The opportunity was taken of making a complete count of other river inhabiting birds seen during the entire traverse. This census has been recorded in full detail by species for each section of the rivers and will form a most valuable basis for future studies.

I would like to offer my sincere thanks to the members of the Society who helped take the census and also to Mr. B. D. Hankins for much patient observation during the breeding season. Thanks are also due to the many landowners who gave permission to cross their properties during the census.

A CONDENSED CENSUS OF RIVER INHABITING BIRDS ON THE TUTAEKURI AND NGARURORO RIVERS

From the rivermouths to Ngaroto and to Whanawhana respectively, 20th and 21st October, 1962

Species	*Tutaekuri*	*Ngaruroro*
Black-fronted Dotterel	63	39
Banded Dotterel	372	514
Pied Stilt	274	323
Bar-tailed Godwit	–	3
White-faced Heron	8	7
Black Shag	21	18
Little Shag (a) Little Pied	6	–
(b) White-throated	16	9
Canada Goose	–	3
Grey Duck/Mallard	24	56
Paradise Duck	71	111
Shoveller	2	7
Black-backed Gull	34	2125
Black-billed Gull	4	–
Red-billed Gull	–	–
White-fronted Tern	–	–
Caspian Tern	1	–
Pukeko	–	3
Pipit	20+	12

★

INDIVIDUAL AND SOCIAL BEHAVIOUR OF THE SOUTHERN BLACK-BACKED GULL

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INTRODUCTION

This paper presents some of the results arising from a two-year study of the general biology of the Southern Black-backed Gull *(Larus dominicanus)* in the Wellington area, in particular the roosting and breeding colony on Somes Island in Wellington Harbour. Aspects discussed include the principal calls and postures, hostile behaviour, roosting and general flock activities and some inter-specific relationships. An attempt has also been made to throw further light on the relationship of *L. dominicanus* to its northern hemisphere relatives. Though purely a southern hemisphere species, the closest relatives of the Southern Black-back lives in the northern hemisphere, forming the complex inter-breeding assemblage of subspecies of the Herring Gull

(L. argentatus) and the Lesser Black-backed Gull *(L. fuscus)* Of the two northern species *L. fuscus* is most closely similar to *L. dominicanus* in plumage, but comparison of the literature on *L. argentatus* and *L. fuscus* with the observed behaviour of *L. dominicanus* described below shows that as far as breeding behaviour is concerned no significant differences can be detected between the two northern species and the southern species. Although the relative degrees of relationship of the three species have been in dispute, results of this study indicate that in the use of the two alarm calls, *L. dominicanus* resembles *L. fuscus.* This is in agreement with the findings of White (1925) who studied all three species (plus the Great Black-backed Gull *L. marinus*) in the field and decided the similarities between *L. dominicanus* and *L. fuscus* are closer than those between *L. dominicanus* and *L. argentatus.*

Generally speaking, young gulls join roosting and feeding flocks as soon as they leave the breeding areas, but most of the principal calls and postures are not performed until the age of about six months (or in the case of some calls, two years) has been reached. Calls and postures associated only with breeding are of course given by breeding birds alone, i.e. birds four years or older (or possibly some birds at the end of their third year). Numerous immature birds, i.e. usually those at the end of their second or third year, display some of the calls and postures concerned with pair formation, but these performances are brief and incomplete.

Within the southern hemisphere the Southern Black-back has representation on all major land masses including Antarctica. In New Zealand the gull may be recorded virtually anywhere (except perhaps some of the highest parts of the Southern Alps) and it is one of the most obvious birds along the coast. It is the largest of the three gulls in New Zealand (the other two being the Red-billed Gull *L. scopulinus* and Black-billed Gull *L. bulleri*) and as well, is numerically strong and commanding of attention by virtue of its contrasting plumage, strident call and noisy scavenging behaviour. No coastal town in New Zealand is without its population of gulls, which line the wharves and flock around rubbish dumps, but which are equally at home when resting on beaches, searching for grubs in a ploughed field, or paddling many miles inland in the upper reaches of a river. We are confronted then with a bird which is well known to many people by sight and reputation, but about which only a few brief works have been published.

In 1938 Steinbacher observed the breeding behaviour of the following six species in a Berlin aviary: Herring Gull, Lesser Black-backed Gull, Great Black-backed Gull, Glaucous Gull *(L. hyperboreus),* Laughing Gull *(L. atricilla),* and *L. dominicanus.* Although non-breeding, *L. hyperboreus* and *L. dominicanus* exhibited the same pair forming behaviour as the first three mentioned species, and Steinbacher concluded that there were no behavioural differences between any of the species. In the course of a short discussion of the relationships of some Ethiopian and Palaearctic birds, White (1952) was unable to detect any "obvious differences" in behaviour between *L. fuscus* and *L. dominicanus.* Harris (1954) recorded that in *L. dominicanus* the male usually calls "Kaloo Kaloo," while the female call "Kla Kla Kla Kla," much the same as a hen. This information is not in agreement with the findings of all other observers and is inexplicable in view of the fact that both sexes have the same calls save only for

the male copulation call. Darling (1938), Paludan (1951), Tinbergen (1935 and later works) and others have, after intensive study, found that the behaviour patterns of *L. argentatus* and *L. fuscus* are practically identical, and the results of this study have shown that the behaviour of *L. dominicanus* is so close to that described for these two species that any differences are of degree rather than kind. Following recent comparative studies on the behaviour of South American and Pacific Laridae, Moynihan (1962), in a brief statement, agreed with Steinbacher (1938) that the behaviour of *L. dominicanus* is very similar to that of *L. argentatus* and *L. fuscus*, and considers the same range of hostile and sexual behaviour patterns occur in *L. dominicanus* and *L. argentatus* "in almost exactly the same social situations, with approximately similar (but probably not always identical) frequencies."

Study of the behaviour of the colonial nesting Southern Black-back is made complex by differences between individual voices and the circumstances of the moment which often cause variations in the intensity of the principal calls and postures. Because of interference from neighbouring birds, those pairs nesting in the middle of a group of breeding gulls suffer more interruptions than those on the edge, and thus observations of behaviour were made as far as possible on those pairs nesting near the edge of a group.

The nomenclature used is that of Tinbergen (1953, 1960 a) and Moynihan (1956) except in the case of calls of alarm and attack. In order to help interpret the changes of pitch involved in some of the major calls, use has been made of the musical stave (see Fig. 1) and in this respect the author is grateful for the advice of Prof. D. G. Lilburn, Music Dept., Victoria University of Wellington. Since individual voices vary in pitch no purpose is served by indicating the clef (i.e. treble or bass, etc.) for each call but this has been described in general terms in the accompanying text. The advantage of this system of illustration over the use of phonetic symbols alone is that the "form" of the call is immediately discernible. Moynihan (1956 and 1958 a & b) used diagrams of a similar type in describing the calls of several North American gulls.

