# 2. Underwater Still Camera Works in the Habitat of *Nautilus* off the East Coast of Viti Levu, Fiji

by

Akihiko SHINOMIYA[1], Mutsuo HATTORI[2], Shozo HAYASAKA[3], Kazushige TANABE[4], Kimihiko ŌKI[3] and Hiroshi SUZUKI[1]

## Introduction

During the period from the latter part of August to mid-September in 1986, the writers performed the photographic works with a baited underwater camera on the sea bottom ranging from 320 to 460 m in depth at the six stations off Suva and two off Ovalau Island (Fig. 1). Rather good 266 pictures showing the bottom sediments and organisms were obtained, and based on these pictures combination of species and their searching for food and feeding behaviors were analyzed.

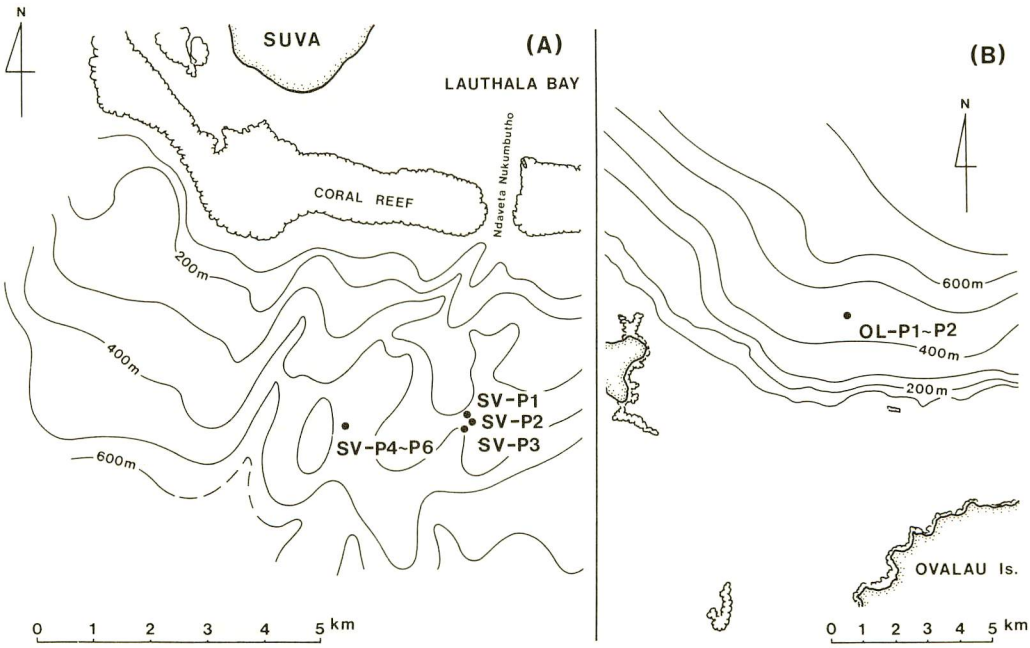


Fig. 1. The stations of underwater still camera works (A : off Suva ; B : off Ovalau Island).

1) Laboratory of Marine Biology, Faculty of Fisheries, Kagoshima University, Kagoshima 890, Japan.
2) Japan Marine Science and Technology Center, Yokosuka 237, Japan.
3) Institute of Earth Sciences, Faculty of Science, Kagoshima University, Kagoshima 890, Japan.
4) Department of Geology, Faculty of Science, the University of Tokyo, Tokyo 113, Japan.

The underwater camera used was devised by one of the writers (M. HATTORI). Small-sized and handy design of this camera system is mainly for convenience in transportation by plane, and its specification is described in the writers' previous paper (HATTORI *et al.*, 1985).

Camera and strobe were attached to an iron frame devised by Dr. U. RAJ of the University of the South Pacific and a bait-stand covered with wire netting was welded to the frontal part of the frame. In comparison with the previous operation (HATTORI *et al.*, 1985), the following three methods were newly introduced this time. (1) The regulator of time interval was improved and longer time interval (10 seconds to a few hours) became available. (2) A wide-angle lens (24 mm) was used instead of standard one (50 mm) to get a larger field of view. (3) A wire netting cover with precisely 5 cm mesh was used for the bait-stand to keep the bait longer and to use as the scale for measuring the sizes of appearing organisms (Fig. 2).

## Field Operation

Among the six stations off Suva, three (SV-P1, SV-P2 and SV-P3) are located at the south of the Ndaveta Nukumbutho passage of the barrier reef with a depth range from 320 to 400 m, while the other three (SV-P4, SV-P5 and SV-P6) are closely located to each other at the southwest of the passage and ranging in depth from 440 to 460 m. The latter three stations are within the area already pointed out to be most abundantly inhabited by *Nautilus* (HAYASAKA, 1985) (Fig. 1, A).

The two stations off Ovalau Island (OL-P1 and OL-P2) are almost the same

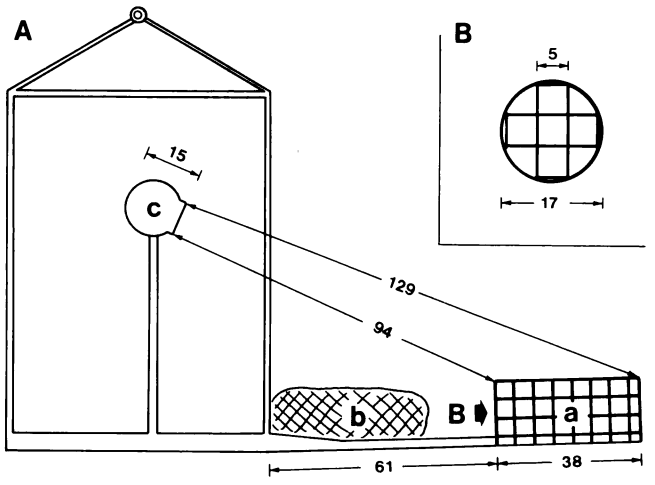


Fig. 2. Side view of the frame with camera system (A) and front view of bait-stand (B). Size in cm. a: main bait, b: supplementary bait, c: camera and strobe.

Table 1. Time range of pictures and data of photographic Stations off Suva (SV) and Off Ovalau (OL). S : start, F : finish of photographing.

| Operation number | Date and time (Time range of pictures) | Time interval (minutes) | Station number | Depth (m) | Hours 0 2 4 6 8 10 12 14 16 18 20 22 24 |
|---|---|---|---|---|---|
| 1 | Aug. 27 (17:02-18:08) | 2 | SV-P1 | 320 | S-F |
| 2 | Aug. 28 (16:47-17:55) | 2 | SV-P2 | 370 | S-F |
| 3 | Aug. 29 (16:01-18:01) | 5 | SV-P3 | 400 | S—F |
| 4 | Sep. 2 (11:02-16:52) | 10 | OL-P1 | 400 | S———F |
| 5 | Sep. 2-3 (18:32- 0:12) | 10 | OL-P2 | 400 | S———F |
| 6 | Sep. 9-10 (16:32- 9:32) | 30 | SV-P4 | 460 | ———F S——— |
| 7 | Sep. 15-16 (12:02- 3:02) | 30 | SV-P5 | 440 | ——F S——— |
| 8 | Sep. 17 ( 9:12-14:42) | 10 | SV-P6 | 450 | S———F |

position (400 m deep), situated near the center of the studied area (Fig. 1, B).

Slices of a few frozen skipjacks put into wire netting cage and the same kind of slices enveloped in the wire netting of small mesh (supplementary) were used as the bait for *Nautilus.*

The photographing time interval was varied between 2 and 30 minutes. The time range of photography was shifted little by little to be able to cumulate the record of organisms appearing for 24 hours in each area, off Suva and off Ovalau Island. The time range and data of photography are shown in Table 1.

## Record of Underwater Photographs taken in Eight Stations

The measurement of animal size was made by comparison with the 5cm mesh of wire netting cover. The measuring methods, being different between groups of animals, are as follows:

BL : Body length of shrimp

CL : Carapace length of true crab and squat crab

TL : Total length of fish

SD : Maximum shell diameter of *Nautilus pompilius,* disk diameter of sea urchin, and diameter of gastropod shell carried by hermit crab

AL : Arm length of sea star

(1) Station SV-P1 (Pl. 1, figs. 1-2).

*Water depth*: 340 m

*Date*: 27th August, 1986

*Time range of pictures*: 17 : 02-18 : 06

*Time interval of pictures*: 2 minutes

*Bottom character*: Light brown, muddy sands. Surface smooth but considerable numbers of mounds and pits are present.

16 : 54 Landing of the frame with camera system on the bottom.

17 : 02 (8 minutes after landing) About ten individuals of flower flute porgy, *Tropidinius amoenus* already appeared around the baits. Total length of each of them is about 25 cm.

After landing, 32 pictures were taken with two minutes interval. In all pictures except for eight, one to ten individuals of this fish are observed to occur (Pl. 1, fig. 1). Fishes are swimming around the baits and often thrust their mouth into the wire netting covering the baits to tear and drag out the bait fish meat (Pl. 1, fig. 2). No other animals than *Tropidinius* appeared.

(2) Station SV-P2 (Pl. 1, figs. 3-8).

*Water depth*: 370 m

*Date*: 28th August, 1986

*Time range of pictures*: 16 : 00-18 : 01

*Time interval of pictures*: 2 minutes

*Bottom character*: Light brown colored muddy sands. Surface smooth but mounds and pits of 10 to 30 cm in diameter are widely developed. On the right side of the bait-stand is a faces-like lump (about 7 cm in diameter) of some small animal.

16 : 27 Landing of the frame with camera system on the bottom.

16 : 51 A squat crab (*Munida* sp., CL about 1 cm) appeared.

16 : 53 (Pl. 1, fig. 3) One more individual of squat crab appeared. And it shows searching behavior for food with widely extending chelipeds against the bait-stand.

16 : 57 (Pl. 1, fig. 4) A rubby snapper (*Etelis coruscans,* TL about 50 cm) appeared and squat crabs disappeared from the field of picture. On the bottom near the bait-stand, a cloud of bottom mud stirred up by feeding action of some other big fish is adrift.

17 : 05 A beardfish (*Polymixia* sp., TL about 20 cm) appeared.

17 : 09 Another beardfish (TL about 20 cm) appeared.

17 : 23 Beardfishes are swimming searching for food with their beards almost touching the bottom 2 to 4 m away from the bait-stand. A cutthroat eel (*Synaphobranchus* sp., TL about 40 cm) is approaching to the baits from the left side of the picture.

17 : 25 A flower flute porgy, *Tropidinius amoenus* (TL about 30 cm) appeared.

17 : 27 (Pl. 1, fig. 5) A spotted pandalid shrimp, *Plesionika* sp. (BL about 12 cm) appeared.

17 : 45 (Pl. 1, fig. 6) A pandalid shrimp, *Heterocarpus sibogae* (BL about 8 cm) and aristaeid shrimp, *Aristaeomorpha foliacea* (BL about 12 cm) appeared.

Among them, *H. sibogae* kept clinging to the bait-stand until the last picture taken at 17 : 55.

17 : 47 An individual of *Munida* sp. (CL about 3 cm) appeared. It stayed at the fixed position without motion until 17 : 55.

17 : 49 (Pl. 1, fig. 7) An individual of *Plesionika* sp. appeared in front of *Munida* sp. The latter threatens the shrimp (*Plesionika*) with its chelipeds opened. A temnopleurid sea urchin (SD about 22 cm) is approaching to the bait-stand from the right and this side of the picture.

17 : 53 (Pl. 1, fig. 8) A snapper, *Etelis carbunculus* (TL about 70 cm) is approaching to the baits.

(3) Station SV-P3 (Pl. 2, figs. 1-8 ; Pl. 3, figs. 1-5).

