Preliminary Report of Morphological Differences of Minke Whales between Coastal Japan (Sub-area 7) and Offshore Area (Sub-area 9) of Western North Pacific

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ABSTRACT

Morphology of minke whales was examined preliminarily in coastal Japan (sub-area 7) and offshore area in the western North Pacific. Although we could not conclude to determine the morphological difference because of small sample size, it suggested that morphological characters of whale in offshore area were similar to those in coastal Japan by applying to discriminant function derived from the previous study.

INTRODUCTION

The Government of Japan conducted a research involving the take of minke whales in the northwestern part of North Pacific in 1994 (Japanese Whale Research Program Under Special Permit in North Pacific, JARPN). The objective of the research was to clarify the stock structure and mixing of stocks distributed in the waters around Japan.

Morphological studies of North Pacific minke whales were conducted between Sea of Japan, Okhotsk Sea and Pacific coast of northern part of Japan, using commercial whaling data (Kato *et al.*, 1992). However, no morphological examination has been conducted between samples from waters around Japan and offshore waters in the North pacific.

This report describes a preliminary comparison of morphology of minke whales taken in offshore (sub-area 9) and coastal (Sanriku, sub-area 7) waters in the North Pacific.

MATERIALS AND METHOD

Whale samples in sub-area 9 was collected by the JARPN cruise between July 5 and September 7, 1994. A total of 21 whales (18 males and 3 females) were sampled and measured on 39 points of body proportion onboard the research base (Fujise *et al.*, in prep.).

Most of the morphological data from samples in sub-area 7 are derived from catches of the small-type whaling operations at

Ayukawa in 1987 season (Kato *et al.*, 1992). Some few data from this sub-area (2 individuals) were obtained from Omura and Sakiura (1956).

Summary of items of body proportion measurements are shown in Fig. 1. Out of 39, 20 items were used in this study because of missing values in several measurements.

To compare the body proportion data, each measurement item was plotted to body length and adopted to the liner discriminant function which reported by Kato *et al.*(1992).

RESULTS AND DISCUSSION

Table 1 shows the statistics of three measurement points by sub-area. Body length (V1) of males was relatively higher in sub-area 9 than Sanriku and Sea of Japan, and seems to be similar to those in S. Okhotsk and N. Okhotsk samples. On the other hand, those in females were considerably lower in sub-area 9 than in the S. Okhotsk and N. Okhotsk.

Figs. 2-4 shows the relative proportion (V2 to V20) to body length in males, for sub-areas 7 and 9. Except two items (V2, V3), all items in samples from sub-area 9 seem to be similar to those in samples in sub-area 7. Items of V2 (tip of snout to center of blowhole) and V3 (tip of snout to eye) is relatively smaller in sub-area 9 than in sub-area 7. However, this differences observed for item V2 and V3 may be caused by the survey facilities. In sub-area 7, researcher should conduct the measurements within limited time due to the nature of commercial whaling, and should be measured at the position landed. In contrast, in sub-area 9, all survey items were conducted with adequate time, and positioning of whales could be corrected. Then, a full analysis have to take this situations into account.

To discriminate minke whales between 'Japan Sea' and 'Sanriku', Kato *et al.* (1992) calculated a liner discriminant function using V2 and V9 (Table 2). The function was calculated as:

$$Z = 57.703(V2\%) + 73.494(V9\%) - 27.494$$

Morphological data in sub-area 9 are adopted to the function, and all samples in sub-area 9 were discriminated to 'Sanriku'. This suggests that whales, at least males, seems to be belong to same stock of 'Sanriku'. As mentioned above, however, further analysis should be required because item V2 used in this function has the possibility of variation caused by the research facilities.

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Table 1. Statistics for the three variables by area.

