

THE NATURE CONSERVANCY

Indonesia Coastal & Marine Program

**KOMODO NATIONAL PARK
CETACEAN SURVEYS**

A RAPID ECOLOGICAL ASSESSMENT OF
CETACEAN DIVERSITY, ABUNDANCE & DISTRIBUTION.

INTERIM REPORT - OCTOBER 2001



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Cover photo:

A Cuvier's beaked whale (*Ziphius cavirostris*) approaches the KNP cetacean survey vessel.

1. Introduction.

1.1 The cetacean survey program in Komodo National Park and World Heritage Area.

Indonesian waters have an exceptional cetacean diversity and at least thirty different cetacean species inhabit these waters. More than one third of all known whales and dolphins species worldwide can be found in the Indonesian Seas, including numerous rare and endangered species (IUCN 1996). Cetacean habitats include major rivers, mangroves, coastal and open ocean environments. These diverse habitats are often in close proximity to one another because of Indonesia's narrow continental shelf, abundant oceanic islands and extreme depth gradients.

In eastern Indonesia, a strictly limited number of deep inter-island channels are suspected to function as migration corridors for cetaceans (PHPA 1984). These passages have considerable ecological significance and conservation value:

- Indonesian island straits and passages form an important migration corridor network for large cetaceans travelling from the Pacific Ocean and eastern Indonesian seas to the Indian Ocean, and vice versa.
- In addition, residential whale and dolphin populations are also likely to use these corridors as part of their home range.
- Indonesia's straits and passages are also likely to function as sensitive bottlenecks to numerous other species of large migratory marine life such as green, hawksbill and leatherback sea turtles, tuna and billfishes, as well as elasmobranchs such as manta rays and (whale) sharks.
- Local activities such as destructive fishing practices and gill netting near these straits can result in regional environmental impacts on cetacean populations and affect large marine ecosystem dynamics (Agardi 1997).

Komodo National Park (KNP) is part of the Nusa Tenggara island chain and located between the islands of Sumbawa and Flores. Komodo National Park includes three inter-island straits and is of importance to the conservation of Indonesia's terrestrial as well as marine bio-diversity (Pet and Djohani 1996).

The rapid ecological assessments on cetacean diversity, distribution and abundance show that the Komodo National Park and World Heritage Area is an important habitat for whales and dolphins (Kahn and Pet 2001), and its long-term protective management benefits from seasonal regular cetacean survey activities. The rapid ecological assessments assist with the on-going inventory program on KNP marine biological diversity, and aim to a) identify sensitive marine areas for cetaceans, b) broaden the array of KNP conservation perspectives and park management measures, and c) provide an additional tool for environmental awareness and community related activities.

2. Survey Objectives.

The key survey objectives of the KNP cetacean rapid ecological assessment program are:

1. To provide base-line data on cetacean diversity, distribution and abundance in all marine habitats of Komodo National Park (KNP) including:
 - i. Coastal habitats of KNP to monitor the presence of vulnerable coastal cetaceans.
 - ii. Inter-island straits and deep channels of KNP to examine their significance as migration corridors for wide-ranging migratory cetaceans occurring in eastern Indonesian waters.
 - iii. Oceanic areas to the north and south of KNP to monitor the presence of oceanic cetaceans.
2. To monitor seasonal patterns in KNP cetacean diversity, distribution and abundance.
3. To identify sensitive marine areas for cetaceans, including preferred feeding grounds, mating locations and migration corridors.
4. To identify regional marine environmental impacts affecting KNP cetaceans.
5. To provide site and species-specific information on KNP cetaceans for:
 - i. Marine resource and park management purposes.
 - ii. Environmental awareness and educational programs.
6. To establish community-based cetacean monitoring programs through the active participation of management agencies and stakeholders including:
 - i. TNC-Komodo Field Office staff
 - ii. Balai Taman Nasional Komodo rangers
 - iii. Komodo National Park dive operators.

3. Survey Methods and Research Activities.

The methodologies involved in this program have been specifically designed to cause minimal disturbance to cetaceans while allowing for discrete and close observations. These procedures have been practiced in Indonesian waters as well as in other parts of the world where benign cetacean research is conducted.

