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台灣東部海域圓花鰹生物學之研究—I
形態測定值之比較

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Biological Studies on Bullet Tuna(*Auxis rochei*) in the Eastern Water of Taiwan(I)
–Morphometric Study–

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624 specimens of bullet tuna (*Auxis rochei*) were collected from August 1985 to July 1986 in the eastern water of Taiwan. The meristic characters and morphometric character were studied. The results obtained reveal that:

1. Meristic characters:

   The number of 1st dorsal fin spines ranges from IX to XII, mode at XI; the number of 2nd dorsal fin rays ranges from 9 to 13, mode at 11; the number of dorsal finlets ranges from 7 to 9, mode at 8; the number of pectoral fin rays ranges from 21 to 24, mode at 22; the number of anal fin rays ranges from 11 to 15, mode at 13; the number of anal finlets ranges from 6 to 8, mode at 7; the number of gill rakers ranges from 41 to 48, mode at 44; and the number of vertebrates is 39.

2. Morphometric character:

   Head length was used as an index of morphometric character. Covariance analysis is employed to perform the task, which showed the bullet tuna (*Auxis rochei*) caught in the eastern water of Taiwan are homogeneous.

前 言

本研究係以形態因子（morphometric character）爲指標，藉統計方法對洄游於台灣東部黑潮流域之圓花鰹作族群（population）上之分析，以了解洄游於花蓮與新港兩區間之圓花鰹關係，俾供將來作資源分析之依據。

材料與方法

形態測定用之標本爲自1985年8月起至1986年7月止，按月於花蓮、新港（圖1）魚市場採集在當地沿岸漁業所漁獲的圓花鰹標本；標本運回研究室後計數8個體節形質；又鰹類的外部形態分析，以頭長最爲有效[1]～[3]，因此，在計量形質部分採用頭長與尾叉長的迴歸關係作比較分析

（圖 2 ）；而性別之判定，係經由解剖之生殖腺作爲依據。8 個體節形質之計數有第 1 背鰭硬棘數、第 2 背鰭軟條數、胸鰭軟條數、臀鰭軟條數、背離鰭數、臀離鰭數、鰓耙數及脊椎骨數等；又頭長之測定係用游標尺從吻端量至鰓膜後緣至 0.1 mm。

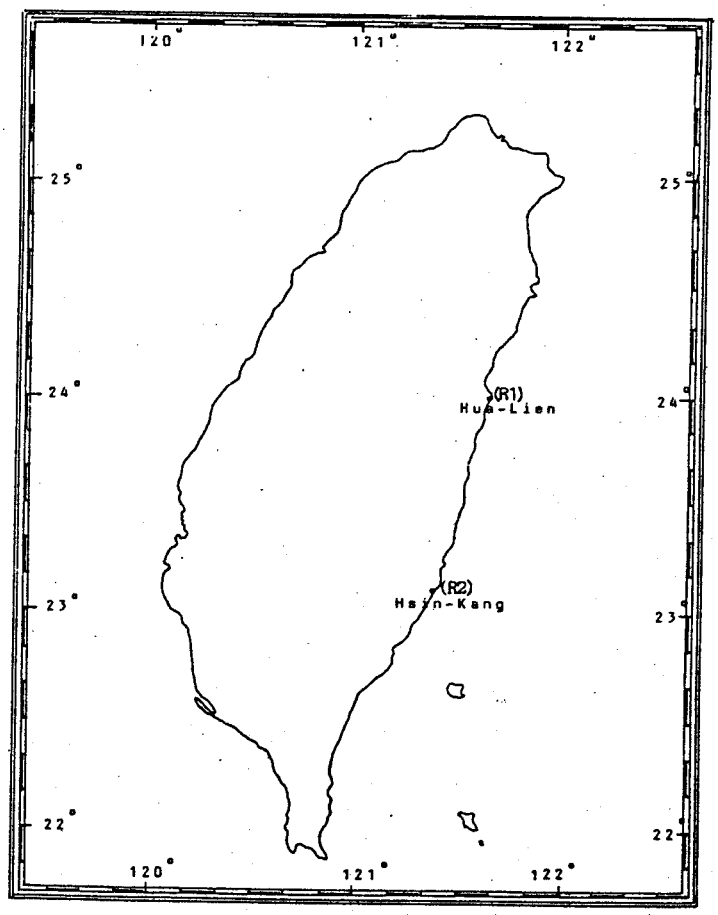
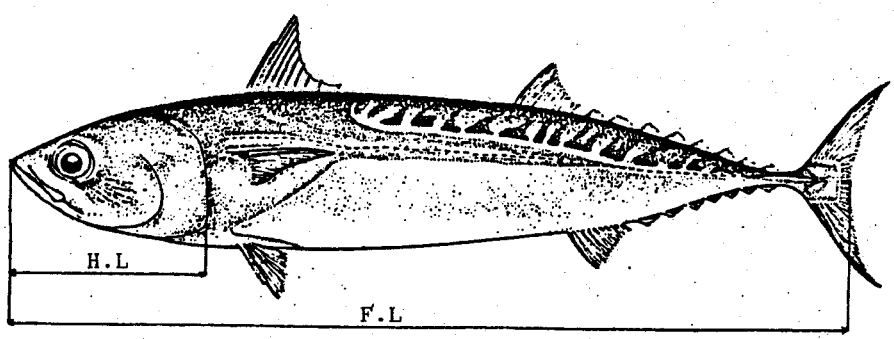


