Scoping options for assessing the impact of cold water pollution mitigation at Keepit Dam

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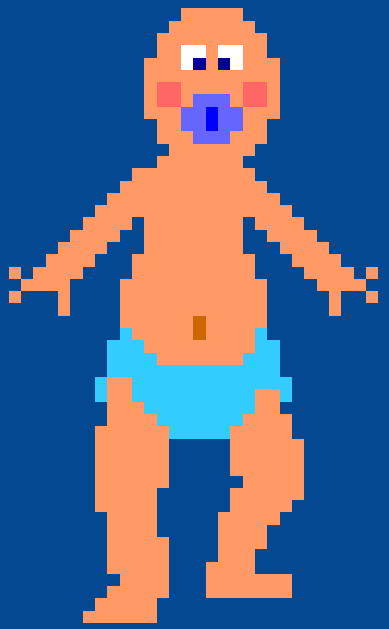
N S W
D P I



NFS Objective 3

Improve key aspects of water quality that effect native fish

summer suppression – the reduction in temperature compared to natural conditions that typically occurs from mid spring to late summer and reaches a maximum in summer;

winter elevation – the increase in temperature compared to natural conditions that typically occurs from mid autumn to mid spring and reaches a maximum in winter;

seasonal displacement – the timing delay of natural temperature peaks, troughs, rises and falls; and

annual amplitude reduction – the reduction in the natural difference between annual maximum and minimum temperatures