On the first occasion in which an animal or plant is introduced into the text, the accepted common name (if in existence) as well as the scientific name is given, but on subsequent occasions (excepting cases where ambiguity may arise) only the common name is used. In addition, the use of the word "gull" refers to the Southern Black-back unless otherwise stated.

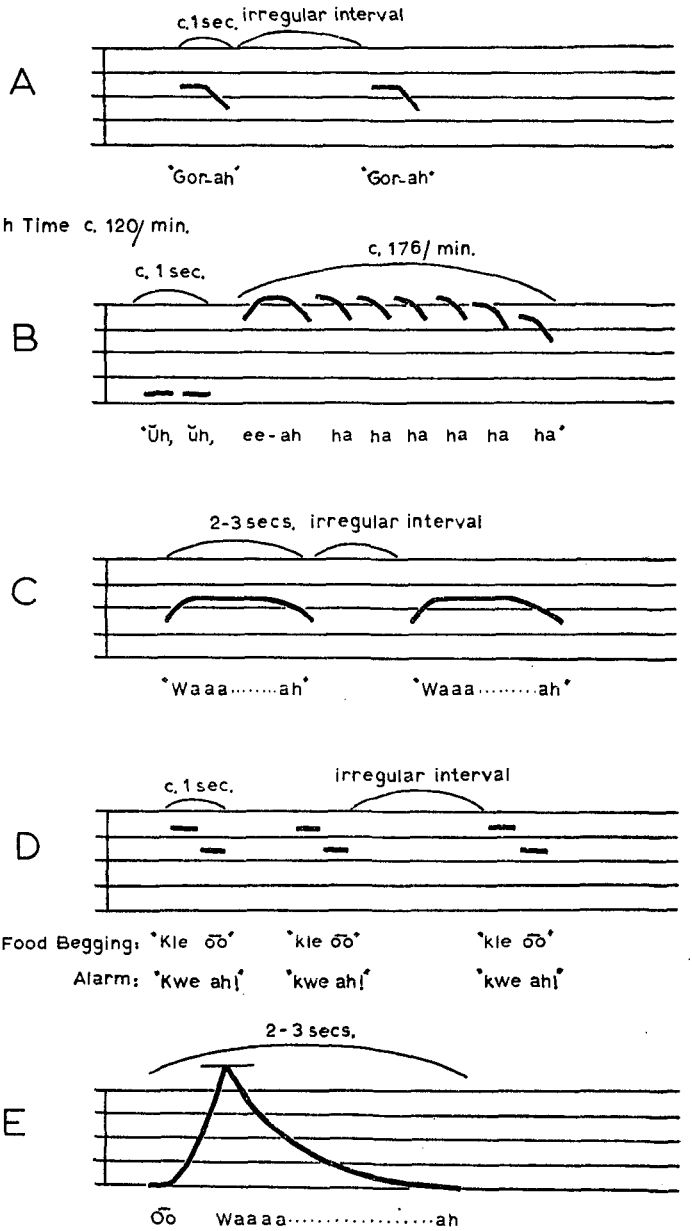
CALLS AND POSTURES

A — *GENERAL AND PAIRFORMING*

1. *The Call Note* (Fig. 1a)

This call is a single, sometimes repeated, hoarse sounding "gor-ah ! gor-ah !" heard occasionally throughout the year, from birds two years of age and older but mainly from breeding adults. It is a non-contagious cry given by a breeding bird sitting or standing in a "relaxed" posture (Plate 1A), alone or with its mate, in or near the nest, and if answered, the mew or long call (described below) may be used. When giving the call, the head is thrust forwards with the neck straight, and then bent slightly down just as the call is emitted, but the manner of delivery varies slightly. A male was observed to

Change in Pitch of Some Calls



A — Call note; B — Long call; C — Mew call; D — Food-begging and alarm call; E — Charge call

give 10 call notes, then break into a long call. In view of the sound emitted, and the attitude adopted, it is considered that this call may represent a low intensity form of the long call. Paludan (1951) has interpreted this call in the Lesser Black-back as "an expression of loneliness for an absent partner," and Tinbergen (1953) records that the cry is contagious in the Herring Gull but does not consider it to be a method by which individual gulls keep in touch with each other. Evidences either for or against these assumptions are scanty in the Southern Black-back, but lone flying birds occasionally give a call sounding rather like the call note.

2. *Oblique-cum-Long-Call* (Fig. 1b)

This very contagious cry is heard throughout the year, but especially in the breeding colony which is continually swept by it. Fledglings one to two months old defend food with a tremulous scream which is a juvenile form of the long call, but most do not develop the call until late in the first year, up to which time their efforts are squeaky and incomplete. An almost complete long call was heard from a gull some five months old. In most instances the gulls give the call as a challenge, e.g. in the course of defending food, themselves, or chicks from others, but it is also one of the initial displays of pair formation. The first soft notes of the call are given with the beak partly opened and tilted slightly downwards. The head is then bent down under the chest so that the beak almost touches the ground. A high pitched note is sounded, then the head is snapped up and a series of loud cries are given with the wings drooped slightly and the whole body shaking at every fresh cry. The complete call (Plate 2A) sounds like "uh, uh, ee-ah-ha-ha-ha-ha-ha-ha," and is the most commonly used call in gull flocks. Stead (1932) describes it as a musical "kaloo-kaloo-kloo-kloo . . ," the last syllable being repeated several times.

3. *Facing-Away*

This is a form of recognition which often occurs when one member of a breeding pair lands beside its mate. One or both birds will, with the body slightly tensed, turn the head away from the other so that the two birds look in opposite directions (Plate 1C). While this happens their bodies may be side by side or facing one another. After this they may commence preening, mewing or head-tossing. It is not known at what age facing-away is first exhibited but it probably occurs only in birds of breeding age. This posture has no associated call, and is similar to the "erect posture" of *L. atricilla* (Noble and Wurm, 1943) but it is not mentioned by Paludan (1951) for the Lesser Black-back, and only indirectly in the Herring Gull by Tinbergen (1953) as when the female of a forming pair approaches a male in the food-begging attitude, the male "may stretch himself . . . looking around he seems to be in search of potential opponents." However, Tinbergen (1960 a & b) has described the posture in both the Lesser Black-back and Herring Gull as one of appeasement during pair forming ceremonies.

4. *The Mew Call* (Fig. 1c)

This is a non-contagious, wailing, drawn out "waaaaah," given with the neck extended and the head pointed slightly downwards (Plate 2C). It is usually given by a bird walking slowly towards the nest or its mate, and never on water (c.f. choking and long call).

