Ethosociological Studies of the Black-winged Stilt *Himantopus himantopus himantopus* I. Ethogram of the Agonistic Behaviours

Tamaki Kitagawa*

Abstract Agonistic behaviour in the Black-winged Stilt, *Himantopus himantopus himantopus*, was observed at Ichikawa City, Chiba Prefecture, from April 1985 to December 1987. For convenience, two components, postures and calls, were described separately. Agonistic postures appeared in coactions between conspecifics or with other animals and were classified into nine categories: (1) *alert* with five types; (2) *leaning body*; (3) *lowering head*; (4) *repelling water*; (5) *patrolling*; (6) *irrelevant behaviours* with nine types; (7) *attacking* with eight types; (8) *avoiding* with six types; and (9) *diversionary display* with two types. Agonistic calls were classified into *alarm calls*, *snake alerting calls*, *aggressive calls*, and *diversionary calls*. These postures and calls are described in detail and situations at which they were observed are described.

Introduction

Among various groups of birds in the Order Charadriiformes, the Family Recurvirostridae with three genera, *Recurvirostra* (four species, *R. americana*, *R. novaehollandiae*, *R. andina*, *R. avosetta*), *Cladorhynchus* (monobasic, *C. leucocephalus*), and *Himantopus* (one polytypic species, *H. himantopus*) is outstanding by extremely long legs, long bills, slim bodies and long and pointed wings. *H. himantopus*, which is classified in five subspecies, breeds along shores of brackish and freshwater bodies in various areas of the both hemispheres even in some remote Oceanic islands such as Hawaii and Galapagos, although breeding is not recorded from Antarctica and the Arctic zones (Cramp and Simmons 1983). Some aspects of its biology were recorded by Yeates (1941, breeding habits), Glutz von Blotzheim *et al.* (1977, breeding habits and behaviours), Goriup (1982, general behaviours), and especially by Hamilton (1975, general behaviours), but many aspects are still only superficially explored, necessitating more detailed studies. The type subspecies *H. h. himantopus* or Black-winged Stilt is distributed Eurasia and Africa, known from southern Europe eastward to Mongolia and southward to South Africa, Madagascar, and Sri Lanka. Its breeding is recorded from northwestern Africa, and Eurasia (Cramp and Simmons 1983). In Japan this subspecies had been known until recently as an accidental visitor. Its breeding was first recorded at a reclaimed shore of Nabeta, Aichi Prefecture in 1975 and 1976 (Hasuo 1982). In 1978 one pair bred at a reclaimed shore of Yazu in Narashino City, and in 1979, another pair bred at the same area and one more pair at a reclaimed shore of Makuhari in Narashino City, all in Chiba Prefecture. Since 1979 more than one pair have bred every year at the Shinhama Imperial Preserve in Ichikawa City, Chiba Prefecture, and have overwintered at Gyotoku Sanctu-

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* Ichikawa High School, 4-1-1 Higashi-Sugano, Ichikawa, Chiba Pref. 272.

Fig. 1. Locations of breeding and overwintering areas studied.

ary and the vicinity (Kunimatsu 1979, Hasuo 1982).

Since 1985 I began to elucidate the ethology, sociology and ecology of *H. h. himantopus* through field observations. This paper represents the first report of my serial studies on this bird.

Behavioural patterns of *H. himantopus* (henceforth cited by the generic name unless distinction is necessary) have been studied by several authors. However, most previous works have been restricted to breeding behaviours (Witherby *et al.* 1940, Staton 1945) except for brief notes on social behaviours (Glutz von Blotzheim *et al.* 1977, Goriup 1982) and a detailed comparative study on behaviours of the Nearctic subspecies, the Black-necked Stilt, *H. h. mexicanus*, by Hamilton (1975). Few precise studies of agonistic behaviours of *Himantopus* have been made in reference to associated movements or situations under which the concerned behaviour patterns were frequently released. This paper describes the agonistic behaviours based upon observations of territorial defence in both breeding and nonbreeding seasons, other intraspecific interactions, and movements elicited by predators and competitors. Discussion of the results will be given in a separate paper. Also ethogram of other behaviours such as maintenance behaviours, reproductive behaviours and parental care will be described elsewhere.

Fig. 2. Locations of Gyotoku Sanctuary and Shinhama Imperial Preserve. SIP, Shinhama Imperial Preserve; p, pond in SIP; c, canal; GBO, Gyotoku Bird Observatory; Sr, Sewage reservoir; Np, North pond; Kp, Kingyo pond; Fp₁₋₃, freshwater ponds.

Study Areas

The study was carried out in Ichikawa City, 139°55' E, 35°40' N, Chiba Prefecture (Fig. 1). The breeding sites are shores of a shallow pond (100 m × 100 m) in Shinhama Imperial Preserve (Fig. 2, p) and a part (50 m × 450 m) of a shallow canal encircling the preserve (Fig. 2, c), into which salt water is poured (Fig. 2). These shores are covered with *Phragmites communis*, and partly surrounded with clumps of trees, *Pleioblastus simonii*, *Machilus thunbergii*, *Pinus thunbergii*, *Pittosporum tobira*, *Celtis sinensis* var., etc. In 1988 breeding sites moved to two newly made ponds (each ca. 50 m × 90 m) in an open land predominated by *Solidago altissima* within Gyotoku Sanctuary, into which ditch water is poured (Fig. 2, Fp₃). In autumn many groups of various compositions, pairs with or without yearlings, uniparental families, yearling pairs and solitary birds, temporarily gathered at the North pond in Gyotoku Sanctuary contiguous to Shinhama Imperial Preserve (Fig. 2). The North pond is ca. 2.9 km², surrounded with *Phragmites communis*. Overwintering places are at shores along the lower reaches of the River Edo (Fig. 1), where broad muddy beaches appear at low tide, and lotus ponds scattered within the wasteland nearby (Fig. 1) at about 3 km distant from Shinhama Imperial Preserve, and the shores of the River Arakawa (Fig. 1), where narrow sandy beaches appear at low tide, at about 6 km distant from Shinhama Imperial Preserve.

Methods

I observed the birds using a binocular telescope ($\times 10$) and a high magnification telescope ($\times 25 \sim \times 60$). The birds could be identified individually by a number of features: feather colouration, deformities or wounds on legs and some other morphological peculiarities. However, these features were useful only for peculiar birds, e.g. birds in nesting or overwintering territories, not always for those in large flocks because accurate individual recognition was difficult in such cases, or not for those observed intermittently as colouration changed by moulting. Several chicks were colour-banded two to three weeks after hatching. Identification of sexes was easy for sexual dimorphism in plumage colouration of wings and back, greenish-black in males whereas brown in females.

