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FINAL DETERMINATION

Aquatic Ecological Community in the Catchment of the Snowy River in NSW

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a final determination to list the Aquatic Ecological Community in the Catchment of the Snowy River in NSW as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 4 of the Act.

Under Part 7A of the Act (Division 1, Section 220D), an ecological community means an assemblage of species of fish or marine vegetation (or both) occupying a particular area. Listing of Endangered Ecological Communities is provided for by Part 7A, Division 2 of the Act.

The area covered by this determination includes all rivers, creeks and streams of the Snowy River catchment within the State of New South Wales and including the Snowy River, Eucumbene River, Thredbo River, Gungarlin River, Mowamba River, Bombala River, Maclaughlin River, Delegate River, Pinch River and Jacobs River. This area includes the river bed channel inundated by the man-made lakes Jindabyne, Eucumbene, Island Bend and Guthega but excludes the ecological communities that have developed in the waters of the impounded man-made lakes.

The Fisheries Scientific Committee, with reference to the criteria relevant to this ecological community, prescribed by Part 16 of the *Fisheries Management (General) Regulation 2010* (the Regulation) has found that:

Background

1. The Snowy River rises in the Australian Alps of the Great Dividing Range in southeastern NSW and follows an indirect route south into Victoria to discharge into Bass Strait at Marlo.

2. There are approximately 2,300 km of lotic streams within the NSW portion of the Snowy catchment with average daily flows of >5 ML day^{-1} (Stein 2008a,b).

3. There are marked gradients in environmental variables throughout the Snowy River catchment. These natural gradients, particularly temperature, rainfall and the distribution of snow fields, drive large and marked differences in the aquatic community structure of these waterways.

4. The overall aquatic ecological community in the New South Wales portion of the Snowy River is characterised by the following assemblage of native species. The list is based on a combination of Australian Museum, I&I NSW, DECCW and literature records and is data deficient for many areas of the Snowy River drainage. Therefore the total species list of the community is much larger. Further, not all of the species listed below will be present at any one location as the species composition will be influenced by the time of year, the environmental characteristics of the location and its position within the stream hierarchy. The species listed in the table are considered aquatic species under the definition of the *Fisheries Management Act 1994*.

Fishes	
Anguilla australis (short-finned eel)	*Macquaria novemaculeata* (Australian bass)
Anguilla reinhardtii (long-finned eel)	*Mordacia mordax* (short-headed lamprey)
**Gadopsis marmoratus* (river blackfish)	**Nannoperca australis* (southern pygmy perch)
Galaxias brevipinnis (climbing galaxis)	*Philypnodon grandiceps* (flat-headed gudgeon)
Galaxias maculatus (common galaxias)	*Philypnodon macrostomus* (dwarf flathead gudgeon)
Galaxias olidus (mountain galaxias)	***Prototroctes maraena* (Australian grayling)
Galaxias sp.1 (not yet described)	*Psuedaphritis urvillii* (congolli)
Galaxias sp.2 (not yet described)	*Retropinna semoni* (Australian smelt)
Geotria australis (pouched lamprey)	
Gobiomorphus australis (striped gudgeon)	
Gobiomorphus coxii (Cox's gudgeon)	
Worms (Annelida)	
Philaemon pungens (leech)	*Antipodrilus davidis* (tubifex worm)
Phreodriloides notabilis (worm)	*Rhyacodrilis bifidus* (tubifex worm)
	Rhyacodrilis coccineus (tubifex worm)
Crustaceans	
Alona davidi (water flea)	*Psammaspides* sp. (syncarid)
Alona elliptica (water flea)	*Australatya striolata* (riffle shrimp)
Dunhevedia crassa (water flea)	*Paratya australiensis* (shrimp)
Caenestheriella sp. (water flea)	*Macrobrachium australiense* (prawn)
Daphnia alpina (water flea)	*Palaemon affinis (*shrimp*)*
Daphnia carinata (water flea)	*Engaeus cymus* (crayfish)
Daphnia magniceps (water flea)	*Engaeus orientalis* (crayfish)
Daphnia nivalis (water flea)	*Euastacus bidawalus* (crayfish)
Daphnia thomsoni (water flea)	*Euastacus brachythorax* (crayfish)
Limnadia sp. (water flea)	*Euastacus claytoni* (crayfish)
Limnadopsis birchii (water flea)	*Euastacus crassus* (crayfish)
Limnadopsis parvispinus (water flea)	*Euastacus diversus* (crayfish)
Lynceus sp. (water flea)	*Euastacus rieki* (crayfish)
Macrothrix spinosa (water flea)	*Euastacus yanga* (crayfish)
Branchinella compacta (water flea)	*Crenoicus* sp. (isopod)
Macrocyclops albidus (water flea)	*Metaphreatoicus australis* (isopod)
Taneroa sp. (water flea)	*Metaphreatoicus lacustris* (isopod)
Cypretta hirsute (ostracod)	
Neoniphargus fulton (amphipod)	
Nemertean	
Argonemertes australiensis (nemertean worm)	
Flatworms (Platyhelminthes)	
Temnocephala comes (flatworm)	*Geoplana lucasi* (flatworm)
Temnosewellia belone (flatworm)	*Geoplana sanguinea* (flatworm)
Geoplana coxii (flatworm)	*Geoplana spenceri* (flatworm)
Geoplana howitti (flatworm)	*Heterorotula contraversa* (flatworm)
Sponges	
Spongilla sp. (sponge)	
Molluscs	*Gyraulus gilberti* (snail)
Ferrissia petterdi (freshwater limpet)	*Gyraulus scottianus* (snail)

