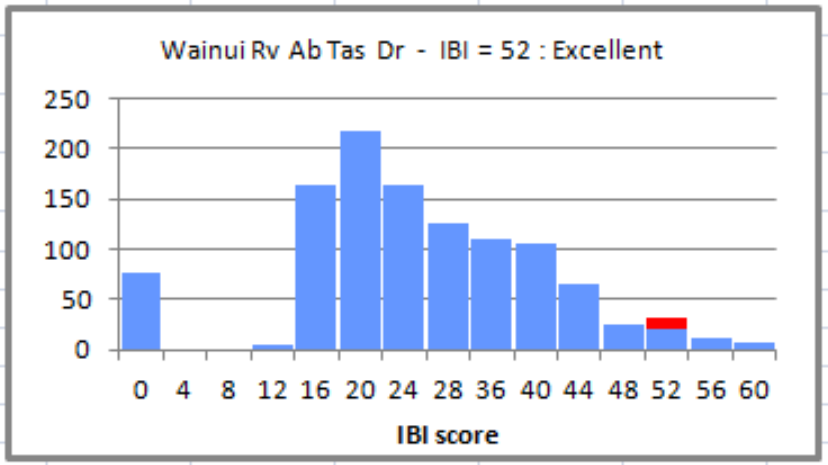


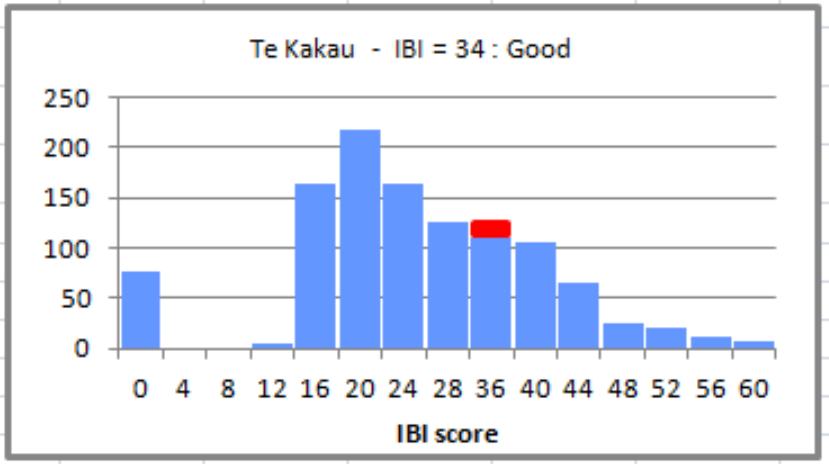

Little Kaituna SH60 - IBI = 48 : Excellent
250
200
150
100
50
0
0 4 8 12 16 20 24 28 36 40 44 48 52 56 60
IBI score


EllisCk AbTasDr - IBI = 38 : Very Good
250
200
150
100
50
0
0 4 8 12 16 20 24 28 36 40 44 48 52 56 60
IBI score


Tukurua SH60 - IBI = 46 : Excellent
250
200
150
100
50
0
0 4 8 12 16 20 24 28 36 40 44 48 52 56 60
IBI score


Puremahia SH60 - IBI = 34 : Good
250
200
150
100
50
0
0 4 8 12 16 20 24 28 36 40 44 48 52 56 60
IBI score


Wainui Rv Ab Tas Dr - IBI = 52 : Excellent
250
200
150
100
50
0
0 4 8 12 16 20 24 28 36 40 44 48 52 56 60
IBI score


Te Kakau - IBI = 34 : Good
250
200
150
100
50
0
0 4 8 12 16 20 24 28 36 40 44 48 52 56 60
IBI score