*Water depth* : 400 m

*Date* : 29th August, 1986

*Time range of pictures* : 16 : 01-18 : 01

*Time interval of pictures* : 5 minutes

*Bottom character* : Light brown colored muddy sands. Surface smooth but mounds (10-20 cm in diameter) and pits (5-10 cm) are observed. Bottom surface is gently sloping to the left side of the picture.

15 : 53 Landing of the frame with camera system on the bottom.

16 : 01 A squat crab, *Munida* sp., appeared on the right side of the bait-stand approaching to the baits with its chelipeds opend.

16 : 06 (Pl. 2, fig. 1) *Munida* sp. moved to the left side of the bait-stand and a hermit crab (*Pylopagurus* sp.) appeared on its left side. The hermit crab carries a tube of serpulid (Annelida) on its back. A flower flute porgy (*Tropidinius amoenus,* TL about 25 cm) approaches to the baits. At about 2 m beyond the bait-stand, an individual of beardfish, *Polymixia* sp., (TL about 20 cm) appeared.

16 : 11 (Pl. 2, fig. 2) Three individuals of *Polymixia* swim behind the bait -stand, and a snapper (*Etelis carbunculus,* TL about 60 cm) approaches to the baits. A spotted pandalid shrimp, *Plesionika* sp., (BL about 7 cm) appeared on the right side of the field of picture. An individual of *Munida* sp. moved to the left corner of the picture and kept its position until 17 : 56. The hermit crab, *Pylopagurus* disappeared.

16 : 16 (Pl. 2, fig.3) Six individuals of *Polymixia* and one of *Tropidinius*

*amoenus* are seen behind the bait-stand. *Etelis carbunculus* is hanging on to the bait fish. A box crab (*Calappa* sp.) appeared.

*Etelis carbunculus* has appeared six times since (at 16 : 21, 16 : 26, 16 : 31, 16 : 41. 16 : 46 and 16 : 51). At 16 : 31, 16 : 41 and 16 : 51, another large individual of this species occurred besides the one observed at 16 : 16. The individuals of *Polymixia,* continuously existing in all the pictures, always swims around the bait-stand searching for food with beard on the bottom surface without hanging on to the bait fish (Pl. 2, figs. 1-8 ; Pl. 3, figs. 1-5).

16 : 36 (Pl. 2, fig. 4) A sea ster (Astropectinidae, AL about 12 cm) appeared.

This continued to wander about the bait-stand until the last picture was taken.

16 : 46 (Pl. 2, fig. 5) The first appearance of *Nautilus pompilius* (# 1, TL about 17 cm) from the left side of the picture. Fairly rapid backward movement of it to the bait-stand is assumed from its swimming posture.

16 : 51 (Pl. 2, fig. 6) *Nautilus pompilius* (# 1), bringing its mouth close to the bait-stand, is searching for the bait fish with its tentacles. Two individuals of *Etelis carbunculus* are swimming in front of camera, but *Nautilus* seems to be indifferent to them.

16 : 56 (Pl. 2, fig. 7) Besides # 1, # 2 *Nautilus* (SD about 11 cm) appeared. Together with the previously appeared large *Nautilus* (# 1), it clings to the bait-stand extending its tentacles to the bait fish. Besides the individual of *Munida* sp. appeared at 16 : 11, another individual of this species appeared. Both of them stay within two different pits separately until 17 : 11 (Pl. 2, fig. 8).

# 1 *Nautilus* continued to feed the bait fish on the left side of the bait-stand until 17 : 21 and on the camera side from 17 : 26 to 18 : 01 without leaving the bait-stand. # 2 *Nautilus* also continued to feed on the left side of the bait-stand until 18 : 01.

17 : 21 (Pl. 3, fig. 1) *N. pompilius* (# 3), almost of the same size as # 1, appeared on this side of picture swimming toward the bait-stand. An individual of *Plesionika* sp. (BL about 12 cm) appeared.

# 3 *Nautilus* is recognized clinging to the back side of the bait-stand at 17 : 26 (Pl. 3, fig. 2), but in the later pictures it was not recognized to occur. The individual of *Plesionika* sp. observed at 17 : 12 is recognized to occur at 17 : 26 but disappeared afterwards.

17 : 26 (Pl. 3, fig. 2) A cutthroat eel, *Synaphobranchus* sp., (TL about 25 cm) appeared.

Another individual of this fish (*Synaphobranchus* sp.) with almost the same size appeared at 17 : 46 (Pl. 3, fig. 4). At 17 : 56 and 18 : 01, an individual of this fish was pictured, respectively.

17 : 51 (Pl. 3, fig. 5) An aristaeid shrimp (*Aristaeomorpha foliacea,* TL about 10 cm) and a pandalid shrimp (*Heterocarpus sibogae,* TL about 10 cm)

appeared clinging to the bait-stand.

Among them, *Heterocarpus sibogae* was recognized to stay by the side of bait-stand at 17 : 56 and 18 : 01.

(4) Station OL-P1 (Pl. 3, figs. 6-8 ; Pl. 4, figs. 1-6).

*Water depth* : 400 m

*Date* : 2nd September, 1986

*Time range of pictures* : 11 : 02-16 : 52

*Time interval of pictures* : 10 minites

*Bottom character* : Light brown muddy sands. Smooth surface with mounds (10-40 cm in diameter) and pits (2-10 cm in diameter).

9 : 45 Landing of the frame with camera system on the bottom.

11 : 02 (One hour and 17 minutes after landing) An individual of squat crab, *Munida* sp., upon the bait frame and the other one on the bottom beside the bait-stand are recognized to occur.

*Munida* sp. was photographed by every shot until the last one (16 : 52) and four individuals at most appeared feeding the bait fish within the wire netting cover (Pl. 3, figs. 6, 8 ; Pl. 4, figs. 1-6).

11 : 22 An individual of astropectinid sea ster (AL about 6 cm) appeared.

11 : 31 A hermit crab (*Parapagurus dofleini,* SD about 8 cm) appeared carrying a sea anemone on its shell.

This individual of hermit crab appeared at 12 : 42, 12 : 52, 13 : 52 (Pl. 4, fig. 1), 14 : 32 and 14 : 42, and another individual (SD about 12 cm) at 15 : 12 (Pl. 4, fig. 3) and 15 : 22. Further, the third individual (SD about 8 cm) appeared at 16 : 02, 16 : 22 and 16 : 32 (Pl. 4, figs. 5-6). Three individuals in all observed during different time ranges are always wandering about the bait-stand leaving trails on the bottom.

11 : 42 *Tropidinius amoenus* -like fish (TL about 25 cm) is passing through the right side margin of the picture.

An individual of this fish appeared again at 13 : 32.

12 : 12 An individual of snapper, *Etelis carbunculus,* (TL about 60 cm) appeared.

This fish is recognized to occur in the pictures taken at 12 : 22 (Pl. 3, fig. 7), 13 : 12, 13 : 32 (Pl. 3, fig. 8), 13 : 42, 14 : 42, 15 : 02, 15 : 32, 15 : 42, 15 : 52, (Pl. 4, fig. 4), 16 : 12 and 16 : 52 (only one individual in each picture). It is difficult to discriminate the individuals in these pictures.

13 : 02 An individual of cutthroat eel, *Synaphobranchus* sp., (TL about 40 cm) appeared.

A few individuals of this species appeared at 14 : 12, 14 : 22, 14 : 32, 15 : 02, 15 : 12 (Pl. 4, fig. 3), 15 : 22, 15 : 32, 15 : 52, 16 : 32, (Pl. 4, fig. 6), 16 : 42 and 16 : 52. Body lengths of the appearing individuals range from TL 15 cm to TL 60 cm. In the picture taken at 14 : 22, two rather small individuals

(TL about 20 cm) lie on the bottom and an individual of about the same size is protruding its head from the muddy bottom (Pl. 4, fig. 2). An eel thrusting its head into the wire netting and feeding the bait fish was photographed at 15 : 32, 15 : 52 (Pl. 4, fig. 4) and 16 : 42, respectively.

13 : 42 An individual of the astropectinid sea star (AL about 6 cm) appeared.

The same individual crept around the bait-stand until 14 : 02 (Pl. 4, fig. 1) and disappeared from the photograph at 14 : 12.

13 : 52 (Pl. 4, fig. 1) The first appearance of *Nautilus pompilius* (# 1, SD about 15 cm) from the left side of the picture.

*Nautilus pompilius* (# 1) feeds the bait fish at the left side of the bait-stand staying at the same position until 15 : 42. This individual moves to the back side of the bait-stand during 15 : 52 to 16 : 22, and subsequently, returns to the left side of the bait-stand at 16 : 32, and feeds the bait at the same position until 16 : 55. At 16 : 55, another individual of *Nautilus pompilius* (# 2, SD about 14 cm) appeared at the camera side of the bait-stand and feeds the bait fish. Only these individuals of *Nautilus* were photographed in this series.

14 : 22 (Pl. 4, fig. 2) A geryonid crab (CL about 4 cm) appeared.

This individual was photographed again at 16 : 22 near the bait-stand (Pl. 4, fig. 5).

15 : 12 (Pl. 4, fig. 3) An individual of the temnopleurid sea urchin (SD about 25 cm) appeared. The sea urchin leaves many small tracks different from those of hermit crab.

16 : 22 (Pl. 4, fig. 5) A spotted pandalid shrimp, *Plesionika* sp., appeared.

16 : 42 An individual of *Plesionika* sp. and beardfish (*Polymixia* sp., TL about 25 cm) appeared.

(5) Station OL-P2 (Pl. 4, figs. 7-8; Pl. 5, figs. 1-8; Pl. 6, figs. 1-4).

*Water depth*: 400 m

*Date*: 2nd to 3rd September, 1986

*Time range of pictures*: 18 : 32-0 : 12

*Time interval of pictures*: 10 minutes

*Bottom character*: Light brown muddy sands. Smooth surface with mounds (5-40 cm in diameter) and pits (2-15 cm in diameter).

16 : 22 Landing of the frame with camera system on the bottom.

18 : 32 (Pl. 4, fig. 7) (One hour and 50 minutes after landing) Five individuals of *Nautilus pompilius* already aggregate around the bait-stand. Two of them (# 4 and # 8) are feeding the bait fish extending their tentacles to the bait. Another individual of *Nautilus* (# 11) extends its tentacles and clings to one (# 4) of the feeding *Nautilus* shells.

A cutthroat eel (*Synaphobranchus* sp., TL about 60 cm) is lying on

the sea bottom facing to the bait-stand. Two shrimps (*Plesionika longirostris,* BL about 8 to 10 cm) are clinging to the bait-stand, and the other two are swimming around the bait-stand. Two pandalid shrimps, *Heterocarpus sibogae,* also cling to the bait-stand.

*Nautilus pompilius* appeared in all the pictures of this series, The number of individuals appeared in each picture ranges from one to nine. Based on the color pattern of each shell, it was recognized that the total number of discriminated individuals attains to more than 14. Every individual of *Nautilus pompilius* avariciously feeds the bait fish, and some of them tend to stay at the same position of the bait-stand and feed the bait for long time. For example, #2 *Nautilus* stayed and fed for one hour and 50 minutes (from 22 : 22 to 0 : 12), #1 and #3 for one hour and a half (from 21 : 42 to 23 : 12, 22 : 32 to 0 : 02, respectively), #4 for one hour and 20 minutes (18 : 32 to 19 : 52) and one hour and 10 minutes (22 : 52 to 0 : 02), and #5 for one hour (20 : 42 to 21 : 42).

The only one individual of *Synaphobranchus* sp. was photographed at 18 : 32 in this series.

*Plesionika longirostris* appeared in almost all the pictures of this series, but it has never been recognized to occur in the pictures of the other series. The maximum number of individuals of this species (about ten) appeared at 18 : 52. This shrimp is easily distinguishable from the other species in having long and white antennae and thoracic legs. *H. sibogae,* occurring in most of the pictures of this series, the number of appearing individuals was about 8 at most.

