

American Eel Roadmap for International Collaboration

Background and context

The American eel (*Anguilla rostrata*) is a species found across a large geographical range, within which a number of countries have established fisheries for both adults and juveniles or 'glass eels'. Following the implementation of the listing of European eel (*Anguilla anguilla*) in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in 2009, a significant increase in demand and price observed for the American eel, and other anguillid eels, in international markets (Gollock *et al.* 2018).

In 2018 the Sargasso Sea Commission (SSC) hosted a workshop in the Dominican Republic, bringing together American eel range states with a specific focus on enhancing coordination and information sharing in regard to fisheries, and capacity building with respect to data collection on harvests and exports. The Dominican Republic workshop was successful in facilitating the sharing of information among the American eel range States. However, that workshop was a one-off event, and key recommendations relating to the need for *A. rostrata* range states to coordinate and share information, and develop a programme of collaborative work have yet to be progressed. Such a programme would address one of the key recommendations outlined in the vision statement of the Dominican Republic workshop calling for collaboration among American eel range States. Further, at the Eighteenth CITES Conference of the Parties a new series of Decisions were adopted, a number of which encouraged collaboration and establishment of joint regional programmes of work to benefit eel species.

Taking into consideration these factors, a Roadmap for Collaboration for American Eel Range States is proposed to be developed. An outline for the Roadmap and summary background information to inform its development are below.

Anquilla rostrata Life history

○ Range

The continental distribution of *A. rostrata* ranges from West Greenland in the north to the northern portion of the Atlantic coast of South America (see Benchetrit and McCleave 2015 for a comprehensive analysis of the range). Despite this large range there is evidence that this species forms one panmictic population with all mature individuals migrating to the Sargasso Sea (Béguer-Pon *et al.* 2015; Bonhommeau *et al.*, 2008; Côté *et al.*, 2013; Gagnaire *et al.*, 2012; Miller *et al.*, 2015). This said, phenotypic variation observed during recent stocking experiments in Canada have indicated that the stock structure may be more complex (Côté *et al.*, 2015; Stacey *et al.*, 2015).

Range states: Belize; Bermuda; Canada; Colombia; Costa Rica; Cuba; Curaçao; Dominica; Dominican Republic; Greenland; Guadeloupe; Guatemala; Haiti; Honduras; Jamaica; Martinique; Mexico; Nicaragua; Panama; Providencia; Puerto Rico; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Trinidad and Tobago; United States of America; Venezuela; Virgin Islands, U.S.

Range map of *Anquilla rostrata* (TBC).

○ Biology

The American eel has a life history best described as 'facultatively catadromous'. True catadromy could be described as feeding and growing in freshwater, and breeding in the marine environment, however, the American eel's growth phase is often described as 'continental' as they are found in fresh, brackish and coastal waters. As such 'freshwater' is not believed to be essential to the continuation of the species – hence facultative catadromy. Breeding and spawning of the American eel occurs in the marine environment and this element is believed to be essential for the completion of the life cycle.

The eel has a number of life stages (Figure 1) that have their own terminology and regional vernacular – leptocephalus, glass eel, elver, yellow eel and silver eel.

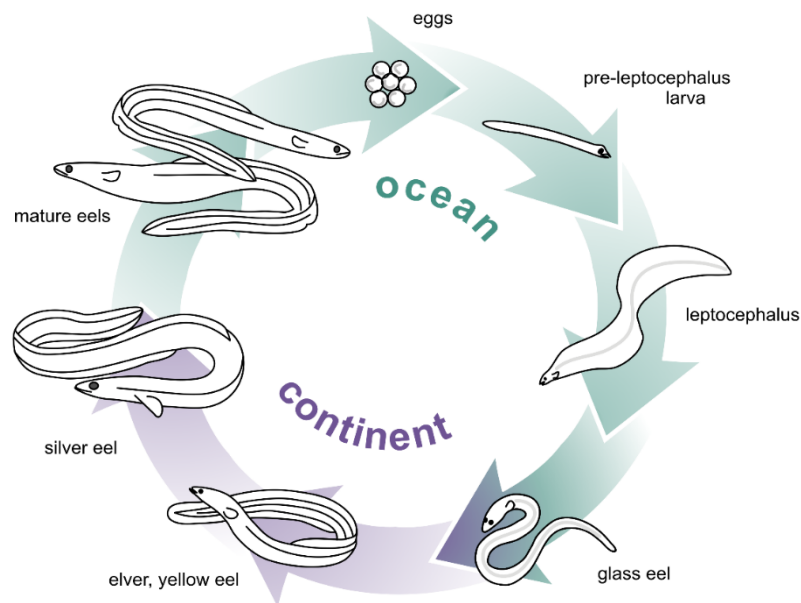


Figure 1 - A schematic diagram of the life cycle of anguillid eels. Source: Henkel et al. 2012.

Little is known about the precise spawning habitat of the *A. rostrata*. A single individual has been tracked to the northern limit of the Sargasso Sea from continental waters (Béguer-Pon *et al.*, 2015) but spawning location is inferred based on size of the leptocephali with the primary area being between 23–28°N and 75–58°W (Miller *et al.* 2015).

Leptocephali, drift and swim with prevailing currents (Antilles Current, Florida Current, and Gulf Stream), which take them to areas near continental waters (Kleckner and McCleave, 1985). Research has indicated that coastal and estuarine waters could be appropriate growth habitat for eels within the species' range (Macgregor *et al.* 2008; Greene *et al.* 2009; Chaput *et al.* 2014; Boivin *et al.* 2015; Benchetrit *et al.* 2017). Jessop *et al.* (2009) indicated that eels can be divided into residents of freshwater, residents of brackish or salt water, and shifters between these habitats. Despite knowledge of these modes, there is still little known about the use of the saline waters by *A. rostrata* across its range.

