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THE STATUS OF THE IRRAWADDY DOLPHIN, *ORCAELLA BREVIROSTRIS*, IN SONGKHLA LAKE, SOUTHERN THAILAND

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ABSTRACT. – Irrawaddy dolphins (*Orcaella brevirostris*) have previously been reported to occur in Songkhla Lake, but there have been no surveys undertaken and little information has been gathered on the status of the population. Boat, aerial and interview surveys were conducted in the Lake, which revealed a low sighting rate and high levels of mortality. It appears that the population is now restricted to the upper freshwater portion of Songkhla Lake, with no movement between the lake and coastal marine waters. Due to the high number of strandings in the area, a local dolphin conservation group was formed in 1996, in an effort to publicise the importance of conserving dolphins in the Lake. However, conservation efforts are difficult to implement and enforce, due to the importance of the Lake to the local community for subsistence fisheries and agriculture. Effective conservation measures are urgently required to ensure the survival of Irrawaddy Dolphins which inhabit this freshwater environment.

KEY WORDS. – Irrawaddy Dolphin, *Orcaella brevirostris*, Thailand, Songkhla Lake, abundance, distribution, conservation, strandings

INTRODUCTION

There have been few studies undertaken on marine mammals of Thailand. There are presently 22 species of cetaceans confirmed from Thai waters, though Andersen & Kinze (1999) considered that up to 27 species could occur. Irrawaddy dolphins (*Orcaella brevirostris*) were first recorded from Thailand in 1903 (Bonhote, 1903). On the east coast, they have been recorded from Trat, near the Cambodian border, south to Pattani, near the border with Malaysia (Kloss, 1916; Pilleri & Gihr, 1974; Andersen & Kinze, 1999; Chantrapornsyl et al., 1996; Stacey & Leatherwood, 1997). Only one confirmed record exists from the west coast, in the Andaman Sea (E. Hines pers. comm.). Andersen & Kinze (1999) reviewed all published and unpublished records of Irrawaddy dolphins in Thailand, which include four published sighting records (Smyth, 1898; Robinson, 1927; Mörzer-Bruyns, 1966) and 12 specimen records. Several Thai individuals and aquaria have previously held Irrawaddy dolphins in captivity, particular in the upper Gulf of Thailand region. Only one Thai aquaria (Oasis Sea World), which is located in Laem Sing, Chantaburi Province, presently displays captive Irrawaddy dolphins (Fig. 1).

Irrawaddy dolphins were first reported to occur in Songkhla Lake by Pilleri & Gihr (1974). Three specimens were collected during this expedition, two were mounted and deposited at the College of Education, Phattulung Province, and one is now housed at the Staatliches Museum für Naturkunde, Stuttgart, Germany (BM563 (45751)). Subsequent reports of dolphins from the Lake have been sporadic (Andersen & Kinze, 1993; Sirimontaporn & Sritakon, 1995), though no dedicated surveys have been undertaken to monitor the population. Preliminary estimates of Irrawaddy dolphin abundance in Songkhla Lake were 100 dolphins (Stacey & Leatherwood, 1997). However uncertain this estimate, it appears that numbers have declined significantly in recent years. In addition to the specimen records listed in Andersen & Kinze (1999), 28 strandings have been recorded from within the freshwater portion of Songkhla Lake (Thale Luang) between January 1990 and May 2001 (Table 1). The high incidence of strandings indicates a potentially important resident population, requiring study of their status and associated threats.

Due to the significant local interest in conserving dolphins in the Lake and the apparent low number of dolphins, surveys of the lake were undertaken in May 2000 and February and

Fig. 1. Irrawaddy dolphins captured from the northern Gulf of Thailand, on display at Oasis Sea World, Chantaburi Province, Thailand.

May 2001. The objectives of these surveys were to determine if dolphins still inhabit the lake and to assess the feasibility of initiating a larger research project in this area.

MATERIALS AND METHODS

Study Site. – Songkhla Lake is situated in Phattulung Province, southern Thailand (Fig. 2). It has a total area of 1,082 km^2 and is southeast Asia's second largest lagoonal lake. Although historically inundated by seawater, lowering sea levels at least 5000 years ago exposed the eastern-most landmass, which has resulted in a large lake almost totally separated from the ocean (Sirimontaporn & Sritakon, 1995). The Lake has a narrow opening to the sea (Fig. 3a) and four distinct habitat types (Table 2).

