

National Report – Cuba

*Fishing for American eel, *Anguilla rostrata**

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Introduction

The American eel (*Anguilla rostrata*) migrates from estuaries and freshwater along the eastern coast of North and Central America to the Sargasso Sea south of Bermuda where their lives come to an end after spawning. Eel leptocephalus larvae develop and return via ocean currents to the continental shelf and enter coastal estuaries as glass eels or elvers. They reside, feed and grow in coastal estuaries and headwaters before returning to the sea to spawn and complete the cycle (Field, 1996). The location of the rivers in which glass eels/elvers are found can influence their size - in Cuban rivers the average size is 5.1 to 5.5 cm TL (total length) and an average weight of approximately 0.14 grams (Hernández, 2019).

Cuba has 633 rivers that flow into the sea via the surface or underground: 272 drain into the Gulf of Mexico and the North Atlantic, while 361 drain into the Caribbean Sea (Ecured, 2020). *A. rostrata* has been recorded in several rivers on the island, which flow into the Atlantic in the North and the Caribbean Sea in the South.

The eastern part of the island (Holguín and Guantánamo provinces) is the most studied, coinciding with the traditional fishing areas (Álvarez, 2018).

Characteristics of the elvers fishery in Cuba.

Commercial fishing for American Eel began in Cuba in 1974, in Holguín province, mainly for the purpose of exportation and breeding under controlled conditions (Fernández and Vázquez, 1978). In Cuba there is no local consumption of eels and, as such, they are not found in local markets.

At the end of the 1990s, the fishery expanded into the Guantánamo province and today it has spread to the major part of the eastern region (GEIA, 2021).

Fishing for American Eel in Cuba has focused on catching elvers. This eel phase was fished in the 1990s, mainly in reservoirs, and catch did not exceed 200 kg. Experimental culture and nutritional studies related to the culture of juvenile stage eels have also been carried out. (Álvarez, 2018).

Fishing season

The period of entry of the eels to the Cuban rivers and with it, the duration of the fishing season varies from one author to another. According to Laria (1975), it extends from August to December, but eels enter most frequently in the month of September. Aguilar (1977) established that the season runs from August to March, with the highest catch volumes being obtained in October and November. In 1978, Fernández and Vázquez stated that the fishing season ran from October to January with the highest yield in November. At present, the fishing season covers the period from September to April (Hernández, 2019).

The fishermen carry out periodic sampling in the rivers from the month of August, although the season generally begins in September (Hernández, 2019).

Fishing schedule

The influence of moon phases seems to be contradictory amongst some authors. Fernández and Vázquez (1978) recommended fishing during the first quarter and full moon phases while more recent publications report that fishing is traditionally carried out in the last quarter and new moon phases (CIP, 2019).

In Cuba, the eels migrate mostly nocturnally. They are usually caught by fishermen very late at night or in the early hours of the morning, between 7:00 p.m. and 6:00 a.m., with an average duration of 2 hours (Fernández and Vázquez, 1978).

Fishing techniques

At least two fishermen operate in each river, and each is equipped with fishing gear that includes a nursery (2-4 m²), 2 fishing nets (600 micron mesh), “milicianos” and others (Hernández, 2019).

The fishing nets are used semi-buried in the sand of the river, in an inclined plane, with stones that keep the bag against the current. This gear is regularly checked and the captured fish are transferred to a rustic hatchery near the shore (Fernández and Vázquez, 1978). The hatcheries are located close to where the fishing gear is operating, in a place with good water flow necessary for the American eel's oxygenation requirements. Eels can stay in this hatchery up to 24 hours, before being transported to another holding area with the necessary conditions to keep them alive, until export.

The “miliciano” has the double function of detecting the entry and capture of eels (Aguiar, 1977). It consists of a plastic mesh cylinder with a conical funnel that is placed against the current, supported by stakes. They are located on the banks of rivers in areas devoid of vegetation and are regularly checked at night. The catch is collected in a floating hatchery near the shore (CIP, 2019).

The fishing areas are approximately 4 to 5 km from the mouths of the rivers. These places, known as “saltaderos”, are characterized by being shallow and with a large amount of stones at the bottom (Fernández and Vázquez, 1978).

