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Food of Nestling Egrets and Night Herons in the Western Lowlands of Central Taiwan

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摘要

顏重威 臺灣中部三種鷺鷥幼雛的食性 臺灣省立博物館半年刊 44(2):
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本研究係撿拾牛背鷺、小白鷺和夜鷺等幼雛剛吐出的食團，攜返實驗室稱重，並分析其內容，以比較此三種鷺鷥的不同食性。結果證實牠們的食物各有偏好，彼此並無競爭。

關鍵詞：鷺鷥營巢處，幼雛，食團。

Abstract

Regurgitated food boluses of Cattle Egret (*Bubulcus ibis*), Little Egret (*Egretta garzetta*), and Black-crowned Night Heron (*Nycticorax nycticorax*) nestlings were analyzed for comparing the food habits of the parent birds. There is no evidence of competition for food resources among these species.

Key words: Heronry, Nestling Egrets and Night Heron, Bolus.

Introduction

The Cattle Egret (*Bubulcus ibis*), Little Egret (*Egretta garzetta*), and Black-crowned Night Heron (*Nycticorax nycticorax*) are very common in Taiwan. They are found in lowland areas from the coast up to 900m of elevation. These three species usually breed or roost in one colony or heronry. In 1951 (Hachisuka and Udagawa) reported about 60 heronries in Taiwan. Chen and Yen (1977) reported 26 active heronries island-wide of which only 6 heronries were found in midwestern and southern Taiwan. Yen (1991) reported on the present status of heronries in mid-western and southern Taiwan where 20 active heronries

were found. Due to rapid changes in the natural environment in recent years, the sites of heronries have also changed. The references above did not analyze the food resources of these species.

The food habits of Cattle Egrets have been studies in Egypt (Kardy, 1942), Japan (Ikeda, 1956; Kosugi, 1960), South Africa (Siegfried, 1966; 1971), and Florida, USA (Fogarty and Hetrick, 1973; Jenni, 1973). Kosugi (1960) also reported on food habits of Little Egrets and Black-crowned Night Herons. The results show that the Cattle Egrets in different areas generally select the same categories of food, although food items vary according to the local environments.

The purpose of this study is to analyze the food preferences of the three species in the heronry, to evaluate possible competition exclusion, and also to evaluate their potential damage on fisheries in the study area.

Study Area and Methods

Food samples were collected at three heronries located in the lowlands of central Taiwan (Fig. 1). The Nan-tun heronry in Taichung City is located in a woods of Taiwan Acacia (*Acacia confusa*) on the eastern side of Tatu Hill. On the west side of the heronry are sugar cane fields, and on the east side are rice fields and a permanent stream (Fig. 2). Little Egrets and Night Herons can be seen feeding at the edge of the stream and ditches, and Cattle Egrets feed regularly on the grasslands and rice fields.

The Shen-kang heronry in Changhwa County is located in the woods of Australian Pine (*Casurina equisetifolia*) on the southern bank of Tatu River very close to the estuary, coastal fish ponds and the sea coast (Fig. 3). Cattle Egrets were found feeding at a garbage dumping area about 3 km from the heronry. Here most of the little Egrets and Night Herons feed at the edge of sandbars in the river and at fish ponds, and Little Egrets also feed in the tidal zone, and in open fields.

The Tsao-hu heronry in Changhwa County is located in a secondary mixed broadleaf woods on a dune surrounded with mostly dry cultivated areas at a distance of about 4 km from coastal fish ponds (Fig. 4). The Cattle Egrets feed mostly in the nearby dry cultivated fields. Almost all the Tsao-hu Little Egrets and Night herons travel to the coastal fish ponds, and sea coast for feeding, and there is probably a little overlap with birds from the Ta-chen heronry about 10 km to the south.

The nests of the three heronries were counted (Nan-tun:1620; Shen-kang:2593; and Tsao-hu:4000) during the breeding season of 1990 (Yen, 1991).

Food samples were collected from 10 to 25 day old nestling Egrets and Night Herons from May 25 to August 17, 1990 during the

late morning. Freshly regurgitated food boluses obtained on the ground below the nests were brought back to the laboratory for weight and examination individually. The food items were divided into two groups: invertebrate and vertebrate. The invertebrates (smaller prey less than 50mm long) were identified to the level of order and, in some cases, family. The vertebrates (larger prey more than 50mm long) were identified to the level of genus and, in some cases, species.

Results

(1) Cattle Egret

A total of 52 food boluses of Cattle Egrets was collected. Boluses varied in weight 3-22g, averaging 10.1g. (Fig. 5). The size of boluses ranged between 35x20x12mm and 53x27x15 mm.

