# Desktop Assessment of Freshwater Fauna of Saint Lucia.

## Contents



## 1. Introduction.

This desktop assessment is concerned with the assessment and rehabilitation of five of Saint Lucia's major rivers. Anthropogenic change since colonization have disturbed natural riparian ecosystems and this has been accelerated in the last sixty years by intensive banana farming and mixed farming on floodplains and steep slopes, with associated deforestation, and fast growth of population centers. More recently three major flood events, Tropical Storm Debbie (1996), Hurricane Tomas (2010) and the Christmas Eve trough (2013) have exacerbated the situation. The devastation caused by these events has been well-documented. This report aims to identify the freshwater fauna of Saint Lucia and its present status. In addition management recommendations are made with the aim of improving ecological conditions in freshwater habitats.

## 2. Summary of Reviewed Reports.

Studies of aquatic fauna in the wider Caribbean focus on two main groups, fish and crustacean decapods (crabs and shrimps). Little information was found on other groups such as aquatic insect larvae and smaller crustaceans.

Saint Lucia is a volcanic island formed where the Atlantic plate is subducting beneath the Caribbean plate. Although the formation started 19 million years ago it continued until about 1 million years ago. Saint Lucia has never been joined to another landmass and is geologically young (The Geological Society of London - Windward Islands, West Indies, 2022). Amerindians brought over terrestrial animal and plant species, but it is unlikely they brought over freshwater animals which are a minor food source and

would be difficult to transport. Thus most native freshwater fish and decapod species have almost certainly evolved from marine species.

This marine origin is strongly supported by the report "Large Scales of Connectivity of Selected Freshwater Species among Caribbean Islands" (Bell et al, 2013). It showed that the great majority of freshwater fish and decapod species in the Caribbean have an **amphidromous life-cycle.** A species is **amphidromous** if the adults live in freshwater and eggs or newly hatched larvae are carried to the sea where they feed and grow before moving upstream as larvae and becoming adults.

Genetic analysis of certain freshwater decapod species in Puerto Rico revealed little or no genetic variation in different water catchments Cook et al, 2009 and 2012). This implies that larvae sometimes may be carried by currents or migrate in coastal waters and move into a different water catchments as juveniles, thus causing genetic mixing.

In addition a genetic study of certain decapod species showed no genetic variation even between Puerto Rico, Trinidad and Panama. (Page et al, 2013). This implies that larvae can travel long distances in salt water in the plankton and then enter a new water catchment a great distance from their origin..

Given this interconnectivity it is argued that amphidromous fish and decapod species on one island have a migratory connection to other islands, particularly those in close proximity and with the same short, steep streams with variable water flow. (Bell et al, 2013).

Thus studies of freshwater fauna on neighboring islands probably can give insight into species likely to be found in Saint Lucia, where little information is available locally.

A field study was carried out on shrimp species by Guy Barnish and published in 1984. It was a detailed investigation of the Cul de Sac river and some of its tributaries involving 31 collection sites. Thirteen species of shrimps were identified. Collections were also made at 34 sites on 22 other rivers and all 13 species were found at one more of these sites and no new species were discovered. Thus it is reasonable to assume that at that time Saint Lucia had 13 species of freshwater shrimps.

*Macrobrachium rosenbergii*, the giant freshwater prawn, has possibly escaped from aquaculture (Krauss, 2010).

Chace and Holcombe published a report in 1969 on the freshwater and terrestrial decapod crustaceans of the West Indies with special reference to Dominica. It contains very detailed descriptions of species. It lists 11 freshwater shrimp species for Dominica. All these species are found in Saint Lucia emphasizing the interconnectivity of the islands.

A more up to date source of information is the "Atlas des Poissons et des Crustacés D'Eau Douce de La Martinique, published by Muséum National d'Histoire Naturelle" in 2002. In it Lim et al. list 12 species of shrimp and one freshwater crab species. All these species are found in Saint Lucia, once again emphasizing the interconnectivity of the islands

Mountain crab, *Guinotia dentata*, locally called bak, is found in streams in the rainforest and surrounding forest. On land they are known to hide under roots of trees, rocks and rotten wood where they dig shallow burrows which are oval in shape. Reproduction takes place entirely in fresh water. Relatively few but large eggs hatch directly into juveniles without larval stages. (Chase and Hobbs, 1969}.

