

Polluted Inheritance

New Zealand's
Freshwater Crisis

MIKE JOY

NEW ZEALAND NOW HAS THE HIGHEST
PROPORTION OF THREATENED AND
AT-RISK SPECIES IN THE WORLD

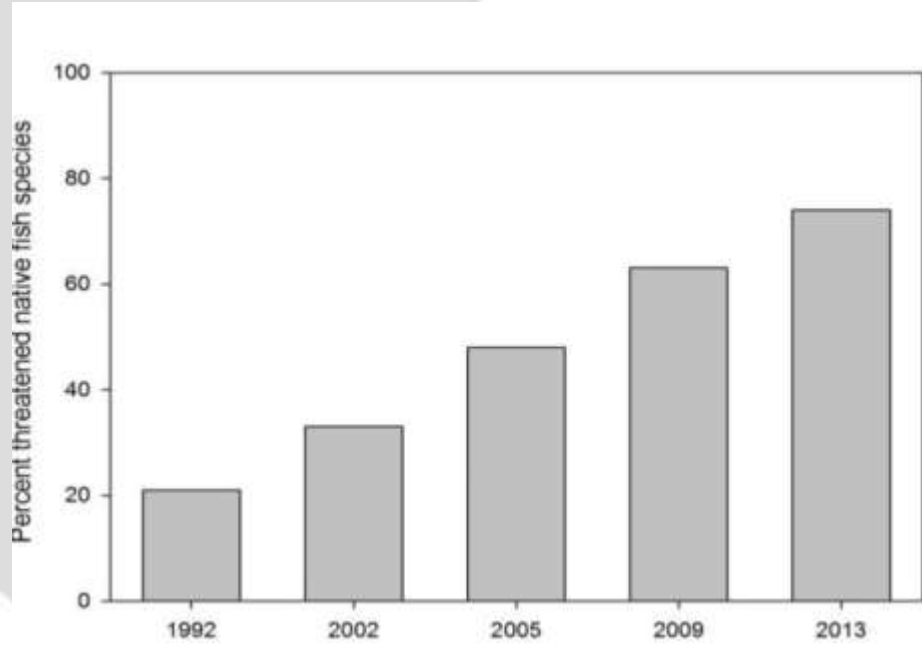
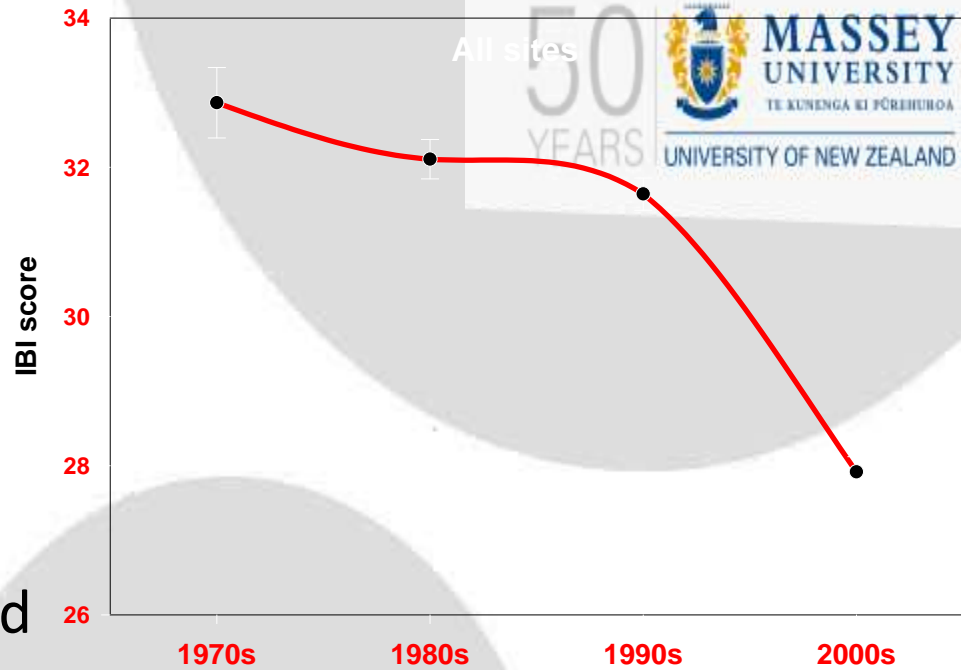
BWB Texts

The state of our freshwater environments,
and the governments “fresh start for
freshwater” the National Policy statement for
freshwater

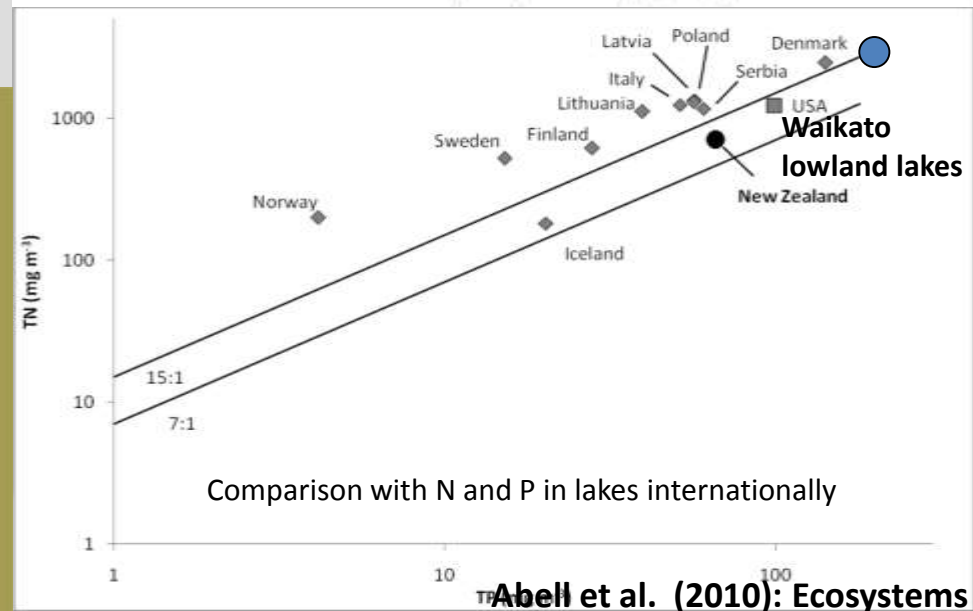
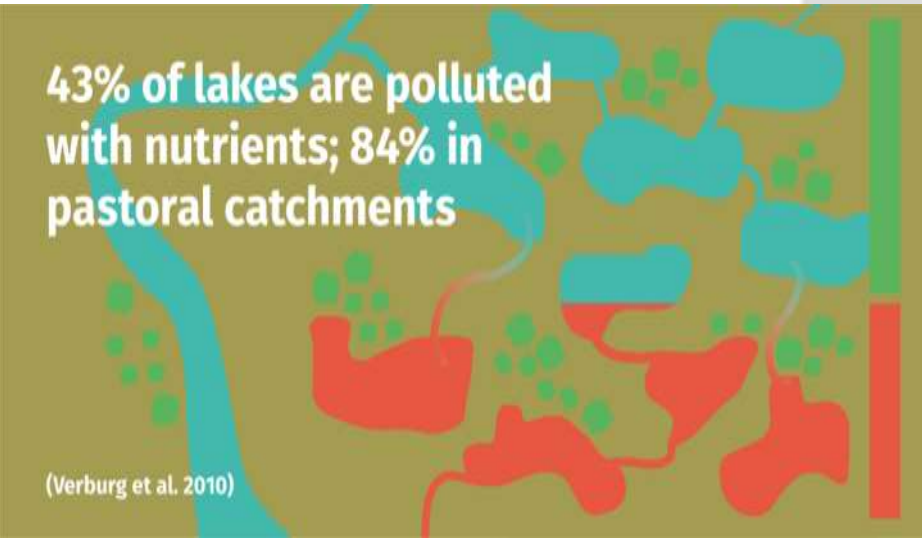
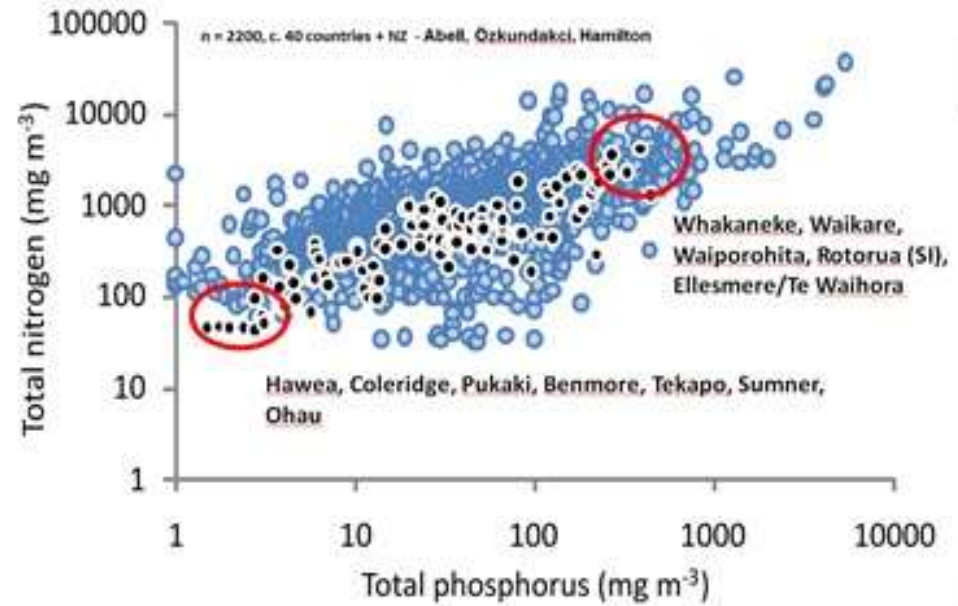
Dr Mike Joy
Ecology - Institute of Agriculture & Environment
Massey University
Palmerston North

Freshwater management failure symptoms:

- 74% of freshwater fish threatened
- + crayfish and kakahi too
- gone by 2050
- no protection under law for native freshwater fish



