

New perspectives on the early life history of tropical eels: Implications for resource management

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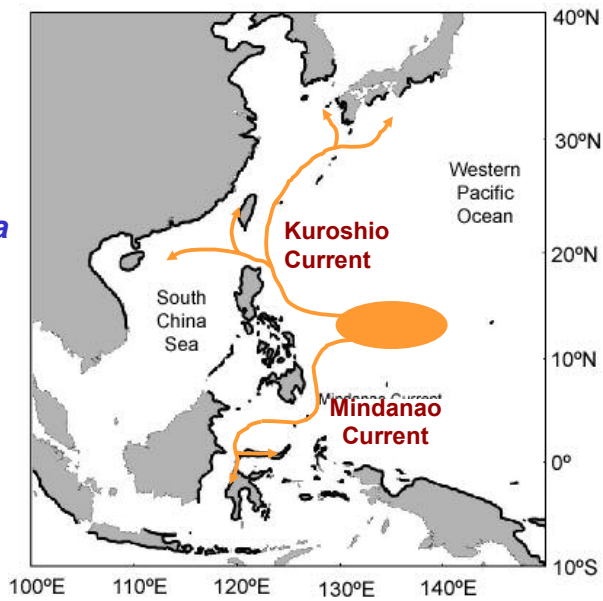
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- The longest know migration of anguillid eels is that of the European eel which migrates to the Sargasso Sea to spawn and then their larvae return back to Europe for recruitment.
- The America eel spawns in a similar area, but then recruits to the east coast of North America.
- More recent research has indicated that other species of temperate eels also make long migrations to spawn offshore such as the Japanese eel, *Anguilla japonica*, in the western North Pacific (Tsukamoto 1992) and the Australian eel, *Anguilla australis*, which appears to spawn in the South Equatorial Current of the western South Pacific (Aoyama et al. 1999).
- However, recent research has also indicated that the widespread tropical eel species *Anguilla marmorata* has multiple genetically distinct populations in various parts of its range in the Indian and North and South Pacific Oceans. The northern population of this species appears to spawn in the North Equatorial Current of the western North Pacific, but unlike the Japanese eel, their leptocephali appear to be transported both north into the Kuroshio Current system, but also to the south by the Mindanao Current (Miller 2002).

