POLICY BRIEF

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Conservation and utilisation of South Pacific freshwater eels

Purpose

The aim of this policy brief is to provide advice to Pacific Island countries and territories (PICTs) on:

- conservation and utilisation of freshwater eels *Anguilla* spp. (*tuna, duna*, etc.) as an emerging issue; and
- policy actions, management strategies, and fishery research activities for conservation and sustainable utilisation of freshwater eels.

Key messages

- Commercial interest in South Pacific freshwater eels is increasing, particularly from East Asian commodity traders, because of the severe depletion of eel populations in other parts of the world.
- There are major gaps in our knowledge of South Pacific freshwater eels.
- Until we have a better understanding of our freshwater eels, we should adopt a precautionary approach to the management of harvesting and of land-use activities that affect the eels and their habitat.

Economic significance

As subsistence fisheries, tropical freshwater eels in the South Pacific are iconic, high-status species that can grow to very large size and are highly prized for their good eating qualities.

South Pacific freshwater eels are unlikely to be able to support significant commercialised fisheries for juveniles and adults due to small population sizes and the comparatively small land area available on islands for eel habitat. There may be some potential for aquaculture of wild-caught young glass-eels. However this needs further investigation.

Cultural significance

Freshwater eels have high cultural importance in many parts of the Pacific, as characters in myths and legends (e.g. 'Hina and the Tuna'), as ancient gods, as totemic creatures, as indicators of riverine ecological and spiritual health, and as the subject of various taboos.

Left: A giant marbled eel *Anguilla marmorata* on sale in Suva Market, Fiji Islands (Y Aoki photo).

Right: Depiction of a scene from the famous Polynesian legend, 'Hina and the Tuna', about the origin of coconuts.

Knowledge gaps

There are large gaps in our scientific understanding of eels. Adult eels make long migrations of several thousand kilometres or more into the open ocean for breeding, and their offspring make similarly long migrations back to land and up rivers. There have been no systematic studies of South Pacific eels to establish their place of breeding, migration patterns, levels of recruitment, growth rates, population abundance and age of reproductive maturity. As a result, we do not know whether Pacific eel populations are decreasing, increasing, or remaining the same. Until we have this information, we cannot use science-based fisheries stock assessment methods to advise on 'safe' catch levels for South Pacific freshwater eels. This situation requires that a precautionary approach be adopted to keep commercial eel catches at conservatively low levels for the time being.

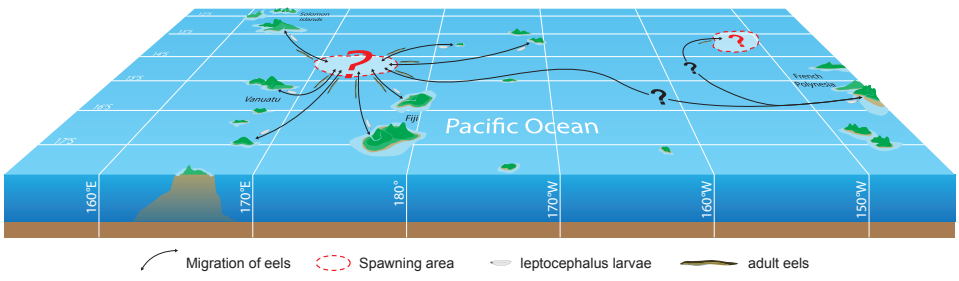
There are also gaps in our knowledge about the social and cultural status of South Pacific eels. Such information is needed to define the objectives of eel conservation and utilisation strategies. For example, in Tahiti a hydro dam was constructed at Lake Vaihiria (site of the legend of 'Hina and the Tuna') but it did not include eel ladders, and as a result eels have disappeared completely from that famous lake.

For the region to obtain maximum benefits from any utilisation of eel resources, the eel products need to be both high-value and value-added. There is as yet little information about the export market potential of the eel species present in the South Pacific. Our species are not the same as those in high demand in Asia. Pacific eels have different body colouration, taste and texture, and it is known that growth characteristics in aquaculture are likely to be different. The question 'How different?' cannot yet be answered because there have not been any aquaculture trials of South Pacific eels, or any market research to find out if they match consumer preferences in export countries.