No published studies of freshwater fish in Saint Lucia were found. However the FishBase database is a useful starting point. A respected global database, it lists 12 freshwater species for Saint Lucia on the Muséum National d'Histoire Naturelle mirror site. Three species listed are introduced, two species of Tilapia, *Oreochromis mossambicus* and *Oreochromis niloticus*, and also *Ophisternon aenigmaticum*, the obscure swamp eel. Tilapia have escaped from aquaculture and are found in larger rivers closer to the sea and lakes. Deliberate introduction also may have taken place. No research was found on the impact of tilapia on native species. Very little information was found about *Ophisternon aenigmaticum.* Nine native species were recorded for Saint Lucia on The FishBase database. However all are species of estuaries, mangroves and coastal waters, although they may occasionally be found in large rivers close to the sea. Breeding often takes place in the ocean.

*Poecilia* species, guppy is also recorded as present in Saint Lucia. Its whole life cycle takes place in freshwater. (Krauss, 2010}. It may have been introduced in an attempt to control mosquito larvae on which it may feed aquaculture.

The "Atlas des Poissons et des Crustacés D'Eau de La Martinique" lists the species of fish found in freshwater upstream from estuaries. Five introduced species are recorded and 16 native species, the majority of which are **amphidromous.** This list of native species is discussed in Section 3.

Of particular local cultural and culinary interest is goby-fry, locally called twi-twi. An overview of goby-fry fisheries was published by K.Bell in 1999. One of the countries he covered was Dominica. Twi-twi are the postlarvae of certain amphidromous fish species which migrate upstream en masse later in the year and at certain lunar periods. Bell's personal research in Dominca in 1989 showed that Sicydium *punctatum* made up 95% of the catch with the remaining 5% a mix of *Sicydium antillarum* and *Eleotris Pisonis*. Only a few *Awaous taiasica* postlarvae were collected and no *Gobiomorus dormotor* although these species are caught in other places in the Caribbean. Interviews with fishermen and women indicated that the twi-twi harvest had declined greatly in recent years (Bell, unpub.data.) Bell suggested that this had happened because of environmental changes such a forest clearance, agriculture and pollution.

## 3. Summary of Freshwater Fauna Species identified in the Desktop Review.

The species listed in this section are based on information from Section 2.

Additional local information below such as local names is from personal communication with Henry Augustin and Melvin Smith, both of whom caught freshwater fish and shrimps in their youth. Their recollections fit well with the Martinique fish list and the Saint Lucian decapod list.

*Table 1. Freshwater Shrimps of Saint Lucia.*

| **Family** | **Scientific Name** | **Life cycle** | **Martinique** | **Dominica** |
|---|---|---|---|---|
| Penaeidae | *Penaeus aztecus subtilis* | Brackish/salt water | | |
| Atyidae | *Atya innocous* | Amphidromous | present | present |
| Atyidae | *Atya scabra* | Amphidromous | present | present |
| Atyidae | *Jonga serrei* | Amphidromous | | present |
| Atyidae | *Micratya poeyi* * | Amphidromous | present | present |
| Atyidae | *Potimirin glabra* or *potimirim* | Amphidromous | present | present |
| Atyidae | *Xiphocaris elongate** | Amphidromous | present | present |

| Family | Scientific Name | Life cycle | Martinique | Dominica |
|---|---|---|---|---|
| Palaeminidae | *Macrobrachium acanthurus* | Amphidromous | present | present |
| Palaeminidae | *Macrobrachium carcinus* | Amphidromous | present | present |
| Palaeminidae | *Macrobrachium crenulatum* | Amphidromous | present | present |
| Palaeminidae | *Macrobrachium faustinu** | Amphidromous | present | present |
| Palaeminidae | *Macrobrachium heterochirus* | Amphidromous | present | present |
| Palaeminidae | *Palaemon pandaliformis* | Brackish/salt water | present | |

Table 1 lists the species identified as present in Saint Lucia, along with the species listed for Dominica and Martinique. The overlap of amphidromous species is very marked, strongly suggestive of interconnectivity between the islands. Thus it is very likely that this is an accurate and probably complete list of Saint Lucia freshwater shrimps. An asterisk indicates Antillean endemics.