The use of permanent fixed fishing gear is an extremely common practice in the lower parts of Songkhla Lake. Virtually the entire upper Thale Sap and lower Thale Luang have fixed fishing nets covering nearly every square meter of water (Fig. 3b). These connected nets are spread across the entire width of the Lake and throughout the entire water column during all seasons. These nets therefore, provide a

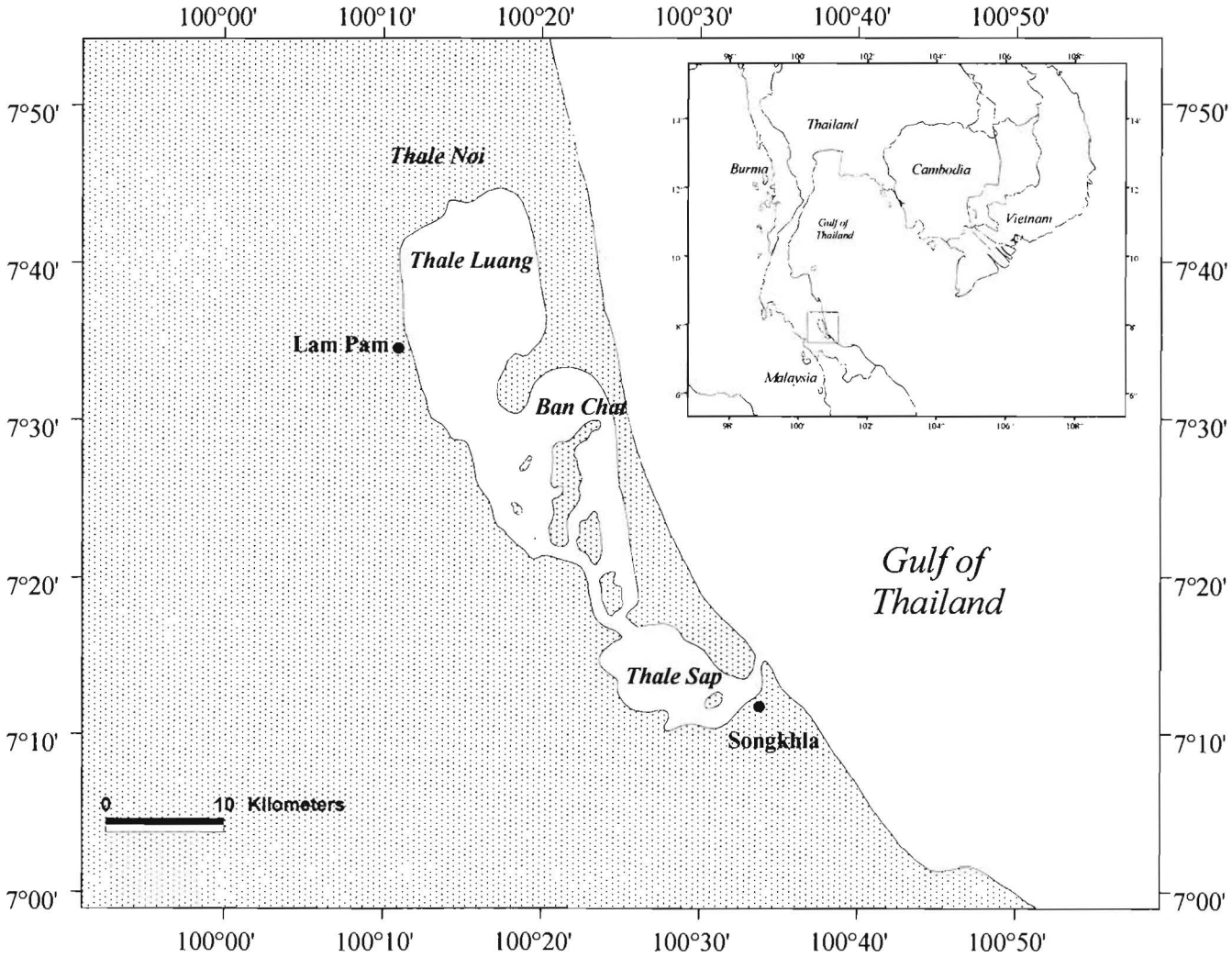

Fig. 2. Map showing the location of Songkhla Lake.

