

# Yangtze River Dolphin, or Baiji (*Lipotes vexillifer*)

## Baiji (*Lipotes vexillifer*): Travel and Respiration Behavior in the Yangtze River

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### Abstract

So few baiji (*Lipotes vexillifer*) survive, and opportunities to observe them in the wild are so rare, that the rudimentary data gathered during three brief encounters in 1987 and 1989 were considered worth analyzing and reporting. It must be acknowledged, however, that these observations may not be representative of the animals' natural behavior, as would have been observed in earlier times when they were much more abundant and widespread in the Yangtze River. Groups of two, two, and three (briefly four) baiji were observed on 18 November 1987, 22 March 1989, and 30 March 1989, respectively, for a total of about seven hours of concentrated study. The group on 30 March was joined briefly by a group of five finless porpoises (*Neophocaena phocaenoides*). All of the baiji appeared to be travelling for the entire time of observations, with no indication of social interactions or feeding. The mean respiration rate of the 30 March group was  $1.21 \pm \text{s.d. } 0.106$  per minute during seven recording bouts. This group, followed for almost ten hours, crossed the river five times, apparently to minimize resistance as they travelled upriver against the current. Their minimum average ground speed was 2.4 km/hr in a current of about 2–3 km/hr, making their actual speed about 5 km/hr. Respiratory behavior of the wild baiji was similar to that of a captive male baiji during its daytime, non-feeding mode of behavior.

### Introduction

The Chinese river dolphin, or baiji (*Lipotes vexillifer*), is suffering a chronic and possibly irreversible decline largely due to human use of the Yangtze River (Chen and Hua 1989, Leatherwood and Reeves 1994, Wang *et al.* 1998, Zhou *et al.* 1995, 1998). It is classified as Critically Endangered by the IUCN (IUCN 1996) and has been declared a national treasure "of the first order" by the People's Republic of China (Wang 1989).

While the baiji has generated considerable international and Chinese national attention (e.g. Zhou and Zhang 1991, Chen and Liu 1992), surveys for population estimates as well as studies of behavior have been generally unsystematic and of short duration (Zhou *et al.* 1998). The lone baiji in captivity, the adult male "Qi-Qi" at the Wuhan Institute of Hydrobiology, has been studied far more intensively than wild baiji in the river (e.g. Liu and Wang 1989, Liu *et al.* 1994, Yang *et al.* 1997).

In autumn 1987 and again in spring 1989, we were fortunate to observe baiji at two disparate locations in the middle and lower reaches of the Yangtze River, enabling us to describe their basic patterns of behavior. While we had hoped to build on these data in a long-term study of baiji behavior, now – about 10 years later – it appears unlikely that much additional information will be obtained, given the present scarcity of sightings. We therefore present what information we have, compare it to the behavioral descriptions of the lone baiji in captivity (Yang *et al.* 1997), and discuss how our limited data might be extrapolated.

### Methods

Searching for baiji was carried out visually with the aid of x7 to x10 power binoculars, variably from the river bank, a 15m long vessel, and 5 to 7m wooden fishing vessels (the latter driven by single-cylinder outboard engines, capable of moving the vessel at 5 to 7km/hr). Fishermen hired by the researchers worked together to search for dolphins, often from as many as 15 vessels. They reported sightings either by shouting from boat to boat, waving flags, or in a few instances using marine-band (VHF) hand-held radios.

Baiji behavior was described on three sighting days: 18 November 1987 and 22 and 30 March 1989. Baiji were also seen (by fishermen, not by us) on 19 and 20 November 1987. In 1987, we followed two baiji to describe behavior from a 7m wooden vessel; on 22 March 1989, our river boat was tied to shore while two animals were observed

passing by; and on 30 March 1989, we again followed three and briefly four baiji from a 7m wooden fishing vessel. During follows, we tended to be 100 to 300 meters behind and slightly to the side of the travelling animals. Thus, we did not have clear views to distinguish individual baiji except briefly when the vessel was close or alongside the animal. Observations were made by naked eye from the fishing vessels but with nine power binoculars from the stationary platform near shore on 22 March 1989. In all cases, a primary observer dictated behavioral descriptions into a portable tape recorder. At the same time, one secondary observer photographed the dolphins when possible, and a third observer recorded weather, location, and other observations on data sheets.

In the laboratory, observer voice recordings were transcribed; and respiration data were entered into a computer spreadsheet and graphed. Statistical analyses were not attempted because of small data sets and the realization that our several days and only about seven hours of observations may present a biased, uncharacteristic view of the species.

## Results

In 1987, baiji were seen on three of four census days on the river, within 10km of the city of Chenglingji, not far from Dongting Lake, and about 1,287km from the Yangtze River mouth at Shanghai. We followed two baiji for 44 minutes on 18 November; and one and three were seen briefly by fishermen working for the research crew, on 19 and 20 November, respectively. Unfortunately, we do not know whether any of these represented repeat sightings.

