

Status of Small Local Populations of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in the Japanese Archipelago

Robert L. Brownell, Jr. and Naoko Funahashi

Bottlenose dolphins (genus *Tursiops*) occur worldwide in tropical and warm-temperate waters, and include both coastal and pelagic populations (Mead and Brownell 1993, Rice 1998). However, because of their cosmopolitan distribution and variable external and osteological characters, many species and subspecies were described over 100 years ago (True, 1889). The lack of large samples, except for *T. truncatus* (Montagu, 1821) originally described from the eastern North Atlantic Ocean, has resulted in over a century of taxonomic confusion (True 1889, Mead and Brownell 1993). Therefore, until recently just the single species *T. truncatus* has been recognized in the scientific literature. Ross (1977) presented evidence for the existence of two species, *T. truncatus* and *T. aduncus* from South Africa but Ross and Cockcroft (1990), after examining specimens from Australia, concluded that specimens from the two locations should be assigned to a single species, *T. truncatus*. However, During the late 1990s, Wang and colleagues (Wang *et al.* 1999, Wang *et al.* 2000a,b) showed that the Indo-Pacific bottlenose can be distinguished from the common bottlenose dolphin using genetic, osteological and external morphology data. Around Japan specimens of *Tursiops* were studied by Kurihara and Oda (2006, 2007) and they concluded that *T. aduncus* were identified from three locations: (1) Amami Islands, Amakusa-Shimoshima Island, and Mikura Island. Within these populations, Morisaka *et al.* (2005) reported geographic variations in the whistles among these Indo-Pacific bottlenose dolphins.

Overall Species Distribution - T. aduncus is reported throughout much of the temperate and tropical Indian Ocean and western Pacific Ocean. These dolphins are found from Cape Agulhas in southeastern South Africa and along the entire rim of the Indian Ocean, including the Red Sea, Persian Gulf, and the Indo-Malay Archipelago. They also occur in the coastal waters around much of the northern half of Australia. In the western- North Pacific this species occurs around Taiwan; the Ogasawara (Bonin) Islands, Izu Seven Islands and Kyushu, Japan. Confirmed records are known from South Africa (Ross 1977, 1984); west and east coasts of Australia (Ross and Cockcroft 1990, Connor *et al.* 2000, Hale *et al.* 2000); Gulf of Tonkin, Taiwan, Hong Kong, China (Wang *et al.* 2000a,b); western Kyushu, Japan (Shirakihara *et al.* 2002); and Mikura Island (Kogi *et al.* 2004). Probable *T. aduncus* populations are known from coastal areas in the Indo-Pacific region include: Pakistan (Pilleri and Gihl 1974), Persian Gulf (Robineau and Rose 1984), southeastern Asian waters north to the East China Sea (Hammond and Leatherwood 1984), Ogasawara Islands and New Caledonia (C. Garrigue in Hale *et al.* 2000).

The Japanese Archipelago is a group of more than 3,000 islands extending some 1,300 miles between the Sea of Japan and the western Pacific Ocean to the south to north of the Mariana Islands. In Japanese waters, at least six populations of Indo-Pacific bottlenose

dolphin are found in a variety of different habitats. Here we review the population size and current threats are discussed below for each of these location/populations (see Fig. 1 for the locations):

1. *Ogasawara (Bonin) Islands*—These islands are approximately 1,000 km south of Tokyo with an estimated population of 200 to 300 animals (Mori 2005). Mori and Okamoto (2013) reported details on this species around the three main islands (Muko Jima ,Chichi Jima and Haha Jima) in water depth is less than 100 meters and in 2010 the number of known individuals identified since 2003 was 216. These authors also noted that future issues include comprehensive research in a wider range of *T. aduncus* habit, continue further study and education for proper dolphin watching and swimming.
2. *Tori Shima , Izu Archipelago[located midway between Ogasawara and Mikura]* – Morisaka *et al.* (2013) reported there are 26 individual Indo-Pacific bottlenose dolphins that use Tori Shima That were photographed in 2008 during a half day survey. Many of these individuals were to Tori Shima from Mikura Island.
3. *Okinawa Islands* — Indo-Pacific bottlenose dolphins are poorly known from the main island (Nishiwaki and Uchida 1977, Uchida 1994). There is no population estimate for these dolphins and no clear history of their hunting because of the past problem of species identification as both *T. aduncus* and *T. truncatus* occur in this region. However, because of the harpoon fishery for cetacean off Okinawa, it is possible that any population around this island was eliminated in the past.
4. *Amami Oshima* –In 1974, 58 *T. aduncus* were captured for the Okinawa Expo which now Churaumi Aquarium in Okinawa (Miyazaki and Nakayama 1989, Uchida 1994, 2006). Funasaka (2013) summarized recent studies of these dolphins around Amami Island, there are nearly 100 animals identified by photo ID from 2007 to 2012 April but no population estimate is available. Funasaka (2013) also noted that the first live captures were conducted in 1974.
5. *Amakusa-Shimoshima Island, western Kyushu* –The population was estimated at 218 individuals with a CV of 5.41% in 1995–1997 using a mark-recapture (Shirakihara *et al.* 2002). Shirakihara and Shirakihara (2013) update information on their long-term studies from this region and provided a new population estimate of 230 (CV=2.5%) in 2007, and 216 (CV=2.1%) in 2008. These authors also noted the average bycatch per year is estimated at 13 animals from interviews to fishermen (2007-2008). PBR is 2 animal/year. They also discuss affect by dolphin watching boats, behavior changes were observed Matsuda *et al* (2011) discussed the effect of dolphin watching boats of the behavior of these dolphins. Yamazaki *et al.* (2008) discussed food habits.
6. *Kagoshima Bay, Southern Kyushu*— Nanbu *et al.* (2006) estimated that there were 50 animals in 1999, 40 animals in 2000 and 50 animals again in 2001. Hirose *et al.* (2013) estimated that a maximum of 50 dolphins occur in this area,