Table 1. Irrawaddy Dolphin strandings in Songkhla Lake since 1990 (lengths are in meters).

#	Date	Location	Length	Cause of death	Specimen location	Specimen type
1	18-Jan-90	Ban Pak Sawa	2.30	Net Entanglement	Lam Pam Dolphin Museum	Mounted
2	20-Mar-91	Ban Samphao Nua	2.50	Net Entanglement	unknown	
3	20-Mar-91	Ban Samphao Nua	0.90	Net Entanglement	unknown	
4	12-Aug-94	Ban Samphao Nua	2.32	Net Entanglement	Lam Pam Dolphin Museum	Full skeleton
5	28-Dec-94	Ban Wae	2.10	unknown	unknown	
6	16-Jan-95	Ban Pak Phan	2.20	unknown	unknown	
7	18-Mar-95	Amphoe Ranot	2.00	Net Entanglement	unknown	
8	18-Apr-95	Ban Lam Pam	-	Net Entanglement	unknown	
9	18-Apr-95	Ban Lam Pam	2.00	Net Entanglement	unknown	
10	21-Mar-95	Ko Yai Peninsular	2.32	Net Entanglement	unknown	
11	28-Mar-95	Ban Khuan Kut	2.20	unknown	unknown	
12	04-May-95	Ko Yai Peninsular	1.88	Net Entanglement	NICA, Songkhla	Full skeleton
13	29-Dec-95	Ban Pak Phan	0.80	unknown	unknown	
14	22-Dec-96	Ko Rap	1.98	Net Entanglement	Lam Pam Dolphin Museum	
15	25-Dec-96	Ko Mok	1.00	unknown	unknown	
16	11-Feb-97	Ban Pak Phan	1.00	unknown	unknown	
17	23-Feb-97	Ban Pak Phan	2.50	unknown	unknown	
18	27-Mar-97	Ko Yai Peninsular	1.00	unknown	unknown	
19	25-Apr-97	Ban Lam Pam	1.00	unknown	unknown	
20	20-Nov-97	Papayurn	2.29	unknown	unknown	
21	03-Jan-98	Klon Lud	0.90	unknown	unknown	
22	Feb-98	Klon Lud	1.00	Net Entanglement	Lam Pam Dolphin Museum	
23	06-Jan-00	Ban Khuan Kut	—	unknown	unknown	
24	04-Feb-00	Ban Khao Chan	—	unknown	unknown	
25	May-00	Ko Yai Peninsular	—	unknown	unknown	
26	12-Oct-00	Arbunting Forestry	1.87	Net Entanglement	Lam Pam Fisheries Station	Body in ground
27	21-Feb-01	Ko Yai Peninsular	0.99	unknown	Lam Pam Fisheries Station	Body in ground
28	18-Apr-01	Ban Lam Pam	2.10	Net Entanglement	Lam Pam Fisheries Station	Body in ground

Table 2. Habitat types of Songkhla Lake (data taken from Sirimontaporn & Sritakon (1995)).

Location	Habitat Type	Salinity (ppt)	Water Depth (m)	Total Area (km^2)	Extent of Fixed Nets
Thale Sap	medium depth, estuarine	13.68 - 28.00	0.9 - 1.4	242	upper half extensive fixed nets
Ban Chat	shallow, estuarine	0.19 - 4.57	0.5 - 0.9	90	complete coverage of fixed nets
Thale Luang	freshwater	0.00 - 0.00	1.0 - 4.0	720	lower quarter extensive fixed nets
Thale Noi	freshwater, slightly acidic	0.00 - 0.00	0.5 - 1.9	30	very few fixed nets

