Kagoshima Univ. Res. Center S. Pac., Occasional Papers, No. 21, 33 - 38, 1991
Survey Team 2, Report 4. The Progress Report of the 1990 Survey of the Research Project,
"Man and the Environment in Papua New Guinea"

NOTES ON *NAUTILUS POMPILIUS* CAPTURED FROM PORT MORESBY AREA, PAPUA NEW GUINEA

Kazushige TANABE, Junzo TSUKAHARA, Akihiko SHINOMIYA and Kimihiko ŌKI

Introduction

Chambered nautiles (genus *Nautilus* LINNAEUS, 1758) is one of the well-known living fossils, which belongs to the family Nautilidae of the cephalopod molluscs. Among five or six currently recognized species of *Nautilus, N. pompilius* LINNAEUS, 1758 has the widest geographic range in the tropical South Pacific from the Philippines in the northwest to American Samoa in the southeast (SAUNDERS, 1987).

During the expedition in Papua New Guinea by T. V. Keiten-maru in November - December, 1990, with the aid of baited traps we collected live animals of *N. pompilius* and other nektobenthic fauna from the water in the southeast of Port Moresby. In this report we describe the trapping records and biological data of the captured *Nautilus*.

Trapping Records

1) Methods of trapping

Trapping experiments were carried out using the R. V. Somber of the Motupore Island Research Center, at six points (T1～T6) in Padana Nahua Channel, about 15 km ESE from Port Moresby City (Fig. 1). A single entry wire-flamed crab pot of about 150 cm (basal diameter) X 100 cm (height) size covered by the nylon net (1.5 cm in mesh size) was used in trapping.

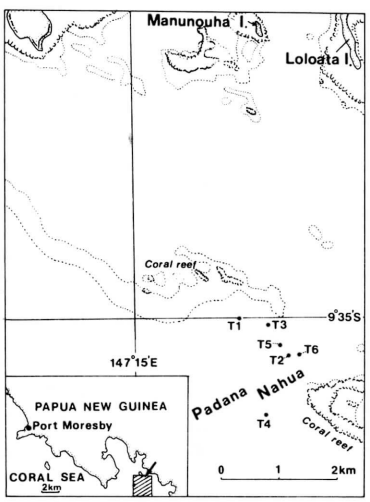

Fig. 1. Map of Padana Nahua Channel, southeast of Port Moresby, Papua New Guinea, showing the trapping locations. Dotted line indicates 20 m contour line.

Two crab pots with bait (Japanese sardine) were set in the morning on the bottom with a line and attached to the surface buoy with a floating line, and drawn up the next morning. Trapping points and their depths were determined by a triangular net on navigational markers and the echo-sounding profiles respectively. All of the trapping points are located at the abruptly dropping scarf of the outer reef margin (see ŌKI *et al.* in this volume).

2) Basic data of *Nautilus*

As a result of six trapping trials, a total of 34 individuals of *N. pompilius* were captured from five points at either 200 m or 250 m in depth (Table 1). Other animals in the traps were extremely rare, and only two large conger eels were found in one of the traps at T6. At T3 (140 m in depth) we only collected three snappers.

Table 1. Measurements of the specimens of *Nautilus pompilius* captured from the Port Moresby area, Papua New Guinea in 1990.