The Northern Population of the Tropical Eel *Anguilla marmorata*

Appears to Spawn in the North Equatorial Current

Aoyama et al. 1999 MEPS
Miller et al. 2002 Mar Biol

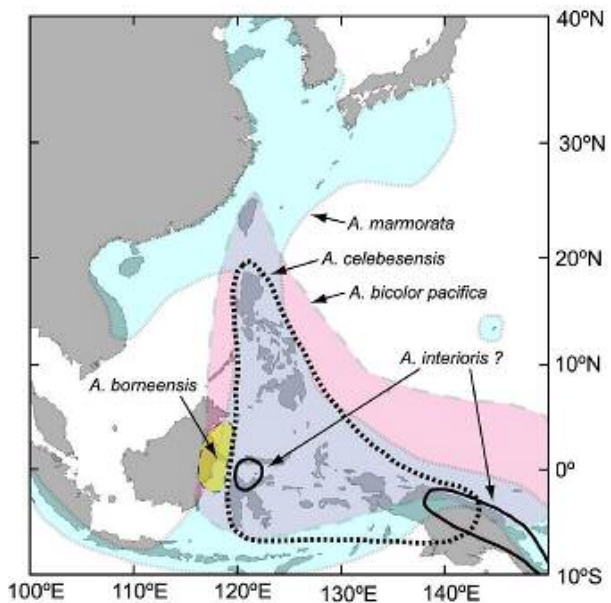


Miller and Aoyama, Quebec 2003

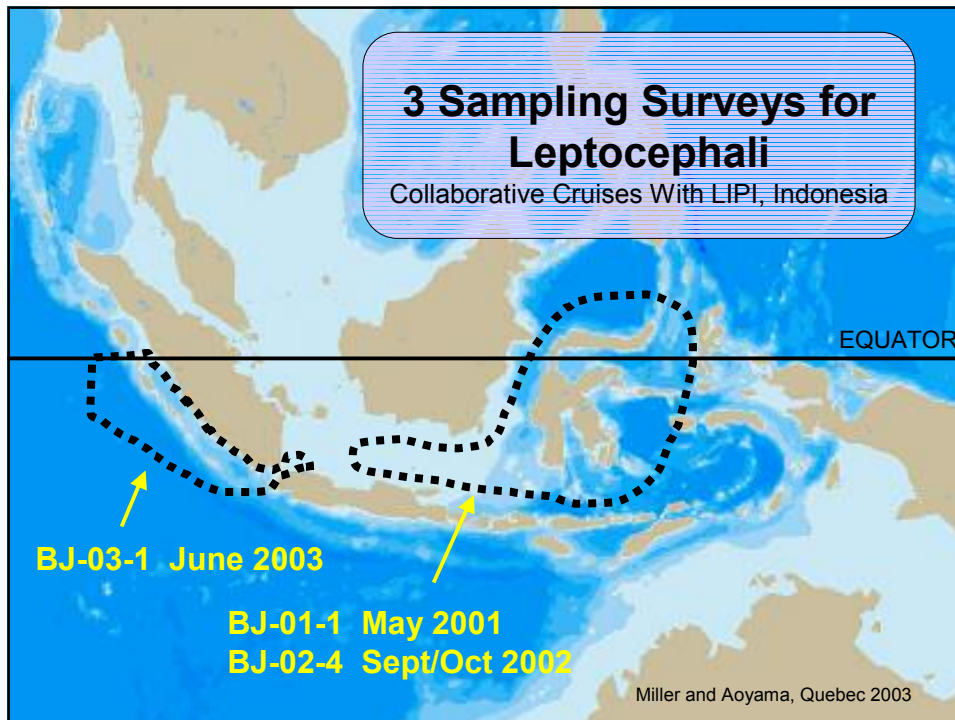
Approximate Ranges

5 Species of Tropical Anguillids

A. marmorata and *A. celebesensis* appear to be most abundant on Sulawesi Island Indonesia



Miller and Aoyama, Quebec 2003

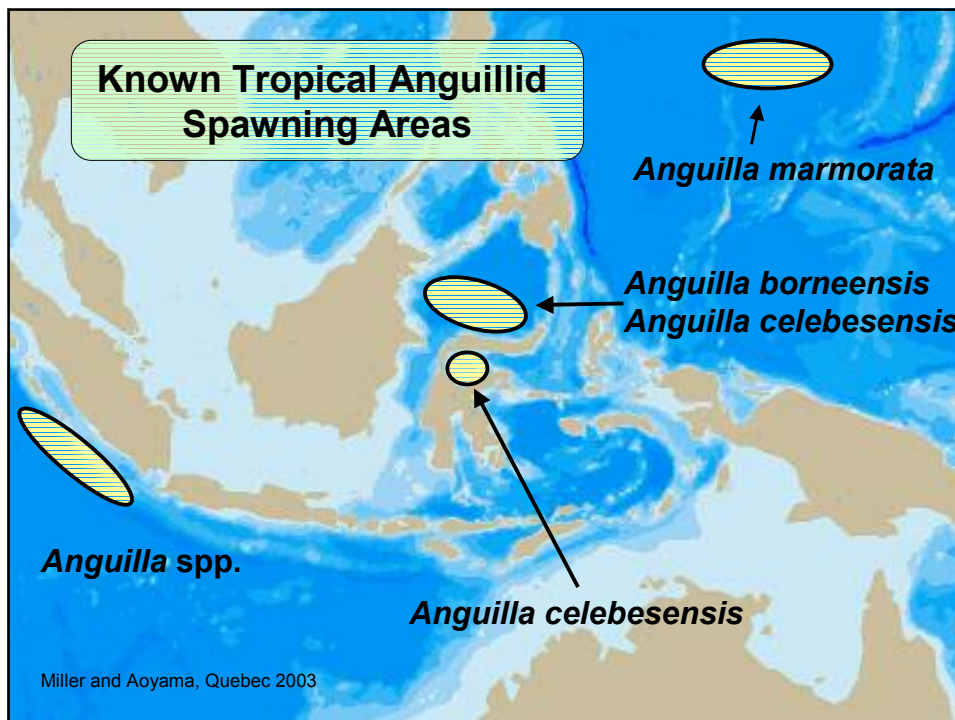


- The first sampling survey for tropical eel leptocephali since the Danish Expedition, was made by the R/V Hakuho Maru of the Ocean Research Institute in 2000 (KH-00-1), and during this cruise several small leptocephali of *Anguilla celebesensis* and *A. borneensis* were collected in the Celebes Sea (Aoyama et al. 2003). This indicated that the silver eels of these two species had made relatively short spawning migrations to spawn offshore.

- During the three sampling surveys for tropical anguillid leptocephali in the Indonesian Seas made by the R/V Baruna Jaya VII of LIPI, Indonesia, tropical anguillid leptocephali were widespread throughout most of the regions sampled, but they were usually collected at low abundances.

