

Action Statement

Flora and Fauna Guarantee Act 1988

No. 129

Prevention of passage of aquatic biota by instream structures

For the purposes of this action statement, instream structures include man-made dams, weirs, stream gauging stations and culverts that block the passage of fish and other aquatic biota.

Description

A barrier to fish passage is any obstacle that prevents or impedes fish from successfully moving along a waterway. Natural barriers such as waterfalls and log jams occur on a relatively small scale, however, the broad occurrence of artificial barriers have had a serious impact on the distribution and abundance of many native fish species (Harris 1984).

Effective instream barriers range in size from high dams and weirs to the not so obvious but often equally obstructive culvert or road crossing. Effective barriers may also be formed by high water velocities produced by channelisation and streambed clearing and by the presence of pollution or haloclines (Evans 1977).

Historically, the design of instream structures used to regulate rivers in Victoria has not given consideration to the requirements of fish for either free passage or for the maintenance of suitable aquatic habitat.

Many fish use different parts of a river system at different stages in their life cycles. For some species, such as the gudgeons and smelt, these can all be within a relatively short stretch of river, but for others, the distances involved can be considerable. For example, golden perch spawn in flooded reaches of lowland rivers, the young use the floodplains as nurseries, they may then disperse, in some cases up to 2 300 km (Reynolds 1983). Silver perch *Bidyanus bidyanus* move over most of the Murray-Darling river system and Murray cod *Maccullochella peelii* have been recorded as covering distances of several hundred kilometres.

O'Brien (1993) identified 18 of Victoria's native fish species for which migration is known to be an essential part of their life cycle. Only two species have no apparent migratory requirements, while for the other 22 native fish species found in Victoria, their migratory requirements are unknown.

Barriers exist throughout Victoria and the majority of these have the potential to affect the movement and survival of a wide range of aquatic biota. The most obvious and dramatic impact is the direct exclusion of migratory fish moving to or from

Table 1

Basin	Stream Gauges	Farm dams & weirs	Fords	Culverts	Natural	total
Murray -Darling drainage	310	504	228	17	86	1145
South - east coastal drainage	397	535	210	31	120	1293
Total	707	1039	438	48	206	2438

(Source: State Fishway Program, NRE 1999)

habitat essential for completion of their life cycle, for example spawning grounds in estuaries or headwaters. However, all aquatic fauna may be affected by barriers due to a number of factors. These include the reduction in diversity and abundance of accessible habitat, ecosystem changes resulting from exclusion of migratory species, the loss of recolonisation opportunities after displacement by seasonal habitat changes, fish kills, angling pressure, increased predation by birds or other fish and, in the longer term, barriers may also lead to a reduction in genetic diversity.

Indirectly, barriers that regulate streams alter the quality, quantity and timing of water delivered downstream, often affecting the habitat, breeding cycles and feeding grounds of native fish (NRE 1999). Barriers may also affect fish moving downstream. Fish larvae washed into dams can become disoriented and starve, be eaten or just not reach their downstream destination while large fish can be damaged by spillways, vertical drops onto concrete or rock sills and turbines (Harris 1984).

The overall impact a barrier has on fish populations is dependent on factors including what species are present and their swimming ability, the height and design of the barrier, frequency and timing of floods that may inundate some barriers and permit fish passage and also the operation of navigational locks or periodic removal of some barriers. Some barriers, especially those less than 2m in height, may be passable by adept swimmers or fish able to climb such as *Galaxias brevipinnis* and eels yet completely restrict many other species. Some of these barriers may also be negotiated during flood events when these coincide with periods of migration.

Distribution

The State Fishway Program has inventoried potential barriers to fish movement in Victoria, identifying 2 438 potential barriers, with farm dams and weirs making up the largest proportion of instream barriers in the state. There are also a significant number of stream gauging sites (weirs specifically designed for streamflow monitoring and major water storages with a stream gauging function) which comprise about 30% of the total number of barriers (NRE 1999). Large numbers of culverts and road crossings were not generally recorded, though these in many cases form an effective barrier to fish movement.

See Table 1. (page 5)

Management Status

Current status

The prevention of passage of aquatic biota as a result of the presence of instream structures is

listed as a potentially threatening process under the Flora and Fauna Guarantee Act 1988.

