## Record of Trapping Experiment

Sampling of living *Nautilus* and other marine fauna using baited traps is one of the main subjects of our field research. It was carried out in the waters off Suva and off Ovalau island during August 22 - September 11, 1986 by the R/V Aphareus of the Institute of Marine Resources, the University of the South Pacific. Methods of trapping are essentially the same as those in our field research in 1983 (*see* TANABE in HAYASAKA, 1985). Details of the experiment are described in the following lines.

### Trapping Locations

Trapping experiment was made at 17 locations about 6-7 km SEE from Suva Point, the southernmost point of Suva Peninsula (Kandavu Passage), Viti Levu, and at four locations about 8 km NNW from Ovalau Island (Fig. 3.) The locations in the Suva area are sited within the main habitat of a large population of *Nautilus,* where a large number of specimens have hitherto been collected by WARD *et al.* (1977) and ourselves (HAYASAKA and SHINOMIYA, 1982; HAYASAKA *et al.,*

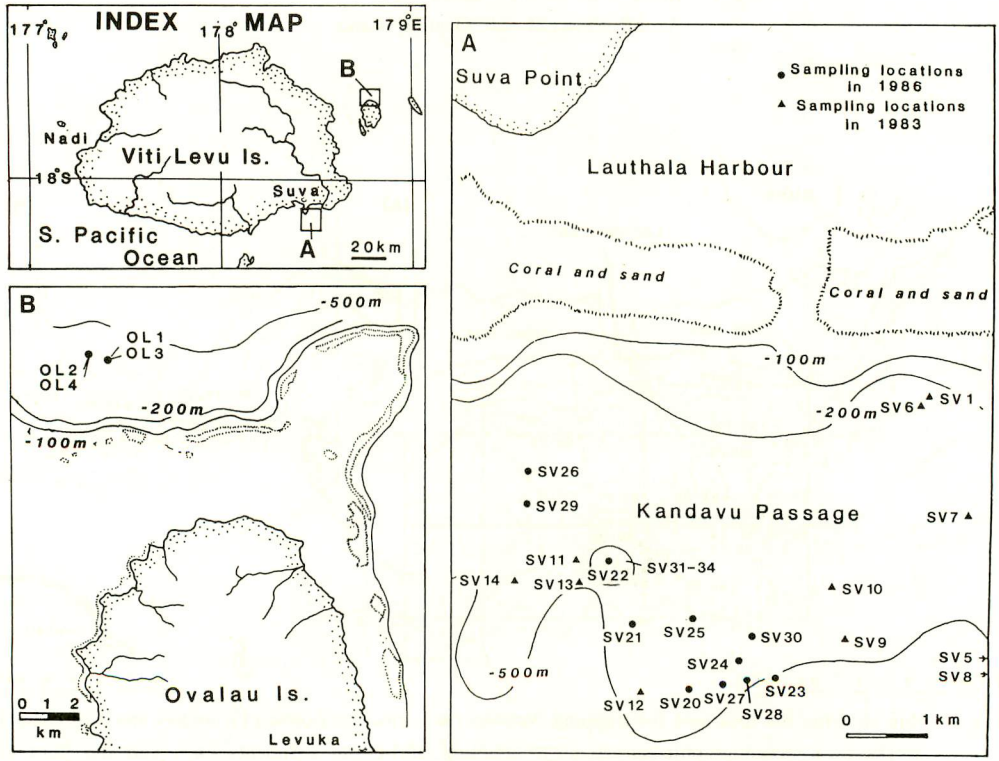


Fig. 3. Map of the Suva and the Ovalau areas, Fiji, showing the trapping locations of *Nautilus pompilius.*

1985).

In both the Suva and the Ovalau areas, trapping points are located in the outer margin of the coral reef, followed by an abruptly dropping scarf.

## Catch Record

As a result of trapping, 222 individuals of *Nautilus* (180 from the Suva area and 44 from the Ovalau area) were captured from 20 locations ranging from 324

Table 1. Capture records of *Nautilus pompilius* from off Suva, Viti Levu Island and off Ovalau Island (localities with prefix SV and OL respectively), Fiji during August 22-September 11, 1986.

| Locality no. | Water depth(m) | No. of hauls | Total number of traps | Number of *Nautilus* captured Total | N/trap |
|---|---|---|---|---|---|
| SV 31 | 293 | 1 | 4 | 0 | 0 |
| SV 26 | 324 | 1 | 4 | 8 | 2.00 |
| SV 29 | 324 | 1 | 4 | 11 | 2.75 |
| SV 30 | 324 | 1 | 4 | 13 | 3.25 |
| SV 28 | 387 | 1 | 4 | 4 | 1.00 |
| SV 24 | 414 | 1 | 4 | 4 | 1.00 |
| SV 25 | 414 | 1 | 4 | 6 | 1.50 |
| SV 33 | 414 | 1 | 4 | 11 | 2.75 |
| SV 21 | 432 | 1 | 4 | 11 | 2.75 |
| SV 20 | 432 | 1 | 4 | 1 | 0.25 |
| SV 22 | 432 | 1 | 4 | 6 | 1.50 |
| SV 32 | 432 | 1 | 4 | 34 | 8.50 |
| SV 34 | 432 | 1 | 12 | 60 | 5.00 |
| SV 23 | 450 | 1 | 4 | 3 | 0.75 |
| SV 27 | 450 | 1 | 4 | 7 | 1.75 |
| OL 1 | 396 | 1 | 4 | 9 | 2.25 |
| OL 3 | 414 | 1 | 4 | 5 | 1.25 |
| OL 4 | 432 | 1 | 4 | 11 | 2.75 |
| OL 2 | 450 | 1 | 4 | 19 | 4.75 |

Table 2. Sex ratios of trapped *Nautilius pompilius* from the Fiji Islands.

| Area | Date of collection | Number of specimens Total | Males | Females | Unknown | References |
|---|---|---|---|---|---|---|
| Off Suva | Summer, 1975 | 48 | 30(62.5%) | 6(12.5%) | 4(9.5%) | WARD *et al.* (1977) |
| | Jan. 1982 | 42 | 26(61.9%) | 14(33.3%) | 2(4.8%) | HAYASAKA & SHINOMIYA (1982) |
| | Aug. -Sept. 1983 | 101 | 81(80.2%) | 19(18.8%) | 1(1.0%) | HAYASAKA *et al.* (1985) |
| | Aug. -Sept. 1986 | 179 | 164(91.6%) | 15( 8.4%) | — | This paper |
| Off Pacific Harbour | Sept. 1983 | 61 | 51(82.0%) | 11(18.0%) | — | HAYASAKA *et al.* (1985) |
| Off Ovalau Islands | Sept. 1986 | 45 | 44(97.8%) | 1( 2.2%) | — | This paper |

m to 450 m in depth (Table 1). Although we tried trapping tests at the stations being close to each other within a limited period of time in the Suva area, the number of captured *Nautilus* per haul varies markedly from location to location. This fact as well as the whole year trapping records by R/V Aphareus (personal communication from Dr. U. RAJ) suggest a patchy distribution of the Suva population at least for the depth interval between 300 m and 500 m. Previous catch records of *Nautilus* in Fiji (WARD *et al.*, 1977; HAYASAKA and SHINOMIYA, 1982; TANABE in HAYASAKA, 1985) show that living animals are distributed in the depths between 75 m and 550 m and found most abundantly at the depths between 360-470 m.

