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The Locomotion Behavior of the Disc Abalone, *Haliotis discus hannai* Ino, in a Tank

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Summary

1. The behavior of disc abalone, *Haliotis discus hannai* Ino, has been observed to be staying at the one stuck place or locomoting around the tank.
2. Although some disc abalones change their stuck place daily, many stick one place in the tank for several days.
3. Nearly all of the disc abalones, however, become active immediately after sunset. Many of them began to locomote in the tank at this time.
4. The greatest speed of locomotion for an adult disc abalone was 12.55 m per hour in the tank in the early hours of night. The longest path of the locomotion of the abalone was 56.2 m for a night.
5. The paths of locomotion of the abalone in the nighttime can be arranged into three fundamental types, the "moving type", the "homing type" and the "staying type".
6. Some of the disc abalones of the "moving and homing types", occasionally grazed on the seaweed which was arranged on the bottom of the tank during locomotion in the nighttime. Some of the remaining disc abalones of the "staying type", which were sticking on the wall of the tank in the nighttime, took a piece of drifting seaweed as food.

It has been known from the previous study that the disc abalone mainly locomotes in the nighttime. This locomotion behavior has been presented in three types, the "moving type", the "homing type" and the "staying type" by Momma and Sato (1). It may be necessary to know the actual occurrence of each type of locomotion behavior among abalones.

Six disc abalones were transferred to the tank in which the seaweed was arranged as a food and their locomotion behavior was observed in detail.

Materials and Methods

The six adult disc abalones, 53 to 137 mm in length, were put into the concrete tank having an area of 8.8 m² and a depth of 0.5 m at Onagawa Fisheries Laboratory, Tohoku University and the observation of their locomotion started after a week.

The water supply into the tank is about 0.5 l per minute and the water temperature was 12 to 14°C during the rearing experiment. The seaweed, *Undaria pinnatifida*, was arranged in the tank as food for the abalones.

The paths of locomotion of the abalones were frequently recorded over the water surface. The recordings were made under red light through the night.

Results

The Daily Observation in the Tank

Most disc abalones stayed at the corners of walls of the tank, though a few of them stayed at the bottom of the tank in the daytime as shown in Fig. 1.

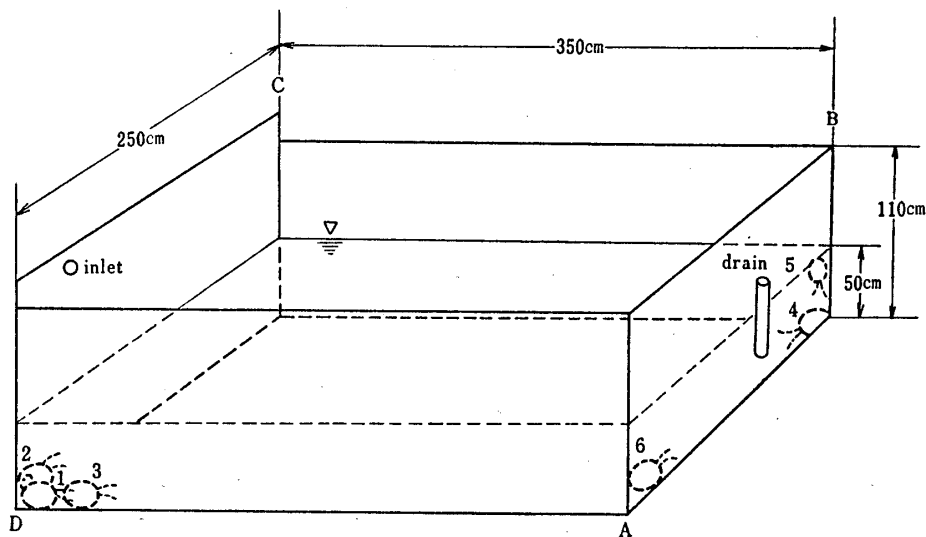


FIG. 1. Stuck positions of the six disc abalones in the tank on October 21, 1967 when the observation started.

Many disc abalones tended to stay at the same place for several days in the tank as shown in Table 1. Disc abalones, No. 2, 3 and 6, stayed at the same place more than five days during the eight days. The stability ratio of the daily stuck positions of each of them was 0.75 to 0.88 during eight days of the observation. While the disc abalones, No. 1, 4 and 5, stayed less than three days at the same place. The stability ratio of each of them was 0.25 to 0.50 during the observation of eight days. On the other hand, the disc abalone occasionally changed its stuck position. The longest distance which any disc abalone moved during a day of 24 hours was 3.8 m in the tank which offered a distance of 3.8 m as shown in Fig. 2.

Observation through a Day in the Tank

According to the 24 hours observation which started at twelve o'clock (noon) of October 21, 1967, abalone, No. 2, did not locomote at all through the day.

TABLE 1. Daily stuck positions of the six disc abalones at each corner of the tank, A,B,C or D. An under-line indicates that the abalone changed its stuck position.

