SWIM Science, Research and Tools Priorities 2022

Note: these science, research and tools priorities were identified through a series of workshops in 2021 and further prioritised and refined in 2022. The topics are in no order of priority/preference.

#	SWIM strategy Outcome 1: Enhanced capacity in regional freshwater management science	
1	**Topic Raised**	**Preparing action plans (under NPS-FM) in response to degradation (overlap with land management and policy)**
	Research Questions:	*1. How effective are the mitigation tools we have?*
		2. What scale are these mitigation tools effective?
		3. What NPS-FM attributes are they effective for (both 2A and 2B attributes)?
2	**Topic Raised**	**Action plans and tool kits**
	Research Questions:	*1. Pull together known means of influencing drivers to allow development of meaningful action plans as required by NPS-FM.*
		2. Identify gaps for future research.
		3. How to link to EDMS, water accounting system and consenting systems to produce action/activity/annual plans?
3	**Topic Raised**	**Monitoring network design**
	Research Questions:	*1. How to integrate long term SOE trend monitoring sites and FMU/regional sites (random-representative of REC, etc.), and DOC Tier 1 (reference) sites to have confidence that we are reporting on FMUs and ensure assessing all ecosystem health attributes and reporting is meaningful?*
		2. Mitigation monitoring – critically need actual real data on the effectiveness of different mitigations in improving water quality. What is going into the modelling is quite high level and coarse based on a combination of a few studies and expert advice. What are some smart study designs that we could use to get some data in the shortest time possible but still be scientifically robust e.g. comparable catchments with and without the mitigation rather than before/after studies. Our Land & Water (OLW) project is set to deliver on this by June 2023. However, timeframes do not match plan notification deadline of December 2024. SWIM is working with the OLW project team o be involved and hope to also get Land Management and Policy SIGs input.
4	**Topic Raised**	**Defining/assessing variability and 'natural state'**
	Research Questions:	*1. How do we account for natural variability, anthropogenic variability, climatic variability and sampling error, given we have control on anthropogenic influences? (assuming NEMS for data collection fully implemented to reduce sampling error)*
5	**Topic Raised**	**Nutrient and sediment load calculators**
	Research Questions:	*1. What tools can councils consistently apply for load accounting for sediment and nutrients in rivers?*
		2. How can we deal with underestimation of stormflow loads?
6	**Topic Raised**	**Delineation, definitions and extent of rivers, streams and wetlands**
	Research Questions:	*1 How are ephemeral streams vs intermittent defined?*
		2. What are consistent definitions for lakes vs wetlands?
		3. How are river, stream, wetland and lake extents delineated and what time period?
		4. How can stream loss be quantified?
7	**Topic Raised**	**Ecological processes in urban areas**
	Research Questions:	*1. How is urban expansion regularly measured and made available to Councils?*
8	**Topic Raised**	**Next steps for LAWA reporting**
	Research Questions:	*1. Is LAWA going to fill the NPS-FM annual reporting needs (or some of it)?*
9	**Topic Raised**	**NEMS for macroinvertebrates**
	Research Questions:	*1. What are the effects of changes in macroinvertebrate sampling methods under the revised macroinvertebrate NEMS on long-term assessments?*
10	**Topic Raised**	**Determining baseline state for lakes**
	Research Questions:	*1. Unable to take actual lake data and model with any degree of confidence across to unmonitored lakes. An alternative is the recently developed bacterial index. Is the bacterial index to estimate lake trophic level robust enough to start using now? If not what further work needs to be done? What would be the cost of using this bacterial index?*
11	**Topic Raised**	**Freshwater quality accounting tool**
	Research Questions:	*1. How do we use existing data (monthly SoE, consent and compliance monitoring) to produce a fit for purpose tool? What frequency and scale is appropriate? How to take a tiered approach*
		2. How does this tool include provision for mātauranga Māori?
		3. How to link quality and quantity (and groundwater)?
12	**Topic Raised**	**Assessment/endorsement of NIWA fish passage app. for NPS/NES requirements**
	Research Questions:	*1. Assess NIWA fish passage app. against the requirements of NPS-FM and NES-FW around fish monitoring past barriers; promote and endorse use through SWIM.*

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13	**Topic Raised**	**Water quantity regimes for Ecosystem health as defined in the NPS-FM**
	Research Questions:	*1. Enable more collection of high resolution water quantity data (through metering and telemetry) to improved decision-making.*
		2. What standard rates should be applied for stock use?
		3. How do changes to catchment hydrology come into the assessment of ecosystem health under the water quantity component?
14	**Topic Raised**	**NPS-FM 3.13 special provisions for attributes affected by nutrients**
	Research Questions:	*1. Explore use of other attributes for soft bottom streams for achieving DIN/DRP criteria (e.g. ecosystem metabolism and DO in relation to managing shading).*
15	**Topic Raised**	**Developing a more holistic and meaningful IBI**
	Research Questions:	*1. Utilise developments in eDNA to develop stronger relationships and more meaningful fish-IBI.*
16	**Topic Raised**	**Formal system approved by RCEOs for providing nitrogen credits for (constructed) wetlands**
	Research Questions:	*1. Develop and get approval for a formal crediting for nitrogen credits in constructed wetlands to increase the rate of construction, and identification/protection, of on farm wetlands*
17	**Topic Raised**	**Satellite remote sensing of lake and CMA water quality**
	Research Questions:	*1. Develop technology, data storage and processes to enable easy and efficient use of satellite technology to map water quality.*
18	**Topic Raised**	**Development of the Cyanofluor tool**
	Research Questions:	*1. Work needs to be carried out to further develop relationships across numerous lakes.*
		2. Update guidance on procedures (e.g. lysing cells ets), and how the tool could be applied in line with the NZ Guidelines for Cyanobacteria in Recreational FW (to a point where the method is
19	**Topic Raised**	**Method for regional or catchment scale relationship development between periphyton biomass (Chlorophyll a) and periphyton cover**
	Research Questions:	*1. Develop a reliable process to calibrate these two attributes in the regional /catchment scale context.*
20	**Topic Raised**	**Nation-wide land use survey updated every two years**
	Research Questions:	*1. Develop land-use data that is publically available in digital format with ability to query attributes.*

	SWIM strategy Outcome 4: Greater capacity and understanding in mātauranga Māori	
21	**Topic Raised**	**Raising the mana and reach of mātauranga Māori**
	Research Questions:	*1. How do we identify opportunitiesto build mātauranga Māori into our collective understanding of the environment?*
		2. How can Councils ensure the link to Te Mana O Te Wai is made?
22	**Topic Raised**	**eDNA sampling for threatened species and mahinga kai**
	Research Questions:	*1. Further development of the eDNA methodologies to enable use for community/cultural and scientific purposes in freshwater ecosystems including lakes and wetlands.*

	SWIM strategy Outcome 5: Greater capacity and understanding in climate change	
23	**Topic Raised**	**Climate Change**
	Research Questions:	*1. What are the key water science questions that we need to be asking and researching? (e.g. Changes in water resource availability, climate impacts on freshwater ecosystems, how climate change might alter restoration pathways)*
		2. What practical steps are Councils taking to account for the effects of climate change?