Observations were made approximately from 1300 to 1800, every three to five days per week from April 1985 to December 1987. Behavioural patterns were recorded together with circumstances at which the respective patterns were released. Besides field recording, many postures and movements were photographed by 35 mm format cameras with 500 mm telephoto lens. Accompanied figures were redrawn from these photos.

In the nonbreeding season on each observation day I first censused the number of *Himantopus* along the River Edo by checking individually recognized birds. Then birds or families checked were observed each for about 30 min to 1 h before checking the next one. In the breeding season the birds were so cautious at nesting sites that observations were made from a one-person-blind set in a bamboo bush. Call notes were represented by means of letter combinations.

Results

Agonistic behaviours occupy a part of the entire ethogram which is now under preparation and consists of the following parts: Resting, sleeping, comfort movement, locomotion, food intake, defecation, agonistic behaviour, reproductive behaviour, and parental care.

Table 1 shows the relative frequency of appearance (total=615 cases) of other animals which elicited agonistic behaviours from *Himantopus* in the course of observations. Actual frequency varied according to season and year. The bird exhibited agonistic behaviours toward other animals mostly in the breeding season, especially in the incubating and parental care period, while with low frequencies in the nonbreeding season. Table 2 shows observed cases of each agonistic postures and calls at invasions of other animals (Table 1, A, B, and C) and at invasion of conspecifics.

The descriptions are conveniently divided in two parts: Postures (A) and calls (B).

A. Behavioural postures

A.1. *Alert* (Fig. 3): Five types are recognized. These appear each at different situations and possibly caused by different underlying mechanisms. All are exhibited by both sexes, and usually accompanied by *alarm call* (B.1.).

Table 1. Relative frequency of animals elicited agonistic postures of *H. h. himantopus*.

Influence→	A	B	C
Frequency of emersion* ↓	<i>Dangerous to adults</i>	<i>Dangerous to chicks and eggs</i>	<i>Nuisant to families</i>
1 Frequent		Moorhen (<i>Gallinula chloropus</i>)	Spotbill Duck (<i>Anas poecilorhyncha</i>)
2 Occasional	Marsh Harrier (<i>Circus aeruginosus</i>) Jungle Crow (<i>Corvus machrohynchos</i>) Man	Blue-green Snake (<i>Elaphe climacophora</i>)	Spotted Redshank (<i>Tringa erythropus</i>) Greenshank (<i>Tringa nebularia</i>) Redshank (<i>Tringa totanus</i>) Long-billed Dowitcher (<i>Limnodromus scolopaceus</i>) Common Snipe (<i>Gallinago gallinago</i>) Little Ringed Plover (<i>Charadrius dubius</i>) Little Egret (<i>Egretta garzetta</i>) Large Egret (<i>Egretta alba</i>) Teal (<i>Anas crecca</i>) Coot (<i>Fulica atra</i>) Muskkrat (<i>Ondatra zibethicus</i>)
3 Rare	Goshawk (<i>Accipiter gentilis</i>) Kestrel (<i>Falco tinnunculus</i>) Peregrine Falcon (<i>Falco peregrinus</i>) Black Kite (<i>Milvus migrans</i>) Buzzard (<i>Buteo buteo</i>) Carrion Crow (<i>Corvus corone</i>) Domestic Dog (<i>Canis familiaris</i>) Domestic Cat (<i>Felis domestica</i>)	Slaty-backed Gull (<i>Larus schistisagus</i>)	Common Pheasant (<i>Phasianus colchicus</i>) Common Sandpiper (<i>Tringa hypoleucos</i>) Asian Wandering Tattler (<i>Tringa brevipes</i>) Dunlin (<i>Calidris alpina</i>) Mongolian Plover (<i>Charadrius mongolus</i>) Grey Heron (<i>Ardea cinerea</i>) Night Heron (<i>Nycticorax nycticorax</i>) Intermediate Egret (<i>Egretta intermedia</i>) Grey Starling (<i>Sturnus cineraceus</i>) Domestic Pigeon (<i>Columba domestica</i>)

* Percent of the total cases (N=615): frequent, 10% < ; occasional, 10~1%; rare, 1% > .

Table 2. Observed cases of agonistic postures and calls.

Behaviour postures and calls			Situation→	Invasion of other animals*						Invasion of conspecifics		Conspecific decoy set within winter territory		Totals
				A		B		C						
				♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	
Code	Group	Type	Performer→	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	
A. Behaviour postures														
A.1.	Alert	Bobbing head (Fig. 3a-b)		4	2	4	1	3	5	1	—	—	—	20
		Ordinary alert (Fig. 3c)		29	27	15	3	16	3	11	9	3	1	117
		Body sleeked (Fig. 3d-f)		2	2	1	1	3	2	13	10	—	—	34
		Alert upright (Fig. 3g-h)		3	1	19	7	29	16	8	5	—	—	88
		Alerting flight (Fig. 3i-j)		39	44	1	—	1	—	1	—	—	—	86
A.2.	Leaning body (Fig. 4)			—	—	1	—	—	—	5	1 (1)***	—	7 (1)	
A.3.	Lowering head (Fig. 5)			—	—	3	—	—	—	3	4 (1)	—	10 (1)	
A.4.	Repelling water			—	—	—	—	—	—	5	3 (3)	—	8 (3)	
A.5.	Parolling			—	—	—	—	—	—	4	—	—	4	
A.6.	Irrelevant postures	Irr. sleeping (sleeping)**(Fig. 6a)		—	—	—	—	—	—	4	1	—	—	5
		Irr. picking up (food intake)(Fig. 6b)		1	1	17	8	11	2	38	45 (7)	—	—	123 (7)
		Irr. sticking (food intake)		—	—	4	4	1	—	7	5	—	—	21
		Irr. ducking head (food intake)(Fig. 6c)		—	—	3	3	—	—	8	2	—	—	16
		Irr. dipping (food intake)(Fig. 6d)		—	—	—	—	2	1	3	1	—	—	7
A.7.	Attacking	Irr. body shaking (comfort behaviour)(Fig. 6e)		—	—	—	—	—	—	3	2	—	—	5
		Irr. tail shaking (comfort behaviour)		—	—	—	—	1	—	2	1	—	—	4
		Irr. head shaking (comfort behaviour)		—	—	—	—	—	—	2	2	—	—	4
		Irr. preening (comfort behaviour)		—	—	1	1	5	—	5	1	—	—	13
		Irr. wing flapping (comfort behaviour)(Fig. 6f)		2	—	—	—	—	—	—	3	—	—	5
		Irr. nesting (reproductive behaviour)(Fig. 6g)		—	—	3	1	—	—	20	10	—	—	34
		Irr. splashing water (reproductive behaviour) (Fig. 6h-i)		—	—	—	—	—	—	2	2	—	—	4
		Irr. neck extending (reproductive behaviour) (Fig. 6j)		—	—	—	—	—	—	—	1	—	—	1
		Irr. sitting (reproductive behaviour)(Fig. 6k)		—	—	—	—	—	—	6	18	—	—	24
		Irr. heel standing (parental care)(Fig. 6l)		—	—	—	—	—	—	8	2	—	—	10
A.7.	Attacking	Flying over head (Fig. 7a)		—	—	10	2	38	7	7	4	—	—	68
		Kicking head in flight (Fig. 7b)		—	—	4	2	24	2	5	1	—	—	38
		Mounting opponent (Figs. 7c, 8b)		—	—	2	—	6	—	6	4 (6)	—	—	18 (6)
		Sinking under water		—	—	—	—	—	—	3	6 (6)	—	—	9 (6)

