

A Study of the Bryde's Whale in the Upper Gulf of Thailand

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ABSTRACT

Bryde's whale (*Balaenoptera edeni* Anderson, 1879) is a baleen whale that uses baleen plates to filter fish from seawater when feeding. The main food of Bryde's whale is the anchovy. In the upper Gulf of Thailand, Bryde's whales are distributed along the coastlines of Phetchaburi, Samut Songkram, Samut Sakhon, Bangkok, Samut Prakan and Chon Buri provinces. This study was conducted during January 2010 – December 2012 using photo identification. The method identified the Bryde's whale population by recognizing the different characteristics of the dorsal fin and other wounds such as marks on the dorsal fin, body and fluke. The color patterns on the upper jaws and in the mouth were also observed. The population of 40 Bryde's whales was identified as seven females with calves. There were 10 calves in total. The mother and calf pairs stayed together for at least 17 months. Bryde's whales were mostly found from April to November. It is recognized that the the upper Gulf of Thailand area is suitable for Bryde's whale as feeding, breeding and nursing grounds.

KEYWORDS: Bryde's whale, distribution, population identification, the upper Gulf of Thailand

INTRODUCTION

The Bryde's whale (*Balaenoptera edeni* Anderson, 1879) is a baleen, whale which mean it has baleen plates for food filtration. This species belongs to Suborder Mysticeti, Family Balaenopteridae. Adults can reach 14-15 m in length and weigh up to 12-20 tonnes (some documents suggest 40 tonnes). Females are slightly larger than males. The body length of a newborn calf ranges between 3.4 and 4.0 m, and its weight ranges between 500 and 900 kg. Bryde's whales mature at the age between 8-13 years and give birth to one calf every two years. The gestation period lasts 11-12 months. The weaning age of a calf is around six months. Bryde's whales have black body with pale or pink abdomen and grey lower jaws. The slim body consists of the following: double blow holes, The 40-70 throat pleats running past the navel, 250-370 pairs of grey baleen plates and a triangular dorsal fin with a pointed tip, which is located towards the tail. Bryde's whales are distributed throughout the world, including the Atlantic, Pacific and Indian oceans. They inhabit the tropical and temperate zones with water temperature of about 16 °C or higher. Generally, Bryde's whales can be seen between latitude 40 °N – 40 °S, both along the coastlines and offshore. The key feature distinguishing Bryde's whales from other baleen whales is the three parallel ridges on the rostrum. Bryde's whales are a solitary species, with only two or three individuals present in a group. However, a loose group of 10-20 individuals can be found around feeding grounds (Jefferson *et al.*, 2008; Kato, 2002; Adulyanukosol *et.al*, 2011).

Previous studies have been limited to Bryde's whales distribution. Data on population, biology and migration of Bryde's whales are missing. However, these data are essential for the conservation of Bryde's whales. Undertaking a Bryde's whale survey for the whole area of the Gulf of Thailand is challenging due to the limitation in resources such as speed boats and funds. As a result, the identification method is adopted for the study of behavior, ecology and population (Well, 2002). The identification method has been applied in many species of marine mammals, namely Beluga whale, Killer whale, Short-finned pilot whale and Indo-Pacific humpbacked dolphin (Würsig and Jefferson, 1990). Bryde's whales have high and curving dorsal fin which is located towards the tail. This distinct characteristic helps differentiating Bryde's whales from fin whales (Jefferson *et al.*, 2008). The dorsal fin of Bryde's whales appears above sea surface every time the whales emerge to breathe or blow, before they dive back down. The vertebrae can also be seen sometimes, unlike the fluke tail which can hardly be seen.

MATERIALS AND METHODS

Boat survey and photo-ID technique modified from Würsig and Jefferson (1990). The survey was done once a month during January 2010 to December 2012. Each survey lasted 5 days and took place along the coasts of Phetchaburi, Samut Songkhram, Samut Sakhon, Bangkok, Samut Prakan and Chon Buri provinces.