Date of collection	Specimen	Sex	Weight (g)			Shell size (mm)			Form ratios			Remarks
			Total	Tissue	Shell	D	B	H	B/D	H/D	B/H	
Nov. 21-22	PM-1	M	663.5	511.4	140.5	149.1	76.6	97.3	.514	.653	.787	Dissected (Nov. 22)
TR-1(200m)	PM-2	M	609.3	450.1	152.8	149.2	74.7	95.7	.501	.641	.781	ditto
	PM-3	M	558.8	408.2	145.3	148.0	71.8	94.8	.485	.641	.757	ditto
Nov. 21-23	PM-4		669.2									Died (Nov. 23)
TR-2(200m)	PM-5		561.1									ditto
	PM-6	M	520.9	388.4	142.4	152.4	77.3	94.7	.478	.602	.794	ditto
	PM-7		572.4									ditto
	PM-8	M	561.0	420.9	134.8	152.5	75.2	94.8	.498	.603	.825	ditto
	PM-9		597.8									ditto
	PM-10		577.7									ditto
	PM-11		613.7									ditto
Nov. 23-24	PM-12	M	823.4	634.3	179.3	165.7	79.5	103.3	.480	.623	.770	Dissected (Nov. 24)
TR-6(200m)												
Nov. 23-24	PM-13	M	699.7	519.4	148.5	158.7	77.2	95.1	.486	.599	.812	ditto
TR-5(250m)	PM-14	M	649.6	474.8	165.1	152.5	73.4	94.3	.481	.618	.778	ditto
	PM-15	M	675.2	496.9	171.4	158.5	74.1	97.0	.468	.612	.764	ditto
	PM-16	M	560.9	463.7	159.9	159.9	80.5	96.6	.503	.604	.833	ditto
	PM-17	M	585.9	436.8	147.0	147.0	74.9	85.2	.510	.580	.879	ditto
	PM-18	M	574.0	402.7	169.7	151.1	75.0	92.8	.496	.614	.808	ditto
	PM-19	M	605.0	456.3	141.9	155.6	74.6	95.3	.479	.612	.783	ditto
	PM-20	M	661.1	478.4	177.0	160.7	76.4	103.2	.475	.642	.740	ditto
	PM-21	M	623.9	462.2	145.0	153.3	73.7	95.2	.481	.621	.774	ditto
	PM-22	M	674.8	501.9	162.8	158.6	77.4	95.9	.488	.605	.807	ditto
	PM-23	M	665.3	459.2	162.7	152.2	78.2	92.6	.514	.608	.844	ditto
Nov. 23-24	PM-24	M	689.5	486.7	160.8	162.0	79.8	101.0	.493	.624	.789	ditto
TR-4(250m)	PM-25	M	571.3	410.4	141.8	150.3	75.3	89.6	.501	.596	.840	ditto
	PM-26	M	697.6	524.4	157.3	157.5	77.8	98.6	.494	.626	.789	ditto
	PM-27	M	720.9	484.5	187.4	157.5	78.5	101.4	.498	.644	.774	ditto
	PM-28	M	595.9	389.5	153.7	148.5	72.4	86.3	.488	.581	.840	ditto
	PM-29	M	650.6	451.1	168.0	156.7	77.2	95.2	.493	.608	.811	ditto
	PM-30	M	616.9	420.9	152.1	155.1	76.3	95.1	.492	.613	.802	ditto
	PM-31	M	554.4	393.4	147.4	150.8	72.9	91.9	.483	.609	.793	ditto
	PM-32	M	724.6	548.4	166.8	162.9	80.4	99.0	.494	.608	.812	ditto
	PM-33	M	642.0	477.9	150.3	159.8	78.1	98.0	.489	.613	.797	ditto
	PM-34	M	557.2	405.9	142.1	146.0	71.2	89.1	.488	.610	.799	ditto

After capture, each animal was labeled, weighed, sexed and measured following the methods described elsewhere in the previous reports (TANABE, 1985, 1988). The captured animals consisted of mature or submature males only. Soft and shell parts of each animal were removed separately, and weighed by means of a dial scale (accuracy±0.01 g) (Table 1). Furthermore, fresh gonad and a small piece of mantle were removed from the soft tissue of 26 animals from four points (T1, 4, 5 and 6). They were frozen or fixed for further genetic and/or histological examinations.

Although we did the trapping experiments during a limited period in November, the absence of females in the total catch seems to interesting. Such an extremely high male/female ratio was recognized in the large samples of *N. pompilius* from Fiji (date of capture: August - September, 1983 and 1986)(TANABE, 1985, 1988).

Discussion

Distribution of *N. pompilius* in the waters around Papua New Guinea has been documented in a number of references literatures (WILLEY, 1895; SAUNDERS & DAVIS, 1985; SAUNDERS, 1987 among others). Morphological variation within and among populations in this region has been further analyzed by SAUNDERS & DAVIS (1985) and SWAN & SAUNDERS (1987). Measurements of the specimens from the Port Moresby area correlate well with the data by these authors.

