Coastal dolphin hunting in the southwest of Madagascar: status of populations, human impacts and conservation actions

SALVATORE CERCHIO[1], NORBERT ANDRIANARIVELO[1,2], YVETTE RAZAFINDRAKOTO[1,2] MARTIN MENDEZ[1,3], AND HOWARD C. ROSENBAUM[1]

[1]*Wildlife Conservation Society, Ocean Giants Program, 2300 Southern Blvd, Bronx, NY, USA*
[2]*Wildlife Conservation Society, Madagascar Country Program, B.P. 8500 Soavimbahoaka, Antananarivo 101, Madagascar*
[3]*Columbia University, EEEB,*

ABSTRACT

In the southwest of Madagascar, traditional Vezo fishermen opportunistically hunt coastal dolphins for local consumption and sale of meat. Interviews of fishermen from the village of Anakao suggest that over 6000 individuals were slaughtered between 1985 and 2000, with 57% of takes occurring after 1995. Species most impacted were spinner, Indo-Pacific bottlenose and Indo-Pacific humpback dolphins, all having a strong coastal distribution and thus vulnerable to traditional hunting. In 2005, a drive hunt of 100-200 spinner dolphins was reported, supporting the figures reported in the interviews. Between 2004 and 2007, boat-based surveys were conducted in this region to establish status of cetacean populations. Eight species of dolphins and two species of baleen whales were observed. At least five deep-water dolphin species were documented highlighting the diversity and ecological importance of the region. Distributions of the three targeted species were primarily coastal and encounter rates very low. In 2008, similar surveys were conducted around Nosy Be in the northwest, where Sakalava fishermen are thought to not hunt dolphins. Group size of humpback dolphins was three-fold larger and individual encounter rate six-fold greater in Nosy Be as compared to Anakao. This dramatic difference suggests that the Nosy Be population is relatively healthy and provides further evidence for the depletion of southwest populations. In response to the apparent impact on dolphins, we have initiated a program of education and awareness-raising, and implemented a series of stakeholder workshops to promote economic alternatives to dolphin hunting in the southwest. This has resulted in the creation of a local Association formed of community stakeholders, with the explicit goals of cetacean conservation, economic advancement and development of community-based ecotourism in a region with a rapidly developing tourism industry. In addition, we are currently exploring the design of MPAs aimed to serve as resilient areas of marine life.

BACKGROUND

There are currently very limited data available on cetaceans off the coasts of Madagascar, regarding species diversity, status of populations, and utilization by coastal village communities. In the southwestern Toliara/Anakao region, the Wildlife Conservation Society initiated research on cetacean biology and the anthropogenic impact on these taxa in 1999. Our recent work indicates that at least ten species inhabit this Southwestern region, suggesting that it is a true hotspot for cetacean diversity, comparable to other areas on the globe known for high cetacean diversity. We also found that dolphin populations are regularly impacted by humans, with local fishermen conducting unsustainable hunting off the villages of Anakao, Soalara and St.

Augustine, part of the Toliara Barrier Reef system (see Figure 1). In an ecosystem that is already stressed by climate change and overharvesting, we believe that synergistic effects of hunting and further environmental change make these populations and the ecosystem particularly vulnerable. To address the hunting threat, the WCS team initiated a program of monitoring and assessment surveys to evaluate the diversity and status of cetaceans in the region and assess anthropogenic impact, followed by a series of community actions to raise awareness and introduce conservation practices.