No. of abalone	Shell length (mm)	October, 1967									Stability ratio
		21	22	23	24	25	26	27	28	29	
1	137	D	D	<u>A</u>	<u>D</u>	D	D	D	<u>C</u>	<u>D</u>	0.50
2	111	D	D	<u>A</u>	A	A	A	A	A	<u>D</u>	0.75
3	108	D	<u>A</u>	A	A	A	A	A	A	A	0.88
4	94	B	<u>A</u>	<u>D</u>	D	D	<u>A</u>	<u>D</u>	<u>A</u>	<u>D</u>	0.25
5	83	B	<u>A</u>	<u>A</u>	<u>B</u>	<u>A</u>	A	A	A	<u>D</u>	0.38
6	53	A	A	<u>A</u>	A	A	A	A	A	A	0.88

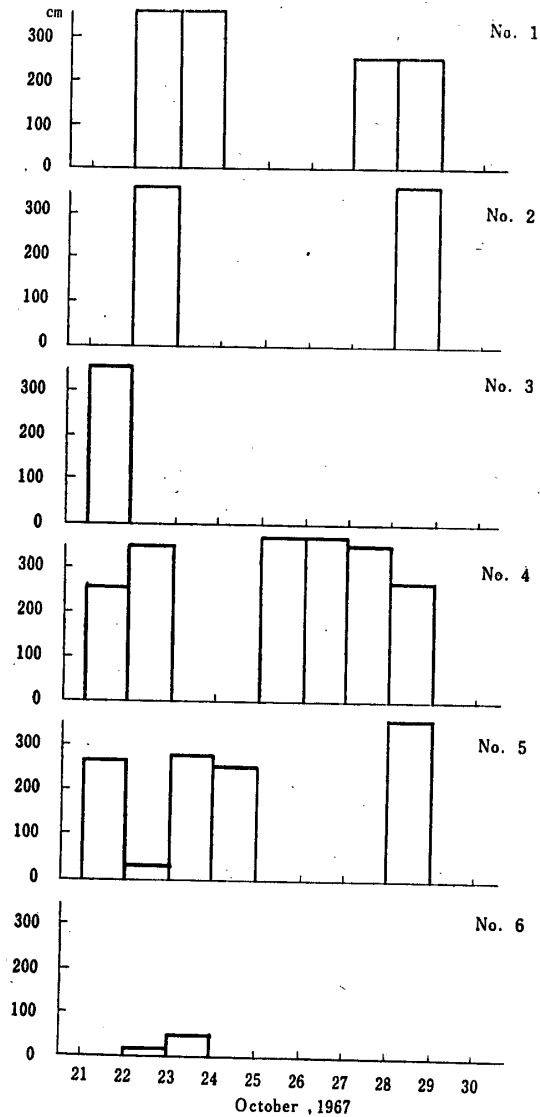


FIG. 2. Distance which the disc abalones moved from one stuck position to another each day during the observation.

Such behavior of the disc abalone should be regarded as "the staying type" presented by Momma and Sato (1). The five other disc abalones which were sticking in the daytime began to locomote in the tank just after sunset and they continued the locomotion through the night as shown in Figs. 3 and 4. Their big locomotions were noted before midnight.

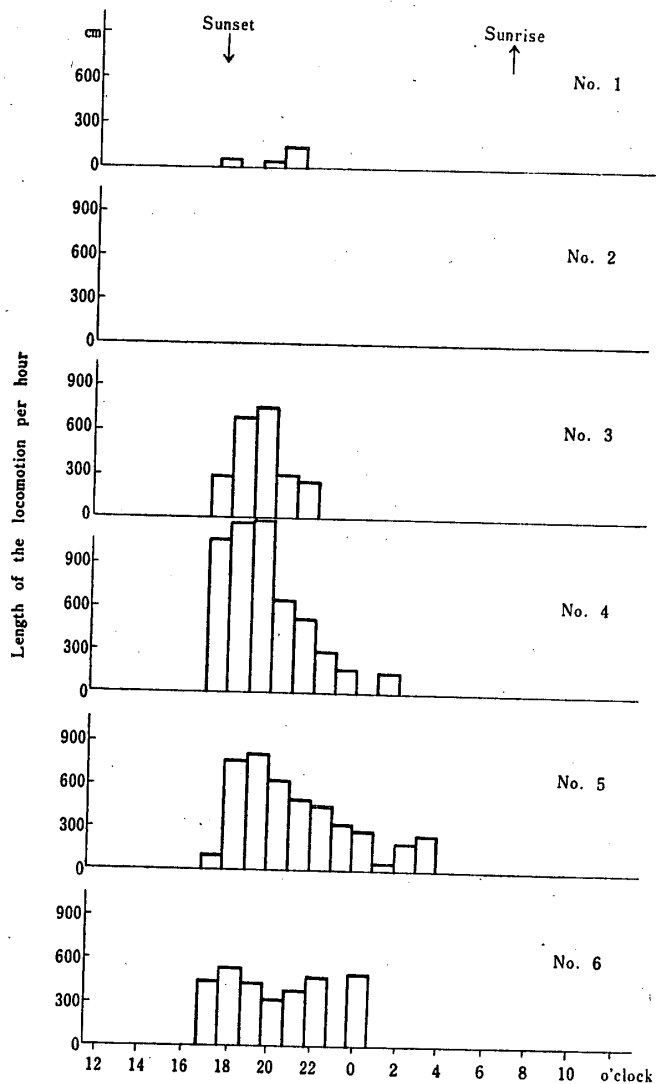


FIG. 3. Length of the locomotion of the six disc abalones per hour through a day which started at 12 o'clock (noon) in October 21, 1967.