After capture, every animal was labeled, weighed, sexed and measured. Sex identification was made by the methods described in HAYASAKA *et al.* (1982). During the period of investigation, females never occurred abundantly, comprising only 8% of the catch for the Suva area and 2% for the Ovalau area (Table 2). This matches well with the previous catch records in Fiji Islands, suggesting the smaller female/male ratio in summer than in winter. Similar seasonal fluctuation of the sex ratio was reported in the trapped *Nautilus* from the Philippines (HAVEN, 1977).

## Notes on *Nautilus* Captured

Measurements data of *Nautilus* captured are listed in Tables 3-4. Except for selected individuals used for laboratory work, most animals captured from off Suva were tagged and released at various points near the trapping sites for a long-term growth analysis. During our field research, one specimen (SV 24-2-1; captured at SV 24 on August 24 and released on August 25 at almost the same location) was recaptured on August 29 at the point about 3 km west from Suva point by the vessel of the Fijian Fisheries Agency. Therefore, the animal has traveled for 5 km or more in five days. Forty-four animals from off Ovalau Island were killed for laboratory research.

Biometric data show that the males from off Ovalau Island are generally smaller but slightly heavier than the males from off Suva (Figs. 4-5) The difference in mean shell size probably owes to paucity of mature specimens in the Ovalau sample (only six specimens with a blacked shell aperture; 14% to the total males), because mature males occupy about 30% of the total males in the Suva sample. The Suva and Ovalau samples are similar in their basic shell form ratios (Fig. 6) and growth pattern of gonad (Fig. 7).

## Discovery of *Nautilus* Jaws in a Shark's Stomach

On September 4, we captured one cat shark (*Cephaloscyllium isabella* BONNETERRE) in the trap no. 4 at the Station OL 3 off Ovalau Island (*see* Fig. 2),

Table 3. Biological data for *Nautilus pompilius* specimens trapped from off Suva Harbour, Viti Levu, Fiji in 1986.

| Date of collection | Specimen | Sex | Weight (g) | | | Shell size (mm) | | | From ratios | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total | Tissue | Shell | D | B | H | B/D | H/D | B/H | |
| Aug. 22-23 | SV 20-2-1 | F | 390.7 | --- | --- | 129.6 | 66.6 | 86.0 | .514 | .663 | .774 | Released (Aug. 24) |
| | SV 21-1-1 | M | 576.7 | --- | --- | 147.3 | 74.8 | 96.5 | .508 | .655 | .775 | ditto |
| | SV 21-1-2 | M | 521.0 | --- | --- | 147.4 | 71.6 | 95.5 | .486 | .648 | .750 | ditto |
| | SV 21-1-3 | M | 201.2 | 130.8 | 70.4 | 105.6 | 57.1 | 66.7 | .541 | .632 | .856 | Killed (Sept. 11) |
| | SV 21-1-4 | M | 538.5 | --- | --- | 152.5 | 71.8 | 94.6 | .471 | .620 | .759 | Released (Aug. 24) |
| | SV 21-1-5 | M | 630.0 | --- | --- | 152.3 | 75.8 | 98.0 | .498 | .643 | .773 | ditto |
| | SV 21-1-6 | F | 400.0 | --- | --- | 128.1 | 69.3 | 81.2 | .541 | .634 | .853 | ditto |
| | SV 21-1-7 | M | 490.4 | --- | --- | 143.9 | 74.2 | 88.8 | .516 | .617 | .836 | ditto |
| | SV 21-1-8 | M | 570.2 | --- | --- | 148.3 | 73.8 | 94.7 | .498 | .639 | .779 | ditto |
| | SV 21-2-1 | M | 525.5 | --- | --- | 143.2 | 69.8 | 88.3 | .487 | .617 | .790 | ditto |
| | SV 21-3-1 | M | 238.2 | 159.9 | 78.3 | 110.2 | 58.8 | 73.1 | .534 | .663 | .804 | Killed (Sept. 11) |
| | SV 21-4-1 | F | 351.4 | --- | --- | 128.4 | 64.6 | 78.6 | .503 | .612 | .822 | Released (Aug. 24) |
| | SV 22-2-1 | M | 497.4 | --- | --- | 139.8 | 71.7 | 93.9 | .513 | .672 | .764 | ditto |
| | SV 22-2-2 | M | 514.0 | --- | --- | 142.9 | 72.8 | 93.9 | .509 | .657 | .775 | ditto |
| | SV 22-3-1 | M | 600.8 | --- | --- | 150.8 | 74.8 | 95.1 | .496 | .631 | .787 | ditto |
| | SV 22-3-2 | M | 419.0 | --- | --- | 134.6 | 72.2 | 83.3 | .536 | .619 | .867 | ditto |
| | SV 22-4-1 | M | 584.2 | --- | --- | 150.7 | 73.5 | 95.5 | .488 | .634 | .770 | ditto |
| | SV 22-4-2 | M | 497.5 | --- | --- | 146.5 | 70.5 | 91.8 | .481 | .627 | .768 | ditto |
| Aug. 23-24 | SV 23-1-1 | M | 181.6 | 118.1 | 63.5 | 101.6 | 53.2 | 62.2 | .524 | .612 | .855 | Killed (Sept. 11) |