It is used in courtship, nest-relief, and calling the chicks to food or shelter, and is given by birds two years of age and older. Tinbergen (1960 a) states that mewing is a threat posture in the pair forming ceremonies of Herring Gulls.

5. *Choking*

Choking is an action concerned mainly with nest building (and nest relief), but also with aggression, and sounds like "wo-wo-wo-wo-wo- -." It is observed in birds two years of age and older. It may occur on land or sea, when a bird is sitting, standing or walking by itself or with its mate, and is contagious to a certain extent. As a bird begins to "choke" it leans forward and the chest and floor of the mouth are lowered so that the throat seems swollen, and the head and chest move rapidly and rhythmically up and down for several seconds accompanied by the above call, which rises and falls in pitch (Plate 2B). Choking is a threat posture of low to medium intensity (as will be discussed in the section on hostile behaviour) and when used in aggressive circumstances is no different in appearance to non-aggressive choking. An observation of choking used in aggressive circumstances by both male and female is as follows. The male of a pair was incubating with the female sitting nearby, when a strange male approached the female, mewing as he did so, and causing the female to choke. Suddenly she stood up and walked over to the nest, whereupon the resident male sprang from the nest, choked vigorously, then drove the strange gull away.

6. *Food-Begging (Head-Tossing)* (Fig. 1 d)

This is a non-contagious soft fluty cry sounding like "kle-oo, kle-oo," heard when females are begging food from their mates, and also prior to copulation (Plates 3A & B). Head-tossing (but not feeding) is seen occasionally throughout the year, and occurs from nearly two years of age onwards. When begging food, the female moves to the male, tossing her head upwards, at the same time emitting the food-begging call. The male responds with similar head-tossing and calls. The female's solicitations show great variation of intensity — she may, between flicks of the head, peck frantically at the male's beak, chest, feet and the ground, while head-tossing can vary from actually hitting the male under the chin with the head, or throwing the head up so that the beak is vertical, to small upward movements of the beak from the horizontal. Generally head-tossing in the male is of the last mentioned type. The male responds to these insistent advances by walking to and fro as if to avoid the female, and by sinuous sideways movements of the head. His neck swells, and suddenly a lump of food is regurgitated which the female greedily consumes, often reaching into his beak, the sooner to grasp it. Occasionally the pair may share the food, and sometimes the male may regurgitate food with no prompting from the female, in which case she walks slowly to the food and eats it in a leisurely manner. Once a female was seen to regurgitate food, which the male consumed, however her action was not prompted by head-tossing, but was probably a disgorging of indigestible food fragments. By the time small chicks are present in a nest all copulatory activity has been abandoned (some four weeks previously), but females with small chicks have occasionally been seen begging food from the male.

7. *Male Copulation Call.*

This non-contagious call is given by the male only during copulation, and is a rapidly repeated "cor-cor-cor," which as copulation progresses, becomes a louder, harsh sounding "car-car-car." Gulls two years of age have not been seen to copulate, though they exhibit other breeding behaviour, albeit briefly and incompletely, and it is considered that complete copulation would not occur before the end of the third year, which in some cases may be the first breeding year. Copulation is usually preceded by head-tossing, following which the male mounts the female, beginning to call as he does so. The male's wings begin to flap slowly and he moves backwards from the shoulders of the female. Immediately before copulation his tail begins to wag from side to side, and is thrust to the right or to the left under the female's tail, fanning out as it does so, (Plates 3C & D). The male remains mounted for about one and a half minutes, during which time copulation occurs an average of five times. Ten to 50 seconds may elapse after mounting before the first copulation. While copulating, the female may flick her head upwards, or peck gently at the male's chest and beak. It was found difficult to recognise a constant post-copulation display except that, as Tinbergen (1953) mentions for the Herring Gull, the birds usually preen after a while. However the birds have been seen to adopt the face-away attitude, commence food-begging, or look at their feet. A curious post-copulation display (which was probably displacement in nature) occurred as follows: After a successful copulation, the male dismounted, adopted a crouch position and began to choke vigorously, at the same time wagging his tail from side to side. He then stood, gazed at his feet, and wagged his tail a second time. Armstrong (1947) states that "among gulls of various species" the sight of a pair copulating, the utterance of sex calls, and food-begging arouses aggression in neighbouring gulls. As yet there is no evidence to support this view in the Southern Black-back, and Tinbergen (1952) when referring to the Herring Gull states that "coition is done not only on the territory, but also in the flock and is very rarely interfered with."

B — *ALARM AND ATTACK*

Before describing these calls, it is necessary to mention certain differences in the alarm calls of gulls closely related to the Southern Black-back. Darling (1938) stated that the patterns of display in the Lesser Black-back and Herring Gull are very similar, and Paludan (1951), who found the "display and notes" identical in the two species, gives as the notes of alarm and anxiety for both species:

(a) Hee-ow, or Kee-ow. (b) Gah-gah-gah.

He considers that (b) "is fully developed in both species, although it may be heard most often from the Herring Gull," but does not describe the conditions under which each call is used. Tinbergen (1953) states that although both species have the same calls, their thresholds are different, and he describes the charge call of the Herring Gull as a modification of the "keew - -," and the alarm call as a "hoarse, rhythmic 'hahaha - hahahaha!'" These are the same two calls mentioned by Paludan, but Tinbergen goes further to say that Herring Gulls react to intruders with the "hahaha" call, mingled with occasional "keews," whereas the Lesser Black-backs usually give the "keew" call, and utter the "hahaha" call only rarely.

The alarm calls of the Southern Black-back are in themselves identical to those described for the two above species, but comparison with the literature indicates that in frequency of occurrence they are closer to those of the Lesser Black-back than to those of the Herring Gull.

1. *Alarm Calls*

The posture of an alarmed bird is one associated with preparation for flight. Plate 1B shows a slightly alarmed bird, which even at that stage shows a strikingly different posture to that of a resting bird (Plate 1A). There are in effect two alarm calls used, and separation of the two by degree of intensity of alarm is difficult at present, but further work will probably throw light on the matter.

The first alarm call (the anxiety call) is mostly given by breeding birds which are usually in flight, and is a chattering, slightly contagious "ha ha haha." Stead (1932) and Oliver (1955) describe the call as "kok-kok-kok," and "ha-ha-haro," respectively. The second call (the alarm call Fig. 1d) is given mainly on the ground, but also in flight, and is very contagious. It is a loud, repeated staccato "kwe-ah, kwe-ah . ." which causes all the birds to stretch their necks, look about, and take to the air uttering the same cry. The call does not develop until the second year, but chicks of two to three months in the company of adults, give a hoarse squeaky cry while circling above an intruder in the colony. Chicks only give the cry if the adults start first, i.e. chicks never initiate an alarm, and under normal circumstances away from the breeding colony and night roost, they do not sound an alarm. The alarm call is common throughout the year and is thus not restricted to the breeding season to the same degree as the anxiety call. Sheep that moved close to nesting birds were met with this cry, which at such times was not contagious, even in those birds which could not see the sheep, yet if a human appeared, all birds eventually left the ground, including those that could not actually see the danger. This was probably due to the fact that in the case of the sheep, no other birds took up the cry thus keeping general alarm at a minimum.