Impacts of cold water pollution

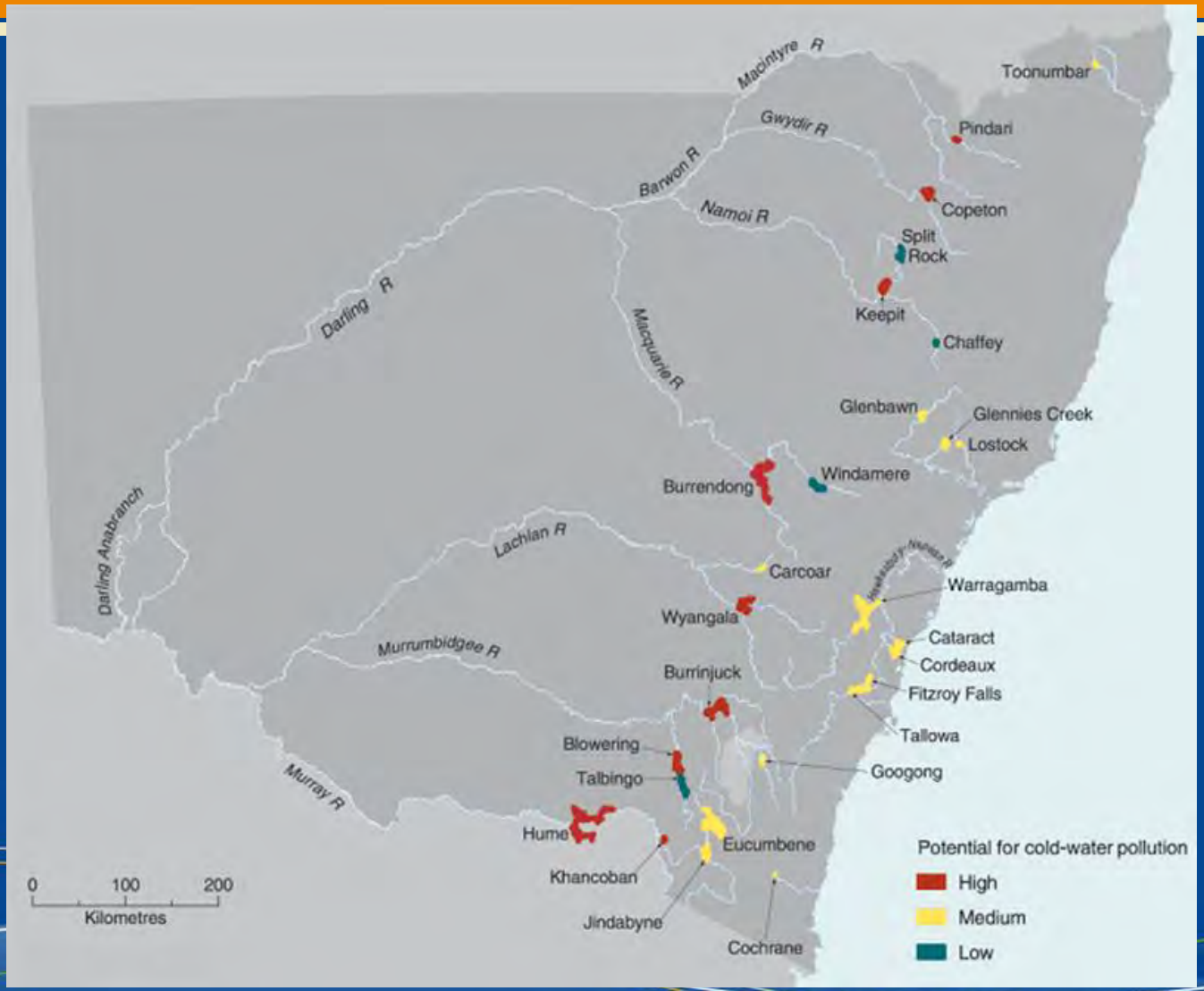
Redistribution of species

Timing and success of reproduction

Growth and metabolism

Recruitment

Extent of cold water pollution



Source: www.dnr.nsw.gov.au

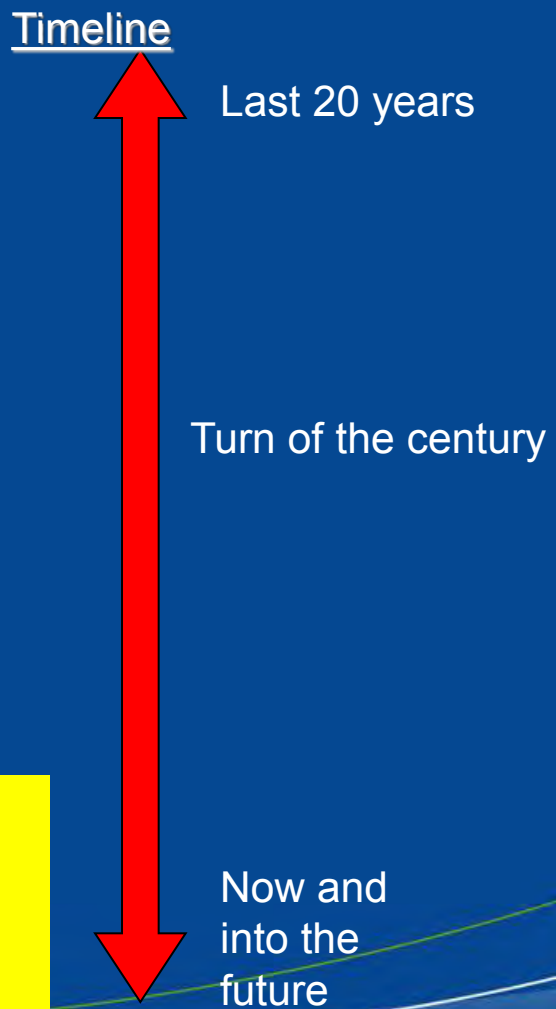
Current state of play

1. Research has shown unequivocally the adverse impact of CWP on native fish

2. Potential solutions to CWP have been scoped and costed (Sherman 2000)

3. There have been numerous calls for action by researchers and managers (e.g. 2001 Workshop CWP in MDB, Native Fish Strategy 2003, CWP Interagency Group, CWP Strategy)