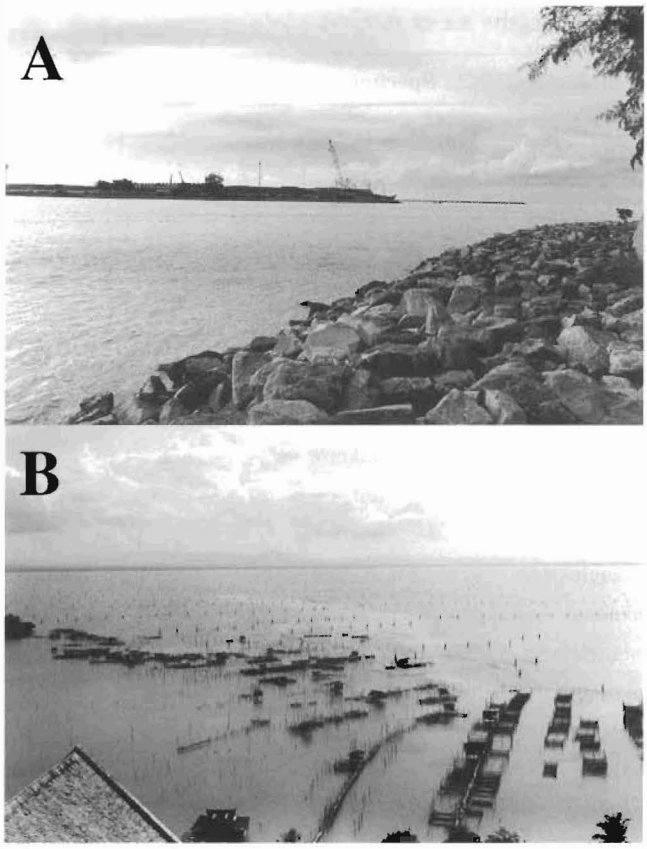

Fig. 3. The only opening of the freshwater lake to the sea is found in the southern portion of the Lake near Songkhla township (a). The use of permanent fishing nets throughout the lower portion of Songkhla Lake could be preventing movements of dolphins between the Lake and marine environments (b).

human-induced barrier to any dolphin movement between the Lake and coastal marine waters.

Surveys. – Due to the shallowness of the Lake, a local long-tail boat was used for the surveys. Although narrow and low to the water, observers were able to stand during observations, which gave approximately 1.5 m viewing height over the survey area. Thale Luang was divided up into four survey sections; upper (Amphoe Ranot), mid (Ko Yai) southeast (Ban Chat) and lower (Four Islands) Thale Luang. Survey lines were oriented north/south and east/west, spaced 2 km apart (Fig. 4). This design ensured that, with a viewing distance of 1 km on either side of the transect line, low-surfacing dolphins could be sighted with confidence in good sighting conditions (Beaufort 0-3). The survey lines covered the entire Thale Luang and included both fresh and brackish-water habitat types. Observers used a pair of Nikon 7x binoculars with built-in compass. One observer used naked eye and one used binoculars on a 30 minute rotation schedule. The boat followed a set of predetermined survey lines, using a global positioning system (GPS). Speed was kept constant at 9-10 km/hour. Environmental parameters (Beaufort state, water depth, turbidity and salinity) were taken every 30 minutes and whenever there was a dolphin sighting.

Once a dolphin group was sighted, data were collected on time of sighting, geographical position, angle of dolphins and bow of boat (relative to north, using binoculars with built-in compass) and initial sighting distance to dolphins. Additional data were collected on group size, group composition (adults or calves) and any unique behaviour or movements. Photographic identification was attempted on all groups sighted using a Canon EOS50 with 70-200 mm lens (f2.8) and 2x converter.

In addition to the line-transect boat surveys, four days of informal searching throughout Thale Luang were undertaken in April 2000 by the second author and on 7 May 2000, by members of the Lam Pam Dolphin Conservation Group.

A microlite aerial survey was conducted on 25 May 2001, which covered the entire Thale Luang (excluding the southeast area of Ban Chat, which is covered with fixed fishing nets). During aerial surveys, one observer and the pilot scanned the Lake using naked eye. The microlite flew 200 m from the water surface at a speed of approximately 100 km/hr. The area around Ko Yai Peninsula was searched extensively, due to the high probability of animals occurring there and previous sightings at this location (Fig. 5).

Informal interviews were undertaken throughout the study period. During the boat surveys and also on days specifically dedicated to interview surveys, fishermen were interviewed by local observers on the boat. During boat survey days, survey effort (total time and distance surveyed) was stopped and resumed once the interview was finished. During 2001, interviews were primarily conducted during survey days dedicated specifically for interviews.

Although informal, a series of pre-determined questions were asked, focusing on the localities and seasonality of dolphin sightings and the level of bycatch. Discussions were also held with local residents, wherever possible, which included members of the local dolphin conservation group and government officials.

Local research institutes, museums and universities were visited in the Songkhla region and throughout Thailand, to catalogue Irrawaddy Dolphin specimens. All specimens were measured and photographed and skin samples were taken from buried and preserved specimens, whenever possible.