It was found repeatedly that a nesting pair would utter the alarm call when the nest was approached, but often break into the anxiety call for the length of time that was spent very close to the nest. On leaving the proximity of the nest the alarm call would be taken up again. The use of the anxiety call in this manner was more noticeable towards the end of incubation and when brooding small chicks, and although sometimes given on the first awareness of danger, it is more common for it to be used when a pair becomes deeply distressed about the safety of their eggs or chicks. It seems logical to conclude that the "kwe-ah . ." alarm call expresses greater alarm than the anxiety call does, since it occurs far more frequently, is much more contagious, and is thus more efficient in a colonial species. But since a modified version is used when attacking a predator, it must express an aggressive tendency that is not associated with the anxiety call. For this quite valid reason Tinbergen (1953) used for the alarm calls of the Herring Gull, different names to those chosen here, and the relationships of these names are as follows:

Anxiety call ("ha-ha-haha") = alarm call (Tinbergen).

Alarm call ("kwe-ah . .") plus charge call (described below) = charge call (Tinbergen).

The names of course relate to different species in which, as stated above, the various calls of alarm are developed to different extents, and it therefore appears likely that the expression of general alarm in the Southern Black-back, both at breeding and non-breeding times has been largely taken over by the "kwe-ah" alarm call.

Apart from the two alarm calls just described, there is one further sound, the status of which however is not fully understood. This sound is a muffled moan which is often given by a few birds at the instant a roosting flock is disturbed. The moan passes rapidly through the flock, being emitted by some, but not all birds, and is accompanied by rustling sounds as the heads of sleeping birds are withdrawn from beneath scapular feathers, and wings are shaken slightly. Moaning and rustling sounds are followed almost immediately by the ("kwe-ah -") alarm call, and the birds begin to fly off. Perhaps the moaning sound has no signalling importance and does not serve to warn other members of the flock, but on the other hand any cry emitted in essentially the same manner by numbers of birds must be given considerations as possibly having some releaser value.

2. *Charge Call* (Fig. 1e)

The charge itself takes place only during flight, being directed at a predator which is close by the nest, and the associated call is the alarm call modified towards aggression. It is not heard outside the breeding season. The charge call is a non-contagious sudden piercing scream sounding rather like "oo-waaaaah!", and is emitted directly above the predator as the gull dives down upon it. At the climax of the call the gull may strike the predator with its beak, feet, or a wing, and may draw blood.

C — *HOSTILE BEHAVIOUR*

The term "hostile behaviour" follows Moynihan (1956), and is used to include all intra-specific behaviour produced by attack and/or escape motivation. Fighting in defence of territory or brood occurs constantly amongst the gulls, and may result in the death of one of the participants. In addition, the adoption of some threat postures can be seen in flocks throughout the year. The use of choking as a threat posture of low to medium intensity has already been mentioned, but there are several other postures used in aggressive circumstances which are now described in approximate order of increasing intensity.

1. *Hunched (Submissive Posture)*

This is an appeasement posture seen very often in immature birds, and sometimes when females approach their mates, but it is also a threat posture of low intensity with no associated call, and is usually witnessed in a bird guarding food. The neck is withdrawn, the shoulders are hunched with the feathers slightly ruffled, and the bird walks "stiffly" round the food it is guarding. If other gulls approach, the upright posture (described below) is assumed, and they are driven away.

2. *Forward*

This posture is not well known, but when adopted the head is lowered and thrust forwards. It has been noted only a few times, in defensive circumstances, without a call, e.g. if a gull adopts the upright threat posture, the bird for whom this action is intended may assume the forward position, after which it will move away. Tinbergen

(1960 b) however, describes the posture in the Herring Gull as one of aggression often associated with a call which is a "muffled version of the long call."

3. *Upright Posture*

This is usually a posture of greater intensity than choking. It has no associated call, and unless a gull commences to choke, is the first attitude assumed when a neighbouring gull trespasses on the territory of another, or approaches too close in a general flock. The bird about to attack draws itself into a tense pose, with the wings held high against the body, the neck extended, and head bent slightly downwards so that it appears to be looking at the ground. The upright posture is sometimes directed against intruders such as small birds and sheep, as well as other gulls. In the case of other gulls, it may be preceded by choking, and usually in all cases it leads to a charge, which may eventuate in grass pulling, or actual combat. Adoption of this posture is sufficient to cause a trespassing bird to become alarmed, and if pressed, take to flight.

4. *Grass-Pulling (Pecking-into-the-Ground)*

This threat posture which has no associated call, is commonly resorted to when a strange gull, or the owner of a neighbouring territory, does not flee at the sight of the upright posture, or choking. The attacking bird eventually charges the other with wings slightly raised, and either closes with it, succeeds in driving it away, or begins grass-pulling. Grass-pulling is a threat posture of high intensity, and consists of pecking and tugging strenuously at grass plants, shrubs, rocks or handy objects, (Plate 4A).

5. *Fighting*

Between periods of pulling at grass, the gulls may strike at each other with their beaks, attempting to grasp whatever part of their opponent is handy. Usually the beak or a wing is caught, and then each bird settles back to tug with wings flailing the air. Heavy blows (Plate 4B) are delivered with the wings whenever opportune, until one bird manages to break away. During a fight the females stand nearby, occasionally choking or mewing, and sometimes chasing other birds. A "dog-fight" may develop amongst the onlookers because several territories are violated at once. Birds have also been seen grass-pulling as a threat posture directed at sheep which have approached too close to the nest or chicks. Feathers plucked out or broken off during a fight are not eaten, but are shaken off the beak. Tinbergen (1952 & 1956) considers territorial fighting in the Herring Gull is a means of spacing out nests, and ultimately the cryptically coloured offspring, consequently mass slaughter by a predator is made more difficult. When a gull is being beaten, it often gives broken "distressed" cries, but on one accasion an adult that was being badly beaten was heard to give the long call, and Tinbergen (1953) mentions having heard what he names the alarm call used in similar circumstances in the Herring Gull. While a fight to the death amongst adults was not seen, several battles were observed where participants emerged with smears of blood around the beak, and numerous corpses were found, as well as dying birds (Plate 4C), suffering from severe and bleeding wounds to the scalp and neck. Scores of chicks are killed by adults in exactly the same way, i.e. by pecks to the back of the head. It is

considered that the killing of adults is the result of mob attacks on a strange bird, and it is significant that several of the injured and dead adults found had broken wings, so that presumably, escape was hindered. Vigorous fighting in the Ring-billed Gull *(L. delawarensis)* has been described by Moynihan (1958 a), in which sometimes serious physical injuries are inflicted; feathers torn out, blood drawn, and eyes gouged.