FISHERMEN INTERVIEW WORK

Initial work in the southwest region began in 1999 with interview surveys by Norbert Andrianarivelo, which indicated extensive hunting of coastal dolphins by Anakao fishermen (Andrianarivelo 2001). It was established that traditional Vezo fishermen opportunistically hunt coastal dolphins for local consumption and sale of meat. Hunting is apparently associated with a period of the year when fishermen aggregate in relatively large numbers to fish for Bonefish *Albula vulpes,* and Indian anchovy, *Stolephorus indicus*, typically between August and December. Fishermen thus have the opportunity to cooperate for corralling and hunting dolphins travelling nearby (a "drive" hunt). It was estimated that over 6200 individuals were taken over a 15 year period from a single village, Anakao (Table 1), with a substantial increase in catches evident during 1995-1999 accounting for 57% of all catches (Figure 2) (Andrianarivelo 2001). This suggested a change in intensity of hunting and impact on populations, possibly associated with a change in hunting technique (using nets) in the mid to late 1980's, and depletion of other food resources (e.g., decrease in fish populations) and subsequent increased adoption of cetacean hunting and consumption through the 1990's. Dolphin species most often taken were spinner dolphins (*Stenella longirostris*), Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) and Indo-Pacific humpback dolphins (*Sousa chinensis*), each having a strong coastal distribution and thus vulnerable to traditional hunting. This work was expanded in 2004 and 2005 by Yvette Razafindrakoto and Mr. Andrianarivelo, assessing hunting and by-catch of cetaceans on a broader regional scale, including other surrounding villages (see Figure 1; Razafindrakoto et al 2009). These interviews supported the findings of the earlier work, and indicated that while there was some by-catch, it was likely much less impactful than the directed hunts.

In October 2005, we documented the drive hunt of a pod of spinner dolphins which resulted in the taking of approximately 100-200 individuals, based upon a range of first-hand accounts. The finding of such a large number of individuals taken in a single hunting event validated numbers that were estimated from interviews. Reports indicated that fishermen first drove the pod up against and on top of a barrier reef during high tide, then set a net around the pod to prevent them from escaping. After the tide receded, the pod stranded on the reef and the fishermen killed and butchered them. Meat was distributed among the members of the village of Anakao, and brought to neighboring villages for sale. The carcasses and excess where immediately buried, apparently in an attempt to conceal the event. Killing of dolphins has been illegal since 2002, and the fishermen are aware of this. Our team was not at the specific hunt site on the day it occurred. Although they were living in the village at the time, and actively conducting interviews and doing boat work, the event was concealed from them for two days. It was only discovered when Andrianarivelo discovered dolphin meat in a village home. A series of interviews with trusted members of the community revealed the details described, which were further validated by

reports from several western hotel operators that also witnessed the event. The clandestine nature of the hunting event raises particular concern.

VESSEL SURVEY WORK

Between 2004 and 2007, boat-based surveys were conducted to establish status of cetacean populations in the region covering approximately 60km of coastline (approximately 1 to 2 months of effort per year). Eight species of dolphins and two species of baleen whales were observed (Figure 3). Distributions of the three species targeted in hunts were primarily coastal (Figure 3a) and encounter rates very low. Other species of dolphins were found further offshore with typically larger group sizes, but were sighted infrequently (Figure 3b).

The major findings of this vessel survey work can be summarized as:

1. High cetacean diversity in the southwest region, highlighting the ecological importance of the area.
2. Low encounter rates of coastal dolphins, suggesting the negative effects of human hunting pressure and depletion of populations.
3. High encounter rate of humpback whales during the breeding season, indicating that the region is an active breeding area and therefore holds potential for a thriving whale-watching industry.

In addition to this work in the southwest, vessel surveys were conducted in the northwest region of Nosy Be during 2007 (5 days of effort) and 2008 (3 weeks of effort). During these surveys there were daily encounters with Indo-Pacific humpback dolphins and Indo-Pacific bottlenose dolphins (Figure 4). Mean group size for humpback dolphins was three times larger in the Nosy Be region than in the Anakao region (Figure 5). Encounter rate for groups of humpback dolphins in Nosy Be was nearly twice as high, together with group size resulting in an encounter rate for individuals that was six times greater (Figure 6a). For bottlenose dolphins, the group encounter rate was similar between regions; however, group size and individual encounter rate was 50% larger in Nosy Be (Figures 5 and 6b). Initial interviews with Sakalava fishermen in the Nosy Be region suggest an absence of directed hunting on these populations. There are two major implications for these preliminary results. First, this provides comparative evidence for the impact of hunting in the southwest, particularly on humpback dolphins. Second, these data suggest that the populations around Nosy Be are relatively healthy and thus a good candidate for protection under a Marine Protected Area designation.