On 18 November, the two apparently adult baiji travelled downriver (with the current), 15.16–16.00h local time. They moved within about 200m of one side of the river, which was 600–800m wide in this area. Our observation vessel, a 7m wooden fishing boat with a one-cylinder outboard motor, followed generally 150–200m behind the dolphins. Travel was judged to be “medium

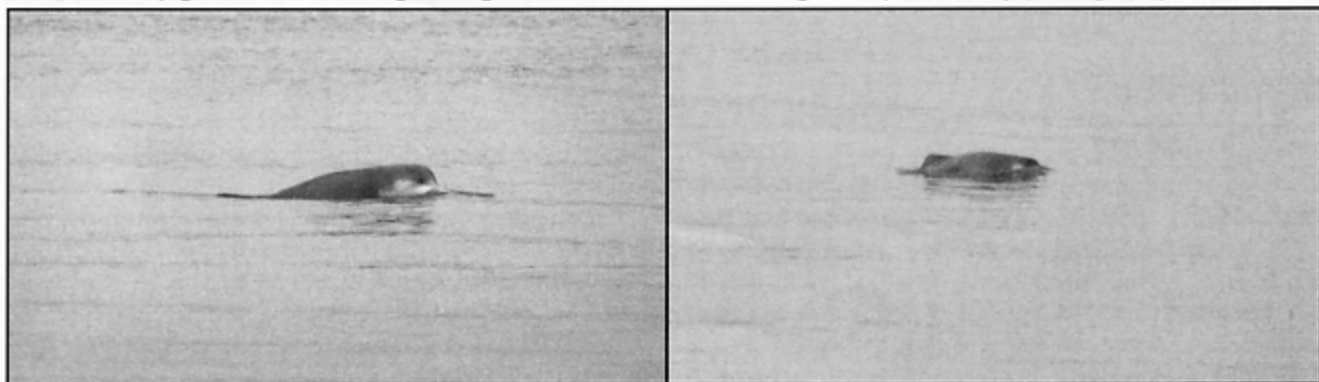
speed,” with no whitewater along the flanks of the animals as they surfaced, estimated to be about 4km/hr (which made distance covered 7–8km/hr because of the generally swift currents of the area). The first surfacing after each longer-than-60 second dive tended to be with head and rostrum exposed, so we could clearly distinguish facial markings and a variably dark “brush-like” shading behind the eyes of one individual (Fig. 1).

In general, we were not able to dictate the fishing vessel's movements to suit our research interests, and stayed too far behind the dolphins for reliable surfacing data. However, short sequences when we were briefly closer revealed the following, with dives longer than 60 seconds underlined: Animal “A” surfaced and respired in second intervals of 12, 7, 15, 15, 68, 13, 18, 22, 17, 16, 79, 18, 20, 15, and 13 before we lost sight of it. Animal “B” surfaced and respired in second intervals of 16, 12, 14, 25, 82, 25, 28, 17, 14, 72, 22, 18, and 15 before it, too, was lost. Short “inter-dive” respiration intervals were between 7 and 28 seconds, and there were three to five of these between the four longer dives. Dolphin “A” exhibited a short dive mean of  $15.5 \pm \text{s.d. } 3.82\text{sec}$  ( $n=13$ ), and Dolphin “B” showed a mean of  $18.7 \pm \text{s.d. } 5.39\text{ seconds}$  ( $n=11$ ). Both animals were lost from view when they dived abruptly approximately eight meters in front of a fast-moving barge.

On 22 March 1989, two baiji were encountered travelling upriver past a mid-river island. Observations were made from a stationary vessel on shore, from a distance of about 200m. The location was at Yubanzhou, in a channel of the mainstem of the river, almost exactly 600km from the mouth of the river at Shanghai. This set of observations was the only one without an observation vessel moving with the animals, and thus may represent the “least-disturbed” baiji encounter described in this note.

The two baiji were observed from 13.23.11 (hours, minutes, seconds, local time) to 14.03.34, or for 40.4min. They travelled approximately 75 to 100m apart, with one dolphin (“A”) in front and the other one (“B”) almost directly behind. Travel was again “medium speed”, or about 4km/hr. However, because the dolphins were travelling

**Figure 1.** Dolphin “A” of 18 November, 1987 (left); and a different Dolphin “A” of 22 March 1989; in both cases to show the pigmentation markings along the head that make recognition possible by photography.

