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How Speculation Became Accepted Truth: Evidence that Aotearoa New Zealand Freshwater Eels Do Not Seem to Spawn "Near Tonga" or "East of Samoa"

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ABSTRACT

For several decades, the assumption that Aotearoa New Zealand freshwater eels spawn near Tonga (for longfin, *Anguilla dieffenbachii*) or east of Samoa (for shortfin, *A. australis*) has been widely repeated across scientific literature, governmental reports, public resources and community narratives, despite limited direct evidence. These claims originated from early scientific speculation and were not updated as new evidence emerged. This illustrates how preliminary ideas can become entrenched as accepted truth through repetition and raises a broader question: how can new scientific findings be communicated effectively when they challenge long-standing narratives?.

1 | From Absence of Evidence to Accepted Paradigm

The life cycle of anguillid eels has long fascinated scientists, in part because their spawning locations remain elusive. This is because adult eels swim up to thousands of kilometres from freshwater habitats to offshore areas to spawn and die. The resulting larvae (leptocephali) spend months drifting and then likely swimming before metamorphosing into glass eels and recruiting into rivers. For both Aotearoa New Zealand species, the longfin, *Anguilla dieffenbachii*, and shortfin, *A. australis*, we have realised that the prevailing view outside of eel migration expert discussions situates spawning sites "near Tonga" and "east of Samoa", respectively (Figure 1). This idea presently seems to be pervasive in Aotearoa New Zealand, appearing not only in some scientific publications (e.g., Keegan et al. 2022, and earlier papers) but also in national news, online resources (e.g., Radio New Zealand 2024; Design brilliance of an "eel pump" helping native stocks thrive | RNZ; Fisheries New Zealand, Overview; Wikipedia New Zealand longfin eel - Wikipedia; Department of Conservation 2026 Eels/tuna: New Zealand freshwater fish; accessed 18 May 2026) and government reports (Fisheries New Zealand 2025), and is widely echoed in public discourse across Aotearoa New Zealand. However, the origin of this hypothesis is less robust than its widespread acceptance suggests, and therefore we are discussing this curious phenomenon here to help promote greater understanding.

Because migrating adult anguillids cannot be directly observed, spawning locations were historically inferred from the distribution and size of leptocephali. In the early 20th century, the Danish "Round the World" expedition led by Johannes Schmidt provided limited evidence for *A. australis* offshore spawning in the western South Pacific (WSP) from one relatively large leptocephalus collected (43 mm; southernmost specimen in Figure 1), later reported in Jespersen (1942). At the time, Schmidt (1928) proposed the separation of Australian (*A. australis australis*) and Aotearoa New Zealand (*A. australis schmidtii*) *A. australis* populations into distinct subspecies, which was supported by later studies (Shen and Tzeng 2007), but possible spawning locations were not suggested.

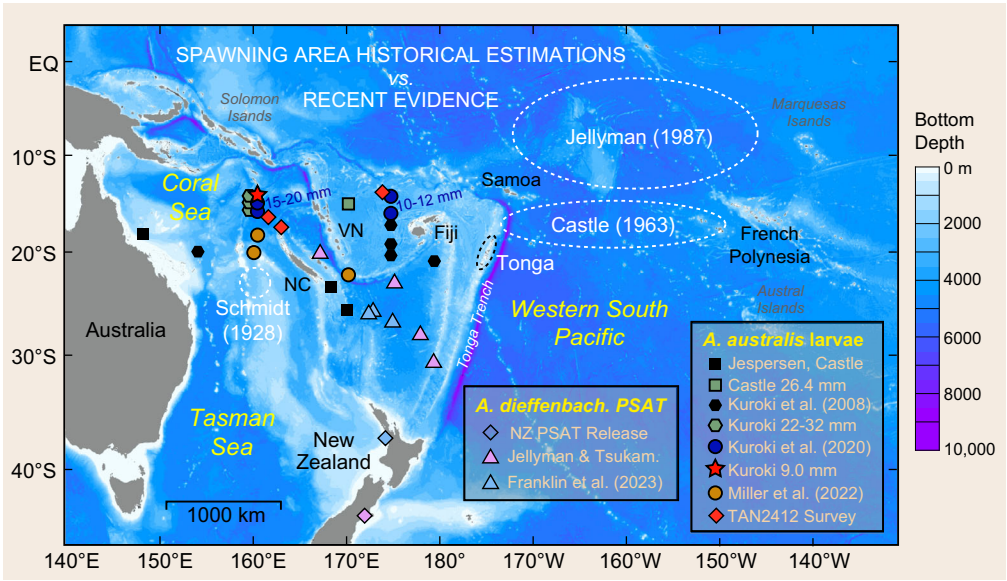

FIGURE 1 | Map of historically proposed spawning areas for Aotearoa New Zealand freshwater eels and available evidence in the region. Historical spawning-area ideas are shown as dashed white circles (modified from Jellyman 2003), while published larval catch-records, larval size data, PSAT release and pop-up locations are shown with symbols. See Miller et al. (2026) for map of ocean currents in the region.

