

Studies on the Little Toothed Whales in the West Sea Area of Kyushu—XIII

Mating Calls and Others of the Bottlenosed Dolphin
caught at Arikawa in Goto Is., Nagasaki Pref.

Kazuhiro MIZUE, Akira TAKEMURA and Kei NAKASAI

The bottlenosed dolphins of the west sea areas of Kyushu were bred in the pond and their underwater signals were collected. And then their mating calls and other quite curious characteristic signals were analyzed. These sounds up to high frequency make many layers which are parallel or convex to the X axis (time) in the sonagram.

Introduction

After the war, acoustic techniques had been introduced into the field of marine biology, and the studies on underwater sounds of marine animals had been progressed rapidly. In Japan, this study has the possibility for the development of epoch-making fishing method. It was begun in many places after the war to breed porpoises and dolphins in order to show and study their behaviors. Their underwater signals have been interested by many biologists. Their acoustic signals are classified roughly into two patterns¹⁾, namely, whistles and clicks. It is clear that the bottlenosed dolphins use both signals in their natural life.

Fig. 1 and Fig. 2 show the typical patterns of whistles and clicks emitted by the bottlenosed dolphins caught in the west sea area of Kyushu. The whistles are used by the dolphins and porpoises chiefly for communication and they are of pure tone which is parallel to the X axis (time) in general as shown in Fig. 1, and they have the frequency be-

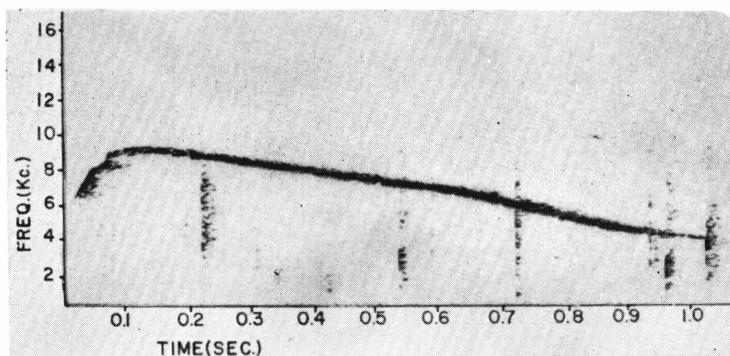


Fig. 1 Sonagram of whistle of bottlenosed dolphin.

tween 5 kc - 10 kc. The clicks are generally used for echo-location and they are of almost white noise which is vertical to the X axis as shown

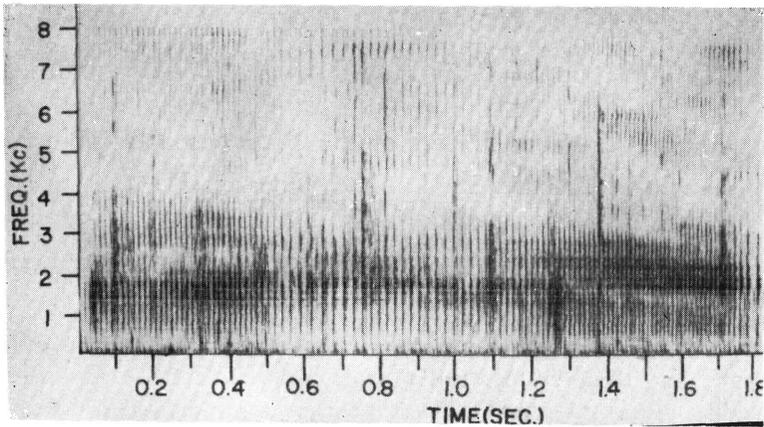


Fig. 2 Sonogram of clicks of bottlenosed dolphin.

in Fig. 2, and they are repeated signals generally with the repetition rate of 1/sec-400/sec. However, it is known that this species bred in the pond emits another pattern of underwater signals more frequently than those above-mentioned two patterns. In 1963, the authors⁴⁾ orally reported this pattern of sound as mating call of this species. The frequencies of those signals were analyzed by sound spectrograph, and the results are reported in this paper.