Cattle Egret nestlings were fed a wide variety of invertebrate and vertebrate prey (Table 1). A total of 2801 items of prey (2766 invertebrate and 35 vertebrate) taken by parent Cattle Egrets were almost entirely terrestrial animals.

The invertebrate prey were small, and there was a variety of many individuals within each bolus. Insecta contributed 97% of the invertebrate prey, occurring in 88% of 52 boluses. Dipterous insects, primarily larvae and pupae, accounted for 89% of invertebrate prey, occurring in 58% of the boluses. Orthoptera, the second most numerous prey, contributed almost 4% of the invertebrate items, occurring in 56% of the boluses. Two families, Acrididae (grasshoppers) and Gryllidae (crickets), comprised 76% of the items taken in this order. Lepidoptera and Coleoptera each contributed nearly 2% of invertebrate prey.

Trace amounts of prey of 7 other orders (Blattoidae, Mantoidae, Dermaptera, Odonata, Hemiptera, Homoptera, Trichoptera) were found.

Arachnida (spiders) made up nearly 3% of invertebrate prey, occurring in 17% of the boluses. Other invertebrates identified in trace amounts were centipedes and crustaceans.

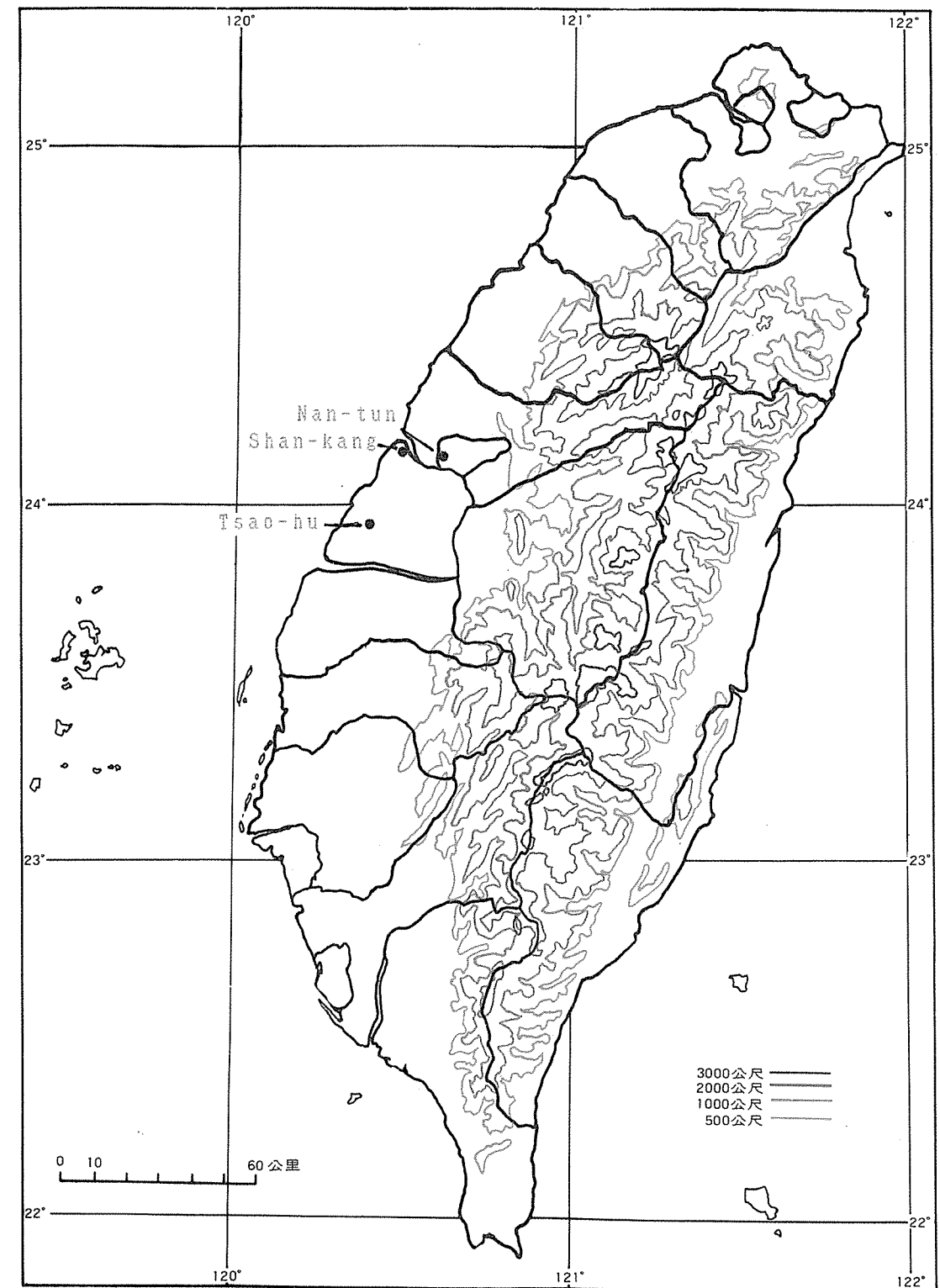


Fig. 1. The Locality of the Three Heronry Study Sites.