Ferrissia tasmanica (freshwater limpet)	*Helicorbis australiensis* (snail)
Glacidorbis hedleyi (snail)	*Isidorella brazieri* (snail)
Austropyrgus buchanensis (snail)	*Isidorella montana* (snail)
Austropyrgus cooma (snail)	*Isidorella newcombi* (snail)
Austropyrgus monaroensis (snail)	*Corbicula australis* (freshwater clam)
Austropyrgus ora (snail)	*Hyridella australis* (freshwater mussel)
Austropyrgus synoria (snail)	*Hyridella depressa* (freshwater mussel)
Austropyrgus tathraensis (snail)	*Hyridella drapeta* (freshwater mussel)
Austropyrgus viridarium (snail)	*Velesunio ambiguus* (freshwater mussel)
Austropyrgus buchanensis (snail)	*Musculium quirindi* (fingernail clam)
Potamopyrgus antipodarum (snail)	*Musculium tasmanicum* (fingernail clam)
Austropeplea lessoni (snail)	*Pisidium carum* (freshwater clam)
Austropeplea tomentosa (snail)	*Pisidium casertanum* (freshwater clam)
Austropeplea brazieri (snail)	*Pisidium etheridgei* (freshwater clam)
Sphaerium sp. (freshwater clam)	*Pisidium hallae* (freshwater clam)
Glyptophysa aliciae (snail)	*Pisidium kosciusko* (freshwater clam)
Glyptophysa placata (snail)	*Pisidium tasmanicum* (freshwater clam)
Insect families	
Order Coleoptera	*Order Hemiptera*
Brentidae (weevils)	Corixidae (water boatmen)
Carabidae (ground beetles)	Gelastocoridae (toad bugs)
Chrysomelidae (leaf beetles)	Gerridae (water striders)
Curculionidae (aquatic weevils)	Hydrometridae (water measurers)
Dytiscidae (diving beetles)	Mesoveliidae (water treaders)
Elmidae (riffle beetles)	Naucoridae (creeping water bugs)
Gyrinidae (whirligig beetles)	Notonectidae (backswimmers)
Hydraenidae (aquatic beetles)	Pleidae (pygmy backswimmers)
Hydrochidae (water scavenger beetles)	Veliidae (small water striders)
Hydrophilidae (water scavenger beetles)	
Noteridae (beetles)	*Order Lepidoptera*
Psephenidae (water pennies)	Pyralidae (aquatic caterpillars)
Ptilodactylidae (water beetles)	
Ptilodoctylidae (water beetles)	*Order Mecoptera*
Scirtidae (marsh beetles)	Nannochoristidae (scorpionflies)
Staphylinidae (rove beetles)	
	Order Megaloptera
Order Diptera	Corydalidae (toe-biters)
Athericidae (water spine flies)	Sialidae (alderflies)
Blephariceridae (net-winged midges)	
Cecidomyiidae (gall midges)	*Order Neuroptera*
Ceratopogonidae (biting midges)	Neurorthidae (lacewings)
Chironomidae (non –biting midges)	Osmylidae (net-winged insects)
Culicidae (mosquitoes)	
Dixidae (meniscus midges)	*Order Trichoptera*
Empididae (dagger flies)	Atriplectididae (vulture caddis)
Sciomyzidae (marsh flies)	Calamoceratidae (sleeping bag caddis)
Simuliidae (black flies)	Calocidae (caddisflies)
Stratiomyidae (soldier flies)	Conoesucidae (caddisflies)
Tabanidae (march flies)	Ecnomidae (caddisflies)
Thaumaleidae (solitary midges)	Glossosomatidae (caddisflies)
Tipulidae (crane flies)	Helicophidae (caddisflies)
	Helicopsychidae (snail-case caddisflies)