- These leptocephali were almost all relatively large in size except in Tomini Bay of northern Sulawesi Island, where two size classes of *Anguilla celebesensis* were collected (Aoyama et al. 2003).

- The small sized leptocephali collected in Tomini Bay indicated that they were likely spawned in the bay and that the *A. celebesensis* silver eels had made a very short spawning migration to spawn over the deep water (> 1000 m) of the bay.



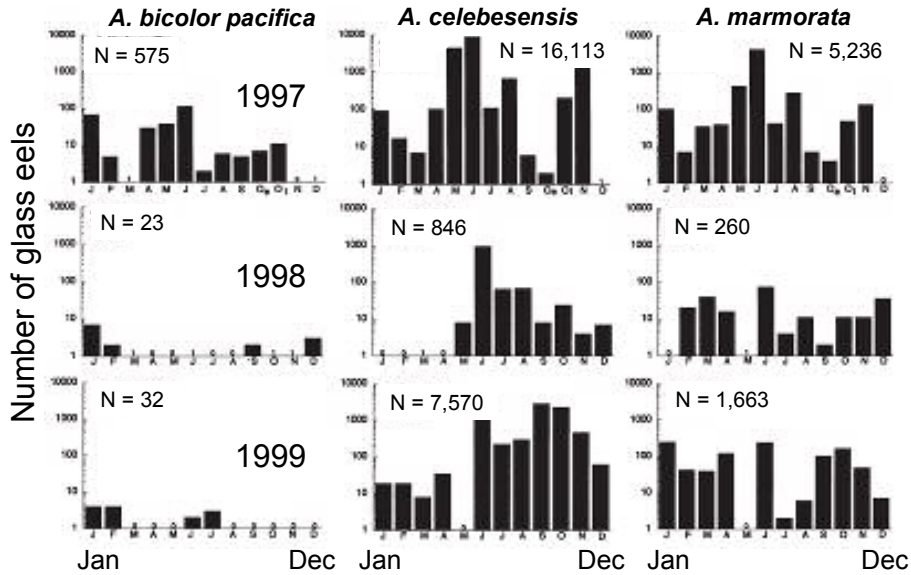
- The results of several studies on the recruitment and ages of glass eels in the Indonesian Seas region have suggested that the spawning and recruitment seasons of tropical anguillid eels are more prolonged than those of temperate anguillid species (Sugeha et al. 2001).

- The ages of *Anguilla celebesensis* glass eels were consistently younger than those of *A. marmorata* when they recruited to the Poigar River of northern Sulawesi Island (Arai et al. 2001), and this supports the hypothesis of a short spawning migration for *A. celebesensis* and a longer spawning migration of *A. marmorata* to spawn in the North Pacific.

- However the ages of *A. celebesensis* glass eels from the northern Philippines are considerably older than those from Sulawesi Island, so based on the current patterns in the region, there must be several different spawning areas of this species and possibly different populations (Arai et al. 2003).