COMMUNITY OUTREACH

After 3 years of population assessment work in the Anakao region, it was apparent that sighting frequency and funding were too low to expect to statistically document a negative trend in population status of the coastal dolphin species. Conversely, it was clear that these populations were being heavily impacted and the hunting pressure was likely unsustainable. In response to the apparent impact on dolphin populations, we have initiated a program of education, awareness-raising and workshops bringing together all stakeholder groups in the region to promote economic alternatives to dolphin hunting. This has resulted in the creation of a local

Association, formed of community stakeholders with the explicit goals of cetacean conservation, economic advancement and development of community-based ecotourism in a region with a rapidly developing tourism industry.

In October 2007, WCS in conjunction with ANGAP (the Malagasy National Parks Administration) organized a community-based workshop on dolphin conservation, with the participation of stakeholders from the main local communities, NGOs, government, and tourism industry. The primary goals of the workshop were to educate the diverse array of stakeholders on dolphin conservation, involve them in the solutions, and introduce the concept of ecotourism and whale-watching as an economic alternative to hunting and a viable source of economic growth and development for the community. The participants developed an Action Plan that included the development of ecotourism initiatives.

In March 2008, WCS and ANGAP coordinated a second workshop to develop the concept of a community-based whale-watching, which would involve all stakeholders and ensure responsible whale-watching activities and equitable dissemination of ecotourism profits throughout the community. A smaller subset of stakeholders, aimed more specifically at community-based groups and leaders, decided upon the creation of Fikambanana Miaro ny Trozo sy Fesotse (FMTF), the [Anakao] Association for the Protection of Whales and Dolphins. The specific objective of the association is to "Increase the standard of life of the local population by the promotion of eco-tourism and the protection of the marine environment". The explicit goals and responsibilities established by the members of the FMTF are:

1. Identify sustainable ways to generate income for the community
2. Raise awareness about whale and dolphin conservation.
3. Develop, validate and instate local laws or "*Dina*" governing whale and dolphin conservation and ecotourism.
4. Control and manage activities relating to ecotourism.
5. Raise funds for training of local guides and boat drivers for whale-watching activities.

Several steps and tasks were identified in the Action Plan to be carried out over the following several months/year, including establishment of membership and a board of directors, a schedule of meetings for proposing, vetting and instating the *Dina*, coordinating with the local hotel operators to establish a role for them in the association, and working with WCS and other NGOs for guidance and support in the creation of regulations and training of operators. The community has taken bold and encouraging steps to promote their own economic advancement and the development of ecotourism in their community. The success of these plans and the ultimate success of community-based ecotourism in the region will in part depend upon continued support and guidance from the NGO and government sectors over the coming years.

SIGNIFICANCE

This study has particular relevance for conservation of the land-sea interface in that it deals with a traditional maritime cultural group in Madagascar, that has for centuries subsisted off marine resources, and now is faced with depletion of those resources (in this case coastal dolphins; however there is a general issue of habitat degradation and fisheries depletion, which likely compounds the threat to dolphin populations). It also relates to poverty and globalization, as this community lives with very little infrastructure at a low standard of living, and is now witnessing

the growth of middle and high-end tourism in the region (with luxury resorts within a kilometer of the village); this development actually presents an opportunity for solutions to the conservation issue of resource depletion through the development of community-based ecotourism, an economic alternative to subsistence hunting. Since both the conservation issue (the dolphin hunt) and the proposed solution (ecotourism) both encompass livelihoods and sustainability, the project has elements of both fisheries and economics. Finally, our conservation work in the community clearly has elements of education, outreach and capacity building.

