REGIA
Marine Seismic Survey

FACT SHEET
Glass Eels
(Aquilla australis)

Introduction

CGG completed assessments of the cause effect pathways arising from the Regia Marine Seismic Survey (Regia MSS). Following these initial assessments the CGG process required further assessment of key environmental values and sensitivities that may be affected by the survey. Focusing on key values and sensitivities enables CGG to:

- Continue the assessment of higher order impacts and risks.
- Change perspective to increase confidence in the assessment process.
- Put the magnitude of impacts and risks into their proper context.
- Address specific concerns raised by relevant persons.

This fact sheet is part of a series focusing on key environmental values and sensitivities and it contains the further assessment undertaken by CGG to understand if the impacts of survey operations to these receptors are of an acceptable level. They form part of the demonstration of acceptable levels of impact put forward by CGG in the Regia MSS Environment Plan (See Appendix F4).

Species-Specific Sensitivity

There are 2 species of freshwater eels that inhabit the southeast and east coasts of Australia, Aquilla australis and A. reinhardtii known colloquially as the short-fin and long-fin eel respectively. Only A. australis is relevant to the MSS because the westward edge of distribution for the long-finned eel is around Wilsons Promontory which is 300 km from the nearest edge of the MSS survey path (see Figure F3-9).

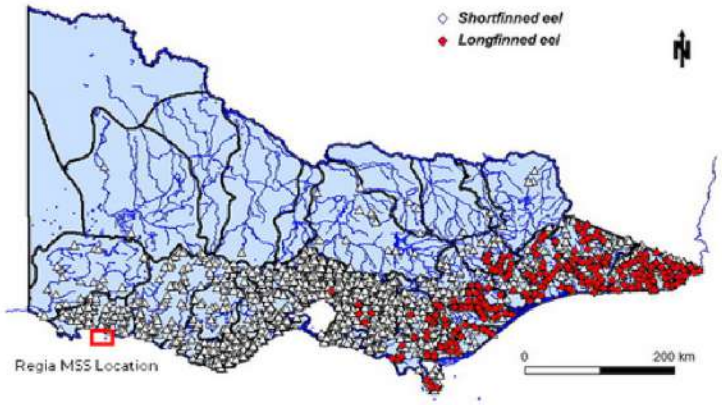


Figure F3-9 - Spatial distribution of both species of freshwater eel across Victoria (VFA Eel Fishery Management Plan) and the location of the proposed Regia MSS survey.

The short-fin eel has a complicated but spectacular life cycle. The juveniles and adults live in freshwater rivers but when reproductively mature the adults migrate many thousands of kilometres to spawning grounds in the Coral Sea. Once spawning has finished the adults perish and never return. The life cycle is then continued by the many trillions of larvae who attempt to make their way back to natal river systems over 200 plus days using prevailing currents and an evolving swimming ability. Adult migration out of the estuaries to the spawning grounds occurs from January to May while the returning glass eels stage occurs during the July-September period.

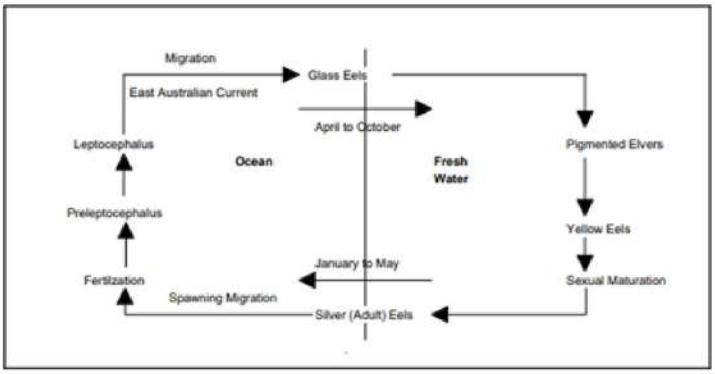


Figure F3-10 - Life cycle of Anguilla australis eels. After Gooley et al. (1999).

This life cycle predisposes this species to very large mortality rates both as larvae and as adults. Adult mortality has been estimated to be at least 30% for migrating adults (Koster et al 2021) and while there have been no direct measurements of larval mortality in eels, as a broadcast spawner it likely exceeds >95 %. Modelling work by Bonhommeau et al. (2009) on A. anguilla indicated <0.2 % of larvae survived the trans-Atlantic migration. With a shorter migration length in A. australis mortality rates would be less than this but still clearly very high.

Australasian short-finned eels are listed as 'near threatened' on the IUCN Red List of Threatened Species, with barriers to riverine movement and freshwater habitat loss identified as key threats. In addition, changes in ocean currents, primary production, and thermal

regimes may affect eel migration, spawning success, and recruitment (Koster et al 2021). These processes operate at landscape scales and are heavily influenced by long term climate trends. Changes to riverine flows and water quality are affected not only by changing climates but also land management regimes adjacent to riverine systems.