Locality	Sex		V1	V2	V9
N.Okhotsk*	Male	mean	744.17	99.250	197.50
		SD	34.024	8.4960	11.779
		max.	800.00	120.00	226.00
		min.	670.00	82.000	184.00
	Female	mean	776.25	109.50	207.38
		SD	33.143	15.240	9.0410
		max.	820.00	139.00	225.00
		min.	710.00	96.000	195.00
S.Okhotsk*	Male	mean	673.56	89.330	182.78
		SD	61.141	8.3270	18.432
		max.	739.00	96.000	206.00
		min.	560.00	68.000	148.00
	Female	mean	712.53	95.000	188.68
		SD	110.69	16.364	27.363
		max.	857.00	124.00	230.00
		min.	510.00	67.000	150.00
Sanriku*	Male	mean	628.33	83.780	167.22
		SD	81.102	10.400	24.293
		max.	794.00	99.000	213.00
		min.	550.00	69.000	137.00
	Female	mean	551.62	70.000	152.25
		SD	43.335	8.1550	13.348
		max.	620.00	81.000	174.00
		min.	461.00	54.000	135.00
Sea of Japan*	Male	mean	717.23	104.71	193.43
		SD	46.562	20.310	12.070
		max.	770.00	163.00	213.00
		min.	600.00	80.000	165.00
	Female	mean	763.33	109.33	211.67
		SD	23.570	3.3000	13.123
		max.	780.00	113.00	230.00
		min.	730.00	105.00	200.00
Sub-area 9	Male (n=18)	mean	738.72	87.670	193.39
		SD	42.325	6.4030	11.917
		max.	809.00	97.000	154.00
		min.	612.00	76.000	214.00
	Female (n=3)	mean	647.00	77.000	172.67
		SD	120.40	13.589	34.586
		max.	755.00	89.000	206.00
		min.	479.00	58.000	125.00

*: After Kato *et al.* (1992)

Table 2. Discriminant function (Z) using variables V2% and V9% for males from 'Sea of Japan' and 'Sanriku' samples, and the percentage of correct discrimination for the two groups.

Z=57.7029(V2%)+73.4939(V9%)-27.4941

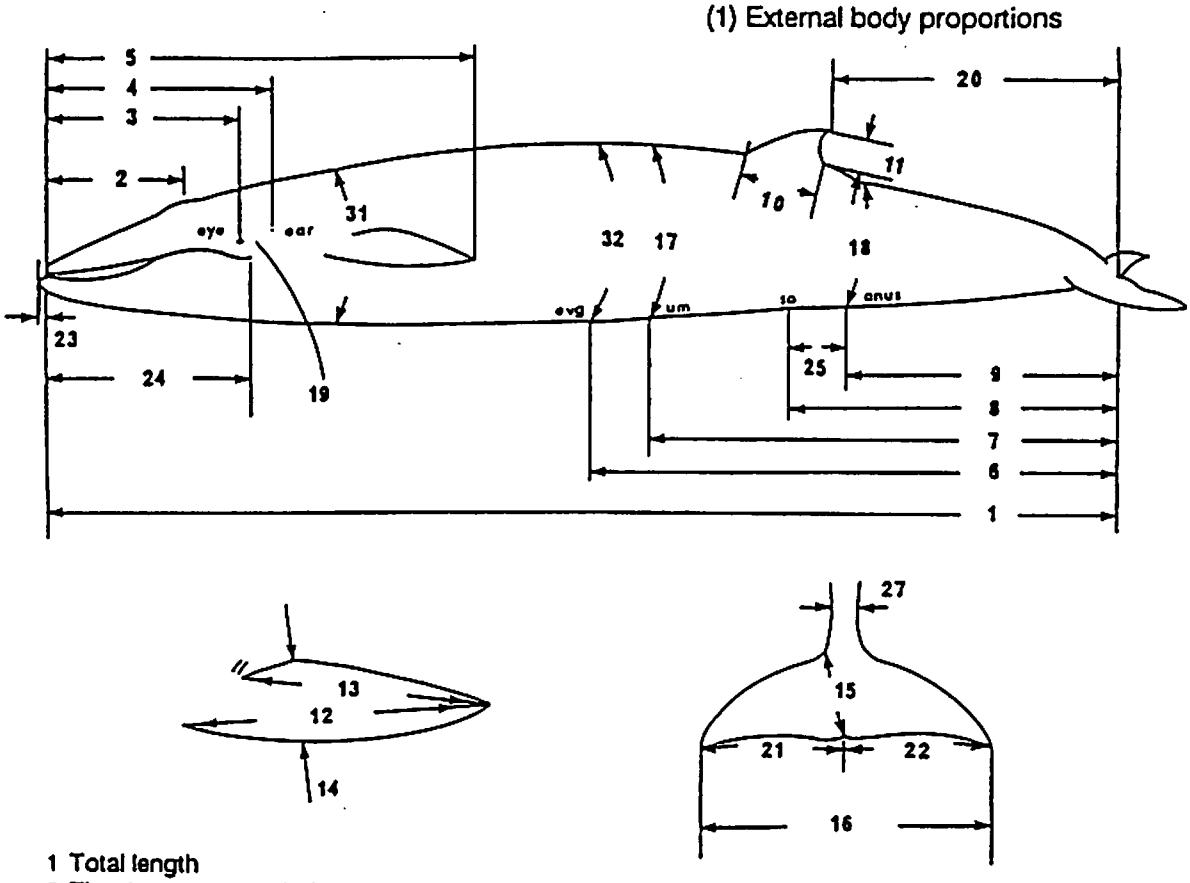
		Sea of Japan	Sanriku
Sea of Japan	n=14	8(57.1%)	6(42.9%)
Sanriku	n= 9	2(22.2%)	7(77.8%)
The percentage of correct discrimination=65.2%			

(After Kato *et al.*, 1992.)

