WELCOME SWALLOWS IN NEW ZEALAND, 1958 - 1965

By A. T. EDGAR

INTRODUCTION

The Welcome Swallow *(Hirundo neoxena)* is an Australian bird self-introduced to New Zealand. The first New Zealand specimen was a straggler obtained at the Auckland Islands in 1943 (Oliver, 1955) and two stragglers were found at Stewart Island in September 1953 (Sansom, 1954). A single bird observed at the base of Farewell Spit in November 1955 (Heather, 1956) was at that time the first accepted record of occurrence in either of the main islands: however, Michie (1959) reporting the presence of breeding pairs in Northland in 1958, states that some time in the 1920's he had a swallow under observation for more than a week in Kaitaia district and that about the same time a bird was shot at Herekino, some 15 miles from Kaitaia, and its wings displayed in the window of the local newspaper office: he adds that sightings of swallows were reported to him from several localities near Kaitaia over the few years prior to 1958. Mrs. L. E. Walker (pers. comm.) recalls that some time in the 1940's two swallows were reported from Nugget Point, Otago. Various papers in the Transactions N.Z. Inst. published during the second half of the nineteenth century contain notes on visual records of "swallows and martins" in various parts of New Zealand. All these have apparently been taken to refer to the Australian Tree Martin *(Hylochelidon nigricans)*, of which the first New Zealand specimen was procured in 1851 (Oliver, 1955). Discussion of these early visual records of swallows and martins is outside the scope of this paper, but it appears possible that some of the birds sighted were in fact Welcome Swallows, not Tree Martins.

Between 1958 and 1965 the spread of Welcome Swallows over the four northern counties has been rapid and successful, and there have been many records of sightings and establishment of small breeding populations in other parts of the North and South Islands. The purpose of this paper is to place on record what has been learned of the life history and population spread of swallows during their first eight years as a resident New Zealand species. It is a summary of information published in *Notornis*, supplied to the Ornithological Society's Recording Scheme, conveyed to me by interested observers and drawn from my own field notebooks during four years of residence in Northland. I acknowledge with gratitude the work of four junior members of the Society, Terence and Dale Calvert, Robert Cowan and Peter Gross: these boys have accompanied me on journeys throughout Northland totalling many hundreds of miles and have acquired an unrivalled knowledge of the underside of Northland bridges in their search for and observation of swallow nests.

The information which has been collected is presented in three sections — Habitat, Field Characters and General Habits; Breeding; Population Spread. This paper is in no sense a complete study of the species and it will be obvious to the reader that there are many gaps in our knowledge of the life history of swallows, but it is hoped

that this account may provide a basis and a directional stimulus for future observation and detailed study, particularly in areas where the swallow population is as yet at an early stage of establishment. All place names mentioned in the text may be found in N.Z. Automobile Association Motor Touring Maps (North Island Sheets 1 - 4, South Island Sheets 1 - 4) or in A Descriptive Atlas of New Zealand (1960).

The origin of unpublished information given to me either direct or through the Recording Scheme is indicated by insertion of the initials of the contributor after the relevant statement, as per the following list.

Mrs. M. J. Barron (M.J.B.)
B. D. Bell (B.D.B.)
Miss Lois J. Bishop (L.J.B.)
R. Cowan (R.C.)
M. P. Daniel (M.P.D.)
C. W. Devonshire (C.W.D.)
Mrs. A. O. Edgar (A.O.E.)
H. A. Findlay (H.A.F.)
Mrs. R. Hows (R.H.)
F. C. Kinsky (F.C.K.)
R. M. Lockley (R.M.L.)
M. G. Macdonald (M.G.M.)
H. R. McKenzie (H.R.McK.)
N. B. Mackenzie (N.B.M.)
R. H. Michie (R.H.M.)
Mrs. K. Reynolds (K.R.)
M. Ross (M.R.)
R. B. Sibson (R.B.S.)
D. J. Trigg (D.J.T.)
A. Wagener (A.W.)
M. A. Waller (M.A.W.)
W. D. Weymouth (W.D.W.)

HABITAT, FIELD CHARACTERS AND GENERAL HABITS

Habitat

Open country, inland or coastal, where there is water in the form of rivers, streams, lakes or pools. All kinds of open country seem acceptable — flat farmland; undulating farmland with streams or swampy areas in the flats or hollows; scrub-covered gumland; extensive areas of swamp; sand dunes covered with natural vegetation as at Ninety Mile Beach, Northland, or with lupins as on Taranaki Coast (M.G.M.); birds may be seen hunting over mangrove swamps. Heavily forested country is not a suitable habitat though birds have been seen adjacent to large areas of bush on the Waitakere Scenic drive near Auckland (A.O.E., R.B.S.), and over lakes in the vicinity of Waitangi exotic forest. In Northland the swallow population is densest in flat coastal areas, but there is a good concentration on the plateau around Lake Omapere (780 ft. a.s.l.). As the population increases in coastal areas there has been a considerable spread up inland valleys in Mangonui, Whangaroa and Hokianga Counties: in 1965 R. Cowan found nesting pairs near Broadwood in broken hilly country under grass and large patches of bush — a type of habitat which on the basis of previous experience would have been thought quite unsuitable. At Kaitaia and Kaikohe, where swallows are well established, birds may be seen flying within the town area.

Field Characters

Welcome Swallows are small birds (length about 150mm, or 6 inches) with rounded heads, slender streamlined bodies and long pointed wings: adults have long deeply-forked tails, the outer feathers much elongated and attenuate. The black bill is short, flattened, broad at the base and triangular in plan, with a wide gape. The feet are small, black, with unfeathered tarsi and long toes and claws.

The full beauty of an adult swallow in good plumage can only be appreciated when the bird is seen at rest, at close range and in a good light. The upper parts from hind crown to upper tail coverts, scapulars and upper wing coverts are metallic blue-black; the black extends as a narrowing line from the eye to the base of the bill, separating the bright rufous of fore-crown and forehead from the slightly less intense rufous of throat, foreneck and upper breast. The rest of the under surface is greyish white, rather browner on the sides of the body and under wing coverts. The primary coverts and quills are blackish brown, the quills edged with buff: small whitish tips on some of the inner secondaries may be visible when the bird is at rest. The tail feathers are blackish brown, slightly glossed on the upper surface; white sub-terminal wedges on the inner webs of all but the central and outermost tail feathers show as a row of white spots when the bird spreads its tail in flight or when about to settle on a perch.

Young birds are less richly coloured than adults and have shorter tails, forked but without the long streamers characteristic of the adult. The rufous of forehead and breast is much paler and the blue of the upper parts less intense. A very young bird which had left the nest though not quite ready to fly had not yet developed the full rufous forehead; the centre of the forehead was pale greyish blue, with a pale rufous patch over each eye. The edges of the gape were pale yellow. When birds are perched facing away from the wind the ruffled back feathers may disclose whitish feather bases: casual observation of these has sometimes created the impression of a whitish rump patch.

Moulting adults have been noted in mid-March (M.R.).

Flight; Feeding Habits; Perching

Swallows feed on insects, generally taken on the wing. Their streamlined bodies, wide gapes, long wings and considerable powers of flight are admirably adapted for this way of life. The "swimming" flight of swallows is characteristic, light and easy, swift and irregular, with frequent changes of direction from side to side or up and down; long sweeps and glides with wings sometimes extended and sometimes half closed alternate with intervals of direct flight and regular wing beats or with swift swerving and banking; low skimming flights over swamp, paddocks or water are varied by direct or circling flights at moderate elevation or wheeling flights high in the air, sometimes almost beyond the limit of unaided visibility. Swallows are on the wing throughout the hours of daylight, from early morning until darkness falls. M. Ross noted that Kaikohe birds were particularly active after a period of drizzling rain, presumably because these conditions had produced a plentiful supply of insects. I have seen a party of swallows busy hunting through the smoke cloud over an area of burning scrub. During low skimming flights over ponds and lakes swallows often dip to the water, sometimes to drink, sometimes to take an insect from the water surface. On the inlets of Northland swallows fly back and forth, quartering low over stretches of salt water near the shore. The neighbourhood of cowsheds and piggeries provides good hunting. Shanks (1960) reported swallows flying round a cowshed, probably feeding on small insects attracted to the skim milk curds and disturbed when the curd is scattered. R. Simpson noted regular hunting flights up and down a small stream which carried off the drainage from a

cowshed; the outflow of liquid from a stack of silage on my farm was another favoured hunting ground. I have seen birds fluttering along the face of a clay bank apparently taking insects from the short vegetation, and birds skimming over paddocks dipping as if to take insects off the grass blades. Swallows may flutter along the walls, eaves and roof of buildings as might a fantail, and sometimes enter cowsheds and piggeries on hunting flights.

Swallows have comparatively short weak legs and feet and do not habitually alight on the ground but have frequently been observed to do so. They often settle on the muddy shore of the lake at Ngawha Springs, and on my farm and elsewhere I have several notes of ground feeding by small parties on paddocks or farm roads, and many more notes of momentary perching on cowpats and grassland, at times or under conditions which precluded collection of nest material as a reason for settling on the ground. On ground perches the body is held in a horizontal position; gait is weak and waddling. Above ground swallows normally perch in an upright attitude, but if a strong wind is blowing they may swing the body to an almost horizontal position, head facing into the wind. Near the nest swallows perch on telegraph wires, power lines, wire fences, bridge rails, fence posts or battens; any stump, stake or log on land or in water may be used if it is conveniently situated. At Lake Ngatu one bird of a pair sat on top of a post and the other on a six-inch nail driven horizontally into the post and projecting from it. Raupo (*Typha* sp.) serves as a perch if it is near the nest, and at one nest bridge adults perched on a *Phormium* flower head. Birds nesting on boats or at boat harbours perch on launches and dinghies, and along the coast sometimes settle on small projections on clay banks and low cliffs.

Young birds not long out of the nest often perch on the dry branches of trees or bushes washed downstream by floods, or on dead twigs of fallen trees in the vicinity of the nest site. Leafy perches are not favoured, but at flocking time large numbers of birds may perch on trees which are bare of leaf, or on dead branches of trees standing in water or around the edges of lakes. Birds which have nested in or hatched from nests attached to farm buildings perch on roof ridges, roofs, or gutters during the nesting season; I have seen a party of birds fluttering round and settling on the lintels and verandah of a house on the edge of Kaitaia town. In autumn, congregations of up to fifty or more swallows may be seen resting in rows on farm buildings, telephone or power lines, flying around to feed and drinking from adjacent watercourses, pools or water tanks.