18 : 42 (Pl. 4, fig. 8) A snapper (*Randallichthys filamentosus,* TL about 70 cm) appeared. An morid cod, *Physiculus* sp., (TL about 15 cm) was photographed near the bait-stand.

*Randallichthys filamentosus* appeared only once at 18 : 42. On the other hand, one or two individuals of *Physiculus* sp. occurred in more than two-thirds of the pictures of this series.

18 : 52 (Pl. 5, fig. 1) A dogfish shark (*Centrophorus scalplactus,* TL about 80 cm) was photographed swimming around the back of the bait-stand.

An individual of the dogfish shark seemingly the same as the one appeared at 18 : 52 was observed again at 21 : 22 to swim across about 3 m above the sea bottom behind the bait-stand.

19 : 02 (Pl. 5, fig. 2) Two phadalid shrimps, *Heterocarpus laevigatus,* appeared. This species has a red colored body and most of the individuals photographed are about 10 cm long.

One to three individuals of this species appeared at 19 : 12, 19 : 32, 19 : 52, 20 : 02, 20 : 12 and 20 : 32 (Pl. 5, figs. 3, 5, 7 and 8, respectively).

20 : 42 (Pl. 6, fig. 1) A conger eel (*Conger verreauxi,* TL about 70 cm) was

photographed swimming across foreground of the picture. This eel appeared only in this picture.

21 : 02 (Pl. 6, fig. 2) Two individuals of *Nautilus pompilius* are swimming at about 1 m above the sea bottom. One of them extends its tentacles to adhere to the shell surface of another individual.

The same individuals of *Nautilus* keeping the same posture were photographed at 21 : 22.

21 : 42 (Pl. 6, fig. 3) Two ratfish (*Chimaera* sp., TL about 120 cm) are swimming at about 1 m above the sea bottom behind the bait-stand. One of these fishes appeared again at 21 : 52.

Comparing the pictures taken before and after the appearance of the dogfish shark or the ratfish, it was recognized that most of the individuals of *Nautilus pompilius* earnestly continued to feed the bait indifferently.

23 : 52 A hermit crab (*Parapagurus dofleini,* SD about 8 cm) appeared behind the bait-stand.

(6) Station SV-P4 (Pl. 6, figs. 5-8; Pl. 7, figs. 1-4).

*Water depth*: 460 m

*Date*: 9th to 10th September, 1986

*Time range of pictures*: 16 : 32-09 : 30

*Time interval of pictures*: 30 minutes

*Bottom character*: Light brown muddy sands. Flat surface with pits (2-10 cm in diameter), but without mounds. On the sea bottom in the foreground of pictures, there are innumerable small protruding tubes (about 5 mm both in length and thickness) which are assumed to be nest tubes of the serpulid (Annelida).

16 : 07 Landing of the frame with camera system on the bottom.

16 : 32 (25 minutes after landing) One spotted pandalid shrimp (*Plesionika* sp.) and three pandalids (*Heterocarpus sibogae*) are already aggregated.

The spotted pandalid shrimp also appeared at 17 : 02 (three individuals) and at 17 : 32 (one individual), respectively. This species did not appear until 6 : 02 in the next morning, and subsequently, one individual at 6 : 32 and 7 : 02, eight at 7 : 32 and three at 8 : 02 were photographed.

Another pandalid shrimp (*Heterocarpus sibogae)* abundantly appeared for longest time in this series of pictures. However, the occurrence of this species fluctuate to some extent in each picture, nemely, one to eight individuals were photographed in each picture from 16 : 32 to 18 : 32 (Pl. 6, fig. 6), 12 to about 50 individuals appeared in the pictures from 19 : 02 to 6 : 02 (Pl. 6, figs. 7-8; Pl. 7, figs. 1-2), and one to nine from 6 : 32 to 9 : 32 (Pl. 7, figs. 3-4).

17 : 02 (Pl. 6, fig. 5) A conger eel (*Congriscus megastomus,* TL about 40

cm) is swimming behind the bait-stand.

The same individual appeared again on this side of picture at 18 : 02.

17 : 32 An individual of *Nautilus pompilius* occurred. A squat crab, *Munida* sp. (CL about 3 cm) approaches to the bait-stand.

Subsequently, 1-5 individuals of *Nautilus pompilius,* were photographed in the seven pictures until 20 : 32, 1-4 individuals were in the 13 pictures from 21 : 32 to 3 : 32, and 1-9 individuals in the 12 pictures from 4 : 02 to 9 : 32, respectively. All of them seems to be adult with diameter of 14-17 cm, and juveniles did not appear. Most of individuals of *Nautilus* avariciously fed the bait, and some of them kept the same posture of clinging to the bait for more than two hours. It was often observed for some individuals to extend their tentacles to attach to shell surface of the other individual. The one individual of *Nautilus* appeared at 10 : 02 at night was photographed nine times until 9 : 02. This suggests a phase of their feeding habit, namely, feeding baits for very long time.

The squat crab, *Munida* sp., disappeared from the pictures from 18 : 02 to 7 : 02. An individual of it appeared again at 7 : 32 (Pl. 7, fig. 3) and 8 : 32 (Pl. 7, fig. 4), respectively.

18 : 02 (Pl. 6, fig. 6) Two aristaeid shrimps (*Aristaeomorpha foliacea,* BL about 10-14 cm) are swimming around the bait-stand to search for foods.

One individual of this shrimp was photographed at 18 : 32, 20 : 32, 21 : 32 and 22 : 32, respectively.

19 : 32 Three pandalid shrimps (*Heterocarpus laevigatus,* BL about 8-10 cm) appeared.

One to four individuals of *H. laevigatus* were photographed at 20 : 32, 21 : 32, 22 : 02, 23 : 02, 23 : 32, 2 : 02, 3 : 02 and 3 : 32, respectively.

20 : 02 (Pl. 6, fig. 7) A cloud of bottom mud stirred up by feeding action of some fish was photographed in this and the two previous pictures (at 19 : 02 and 19 : 32). The fish itself is not photographed in any one of these three pictures. It was recognized, however, that the water current flows from the right foreground to the back left side of the picture.

20 : 32 A pandalid shrimp (*Heterocarpus gibbosus,* BL about 10 cm) is clinging to the bait-stand mingling with *H. sibogae.*

Subsequently, 1-5 individuals of *H. gibbosus* were photographed at 21 : 02 (Pl. 6, fig. 8), 21 : 32, 22 : 32, 23 : 02, 23 : 32, 1 : 32 and 2 : 32, respectively.

21 : 02 (Pl. 6, fig. 8) A sea cucumber was photographed on the right background of the picture.

In the next picture (at 21 : 32) this species is observed to occur on the left side, and it is inferred that the moving speed of the sea cucumber was about 1 m per 30 minutes.

22 : 32 A ratfish, *Chimaera* sp., appeared at the background of the picture, about 4 m beyond the bait-stand.,

After one hour, the tail part of the swimming ratfish was photographed on the right side of the picture. It was recognized that the frame with camera system was shifted by a certain animal, from the change of locations of pits and mounds on the pictures at 23 : 02 and 23 : 32. At 0 : 32, the species of *Chimaera* showing upside-down posture is facing its abdomen to the camera and its mouth to the bait-stand (Pl. 7, fig. 1). The body length of this ratfish is about 150 cm. The shift of the frame might be resulted from the feeding activity of this ratfish. The *Chimaera* fish did not appear in the following pictures.

3 : 32 (Pl. 7, fig. 2) A hermit crab (*Parapagurus dofleini*, SD about 8 cm) appeared near the bait-stand carrying a sea anemone on its dorsal side. The sea anemone opens its tentacles.

The same hermit crab appeared carrying a sea anemone opening its tentacles at 4 : 32, 5 : 32, 6 : 02 and 8 : 32 (Pl. 7, fig. 4), respectively.

7 : 32 (Pl. 7, fig. 3) Four individuals of *Nautilus pompilius* were feeding the bait fish, and another individual was swimming with widely opend tentacles. About eight individuals of *Plesionika* sp. aggregated on the sea bottom. A gurnard (*Lepidotrigla* sp., TL about 25 cm) was photographed on the left side of the picture. This fish appeared only in this picture. One individual of *Synaphobranchus* and two of *Polymixia* were also recognized.

(7) Station SV-P5 (Pl. 7, figs. 5-8; Pl. 8, figs. 1-6).

*Water depth*: 440 m

*Date*: 15th to 16th September, 1986

*Time range of pictures*: 12 : 02-03 : 02

*Time interval of pictures*: 30 minutes

*Bottom character*: Light brown muddy sands. Flat and smooth without pits and mounds until the picture at 19 : 02. The frame with camera system was largely shifted at 19 : 32 (cause unknown). In the pictures from 20 : 02 to 3 : 02, many parallel drag marks with about 50 cm intervals are observed.

11 : 27 Landing of the frame with camera system on the bottom.

12 : 02 (Pl. 7, fig. 5) (35 minutes after landing) A spotted pandalid shrimp (*Plesionika* sp.) is approaching to the bait-stand.

This shrimp disappeared after 12 : 32. Four, seven, and four individuals of this spotted pandalid shrimp occurred again at 15 : 32 (Pl. 7, fig. 7), 16 : 32 (Pl. 7, fig. 8) and 17 : 32, respectively. Subsequently this shrimp disappeared.

13 : 02 A rubby snapper (*Etelis carbunculus*, TL about 70 cm) appeared on the right side of the bait-stand.

This ruddy snapper stirring up a cloud of bottom mud by feeding action on the bait fish was photographed at 14 : 02 (Pl. 7, fig. 6). An individual of this fish of the same size occurred swimming around the bait-stand at 15 : 02 and 21 : 02.

14 : 32 Two *Nautilus pompilius* appeared.

Two to four individuals of *Nautilus pompilius* were photographed in the seven pictures until 18 : 02 (Pl. 7, figs. 7-8 ; Pl. 8, fig. 1). The species of *Nautilus* did not appear until 20 : 02. Subsequently, two individuals were photographed at 20 : 32 and 22 : 02, 1-3 from 23 : 02 to 0 : 02 and 1-7 from 1 : 02 to 3 : 02, respectively. The photographed individuals were all of adult stage, and were always clinging to and feeding the bait fish. The individuals swimming with widely opened tentacles are larger in number at night (Pl. 8, figs. 2-5) than in the daytime (Pl. 7, figs. 7-8 ; Pl. 8, fig. 1). This suggests that the momentum of *Nautilus* at night is much larger than that in the daytime. Through the comparison between the individuals appearing in the daytime (from 14 : 32 to 18 : 02) and at night (from 1 : 02 to 3 : 02), it is recognized that the individuals are perfectly replaced with each other.

15 : 32 (Pl. 7, fig. 7) A beardfish (*Polymixia* sp., TL about 20 cm) is swimming about 3 m above the sea bottom far from the bait-stand. A cutthroat eel (*Synaphobranchus* sp., TL about 20 cm) was photographed at the left corner of the picture.

These fishes did not appear in the other pictures of this series.

16 : 32 (Pl. 7, fig. 8) A homolid crab (CL about 5 cm) appeared near the bait-stand. A squat crab (*Munida* sp., CL about 3 cm) extends its chelipeds toward the bait-stand.

The homolid crab, of which dactylus on the 4th ambulatory leg is subchelate, has a habit to carry a chip of wood, a piece of shell, etc., on its carapace with 4th ambulatory legs for protecting from the predator. The photographed homolid crab carries a piece of wood of about 30 cm length on the dorsal side. This individual crawled around the bait-stand at 17 : 02 and 17 : 32.

17 : 02 Two aristaeid shrimp, *Aristaeomorpha foliacea,* and three pandalid shrimp, *Heterocarpus sibogae,* were clinging to the bait-stand.