- and most notable are the large swellings on the lateral sides of three dolphins in this location (see their figure 10, page 250). Shirakihara *et al.* (2012) reported long-distance movements between dolphins in Kagoshima Bay and Tsukumi Bay, Oita, Northeast Kyushu.
7. *Kunda Bay, Kyoto* –Morisaka *et al.* (2013) reported small numbers of dolphins from this bay, 2 dolphins found on 20 September 2012 were confirmed as animals born in the Amakusa population in 2006 and 2007. These two dolphins were again observed by locals in a nearby area until 24 October 2012.
 8. *Mikura Jima, in the Izu Seven Islands (Izu Shichito Shoto)*— Mikura Island is approximately 185 km south of Tokyo off the Izu Peninsula. Dolphins regularly occur around Mikura Island but not around the other Izu Islands, except for Miyake and Toshima Islands. Between 1994 and 2001, a total of 169 dolphins were cataloged (Kogi *et al.* 2004) around Mikura. Kakuda *et al.* (2002) first reported that bottlenose dolphins are resident around Mikura Island. Since 1995, some dolphins are found around Toshima Island and some of these are known individuals from Mikura Jima. Kogi *et al.* (2013) updated new details of their long-term field project around Mikura Island and noted that 225 dolphins were identified from 1994 to 2011, but calf survival rate decreased since 2007 and population has decreased in the 2008 survey. After 2011 survey the population estimate was only 109 individuals (identified 111, but 2 calf were missing during survey period). Kogi (2013) stated that the reason for this large decline is unknown at this time. Kogi (2013) also recommended further improvement of dolphin watching operations.
 9. *Noto Jima [eastern side of Noto Peninsula] , Ishikawa Prefecture (Sea of Japan)*, [need ref. in the Sea of Japan. Mori (2013) reported that a small number (9) of these dolphins use this location, and there are some matches between two of these dolphins and ones known from Amakusa region. Also Mori (2013) noted that there is a high level of dolphin-watching and swimming with these individuals in the Noto Peninsula area.

Conservation status - Throughout their range Indo-Pacific bottlenose dolphins appear to have a number of local, resident populations. Some resident populations appear to be relatively small (Amakusa-Shimoshima, western Kyushu, Japan just over 200 dolphins, based on photo-id (Shirakihara *et al.* 2002). This is one of the largest populations in Japanese waters, but at the present time there is a large annual bycatch. Around Mikura Island, based on an eight year photo id study, a total of 169 dolphins were photographed (Kogi *et al.* 2004), but this population is now in decline for some unknown reason (Kogi *et al.* 2013). Little is known about these dolphins around the Amami Islands, but possible large numbers were removed in the past as live-captures for Japanese aquariums. Reeves *et al.* (2003) noted that although this species is not considered endangered, its near-shore distribution makes it vulnerable to direct exploitation (including live-capture and removal), fishery conflicts and environmental degradation. This concern is especially true at the level of small, local, resident individual populations.

Recommendations:

1. There is an urgent need to investigate the reason for the large decline observed in the Mikura Island population in recent years,
2. Better monitoring of the bycatch is needed for these small populations, especially for Amakusa-Shimoshima Island area,
3. Investigate fisheries conflicts, especially around Amakusa-Shimoshima and Izu Islands where some fishermen are talking about the need to cull the dolphins. This issue should also be examined in the other regions of Japan where these small populations of Indo-Pacific bottlenose dolphins are living.
4. Both dolphin watching and swim-with programs needs to be carefully monitored, and their management systems need to be evaluated.
5. Additional research is needed on habitat use and interactions with humans in these areas.

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Figure 1. Coastal locations where populations of Indo-Pacific bottlenose dolphins, *Tursiops aduncus*, are found in southern Japan.