Table 3. Results for the discrimination of Okhotsk Sea and sub-area 9 samples using the function in Table 2.

		Sea of Japan	Sanriku
Okhotsk (North)*	n=12	2(16.7%)	10(83.3%)
Okhotsk (South)*	n= 9	5(55.6%)	4(44.4%)
Whole Okhotsk*	n=21	7(33.3%)	14(66.7%)
Sub-area 9	n=18	0(0.0%)	18(100%)

*: After Kato *et al.* (1992)



1 Total length
2 Tip of snout to blowhole
3 Tip of snout to eye (centre)
4 Tip of snout to ear
5 Tip of snout to tip of flipper
6 Notch of flukes to end of ventral groove
7 Notch of flukes to umbilicus
8 Notch of flukes to reproductive aperture
9 Notch of flukes to anus
10 Dorsal fin, length at base
11 Dorsal fin, height
12 Flipper, tip to anterior insertion
13 Flipper, tip to posterior insertion
14 Flipper, maximal width
15 Flukes, depth
16 Flukes, tip to tip
17 Girth at umbilicus
18 Girth at anus
19 Centre of eye to ear
20 Notch of flukes to tip of dorsal fin
21 Flukes, notch to tip (left)
22 Flukes, notch to tip (right)
23 Lower jaw, projection beyond tip of snout
24 Tip of snout to angle of gape
25 Centre of anus to centre of reproductive aperture
27 Width of flukes at insertion
31 Girth at axilla
32 Girth at end of ventral groove

Fig. 1. Schematic diagram showing the body proportion measurements (After Kato et al. 1992).