A.8. Avoiding	Chasing walking nearby	—	—	7	4	13	4	39	16(17)	—	—	83(17)
	Running toward (Fig. 7d)	—	—	—	—	6	—	8	5(6)	—	—	19(6)
	Rushing (Fig. 7e)	—	—	10	3	38	6	11	3(1)	—	—	71(1)
	Landing nearby	—	—	17	4	22	2	38	21	—	—	104
	Leaping up (Fig. 7f)	—	—	—	—	5	1	8	3(2)	—	—	17(2)
	Offensive flight (Fig. 7g)	4	2	—	—	23	6	27	11	—	—	73
	V shaped flight (Fig. 7h)	3	—	12	—	5	5	3	—	—	—	28
	Opening and shutting wings (Fig. 7i-j)	—	—	12	6	—	2	—	—	—	—	20
	Biting (Fig. 7k)	—	—	—	—	1	—	2	2	—	—	5
	Pecking	—	—	—	—	—	—	—	—	2	—	2
	Kicking (Fig. 7m)	—	—	—	—	—	1	6	4(1)	—	—	11(1)
	Submission (Fig. 8a)	—	—	—	—	—	—	2	2(14)	—	—	4(14)
	Escaping	13	6	—	—	—	—	46	21(12)	—	—	86(12)
	Bending down (Figs. 7l, 8c)	—	—	—	—	—	—	12	8(4)	—	—	20(4)
A.9. Diversionary display	Lying down	—	—	(3)	—	—	—	—	—	—	—	—(3)
	Concealing	—	—	(4)	—	—	—	—	—	—	—	—(4)
	Fleeing	30	26(3)	—	1	—	1	62	39(11)	—	—	159(14)
	Opening and closing wings (Fig. 9a-b)	3	1	—	—	1	—	1	—	—	—	6
	Fluttering wings (Fig. 9c-e)	2	—	1	1	1	1	6	3	—	—	15
	Totals	135	112(10)	147	52	255	67	451	281(92)	5	1	1506(102)
B. Calls	B.1. Alarm call	4	3	1	—	7	1	4	3	—	—	23
	Low pitched alarm call	64	43	16	8	37	20	38	17	—	—	243
	Ordinary alarm call	27	24	4	2	4	1	1	—	—	—	63
	High pitched alarm call	—	—	5	4	—	—	—	—	—	—	9
	B.2. Snake alerting call	2	—	—	—	—	—	12	3	—	—	17
	B.3. Aggressive call	—	—	—	—	—	—	4	3	—	—	7
	Ki ki kyu- call	—	—	—	—	—	—	6	1	—	—	8
	Ki-kiki- call	—	—	—	—	—	1	8	3	—	—	26
	Kue- call	6	2	2	2	2	1	2	2	—	—	7
	Kye- call	3	—	—	—	—	—	3	3	—	—	6
	Kyuru- call	—	—	—	—	—	—	—	—	—	—	10
	Pyra call	—	—	—	—	—	—	—	—	—	—	—
	Pyra call	7	3	—	—	—	—	—	—	—	—	—
	Diversionary call	—	—	—	—	—	—	—	—	—	—	—
	Totals	113	75	28	16	50	24	78	35	—	—	419

* A, B, C, intruders (cf. Table 1). ** Autochthonous behaviour group. *** Chicks or yearlings accompanied by parent(s). Cases made by in parentheses; in n_1 (n_2) n_1 does not include n_2 .

Fig. 3. Alert postures. a-b, bobbing head; c, ordinary alert; d, body sleeked with drooping wings; e, body sleeked standing side by side; f, body sleeked looking the other way; g-h, alert upright; i-j, alerting flight. (scale = 10 cm).

A.1.1 Bobbing head (Fig. 3a-b): Feathers normal or rarely sleeked, trunk held horizontally or rarely obliquely up, and head repeatedly bobbed several centimetres up and down.

The bird performs *bobbing head* toward conspecific invaders and any suspicious animals such as Grey Heron, Moorhen, Night Heron, Common Snipe and man, which appeared in the nesting territory or approached the nest or the chicks.

Bobbing head is occasionally shown during *neck-retracted-resting* (in *comfort postures*, unpubl.), body sleeked (A.1.3., Fig. 3d-f), and *alert upright* (A.1.4., Fig. 3g-h), and sometimes followed by other *alert* postures (A.1., Fig. 3) or *chasing* (A.7.5., Fig. 7, d-j).

Fig. 4. Leaning body.

A.1.2. *Ordinary alert* (Fig. 3c): Feathers sleeked, trunk held slightly obliquely up, neck extended upward, and head kept high.

Ordinary alert is frequently exhibited when recognizing hetero- and conspecific invaders, or sometimes after driving these invaders out of the nesting territory. *Ordinary alert* is usually accompanied by *alarm call* (B.1.).

A.1.3. *Body sleeked* (Fig. 3d–f): Similar to *upright posture* described by Hamilton (1975). Feathers sleeked, trunk held obliquely up, and head kept high.

Body sleeked is exhibited mostly between territory owners and conspecific invaders at the territorial borders or within the territory. The owner and invader stand side by side (Fig. 3e), or looking the other way (Fig. 3f), sometimes still for a while, or walk slowly with this posture. The birds sometimes hold out both wings very slightly from flanks, rarely drooping one wing or both slightly (Fig. 3d). At prolonged conflicts, the birds bent legs slightly, trunk a little obliquely down, and head kept slightly high (Fig. 3e). In the last case this posture sometimes shifts to *irrelevant crouching* (A.6.9., Fig. 6k–l) or *lowering head* (A.3., Fig. 5). *Body sleeked* is sometimes preceded or followed by *alert upright* (A.1.4., Fig. 3g–h), or followed by *irrelevant picking up* (A.6.2.1., Fig. 6b), and *leaning body* (A.2., Fig. 4), *lowering head* (A.3., Fig. 5), and rarely accompanied by *bobbing head* (A.1.1., Fig. 3a–b).