RESULTS

Boat Surveys. – A distance of 545.2 km, during 54 hours of search effort was covered. A total of four dolphin groups were sighted during surveys in May 2000 and February 2001 (Fig. 6). No dolphin groups were sighted during surveys in May 2001 (Table 3). Average group size was 4.3 ± s.d. 2.9 (range 1-10) with a sighting rate of 0.03 dolphins/linear km. The groups were sighted in 2.3 – 2.7 m of water, the deepest section of the Lake on all four occasions. All groups were sighted in freshwater, with a salinity of 0.0 ppt (Table 3). A total of 148 minutes were spent in direct observation of dolphin groups. Photo-identification proved difficult as a

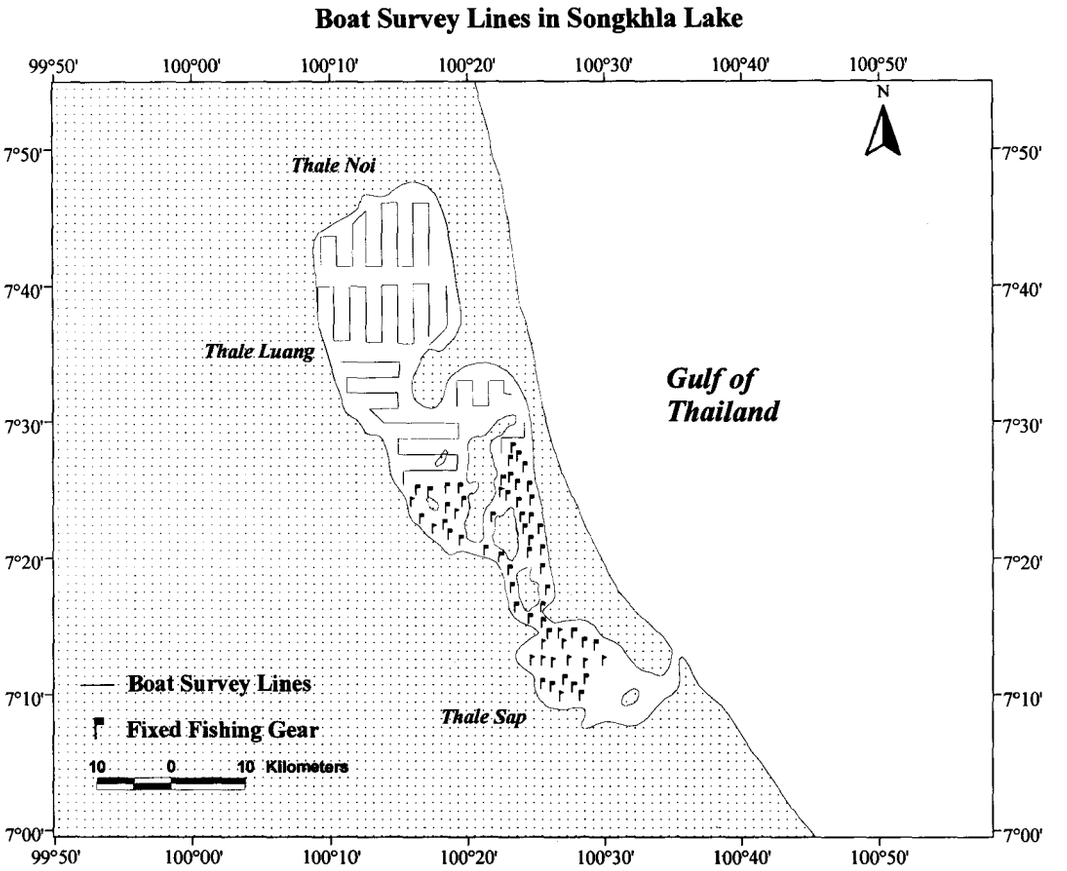

Fig. 4. Boat survey lines. The flags (⚑) represent areas of Songkhla Lake which we were not able to survey, due to fixed fishing nets obstructing the channel.