*Macrobrachium rosenbergii*, the giant freshwater prawn, has possibly escaped from aquaculture?

Additional local information below such as local names is from personal communication with Henry Augustin and Melvin Smith, both of whom caught freshwater fish and shrimps in their youth. Their recollections fit well with the Martinique fish list and the Saint Lucian decapod list.

Eleven species are amphidromous**.** Collectively these species have the local name kwibich. All are probably edible but are variable in size. The largest is the commercial "crayfish" *Machaerium carcinus,* sometimes locally called guaj. Other species that are also caught and have names such as bouk and chouvwet. Bouk probably refers to the smaller species such as *Atya.*

The freshwater mountain crab, *Guinotia dentata*, locally called bak, is common in the rainforest. It is collected and eaten and occasionally sold.

*Figure 1. Guinotia dentata,* image Roger Graveson

No detailed scientific study of freshwater fish in Saint Lucia was found.

*Table 2. Estuarine Fish of Saint Lucia.*

| **Family** | **Scientific Name** |
|---|---|
| Anguillidae | *Anguilla rostrata* |
| Carangidae | *Caranx bartholomaei* |
| Carcharhinidae | *Carcharhinus leucas* |
| Centropomidae | *Centropomus ensiferus* |
| Centropomidae | *Centropomus parallelus* |
| Centropomidae | *Centropomus pectinatus* |
| Sciaenidae | *Cynoscion acoupa* |
| Gerreidae | *Gerres cinereus* |
| Mugilidae | *Mugil liza* |

Table 2 list fish species listed on the FishBase website; these species are found mainly in estuaries, brackish water and saltwater.

*Table 3. Introduced Fish Species in Saint Lucia.*

| **Family** | **Scientific Name** | **Common Name** |
|---|---|---|
| Synbranchidae | *Ophisternon aenigmaticum* | Obscure swamp eel |
| Cichlidae | *Oreochromis mossambicus* | Mozambique tilapia. Akinson. |
| Cichlidae | *Oreochromis niloticus niloticus* | Nile tilapia. Akinson. |
| Poecillidae | *Poecilia reticulata* | Guppy |
| Poecillidae | *Poecilia vivipara* | Guppy |

Table 3 lists the introduced fish species identified in Section 2.

However there are smaller fish species present in rivers further inland. No scientific information was found in the literature on these species in Saint Lucia. However as these species in the West Indies tend to be **amphidromous**, for reasons explained in Section 1, species list of neighbouring islands are likely to be very similar to Saint Lucia's list.

The most complete list was for Martinique.

*Table 4. Freshwater Native Fish of Martinique*

| Family | Scientific Name | Lifecycle |
|---|---|---|
| Eliotridae | *Dormitator maculatus* | Amphidromous |
| Eliotridae | *Eleotris perniger** | Amphidromous |
| Eliotridae | *Eleotris pisonis* | Amphidromous |
| Eliotridae | *Gobiomorus dormitor* | Amphidromous |
| Eliotridae | *Guavina guavina* | Amphidromous |
| Gobidae | *Awaous banana* | Amphidromous |
| Gobidae | *Ctenogobius pseudofasciatus* | Amphidromous |
| Gobidae | *Sycidium plumieri* | Amphidromous |
| Gobidae | *Sycidium punctatum* | Amphidromous |
| Gobiesocidae | *Gobiesox nudus* | Amphidromous |
| Mugilidae | *Agonostomus monticola* | Amphidromous |
| Rivulidae | *Rivulus cryptocallus** | Freshwater |
| Synbranchidae | *Synbranchus marmoratus* | Amphidromous |
| Syngnathidae | *Microphis brachyurus* | Freshwater or brackish water |

Table3 is a list of fish species found in inland freshwater streams in Martinique. An asterisk indicates Antillean endemics. Given the physical similarity of Saint Lucia and Martinique, their proximity and the preponderance of amphidromous species, it is very likely that a list of Saint Lucian fish species would be very similar.