Threats to eels

Eel species world-wide, including South Pacific eels, face several common threats:

- Climate change, which may affect early larval survival or larval transport (for example, through altering prevailing oceanic conditions or current systems).
- Habitat degradation, through gravel extraction, deforestation and resulting siltation of rivers, land development, discharge and outfalls, organic and metallic pollutants, and modification of river beds and banks.
- Loss of connectivity between habitats used by eels during their life history. Barriers to eel migration, both up-river and down-river can include dams, weirs, road culverts, etc. that prevent access to critical habitats or their return to the sea for reproduction.
- Overfishing, especially of large, ready-to-spawn 'silver eels'.
- Parasites, especially those of the air bladder, which hinder the daily vertical migrations that silver eels swimming in the open sea use to avoid predators.
- Water pollution, through sedimentation or chemicals and discharges.



South Pacific freshwater eels make long migrations for breeding at open-ocean spawning grounds in very precise locations which are still unknown, and their larvae migrate all the way back to the various island groups.

South Pacific eels face additional threats:

- Recruitment of South Pacific glass eels is unique. Compared to other eel species inhabiting continents, e.g. Japanese, European and North American eels, South Pacific eels have to find tiny islands in a very big ocean to reach their growth habitat. Though there is little information about their recruitment, it can be predicted that South Pacific eels have less chance to successfully recruit from the ocean to the rivers and lakes of small islands, compared with eels from large land masses.
- People lack awareness that South Pacific eels migrate to the open ocean for breeding, and that big eels migrating to breeding grounds should be protected. Most Pacific Island people mistakenly believe that eels breed in the same rivers and lakes where they are caught.
- Increased commercialisation – the South Pacific is the only one of the world's major eel regions to have not yet faced heavy commercial pressure. Eels in other regions of the world are now severely depleted and listed as 'endangered' by IUCN (International Union for Conservation of Nature) with eel populations continuing to decrease. The fisheries administrations of Pacific Community (SPC) member countries now report increasing numbers of enquiries about eels from commodity traders. South Pacific eels could become the next 'sea cucumber' and face risk of severe depletion.

Conservation of eels

Effective conservation of eels requires action in these areas:

- Protection of eel habitats
- Maintenance of connections between eel habitats so they can freely migrate
- Protection of silver eels that are migrating down rivers and out to sea for breeding
- Measures to limit eel harvests and keep utilisation of the resource at sustainable levels

Protection of eel habitats includes maintaining water quality and ensuring sufficient cover and hiding places for large eels to live throughout their entire range (not just in nature reserve areas).

The highly migratory nature of eels makes it vital to avoid creating barriers to their movement, or to mitigate barriers through including eel ladders in developments such as dams, weirs and road culverts. Areas of pollution that eels cannot pass through should be avoided or remedied.

Consideration should be given to declaring appropriate areas of remaining pristine river catchment as reserves, and maintaining this pristine state not just for eels but also for other freshwater fish. These areas could also provide opportunities for eco-tourism based on visitors swimming with or feeding big eels.

Utilisation of eels

Commercial utilisation of eels may be based on:

- ***Fisheries*** for juvenile and adult eels in rivers, lakes and estuaries.
- ***Aquaculture*** in ponds or tanks, stocked with glass eels captured in estuaries when they enter coastal waters from the open ocean.

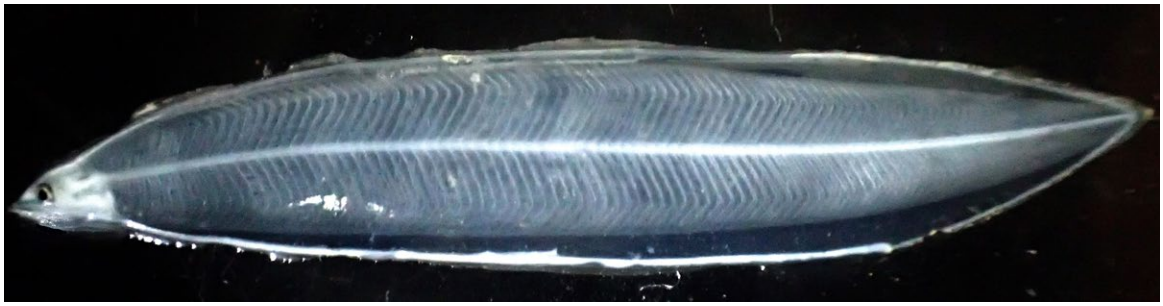
The South Pacific region could potentially support some modest-sized commercial fisheries for eels on larger islands. However, the lack of scientific information on eel population dynamics means we are unable to determine the sustainable limits on eel harvests. South Pacific eels are listed as 'data deficient' by the IUCN.