Lakes & global comparisons



What a failed environment looks like

Rivers and Estuaries

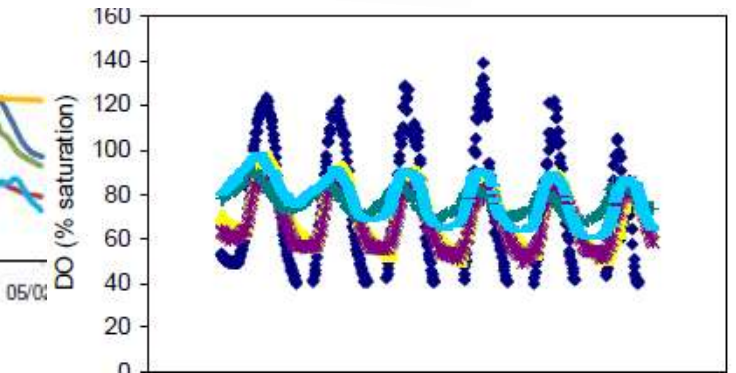
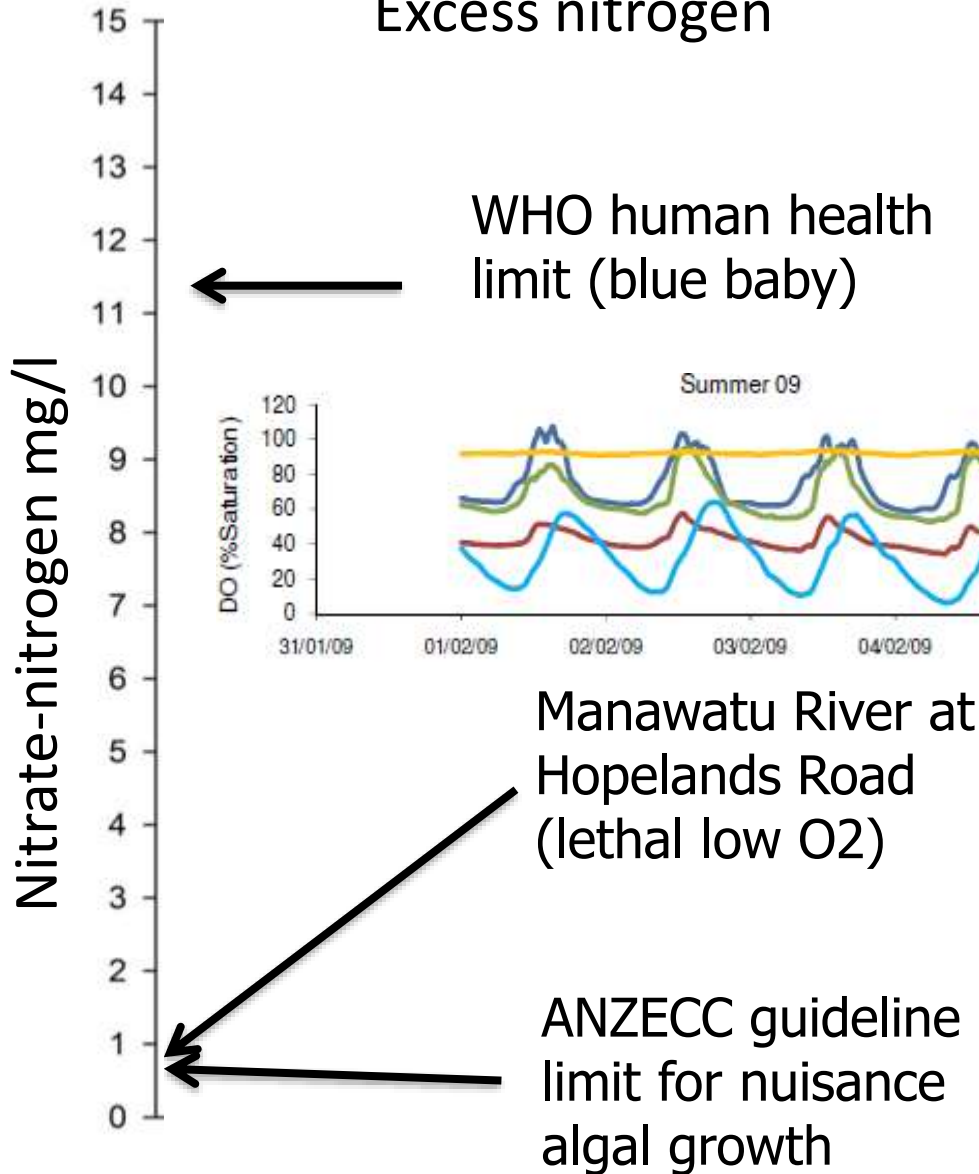
Sedimentation

- River beds higher than surrounding land in many places – pumps and stop banking
- most harbours and estuaries are so choked with sediment from land-use change leading = big impacts on oceanic commercial fish species (NIWA)
- in stream habitat loss for fish and insects

Nutrients – excesses lead to oxygen fluctuation, mats of slime on stream beds, habitat loss, cant swim ...

What is wrong with nutrients in water?

Excess nitrogen

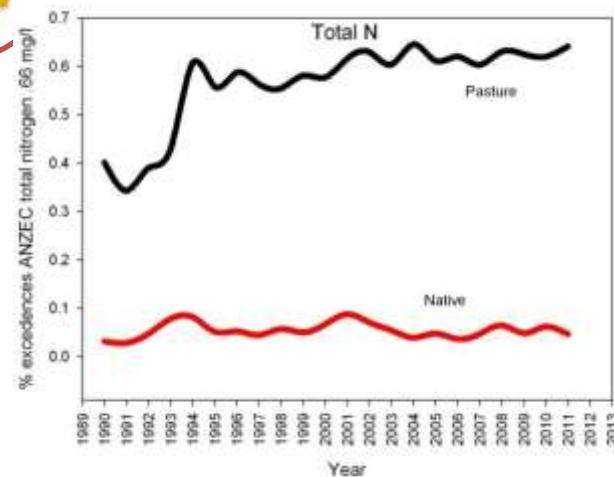
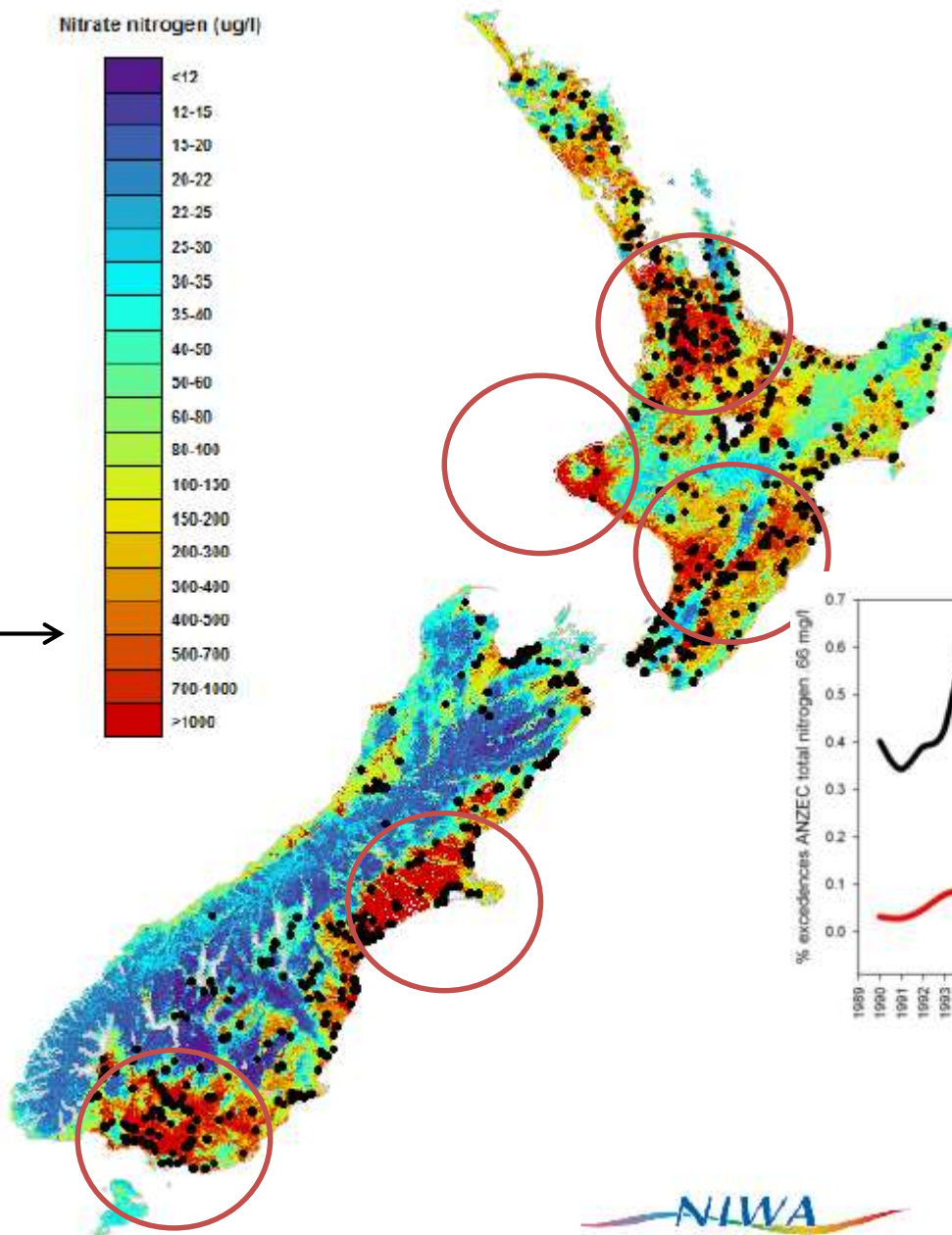
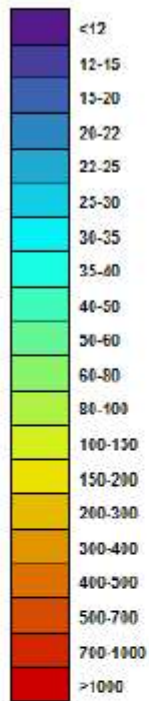


What a failed environment looks like

Nitrate

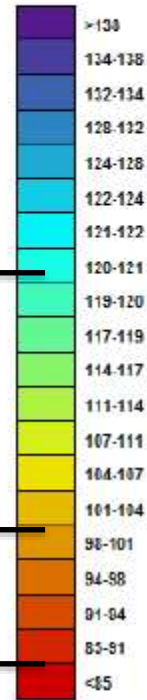
ANZECC
trigger level →

Nitrate nitrogen (ug/l)