One to two individuals of *A. foliacea* were photographed at 23 : 32, 3 : 02 and 3 : 32, respectively.

*H. sibogae* abundantly appeared for long time in the pictures of this series. One to ten individuals were photographed in each picture from 17 : 02 to 18 : 02 (Pl. 8, fig. 1), 15 to about 50 individuals appeared in each picture from 18 : 32 to 3 : 32.

19 : 32 Five individuals of pandalid shrimp, *Heterocarpus laevigatus,* appeared.

One individual of this shrimp was photographed at 21 : 32, 0 : 32, 2 : 02

and 2 : 32 (Pl. 8, fig. 5), respectively.

20 : 32 (Pl. 8, fig. 2) An individual of pandalid shrimp, *Heterocarpus gibbosus* was clinging to the bait-stand mingling with *H. sibogae.*

Subsequently, 1-7 individuals of *H. gibbosus* were photographed in each picture until 3 : 32.

(8) Station SV-P6 (Pl. 8, figs. 7-8).

*Water depth*: 450 m

*Date*: 17th September, 1986

*Time range of pictures*: 9 : 12-14 : 42

*Time interval of pictures*: 10 minutes

*Bottom character*: Light brown muddy sands. Almost flat in the pictures until 11 : 42. At 11 : 52 the frame with camera system was shifted a little during trawling experiment. Then the lower half of bait-stand was buried in the bottom. The bottom features after this was also flat with many tubes (about 2 cm in length) probably of the serpulid nest.

9 : 10 Landing of the frame with camera system on the bottom.

9 : 22 (12 minutes after landing) A conger eel (*Congriscus megastomus,* TL about 22 cm) appeared. This species did not appear in the other pictures.

9 : 42 An individual of *Nautilus pompilius* is clinging to the bait fish.

Table 2. List of species and hourly maximum number of occurrence off Suva.

| Scientific name | Hours | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | | 8 | | 10 | | 12 | | 14 | | 16 | | 18 | | 20 | | 22 | | 24 | | 2 | | 4 | | 6 |
| **MOLLUSCA** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | 9 | 6 | 8 | 5 | 1 | | 3 | 3 | 5 | 4 | 4 | 3 | 4 | 3 | 5 | 3 | 4 | 3 | 3 | 7 | 6 | 3 | 4 | 6 |
| **CRUSTACEA** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | | 2 | 2 | | 1 | 1 | 1 | 1 | | | | 2 | | |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | 1 | 5 | 7 | 4 | 3 | 6 | 3 | 3 | | |
| H. laevigatus Bate | | | | | | | | | | | | | 2 | 5 | 1 | 3 | 1 | 4 | 1 | | 2 | 3 | | |
| H. sibogae De Man | 12 | 9 | 2 | 3 | | | | | | | | 3 | 3 | 32 | 29 | 36 | 26 | 34 | 35 | 31 | 36 | 38 | 33 | 26 | 17 |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | |
| P. sp. | 1 | 8 | 3 | | | | 1 | | | 4 | 7 | 4 | | | | | | | | | | | | | |
| Munida sp. | | 1 | 1 | | | | | | | | 2 | 2 | | | | | | | | | | | | | |
| Parapagurus dofleini Balss | 1 | | 1 | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 |
| Pylopagurus sp. | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | |
| **ECHINODERMATA** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | 1 | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | |
| Astropectinid sea star | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | |
| **PISCES** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | |
| Synaphobranchus sp. | | 1 | | | | | | | | 1 | | 2 | 1 | | | | | | | | | | | | |
| Conger verreauxi Kaup | | | | | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | | | 1 | | | | | | | | 1 | 1 | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polymixia sp. | | 2 | | | | | 2 | 3 | | 2 | 20 | 16 | 4 | | | | | | | | | | | | |
| Etelis carbunculus Cuvier | | | | | 1 | 1 | | 1 | 1 | 1 | 2 | | | | | 1 | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | | | | | | | | 1 | 10 | 4 | | | | | | | | | | | | |
| Lepidotrigla sp. | | 1 | | | | | | | | | | | | | | | | | | | | | | | |

The same individual of *N. pompilius* was photographed at 10 : 02. After this, no *Nautilus* appeared until 12 : 22. Another individual of this species appeared at 12 : 32, subsequently, 2-3 individuals were photographed in five pictures until 13 : 22. From 13 : 42 to 14 : 42, 2-5 *Nautilus* occurred in each picture. All individuals photographed were of adult stage, and they avariciously fed the bait within the half-buried bait-stand (Pl. 8, figs. 7-8).

10 : 02 A rubby snapper (*Etelis carbunculus,* TL about 70 cm) appeared.

Seemingly the same individual was phothgraphed in both pictures at 10 : 22 and 11 : 02.

12 : 32 Two individuals of beardflsh (*Polymixia* sp., TL about 20 cm) appeared.

Two and three individuals of this species were photographed at 12 : 42 and 13 : 12 (Pl. 8, fig. 7), respectively. Subsequently this fish disappeared from the pictures.

## Time-zone of Appearance and Behavior of Each Animal Group

Based on the information from the photographs and the data on the samples obtained by trapping and trawling (SUZUKI *el al.,* in this volume), the organisms seen in photographs were identified. The time of appearance of these organisms

Table 3. List of species and hourly maximum number of occurrence off Ovalau Island.

| Scientific name | Hours 6 | 8 | 10 | 12 | | 14 | | 16 | | 18 | | 20 | | 22 | | 24 | | 2 | | 4 | | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MOLLUSCA** | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | | | | | | 1 | 1 | 1 | 2 | | 5 | 6 | 8 | 8 | 8 | 7 | 7 | | | | | |
| **CRUSTACEA** | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | | | | | | | | | | | | |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | | | | | | | | |
| H. laevigatus Bate | | | | | | | | | | | | 4 | 3 | 1 | 3 | 2 | 2 | | | | | |
| H. sibogae De Man | | | | | | | | | | | 5 | 6 | 4 | 3 | 2 | 5 | 4 | | | | | |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | 6 | 5 | 4 | 2 | 3 | 3 | 3 | | | | | |
| P. sp. | | | | | | | | | 1 | | | | | | | | | | | | | |
| Munida sp. | | | | 4 | 3 | 3 | 4 | 2 | 4 | | | | | | | | | | | | | |
| Parapagurus dofleini Balss | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | 1 | | | | | | |
| Pylopagurus sp. | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | 1 | | 1 | | | | | | | | | | | | | |
| **ECHINODERMATA** | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | 1 | | 1 | | | | | | | 1 | | | | | | | |
| Astropectinid sea star | | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | |
| **PISCES** | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | | | | | | | 1 | | | 1 | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | 2 | | | | | | | | |
| Synaphobranchus sp. | | | | | | 1 | 3 | 2 | 2 | | 1 | | | | | | | | | | | |
| Conger verreauxi Kaup | | | | | | | | | | | | | 1 | | | | | | | | | |
| Congriseus megastomus (Gunther) | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | 1 | 2 | 3 | 2 | 2 | 2 | | | | | | |
| Polymixia sp. | | | | | | | | | 1 | | | | | | | | | | | | | |
| Etelis carbunculus Cuvier | | | | | 3 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | 1 | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | 1 | | 1 | | | | | | | | | | | | | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | |

were listed in Appendixes 1-8, in which the number of individuals of each species identified in each picture is described.

Based on these data in the appendixes, the maximum numbers of individuals of each species observed for every one hour in each area, namely off Suva (SV-P1-P6) and off Ovalau Island (OL-P1 and P2) were summarized in Tables 2 and 3. For example, if 30 pictures were obtained for one hour, the number of appearing individuals of each species for this period of time was represented by the maximum number of individuals counted in one of these pictures.

## 1. Nautilus

*Nautilus* with shells of 11-17 cm diameter appeared in the pictures taken at all the stations except for the Stations SV-P1 and P2. It appeared almost always (1-9 individuals) except for the time-zone 11 : 00-12 : 00, and rather abundantly appeared from 5 : 00 to 8 : 00 and from 20 : 00 to 21 : 00.

As the first instance, detailed feeding hehavior of *Nautilus* will be described based on the pictures taken at the Stn. SV-P3, where the time interval of pictures was shortest (2 minutes). At 16 : 46, 53 minutes after landing of the camera frame on the sea bottom, a rather large (SD about 17 cm) individual of *Nautilus* (# 1) first appeared (Pl. 2, fig. 5). It seems moving backward rather rapidly toward the bait-stand with jet propulsion. In the picture at 16 : 51, # 1 *Nautilus* already turned over and is extending its tentacles to the bait fish (Pl. 2, fig. 6). At 16 : 56, # 1 *Nautilus* brings its body close to the bait-stand and begins to eat the baits together with another rather small *Nautilus* (# 2, SD about 11 cm) (Pl. 2, fig. 7). It may be said that the *Nautilus* species has a high ability to search for foods and shows rapid response to the discovered foods. # 1 *Nautilus* kept feeding until 17 : 06 and left there and moved to the camera side of the bait-stand passing through immediately above # 2 (17 : 16) (Pl. 2, fig. 8). # 2 *Nautilus* was pushed by # 1 and left the bait-stand (Pl. 3, fig. 1), and moved to the place where # 1 was previously feeding (17 : 26) after ascertaining the behavior of # 1 (Pl. 3, figs. 2-3). From the fact that the earlier arrived larger individual (# 1 *Nautilus*) behaves advantageously over # 2 showing subordinate behavior, a kind of dominance-subordinate hierarchy is presumed to exist among the population of this species.

In the ten serial pictures taken at the Stn. OL-P2 with ten minutes interval, behaviors of 12 individuals discriminated based on the differences in color patten were observed (Pl. 4, figs. 7-8 ; Pl. 5, figs. 1-8). During this period of time, two individuals kept feeding in the fixed postures for long time ; # 8 for one hour and 20 minutes (18 : 32-19 : 52) and # 4 for one hour and 10 minutes (18 : 32-19 : 42). # 7 and # 13 kept feeding for 20-30 minutes but frequently changed the place for feeding. Attaching behavior of one individual to another by its tentacles were observed between # 11 and # 4 (Pl. 4, fig. 7), # 10 and # 11 (Pl.

5, fig. 2), #9 and #4 (Pl. 5, fig. 6) and #12 and #7 (Pl. 5, fig. 8).

The *Nautilus* individuals gathering around the bait-stand showed various behavior as mentioned above, but on the whole they seemed to keep sticking to the baits. Other than the foregoing cases, several individuals of *Nautilus* kept feeding in the fixed postures for long time; one for 2 hours, one for one hour and 50 minutes, two for one hour and a half and two for one hour and 10 minutes. The longest record of stay on the bottom around the bait-stand was recognized at the Stn. SV-P4; one individual discriminated by its color pattern continued to appear in the pictures for 11 hours (10:02-9:02).

The maximum number of individuals appearing in one of the serial pictures taken at the Stn. OL-P2 was nine. Through the discrimination of individuals, however, more than 14 individuals were recognized to occur at this station. This may be also the case at the other stations, individuals namely, individuals more than the maximum number of individuals appearing in one of the serial pictures are really existing replacing with each other.

The behaviors of *Nautilus* around the bait-stand at the Stn. SV-P5 in the daytime and the nighttime were compared. In the eight pictures taken in the daytime (14:32-18:02), all the individuals of *Nautilus* are earnestly feeding and no moving individuals were photographed. On the contrary, in all the pictures (nine) taken in the nighttime (20:32-2:32) except for the one (1:02), one to three appearing *Nautilus* are moving forwardly or backwardly opening their tentacles. This suggests that this species behaves more actively at night than in the daytime.