3.1 Survey method I: TNC speedboats.

The majority of the visual and acoustic cetacean surveys were carried out from a 25-foot TNC Yamaha speedboat cruising at 16-18 knots. This survey focused on the coastal areas, bays and inter-island passages of Komodo National Park. While underway, a minimum of two experienced observers conducted visual surveys of the surrounding waters. If cetaceans were sighted the vessel's course and speed were adjusted to allow for a discreet approach and close observation.

Whenever possible a positive species identification (ID) was made. Unidentified cetacean encounters were recorded as such after a minimum of 10 minutes of visual survey efforts focused on obtaining a positive identification. Unidentified cetacean encounters were usually the result of unfavourable light conditions, sea state, lack of proximity, active avoidance behaviour or operational constraints.

Time, sea surface conditions, GPS location, species sighted, estimated abundance, group composition, the presence of newborn calves, minimum distance from vessel, direction of travel and selected behaviours and species associations were recorded on standardised, waterproof data sheets. Photo-identifications were made of individuals with distinctive colourations, marks or scars using Nikon F80 and Nikon 601 SLR cameras, both equipped with a Nikkor 70-300mm lens. In addition, a Sony PC-10 digital video camera was also frequently used to record the diversity of cetacean species and behaviours. After the ID and recordings were completed, the vessel departed from the sighting area at a reduced speed and resumed the predetermined survey route.

During offshore routes, the visual surveys were complimented by periodical acoustic listening stations using two directional Burns Electronics custom VHLF hydrophones (30Hz-20kHz) and audio amplifiers with high and low pass filters. Acoustic surveys were only conducted if the vessel was located four or more nautical miles offshore to minimise any coastal interference. Listening stations were conducted every 30 minutes, or approximately 7-8 nautical miles apart depending on offshore conditions. Acoustic contacts with priority species were digitally recorded with a Sony Portable MiniDisc Recorder (MZ-R70). The survey commenced in the early morning departing from The Nature Conservancy - Komodo Field Office in Labuan Bajo, Flores, Nusa Tenggara Timor and returned before sunset each day.

3.2 Survey method II: Local live-aboard vessels.

Visual and acoustic cetacean surveys were also carried out from the local live-aboard vessel Parewa III. Use of the live-aboard increased the coverage to remote areas and allowed the surveys to continue during less optimal weather conditions. The data collection procedures did not differ between survey methods and are described in Section 3.1. The vessel speed averaged 6-7 knots. Increased observer height and regular use of Steiner Commander III 50x7 marine binoculars increased the visual survey range. The majority of the acoustic surveys were conducted while on-board the live-aboard vessel. Listening stations were conducted on the hour for at least five minutes. Stations were only conducted when located more than 4 nautical miles (nm) offshore to minimise disturbance and spaced approximately 6 nm apart.

4. **Survey results and discussion.**

4.1 Visual survey effort.

Surveys were conducted from 01 October to 21 October 2001. The survey effort comprised of 15 field days and totaled 118.25 active survey hours. The surveys covered an estimated 1265.50 nautical mile (nm). In total 14 cetacean species were identified, which is the highest species diversity per survey to date. Apart from the blue whale (*B. musculus*, Suborder Mysticeti) all species observed during 91 cetacean encounters were toothed whales and dolphins (Suborder Odontoceti). An estimated 2184 individual cetaceans were sighted during the visual survey effort (Table 1).

4.2 Acoustic survey effort.

The acoustic survey included 23 omni-directional hydrophone listening stations. Acoustic contact with cetaceans was recorded in 30.44% of the listening stations (Table 2). The listening range was calculated at 6 nm and acoustic survey covered an estimated 2601.2 nm² in total.