Index of Biological Integrity - Tasman Region : Fish

Centre for Freshwater Ecosystem Modelling and Management, Massey University

Testing Tasman IBI

Site	IBI score	Rating
Lower Onekaka	60	Excellent
Lower Parawhakaoho	50	Excellent
Little Kaituna SH60	48	Excellent
Tukurua SH60	46	Excellent
Puremahia SH60	34	Good
Puremahia @ bush edge	32	Good
Wainui Rv Ab Tas Dr	52	Excellent
Wainui 1km u-s Ab Tas	46	Excellent
Takaka Harwoods	38	Very Good
Takaka Catchment	60	Excellent
MotupipiRv	32	Good
Powell Ck	38	Very Good
EllisCk AbTasDr	38	Very Good

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RiVAS

- Expert panel approach to identify:
  - Areas/catchments
  - Attributes and indicators (scores)
  - Thresholds
- In a spreadsheet it uses data to then rank the areas/catchments on a national, regional or local scale

RiVAS cont.

Data is used for the following attributes:

- Fish IBI
- Spawning
- Migratory species
- ‘Declining’ species
- Stronghold
- River flow
- Water quality
- Introduced fauna
- Physical migration barriers
- Riparian shading

RiVAS – native fish

Tasman Stream Group	area (square km)	1 Fish Score		2 Spawning Score		3 Diadromous Score		4 Declining Species Score	
		Average number native fish	Regional score	Number of whitebait sites	Defined score	Average national score	Regional score	Number declining species	Defined score
unnamed	13	0	0	0	0	1.0	1	0	0
Abel Tasman	281	18397	2	2	3	2.1	3	7	3
Aorere River	559	27054	2	2	3	1.8	2	5	2
Coastal Golden Bay	354	24190	2	6	3	2.4	3	9	3
Coastal Moutere	51	3212	1	3	3	2.4	3	4	2
Dart	83	0	0	0N/A		1.0	1	0	0
Maruia	446	18507	2	0N/A		1.2	1	3	1
Matakitaki	897	8492	1	0N/A		1.1	1	4	2
Motueka	195	2935	1	1	2	1.0	1	3	1
Motueka West Bank Granite	94	5541	1	1	2	1.8	2	5	2
Motueka West Bank Karst	303	7393	1	0N/A		1.3	1	5	2
Moutere	1074	47086	3	2	3	1.5	2	8	3
Motupiko	282	12511	2	0N/A		1.1	1	3	1
Nelson Lakes	519	15972	2	0N/A		1.0	1	2	1
Richmond-Nelson	47	3106	1	5	3	2.2	3	3	1
Riwaka River	85	7687	1	1	2	1.7	2	5	2
Sherry	56	3475	1	0N/A		1.0	1	1	1
Takaka	894	32457	3	1	2	1.4	2	8	3
Upper Buller tribs	1988	40068	3	0N/A		1.1	1	7	3
Wairoa-Lee-Roding	441	9785	2	1	2	1.4	2	7	3
Waiwhero	18	543	1	0N/A		2.0	3	3	1
Wangapeka	319	8006	1	0N/A		1.2	1	2	1
West Coast	559	45002	3	3	3	2.4	3	9	3