Many observers have commented on the tameness of swallows. Michie (1959) writes that a bird preening on a wire a few feet from Awanui bridge took no notice when a heavy cream lorry laden with cans rattled over the bridge. Findlay (1960) describes how swallows at a farm near Kawakawa were quite fearless and would fly within a few feet of a person sweeping the yard. Hall (1960) mentions a swallow perched on a stump which showed no alarm when approached to within twenty feet, and on a number of occasions I have encountered birds which permitted even closer approach. R. Simpson mentions a swallow which flew into a classroom at Te Iringa; it did not panic, but flew around for a while and then perched on the head of a drawing pin stuck in the schoolroom wall.

FOOD

No list of insect species taken by swallows in New Zealand has yet been compiled, but small species of Diptera probably form a large proportion of their diet. Skegg (1962) records that droppings at a nest site contained shiny wing cases of some insect. On a number of occasions it has been noted that proportion of the droppings at a nest site were bright pink; normal droppings are white. Residents in Pukenui district say that the greatly increased swallow population has coincided with a reduction in the number of mosquitoes. K. A. J. Wise (Entomologist, Auckland War Memorial Museum), reporting on insect remains from swallow droppings collected by Miss L. J. Bishop from below a nest on a rocky island at Houhora Heads, states that swallows had been feeding mainly on small flies including midges but not mosquitoes, and that there were also a few remains of small beetles and larger insects. A sample of droppings from near Kawakawa also contained insect remains, mainly of small flies and a few small beetles. Malcolm Ross has seen swallows hunting small blue butterflies.

VOICE

The call note, uttered frequently in flight and less frequently from a perch, is a short single "twit" or "tswit." The same note, frequently and rapidly repeated, runs into a twitter, commonly heard and apparently a conversational note: sometimes this conversational twitter alters somewhat in quality and gives the impression of mutual excitement. I have heard twittering notes uttered by pairs of birds investigating a possible nest site, constructing a nest, or flying to and fro under a bridge on which a nest has already been constructed. Much twittering takes place when a family of young birds take to the air with the parents, and when the young birds return to the nest after a flight. Parties of birds congregated at areas of abundant food supply such as seepages, drainage trickles from cowsheds, piggeries or silage heaps keep up a continuous twitter, as do similar parties fluttering around farm buildings, houses or coastal banks.

The alarm note, as uttered by parent birds when an intruder is near the nest, is sharper and louder than the call note and sounds to me like "tswee" or sometimes "sweert": occasionally it has a bisyllabic sound " tit-swee," accent on the second syllable.

Song is a mixture of squeaky twitter and trills, not loud and of low carrying power, but pleasing to the ear. Duration of each song varies from three to about 12 seconds, and the song may be single, repeated two or three times, or continued in a series lasting up to a minute. I have notes of singing from August till January, sometimes on the wing, more often from a perch. Possibly song on the wing occurs more frequently than my notes indicate: there are few windless days in Northland and so small a song from flying birds could pass unnoticed when a wind is blowing. The longest series of songs I have heard was from a bird perched on a stump near a bridge which the pair was investigating as a possible nest site (which in the event was not found acceptable). Shorter songs I have heard on a number of occasions from birds on wire perches near a nest under construction (sometimes the first nest of the season, sometimes a second nest built when the first had fallen down after a brood had flown): less frequently

males were heard singing short songs from a nearby perch while the female was on the nest. In January, a male bird sang from a wire perch while two other adults and a family of four young birds perched or flew around the nest bridge (R.M.L.).

FLOCKING

The main nesting season in Northland is from August to December with some nests still occupied in January and February. Young birds remain in the neighbourhood of the nest site for a period which may vary from a few days to several weeks, while the parents rear another brood: sometimes I have seen parties of young birds which appeared to be composed of a first and a second brood still around the nesting area while the parents were busy with a third clutch. By November, still well before the end of the nesting season, flocks of 20 - 25 or in the Far North even larger gatherings of young birds are frequently seen.

From late December flocks of old and young birds begin to form. In December 1963 a flock of over 50 birds congregated around farm buildings at Kerikeri Inlet: by 5th January 1964 the number was reduced to 17, and about this number remained till 12th March, when they left the area. A similar gathering was noted at the same place in December 1964. Ross (1962) records a flock of 40 - 60 birds near Ngawha on 17th February 1962, and from Te Iringa (south of Kaikohe) a flock of 32 on 10th February 1962 which increased to 37 on 20th February and for a brief period on 22nd February to about 100. Smaller numbers were seen until about 12th March, when they left the area.

It may be that this autumn flocking is in some way connected with an inherent migratory urge, but I have no evidence of migration and the dispersal of autumn flocks noted above may merely indicate that the birds have moved on and joined another flock where food supply is more plentiful. Winter flocks have been recorded all over Northland: A. Wright reports a winter flock of c. 100 birds from Kaitaia; Ross (1962) records flocks of 20 - 30 birds seen at Kaikohe sewage farm from May to August 1961, similar numbers in June 1962 and (pers. comm.) in July 1963. He also records a large flock at Kauri Log Lake, Ngawha, in July 1962. A winter flock of c. 100 birds has been seen at the nearby Lake Tuwhakino and a smaller flock at Moerewa oxidation pond. (H.A.F.).

A flock of over 50 birds was seen over a lake near Waitangi in May 1964, and over the three winters 1963 - 65 flocks of 30 - 50 birds visited a 5-acre lake on my farm at irregular intervals and flocks of similar size were seen elsewhere in Bay of Islands County. It appears that these winter flocks range widely from one feeding ground to another: appearances of flocks over my farm lake have varied from three to seven days in any one winter month. Sometimes a flock stays around the lake for three or four days, but more often flocks are present for one or two days only and may not be seen again for a week or a fortnight, during which period flocks of similar size are reported from other parts of the district.

A proportion of the swallow population does not join the winter flocks: throughout Northland there are many records of pairs or small parties remaining around the nest area during winter, sometimes using the old nest as a roost. Throughout each winter small numbers of

swallows are around my farm most of the time, quite distinct from the larger flocks which visit it at intervals. The nearest known nest site is about 1½ miles away. It would appear that the food requirements of the swallow population in winter are met partly by flocking, partly by dispersal into smaller parties and partly by continued occupation of such nesting areas as provide sufficient food supply for a limited number of birds. The number of swallows seen by travellers through a district at any time outside the main nesting season is therefore not necessarily a true indication of population abundance in that district. It is a matter of luck whether a traveller happens to encounter an autumn congregation or a winter flock, and apart from these he is likely to see only late nesters, or birds which have not flocked and may be either around nest sites or ranging farther afield than they would during the nesting season.

Although I have no evidence of migration, one record suggests a possible northward movement. On the evening of 18th May 1963 a party of thirteen swallows appeared on a paddock near my house. They were new arrivals, and obviously very tired. They perched on cowpats and on the ground and when approached were most reluctant to move and only flew a few feet to alight again on the ground or on a fence wire. The following day they were still there, flying around but still not particularly active. The next day the flock had gone, leaving only the three or four birds which had been in the area daily before the party arrived and remained after it departed. The wind had blown from the south-east on 15th - 17th May and from the south on 18th May.

BREEDING

Some of the material in this section is drawn from the published or unpublished notes of other observers but most of it is from my own notebooks. During 1962, 1964 and 1965 seasons routine checks have been carried out at approximately weekly intervals on a number of swallow bridges within thirty miles of my home at Kerikeri and in the course of these I have gathered some useful information. This is supplemented by notes made during the period 1961 - 64 on nests outside the routine study area, and in 1965 by the results of an investigation of the present distribution of swallows in the four northern counties, in the course of which I have travelled some hundreds of miles and recorded about 270 nests.

The substance of what has been learnt about siting and construction of nests, eggs and dates of laying, clutch size, incubation and fledging periods, hatching and fledging success is summarised in the following pages, which however make no claim to be more than a preliminary survey. A total of 112 clutches or part clutches was recorded in the routine study area, but the regularity of recording suffered frequent setbacks. Sometimes flooding of streams interrupted the sequence of inspections; nests or their contents were lost (often at a critical time) by accident, vandalism or predation. When a bridge is occupied by several pairs and when re-nesting takes place after more than one nest has been lost it can be difficult or impossible to establish with certainty the ownership of the new nests; in sites occupied by only one pair of birds a lost nest may be replaced by a new one placed in an inaccessible position. Because of these hazards it was possible to follow the breeding sequence of only a limited number of pairs through the whole of

each nesting season. I have not yet had an opportunity to study closely the day-to-day breeding activities of individual pairs; nests that were geographically convenient were either inaccessible or awkwardly sited for observation. Much more remains to be done in this direction, but this general survey may serve a purpose in drawing attention to variables which might not be apparent in a more detailed study of individual pairs.

Selection of Nest Sites

During the early years of their establishment in Northland swallows have exhibited a marked preference for nest sites over flowing water and up to 1964/65 about 95% of the nests recorded in my notes were attached to concrete bridges, wooden bridges and culverts, the proportion of nests on each type of construction being approximately as 100:50:10. I find no particular significance in the relative numbers of nests under concrete and wooden bridges and think this is more an indication of the type of bridge site available than of any other factor. In the Far North there existed a high proportion of wooden bridges, and further south most of the main road bridges were concrete, with many wooden bridges on side roads and on farms. Gradual replacement of wooden bridges by concrete or steel and concrete bridges need apparently make little difference to the swallows and the location seems more important than the type of bridge. In a number of cases where swallows previously nested under a wooden bridge and where this has now been replaced by a more permanent structure, the birds are using the new bridges as nest sites.

Writing of swallows in Australia Mathews (1919) states "they nest in a great variety of situations such as down wells, in caves, on the side of or under a ledge on a rocky cliff, inside dwelling houses, open hollow trees, inside empty 400-gallon tanks, on rafters on outbuildings, etc." Serventy and Whittell (1962) state "favourite sites are the verandahs of country railway stations, shops and hotels. The nests may also be built under bridges and jetties . . ." Mathews does not mention bridges at all, Serventy and Whittell place bridges fairly low on the list of preferred nesting sites. It is interesting to compare these passages with the situation in New Zealand, where a summary of nest site preferences could read "most swallows nest under bridges and culverts, some on houses and outbuildings and a few in other artificial or natural sites." It may be that the birds which first made their way from Australia to New Zealand were bridge-nesters, and that this preference has been transmitted to their descendants, to be modified over the years by various factors. Shortage of suitable sites could be one cause; another cause could be successive failures to raise a family from a nest under a bridge. In 1959/60 a pair at Kawakawa were driven from their nest bridge by persecution and shifted to a bowling pavilion where they built a nest and raised young (H.A.F.); another bridge near Moerewa had been used as a nest site for some years but nests were persistently interfered with or destroyed by children and no nest was built on this bridge in 1965/66 season. Several bridges on the main road Hikurangi-Kawakawa had been occupied in previous seasons and the birds were back again in 1965 Spring but were driven away by a programme of spray painting the undersides of the bridges and presumably nested elsewhere.

