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Tocantins River

Category: Inland Aquatic Biomes.

Geographic Location: South America.

Summary: One of the largest rivers in South America runs through the Cerrado and Amazon, connecting populations in central Brazil and bringing energy and sustainability to several native populations.

The Tocantins River rises in the state of Goiás in central Brazil and runs northward through different sedimentary basins for 1,553 miles (2,500 kilometers) in the states of Tocantins, Maranhão, and Pará. It is formed by two main tributaries: the Parani and Maranhão rivers. At the end of its course, the Tocantins flows into the Amazon River near Belém. *Tocantins* means “toucan’s beak” in the Tupi indigenous language.

The landscape drained by the river is relatively flat, with flooded plains; the banks of the river sometimes flood, creating white-sand igapó forest. The soils are nutrient-rich in many areas, but other areas have low nutrient availability in the soil.

The basin of the Tocantins is formed by another important river, the Araguaia, and has an average discharge of 388,461 cubic feet (11,000 cubic meters) per second. Rapids and falls are the most common aquatic habitats in the Tocantins, dominating the upper course; they are less common in the middle reaches, but form an important habitat on the lower course, which is now largely inundated by the Tucuruí Reservoir.

Rocky and sandy islands and beaches are usually found in the middle course; clay islands dominate in the lower reaches. Floodplain lakes are less frequent along the Tocantins. The period of rising water is October to April, with high-water peaks

in February (upper Tocantins) and March (middle and lower courses). The Tocantins-Araguaia system dries up from May to October, with the lowest water levels in September.

The Tocantins and its tributaries can be classified as clear, nutrient-poor, low-ion, and sediment-load rivers. Recently, heavy anthropogenic interventions are changing this pattern. The lower Tocantins has many marginal lakes and numerous islands; it, is influenced by both the annual rise and fall of the main river and by tidal cycles. This part of the river course is a complex and fragile ecosystem.

Floodplain lakes and seasonally inundated forests in tributaries of the Tocantins are key habitats for the maintenance of aquatic food webs.

Human Settlement

The history of human occupation in the region dates back 11,000 to 12,000 years, with the first evidence of human presence in the middle Tocantins. This period corresponds to the beginning of the Holocene. The period of Portuguese colonization started in 1625, when a group of Jesuit missionaries established the first settlement in the middle Tocantins. Later, *Bandeirantes* from São Paulo went through the entire region in search of gold and minerals, and pioneered commercial navigation along the river.

Currently, there are several indigenous tribes in the region belonging to different cultures. The Apinajé and Karajá are the major indigenous people living in the region, along with the Xerente, Javaé, Xambioá, and Krahô. These tribes live in the lands on the left bank of the Tocantins and the right bank of the Araguaia, in the north of Tocantins state. Captain S. C. Bullock provided a vivid report on one expedition that took place in the spring of 1922 through the Tocantins-Araguaia rivers, describing the geography, climate, landscape, and human diversity. The expedition wanted to confirm the navigability of the river and to search for minerals with economic value in the vicinity.

Biodiversity

The region of the Tocantins River is biologically rich. The eutrophic soils sustain a rich and diverse biota, with many unique species that are found

only in this place in the world, that is, they are endemic here. The forests in the region are generally classified as evergreen tropical rainforest. Additionally, the zoological diversity is remarkable. A total 153 species of mammals have been recorded, of which eight are primates and 21 are rodents. Also noteworthy is bat diversity, with more than 90 species.

Many other eye-catching species can be found in the region, such as spectacled caimans (*Caiman crocodilus*), black caimans (*Melanosuchus niger*), yellow-spotted sideneck turtles (*Podocnemis unifilis*), American manatees (*Trichechus inunguis*), and two species of river dolphins (*Ina geoffroyensis* and *Sotalia fluviatilis*). Bird diversity is particularly high, with 527 known species, including toucans, hawks, and the marvelous scarlet macaw (*Ara macao*).

The Tocantins-Araguaia Rivers harbor more than 300 fish species from 30 different families, most of which are migratory species. Upstream reproductive migration occurs in the early rainy season (October to March), followed by return movements by the end of the high-water season. An interesting pattern is the decrease in species richness of fish from mouth to headwaters.

However, fish diversity in the Tocantins is considered to be low by Amazonian standards. For the sake of comparison, the much larger St. Lawrence River basin in Canada, spanning 1,900 miles (3,058 kilometers), has 67 recorded fish species in 20 families. This fact emphasizes the rich biological diversity along the Tocantins river channel and the long-recognized diversity gradient between tropical and temperate ecosystems.