4. But if these solutions are to be adopted during dam upgrades, we need to **demonstrate** that the invested $$ are returning improvements in native fish communities



Keepit Dam upgrade: a potential case study

- Namoi River
- capacity of 423 000 ML
- maximum depth of 40m
- mean depth of 9.6m
- area of 44km^2

Temperature suppression downstream of Keepit Dam is observed from September to March.

State Water Corporation (SWC) currently exploring the feasibility of installing a multi-level offtake (2009?)

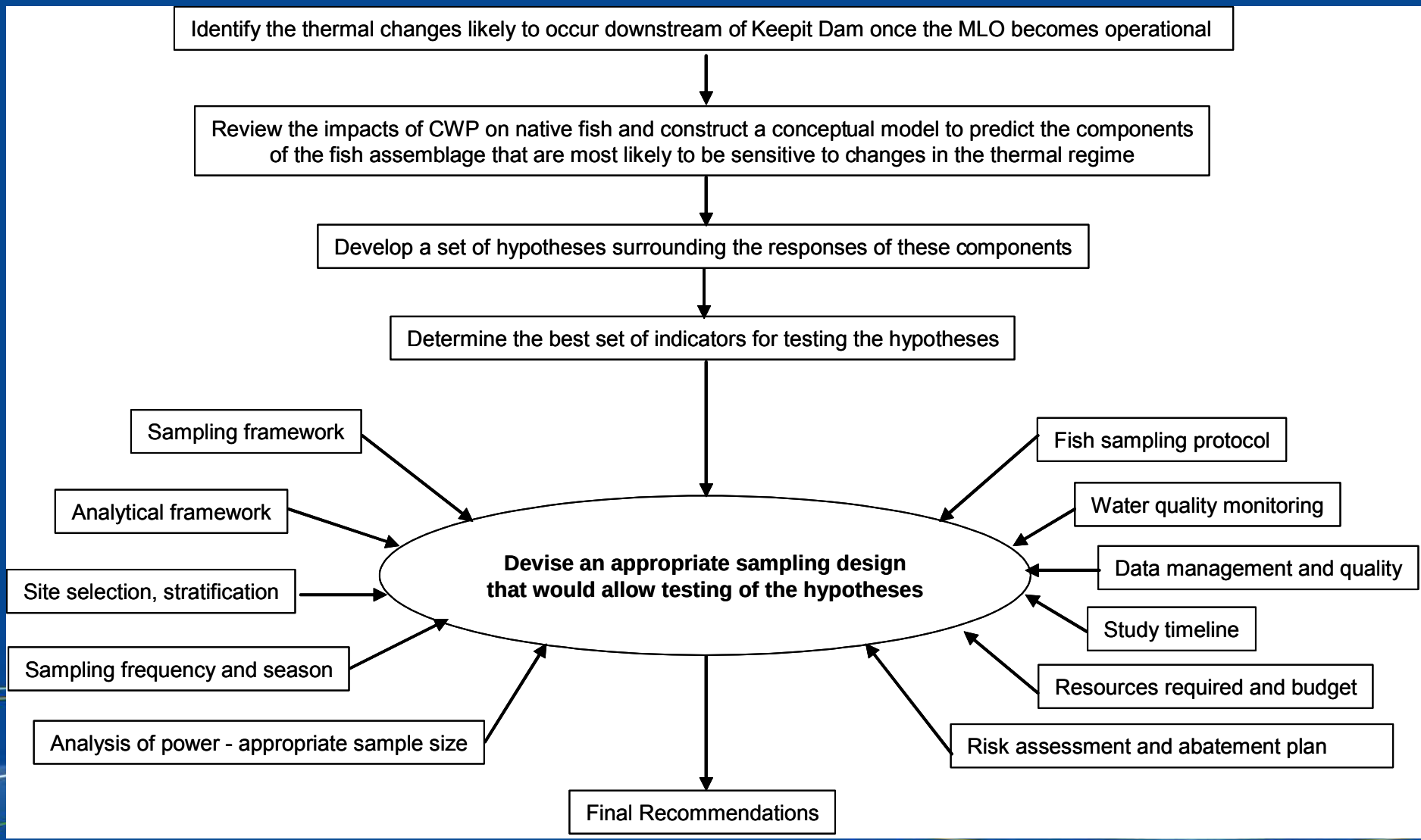
Would the Keepit Dam upgrade provide a suitable case study for CWP remediation?