Skegg (1962) records our impression that swallows favoured as nest sites bridges which were so situated that the birds could have a clear sweep through under the bridge and that bridges where this was hampered by presence of willows or other vegetation were not favoured. Subsequent observations confirm that this impression remains substantially correct but with the rapid rise in swallow population and increasing demand for sites, nests are now being built under many bridges and culverts where entry and exit conditions are less easy than appeared to be desirable in early 1962, and in some situations which would then have seemed quite unsuitable. In 1965 nests were found inside two pipe culverts, the downstream ends of which were blocked by floodgates; in each case the nest was well inside the culvert near its closed end.

The wide variation in placement of nests under bridges makes it impossible to generalise on the factors which affect selection of the particular position in which nests are placed. Michie (1959) noted that Awanui birds apparently chose a site under the end of a wooden main-road bridge in preference to any other part of it because the vibration from road traffic was less at that point, although nearer the centre of the bridge the nest would have been over the water and safer from interference. Under other main road bridges of solid construction which eliminates the vibration factor nests have been built year after year in situations vulnerable to human interference though alternative safer sites were readily available. There are signs that the human interference factor is beginning to imprint itself on the consciousness of some pairs; on several bridges nests were in previous years placed in accessible situations but are now situated high up under the crown of the bridge and over deep water. On the other hand, several big bridges on which nests had in previous years been built in inaccessible positions have now been abandoned in favour of small bridges, low over the water of streams, in the same area. A possible reason for abandonment of the big bridges could have been that the site was exposed to too much wind and sunlight.

Nests in pipe culverts or under wooden bridges on by-roads and farm roads may be as low as $1\frac{1}{2}$ - 2 feet above running water and in such situations are liable to be submerged or washed away by flash floods. Under other bridges nests may be placed at any height from 3 - 15 feet above ground or water level, and on buildings from 5 - 25 feet above ground. Although the placement of nests indicates little instinct to guard against human predation there is a measure of protection against other predators in that a large proportion of nests are so constructed that there is only a narrow (40 - 80 mm.) gap between the nest rim and some horizontal or near-horizontal surface above it (bridge decking, beam or eave). This often makes inspection of nest contents quite difficult, even when using an adjustable mirror on a pole.

Records of nesting on buildings were sparse until a year or two ago. I have already mentioned a nest in Kawakawa bowling pavilion in 1959 and Shanks (1960) reported nest building in a shed at Waiomio the same year; my other records from Bay of Islands County are recent ones from a farm cottage at Pakaraka, a farmhouse north of Waipapa, and attempted nesting on a house at Kerikeri Inlet, but there may be others of which news has not reached me. In Mangonui County birds nested in a woolshed near Herekino in 1961/62 (R.C.) and in

1963/64 in a boatshed at Awanui (R.H.). For 1964 and 1965 there are, however, numerous records of nests on farmhouses, cowsheds, piggeries, etc., a nest is reported to have been built on Herekino post office, and for two seasons there has been a nest under the eaves above an upstairs window at Houhora Hotel. From others parts of Northland I have records of a cowshed nest near Broadwood, a nest on a piggery at an inland farm in Whangaroa County, and one on a pumphouse at Poutu (M.J.B.). Nests have been found under Northland jetties at Pukenui, Kohukohu and Waitangi. Birds nested inside an old "pill-box," relic of 1939/45 war, at Kerikeri airfield; entry to the pillbox was by a small manhole or through square nine-inch gunslits and the nests were on the inside wall. Turbott (1965) mentions attempted nesting inside a concrete water guage in Canterbury and possible nesting in a converted railway carriage used as a caravan. Birds at Okaihau nested on a water tower and at Pukenui each of two reservoirs (constructed of concrete slabs and with a corrugated iron cover) had a nest, one built on the inside wall and the other on the wooden framework which supported the cover; entry was possible only through the narrow opening between the top of the uppermost slab and the sheets of corrugated iron. At Waipukurau swallows nested inside a corrugated iron tank for three seasons (B.D.B.).

Michie (1959) records nesting under a rickety wooden platform used by boatmen, three to four feet above the water and about a chain and a half from the lake edge at Lake Ngatu (Paparore). In 1962 birds were nesting at the came place under a similar structure, then used as a ski-ramp. Turbott (1965) records nesting in a launch at Lake Ellesmere in 1961/62, 1962/63, probably 1963/64 and certainly 1964/65 season; the first nest, which was destroyed by the owner of the launch before he realised what it was, had been built against the glass of the cabin window. Subsequent nests were also inside the cabin but on a ledge towards the bow. Swallows nested in the cabin of a boat anchored in Awanui Creek in 1962. Eggs were laid and hatched; the boat went to sea with the swallows on board and the parents continued to feed their chicks after it had returned to its anchorage (R.H.M.). In 1965 birds nested in a launch at Kerikeri Inlet, and in an old boat pulled up on the beach near Te Kao wharf there was a nest with four eggs in December. This nest was inside the cabin, just above the entrance; having entered the cabin the observer had to turn round to see it, and the parent bird had to double back to settle on the nest.

Swallows attempted to nest in the cabin of a truck at Houhora Heads (L.J.B.), and in the cabin of a dragline excavator left standing on the job over the week-end, near Moerewa (D.J.T.). Near Motutangi a cave has been hollowed out of a consolidated sandbank and houses a number of pigs. On the wall of this cave a swallow nest was found attached to the soft sandstone. The investigator who entered the cave after we had seen a swallow fly out was somewhat alarmed by the hurried exodus of startled swine.

Tokoroa Island is a basalt stack in the channel at Houhora Heads. On the leeward side and just above high water mark there is a large hollow or small cave about five feet high and five feet deep. A swallow nest was built on the rock wall in a small pocket well protected by overhang. The site was occupied in December 1965 and had been used in two of the preceding three years (A.W.).

I have seen a nest in a hollow on the crumbling cliffs at Kaimaumau and there are reports of nests built on sandstone cliffs or steep banks at Henderson Bay, at some inland localities north of Awanui (A.W.), and at Coal Creek, Ninety Mile Beach (L.J.B.).

Territory

A survey of nesting sites in Northland during spring and summer 1965 produced some interesting information on exceptions to the general rule "one site, one nest." In Table 1 figures are presented for two hundred nest sites, one hundred in Mangonui County and one hundred in other parts of Northland. Most of the sites were bridges and culverts. Nest figures refer to nests actually in use or obviously recently used; broken or partly built nests are not included.

TABLE 1

	Nests per site				Total	Total
	one	two	three	four	sites	nests
Mangonui	79	16	3	2	100	128
Eleswhere	90	9	–	1	100	112
Total	169	25	3	3	200	240

Although the higher figure for Mangonui County may in some degree be due to the density of swallow population in that area, I am doubtful whether this factor as yet greatly influences the situation. Ledgard (1960) found one nest in use and two which appeared to have been used in 1958/9 season under a bridge at Tokerau; Graham (1960) found two nests with eggs and a third nest partly completed under a bridge at Herekino. In Bay of Islands County Ross (1960) records two nests under a bridge at Te Iringa and Shanks (1960) four nests under two bridges at Waiomio. There was no population pressure in those early years, so I think it can be assumed that a proportion of the swallow population has a tendency to a mild form of colonial nesting. The bridge at Waiomio which was occupied by one pair in 1958 and two pairs in 1960 was used by five pairs in 1964 and four pairs in 1965. Pukenui jetty (not included in Table 1) had in December 1965 one nest with five eggs, two other nests each with a sitting bird, one new nest being built, and the remains of an old nest.

Multiple nesting is not necessarily connected with the size of the bridge. Skegg (1962) records five nests, four of which appeared to have been in recent use, under a wooden culvert on Kaimaumau road (it had only one nest with five eggs in December 1965). Of the two Mangonui records of four-nest bridges in Table 1, one was a small wooden culvert, the entrance to which was partly closed by growing flax; the other was a medium sized concrete bridge with steel girders which had replaced a culvert where Skegg (1962) reported two nests.

Courtship

After a pair have arrived on their chosen territory and before nest building starts a few days are spent in courtship activities. The pair indulge in high level chasing flights, following each other around in wide swift circles; and at much lower levels slow, sometimes almost hovering flights are accompanied by much tail fanning by one or

both birds. A pair may sit close together on a wire perch, uttering a crooning twitter and occasionally rubbing bills. I have sometimes seen courtship feeding, the hen sitting on a perch, the male flying round. Each time he approaches she makes a little movement, or opens her bill; sometimes he flies past and continues his flight for a time before returning. The offer and acceptance of food may take place after he has settled beside her on the perch, or as he hovers in front of her. On August 5th 1965 a swallow was seen at Kerikeri chasing a wind-blown feather floating through the air. Judging by known dates of laying first eggs in the district that season this may have been a little too early a date for collection of final lining material; pursuit of the feather may perhaps have been in play or in some way a part of pre-nuptial activity.

Nest sites which have been used in previous years seem to be accepted with little ado other than normal courtship behaviour, but looking for new nest sites sometimes involves much indecisive activity. A pair on my farm spent from 4th - 20th October going from one prospective site to another — a concrete cattle-stop bridge, a hayshed, an implement shed and a woolshed — each site holding their attention for a few days; none proved acceptable and the pair departed to nest elsewhere.

I have noticed that nest sites which have been used in previous seasons are often taken up early in the new nesting season and that new sites may not be occupied till a month or six weeks later. This leads me to think that perhaps old birds tend to nest early, using known sites, and that nesting activities of young birds are often delayed until much later in the spring.

Nest Building

Swallows make mud nests and the eggs are laid on a lining of feathers. Nests may be attached to a vertical surface or placed on a horizontal or sloping ledge. There is considerable variation in the size and shape of individual nests, depending on their situation.

Both sexes build. Michie (1959) writes: "I was able to watch both birds at close range for more than half an hour. They were gathering mud from the lake edge, flying to the same place each time, hovering for a few seconds three feet or so above the ground, then diving down without alighting and scooping a mouthful of mud, after which they returned to the site of the nest. After several trips they flew further afield and out of my sight either to get a snack or to gather grass straw to mix with the mud. On these trips they would be away four or five minutes and as their flight is so rapid I could not see whether they carried any straw or not." Quite frequently swallows alight on the ground to collect mud or straw, and when so engaged often display marked indifference to the presence of humans in the vicinity. This was particularly noticeable with a pair of birds at Waitangi; they went on with the job of mud collection from the edge of a wet patch of soil without any apparent regard for the movement around them of people working on their boats. The mud is carried to the nest site and attached to a vertical or horizontal surface, subsequent mud pellets being added, compacted and reinforced with vegetable or other material as the mudwork of the nest takes shape.

