



**Proposal for creation of a “zoning with regulation of use in the Cananéia estuarine-lagoon complex” aiming the conservation of the estuarine dolphin, *Sotalia guianensis* (van Bénédén) (Cetacea, Delphinidae)**

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**Abstract.** The increase in human activities in the coastal region has affected the stability of certain cetacean populations. In the Southeastern Brazilian coast, the populations of estuarine dolphins, *Sotalia guianensis* (van Bénédén, 1864) suffer strong pressure as a result of long exposure to pollution, reduction of habitats, by-catch and tourism. Since 1981, the Instituto de Pesquisas Cananéia (IPeC) studies the biology and ecology of the estuarine dolphin in the Cananéia-Paranaguá estuarine-lagoon complex. Since then, we have obtained information on group structure, population density, reproduction, foraging, behavior, acoustics, video identification and interactions with other species, including the local human community. These data indicates that the traffic of fishing boats does not interfere in the activities of the estuarine dolphin. However, small boats with outboard motor may interfere physically; through collisions with dolphins or stressing them, and also may interfere in their acoustic behavior. Therefore, with the intention of acting effectively in the conservation of the estuarine dolphin, without excluding human activities we formulated a proposal for creation of an area of "zoning with regulation of use" which consists in outlining sectors of greater density of dolphins in the Cananéia estuarine-lagoon complex.

**Key words:** Boats, tourist activities, human impact, acoustics, behavior, conservation.

**Resumo.** Proposta de criação de “zoneamento com regulamentação de uso no Complexo Estuarino Lagunar de Cananéia” visando à conservação do boto-cinza, *Sotalia guianensis* (van Bénédén) (Cetacea, Delphinidae). O aumento de ações humanas na região costeira tem afetado a estabilidade das populações de cetáceos. Nas baías da costa sudeste, as populações de boto-cinza, *Sotalia guianensis* (van Bénédén, 1864) vêm sofrendo forte pressão por estarem expostas à poluição, diminuição dos habitats, captura acidental e ao turismo. Desde 1981, o Instituto de Pesquisas Cananéia (IPeC) estuda a biologia e ecologia do boto-cinza no Complexo Estuarino Lagunar Cananéia/Paranaguá. Durante este período, obtivemos diferentes informações sobre estrutura de grupo, densidade populacional, reprodução,

alimentação, comportamento, acústica, videoidentificação e interações com outras espécies, incluindo comunidade local. Estes dados denotam que o tráfego de embarcações pesqueiras não interfere nas atividades do boto, mas que pequenas embarcações com motor de popa, podem interferir tanto impactando fisicamente os animais, estressando e colidindo com os mesmos, quanto no seu comportamento acústico. Assim, com o intuito de atuar efetivamente na conservação do boto-cinza, sem contudo, excluir atividades humanas, formulamos uma proposta de criação de uma área de “zoneamento com regulamentação de uso” que consiste na delimitação de setores de grande densidade de botos no Complexo Estuarino Lagunar Cananéia.

**Palavras-chave:** Atividades turísticas, embarcações, impactos humanos, acústica, comportamento, conservação.

## Introduction

Over the past decades, environmental questions have become the central focus of great world-wide discussions given that they are directly related to the maintenance of basic conditions of survival in our planet. Basic research must be the starter for such discussions. In Brazil, basic studies involving cetaceans have gained new perspectives with the publication of the Action Plan for Aquatic Mammals of Brazil (IBAMA 1997, 2001). Although the species *Sotalia fluviatilis* is classified in the category “data deficient” in this Action Plan, it is under strong anthropogenic pressure, such as pollution, loss of habitat, by-catch and intentional harassments by tourism and leisure boats (Siciliano 1994, Di Benedetto *et al.* 1998, Rosas 2000, Kajiwara *et al.* 2004, Kunito *et al.* 2004). The confirmation of two species of the genus *Sotalia* is recent (Monteiro-Filho *et al.* 2002, Cunha *et al.* 2005, Caballero *et al.* 2007) and the status of conservation of *S. guianensis* until now was not evaluated by the IUCN (IUCN 2007).

In the Cananéia estuary, southern coast of São Paulo State, the estuarine dolphin *S. guianensis* (van Béneden, 1864) is seen in a positive way by the local community. Especially considering the interaction displayed during foraging activities, in which the dolphin conducts shoals of fish to the “cerco-fixo” (a local traditional fish trap), helping the fishermen to capture the fish (Monteiro-Filho 1995). The species is also seen as a great tourism attraction in the region, which constitutes of an important source of income for the community. Although dolphin-watching tourism may promote economic benefits (IFAW 1995); it may disturb the balance in dolphins’ populations if it is not regulated (Coscarella *et al.* 2003). The EMBRATUR National Tourism Project (1992 *apud* Becker 1995) considers the southern coast of São Paulo State as one of the greatest areas of potential increase in nautical facilities, with the possibility of implantation of marinas in the coast.