A.1.4. *Alert upright* (Fig. 3g–h): Same as *giraffe posture* described by Hamilton (1975). Feathers fairly sleeked, trunk held fairly obliquely up, head kept highest, and neck extended obliquely up.

The bird occasionally walks slowly with this posture toward the opponent or pays attention to it in standstill. *Alert upright* is rarely accompanied by *bobbing head* (A.1.1., Fig. 3a–b), or the bird rarely runs toward the opponent with this posture. *Alert upright* is exhibited especially in the breeding season between territory owners and conspecific invaders during conflict, or toward other species approaching the nest or chicks or crossing the territory, such as Moorhen, Spotbill-duck, Teal, Common Pheasant, Common Snipe, Long-billed Dowitcher, Blue-green Snake and man.

A.1.5. *Alerting flight* (Fig. 3i–j): Comparable with *flying* postures (unpubl.) or *offensive flight* (A.7.5.6., Fig. 7g) in *chasing* postures (A.7.5.) but legs slightly dangled and neck kept slightly down.

If an animal dangerous for eggs or chicks such as Carrion Crow, Jungle Crow,

Fig. 5. Lowering head. a, lowering head standing side by side; b, lowering head standing face to face. (scale = 10 cm).

Buzzard, Slaty-backed Gull and Marsh Harrier flies over the nesting territory or man enters there, the owner flies around, uttering *high pitched alarm call* (B.1.3.), *aggressive call* (B.3.) or *ordinary alarm call* (B.1.2.). Neighbouring individuals usually join in this flight. *Alerting flight* is usually preceded or followed by *offensive flight* (A.7.5.6., Fig. 7g) in *chasing postures* (A.7.5.).

A.2. *Leaning body* (Fig. 4): Feathers sleeked, trunk held fairly down, or horizontally, or rarely obliquely up, and leaned toward the opponent. The collateral wing occasionally slightly drooped downward and the other wing held perkily slightly, or rarely moved inversely. Legs sometimes slightly bent.

Leaning body sometimes occurs during *irrelevant picking up* (A.6.2.1., Fig. 6b), and *body sleeked* (A.1.3., Fig. 3d-f). *Leaning body* is exhibited by both sexes and is occasionally performed when the territory owner and invader, or two neighbouring families, get close together at the territorial border. Once a bird performed *leaning body* when ready to be mounted back (cf. A.7.3., Figs. 7c, 8b) by others. Occasionally, *Leaning body* is exhibited between pairs during *showing nest spot* (in *nest building postures*, unpubl.), but once the last year young performed this posture toward the mother on the nest when a female performed *showing nest spot*. A female usually exhibits *leaning body* during *splashing water* (in *copulation postures*, unpubl.)

A.3. *Lowering head* (Fig. 5): Feathers fairly sleeked, trunk held fairly downward, and head kept lowest.

Usually two birds, occasionally all members of two families, perform this posture standing side by side (Fig. 5a), face to face (Fig. 5b), or looking the other way and still for a while with legs sometimes slightly bent. This posture is very rarely accompanied by a specific call "pya! pya! pya!.....", and sometimes followed by *irrelevant crouching* (A. 6.9., Fig. 6k-1), interposed by *irrelevant picking up* (A.6.2.1., Fig. 6b), and *leaping up* (A. 7.5.5., Fig. 7f). *Lowering head* is exhibited by both sexes and usually at opposition between territory owners and invaders at the territorial border and rarely toward the moorhen approaching the nest.

A.4. *Repelling water*: Feathers slightly sleeked. Comparable with *lowering head* (A.3., Fig. 5) or *touching water surface* before *preening postures*, unpubl.).

With this posture the bird repels water or pecks the water-surface quickly. *Repelling*

water is exhibited by both sexes and performed by the territory owner toward invaders or reversely, mostly during *chasing* postures, such as *walking nearby* (A.7.5.1.). *Irrelevant preening* (A.6.4.) and irrelevant head shaking (A.6.3.3.) sometimes occur during *repelling water*.

A.5. *Patrolling*: Identical to *slow walking* (in *locomotion* postures, unpubl.). Feathers normal, head kept fairly high, and trunk held nearly horizontally. Similar to *foraging* (in *food intake* postures, unpubl.), but not accompanied by *feeding* posture.

Patrolling was exhibited only by a particular male several times. With this posture and in a slow walking this male frequented a place within his nesting territory which was invaded frequently.

A.6. *Irrelevant postures* (Fig. 6): Nine kinds of *irrelevant postures* were recognized usually at close conflicts between territory owners and conspecific invaders, during fighting between families, and in driving away heterospecific invaders in the nesting territory, such as Spotbill Duck, Teal, Little Egret, Moorhen, Common Pheasant, Asian Wandering Tattler, Muskrat and man. All exhibited by both sexes, except for *irrelevant neck extending* (A.6.8., Fig. 6j) which was only once performed by a female. However, some cases require more precise observations, e.g. *irrelevant sleeping*, *irrelevant shaking*, *irrelevant wing flapping*, and *irrelevant neck extending*.

A.6.1. *Irrelevant sleeping* (Fig. 6a): Observed only several times. Just after the male owner of the winter territory approached a clay decoy set within there and pecked it, the bird exhibited *irrelevant sleeping* for about ten minutes. The posture was not distinguished from actual *sleeping* (unpubl.).

A.6.2. *Irrelevant food intake*: Four distinct types are recognized. All usually accompanied by *low pitched* or *ordinary alarm call* (B.1.1., B.1.2.) and sometimes with actual food intake.

A.6.2.1. *Irrelevant picking up* (Fig. 6b): Most frequent among *irrelevant postures*. Comparable with *picking up* (in *food intake* postures, unpubl.), but feathers more sleeked. The bird approaches the opponent with vigorous picking-up of the water surface or the muddy ground.

A.6.2.2. *Irrelevant sticking*: Comparable with *sticking* (in *food intake* postures). The bird sticks bill into water and behaves as if catching underwater prey.

A.6.2.3. *Irrelevant ducking head* (Fig. 6c): Comparable with *ducking head* (in *food intake* postures). The bird ducks the head into water and vigorously churns the bottom of the water.