When the nest is attached to a vertical surface without any support beneath, construction commences by making a small mud bracket,

which eventually becomes the bottom of the mud structure. More mud is added to the top and sides of the bracket till it gradually assumes the shape of a shallow U; from this the sides are built outwards and upwards till the mudwork becomes a shallow bowl with firm rims and a deep base, but with a gap of varying depth at top centre of the area of attachment which still gives this part of the nest, when removed from the wall, the U appearance. This is illustrated in Figure 1 in which A, B and C show the variation in size and shape of three unsupported nests as seen in rear elevation (i.e., the flat surface of attachment to a vertical wall). A1, B1 and C1 show the same nests in plan (i.e., as seen from above).

The inside of the bowl (egg chamber) is lined first with vegetable or other material and later with feathers. Generally one type of mud is used for the whole construction but I have seen some nests where part was made of yellow and part of grey clay, and a few in which pellets of yellow and grey clay were mixed throughout the structure, sometimes unevenly and sometimes more or less in layers. Compacting material used in the mud structure may be dry grass, an occasional blade of green grass, rootlets of grass or ferns, scraps of fibrous material, fragments of wood, small land weeds or pieces of green water weed. Turbott (1965) lists leaves of *Ruppia* sp., a few fruits of *Lemna* sp., a seed and some leaves of *Trifolium* sp., some fruits of *Festuca arundinaceae* and a filamentous green algae as strengthening material used in a partly completed nest collected from a water gauge in Canterbury. Some nests have a little cattle or horse hair in the nest rim.

The first lining in some nests is mainly grass straw; in others a mixture of grass, rootlets, scraps of fern, small dry leaves, fine fibrous material and sometimes cow, horse or dog hair and some short fur; often a pad of sheep's wool forms part of this lining. The feather lining may be so generous that the feathers project over the nest rim and the eggs can hardly be seen amongst the feathers, or relatively sparse. A profuse feather lining may be individual preference or merely an indication that plenty of feathers are easily available; a sparse feather lining may be due to shortage of feathers, related to use of much wool in the nest lining, or due to lack of time; a nest is often well lined with feathers for the first clutch, less so for the second or subsequent clutches. Many kinds of feathers are used, depending apparently on availability; chicken feathers, black, white, mixed, or coloured; duck feathers of various colours, and feathers of Turkey, Pheasant, Guinea Fowl, and Red-billed Gull have been noted. Usually the feather lining is loosely laid but one nest had the feathers pressed into a tight pad. Some birds seem to be selective and many discarded feathers may be found below the nest, others seem to use what comes and throw none away, at any rate in the nest vicinity. 30 to 65 feathers have been counted in the inner lining of nests; in the nest with 30 the feathers were rather larger than usual.

Skegg (1962) notes our impression that the rougher the surface to which the nest is attached the less deep the area of attachment, and vice versa. In the light of further experience I now suggest that security of attachment to a relatively smooth surface is increased by a larger total area of attachment rather than by extra depth alone. Nests A and B were on relatively smooth walls, nest C on a rougher wall. Details of the three nests are as follows:

	A	B	C
Greatest breadth (side to side), mm.	150	205	115
Greatest width (back to front), mm.	90	90	85
Greatest depth, mm.	95	85	80
Depth of egg chamber, mm.	40	42	30
Weight in ounces	12	10	6

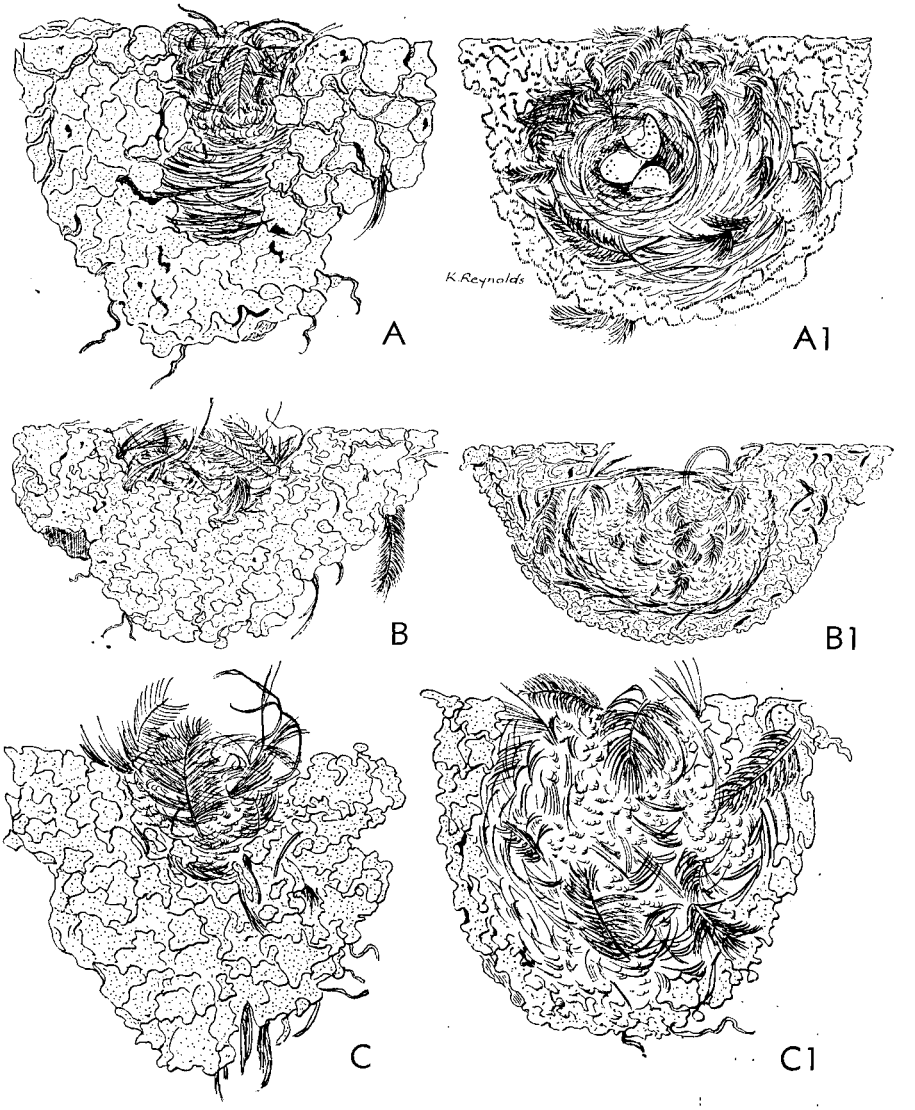


FIGURE 1 — Swallow Nests (not to scale)

In most nests the egg chamber is roughly circular and about 60-80 mm. across at the rim. Skegg (1962) found that egg chambers were normally 30-35 mm. deep, but had one nest with an egg chamber 50 mm. deep, this probably because instead of the normal 40 - 80 mm. gap between the top of the nest rim and the horizontal surface below which the nest is placed, this particular nest had very little headroom because it was built close to an angle in the wall which sloped forwards just above the back of the nest.

Unsupported nests under concrete bridges may be attached to retaining walls, buttresses or beams; those under wooden bridges to supporting beams or cross beams (log, squared timber or concrete). Concrete bridges without beams and with smooth vertical walls are not favoured as nest sites. Under one wooden bridge the clay bank was retained by a rough plank wall with vertical gaps between the planks. A nest was built across a gap, attached to the two planks and with a projection of its rear wall which anchored it to the clay between them. In a pipe culvert a root had grown through the gap between two pipes. A nest was built across this gap, with its rear wall extended into the gap and around the ingrowing root, which helped to support an otherwise precariously sited construction.

Unsupported nests are insecure and often fall with their own weight. Only a limited number last for a full season and so far I know of only two cases where such a nest was fit for use in a second season. All early nests reported were of the unsupported type but Skegg (1962) recorded from Houhora a small cup-shaped nest only 30 mm. deep placed on top of a culvert pipe. In 1962/3 season I found a nest at Waiomio placed on the flat flange of a steel girder under a wooden bridge. It was 90 mm. from front to back and 55 mm. deep, with a flat bottom where it sat on the horizontal surface and a flat back against the vertical surface. Like unsupported nests it had a gap in the back mudwork which in this case extended right down to the bottom of the nest and was filled with the grass lining. This was the first flat nest I had seen in this district where most of the bridges then under observation were of types which required construction of unsupported nests. Flat nests, however, are becoming increasingly common in Northland wherever the type of bridge provides a suitable supporting surface; I have seen nests placed on top of wooden beams, and some built partly on the projecting malthoid layer between wooden beam and steel girder; this is a rather insecure foundation as the malthoid sags with the weight of the nest, which tips forward. Flanges of steel girders are being used, when available; very small nests have been built on top of projecting bolts, and equally small nests, triangular in side elevation, have been built on top of diagonal steel struts near their junction with the girder. Under two wooden bridges flat nests had been placed on top of a pile of silt which had accumulated close under the decking. This gradual change in nest construction is all to the good as flat nests are smaller, easier to build and much more durable than unsupported nests.

Building of the first unsupported nest of the season usually appears to take nine to twelve days; mudwork is finished in four to six days and sometimes there seems to be a pause in activity when this is accomplished and before lining operations are put in hand. Building of second and subsequent nests after earlier nests have fallen or been knocked down is a much quicker process, usually completed in about

six days, four of which are occupied on mudwork and two on lining. I have as yet no record of the time taken to build a flat nest. When a nest falls down a new nest is generally built near the site of the old one, sometimes in exactly the same location. When a nest has broken off but part of its base is still fixed to the wall the birds sometimes, but infrequently, build a new nest up on the old structure. When a crack develops in the mudwork due to vibration or other causes and during the incubation or fledging periods, the birds sometimes carry out emergency repairs, bringing new mud pellets to close the crack.

Eggs

With the first clutch of the season the time-lag between apparent completion of nest lining and laying of the first egg seems to be usually three to six days. Sometimes (perhaps due to bad weather) this may be extended to a week or ten days, occasionally even longer. One nest was apparently fully ready on 6th October but the first egg was not laid till October 23rd. With second and subsequent clutches my records show that the first egg may be laid as soon as lining is completed, usually within one to three days of completion, occasionally four to six days. In one case I saw a male bird bringing a feather to a nest in which the hen was sitting, having already laid two eggs of her second clutch of five.

Eggs vary in shape, some being blunt ovals and others tapering towards the smaller end. Blunt and tapering ovals may be found in the same nest. The eggs are white, with a pinkish tinge when fresh, speckled and blotched with shades of brown or reddish brown and a few light grey undermarkings. The speckles and blotches are variable in density and distribution. In most eggs they are concentrated mainly in a zone at the larger end, with sparse markings on the rest of the egg. In other eggs the zone is present but the rest of the egg is more profusely spotted, and in some there is little or no suggestion of a zone, though there may be a cluster of closely set spots somewhere on the large end and scattered spots elsewhere. A few eggs have only a few small scattered blotches and otherwise the markings consist of irregularly distributed brownish specks.