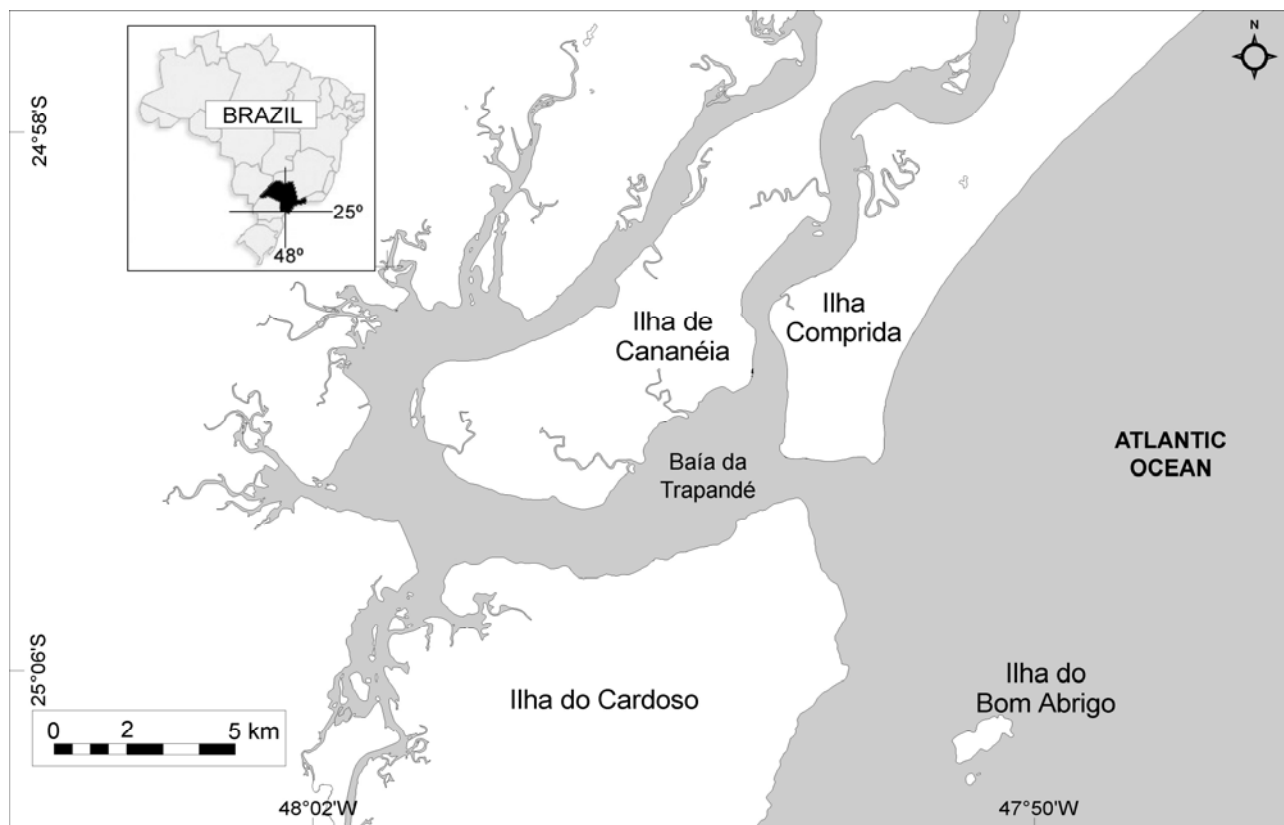
A team of 33 researchers has been investigating the estuarine dolphin in that area for the past 26 years, which enabled an effective monitoring of different aspects of the biology and ecology of this dolphin population. This kind of research is of fundamental importance so that we can suggest conservation proposals in the region where dolphins are present all year round; mating, nurturing their calves and feeding, including during the night. It is worth stressing that a good part of the studies developed by us follow the suggestions stated in the item “Projetos e Ações Prioritárias” (Projects and Priority Actions) from the Action Plan for Aquatic Mammals from Brazil (IBAMA 2001).

Considering this reality, and the fact that in the Cananéia estuarine-lagoon complex, the estuarine dolphin has been suffering impacts by human action, such as possible collisions with high speed boats; noise interference generated by boats (Gonçalves 2003, Rezende 2008), organochlorine contamination (Kajiwara *et al.* 2004, Kunito *et al.*, 2004), by-catch (Rosas 2000) and by the increase of the local tourism (Filla 2008); a proposal of zoning with regulation of use was elaborated aiming the protection and conservation of the population of estuarine dolphins inhabiting this area.