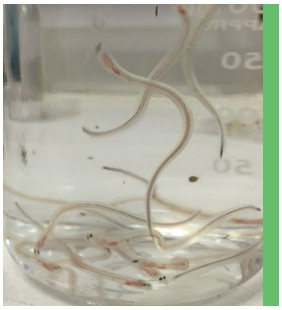
Sustainable capture of glass eels for aquaculture is based on the assumption that the number of glass eels arriving from the open ocean far exceeds the number required to maintain the adult eel populations on land. Therefore a surplus could be safely harvested for rearing in ponds. This assumption may be true of many but not all places, and it needs verification.

To capture maximum economic benefits for Pacific Island countries and territories, preference should be given to aquaculture proposals where glass eels will be farmed in the region and exported as finished products, rather than allow export of glass eels to foreign countries.

Left: Ocean swimmer: a leptocephalus larva of giant marbled eel *Anguilla marmorata*, captured in a plankton net from the open ocean between Fiji and Tuvalu (M Kuroki photo).

Right: Fijian glass eels swimming in a jar, after capture at a river mouth near Suva (C Hewavitarane photo).





Two 100 cm, 500 g specimens of Pacific shortfin eel *Anguilla obscura* caught in Tailevu Province, Fiji Islands (T Pickering photo).

Suggested policy actions

1. Support research to answer the basic life history parameters for South Pacific eels so appropriate policies and management can be based on the best available science.
   a. Find out the contribution of South Pacific freshwater eels to subsistence fisheries, and their importance in cultural traditions.
   b. Conduct periodic population surveys of eels in key 'sentinel' rivers, in fish catches, and in markets, to provide estimates of eel population and size structure and trends over time.
   c. Conduct surveys to establish the abundance and seasonality of glass eel recruitment so as to estimate safe catch limits, determine a sustainable number of catch locations, and declare open/closed seasons for glass eel collection for aquaculture.
   d. Ensure that any decisions to increase harvest of juvenile and adult eels beyond precautionary levels shall be science-based, after surveys and data analysis to estimate eel recruitment and population dynamics.
   e. Maximise the value of harvested eels through: (i) market research to find out which consumer preferences are best matched by the characteristics of South Pacific eel species; and (ii) requirement that glass eels captured in the Pacific be farmed in the Pacific, rather than exported to stock eel farms overseas.
2. Adopt management strategies to protect eels from threats of depletion.
   a. Formulate guidelines for developers and resource managers about ways they can avoid or mitigate any adverse effects on eel habitats caused by land use activities, discharges, or infrastructure developments.
   b. Restore degraded habitats back to a condition favourable for eels.
   c. Require that builders of river structures like dams and bridges shall avoid or remedy any barriers caused to eel migrations.
   d. Protect silver eels migrating for breeding, by (i) increasing public awareness about eel life cycle and the importance of protecting silver eels, and (ii) consider introducing upper size limits on catching of eels (as already introduced in New Zealand).
   e. Formulate national Freshwater Eel Management Plans (as for other species of high commercial interest, such as sea cucumbers), regulations, and codes of practice for freshwater eel conservation and utilisation, that take account of both scientific and cultural dimensions of freshwater eels in the South Pacific.
   f. Adopt a precautionary approach (pending research to fill knowledge gaps) for management of land use activities that affect eels and their habitats, and for management of freshwater eel harvesting.
   g. Improve monitoring, control and surveillance mechanisms on data collection, enforcement and prosecution to ensure that eels are within their scope.
   h. Consider establishing a mechanism for regional coordination of eel management, because South Pacific eels are highly migratory species whereby multiple PICT jurisdictions share the same breeding stocks of the three main eel species.

Further reading

Pacific shortfin eel *Anguilla obscura*. IUCN Red List of Threatened Species assessment, http://www.iucnredlist.org/details/full/196302/0

Polynesian longfin eel *Anguilla megastoma*. IUCN Red List of Threatened Species assessment, http://www.iucnredlist.org/details/196301/0

Giant marbled eel *Anguilla marmorata*. IUCN Red List of Threatened Species assessment, http://www.iucnredlist.org/details/166189/0

New Zealand eel fisheries management measures, https://www.beehive.govt.nz/release/maximum-size-limit-eels-now-nationwide

Workshop on South Pacific freshwater eels, Suva, Fiji, 13-15 August 2016: Current knowledge and future research. Pacific Community SPC, Noumea, New Caledonia, http://www.spc.int/DigitalLibrary/Doc/FAME/Reports/Pickering_17_Eel_Workshop_Report

Technical assistance

For advice on the status and management of freshwater eels in the tropical Pacific, contact SPC's Fisheries, Aquaculture and Marine Ecosystems Division (cfpinfo@spc.int).