



Fish Passage and Fish Migration

Tim Marsden



Fish Migration

- Regular movements of freshwater fish between rivers, floodplains or the sea to breed and grow
- Critical for the survival of native fish populations.
- Most of Australia's rivers dry up to a series of waterholes between rains.
- The “boom and bust“ cycle leads to many unique migratory patterns among our fish.

Fish migrate at all times of the year under many different flow conditions

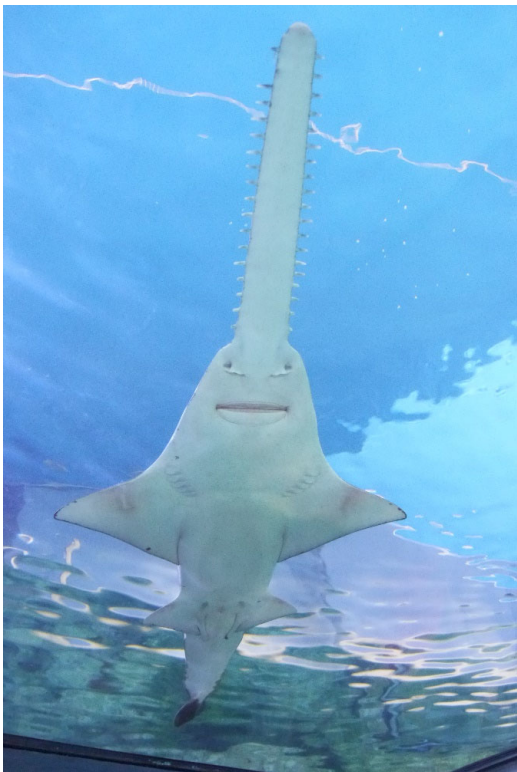


Migratory Fish Species



Life Stages That Migrate

- In Australia fish are moving at all life stages and sizes (7mm to **3000mm**)
- Adults are dispersing after spawning and juveniles are dispersing after hatching
- Need to know species are utilising a structure to determine what species will be catered for



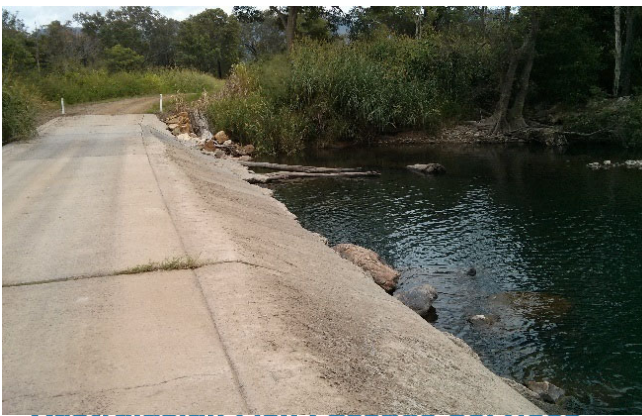
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All structures need to cater for all fish species and life stages



What is a Barrier

- Any structure that inhibits the movement of fish throughout a river system



Why are they Barriers

- Vertical drops greater than 100mm
- High velocities
- Excessive water turbulence
- Long swimming distance without resting
- Shallow water
- Reduced light levels



Passage Solutions – Elimination

- Barrier Elimination is always the best option
- Replacement of structure
 - Opens whole channel
 - Provides many passage paths
 - No entrance issues
 - Naturally roughened floor



Passage Solutions – Best Practice Design

- Opens barrier to effective passage
 - Opens larger proportion of channel
 - Provides roughened floor for natural passage
 - Has low flow channel with natural bed
 - Provides roughened walls for surface species
 - Has low decks to drown out easily