The maximum catch to be consigned in large nurseries is 25 Kg and 5 Kg in medium ones. The elvers can be in them for up to 24 hours, as long as there is a good current flow that guarantees oxygenation (Hernández, 2019).

After the fishermen deliver them, the eels are kept alive in a room with all the necessary conditions, which includes: oxygenation, water changes at temperatures of 14 to 16 ° C, deposited in nylon that are placed in polyfoam boxes and with these conditions they are exported alive (Hernández, 2019).

In general, this fishery is very artisanal since it depends fundamentally on the constant vigilance and cleaning of the gear, as well as the regular harvesting of eels throughout the fishing season (Fernández and Vázquez, 1978).

Volume of catches and exports

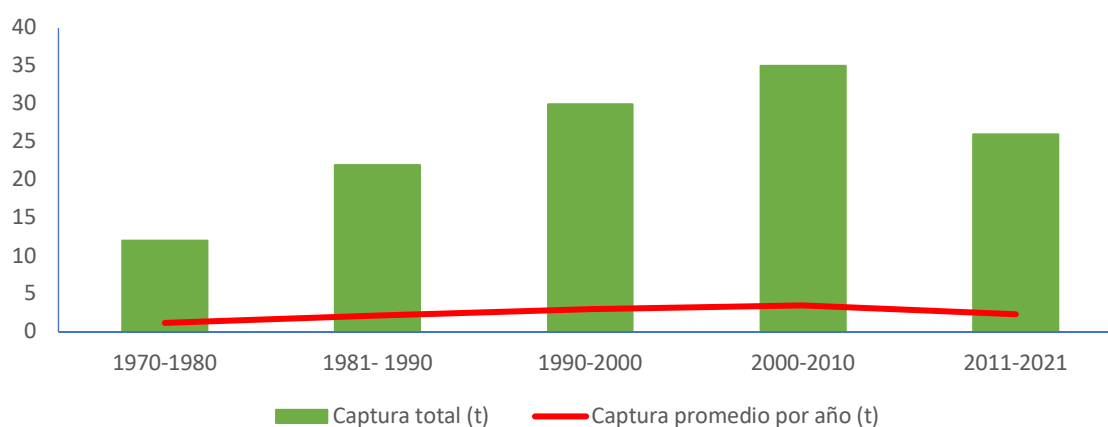
Based on the increase in the export values of the kg of live eel, which reached around 7000 USD per kg, the Food Industry Business Group (GEIA) fisheries division undertook the task of proposing a program to increase fisheries and consequently exports. As a result of this, in the 2020-21 season, which ended in March 2021, the provinces that participate in the elver fisheries have increased from two to six (Guantánamo, Holguín, Santiago de Cuba, Granma, Las Tunas and Camagüey); therefore, the number of rivers being fished increased to 30. Despite the aforementioned, Guantánamo and Holguín provinces continue to be the provinces that exploit the most rivers, with the largest capture and export levels. These two provinces represent 90% of both values (GEIA, 2021).

As can be seen in the graph, in general from the 1990s the catch has been relatively stable, although some years it has been affected by weather phenomena or, as happened recently, by the decrease in fishing activity due to COVID -19.

Table 1: Historical total eel catch by decade

Years	Total catch
1970-1980	12 t
1981- 1990	22 t
1991-2000	30 t
2001-2010	35 t
2011-2021	26 t

Chart 1: Total historical catches and average catches per year.



In the last 5 years, the catches and exports of glass eels (Table 2) have been affected by different factors, e.g. the values of exports in 2020 and 2021 have been

affected by Covid-19 and, in 2017, the catch was affected due to the passage through the north eastern zone of Hurricane Irma (GEIA, 2021).

Table 2: CARIBEX –Historical series - Exports Live eels.

Years	Live eels			
	Catch	Export	Price	Value
	Kg	Kg	USD/Kg	USD
2017	160	155	1.828,11	283.357,11
2018	1388	1.177	4.927,13	5.798.345,55
2019	1654	1.651	5.389,16	8.897.499,98
2020	950	912	3.288,98	3.000.020,2
2021	430	449	3.780,5	1.697.433

The statistics reflect a resource that constitutes an important item for export and the expenses incurred annually, after the initial investment, are minimal compared to the high income for its price in the international market.