Effects of Human Activity

Four large dams were constructed along the Tocantins River. The two largest ones are Tucuruí and Serra da Mesa, which together generate more than 9,000 megawatts of energy. With the construction of the Tucuruí Dam—the largest dam ever built in a tropical rainforest—the natural flow of Tocantins changed, and the migratory fish movements become dependent on the controlled water flow of the hydroelectric dam. Long-distance migratory species, such as large catfish, were directly

affected because their upstream movements were interrupted by the dam.

However, other migratory species whose life cycles are completed downstream from the dam were also adversely affected, probably due to separate reasons, but perhaps stemming from altered sediment loads, different patterns of river bank exposure, and related changes in the flora communities downstream.

Despite helping with the development of the region, these dams have further negative effects. Twenty years after the river flow-closure by the Tucuruí Dam, a substantial reduction in fish-species richness occurred in the mid-Tocantins River. The main factor explaining this reduction may be associated with the lack of transference for fish from downriver to upriver. In addition, there is further evidence that the changes in the river channel modified not only species composition, but also size distribution of fish along the middle Tocantins River. It is estimated that only 20 percent of the species are large after the dam's closure.

There is vivid local fishery activity in the middle Tocantins, both professional and artisanal, with an interesting symbiosis between fishers and dolphins (*Ina geoffroyensis*), which are trained to herd the fish against fences, to be rewarded with some trapped fish. Fisheries on the mid-Tocantins have a seasonal pattern. Almost half of the total capture is concentrated from May to August. This fact could be explained by the low level of the Tocantins River in this period, in parallel with the increase in the density of fish assemblage and the presence of large beaches. Nonetheless, the closure of the Tucuruí Dam and others along the river also negatively influenced this activity.

The large commercial species have decreased in number and are qualitatively reduced in that area of the Tocantins. Although total species richness remained the same, changes in fish community occurred in the long term, such as the dominance of predatory species. Fishers also noticed that the Tucuruí Reservoir has led to an unprecedented increase in the abundance, length, and weight of some migratory fish species upstream of the dam. However, immediately after the closure of the reservoir in 1984, catches in the lower Tocantins

decreased by 65 percent in the two subsequent years. Climate change may impact the migratory patterns of some fish species as well, and alter the mix in varieties of fish that thrive in the different segments of the river.

The Tocantins-Araguaia region is an agricultural frontier and one of the most deforested regions of legal Amazonia. This region has been ravaged by fire, commercial logging, agriculture, and cattle raising, mainly following the roads. It is estimated that the Tocantins has lost about 50 percent of its forest cover. Although deforestation fuels the expansion of development frontiers, selective slashing of inundated trees in floodplains and riparian forests may pose a direct threat to fisheries. These changes affect the discharge of the river and patterns of flow and depth all along its length.

Conservation Efforts

Currently, there are only five protected areas in the basin. The 24,711-acre (10,000-hectare) biological reserve of Águas Emendadas and Chapada dos Veadeiros National Park protect the headwaters of the Tocantins River. The 1,388,732-acre (562,000-hectare) National Park and Indigenous Reserve of Araguaia preserves the middle Araguaian floodplains, whereas a small biological reserve north of Mocajuba preserves part of the lower Tocantins landscape.

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Further Reading

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Torngat Mountain Tundra

Category: Grassland, Tundra, and Human Biomes.

Geographic Location: North America.

Summary: This ancient and mountainous landscape at the northern extremity of the Labrador coast supports a pristine and fragile ecosystem.

The Torngat Mountain Tundra biome occupies northern Labrador and the western slopes of the Torngat Mountains in Quebec, Canada, covering 12,500 square miles (32,375 square kilometers). The region consists of steep mountains, deep U-shaped valleys, and impressive fjords carved by glaciers along the Labrador Sea. The valleys contain Arctic tundra shrubs and riparian willow and alder thickets. At higher elevations, vascular plant vegetation becomes increasingly sparse and transitions into a rocky landscape covered by moss and lichens.

The native Inuits refer to this region as *Torn-gait*, for "the place of the spirits." This name was derived from the presence of Torngarsoak, who was believed to control the life of the sea animals and took the form of a polar bear. The Torngat Mountain tundra has been home to the Inuit and their predecessors for thousands of years. The incredible and pristine Torngat wilderness is known for its impressive and deep fjords, the highest mountains east of the Rockies, the only tundra-dwelling black bears, and the southernmost denning of polar bears on the North American east coast. In January 2005, a significant part of this region became established and protected as Torngat Mountains National Park.