4.3 Cetacean species diversity in Komodo National Park.

The species diversity recorded during the October 2001 survey was exceptionally high (Table 3). The 14 species encountered constituted considerable phylogenetic diversity including 10 genera from four taxonomic families (Fam. Balaenopteridae - 1 sp., Fam. Delphinidae - 10 sp., Fam. Physeteridae - 2 sp., Fam. Ziphiidae - 1 sp.; see Rice 1998 for taxonomic review of all marine mammals). Species encountered during the survey include the long-nosed spinner dolphin (*S. longirostris*), two species of bottlenose dolphin (*T. truncatus* and *T. aduncus*), pan-tropical spotted dolphin (*S. attenuata*), Fraser's dolphin (*L. hosei*), Risso's dolphin (*G. griseus*), pygmy killer whale (*F. attenuata*), rough-toothed dolphin (*S. bredanensis*) and the vulnerable in-shore Indo-Pacific humpbacked dolphin (*S. chinensis*).

The current surveys have also identified a relatively high occurrence of rare whale species in the waters adjacent to KNP. These include the blue whale (*B. musculus*), Cuvier's beaked whale (*Z. cavirostris*), sperm whale (*P. macrocephalus*), dwarf sperm whale (*K. simus*) and the killer whale or orca (*O. orca*).

A single new species was sighted (*T. aduncus*) and this suggests that the 1999-2001 cetacean REA efforts have been successful in recording the majority of cetacean species which inhabit KNP waters (Table 3). Species diversity continues to be a priority for all surveys as seasonal patterns in cetacean diversity, distribution and abundance are likely to occur in Indonesian and KNP waters. Also of importance is the confirmation of several rare and endangered baleen whales known to occur within KNP boundaries, such as the blue and fin whale (*B. musculus* and *B. physalus* respectively, IUCN/UNEP 1988). *B. physalus* has not been identified in KNP during the 1999-2001 survey effort. The October 2001 survey did not locate the pygmy Bryde's whales (*B. edeni*), a relatively unknown species known to reside in these waters. These whales were frequently sighted in 1999 and 2000 and were positively identified using genetic profiling techniques (Dizon *et al.* 2000; Kahn *et al.* 2001).

4.4 Cetacean distribution in Komodo National Park.

All cetacean sighting coordinates of the October 2001 survey were transcribed to a GIS format and assigned species-specific data points (Fig. 1). The distribution of cetaceans shows the distribution of the cetacean species encountered. Cetacean species were colour-coded and allocated the following symbols:

Category	Symbol
Sub-order Mysticeti - baleen whales	●
Families Physeteridea and Kogiidae - sperm whales	■
Family Ziphiidae - beaked whales	★
Family Delphinidae - dolphins	▲
Globicephalinae - a Delphinidae subfamily of six species*	+
Unidentified small cetacean (≤ 6 metre)	△
Unidentified large cetacean (> 6 metre)	○
Unidentified beaked whale (Fam. Ziphiidae)	☆

* - The Globicephalinae subfamily is based on a systematic revision of the Delphinidae and includes six species: *Feresa attenuata*, *Peponocephala electra*, *Globicephala macrorhynchus* and *G. melas*, *Pseudorca crassidens* and *Griseus grampus* (LeDuc *et al.* 1999). It replaces the historical blackfish category that includes the majority of these species as well. For the Indonesia cetacean surveys, Globicephalinae sightings are recorded when sightings of members of the subfamily can not be identified to species. This occurs infrequently and is due to the similarities of *P. electra*, *F. attenuata* and juvenile *G. grampus*, in particular during unfavourable sighting conditions.

The distribution patterns of the previous surveys (Kahn 2001) have been largely confirmed by the record sighting frequency during this survey (Fig. 1). The *T. truncatus* continues to dominate the distribution of sightings within KNP borders. In the eastern part of KNP at the entrance of Selat Molo and near Nusa Kode both large and medium size pods of *S. longirostris* are especially common (Fig. 1).