## Material and methods

### Study area

The Cananéia Estuarine-Lagoon Complex (Fig. 1) is located in the southern coast of São Paulo State. The region has 110km of extension, consisting of a protected channel (Mar Pequeno), a bay (Baía de Trapandé) and three islands (Ilha Comprida to the east, Ilha do Cardoso to the south and Ilha de Cananéia to the west), with narrow coves to the north (Barra do Icapará) and to the south (Barra de Cananéia). This estuarine system represents one of the most preserved ecosystems in the Brazilian coast and since it is part of a State and Federal Area of Environmental Protection, the complex is legally protected (Schaeffer-Novelli *et al.* 1990).



**Figure 1.** Cananéia estuarine-lagoon complex, southeastern Brazil: area where the zoning with regulation of use will take place. (Source: Domit, 2006).

### Research Procedures

The different studies regarding the biology and ecology of the estuarine dolphin were gathered with the intention of formulating a proposal of an area for the protection of the estuarine dolphin in the region of Cananéia. These studies are already available in different scientific journals and were carried out by the team of researchers working in the Estuarine Dolphin Project from 1981 to 2007.

Having all the data mentioned above and based on the present Brazilian legislation, we are contacting the Brazilian governmental agency responsible for the environmental policies (IBAMA-Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis) to make possible that the rules proposed herein can be implemented in the Estuarine region of Cananéia.

### Results

During the 26 years of estuarine dolphin research in Cananéia, many studies were carried out. The main results of the studies regarding the estuarine dolphin biology and ecology are shown in Table I.

After putting together the data collected and having contacted the IBAMA; it was possible to elaborate the "Proposal of zoning with regulation of use" for the Cananéia estuarine-lagoon complex

(Table II), where the sectors with greater densities of estuarine dolphins in the region are considered priority for the conservation of this species. In addition, the human activities occurring in these sectors should be monitored.

### Discussion

According to the Action Plan for Aquatic Mammals of Brazil (IBAMA 2001), the main threats that affect the genus are related directly to the destruction of habitats within its distribution area, including pollution resulting from industrial waste, toxic substances used in agriculture, river dam for both electricity production and irrigation, as well as the deforestation of riverbanks, lakes and mangrove areas. The increase of boat traffic and urban development in the coastal areas along with the mangroves and estuaries are gradually affecting the stability of dolphin's populations. In coastal bays along the Brazilian Southeast region the *Sotalia* populations are under severe human pressure resulting in exposition to the synergic effects of pollution, habitat loss, bycatch and intentional molesting by leisure and tourist boats. In the state of Santa Catarina, for instance, the unorganized and non regulated practice of cetacean observation tourism is also a threat to the local population (IBAMA 2001).

**Table I.** Themes developed during several studies on the biology, ecology and conservation of the estuarine dolphin, *S. guianensis*, in the Cananéia estuarine-lagoon complex, southern coast of São Paulo State, Brazil, with the respective sampling periods and results that contributed to the elaboration of the proposal of zoning with regulation of use in Cananéia.

