THE UNDERWATER SOUND OF GANGES RIVER DOLPHINS *(PLATANISTA GANGETICA)*

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ABSTRACT

Various types of underwater sound emitted by the Ganges river dolphin were studied. Clicks were 87% of all, seems to be a method of echo-location. Bursts were 5%, far more frequently than that of sea dolphins, must be a means of communication. Twitterings or chirps appeared on the sonargram in a stratified zone, are a pattern of burst. The sounds like mewing of cat and creaking boat, were both appeared in a stratified zone. Among those appeared in a stratified zone, some were proved to be quick repetition of clicks, others did not appear in a click pattern however play back speed was reduced.

INTRODUCTION

From the view points of various field, Ganges river dolphin (*Platanista gangetica*) was studied by Japanese scientists in Pakistan from October 1969 through March 1970. The basecamp of the expedition was set at Mymensingh, East Pakistan throughout the period. During the period, 20 individuals were caught by the local fishermen. Among them, 4 living individuals were transported to Tokyo by air on February 4. This is an analysis on the underwater sound emitted by them.

On the other fresh water dolphins, the Amazon river dolphin (*Inia geoffrensis*) and the buffeo negro (*Sotalia fluviatilis*), reports were presented by Shevill (1962), Caldwell and Evans (1962). According to the reports, the above two species of dolphins did not emit whistles but only clicks. However, Shevill wrote about his susticion that *Sotalia* might emit whistles on some occasions.

Among the four species known as the members of the family Platanistidae, only the Ganges river dolphin is believed to be blind and has a distinct swelling wall on the maxillary bones. Examination with a flashlight on and off at 10 cm distant from the dolphin's eyes, showed no sign of reaction. Of course anatomical and histological studies on those dolphins have been carrying on until present day, but the results have not been completed yet. Because of this species of dolphins are supposed to be blind, we consider that they must rely much more on the guidance of the underwater sound than the other dolphins with clear eyesight do.

An address about the experiment was given by M. Nishiwaki at the Seventh Annual Conference on Biological Sonar and Diving Mammals held at the Stanford Research Institute on October 23, 1970. Although Proceedings of the conference will be published, this report have to claim the originality.

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METHOD OF THE STUDY

An indoor freshwater pool was set at a quiet place in the pine tree forest near by Kamogawa Beach, about 60 miles distant from Tokyo. The pool was 7 m long, 4 m wide and 2 m deep. Inside of the pool was covered with plastic. The pool was heat and sound proofed by the method of stuffing artificial fiber wool between the cement base and the plastic cover. Water and air temperature was kept constantly about 23°C.

As the pool had been so prepared that four individuals of *Platanista* and those of two *Inia* were kept in it. Sex and body length of those were:

Platanista	No. 1	118 cm	female
,,	No. 2	121	,,
,,	No. 3	127	,,
,,	No. 4	126	male
Inia	No. 1	210	,,
,,	No. 2	203	female

After the dolphins had grown accustomed to the pool, recording of the underwater sound was carried out.

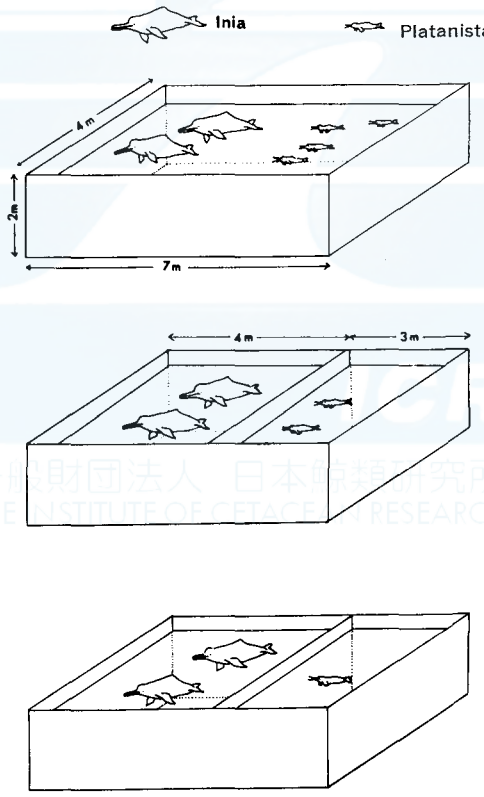

Fig. 1. Situation of the pool, the Ganges river dolphins were in.