RiVAS – native fish

Tasman Stream Group	6 Stronghold Score		7 Flow Score		8 WQ Score		9 Introduced Fauna Score		10 Physical Barrier Score		12 Riparian Shading Score	
	Number of stronghold sites	Defined score	Average national score	Regional score	Average regional score	Regional score	Average national score	Regional score	Proportion of zone affected	Defined score	Average riparian cover	Defined score
unnamed		0	3.0	3	2.7	2	2.2	1	0.00	3	0.71	3
Abel Tasman		3	2.6	3	2.7	3	2.4	3	0.14	2	0.71	3
Aorere River		3	3.0	3	2.8	3	2.9	2	0.01	2	0.63	3
Coastal Golden Bay		2	2.8	2	2.6	2	2.5	3	0.20	2	0.64	3
Coastal Moutere			2.0	1	2.0	1	2.1	3	0.22	2	0.63	2
Dart			2.9	3	2.9	3	2.5	2	0.00	3	0.69	3
Maruia		2	2.7	2	2.9	3	2.3	2	0.00	3	0.63	3
Matakitaki		2	2.8	3	2.9	3	2.4	2	0.00	3	0.59	2
Motueka		3	3.0	2	2.9	3	2.4	2	0.00	3	0.61	3
Motueka West Bank Granite			2.5	3	2.7	2	2.4	2	0.35	2	0.63	3
Motueka West Bank Karst			2.9	3	2.9	3	2.7	2	0.00	3	0.68	3
Moutere			2.6	1	2.3	1	2.3	3	0.10	1	0.56	2
Motupiko		1	2.9	2	2.5	2	2.1	2	0.00	2	0.58	3
Nelson Lakes			3.0	3	3.0	3	2.3	2	0.00	3	0.56	2
Richmond-Nelson			2.2	2	1.7	1	1.2	2	0.00	1	0.58	2
Riwaka River			2.7	2	2.8	3	2.5	2	0.02	2	0.63	3
Sherry			2.8	2	2.6	2	2.2	2	0.00	1	0.56	2
Takaka			2.9	2	2.9	3	2.7	2	0.00	2	0.63	3
Upper Buller tribs		3	2.9	3	2.9	3	2.3	2	0.00	2	0.64	3
Wairoa-Lee-Roding			2.7	1	2.8	2	2.6	2	0.00	2	0.69	3
Waiwhero			2.0	1	2.1	1	2.2	2	0.00	2	0.55	2
Wangapeka			2.9	3	2.9	3	2.7	2	0.00	3	0.67	3
West Coast		3	3.0	3	2.8	3	2.8	3	0.01	2	0.70	3

RiVAS

Tasman Fish Stream Group	Sum
Abel Tasman	28
Aorere River	25
Coastal Golden Bay	25
Coastal Moutere	18
Dart	15
Maruia	19
Matakitaki	19
Motueka	21
Motueka West Bank Granite	19
Motueka West Bank Karst	18
Moutere	19
Motupiko	16
Nelson Lakes	17
Richmond-Nelson	16
Riwaka River	19
Sherry	12
Takaka	22
Upper Buller tribs	23
Wairoa-Lee-Roding	19
Waiwhero	13
Wangapeka	17
West Coast	29

Hydraulic Modelling: Step 1
Relevant Management Objectives

Ecosystem Health
Management Objectives

- All surface and ground waters have healthy mauri (vital energy).
- There is a diversity of indigenous flora and fauna and a range of life stages expected for the water body type.
- Water quality provides at least the minimum requirements for healthy, functioning and resilient aquatic populations (population dynamics, feeding, growth and breeding are occurring within expected ranges for the water body type).

Applies to: All surface and groundwater – including rivers, streams, springs, groundwater, wetlands and freshwaters where they flow into coastal areas.

- There is good habitat diversity, including riparian and wetland vegetation, bed/bank substrate, meander, width/depth, floodplain connectivity and bank shape suitable to aquatic and riparian fauna needs.

Applies to: All rivers, streams, springs, lakes and wetlands

8

Fishing and Food Gathering
Management Objectives

- Kai (food) are safe to harvest and eat.
- In locations that are valued mahinga kai (resource gathering sites), the desired species are plentiful enough for long-term harvest and the range of desired species is present across all life stages.
- Locations that are valued mahinga kai (resource gathering sites) are accessible and able to be used to the extent desired and tikanga (ritual and ceremonies) and preferred methods of harvest are able to be practised.
- All locations that are valued mahinga kai (resource gathering sites) have healthy mauri (vital energy).

Applies to: All surface waters and freshwater where it flows into coastal areas.

Note: the implementation methods for such objectives will require elements outside of the scope of the FLAG project.

10

Cultural and Spiritual Values
Management Objectives

- Our water bodies have healthy mauri (vital energy).
- Those water bodies which do not have a healthy mauri are enhanced over time.
- Surface and ground water is suitable for cultural and spiritual uses and rituals (tikanga).