Study Theme	Sampling Periods	Contribution for the proposal
Individual Identification	Two sampling periods: From 06/2001 to 08/2002; From 08/2004 to 08/2005.	48 individuals with natural marks on the dorsal fin, on the head and on the back were identified (De Oliveira & Monteiro-Filho <i>in press</i> ).
Density estimation	Two sampling periods: From 01/2001 to 09/2001; From 05/2003 to 05/2004.	Besides the estimation of the dolphin population, it was also possible to observe a difference in use and in spatial and temporal distribution by the dolphins (Bisi 2001, Havukainen 2004).
Reproductive biology	From 04/1997 to 10/1999	Size and age of sexual maturity, length of birth, time of gestation and lactation, fetal growth rate, reproductive cycle and observation of senescent ovaries in females above 25 years, were estimated. Promiscuous reproductive systems, with sperm competition were also observed (Rosas & Monteiro-Filho 2002, Rosas & Barreto <i>in press</i> ).
Pollution	From 04/1997 to 10/1999	Organochlorine values (DDT and PCBs) in the bubbler and hepatic concentrations, especially Cu and Zn, were detected in similar levels to what was found in dolphins from highly industrialized regions (Kajiwara <i>et al.</i> 2004, Kunito <i>et al.</i> 2004).
Behavior	Two sampling periods: From 1981 to 1991 From 01/2004 to 07/2005.	The behavioral studies demonstrated the great importance of the Cananéia estuary for the performance of elaborated and complex foraging strategies, with many different patterns performed individually or in associations (Monteiro-Filho 1992, Rautenberg & Monteiro-Filho <i>in press</i> ).
Infant's Behavior	From 1981 to 2005.	The results demonstrated that calves have great variation of behavioral patterns in different ages. They occur in different frequencies and were grouped in eleven categories (Domit 2002, 2006, Monteiro-Filho <i>et al. in press</i> ).
Group Structure	From 1984 to 1999	Describes the category "family" as the most frequent grouping in the estuarine dolphin in Cananéia (Monteiro-Filho 2000).
Nocturnal Activities	1) Behavior: from 03/2003 to 10/2003; 2) Acoustics: from 08/2002 to 07/2005.	During the nocturnal period, the dolphins, including calves, remain in the region of Cananéia engaged in feeding activities and demonstrating great acoustic activity (Atem & Monteiro-Filho 2006, Oliveira <i>et al. in press a</i> ).
Strandings on beaches in the region	Since 1981	Information collected since the beginning of the project. The specimens are deposited in the collections of the Museum of Natural History of UNICAMP (ZUEC) and at Instituto de Pesquisas Cananéia (IPeC).
Skull morphometric analysis	From 1998 to 2001	The data collected in this study support the description of two species for the <i>Sotalia</i> genus (Monteiro-Filho <i>et al.</i> 2002).
Ethnic knowledge	From 2001 to 2006	Diagnosis of specific traditional knowledge about the species, as well as, the local communities' socio-environmental needs (Oliveira & Monteiro-Filho 2006, Oliveira <i>et al. in press b</i> ).
Interaction with local fishermen community	From 1982 to 1990	Description of the interactions between dolphins and fishermen, especially close to the "cercos-fixos" (traditional fish trap) (Monteiro-Filho 1995).
Acoustics	From 1989 to 1998	Four categories of sound emissions were described (Monteiro-Filho & Monteiro 2001).
Acoustic and vessel interference	Two sampling periods: From 1998 to 2000 From 06/2002 to 01/2003	The sound produced by outboard motor boats interferes in the dolphin's sound emission and behavior (Gonçalves 2003, Rezende 2008).
Impact of touristic activities	From 12/2004 to 03/2007.	Just as the acoustics, preliminary results about the impact of tourism show that small (and high speed) boats with outboard motors cause immediate reaction by the dolphins (Filla 2008).

**Table II.** Items that compose the "Proposal of zoning with regulation of use" in the Cananéia Estuarine-Lagoon Complex, submitted to the IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis).

<i>Item</i>	<i>Proposal</i>
Boat Traffic	Aluminum boats with outboard motor should transit in low speed whenever a dolphin is seen from a distance of 500 m, therefore, reducing the impact generated by the noise of the engine, and allowing the boats to be sighted from certain distance. All boats should keep a minimum distance of 50 meters from the animals and if/when the animal are being watched, they should keep the engines on neutral so that their presence and localization are easily noticeable by the animals. Never, under any circumstances, should the animals be separated from the group, especially calves from their mothers.
Nautical Sports	Jet-ski and water-ski should be avoided in the region, and totally forbidden in the areas of major occurrence of estuarine dolphins, which should be marked with signaling buoys.
Tourism	Avoid changing direction of the boats when aiming to get closer or to follow an animal or group. The total time of observation of the same group of dolphins is limited to a maximum of 30 minutes. A maximum of 03 boats can stay close (less than 100m) to the same group of dolphins at the same time.
Scientific studied	Exceptionally, scientific research involving estuarine dolphins is allowed. Approaching cetaceans with boats and aircrafts can be done exclusively with scientific purposes. Invasive scientific research or biopsy techniques that perforate or remove living animal tissues without contention should be avoided at all costs and can only take place with official authorization from the Conservation Unit corresponding to the Federal Office in charge (IBAMA).
Responsibilities	The responsibility for breaking the rules must be attributed to the conductors of the boats and their owners.
Monitoring	A continuous monitoring of all nautical activities in the region should occur and the results of this monitoring should be forwarded to the local environmental authorities.

Continuous efforts which enable the monitoring, in an effective way, of different biological and ecological aspects of the estuarine dolphin populations, are of fundamental importance so we can base conservation proposals. This is the case of the Cananéia region where the dolphins are present throughout the year. The animals use the area to breed, feed and nurture their calves, and are very active including during the night (Monteiro-Filho 1992, Rosas & Monteiro-Filho 2002, Atem & Monteiro-Filho 2006, Monteiro-Filho *et al.* in press, Oliveira *et al.* in press a, Rautenberg & Monteiro-Filho in press, Rosas & Barreto in press). In this area, the estuarine dolphin also interacts with the traditional local communities (Monteiro-Filho 1995).