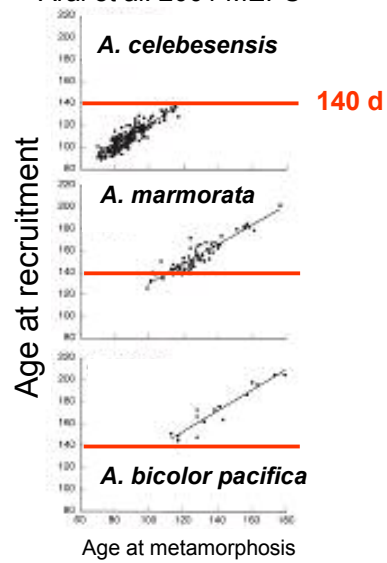
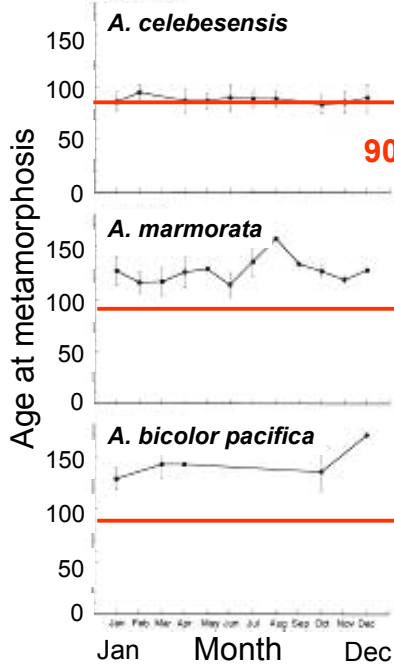
- These findings and the discovery of several clearly separated spawning areas of tropical eels indicate that unlike temperate eels, there may be multiple populations of several species of tropical eels. This suggests that over harvest of eels in a particular local area could have a much greater effect on the future recruitment to that specific area because of the possible separation of these species into local populations that only recruit back to the same general area from which they came.

Recruitment Season May be More Prolonged and Variable
For Tropical Glass Eels Sugeha et al. 2001 MEPS



Larval Duration is Shorter
in the Indonesian Mottled Eel
Anguilla celebesensis

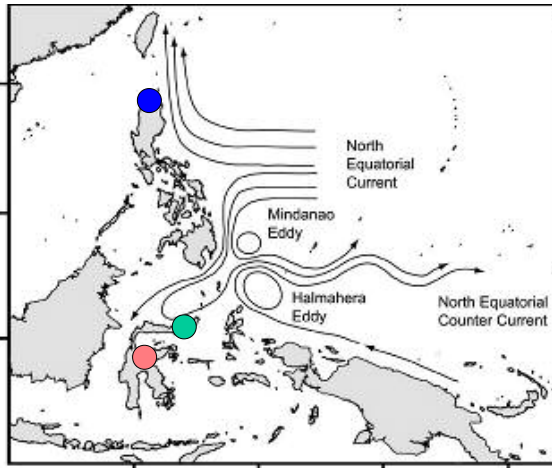
Arai et al. 2001 MEPS



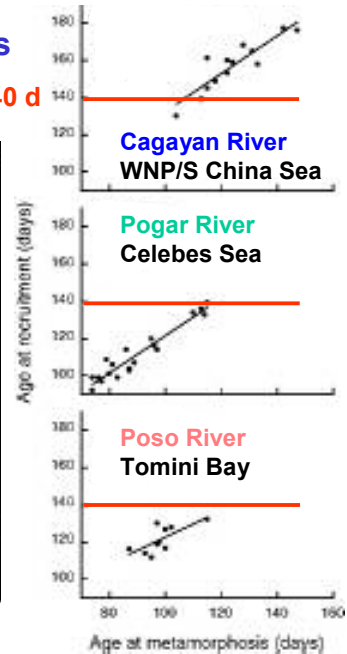
Larval Duration of *A. celebesensis* May Be Different Among Some Areas

Arai et al. 2003 MEPS

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Miller and Aoyama, Quebec 2003



General Conclusions

- Some tropical eels make short spawning migrations
- Local spawning may result in isolated populations of tropical eels, if larvae don't mix between different areas
- Must verify if northern population of *A. marmorata* is panmictic
- Resource managers should consider geography, ocean circulation, and the potential for local populations of tropical eels