Applies to: All surface and groundwater

- Wai Tapu (sacred waters) are not degraded by human and animal waste discharges, contaminants and excess sediment.
- Valued features, taonga (treasures) and unique properties of water at Wai Tapu (sacred waters) are maintained and protected.

Applies to: Te Waikoropupu Springs, Fish Creek Springs, Takaka Oxbow Spring.

Recreation - Management Objectives

- Surface waters are safe for swimming during the months Nov – April (excluding times of flood flow)
- Surface waters are safe for secondary contact recreation.

Applies to: All surface waters

Step 2 - Identify Critical Ecological Values for particular waterway

Critical values may be a:

- particular fish community eg riffle-dwellers, pool dwellers
- life stage eg whitebait eggs

Some rules of thumb

- Native fish:
  - Riffle-dwellers often the most vulnerable *(koaro, torrentfish, blue-gill bully, red-fin bully, long-fin eel juveniles)*
  - Run and pool dwellers are resilient to flow variability
  - need riparian and in-stream cover
- Trout requirements (velocity and depth in particular) are sufficient to also provide for:
  - Fast-water native fish (torrentfish, blue-gill bully)
  - Black and Pied Shags
- Trout requirements NOT sufficient for some native invertebrates
- Metabolic rates and food requirements are higher in warmer water temperatures ... so fish need more water in summer

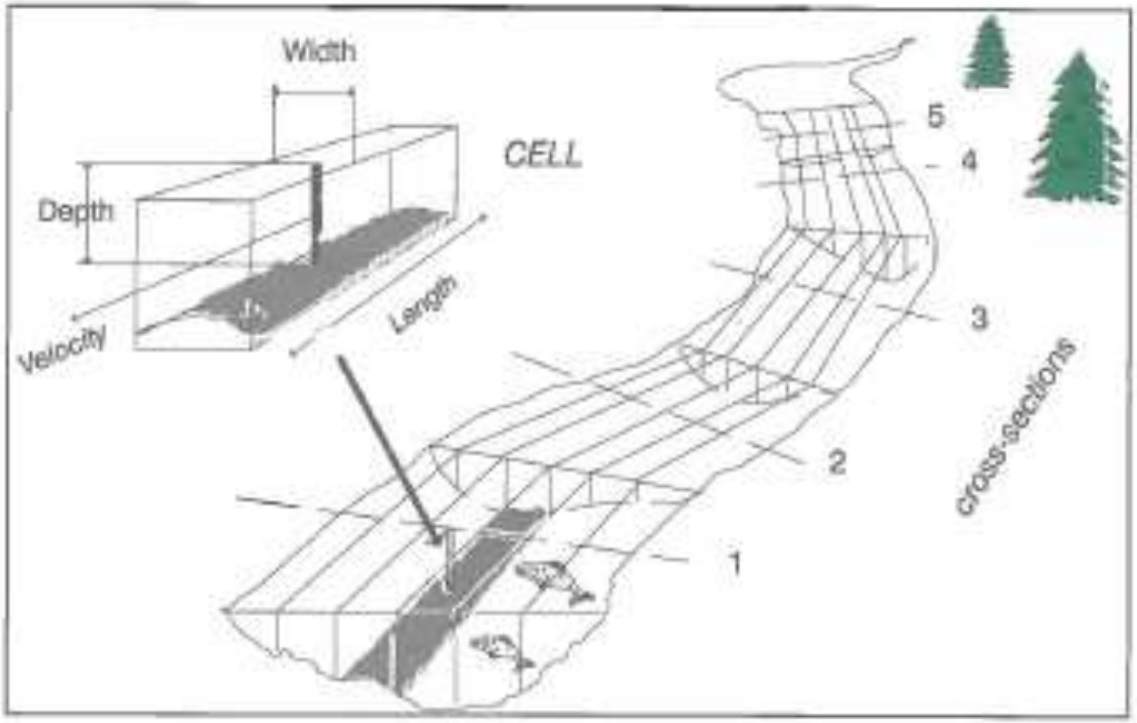
Background: **Optimum Stream Sizes**
(mean annual minimum flow)