| | SV 23-2-1 | M | 357.4 | --- | --- | 138.4 | 72.3 | 92.9 | .522 | .671 | .778 | Released (Aug. 25) |
| | SV 23-4-1 | M | 368.5 | --- | --- | 125.3 | 70.0 | 77.7 | .559 | .620 | .901 | ditto |
| | SV 24-1-1 | F | 393.7 | --- | --- | 131.1 | 64.3 | 83.9 | .490 | .640 | .766 | ditto |
| | SV 24-2-1 | M | 520.3 | 394.2 | 126.1 | 145.8 | 70.1 | 91.5 | .481 | .628 | .766 | ditto |
| | SV 24-3-1 | M | 598.7 | --- | --- | 153.5 | 75.0 | 101.1 | .489 | .659 | .742 | ditto |
| | SV 24-3-2 | M | 519.0 | --- | --- | 146.6 | 74.4 | 91.0 | .508 | .621 | .818 | ditto |
| | SV 25-1-1 | M | 499.2 | --- | --- | 138.4 | 72.3 | 92.9 | .522 | .671 | .778 | ditto |
| | SV 25-2-1 | M | 505.0 | --- | --- | 140.6 | 72.4 | 91.2 | .515 | .649 | .794 | ditto |
| | SV 25-3-1 | M | 487.2 | --- | --- | 136.9 | 76.5 | 89.5 | .559 | .654 | .855 | ditto |
| | SV 25-3-2 | M | 595.8 | --- | --- | 152.1 | 74.3 | 97.8 | .488 | .643 | .760 | ditto |
| | SV 25-4-1 | F | 465.6 | --- | --- | 144.1 | 66.7 | 92.8 | .463 | .644 | .719 | ditto |
| | SV 25-4-2 | F | 466.4 | --- | --- | 146.3 | 69.3 | 94.5 | .474 | .646 | .733 | ditto |
| Aug. 24-25 | SV 26-1-1 | M | 580.0 | --- | --- | 148.8 | 76.4 | 101.3 | .513 | .681 | .754 | Released (Aug. 26) |
| | SV 26-2-1 | M | 499.5 | --- | --- | 147.2 | 79.4 | 95.9 | .539 | .651 | .828 | Killed (Aug. 26) |
| | SV 26-2-2 | M | 494.6 | --- | --- | 140.6 | 71.9 | 91.3 | .511 | .649 | .788 | Released (Aug. 26) |
| | SV 26-2-3 | F | 359.6 | --- | --- | 128.3 | 64.9 | 76.3 | .506 | .595 | .844 | ditto |
| | SV 26-2-4 | M | 357.0 | --- | --- | 127.3 | 68.5 | 80.5 | .538 | .632 | .851 | ditto |
| | SV 26-2-5 | M | 256.2 | --- | --- | 113.2 | 62.5 | 74.5 | .552 | .658 | .839 | Killed (Aug. 26) |
| | SV 26-2-6 | M | 497.0 | 380.6 | 116.4 | 140.0 | 71.8 | 93.1 | .513 | .665 | .771 | Died (Aug. 25-26) |
| | SV 26-4-1 | M | 578.7 | --- | --- | 153.6 | 74.5 | 102.5 | .485 | .667 | .727 | Released (Aug. 26) |
| | SV 27-2-1 | F | 420.9 | 294.0 | 126.9 | 135.2 | 66.7 | 86.1 | .493 | .637 | .432 | Died (Aug. 25-26) |
| | SV 27-2-2 | M | 627.6 | 481.9 | 145.7 | 153.9 | 74.7 | 99.6 | .485 | .647 | .750 | ditto |
| | SV 27-3-1 | M | 561.7 | --- | --- | 168.4 | 75.0 | 95.3 | .445 | .566 | .787 | Released (Aug. 26) |
| | SV 27-3-2 | M | 573.8 | 445.1 | 128.7 | 145.8 | 72.7 | 91.4 | .499 | .627 | .795 | Died (Aug. 25-26) |
| | SV 27-3-3 | M | 557.0 | --- | --- | 147.1 | 74.1 | 92.5 | .504 | .629 | .801 | Released (Aug. 26) |
| | SV 27-4-1 | M | 507.3 | --- | --- | 144.5 | 77.3 | 94.2 | .535 | .652 | .821 | ditto |
| | SV 27-4-2 | F | 555.8 | --- | --- | 147.3 | 72.1 | 93.6 | .489 | .635 | .770 | ditto |
| | SV 28-3-1 | M | 594.1 | 470.5 | 123.6 | 146.9 | 70.1 | 89.5 | .477 | .609 | .783 | Died (Aug. 25-26) |
| | SV 28-3-2 | M | 559.3 | 373.0 | 186.3 | 144.8 | 69.3 | 94.8 | .479 | .655 | .731 | Released (Aug. 26) |
| | SV 28-4-1 | M | 477.8 | 353.4 | 124.4 | 139.8 | 69.8 | 91.1 | .499 | .652 | .766 | Died (Aug. 25-26) |
| | SV 28-4-2 | M | 528.8 | 359.2 | 133.6 | 145.6 | 72.4 | 96.3 | .497 | .661 | .752 | ditto |
| Aug. 25-26 | SV 29-1-1 | M | 576.5 | --- | --- | 137.5 | 73.8 | 97.1 | .537 | .706 | .760 | Released (Aug. 26) |
| | SV 29-1-2 | M | 581.0 | --- | --- | 149.9 | 72.8 | 96.5 | .486 | .644 | .754 | ditto |
| | SV 29-1-3 | M | 548.5 | --- | --- | 145.0 | 71.7 | 93.9 | .494 | .648 | .764 | ditto |
| | SV 29-1-4 | M | 574.9 | --- | --- | 154.9 | 74.2 | 100.0 | .479 | .646 | .742 | ditto |
| | SV 29-1-5 | M | 513.3 | --- | --- | 142.0 | 71.8 | 93.6 | .506 | .659 | .767 | ditto |
| | SV 29-2-1 | F | 518.2 | --- | --- | 145.3 | 69.2 | 96.5 | .476 | .664 | .717 | ditto |
| | SV 29-2-2 | M | 440.4 | --- | --- | 134.5 | 71.7 | 87.9 | .533 | .653 | .816 | ditto |
| | SV 29-2-3 | M | 680.1 | --- | --- | 158.3 | 76.5 | 104.5 | .483 | .660 | .732 | ditto |
| | SV 29-2-4 | M | 540.8 | --- | --- | 141.8 | 76.2 | 94.3 | .537 | .665 | .808 | ditto |
| | SV 29-2-5 | M | 490.0 | --- | --- | 139.2 | 75.5 | 91.8 | .542 | .659 | .822 | ditto |
| | SV 29-4-1 | M | 539.6 | --- | --- | 147.9 | 71.8 | 97.5 | .485 | .659 | .736 | Killed (Aug. 26) |