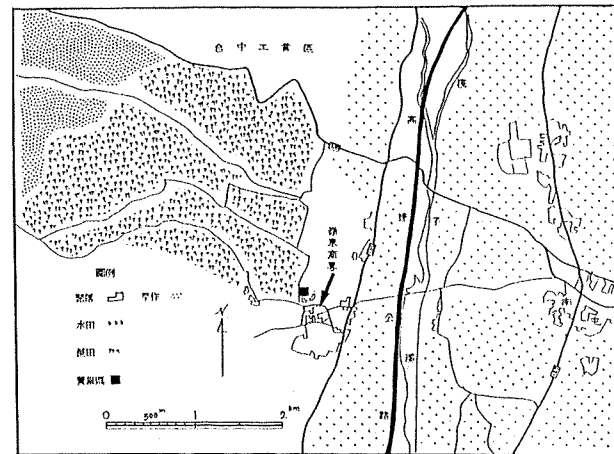


Fig. 2. The Nan-tun Heronry and Its Surrounded Environments.

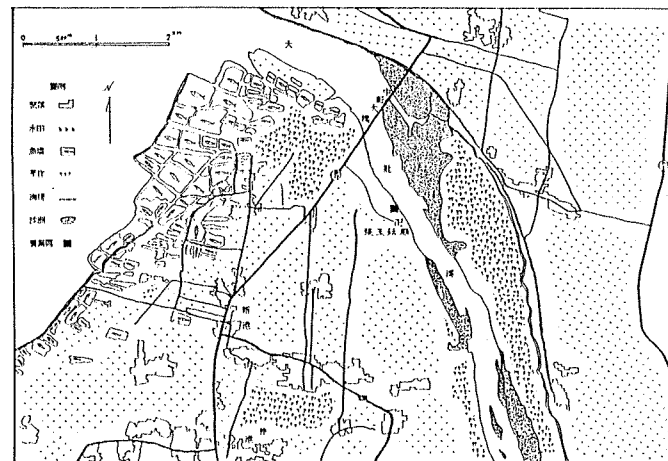


Fig. 3. The Shan-kang Heronry and Its Surrounded Environments.

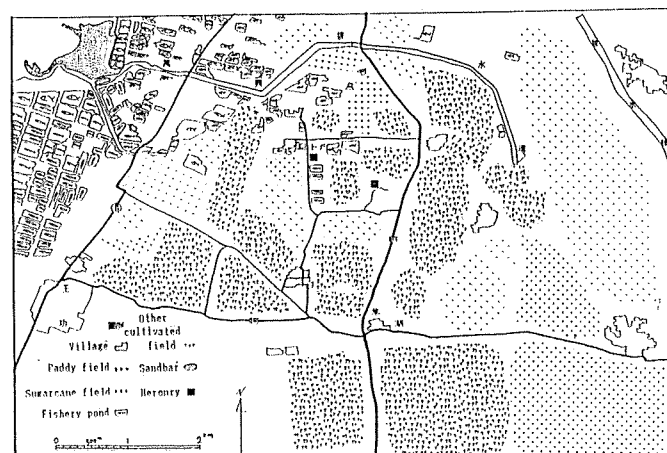


Fig. 4. The Tsao-hu Heronry and Its Surrounded Environments.