## 2. Crustacea and Echinodermata

During the photographing at eight stations, about 12 species of Crustacea appeared. Among them, shrimps were most common. *Heterocarpus sibogae* was most abundant with subordinate occurrence of *H. laevigatus, H. gibbosus* and *Plesionika longirostris. Aristaeomorpha foliacea* rerely appeared. These five species of shrimp appeared mainly at night. *H. sibogae* appeared most abundantly between 18:00 and 3:00, and a few early in the morning (7:00-9:00) and in twilight (16:00-17:00).

A shrimp showing a peculiar pattern of appearance in contrast to those of the foregoing five is *Plesionika* sp. This large species (BL attains up to 14 cm) has a large red spot on the postero-central surface of abdomen, which has a withish blue colored fringe. The size of red spot varies from individual to individual and sometimes it is very small. The second antenna is white colored and as long as three times of body length. The body color is pale blue and almost transparent. The time range of its appearance is 6:00-17:00 and the maximum number of appearance was observed at 7:00-8:00 and 15:00-17:00. It is noticeable that the time of its appearance is in the daytime, while that of the five species mentioned above is mainly at night.

Differences in type of behavior between the above mentioned six species were also recognized. The three species, *H. sibogae, H. gibbosus* and *H. laevigatus,* were usually clinging to the bait showing active feeding behavior. On the contrary, most of the appearing individuals of *P. longirostris* and *A. foliacea* were swimming, and *Plesionika* sp. kept crawling on the bottom surface. The latter three species seems to be rather inactive in feeding behavior.

The number of appearing individuals and species of shrimps shows clear difference between the areas off Suva and off Ovalau Island. *P. longirostris* appeared only at the stations off Suva and the numbers of individuals are almost the same as those of *H. sibogae* and *H. laevigatus.* On the contrary, at the stations off Suva, *H. sibogae* always predominates over the other species.

Among the Crustacea, *Munida* sp. and *Parapagurus dofleini* are also rather common. *Munida* sp. usually creeps into the bottom sediments and sometimes crawl out and shows a feeding behavior. Many individuals of *Munida* sp. creeping into and crawling on the bottom sediments were photographed. The appearance of *Munida* sp. was restricted to 7:00-17:00 and it is regarded to be diurnal. *P. dofleini,* a hermit crab carrying a sea anemone on its back, appeared between 3:00 and 8:00, 11:00 and 16:00 and at 23:00 without fixed time range of appearance. It stays for rather long time wandering about the bait-stand and sometimes feeds the bait fish. The sea anemone attached to the shell surfase of the hermit crab widely opened its tentacles from 3:00 to 8:00 and closed from 11:00 to 16:00 and at 23:00.

Echinodermata is represented by sea cucumber, temnopleurid sea urchin and astropectinid sea star. Among them, sea cucumber (only one individual) was passing through the bottom near the bait-stand without any feeding behavior. On the contrary, sea urchins and sea star appeared at a few stations wandering around the bait-stand showing searching behavior for food.

### 3. Pisces

Twelve species of fishes appeared. Among them, the species showing rather abundant occurrence are *Polymixia* sp., *Tropidinius amoenus, Physiculus* sp., *Synaphobranchus* sp., and *Etelis carbunculus,* and next to these species *Chimaera* sp., *Centrophorus scalplactus* and *Congriscus megastomus* occurred.

Time range of appearance of the abundantly occurring three species, *Polymixia* sp., *T. amoenus* and *Synaphobranchus* sp. were from 7:00 to 18:00 and the former two species appeared most abundantly at the twilight from 16:00 to 18:00. These three species are regarded to be diurnal. Although an individual of *E. carbunculus* appeared at 23:00, it usually appeared from 6:00 to 17:00 and is regarded to be diurnal. On the contrary, *Physiculus* sp. appeared only at night (18:00-23:00) and is regarded to be nocturnal. Among the subordinately abundant three species, *Chimaera* sp. appeared at night (21:00-1:00, nocturnal)

and C. *scalplactus* appeared at the evening (16 : 00-21 : 00, twilight to nocturnal). On the other hand, *C. megastomus* appeared in the daytime and regarded to be diurnal.

The types of behavior of the foregoing eight species are as follows. The species behaving in crowds are only two, *Polymixia* sp. and *T. amoenus,* and were photographed showing their feeding activities. The largest species, *Chimaera* sp. did not show feeding activity, but during its appearance in a few serial pictures the camera frame had largely shifted (SV-P4). It is inferred that this large fish bites and shakes the frame with a camara system.

*Polymixia* sp. with a pair of beard always swam around the bait-stand searching for foods on the sea bottom by its lowered head. This species was always wandering on the bottom a few meters apart from the bait-stand. This suggests the behavior of this species to feed on the small particles of bait fish meat produced by the feeding actions of the other animals.

*Synaphobranchus* sp. having a habit to creep into the bottom sediments was sometimes observed protruding its head from the bottom. This species usually stays longer around the bait-stand. Another species making long stay is *E. carbunculus.*

It is noticeable that *Physiculus* sp., *Conger verreauxi* and *Randallichthys filamentosus* appeared at the stations only off Ovalau Island, while *C. megastomus, Etelis coruscans* and *Lepidotrigla* sp. appeared only off Suva. *Polymixia* sp. mostly appeared at the stations off Suva with the exception of only one individual off Ovalau.

## Concluding Remarks

Photographing *Nautilus* and some other organisms gathering around the baits and analyzing the species composition and searching and feeding behaviors were carried out. *Nautilus* always showed active feeding behavior except for one hour from 11 : 00 to 12 : 00. Twelve species of Crustacea, three of Echinodermata and 12 of Pisces appeared, and all of them except for sea cucumber showed active searching for food and feeding behaviors. As the result, three types were discriminated in mode of appearance, namely, nocturnal, diurnal and twilight.

The camera system used in the present study were quite effective for recording the species composition of appearing organisms, time of appearance, and searching and feeding behaviors of them. As to the time interval of photographing, short interval (several to ten minutes) was suitable to analyzing the behavior of each appearing organism, while long interval (ten minutes to a few hours) was to understanding the whole time range of appearance of them.

Long roll of photographing film is useful to fulfill both the requirements mentioned above, but it is attended with a few difficulties concerning the cost

and the convenience in handling. It is possible, however, to improve the camera system by adding one more strobe light which may give clear image of organisms having been in the shadow of another strobe light.

This camera system is always operated with the baits. Therefore, it is impossible to get the information on distribution and behavior of organisms under natural condition. In this respect, towing and self-driving photographic system must be useful (OHTA, 1983; HASHIMOTO and HOTTA, 1985), but it has a problem concerning the transportation to the remote areas of study. If it is realized in the future to send a research ship to the area of field study, the use of this type of photograhing system must be quite effective.

## Acknowledgments

The writers wish to express their deep gratitude to Prof. Uday RAJ of the Institute of Marine Resources, the University of the South Pacific, for his careful arrangements and advice for the present study.

Thanks are also due to Prof. Toshio SAISHO, Prof. Yoshiko KAKINUMA and Dr. Junzo TSUKAHARA of Kagoshima University, for their cooperation in interpreting the underwater photographs.