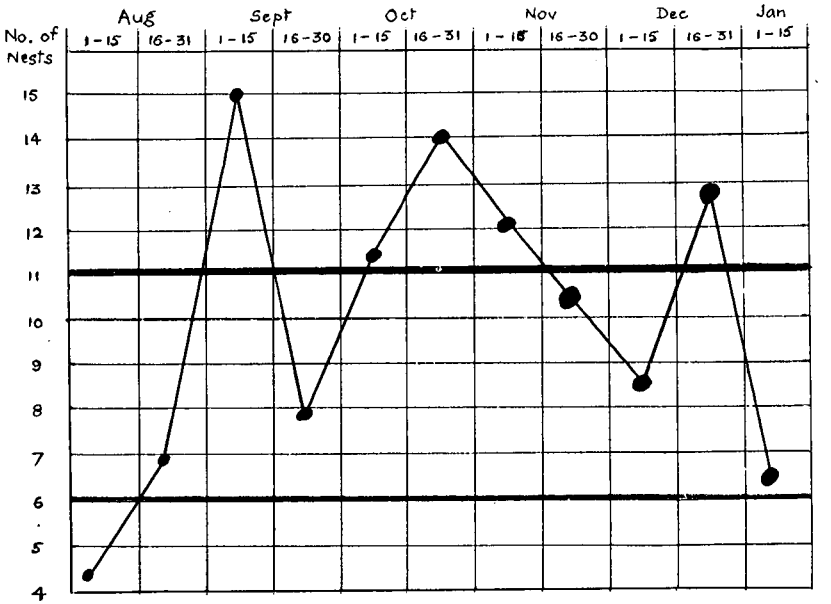
Michie (1959) records measurements of two eggs as 17.5 x 14 mm. Skegg records three eggs at 18 x 12.5, 17 x 12.5 and 17 x 12 mm. R. Cowan measured a clutch of four eggs at 17.5 x 12.5, 17 x 13.5, 18 x 13 and 18 x 13; and two eggs, the fifth attempt of this pair in 1965 season, at 17.5 x 13 and 16 x 12.5 mm. I have measurements of five single eggs at 17 x 13.2, 17 x 14, 17.5 x 13.8, 18 x 14 and 19 x 13, and of a clutch of three eggs at 18 x 13.5, 18.8 x 13.5 and 19.2 x 13.0 mm. The average of nineteen eggs as above detailed is 17.7 x 13.2 mm., and the range 16 - 19.2 x 12 - 14 mm. Serventy and Whittell (1962) give a range for Western Australia of 18 - 19 x 13 - 14 mm.

Records of Laying of First Eggs

The graph at Figure 2 summarises information recorded from 103 clutches over three seasons at nest sites in Bay of Islands County. This sample gives, I think, a reasonably accurate picture of the sequence of nesting in that area. The three peaks indicate the times at which maximum numbers of first, second and third clutches are laid. A few second clutches were laid in late August and September after the first clutch had been accidentally lost. Third clutches were spread over the period November - January.

There are a few records of late laying from different parts of Northland. Skegg (1962) records a fresh egg at Houhora in the last week of January; Flux and Wilson (1965) found two nests with single eggs and one with a clutch of three in the third week of February. Ross (1960) mentions an egg laid in a Te Iringa nest in the last week of February and (pers. comm.) a nest with two eggs at Kaikohe on 9th February. The Te Iringa egg did not hatch, and in my experience a fairly large proportion of eggs laid after mid-January are infertile or deserted.

FIGURE 2



The four August 1/15 records are for 1964. In 1965, first eggs from the same four nest sites were about three weeks later. In 1964 July was wet and relatively mild, and rain fell on 23 days; August had rain on 19 days. In 1965 rain fell on only 14 days in July and 16 in August; there were several days of overnight frost between 12th and 20th July, and a few very light frosts at the beginning of August.

Incubation

As far as I have been able to ascertain, egg-laying takes place in the early morning and one egg is laid each day till the clutch is complete. It is probably correct to assume that brooding normally commences when the last egg has been laid. On several occasions, however, I have found a bird on the nest about noon, or in the afternoon, when only part of the full clutch has been laid. Many more careful observations are needed to ascertain with any degree of exactitude the time and pattern of laying and the period of incubation. At this stage I can only state that the period of incubation from laying of

the last egg till hatching of that egg is about fifteen days. A number of clutches are known to have hatched on the fifteenth day. I think, but cannot be certain, that in a few nests eggs hatched on the fourteenth day. One nest in which the full clutch of three eggs had already been laid by 1200 hours on 12th September still had three eggs at 1710 hours on 27th September. The eggs subsequently hatched. If this took place on the morning of 28th September this would be the sixteenth day.

Generally all fertile eggs of a clutch hatch on the same day but three examples indicate that this may not invariably be the case:

Date and Time Inspected	Chicks in nest	Final number hatched
October 7th 1700 hrs.	two	four
October 9th 1700 hrs.	one	three
November 15th 1730 hrs.	one	two

In each case the time of the inspection was approximately an hour and a half before sunset.

I cannot say whether the male takes any part in incubation. From the number of occasions when at various times of the day I have found fertile eggs uncovered by either parent it is apparent that periods of inattentiveness are not infrequent.

Fledging

Such information as I have been able to record shows that the fledging period varies from eighteen to twenty-two or twenty-three days, and is generally twenty or twenty-one days. Under incubation I mentioned a clutch of eggs which had not hatched at 1710 hours on 27th September and were assumed to have hatched on the morning of September 28th. These three chicks were observed to leave the nest and fly around with their parents at 12 noon on October 16th, i.e., the eighteenth day from hatching. Flight was reasonably strong and there was no indication that their departure from the nest was premature or due to panic; the parents were rather excitable but the chicks flew well.

A brood which hatched on 24th December were perching, but not yet ready to fly on 11th January, the eighteenth day. A brood which hatched on 23rd December flew from the nest on 11th January, the nineteenth day. I have several records of a fledging period of twenty or twenty-one days. A brood hatched on 10th November appeared to be fully fledged but showed no inclination to leave the nest on 1st December, the twenty-first day; a brood hatched on 16th September exploded from the nest on the evening of 9th October, the twenty-third day. It is, however, possible that they had flown earlier that day, or perhaps even the day before, and returned to the nest to roost.

When first hatched the chicks are naked, with long necks, large heads and closed eyes. The eyes open about the third day. When the chicks are only a few days old it is usually fairly easy to count them even if the nest is in a dark corner; if one scratches lightly with one's mirror on the horizontal surface above the nest this usually produces a full muster of open yellow gapes. As the fledglings grow bigger and wing and tail feathers start to grow, and particularly in the later stages of growth, the nest becomes so full of chicks that it is often

difficult to tell how many there are in it; only one or two may respond to the mirror scratching while the others, full fed, sleep on.

Chicks are fed by both parents, usually at fairly short intervals in the morning and the evening but at longer intervals during the heat of the day. G. J. H. Moon (pers. comm.) informs me that at one nest he watched, nestlings were not fed for periods of up to two hours in the forenoon and up to three hours later in the day, but were apparently unaffected.

Nest sanitation is efficient. I have no conclusive data on cessation of production of the faecal sac; in the later stages of development chicks squirt over the edge of the nest, but fouling of the nest rim is surprisingly infrequent. Empty eggshells are removed by the parent; occasionally one finds them below the nest but generally this is not so, and they must be carried away for some distance.

A few days before the chicks are ready to fly individual chicks may be seen stretching their wings and moving them up and down. In the last day or two chicks may perch on the nest rim, or leave the nest and move along the horizontal surface on which it is placed (girder flange, beam, etc.), should one be available. Chicks hatched in nests attached to a vertical surface can of course go no further than the nest rim until they are ready to fly.

Chicks which are nearly but not quite ready to fly may panic when the nest is approached and take premature flight. This does no harm if the young birds are sufficiently grown to permit a short flight and immediate return to the nest as soon as the apparent danger is past but sometimes one chick, less developed than the others, may be able to do no more than flutter down at an angle, and have to be retrieved from the water, long grass or a blackberry thicket and returned to the nest. Chicks which have flown voluntarily at due time may at first spend only a brief period on the wing before they return to the nest to rest, but soon undertake much longer flights, returning to the nest to roost for a day or two, and in any case roosting in the vicinity of the nest for a few nights before they travel further afield. Parents may be seen feeding flying young on the wing.

Clutches and Clutch Size

For Australia, Mathews (1919) states "Clutch, three to five." Writing of Western Australia, Serventy and Whittell (1962) state "the clutch consists of three, sometimes only two, and on occasions as many as four eggs . . . two broods are raised annually."

In Northern New Zealand swallows are double-brooded or treble-brooded and the clutch is usually three to five, with one record of two. A sample of 132 clutches from the Bay of Islands gives the following result:

Clutch	Number of Clutches	Percentage
Two	1	1
Three	31	23
Four	57	43
Five	43	33
	132	100%

One egg hatched from the two-egg clutch, the other was infertile.

A breakdown of the above clutch records by months of laying is as follows:

Month	Eggs in Clutch 2	3	4	5	Total Clutches
August		4	5		9
September		3	12	11	26
October		5	9	15	29
November	1	7	71	9	34
December		10	11	8	29
January		1	3		4
February		1			1
	1	31	57	43	132

Of forty-three five-egg clutches, five were certainly and three probably first clutches; thirteen were certainly and fifteen probably second clutches; four were certainly and three probably third clutches.

The period between vacation of the nest by young birds and laying the first egg of the next clutch varies; in two cases it was only seven to eight days, frequently eleven to thirteen days, sometimes up to three or four weeks.

Sequence of Clutches; Hatching and Fledging Success

In Tables 2, 3 and 4 figures are presented from the records of twenty-five pairs on which it was possible to keep a check throughout one or other of three nesting seasons. The following symbols indicate the fate of nests, clutches or fledglings lost:

(a) = eggs disappeared from nest before hatching.
(b) = nest fell or was knocked down; subsequent layings (if any) in a new nest.
(c) = eggs infertile, deserted or did not hatch.
(d) = young disappeared from nest before fledging.