Passage Solutions - Fishways



Cone
Fishway to
eliminate
drops

Baffles to
break up flow
of straight
walls



Bypass
rock ramp
fishway

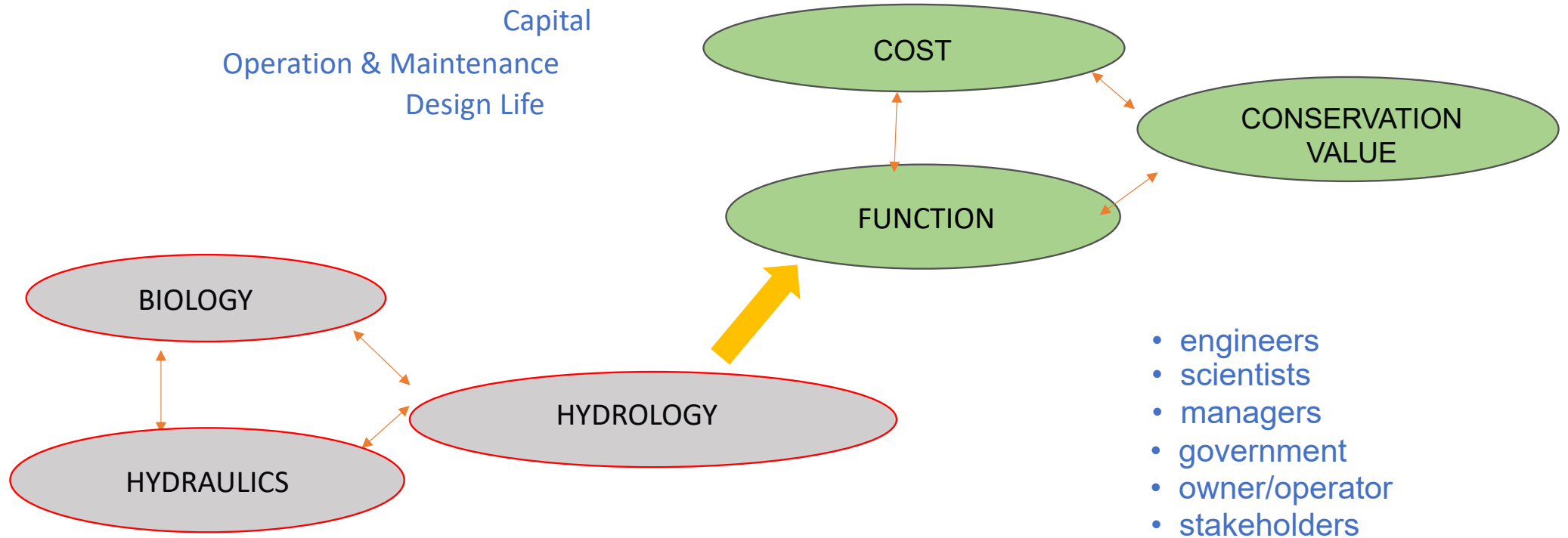
**Wide range of costs
from Thousands to
Millions**