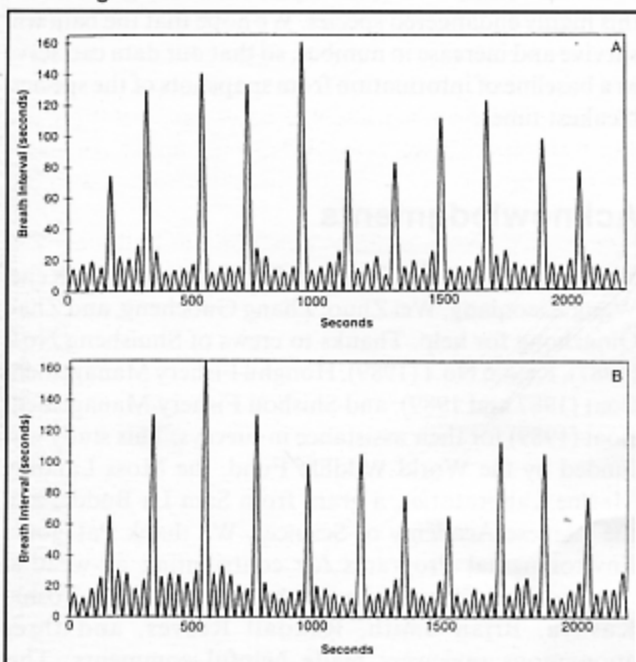


upriver into a current of about 1–3km/hr, they made slow progress, covering only about one kilometer along the mid-river island during the 40.4min of observations. This explains why we were able to watch the traveling dolphins for so long from a stationary viewing site.

As in 1987, surfacings after a long dive tended to be with head and rostrum exposed. Again, we were able to distinguish animals by markings on the head and back. Baiji “A” was slightly smaller than “B” and had a lighter head and back, with heavy criss-cross scarring on its back. Baiji “B” was less scarred and appeared to be darker overall.

The surfacing/respiration pattern for both animals is summarized in Figure 2. While long dives were always greater than 60 seconds (“A” mean =  $110.4 \pm \text{s.d. } 28.70\text{sec}$ ,  $n=11$ ; “B” mean =  $102.8 \pm \text{s.d. } 31.02\text{sec}$ ,  $n=11$ ), there were three to five shorter respiration intervals between them, all lasting less than 35 seconds (“A” mean =  $17.2 \pm \text{s.d. } 5.79\text{sec}$ ,  $n=49$ ; “B” mean =  $19.3 \pm \text{s.d. } 5.79\text{sec}$ ,  $n=53$ ). Figure 2 shows the remarkable consistency in surfacing/dive patterns for the approximately 37 minutes of observation of each dolphin, with the unproved possibility of “bouts” of several long and several short dives by both baiji (compare the longer dives around 500 and 1,700 seconds for both dolphins with shorter dives at the beginning, middle, and end of observations. Overall, the respiration rates were 60 respirations per 34.26min, or 1.75/min, for dolphin “A”; and 64 respirations per 35.88min, or 1.78/min, for dolphin “B”.

**Figure 2.** Surfacing and dives, which were correlated fully with respirations, for two dolphins observed for slightly longer than one-half hour, 22 March 1989. Note the high regularity of short respiration intervals and longer dives.



On 30 March 1989, dolphin researchers from the Wuhan Institute of Hydrobiology observed a group of three, briefly four, baiji from 07.15 to 17.00, or for almost ten hours. During that time, the animals travelled mainly upstream, with occasional meandering, for a total distance of 24km, or at a minimum average speed of approximately 2.4km/hr. Since the current was estimated at about 2–3km/hr for that area (Chen Peixun, pers. observ.), the dolphins may have travelled at a speed of about 5km/hr.

Several of us travelled with the baiji from 09.45 to 15.00, and described respirations of three, briefly four, animals during seven bouts when we could count all respirations. Unfortunately, our distance of generally 100–300m from the dolphins only occasionally allowed us to differentiate them, and we were forced to count all surfacings during these bouts of better observations, and – for overall estimates of numbers of blows per individual – divide by the three (briefly four) animals present in the group. These data are presented in Table 1, and they show a mean of  $1.21 \pm \text{s.d. } 0.106$  respirations/min ( $n=7$  bouts).

Three dolphins travelled together, generally within 5 to 15m of each other, throughout the day. A smaller individual, possibly a subadult, travelled close beside a larger dolphin, and a second even larger one was generally ahead of the two, by up to 15m. From at least 12.23 through 12.38 (see Table 1), these three were joined by another large animal. This large individual travelled in the lead, and while it was present, the other three dolphins bunched closely together, trailing behind. We did not see the large “newcomer” approach or leave, but are certain from at least one almost synchronous set of surfacings that there were four individuals in the group for at least 15 minutes.

