

# Marine Turtle Newsletter

## Sea Turtle Bycatch by *Cerco-fixo* in Cananéia Lagoon Estuarine Complex, São Paulo, Brazil

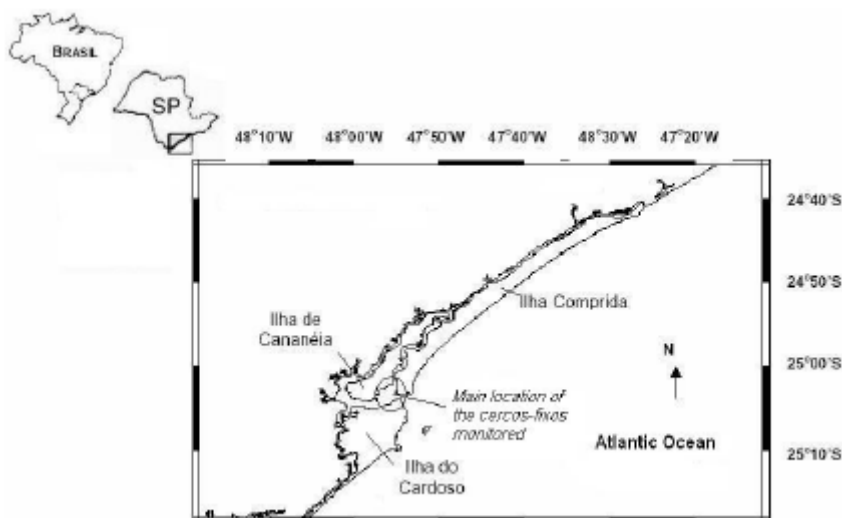
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The lagoon estuarine complex of Cananéia (25°S; 48°W) is located in the southern portion of São Paulo State, southeastern Brazil (Fig. 1). It falls within a larger protected area proclaimed a Natural World Heritage Site by UNESCO in 1999. It contains part of the last remains of the original Atlantic Forest that have great biodiversity. The long estuarine system has a muddy bottom and relatively turbid waters (Schaeffer-Novelli *et al.* 1990). It is surrounded by large areas of mangrove and contains high concentrations of nutrients, zooplankton, shrimp, and fish (Besnard 1950; Schaeffer-Novelli *et al.* 1990). These features, together with large beds of seagrasses and algae along the estuary, provide ideal foraging habitat for sea turtles.



**Figure 1.** Study area and the main location of the *cerco-fixos* monitored.

In the Cananéia lagoon estuarine complex, intensive fishery activities can be divided into two categories: the industrial or offshore fishery and the artisanal or inshore (lake estuarine) fishery (Mendonça 1998). The artisanal fishery employs the use of various fishing gears; however, the fixed fence trap, known locally as *cerco-fixo*, is the most frequently used and is socially and economically important in the region. The *cerco-fixo* dates back more than fifty years along the entire lagoon estuary, and currently more

than 90 traps are set in the region (Mendonça 1998). This gear targets mullets (*Mugil platanus*) and many other fish species (Dias 1990; Ramos *et al.* 1980). The *cercos-fixos* is placed perpendicular to the estuary borders and is comprised of three main parts: *espia*, *ganchos* and *casa-de-peixe* (Fig. 2). The *espia* is a fence that runs perpendicular to the shore and acts as a lead by conducting fish along into the *ganchos* and the *casa-de-peixe*. The *ganchos* and *casa-de-peixe* are enclosed areas where captured fish remain until they are removed by fishermen. The fish removal or *despesca* is accomplished periodically, usually once or twice per week. It is done at least by 2 fishermen who drag a smaller net inside the *casa-de-peixe*.

Location	Number of <i>cercos-fixos</i>	Number of turtles trapped
Ilha de Cananéia	4	16
Ilha do Cardoso	5	107
Ilha da Casca	1	13
Ilha Comprida	4	13
Unknown	-	14
<b>Total</b>	<b>14</b>	<b>163</b>

**Figure 2.** “*Cercos-fixos*” and its 3 main parts, from back to front: *espia*, *ganchos* and *casa-de-peixe*. Photo credit: Flávia C. Oliveira.

Unlike from the pound nets found in inshore waters along the east coast of the United States that are made with fiber netting (Epperly 1995; Mansfield 2006), *cercos-fixos* are constructed with vegetal material such as trees, palms and bamboos. Oliveira (2007) noted that the *cercos-fixos* fishermen (*cerqueiros*) are familiar with a great variety of Atlantic Forest plant species that are suitable for this kind of use; the species from the botanical family Myrtaceae appeared to be the most commonly used material for construction.