Aim of the project

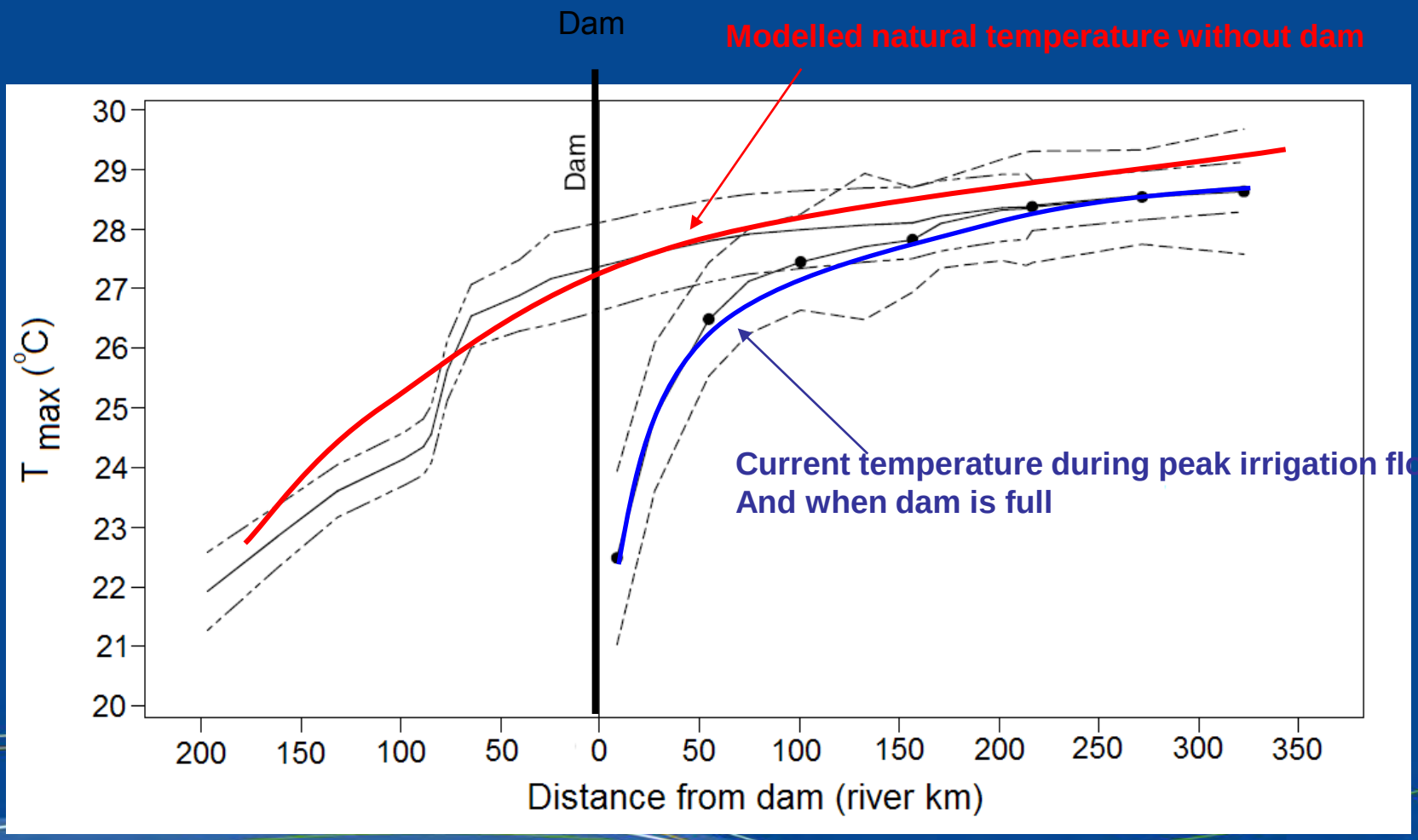
…..to ensure that if a full impact assessment was undertaken, that it would provide a scientifically-robust and cost effective assessment of changes in the native fish assemblage associated with the CWP mitigation

That is, to provide background information and analysis that will inform the design of a full impact study