In the straits and offshore areas adjacent to KNP a more diverse pattern is becoming evident. Numerous species of oceanic delphinids are abundant in the deeper waters of Komodo National Park. The large and deep expanse of water within KNP borders between Nusa Kode, Padar and south Komodo is frequented by large pods of *S. attenuata*, numbering up to 350 individuals. This part of the Park also inhabits *G. griseus*, and even *P. macrocephalus* has been observed inside Park boundaries. In this instance, a group of at least 9 sperm whales were tracked visually and acoustically from initial contact in the Sumba Sea at 12:05. Visual length estimates indicated that this to be a nursery group, made up of closely related mature females and immature offspring of both sexes (e.g. Best 1979, Kahn 1991). The whales were consistently travelling northeast towards Nusa Kode while continuing their regular deep-diving routine indicative of feeding behaviour (e.g. Kahn *et al.* 1993). The whales were located well within Komodo National Park boundaries by 14:05. The observations were stopped shortly after due to logistical constraints. Thus during the October 2001 survey, the southern waters of KNP and the waters of the Sumba Sea just past KNP boundaries were frequently inhabited by large pods of oceanic delphinids, as well as specialised, deep-diving teuthophagous cetaceans such as Risso's dolphins and sperm whales.

Beyond the continental shelf in the northern region of KNP and the Flores Sea, deep-diving cetaceans are dominant, as expected. The relatively unknown dwarf sperm whale (*Kogia simus*), as well as the Cuvier's beaked whale (*Ziphius cavirostris*) were repeatedly encountered in these offshore waters, especially along the 2000m depth contour due north of Selat Linta and Komodo Island (Fig. 1).

Highly migratory cetacean species such as the blue whale (*B. musculus*) were sighted just north of Banta Island on 02/10/02 at 08:19. This blue whale had an estimated length of 18m and was travelling westward. It is important to note that the sighting area as well as direction of travel between this encounter and the previous October 2000 blue whale sighting were similar. Although the sample size is still very limiting, the KNP blue whale sightings to date may indicate a regional migratory pattern of this endangered species. The fact that this, and other migratory whale species, such as orcas, as well as bull sperm whales, are repeatedly sighted within close proximity to the Banta Island anchorage underlines the need for additional protection of this area and the inclusion of Banta Island in KNP borders. This management measure for migratory marine species of special concern has been incorporated in the 25-year master plan (Pet and Yeager 2000).

The San Geang area presents a significantly different marine environment to all other KNP regions surveyed. It is the only representative of an oceanic volcanic island within survey distance from Labuan Bajo, and continues to produce a relatively high number of sperm whale (*P. macrocephalus*), Globicephalinae and orca (*O. orca*) sightings. Ziphiids are occasionally sighted to the west of the island. The orca pod sighted on 02/10/01 at 16:12 consisted of three whales (adult male, adult female and juvenile), and was located between San Geang and Wera, Sumbawa. All were photo-identified but no matches with previous orcas in KNP were found. It is worthy to note that the orcas were sighted on the same day and in a similar area as the blue whale. This exceptional sighting pattern occurred also during the October 2000 survey and could indicate a predator-prey interaction.

The orcas were not travelling in any particular direction. Instead, the whales were milling around the same general area, making repeated shallow dives of 1-3 minutes during the 1.25 hour observation period. Another interesting aspect of the orca encounter was the earlier sighting that day at 15:18 of ten *F. attenuata*, at the northeastern side of San Geang (Fig.1). This pod was travelling at very high speeds towards the east. The rapid porpoising behaviour observed during this sighting is not characteristic for this species and likely to be a fleeing response from the orcas in the area. Orca observations were ceased because of approaching nightfall and no resightings were made.

During 1999 and 2000 pygmy Bryde's whales, *Balaenoptera edeni*, have been repeatedly sighted in an inter-island passage between Nusa Kode and south Rinca, as well as in several bays along east Komodo Island, including Loh Namu and Loh Liang. The present survey did not record any *B. edeni* sightings. However, observations by both TNC field staff and Park Rangers of small baleen whales in these bays in 2001 (J. Subijanto, pers. comm.), indicate these whales are likely to be present in KNP waters year round. The low abundance at the southeastern part of the Park may be due to a shift in distribution. Cetacean sighting report from two live-aboard dive operators active in the volunteer program, Pindito and Evening Star, also list small *Balaenoptera* whale sightings at Loh Liang, KNP.