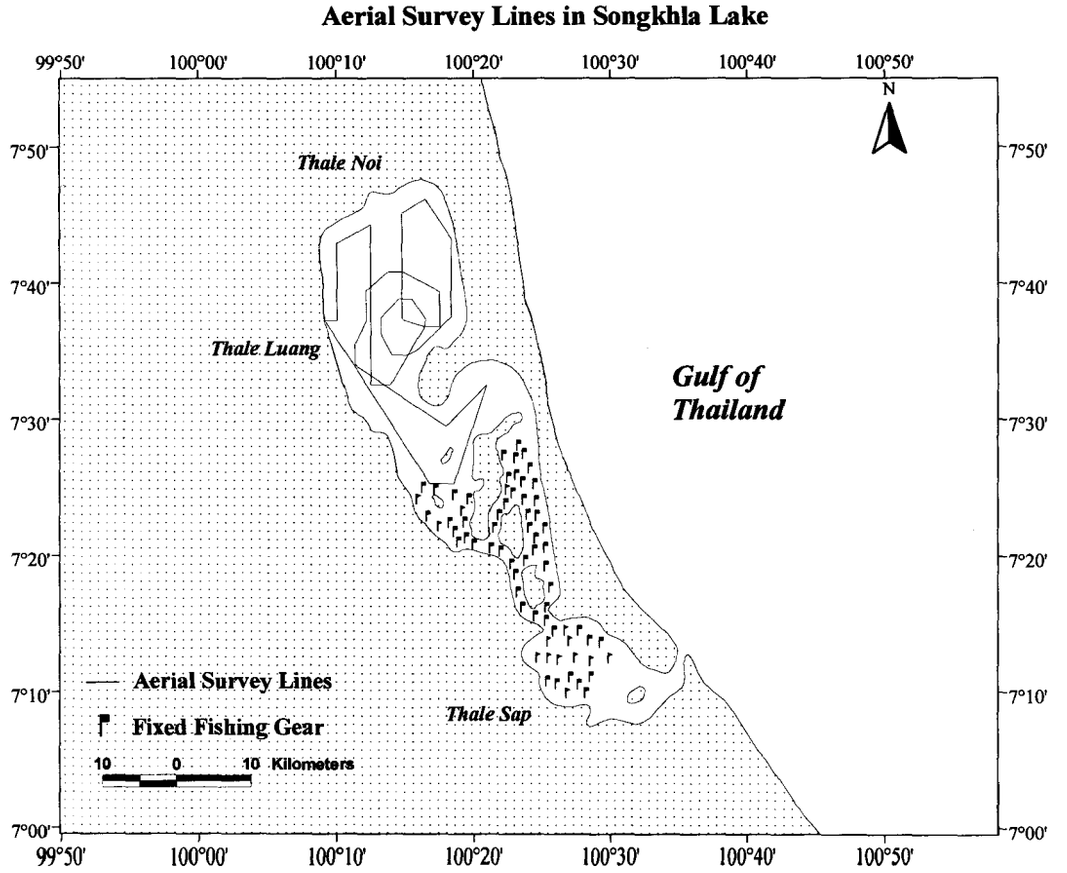

Fig 5. Aerial survey lines covered on 25 May 2001.

