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SUPPLEMENTARY INFORMATION

RATIONALE FOR, AND IMPACTS OF, NEW DAMS AND OTHER WATER INFRASTRUCTURE IN NSW

HEARING 2 NOVEMBER 2020

Endangered Fish – Silver Perch & Murray Cod

The CHAIR: *In your submission in relation to Gin Gin weir ...you mention that the Government promised a fish ladder for the weir in 2011 but that has not yet been installed. Please explain to the Committee the importance of the fish ladder, and why it is one of your key recommendations to install this opposed to expanding that weir.*

Please find below some information on fish passages and endangered fish.

Fish Passage and Fishways in NSW - extract

In New South Wales, over 4000 weirs and dams have been built across inland and coastal rivers. They may be as apparently innocuous as low-level regulators used to divert water, or as large and permanent as the Yarrawonga Weir, but they all have the potential to block the movements of fish.

Fish passage - that is, the directed movement of fish past a point in a stream - can also be blocked by factors that affect fish behaviour, such as release of unnaturally cold water from a dam, or changes in the cycles of river flows that stimulate and guide migrating fish.

Various fish species migrate up-river from the sea at some stage of their lives; others swim down-river to the sea; and still others need to move from place to place within a river. When the movements are blocked the populations of these fish species are affected and they decline in numbers, sometimes becoming locally extinct. Of the 55 species of native freshwater fish living in New South Wales, 32 have now been shown to be migratory, requiring free passage to sustain their populations. The same principle applies, to some degree, to all freshwater fish species.

Only a few Australian fish species jump like salmon in the Northern Hemisphere. Australian fish use differing swimming tactics to pass obstacles. Several are even capable of climbing wet vertical surfaces.

The distance over which fish have to swim under stress to negotiate a physical barrier is important to fish passage. At many barriers with sloping downstream faces, fish may be able to ascend part-way up, only to become exhausted and be washed back downstream. To allow fish past barriers, fishways can be built.

Fishways

Fishways are structures that allow fish to pass barriers. The first 44 fishways in New SouthWales were constructed between 1913 and 1985,but they did not perform effectively, usually because of design failures. Since research into fish behaviour and fishways began in the state in 1985, 27 fishways have been built, using designs that are more reliable. Seven broad categories of fishways have been used or are being planned in New South Wales: the pool type (including vertical-slot), Denil, lock, trap-and-transport, rock-ramp, bypass, and eel fishways.

An effective fishway successfully transmits at least 95% of all fish species and individuals attempting to negotiate the barrier, and operates in at least 95% of the range of flow conditions experienced at that site.

A critical requirement of fishway design is that fish attempting to migrate must be able to find the fishway entrance and enter without delay. Then they need to be able to ascend through the fishway, exit in an area where they will not be swept back downstream, and continue with their upstream movement. These requirements usually need to be met over the full daily and seasonal cycles…….

Regulatory responsibility

The state department, NSW Fisheries, is committed to restoring fish passage. The department has regulatory responsibility for protecting fisheries resources and providing fish passage, and, under the NSW Fisheries Management Act 1994, may require a fishway to be built around any new in-stream barrier. The State Fishways Program has been created to link the engineering expertise of state government agencies such as the NSW Department of Land and Water Conservation with the fish-biology expertise of NSW Fisheries, to build successful fishways.

<u>Reference</u>

Fish Passage and Fishways in New South Wales: A Status Report by Garry Thorncraft & John H. Harris, technical report no. 1/2000 published by the CRC for Freshwater Ecology, May 2000.

Two examples of why fishways are so important
Endangered Fish – Silver Perch & Murray Cod

Silver Perch *Bidyanus bidyanus*
Silver perch are omnivorous, with algae becoming increasingly important in the diet with age. They undertake long upstream migrations entirely within freshwater. Generally, spawning occurs in spring to summer with an increase in water level and increase in water temperature above 23°C.

Spawning and biology
Silver perch spawn in late spring and early summer. Originally water temperatures of close to 24 degrees Celsius were considered necessary for spawning to occur. However "required" spawning temperature is flexible and they can and do spawn at lower temperatures.

Conservation

As recently as the 1970s, silver perch abounded in the entire Murray-Darling Basin, vast though it is. Since then, however, they have undergone a mysterious, rapid and catastrophic decline. Silver perch have now declined close to the point of extinction in the wild. Based on simple catchment area estimates, the silver perch has disappeared from 87% of its former range. Only one sizeable, clearly viable and self-sustaining population now survives in their natural range, in the central reaches of the Murray Rive. For these reasons, the Australian federal government has listed wild silver perch as critically endangered under national environmental law.

Reasons for decline
Reasons for the catastrophic decline of silver perch are only partially understood, although dams, weirs and river regulation and the virtual removal of spring floods appear to have removed the conditions silver perch need to breed and recruit successfully on a large scale. Weirs are also believed to have blocked the migrations of spawning adults and juveniles, which are important to maintain populations over the lengths of rivers. Weirs also kill most drifting silver perch larvae that pass through them, if they are of an undershot design. Recent studies have proven more than 90% of silver perch passing through undershot weirs are killed. As well weirs trap drifting silver perch eggs (and larvae), where they are either diverted down irrigation offtakes, resulting in eventual death, or sink into fine weir pool sediments and die. Silver perch may rely on their eggs settling onto clean, well oxygenated substrates of coarse sediments. In this era of flow regulation and flood curtailment by dams, which control the flood events that remove fine

sediment, and chronic siltation from poor agricultural practices, the eggs may now frequently land in anoxic fine sediment and organic matter — including in weir pools — and fail to survive.