Just as an example, taking as a reference the official data published by the National Statistics and Information Office (ONEI) for the year 2018, the capture of elvers only represents 0.002% of the total catches made by fishing companies, however they represent 7.42% of the export earnings of these products due to their high price.

Table 3: Comparison of eel catch and export earnings versus total catch and export earnings of fishery products.

	Capture	Export earnings
Fishery products	51214.6 t	78 million USD
Glass eels	1.2 t	5.8 million USD
%	0.002 %	7.42 %

Unfortunately, there is little data available referring to fishing effort and how it has changed over time.

Main problems affecting the elver fishery

Undoubtedly, one of the main problems to achieve the sustainable exploitation of the glass eels has been the lack of resources. Although the fishing of this species is carried out with artisanal means, once it is removed from the environment, its conservation and transfer becomes more complicated to avoid high mortality.

The organization of fishing activities in our country is established through territorial companies that govern and control all aquaculture activities, productive and development policies. Therefore, we consider that the fisheries have been subjected to external and internal factors, which have determined the variations observed in the fishing statistics. The fundamental limiting factors have been:

- Lack of market for exports from the 1980s and 1990s
- Lack of knowledge of the techniques of capture, maintenance, conservation and long-distance transfers.
- Lack of financing for exploitation logistics.

The lack of experience in management has also interfered in the use of the species in its adult stage. Although several research centers in the fisheries sector have been studying the breeding, feeding and reproduction of the American eel, they have met with limited success.

Other factors, such as the increase in the frequency and severity of weather phenomena such as hurricanes and intense droughts, have been observed to cause less abundant catches. So, it can be inferred that climate change will be an important factor to consider in the near future.

Roads, bridges and other man-made barriers also stand in the way of rivers and thus in the way of migrations of this species, which can undoubtedly affect its life cycle. The damming of rivers deserves a separate point, because in addition to constituting architectural barriers in themselves, they reduce the flow of the rivers.

Finally, the incidental fishing of elvers is another factor that affects the abundance of the species. A curious case is that of the Tetí (*Sicydium plumieri* and *Sicydium punctatum*), fingerlings that only appear with the last quarter moon phase. As they enter large banks in the Bay of Baracoa from the high seas, their abundance is so great that the water seems boil and darken. The fish, tiny like eel elvers, are attracted by the fresh water to openings where rivers connect to the ocean. Forming a great cloud, they enter the mouth of the Duaba, Toa and Miel rivers, in a unique spectacle.

The mystery of Tetí is one of the most deeply rooted in the Baracoa area, and its fishing, which the residents carry out with whatever equipment they have, constitutes a local rite. With its peculiar and delicious flavor, this little fish is considered a very invigorating food, and aphrodisiac properties are attributed to it.

Although eels accompany the Tetí in their aggregations, they were not, until recently, used for human consumption.

Regulations and conservation measures.

Our country has environmental legislation that, in addition to implementing the International Conventions to which it is a party, regulates the use of some species that are of interest to national biodiversity. Resolution 160 of 2011 of the Ministry of Science, Technology and Environment (CITMA), "Regulations for the control and

protection of species of special significance for biological diversity in the country”, establishes the species of special significance for national biological diversity, through their inclusion in the List of Species that is attached to the Resolution and controls their sustainable use, as well as their exportation by any means, through the environmental licensing regime. The *Anguilla rostrata* is not on the aforementioned List of Species, so it is not controlled by the Office of Regulation and Environmental Safety (ORSA), CITES Management Authority and authority for the application of Resolution 160.

Although there is no specific legislation for American eels, fishing requires licenses issued by the Ministry of Food Industry (MINAL) like any other fishing resource. The licenses regulate fishing areas, gear and fishing effort, among other aspects.

Since 1996, the former Ministry of the Fishing Industry approved a Manual of Work Procedures for the management of *Anguilla rostrata*, which is mandatory.

There is a system of fishing licenses for each company, and there is a control system for the entire process that includes daily, monthly and annual reports of fisheries, transportation, shipping and international trade. The system is monitored at the national level by the Ministry of the Food Industry. There is only one company authorized for export, which is the CARIBEX company, belonging to the GEIA.