Local information supports this idea:

*Agonostomus monticul* , locally called milé, is a medium-sized fish up to 35cm in length, found in medium-sized rivers with fast flow and rocky bottoms. It has an amphidromous life-cycle. Locally they are caught and eaten. Observed by the consultant in River D'Orée, 2021.

Twi-twi fishing was practiced in Saint Lucia. It is not known if it still takes place. Eliotridae, Gobidae and Gobiesocidae species are all possible participants in twi-twi migrations.

*Synbranchus marmoratus*, zandj (nwé), is known in Mamiku and Dugard, often living in very wet mud. When water levels are low they dig tunnels in the bank of stream bed to survive. They breed in freshwater and thus are not amphidromous.

*Gobiesox nudus*, tétard, was known in, Choiseul.

*Awaous banana*, jolpot, is present on Mamiku River.

*Poecilia* species, guppies, are present in Mamiku River

## 4. Present Status of Freshwater Fauna in Saint Lucia.

Since colonization there has been anthropogenic disturbances caused by activities such as deforestation, agriculture, industry, and urbanization which have negatively impacted riparian health. Recently Saint Lucia suffered three very destructive rain events, Tropical Storm Debbie (2009), Hurricane Tomas (2010) and the Christmas Eve trough (2014).

The flooding decimated the adult populations of fish and decapods. This was recognized by the government which imposed a moratorium on the harvest and sale of freshwater "shrimp, prawns or crayfish." The massive siltation of riverbeds created long-term problem as the fast running clear water, rocky beds, rock pools and riverbank vegetation, all of which are critical habitats for freshwater fauna, had disappeared along long stretches of rivers. Landslides with exposed soil continued to add sediment to the rivers long after the flood events.

It is now eight years since the last major flood and most landslides have revegetated to some extent. Though no studies were found in the literature, it is reasonable to assume in that in some areas riparian conditions have improved. Rehabilitation interventions such as being proposed in this project will also help in the rehabilitation process.

The amphidromous life cycles of most of the fish and decapod species has a great advantage. If a river loses a populations of a particular species it can return naturally from another water catchment on the island or even from a neighboring island, once conditions in the river improve. Thus it may be that fish and decapod species are now repopulating Saint Lucia's rivers or increasing populations in areas where they survived but numbers were low.

However there is one major disadvantage to the amphidromous life cycle. There needs to be a continuous water course for the postjuvenile larvae to move upstream. Although they can climb rocks they will not get past an obstruction such as dam.

## 5. Management Recommendations.

Virtually all species of freshwater decapod and freshwater fish require migration from the sea upstream as part of their lifecycle. Physical barriers impede or totally block this migration. Thus shrimp and fishways must be provided to bypass any obstructions.

The larvae of most freshwater fauna species feed and grow in salty and brackish water. Thus both the reduction in siltation of seagrass beds and the careful conservations of extant mangroves will increase adult populations upstream

The moratorium on "crayfish" collection should be kept in place.

All management recommendations in the desktop vegetation report will also benefit the fauna.

## 6. Conclusion.

Despite limited information on Saint Lucia it was possible to compile an accurate list of freshwater decapods for Saint Lucia and a likely list of freshwater fish species. Studies of fauna populations before and after the three major flood events were not available but clearly there was a great decline and possible extirpation of some species in some rivers.

Amphidromy will allow repopulation of species from other watersheds on the island or from neighboring islands once ecological conditions improve. Thus any rehabilitation interventions which improve the structure of rivers will benefit the fauna as long as they do not prevent the upstream migration of fish and shrimp larvae.

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