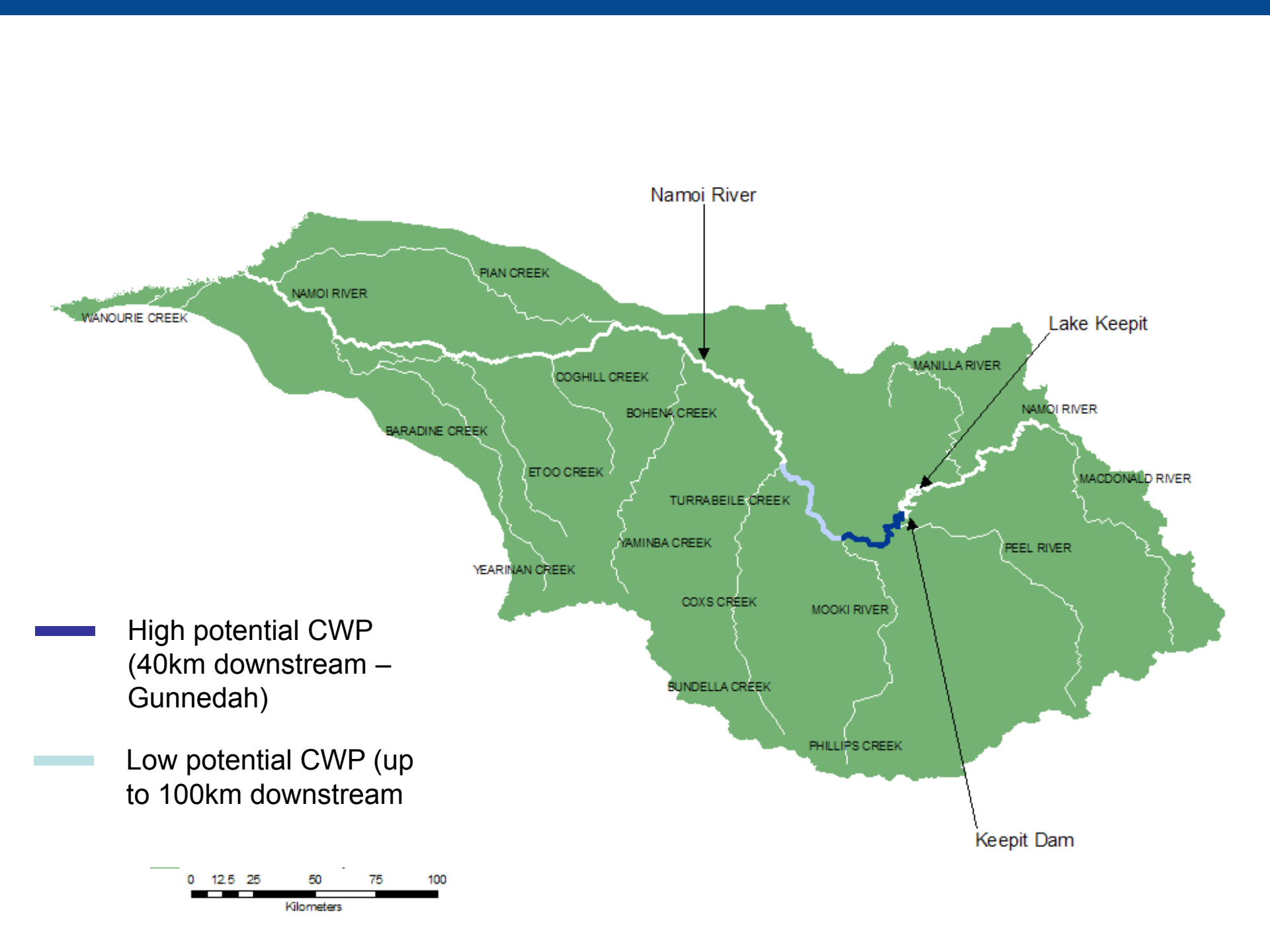
Scoping Process



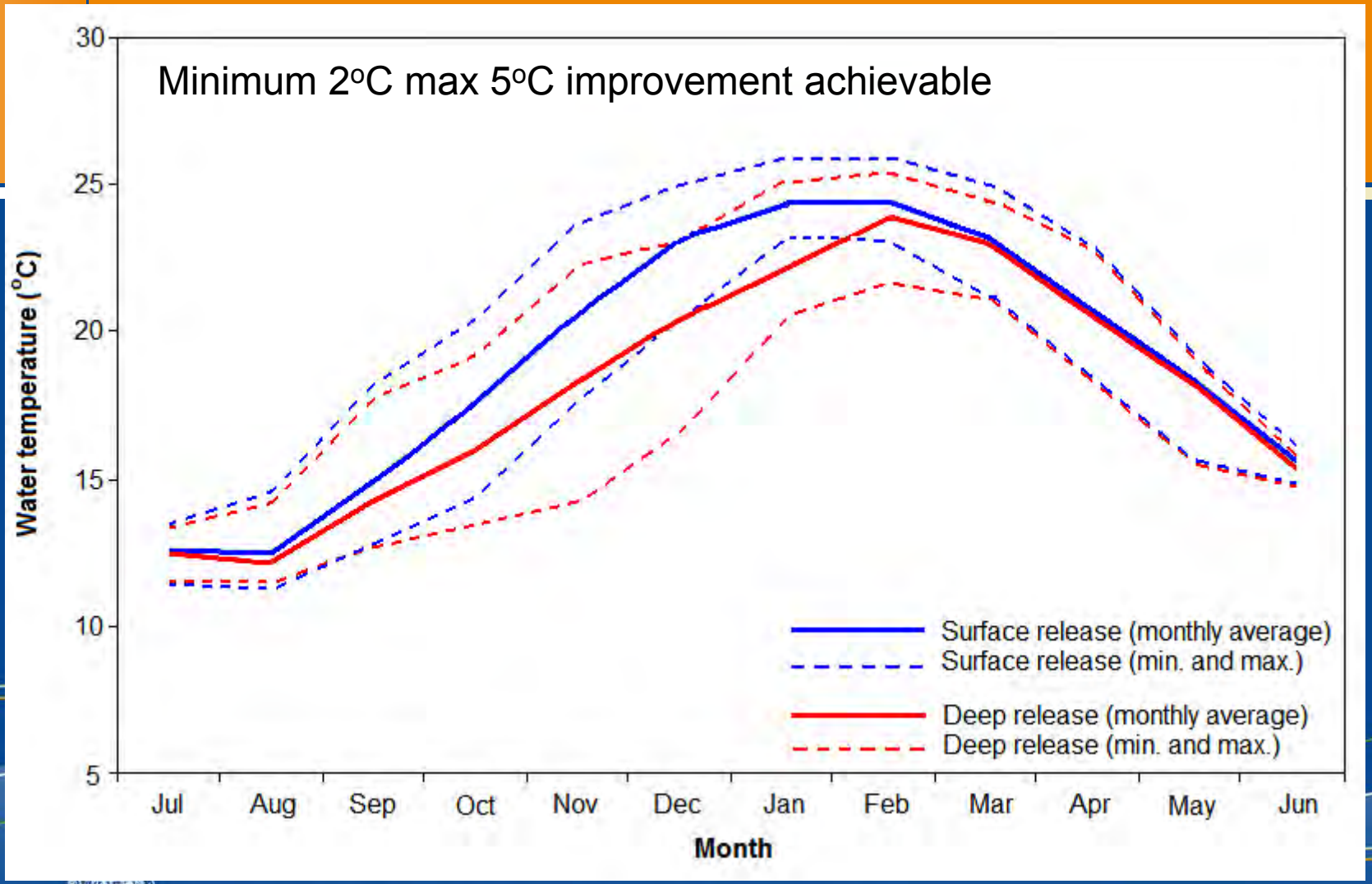
Current state of CWP downstream of Keepit



Source: Preece and Jones (2002)


Namoi River
Lake Keepit
Keepit Dam
PIAN CREEK
NAMOI RIVER
WANOURIE CREEK
COGHILL CREEK
BOHENA CREEK
BARADINE CREEK
ETOO CREEK
TURRABEILE CREEK
YAMINBA CREEK
YEARINAN CREEK
COXS CREEK
MOOKI RIVER
BUNDELLA CREEK
PHILLIPS CREEK
MANILLA RIVER
NAMOI RIVER
MACDONALD RIVER
PEEL RIVER
High potential CWP (40km downstream – Gunnedah)
Low potential CWP (up to 100km downstream
0 12.5 25 50 75 100
Kilometers

Expected improvement in CWP from MLO operation



Source: Manly Hydraulics Lab

What components of the fish assemblage may be sensitive to this level of improvement?

Component	*Hypothesised response to MLO operation*	*Indicator(s)/method(s) used to test hypothesis*
1. Redistribution of species	**Hypothesis 1** change in assemblage composition or structure **Hypothesis 2** change in the abundance of certain species	Assemblage composition, species richness, species diversity, proportion of native species to alien species Abundance
2. Spawning and larval production	**Hypothesis 3** increase in the successful spawning of fish **Hypothesis 4** change in the chronology or timing of spawning of fish	Abundance of egg or larval life stages, GSI for reproductive status. Timing of appearance of egg and larval life stages, GSI to establish chronology or timing of spawning
3. Recruitment	**Hypothesis 5** increased success of recruitment	Abundance of recent recuits
4. Growth	**Hypothesis 6** increased growth rates of fish	Changes in fish weight from cage experiments

1. Redistribution of species

Why considered:

Temperature change can cause:

- Short term changes in fish behaviour and dispersal;
- Longer term changes in mortality, spawning and recruitment…species replacement

Likely response to 2-5^{o}C improvement:

Likely to be very subtle because change in temperature is within tolerable range of juveniles and adults

Verdict:

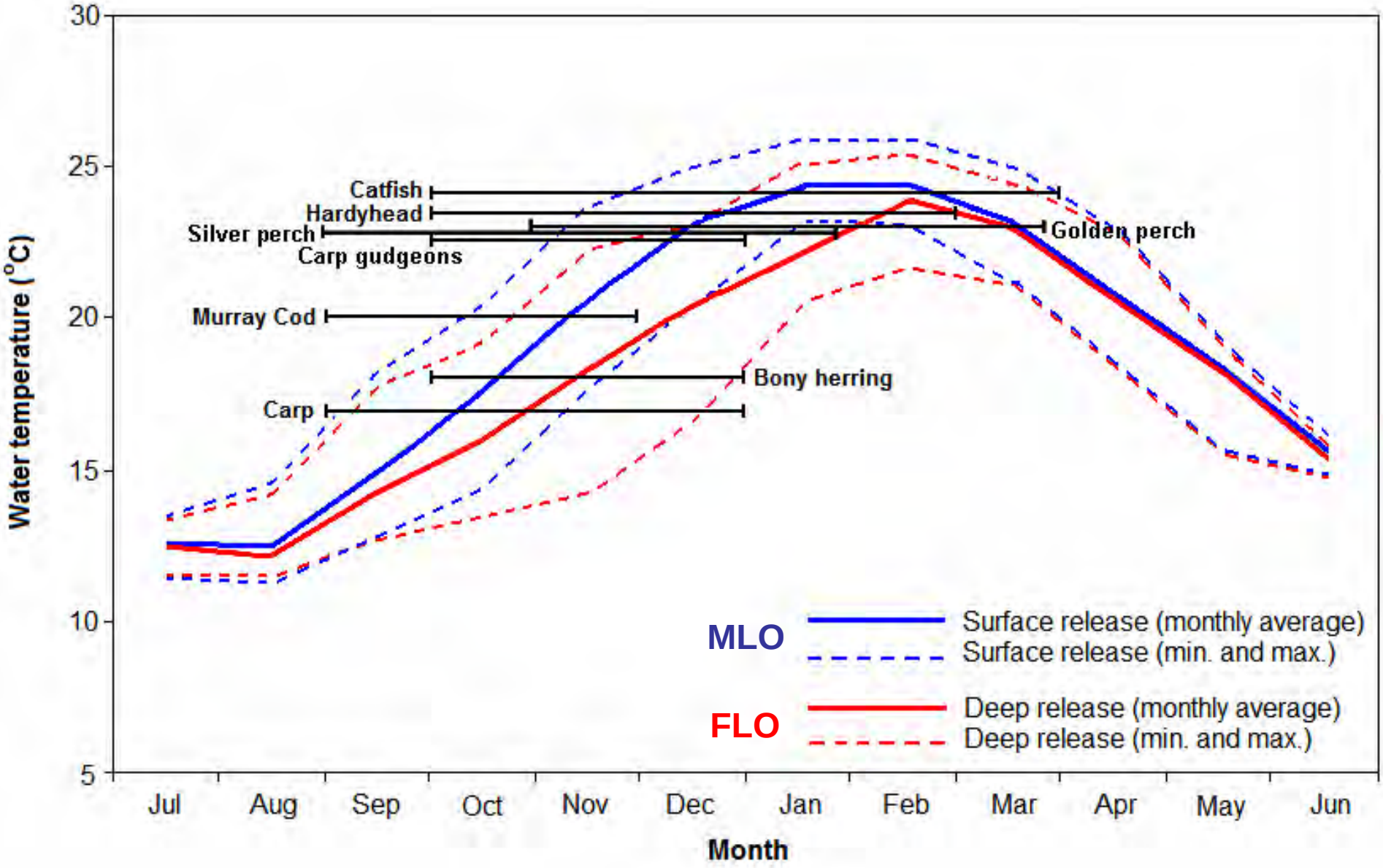
Will be hard to detect a change with this indicator

2. Spawning and larval production

Why considered:

- Increased chance of spawning failure if temperature is below critical spawning thresholds throughout the window potential spawning
- development and eventual hatching of fish eggs is sensitive to temperature

2. Spawning and larval production



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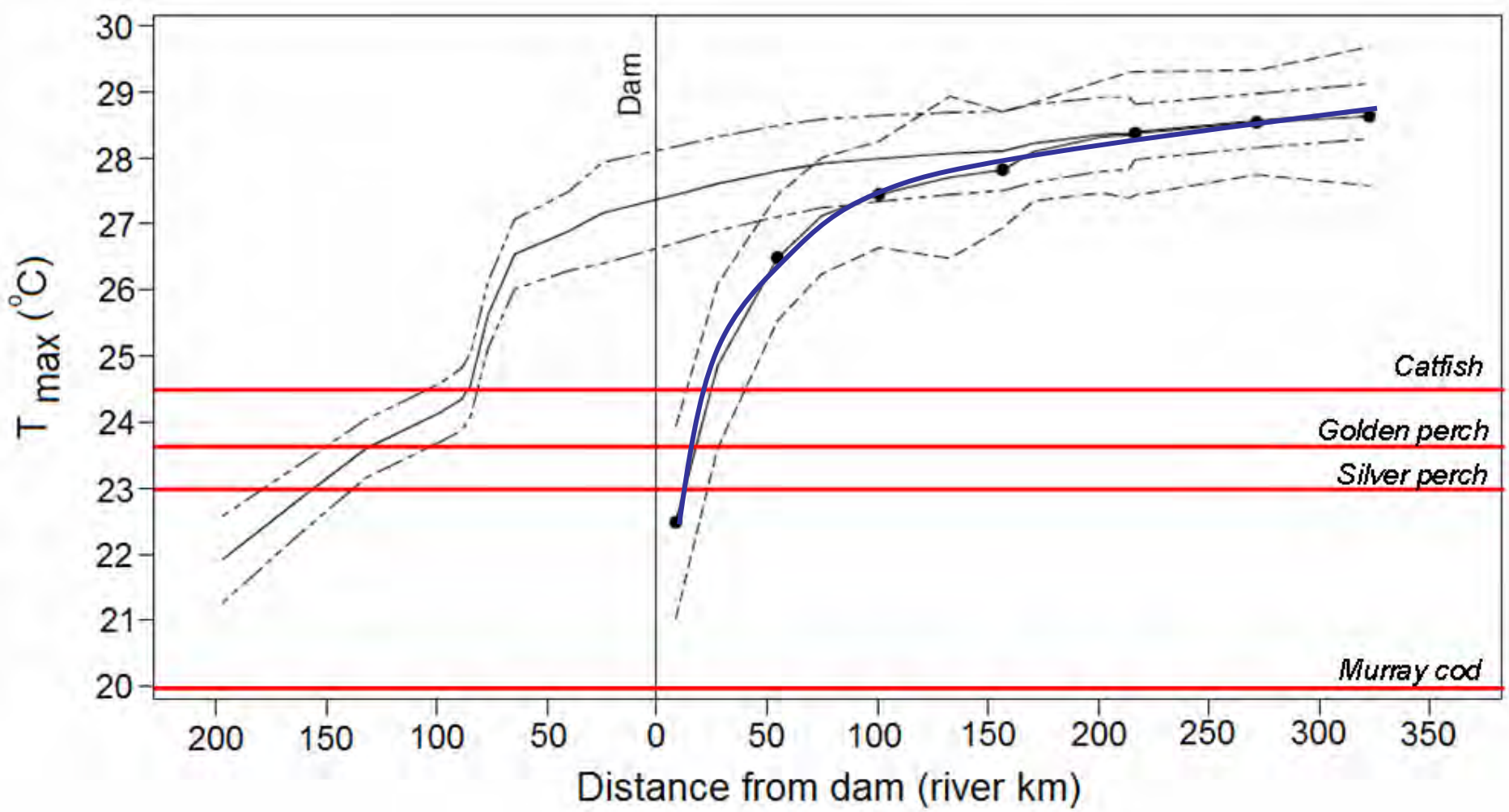