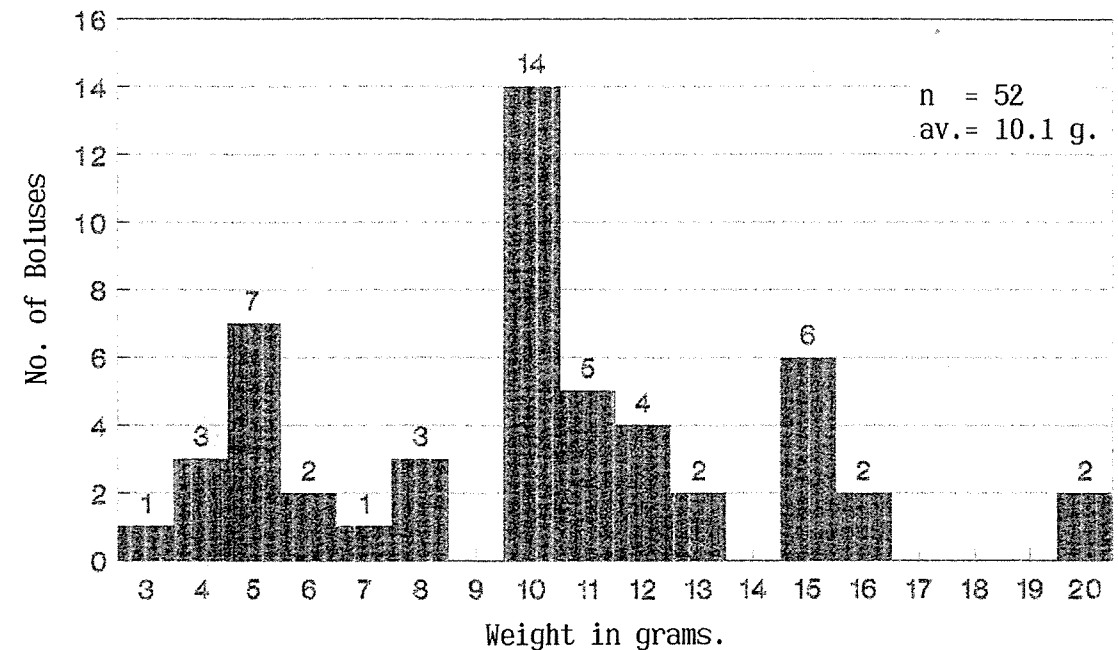


Fig. 5. Food Bolus weights for Cattle Egrets.

The vertebrate prey were much larger in size than the invertebrate prey, and several boluses were composed entirely of a few individuals of the same vertebrate species. Reptilia of the order Squamata contributed 71% of the vertebrate items of prey, occurring in 15% of the boluses. Two families of this order, Lacertidae and Scincidae, were represented in 10% and 6% of the boluses, respectively.

Amphibia of the order Anura (Raniidae and Bufonidae) made up 26% of the vertebrate prey items, occurring in 13% of the boluses. Mammalia were represented by only one mouse in one bolus.

Other trace materials taken by Cattle Egrets were unhulled rice grain, rice straw, and 11 rubber bands (the only inorganic material found in the boluses).

(2) Little Egret

A total of 47 boluses of Little Egrets was collected. Boluses varies in weight from 6-20g, averaging 12.2g. (Fig. 6).

Little Egret nestlings were fed mostly aquatic invertebrate and vertebrate prey (Table 2). Of 522 identified food items, 313 items

were invertebrate and 209 were vertebrate prey.

Insecta comprised 90% of invertebrate prey, occurring in 26% of the boluses. Coleoptera, Diptera, and Lepidoptera made up 50%, 28%, and 8% of invertebrate prey, respectively, each order occurring in 9% of the boluses. Orthoptera made up only 5% of the prey but occurred in 15% of the boluses. Only 2 items of Blattoidea were found in one bolus.

Vertebrate prey (209 items) formed the major source of food. Osteichthyes (fishes) accounted for 81% of the items of vertebrate prey, occurring in 62% of the boluses. Two orders, Perciformes and Cypriniformes, accounted for 61% and 20% of vertebrate prey, respectively, occurring in 45% and 17% of boluses, respectively. Three species of fresh-water fishes contributed 14% of the fish items, while five species of salt-water fishes contributed 86% of the fish items.

Amphibia (Anura, Raniidae) made up 18% of vertebrate prey items, occurring in 45% of the boluses. All of amphibians were rice frogs which were common in the study area. Reptilia (Squamata, Lacertidae) contributed only 1% of vertebrate prey, occurring in 4%

Table 1. Contents of 52 Boluses Regurgitated by Nestling Cattle Egrets.

Food Items	No. taken	%	No. boluses	%
Invertebrates				
Insecta	2683	97.00	46	88
Blattoidea	2	trace	1	2
Mantoidea	2	trace	2	4
Orthoptera	101	4	29	56
Acridiidae	57		7	
Gryllidae	20		4	
<i>Brachytrupes portentosus</i>	6		3	
Tettigoniidae	1		1	
Formicidae	1		1	
Tenobronidae	11		2	
Gryllotalpidae	5		2	
Dermaptera	2	trace	1	2
Forficulidae	2			
Odonata (larva)	17	trace	3	6
Hemiptera	1	trace		2
Belostomatidae				
Homoptera	5	trace		6
Trichoptera	1	trace	1	2
Lepidoptera (larva)	51	2	6	12
Coleoptera	52	2	10	20
Carabidae (larva)	50		8	
Melolonthidae (larva)	2		2	
Diptera	2449	89	30	58
Calliphoridae	91		18	
Muscidae	126		6	
Unidentified larva & pupae	2232		28	
Arachnida				
Araneida	80	3	9	17
Myriapoda				
Diplopoda	1	trace	1	2
Crustacea	2	trace	1	2
Total invertebrates	2766	100%		
Vertebrates				
Amphibia				
Anura	9	26	7	13
Ranidae	8		7	13
Bufonidae	1		1	2
Reptilia				
Squamata	25	71	8	15
Scincidae	6		3	6
<i>Eumeces chinensis</i>	4		2	
<i>e. elegans</i>	2		1	
Lacertidae	19		5	10
<i>Takydromus stejnegeri</i>	19			
Mammalia				
Muridae	1	3	1	2
Total vertebrates	35	100		
Miscellaneous Items	23		7	14
Unhulled rice	6		5	10
Rice straw	6		2	4
Rubber bands	11		1	2
Total no. of items taken	2824			