WORKS CITED

Andrianarivelo, N., 2001. Essai d'évaluation de l'importance de la pêche aux dauphins dans la région d'Anakao (sud-ouest de Madagascar). Unpublished DEA thesis. Institut Halieutique et des Sciences Marines, Université de Toliara, Madagascar.

Razafindrakoto, Y., Andrianarivelo, N., Cerchio, S., Rosoamananto, I. & Rosenbaum, H.C., 2009. Preliminary assessment of cetacean incidental mortality in artisanal fisheries in Anakao, southwestern region of Madagascar. Western Indian Ocean Journal of Marine Science, in press.

TABLES AND FIGURES

Table 1. Results of interview surveys of 237 fishermen in the village of Anakao, Madagascar, on dolphin mortalities between 1975 and 2000. Hunting kills described by fishermen are notes ad Direct Takes, whereas mortalities described as stranding events are noted separately. We place "Stranding" in quotations marks because we do not believe these to be natural stranding events, but rather forced strandings in a developing drive hunt.

Species	Direct Take	"Stranding"	Total
Spinner Dolphin	2289	1286	3575
Bottlenose Dolphin	2132	256	2391
Humpback Dolphin	26	35	61
Unidentified dolphin	410	110	520
Total	4859	1718	6581

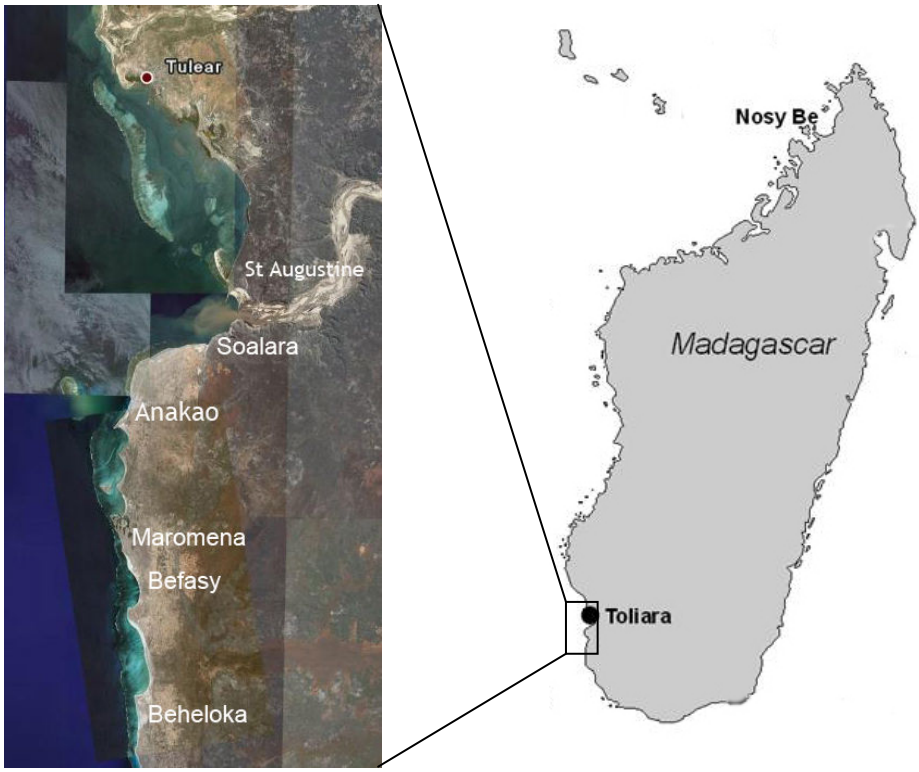


Figure 1. Location of study sites with detail of the Toliara/ Anakao region.

