

FLORA AND FAUNA GUARANTEE - SCIENTIFIC ADVISORY COMMITTEE
FINAL RECOMMENDATION ON A NOMINATION FOR LISTING

The prevention of passage of aquatic biota as a result of the presence of instream structures.
(Potentially Threatening Process)

Date of receipt of the nomination: 13 May 1993
Date of preliminary recommendation: 17 June 1993
Date of final recommendation: 21 September 1993

File No.: 93/1113

Validity:

The nomination is for a valid item and the prescribed information was provided. In the opinion of the SAC the process is adequately defined and described.

The nominated process is caused by the existence of artificial barriers which prevent or impede fish and other aquatic species from moving along Victorian waterways. Effective instream barriers range in size from high dams and weirs, flood and erosion control structures and tidal barriers, to less obvious structures such as culverts or road crossings. Barriers exist throughout Victoria and the majority have the potential to affect the movement and survival of a wide range of aquatic biota. The most obvious and dramatic impact of barriers is the direct exclusion of migratory fish species moving to, or from, habitat which is essential for the completion of their life cycle, such as spawning grounds in estuaries or headwaters. Barriers may cause a reduction in diversity and abundance of accessible habitat, may alter ecosystems because of the exclusion of migratory species, the loss of recolonisation opportunities after displacement by seasonal habitat changes, fish kills, angling pressure, increased predation by birds and exotic species. The separation of populations by barriers may also have the potential to cause a reduction in the diversity of gene pools. The possible impact of barriers on fish populations is dependent on factors such as species life history, their swimming ability, the height and design of a barrier, frequency and timing of floods that may inundate particular barriers and enable fish passage, as well as the existence of navigational locks and the periodic removal of barriers.

The range of flora or fauna affected or potentially affected was adequately stated in the nomination.

Significance of the threat which the potentially threatening process poses or has the potential to pose was adequately stated in the nomination.

Eligibility for listing as a potentially threatening process under the Flora and Fauna Guarantee

The nominated item satisfies at least one criterion of the set of criteria prepared and maintained under Section 11 of the *Flora and Fauna Guarantee Act 1988*, and stated in Schedule 1 of the *Flora and Fauna Guarantee Regulations 1990*.

Evidence that criteria are satisfied:

Criterion 5.1 *The potentially threatening process, in the absence of appropriate management, poses or has the potential to pose a significant threat to the survival of a range of flora or fauna.*

Evidence:

The majority of barriers which exist throughout Victoria have the potential to affect the movement and survival of a wide range of aquatic biota, including fish and invertebrate species. Those species of fish which are known to migrate either up or downstream for spawning or other reasons are most likely to be adversely affected by instream barriers. Some of these species are absent from areas where access is restricted by impassable barriers (Koehn 1986). There are many other species whose migratory requirements are unknown which may be potentially at risk from instream barriers. The exclusion of migratory species by artificial instream barriers also has the potential to significantly affect freshwater fish species composition.

For species which do not appear to migrate during their life-cycle, instream barriers may influence their ability to maintain populations following resultant reductions in the abundance and diversity of accessible habitat, changes in ecosystem, reduction in recolonisation opportunities and population fragmentation (e.g. Freshwater catfish *Tandanus tandanus*, Freshwater blackfish *Gadopsis marmoratus*). Although there is a lack of scientific information, aquatic invertebrates may be affected in similar ways by the existence of instream barriers.

Large fish can be physically damaged by movement over spillways, vertical drops onto concrete or rock sills and turbines (Harris 1985).

Species which have very localised distributions and small population sizes may be particularly affected by isolation and may be at a greater risk to unexpected environmental catastrophes (e.g. Trout cod, Freshwater herring).