A.6.2.4. *Irrelevant dipping* (Fig. 6d): Comparable with *dipping* the bill to catch small benthos (in *food intake* postures). Head kept lowest, trunk held fairly obliquely down.

With this posture the bird swings its head repeatedly, and rubs its bill lightly against the mud.

Irrelevant food intake, comparable with the *food intake*, and aroused during conflicts between territory owners and conspecific invaders at the territorial border, at driving an invader in walking, and at driving a heterospecific animal, e.g. Asian Wandering Tattler, Moorhen, Spotbill Duck, Teal and Blue-green Snake.

Fig. 6. Irrelevant postures. a, irrelevant sleeping; b, irrelevant picking up; c, irrelevant ducking head; d, irrelevant dipping; e, irrelevant body shaking; f, irrelevant wing flapping; g, irrelevant nesting; h-i, irrelevant splashing water; j, irrelevant neck extending; k, irrelevant sitting; l, irrelevant heel standing. (scale = 10 cm).

A.6.3. *Irrelevant shaking* : Three types are distinguished.

A.6.3.1. *Irrelevant body shaking* (Fig. 6e): Comparable with *body shaking* (in *comfort postures*, unpubl.).

A.6.3.2. *Irrelevant tail shaking*: Comparable with *tail shaking* (in *comfort postures*).

A.6.3.3. *Irrelevant head shaking*: Comparable with *head shaking* (in *comfort postures*).

Rarer than other irrelevant postures. It is difficult to distinguish these from the autochthonous postures. *Irrelevant shaking* is usually exhibited just after having driven a conspecific invader or during conflicts between territory owners and invaders at the territorial border. Once a bird exhibited *irrelevant tail shaking* after *alert upright* (A.1.4., Fig. 3g–h) toward Common Pheasant which landed nearby.

A.6.4. *Irrelevant preening*: Identical to *preening feathers* (in *comfort postures*). *Irrelevant shoulder preening*, *irrelevant belly preening*, *irrelevant breast preening*, *irrelevant side preening* and *irrelevant leg preening* are distinguished.

In irrelevant preening the bill touches and actually preens feathers as in autochthonous *preening* but *irrelevant preening* is performed more vigorously and ceases instantly. Various types of *irrelevant preening* are performed, sometimes preceded by *repelling water* (A.4.), or sometimes during *bobbing head* (A.1.1., Fig. 3a–b), usually by territory owners toward conspecific invaders, or reversely, and also at driving away heterospecific invaders such as Spotbill Duck, Teal and Little Egret.

A.6.5. *Irrelevant wing flapping* (Fig. 6f): Rarer than other *irrelevant postures*. Identical to *wing flapping* (in *comfort postures*), and difficult to distinguish from the autochthonous type, performed during conflicts between families, and by the bird to man.

A.6.6 *Irrelevant nesting* (Fig. 6g): Comparable with *gathering nest materials* (in *nest building postures*, unpubl.).

The bird pulls up withered grass from the ground or the water bottom and throws it aside or backward. Performance is more vigorous but only for a time shorter than in the autochthonous posture. This posture appears at intense conflicts between families or between territory owners and invaders in close proximity, sometimes during the performance of other agonistic behaviours. Once *fluttering wings* (A.9.2., Fig. 9d) preceded this posture.

A.6.7. *Irrelevant splashing water* (Fig. 6h–i): Identical to *splashing water* (in *copulation postures*, unpubl.). Neck extended forward, trunk held fairly or a little obliquely down, head kept lowest, and followed by splashing the water surface fractionally with bill.

The intensely threatened or approached birds mostly exhibit this posture toward the opponent, sometimes preceded by *repelling water* (A.4.) or *lowering head* (A.3., Fig. 5). Although the autochthonous posture is performed only by females in *copulation* procedure, *irrelevant splashing water* is taken by both sexes of any ages, e.g. male to male, female to female, female to male, yearling to yearling.

A.6.8. *Irrelevant neck extending* (Fig. 6j): Identical to *extending neck* followed by *splashing water* (in *copulation postures* of female, unpubl.). Rarer than *irrelevant splashing water* (A.6.7, Fig. 6h–i).

When a territory pair and a conspecific invader were at territorial dispute, the female owner once took *irrelevant neck extending* nearby. After driving away a conspecific invader or at conflicts between families, a female sometimes invites the partner male to copulate with her, performing the autochthonous posture and actual copulation occasionally takes place.

A.6.9. *Irrelevant crouching*: Two distinct types are recognized.

A.6.9.1. *Irrelevant sitting* (Fig. 6k): Comparable with *sitting* (in *resting* postures, unpubl.) or *settling* (in *incubation* postures, unpubl.). Occasionally accompanied by *fluttering wings* (A.9.2., Fig. 9c–e).

A.6.9.2. *Irrelevant heel standing* (Fig. 6l): Similar to *heel standing* (in *resting* postures) or *heel stand brooding* (in *parental care* postures, unpubl.), but feathers sleeked. Occasionally accompanied by *fluttering wings* (A.9.2., Fig. 9c–e), and rarely also by one kind of *aggressive calls* “ki ki kyu-, ki ki kyu-....” (B.3.1.).

Irrelevant crouching is exhibited at intense conflicts between families, sometimes during the performance of *body sleeked* (A.1.3., Fig. 3d–f), *lowering head* (A.3., Fig. 5) and other postures. The bird occasionally performed *irrelevant crouching* in the water breast deep.

A.7. *Attacking* (Fig. 7): Eight distinct types are recognized. Although almost all *attacking* postures are exhibited by both sexes, actual pecking was done several times by only a particular male. *Attacking* occurs commonly at nesting territories, between territory owners and invaders and by territory owners toward other animals appearing within the territory, e.g. Coot, Moorhen, Spotbill Duck, Teal, Spotted Redshank, Green-shank, Long-billed Dowitcher, Grey Starling, Little Egret, Intermediate Egret, Little Ringed Plover, Blue-green Snake, Muskrat, man, etc.

A.7.1. *Flying over head* (Fig. 7a): Similar to *head and legs down flight* described by Hamilton (1975). Comparable with *flying* posture in a short distance flight (unpubl.). Legs dangled, neck extended downward, and head fairly lowered.

The bird flies up and flaps over, or sometimes hovers over the opponent for a while and lands nearby. This posture is usually repeated until withdrawal of the opponent.

A.7.2. *Kicking head in flight* (Fig. 7b): The bird kicks the head, the upper-neck or the back of the opponent.

Performed frequently during or after *flying over head* (A.7.1., Fig. 7a) or after or during *offensive flight* (A.7.5.6., Fig. 7g). After kicking, the bird lands near the opponent and sometimes repeats the posture. The attacked bird sometimes performs *bending down* (A.8.3., Figs. 7l, 8c).