Changes in the size of the spawning stock (i.e. adults) have been identified as the most likely cause of declining recruitment of eels (see review by Jellyman 2022) and so it is factors affecting the adult population that are likely to have the largest effect on the population health of A. australis. As previously mentioned, climate related changes and modification of the landscape are affecting the carrying capacity of rivers to support populations of eels and other species. Fishing is also a major pressure on eel stocks and there has been a commercial fishery for short-finned eels across Southern Victoria since the 1950's.

Pre-migrating adults have been found to spend a lot of time in the estuaries of rivers before starting their migrations, making them more vulnerable to net fisheries than was previously thought (Crook et al. 2014). Catches reached a peak in the mid 1990's with a low in 2009, but have since stabilised around 30-80 tonnes/year (Southern Shortfin Eel 2020 (fish.gov.au)). The massive decline in catches from 1993 was related to the so-called millenium drought throughout the late 90's and early 2000's (Dijk et al 2013) illustrating the powerful links between eel health and environmental conditions.

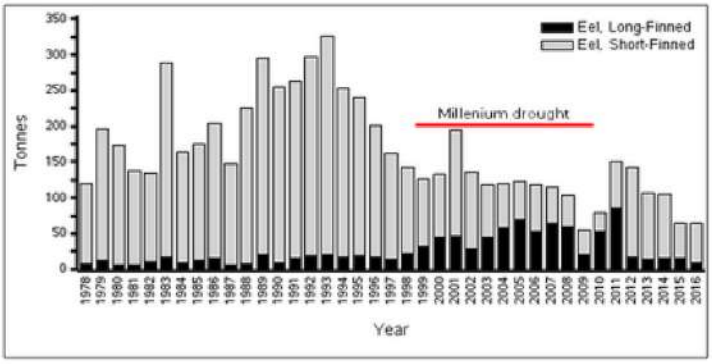


Figure F3-11- Annual commercial catches of eels in Victoria (VFA 2017). Red line encompasses those years when extended drought conditions prevailed.

Once adults begin migrating to their spawning grounds they travel quickly, with migration speeds between 10-50 km/day (Koster et al 2021). The annual timing of adult migrations is from January to May each year.

There are no scientifically derived studies indicating mortality effects on eels from seismic surveys, which we group with fish containing swim bladders when assessing seismic effect studies. Adult eels are undertaking their migrations over an extended period of 5 months and the work of Crook et al (2014) indicates that migration from estuaries is a highly variable process. Given the extended and volatile timing of migration from estuaries and the high mobility of individual animals we do not anticipate any critical effects to the local populations of eels from the Regia MSS.

Magnitude of Effect

If any individual adult eels are within proximity to the seismic arrays when acquisition is occurring, there will likely be non-lethal impacts. However, given the mobility of adult eels, their intrinsic drive to get to their spawning grounds, and the soft startup procedures of the Regia MSS the risks associated with this event are extremely low and impossible to distinguish from the large-scale changes inherent in the population each year and driven by multiple factors as previously described.

For the larval leptocephelae and glass eel stages, they are most prevalent in regional waters during the winter-spring months. If the Regia MSS is scheduled outside this timeframe, then all interactions with this stage of the life cycle will be avoided.

Cumulative Impacts

As discussed above there is no evidence to support an expectation of significant and measurable cumulative impacts to short-finned eels because of the Regia MSS. Large scale drivers including fishing continue to be the major influences on the population health of eels.

Recovery Potential

There is no identified recovery plan for this species, nor do we anticipate impacts of sufficient scale to be considered for future recovery plans. The species has proven resilient to fishing and other anthropogenic pressures for millennia.

Conservation Status

The short-finned eel Anguilla australis is not under any conservation status. However, short-finned eels are of cultural significance to First Nations people. The Gunditjmara people of south-western Victoria built and used sophisticated aquaculture systems throughout the Budj Bim Cultural Landscape to exploit eel migrations at least 7,000 years ago. Budj Bim Cultural Landscape is listed as a World Heritage Area and is protected by Victoria's Aboriginal Heritage Act 2006. One of the values of this World Heritage Area is the Budj Bim lava flows, which provides the basis for one of the world's most extensive and oldest aquaculture systems developed by the Gunditjmara, based on deliberate redirection, modification and management of waterways and wetlands (UNESCO 2023). There is no direct effect, and no measurable indirect effect, from the Regia MSS to the Budj Bim Cultural Landscape.

Mitigation Effectiveness

Potential impacts could be minimised or avoided by scheduling of the Regia MSS to outside the period when elvers are returning to the river systems along the Southwest coast during the months of April to October. However, this measure would increase the effects on other more sensitive species.