TABLE 2

Record of six two-clutch pairs

Pair No	One		Two		Three		Four		Five		Six	
Clutch	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Eggs	3	4	4	4	4	4	4	5	4	5	5	5
Hatched	3	4	1	2	2	3	4	2	(a)	5	5	4
Fledged	3	3	1	2	2	3	4	2	-	5	5	4

TABLE 3

Record of six three-clutch pairs

Pair No	Seven			Eight			Nine			Ten			Eleven			Twelve		
Clutch	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Eggs	3	4	3	3	5	3	3	5	3	3	5	4	4	5	3	4	5	4
Hatched	3	4	3	3	5	3	(b)	3	2	3	4	3	4	4	(a)	3	4	4
Fledged	3	4	3	3	3	3	-	2	2	3	4	3	3	4	-	2	4	4

TABLE 4
Record of thirteen pairs of mixed history

Pair No	Thirteen			Fourteen			Fifteen			Sixteen			Seventeen		
Clutch	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Eggs	1	4	3	2	4	4	3	5	5	4	3	3	4	4	4
Hatched	(b)	3	(a)	(c)	(c)	4	(c)	3	4	(c)	2	(c)	3	1	(a)
Fledged	-	3	-	-	-	2	-	3	4	-	2	-	3	1	-

Pair No	Eighteen			Nineteen			Twenty			Twenty-one			Twenty-two		
Clutch	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Eggs	5	2	3	5	4	3	5	5	3	5	5	4	5	5	4
Hatched	4	(b)	3	1	1	(b)	4	2	(b)	(b)	5	3	(a)	4	(a)
Fledged	4	-	3	1	(b)	-	(d)	2	-	-	5	2	-	4	-

Pair No	Twenty-three			Twenty-four					Twenty-five				
Clutch	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Eggs	5	5	5	4	3	0	5	2	4	3	5	3	4
Hatched	5	3	5	(b)	(b)	(b)	(b)	(b)	3	(b)	(b)	(b)	(a)
Fledged	5	(d)	5	→	-	-	-	-	3	-	-	-	-

A comparison of egg production by two-clutch and three-clutch pairs is as follows:

	Six two-clutch pairs	Six three-clutch pairs
Average eggs 1st clutch	4.0	3.3
2nd clutch	4.5	4.8
3rd clutch	–	3.3
All clutches	4.25	3.8
Total eggs laid	51	69
Eggs per pair	8.5	11.5

In the two-clutch pairs the second clutch was equal to or greater than the first clutch. The three-clutch pairs conformed to the general rule that in treble-brooded species the second brood is larger than the first or third.

The thirteen pairs listed in Table 4 show much variation in sequence of clutch size and I think that this is probably due to the disasters which overtook early clutches. I suggest that pairs thirteen, twenty-four and twenty-five were probably by nature three-clutch pairs. Pair thirteen laid one egg of its first clutch before one visit and before the next visit the nest had fallen, but the 4,3 sequence for the next two clutches would indicate conformity with the three-clutch rule. Pairs twenty-four and twenty-five had a difficult time. With pair twenty-four the site was under a rickety wooden bridge over which heavy earth-moving machines passed at intervals and on successive occasions the nest was dislodged by vibration. Pair twenty-five seemed unable to effect secure attachment of the nests to a vertical surface, although a

nest in the same situation the previous year housed three clutches without accident; the presence of a 5-egg clutch in the sequence could indicate that for these two pairs the normal number of clutches would have been three.

I have no knowledge of the history of pair fourteen except for one season. The nest site was a small farm bridge now replaced by a culvert and this has not been used as a nest site.

Pair seventeen site is the same as that used by pair two (two clutches) in the previous season. The poor result from the second clutch may have stimulated the pair to a third laying.

If the three-clutch rule is valid and if the maximum clutch is five eggs it would seem that pairs eighteen to twenty-three were by nature two-clutch pairs stimulated to produce a third clutch by poor results from or disaster to early clutches.

Pairs fifteen and sixteen displayed an unusual departure from normal behaviour. Eggs which fail to hatch may be cast out of the nest during the fledging period or may still be in the nest when the young birds leave, in which case they are usually ejected from the nest before the new clutch is laid. The clean-up of the nest may be a thorough affair, with a new feather lining and sometimes addition of extra mud to the nest rim, or it may be a much more casual effort. Pair fifteen laid a first clutch of three eggs which were covered for the normal incubation period and were still warm on the evening of the fifteenth day, with the parents on a wire near the nest. At the next visit there were eight eggs in the nest, and the bird was still sitting on eight eggs on two subsequent visits. Three chicks hatched, and at some time around hatching date the three original eggs were cast out. At least one egg of the second laying was in the nest until the young birds fledged and when they left it was found on the ground below the nest. The third clutch hatched normally.

Pair sixteen laid four eggs by 21st September and these would normally have hatched by 5th - 7th October. They did not hatch and were still in the nest, though cold, on 24th October. By 31st October three fresh eggs had been laid on top of the original four which by now were dull and discoloured, and the bird was sitting on seven eggs. On 15th November the first chick had hatched and there were still at least five eggs in the nest; a second chick hatched after that inspection and all but one egg of the first clutch had been cast out by November 20th. This too had gone by 3rd December when the two chicks were well grown. After they had departed the nest was cleaned out, new mud added to the rim, and a third clutch of three was laid on a sparse feather lining.

Table 5 compares hatching and fledging success and losses from Tables 2, 3 and 4, and expresses these as a percentage of total eggs laid.

TABLE 5

ex Table	2		3		4		Total	
Eggs laid	51		69		164		284	
Hatched	35	69%	55	80%	63	38%	153	54%
Fledged	34	67%	50	73%	52	31.7%	136	48%
Losses — eggs	16	31%	14	20%	101	61.6%	131	46%
fledglings	1	2%	5	7%	11	6.7%	17	6%
% fledged to hatched		97%		91%		83%		89%

Percentage of fledged to hatched is quite good at 89% but percentage of fledged to eggs is low at 48%; this is of course partly related to the hazards of human interference with nests in accessible positions and of insecure attachment of nests placed on vertical surfaces.

A breakdown of the causes of egg losses is as follows:

	Eggs	% of Losses	% of Total eggs
Lost by nest falling or knocked down	42	32	15
Lost by predation, human or otherwise	27	21	9
Deserted, infertile, did not hatch	62	47	22
	131	100%	46%

Of seventeen nestlings lost one was by nestfall, seven by predation and nine by other causes.

The casualty list would probably be lower in a district where more nests are placed on horizontal surfaces. In unfavourable circumstances it can be considerably higher. In 1964/65 season one large main road bridge was occupied by five pairs. Details of this small colony are not included in Tables 2 - 4. The situation became too confused to permit accurate identification of nest owners and fortunately it is not typical. The colony was subject to periodic persecution by local children and also some predation by sparrows. Five pairs of swallows built in one season a total of seventeen nests and laid forty-seven eggs, but hatched only fourteen chicks, all of which survived to flying stage.

As noted, the figures for percentages hatched and fledged in Table 5 are affected to some extent by predation and nest fall. I have extracted from Tables 2 - 4 figures for nests unaffected by either of those factors, to study results from different sizes of clutch.

Of eleven three-egg clutches (33 eggs) 25 hatched and 25 fledged.
Percentage of fledged to hatched 100
Percentage of fledged to eggs 76

These percentage figures are close to those obtained by summarising all my records of three-egg clutches.

Of nineteen four-egg clutches (76 eggs) 51 hatched and 45 fledged. This gives a fledged/hatched 88% and fledged/eggs 59%, but a truer figure probably emerges from a larger sample:—

Of thirty four-egg clutches (120 eggs) 95 hatched and 88 fledged.
Percentage of fledged to hatched 93
Percentage of fledged to eggs 73

Of eighteen five-egg clutches (90 eggs) 69 hatched and 66 fledged.
Percentage of fledged to hatched 96
Percentage of fledged to eggs 73

These figures are close to those obtained from all my five-egg records.

Nestling mortality was therefore nil in three-egg clutches, 7% in four-egg clutches and 4% in five-egg clutches. Percentage of fledged to eggs was best at 76% in three-egg clutches, and 73% in both four-egg and five-egg clutches.

Survival After Fledging

Twenty-five pairs (Tables 2 - 4) produced 136 flying young, an average of 5.4 flying young per pair. The best of the two-clutch pairs produced nine and the best of the three-clutch pairs ten.

I have no very useful information on survival after fledging. It is not possible to keep track of young birds after they have left the vicinity of the nest. On a number of occasions I have seen a family around the nest bridge a week or longer after hatching, sometimes complete and sometimes less one bird. I have only once found a swallow dead on a road. It is unfortunate that a row of swallows sitting on a wire has an irresistible attraction for a certain type of youth armed with an air gun. Young swallows do not seem to crash into plate glass windows as do young kingfishers, shining cuckoos and some passerines.

Causes of Loss; Predation

As already noted, 32% of losses in Tables 2 - 4 were by nests falling or being knocked down, and 21% by predation. Many nests were knocked down by thoughtless children for no reason except wanton mischief, and in one case four nests under a multiple-nesting bridge had been carefully removed from their position on vertical surfaces by some person, and placed on the ground. Two of them contained eggs. Under one bridge a nest had become detached from its anchorage and someone had found a forked stick with which he propped the nest against the wall in nearly its original position. This first aid was successful and the birds reared their family.

Skegg (1962) mentions a case where a nest had been built under a gap between two bridge planks and was full of road dust which had buried the single egg, and I have seen this happen elsewhere. Use of wool as lining material in the nest can have its pitfalls. On one inspection round we found a young bird, ready to fly, hanging below the nest with one foot firmly entangled in part of the wool lining.

A Hokianga farmer had swallows nesting in an outbuilding and found that their nests were repeatedly predated by rats. Eventually he closed up the building to prevent ingress by the swallows, so that they might seek an alternative building site (R.C.). I have suspected rat predation as a cause of losses at some nest bridges but have as yet no proof. It is also possible that Mynas may bear responsibility for disappearance of chicks from some nests; again I have no proof, but Mynas were in the area and it was difficult to think of any other cause of loss, having regard to the nest situation.

Red-billed Gulls sometimes dispute perches with swallows. Pied Stilts and Dotterels appeared to resent the presence of swallows hunting insects over a stream which spilled out on to a beach (M.J.B.). I have not noticed any antagonism between swallows and any other bird except House Sparrows, which sometimes chase swallows off wire perches and not infrequently interfere with their nests. H. A. Findlay mentions that as early as 1960 he saw straw hanging from swallow nests under a bridge at Kawakawa. Swallows which attempted to nest on a house near Kerikeri were driven off by sparrows. In 1964 season I came across several instances of sparrow interference. On one occasion two sparrows were seen taking feathers from the lining of a nest. A nest from which young swallows had flown was taken over by sparrows and

partially lined with binder twine and some feathers. A newly built swallow nest was appropriated before the swallows used it and similarly lined; another new nest was seen to have loose straw projecting from it and on investigation proved to contain three sparrow eggs. All these instances occurred under one multiple-nesting bridge, and it is interesting to note that in 1965 season there has been no sparrow interference whatever at this bridge, though human predation unfortunately still occurs from time to time. At another bridge there were in a nest four swallow eggs which should have hatched about 31st August; they were seen on August 29th. Inspection of the nest was not possible on 5th September because of flooding. By 13th September, when the chicks (if hatched) would have been about half grown, the parent swallows had completed and lined a second nest and the first nest was empty and had no feather lining. On 27th September it was filled with wool and rubbish and a dead cock sparrow dangled below the nest, one foot entangled in a strand of binder twine.