1. Once Bryde's whales were encountered, the geographical position was recorded by Global Positioning System (GPS).
2. A Digital Single-Lens Reflex (DSLR) camera with 70-300 and 80-400 zooming lenses was used to photograph the characteristics and behavior of Bryde's whales.
3. Bryde's whale individuals were identified by distinct features using photo-ID techniques. The dorsal fin was the most outstanding feature. Other features included nicks on the head, body and tail. The differences in patterns on the mouth's edge/baleen plates and black spots/marks on the palate were also inspected. The data were input as part of the study of population, migration and biology of Bryde's whales, including as feeding, breeding and nursing of calves.
4. The distribution of Bryde's whales was mapped in the upper Gulf of Thailand.

RESULTS

Distribution

The boat survey was done by Marine and Coastal Research Center, the upper Gulf of Thailand, during January 2010-December 2012. It was found that Bryde's whales were distributed along the coastlines of Phetchaburi, Samut Songkhram, Samut Sakhon, Bangkok, Samut Prakan and Chon Buri provinces (Fig. 1). Bryde's whales can be found in the highest numbers in Samut Sakhon province (51%). Other areas are in the order of size of distribution: Samut Songkhram province (21%), Samut Prakarn province (12%), Phetchaburi province (10%), Bangkok province (3%), Chacheongsao province (2%), and Chon Buri province (1%).

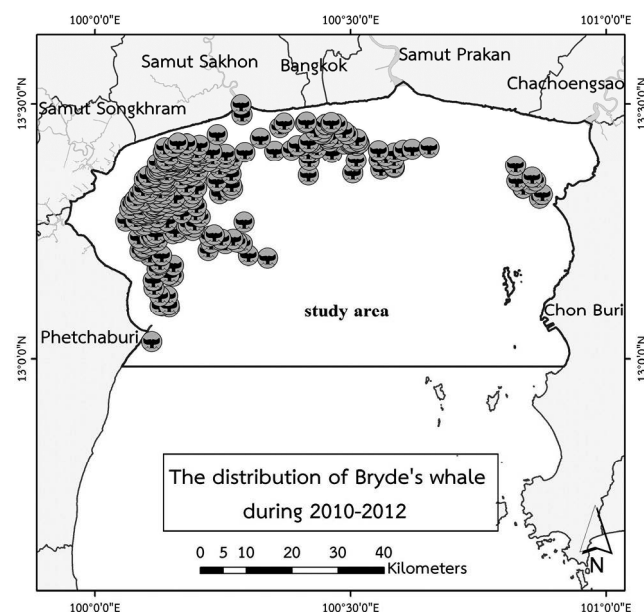


Fig 1. Map of Bryde's whales distribution from boat survey during January 2010 to December 2012.

The number of Bryde's whales varied between months with an average of 0-13.33 individuals per day (Fig. 2). The average numbers of Bryde's whales for the years 2010, 2011 and 2012 were 7.33 ± 11.71 ($N = 12$), 9.75 ± 10.42 ($N = 12$) and 12.50 ± 13.81 ($N = 12$), respectively. The period when Bryde's whales were encountered most frequently was between April-November, especially in September. The highest number of encounters was in September 2011, with up to 19 animals per day. The average numbers of animals found in September 2010 and 2012 were 13.33 and 9.80 animals per day, respectively. Bryde's whales were seen the least during December-March with only 1-2 animals per day. No whale was seen during January, March-April in 2010, January-March 2011 or in February 2012.

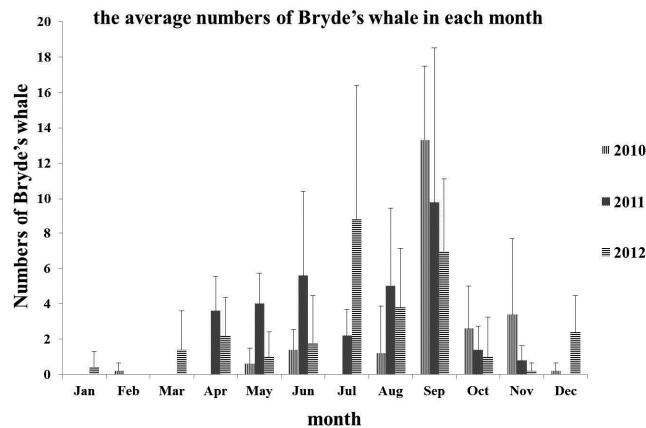


Fig. 2. Graph showing average numbers (Mean $\pm$ SD) of Bryde's whales from the survey during January 2010 to December 2012.