Table 3. Continued.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SV 30-1-1 | M | 435.4 | --- | --- | 131.2 | 73.8 | 85.6 | .563 | .652 | .862 | Released (Aug. 26) |
| | SV 30-1-2 | M | 604.7 | --- | --- | 150.7 | 74.8 | 98.2 | .496 | .652 | .762 | ditto |
| | SV 30-1-3 | M | 353.2 | --- | --- | 124.2 | 67.1 | 84.2 | .540 | .678 | .797 | ditto |
| | SV 30-1-4 | M | 569.6 | --- | --- | 148.4 | 73.4 | 96.8 | .495 | .652 | .758 | ditto |
| | SV 30-2-1 | M | 559.6 | --- | --- | 147.8 | 73.6 | 98.6 | .498 | .667 | .746 | ditto |
| | SV 30-2-2 | M | 519.5 | --- | --- | 145.6 | 70.3 | 94.0 | .483 | .646 | .748 | ditto |
| | SV 30-3-1 | M | 528.2 | --- | --- | 148.6 | 70.2 | 97.5 | .472 | .656 | .720 | ditto |
| | SV 30-3-2 | M | 461.2 | --- | --- | 138.0 | 72.8 | 91.1 | .528 | .660 | .799 | ditto |
| | SV 30-3-3 | M | 320.7 | --- | --- | 120.9 | 68.0 | 82.5 | .562 | .682 | .824 | ditto |
| | SV 30-3-4 | M | 362.3 | --- | --- | 127.2 | 67.0 | 83.3 | .527 | .655 | .804 | ditto |
| | SV 30-4-1 | M | 510.0 | --- | --- | 145.8 | 75.7 | 93.1 | .519 | .639 | .813 | ditto |
| | SV 30-4-2 | M | 427.8 | --- | --- | 134.0 | 67.1 | 85.5 | .501 | .638 | .785 | ditto |
| | SV 30-4-3 | M | 341.6 | --- | --- | 125.6 | 69.0 | 83.6 | .549 | .666 | .825 | ditto |
| Sept. 9-10 | SV 32-1-1 | F | 476.1 | 344.0 | 132.1 | 143.4 | 66.4 | 91.5 | .463 | .638 | .726 | Killed (Sept. 11) |
| | SV 32-1-2 | M | 394.2 | --- | --- | 129.6 | 67.0 | 86.0 | .517 | .664 | .779 | Released (Sept. 11) |
| | SV 32-1-3 | M | 378.3 | --- | --- | 129.2 | 69.4 | 82.3 | .537 | .640 | .843 | ditto |
| | SV 32-1-4 | M | 483.2 | --- | --- | 145.2 | 71.9 | 92.8 | .495 | .639 | .775 | ditto |
| | SV 32-1-5 | M | 561.5 | --- | --- | 150.6 | 73.5 | 98.2 | .488 | .652 | .748 | ditto |
| | SV 32-1-6 | M | 567.3 | --- | --- | 152.2 | 76.3 | 102.4 | .501 | .673 | .745 | ditto |
| | SV 32-1-7 | M | 460.3 | --- | --- | 140.9 | 73.3 | 92.4 | .520 | .656 | .793 | ditto |
| | SV 32-1-8 | M | 451.5 | --- | --- | 134.4 | 74.7 | 85.1 | .556 | .633 | .878 | ditto |
| | SV 32-1-9 | M | 502.3 | --- | --- | 144.5 | 73.4 | 95.4 | .508 | .660 | .769 | ditto |
| | SV 32-1-10 | M | 538.3 | --- | --- | 143.4 | 71.6 | 93.9 | .499 | .655 | .763 | ditto |
| | SV 32-1-11 | M | 223.9 | 150.8 | 73.1 | 108.4 | 58.5 | 71.9 | .540 | .663 | .814 | Killed (Sept. 11) |
| | SV 32-1-12 | M | 604.7 | --- | --- | 150.6 | 73.6 | 99.4 | .489 | .660 | .740 | Released (Sept. 11) |
| | SV 32-2-1 | M | 575.8 | --- | --- | 148.7 | 74.2 | 97.9 | .499 | .658 | .758 | ditto |
| | SV 32-2-2 | M | 477.0 | --- | --- | 140.0 | 73.8 | 89.0 | .527 | .636 | .829 | ditto |
| | SV 32-2-3 | M | 331.6 | --- | --- | 124.2 | 68.0 | 83.4 | .548 | .671 | .815 | ditto |
| | SV 32-2-4 | M | 425.8 | --- | --- | 131.6 | 71.3 | 86.9 | .542 | .660 | .820 | ditto |
| | SV 32-2-5 | M | 513.1 | --- | --- | 144.1 | 73.3 | 98.7 | .509 | .685 | .743 | ditto |
| | SV 32-2-6 | M | 535.0 | --- | --- | 148.4 | 70.9 | 98.5 | .478 | .664 | .720 | ditto |
| | SV 32-2-7 | M | 540.0 | --- | --- | 144.9 | 74.6 | 94.8 | .515 | .654 | .790 | ditto |
| | SV 32-2-8 | M | 311.5 | --- | --- | 117.0 | 63.5 | 76.1 | .543 | .650 | .834 | Released (Sept. 11) |
| | SV 32-2-9 | M | 348.3 | --- | --- | 122.8 | 66.2 | 78.0 | .539 | .635 | .849 | ditto |
| | SV 32-3-1 | M | 594.0 | --- | --- | 151.9 | 76.8 | 102.4 | .506 | .674 | .750 | ditto |
| | SV 32-3-2 | M | 309.8 | --- | --- | 118.8 | 66.4 | 79.4 | .559 | .668 | .836 | ditto |
| | SV 32-3-3 | M | 604.1 | 453.5 | 150.6 | 153.5 | 73.4 | 103.8 | .478 | .676 | .707 | Killed (Sept. 11) |
| | SV 32-3-4 | M | 653.0 | --- | --- | 155.6 | 75.9 | 101.0 | .488 | .649 | .751 | Released (Sept. 11) |
| | SV 32-3-5 | M | 420.0 | --- | --- | 134.3 | 68.6 | 85.7 | .511 | .638 | .800 | ditto |
| | SV 32-3-6 | M | 583.1 | --- | --- | 148.9 | 74.1 | 99.0 | .498 | .665 | .748 | ditto |
| | SV 32-3-7 | M | 565.2 | --- | --- | 146.9 | 70.9 | 95.3 | .483 | .649 | .744 | ditto |
| | SV 32-3-8 | M | 565.9 | --- | --- | 144.9 | 73.9 | 94.3 | .510 | .651 | .784 | ditto |
| | SV 32-3-9 | M | 417.0 | --- | --- | 130.8 | 72.3 | 88.5 | .553 | .677 | .817 | ditto |
| | SV 32-4-1 | F | 353.0 | 246.6 | 106.4 | 127.6 | 67.2 | 80.9 | .527 | .634 | .831 | Killed (Sept. 11) |
| | SV 32-4-2 | M | 298.5 | --- | --- | 115.8 | 64.1 | 75.2 | .554 | .649 | .852 | Released (Sept. 11) |
| | SV 32-4-3 | M | 312.9 | --- | --- | 119.9 | 66.8 | 88.8 | .557 | .741 | .752 | ditto |
| | SV 32-4-4 | M | 549.8 | --- | --- | 144.5 | 73.7 | 92.8 | .510 | .642 | .794 | ditto |
| | SV 33-1-1 | M | 471.0 | --- | --- | 144.3 | 70.3 | 96.3 | .487 | .667 | .730 | ditto |
| | SV 33-1-2 | M | 474.7 | --- | --- | 144.2 | 69.0 | 96.4 | .479 | .669 | .716 | ditto |
| | SV 33-1-3 | M | 521.3 | --- | --- | 143.3 | 73.7 | 98.2 | .514 | .685 | .751 | ditto |
| | SV 33-1-4 | M | 350.0 | --- | --- | 124.8 | 66.8 | 79.8 | .535 | .639 | .837 | ditto |
| | SV 33-2-1 | M | 525.9 | --- | --- | 142.6 | 73.6 | 93.5 | .516 | .656 | .787 | ditto |
| | SV 33-2-2 | M | 584.7 | --- | --- | 147.6 | 69.7 | 97.3 | .472 | .659 | .716 | ditto |
| | SV 33-2-3 | F | 334.1 | 242.6 | 91.5 | 128.9 | 62.2 | 84.2 | .483 | .653 | .739 | Killed (Sept. 11) |
| | SV 33-3-1 | M | 242.9 | 164.5 | 78.4 | 110.5 | 59.9 | 70.8 | .542 | .641 | .846 | ditto |
| | SV 33-3-2 | M | 679.3 | --- | --- | 153.0 | 73.2 | 96.0 | .478 | .627 | .763 | Released (Sept. 11) |
| | SV 33-3-3 | M | 453.7 | --- | --- | 135.8 | 70.5 | 84.5 | .519 | .622 | .834 | ditto |
| | SV 33-3-4 | M | 400.8 | --- | --- | 128.3 | 69.6 | 83.0 | .542 | .650 | .839 | ditto |
| Sept. 10-11 | SV 34- 1 | M | 436.5 | --- | --- | 137.0 | 73.2 | 91.1 | .534 | .665 | .804 | Released (Sept. 12) |
| | SV 34- 2 | M | 584.3 | --- | --- | 147.4 | 76.0 | 92.8 | .516 | .630 | .819 | ditto |
| | SV 34- 3 | M | 522.0 | --- | --- | 142.3 | 71.0 | 93.9 | .499 | .660 | .756 | ditto |
| | SV 34- 4 | M | 433.7 | --- | --- | 134.1 | 71.8 | 88.6 | .535 | .661 | .810 | ditto |
| | SV 34- 5 | M | 566.0 | --- | --- | 160.9 | 74.4 | 103.5 | .462 | .643 | .719 | ditto |
| | SV 34- 6 | M | 397.2 | --- | --- | 131.8 | 72.3 | 85.8 | .549 | .651 | .843 | ditto |
| | SV 34- 7 | M | 590.3 | --- | --- | 150.5 | 72.9 | 102.0 | .484 | .678 | .715 | ditto |
| | SV 34- 8 | M | 617.2 | --- | --- | 152.8 | 76.1 | 100.5 | .498 | .658 | .757 | ditto |
| | SV 34- 9 | F | 505.3 | --- | --- | 143.5 | 69.6 | 93.6 | .485 | .583 | .744 | ditto |
| | SV 34-10 | M | 328.6 | --- | --- | 125.2 | 66.5 | 79.5 | .531 | .635 | .836 | ditto |
| | SV 34-11 | M | 361.8 | --- | --- | 127.8 | 69.7 | 83.3 | .545 | .652 | .837 | ditto |
| | SV 34-12 | F | 278.3 | --- | --- | 113.8 | 61.7 | 75.6 | .542 | .664 | .816 | ditto |
| | SV 34-13 | M | 442.4 | --- | --- | 133.4 | 71.0 | 80.9 | .532 | .606 | .878 | Died (Sept. 12) |
| | SV 34-14 | M | 314.3 | --- | --- | 120.4 | 63.1 | 73.2 | .524 | .608 | .862 | Released (Sept. 12) |
| | SV 34-15 | M | 601.0 | --- | --- | 150.4 | 74.7 | 94.3 | .497 | .627 | .792 | ditto |