Australasian Fish Passage Services

Fish
Lift

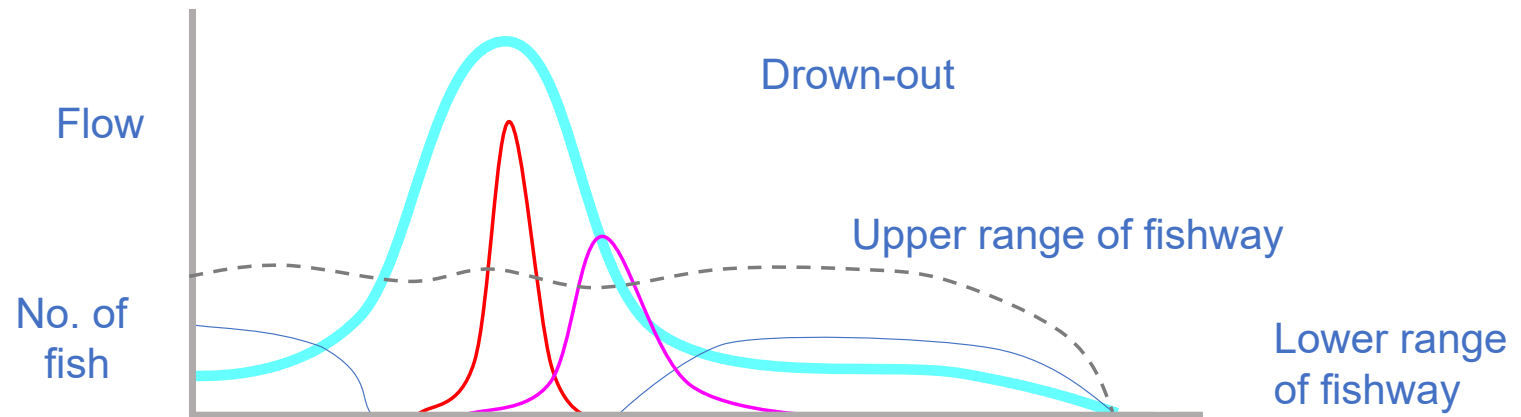


Design Process – Function to Design



- the solution will be unique
- site-based decision / catchment vision

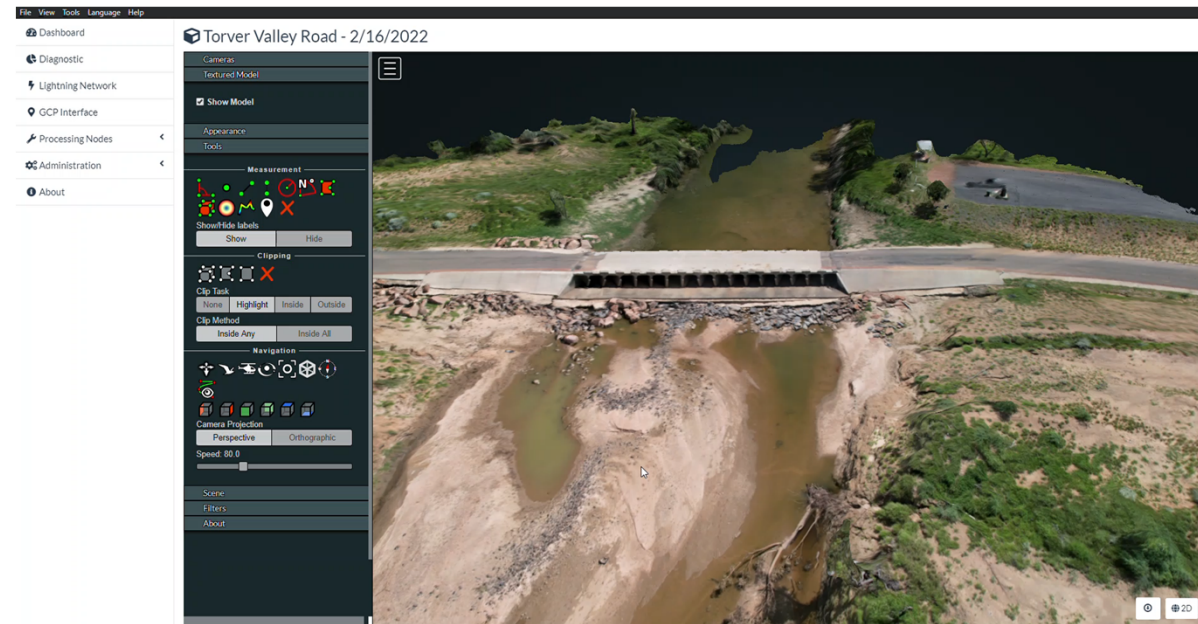
Design Process – Biology ↔ Hydrology



Function → Design
→ 2 fishways cheaper than 1
→ 90% operation more functional than 95%