圖 1　圓花鯖採樣位置圖

Fig. 1　Sampling stations for bullet tuna



H.L : Head length

F.L : Fork length

圖 2　本研究所測量的魚體部位

Fig. 2　Body parts measured in present study.

形質之兩區間比較，在體節形質部分採用平均值差異性檢定，當樣品之變方相同時，用 Student 之 t-test ；變方不同時，用Welch 之V-test ，而形態形質部分則以變積分析（ covariance analysis ）法來檢定迴歸直線間之迴歸係數及修正平均值之差異性[4]～[8]。

結　果

一體節形質（Meristic characters ）：

將各區雌雄標本魚作體節形質之差異性檢定，結果並無差異存在（附表 1 ），因此，把雌雄魚

附表 1　雌雄別之各體節形質比較

Appendix Table 1　Comparisons of meristic characters of *Auxis rochei* between male and female.

a) Sample from Hua-Lien

Characters	sex	N	Range	X	S.D	Comparison
1st Dorsal Fin Spines	Male	88	IX-XII	10.71	0.729	N.S
	Female	93	IX-XII	10.66	0.728	
2nd Dorsal Fin Rays	Male	118	9-13	10.80	0.867	"
	Female	127	9-13	10.87	0.896	
Dorsal Finlets	Male	145	7-9	7.97	0.338	"
	Female	123	7-9	7.98	0.359	
Pectoral Fin Rays	Male	102	21-24	22.43	0.719	"
	Female	115	21-24	22.50	0.745	
Anal Fin Rays	Male	102	11-15	12.72	0.887	"
	Female	107	11-15	12.75	0.931	
Anal Finlets	Male	126	6-8	7.01	0.227	"
	Female	114	6-8	6.99	0.232	
Gill Rakers	Male	96	42-48	44.71	1.653	"
	Female	83	42-48	44.73	1.682	
Vertebrates	Male	55	39	39	0	"
	Female	61	39	39	0	

b) Sample from Hsin-Kang

Characters	sex	N	Range	X	S.D	Comparison
1st Dorsal Fin Spines	Male	124	IX-XII	10.62	0.667	N.S
	Female	112	IX-XII	10.62	0.687	
2nd Dorsal Fin Rays	Male	135	9-13	10.88	0.898	"
	Female	139	9-13	10.91	0.948	
Dorsal Finlets	Male	160	7-9	8.02	0.320	"
	Female	151	7-9	8.03	0.373	
Pectoral Fin Rays	Male	127	21-24	22.46	0.787	"
	Female	131	21-24	22.48	0.797	
Anal Fin Rays	Male	136	11-15	12.92	0.863	"
	Female	141	11-15	12.97	0.910	
Anal Finlets	Male	158	6-7	6.97	0.168	"
	Female	173	6-8	6.96	0.196	
Gill Rakers	Male	98	41-48	44.65	1.658	"
	Female	113	41-48	44.56	1.770	
Vertebrates	Male	61	39	39	0	"
	Female	72	39	39	0	

N: Sample size.　X : Average.　S.D: Standard deviation.
N.S : Not significant, P> 0.05.

合併，再作兩區間的比較，又無顯著差異（表 1 ），故在處理計數形質資料時，乃將此兩區者合併，其結果如圖 3 所示：

表 1　兩區間各體節形質之比較

Table 1　Comparisons of meristic characters of *Auxis rochei* between Hua-Lien area (R1) and Hsin-Kang area (R2).