Regarding the impact evaluation, studies involving acoustic and monitoring of the tourism activities in the region point out to a negative impact when small sized boats with outboard motors are present in the area. The noise emitted by this kind of boat has been shown to make the dolphins swim away from the boat (avoidance reaction) or even cause change in the acoustic niche (Gonçalves, 2003, Rezende 2008). Moreover, the increase in boat

traffic is of great concern in some regions across the Brazilian coast (Valle & Melo 2006, Santos-Jr *et al.* 2006) since it may cause serious damage to the dolphin populations and may push the dolphins to abandon the area such as already has happened on other locations in the world (Watkins 1986 Richardson *et al.* 1995, Ritter 2002, Magalhães *et al.* 2002, Coscarella *et al.* 2003, Lusseau 2003, Ng & Leung 2003).

Studies concerning population density in different places have shown alarming rates of abandonment of area for certain cetacean species. For *S. guianensis*, two records of abandonment of area are reported. The first one was within the northern limit of its geographic distribution (Edwards & Schnell 2001) and the other nearby the southern limit (Filla 2004). In both cases the most likely cause for the abandoning of the area was the increase in human activities, especially the increase in boat traffic. Recent studies with this species, such as those carried out by Gonçalves (2003) and Rezende (2008), in Cananéia (SP) and Keinert (2006) Ilha das Peças Island (PR), have shown that not only the exaggerated proximity of the boats is damaging, but also the sound

produced by their engine can be harmful to the dolphin's population. The above-mentioned studies analyzed boats with central engine (diesel) and boats with outboard motor (petrol), showing that the acoustic emissions registered are within the *S. guianensis* acoustic range. As a result the increase in traffic may cause serious damage to the dolphins' population and force them to abandon the area.

One of the most serious consequences of the interaction of cetaceans with high speed boats is the possibility of collision. According to Ana Rita dos Santos Lopes (personal observations) 17.26% of the estuarine dolphins found in the beaches along the Cananéia region, over the past six years, showed evidences of crash with boats (scars, recent cuts and/or bruises and bleeding).

One way of protecting marine habitats is to create small protection areas, with special attention to particularly valuable places for certain species which offer great benefits for the local communities. The planning for marine protected areas should contain initiatives that have influence in the decisive processes within the society. In that sense, it is necessary to motivate the government, the people from the local communities, and national and international organizations to conserve the biological diversity and the cultural integrity (IUCN 2002).

Hence, an area of protection of zoning with regulation of use in the region of Cananéia is proposed herein following the orientations of the IUCN (1999) guide for marine protection areas. This work is a concrete and ethically consistent proposal to conserve the species, and does not exclude the human activities (Filla *et al.* 2002, Filla & Monteiro-Filho 2006), avoiding conflicts and bad utilization of the conservation areas such as those reported by Wedekin *et al.* (2002) in the Santa Catarina State and by Silva & Silva Jr. (2002) in the Fernando de Noronha Arquipelago.

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### References

- Atem, A. C. G. & Monteiro-Filho, E. L. A. 2006. Nocturnal Activity of the Estuarine Dolphin (*Sotalia guianensis*) (Cetacea, Delphinidae) in the Region of Cananéia, São Paulo State, Brazil. **Aquatic Mammals**, 32(2): 236-241.
- Becker B. K. 1995. **Levantamento e avaliação da Política Federal de Turismo e seu impacto na região costeira**. Série Gerenciamento Costeiro, Vol. 3. Ministério do Meio Ambiente/PNMA, Brasília, Brazil, 50p.
- Bisi, T. L. 2001. Estimativa da densidade populacional do boto-cinza *Sotalia guianensis* (Cetacea, Delphinidae) na região estuarina lagunar de Cananéia, SP. **Bachelor Thesis**. Universidade Estadual Paulista Júlio de Mesquita Filho. Rio Claro, Brazil, 35p.
- Caballero, S., Trujillo, F., Vianna, J. A., Barrios-Garrido, H., Montiel, M. G., Beltrán-Pedrerros, S., Marmontel, M., Santos, M. C., Rossi-Santos, M., Santos, F. R. & Baker, C. S. 2007. Taxonomic status of the genus *Sotalia*: species level ranking for "tucuxi" (*Sotalia fluviatilis*) and "costero" (*Sotalia guianensis*) dolphins. **Marine Mammals Science**, 23(2): 358-386.
- Coscarella, M. A., Dans, S. L., Crespo, E. A. & Pedraza, S. N. 2003. Potential impact of unregulated dolphin watching activities in Patagonia. **Journal of Cetaceans Research and Management**, 5(1): 77-84.
- Cunha, H. A., Da Silva, V. M. F., Lailson-Brito Jr, J., Santos, M. C. O., Flores, P. A., Martin, A. R., Azevedo, A. F., Fragoso, A. B. L., Zanelatto, R. C. & Solé-Cava, A. M. 2005. Riverine and marine ecotypes of *Sotalia dolphins* are different species. **Marine Biology**, 148: 449-457.
- De Oliveira, L. V. & Monteiro-Filho, E. L. A. 2008. Individual identification and habitat use by the estuarine dolphin, *Sotalia guianensis*, (Cetacea, Delphinidae) through video images on Cananéia region, Southeast Brazil. **Journal of the Marine Biological Association of the United Kingdom**. (in press).
- Di Benedetto, A. P. M., Ramos, R. M. A. & Lima, N. R. W. 1998. Fishing activity in northern Rio de Janeiro State (Brazil) and its relation with small cetaceans. **Brazilian Archives of Biology and Technology**, 41(3): 296-302.
- Domit, C. 2002. Comportamento de filhotes de *Sotalia guianensis* (CETACEA: DELPHINIDAE), na região do Complexo