POPULATION SPREAD

As at 1965, Northland is the main stronghold of swallows in New Zealand. Swallow population is dense in Mangonui and Bay of Islands Counties, increasing in Whangaroa and Hokianga Counties, scattered in Whangarei and Hobson Counties. In Rodney County swallows have bred on the eastern side of Kaipara harbour, and there are sight records from Kaipara South Head. A few birds have been seen around Auckland, and in coastal areas at Firth of Thames and Bay of Plenty. Breeding has been reported from Waikato, Hawkes Bay, Manawatu and Wairarapa, and sightings from Taranaki.

The only reports of breeding in South Island come from Canterbury, but there are recent sight records from Cook Strait Islands, Marlborough, Nelson, West Coast, and a report of sighting from Southland.

The spread of population in the four northern counties is discussed in some detail and reports from other districts are summarised.

Mangonui County

This comprises the long peninsula running from Waipapakauri to Cape Reinga with Ninety Mile Beach on its western side and Rangaunu Bay, Houhora and Parengarenga harbours on the eastern coast, and a smaller peninsula with Lake Ohia at its base and Cape Karikari at its tip, between Rangaunu and Doubtless Bays; at the eastern end of Doubtless Bay is Mangonui harbour. The Awanui-Kaitaia-Ahipara triangle is flat country, separated by a range of hills from Herekino harbour. South of the coast road from Awanui to Mangonui the land rises to the Maungataniwha Range.

In 1958/59 season Michie (1959) reported nesting of two pairs of swallows at the southern end of the large peninsula, one pair at Awanui and one pair at Paparore; in the same year swallows were present at Pukenui (Houhora harbour) and may have nested; they certainly did so in 1959/60 season (A.W.). Michie also reported a nest at Aurere Flat, west of Kaingaroa and near the base of the smaller peninsula. In the following season (1959/60) Ledgard (1960) reported two nests at Tokerau, on Doubtless Bay, and Graham (1960) two nests at Herekino. It seems reasonable to suppose that the present swallow population of Mangonui County is largely if not wholly made up of successive generations descended from these eight pairs.

Establishment of swallows on the main peninsula has been most successful, especially on its southern half. By 1960/61 there were already a number of nests around Pukenui, Raio and Motutangi. Skegg (1962) reported four sites between Paparore and Kaimaumau and his most northerly nest was about two miles north of Houhora; there were reports of sightings from Waihopo (K. Bond) and Paua (D. V. Merton). Nests were reported from near Te Kao in 1962/63, Tangaoke Landing and Te Paki Road in 1964/65. On the west coast there was report of a nest south of Hukatere in 1960 and of sightings at the Bluff in 1962, Scott Point and Cape Reinga (A.W.) in 1964. In December 1965 we found that the four sites reported by Skegg (1962) between Paparore and Kaimaumau were still occupied, plus another four sites on the same stretch of road; twenty-one birds (not flocked) were seen around Kaimaumau. On a by-road south of Waiharara a bridge had one old and three new nests and we saw a flock of twenty-five young birds. On or near the road Motutangi-Ngataki and under Pukenui wharf there were eighteen nests; every farm in this area seems to have swallows nesting under farm bridges or on buildings. Three nests were found between Ngataki and Te Kao; near Te Kao school there were three nests under a bridge around which fourteen birds were flying and perching. Other nests were found at Tangaoke, Te Kao wharf, south of Paua road junction and north of Te Hapua road junction.

In the stretch from Kaingaroa to Mangonui where Aurere and Tokerau nests were recorded in 1958/59 and 1959/60, Skegg recorded in 1961/62 season nests at Kaingaroa, Aurere and Parapara stream. In 1962/63 there was a nest at Lake Ohia and the nesting range extended eastwards to Taipa (L.J.B.). This eastward extension had continued to Cooper's Beach by 1964/65 and to Kohomaru road junction (east of Mangonui) by 1965/66. North of the main road there have been frequent visual records from various parts of the small peninsula, from 1959/60 onwards. At the time of the solar eclipse in May 1965 swallows at Matai Bay were put to flight each time a rocket was launched. No search was made for nests in this area but swallows are undoubtedly breeding. South of the main road swallows have spread inland along roads which follow the course of streams and rivers. In December 1965 there was one nest on a road about a mile south of Kaingaroa, eleven nests at eight sites on the road south of Lake Ohia and two nests on the Parapara road. Taipa river divides to become Paranui stream and Oruru river. There were five nests on Paranui road, and along the valley of the Oruru river and its tributaries we found ten nests, most of them in Peria district where there is a good swallow population and further search would certainly have added more nest sites to the record.

Swallows are numerous in the flat lands in the Awanui-Kaitaia-Ahipara triangle. No detailed search was made in this area, but the total number of nests must be very large; on nine miles of road seventeen nests were found at thirteen main road bridge sites. Swallows have spread along the Awanui River and its tributaries as far as Fairburn and Kaiaka on Te Puhi stream, Pamapuria in Victoria Valley, and south to Takahue; nowhere in great numbers, but widely distributed.

A ridge of hilly forested country lies between Ahipara and Herekino, and it is geographically more convenient to discuss the Herekino swallows along with those of northern Hokianga.

Whangaroa County

Relatively small in total area, with forest in its north-western corner and along much of its southern boundary, Whangaroa county has so far only a limited swallow population. On the east coast there have been since 1963 frequent sightings of swallows at the mouth of Takou River and they probably breed somewhere in this area, but the main concentration is around the southern side of Whangaroa harbour. The first record for this county is by Skegg (1962), who saw three swallows on power lines at Pupuke road junction. In December 1965 we found twenty nests. Most of these were in the lower reaches of streams which flow into Whangaroa harbour (Kaeo area, three nests; Pupuke river, five nests; Waihapa area — west of Waitaruke, eight nests); four nests were well inland on Otangaroa road, up the Wainui River.

Hokianga County (including Herekino — see Mangonui County)

We know that there were two nests at Herekino in 1959/60 season. Present distribution of swallows lends weight to the belief that colonisation of Herekino and Whangape harbours and part of Hokianga harbour may have been accomplished by descendants of these original pairs.

In December 1965 we found two nests on the Ahipara road just north of Herekino and three nests under bridges on the southern side of Herekino harbour; another bridge which was occupied in 1963/64 season was being dismantled and replaced. Awaroa bridge has been used as a nest site for some years. On the main road from Herekino past Awaroa bridge to Panguru turnoff we found eight nests, and seven nests on four miles of Diggers Valley road which then climbs steeply into hilly country; in 1964/65 there was a nest about two miles up the Waiotehue road.

Awaroa river drains into Whangape harbour. There was a nest at Whangape; near Pawarenga, on the southern bank of Rotokakahi river which is the other arm of Whangape harbour, we found six nests in October 1965; the big bridge at Rotokakahi was occupied in 1963/64 season (R.C.) but is not now used. In previous years there have been nests under bridges on Kohe road, which runs westwards from near Rotokakahi to a point further upstream on Awaroa river, and in 1965 two nests were found further inland, north of Runaruna.

The steep broken country of Warawara forest lies between Whangape harbour and the Mitimiti-Panguru road, but birds now nesting at Mitimiti could have come down the coast from Whangape. A few miles further south is the entrance to Hokianga harbour. On its southern side there was a nest near Whirinaki in 1961/62 (M.R.); in December 1965 we found nests at Oue and near Pakanae and birds nested at Waiotemarama (H.R.McK.); across the harbour at Panguru birds have nested since 1963/64 (R.C.).

Further east, Mangamuka and Waihou rivers drain into the upper reaches of Hokianga harbour. Two nests were found near Mangamuka in 1965; there were sightings near Mangamuka bridge in 1963 and 1964 and near Umawera in 1964. West of Mangamuka river birds nested at Kohukohu in 1963/64, at Te Karae in 1964/65, north of Kohukohu and near Motukaraka in 1965/66. There were sightings between Rangiahua and Horeke in 1963; in 1965 we found a nest a mile south of Horeke, five nests on Marangai-Horeke road and two

nests near Rangiahua, one in a site known to have been occupied in the previous season. The Waihou river valley runs eastwards nearly to Okaihau. It seems likely that colonisation of Waihou and Mangamuka valleys may have been by birds which spread from the abundantly populated area round Okaihau and Lake Omapere in Bay of Islands County.

Bay of Islands County

In Bay of Islands as in Mangonui the first record of nesting swallows was in 1958/59 season, when two nests were built at Waiomio (Shanks, 1960). In 1959/60 season birds nested at Kawakawa (Findlay 1960), and Ross (1960) reports two nests at Te Iringa, south of Kaikohe; he also quotes sight records by Mr. Barrett of Old Bay Road, east of Ohaewai, which indicate probable nesting in that area. Mr. Gallagher of Kaikohe tells me that he saw his first swallow while duck shooting at Lake Omapere in May 1958.

It is not difficult to build up a picture of spread which postulates progressive radial dispersal of young birds to find new sites at increasing distances from these original centres.

East of Waiomio the country is hilly and broken with considerable areas of forest, and spread seems to have been in a southerly direction. At Waiomio Shanks (1960) records two nests in 1958/59, three nests in 1959/60; in 1960 winter a flock of seventeen birds was seen. Four nests were occupied in 1960/61 and in that season birds were sighted at Towai and Motatau, both about six miles away in a direct line. In 1962/63 there were six pairs at Waiomio and birds were nesting further south at Akerama, and at Hukerunui, Whakapara and Hikurangi in Whangarei County; there were also nests in the Towai-Maromaku-Motatau area.

Kawakawa birds which nested in 1959/60 may have come from Waiomio or may have been a separate nucleus. Spread from there appears to have been westwards to Moerewa, Otiria and Ngapipito, south-west to Pokapu and Matawaia, northwest to Pakaraka and Oramahoe and north-east to Opua and perhaps to Waitangi. Birds sighted at Karetu and at Waikare, east of Opua, are probably an extension of this group.

Old Bay Road birds probably spread eastwards towards Paihia, westwards to Okaihau and northwards to Kerikeri, where the first nest was recorded in 1960/61 season. In 1963/64 I knew of five nests in Kerikeri district, in 1964/65 eight and in 1965/66 fifteen nests. The birds sighted and thought to be breeding at Takou Bay, on the border of Whangaroa county, were perhaps the present northern limit of this spread; in 1965 five birds were seen on Moturoa island at the mouth of Kerikeri Inlet.

From the progeny of Te Iringa birds may have come the Kaikohe population and perhaps that around Lake Omapere. In any case they did well, for Ross (1962) records a flock of 100 in February 1962. There is good swallow feeding ground at Te Iringa and this flock may have congregated from a wide area; the southern shore of Lake Omapere is only about six miles away. Okaihau lies just north of Lake Omapere and as already mentioned swallows have spread from there down the Waihou valley and also down the Utakura river towards Horeke. From Te Iringa there has also been a southward spread towards Matarau and Three Bridges on the Huehue stream.