Table 3. Continued.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SV 34-16 | M | 566.0 | --- | --- | 144.3 | 72.4 | 95.6 | .502 | .663 | .757 | ditto |
| | SV 34-17 | M | 542.8 | --- | --- | 146.8 | 70.4 | 93.4 | .480 | .636 | .754 | Died (Sept. 12) |
| | SV 34-18 | M | 571.0 | --- | --- | 144.9 | 73.9 | 96.5 | .510 | .666 | .766 | Released (Sept. 12) |
| | SV 34-19 | M | 600.5 | --- | --- | 147.1 | 73.6 | 94.3 | .500 | .641 | .780 | ditto |
| | SV 34-20 | M | 637.8 | --- | --- | 152.9 | 74.9 | 101.5 | .490 | .664 | .738 | ditto |
| | SV 34-21 | M | 507.3 | --- | --- | 145.5 | 73.7 | 96.8 | .507 | .665 | .761 | ditto |
| | SV 34-22 | M | 540.0 | --- | --- | 147.4 | 74.4 | 97.5 | .505 | .661 | .763 | ditto |
| | SV 34-23 | M | 517.2 | --- | --- | 142.2 | 71.1 | 95.2 | .500 | .669 | .747 | ditto |
| | SV 34-24 | M | 541.0 | --- | --- | 145.6 | 71.7 | 95.0 | .492 | .652 | .755 | ditto |
| | SV 34-25 | M | 538.2 | --- | --- | 141.1 | 73.0 | 96.5 | .517 | .684 | .756 | ditto |
| | SV 34-26 | M | 209.5 | 144.8 | 64.7 | 105.2 | 58.0 | 70.2 | .551 | .667 | .826 | Killed (Sept. 12) |
| | SV 34-27 | M | 528.9 | --- | --- | 155.2 | 71.7 | 97.2 | .462 | .626 | .738 | Released (Sept. 12) |
| | SV 34-28 | M | 558.1 | --- | --- | 145.9 | 73.8 | 95.2 | .506 | .653 | .775 | ditto |
| | SV 34-29 | M | 574.7 | --- | --- | 150.8 | 72.6 | 100.1 | .481 | .664 | .725 | ditto |
| | SV 34-30 | M | 593.1 | --- | --- | 146.0 | 73.1 | 94.5 | .501 | .647 | .774 | ditto |
| | SV 34-31 | M | 632.8 | --- | --- | 156.3 | 72.1 | 100.4 | .461 | .642 | .718 | ditto |
| Sept. 10-11 | SV 34-32 | M | 428.4 | --- | --- | 135.7 | 69.3 | 88.4 | .511 | .651 | .784 | ditto |
| | SV 34-33 | M | 583.1 | --- | --- | 149.3 | 70.4 | 97.0 | .472 | .650 | .726 | ditto |
| | SV 34-34 | M | 517.1 | --- | --- | 147.1 | 72.5 | 95.6 | .493 | .650 | .758 | ditto |
| | SV 34-35 | M | 465.8 | --- | --- | 138.8 | 70.7 | 92.9 | .509 | .761 | .761 | ditto |
| | SV 34-36 | M | 270.3 | --- | --- | 112.7 | 62.9 | 73.0 | .558 | .648 | .862 | ditto |
| | SV 34-37 | M | 445.1 | --- | --- | 133.9 | 72.4 | 90.6 | .541 | .677 | .799 | ditto |
| | SV 34-38 | M | 493.1 | --- | --- | 140.8 | 69.9 | 89.6 | .496 | .636 | .780 | ditto |
| | SV 34-39 | M | 619.3 | --- | --- | 150.2 | 73.5 | 98.3 | .489 | .654 | .748 | ditto |
| | SV 34-40 | M | 580.4 | --- | --- | 153.3 | 73.4 | 98.6 | .479 | .643 | .744 | ditto |
| | SV 34-41 | M | 494.9 | --- | --- | 145.2 | 73.3 | 90.9 | .505 | .626 | .806 | ditto |
| | SV 34-42 | M | 438.8 | --- | --- | 149.3 | 75.5 | 99.0 | .506 | .663 | .763 | ditto |
| | SV 34-43 | M | 516.1 | --- | --- | 142.5 | 71.5 | 95.6 | .502 | .671 | .748 | ditto |
| | SV 34-44 | M | 441.4 | --- | --- | 130.8 | 71.0 | 84.3 | .543 | .644 | .842 | ditto |
| | SV 34-45 | M | 425.3 | --- | --- | 136.5 | 70.8 | 91.2 | .519 | .668 | .776 | ditto |
| | SV 34-46 | M | 454.2 | --- | --- | 141.1 | 69.9 | 91.8 | .495 | .651 | .761 | ditto |
| | SV 34-47 | M | 356.7 | --- | --- | 123.6 | 67.2 | 81.9 | .544 | .663 | .821 | ditto |
| | SV 34-48 | M | 611.8 | 463.6 | 148.2 | 152.0 | 77.1 | 102.2 | .507 | .672 | .754 | Killed (Sept. 12) |
| | SV 34-49 | M | 542 | --- | --- | 146.9 | 76.0 | 98.9 | .517 | .673 | .768 | Kept in IMR |
| | SV 34-50 | M | 539 | --- | --- | 149.9 | 73.6 | 98.9 | .491 | .660 | .744 | ditto |
| | SV 34-51 | M | 596 | --- | --- | 149.5 | 73.6 | 98.1 | .492 | .656 | .750 | ditto |
| | SV 34-52 | M | 400 | --- | --- | 131.2 | 70.6 | 84.0 | .538 | .640 | .840 | ditto |
| | SV 34-53 | M | 542 | --- | --- | 149.0 | 69.5 | 93.2 | .466 | .626 | .746 | ditto |
| | SV 34-54 | M | 476 | --- | --- | 149.0 | 68.9 | 91.9 | .462 | .617 | .750 | ditto |
| | SV 34-55 | M | 535 | --- | --- | 143.4 | 74.1 | 92.4 | .517 | .644 | .802 | ditto |
| | SV 34-56 | M | 624 | --- | --- | 154.6 | 75.9 | 104.2 | .491 | .674 | .728 | ditto |
| | SV 34-57 | M | 567 | --- | --- | 149.3 | 73.8 | 97.6 | .494 | .654 | .756 | ditto |
| | SV 34-58 | M | 469 | --- | --- | 136.2 | 71.4 | 87.8 | .524 | .644 | .813 | ditto |
| | SV 34-59 | M | 487 | --- | --- | 142.8 | 72.7 | 91.3 | .509 | .639 | .796 | ditto |
| | SV 34-60 | M | 315 | --- | --- | 119.5 | 63.0 | 79.8 | .527 | .668 | .789 | ditto |