Reasons for conservation status

In its final recommendation the Scientific Advisory Committee (SAC 1993) determined that the presence of instream structures as barriers to fish passage is a potentially threatening process that, in the absence of appropriate management:

- poses a significant threat to the survival of a range of flora and fauna; and
- poses a significant threat to the survival of two or more taxa; and
- poses a significant threat to the evolutionary development of two or more taxa.

Management Issues

The need to provide fish passage in Victorian streams has only recently been generally recognised as a serious threat to aquatic biodiversity, and there is a significant knowledge gap in the management of this potentially threatening process.

A number of long and short-term management challenges must be met if the above objectives are to be achieved. These challenges relate to furthering our understanding of ecological issues surrounding fish movement, communicating these issues to river managers and the general public, and providing economically viable solutions to the problem of fish barriers.

Ecological issues

There is a dearth of knowledge about the species biology of many of Victoria's native fish species. This is reflected in uncertainty over the migratory requirements for most species, including several with a high conservation status. Any action needs to consider this uncertainty and provide solutions that conservatively allow for potential biological requirements of fish.

Priority pathways for migratory species, which are important for the immediate survival of particular taxa, need to be fully identified.

The appropriate design of fishways is a developing science that requires further research. We still lack much of the basic knowledge about biological and hydrodynamic characteristics of our native fish species (MDBC 1999). Important factors that require further investigation include the identification of the migratory requirements and environmental cues used by many native fish, an assessment of the swimming abilities of native fish appropriate to migratory life-stages, an investigation of the design parameters required for firstly attracting fish to the entrance of fishways and then for ensuring safe passage through a

fishway. All fishways designs currently in use are considered experimental, an appropriate fishway monitoring program is required to determine, and where required, improve the effectiveness of fishway designs used to date.

In a special case, it is apparent that two conservation-listed species, (barred galaxias *Galaxias fuscus* and mountain galaxias *Galaxias olidus* and the spotted tree frog *Litoria spenceri*), may in fact benefit from the presence of instream barriers. These species appear susceptible to predation from the introduced trout species *Salmo trutta* and *Oncorhynchus mykiss*, which appear to be contributing to their decline in certain habitats (NRE 1995, G. Gillespie, pers. comm.). Although their migratory requirements are unknown, predation is considered to be an immediate threat to their conservation, and some barriers have been installed in trout free areas containing *Galaxias fuscus* (Saddler pers. comm.). The installation of barriers is also being considered to restrict the spread of carp *Cyprinus carpio*.

Previous management action

The need to provide fish passage was recognised early by some river managers in Australia, and the first recorded fishway was built in 1913. A total of 44 fishways had been built in NSW by 1985, while the first Victorian fishway was constructed on Lerderderg weir in 1980, and the second constructed in Cardinia Creek in the early 1980s (Harris 1984).

Unfortunately the majority of these early fishways were poorly built or used inappropriate designs and were generally not maintained. As a result, the fishways provided limited fish passage, if any. The main reason for this failure was that the behaviour and swimming ability of indigenous fish species had not been considered. Fishway designs were taken from the Northern Hemisphere where upstream migrations are dominated by large powerful adult salmonids, which can leap to overcome barriers. In Australian streams, upstream migrations are predominantly by species that neither leap nor have the swimming ability of adult salmonids. In addition, a number of these migrations, particularly in Victorian coastal areas, are undertaken by juvenile fish which rely on very different hydraulic conditions to pass obstructions.

Recognising this, in 1980 NSW Fisheries engaged George J. Eicher, a prominent American fishways expert, to visit Australia and advise on a fish-passage facility program. The resulting report (Eicher 1982) identified some problems with existing fishways, suggested suitable designs and indicated future research priorities. The first fishway built using these insights, a vertical slot design, was constructed at Torrumbarry Weir on

the River Murray in 1985 (Thorncraft & Harris 2000).

The Murray-Darling Basin Commission's Fish Management Plan (1991) identified fish passage as a key issue for sustainable native fish populations. This spurred the establishment of formal state fishway programs in Victoria, NSW and Queensland. The Commission has recently completed a review of fish passage within the basin (Murray Darling Basin Commission 1999), and are currently preparing specific management actions to be undertaken by each state to improve fish passage throughout the Basin.

The third Victorian fishway was placed at Dights Falls on the Yarra River by 1994. Ad hoc fish monitoring surveys and anecdotal reports have shown it to be at least partially successful in reintroducing catadromous fish into most of the catchment. A prototype rock ramp design was constructed on the Barwon River in 1995. This has also been highly successful with over ten thousand fish having been recorded as passing upstream in a single night (O'Brien 1995).