Methods

The underwater sounds of these animals were collected in a pond divided from the open sea with steel net. The tidal current in the neighborhood of this pond is always very fast and the water of the tidal current flows in this pond very well. As the result, the water of this pond is maintained very clear so as to facilitate observation of the behavior of these animals in detail. Fig. 3 shows that pond. This pond is about 70 m

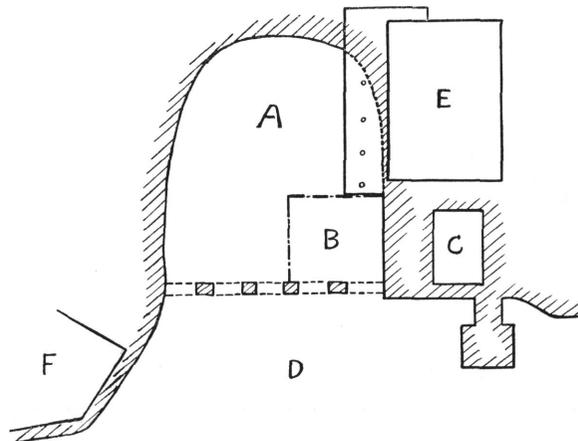


Fig. 3 Breeding pond, A—pond, B—small enclosure (dolphins are bred here), C—small pond, D—open sea (channel), E—aquarium, F—hotel, — plastic net, steel net.

in diameter. Many yellowtails, globefishes, sea-breams and spiny lobsters are bred in this pond and there are a lot of marine adhering animals like oysters, barnacles, sea-urchins, mussels and seaweeds at the bottom and walls of this pond. The depth of this pond is about 10m at the center and about 5 or 6 m at the circumference. This pond is divided by plastic net (Kuremona) to provide a small enclosure of about 30m × 30m as shown by the dotted line in Fig. 3, where a male and a female dolphins were bred. The bottlenosed dolphins' signals reported in this paper were recorded at the latter part of June in 1963. The water temperature was 23°C at the time of recording and the weather was fine and calm. The bottlenosed dolphins had been bred in this pond for about one year after they were caught at Arikawa Bay of Goto Islands in Nagasaki Prefecture in the summer of 1962. The hydrophone is OKI 57TA-2 (Fig. 4). The tape recorder is SONY FT-2 and the analyzing machine is RION sound spectrograph SG-O 4 A. The characteristics of these instruments are shown in Fig. 5, The hydrophone was submerged to the depth of 2 m when the recording was made.

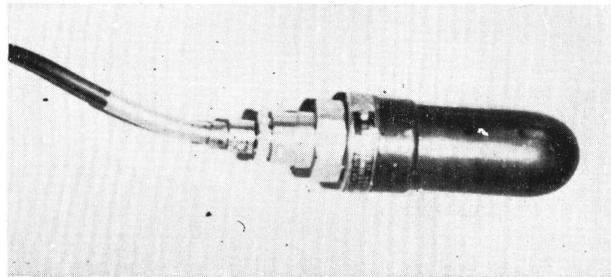


Fig. 4 Hydrophone.

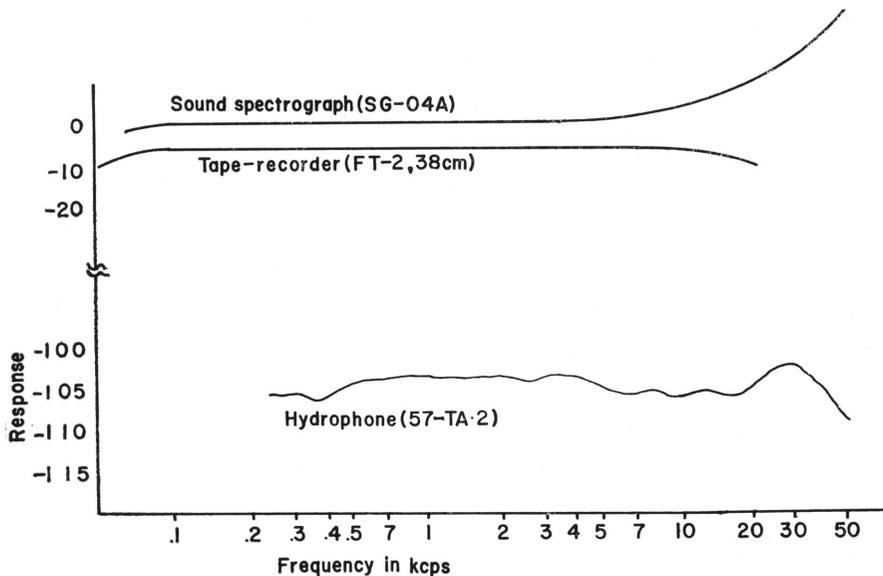


Fig. 5 Characteristics of instruments.