There are also no studies on the size and status of the *A. rostrata* populations in Cuba, but every year before the season begins in August, samples of the resource are carried out in the main rivers and sent to the Fisheries Research Center (CIP) for their analysis, particularly with respect to aquaculture health.

Capturing, extracting, landing, transporting, processing or marketing, without the corresponding authorization from the Ministry of the Food Industry, species destined exclusively for state commercial fishing such as eel, constitute violations of the fishing regime according to Decree No. 1 “Regulation of Law 129 “Fishing Law” of December 24, 2019.

In addition to the fines established in said regulation and depending on the importance and seriousness of the detected infraction, other measures such as the suspension or cancellation of the license and the confiscation of the product, fishing gear and equipment, including ships, boats and naval devices and any other means used to commit the offense or directly linked to it can be applied.

As the highest advisory body on the management and administration of aquatic resources, the Fisheries Advisory Commission is in charge of proposing regulations and legal issues to achieve sustainable economic exploitation. In recent years this Commission has been paying attention to this resource mainly due to its economic potential and the need to conserve it. A new specific legislation is currently being drafted for this fishing resource.

The Fisheries Research Center (CIP) created a line of research on eel, to be able to take management measures for the species. The general objective of the

research project is to extend commercial fishing for American eel in its larval stage, under a responsible approach, to other regions of the country.

This project also aims to identify the main aquariums with the presence of eel by provinces and their environmental quality; establish exploitation strategies by rivers according to their hydrographic characteristics; raise the efficiency of traditional fishing gear and guide sustainable management policies and strategies for the exploitation of the resource according to the particularities of each region.

Future perspectives

Despite the rise in capture, and with intensive management with the available resources, it is considered that the eel fishery has not reached its potential. As a consequence, it has been considered necessary to promote the expansion of the capture areas of the species, prospecting in new rivers, which require significant material and financial resources not currently available (Hernández, 2019).

With the aim of stimulating eel capture, new payment rates were established for fishermen and all the personnel involved, increasing the payment and making it progressive according to the number of kilograms caught (MINAL, 2019).

There are several projects on this topic presented to attract foreign financing. Specifically, the Aquaculture Development and Technologies Company (EDTA) has a project to grow American eels, but it has not been possible to find a foreign partner with experience in the matter, as trials have been carried out and they have not been successful (MINAL, 2019).

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Annex 1: Historical captures (Kg) (Fernández and Vázquez, 1978 and Álvarez, 2018) -

Year	Sept	Oct	Nov	Dec	Jan	Feb	Total
1974		1,839.6	3,154.3	1,664.9	272		6,930.8
1975						11	11
1976		222	3,038.1	205.8	156		3,621.9
1977		15.1	102.3	224.6	7.5	30.1	379.6
1978							
1980							
1981							
1982		6	17				23
1983			38				38
1984				28			28
1985							
1986							
1987		30	142	220			392
1988					25		25
1989		198	816				1014
1990					61		61
1991			58	38			96
1992							
1993		4					4
1994					11.1		11.1
1995		484.7	94.2				578.9
1996		19.2	20.3	2	36.4	11.5	89.4
1997	22.3	18.2	1.5				43
1998		1.1	15.3	1			17.4
1999			5.1				5.1
2000		377.4	488.4	177.6	66.6		1174.5

Annex 2: List of rivers by province where fishing is currently carried out

Camagüey

1. Playa Guanaja

Las Tunas

2. Delicia

Holguín

3. Sagua
4. Rio Grande
5. Cananoba
6. Jiguaní
7. Quesigua
8. Guajabaney
9. Yabazón
10. Gibara
11. Cacoyoguín
12. Cayo Guan
13. Potosí
14. Yamanigüey

Granma

15. El Macío
16. Río Mota
17. Ojo de toro

Santiago de Cuba

18. Río la mula
19. Palma mocha

Guantánamo (Baracoa)

20. Toa
21. Miel
22. Duaba
23. Macaguaní
24. Mata
25. Marabi
26. Camarones
27. Navas
28. Santa María
29. Nibujón
30. Barigua