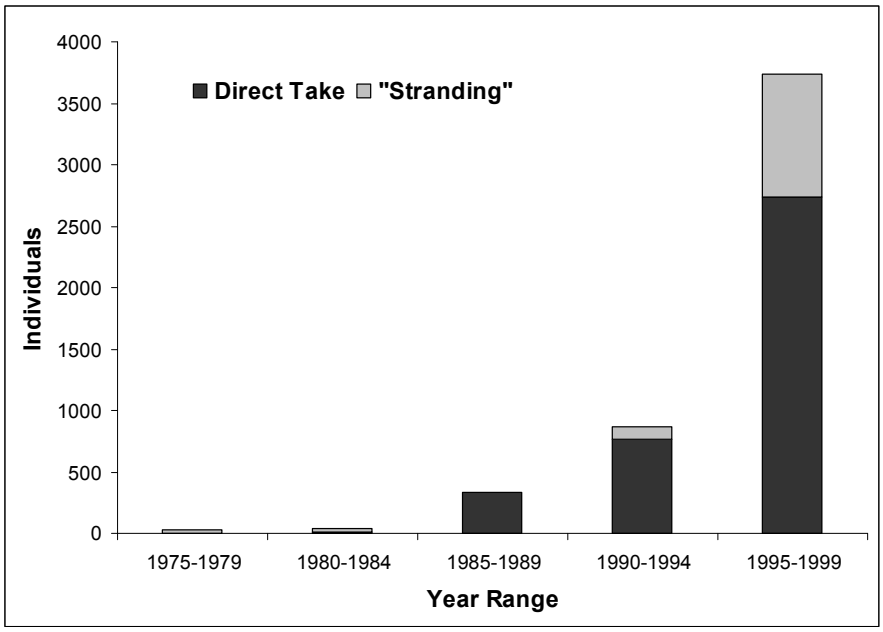


Figure 2. Takes of coastal dolphins off Anakao estimated from interviews in 5 year time blocks.