- Estuarino Lagunar de Cananéia, São Paulo. **Bachelor Thesis.** Universidade Estadual de Londrina, Londrina, Brazil, 86p.
- Domit, C. 2006. Comportamento de pesca do boto-cinza, *Sotalia guianensis* (van Benédén, 1864). **Master Thesis.** Universidade Federal do Paraná, Curitiba, Brazil, 96p.
- Edwards, H. H. & Schnell, G. D. 2001. Status and ecology of *Sotalia fluviatilis* in the Cayos Miskito Reserve, Nicaragua. **Marine Mammals Science**, 17(3): 445-472.
- Filla, G. F. 2004. Estimativa da densidade populacional e estrutura de agrupamento do boto-cinza *Sotalia guianensis* (Cetacea: Delphinidae) na baía de Guaratuba e na porção norte do Complexo Estuarino da Baía de Paranaguá, PR. **Master Thesis.** Universidade Federal do Paraná, Curitiba, Brazil, 67p.
- Filla, G. F. 2008. Monitoramento das interações entre o boto-cinza, *Sotalia guianensis* (van Benédén, 1864), e atividades de turismo no Complexo Estuarino-Lagunar de Cananéia, litoral sul do Estado de São Paulo. **PhD Thesis.** Universidade Federal do Paraná, Curitiba, Brazil, 159p.
- Filla, G. F., Monteiro-Filho, E. L. A., Rautenberg, M., Rezende, F., Bernardi, L. R., Monteiro, K. D. K. A., Oliveira, F., Bisi, T. L., De Oliveira, L. V., Rodrigues, R. G. & Domit, C. 2002. Projeto Boto-cinza: o desenvolvimento de um programa de caráter interdisciplinar como modelo para futuras propostas de conservação de cetáceos no Brasil. **10<sup>a</sup> Reunion de Trabajo de Especialistas en Mamíferos Acuáticos de America del Sur & 4<sup>o</sup> Congreso SOLAMAC (Sociedade Latino Americana de Especialistas em Mamíferos Aquáticos)**, Valdivia, Chile, 83p.
- Filla, G. F. & Monteiro-Filho, E. L. A. 2006. Proposal of creation of protection area to conservation of estuarine dolphin (*Sotalia guianensis*) in the Complexo Estuarino Lagunar Cananéia/ Paranaguá. **Workshop Internacional sobre Pesquisa e Conservação dos Golfinhos do Gênero Sotalia**, Armação dos Búzios, Rio de Janeiro, Brazil, 62p.
- Gonçalves, M. 2003. Interações entre embarcações e *Sotalia guianensis* (Cetacea: Delphinidae), no estuário de Cananéia, Estado de São Paulo, Brasil. **Bachelor Thesis.** Universidade dos Açores. Portugal, 47p.
- Havukainen, L. 2004. Estimativa da densidade populacional do Boto-cinza *Sotalia guianensis* (Cetacea: Delphinidae), na Baía de Trapandé, no Município de Cananéia, litoral sul do Estado de São Paulo. **Bachelor Thesis.** Universidade de Mogi das Cruzes-UMC, Mogi das Cruzes, Brazil, 27p.
- IFAW, International Fund for Animal Welfare. 1995. **Report of the Workshop on the Scientific Aspects of Managing Whalewatching.** Montecastello di Vibio, Italy, 1-40.
- IBAMA, Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis. 1997. **Mamíferos Aquáticos do Brasil: Plano de Ação.** Diretoria de Ecossistemas/ Departamento de Vida Silvestre (Ed.), Brasília, Brazil, 79p.
- IBAMA, Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis. 2001. **Mamíferos Aquáticos do Brasil: Plano de Ação. Versão II.** Diretoria de Fauna e dos Recursos Pesqueiros/IBAMA (Ed.), Brasília, Brazil, 96p.
- IUCN, The World Conservation Union. 1999. **Guidelines for Marine Protected Areas. World Commission on Protected Areas; Best Practice Protected Area Guidelines Series**, 3: 1-126.
- IUCN, The World Conservation Union. 2002. **Sustainable Tourism in Protected Areas, Guidelines for Planning and Management. World Commission on Protected Areas (WCPA), Best Practice Protected Area Guidelines Series**, 8: 1-190.
- IUCN, The World Conservation Union. 2007. **The 2007 IUCN Red List of Threatened Animals. The IUCN Species Survival Commission, 2000**, accessible at <http://www.redlist.org>. Accessed 10/01/2007.
- Kajiwara, N., Matsuoka, S., Iwata, H., Tanabe, S., Rosas, F. C. W., Fillmann, G. & Readman, J. W. 2004. Contamination by Persistent Organochlorines in Cetaceans Stranded along Brazilian Coastal Waters. **Archives of Environmental Contamination and Toxicology**, 46(1): 124-134.
- Keinert, A. C. 2006. Análise dos ruídos produzidos por embarcações sobre uma população de boto-cinza, *Sotalia guianensis* (Cetacea, Delphinidae) no Estado do Paraná. **Bachelor Thesis.** Universidade Federal do Paraná, Curitiba, Brazil, 34p.
- Kunito, T., Nakamura, S., Ikemoto, T., Anan, Y., Kubota, R., Tanabe, S., Rosas, F. C. W.,

