NOMINATION NO. 197
ITEM NO. T5811

FLORA AND FAUNA GUARANTEE - SCIENTIFIC ADVISORY COMMITTEE

FINAL RECOMMENDATION ON A NOMINATION FOR LISTING

Alteration to the natural flow regimes of rivers and streams
(Potentially Threatening Process)

Date of receipt of the nomination: 4 September 1991 **File No.:** 91/1952
Date of preliminary recommendation: 18 October 1991
Date of final recommendation: 10 March 1992

Validity:

The nomination is for a valid item and the prescribed information was provided. The nominated process was adequately defined and described.

The nominated process is the regulation of the flow of many rivers, mainly by irrigation, water conservation and hydro-electric schemes. Regulation often reduces the amount of water flowing downstream and reduces the incidence and magnitude of flooding. Irrigation storages often reverse the natural pattern of water flow downstream causing summer flows to be higher and winter/spring flows lower (Cadwallader & Backhouse 1983, Merrick & Schmida 1984, OCE 1988). The process affects stream biota by reducing flows, altering the seasonality of flows, reducing the frequency and size of flood flows, altering river levels and increasing the rate of fall of river levels (Cadwallader & Lawrence 1990). Reduced flows, altered seasonality of flows and reduced flooding are the major threats.

The process occurs in rivers and streams throughout the State. Koehn (1985) noted that there were about 248 water storages (dams and weirs) on natural waterways in Victoria, downstream of which the natural flow regime has been altered. Only in East Gippsland and the Mallee are there no major storages, and there are few in far south-western Victoria (OCE 1988).

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 alteration to the natural pattern of water flow has been cited by many authors as one of the prime causes for the dramatic decline in distribution and abundance of many of Victoria's native freshwater fish species since the advent of Europeans (Cadwallader 1978, McDowall 1980, Cadwallader & Backhouse 1983, Merrick & Schmida 1984, Mitchell 1990, Koehn & O'Connor 1990a, 1990b, Cadwallader & Lawrence 1990), having profound implications for the physical and biological aspects of the aquatic environment (OCE 1988).

Many native freshwater fish species are dependent on natural seasonal flows to trigger and/or facilitate essential life history events, such as spawning, access to and provision of important habitat (e.g. utilisation of the inundated floodplain as rearing habitat for larvae and juveniles), and migration to the spawning zone and other critical habitats. If disruptions to the natural pattern of streamflow occur, then spawning success and the survival of larvae and fry may be reduced (Cadwallader 1978, OCE 1988, Geddes & Puckridge 1988, Anderson 1988, OWR 1990, Koehn & O'Connor 1990a, 1990b, Mitchell 1990, Cadwallader & Lawrence 1990). If this continues from one year to the next, recruitment is reduced leading to a decrease in abundance and the possible disappearance of a species from a stretch of stream.

In the most extreme cases, entire populations of aquatic flora and fauna can be destroyed by river diversion e.g. there is essentially no flow immediately below the West Gellibrand Dam on the Gellibrand River, or immediately below the Upper Yarra Dam, where the Yarra River is now generally dry for several kilometres.

Sudden changes in flow, particularly those associated with the end of irrigation releases or the operation of hydro-electric schemes, may lead to:

- fish and/or eggs being left stranded above the water level where they may die (Koehn & O'Connor 1990b, Cadwallader & Lawrence 1990)
- fish eggs being flushed away or exposed
- drift of invertebrates
- severe reduction of the availability of suitable habitat, particularly in reduced flows where fish rearing and spawning areas may become unusable (Tunbridge 1988, Hall 1991, Hall & Harrington 1991).

A reduction in the frequency of flooding would affect many waterbird species, as the inundation of riparian and floodplain areas stimulates their reproductive activity, provides secure habitat and enhances food sources for fledglings (OCE 1988).

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

Evidence:

Documented evidence was provided to show that the nominated process has the potential to reduce the distribution and abundance of a number of fish species, by changing times and levels of floods. A number of fish species are threatened by the effects of altered natural flow regimes:

Maccullochella peelii (Murray Cod), *M. macquariensis* (Trout Cod), *Prototroctes maraena* (Australian Grayling), *Macquaria novemaculeata* (Australian Bass), *M. australasica* (Macquarie Perch), *M. ambigua* (Golden Perch), *Bidyanus bidyanus* (Silver Perch), *Tandanus tandanus* (Freshwater Catfish), *Galaxias brevipinnis* (Climbing Galaxias), *G. truttaceus* (Spotted Galaxias).

Three other fish species whose survival in Victoria is threatened, but whose ecology is little known, are likely to have undergone decline as a result of the nominated process. At least eight other native freshwater species are affected by the process, and although presently widespread, may become threatened in the longer term.

At least one amphibian is likely to have been affected by the process. Watson *et al.* (1991) stated: "Alteration of flow regimes and inundation of the suitable habitat presumably are the causes of the loss of the population of *Litoria spenceri* (Spotted Tree Frog) on the Thomson River at a site now covered by the lake formed behind the Thomson River Dam."

A species of stonefly (*Stenoperla australis*) was recorded in the Thomson River at the site of the later Thomson Dam. Following dam construction, the species appears to have disappeared from the Thomson system (Doeg *et al.* 1987). Studies on the effects of dam construction (Blyth *et al.* 1984; Chessman *et al.* 1987; Doeg *et al.* 1987; Marchant 1989) have identified many invertebrate taxa that are affected by changed water flow and high sediment levels resulting from dam construction, and which were clearly reduced in abundance. A loss of abundance of invertebrates means a loss of food supply to fish.

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 or fauna.*

Evidence:

The SAC was satisfied that the nominated process can cause local extinctions of aquatic fauna and change the species composition of streams. The process leads to reductions in the range and sizes of fish populations, fragments populations and causes reductions in the numbers of differing year classes. This can cause loss of genetic variation and hence reduce the species' ability to adapt to environmental change.

Background Information:

- Murray Cod, Trout Cod, Australian Grayling, Macquarie Perch and Spotted Tree Frog have been listed on Schedule 2 of the FFG Act.

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 public comment for a period of at least 30 days.

The preliminary recommendation was advertised in:

"The Age" - on 13 November 1991
"The Weekly Times" - on 13 November 1991
Government Gazette - on 13 November 1991

Submissions closed on 16 December 1991.

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 concludes 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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Hall, D.N. & Harrington, D.J. (1989) Observations on the spawning and early life history of Australian grayling *Prototroctes maraena Gunther,* in the Barwon River, Victoria. *Arthur Rylah Inst. Env. Res. Tech. Rep. Ser.* No. 84, 31 pp. Department of Conservation Forests and Lands, Melbourne.

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Koehn, J.D. (1985) Environmental problems and approaches to determining habitat requirements for freshwater native fish in Victoria. In: *Proceedings of the River Management Association*. Offices of the Rural Water Commission, Armadale.

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Endorsement by the Convenor of the Scientific Advisory Committee **Date**

30 March, 1992

Dr. Neil Murray