Photo-ID

The Photo-ID technique relied on distinct features of Bryde's whales (Fig. 3) such as dorsal fin, nicks (on the head, body and fluke), patterns (on the mouth's edge and baleen plates) and black spots/marks (on the palate). The study was able to identify 40 whales by considering the following features:

1. The dorsal fin was the first feature to be considered. The differences were scars or other observable characteristics. In some cases, the fin was complete but the shapes could be differentiated; for example by sickle-shaped fin, triangular fin, curved tip or round tip. The technique required skills and expertise in observation. There were 10 animals that could be distinguished by dorsal fin alone; for the rest we had to examine other features as well.
2. Nicks on the head such as marks, scratches or scars. There were 12 animals with these nicks.
3. Scars on the body such as marks, swollen parts, small pits, white blotches and arched-back. There were nine animals with these scars.
4. Nicks on the fluke such as chipped fluke, twisted fluke and scarred fluke. Only three animals were found with these nicks, as Bryde's whales do not usually show their tails. This meant that the available data on this aspect was limited.
5. Individual patterns on the mouth's edge and baleen plates were found on 36 animals.
6. Black spots/marks on the palate were seen on 13 animals.
7. There were 4 whales that had no mark, but all of them were calves. The calves were small and still had a perfect dorsal fin. They had no marks on any part of the body. It was not possible to take photographs to see patterns on the mouth's edge and baleen plates because the calves could not lift their mouth above sea surface. They were named for monitoring purposes, as marks might appear in the future.

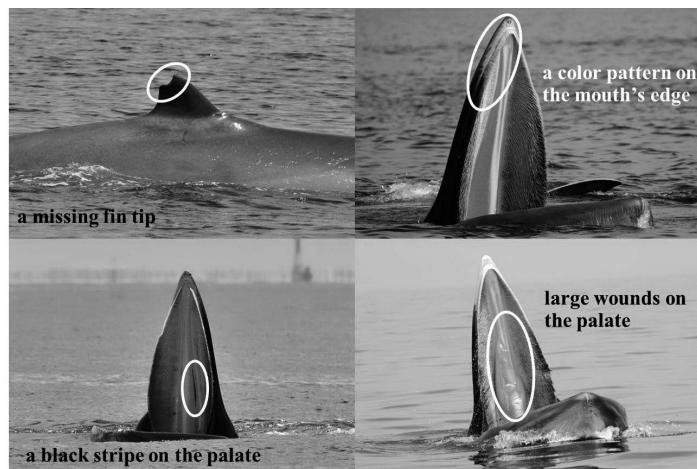


Fig. 3. Characteristics of Bryde's whales that were observed using Photo-ID techniques.

Breeding and nursing

This study encountered breeding behavior on six occasions; one time in 2010, three times in 2011 and twice in 2012. An assumed male whale chased after a female whale (found with a calf or calf that was previously nursing). If the female whale was still nursing a calf, the male whale drove the calf away in order to mate with the female. Of the six times, there was only one time that a male approached a female that was no longer nursing a calf (Mae Tong-On). This breeding behavior was observed at about 6-11 kilometers distance from the coasts of Samut Sakhon, Phetchaburi and Samut Prakan provinces in water depths of 6.5-14 meters (Table 1).

Table 1. Detailed information of breeding behavior found in the upper Gulf of Thailand from the survey, during January 2010-December 2012.