During pair forming ceremonies the male may attack the female, following her food-begging or mewing advances. Such attacks are infrequent and usually consist of pecking at the female's head, neck, or wing and tail tips. However a most vigorous and prolonged fight between a male and female was seen in September, about one month before laying commenced. The fight lasted about five minutes and left both birds exhausted. Noble and Wurm (1943) mention several cases of sexual fighting in the Laughing Gull and the Herring Gull, where minor clashes have occurred between the members of a forming pair.

Fighting, or at least sparring, develops at an early age, i.e. as soon as chicks of one brood come into contact with chicks of another brood. Only one case of aggression within a brood was recorded as follows: Mr. R. Mander reported (pers. comm.) that he discovered a nest with two small chicks in which the third egg, though about to hatch, was covered at its big end by the shell of one of the other eggs. On removal of the third chick from its shell, the first two chicks attacked it. Very small chicks can be induced to aim pecks at an extended finger as if it were the beak of a parent, and on occasions they make half-hearted pecks at food fallen from their parent's beak. Since very small chicks are not readily frightened, the action observed by Mr. Mander was probably not one of displacement, but merely the misidentification of food.

FLOCK BEHAVIOUR

A — *ROOSTING AND AWAKENING*

On Somes Island the gulls roost over almost exactly the same area as is used for nesting during the breeding season, except that they tend to concentrate in relatively dense flocks comprising several hundred individuals in a few open and fairly level places, including the light-house vicinity, and the east, west, and south-west beaches. Over the rest of the area in which roosting occurs (i.e. predominantly steep slope areas) the birds are scattered in gullies and on slopes, amongst scrub and under trees, so that strictly speaking they are not in compact flocks. The limited banding results so far available show that at least some birds consistently return to the same spot to roost (and nest).

From late afternoon onwards, i.e. from about two and a half hours before sunset, gulls begin to arrive at the island to roost for the night, the first birds usually wheeling slowly about before settling on the water 100 - 200 yards off-shore. Nearly all the birds that arrive join the group sitting on the water, and eventually fly to the land any time after dusk. Sometimes they remain out on the water until the early hours of the morning before flying, practically in mass, to an adjacent roosting site on the island. At other times, especially in stormy weather, they may remain sitting on the water all night, apparently unaffected by waves and spray. The reason for a reluctance to land on the island at such times is not known, but may be correlated

with phases of the moon. Disturbances have a varying affect on the roosting flock — sometimes after the appearance of a predator the gulls may fly out on the water and not return for several hours (if at all), while at other times they may return within a few minutes.

In general the birds usually arrive separately about dusk at a roosting site, either landing directly on a particular spot (especially those birds that appear to be established pairs) or subsequently walking about before settling in a nearby place. Varying lengths of time are then spent preening and looking around so that at least 10 minutes, and usually much longer may elapse before a bird actually sits down. A further period of varying length then passes before the eyes are shut for the last time. Long calling is common when the birds first land, and even occasional alarm calls may be given. Some sparring and general restless behaviour invariably occurs as the flock settles down, but eventually there is general silence broken only by intermittent long calls. The gulls sleep either standing or sitting, with their beaks tucked inside the scapular feathers of one wing, or with the head pointing forwards. Places chosen on first arrival at the roosting site are usually adhered to during the night unless the positioning is upset by one gull chasing another. This is very common during the breeding season, when in fact the roosting flock of as yet non-breeding adults and immature birds is virtually never silent or completely still, there always being some choking, long calling, head-tossing, sparring, etc. The overall effect is that with the continual sparring, the flock is repeatedly drifting, spreading out, and later reconcentrating, so that individual birds are often on the move and thus obtain little sleep. There is also more unsettled behaviour on moonlight nights than an completely dark nights. The distance between individuals in a roosting flock varies according to the terrain, but on flat ground is about three to five feet.

Soon after the first light appears in the eastern sky, some birds take off on brief flights of a few hundred yards, but return again. Members of the flock commence long calling, and the volume of noise rises at a gradually increasing rate so that after about one half to three-quarters of an hour, all birds are active. (In the breeding season this activity includes long calling, choking, head-tossing, etc., and chicks also begin calling soon after first light.) Coupled with the steady increase of noise is an increase of movement such as preening, stretching, sparring, and walking about. Also the birds begin gradually to space themselves out so that they are further away from their neighbours than they were during the night. About one hour after first light birds begin leaving their roosting areas singly, in pairs, and in small groups, to wheel about the island, and there is a continuous noise of general calling. Between one and a half to two hours after first light most birds leave the island in the morning flight. This consists of many individual gulls wheeling over parts of the colony, and gradually drifting in a general direction (mainly northwards along either side of the island towards the harbour shore about two miles distant) so that there is an almost continuous thin stream of birds which lasts about half an hour, leaving the colony in several main directions. Many of the birds land at the Hutt River mouth (where at low tide there are mud-flats, and nearby a large rubbish tip) or close to the outfalls of the two meat-works on the edge of the harbour.

B — *GENERAL ACTIVITIES*

The Southern Black-back is not a completely gregarious species, but does roost, breed, and to a large extent feed in flocks. Colonial existence however is of great importance to the birds, and much of their behaviour, such as that related to defence and courtship, is directed towards, or modified by existence in a flock. Many activities are contagious to a greater or lesser degree; e.g. bathing, feeding, perhaps also paddling (described below), preening and drinking, as well as alarm and other calls, while other activities such as stretching and yawning appear not to be contagious. Many flight movements are made in loose groups, and generally the gulls in a particular area will stand together. However, birds are repeatedly seen singly, or in very small groups scattered along the coastline, and pairs may breed in solitude, so that as stated above the species is not a completely gregarious one.

Soon after sunrise most birds arrive at a feeding site such as a tip, meat works' outfall, wharf, beach, or playing area, where some time is spent in individual activities. These activities include a lot of preening as well as sleeping, inspecting feet, occasional sparring, bathing and simply standing about. At least two kinds of stretching can be seen, both of which are developed in quite small chicks. The first kind is one in which the leg and wing on one side are straightened backwards and slightly downwards as the bird leans forward on the other foot. The other kind is more elaborate but less common than the first: the bird leans right forward on tip-toes, tail and wing tips in the air, wings slightly flexed or flapping slightly, and the head and throat parallel to, and almost touching the ground.