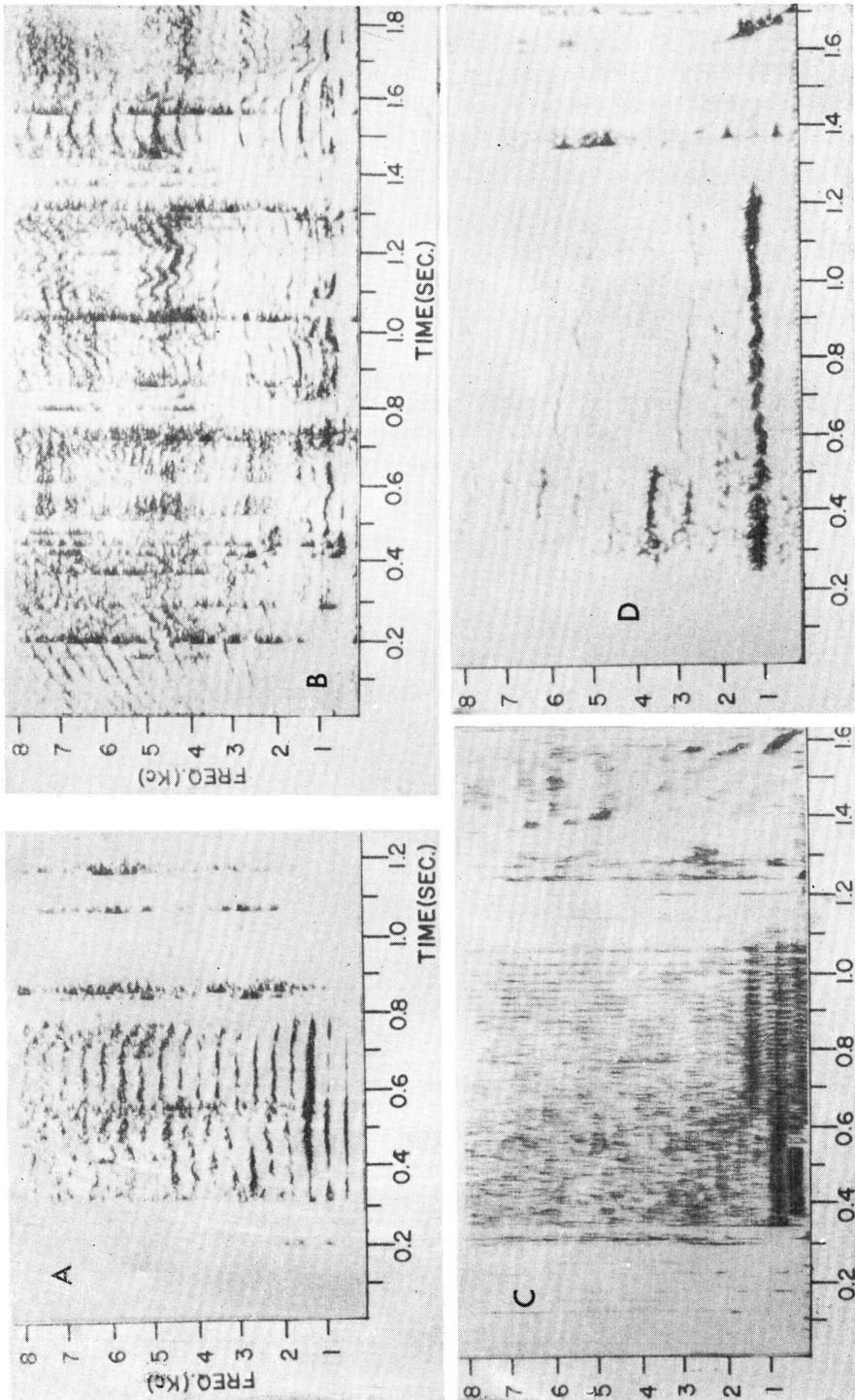


Fig. 6 Sonogram of various kinds of cry.