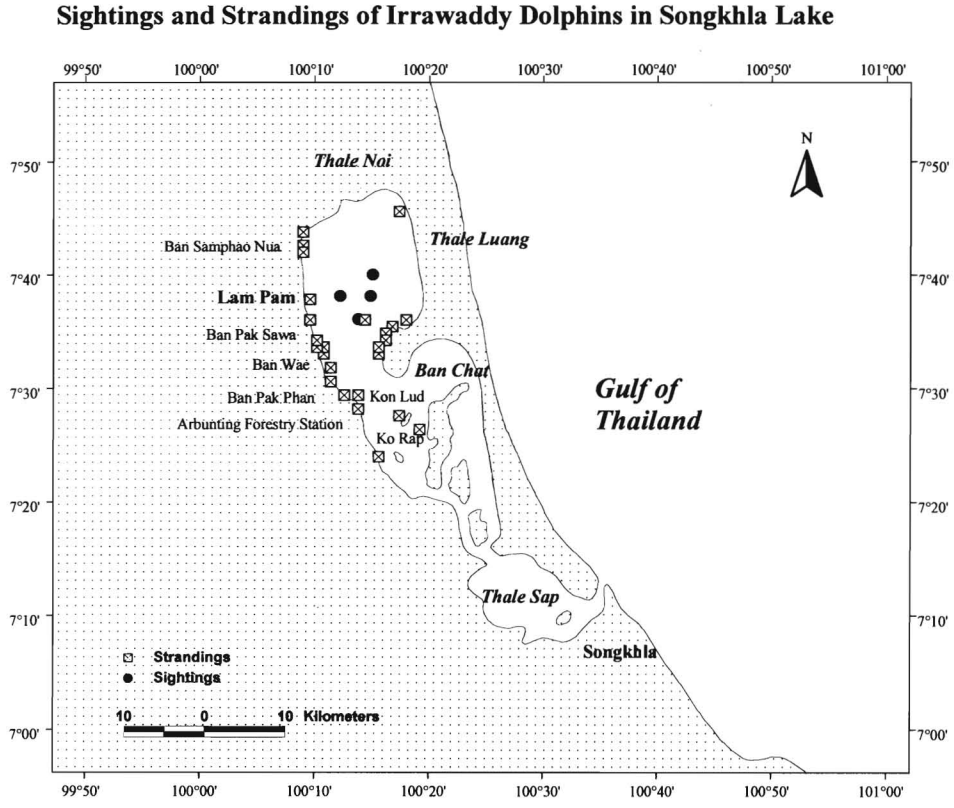

Fig 6. Location of recent sightings from Songkhla Lake and strandings from January 1990 to May 2001.

result of the dolphins shy, unobtrusive surfacing behaviour. No individuals were identified.

It was hoped that boat surveys using distance sampling methodology could be used to estimate total dolphin abundance within the Lake. However, due to the low number of sightings, line transect analyses were not feasible.

Aerial Survey. – A total of 204.4 km of survey, during 127 minutes were covered in aerial survey. The weather conditions were good, with clear visibility and low wind (Beaufort 0 to 3) throughout the survey. No dolphins were sighted.

Interviews. – A total of 86 fishermen were interviewed during the study period. Of these, 69% reported that they had previously seen dolphins only in the deepest portion of the lake, north of Ko Yai Peninsula (the location of the four sightings). The 31% of fishermen that had never seen dolphins in the Lake were interviewed in the very north portion of Thale Luang, Thale Noi and the southeast portions of the lake (Ban Chat). Although they had never seen dolphins in the Lake, they all knew from other fishermen that dolphins could be found near Ko Yai Peninsula. Eighty-seven percent of these fishermen fished everyday, in the same area throughout the majority of their lives.

Of the 69% of fishermen that had previously seen dolphins in the Lake, 72% had also previously seen a dead dolphin (either floating in the water or caught in a fishing net).

Table 3. Sightings of Irrawaddy Dolphins in Songkhla Lake.

DATE	EFFORT	POSITION	GROUP SIZE SIZE (HIGH - LOW)	DEPTH (m)	SALINITY (ppt)	TURBIDITY (cm)	AREA
30-Apr-00	OFF	—	18 (14 - 20)	—	—	—	Ko Yai Peninsula
07-May-00	OFF	—	5 (4 - 3)	—	—	—	Ko Yai Peninsula
26-May-00	ON	07°38.113 N 100°14.903 E	5 (6 - 4)	2.3	0.00	40	Ko Yai Peninsula
26-May-00	ON	07°36.217 N 100°12.237 E	1 (2 - 1)	2.4	0.00	35	Ko Yai Peninsula
29-May-00	ON	09°40.022 N 100°15.056 E	3 (4 - 3)	2.5	0.00	40	Ko Yai Peninsula
21-Feb-01	ON	07°36.088 N 100°13.801E	8 (10 - 6)	2.7	0.00	40	Ko Yai Peninsula

Although 46% of interviewees considered bycatch in gillnets one of the primary threats to the dolphins, only one interviewee admitted to previously having caught a dolphin while fishing. It became clear through interviews that the fishermen do not want to catch dolphins in their nets, but are unable to stop them from becoming entangled – especially if the net is left unattended.

Recovery of Stranded Specimens. – A database has been maintained for all stranded specimens since 1990 by the second author. Many specimens were either caught in gillnets and reported by fishermen or were found dead on the lake-shore by local residents. From January 1990 to December 2000, a total of 25 stranded specimens were recovered, including one live animal which later died (Fig. 7). During the first six months of 2001, three animals are known to have stranded, including one neonate (Fig. 8).

A total of 13 Irrawaddy dolphin skeletal specimens from Thailand were measured and photographed (Appendix 1). Additionally, two stuffed specimens and one adult specimen in formalin were available for examination.