A.7.3. *Mounting opponent* (Figs. 7c, 8b): Following *kicking head in flight* (A.7.2., Fig. 7b) or during *flying over head* (A.7.1., Fig. 7a), *mounting opponent* is sometimes performed. The bird rides on the back or the neck of the opponent, but gets off at once. The attacked bird sometimes performs *bending down* (A.8.3., Figs. 7l, 8c).

A.7.4. *Sinking under water*: Usually performed after *mounting opponent* (A.7.3., Figs. 7c, 8b) at vigorous conflicts between families. The bird rides on the back or neck of the opponent and sinks it under the water. Several kinds of *aggressive call* (B.3.), e.g. “ki-kiki-, ki- kiki-”, “kyuru-, kyuru-” or in yearling bird “pipipipi...”, are accompanied by this posture. The attacked bird sometimes bends down for itself (A.8.3., Figs. 7l, 8c).

A.7.5. *Chasing*: Eight types are distinguished.

A.7.5.1. *Walking nearby*: Identical to *walking* (in *locomotion* postures, unpubl.). During *walking nearby* the bird walks slowly toward the opponent, frequently together with *irrelevant food intake* (A.6.2.) and *low pitched alarm call* (B.1.1.) or *ordinary alarm*

Fig. 7. Attacking postures. a, flying over head performed toward Spotbill Duck; b, kicking head in flight performed toward Moorhen; c, mounting opponent performed toward spotbill duck; d, running toward. e, rushing; f, leaping up; g, offensive flight accompanied by pecking and kicking of upper bird toward lower one; h, v shaped flight; i-j, opening and shutting wings; k, biting; l, bending down; m, kicking. (scale = 10 cm).

call (B.1.2.).

A.7.5.2. *Running toward* (Fig. 7d): Comparable with *body sleeked* (A.1.3., Fig. 3d-f), but trunk held fairly horizontally. With this posture the bird runs toward the opponent.

A.7.5.3. *Rushing* (Fig. 7e): Similar to *crouch-run* described by Hamilton (1975). Neck retracted, bill and face pointed forward, and trunk held almost horizontally. With this posture the bird dashes toward the opponent.

A.7.5.4. *Landing nearby*: Identical to *landing* (in *locomotion* postures). In the incubating period or the parental care period, the territory owner who recognized the invader flies up quickly or performs *offensive flight* (A.7.5.6., Fig. 7g) and lands near it, sometimes followed by *opening and shutting wings* (A.7.5.8., Fig. 7i-j). The invader usually flees before or just after the owner's landing. If the invader does not flee, the owner performs *landing nearby* in succession.

A.7.5.5. *Leaping up* (Fig. 7f): The bird leaps up in the air several times. In case of conflict between conspecifics, *leaping up* is sometimes made before or during *lowering head* (A.3., Fig. 5) or *body sleeked* (A.1.3., Fig. 3d-f) and followed by mutual *kicking* (A.7.8., Fig. 7m). *Leaping up* is rarely accompanied by call "pya pya pya...".

A.7.5.6. *Offensive flight* (Fig. 7g): Similar to *alerting flight* (A.1.5., Fig. 3i-j), but neck and legs held more horizontally, wings bit vigorously, and usually accompanied by *aggressive call* (B.3.) “kye-kye-kye-kye-.....”, or by *high pitched alarm call* (B.1.3.) “kikikikiki.....”. When repulsing enemies such as Japanese Jungle Crow, Slaty-backed Gull and Black-tailed Gull, the bird flies up and rapidly pursues the opponent, sometimes *pecking* (A.7.7.), *kicking* (A.7.8., Fig. 7m) or *kicking head in flight* (A.7.2., Fig. 7b) occurred during *offensive flight*.

The owner of the nesting territory made *offensive flight* against heterospecific invaders such as Little Ringed Plover, Kentish Plover, Moorhen and Spotbill Duck, or conspecific invaders, especially in the early phase of the parental care period. At the termination of *offensive flight*, *landing nearby* (A.7.5.4.) or *opening and shutting wings* (A.7.5.8., Fig. 7i-j) occurred. Against the conspecific invaders, *kicking head in flight* (A.7.2., Fig. 7b) is occasionally performed. Then the attacker flies upward, and the attackee flies up in a moment, both making seesaw pursuit in performing *kicking* (A.7.8., Fig. 7m), *pecking* (A.7.7.) or *biting* (A.7.6., Fig. 7k).

A.7.5.7. *V shaped flight* (Fig. 7h): Similar to *dihedral wing flight display* (Hamilton 1975). Wings held obliquely up in V shape.

Detecting conspecific invaders or other suspicious enemies such as Moorhen and Spotbill Duck in the nesting territory, the owner flies up and glides hurriedly to the opponent straightforward, keeping the same posture mentioned above. This posture is performed frequently in incubating or parental care period. The opponent flees or hides into reeds usually before the arrival of attacker. The attacker lands near the opponent and usually performs *opening and shutting wings* (A.7.5.8., Fig. 7i-j).

A.7.5.8. *Opening and shutting wings* (Fig. 7i-j): Usually performed at the final stage of *running toward* (A.7.5.2., Fig. 7d), *rushing* (A.7.5.3., Fig. 7e), landing after *v shaped flight* (A.7.5.7., Fig. 7h), or sometimes at *landing nearby* (A.7.5.4.). The bird opens and shuts one wing or both quickly.

With this posture the bird chases down the opponent, usually Moorhen, in reeds. *Leaning body* (A.2., Fig. 4) or *irrelevant picking up* (A.6.2.1., Fig. 6b) rarely follows this posture.

A.7.6. *Biting* (Fig. 7k): Performed at vigorous combats between families, occasionally during or after *mounting opponent* (A.7.3., Figs. 7c, 8b) or *sinking under water* (A.7.4.).

With bills opened birds bite in the head, wing, or tail sometimes mutually. Once a bird bit at a juvenile Spotbill Duck.

A.7.7. *Pecking*: Performed with bills closed, occurred sometimes during *offensive flight* (A.7.5.6., Fig. 7g), but actual *pecking* observed only several times, when the owner of a winter territory perceived a clay decoy set within the territory. *Irrelevant sleeping* (A.6.1., Fig. 6a) occurred just after *pecking*.

A.7.8. *Kicking* (Fig. 7m): Performed at conflicts between families, territory owners and invaders, and rarely between the owner and an invading Long-billed Dowitcher, usually accompanied by *aggressive call* (B.3.) and occasionally preceded by *leaping up* (A.7.5.5., Fig. 7f) or *leaning body* (A.2., Fig. 4). This is also performed sometimes during

Fig. 8. Avoiding postures. a, submission; b, mounting opponent; c, bending down. (scale = 10 cm).

offensive flight (A.7.5.6., Fig. 7g).