Sparring between members of a flock usually involves only assumption of threat postures such as the upright posture, and chasing; fighting rarely if ever occurs in a resting flock. On the whole, adults are superior to young birds in the flock hierarchy and usually experience no difficulty in obtaining desired food or space, but the position of superiority of second year birds over first year birds is less clearly defined; often a first year bird will successfully challenge a second year bird over some material object. The question of whether an individual hierarchical system exists, superimposed on the general hierarchical system based on age groups remains unanswered at present, but it is possible that such a system does exist.

Bathing ranges from vigorous splashing of the wings and ducking of the head under water, to lifting off the water and plunging in from a distance of one or two feet, to grasp a stick or some object of no apparent value to the bird. This last behaviour is quite apart from diving into water for food such as starfishes or molluscs, for the stick or object retrieved may be turned around in the beak, dropped, dived for, and dropped again, so that the whole performance is repeated several times and seems to be best interpreted as some sort of play. Another activity associated with feeding but not often seen is "paddling," which usually occurs when the birds are standing in very shallow water, or on mud-flats or exposed beds of seaweed, but sometimes on land. When paddling a gull appears to be "marking time," i.e. lifting its feet alternately, pausing every now and then to peer down between its feet, and occasionally peck at something. The action was thought by Tinbergen (1953) to expose small marine creatures so that they might be more easily picked up.

The early morning activities gradually pass into activity mainly associated with feeding which lasts intermittently for several hours. Feeding involves active scavenging in or near rubbish tips, sewer outlets, or places where offal is discharged, as well as rivers, ploughed fields, beaches and shallow water, etc. Usually well before midday the flock gathers at some customary resting place which is often in, or adjacent to, the feeding site, and remains there for a large part of the afternoon. The birds (which may come from several different night roosts) mostly stand about, sleep, preen, or bathe, but no opportunity is overlooked to obtain food, and individuals often leave the flock to resume feeding for a period.

Adverse weather, such as strong winds or heavy rain, modifies all activities, which are either carried on in a subdued manner or otherwise decreased in duration. In a storm the birds are forced to stand head on to the wind so that normal individual and contagious flock behaviour as well as sparring is prevented, but no matter how driving or cold the rain or wind may be, the birds rarely seek shelter Different feeding-sites may be frequented however, and during wet weather gulls commonly visit pasture or grassy areas where they dig for worms. Also roosting may be affected by very bad weather so that many birds spend most, if not all the night, out at sea instead of on land. In the late afternoon before dusk gulls fly away from the flock singly or in small groups, and begin to drift slowly in the general direction of their respective night roosts, which the majority reach about sunset.

General flock behaviour is affected to a large extent by the time of the year, for the reason that the age structure of the flock changes before and after breeding. Since nearly all the adults leave in spring and summer to breed, and return in autumn accompanied by the chicks of the season, conditions are gradually changing much of the time, and are thus relatively constant only during winter. The variable nature of the structure of the flock means that different degrees of intra-specific competition obtain at different times of the year.

SOME INTER-SPECIFIC RELATIONSHIPS

A — *FEEDING AND GENERAL*

Relationships between the Southern Black-back and other species vary to some extent with the individual as well as the age of the birds concerned, but in general all smaller birds yield food or space to the gull. In Wellington Harbour, the only birds to which the gull will regularly concede food or space are the Arctic Skua *(Stercorarius parasiticus)* and the Giant Petrel *(Macronectes giganteus)*, the former being a little smaller than the Southern Black-back, but the latter much larger. (Wandering Albatrosses *(Diomedia exulans)* also frequent the harbour, especially the waterfront, where Secker (1956) mentions that in general they are not disturbed by the presence of gulls). Arctic Skuas may sometimes be seen in the harbour relentlessly pursuing gulls in flight and eventually forcing them to drop the food they are carrying, while at the places where meat works' outfalls reach the surface of the sea, Giant Petrels occupy the central position, lunging about and siezing large pieces of offal. The Southern Black-backs

scavenge in a wide circle surrounding the Giant Petrels, and on the fringe of the whole flock are Red-billed Gulls, so that sheer size determines which species occupies the most favoured place. In the absence of Giant Petrels, Southern Black-backs occupy the central position with Red-billed Gulls still on the fringe of the flock. Species towards which the gulls have on occasions shown markedly aggressive behaviour include:

Black Shag *(Phalacrocorax carbo)* — Mr. L. J. Paul reported (pers. comm.) seeing an immature gull attacking a shag for no apparent reason; the shag did not retaliate. (Mr. Paul also witnessed a display of aggressive behaviour by a group of gulls directed against an Australian Magpie *(Gymnorhina hypoleuca).* Caspian Tern *(Hydroprogne caspia)* — usually the terns yield their position to gulls and sometimes the gulls may deliberately drive them away, but an adult Caspian was once seen to attack a first year Southern Black-back that approached too close. Red-billed Gull: Southern Black-backs are invariably successful in competition with Red-bills for food or space, and the smaller species moves quickly aside for the larger on every occasion. Sometimes there is actual persecution, and Southern Black-backs have been seen deliberately chasing Red-bills when no food was at stake. Young Southern Black-backs are not so intolerant as adults, and first year birds join and apparently accompany flocks of Red-billed Gulls. In comparison with mixed flocks of Southern Black-backs, Caspian Terns and Red-billed Gulls which may not be without minor conflicts, flocks of Red-billed Gulls, Caspian and White-fronted Terns *(Sterna striata)* have been observed where all species are mixed together quite amicably.

Rock Pigeon *(Columba livia)*: In city areas these common birds are often forced to yield food to Southern Black-backs, and like the Red-billed Gulls, may be harassed for no apparent reason. The mixed flocks of sea birds that are often seen following schools of fish may comprise species such as Cape Pigeon *(Daption capensis),* Red-billed and Southern Black-backed Gulls, White-fronted Terns, Subantarctic Diving Petrel *(Pelecanoides urinatrix),* etc., all of which fish independently so that conflict over food it not pronounced. Also small birds including the House Sparrow *(Passer domesticus),* Chaffinch *(Fringilla coelebs),* Goldfinch *(Carduelis carduelis),* Starling *(Sturnus vulgaris),* Rock Pigeon, etc., have been seen fossicking quietly amongst tidal debris in the vicinity of gulls, which have displayed no interest in their presence.