The crew of the vessel used for the live-aboard survey, Parewa III, increased their cetacean identification capabilities through our on-board training activities and requested to be included in the outreach program. On 18/10/01, Parewa reported a blue whale sighting at 17:00. Estimated

length of the whale was 30 m and it was swimming 500 m from the coast, close to the Sape lighthouse. The approximate coordinates are 08° 33' 00 S, 119° 01' 50 E. This identification could not be checked. However, the large size reported and the fact that this crew had recently witnessed this species during the dedicated cetacean surveys indicates the data is reliable. In addition, Parewa's crew reported a stranding of a large baleen whale (estimated length 15 m) during the month of September 2001 on one of the beaches on the NE Sumbawa side of Selat Sape, near Kelapa Isl. The approximate coordinates are 08° 39' 50 S, 119° 09' 50 E. No further details are available.

These sightings are of considerable interest as it confirms the movement of large baleen whales through Selat Sape. Surprisingly, the passage route for blue whales may be extremely coastal. If this constitutes regular migratory behaviour for blue whales passing through Indonesian island corridors, then these endangered whales are highly vulnerable to coastal and destructive fishing practices, including reef bombing (Ketten 1998, Gordon and Moscrop 1998, Kahn et al. 2000).

Species-specific sighting frequencies and abundances have been calculated for the October 2001 survey (Figs. 2 and 3, respectively). These figures show the exceptional high diversity and abundance encountered during the October 2001 survey. Overall, both the sightings as well as estimated abundance are dominated by *Stenella* and *Tursiops* species. This is in agreement with the long-term sighting results for KNP (Fig. 4). Comparative studies of the three completed KNP cetacean survey years to date are currently in preparation, including species-specific seasonal and annual analyses.

5. Constituency building & community involvement.

5.1 Cetacean survey field training.

The field training of TNC-KFO staff continued during the October 2001 surveys. A 'train the trainer' component was added to the capacity building activity with the selection of two recipients, the TNC-KFO Cetacean Coordinator and a Senior Balai Taman Nasional Komodo Ranger. It was decided to concentrate training efforts of these individuals, to increase their expertise on local cetacean species identification, ecology and management and conservation issues. In addition, these key persons will continue to work together during the dedicated KFO cetacean monitoring days, and coordinate the volunteer sightings and community outreach programs. These are currently implemented for the floating and land-based ranger stations as well as the KNP dive industry.

During the field training the significance and objectives of the program were explained to all participants and interests in cetacean ecology were discussed. Whale and dolphin identification techniques at sea were practiced and verified. In-depth field training on positive species identifications were conducted for 14 species (Table 3). Several cetacean species were sighted each day, giving all participants ample practice and a valuable exposure to the diversity and ecology of cetaceans in Komodo National Park.

The identification skills of the TNC and PKA survey team members have improved substantially by the end of the field training. Currently the trainees have a high degree of accuracy with identifying 5 species independently: Sperm whale (*P. macrocephalus*), spinner dolphin (*S. longirostris*), spotted dolphin (*S. attenuata*), bottlenose dolphin (*T. truncatus*), Risso dolphin (*G.*

grampus). In addition, the observer error in the standard data collection has improved significantly (e.g. estimated abundances, presence/absence of calves, direction of travel, area, as well as numerous behaviours).

5.2 Educational and environmental awareness activities.

Several KNP cetacean video, slide and PowerPoint presentations were given to both specialist as well as general audiences. Participants in the presentations included TNC Indonesia Program, senior management, environmental monitoring teams and field staff, TNC Asia/Pacific fund raisers and VIP guests and Taman Nasional Komodo rangers. These presentations illustrated the results to date and the ecological importance of the research area for both resident as well as migratory cetaceans. The presentations also introduced TNC's Indonesia Cetacean Program (ICP) for 2001-2004. Several of the ICP components were discussed in detail, including national and site-specific initiatives, policy development, visual and acoustic cetacean surveys, focus research on priority species, as well as comprehensive educational and capacity building components.

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Tables.