- Adult brown trout – 10,000 L/sec
- Trout fingerlings – 2,000 L/sec
- Torrentfish – 5,000-15,000 L/sec
- Native bed-dwelling fish – 1,000 L/sec
- Native invertebrates – 100-100,000 L/sec

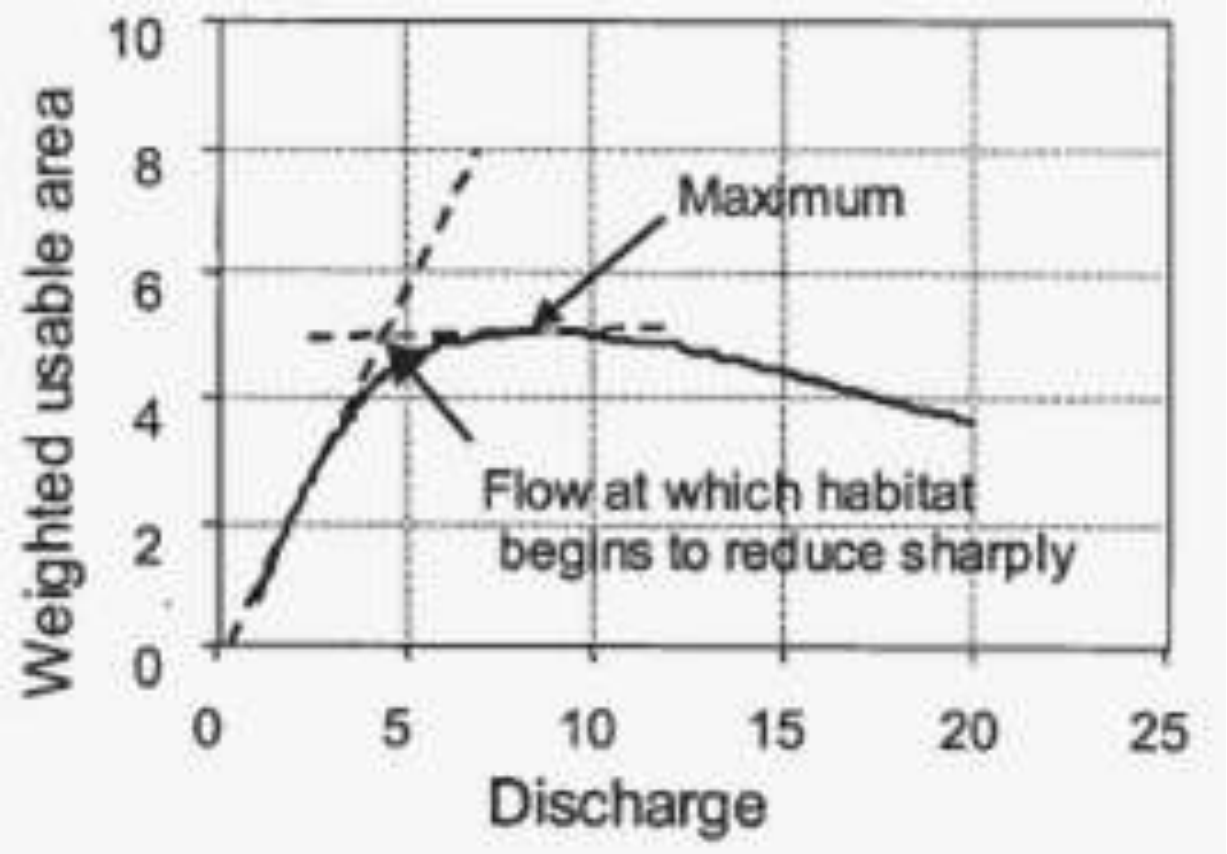
Step 3 - Deriving Minimum Flows Using Hydraulic Habitat Modelling