A.8. *Avoiding* (Fig. 8): Six different types are recognized. Among those, *lying down* (A.8.4.) and *concealing* (A.8.5.) are performed only by chicks.

A.8.1. *Submission* (Fig. 8a): Head kept fairly low, neck retracted slightly, and feathers of mid back or rump ruffled and erected.

The volant juvenile bird sometimes performs *submission* when approaching the parent(s), or approached by parent(s) or by other dominant individuals. Although adults scarcely exhibit *submission*, the member of a pair rarely exhibits this posture each other, when both approach nearby, e.g. at alternation of *incubation* behaviour (unpubl.). Or a partner catching and nipping a large food animal makes this posture when approached by the other partner of the pair.

A.8.2. *Escaping*: The approached or threatened bird flees in jumping, walking, or light running for a short distance, rarely with *submission* (A.8.1., Fig. 8a).

A.8.3. *Bending down* (Figs. 7l, 8c): The bird attacked by *kicking head in flight* (A.7.2., Fig. 7b), *mounting opponent* (A.7.3., Figs. 7c, 8b) or *sinking under water* (A.7.4.) often bends its legs and leans over.

A.8.4. *Lying down*: The early stage chick lies down on the ground stimulated by *alarm call* (B.1.) of parent(s).

When a human observer approaches chicks, they lie down in motionless until bodies are touched with his fingers.

A.8.5. *Concealing*: By *alarm call* (B.1.) of parent(s), not yet volant chicks of the later stage escape from the enemy in walking hurriedly or swimming toward the opposite shore, and conceal themselves among reeds or bushes.

Chicks performing *concealing* exhibit *lying down* toward a human observer, if approached.

Table 3. Observed cases of avoiding postures caused by agonistic postures.

	Avoiding						Totals
	Submission	Escaping	Bending down	Lying down	Concealing	Fleeing	
Body sleeked	—	3	—	—	—	—	3
Alert upright	—	1	—	—	—	—	1
Leaning body	—	1	—	—	—	—	1
Lowering head	—	2	—	—	—	1	3
Repelling water	—	1	—	—	—	—	1
Irrelevant picking up	—	6	—	—	—	2	8
Irrelevant dipping	—	1	—	—	—	—	1
Irrelevant preening	—	1	—	—	—	—	1
Irrelevant nesting	—	3	—	—	—	1	4
Flying over head	—	3	2	—	—	—	5
Kicking head in flight	—	—	3	—	—	—	3
Mounting opponent	—	—	4	—	—	2	6
Sinking under water	—	—	4	—	—	—	4
Walking nearby	12	16	—	—	—	39	67
Running toward	2	10	—	—	—	1	13
Rushing	4	7	—	—	—	6	17
Landing nearby	—	6	—	—	—	42	48
Offensive flight	—	1	—	—	—	16	17
V shaped flight	—	2	—	—	—	—	2
Ordinary alarm call	—	—	—	3	4	—	7
Totals	18	64	13	3	4	110	212

A.8.6. *Fleeing*: The invader usually flies away, just after approached or attacked by the owner of the territory or dominant individuals, but sometimes takes off and flees soon before the owner's access. Birds approached suddenly by a man or threatened by other enemies such as Marsh Harrier, Black-eared Kite and crows, occasionally take off and perform *alerting flight* (A.1.3., Fig. 3i-j), but they sometimes fled away.

The bird *flees* against dangerous animals such as crows, raptors and man, but rarely exhibits other *avoiding* postures against heterospecific animals. Table 3 shows the postures which elicited avoiding postures at conflicts between families, or territorial owners and invaders.

A.9. *Diversionary display* (Fig. 9): Two types, exhibited by both sexes, are distinguished.

A.9.1. *Opening and closing wings* (Fig. 9a-b): Opening and closing one wing or both more slowly and continuously than in *opening and shutting wings* (A.7.5.8., Fig. 7i-j) in *attacking* (A.7.). Exhibited at invasion of other animals or conspecifics into the territory, or just before driving away conspecific or heterospecific invaders such as Spotbill Duck, or around a human observer. The bird sometimes utters low calls sounding "gyu- gyu-gyu-....." or "gye- gye- gye-...".

A.9.2. *Fluttering wings* (Fig. 9c-e): The bird stands and opens one wing or both either fully or partly, and flutters in standstill. Performed more frequently than *opening*

Fig. 9. Diversionary displays. a-b, opening and closing wings; c-e, fluttering wings. (scale = 10 cm).

and closing wings (A.9.1., Fig. 9a-b) and sometimes made during *irrelevant crouching* (A. 6.9., Fig. 6k-1) or occasionally accompanied by *irrelevant picking up* (Fig. 9b). Probably same to *wing-flagging* and *extended wing display* (Hamilton 1975), but exhibited rather during conflicts between families than toward approaching man, sometimes accompanied or preceded by call “gye-gye-gye-...”.

B. Calls

B.1. *Alarm call*: According to the intensity, three types are recognized.

B.1.1. *Low pitched alarm call*: One note/s, “ki, ki, ki, ki,....”. This appears at low intensity alerting, e.g. approach of an invader to the territory, or followed to *ordinary alarm call* (B.1.2.).

B.1.2. *Ordinary alarm call*: Two notes/s, “ki ki, ki ki, ki ki,....”. Appearing at high intensity alerting such as before driving away conspecific invaders and other animals such as Spotbill Duck, Moorhen, Greenshank and crows.

B.1.3. *High pitched alarm call*: More than three notes/s, “kikikikikiki.....”. Uttered at alerting of the highest intensity, as in case of driving away some dangerous animals such as Moorhen, crows and man invading within or over the nesting territory.

Alarm call is uttered frequently in breeding sites but rarely in overwintering sites, and usually accompanied by alert (A.1.). As shown in Table 4, *ordinary alarm call* (B.1.2.) is mostly associated with *walking nearby* (A.7.5.1.) in *chasing* (A.7.5.), *irrelevant food intake* (A.6.2.), and *offensive flight* (A.7.5.6., Fig. 7g). Birds usually utter *ordinary alarm call* (B.1.2.) immediately after hetero- and conspecific invaders or enemies appear in nesting territories, sometimes preliminarily preceding to *attacking* (A.7.), *irrelevant postures* (A.6.) or *diversionary display* (A.9). When a human observer entered in the breeding site, birds behave equally as described above. Usually *low pitched alarm call* (B.1.1.) follows *ordinary alarm call* (B.1.2.), if invaders go away from the nesting territories or an observer sits quietly or conceals in a blind. *High pitched alarm call* (B.1.3.) is well connected with specific postures such as *alerting flight* (A.1.5., Fig. 3i–j) and *offensive flight* (A.7.5.6., Fig. 7g), so that is comparable with *kye- call* (B.3.4.) in *aggressive call* (B.3.).