Table 1: KNP cetacean visual survey summary for the October 2001 period.

KNP cetacean visual survey effort 01 - 21 October 2001	Survey method 1	Survey method 2	Survey October
Total no. of days surveyed	10	5	15
Survey effort (hrs)	70.75	47.50	118.25
Estimated area surveyed (nm)	978.50	287.0	1265.50
Cetacean identification encounters	67	24	91
Estimated number of cetaceans surveyed	1590	594	2184
Cetacean species identified	11	8	14

Table 2: KNP cetacean acoustic survey summary for the October 2001 period.

KNP cetacean acoustic survey effort 01 - 21 October 2001	
Listening stations	23
Cetacean contact	7
Acoustic encounter rate (%)	30.4
Area covered (nm ²)	2601.2

Table 3: Cetacean species positively identified in Komodo National Park and adjacent waters for the 1999 - 2001 survey periods.

Cetacean species		May 1999	Oct 1999	April 2000	Oct 2000	April 2001	Oct 2001
1. Long-nosed spinner dolphin	<i>S. longirostris</i>	◆	◆	◆	◆	◆	◆
2. Bottlenose dolphin	<i>T. truncatus</i>	■	■	■	■	■	■
3. Pan-tropical spotted dolphin	<i>S. attenuata</i>		■	■	■	■	■
4. Melon-headed whale	<i>P. electra</i>	●	●	●	●	●	
5. Pygmy Bryde's whale	<i>B. edeni</i>		●	●	●		
6. Sperm whale	<i>P. macrocephalus</i>	●	●			●	●
7. Fraser's dolphin	<i>L. hosei</i>		●	●	●	●	●
8. Risso's dolphin	<i>G. griseus</i>		●		●	●	●
9. Pygmy killer whale	<i>F. attenuata</i>		○		○		○
10. Dwarf sperm whale	<i>Kogia simus</i>			○			○
10. Pygmy/dwarf sperm whale	<i>Kogia sp.</i>	○					
11. False killer whale	<i>P. crassidens</i>	○	○	○		○	
12. Common dolphin	<i>Delphinus sp.</i>	○					
13. Rough-toothed dolphin	<i>S. bredanensis</i>		○	○	○		○
14. Cuvier's beaked whale	<i>Z. cavirostris</i>		○		○		○
15. Blue whale	<i>B. musculus</i>				○		○
16. Orca	<i>O. orca</i>				○	○	○
17. Short-finned pilot whale	<i>G. macrorhynchus</i>					○	
18. Indo-Pacific humpbacked dolphin	<i>S. chinensis</i>					○	○
19. Bottlenose dolphin	<i>T. aduncus</i>						○

◆ = Abundant; ■ = Common; ● = Uncommon; ○ = Rare (Categories based on Kahn *et al.* 2000). The *Kogia sp.* sighting is included for completeness but not counted as a positive species identification

Figures.

Figure 1: Cetacean species diversity and distribution in Komodo National Park and adjacent waters - Oct 2001 survey.