Notes. Specimen SV 24-2-1 was recaptured near the station SV-20 on Aug. 29.
Specimens SV 26-2-1 and SV 26-2-5 were used for oxygen isotope analysis.
12 specimens from SV 34-49 to 34-60 were kept in IMR and used for experiments on visual behaviours by Prof. Muntz, W. R. A.

Table 4. Biological data for *Nautilus pompilius* specimens trapped from off Ovalau Island, Fiji in 1986.

| Date of collection | Specimen | Sex | Weight (g) | | | Shell size (mm) | | | From ratios | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total | Tissue | Shell | D | B | H | B/D | H/D | B/H | |
| Sept. 2-3 | OL 1-1-1 | M | 488.3 | 350.2 | 138.1 | 144.0 | 69.8 | 93.9 | .485 | .652 | .743 | Killed (Sept. 3) |
| | OL 1-2-1 | M | 631.1 | 500.7 | 130.4 | 150.4 | 74.4 | 93.9 | .495 | .624 | .792 | ditto |
| | OL 1-2-2 | M | 559.3 | 431.4 | 127.9 | 148.7 | 72.6 | 96.7 | .488 | .650 | .751 | ditto |
| | OL 1-3-1 | M | 633.5 | 471.1 | 162.4 | 147.9 | 71.9 | 94.5 | .486 | .639 | .761 | ditto |
| | OL 1-3-2 | M | 546.3 | 424.0 | 122.3 | 145.4 | 71.5 | 96.6 | .492 | .664 | .740 | ditto |
| | OL 1-4-1 | M | 476.2 | 362.7 | 113.5 | 141.0 | 69.2 | 92.3 | .491 | .655 | .750 | ditto |
| | OL 1-4-2 | M | 561.9 | 417.2 | 144.7 | 151.4 | 74.9 | 96.9 | .495 | .640 | .773 | ditto |
| | OL 1-4-3 | M | 578.3 | 450.0 | 128.3 | 150.7 | 74.7 | 97.4 | .496 | .646 | .767 | ditto |
| | OL 1-4-4 | M | 565.7 | 419.2 | 146.5 | 151.2 | 74.9 | 97.0 | .495 | .642 | .772 | ditto |
| | OL 2-1-1 | M | 547.2 | 418.2 | 129.0 | 145.8 | 72.7 | 93.9 | .499 | .644 | .774 | ditto |
| | OL 2-1-2 | M | 619.5 | 581.8 | 137.7 | 150.8 | 69.5 | 98.7 | .461 | .655 | .704 | ditto |
| | OL 2-1-3 | M | 568.5 | 435.4 | 133.1 | 143.4 | 73.5 | 95.5 | .513 | .666 | .770 | ditto |
| | OL 2-1-4 | M | 567.7 | 432.6 | 135.1 | 147.5 | 71.4 | 95.3 | .484 | .646 | .749 | ditto |
| | OL 2-2-1 | M | 563.0 | 428.6 | 134.4 | 147.8 | 70.2 | 89.9 | .475 | .608 | .781 | ditto |
| | OL 2-2-2 | M | 523.5 | 402.4 | 122.1 | 140.0 | 71.9 | 93.2 | .514 | .666 | .771 | ditto |
| | OL 2-2-3 | M | 504.8 | 379.5 | 125.3 | 141.7 | 71.5 | 93.5 | .505 | .660 | .765 | ditto |
| | OL 2-2-4 | M | 499.0 | 378.7 | 120.3 | 138.4 | 71.9 | 86.4 | .520 | .624 | .832 | ditto |
| | OL 2-2-5 | M | 518.0 | 400.5 | 117.5 | 143.4 | 69.9 | 94.4 | .487 | .658 | .740 | ditto |
| | OL 2-2-6 | M | 608.1 | 471.4 | 136.7 | 151.6 | 74.2 | 94.3 | .489 | .622 | .787 | ditto |
| | OL 2-3-1 | M | 599.4 | 465.2 | 134.2 | 147.7 | 74.5 | 95.6 | .504 | .647 | .779 | ditto |
| | OL 2-3-2 | M | 526.9 | 389.7 | 137.2 | 149.1 | 73.0 | 96.2 | .490 | .645 | .759 | ditto |
| | OL 2-3-3 | M | 543.9 | 433.2 | 110.7 | 144.5 | 74.2 | 93.1 | .513 | .644 | .797 | ditto |
| | OL 2-3-4 | M | 607.3 | 476.0 | 131.3 | 150.3 | 71.7 | 97.6 | .477 | .649 | .735 | ditto |
| | OL 2-3-5 | M | 542.4 | 428.6 | 113.8 | 144.0 | 71.5 | 91.7 | .497 | .637 | .780 | ditto |
| | OL 2-3-6 | M | 564.7 | 430.5 | 134.2 | 147.3 | 75.0 | 95.7 | .509 | .650 | .784 | ditto |
| | OL 2-3-7 | M | 262.2 | 190.4 | 71.8 | 112.6 | 61.4 | 72.2 | .545 | .641 | .850 | ditto |
| | OL 2-4-1 | M | 507.8 | 366.7 | 141.1 | 138.3 | 71.9 | 89.3 | .520 | .646 | .805 | ditto |
| | OL 2-4-2 | M | 618.0 | 470.2 | 147.2 | 150.8 | 74.4 | 97.4 | .493 | .646 | .764 | ditto |
| Sept. 3-4 | OL 3-1-1 | M | 551.2 | 435.5 | 115.7 | 144.3 | 71.7 | 91.3 | .497 | .633 | .785 | Killed (Sept. 4) |
| | OL 3-1-2 | M | 561.1 | 428.5 | 132.6 | 143.9 | 73.4 | 94.3 | .510 | .655 | .778 | ditto |
| | OL 3-1-3 | F | 386.4 | 269.3 | 117.1 | 134.1 | 65.7 | 85.3 | .490 | .636 | .770 | ditto |
| | OL 3-1-4 | M | 552.6 | 424.0 | 128.6 | 147.3 | 71.6 | 95.2 | .486 | .646 | .752 | ditto |
| | OL 3-2-1 | M | 545.8 | 420.6 | 125.2 | 143.0 | 69.8 | 88.2 | .488 | .617 | .791 | ditto |
| | OL 3-4-1 | M | 585.0 | 450.7 | 134.3 | 148.4 | 74.4 | 94.8 | .501 | .639 | .785 | ditto |
| | OL 4-3-1 | M | 578.0 | 431.5 | 146.5 | 150.8 | 76.6 | 99.0 | .508 | .656 | .774 | ditto |
| | OL 4-3-2 | M | 496.5 | 367.2 | 129.3 | 138.6 | 72.0 | 89.5 | .519 | .646 | .804 | ditto |
| | OL 4-3-3 | M | 374.3 | 263.9 | 110.4 | 124.2 | 68.1 | 79.0 | .548 | .636 | .862 | ditto |
| | OL 4-3-4 | M | 442.5 | 321.7 | 120.8 | 136.3 | 71.6 | 91.2 | .525 | .669 | .785 | ditto |
| | OL 4-3-5 | M | 522.6 | 386.0 | 136.6 | 138.5 | 69.1 | 89.3 | .499 | .645 | .774 | ditto |
| | OL 4-3-6 | M | 605.0 | 467.3 | 137.7 | 152.3 | 74.5 | 97.6 | .489 | .641 | .763 | ditto |
| | OL 4-3-7 | M | 448.6 | 322.0 | 126.6 | 134.7 | 70.7 | 83.5 | .525 | .620 | .847 | ditto |
| | OL 4-3-8 | M | 370.8 | 270.8 | 100.0 | 126.1 | 68.7 | 82.6 | .545 | .655 | .832 | ditto |
| | OL 4-3-9 | M | 470.2 | 335.1 | 135.1 | 142.5 | 75.2 | 89.9 | .528 | .631 | .836 | ditto |
| | OL 4-3-10 | M | 418.6 | 310.1 | 108.5 | 134.2 | 71.5 | 84.9 | .533 | .633 | .842 | ditto |
| | OL 4-4-1 | M | 519.2 | 383.6 | 135.6 | 139.3 | 79.0 | 89.5 | .567 | .642 | .883 | ditto |