Castle (1963) and later Jellyman (1987) then inferred possible *A. australis* spawning regions from the limited larval evidence, and from the oceanographic knowledge available at the time. Based on the four *A. australis* leptocephali available then, including the one from Jespersen (1942), and three additional specimens later identified in collections by Peter Castle (Victoria University of Wellington), one of which measured only 26.4 mm, Castle (1963) stated, "*Taking into consideration the general east-west trend of the prevailing current system in this area it seems likely that the breeding area for these species is well to the east of New Caledonia-that is, between Fiji and Tahiti*". The drift-time assessment of Jellyman (1987) of those historical collections led to the hypothesis of a spawning area ***east of Samoa*** for "*A. australis* destined for New Zealand" (Figure 1), but this interpretation was based on southward current pathways that have since been revised (Ganachaud et al. 2014). In the same paper, Jellyman also mentioned a possible spawning area for *A. dieffenbachii*, stating: "*If the spawning ground of longfinned eels has a latitude similar to that of the Atlantic eels, then a location* ***east of Tonga*** *is suggested*". However, this remains entirely inferential, because to date, *A. dieffenbachii* leptocephali have never been collected or reported, leaving the location of their spawning area unresolved.

Over time, these estimates seem to have been reiterated and progressively solidified through repeated citation, gradually shifting from informed conjecture to perceived consensus. In the process, the Aotearoa New Zealand-focused hypothesis for *A. australis* was often amalgamated into a general spawning location for the species as a whole, while the proposed *A. dieffenbachii* spawning area shifted from "east of Tonga" to "near Tonga", despite remaining unsupported by direct larval evidence.

2 | Updates from Genetic Larval Identification, Tracking and Modelling Studies

The development of genetic identification techniques for anguillid leptocephali marked a major advance in the search for Aotearoa New Zealand eel spawning areas. In 1995, a Japanese research cruise into the WSP, led by Katsumi Tsukamoto of the University of Tokyo, provided the first DNA-based identification of anguillid leptocephali in the world, and was important for collecting 22–32 mm *A. australis* leptocephali in the western South Equatorial Current (SEC) region on the east side of Vanuatu (Aoyama et al. 1999). Data from that and two subsequent cruises were later combined by Kuroki et al. (2008), who compiled contemporary and historical catch records to document the spatial patterns of larval distribution (Figure 1). After three more large larvae (45–49 mm) were caught in 2013 (Miller et al. 2022), the most recent Japanese research cruise in 2016 collected 15–20 mm *A. australis* leptocephali on the west side of Vanuatu along with a 9-mm larva (16 days old from otolith analysis), which implied relatively nearby spawning, presumably upstream in the westward flowing SEC. A couple of 10–12 mm *A. australis* leptocephali were also caught on the east side of Vanuatu near Fiji (Figure 1) that showed spawning occurred in two widely separated SEC areas, presumably by the two subspecies. Kuroki et al. (2020) speculated that the Australian subspecies had spawned in the west and the Aotearoa New Zealand subspecies in the east, as recently illustrated by Miller (2023).

Even before most of the larval sampling was conducted, Don Jellyman (NIWA, Christchurch, Aotearoa New Zealand), in collaboration with Katsumi Tsukamoto, started a new type of research effort in May 2000 to directly track *A. dieffenbachii* adults using pop-up satellite archival tags (PSATs). These studies,

and subsequent ones, encountered various technical limitations, including premature tag release (see Jellyman and Tsukamoto 2010), incomplete migration tracks (Franklin et al. 2023) and predation (Jellyman et al. 2024), but collectively the eels that retained their tags moved in the direction of east or southeast of New Caledonia (Figure 1). The cumulative tracking evidence provided valuable information on migration direction and did not support a Tonga-centred spawning area hypothesis.

In parallel, oceanographic simulations placed both *A. australis* and *A. dieffenbachii* spawning areas within the New Caledonia-Vanuatu-Fiji region, rather than near Tonga (Jellyman and Bowen 2009). The modelling further suggested strong spatial structuring of recruitment, whereby spawning west of Vanuatu would favour larval transport towards Australia, while spawning east of Vanuatu would result predominantly in arrivals to Aotearoa New Zealand.

Thus, to date and despite advances, the precise spawning locations of Aotearoa New Zealand eels remain unresolved, mainly because genetic markers to distinguish between the two *A. australis* subspecies of leptocephali are lacking, and tag pop-locations do not indicate certain spawning locations. Importantly, the persistence of the Tonga-centred hypothesis has not been matched by an equivalent accumulation of direct supporting evidence. While larval distributions, PSAT trajectories and oceanographic modelling are consistent with certain spawning scenarios, they do not constitute definitive proof of spawning sites, because confirmation will require the collection of eggs, newly hatched larvae, or direct observation of spawning adults.

3 | The First Aotearoa New Zealand "Eel Cruise" and Greater Understanding in the Future

In 2024, we conducted the first dedicated Aotearoa New Zealand-led eel cruise named the "Great Migration", that successfully captured additional *A. australis* leptocephali in the WSP during a different season, further confirming the presence of spawning in the SEC region (Miller et al. 2026). For Aotearoa New Zealand, knowledge about where the eel species spawn is essential because even substantial investment in freshwater restoration and eel management may not lead to increased recruitment if climate-driven changes in ocean currents, productivity, or larval transport reduce the number of larvae returning to the country. Because eels are taonga (treasured) species, any reframing of their life history must be developed and communicated through transparent, collaborative processes grounded in mātauranga Māori and engagement with iwi and local communities (Skilton et al. 2026).

The trajectory of the Aotearoa New Zealand eel spawning hypotheses illustrates how scientific speculation can become entrenched as accepted knowledge when repeatedly cited, simplified and insufficiently reassessed. The persistence of the "near Tonga" narrative may also reflect the challenge of translating complex science into public-facing information along with integration of mātauranga Māori and stakeholder perspectives. Mitigating this requires scientists to communicate uncertainty clearly, distinguish inference from evidence and revisit widely repeated claims as new information emerges. In this case, efforts to update the public narrative have only recently begun.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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