Species which appear to be almost completely ignored by the gulls include the North Island (Variable) Oystercatcher *(Haematopus unicolor),* one pair of which even nested unsuccessfully in the 1961-62 season near gulls on Leper Island in Wellington Harbour; Mallard Duck *(Anas platyrhynchos);* Paradise Duck *(Tadorna variegata)* (a female was seen to walk through the middle of a flock of gulls unmolested, and a first year bird stepped out of its way); Blue Reef Heron *(Egretta sacra)* (a small group of gulls plus two herons were seen fossicking at the water's edge within inches of each other — neither species paying any attention to the other.) Although gulls may tolerate the presence of the Blue Reef Heron, they are apparently intolerant of egrets, and Jenkins (1962) briefly describes a Little Egret *(Egretta garzetta)* being closely pursued by an adult gull.

B — *ROOSTING*

Apart from the Southern Black-backs, Somes Island forms an important night roost for thousands of Red-billed Gulls and Starlings, as well as Northern Blue Penguins *(Eudyptula minor)* and a few Black Shags. (The penguins and some Starlings also breed on the island.) Starlings roost in the shelter belts of *Cupressus macrocarpa,* Taupata *(Coprosma repens),* etc., as well as the tall *Olearia* scrub near the top of the island, and the penguins occupy burrows and caves mainly near the shore, so that in effect neither species comes in contact with the Southern Black-backs. Large flocks of Red-billed Gulls roost during autumn and winter on rocky headlands and stacks, and on some of the lower slopes of the island. Most of the places occupied by the Red-bills hold at least some pairs of Southern Black-backs during the breeding season (except some of the rocky stacks) so that it might be assumed in the absence of Red-bills that the other species would roost in those places. However, the two species keep largely to themselves, and although on some slopes the edges of the two flocks may be in close proximity, there is virtually no dispute over roosting areas. A small number of Black Shags often roost during autumn and winter on Shag Rock (off the south end of the island), but appear not to associate with the gulls in any way.

C — *BREEDING*

During the breeding season intolerance towards all other animals increases markedly so that sheep and even small birds such as House Sparrows, finches and Starlings are driven away from the vicinity of the nest, and Harriers *(Circus approximans)* are chased by numbers of birds. On the other hand, two pairs of North Island (Variable) Oystercatchers were seen once to fly quite low over parts of the colony without evoking any discernible response from the gulls. Small birds (i.e. small passerines) form an important part of the diet of some chicks, as do tadpoles of *Hyla aurea* (which are common during summer) and skinks *(Leiolopisma zelandica),* geckos *(Hoplodactylus pacificus),* and perhaps Field Mice *(Mus musculus)* are possibly caught and killed by the gulls. Occasional visits ashore by an Elephant Seal *(Mirounga leonina)* during the 1961-62 season roused no antagonism in the gulls, but human activity readily caused disturbances.

SUMMARY

The closest relatives of the Southern Black-back are to be found in the northern hemisphere, amongst the interbreeding assemblage of subspecies of the Herring and Lesser Black-backed Gulls. The limited available literature taken together with the results of this study shows that as far as gneeral behaviour is concerned, no significant differences can be detected between the three species, but features of the alarm calls indicate that the Southern Black-back is related rather more closely to the Lesser Black-back than to the Herring Gull. General, pair-forming and hostile calls and postures have been outlined, and roosting and some aspects of general flock behaviour described. Most birds with which the gulls are in contact will concede food or space, notable exceptions being the Arctic Skua and Giant Petrel.

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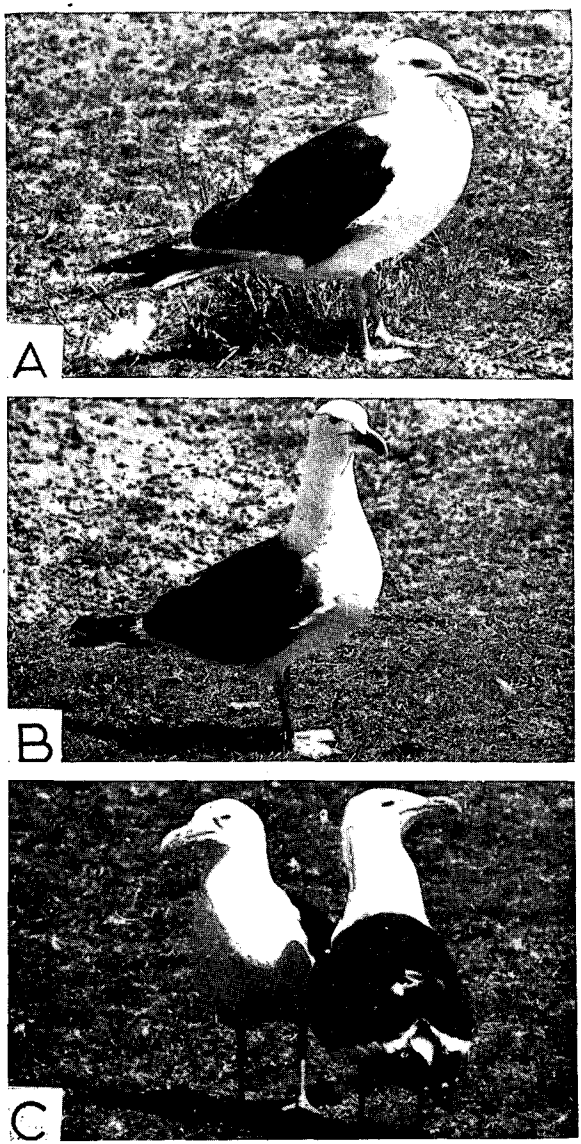

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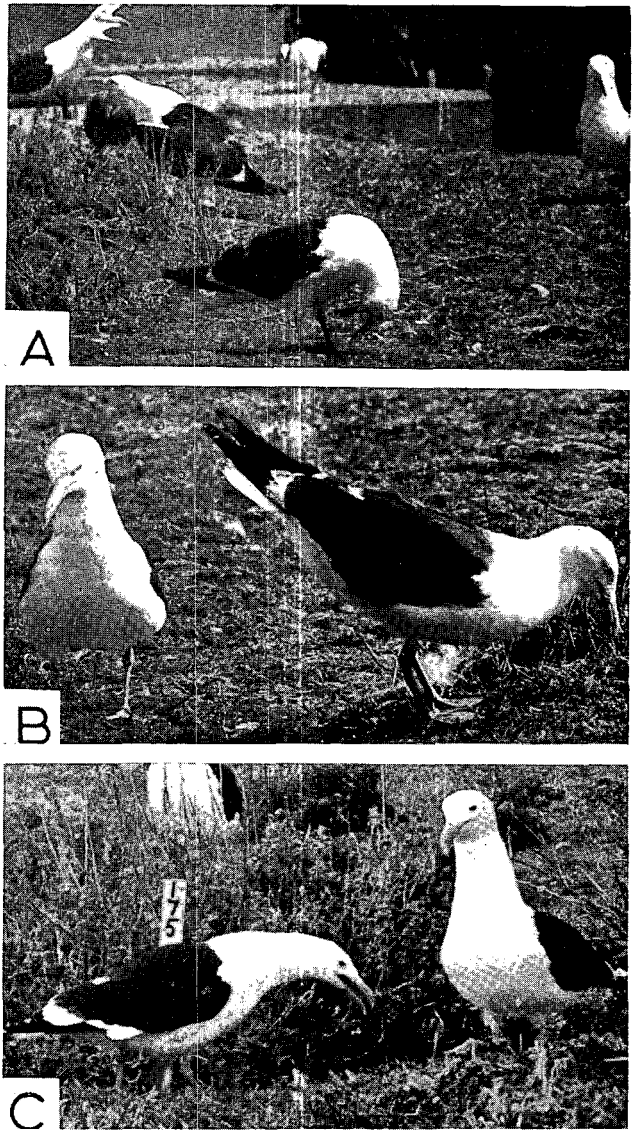
XXI — 1 (a) "Relaxed" posture; note withdrawn neck. (b) Slightly alarmed bird; note upthrust neck and alert expression. (c) The face-away attitude.