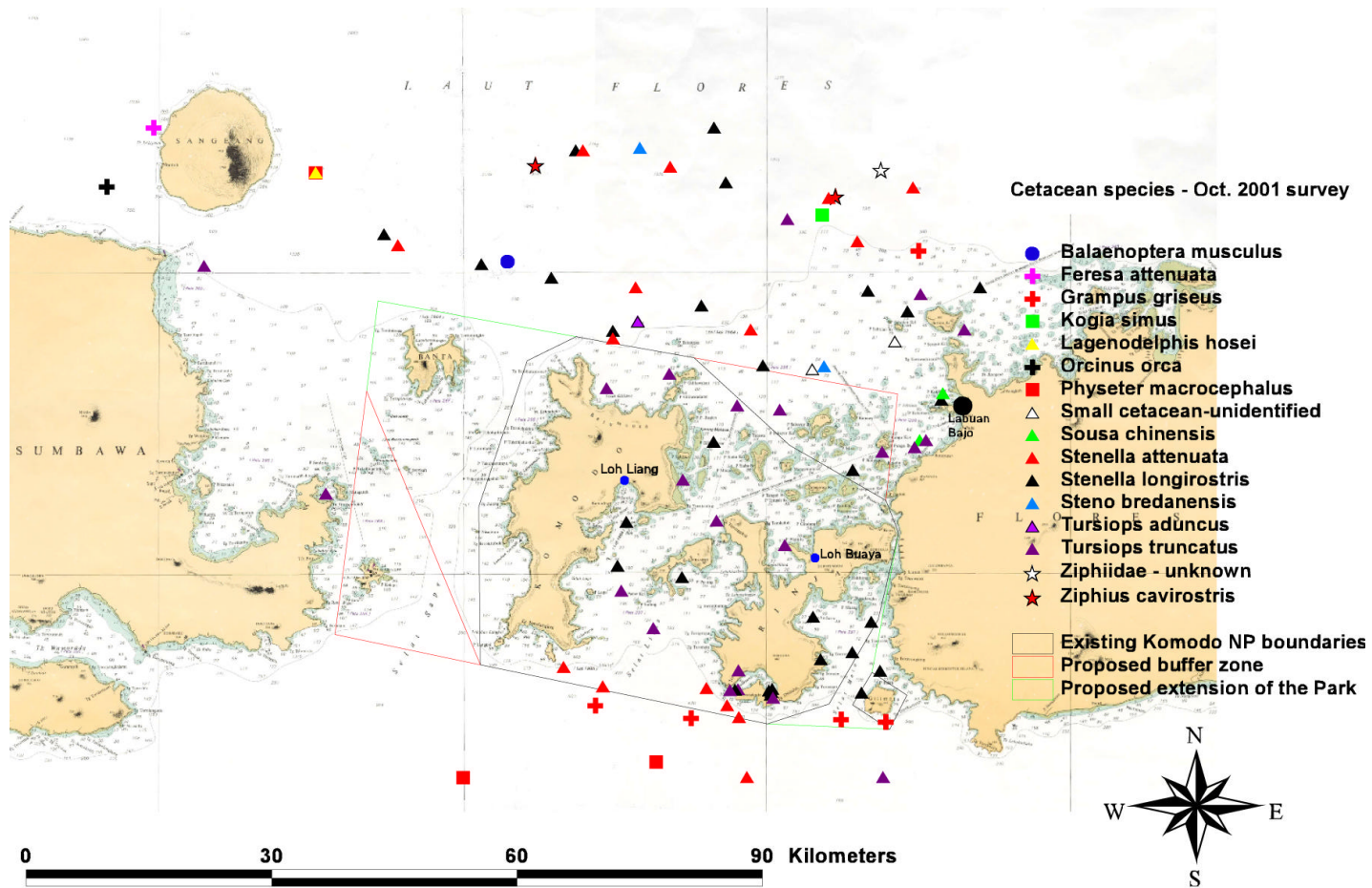


Figure 2: Species-specific sighting frequency (%) during the October 2001 Komodo NP survey.

