

Recruitment of freshwater eels as ‘glass eels’ in Fiji Islands – New research results about species composition and seasonality

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Freshwater eels of the family Anguillidae (tuna or duna in Polynesia and Fiji) are iconic species in the islands of the South Pacific, and are of high cultural importance and of potentially high value as fisheries or for capture-based aquaculture. They are also vulnerable to habitat degradation, human-made physical barriers or water pollution in rivers along the routes of their long migrations to open-ocean spawning locations, from which their offspring ultimately return to swim back up-river as ‘glass eels’.

The South Pacific is the least-studied of the world’s freshwater eel regions, and there are large knowledge gaps. Little is known about their breeding locations, migration patterns, levels of recruitment, growth rates, population abundance, and age at reproductive maturity – the very information needed for science-based methods to manage the conservation and utilisation of South Pacific freshwater eels. With increasing pressure for the supply of anguillid glass eels for the Southeast Asian aquaculture market, a more robust understanding of the strength of glass eel recruitment in the South Pacific is vital for conservation and management.

This makes especially welcome two recently published scientific papers stemming from the work of Dr Chinthaka Hewavitharane, a Fijian post-doctoral researcher who gained his PhD on eels at Kyushu University in Japan under the supervision of Professor Mochioka at the Department of Animal and Marine Bioresource Science.² To confirm which of the six species of anguillid eels present in the western South Pacific actually do recruit into Fiji Islands, and to better understand the inshore recruitment mechanisms of tropical eels, the collaborative research team comprising Dr Hewavitharane, Prof Mochioka, Dr Pickering (Pacific Community) and Prof Rico (University of the South Pacific) collected 1,368 glass eels from the mouth of a small river near Navua on Viti Levu during monthly sampling for a period of 14 months. The scientists confirmed using both morphological characters and DNA barcoding that, of the six possible western South Pacific species, only three species are making landfall at their site in Fiji: one short-finned eel (*Anguilla obscura*) and two long-finned eels (*A. marmorata* and *A. megastoma*).

Anguilla obscura was the most abundant species (comprising 55.0% of the glass eel catch), with peak recruitment periods from February to April. *Anguilla marmorata* was the second most abundant species (41.4%), with peak recruitment periods in April and September–October. *Anguilla megastoma* only comprised 3.9% of the glass eels collected, with peak recruitment periods in April and October.

Outside of the peak recruitment times, *Anguilla obscura* and *A. marmorata* could be caught in low numbers at almost any time of the year. In other words, there’s a steady, low level of ‘trickle’ recruitment, in contrast to temperate latitude eels where recruitment is strongly seasonal in massed ‘eel runs’. Even in Fiji there are strong recruitment events – the results



Dr Chinthaka Hewavitharane and Prof Mochioka (Kyushu University) conducting an electrofishing population study of juvenile eels in a Fijian river near Suva. Image: Tim Pickering, SPC

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² See Hewavitharane et al. 2017 and 2018. These two new reports about glass eel recruitment are based on field work completed in Fiji during 2015 and 2016.

show that the best catches of glass eels occur during periods of heavy rain, from September to October and from February to April, commencing one hour after sunset on the day following a new moon.

Genetic techniques such as DNA bar-coding are powerful new tools for population studies of fish, especially early life history stages that have few morphological characters to reliably allow identification to species level. Even so, the capacity of national institutions in the South Pacific to utilise such high-tech tools is limited. It would be interesting and useful if reliable methods could be found to identify glass eels to species level using only observations of morphological characteristics made with the type of light microscope available in any high school. Hewavitharane (2017) demonstrated that the external morphological characteristics of anodorsal length ratios and the pigmentation patterns of the caudal fin and caudal peduncle are, together, sufficient to classify the three Fijian species of eels using morphological characteristics alone. This is a useful result that simplifies the research and monitoring techniques of anguillid glass eel recruitment for conservation, fisheries management or aquaculture purposes in the South Pacific.

Information on the recruitment of tropical eels in the South Pacific is still very rudimentary. The insights provided by Hewavitharane and colleagues (2017 and 2018) about key life history traits and ecology, such as seasonal patterns of recruitment, abundance and species composition of the glass eels arriving to inhabit freshwater bodies at this study site on Viti Levu, Fiji Islands, are important contributions toward the knowledge needed to design appropriate management and conservation programmes aimed at efficiently protecting or sustainably utilising these vulnerable fish species. Similar research is needed in other parts of Fiji, and in other island groups of the South Pacific.

References

Hewavitharane C.A., Pickering T.D., Ciro R. and Mochioka N. 2017. Species identification and morphological differences of anguillid glass eels recruiting to Viti Levu Island of Fiji in the western South Pacific. *Aquaculture Science* 65(4):357–366. Available at <https://core.ac.uk/download/pdf/157769336.pdf>

Hewavitharane C.A., Pickering T.D., Ciro R. and Mochioka N. 2018. Species composition, abundance and seasonal recruitment patterns of freshwater eels (*Anguilla* spp.) to Viti Levu, Fiji Islands, in the western South Pacific. *Marine and Freshwater Research*. Available at <https://doi.org/10.1071/MF1810>



Glass eel net deployed at the river mouth sampling site near Navua, Fiji Islands. Image: Tim Pickering, SPC



Glass eels captured in Fiji for identification and description as part of the eel recruitment research. Image: Tim Pickering, SPC

For more information

SPC recently published a Policy Brief about conservation and management of freshwater eels, available at: [<http://purl.org/spc/digilib/doc/vroyz>]

Two *SPC Fisheries Newsletter* articles relating to freshwater eel research in the region can be found at:

[http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/142/FishNews142_30_Pickering.pdf], and

[http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/150/FishNews150_11_Pickering.pdf]