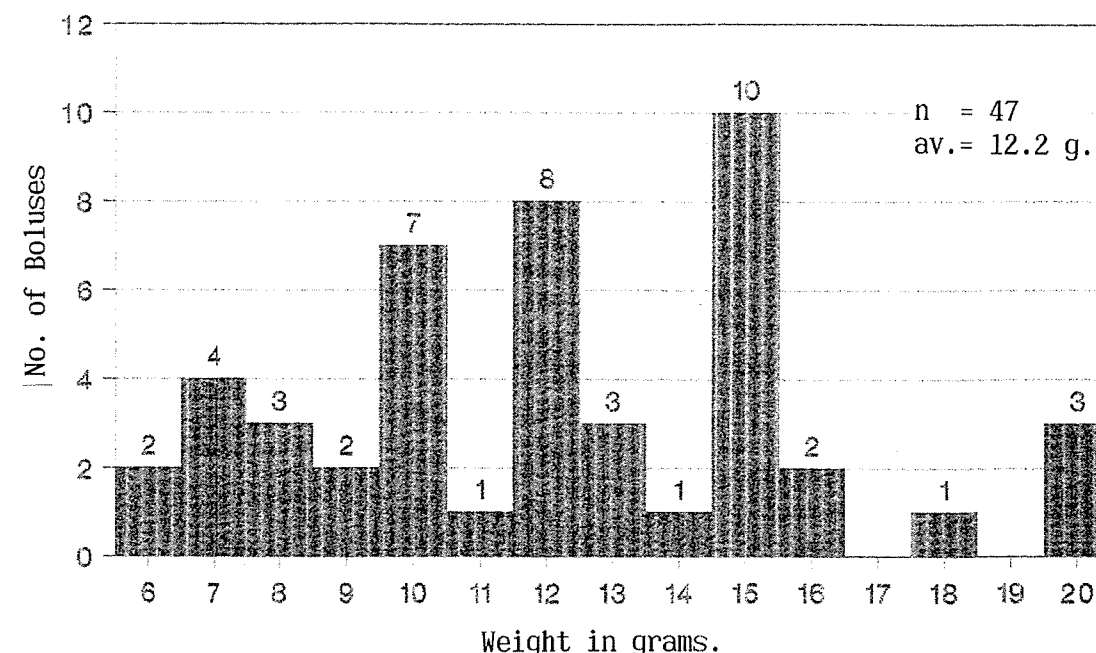


Fig. 6. Food Bolus weights for Little Egrets.

of the boluses. Mammals were not found in Little Egret boluses.

Most fish taken ranged in length from 30 to 80mm. The smallest fish was 25mm long, the largest 125mm long. Only 3 fish were longer than 80mm. The length-frequency distribution for each species of fish is shown in Fig. 7.

(3) Black-crowned Night Heron

A total of 34 boluses of Black-crowned Night Herons was collected. The weight of food at each boluses varied in weight from 9-55g, averaging 26.2g. (Fig. 8).

Black-crowned Night Heron nestlings were fed mostly aquatic vertebrates with a few items of crustacea and domestic ducklings and chick (Table 3). Of 69 identified food items, osteichthyes of three orders accounted for 27% of vertebrate prey items, occurring in 34% of the boluses. Three species of fresh-water fishes were identified, but two specimens of semi-digested fish could not be identified. Amphibia (all rice frogs) accounted for 59% of vertebrate prey, occurring in 34% of the boluses. Other food items included domestic

ducklings, chicks, and trachea and lung of domestic duck or chicken, making up 14% of items taken and occurring in 24% of the boluses. A duckling or a chick formed a whole bolus while several small fishes or frogs made up a single bolus.

Fig. 9 shows the length-frequency distribution of Tilapia prey and Carassius prey. Tilapia prey (80-150mm) were about twice the length of Carassius prey (50-57mm).

