



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

**Increase in sediment input to rivers and streams due to human activities**  
(Potentially Threatening Process)

Date of receipt of the nomination: 17 May 1991  
Date of preliminary recommendation: 18 June 1991  
Date of final recommendation: 18 October 1991

File No.: 91/2850

**Validity:**

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

The nomination covers three phases of sediment: suspended (particles in the water column), deposited (particles lying on the stream bed) and hyporheic (particles within the matrix of the stream bottom). Sediment enters rivers and streams as part of the normal geological process, and in undisturbed catchments the input is generally low (Olive & Rieger 1987) and is unlikely to have adverse effects on aquatic flora and fauna. Input of sediment can be greatly accelerated by human activities.

The deleterious effects of increased sediment on biological resources of streams have been known for some time (e.g. Cordone & Kelly 1961, Chutter 1969). The process results in a variety of effects on stream biota, including direct fatality, reduced growth rates, reduced feeding, altered diet and behaviour, displacement and increased stress and incidence of disease. It can lead to reduced photosynthesis because of reduced light transmission, lower water temperatures and loss of habitat caused by blanketing of the substrate.

The nominated process is operating in rivers and streams throughout the State (DWR 1989; Mitchell 1990). It is caused by increased erosion, caused in turn by changes in land use such as land clearance for agriculture (OCE 1988), grazing and cropping of stream frontages (Patrick 1988) forestry activities (Olive & Rieger 1987; Papworth *et al.* 1990), and by mining and gravel extraction, run-off from construction sites and industrial discharges (DWR 1989). Dam construction is a major source of sediment (Blyth *et al.* 1984; Davey *et al.* 1987). Very few rivers and streams in Victoria could be regarded as being free of the nominated process.

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:**

Several studies have shown that additional sediment has a serious effect on aquatic macroinvertebrate communities (e.g. Blyth *et al.* 1984; Doeg *et al.* 1987), reducing the diversity or substantially changing the composition of the communities. Increased sediment is a significant cause of loss of fish habitat and breeding grounds (OCE 1988), and it has been identified as a major threat to Victorian native freshwater fish (Koehn & O'Connor 1990) and a cause for decline in the range and abundance of native fish species (Cadwallader 1978).

The range of flora and fauna affected is broad, covering algae which depend on substrate surfaces for attachment, macroinvertebrates living in or on the substratum and fish which lay eggs that lodge between substrate particles or which require a silt-free surface for attachment.

**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 range and abundance of a number of fish species, by smothering the eggs and reducing reproduction. In addition, juveniles tend to suffer increasing mortalities in increasing concentrations of suspended sediment. A number of fish species are threatened by the effects of increased sediment on their eggs and juveniles:

*Macquaria australasica* (Macquarie Perch)  
*Gadopsis marmoratus* (Freshwater blackfish)  
*Galaxias maculatus* (Common galaxias)  
*G. brevipinnis* (Climbing galaxias)  
*G. truttaceus* (Spotted galaxias)

For example:

- Tests on *Galaxias brevipinnis* eggs have shown a 100% mortality rate when they are covered with silt, compared to successful hatching of a control group. High mortalities have also been reported for Macquarie Perch and Spotted galaxias.
- The male Blackfish guards the eggs and keeps them free of sediment. If the male is removed or leaves, the eggs are likely to become covered with silt and will die. Blackfish eggs have shown high mortalities when covered with silt and increased larval mortalities have been reported with increased suspended sediment. The newly-hatched larvae stay attached to the eggs for a few weeks, and may also suffer significant mortality.
- Juvenile Common galaxias returning from the sea are very susceptible to heavy sediment loads, if the river system has undergone a high rate of flushing. Juveniles of the species appear to be more susceptible to sediment than adults.

Twelve other native freshwater species lay eggs on or among the stream-bed and may be liable to smothering from increased sediment deposition. Of these, nine are considered by Koehn & Morison (1990) to be threatened in Victoria:

*Geotria australis* (Pouched lamprey), *Galaxias olidus* (Mountain galaxias), *G. rostratus* (Flat-headed galaxias), *Prototroctes maraena* (Australian Grayling), *Tandanus tandanus* (Freshwater catfish), *Craterocephalus stercusmuscarum* (Freshwater hardyhead), *Gobiomorphus coxii* (Cox's gudgeon), *Maccullochella peelii* (Murray Cod) and *M. macquariensis* (Trout Cod).

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 below the dam (Doeg *et al.* 1987).

**Sub-criterion 5.2.1** *The potentially threatening process poses or has the potential to pose a significant threat to the evolutionary development of two or more taxa.*

**Evidence:**

The SAC was satisfied that the nominated process can cause local extinctions of aquatic fauna and change the species composition of streams. Many species of benthic invertebrates require clean substrate for attachment, so are susceptible to sedimentation and are absent in disturbed sites. Increased sediment can cause benthic invertebrate fauna to leave their present habitat and drift downstream. There appears to be a threshold level of suspended sediment at which drift of invertebrate species occurs. This level of suspended sediment appears to be higher than levels which naturally occur in undisturbed streams (Doeg & Milledge in press). The species found to be susceptible to sediment tend not to occur in degraded sites, and there is a clear inference that the species have left. Studies of the effect of additional sediment input on flora and fauna have come mainly from work on the effects of dam construction (Blyth *et al.* 1984; Chessman *et al.* 1987; Doeg *et al.* 1987; Marchant 1989). More than 20 taxa have been shown in several studies to be affected e.g.: *Austrophlebooides pusillus* (mayfly), *Agapetus* sp. 1 (caddisfly), members of the genus *Notalina* and family Hydropsychidae (caddisflies), members of the genera *Australimnius*, *Simsonia* and *Sclerocyphon* (beetles), *Ablabesmyia* sp. 7E and members of the genera *Eukefferiella* and *Thienemanniella* (dipterans). At least a further 30 taxa have been shown in single studies to be affected. All these species of invertebrates were clearly reduced in abundance. Evolutionary development may be affected locally because of severe reductions in numbers, and a loss of abundance of invertebrates means a loss of food supply to fish.

**Background Information:**

- Macquarie Perch, *Galaxias olidus* var. *fuscus*, Murray Cod, Trout Cod, Australian Grayling and Tasmanian Mudfish have received the SAC's final recommendation for listing on Schedule 2 of the FFG Act.
- Following construction of the Thomson Dam, the total number of macroinvertebrate species fell, compared to prior to construction. A number of rare species disappeared that were not cited in the nomination, because the survey data were not adequate to show whether they had declined as a result of sedimentation or because of some other factor.

## 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 10 July 1991

"Weekly Times" - on 10 July 1991

*Government Gazette* - on 10 July 1991

Submissions closed on 12 August 1991.

### **Further evidence provided:**

Several public submissions supporting the recommendation were received by the Scientific Advisory Committee. No new 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 criterion 5.1 is satisfied.

The SAC also concludes that sub-criteria 5.1.1 and 5.1.2 have been satisfied and that no evidence exists to suggest that primary criteria 5.1 and 5.2 cannot be satisfied as a consequence of sub criteria 5.1.1 and 5.1.2 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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Endorsement by the Convenor of the Scientific Advisory Committee

Date

  
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 Dr. Neil Murray

18 October 1991