**Table 1. Surfacing data on baiji travelling upriver on 30 March 1989.** Because we could not clearly distinguish between individual dolphins from our vantage point almost directly behind them, we logged all surfacings during seven unequivocal bouts of data gathering, and calculated mean respirations per minute by dividing by the number of dolphins present.

| Time              | Number of Minutes | Number of Baiji | Number of Respirations | Respirations/Minute |
|-------------------|-------------------|-----------------|------------------------|---------------------|
| 10.06.53–10.14.49 | 7.93              | 3               | 30                     | 1.26                |
| 10.42.32–11.04.49 | 22.28             | 3               | 86                     | 1.29                |
| 11.20.54–11.48.40 | 27.75             | 3               | 86                     | 1.03                |
| 12.00.39–12.11.39 | 11.00             | 3               | 40                     | 1.21                |
| 12.23.14–12.38.13 | 14.98             | 4               | 68                     | 1.13                |
| 12.49.10–13.06.45 | 17.58             | 3               | 71                     | 1.35                |
| 14.15.28–14.33.17 | 17.80             | 3               | 64                     | 1.20                |



The three "primary" dolphins crossed from one side of the river to the other on at least five occasions. At times, this crossing took place abruptly, apparently bringing the dolphins into the lee of currents at the far side of a river bend, and away from forceful or swift currents just before a river bend. However, our observations of crossovers are not numerous enough to "prove" that the baiji use a particular travelling strategy consistently.

Baiji were seen with finless porpoises (*Neophocaena phocaenoides*), at least briefly, during all but the 22 March 1989 encounter. On 18 November 1987, at least five finless porpoises appeared to join the two travelling baiji for approximately five minutes. There was no sign of change in headings, speed, or behavior of the baiji. During the long 'follow' of 30 March 1989, two to five finless porpoises accompanied the three "primary" baiji on four occasions, staying with them for two min. to as long as 25min. Again, it was our impression that the finless porpoises approached the baiji, while the baiji did not appear to change their travel direction or speed. The baiji in two other sightings reported to us by fishermen (on 19 and 20 November 1987) were also said to have had finless porpoises near or with them, but we obtained no further information on this point.

## Discussion

The baiji described here were all in groups of two to three, with one brief grouping of four. Chen and Hua (1989) reported that during a survey between November 1985 and February 1986, most of the groups observed were larger than five, with some of them containing up to nine to 16 animals. The small groups that we encountered may not represent the optimal group size for this species. The fact that three dolphins stayed together for at least 10 hours while they travelled several dozen kilometers indicates some degree of fidelity among adults. In the present cases, however, we are ignorant of sex, age, and possible kinship among the group members.

All three of the groups that we observed were travelling, with no indications of socializing, playing, or resting. The dolphins may well have been feeding while travelling, but we did not see fish or other prey in their mouths, and have no further information on this point. Swimming speeds and surfacing/dive/respiration patterns were remarkably consistent among groups, among animals within a group, and for individuals over time. We are reluctant to call the behavior of baiji "consistent," however, because we appear to have observed them only during the one behavioral mode of travel. At any rate, the two dolphins of 18 November 1987 averaged surfacing intervals of 15 to 19 seconds, and dives of somewhat more than one minute. Interestingly, the two animals observed on 22 March 1989 exhibited very similar average surfacing intervals, but

with long dives considerably longer than those of the 1987 dolphins (103 and 110sec). Respiration rates of the latter two animals swimming upriver were about 1.75/min. This is much higher than those of the three to four dolphins of 30 March 1989, which averaged only 1.21/min during their travel, also upriver.

The respiration rates of the two baiji of 22 March 1989 were remarkably similar to that of Qi-Qi, at 1.77/min (Yang *et al.* 1997). Furthermore, surfacing intervals and long dives of 22 March were quite similar to Qi-Qi's daytime "general" (non-feeding) surfacings and dives.

Multiple river crossings by the three dolphins of 30 March 1989 were of particular interest. This kind of movement pattern has been observed quite often when animals were travelling upstream (Wang Ding, pers. observ.), and the crossings suggest that the animals were attempting to shorten the distance to be covered, to swim in areas of least current, or both. It is also possible, however, that these crossings of the river were prompted by other factors not related to distance or current. It is even possible that the abrupt changes in direction and river side were related to searching for or following prey. Interactions between the baiji and finless porpoises would also be interesting to study further. Our brief observations suggested a curiosity of finless porpoises toward baiji, but not the reverse. There was no obvious indication of aggressive or competitive interactions.

Finally, we do not wish to attribute too much significance to these brief observations of baiji. They would hardly be worth reporting if there were a reasonable chance to gather more data on swimming, surfacing/diving, and inter-individual affiliations and interactions during different behavioral modes and in different kinds of habitat. Alas, such data may not be easily gathered on this highly endangered species. We hope that the baiji will survive and increase in number, so that our data can serve as a baseline of information from snapshots of the species' bleakest times.

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