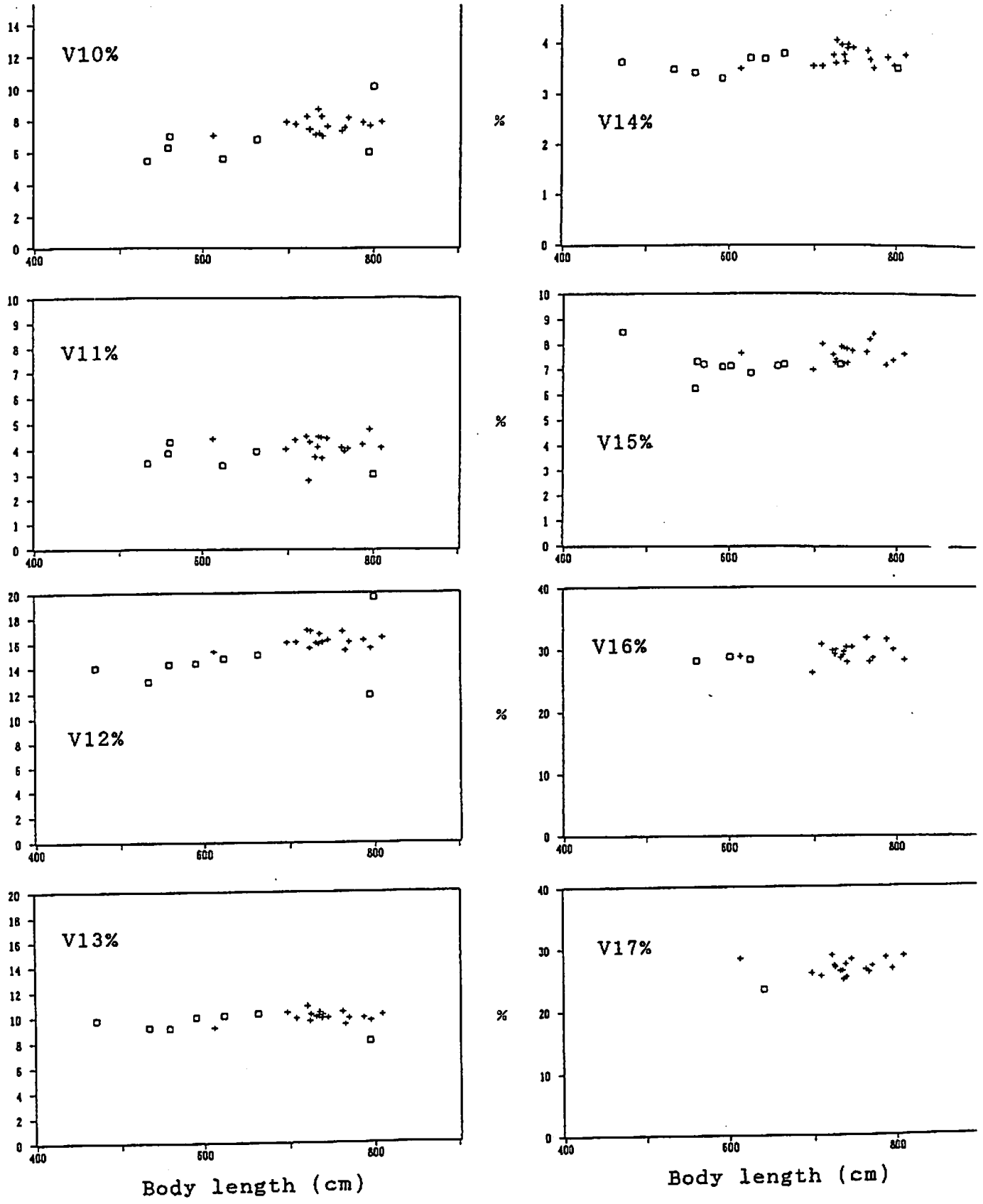


Fig.3. Plots of relative proportions of V10 - V17 (V10%- V17%) to body length by sampling area (cm). □:Area 7, +:Area 9.