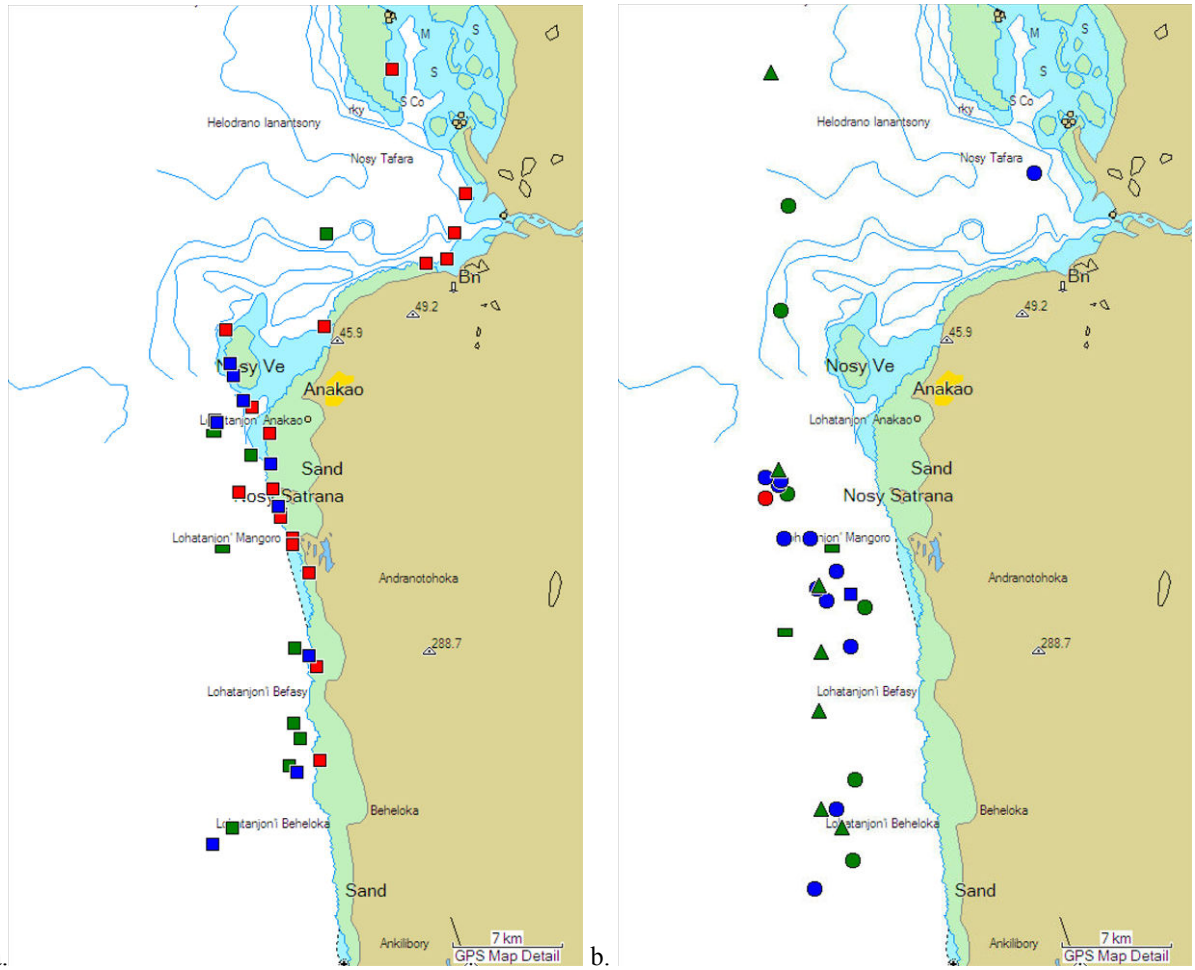


Figure 3. (a) Inshore dolphin sightings off Anakao, 2004-2007: *Sousa chinensis*, red squares; *Tursiops aduncus*; blue squares; *Stenella longirostris*, green squares. (b) offshore dolphin sightings: *Stenella attenuata*, green triangles; *Grampus griseus*; blue circles; *Globicephala macrorhynchus*, green circles; *Tursiops truncatus*; blue square; *Pepanocephala electra*, red circle.

Species legend

- *Sousa chinensis*
- *Tursiops spp.*
- *Stenella longirostris*
- *Stenella attenuata*
- *Stenella sp.*
- *Grampus grisius*
- *Globicephala macrorhynchus*
- *Peponocephala electra*