DISCUSSION

If conservation efforts are not initiated immediately, the Irrawaddy dolphin population which inhabits Songkhla Lake will certainly face extirpation. A large group of approximately 18 dolphins were sighted during informal surveys in April 2000. However, boat and aerial surveys covering the entire lake in May 2001, failed to observe any dolphins. The extensive survey coverage and lack of sightings suggests that the population is probably small and extremely vulnerable to further threats and disturbances. Although very few dolphins have been sighted during boat surveys, the occurrence of several stranded calves each year, indicates the population is still reproducing.

The primary threat to the population is bycatch in fisheries. However, other threats such as overfishing, deterioration of water quality, eutrophication and potential dam and salinity barrier construction, also pose significant problems. Additionally, as the population declines, in-breeding depression could have a direct impact on the population.

In response to the large number of strandings which had been occurring in the area, a dolphin conservation group was established in 1996 in Lam Pam, Phattulung. This group has been running numerous community activities to raise public awareness and appreciation for the dolphins and their habitat. However, as is the case in many developing countries, poverty and increasing human population growth ensure conservation measures are difficult to implement and enforce.

The population appears to be restricted to the freshwater upper portion of Thale Luang. Due to the shallow water in Ban Chat region (average 0.5 m) and intensive fishing pressure (including permanent fishing structures spread throughout the lower Thale Luang and upper Thale Sap), it is highly improbable that dolphins are able to move into the lower regions of the Lake and out into the sea. No sightings have recently been reported of Irrawaddy dolphins from the coastal marine area parallel to the Lake, which may be either due to a lack of survey effort or an actual absence of dolphins. The closest known coastal marine specimen is from Surrat Thani (END 062), approximately 200 km north from the lake opening.

Within Thailand and throughout much of southeast Asia, the status of most small cetaceans is unknown. Very few

Fig. 7. This Irrawaddy dolphin was caught in a fishing net and was held in shrimp pools for two days before it died. The dolphin's body is severely emaciated.

Fig. 8. Lateral and ventral view of a young calf, which was found stranded in the freshwater portion of Songkhla Lake.

dedicated surveys are being undertaken to assess abundance and distribution, although several species are known to occur in coastal waters. Information is therefore lacking regarding population size, distribution and stock structure of many potentially endangered populations. The continued exploitation of Irrawaddy Dolphins and other small cetaceans in Thai aquaria and throughout Asia is of major concern – particularly if captured from small, isolated populations.

Only two lagoonal lake populations of Irrawaddy dolphins are known in the world; Songkhla Lake, southern Thailand and Chilka Lake, Orissa, India. Although little studied, both populations are showing evidence of significant declines. The loss of even one of these populations would have important conservation implications for the future of the species within southeast Asia.

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Appendix 1. Skeletal specimens of Irrawaddy Dolphins from Thailand.

	REG. NO	SPECIMEN TYPE	HABITAT	ORIGIN	INSTITUTE	CBL*
1	LFS 05	full skeleton	lake	Songkhla Lake	Lam Pam Fisheries Station	303.2
2	LFS 06	full skeleton	lake	Songkhla Lake	Lam Pam Fisheries Station	303.6
3	un-numbered	partial skull	lake	Songkhla Lake	National Institute of Coastal Aquaculture	—
4	un-numbered	partial skull	lake	Songkhla Lake	Hat Yai University	—
5	563 (45751)	skull	lake	Songkla, Lake	Staatliches Museum für Naturkunde, Stuttgart, Germany	290.0
6	un-numbered	skull	lake	Songkhla Lake	National Institute of Coastal Aquaculture	304.0
7	LFS 01	skull	lake	Songkhla Lake	Lam Pam Fisheries Station	294.2
8	LFS 02	skull	lake	Songkhla Lake	Lam Pam Fisheries Station	286.1
9	un-numbered	full skeleton	marine	Thailand	Buarapa University	308.1
10	END 062	full skeleton	marine	Suratthani	Phuket Marine Biological Station	291.1
11	END 022	full skeleton	marine	Sumut Sungkram	Phuket Marine Biological Station	280.8
12	un-numbered	full skeleton	marine	Buarapa Beach	Buarapa University	288.2
13	OBRE01-18/04	full skeleton	lake	Songkhla Lake	Lam Pam Fisheries Station	303.2

* CBL = Condylobasal Length