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Appendix 1. List of species and number of occurrence at the Station SV-P1.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 17: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 18: | | | | |
| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 0 | 2 | 4 | 6 | 8 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Nautilus pompilius* Linnaeus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Aristaeomorpha foliacea* (Risso) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Heterocarpus gibbosus* Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *H. laevigatus* Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *H. sibogae* De Man | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Plesionika longirostris* (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *P.* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Munida* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Parapagurus dofleini* Balss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pylopagurus* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Calappa* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Astropectinid sea star | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Centrophorus scalplactus* McCulloch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Chimaera* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Synaphobranchus* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Conger verreauxi* Kaup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Congriseus megastomus* (Gunther) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Physiculus* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Polymixia* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Etelis carbunculus* Cuvier | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *E. coruscans* Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Randallichthys filamentosus* (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tropidinius amoenus* (Snyder) | 10 | 2 | 2 | 3 | 4 | 2 | | | 1 | | 1 | 1 | 4 | 5 | 3 | 2 | 2 | 5 | 4 | 6 | 1 | | 3 | 1 | 4 | 2 | 1 | | 3 | 4 | 1 | 2 | 2 | 1 |
| *Lepidotrigla* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix 2. List of species and number of occurrence at the Station SV-P2.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16: | | | | | | | 17: | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Nautilus pompilius* Linnaeus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Aristaeomorpha foliacea* (Risso) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| *Heterocarpus gibbosus* Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *H. laevigatus* Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *H. sibogae* De Man | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 |
| *Plesionika longirostris* (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *P.* sp. | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | 1 | | | |
| *Munida* sp. | | | 1 | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 |
| *Parapagurus dofleini* Balss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pylopagurus* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Calappa* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 |
| Astropectinid sea star | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Centrophorus scalplactus* McCulloch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Chimaera* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Synaphobranchus* sp. | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | |
| *Conger verreauxi* Kaup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Congriseus megastomus* (Gunther) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Physiculus* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Polymixia* sp. | | | | | | | | | | 1 | 1 | | | | | | | | 3 | | | | | | | | | | | | | | | | |
| *Etelis carbunculus* Cuvier | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| *E. coruscans* Valenciennes | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Randallichthys filamentosus* (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tropidinius amoenus* (Snyder) | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| *Lepidotrigla* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix 3. List of species and number of occurrence at the Station SV-P3.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16: | | | | | | | | | | | | 17: | | | | | | | | | | | | 18: |
| | 1 | 6 | 11 | 16 | 21 | 26 | 31 | 36 | 41 | 46 | 51 | 56 | 1 | 6 | 11 | 16 | 21 | 26 | 31 | 36 | 41 | 46 | 51 | 56 | 1 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | | | | | | | | | | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. laevigatus Bate | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. sibogae De Man | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | |
| P. sp. | | | 1 | | | | | | | | | | | | | | 1 | 1 | | | | | | | |
| Munida sp. | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | (1) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Parapagurus dofleini Balss | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pylopagurus sp. | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | |
| Astropectinid sea star | | | | | | 1 | | 1 | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | 1 | | | | | | | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | | | | | | | | | | | | |
| Synaphobranchus sp. | | | | | | | | | | | | | | | | | | 1 | 1 | | | 2 | | 1 | 1 |
| Conger verreauxi Kaup | | | | | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polymixia sp. | | 1 | 3 | 7 | 6 | 8 | 3 | 8 | 7 | 11 | 20 | 14 | 14 | 11 | 14 | 13 | 16 | 6 | 10 | 8 | 8 | 3 | 3 | 2 | 4 |
| Etelis carbunculus Cuvier | | | 1 | 1 | 1 | 1 | 2 | | 2 | 1 | 2 | | | | | | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | 1 | | 1 | | | | | | | | | | | | | | | | | | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix 4. List of species and number of occurrence at the Station OL-P1.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11: | | | | | 12: | | | | | | 13: | | | | | | 14: | | | | | | 15: | | | | | | 16: | | | | | |
| | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | 1 | 1 | 2 |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. laevigatus Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. sibogae De Man | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P. sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | |
| Munida sp. | 3 | 4 | 3 | 2 | | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 4 | 3 | 4 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 4 | 4 |
| Parapagurus dofleini Balss | | | | 1 | | | | | | 1 | 1 | | | | | 1 | 1 | 1 | | | | 1 | 1 | | | 1 | 1 | | | | 1 | | 1 | 1 | | |
| Pylopagurus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | 1 | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 | | | | | | | | | | |
| Astropectinid sea star | | | 1 | | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Synaphobranchus sp. | | | | | | | | | | | | 1 | | | | | | | 1 | 3 | 1 | | | | 1 | 1 | 2 | 2 | | 1 | | | | 2 | 1 | 1 |
| Conger verreauxi Kaup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polymixia sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Etelis carbunculus Cuvier | | | | | | | | 1 | 3 | | | | 1 | | 1 | 1 | | | | | | 1 | | | 1 | | 1 | 1 | 1 | 1 | | 1 | 1 | | | 1 |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | | 1 | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix 5. List of species and number of occurrence at the Station OL-P2.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 18: | | | 19: | | | | | | 20: | | | | | | 21: | | | | | | 22: | | | | | | 23: | | | | | | 0: | |
| | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | 5 | 4 | 5 | 6 | 3 | 5 | 4 | 4 | 4 | 6 | 2 | 5 | 8 | 8 | 4 | 8 | 8 | 6 | 6 | 5 | 4 | 4 | 1 | 4 | 5 | 6 | 8 | 5 | 7 | 6 | 6 | 7 | 6 | 6 | 7 |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. laevigatus Bate | | | | 2 | 4 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | 2 | 2 | 1 | 1 | | 1 | | 1 | | 3 | 3 | 2 | 3 | 1 | 2 | | 2 | 1 | | | | 2 |
| H. sibogae De Man | 2 | 2 | 5 | | 4 | 6 | 5 | 4 | 1 | 2 | 1 | 1 | 3 | 4 | | 1 | | 1 | 2 | 3 | 3 | | | 1 | | 1 | 2 | 3 | 3 | 3 | 5 | 2 | 2 | 4 | 2 |
| Plesionika longirostris (Borradaile) | 4 | 6 | 6 | 1 | 1 | 3 | 5 | 1 | 4 | 3 | 2 | 3 | 4 | 4 | 3 | 2 | | | | 2 | | 1 | 3 | 1 | | | | 2 | 1 | 1 | 1 | | 3 | 3 | 1 |
| P. sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Munida sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Parapagurus dofleini Balss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Pylopagurus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | |
| Astropectinid sea star | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | 1 | | 1 | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | | | | | | | 2 | 1 | | | | | | | | | | | | | | |
| Synaphobranchus sp. | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conger verreauxi Kaup | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | 1 | | | | | 2 | 1 | | | | 3 | 2 | | | 2 | 2 | 2 | 1 | | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | | 2 | 1 | 1 | | |
| Polymixia sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Etelis carbunculus Cuvier | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix 6. List of species and number of occurrence at the Station SV-P4.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16: | 17: | | 18: | | 19: | | 20: | | 21: | | 22: | | 23: | | 0: | | 1: | | 2: | | 3: | | 4: | | 5: | | 6: | | 7: | | 8: | | 9: | |
| | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | | | 1 | 1 | 3 | 3 | 3 | 5 | 1 | | 3 | 3 | 4 | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 2 | 4 | 6 | 1 | 1 | 9 | 6 | 5 | 6 | 8 | 5 | 5 |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | 2 | 1 | | | | 1 | | 1 | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Heterocarpus gibbosus Bate | | | | | | | | | 1 | 5 | 1 | | 1 | 3 | 2 | | | | 1 | | 1 | | | | | | | | | | | | | | |
| H. laevigatus Bate | | | | | | | 3 | | 1 | | 3 | 1 | | 4 | 2 | | | | | 2 | | 3 | 1 | | | | | | | | | | | | |
| H. sibogae De Man | 3 | 2 | 1 | 4 | 8 | 17 | 29 | 29 | 26 | 24 | 26 | 18 | 18 | 25 | 19 | 31 | 11 | 32 | 36 | 38 | 33 | 31 | 21 | 26 | 25 | 12 | 17 | 12 | 5 | 9 | 7 | 2 | 1 | 3 | 2 |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P. sp. | 1 | 3 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 8 | 3 | | | |
| Munida sp. | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | |
| Parapagurus dofleini Balss | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | | | | 1 | | |
| Pylopagurus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Astropectinid sea star | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | 1 | | 1 | | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| Synaphobranchus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conger verreauxi Kaup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | 1 | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | |
| Polymixia sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Etelis carbunculus Cuvier | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## Appendix 7. List of species and number of occurrence at the Station SV-P5.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 12: | | 13: | | 14: | | 15: | | 16: | | 17: | | 18: | | 19: | | 20: | | 21: | | 22: | | 23: | | 0: | | 1: | | 2: | | 3: | |
| | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 | 2 | 32 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | | | | | | 2 | 3 | 4 | 2 | 4 | 3 | 2 | 4 | | | | | 2 | | | 2 | | 3 | 1 | 2 | | 1 | 7 | 3 | 6 | 3 | |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | 2 | | | | | | | | | | | | | 1 | | | | | | | 2 | 1 |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | | | | 1 | (1) | 4 | 7 | 7 | 4 | 2 | 3 | | 6 | 5 | 3 | 3 | 2 | 3 |
| H. laevigatus Bate | | | | | | | | | | | | | | | | 5 | | | | 1 | | | | | | 1 | | | 1 | 1 | | |
| H. sibogae De Man | | | | | | | | | | 1 | 3 | 2 | 10 | 32 | 24 | | 33 | 36 | (1) | 25 | 30 | 34 | 24 | 35 | 15 | 28 | 30 | 23 | 32 | 21 | 23 | 33 |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P. sp. | 1 | | | | | | | 4 | | 7 | | 4 | | | | | | | | | | | | | | | | | | | | |
| Munida sp. | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Parapagurus dofleini Balss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pylopagurus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Astropectinid sea star | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Synaphobranchus sp. | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| Conger verreauxi Kaup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polymixia sp. | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| Etelis carbunculus Cuvier | | | 1 | | 1 | | 1 | | | | | | | | | | | | 1 | | | | | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## Appendix 8. List of species and number of occurrence at the Station SV-P6.

| Scientific name | Minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 9: | | | | | 10: | | | | | | 11: | | | | | | 12: | | | | | | 13: | | | | | | 14: | | | | |
| | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 | 52 | 2 | 12 | 22 | 32 | 42 |
| MOLLUSCA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nautilus pompilius Linnaeus | | | | 1 | | 1 | | | | | | | | | | | | | | | 1 | 2 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 | 2 | 5 | 5 | 5 |
| CRUSTACEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aristaeomorpha foliacea (Risso) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Heterocarpus gibbosus Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. laevigatus Bate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H. sibogae De Man | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plesionika longirostris (Borradaile) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P. sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Munida sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Parapagurus dofleini Balss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pylopagurus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Homolid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calappa sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Geryonid crab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECHINODERMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Holothurian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temnopleurid sea urchin | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Astropectinid sea star | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PISCES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Centrophorus scalplactus McCulloch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chimaera sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Synaphobranchus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conger verreauxi Kaup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Congriseus megastomus (Gunther) | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Physiculus sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polymixia sp. | | | | | | | | | | | | | | | | | | | | | 2 | 2 | | | 3 | | | | | | | | | |
| Etelis carbunculus Cuvier | | | | | | 1 | | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| E. coruscans Valenciennes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Randallichthys filamentosus (Fourmanoir) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tropidinius amoenus (Snyder) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lepidotrigla sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Plates 1-8

## Explanation of Plate 1

Station SV-P1 (Depth 320m)

Fig. 1. 17 : 46 Five individuals of flower flute porgy, *Tropidinius amoenus* aggregating around the bait-stand.

Fig. 2. 18 : 06 *Tropidinius amoenus* clinging to the bait meal.

Station SV-P2 (Depth 370m)

Fig. 3. 16 : 53 Two squat crabs, *Munida* sp., extending their chelipeds.

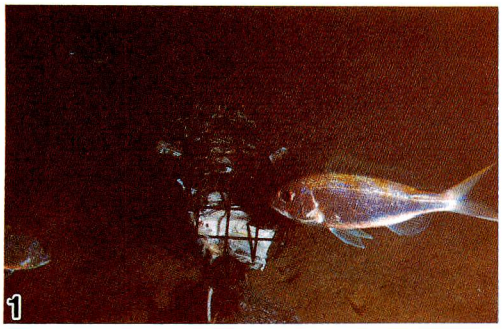
Fig. 4. 16 : 57 A rubby snapper, *Etelis* sp., at the left side.

Fig. 5. 17 : 27 A spotted pandalid shrimp, *Plesionika* sp., at the right side.

Fig. 6. 17 : 45 A pandalid shrimp (*Heterocarpus sibogae*) at the foreground and an alistaeid shrimp (*Aristaeomorpha foliacea*) at the background of the picture.

Fig. 7. 17 : 49 An individual of *Plesionika* sp. (at the left side) and *Munida* sp. threatening the shrimp.

Fig. 8. 17 : 53 A snapper, *Etelis carbunculus,* a temnopleurid sea urchin, and *Munida* sp. approaching to the bait-stand.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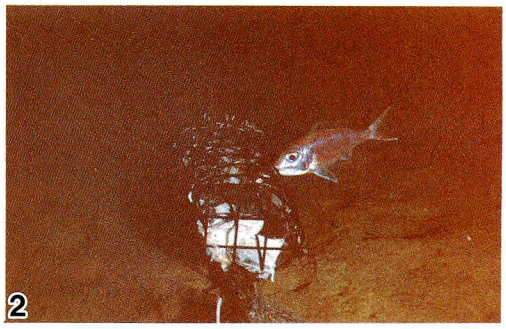
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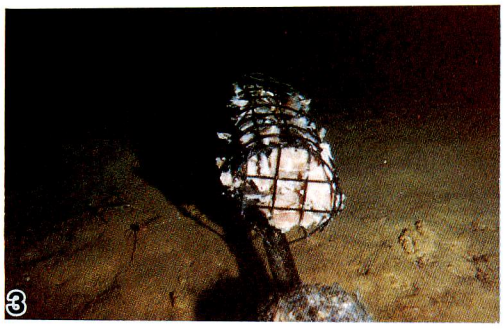
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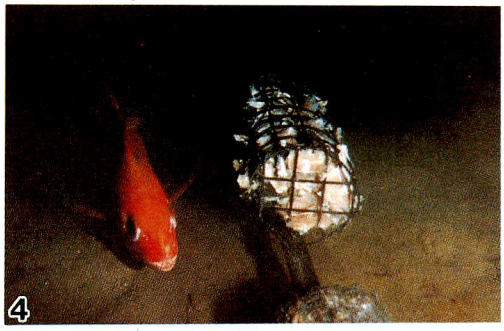
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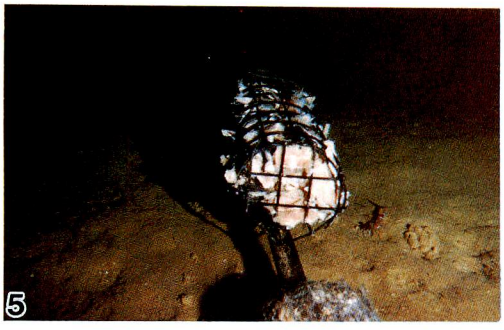
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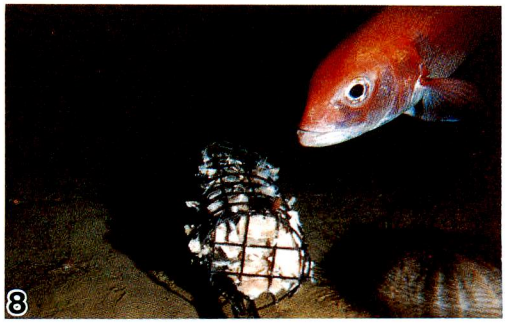
6


7


8

## Explanation of Plate 2

Station SV-P3 (Depth 370m)

Fig. 1. 16 : 06 A flower flute porgy (*Tropidinius amoenus*) at the left corner, a beardfish (*Polymixia* sp.) at the right side, a squat crab (*Munida* sp.) and a hermit crab (*Pylopagurus* sp.) at the left foreground.

Fig. 2. 16 : 11 A spotted pandalid shrimp (*Plesionika* sp.) at the right foreground, a snapper (*Etelis carbunculus*) at the background, and *Polymixia* sp. at the left and right sides.

Fig. 3. 16 : 16 A box crab (*Calappa* sp.) at the left foreground and *E. carbunculus* feeding the bait meal.