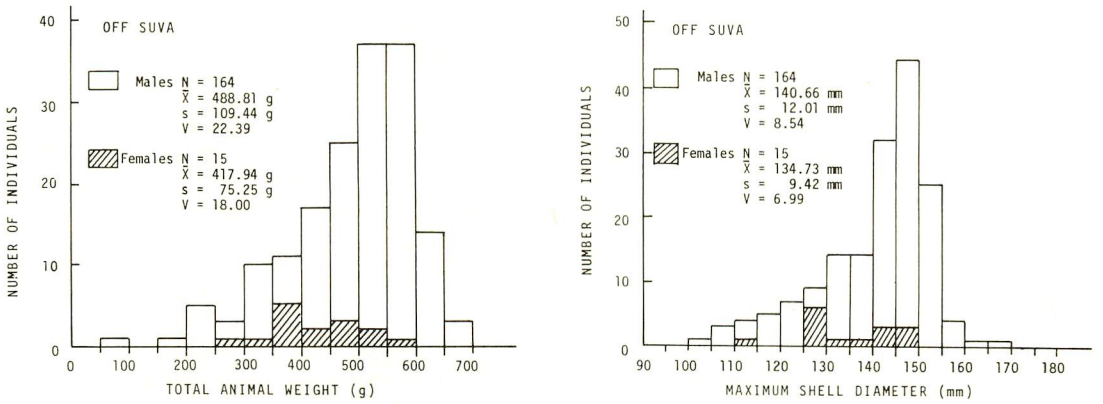


Fig. 4. Weight and maximum shell size distributions in the sample of *Nautilus pompilius* from the water off Suva, Viti Levu Island. $\bar{X}$ : arithmetic mean, s : standard deviation, V : coefficient of variation.

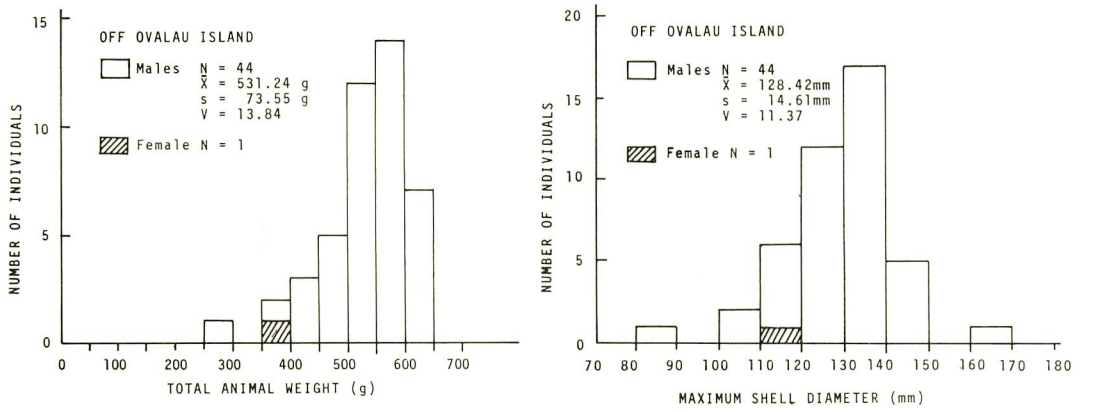


Fig. 5. Weight and maximum shell size distributions in the sample of *Nautilus pompilius* from the water off Ovalau Island. $\bar{X}$ : arithmetic mean, s : standard deviation, V : coefficient of variation.

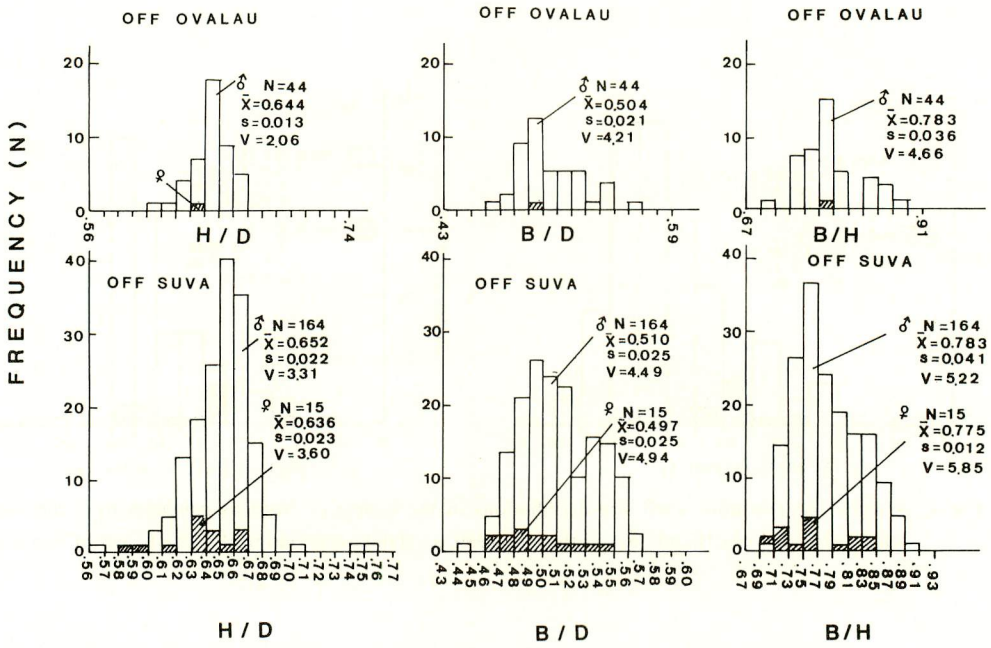


Fig. 6. Histograms of shell form ratios for samples of *Nautilus pompilius* from the water off Suva and off Ovalau Island. D : shell diameter, B : whorl breadth, H : whorl height, $\bar{X}$ : arithmetic mean, s : standard deviation, V : coefficient of variation.