Order Ephemeroptera	Hydrobiosidae (caddisflies)
Ameletopsidae (killer mayflies)	Hydropsychidae (net-spinning caddis)
Baetidae (mayflies)	Hydroptilidae (micro caddis)
Caenidae (mayflies)	Leptoceridae (stick caddis)
Coloburiscidae (spiny nymphs)	Limnephilidae (northern caddisflies)
Leptophlebiidae (prong-gilled mayflies)	Odontoceridae (caddisflies)
Oniscigastridae (mayflies)	Philopotamidae (caddisflies)
Siphlonuridae (mayflies)	Philorheithridae (caddisflies)
	Polycentropodidae (caddisflies)
Order Odonata	Tasimiidae (caddisflies)
Aeshnidae (hawkers)	
Coenagrionidae (damselflies)	*Order Plecoptera*
Corduliidae (emerald dragonflies)	Austroperlidae (stoneflies)
Diphlebiidae (damselflies)	Eustheniidae (stoneflies)
Gomphidae (club-tailed dragonflies)	Gripopterygidae (stoneflies)
Isostictidae (damselflies)	Notonemouridae (stoneflies)
Lestidae (damselflies)	
Libellulidae (skimmers or perchers)	
Megapodagrionidae (flatwings)	
Protoneuridae (threadtails)	
Synlestidae (malachites)	

***** Denotes a listed threatened species in the Act.
** Denotes a listed vulnerable species under the national EPBC Act & protected species under the Act.

5. Snowy, Pinch and other falls in the Burnt Hut Gorge and Willis Sand Zone reaches form natural barriers to upstream fish passage under a majority of flow conditions (Lugg et al. 2006; Haeusler and Bevitt 2007; Gilligan and Williams 2008).

6. Four major dams; Guthega, Island Bend Pondage, Eucumbene and Jindabyne, and several smaller diversion structures have been constructed in the Snowy River catchment as part of the Snowy Mountains Hydro-Electric Scheme (SMS). The SMS was constructed between 1955 and 1967 for hydro-electric power generation and provision of a water resource for irrigators in the Murray and Murrumbidgee valleys (Snowy Hydro 2003).

7. It is recognised that the catchment consists of more than just a single discrete ecological community, but is composed of a series of related ecological communities that are linked in a hierarchical manner by the stream network. The threatening processes acting upon each of these ecological communities vary depending on the position of the waterways within the catchment hierarchy. Broad categorisation of ecosystems affected by similar suites of threatening processes are i) un-regulated streams upstream of impoundments (34% of the Snowy River Catchment's waterways), ii) streams inundated by impoundments (9% of the Snowy River Catchment's waterways), iii) regulated rivers downstream of the impoundments (10% of the Snowy River Catchment's waterways) and iv) un-regulated tributary streams downstream of the impoundments (47% of the Snowy River Catchment's waterways).