- Fillmann, G. & Readman, J. W. 2004. Concentration and subcellular distribution of trace elements in liver of small cetaceans incidentally caught along the Brazilian coast. **Marine Pollution Bulletin**, 49: 574-587.
- Lusseau, D. 2003. Effects of tour boats on the behavior of bottlenose dolphins: using Markov Chains to model anthropogenic impacts. **Conservation Biology**, 17(6): 1785-1793.
- Monteiro-Filho, E. L. A. 1992. Pesca associada entre golfinhos e aves marinhas. **Revista Brasileira de Zoologia**, 9: 29-37.
- Monteiro-Filho, E. L. A. 1995. Pesca interativa entre o golfinho *Sotalia f. guianensis* e a comunidade pesqueira de Cananéia. **Boletim do Instituto de Pesca de São Paulo**, 22(2): 15-23.
- Monteiro-Filho, E. L. A. 2000. Group organization of the dolphin *Sotalia fluviatilis guianensis* in an estuary of southeastern Brazil. **Ciência e Cultura Journal of the Brazilian Association for the Advancement of Science**, 52(2):97-101.
- Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. 2001. Sounds of *Sotalia fluviatilis guianensis* (Cetacea: Delphinidae) in an estuarine region in southeastern Brazil. **Canadian Journal of Zoology**, 79(1): 59-66.
- Monteiro-Filho, E. L. A., Reis, S. F. & Monteiro, L. 2002. Skull shape and size divergence in dolphins do the genus *Sotalia*: A tridimensional morphometric analysis. **Journal of Mammalogy**, 83(1): 125-134.
- Monteiro-Filho, E. L. A., Neto, M. M. S. & Domit, C. 2008. Comportamento de filhotes. Chapter 11 in: Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. (Eds). **Biologia, ecologia e conservação do boto-cinza**. Páginas & Letras Editora e Gráfica LTDA, São Paulo, Brazil. (in press).
- Magalhães, S., Prieto, R., Silva, M. A., Gonçalves, J., Afonso-Dias, M. & Santos, R. 2002. Short-term reactions of sperm whales (*Physeter macrocephalus*) to whale-watching vessels in the Azores. **Aquatic Mammals**, 28(3): 267-274.
- Ng, S. L. & Leung, S. 2003. Behavioral response of Indo-Pacific humpback dolphin (*Sousa chinensis*) to vessel traffic. **Marine Environmental Research**, 56: 555-567.
- Oliveira, F. & Monteiro-Filho, E. L. A. 2006. Relação entre pescadores e botos na região de Cananéia: olhar e percepção caiçara. PP. 253-270. In: Diegues, A. C. S. (Ed.). **Enciclopédia caiçara. Festas, lendas e mitos caiçaras**. Hucitec, São Paulo: Hucitec, 414p.
- Oliveira, F., Rodrigues, R. G. & Monteiro-Filho, E. L. A. 2008a. Atividade noturna. Chapter 13. In: Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. (Eds). **Biologia, ecologia e conservação do boto-cinza**. Páginas & Letras Editora e Gráfica LTDA, São Paulo, Brazil. (in press).
- Oliveira, F., Beccato, M. A. B., Nordi, N. & Monteiro-Filho, E. L. A. 2008b. Etnobiologia: Interfaces entre os conhecimentos tradicional e científico. Chapter 19. In: Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. (Eds). **Biologia, ecologia e conservação do boto-cinza**. Páginas & Letras Editora e Gráfica LTDA, São Paulo, Brazil. (in press).
- Rautenberg, M. & Monteiro-Filho, E. L. A. 2008. Cuidado Parental. Chapter 12. In: Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. (Eds). **Biologia, ecologia e conservação do boto-cinza**. Páginas & Letras Editora e Gráfica LTDA, São Paulo, Brazil. (in press).
- Rezende, F. 2008. Alterações acústico comportamentais. Chapter 04. In: Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. (Eds). **Biologia, ecologia e conservação do boto-cinza**. Páginas & Letras Editora e Gráfica LTDA, São Paulo, Brazil. (in press).
- Richardson, W. J., Finley, K. J., Miller, G. W., Davis, R. D. & Koski, W. R. 1995. Feeding, social and migration behavior of bowhead whales *Balaena mysticetus*, in Baffin Bay VS. The Beaufort Sea – regions with different amounts of human activity. **Marine Mammals Science**, 11(1):1-45.
- Ritter, F. 2002. Behavioural observations of rough-toothed dolphins (*Steno bredanensis*) off La Gomera, Canary Islands (1995-2000) with special reference to their interactions with humans. **Aquatic Mammals**, 28(1): 46-59.
- Rosas, F. C. W. 2000. Interações com a pesca, mortalidade, idade, reprodução e crescimento de *Sotalia guianensis* e *Pontoporia blainvillei* (Cetacea, Delphinidae e Pontoporiidae) no litoral sul do Estado de São Paulo e litoral do Estado do Paraná, Brasil. **PhD Thesis**. Universidade Federal do Paraná, Curitiba, Brazil, 145p.
- Rosas, F. C. W. & Monteiro-Filho, E. L. A. 2002. Reproduction of the estuarine dolphin (*Sotalia guianensis*) on the coast of Paraná, southern Brazil. **Journal of Mammalogy**, 83(2): 507-