First, the underwater sound emitted by all the dolphins in the pool was recorded twice for total 15 hours. Then the pool was divided into two. This time, one of the two was 4 m long, 3 m wide and naturally 2 m deep. Then, two Ganges river dolphins (126 cm male and 127 cm female) were put into it. The sound emittion by those Ganges river dolphins was recorded for total 5 hours. In the next place, a Ganges river dolphin was placed in the divided rectangular pool (127 cm female) and the sound emittion by it alone was recorded for two hours. The situation was as appear in Fig. 1.

The recording apparatuses were shown in Figs. 2 and 3.

1. Hydrophone, Style St-6501, the Oki Electronics Industry Co., Ltd. made.

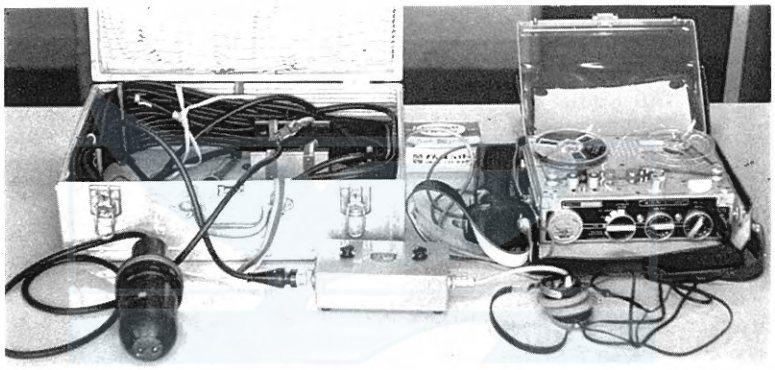

Fig. 2. Recording apparatus.

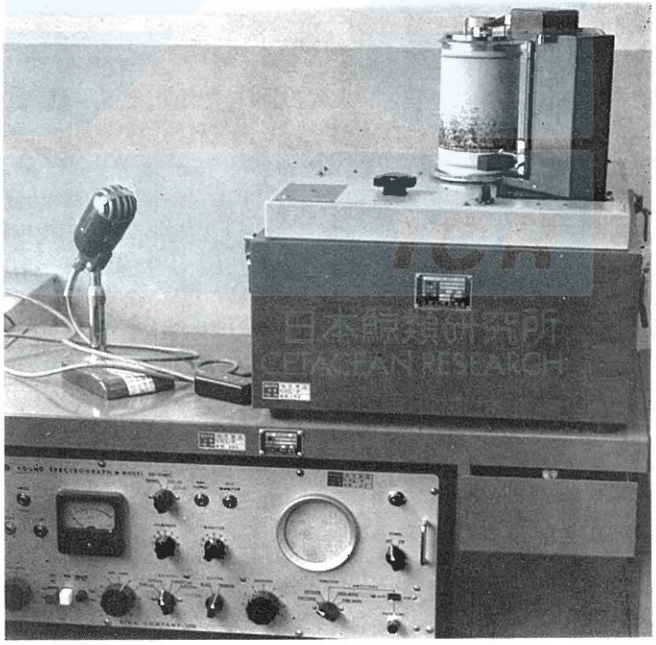

Fig. 3. Sonargraph apparatus.

2. Pre-amplifier, Style St-65, the Oki Electronics Industry Co., Ltd. made.
3. Tape Recorder, Style No. 3, Nagura Electric Co., Ltd. made.
4. Sonargraph, Style SG-04Al, Rion Co., Ltd. made.

Performance of those apparatuses is shown in Fig. 4.

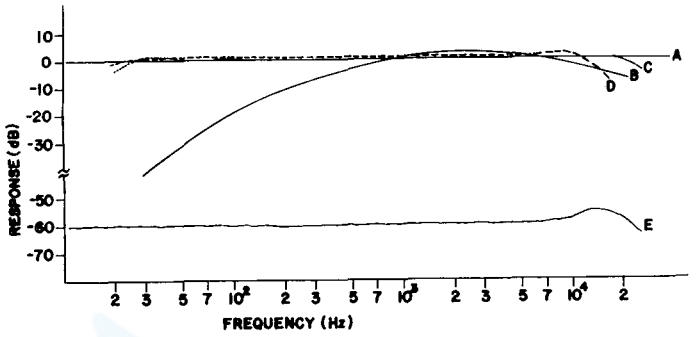

Fig. 4. Performance of the apparatus.