8. Within the NSW portion of the Snowy River catchment approximately 990 km of streams (44%) fall within national parks and reserves. However, because of the hierarchical nature of stream networks, these waterways are affected by factors outside of the protected areas.

Criteria – reduction in ecological function, geographic distribution or genetic diversity (Regulation clause 277)

1. Recent surveys of riverine health of the Snowy River catchment under the NSW Governments MER program suggest that the health of the fish community of the Snowy catchment is *Very Poor*, with 'expectedness' (the proportion of native fish expected to be present that were collected) being *Very Poor* and 'nativeness' (the proportion of the fish community consisting of native species) being *Poor* (DECCW 2010). The health of macro-invertebrate communities is moderate to good and hydrology is poor to moderate (DECCW 2010). For all ecosystem components, the Snowy River catchment is typically the poorest in condition within the Southern Rivers CMA region and of coastal catchments in NSW (DECCW 2010).

2. Two of the 15 native fish species *Nannoperca australis* (southern pygmy perch), and *Gadopsis marmoratus* (river blackfish) in this community are listed in the Threatened Species Schedules for New South Wales. *Prototroctes maraena* (Australian grayling) is listed as Vulnerable under the *Commonwealth Environment Protection and Biodiversity and Conservation Act 1999* and listed as a protected species under the *Fisheries Management Act 1994.*

3. The aquatic ecosystems of the Snowy catchment also include the following *Matters of National Environmental Significance* (identified using the Department of the Environment, Water, Heritage and Arts website – Protected Matters Search Tool):

National Heritage Places	Australian Alps National Park and Reserves NSW
Wetlands of International Significance	Blue Lake
Threatened ecological Communities	Alpine Sphagnum bogs and associated fens
	Upland wetlands of the New England Tablelands and the Monaro Plateau.
Frogs	*Heleioporus australiacus* (Giant burrowing frog)
	Litoria verreauxii alpina (Alpine tree frog)
	Litoria aurea (Green and golden bell frog)
	Litoria castanea (Yellow spotted bell frog)
	Litoria booroolongensis (Booroolong frog)
	Litoria littlejohni (Littlejohn's tree frog)
	Litoria raniformus (Southern bell frog)
	Pseudophryne corroboree (Corroboree frog)
Waterbirds	*Ardea modesta* (Great egret)
	Ardea ibis (Cattle egret)
	Gallinago hardwickii (Japanese snipe)
	Oxyura australis (Blue billed duck)*
	Rostratula benghalensis australis (Painted snipe)

* This species was not identified by the DEWHA - *Protected Matters Search Tool* but is listed as a Vulnerable species under the NSW *Threatened Species Conservation Act 1995*.

4. The hydrological regime is considered a key driver of ecosystem health in river ecosystems (Bunn and Arthington 2002). The hydrologic regime of the Snowy River downstream of Guthega, Island Bend and Jindabyne Dams and the Eucumbene River between Eucumbene Dam and Lake Jindabyne has been substantially altered since

creation and operation of the SMS (Pendlebury et al. 1996; Erskine et al. 1999; Williams and Russell 2009; Morton, Green and Williams 2010). Ecological function has been reduced as a result of the mean annual natural flows below Jindabyne Dam being reduced by 99%, by 96% at Dalgety and by 65% in the lower reaches of the river, seasonal shifts in peak flows, reduction in the frequency and magnitude of floods and reduced mean summer base-flows. Ecological function below Guthega Power Station is also affected by peaking discharge releases (Williams and Russell 2009). These changes in hydrology have affected the availability and distribution of physical habitats, disrupted life history processes of aquatic biota, reduced fish passage, reduced longitudinal and lateral connectivity, altered water quality, affected geomorphological processes and facilitated the establishment of alien aquatic plant and animal species over approximately 10% of the aquatic ecosystem of the Snowy River catchment.