The widespread species *N. pompilius* exhibits high levels of genetic and morphological differentiation among local populations (WOODRUFF *et al.*, 1987; SWAN & SAUNDERS, 1987; TANABE & TSUKAHARA, 1987; TANABE *et al.*, 1990). It is also closely allied morphologically to the population from Palau distinguished as *N. belauensis* SAUNDERS, 1981, suggesting that the latter merely represents a geographic variant of the former, or otherwise they are closely related sibling species (TANABE *et al.*, 1990). Summarization of the available measurements for large collections of *N. pompilius* from the Philippines, Fiji and Papua New Guinea (Port Moresby area), and of *N. belauensis* from Palau shows that the Port Moresby population is intermediate in shell size, animal weight and shell proportion at maturity between the Fiji and Philippine populations (Figs. 2-4).

SAUNDERS & DAVIS (1985) first described the sympatric occurrence of *N. pompilius* and *N. scrobiculatus* [LIGHTFOOT, 1786] in the waters off Manus Island, about 800 km north of Port Moresby. These two species are easily distinguished both genetically (WOODRUFF *et al.*, 1987) and morphologically (SWAN & SAUNDERS, 1987). Furthermore, specimens of *N. pompilius* from Manus Island are essentially similar in external shell morphology, coloration and size to those from the Port Moresby area. The phylogenetic relationships and the isolation mechanism of the two species, however, have not yet been sufficiently elucidated. We should further investigate these problems from comparative morphological, ecological and genetic points of view.

Acknowledgment. We thank Dr. Neil H. LANDMAN for critical reading of the manuscript.

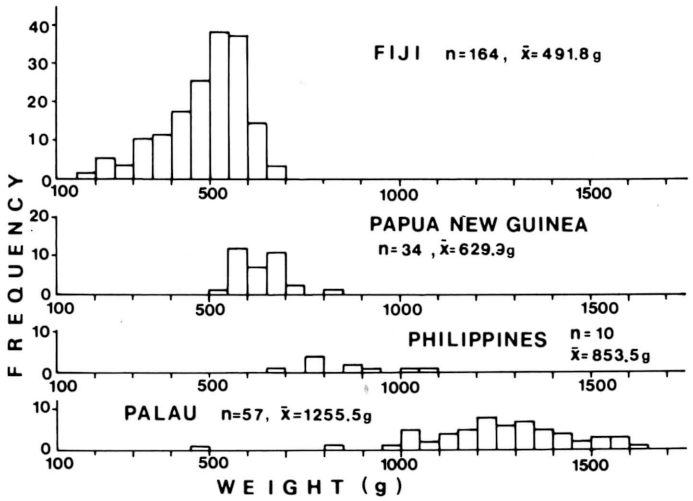

Fig. 2. Geographic variation of the total live weight for male specimens of *Nautilus pompilius* from Fiji, Papua New Guinea, Philippines and *N. belauensis* from Palau. Data for the Fiji, Philippine and Palau populations are from TANABE (1985, 1988), HAYASAKA *et al.* (1982) and TANABE (in prep.) respectively.

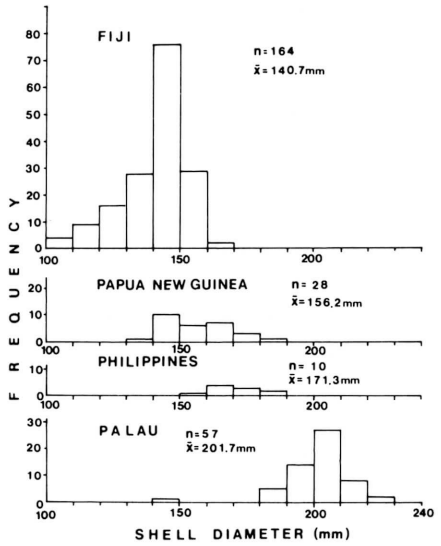

Fig. 3. Geographic variation of shell diameter for male specimens of *Nautilus pompilius* from Fiji, Papua New Guinea, Philippines and *N. belauensis* from Palau. Data for the Fiji, Philippine and Palau populations are from TANABE (1985, 1988), HAYASAKA *et al.* (1982) and TANABE (in prep.).