Characters	Group	N	Range	$\bar{X}$	S.D.	Comparison
1st Dorsal Fin Spines	R1	216	IX-XII	10.71	0.7497	N.S
	R2	270	IX-XII	10.63	0.6839	
2nd Dorsal Fin Rays	R1	275	9-13	10.84	0.8981	"
	R2	319	9-13	10.90	0.9390	
Dorsal Finlets	R1	310	7-9	7.97	0.3527	"
	R2	341	7-9	8.03	0.3527	
Pectoral Fin Rays	R1	238	21-24	22.46	0.7445	"
	R2	272	21-24	22.47	0.8026	
Anal Fin Rays	R1	228	11-15	12.74	0.9208	"
	R2	285	11-15	12.95	0.8989	
Anal Finlets	R1	267	6-8	7.00	0.2626	"
	R2	348	6-7	6.97	0.1857	
Gill Rakers	R1	198	42-48	44.72	1.7083	"
	R2	230	41-48	44.60	1.7592	
Vertebrates	R1	121	39	39	0	"
	R2	135	39	39	0	

N : Sample size.　　$\bar{X}$: Average.　　S. D. Standard deviation.
N.S. : Not significant, $P > 0.05$.

第一背鰭硬棘數：變異範圍介於 IX–XII ，平均值爲 10.7 ，大部分變值集中於 XI 。

第二背鰭軟條數：範圍爲 9 － 13 ，高峯在 11 。

背離鰭數：範圍爲 7 － 9 ，高峯在 8 。

胸鰭軟條數：範圍爲 21 － 24 ，以 22 數分布最大。

臀鰭軟條數：範圍爲 11 － 15 ，高峯在 13 。

臀離鰭數：範圍爲 6 － 8 ，高峯在 7 。

鰓耙數：範圍爲 41 － 48 ，高峯在 44 。

脊椎骨數：所有樣品之脊椎骨數爲 39 枚（ 20 ＋ 19 ），顯示此爲非常穩定之形質。

二形態形質（ Morphometric characters ）：

爲明瞭此兩地區標本間在外部形態上是否差異，首先檢定同地區的雌雄標本魚之間，並無差異存在（表 2 ）。因此，雌雄合併，求得各區標本的頭長與尾叉長的迴歸關係（圖 4 ），並經迴歸係數顯著性檢定之結果，得知頭長與尾叉長之關係，係成直線迴歸之關係（表 3 ）。最後以變積分析檢定各區標本間，在尾叉長與頭長的迴歸關係上是否差異，結果如表 4 ，顯示各區標本間在外部形態上並無顯著差異存在。因此，將兩區標本合併，求得頭長與尾叉長的關係式爲 $Y = -0.07958 + 0.25542\ X$（圖 5 ）。