5. The impoundment of lotic waterways to form lentic reservoirs results in a massive transformation of ecological processes affecting all forms of aquatic biota. The creation of lakes behind Guthega, Island Bend, Eucumbene and Jindabyne Dams in the Snowy River catchment has reduced both the ecological function and geographic distribution of the natural ecological community of the aquatic ecosystem of the Snowy River catchment over approximately 9% of waterways of the catchment.

6. The hydrology of un-regulated tributaries of the Snowy River downstream of Jindabyne is not directly affected by the SMS. However, as 56% of the freshwater fish fauna occupying these streams require access to estuarine and/or marine environments to fulfil their life-cycles, fish communities in un-regulated tributary streams (representing 47% of waterways within the Snowy River catchment) are directly affected by the impacts of the altered hydrological regime on the Snowy River estuary. These estuarine impacts have resulted in the almost total recruitment failure of Australian bass since 1988 (SR CMA 2007) and are also likely to affect several other estuarine dependent diadromous fish species.

7. The hydrology of unregulated tributaries of the Snowy River upstream of the Snowy Mountains Hydro-electric Scheme infrastructure remains in a natural condition. However, the artificial fish passage barriers created by Jindabyne, Island Bend, Eucumbene and Guthega Dams, and the exacerbation of the natural fish passage barriers created by falls in the Burnt Hut Gorge and Willis Sand Zone reaches through flow reductions downstream of Jindabyne Dam (Haeusler and Bevitt 2007), inhibit the upstream migration of diadromous fish species. As a result, at least four diadromous species known to have historically occupied the upper Snowy River catchment (Australian grayling, long-finned eel, short-finned eel and climbing galaxias (Lugg et al. 2006)), representing 25% of the fish fauna of the NSW portion of the catchment are excluded from accessing up to 43% of their natural habitats within the catchment. The absence of these species (particularly the two eels which typically dominate the biomass of fish communities in coastal rivers) is likely to have resultant effects on ecological functions within the Snowy River catchment aquatic ecosystem.

8. The occurrence of the alien fishes; *Carassius auratus* (goldfish), *Misgurnus anguillicaudatus* (oriental weatherloach), *Perca fluviatilis* (redfin perch), *Gambusia holbrooki* (eastern mosquitofish), *Onchorhynchus mykiss* (rainbow trout), *Salmo trutta* (brown trout), *Salvelinus fontinalis* (brook trout), *Salmo salar* (Atlantic salmon), and their dominance in several waterways is likely to reduce ecological function of the native aquatic ecological community. As at 2009, 53% of individual fish in the Snowy

catchment were alien species and they constituted 22% of fish biomass (I&I NSW Freshwater Fish Research Database, unpublished data).

9. In light of the above, the Fisheries Scientific Committee has found that the aquatic ecological community in the catchment of the Snowy River has undergone a very large reduction in ecological function within a time frame appropriate to the life cycle and habitat characteristics of the component species; this meets the criteria of an Endangered Ecological Community.

Criteria – threatening processes (Regulation clause 272)

1. The Fisheries Scientific Committee has identified the following threats to the continued survival of the Aquatic Ecological Community in the catchment of the Snowy River:

   - Since construction of the Snowy Mountains Scheme (SMS) in 1967, flows in the Snowy River have been diverted into the Murray and Murrumbidgee Rivers, with only 1% and 4% of Mean Annual Natural Flows being recorded in the Snowy River at Jindabyne and Dalgety respectively. Construction of the SMS has affected all components of the flow regime in the Snowy River below Jindabyne Dam, with reduced baseflows, flow variability, spring snowmelts and floods (Pendlebury *et al*. 1996, Rose and Bevitt 2003, Bevitt and Jones 2008, Lugg et al. 2006, Gilligan and Williams 2008). The nature of the hydrological impacts varies greatly depending on the location. For example, some parts of the system:
     - Have no flows (i.e. Eucumbene River below Eucumbene Dam),
     - Have no base flows but still receive large spring flow melt releases (i.e. Snowy River below Guthega),
     - Receive a small base flow without large events (i.e. Snowy River below Jindabyne), and

     Many of the unregulated rivers in the Snowy Mountains typically have a constant base flow and a highly predictable October spring snow melt signal. The flora and fauna of the Snowy Mountains rivers and streams have evolved with these stable and predictable cold water river discharges.