Competition for food

There is competition for food between introduced carp and silver perch at larval, juvenile and adult stages. Introduced carp are having very large impacts on a number of native Murray-Darling fish species due to competition at the larval stage which is considered most serious.

Raising of the Gin Gin weir is expected to create conditions which suit feral fish such as carp and gambusia.

Installation of fishways

Since 2000, the installation of fishways in many Murray River weirs, allow native fish to pass through them and successfully migrate long distances again. Recent carefully managed environmental flow events have seen silver perch numbers in the last remaining viable population (lower Murray) increase strongly.

Reference

Australian Government Advice for Silver Perch (PDF) *Australian Government - Department of the Environment and Energy*. 2013

http://www.environment.gov.au/biodiversity/threatened/species/pubs/76155-conservation-advice.pdf

Murray Cod *Maccullochella peelii*

Trout Cod *Maccullochella macquariensis*

For decade after decade, debate about excessive fishing pressure, number of fishermen, number of nets, net mesh size, bag limits, minimum size limits and take of small cod, closed seasons and the taking of spawning cod full of eggs during spring, and other sundry issues, raged on and on without proper resolution, with fishing regulations either not amended, or amended and largely unenforced and completely ignored, and with heavy commercial, recreational and illegal fishing pressure continuing unrelenting and unabated. The end result was a Murray cod population, initially unimaginably abundant, continually fished down and down and down without pause, until in the early to mid 20th century a number of other factors such as river regulation (listed below) emerged to drive the species even further into decline. All of these drivers of decline have left this iconic Australian fish in a perilous situation. There are now grave concerns for the long-term survival of wild Murray cod populations.

Reproduction

Murray cod reach sexual maturity between four and six years of age, Murray cod spawn in spring, cued by rising water temperatures and increasing photoperiod (daylight length). Murray cod breed annually, with or without spring floods, and at temperatures as low as 15°C but more generally at temperatures of 20–21°C. Spawning is preceded by significant upstream migrations if high spring flows or floods allow.

Effects of river regulation

The breeding of Murray cod and other Murray-Darling native fish was adapted to the natural flow patterns of high flows in winter, high flows and floods in spring, low flows in summer and autumn. River regulation for irrigation has reversed these natural flow patterns, with negative effects on the breeding and recruitment of Murray cod. The Murray and most southern tributaries now experience high irrigation flows in summer and autumn and low flows in winter and spring. Small and medium floods including the once annual spring flood-pulse have been completely eliminated. The species exhibits a high degree of parental care for their eggs which are spawned in the spring and are generally laid in hollow logs or on other hard surfaces.

Habitat degradation / siltation

Hundreds of thousands of “Snags”, mainly River Red Gum, have been removed from lowland reaches of the Murray-Darling basin over the past 150 years. The removal of such a vast number of snags has had devastating impacts on Murray cod and river ecosystems, as snags are critical habitats and spawning sites for Murray cod. Snags are also critical for the functioning of lowland river ecosystems — as one of the few hard substrates in lowland

river channels composed of fine silts, snags are crucial sites for biofilm growth, macroinvertebrate grazing and general in-stream productivity.

Vegetation clearing and cattle trampling river banks create severe siltation, which fill in pools, degrade river ecosystems and make rivers and streams uninhabitable for Murray cod. This is exacerbated by removal of riparian (riverbank) vegetation which causes siltation and degrades river ecosystems in many ways.

Thermal pollution

Thermal pollution is the artificial reduction in water temperatures, especially in summer and autumn, caused when frigid water is released from the bottom of reservoirs (*including weirs)* for irrigation demands. Such temperature suppression typically extends several hundred kilometres downstream. Thermal pollution inhibits both the breeding of Murray cod and the survival of Murray cod larvae, and in extreme cases inhibits even the survival of adult Murray cod.

The rare floods that do break free of the dams and weirs of the Murray-Darling system have their magnitude and duration deliberately curtailed by river regulators. Increasing research indicates this management practice is very harmful and drastically reduces the general ecosystem benefits and breeding and recruitment opportunities for Murray cod and other Murray-Darling native fish species these now rare floods can provide.

Physical barriers to fish movement

Dams, weirs and other instream barriers block the migration of adult and juvenile Murray cod and prevent recolonisation of habitats and maintenance of isolated populations. Additionally, recent study has proven approximately 50% of Murray cod larvae are killed when they pass through undershot weirs.

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All of these are likely to occur if the Gin Gin weir is raised.

Introduced carp

There is serious competition for food between larval/early juvenile introduced carp and larval/early juvenile native fish. Introduced carp dominate the fish faunas of lowland Murray-Darling rivers; the sheer amount of biomass carp now take up, and the large numbers of larvae carp produce, causes serious negative effects on river ecosystems and native fish. Carp are the main vector of the introduced Lernaea parasite (*Lernaea cyprincea*) and serious vectors of the introduced Asian fish tapeworm (*Bothriocephalus acheilognathi*).

References

Koehn, J. D. (2004). “Threats to Murray Cod” (PDF). Murray Darling Basin Commission.

McDowall, R., ed. (1996).*Freshwater Fishes of south-eastern Australia* (Rev. ed.). Sydney: Reed Books

Marine and Freshwater Research.57 (2): 187–191.

Baumgartner, L. J.; Reynoldson, N.; Gilligan, D. M. (2006). "Mortality of larval Murray cod (*Maccullochella peelii peelii*) and golden perch (*Macquaria ambigua)* associated with passage through two types of low-head weirs".

“Murray Cod” Native Fish Australia. https://web.archive.org/web/20071010105433/http://www.nativefish.asn.au/cod.html