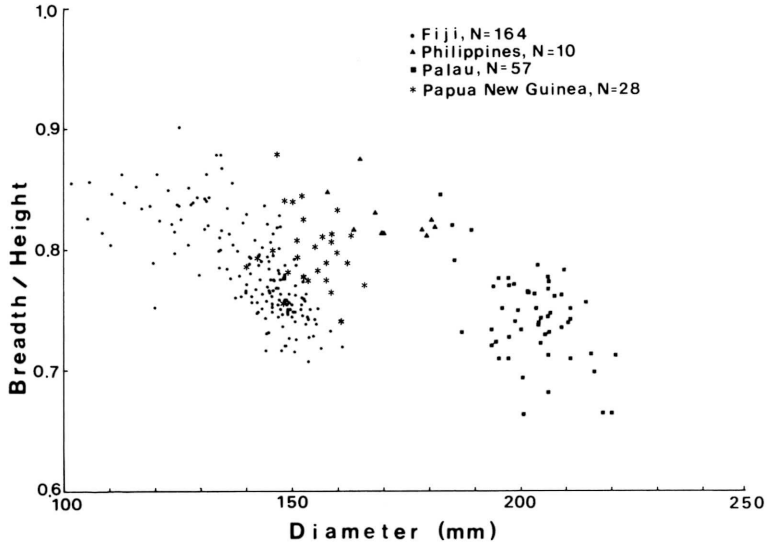

Fig. 4. Scatter plot of shell breadth/height retio vs. shell diameter for male specimens of *Nautilus pompilius* from the Philippines, Fiji and Papua New Guinea and *N. belauensis* from Palau. Data for the Fiji, Philippine and Palau populations are from TANABE *et al.* (1990).

References

HAYASAKA, S., SAISHO, T., KAKINUMA, Y., SHINOMIYA, A., ŌKI, K., HAMADA, T., TANABE, K., KANIE, Y., HATTORI, M., VUSSE, F. V., ALCALA, L., CORDERO, P. C. Jr., CABRERA, J. J. & GARCIA, R. G. 1982. Mem. Kagoshima Univ. Res. Ctr. S. Pacific, 3 : 67-137.

SAUNDERS, W. B. 1987. "The species of *Nautilus*. "*Nautilus*. The biology and paleobiology of a living fossil (eds. SAUNDERS, W. B. & LANDMAN, N. H.), 35-52. Plenum, New York.

—— & DAVIS, L. E. 1985. Sci. Papua New Guinea, 11 : 60-69.

SWAN, A. R. H. & SAUNDERS, W. B. 1987. "Morphological variation in *Nautilus* from Papua New Guinea. "*Nautilus*. The biology and paleobiology of a living fossil (eds. SAUNDERS , W. B. & LANDMAN, N. H.), 85-104. Plenum, New York.

TANABE, K. 1985. Kagoshima Univ. Res. Ctr. S. Pacific, Occas. Paps., 4 : 10-17.

—— 1988. Kagoshima Univ. Res. Ctr. S. Pacific, Occas. Paps., 15 : 5-14.

—— & TSUKAHARA, J. 1987. "Biometric analysis of *Nautilus pompilius* from the Philippines and the Fiji Islands. "*Nautilus*. The biology and paleobiology of a living fossil (eds. L ANDMAN, N. H. & SAUNDERS, W. B.), 105-113. Plenum, New York.

—— , —— & HAYASAKA, S. 1990. Malacologia, 31 : 297-312.

WILLEY, A. 1895. Nat. Sci., 6 : 405-414.

WOODRUFF, D. S., CARPENTER, M. P., SAUNDERS, W. B. & WARD, P. D. 1987. "Genetic variation and phylogeny in *Nautilus*. "Nautilus. The biology and paleobiology of a living fossil (eds. LANDMAN, N. H. & SAUNDERS, W. B.), 65-83. Plenum, New York.