RESULT AND DISCUSSION

1. *Clicks*: The Ganges river dolphins emitted cricks frequently. It was easily presumed that the sound was emitted and received as a sense of echo-location.

Repetition rate of this sound was varied each time as indicated in Figs. 1 and 2 of Plate I. It was five times per second for the most seldom and 100 times for the most frequent. The frequent emittions seem to have been aiming at near by objects and the seldom emittions seem to have been aiming at distant objects. This phenomenon is equal to the dolphins at sea.

It is characteristic of this species, clicks went up to a fairly high wave frequency, which is never reached by the sea dolphins. With our apparatus, as high as 20KHz wave frequency was recorded. However, it is presumed that higher frequency than that can be emitted by this species of dolphins. Shown in Fig. 3 of Plate I.

2. *Bursts*: Although sea dolphins too emit the bursting sound out. It seems there is no special meaning with it. While this species of dolphins emitted bursts not only once but multiple times at a time as usual. Frequency of this sound emittion is next to that of clicks though far less than the latter.

By the Ganges river dolphin, this sound seems to be used as a means of communication as well as following mentioned " twittering " sound. Sonargram of this sound is shown in Fig. 4 of Plate I. Observing the Ganges river dolphins in wild or in the pool, they seemed not to have lived in school but were swimming solitary to and for in the river or in the pool. Communication between one another seemed to have been rather infrequently. Need of communication is far more among sea dolphins than by the solitary individuals.

3. *Twitters*: This is a sound heard like twittering of birds to human ears; it is quite different from burstings. But, generally, there is no difference between the two if the patterns of them appeared in the sonargram were analized. Bursts continued about 0.4 seconds, comparatively longer period of a time, while twitters

continued only about 0.1 second. This sound also seemed to be a means of communication. Sonargram of this is shown in Fig. 5 of Plate I.

4. *Whistles*: This species of dolphins emitted few whistles which are said to be pure tone. How seldom the Ganges river dolphins whistles! Among sea dolphins, the false killer whale (*Pseudorca crassidens*) whistles very often and the bottle-nosed dolphin (*Tursiops gilli*) seems to do conversation by the help of this whistles. However, we can hardly admit that the Ganges river dolphins are able to converse by means of their whistles. This sound may be emitted spontaneously by the Ganges river dolphin. Sonargram of this is shown in Fig. 6 of Plate I.

5. *Stratiform sound*: In the sonargram, it was found a group of sounds which were appeared in parallel laminations. As it is well known, many species of sea dolphins emit this stratiform sound spontaneously at times of mating, menacing others of taking food etc. The Ganges river dolphins sometimes emitted a sound like mewing of a pussy and some other times a sound like a creaking boat. The sonargram indicated these in the patterns of stratiform sound. Watkins (1967) considered this type of sound to be a very quick repetition of clicks.

Fig. 1 of Plate II shows this type of sound playback at the natural speed of tape-rotation. Fig. 2 of Plate II shows the same sound at half rotation speed, that is, the wave frequency was reduced in half cycle. At this speed, the pattern still shows parallel laminations. However, as in Fig. 3 of Plate II, when tape rotation was reduced to 1/4 at speed, analysis of the sound did not appear in parallel laminations. It appeared in the typical clicks pattern. The opinion of Watkins was proved.

But on the other hand, the sound similar to mewing of pussy did not appear in the clicks pattern, even when the speed was reduced to 1/4 (Fig. 5 of Plate II), or even to 1/12 as shown in Fig. 6 of Plate II. It did not appear in the clicks pattern. The sound of this type is emitted by various species of dolphins very often and the sound of the killer whale (*Orcinus orca*) is almost always of this type. We came to conclude that this type of sound of parallel laminations must have been different from what Watkins wrote about. It is yet unknown whether these sounds were spontaneously emitted or not.

In the following, above mentioned variety of sounds are shown in the rate of frequency.

Clicks	87%
Bursts	5%
Twitters –	3%
Whistles –	1%
Stratiform sounds (parallel laminations)	4%
Total	100%

ACKNOWLEDGEMENT

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EXPLANATION OF PLATES

Underwater sound emitted by Ganges river dolphin.