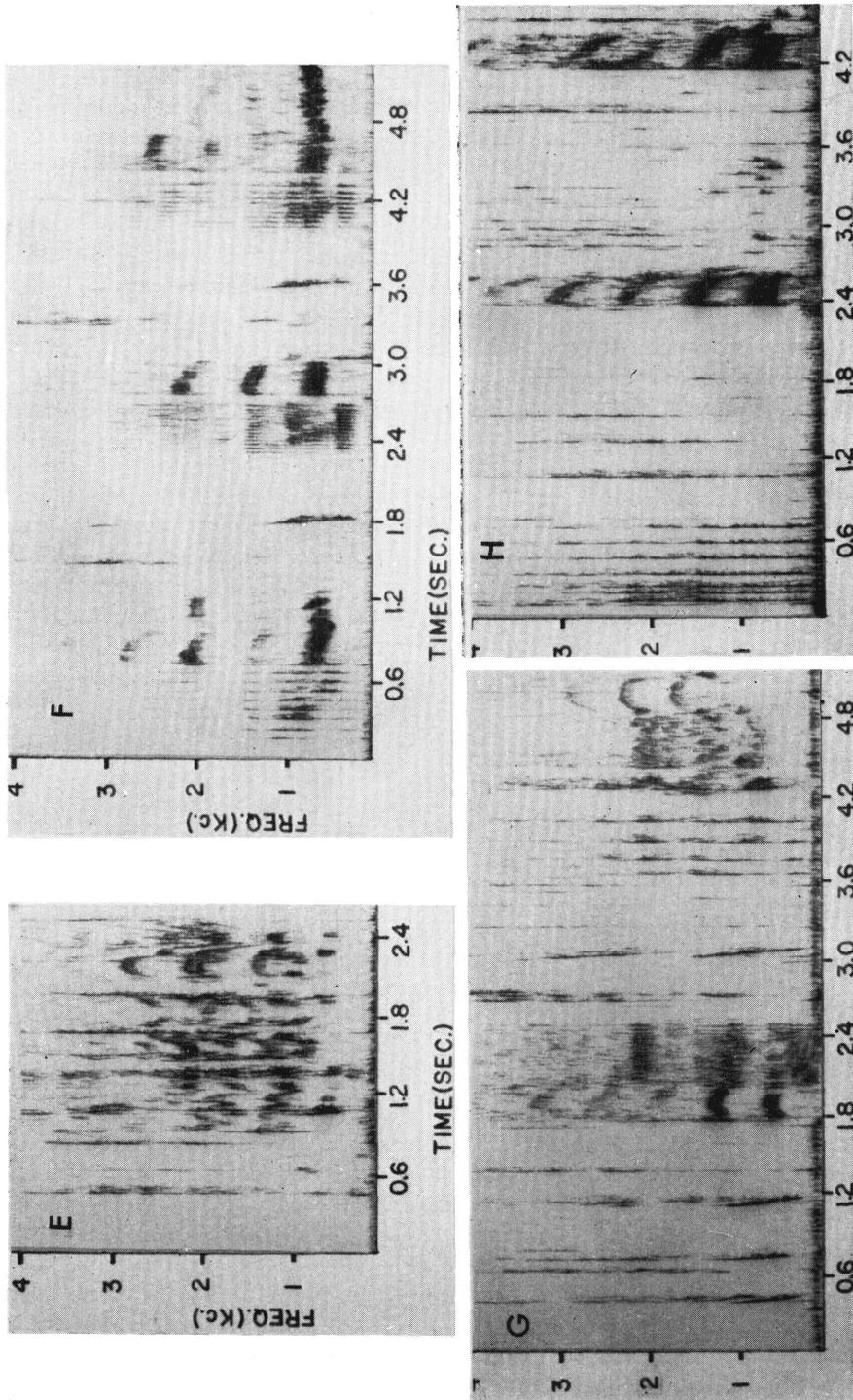


Fig. 6 Sonogram of various kinds of cry.

Analysis and Discussion

1. Mating Call

It has been observed that the bottlenosed dolphins in nature make reproductive behaviors at a certain period of the year. But their reproductive period is not regular and it covers all year round when they are bred. Their reproductive behaviors are divided into courtship and copulative action. It seems that they do not emit signals during the copulation but they emit very curious signals, different from whistles or clicks, in the course of courtship. The male of this animal raises a loud cry and then emits signals of courtship successively. Therefore the mating call is composed of that cry and the signals of courtship, and it is guessed that these sounds were emitted mostly by the male. The sonagram of that cry is shown in Fig. 6. This voice generally continues for about a second. The sonagram in Fig. 6 shows the figures up to 4 kcps. But it contains many layers and is quite different from the figure of whistles. It is clear that the figure of this voice is heaped in many layers at least up to 28 kcps, as verified by the echo-sounder (28 kcps) which was also used for collecting dolphins' signals. And then it is clear that there are many kinds of cry in those sonagrams in Fig. 6 though it seems that all cries sound the same to human ears. The courtship signals immediately after that cry are characteristic in the mode of repetition and in the tone of voice. Those signals are shown in a sonagram in Fig. 7. It sounds

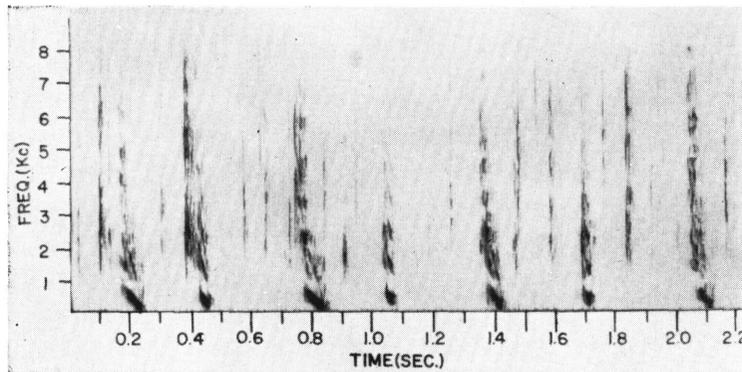


Fig. 7 Sonagram of courtship signals immediately after cry.