   - Natural in-stream structures, such as falls or cascades and sand-slug accumulations, as well as constructed features, such as dams and weirs, have regulated natural flows thereby affecting the normal reproductive and other biological cues of species in the community. The flow regulation has altered the seasonal flow regime from natural winter-spring floods and low flows in summer, to high flows in summer. River regulation has also significantly reduced the frequency, extent and duration of flooding. The reproduction of many native fishes is closely linked to high flows and flooding in spring, and regulation has reduced the incidence of spawning and the conditions suitable for the high survival of larvae and juveniles (Humphries and Lake 2000, Lugg et al. 2006, Gilligan and Williams 2008).

     In-stream structures have reduced upriver fish migrations, particularly of the more mobile species, because few barriers allow fish passage. This has fragmented populations and reduced the habitat available to many species. There are major differences in the fish assemblages, especially of diadromous migratory fish, above and below Snowy Falls (Lugg et al. 2006, Gilligan and Williams 2008).The installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams have been listed as a Key Threatening

Process in Schedule 6 of the *Fisheries Management Act 1994*. The alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands has been listed as a Key Threatening Process in Schedule 3 of the *Threatened Species Conservation Act 1995.*

- Large in-stream structures, particularly Jindabyne Dam, cause thermal pollution. The release of warmer water from above the thermocline in the dam has altered the natural temperature regime downstream, with potential adverse effects on fish reproduction, migration and distribution. Migration is an important part of the biology of most native fishes, and usually occurs at temperatures around or over 20°C between spring and mid-autumn. Thermal pollution inhibits migration, subsequently restricting distribution to areas well below dams; this also results in a loss of habitat for some fish species (Astles *et al*. 2003).

- Land use practices in the catchment such as the clearing of riparian vegetation and its replacement with introduced species such as willows and continued access of stock to the riparian zone increases erosion and subsequent siltation in the waterways, and removes potential habitat and reproductive sites for some fish species (e.g. river blackfish [*Gadopsis marmoratus*] are thought to use fallen, submerged trees as spawning sites) (Jackson *et al*. 1996). Clearing of the floodplain vegetation for agriculture also reduces carbon inputs which are a basis of the food resources for in-stream invertebrates and the food chains in general. Degradation of native riparian vegetation along NSW waterways has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*. The clearing of native vegetation has been listed as a Key Threatening Process in Schedule 3 of the *Threatened Species Conservation Act 1995.*

- The aquatic macroinvertebrate assemblages of the upper Snowy River were different from the assemblages occurring in reference (nearby unregulated rivers) and control (rivers with highly altered flow regimes and not receiving environmental flows). These differences were due to reductions in habitat diversity and area and constancy of hydraulic habitats caused by Jindabyne Dam. These differences still occurred following environmental flow releases and are unlikely to change until there is an increase in base flows and the regular occurrence of high flow events in the hydrological regime (Brooks *et al*. 2007).

- The loss of aquatic plants from the Snowy River has contributed to the degradation and destabilisation of the ecosystem, and to an overall reduction in biodiversity. Aquatic macrophytes play an essential role in ecosystems through primary production, stability of the substratum, and by providing shelter, habitat, spawning sites, nursery areas, and food for fish, crustaceans and other organisms.

- The removal of snags reduces the amount of aquatic habitat and sites available for reproduction of fishes and invertebrates. Native species, particularly Australian bass and river blackfish are strongly associated with underwater structures such as snags and depend on habitats with dense accumulations of woody debris. These areas also provide vital substrata for many invertebrates. River blackfish and various species of gudgeons spawn adhesive eggs onto and in submerged logs (Jackson *et al*. 1996, Larson and Hoese 1996). Thousand of snags have been removed from the Orbost and Sandy Point reaches to enhance navigability (Haupt 2000). In addition, the loss of riparian vegetation means that there is no longer a

ready source of new snags in some areas. The removal of large woody debris has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*.