Design Process – Concept → Final Design

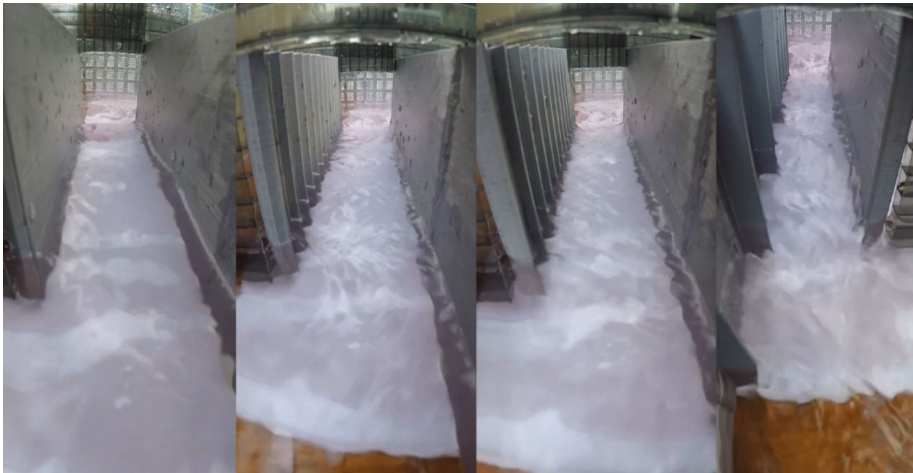
1. Team from the start: engineers, scientists, owners , operators
2. Hydrology & Biology
3. Site visit
 - In person - virtual
4. Options Analysis (workshop/MCA)
5. Transparency of risk
6. Expectation and outcomes



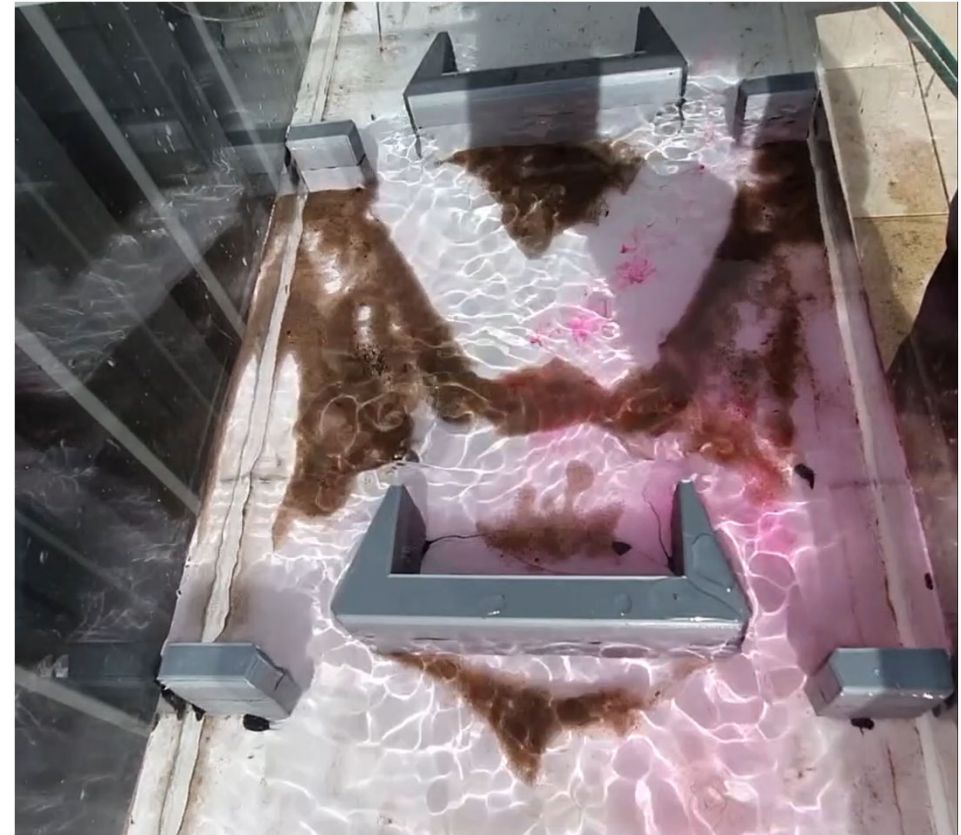
1. Attracting fish to the fishway entrance
2. Passing fish safely through the fishway
3. Upstream and downstream

3D Print = Rapid Designing

- As each design unique, each solution unique
- Many combinations makes optioneering in CFD a long process
- 3D print and mini flume rapidly discard non-viable options
- Have limitations relating to the size and scale of the site



Australasian Fish Passage Services



Conclusions

1. Fish passage an integral part of dam or weir design
2. Two components to design: attraction and passage
3. Teamwork - engineers and biologists
 - from the business case to commissioning
4. Link hydrology & biology with objectives
5. Let function determine design
6. Transparency of risk