Sub-criterion 5.1.1 *The potentially threatening process, in the absence of appropriate management, poses or has the potential to pose a significant threat to the survival of two or more taxa.*

Evidence:

The nominated process has the potential to affect the survival of a number of fish species, particularly those which migrate either up or downstream for spawning or other reasons (e.g. Freshwater herring *Potamalosa richmondia*, Macquarie perch *Macquaria australasica*, Australian grayling *Prototroctes maraena*, Silver perch *Bidyanus bidyanus*, Golden perch *M. ambigua*, Tasmanian mudfish *Galaxias cleaveri*, Murray cod *Maccullochella peelii*, Pouched lamprey *Geotria australis*, Australian bass *Macquaria novemaculeata*, Broad-finned galaxias *Galaxias brevipinnis*, Spotted galaxias *G. truttaceus*, Striped gudgeon *Gobiomorphus australis*, Short-finned eel *Anguilla australis*, Long-finned eel *A. reinhardtii*, Common galaxias *G. maculatus*, Short-headed lamprey *Mordacia mordax*, Tupong *Pseudaphritis urvillii*).

The final recommendation reports for the FFG listed species, Australian grayling, Trout cod, Murray cod, Macquarie perch and Freshwater herring identified the existence of artificial barriers, such as dams and weirs, as a threat. The preliminary recommendation report for Australian bass (*Macquaria novemaculeata*) also noted that barriers can disrupt the migratory spawning movements of the species. This species congregates at barriers where it may be prone to high fishing mortality.

Many other species whose migratory requirements are unknown may be potentially at risk from instream barriers. These include the Variegated pigmy perch *Nannoperca variegata*, Barred galaxias *G. olidus* var. *fuscus*, Trout cod *M. macquariensis*, Yarra pigmy perch *Edelia obscura*, Eastern little galaxias *G. pusilla*, Flat-headed galaxias *G. rostratus*, Mountain galaxias *G. olidus*, Cox's gudgeon *Gobiomorphus coxii*, Two-spined blackfish *Gadopsis bispinosus*.

Although Short-finned and Long-finned eels can negotiate large obstacles such as waterfalls and dams by climbing wet surfaces or even moving over land, they may suffer increased predation while congregating at, or negotiating, difficult barriers (Cadwallader and Backhouse 1983, Harris 1986). Lampreys can negotiate small barriers (e.g. less than 2 m high) by climbing wet surfaces, however increased mortality can result from difficult passage (Harris 1984, 1986). Broad-finned galaxias can climb high waterfalls and moist rock surfaces, although they may be restricted by smooth-surfaced or high man-made structures and may suffer increased predation or injury when negotiating difficult barriers (McDowell 1980, Sloane 1984). Striped gudgeon may also be restricted by man-made structures and may suffer the same fate (Harris 1986).

Tupong, which are relatively poor swimmers, have been noted to be unable to pass barriers (Hortle 1979), and appear to have been prevented from moving upstream by a pipe culvert on a road crossing and were not found in the upper reaches of steep streams in the Otway region (Koehn and O'Connor 1990a).

Harris (1986) noted the disappearance of the Golden perch, a species which can undertake long upstream spawning migrations, from the Upper Murray River because of the existence of large dams. Koehn (1986) suggested that the absence of migratory species such as the Common galaxias, the Spotted galaxias and the Tupong in the upper Bunyip and Lang Lang Rivers could be related to obstructions to passage. Dight's Falls, a two metre high barrier on the lower Yarra River, may also restrict the passage of Tasmanian mudfish, Australian grayling, Spotted galaxias, Tupong and Common galaxias (CNR unpublished survey results). It has been suggested that the restricted distribution of the Golden perch could be due to the presence of weirs on the Goulburn, Campaspe and Loddon Rivers and at Yarrowonga (Cadwallader 1977, Cadwallader 1978, Reynolds 1983, Brumley 1987). Golden perch spawn in the upper reaches of river so that pelagic eggs and larvae are not swept downstream into saline waters where they may die (Reynolds 1983). Gonads may be reabsorbed by Golden perch when appropriate spawning conditions are not met (Cadwallader and Backhouse 1983). The reduction of Silver perch in tributaries above the Yarrowonga weir could be primarily because of this barrier (Reynolds 1983).