What a failed environment looks like

Semi-quantitative MCI



Healthy

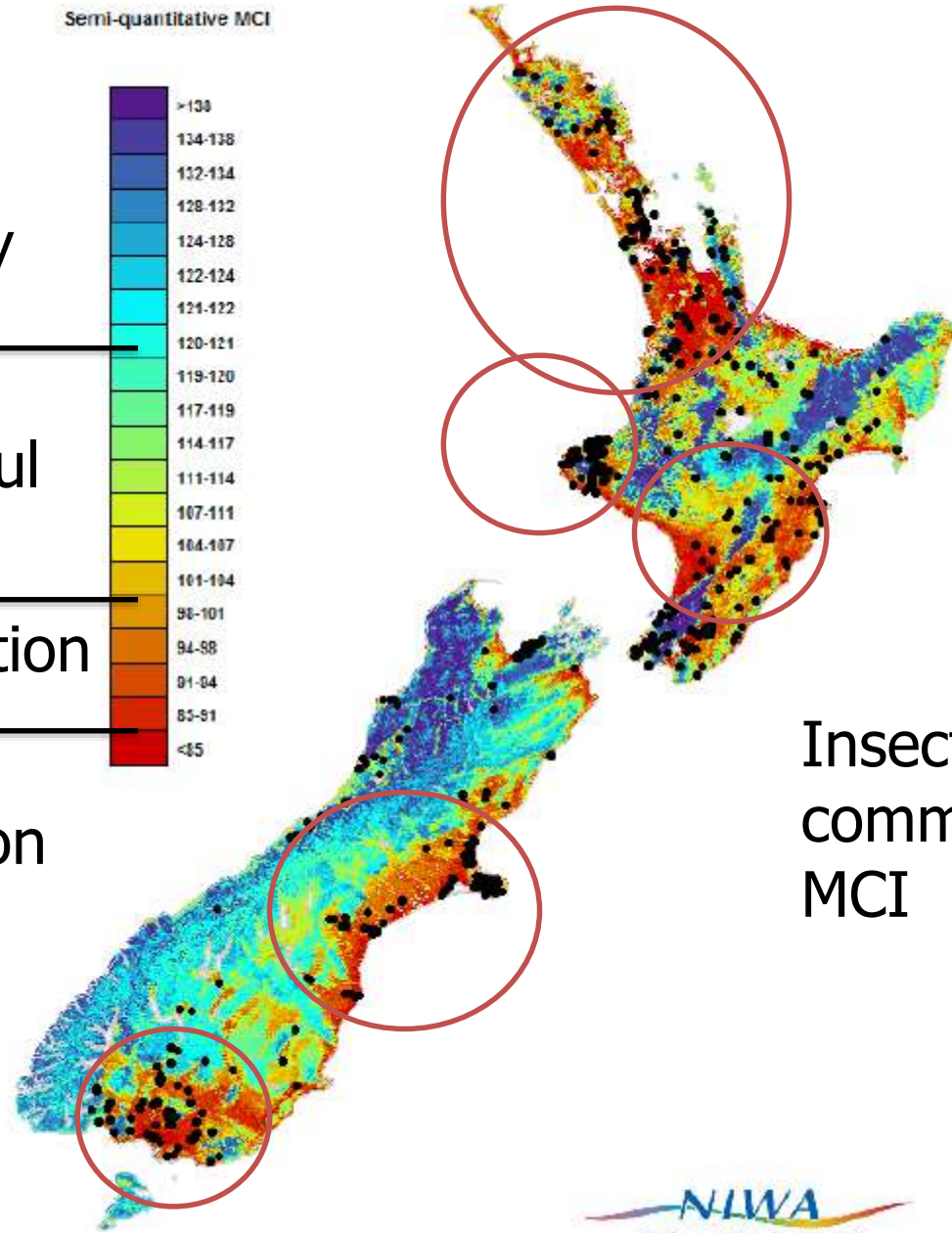


Doubtful

Moderate pollution



Severe pollution



Insect community index MCI

What a failed environment looks like

Human health

- pathogens E. coli & Nitrate

18 – 34K NZers contract waterborne diseases p.a.

NZ now has the OECD highest frequency per-capita globally of waterborne diseases - coliform enteritis, campylobacteriosis, cryptosporidiosis and salmonellosis (Crypto strongly linked to dairy)

Canterbury now has some of the highest rates of gastro intestinal disease in the world.

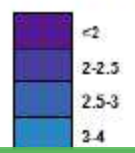
Some Ashburton residents already have N levels in drinking water exceed WHO (pregnant women and bottle fed babies cant consume)

- benthic cyanobacteria mats (already killing dogs and horses and one day children)

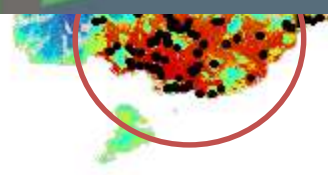
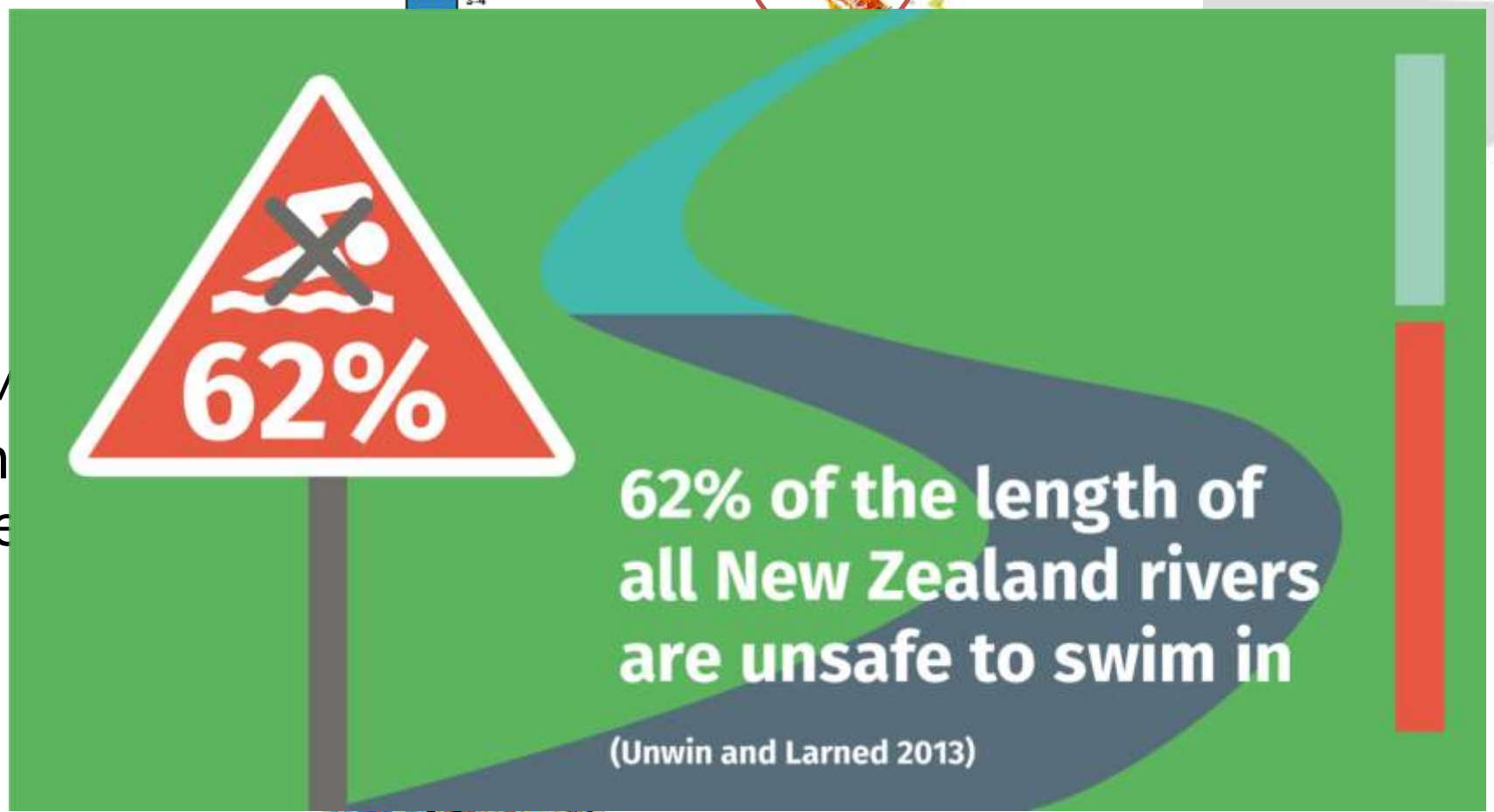
What a failed environment looks like

Pathogens

E. coli (MPN/100 ml)



M
h
le



The drivers of degradation



Excess

- Nutrients
- Sediment
- Abstraction (irrigation)
- Invasive species
- Physical impacts (dams, stopbanking, irrigation pumps, flood control...)

all driven by the last ~ 20 years

- dairy cows * 2 now 6.5 million (90 million human equivalents) 10mill total cattle 140 m people
- dairy production * 4

That increase through artificial fertilisers – e.g. nitrogen 800% - the global nitrogen bomb and planetary boundary)

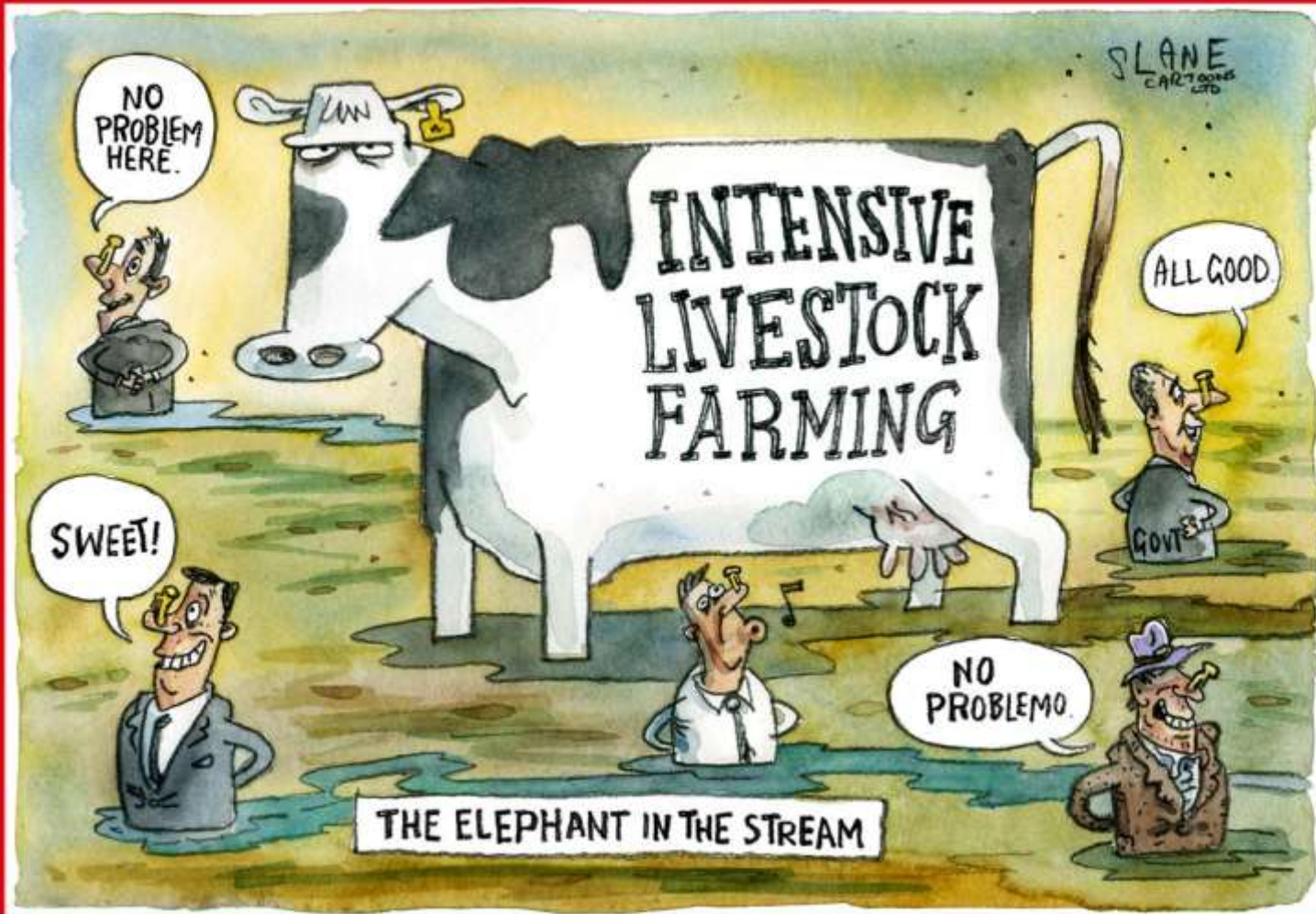
PALM KERNEL - at 2.3 million tonnes/yr. NZ is the biggest palm kernel consumer globally