Date	Pairs	Location of breeding behavior
5 Nov 2010	Jao Buntern and Mae Wansuk with Jao Sukjai (calf)	10 km. from the coasts of Bang Kachao sub-district, Mueang district, Samut Sakhon province with water depth of 8.9 m.
15 Aug 2011	Jao Mesa and Mae Gunya with Jao Maruay (calf)	11 km. from the coasts of Kalong sub-district, Mueang district, Samut Sakhon province with water depth of 11.1 m.
7 Sept 2011	Jao Bangsaen and Mae Gunya with Jao Maruay (calf)	9 km. from the coasts of Ban Pak Thale sub-district, Baan Laem district, Petchaburi province with water depth of 13-14 m.
7 Sept 2011	Jao Mesa and Mae Tong-On with Jao Taengthai (calf)	8 km. from the coasts of Ban Pak Thale sub-district, Baan Laem district, Petchaburi province with water depth of 12 m.
5 Jun 2012	Jao Buntern and Mae Wansuk with Jao Saensuk (calf)	9 km. from the coasts of Laem Fa Pha sub-district, Phra Samut Chedi district, Samut Prakan province with water depth of 7 m.
9 Jul 2012	Jao Buntern and Mae Tong-On (separated from the calf)	6 km. from the coasts of Laem Fa Pha sub-district, Phra Samut Chedi district, Samut Prakan province with water depth of 6.5 m.

There were seven Bryde's whales found with a calf, but the total number of calves found was 10. This was because three of the Bryde's whales gave birth twice; namely Mae Sodsai, Mae Gunya and Mae Wansuk (Table 2). The first calf of Mae Gunya was found only once in September 2010 so it did was not included in the population of 40 Bryde's whales.

Table 2. Detailed information on sighting of Bryde's whales and calves from the survey during January 2010-December 2012.

Date (first encounter)	Names of Bryde's whale – calf	Date (last seen together)	sighting duration (month)
19 Aug 2010	Mae Sodsai – the first calf	5 Nov 2010	3 months
22 Sept 2010	Mae Srikhram - Jao Seefah	6 Oct 2011	14 months
29 Sept 2010	Mae Gunya – the first calf	seen once	-
5 Nov 2010	Mae Wansuk - Jao Sukjai	22 Mar 2012	17 months
25 Apr 2011	Mae Sakhon - Jao Thachin	28 Aug 2012	16 months
23 May 2011	Mae Tong-On - Jao Taengthai	16 Sept 2011	4 months
26 May 2011	Mae Khaoniew - Jao Somtum	14 Oct 2012	17 months
15 Aug 2011	Mae Gunya - Jao Maruay	4 Nov 2012	15 months
23 Mar 2012	Mae Sodsai – Jao Meena	23 Sep 2012	6 months
5 Jun 2012	Mae Wansuk – Jao Saensuk	21 Dec 2012	7 months

CONCLUSIONS AND DISCUSSIONS

Bryde's whales were distributed along the coastlines in the upper Gulf of Thailand. This was because the anchovy, the main food of Bryde's whales, is found along the coastlines and around the islands within Thai seas stretching to the border of Malaysia. The area near fish traps in Samut Sakhon province to Samut Songkram province was the area with the highest distribution of anchovy (Saikliang, 1990). The survey showed that almost every time Bryde's whales were sighted, foraging behavior was also observed. While foraging, the whales' mouth protruded out of the sea, and this phenomenon can be seen from long distance. Push-net boats fishing for anchovy could sometimes be seen in the sighting area as well. These boats took advantage of the sighting by fishing near the area, as there was a large shoal of anchovy.

The photo-ID technique in this study mainly focused on the dorsal fin, as it had distinct characteristics and could be observed every time Bryde's whales surfaced. Despite the differences in the fin features, researchers are still required to have skills and expertise in observation. Other individual features were therefore taken into consideration, especially patterns on the mouth's edge/baleen plates and black spots/marks on the palate. These extra features were difficult to observe if the mouth did not emerge above seawater, or if the whales did not open the mouth. Nonetheless, every additional feature was needed to reduce error in identification, as features could change over time, for example the shape of dorsal fin. This study is different from other studies that only observe dorsal fin characteristics. For example, the study of Bryde's whales in the Gulf of California in Mexico by Tershy *et.al* (1990) and the study of large whales (Fin whale and Sei whale) by Wells (2002). It was important to choose natural marks that were permanent and did not change throughout the study period (Hammond, 1986 and Würsig and Jefferson, 1990).