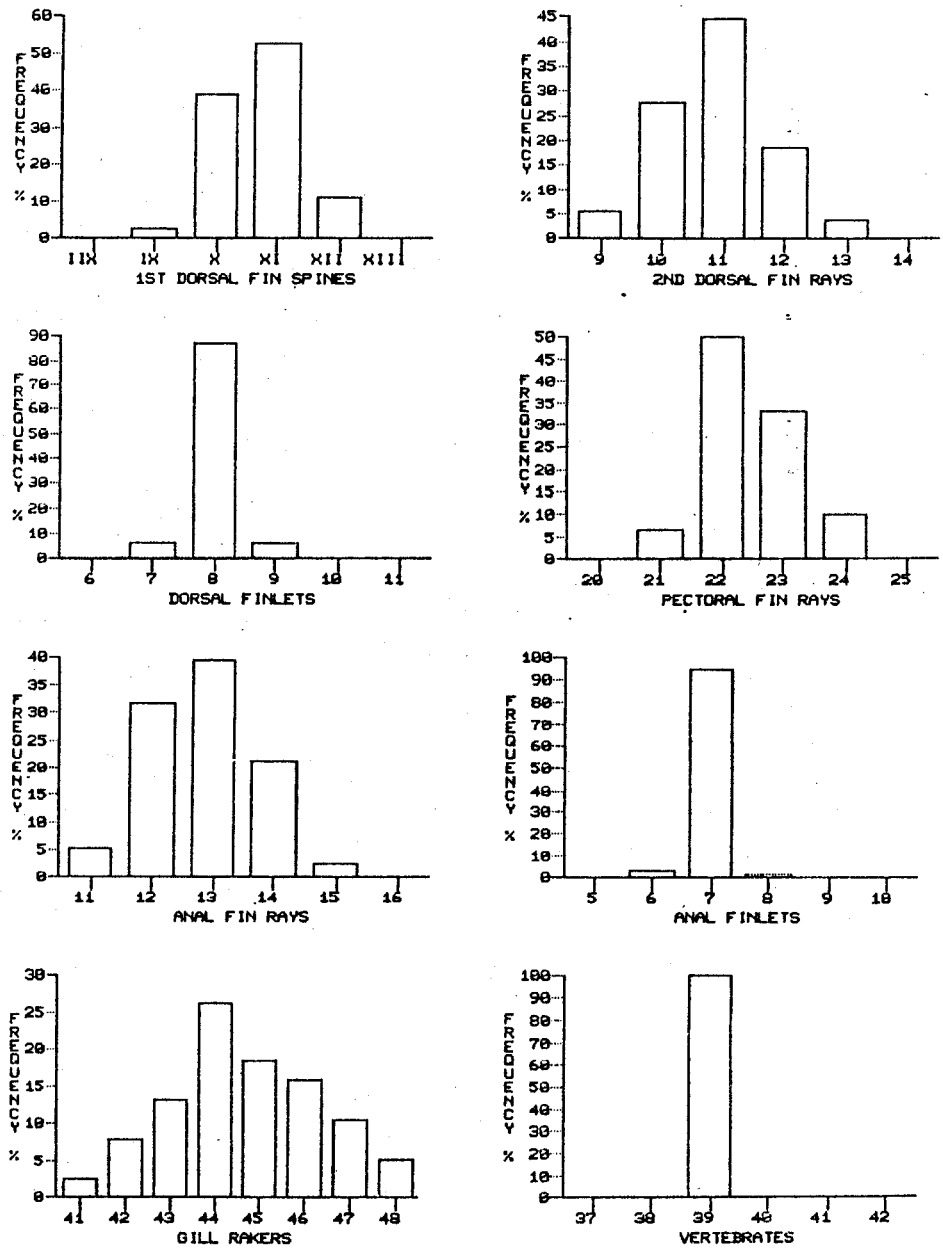


圖 3　兩區標本合併後各體節形質之頻度分佈

Fig. 3　Frequency distribution of the meristic characters for *Auxis rochei* of different origin combined.

表 2　雌雄別之頭長與尾叉長迴歸關係比較

Table 2　Comparison of regression lines of head length and fork len length relationship between male and female.

a) Sample from Hua-Lien.

	within	df	Σx^2	Σxy	Σy^2	Reg. Coeff.	Deviations from Regression		
							df	ss	Ms
1	MALE	44	140.3445	35.2867	9.3800	0.251	43	0.507895	0.011812
2	FEMALE	47	142.8667	35.5617	9.7598	0.256	46	0.403121	0.008764
3	-	-	-	-	-	-	89	0.911016	0.010236
4	Pooled. W	91	283.2112	71.8484	19.1398	0.254	90	0.912440	0.010138
5	-	-	-	Difference between slopes			1	0.001424	0.001424
6	Between.B	1	0.0007	-0.0025	0.00816	-	-	-	-
7	W + B	92	283.2119	71.8459	19.14796	-	91	0.921913	-
8	-	-	-	Between adjusted means			1	0.009473	0.009473

Comparison of slopes F = 0.13912　　df = 1,89　　N.S. P> 0.05.

Comparison of elevations F = 0.93441　　df = 1,90　　N.S. P> 0.05.

b) Sample from Hsin-Kang.

	within	df	Σx^2	Σxy	Σy^2	Reg. Coeff.	Deviations from Regression		
							df	ss	Ms
1	MALE	49	163.5200	41.1140	10.7928	0.251	48	0.455465	0.009489
2	FEMALE	54	249.9971	64.6873	17.32182	0.259	53	0.583839	0.011016
3	-	-	-	-	-	-	101	1.039304	0.010290
4	Pooled. W	103	413.5171	105.8013	28.11462	0.256	102	1.044603	0.010241
5	-	-	-	Difference between slopes			1	0.005299	0.005299
6	Between. B	1	0.00141	-0.0012	0.001	-	-	-	-
7	W + B	104	413.51851	105.8001	28.11562	-	103	1.046309	-
8	-	-	-	Between adjusted means			1	0.001706	0.001706

Comparison of slopes　F = 0.51497　　df = 1,101　　N.S. P> 0.05.

Comparison of elevations F = 0.16659　　df = 1,102　　N.S. P> 0.05.