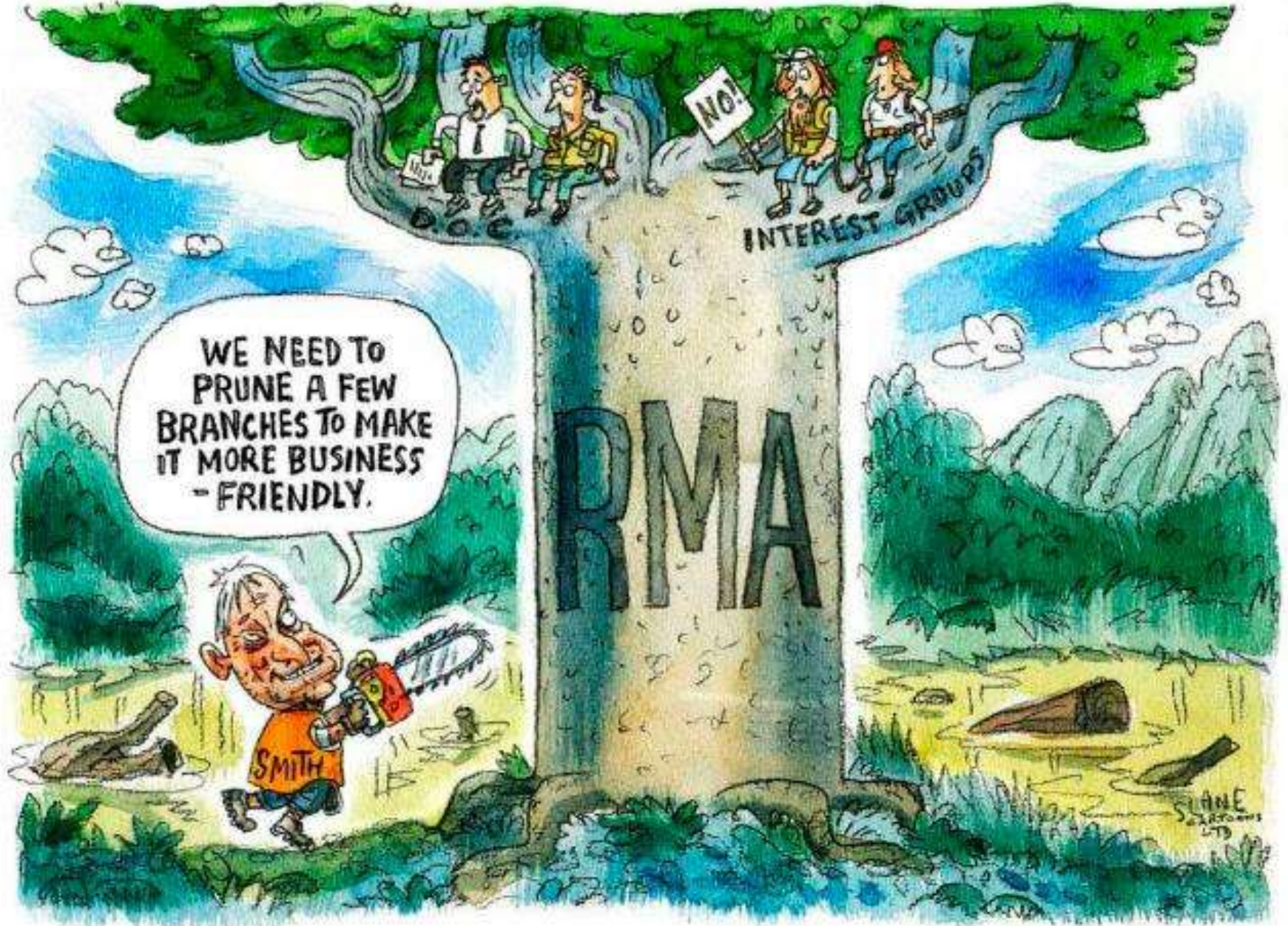


What is the government response to the crisis?

50
YEARS

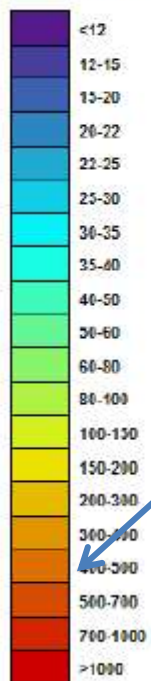
NEW ZEALAND **LISTENER**



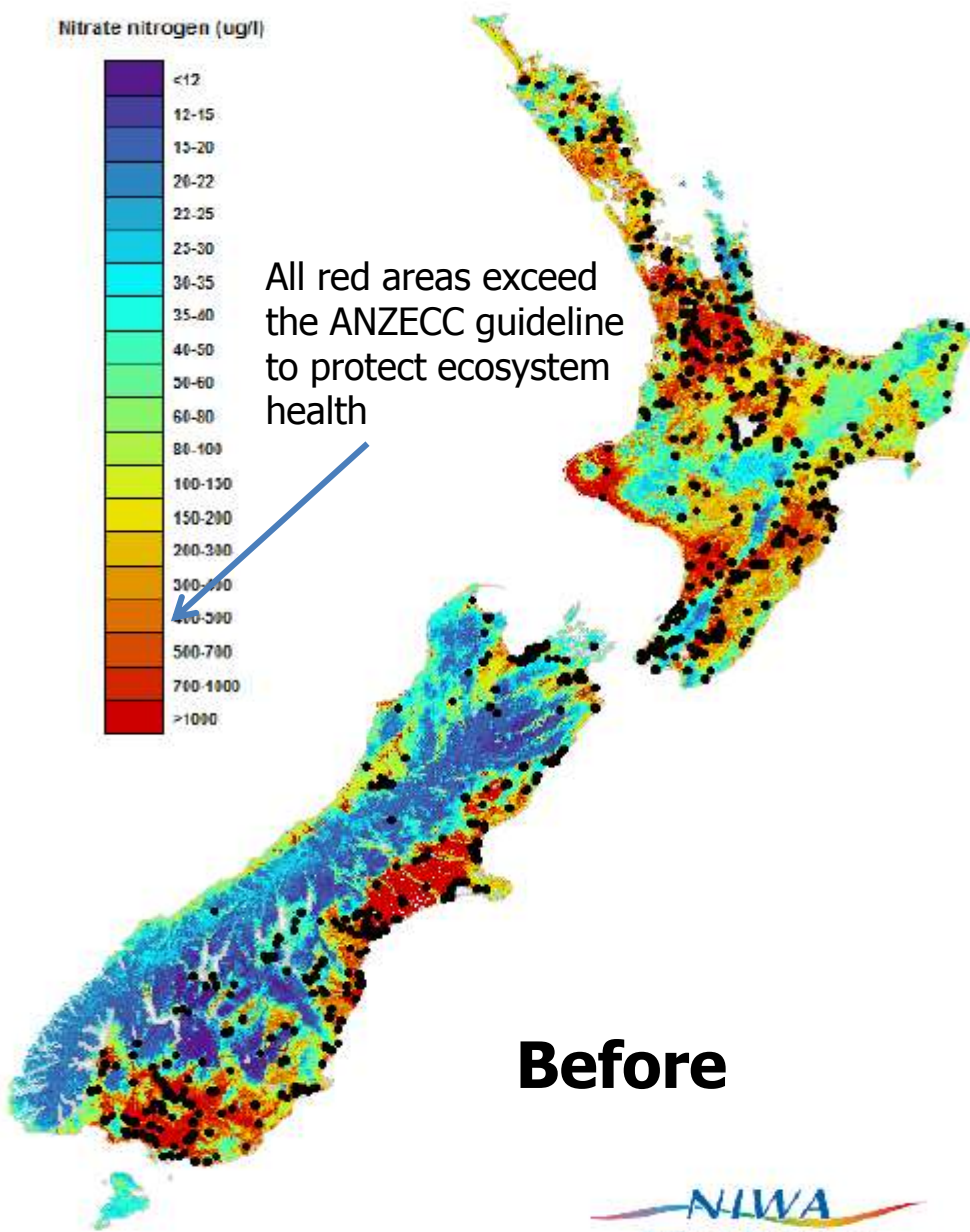


"A fresh start for freshwater" NPS objectives 2014: (making the problem disappear)

Nitrate nitrogen (ug/l)