Criterion 5.2 *The potentially threatening process, in the absence of appropriate management, poses or has the potential to pose a significant threat to the evolutionary development of a range of flora and fauna.*

Evidence:

Species whose population structure is altered from an interbreeding continuum to a series of small isolates are likely to lose genetic variability and in extreme cases become inbred (e.g. Allendorf & Leary 1988).

Fish larvae which are washed downstream into dams can become disorientated and starve, be eaten or fail to reach their downstream destination. The loss of invertebrates that are washed into weirs and dams may result in a poor recolonisation and reduction in genetic diversity downstream of the barrier.

Background Information

There are about 250 dams and weirs, over 100 flood and erosion control structures and numerous tidal barriers, road crossings and culverts in Victoria (Koehn 1985, DWR 1989).

- 14 migratory fish species occur in the Murray-Darling basin which has over 150 dams and weirs and numerous causeways and small barriers (Mallen-Cooper 1989).
- Harris (1984) estimated that passage for survival, maintenance of population abundance and distribution is required by approximately 70% of the fish species present in coastal drainages in south-eastern Australia, with about 50% of the area of available habitat having been restricted by barriers.
- There have only been a few recent attempts made in Victoria to incorporate fishways into artificial instream structures (KoeHN and O'Connor 1990b). The majority of instream structures created to regulate rivers in Victoria have not been designed to consider the requirements of fish in terms of passage or maintenance of availability of habitat.
- Instream structures can sometimes be beneficial to species such as *G. fuscus* and *G. olidus* to prevent immediate extinctions of local populations where the threat of predation by trout is greater than the threat caused by restricted passage (Tilzey 1976, Jackson and Williams 1980, Raadik *pers. comm.*).
- "The alteration of natural temperature regimes of rivers and streams" has been listed as a potentially threatening process under the *Flora and Fauna Guarantee Act 1988*. Dams and weirs can cause water temperatures downstream to be unsuitable for spawning (e.g. Macquarie perch) (Cadwallader 1981, Cadwallader and Backhouse 1983).

Advertisement for public comment

In accordance with the requirements of Section 14 of the *Flora and Fauna Guarantee Act 1988*, the preliminary recommendation was advertised for a period of at least 30 days.

The preliminary recommendation was advertised in:

"The Age" - on 4 August 1993

"The Weekly Times" - on 4 August 1993

Government Gazette - on 5 August 1993

submissions closed on 6 September 1993.

Further evidence provided:

No public comments were received by the Scientific Advisory Committee.

No evidence was provided to warrant a review of the Scientific Advisory Committee's preliminary recommendation that the potentially threatening process is eligible for listing.

Documentation

The published information and research data provided to the SAC have been assessed. To the best of their knowledge, the SAC believes that the data presented are not the subject of scientific dispute and the inferences drawn are reasonable and well supported.

Final Recommendation of the Scientific Advisory Committee

The Scientific Advisory Committee concludes that on the evidence available the nominated item is eligible for listing in accordance with Section 11 of the Act because primary criteria 5.1 and 5.2 are satisfied.

The SAC also concluded that sub-criterion 5.1.1 has been satisfied and that no evidence exists to suggest that primary criterion 5.1 cannot be satisfied as a consequence of sub-criterion 5.1.1 being satisfied.

The Scientific Advisory Committee recommends that the nominated item be supported for listing on Schedule 3 of the *Flora and Fauna Guarantee Act 1988*.

Selected references:

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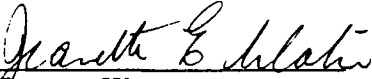
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- Koehn, J. D. & O'Connor, W. G. (1990b) Biological information for management of native fish in Victoria. Government Printer, Melbourne. 165p.
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Endorsement by the Convenor of the Scientific Advisory Committee

Date

3 December 1993


 Dr Jeanette Watson
 Acting Convenor