1. Measure physical parameters (eg velocity, depth, substrate, cover) at cross-sections at a given flow
2. Develop Suitability Index for each species for each parameter
3. Calculate Usable Habitat (suitability index × area)

4. Sum usable habitat to give Weighted Usable Area (WUA)
5. Repeat at different flows
6. Graph WUA vs flow for a given species



Deriving Minimum Flows



Hydraulic habitat modelling is the ideal approach, especially where values and demand are both high.

Yes, Takaka N catchments we have high values ...

But there is a problem:

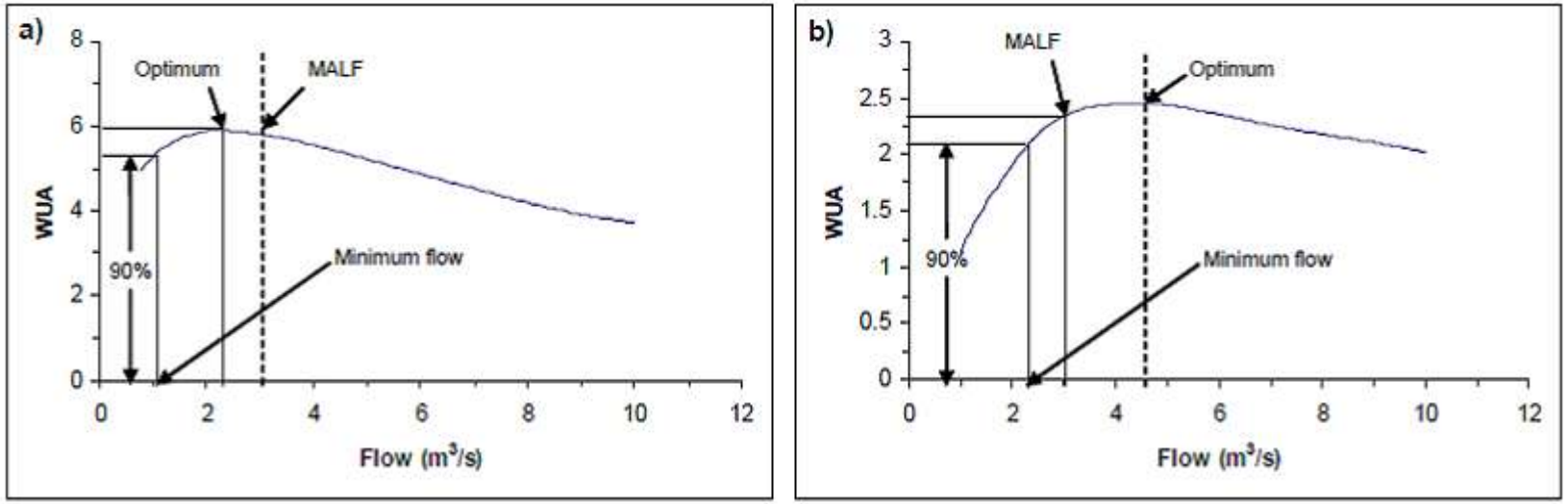
- There is little money to invest in these approaches for these streams.

We currently have low demand. Focus on preventing over-allocation.

Expert opinion could be the appropriate tool.

Deriving Minimum Flows

More flow isn't always better, particularly for larger rivers.



Derivation of minimum flow based on retention of a proportion (90% in this case) of available habitat (WUA)

Deriving Minimum Flows

No flow will maintain maximum habitat for all species and life stages. Usually conflicting flow requirements eg young trout found in low velocities and adult trout found in deep water with higher velocities.

Rivers with large morphological variation (riffles, runs and pools) some of the different requirements can still be catered for.