Discussion

The regurgitated food boluses of Egret and Night Heron nestlings in this study consisted almost entirely of animal matter. The major food items of the three species nesting together are significantly different (Table 4). The total items of invertebrate prey taken by Cattle Egrets was about 8 times greater than that taken by Little Egrets, whereas Little Egrets took about 6 times greater number of vertebrate prey than did Cattle Egrets. Among invertebrate prey, Cattle Egrets took mostly dipteran larvae and pupae whereas Little Egrets took mostly coleopteran larvae. Among verteb-

Table 2. Contents of 47 Boluses Regurgitated by Nestling Little Egrets.

Food Items	No. taken	Size (mm)	%	No. Boluses	%
Invertebrates					
Insecta	284		91	12	26
Blattoidea	2		trace	1	2
Orthoptera	16		5	7	15
Gryllidae	5			2	
Tettigoniidae	1			1	
Tenobronidae	1			1	
Gryllotalpidae	9			3	
Lepidoptera (larva)	24		8	4	9
Coleoptera (larva)	155		50	4	9
Carabidae	5			3	
Dytiscidae (larva)	150			1	
Diptera (larva & pupa)	87		28	4	9
Arachnida					
Araneida	28		9	6	13
Crustacea	1		trace	1	3
Total invertebrates	313		100		
Vertebrates					
Osteichthyes	170		81	29	62
Cypriniformes	42		20	8	17
Cyprinidae— <i>Carassius</i> spp.	7	60–75		5	
— <i>Gnathopogon</i> spp.	29	37–41		1	
— <i>Zacco</i> spp.	6	58–90		2	
Perciformes	128		61	21	45
Mugilidae— <i>Liza</i> spp.	102	25–125		13	
Sillaginidae— <i>Sillago</i> spp.	1	90		1	
Cichlidae— <i>Tilapia</i> spp.	9	40–68		5	
Eleotridae— <i>Eleotris</i> spp.	5	30–32		1	
Ambassidae— <i>Ambassis</i> spp.	11	31–62		1	
Amphibia					
Anura					
Raniidae— <i>Rana</i> spp.	37		18	21	45
Reptilia					
Squamata					
Lacertidae	2		1	2	4
Total vertebrates	209		100%		
Total of food items taken	522				

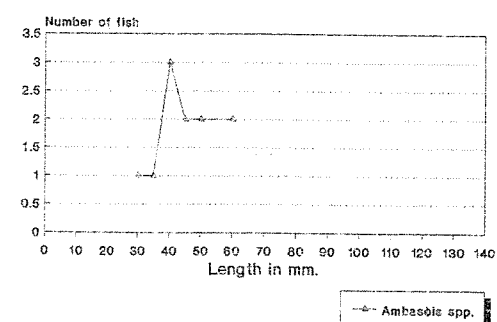
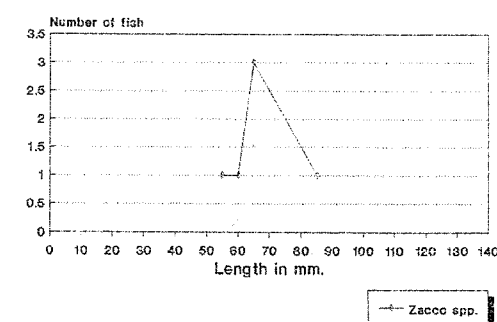
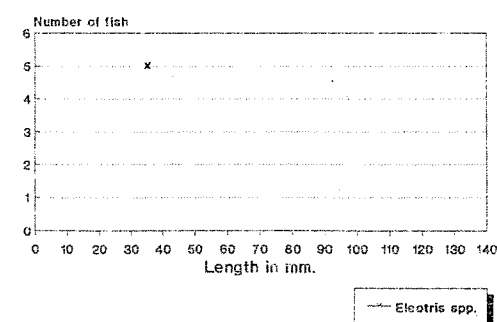
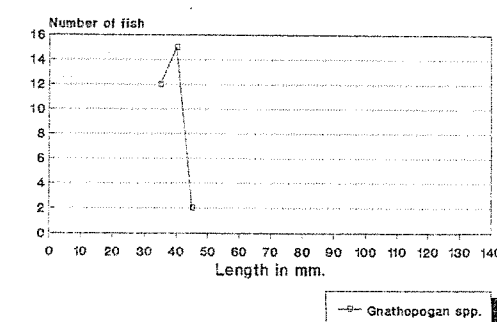
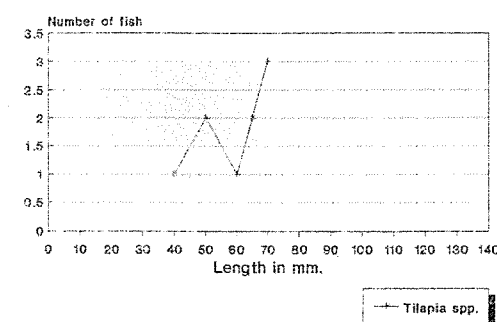
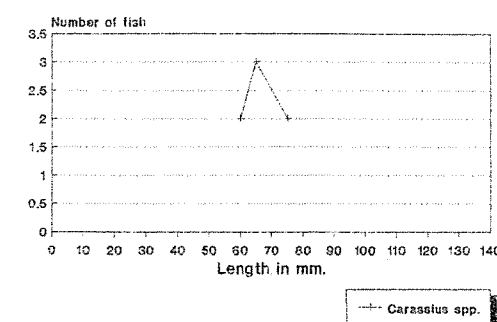
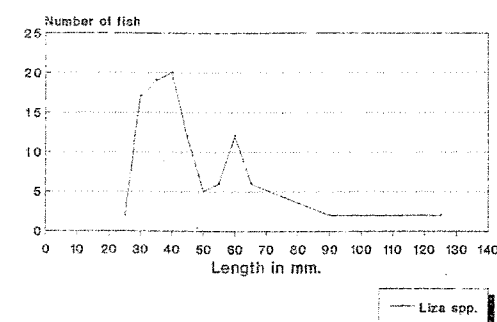