All red areas exceed the ANZECC guideline to protect ecosystem health



Before

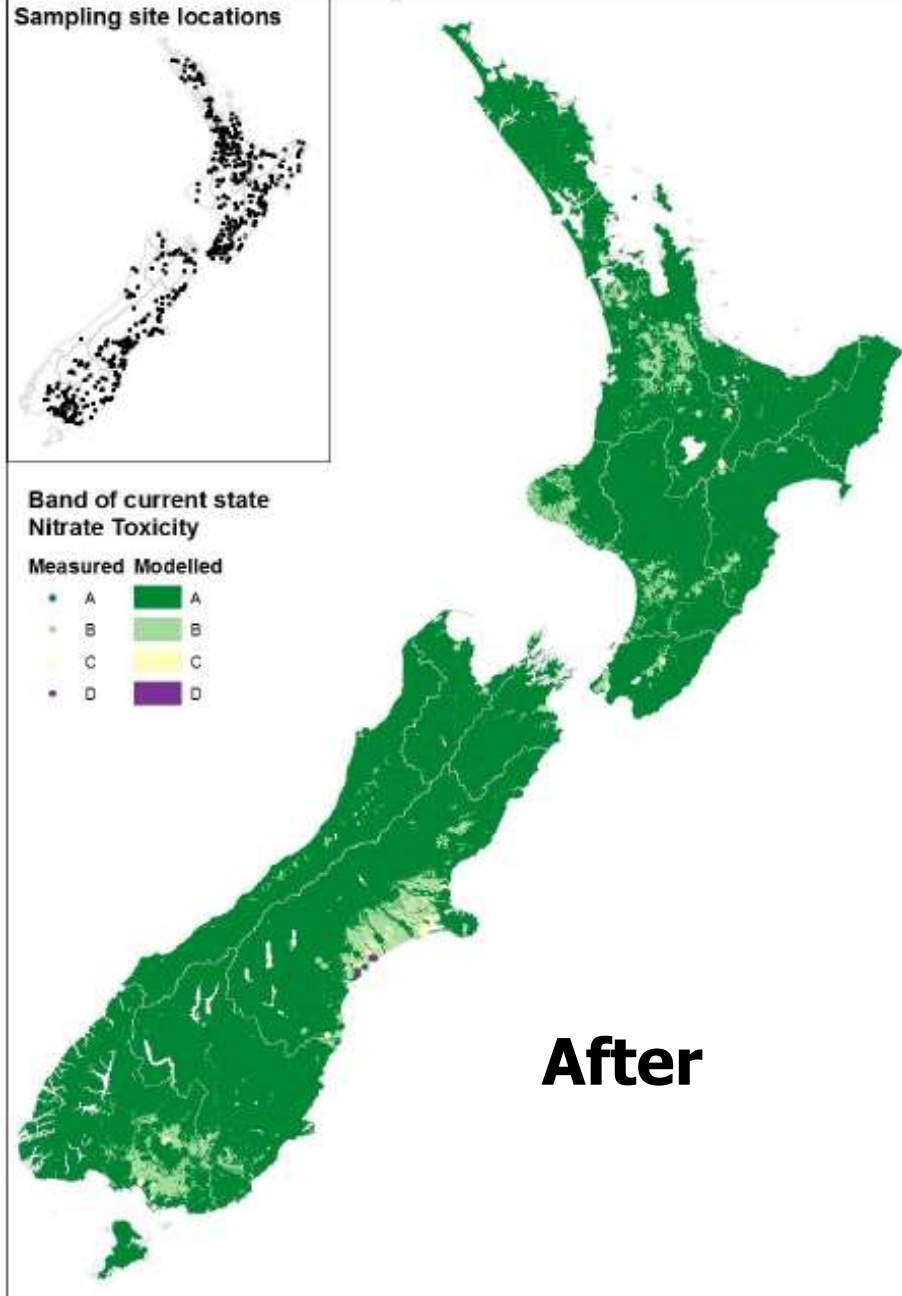
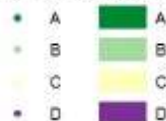


Sampling site locations



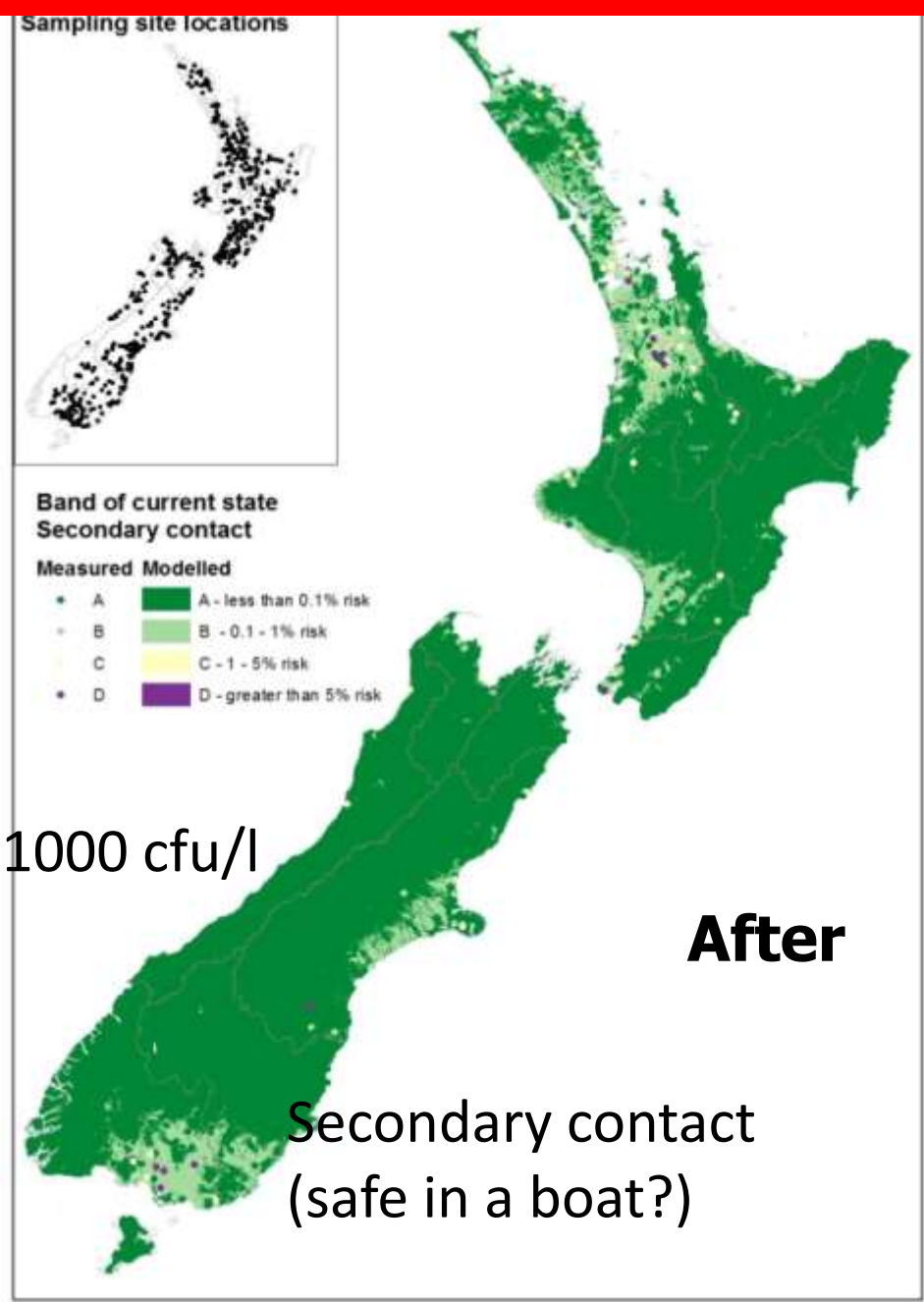
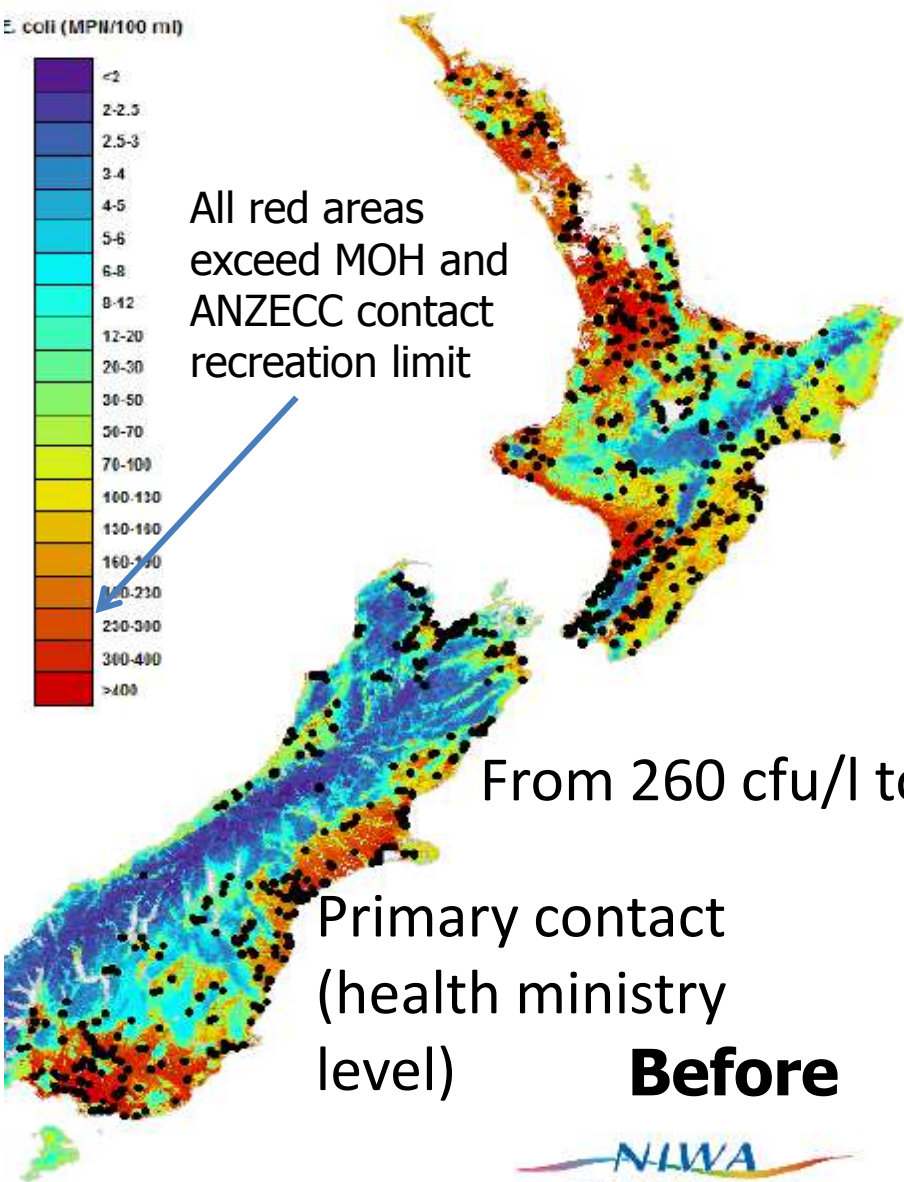
Band of current state
Nitrate Toxicity