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Why considered:

- Increased chance of spawning failure if temperature is below critical spawning thresholds throughout the window potential spawning
- development and eventual hatching of fish eggs is sensitive to temperature

Likely response to 2-5^{o}C improvement:

- Response may be localised to immediately downstream of dam and is likely to be undetectable beyond 25km downstream

Verdict:

- Will be hard to detect a change with this indicator

3. Recruitment

Why considered:

Fish are more susceptible to mortality from anthropogenic disturbances during egg and larval stages than as adults

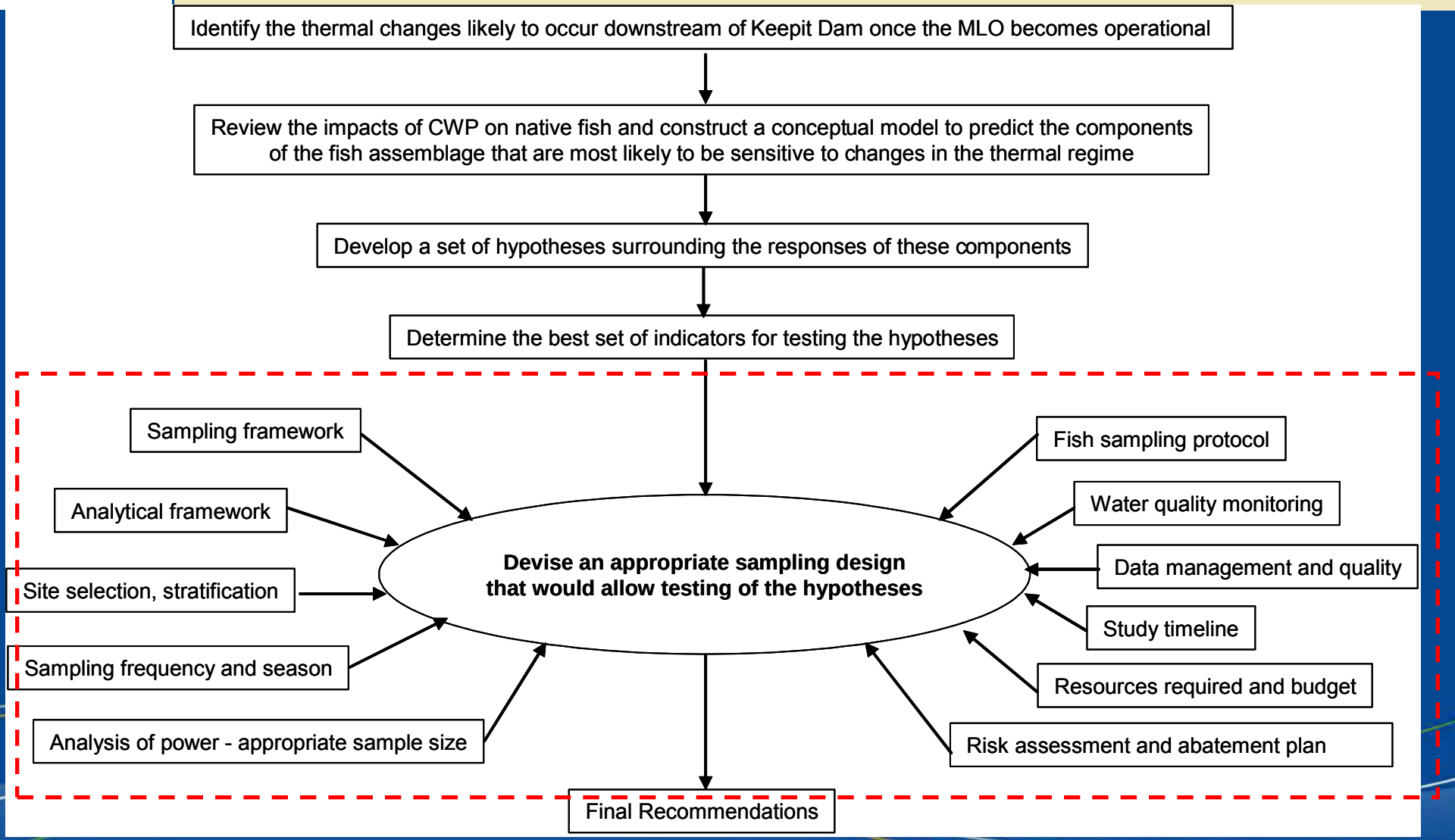
Likely response to 2-5^{o}C improvement:

Changes in mortality of eggs and larvae may be inconsequential

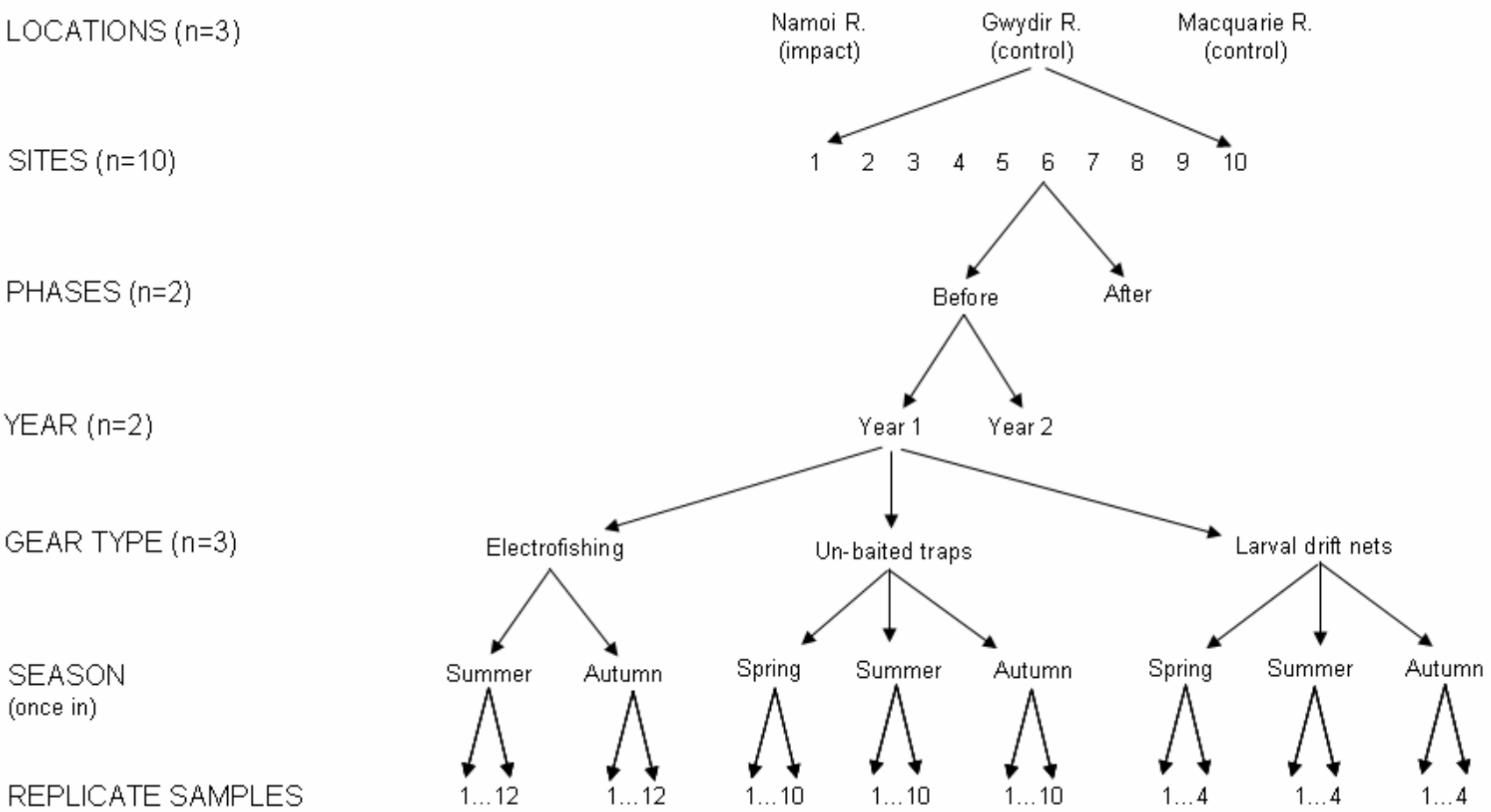
Verdict:

Will be hard to detect a change with this indicator

Scoping Process



MBACI Design



Risk assessment

1. Will the MLO at Keepit actually be constructed?

2. The project requires a period of monitoring during a CWP event. What if there is no CWP?

Final recommendations

1. Trialling ecological response to CWP mitigation is of very high priority

2. A study must be based on a rigorous experimental design (MBACI- multiple controls and years before and after)

3. But the timing is wrong – no water in dams or CWP. May have to wait a few years

4. Keepit Dam is not an ideal site for this study. The level of thermal improvement is less than first anticipated and it may be difficult to detect an ecological effect.

SWC proposed dam safety upgrades (potential alternatives)

Dam	2008	2009	2010	2011	2012	2013	2014
Keepit		√	√	√			
Chaffey						√	√
Blowering	√	√	√				√
Burrendong				√	√		
Wyangala	√	√					
Copeton			√	√	√	√	
Spilt Rock			√	√	√		

Quality assurance/control

- Steering committee to review report and advise:
  - Jim Barrett (chair/MDBC)
  - Craig Boys (ecologist/principal investigator)
  - John Harris (independent ecologist)
  - Wayne Robinson (independent biometrician)
  - Jocelyn Karsten (State Water Corporation)
- Independent expert panel of independent ecologists
  - Simon Nicol
  - Peter Jackson
- NFS Implementation working group