Fig. 7. Length-frequency Distribution Fishes Taken by Little Egrets.

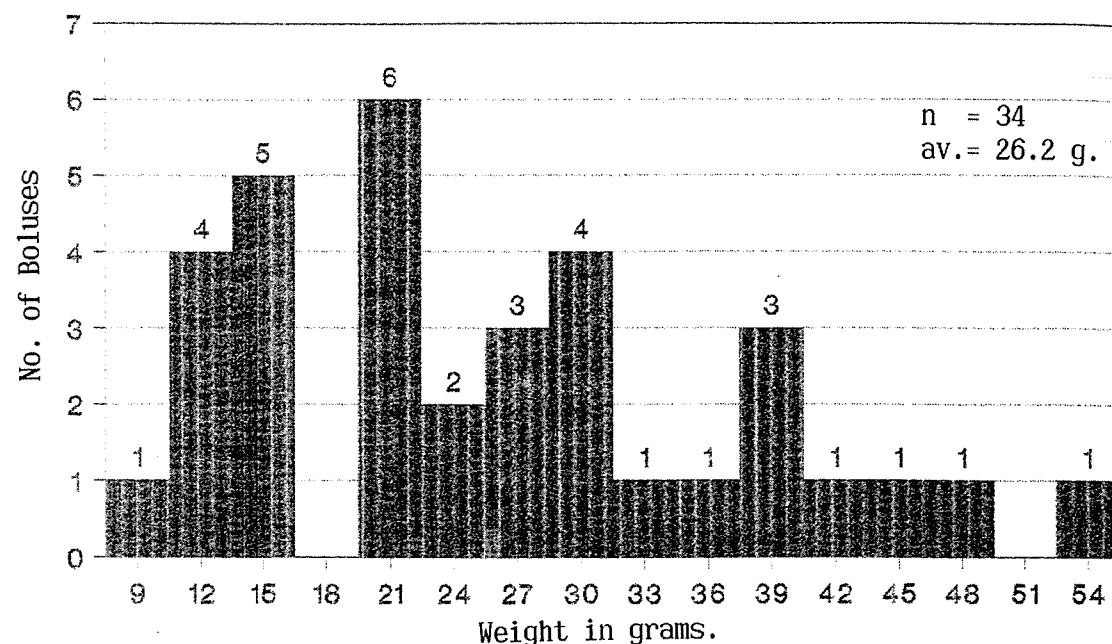


Fig. 8. Food Bolus weights for Black-crowned Night Herons.

Table 3. Contents of 34 Boluses Regurgitated by Nestling Black-crowned Night Herons.