In addition to fish, juvenile sea turtles are often captured in *cercos-fixos* (Nagaoka *et al.*, 2005). It remains unclear whether the sea turtle captures are incidental or the result of the turtles searching for food. Captured turtles remain unharmed and stay inside the *cercos-fixos* until they are released by the fishermen. This situation presents a great opportunity to collect scientific data prior to releasing them. An important observation is that the sea turtles caught in *cercos-fixos* do not suffer injuries or lethal entanglement risks during the *despesca* due the small mesh size used (3 – 4.5cm). The similarity between *cercos-fixos* and pound net is that both have the potential to provide means of systematically studying an in-water sea turtle population (Epperly 1995). However, entanglement in large mesh pound net leaders is a threat to sea turtles in Virginia, USA (Mansfield 2006).



**Table 1.** Number of turtles trapped by *cercos-fixos* according to location in the study area.

Since 2003, we have been working with *cerqueiros* on different islands of Cananéia lagoon estuarine complex, including Ilha de Cananéia, Ilha do Cardoso, Ilha da Casca and Ilha Comprida, to monitor and record incidentally captured sea turtles. The turtles captured were measured (curved carapace length - CCL and curved carapace width - CCW), weighed and tagged with inconel tags (No. 681, National Band & Tag Co., USA) on both front flippers. For each turtle, we photographed the entire body including the post-orbital scales for a photo-identification study in additionally any abnormalities observed. We also collected tissue samples for genetic analyses and epibionts. Following this, the turtles were released.

From October 2004 through July 2007, 163 juveniles green turtles (*Chelonia mydas*) (mean CCL = 37.7cm  $\pm$  3.55 SD, mean CCW = 34.3cm  $\pm$  3.57 SD and mean weight = 5.9kg  $\pm$  2.06 SD) were captured in 14 *cercos-fixos* (Table 1). The capture location for 14 turtles were unknown, because the turtles had been relocated by fishermen to pools in Parque Estadual Ilha do Cardoso (Cardoso Island State Park) when we were not present. Following data collection, these 14 turtles were released immediately, except for four that needed some veterinary care. Over the duration of the study, 7 green turtles have been recaptured.

Due to logistic problems, the monitoring of *cercos-fixos* was sporadic, hindering estimates of catch per unit effort. Although our reported number of incidental captures in southern São Paulo is smaller than the >350 turtles per year captured incidentally by coastal fisheries in the northern coast of São Paulo (Gallo *et al.* 2006), our data nevertheless suggest that this is an important foraging area for juvenile green turtles. The size of green turtles encountered in our study (small juveniles) is consistent with the size class of turtles incidentally captured by pound nets in estuarine areas of North Carolina (Epperly *et al.* 2007), and slightly larger than the mean size of green turtles captured in northern São Paulo (Gallo *et al.* 2006). Small juvenile green turtles are commonly observed in coastal waters due to the foraging strategy of this size class (Mortimer 1982).

The highest number of individuals observed was in Ilha do Cardoso. This may have been due to better foraging conditions and/or increased fishing effort there. In addition, in our experience the greatest collaboration with fishers occurred in Ilha do Cardoso, which may have also facilitated greater efficiency of the data collection. Studies are underway to verify the extent of seagrass beds or other potential forage for green turtles in this location.

The recapture of seven out of tagged 163 individuals suggests that there is a considerable number of sea turtles transiting through and/or using the region for feeding and development. Indeed, some turtles are residents for at least several months, as we recaptured one individual 3 times in a nine month period. Also, we necropsied 13 dead stranded turtles found during monitoring of Ilha Comprida beach and observed seagrasses, algae and mangrove seeds in the gastrointestinal contents.

Overall, the frequent occurrence of green turtles in *cercos-fixos* has created an ideal means for monitoring these animals and their status in the study area, particularly because incidental capture in this gear is neither lethal nor harmful to the turtles. We intend to conduct studies on identifying the home ranges of juvenile green turtles, cataloguing critical foraging areas in the region, evaluating their feeding ecology, investigating the genetics of possible hybrids and to continuing the monitoring of incidentally captured sea turtles in the *cercos-fixos*. Most importantly, the support and collaboration of *cercos-fixos* fishermen is crucial to the collection of data by researchers.

*Acknowledgements:* This study was supported in part by funds from the PADI Foundation. We are grateful to Projeto TAMAR for providing the flipper tags, Natalia Bahia and Barbara De Loreto for fieldwork assistance and Karin Monteiro, Krista Fisk, Kerstin Kalchmayr and Matthew Godfrey for the English review and suggestions. License COTEC PROCESSO SMA Nº 40.607/2002 and license IBAMA/SISBIO 12711-1/2007. More photos from our studies are available in the Image Library of SEATURTLE.ORG: <<http://www.seaturtle.org/cgi-bin/imagelib/index.pl?user=6922&cat=500&thumb=1>>

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