- 515.
- Rosas, F. C. W. & Barreto, A. S. 2008. Reprodução e Crescimento. Chapter 05. In: Monteiro-Filho, E. L. A. & Monteiro, K. D. K. A. (Eds). **Biologia, ecologia e conservação do boto-cinza**. Páginas & Letras Editora e Gráfica LTDA, São Paulo, Brazil. (in press).
- Santos-Jr, É., Pansard, K. C., Yamamoto, M. E. & Chellappa, S. 2006. Comportamento do boto-cinza, *Sotalia guianensis* (Van Benédén) (Cetacea, Delphinidae) na presença de barcos de turismo na Praia de Pipa, Rio Grande do Norte, Brasil. **Revista Brasileira de Zoologia**, 23(3): 661-666.
- Schaeffer-Novelli, Y., Mesquita, H. S. L. & Cintrón-Molero, G. 1990. The Cananéia Lagoon Estuarine System, São Paulo, Brazil. **Estuaries**, 13(2): 193-203.
- Siciliano, S. 1994. Review of small cetaceans and fishery interactions in coastal waters of Brazil. In: Perrin, W. F. Donovan, G. P. & Barlow, J. (Eds.). **Gillnets and cetaceans. Report of the International Whaling Commission**. Special Issue 15: 241-250.
- Silva, F. J. L. & Silva Jr, J. M. 2002. Incremento do turismo e implicações na conservação dos golfinhos rotadores no Parque Nacional Marinho de Fernando de Noronha. **III Congresso Brasileiro de Unidades de Conservação**, Fortaleza, Brazil, 135-144.
- Valle, A. L. & Melo, F. C. C. 2006. Alterações comportamentais do golfinho *Sotalia guianensis* (Gervais, 1953) provocadas por embarcações. **Biotemas**, 19(1): 75-80.
- Watkins, W. A. 1986. Whale reactions to human activities in Cape Cod waters. **Marine Mammal Science**, 2(4):251-262.
- Wedekin, L., Daura-Jorge, F. G. & Simões-Lopes, P. C., 2002. Desenhos de unidades de conservação marinhas com cetáceos: estudo do caso do boto-cinza *Sotalia guianensis*, na Baía Norte de Santa Catarina, sul do Brasil. **III Congresso Brasileiro de Unidades de Conservação**, Fortaleza, Brazil, 56-62.

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