Food Items	No. taken	Size (mm)	%	No. boluses	%
Invertebrates					
Crustacea	5		100	3	8
Total invertebrates	5		100		
Vertebrates					
Osteichthyes	17		27	13	34
Perciformes—Cichlidae					
<i>Tilapia</i> spp.	9	80–150		8	
Cypriniformes—Cyprinidae					
<i>Carassius</i> spp.	5	50–75		2	
Siluriformes—Clariidae					
<i>Clarias</i> spp.	1	85		1	
Semi-digested fishes	2			2	
Amphibia					
Anura—Raniidae— <i>Rana</i> spp.	38		59	13	34
Others	9		14	9	24
Domestic duckling	4			4	
Domestic chickling	2			2	
Trachea and lung of domestic duck or chicken	3			3	
Total vertebrates and others	64		100%		
Total of food items taken	69				

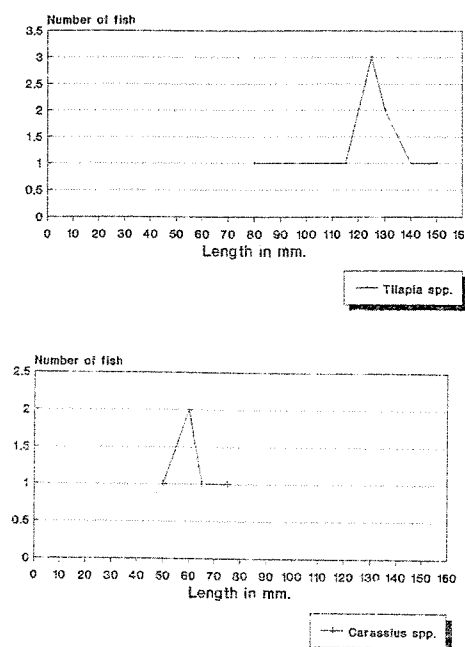


Fig. 9. Length-frequency Distribution of Fishes Taken by Black-crowned Night Herons.

rate prey, Cattle Egrets took mostly lizards whereas Little Egrets took mostly fishes. Black-crowned Night Herons took no insects, and the vertebrate prey consisted of approximately equal amounts by weight of fishes, frogs and domestic poultry. There is no evidence of competition for food resources among these species.

Cattle Egrets were quite often feeding in the garbage dumping area in an open field about 3 km from the Shen-kang heronry which may account for high proportion of dipteran larvae and pupae in their diet. The percentage of orthopteran prey in this study was not so high as in other studies in South Africa and the United States (Siegfried, 1966; Fogarty and Hetrick, 1973; Jenni, 1973), but orthopterans were second to dipterans in this study.

Major items of prey of both Little Egrets and Night Herons were fishes and frogs. However, Little Egrets took a large proportion of salt-water fishes caught along the sea coast and the estuary whereas Night Herons took no salt-water fishes. Both species feed on fresh-water fishes in streams, ditches and ponds,

Table 4. Comparison of Major Food Items of Nestling Cattle Egret, Little Egret, and Black-crowned Night Heron.

Food Items	Cattle Egret		Little Egret		Black-crowned Night Heron	
	No. taken	%	No. taken	%	No. taken	%
Invertebrates	2766	100	313	100	5	100
Insecta	2683	97	284	91	—	—
Arachnida	80	3	28	9	—	—
Myriapoda	1	trace	—	—	—	—
Crustacea	2	trace	1	trace	5	100
Vertebrates	35	100	200	100	55	100
Osteichthyes	—	—	161	80	17	31
Amphibia	9	26	37	19	38	69
Reptilia	25	71	2	1	—	—
Aves	—	—	—	—	9	—
Mammalia	1	3	—	—	—	—
Others	trace		—		—	100

but the Little Egret feeds in daytime and the Night Heron feeds mostly at night. The rice frog is widely distributed in the study area. Little Egrets took smaller *Tilapia* (40–68 mm) than Black-crowned Night Herons (85–145 mm). Crustacean prey was the major food item (42%) of Little Egrets reported for Japan (Kosugi, 1960), but only one crustacean item was found in this study. Kosugi reported (1960) that the diet of the non-breeding Black-crowned Night Heron in Japan consisted of 28% insects whereas no insects were found in this study.

The differences in prey taken by these three species reflect differences in their feeding grounds. Cattle Egrets are usually found feeding on rice fields (especially during plowing or cropping), grasslands, garbage dumps, and cattle farms where the food prey is terrestrial. Little Egrets are seen feeding on the sea coast, estuary, along sandbars in the river, fish ponds, ditches, and also sometimes on wet rice fields where a lot of aquatic animals could be taken. Black-crowned Night Herons are often seen feeding inland at the edge of streams, ditches, and fish ponds where only aquatic animals could be taken. Little Egrets may occasionally follow the plowing in rice fields where the insect prey are abundant. It may also feed on the grassy banks of fish ponds which accounts for some overlap in food prey items with those of Cattle Egrets.

The fishery farmers of Taiwan believe that Little Egrets and Black-crowned Night Herons take many eels and shrimps from their ponds, but this study gives no evidence for their claims. It is possible, however, that Little Egrets and Black-crowned Night Herons might take eels and shrimps in other places with different natural environments. More research on the potential damage of these birds to fisheries is recommended.

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