B.2. *Snake alerting call*: Soft and high call sounding “ku-ku-ku-.....kukukukuku”, “kikikikiki”, “gugugugu”, and “gugu gugu gugu”.

This call is heard only when chasing a snake swimming across the nesting territory, and is usually accompanied by *body sleeked* (A.1.3., Fig. 3d–f), *alert upright* (A.1.4., Fig. 3g–h) or *walking nearby* (A.7.5.1.), sometimes interposed by *flying over head* (A.7.1., Fig. 7a), *kicking head in flight* (A.7.2., Fig. 7b), *leaping up* (A.7.5.5., Fig. 7f), and *landing nearby* (A.7.5.4.). When one individual utters *snake alerting call*, the partner of the bird and neighbouring families usually join together.

B.3. *Aggressive call*: Six types are recognized.

B.3.1. *ki ki kyu-*, or *ki ki ki kyu- call*: Produced at conflicts among families or individuals on the territorial border, and occasionally connected with *irrelevant crouching* (A.6.9., Fig. 6k–l).

B.3.2. *ki- kiki- call*: Produced at more vigorous fighting between families than *ki ki kyu- call* (B.3.1.) and accompanied by *leaping up* (A.7.5.5., Fig. 7f), *mounting opponent* (A.7.3., Figs. 7c, 8b), *sinking under water* (A.7.4.), rarely interposed by *kicking* (A.7.8., Fig. 7m).

B.3.3. *kue- call*: At fighting between families, observers or family members not concerned actual fighting utter this call repeatedly, “kue-, kue-,.....”, which sounds as if scoffing.

B.3.4. *kye- or kyu- call*: The bird utters this slightly wobbled call repeatedly, “kye-, kye-,” or “kyu-, kyu-,.....”, when pursuing enemies such as crows and Slaty-backed Gull in the air, or when nose-diving toward enemies such as a cat and a man on the ground, also when making alerting flight (A.1.5., Fig. 3i–j) or *offensive flight* (A.7.5.6., Fig. 7g).

B.3.5. *kyuru- call*: Produced repeatedly “kyuru-, kyuru-,.....” at conflicts between families, or at flying back from nose-diving to an enemy on the ground.

B.3.6. *pya call*: With several notes as “pya, pya, pya,....”, rarely connected with

Table 4. Observed cases of calls associated with agonistic postures.

Behaviour postures ↓	Alarm call			Snake	Aggressive call				Diver- sionary call	Total		
	Low pitched alarm call	Ordinary alarm call	High pitched alarm call	Snake alerting call	Ki ki call	Ki- kiki- call	Kue- call	Kye- call			Kyuru- call	Pyu- call
Ordinary alert	9	25	3	—	—	—	—	—	—	—	3	40
Body sleeked	2	12	1	1	3	1	2	—	—	—	—	22
Alert upright	1	34	8	1	1	—	—	2	—	—	—	47
Alerting flight	2	54	14	—	—	—	—	6	3	—	—	79
Lowering head	—	—	—	—	—	—	—	—	—	2	—	2
Repelling water	—	—	—	—	—	—	—	—	—	1	—	1
Irrelevant picking up	—	7	1	—	—	—	—	—	—	—	1	9
Irrelevant preening	—	2	1	—	—	—	—	—	—	—	—	3
Irrelevant sitting	—	1	—	—	4	—	—	—	—	—	—	5
Irrelevant heel standing	—	—	—	—	2	—	—	—	—	—	—	2
Flying over head	—	6	2	—	—	—	—	—	—	—	—	8
Kicking head in flight	1	—	—	—	—	—	—	1	—	—	—	2
Mounting opponent	—	1	—	—	1	2	1	—	1	—	—	6
Sinking under water	—	—	—	—	1	2	1	—	2	—	—	6
Walking nearby	1	8	—	1	—	—	—	—	—	—	—	10
Landing nearby	—	5	—	—	—	—	—	—	—	—	—	5
Leaping up	—	—	—	—	—	1	—	—	—	—	1	2
Offensive flight	—	10	5	—	—	—	—	5	—	—	—	20
Opening and closing wings	—	2	—	—	—	—	—	—	—	—	2	4
Fluttering wings	—	—	—	—	2	—	—	—	—	—	3	5
Totals	16	167	35	3	14	6	4	14	6	3	10	278

leaping up (A.7.5.5., Fig. 7f) or *lowering head* (A.3., Fig. 5).

Although exhibited at combats between families or repulsing enemies, those types of aggressive call are uttered each at different situation, each connected each with specific postures (Table 4).

Until the change of call, juveniles utter identical calls sounding “pi, pi, pi, pi...”, even at different situations at which adults elicit *ki ki kyu-* call (B.3.1.), *ki-kiki-* call (B.3.2.), *kue-* call (B.3.3.) or *kyuru-* call (B.3.5.).

B.4. *Diversionary call*: Low and soft call sounding “gye, gye, gye,” or “gue, gue, gue,”.

In the parental care period parent(s) uttered this call on the ground to divert attention of the human observer from the nest or chicks, sometimes associated with *opening and closing wings* (A.9.1., Fig. 9a–b) and *fluttering wings* (A.9.2., Fig. 9c–e, Table 4).

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セイタカシギの行動社会学的研究

I. 敵対行動

1) 千葉県市川市で、1985年9月から1987年12月にかけて行ったセイタカシギの敵対行動に関する研究結果を述べた。

2) 敵対行動は行動姿勢と声に分けて記述した。

3) 敵対姿勢は同種または異種個体との関係で生じるもので、1. 警戒姿勢、2. 傾斜姿勢、3. 低頭姿勢、4. 水面につき、5. パトロール、6. 転移姿勢、7. 攻撃姿勢、8. 忌避姿勢、9. 牽制姿勢に区分された。

4) 敵対発声は、1. 警戒声、2. ヘビ警戒声、3. 攻撃声、4. 牽制声に区分された。

5) これらの行動姿勢と声が生じる状況も併せて述べた。

6) 同種個体間で生じる忌避姿勢とその発現に関連した敵対姿勢についてまとめた。

7) 各敵対発声と関連して生じる行動姿勢について述べた。

北川珠樹：市川高校、〒272 市川市東菅野 4-1-1