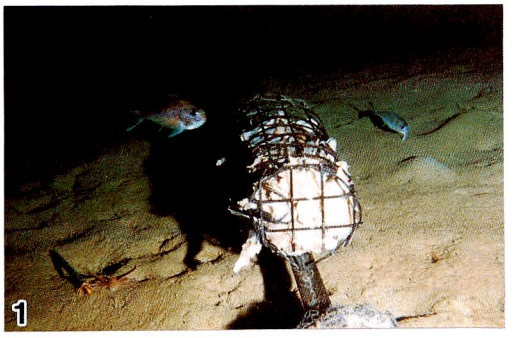
Fig. 4. 16 : 36 Astropectinid sea star (at right corner) and *Polymixia* sp. searching for foods.

Fig. 5. 16 : 46 The first appearance of *Nautilus* (#1).

Fig. 6. 16 : 51 #1 *Nautilus* extending its tentacles to the bait and two individuals of *E. carbunculus* (at foreground).

Fig. 7. 16 : 56 #1 and #2 *Nautilus* clinging to the bait-stand.

Fig. 8. 17 : 11 #1 *Nautilus* moving forwards and pushing #2.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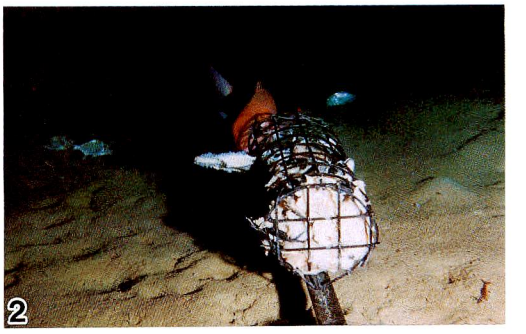
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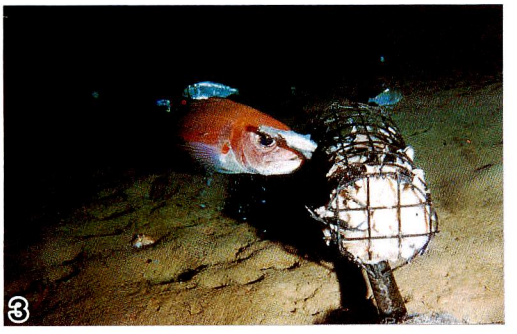
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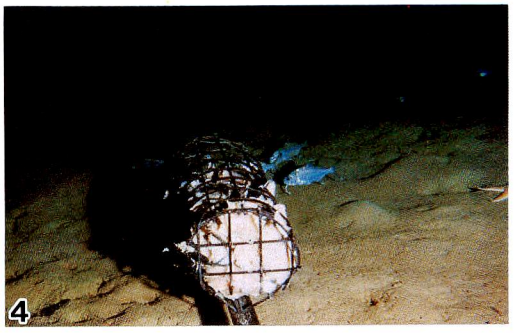
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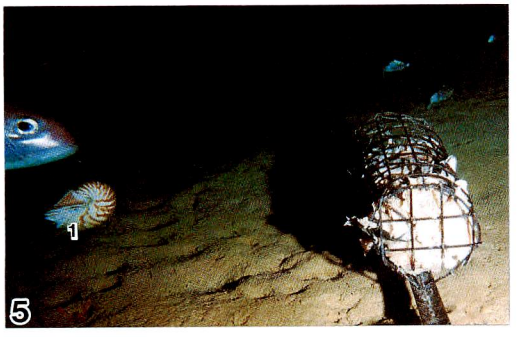

1
5


1
6


1
2
7


1
2
8

## Explanation of Plate 3

Station SV-P3 (continued)

Fig. 1. 17 : 21 Three *Nautilus* (#1-#3) and a spotted pandalid shrimp (*Plesionika* sp., at right side).

Fig. 2. 17 : 26 #2 *Nautilus* watching the motion of #1, and #3 clinging to back side of the stand, and a cutthroat eel (*Synaphobranchus* sp.) at the left corner.

Fig. 3. 17 : 41 #2 *Nautilus* starts feeding again.

Fig. 4. 17 : 46 Two *Synaphobranchus* sp. (at the right foreground) and a pandalid shrimp (*Heterocarpus sibogae*) at the central foreground.

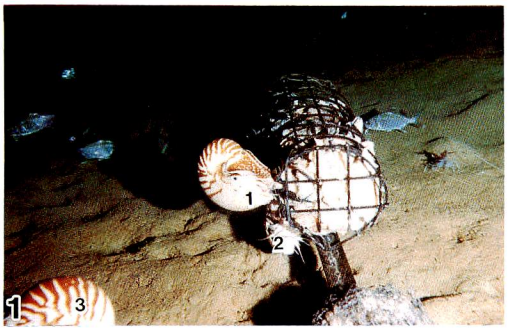
Fig. 5. 17 : 51 An aristaeid shrimp, *Aristaeomorpha foliacea* on the bait-stand.

Station OL-P1 (Depth 400m)

Fig. 6. 11 : 12 Three squat crabs, *Munida* sp. on the bait-stand and the sea bottom.

Fig. 7. 12 : 22 Two snappers, *Etelis carbunculus* (at the center).

Fig. 8. 13 : 32 *E. carbunculus* and temnopleurid sea urchin (at the right corner).


1
1
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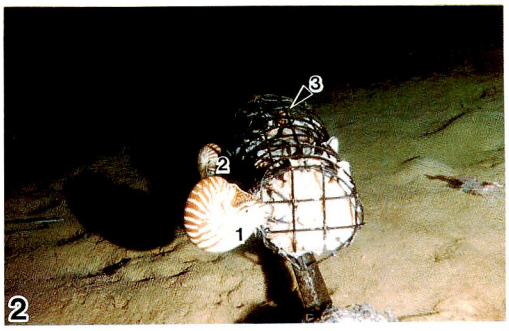
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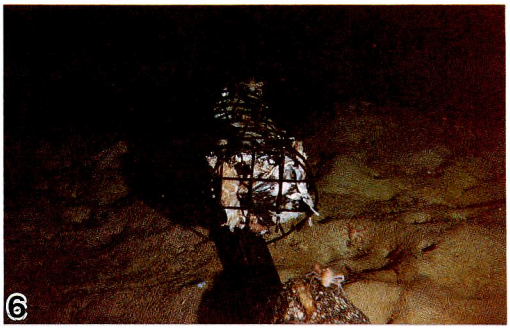
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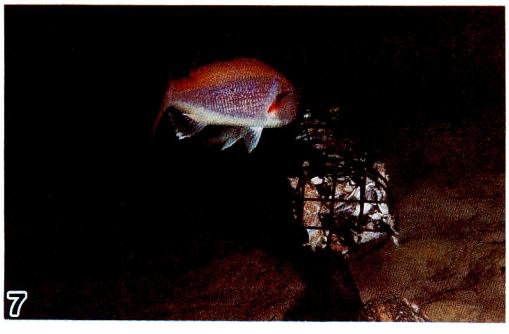
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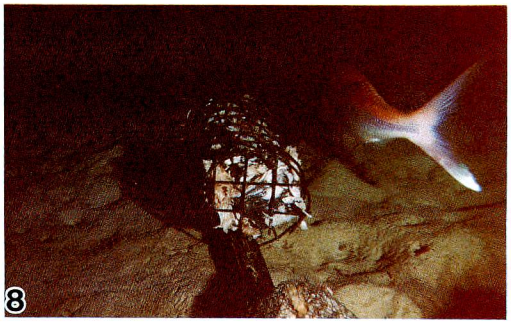
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## Explanation of Plate 4

Station OL-P1 (continued)

Fig. 1. 13 : 52 *Nautilus* clinging to the bait-stand, a hermit crab, *Parapagurus dofleini* and astropectinid sea star at the left side.

Fig. 2. 14 : 22 Three cutthroat eel (*Synaphobranchus* sp.) at the left side and a geryonid crab at the left corner.

Fig. 3. 15 : 12 *Parapagurus dofleini* (at the right foreground), temnopleurid sea urchin (at the right side), and *Synaphobranchus* sp. (at the right corner).

Fig. 4. 15 : 52 A snapper, *Etelis carbunculus* approaching to the bait-stand and *Synaphobranchus* sp. feeding the baits.

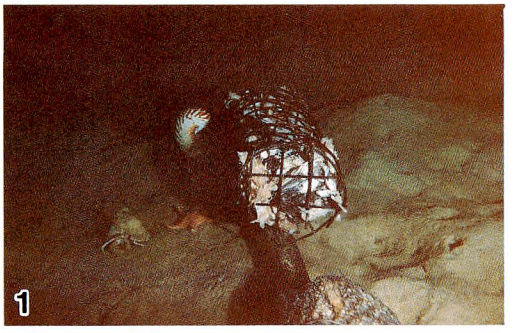
Fig. 5. 16 : 22 A geryonid crab and *Parapagurus dofleini.*

Fig. 6. 16 : 32 Two *Synaphobranchus* sp. approaching to the bait-stand.

Station OL-P2 (Depth 400m)

Fig. 7. 18 : 32 One hour and 50 minutes after the landing. Five *Nautilus* aggregating around the bait-stand, four pandalid shrimp, *Plesionika longirostris,* two shrimps, *Heterocarpus sibogae,* and *Synaphobranchus* sp. (at the left foreground).

Fig. 8. 18 : 42 A snapper, *Randallichthys filamentosus* (at the left corner) and a morid cod, *Physiculus* sp. (at the foreground).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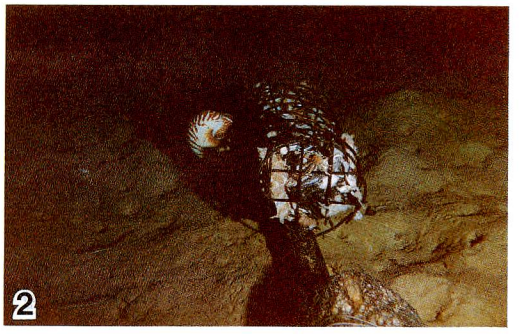
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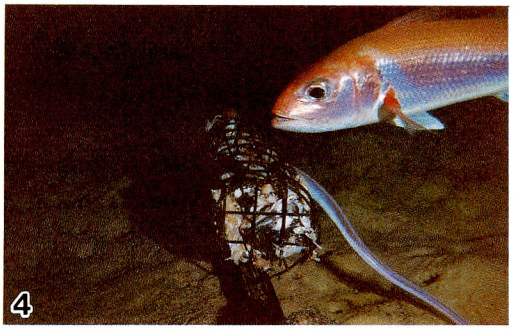
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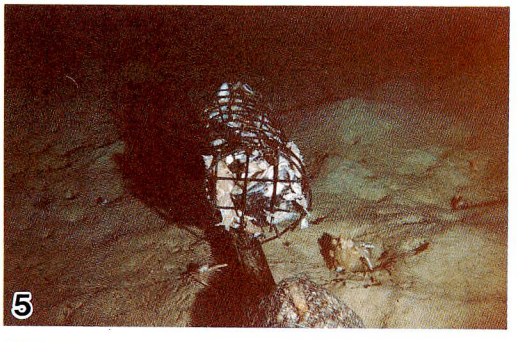
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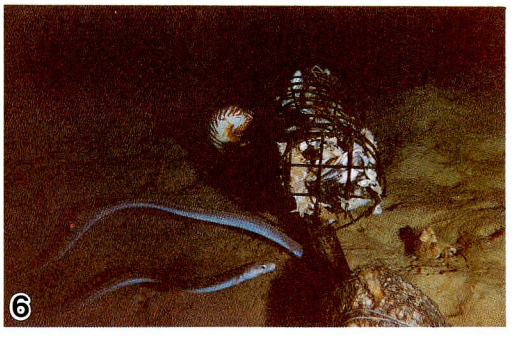
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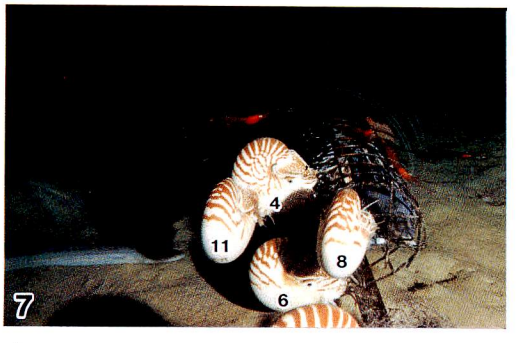
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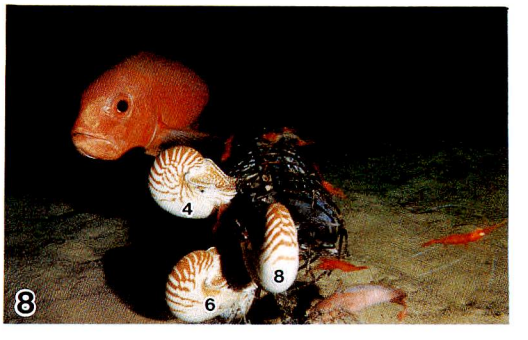
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## Explanation of Plate 5