In October 1996 the Victorian Fishway Implementation Committee was formed, comprising key fish biologists and representatives from the Department of Natural Resources and Environment's five regions. This expert forum was established to identify priority barriers for fishway installation and target available fishway funding.

The State Fishway Program was established in 1997, allocating \$1.85M provided by the Victorian Government to identify priority barriers for remediation and to undertake works. Under the Program, agreements have been signed with Catchment Management Authorities, Melbourne Water and other Agencies to construct fishways on priority barriers. A number of these Authorities have also contributed financially towards the construction of fishways and have established their own fishway programs.

Initial funding under the State Fishway Program has now been fully allocated and to June 2001, works at 58 fishway sites have been completed for a gain of at least 4,500 km of riverine habitat. These include the removal of some minor barriers, a number of rock-ramp fishways in coastal areas such as at Dight's Falls on the lower Yarra River and at several sites on the Barwon River, and also some large vertical-slot fishways such as on the Broken Creek.

A study of the effect of rock-ramp fishways on gauging weirs was recently completed (Haupt 2000), while other research on appropriate designs is proposed. Studies on the importance of downstream movement for both adult and juvenile

Murray-Darling Basin fish are currently being undertaken.

Major Management Objective

Long term objectives

- to open up free passage for native fish in all river systems through the modification or removal of man-made instream barriers;
- to ensure that all future instream works do not impede native fish passage;
- to reverse declines in the conservation status of many individual species or ecological communities.

Objectives of this Action Statement

- to provide free passage along identified critical pathways for the conservation of threatened species.
- to ensure that the Authorities responsible for construction and maintenance of instream structures meet their statutory obligations regarding provision of fish passage.
- to ensure that all approvals processes for works on waterways formally consider the need for fish passage.
- to increase the knowledge base of movement and migratory requirements of native fish to ensure the appropriate design and placement of fishways.
- to produce design manuals as used by water and road engineers to assist with the incorporation of fish friendly design of works.
- to improve public knowledge and understanding of ecological, social and economic issues related to the presence of fish barriers.

Intended management actions

Implementation of this Action Statement will be pursued through the Victorian Government working in partnership with Catchment Management Authorities, Water Authorities and the community. The Victorian Government is currently preparing the State River Health Strategy (publication due 2001). This Strategy recognises and promotes the need for free passage for native fish as an integral component of healthy rivers.

Construction of fishways on identified critical pathways

1. Continue to construct fishways on priority barriers. Priority sites have been identified under the State Fishway Program.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division), Catchment Management Authorities, Melbourne Water.

Ensure appropriate statutory provisions and compliance by appropriate Authorities

2. Seek to amend legislation to require that fish passage be considered in any major asset replacement or refurbishment. Consideration should initially focus on the potential to remove the structure prior to the construction of a fishway.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division), Catchment Management Authorities, Melbourne Water.

3. Actively promote the need for fish passage and ensure Authorities are aware of their statutory obligations. Approval processes for work on waterways will be implemented to ensure fish passage is comprehensively considered.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division), Catchment Management Authorities, Melbourne Water.

Research and development

4. Identify priorities for research to improve fish passage, including fish movement, behaviour and fishway conditions, ensuring the appropriate design and placement of fishways. Assessment of design effectiveness should be integral to works programs, furthering future improvements.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division)

Design guidelines for construction engineers

5. Promote the application of the national design guidelines for culverts and crossings to provide fish passage which are currently being developed, with particular emphasis on the engineering profession within Victoria and on agencies commissioning works.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division), Catchment Management Authorities

Redundant instream structures

6. Implement a study into the long-term management of weirs and dams which will identify those structures that no longer serve a purpose and are no longer valued by the community. In such instances the removal would complement the provision of fishways.. A program for removal will be considered as funding is allocated.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division)

Improving public understanding

7. Promote the importance of providing fish passage for maintaining healthy rivers through a variety of avenues, targeted to key stakeholders such as recreational fishermen.

Responsibility: DSE (Catchment and Water Division, Parks, Flora and Fauna Division), DPI (Fisheries Division), Catchment Management Authorities, VRFish (peak angling body)

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Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

Flora and Fauna Guarantee Action Statements are available from the Department of Sustainability and Environment website: <http://www.dse.vic.gov.au>

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