Yellow-phase *A. rostrata* spend 3 to 30 or more years inland or in coastal areas before entering the silver phase in readiness for the oceanic spawning migration (Daverat *et al.*, 2006; MacGregor *et al.*, 2009).

Threats

There is a broad suite of threats that are believed to impact the American eel, however, the significance of any single threat, or the synergy it may have with others, is not well understood (Jacoby *et al.* 2015). These include barriers to migration, habitat loss, unsustainable fisheries, pollutants, diseases and parasites and the impact of climate change.

Habitat loss resulting from barriers may contribute to reduced eel abundance across the species range, however, eel ladders are beginning to be constructed on barriers to reduce this loss. Passage through turbines at hydropower dams during downstream migration represents a major source of eel mortality (Ritter *et al.*, 1997). Turbine-induced mortality ranges from 5 to 97%, depending on turbine type, flow rate, and length of the fish (Buysse *et al.*, 2014; Hadderingh, 1990).

Unsustainable exploitation is a threat that impacts many species of anguillid eels. The USA and Canada have historically been the primary fishing range States, but more recently there has been an increase in harvest in

the Caribbean – particularly Haiti and the Dominican Republic (Gollock et al. 2018). Glass eels/elvers are exported to Asia to meet demand for farms and *A. rostrata* has increasingly met this demand since the export of European eels was banned from the EU in 2010 (Gollock et al. 2018). Increased worldwide demand for glass eels and elvers is also believed to have led to a rise in poaching of *A. rostrata*.

Pollutants have been implicated as having an impact on the health and spawning success of *A. rostrata* (Caron et al., 2016; Pannetier et al., 2016). Some recent studies indicate that levels of toxins are declining in some locations (Byer et al., 2013b, 2013a, 2015), and in some specific cases negative effects are apparently absent (e.g. dioxins; Hoobin et al. 2018), but there is still regional concern in relation to other xenobiotics.

Anguillicola crassus has been found in some catchments in the range of *A. rostrata*, (see ASMFC 2017) but at present, and from a single study, seem to be absent from those that drain in to the Gulf of Mexico (Cox et al., 2016).

Oceanic effects on long-term patterns of *A. rostrata* recruitment are poorly understood, but they may play a role in the changing abundance of eels along the Atlantic coast of North America (Castonguay et al., 1994). A recent study indicated that abundance of larval *A. rostrata* in the Sargasso Sea had declined since the early 1980s (Hanel et al., 2014). At the larval stage, changes in marine primary production and thus food availability associated with climate change have been suggested as a cause of declines of *A. rostrata* (Bonhommeau et al., 2008).

Stock status

It is generally accepted that the stock status of *A. rostrata* has declined over the past decades. It is listed as globally Endangered on the IUCN Red List of Threatened species (Jacoby et al., 2015). A recent assessment was carried out by the Atlantic States Marine Fisheries Commission on the status of the species in the USA, which built upon a similar analysis carried out in 2012 (ASMFC, 2012, 2017). A range of data sets for ‘young of the year’ and yellow eels, fisheries dependent and independent, were used in both assessments. While results varied, all three analyses indicated downward trends in the datasets until the early 1990s, after which they have stabilised. As a consequence, the stock has been designated as ‘depleted’ (ASMFC, 2012, 2017). A recent evaluation of American Eel abundance series in Canada identified 12 robust fisheries-independent time series to examine abundance. Generalized linear mixed models included temporal, environmental, and effort variables to account for changes in catchability. Trend analysis indicated that American Eel abundance were stable (six surveys), declining (four surveys) or increasing (two surveys) (Cornic et al. in press). Because of inter-index variability, it is difficult to postulate a single index that fully reflects trends in American Eel in Canada. However, the status of the available indices in Canada at this time appears to be stable.

There is little understanding of the stock status across the southern part of the species range.

Use

A. rostrata has traditionally been consumed in small amounts domestically across its range. Harvesting of glass eels is predominantly carried out with the purpose of export. Unlike in Europe or Asia, there is no long-term tradition of farming eels in the Americas and most glass eels are exported to East Asia. Yellow eels are used for bait in other fisheries in the USA. It is well documented that *A. rostrata* is very important and widely used for sustenance, reverence, and practical purposes by indigenous people currently and in historical times (Miller and Casselman, 2014).

Roadmap for International Collaboration on the American Eel

Objectives

| Objective 1 | | |
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| <i>A voluntary forum for improved co-ordination and collaboration between American eel range states is established.</i> | | |
| Goal | Action | Time Scale |
| Range state representatives meet regularly to update each other and share relevant information on American Eel. | A co-ordination mechanism is agreed upon by range states. | |
| | Membership of the forum and key stakeholders are agreed | |
| | Dates and agenda items agreed for first year. | |
| | Virtual and/or in-person meetings agreed. | |
| | Review and evolution of forum | |
| Objective 2 | | |
| <i>Identify and address key knowledge and capacity gaps in relation to management of American eel fisheries and trade.</i> | | |
| Goal | Action | Time Scale |
| Range states agree where data collection and/or stakeholder engagement is needed in order to strengthen management both nationally and internationally. | Review relevant knowledge and data across the range. | |
| | Identify capacity limitations in addressing knowledge gaps and associated opportunities to collaborate. | |
| | Working groups are established to address priority activities. | |

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| | Working groups report on progress at range state forum. | | | |
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Timeline/GANTT

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