Station OL-P2 (continued)

| | | |
|---|---|---|
| Fig. 1. | 18 : 52 | A dogfish shark, *Centrophorus scalplactus.* |
| Fig. 2. | 19 : 02 | The feeding actions of the discriminated individuals of *Nautilus* based on the color pattern of their shell (refer to text for details). |
| Fig. 3. | 19 : 12 | |
| Fig. 4. | 19 : 22 | |
| Fig. 5. | 19 : 32 | |
| Fig. 6. | 19 : 42 | |
| Fig. 7. | 19 : 52 | |
| Fig. 8. | 20 : 02 | |


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## Explanation of Plate 6

Station OL-P2 (continued)

Fig. 1. 20 : 42 The posterior view of a congrid eel, *Conger verreauxi* at the right side of the picture.

Fig. 2. 21 : 02 Two individuals of *Nautilus* connecting together and a morid cod, *Physiculus* sp. (at the center).

Fig. 3. 21 : 42 Two ratfish, *Chimaera* sp.

Fig. 4. 22 : 42 A pandalid shrimp, *Heterocarpus sibogae.*

Station SV-P4 (Depth 460m)

Fig. 5. 17 : 02 A conger eel, *Congriseus megastomus* and two spotted pandalid shrimps, *Plesionika* sp.

Fig. 6. 18 : 02 An individual of *Nautilus* and aristaeid shrimp, *Aristaeomorpha foliacea.*

Fig. 7. 20 : 02 Four *Nautilus* clinging to the bait-stand and about 30 individuals of *H. sibogae* aggregating to the stand.

Fig. 8. 21 : 02 *H. sibogae* increased in number of individuals and five individuals of pandalid shrimp, *H. gibbosus.*


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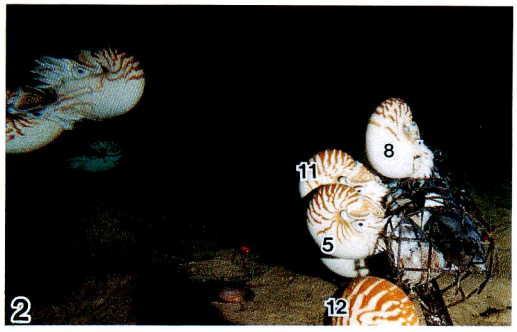
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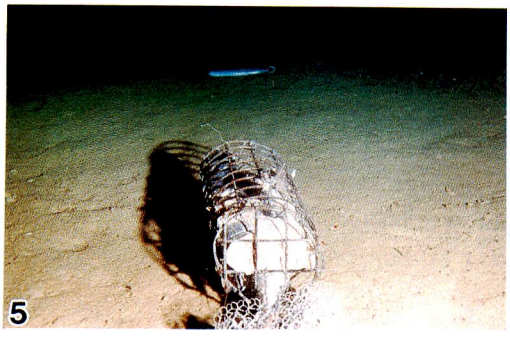
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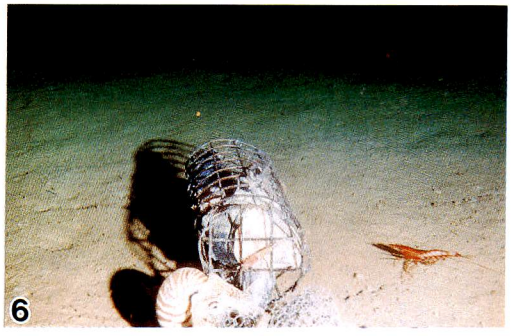
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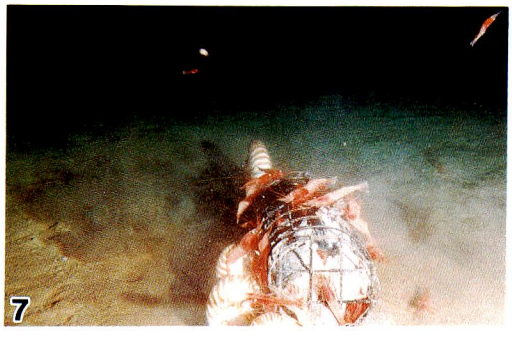
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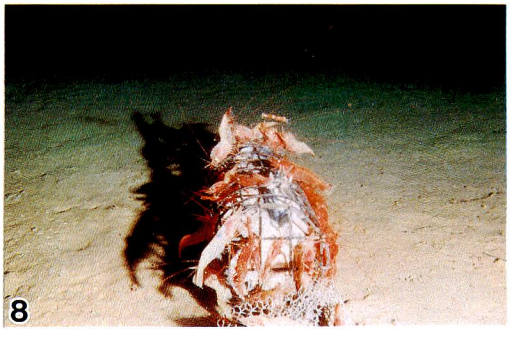
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## Explanation of Plate 7

Station SV-P4 (continued)

Fig. 1. 0 : 32 The abdominal view of a ratfish, *Chimaera* sp. Note the change of the bottom surface resulted from the shift of the frame with camera system.

Fig. 2. 3 : 32 A hermit crab, *Parapagurus dofleini,* carrying a sea anemone opening its tentacles on the dorsal side.

Fig. 3. 7 : 32 7-8 individuals of spotted pandalid shrimp (*Plesionika* sp.) at the right side, a gurnard, *Lepidotrigla* sp. at the left side, a conger eel (*Synaphobranchus* sp.) at the left corner, and a beardfish (*Polymixia*).

Fig. 4. 8 : 32 *Nautilus* attaching to another individual, *Parapagurus dofleini,* and a squat crab, *Munida* sp. (at the left corner).

Station SV-P5 (Depth 440m)

Fig. 5. 12 : 02 35 minutes after the landing. One individual of *Plesionika* sp. at the right side of the bait-stand.

Fig. 6. 14 : 02 A rubby snapper, *Etelis carbunculus* and a cloud of stirred up bottom mud.

Fig. 7. 15 : 32 Four *Nautilus* clinging to the bait-stand, *Plesionika* sp. at the foreground, and *Polymixia* sp. at the background.

Fig. 8. 16 : 32 *Nautilus* feeding the baits, a homolid crab (at the right side), *Plesionika* sp. (at the left side and on the bait-stand), and *Munida* sp. (at the foreground).


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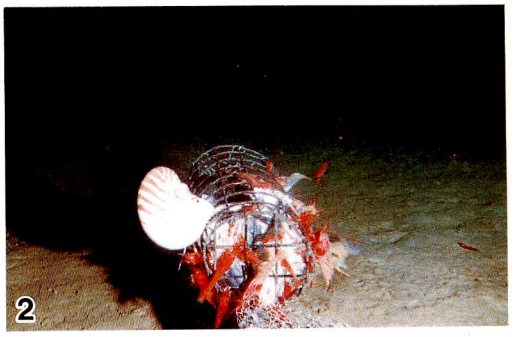
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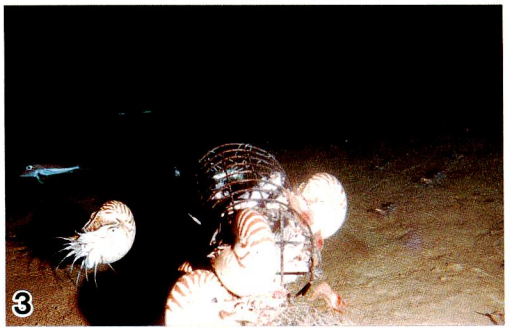
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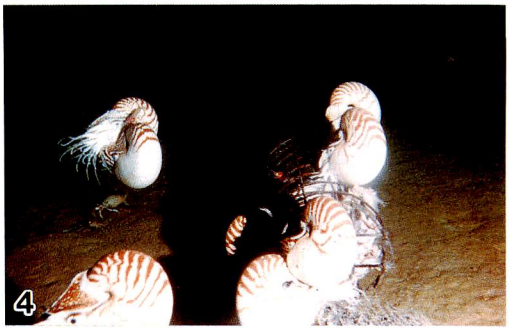
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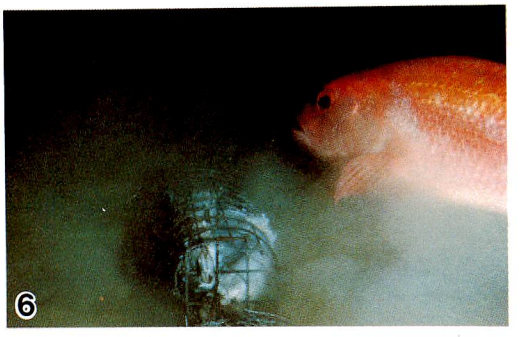
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## Explanation of Plate 8

Station SV-P5 (continued)

Fig. 1. 18 : 02 Three individuals of *Nautilus* clinging to the bait-stand and about ten individuals of pandalid shrimps, *Heterocarpus sibogae.*

Fig. 2. 20 : 32 *H. sibogae* increased in number of individuals and some pandalid shrimps, *H. gibbosus.*

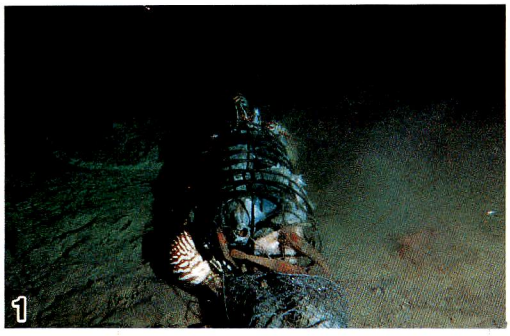
Fig. 3. 23 : 02
Fig. 4. 1 : 32
Fig. 5. 2 : 32
} Some *Nautilus* swimming with opened tentacles.

Fig. 6. 3 : 02 An aristaeid shrimp, *Aristaeomorpha foliacea* at the center of the picture.

Station SV-P6 (Depth 450m)

Fig. 7. 13 : 12 Three individuals of *Nautilus* and a beardfish, *Polymixia* sp.

Fig. 8. 14 : 22 Five individuals of *Nautilus* clinging to the half buried bait-stand and feeding the bait meal.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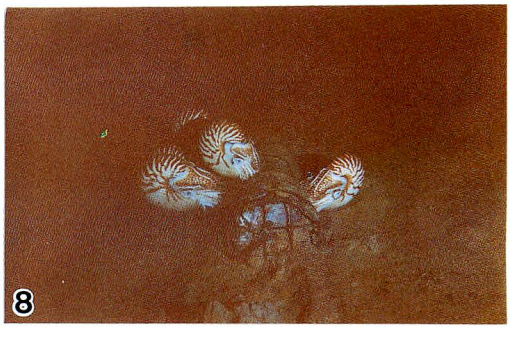
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