There were at least seven female whales in the upper Gulf of Thailand. The females were usually found nursing their calf. This was especially true for Mae Wansuk and Jao Sukjai (Fig. 4). They were encountered for the first time in November 2010, when Jao Sukjai was about 5-6 meters in length and the age of about 3-4 months. They were found foraging in the upper Gulf of Thailand together since then until March 2012 (17 months), when Jao Sukjai was found foraging alone. The calf stayed at about 50-100 meters distance from Mae Wansuk and fed on fish without getting close to the mother. They were no more seen together in April and May 2012. Mae Wansuk was found with another calf (Jao Saensuk) in June 2012. The calf was small (about 3-4 meters long), at an age of no more than one month. Meanwhile, Jao Sukjai was found feeding alone. This showed that Bryde's whales in the upper Gulf of Thailand have high rate of pregnancy and birth. It also suggested that Bryde's whales can be pregnant while nursing a calf.

Best (1977) studied Bryde's whales in South Africa. He found that Bryde's whales living near coastlines had a reproductive cycle of around two years. Kato (2002) concluded that the cycle of Bryde's whales reproduction was two years, consisting of a 11-12 month gestation period, a six month milk feeding period, and six months of rest. This study also reported on breeding behavior of Bryde's whales. An assumed male whale chased after a female whale (the whale with a calf or known to be female). The breeding was a monogamous, meaning that there was 1:1 ration between male and female. There was no polygamy. This was consistent with the findings of Lockyer (1984) which stated that baleen whales had monogamous breeding behavior but they did not pair for life.

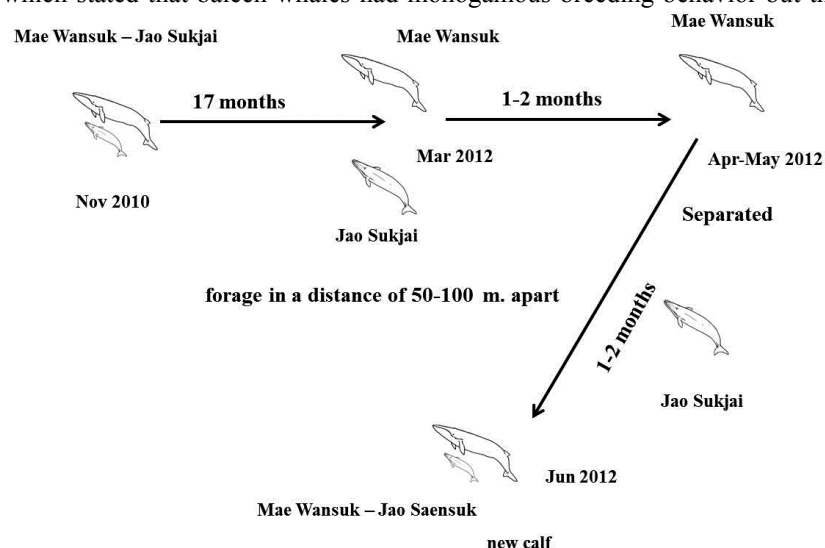


Fig. 4. The period in which Mae Wansuk and Jao Sukjai were together until separation, after which Mae Wansuk had a new calf.

Bryde's whales along the coasts of South Africa bred all year round (Best, 1977), while Bryde's whales in the warm-water zone had uncertain breeding period but were able to give birth the whole year (Jefferson *et.al.*, 2008). This study was conducted in the tropical sea and found that the breeding period of Bryde's whales in the upper Gulf of Thailand was between April-September. This period coincided with the time when a large number of Bryde's whales were sighted in loose groups. This condition provided more opportunity for male whales to select female whales for mating. Overall, Bryde's whales in the upper Gulf of Thailand seemed to breed and give birth all year round.

This first study of Bryde's whales in Thailand faced many limitations. In the future, other methods should also be applied. For example, satellite tagging could be used to observe long distance migration of Bryde's whales. Tissue biopsy techniques could help in the comparison of DNA samples taken from wild animals and from stranded carcasses, or from bones found on coastlines. The data suggests that there is a need for setting up a management plan for breeding and nursing grounds for Bryde's whales. This development would bring success to the efforts to conserve Bryde's whales of Thailand.

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