PLATE I

Fig. 1. Clicks
Fig. 2. Clicks.
Fig. 3. Clicks.
Fig. 4. Bursts.
Fig. 5. Twitters.
Fig. 6. Whistles.

PLATE II

Fig. 1. Stratiform sound at natural speed of tape-rotation.
Fig. 2. Stratiform sound in Fig. 1 reduced to half speed rotation.
Fig. 3. Stratiform sound in Fig. 1 reduced to 1/4 speed rotation.
Fig. 4. Stratiform sound at natural speed of tape-rotation.
Fig. 5. Stratiform sound in Fig. 4 reduced to 1/4 from natural rotation speed.
Fig. 6. Stratiform sound in Fig. 4 reduced to 1/12 from natural rotation speed.

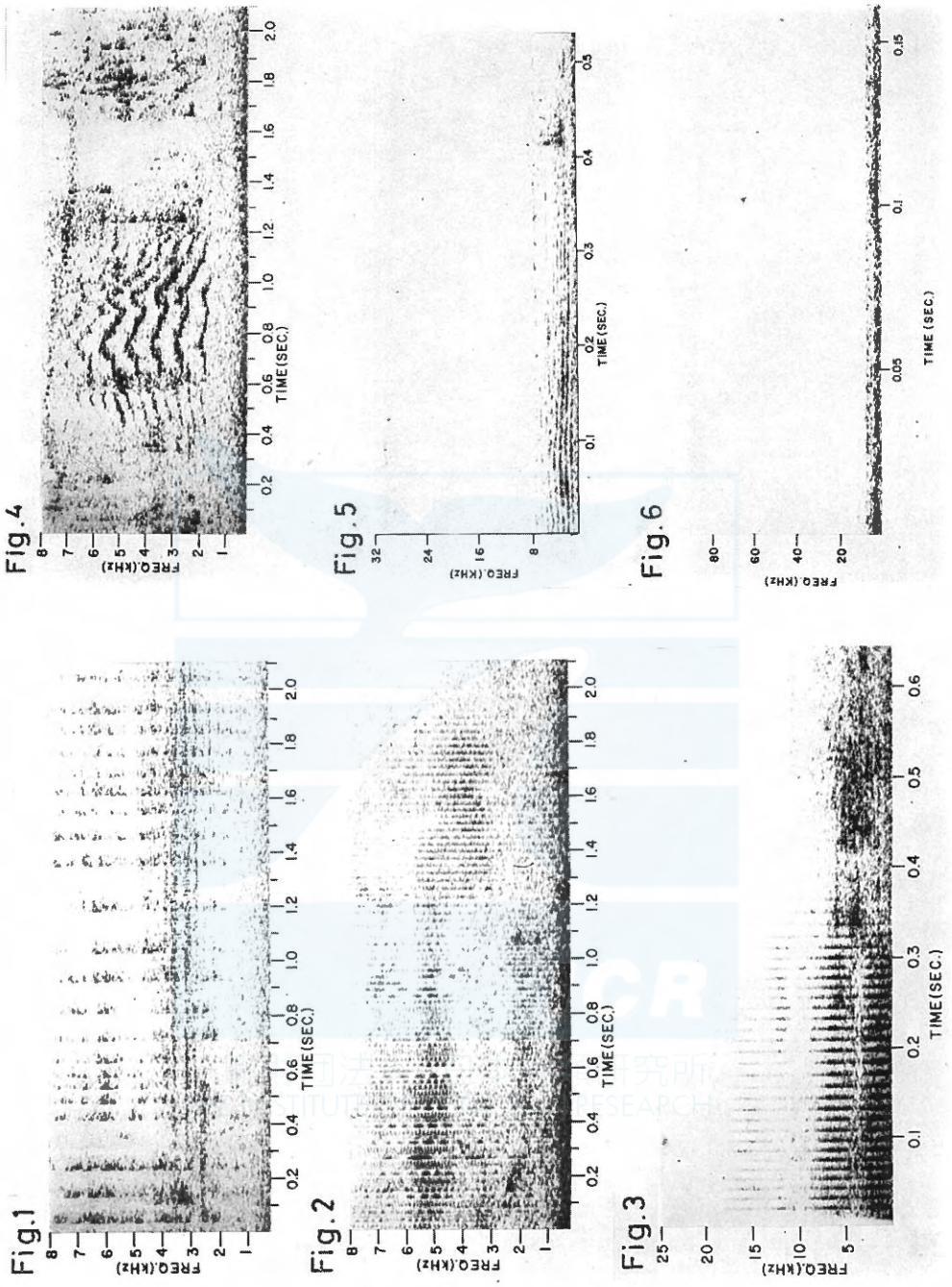
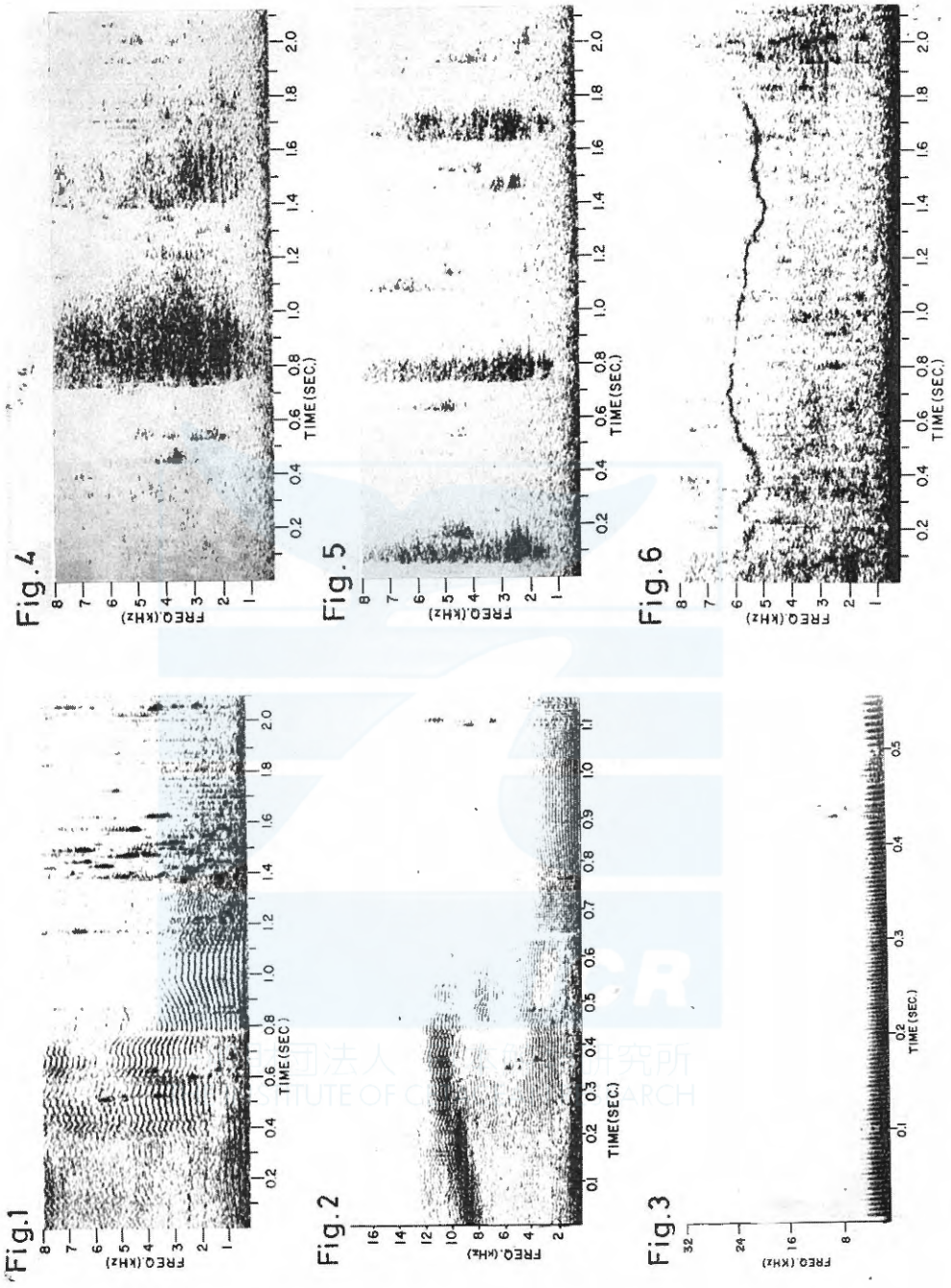


Fig.1
Fig.2
Fig.3
Fig.4
Fig.5
Fig.6
FREQ.(KHz)
TIME(SEC.)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