Measured Modelled

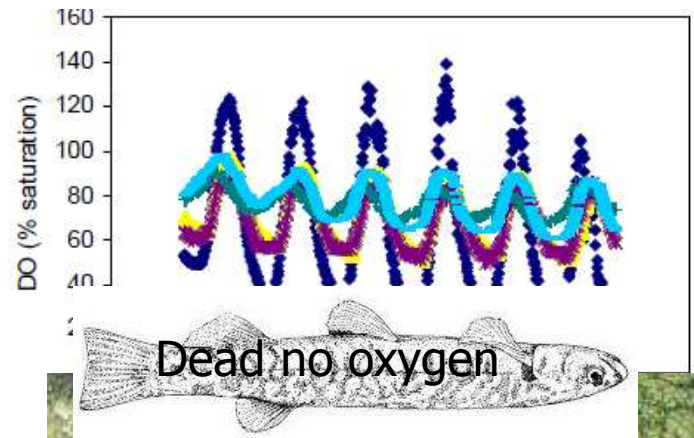
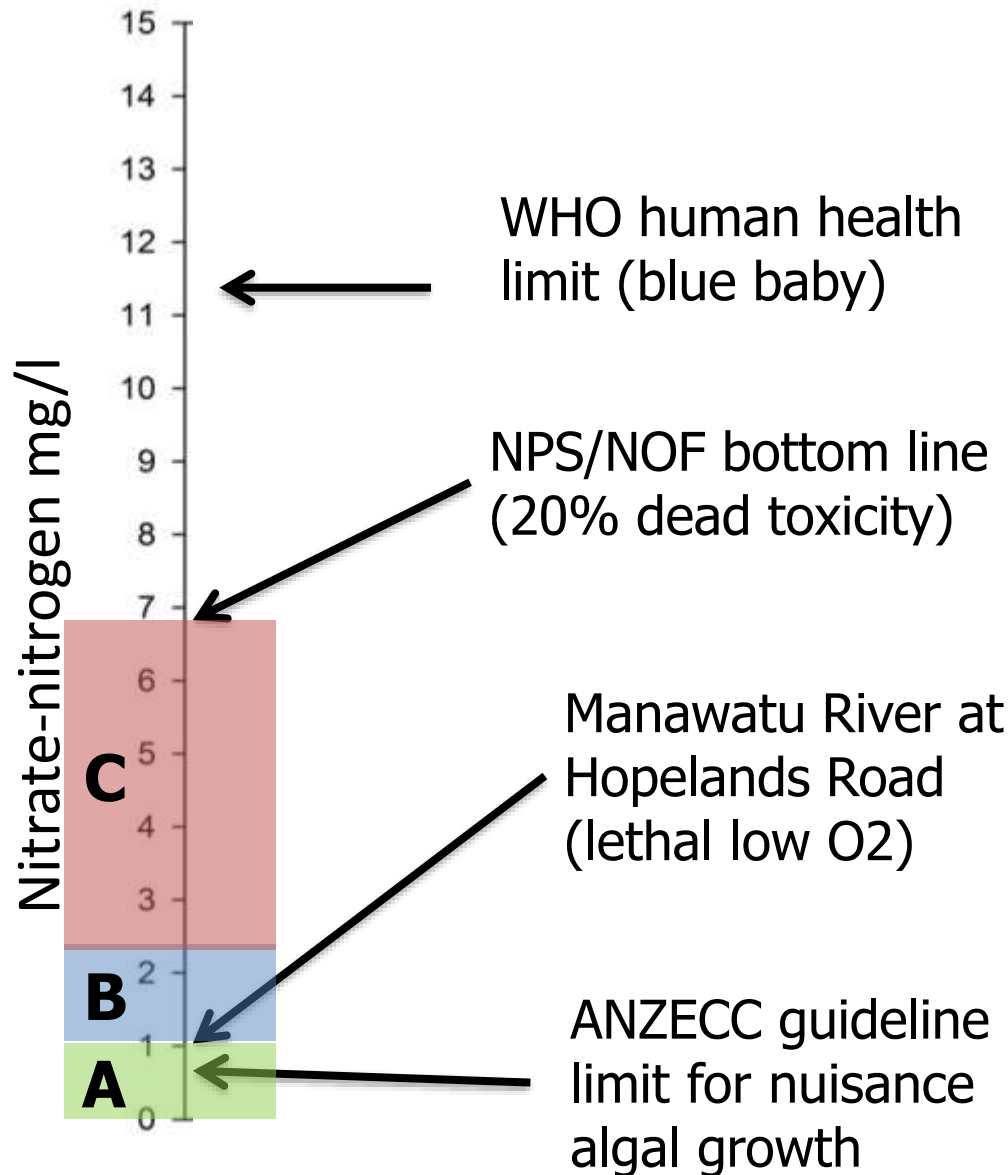


After

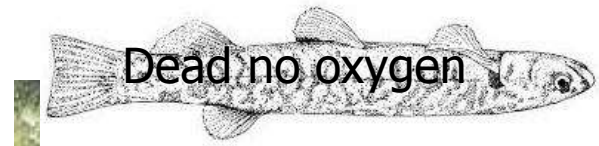
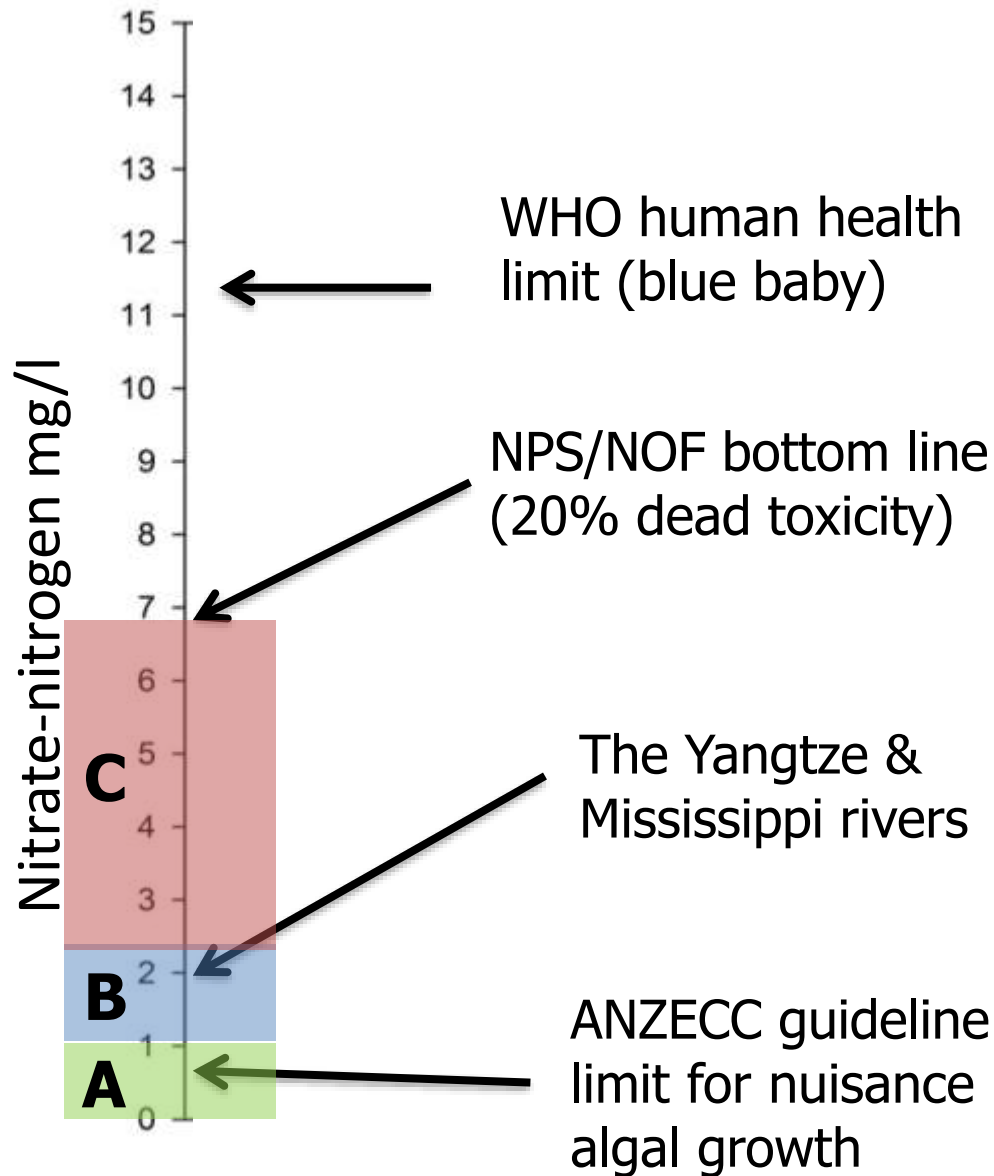
“A fresh start for freshwater” NPS objectives 2014: (making the problem disappear)



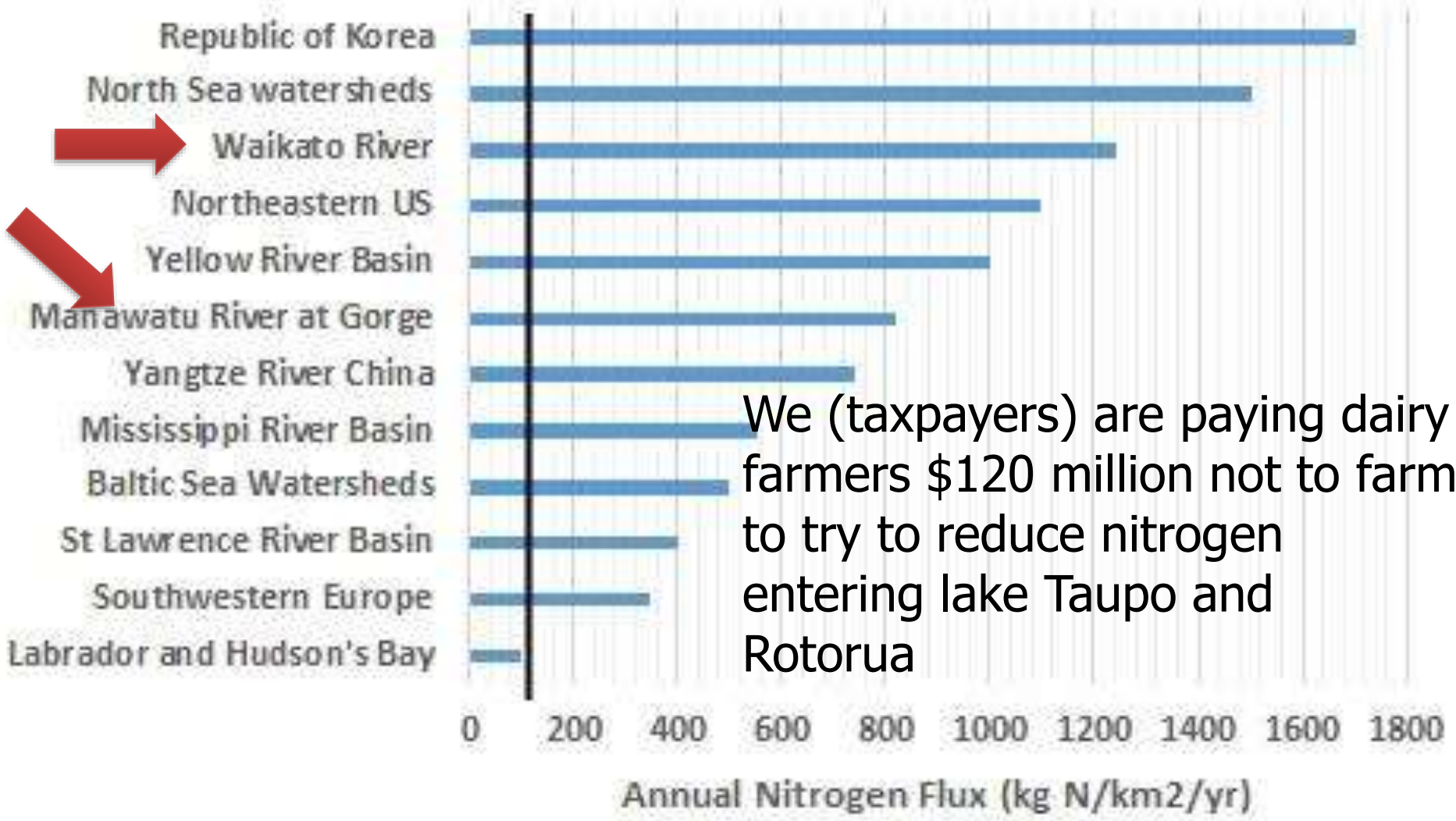
The government response to the crisis— shift the goal posts