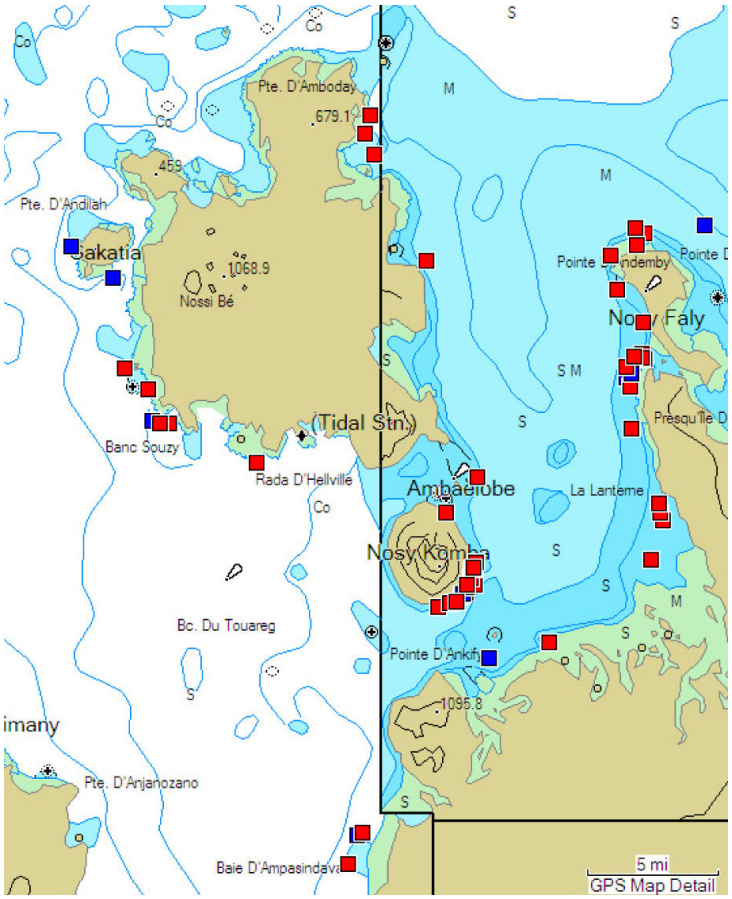


Figure 4. Dolphin sightings off Nosy Be, 2007-2008: *Sousa chinensis*, red squares; *Tursiops aduncus*; blue squares.

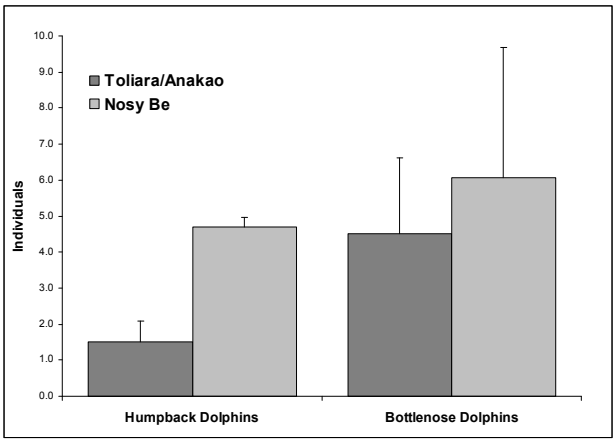
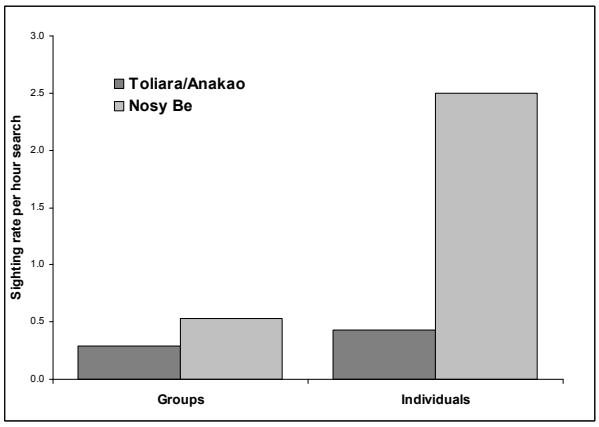


Figure 5. Mean (+s.d.) group size for *Sousa chinensis*, and *Tursiops aduncus* off Anakao and Nosy Be, indicating larger average group sizes of both species sighted off Nosy Be.

a. 

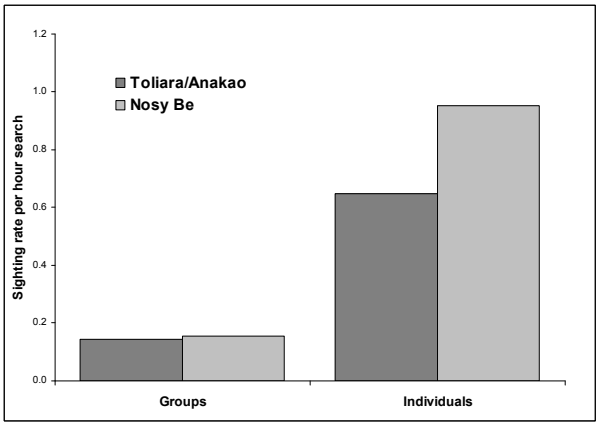
b. 

Figure 6. Encounter rates of (a.) *Sousa chinensis*, and (b.) *Tursiops aduncus* for both groups and individuals off Anakao and Nosy Be, demonstrating the greater sighting frequency of particularly *S. chinensis* off Nosy Be.