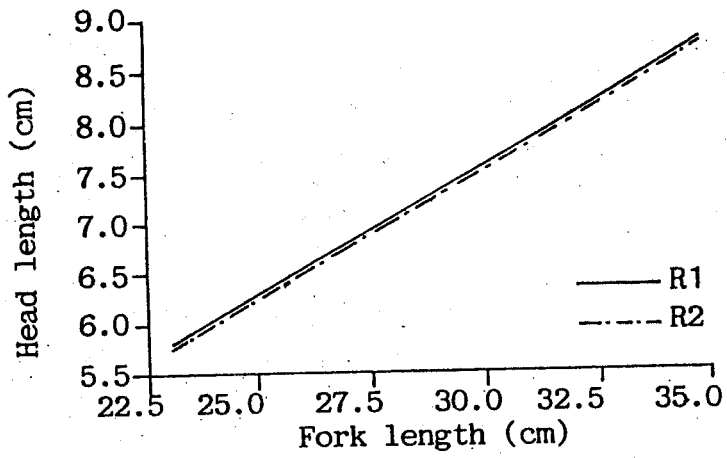


圖 4　兩區標本之頭長與尾叉長關係

Fig. 4　Relationship between head length and fork length of samples from Hua-Lien (R1) Hsin-Kang(R2).

表 3　兩區標本之頭長對尾叉長之迴歸統計

Table 3　Regression statistics of head length on fork length of *Auxis rochei*.

Sampling area	N	SX	SY	SX^2	SY^2
Hua-Lien	93	2705	682.9	78960.9	5033.69
Hsin-Kang	105	3050.9	757.6	89061.1	5494.38

Sampling area	SXY	b	a	r	t
Hua-Lien	19934.69	0.25368	-0.03561	0.976	42.415
Hsin-Kang	22118.77	0.25585	-0.21888	0.981	51.621

N = number used in samples; S = summation; X = fork length(cm); Y = head length(cm); b = regression coefficient; a = intercept; r = correlation coefficient; t = the value for testing the significance of b.

表 4　兩區標本間之頭長與尾叉長迴歸關係比較

Table 4　Comparison of regression lines of head length and fork length relationship among the samples from Hua-Lien(R1) and Hsin-Kang (R2).

Source of variation	df	Σx^2	Σxy	Σy^2	b	df	S.S.	M.S.
R1	144	523.101	137.523	37.941	0.263	143	1.78627	0.0125
R2	173	630.336	158.314	42.669	0.251	172	2.90176	0.0169
						315	4.69343	0.0149
Pooled	317	1153.437	295.837	80.610	0.256	316	4.73284	0.0150
Difference between slopes						1	0.03941	0.03941

Fb = 2.64 N. S.　P> 0.05

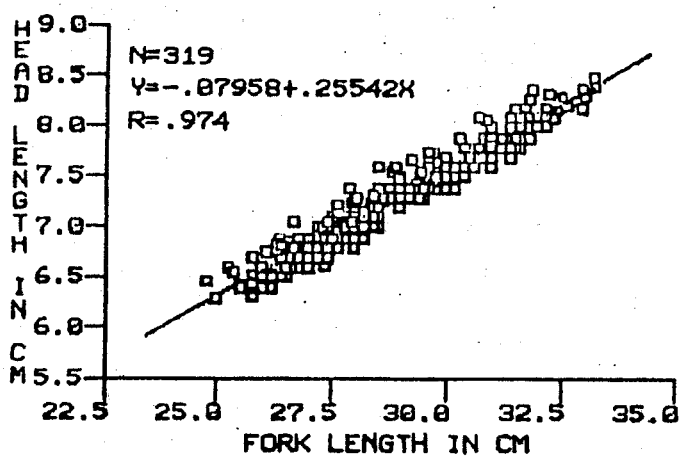


圖 5　兩區標本合併後之頭長與尾叉長之關係

Fig. 5　Relationship between head length and fork length of *Auxis rochei* samples from Hua-Lien and Hsin-Kang.

討　論

由圖 3 之脊椎骨數分布可看出，兩區合併後之脊椎骨數皆爲39枚，顯示此爲非常穩定之形質，在種以上的系統分析及在其形質之相對位置之探討中，當有其價值[9]。

由形態形質檢定分析之結果，兩區間並無差異存在，可以說在花蓮與新港兩區之圓花鰹應視爲同一族群。

摘　要

自 1985 年 8 月至次年 7 月，按月於花蓮、新港魚市場，採集當地沿岸漁業所漁獲之圓花鰹標本數 624 尾，將體節形質及非體節形質分別以 t-test 及 Covariance analysis 等方法比較後，其結果顯示：花蓮及新港兩區間之圓花鰹應視爲同一族群。

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