The government response to the crisis— shift the goal posts



Our deadly nitrogen addiction NZ



We (taxpayers) are paying dairy farmers \$120 million not to farm to try to reduce nitrogen entering lake Taupo and Rotorua

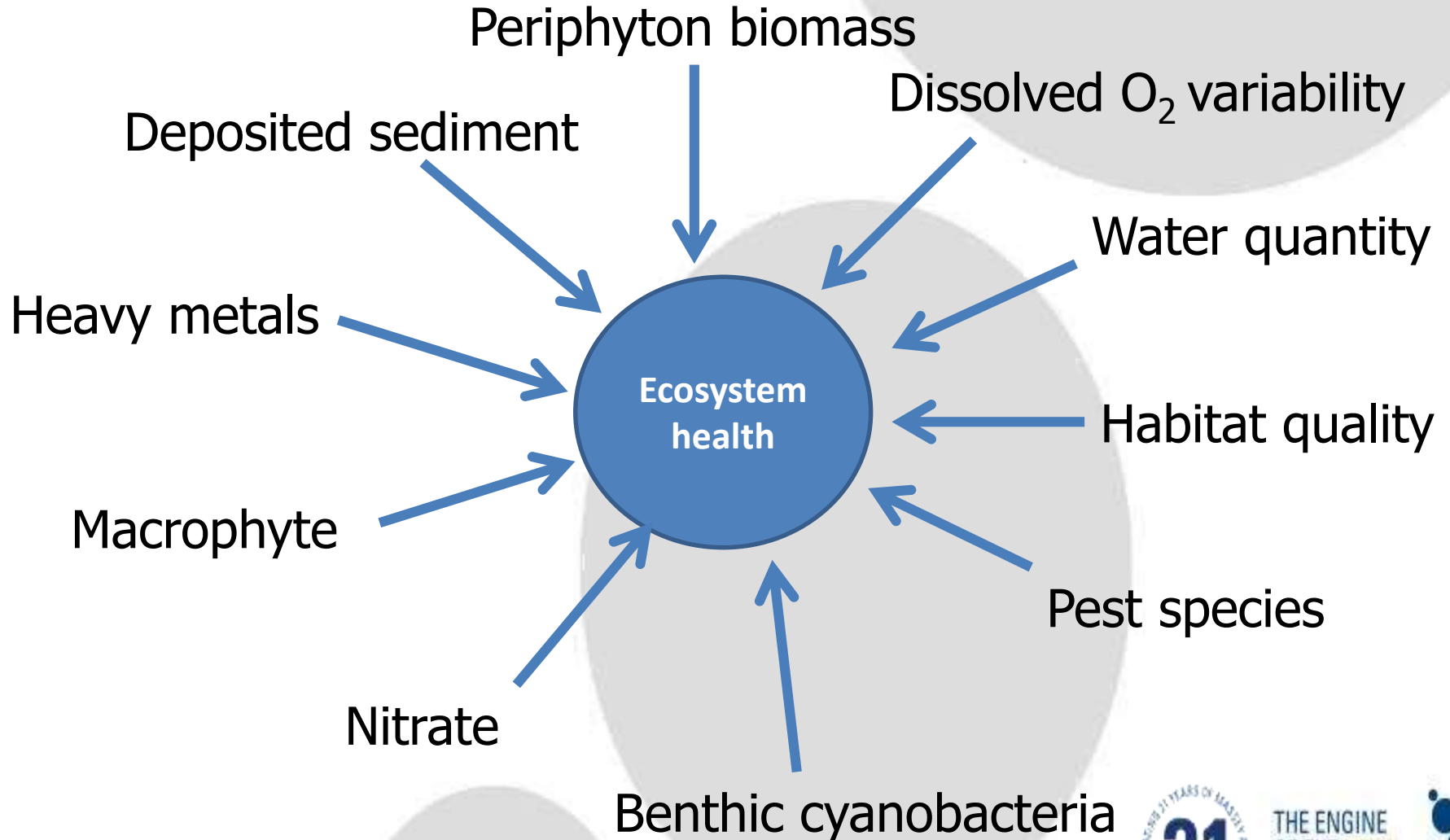
The government response to the crisis— lies and denial

What is not in the National Objectives Framework:

Temperature, O₂, physical impacts, groundwater, estuaries, offshore impacts, benthic cyanobacteria, pathogens, clarity.



Crucial measures of ecosystem health



What is in NOF/NPS

~~Periphyton biomass but crucial 17% exemption~~



Ecosystem health

~~Nitrate toxicity only~~

Changes to the NOF/NPSfw after submissions 2017

MCI in? and set at “severe pollution” level

Degradation category (Boothroyd and Stark 2000)	Quality class (Stark and Maxted 2007)	MCI score
Clean water	Excellent	> 119
Doubtful quality or possible mild pollution	Good	100-119
Probable moderate pollution	Fair	80-99
Probable severe pollution	Poor	< 80



Changes to the NOF/NPSfw after submissions 2017

The Manawatu River
example of the new NPS-FW

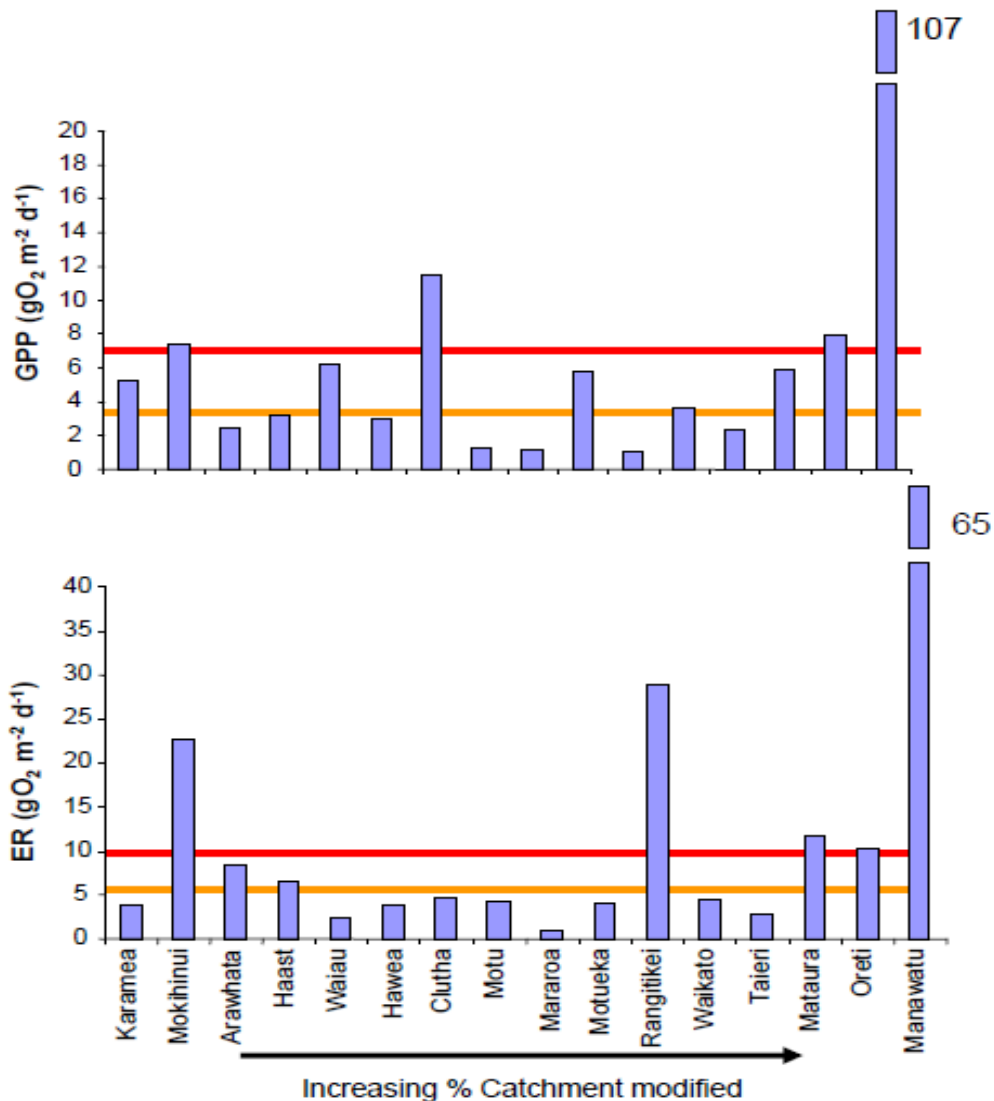


Figure 1. Measurements of gross primary production (GPP) and ecosystem respiration (ER) in a variety of large rivers throughout New Zealand. The rivers are arranged in order of % catchment modified. The orange and red lines are guidelines representing the transition from good to satisfactory health, and satisfactory to poor ecosystem health, respectively.