and appears in the sonagram that a block of these signals consists of two parts, and two blocks of these signals are emitted per second. These signals in low frequency (0-8 kc) make many layers in the sonagram, but those in high frequency make white noise like clicks.

SHEVILL and WATKINS of the Woods Hole Oceanographic Institution gave the authors a copy of the tape of mating calls of Atlantic bottlenosed dolphin recorded by WOOD of the Point Mugu Marine Bioscience Facility. And then, through the kindness of CALDWELL of the Los Angeles County Museum, the authors could hear the Atlantic bottlenosed dolphin's mating calls tape-recorded by himself, but the mating calls sound quite different between these Atlantic bottlenosed dolphins and the Japanese

bottlenosed dolphins

2, Other characteristic signal

A quite characteristic signal of the bottlenosed dolphin at the time of feeding can be heard through the hydrophone submerged in the pond. This signal sounds very much like a short call of the cat. The sonagram of that sound is shown in Fig. 8. This sound also makes many layers

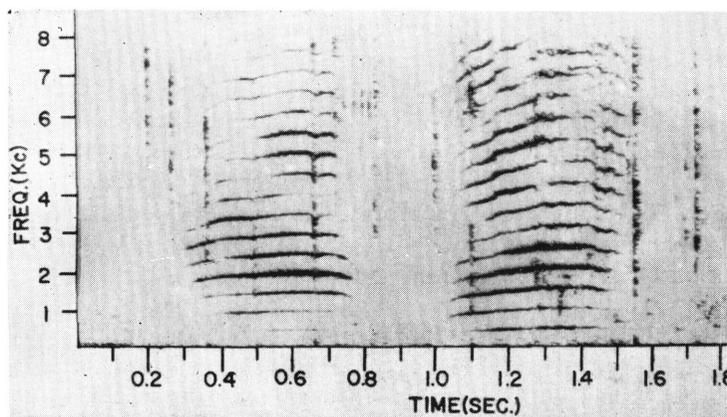


Fig. 8 Sonagram of signals emitted immediately before feeding.

like in case of mating call. The limit of this sound is about 15 kcps but the main energy is at 0-8 kcps. In our bottlenosed dolphins, this sound is emitted just before they caught the feed which was thrown. BUSNEL²⁾ showed sonagrams of the signal concerning feeding behavior and the dominant signal of *Phocaena phocaena* in his paper. It seems that the noise of our bottlenosed dolphins is like signals of *P. phocaena*. If the whistle is tape-recorded in an overloaded condition, the voice sounds unharmonic and appears in several layers in its sonagram, but the unharmonic voice of the whistle can be easily distinguished from the above-mentioned layer-forming signals. It is also evident at a glance of the sonagram that these layer-forming signals are neither whistles nor clicks, but according to WATKINS, these curious signals are a kind of extraordinary clicks, and its repetition rate is shown by the distance between layers in the sonagram.

Conclusion

1. Two bottlenosed dolphins (a male and a female) were bred in the pond, and those dolphins' underwater signals were collected by hydrophone and analyzed by sound spectrograph.
2. The bottlenosed dolphins in the breeding emit mating calls in their reproductive behavior. These are characteristic signals which are different from whistles and clicks.
3. The dolphins' mating calls consist of two sorts, a loud cry and subsequent courtship signals.
4. The dolphins emit quite curious characteristic signals like a short call of the cat just before they catch the feed which was thrown into the

pond.

5. These sounds make many layers which are parallel or convex to the X axis (time) of the sonagram.
6. These underwater sounds were collected from the bottlenosed dolphins caught in the west sea area of Kyushu but their mating calls sound very different from those of the Atlantic bottlenosed dolphins.

Acknowledgments

First of all, the authors gratefully acknowledge the valuable suggestions and helps made by Mr. W. E. SCHEVILL and Mr. W. A. WATKINS of the Woods Hole Oceanographic Institution, and sincere gratitude is due to Dr. POULTER of the Stanford Research Institute who kindly offered analyzing machines and supported this work. Gratitude is also due to the members of the Nagasaki Branch of NHK who helped with great kindness in the collection of many underwater sounds.

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