- Deterioration of water quality is a threat to the ecological community because good water quality is essential for the health of aquatic ecosystems. Reduced flows have probably affected water quality attributes such as dissolved oxygen concentration and temperature in the reach immediately downstream of Jindabyne. There are also increased temperature variations attributable to smaller volumes in the rivers and poor mixing. There is also reduced dissolved oxygen associated with lower mixing (Williams and Russell 2009).

- In pools greater than 4 m deep upstream of Dalgety, oxygen stratification occurs during low summer flows. Strong thermal gradients often occur during summer with temperature differences of up to 6.5 °C occurring between surface and bottom waters. Hypolimnetic hypoxia and anoxia limit the amount of fish habitat and are unlikely to from prior to the construction of Jindabyne Dam (Turner and Erskine 2005).

- The rate of sedimentation into the Snowy River has greatly accelerated since European settlement due to mining, land clearing, grazing, cropping, stream and gully erosion. This has resulted in elimination of deep holes and smothering of gravel beds and aquatic plants which has caused loss of refuge and breeding habitat with a direct impact upon fish and their food chain.

- There are at least eight introduced fish species: *Carassius auratus* (goldfish), *Gambusia holbrooki* (eastern gambusia), *Salmo trutta* (brown trout), *Perca fluviatilis* (redfin perch), *Salmo salar* (Atlantic salmon), *Salvelinus fontinalis* (brook trout), *Onchorhynchus mykiss* (rainbow trout) and *Misgurnus anguillicaudatus* (oriental weatherloach) in the Snowy River system (Lugg et al. 2006, Gilligan and Williams 2008). Trout and salmon are targeted by recreational fishers and these species are regularly stocked into the Snowy River by the state fisheries agency. Introduced species can act as predators, competitors, habitat modifiers and disease carriers. In particular, redfin perch and trout prey on small native species such as galaxiids and juveniles of larger species and gambusia are known to 'fin-nip' other species. The introduction of fish to fresh waters within a river catchment outside their natural range has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*.

- The impacts of climate change on rain and snow fall within the catchment threaten the ecological function of the aquatic ecosystem. Increases in air temperature of 0.2^{o}C per decade since then 1950s in the alpine sections of the Snowy Mountains have been reported (Hennessy et al. 2008; Green and Pickering 2009) and have affected runoff across the entire catchment (Morton, Green and Williams 2010).

2. The Committee recognises the initiatives undertaken by the Snowy Hydro Limited, State, Commonwealth and local governments, Southern River Catchment Management Authority, community groups and private interest stakeholders to address concerns about the decline in the health of this aquatic community. Improvements have been, or are being made in numerous areas, including environmental flows, thermal discharges, riparian vegetation management, and fish passage at smaller weirs. The Committee

also recognises that changes to commercial and recreational fishing regulations have been made in the interests of protection of threatened species and stock conservation for exploited species. At this stage, the Committee does not consider that the benefits of these programs have reversed the decline of the aquatic community in the Snowy River.

3. In light of the above, the Fisheries Scientific Committee is of the opinion that there are current threatening processes affecting the aquatic ecological community in the natural drainage system of the Snowy River.

Conclusion pursuant to section 220FB(2) of the Act

In the opinion of the Fisheries Scientific Committee:

a. The Aquatic Ecological Community in the catchment of the Snowy River is facing a very high risk of extinction in New South Wales in the near future, as determined in accordance with the criteria prescribed by the Regulation as discussed above; and
b. That it is not eligible to be listed as a critically endangered ecological community.

The Aquatic Ecological Community in the Natural Drainage System of the Snowy River is eligible to be listed as an ENDANGERED ECOLOGICAL COMMUNITY.

Sources and Links

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