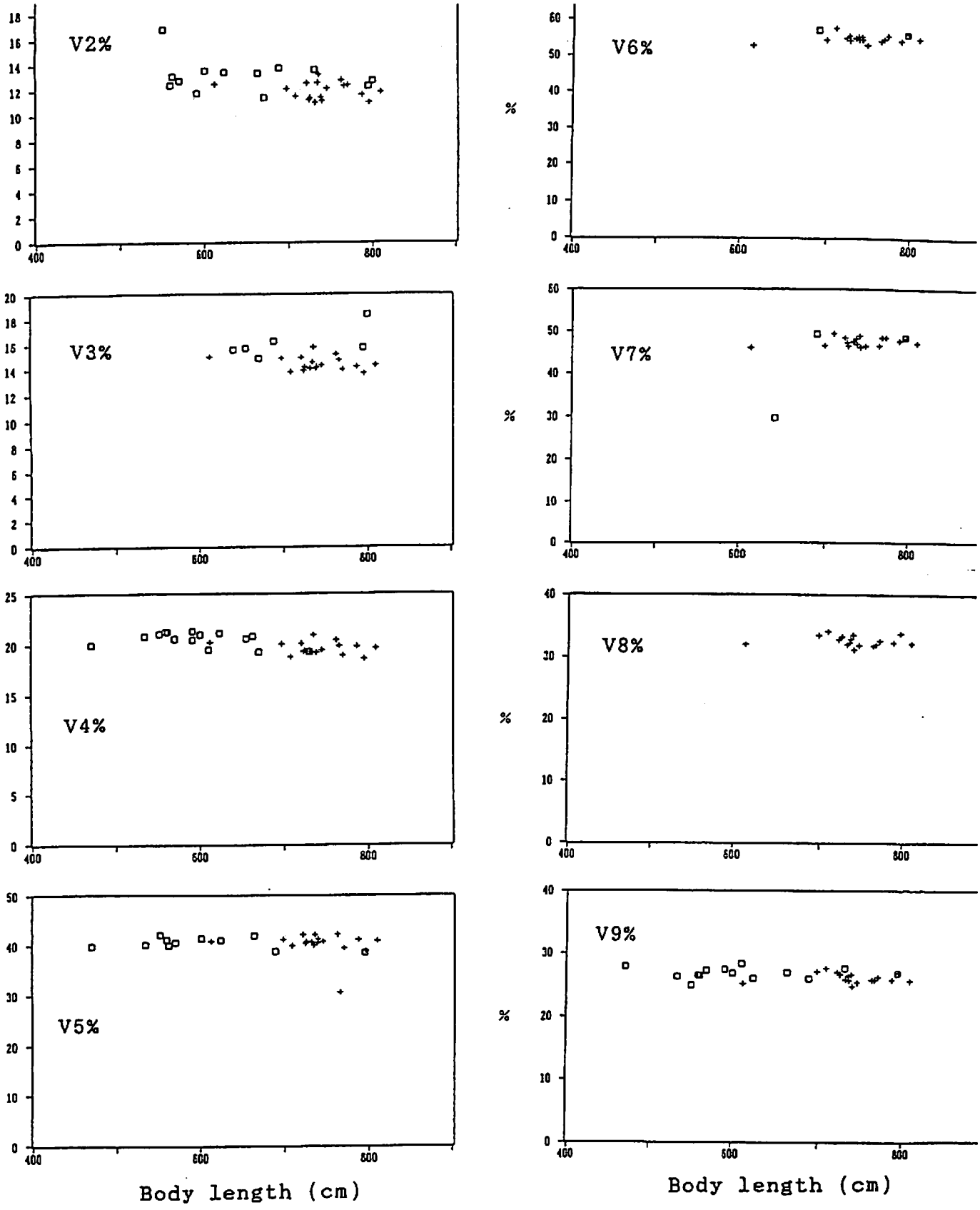


Fig.2. Plots of relative proportions of V2 - V9 (V2%- V9%) to body length by sampling area (cm). □:Area 7, +:Area 9.

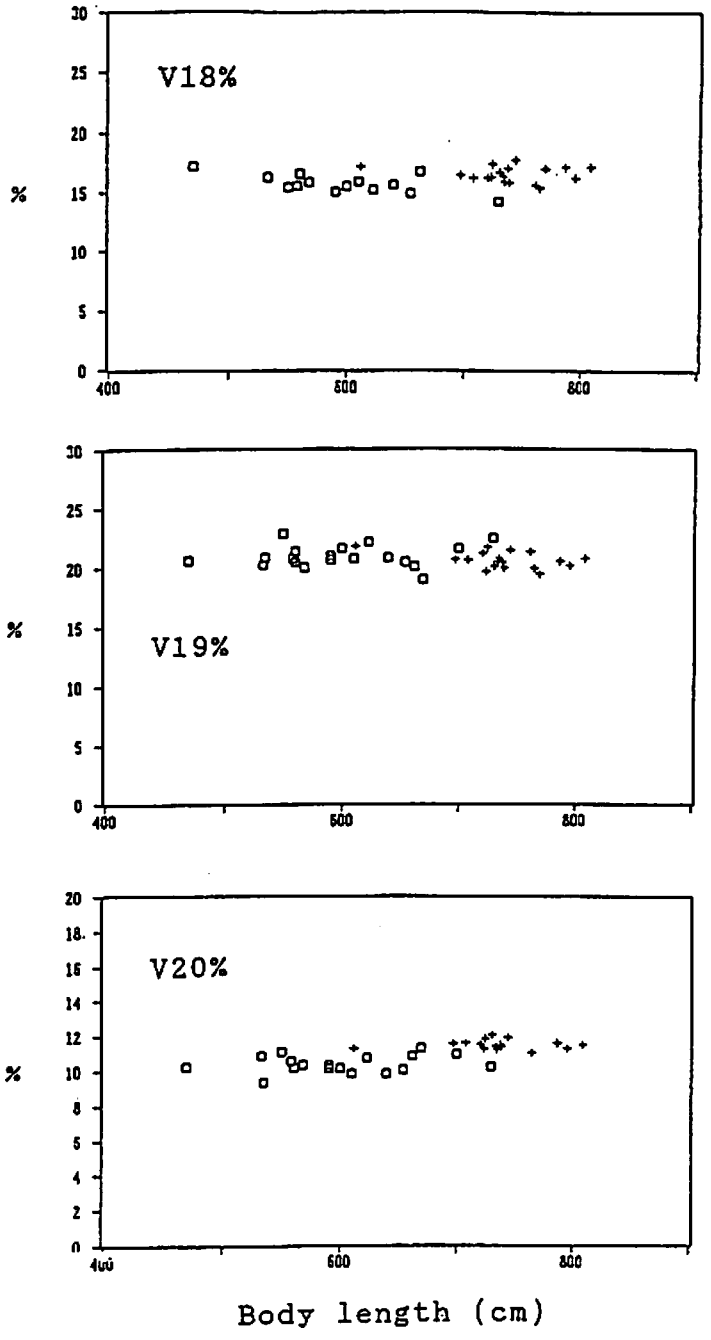


Fig.4. Plots of relative proportions of V18 - V20 (V18%- V20%) to body length by sampling area (cm). □:Area 7, +:Area 9.