Among the disc abalones, Nos. 3, 4 and 5, stuck at the positions which were different from those of the previous day at the end of locomotion. This behavior of disc abalones should be regarded as "the moving type" presented by Momma and Sato (1). The remaining disc abalones, Nos. 1 and 6, on the other hand, returned to stick at the same position of the previous day at the end of loco-

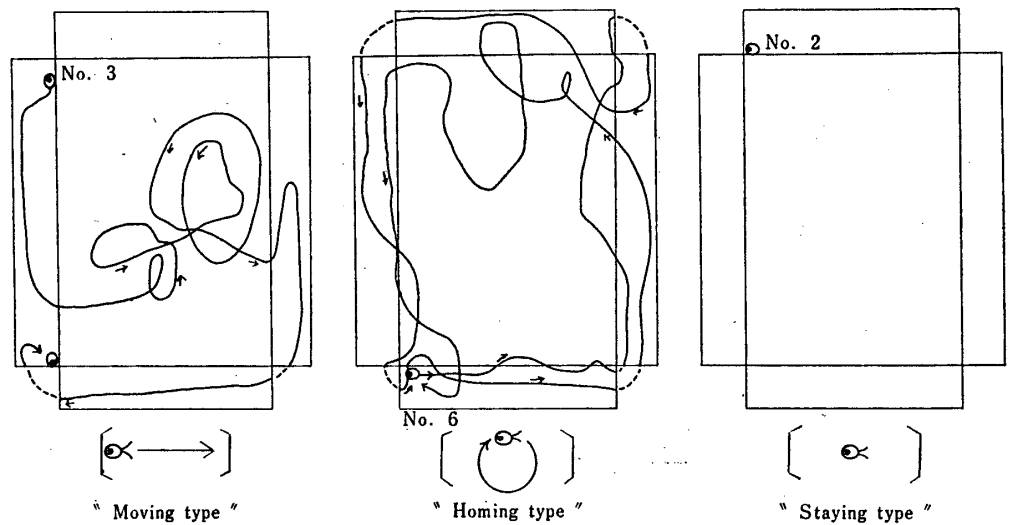


FIG. 4. Actual path of the three types of the locomotion behavior of the disc abalones, Nos. 2, 3 and 6, through the night starting at 16 o'clock in October 21, 1967.

tion. This behavior of disc abalones should be regarded as "the homing type" presented by Momma and Sato (1).

The length of locomotion of the disc abalones of "the moving and homing types" was 1.9 to 56.2 m per night. These disc abalones occasionally grazed on the seaweed which was arranged on the bottom of the tank on the path of locomotion in the nighttime. Whereas some of the disc abalone of "the staying type" took drifting pieces of seaweed as food.

Discussions

Although some disc abalones change their positions by day, many disc abalones were sticking at one place for several days according to the observation by day. This is similar to the observations of disc abalone in the fishing ground by Momma and Sato (1). A few of these disc abalones do not locomote in the tank even in the nighttime. Most of the disc abalones, however, locomote in the tank after sunset. The disc abalone, therefore, seemed to be nocturnal in its behavior in the tank like the observation of the locomotion behavior of disc abalone in the fishing ground by Momma and Sato (1). This nocturnal behavior of the abalone has already been noted by Tago (2), Forster (3) and Ino (4). It is also proved from the experimental results by Tamura (5) that the oxygen consumption of abalone increases in the nighttime.

The locomotion behavior of the disc abalone in the tank has been recognized as of three types "the moving, homing and staying types", just as in the case of the observation in the fishing ground reported by Momma and Sato (1). The longest path of locomotion of the disc abalone of "the moving and homing types" was 56.2 m during a night in the tank. Also it has been reported by Midorikawa,

Nonaka and Uno (6), that another disc abalone, *Haliotis discus*, locomoted 26.5 m. during two and a half hours in the nighttime. Such locomotion of the disc abalones of the two species seems to be more conspicuous as compared with the case of the Siebold's abalone which has been considered to be mostly sticking at one place through the day, daytime and nighttime, and to be consuming drifting pieces of seaweed as reported by Nonaka, Sasaki and Midorikawa (7). Sinclair (8) observed that *Haliotis australis* locomote more actively than *Haliotis iris*. This observation should suggest that there is a difference in locomotion activities among species.

Some of the disc abalone of "the staying type" also took drifting pieces of seaweed as food in the tank of the present experiment. Leighton and Boolootian (9) have also indicated that the abalone could be held the drifting pieces of algae. The disc abalone of "the moving and homing types" however, occasionally grazed on the seaweed arranged on the path of locomotion on the bottom of the tank. Therefore, one of purposes of the locomotion of the disc abalone in the nighttime seems to be to seek food such as seaweed.

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