Manawatu River example for the new NPS_FW Nitrate N for two sites on Manawatu River (both get an “A” score in NOF/NPS)

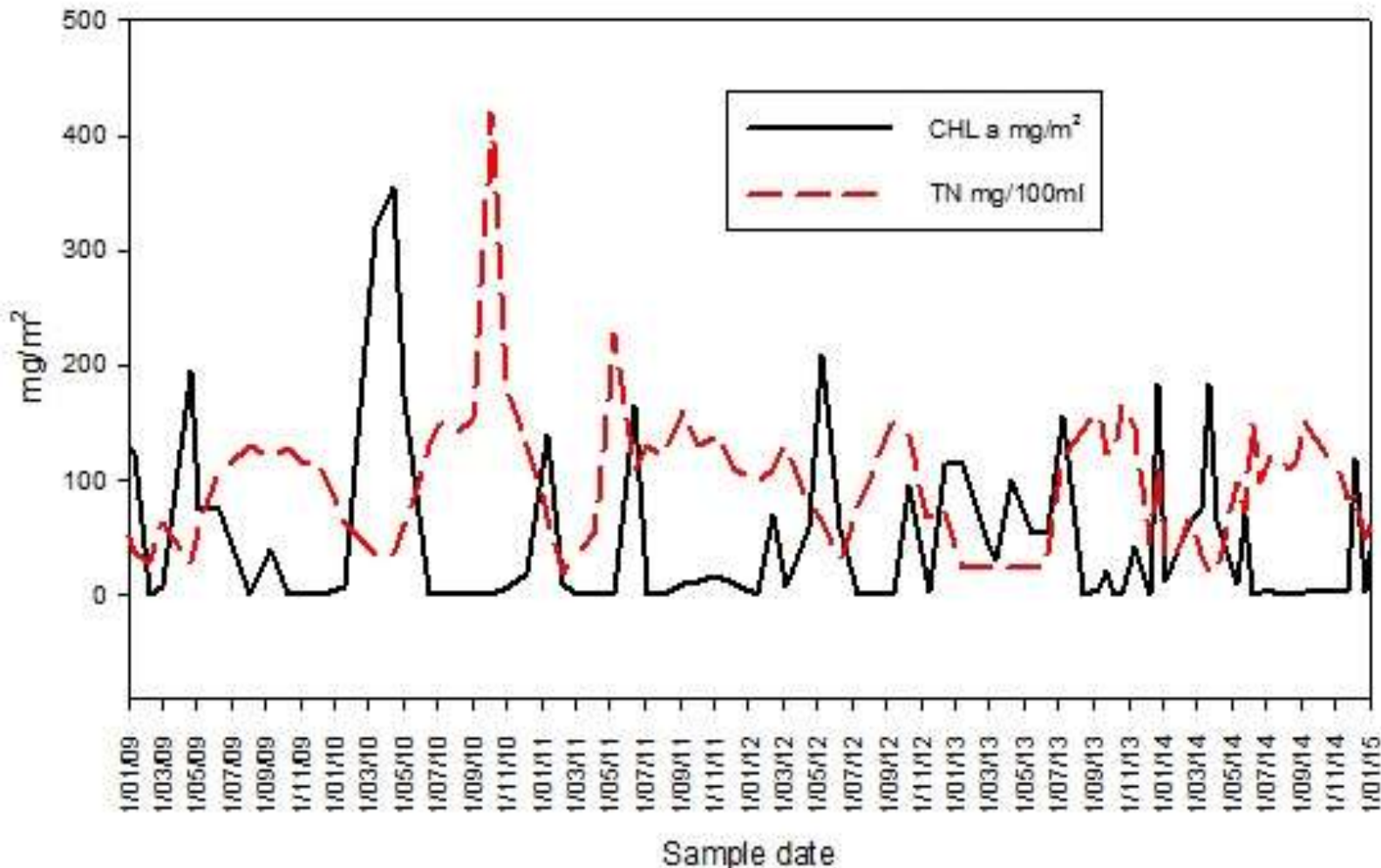
Nitrate nitrogen mg nitrate-nitrogen/l statistics for the two Manawatu River example sites for. Data for Hopelands road for 2009 – 2015 came from Horizons Regional Council and for Opiki Bridge 1989 -2011 from the National river water quality network (NRWQN).

Statistic	Hopelands Road	Opiki Bridge
Mean	0.65	0.46
Standard Error	0.04	0.04
Median	0.62	0.43
Standard Deviation	0.41	0.25
Range	1.66	1.35
Minimum	0.00	0.07
Maximum	1.66	1.42

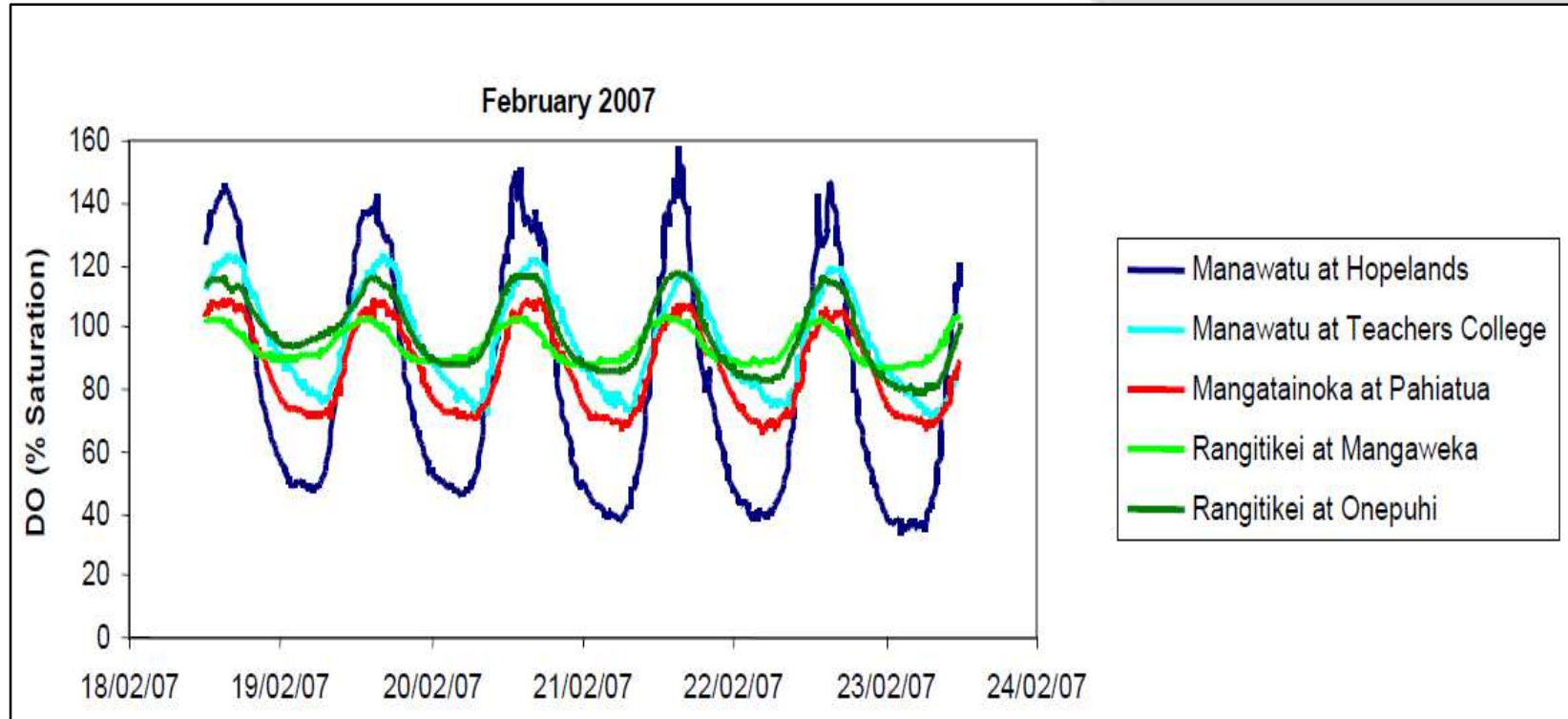
Mean and median dragged down by summer values BUT just gone to periphyton

Manawatu River at Hopelands Road

Periphyton biomass vs. TN for Hopelands Road



Dissolved oxygen



Manawatu at Hopelands drops to 34% DO
(= 3.0 mg/l at 20 deg C)

Manawatu at Hopelands drops to 34% DO
(= 3.0 mg/l at 20 deg C) Scores "A" for Nitrate

ANZECC guidelines for slightly disturbed ecosystems with a dissolved oxygen limits of 98% minimum and 105% maximum (Table 3.3.10) (ANZECC 2000).

The USEPA has limits of 6 mg/l (89% @ 20°C) to avoid acute mortality in Salmonid species, and some US states have limits of 5mg/l (average of 7 daily minima) (55% DO @20°C) (Saari et al. 2017).

- Saari et al. (2017) the main groups of freshwater invertebrates the Ephemeroptera, Plecoptera, or Trichoptera (EPT) taxa are more sensitive than fish to low levels of dissolved oxygen.

Periphyton biomass

Value	Ecosystem health		
Freshwater Body Type	Rivers		
Attribute	Periphyton (Trophic state)		
Attribute Unit	mg chl-a/m ² (milligrams chlorophyll-a per square metre)		
Attribute State	Numeric Attribute State (Default Class)	Numeric Attribute State (Productive Class)	Narrative Attribute State
	Exceeded no more than 8% of samples:	Exceeded no more than 17% of samples:	
A	≤50	≤50	Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.
B	>50 and ≤120	>50 and ≤120	Occasional blooms reflecting low nutrient enrichment and/or alteration of the natural flow regime or habitat.
C	>120 and ≤200	>120 and ≤200	Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or alteration of the natural flow regime or habitat.
National Bottom Line	200	200	
D	>200	>200	Regular and/or extended-duration nuisance blooms reflecting high nutrient

Hopelands Road scores an “A” for periphyton biomass

Chlorophyll a mg/m ²	Attribute state	Number of samples (total 35)	Proportion of samples
<50	A	26	74.29%
>50 and < 120	B	2	5.71%
>120 and < 200	C	5	14.29%
>200	D	2	5.71%

3 years

Chlorophyll a mg/m ²	Attribute state	Number of samples (total 86)	Proportion of samples
<50	A	53	61.63%
>50 and < 120	B	19	22.09%
>120 and < 200	C	11	12.79%
>200	D	3	3.49%

7 years

Opiki site also scores an "A" for periphyton biomass

Table 3. Data on periphyton biomass for Manawatu River Opiki site for 17 years December 2008 to March 2015

Chlorophyll a mg/m ²	Attribute state	Number of samples (total 35)	Proportion of samples
<50	A	45	76.27%
>50 and < 120	B	8	13.56%
>120 and < 200	C	5	8.47%
>200	D	1	1.69%

Table 4. Horizons Regional Council data on periphyton 2008 from 65 sites for the period December 2008 to April 2015

Chlorophyll a mg/m ²	Attribute state	Number of samples (total 4025)	Proportion of samples
<50	A	3400	84.47%
>50 and < 120	B	439	10.91%
>120 and < 200	C	124	3.08%
>200	D	62	1.54%

Summary

The NPS/FW is a scam

- the NPS-FM changes have not addressed any of the flaws identified in the initial Policy Statement.
- the status quo water and habitat quality in NZ is the new normal/acceptable level under this NPS (nothing to be seen here move along) – the NPSFW was set as status quo to maintain or improve
- none of the NPS parameters address ecosystem health

the example of what a complete failure the NOF? NPS-FW is the two sites on the Manawatu River. They show that a site can have the worst ecosystem respiration and GPP rates ever measured, have lethal low oxygen levels and still score an “A” for all NPS measures