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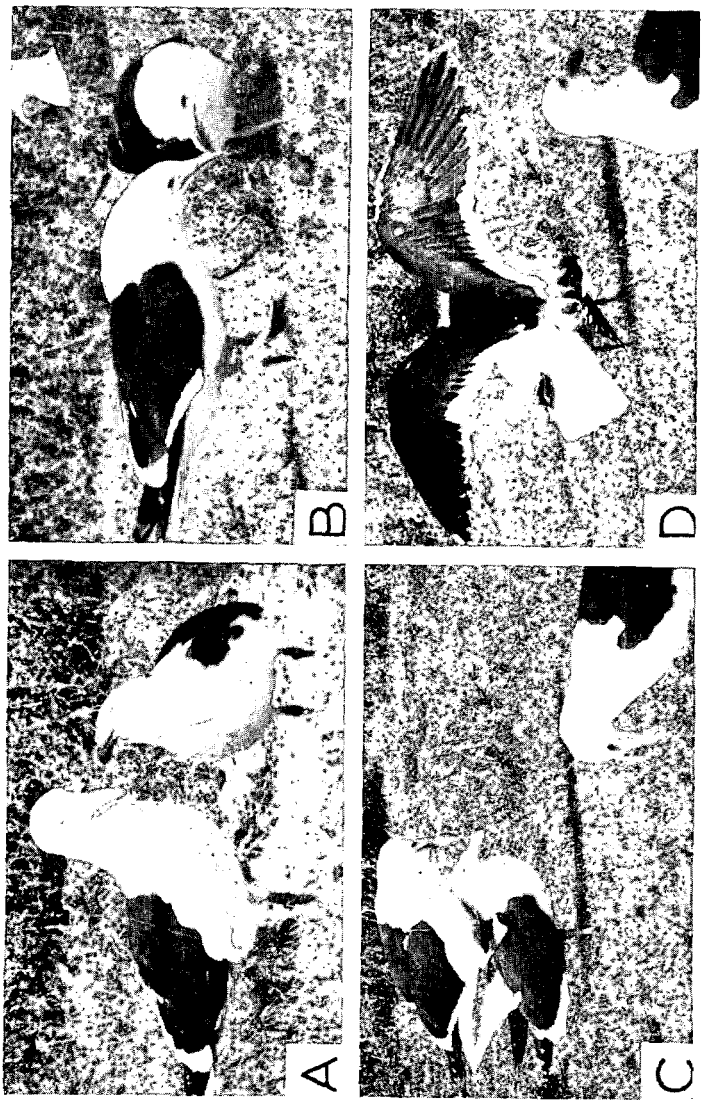
XXII — 2 (a) Long call. The bird on the right is about to start; the one in the foreground has commenced and will adopt the final position shown by those on the left. (b) Choking; note lowering of the floor of the mouth. (c) The mew call.



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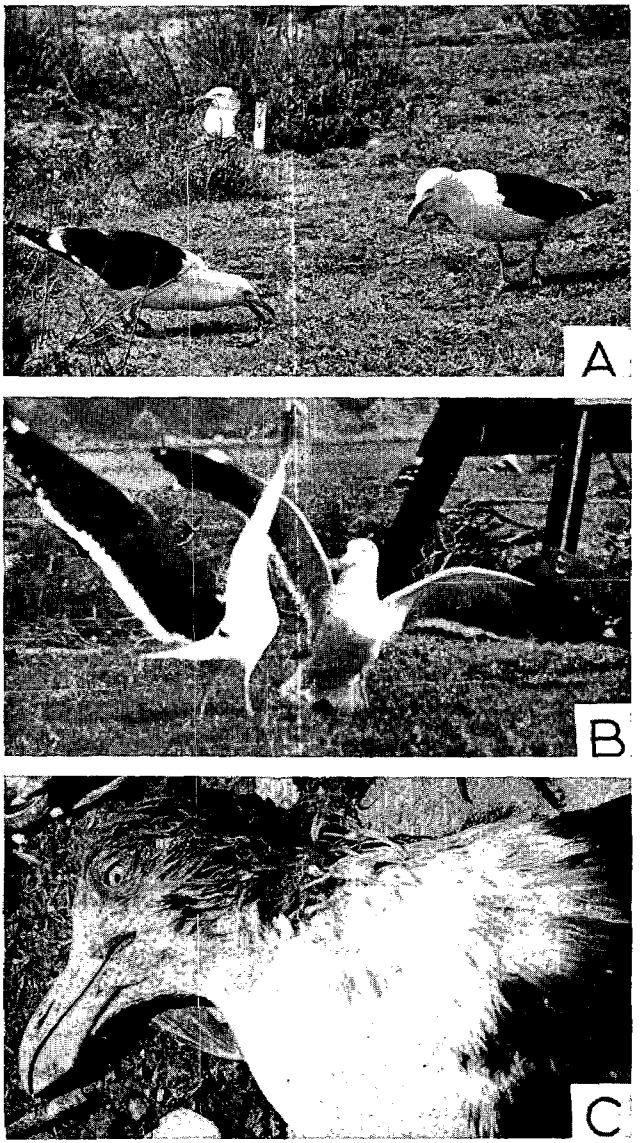
XXIII — 3 (a) Food-begging or head-tossing; the female is on the right. (b) Male feeding female; note swollen neck and foot raised with the effort of regurgitation. (c) Male mounting female for copulation. (d) Copulation: note the lack of interest of the nearest bird.



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XXIV — 4 (a) Grass pulling. The bird on the right is about to lunge forward and commence grass pulling. (b) Wing blows being delivered during fighting. (c) Adult male severely injured but still alive, after attacks by other adults.