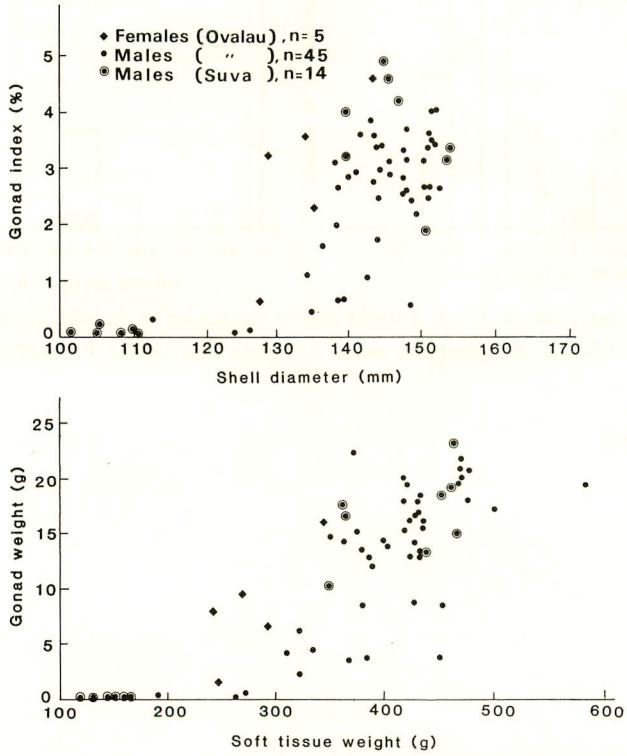


Fig. 7. Scatter plots of gonad index versus shell diameter and of gonad weight versus soft tissue weight for *Nautilus pompilius* from the water off Suva and off Ovalau Island.

together with one *Nautilus* and many shrimps. After having dissected the shark, we found two cephalopod mandibles in the stomach. Based on their characteristic features, the larger and smaller ones can be identified as *Nautilus pompilius* and an unknown coleoid (possibly *Octopus* judging from the relatively short hood in the upper jaw) respectively (Fig. 8). The anterior calcified portion of the nautilus jaws has been dissolved away by the reaction with the acidic gastric juice. As no empty shell of *Nautilus* was found within the same trap, the shark evidently fed on the nautilus and coleoid before entering it. It remains uncertain whether the shark ate the healthy *Nautilus* or not. Finding the jaws of a nautilus in a shark was also documented briefly by WARD (1983) in New Caledonia. These lines of evidence strongly suggest that the deep sea shark is one of the predators of *Nautilus*.

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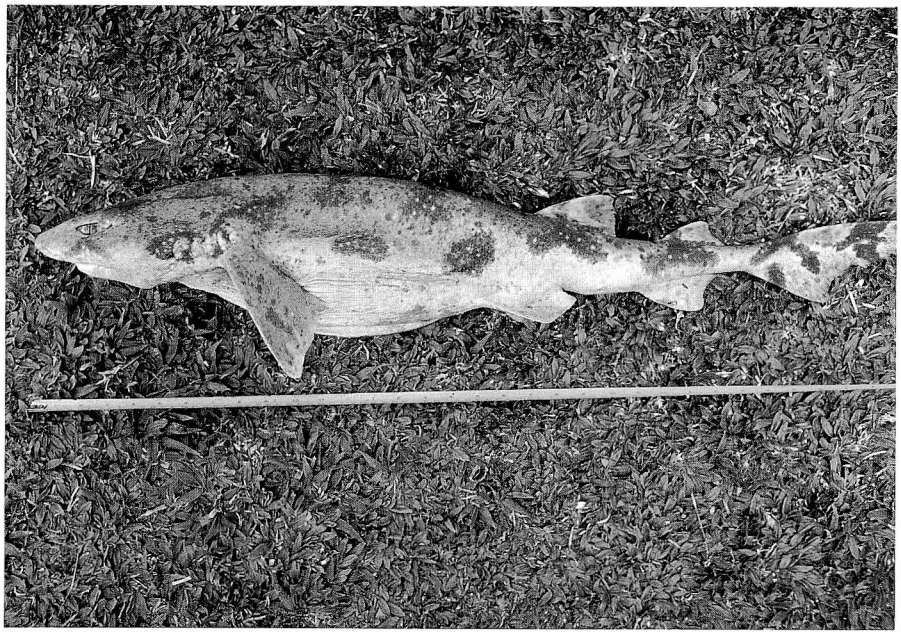
(Kazushige TANABE)



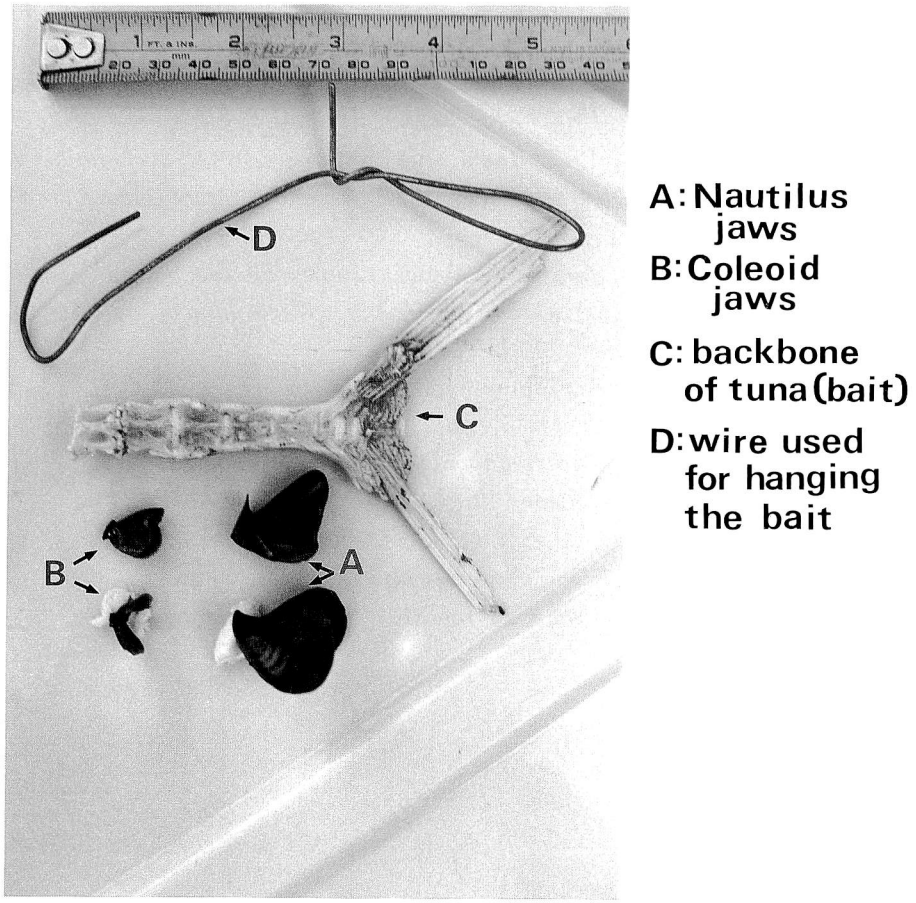



Fig. 8. Cat shark (*Cephaloscyllium isabella* BONNETERRE, ca. 95 cm in length) (above) and its stomach contents (below). Station OL 3 (414 m in depth).