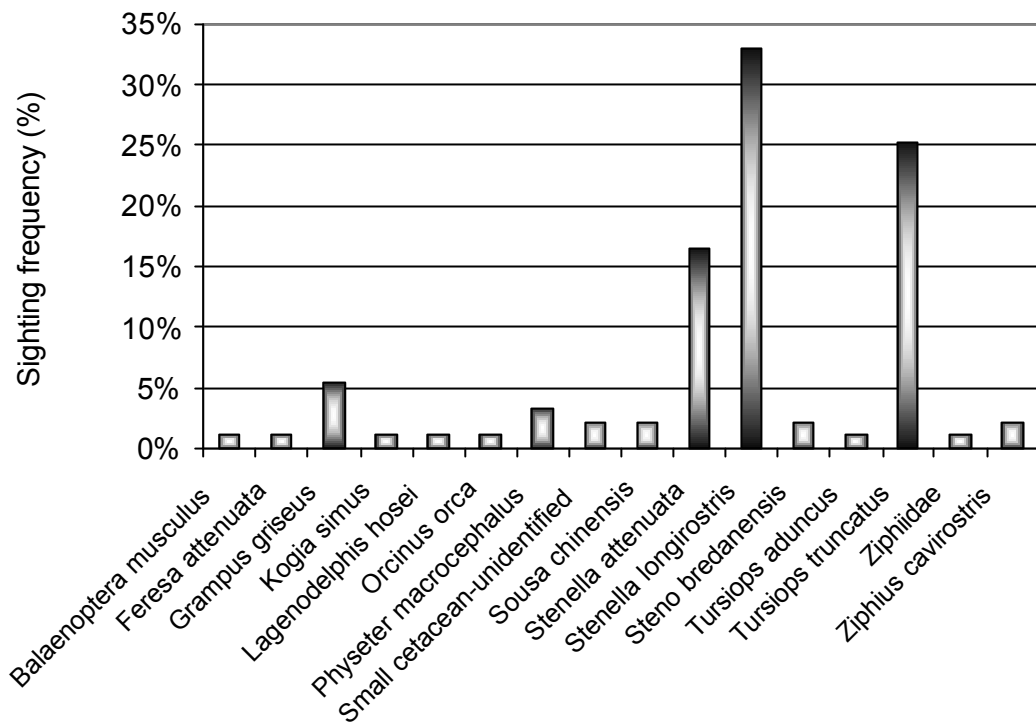


Figure 3: Species-specific abundance (%) during the October 2001 Komodo NP survey.

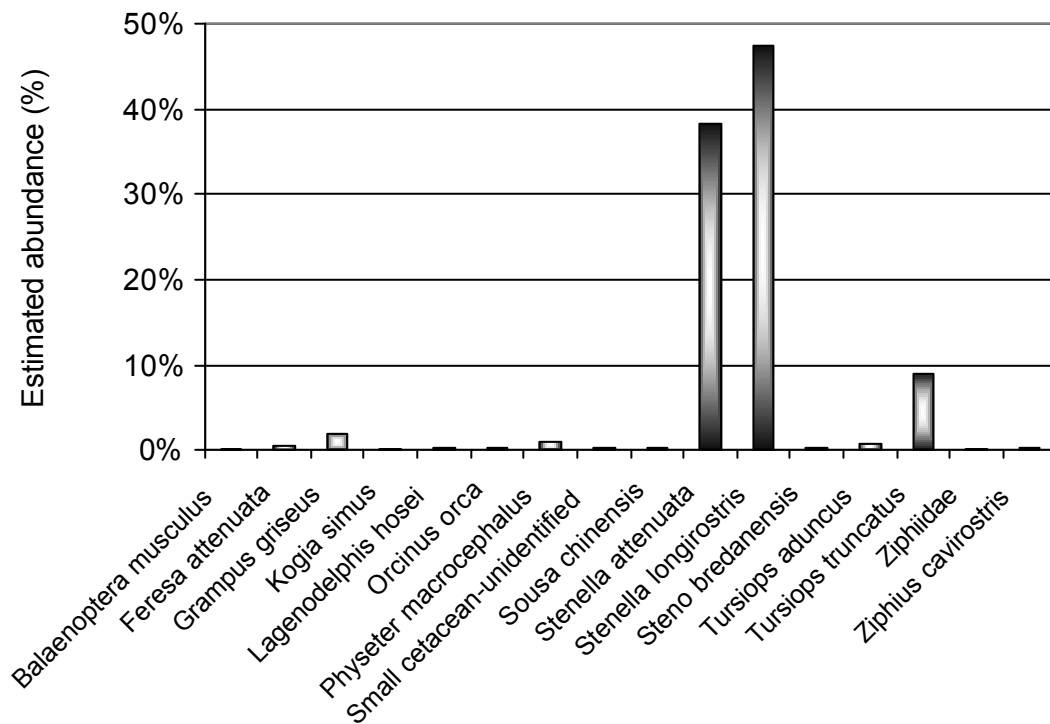


Figure 4: Species-specific cetacean sightings (n=390) for all Komodo NP survey days to date (n=86).