Whangarei County

Apart from the southward extension from Waiomio already mentioned I have not explored this area. The most southerly nest I have found was about four miles north of Kamo. I have had a report of nesting near Riponui (K.R.) and of a sighting in August 1964 at Awaroa river between Whangarei and Onerahi (C.W.D.). No other reports have been received, but it is fairly certain that quite a number of nests will be found in the northern half of the county, and perhaps elsewhere, when a search is made.

Hobson County and Kaipara Harbour

North of Dargaville a sighting was reported in September 1963 near Mamaranui (M.R.), and a nest found near Ahikiwi in 1965 was photographed and reported in the local paper. I have been told of nesting at Dargaville, and in 1965 a bird was seen at Tangiteroria, on the Dargaville-Whangarei highway. South of Dargaville there is an unconfirmed report of sighting at Te Kopuru in 1960, and I am told that birds nested under bridges in that area in 1965.

Near Poutu a swallow was seen on 25th October 1963 (M.R.). There was an unconfirmed report of breeding in 1963/64 season; two birds were watched feeding over a swamp on 9th July 1964; in 1964/65 season a pair nested in a small isolated pumphouse and lost two clutches, but may have had later success as a party of five or six birds was seen around the homestead on 3rd April 1965 (M.J.B.).

At Kaipara South Head sightings were reported from 11th - 31st May 1963; the following autumn birds were again present up till 10th April 1964, when three birds were seen (M.A.W.).

Tapora is on the peninsula which lies east of Poutu and across the harbour. Birds were seen on a farm at Tapora from August 1964 (W.D.W.). A Field Study Course was held at Kaipara in January 1965 and during the course Miss Goodwin and Miss McIntyre found three nests (one old, one with one egg, and one just started) under a bridge on Island road, and saw eleven or twelve swallows. In April 1965 two adults were around the same bridge (R.B.S.).

Kaipara harbour and the Wairoa valley are ideal swallow country and a big increase in swallow population may be expected.

Auckland and Adjacent Areas

I have been told that birds were seen at Leigh, on the east coast about 40 miles north of Auckland, about 1963, but have been unable to confirm this.

Single birds were seen in the Waitakere ranges near Auckland in March 1961 (A.O.E., R.B.S.), another bird in Auckland area in October 1963 (R.B.S.) and one at Mangere oxidation ponds on 1st March 1964 (H.R.McK.).

Firth of Thames

Three birds were seen at Miranda in April 1964 (H.R.McK.). The swallows apparently remained in the district. One bird was seen two miles inland on May 2nd (F.C.K.), three were flying over canals and fields and under a bridge on May 19th, one was over Miranda pools on August 14th and there were frequent sightings at or near the pools from 14th September 1964 till 12th October 1965 (H.R.McK.).

Note: On the inset maps distribution of the Welcome Swallow is indicated as follows:—

Solid black — continuous occupation.

Round spots — nest sites in areas of scattered occupation.

Crosses — sightings.

Waikato

During 1963 shooting season swallows were seen three times at Whangamarino creek, the largest number on one occasion being twelve; some were bathing in shallow water and others were hunting over the water for insects. In May 1964 swallows were reported from lakes just north of Waikato river mouth (H.R.McK.). In 1964/65 season birds were seen frequently around a house and a bridge in Whangamarino district, but no nest was found (M.P.D.). In October 1965 R. T. Adams found a breeding pair under a humpback bridge on Waerenga-Island Block road. Further south, between Ohinewai and Lake Waikare, a farmer reported that a number of swallows had been seen perched on willows in May 1965. In October a nest was found, again by R. T. Adams; two pairs were seen in the area in October (H.R.McK., R.B.S.).

Bay of Plenty

Hall (1960) reported a swallow seen hawking over a swamp two miles from Matata in March 1959; it was seen at the same place on subsequent visits, and in November 1959 three birds were seen over another swamp three miles from the original sighting. I have no other information from the district except a note of a possible sighting near Te Puke.

Hawkes Bay

Hankins (1963) describes a nest under a small wooden farm bridge near Waipukurau which had four eggs on 25th November 1962. Two chicks hatched, but the nest later came to grief in a flood. A recent report from Wildlife Branch states that Mr. L. V. Hansen, also of Waipukurau, had a swallow nest on his property in each season

since 1962/63. A flock of about twenty birds was seen at the south end of Lake Hatuma in 1963/64 season. I have no recent estimate of increased population. At Bay View, north of Napier, two birds were seen in the period June - August 1964 (N.B.M.).

Taranaki

Six swallows were seen by M. G. Macdonald and F. C. Kinsky on 11th July 1964 at the mouth of Waiongana river, between New Plymouth and Waitara. Two or three birds are reported to have been seen at the same place by Mr. Brandon in the previous year. In July 1965 a bird was seen at Waiongana river, one at Waiwakaiho river mouth a little further west, and one at New Plymouth airport (M.G.M.).

Manawatu

The first record of swallows in Manawatu was when Miss Ngaire Shailer, Lake Road, Oroua Downs (near Himatangi) wrote to the late Major R. A. Wilson in March 1961 saying that two swallows had been around a cowshed for about a month. Birds are known to have nested in 1962/63 season and there was a newspaper report of a flock of twelve birds seen near Himatangi in May 1963. In 1964 there were records of sightings from Himatangi and Tangimoana, at the mouth of the Rangatikei river, and up to sixteen birds were counted. In 1965 twenty-two birds were counted, mostly in Tangimoana area; birds bred in a hayshed near Lake Omanuka, near the road from Himatangi to Sanson, in 1964/65 season; a number of birds were seen over some of the numerous small lakes between the main road and the coast in December 1965. The total population in this district may be considerable, but they are difficult to count (E.D.).

Wairarapa

R. Cavanagh reported sightings of quite a few swallows around Pirinoa, south of Lake Wairarapa, in 1963. In May 1964 a bird was seen feeding over a lagoon about three miles from Featherston and Mr. Nix of Kahutara found what was probably an old nest that year. In September 1965 a pair was found breeding under a bridge between Featherston and Martinborough (B.D.B.).

Cook Strait Islands

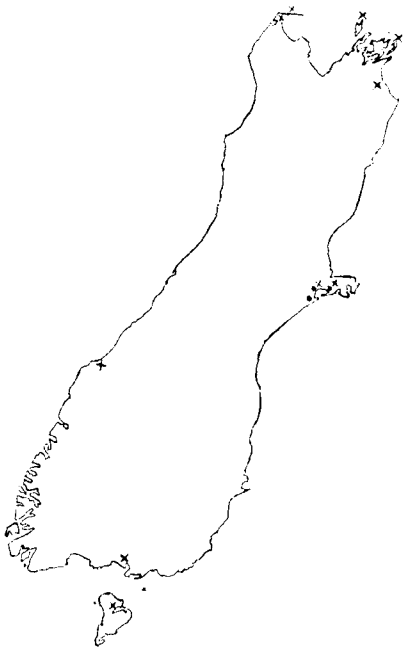
Mrs. Jepson saw two swallows perched on wires on Stephens Island in December 1961 (B.D.B.). On The Brothers A. Wright saw a bird flying and perching on the fence near a hen run on the morning of 16th September 1964; it remained till about 2 p.m. On the previous two days there had been gale force north-west winds and heavy rain; on the 16th the wind was southerly, thirty knots, with cloud down to 900 feet, and there had been rain earlier in the day.

Marlborough

My only record from this area is of two birds seen flying round Smith's Bridge, five miles east of Blenheim, on 24th July 1957 (J. A. Cowie).

Nelson

Heather (1956) records a sighting at the base of Farewell Spit on 25th November 1955. In April 1965 a party of eight birds was reported over the lake at the base of the Spit, and B. D. Bell saw seven birds (probably the same party) twelve miles along the Spit.



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Crosses — sightings.

West Coast

A swallow was seen by G. P. Adams at Jackson's Bay, South Westland, on 31st August 1962 (B.D.B.).

Canterbury

Turbott (1965) describes the establishment of swallows as breeding birds around Lake Ellesmere. The first nest, at Lakeside, was in 1961/62 season; birds nested there in 1962/63, perhaps in 1963/64, and in 1964/65 seasons. Swallows were seen at Kaituna in January 1963 and nested at Ataahua in 1963/64 season. Birds which may have been this family were seen four miles from the lake up the Kaituna valley in December 1963. Two birds were seen at North Selwyn Huts in January and one in early February 1964.

Southland

Henderson (1964) describes a bird observed intermittently from November 1963 to March 1964 at Otatara. Editorial comment was that the account and accompanying sketch answered the description of a juvenile Welcome Swallow but "a small patch of creamy yellow on the upper tail coverts or very low on the rump" and the description of the upper parts as "rich velvety brownish black" raises some doubt as to whether the bird was not in fact a Tree Martin.

DISCUSSION

Before 1958 there were in northern New Zealand vast areas of suitable swallow habitat, underpopulated by insect-eating birds. Conditions were ideal for successful colonisation by the 1958 invasion. Population increase has been rapid in the areas of original establishment; there has already been considerable secondary range expansion which will no doubt continue as long as additional ecologically suitable areas are available for occupation.

We know that five pairs bred in 1958/59 at Awanui, Paparore, Aurere and Waiomio. Other pairs may have nested unrecorded at Pukenui, Tokerau, Herekino and in Kaikohe district. It is not possible to estimate the present swallow population of the four northern counties with any degree of accuracy, but in my travels during 1965/66 season I have recorded 270 nests = 270 breeding pairs at the start of that season. The search for nests was undertaken primarily as an index to present distribution, and of necessity was limited to main roads and a proportion of by-roads. I should be very surprised if I recorded more than 25% of the nests which actually existed; if we accept that figure this would give a total of 1080 breeding pairs, about half of these in Mangonui County. I suggest this is not an over-estimate.

There has been a suggestion that the establishment of breeding populations in Waikato, Hawkes Bay, Manawatu, Wairarapa and Canterbury may have been brought about by southward spread of swallows from Northland. As we have seen, there is as yet no population pressure in Northland which cannot be eased by secondary range expansion in that area; I therefore propose an alternative theory to account for these later colonisations.

It may be significant that first sight records for Bay of Islands, Kaipara and Waikato were in May, Firth of Thames in April, Bay of Plenty and Auckland area in March. Taranaki and Marlborough birds were not seen till July but may have been in the area for some time, though unobserved. Presumably the autumn months would be the time of northward movement from Tasmania, and strong westerly winds at that season could give stragglers assisted passage to New Zealand, where some of the survivors remained to breed. We know that swallows appeared at Herekino and Kaitaia about forty years ago, that stragglers were collected at the Auckland Islands in 1943 and at Stewart Island in 1953; a bird was seen at Farewell Spit in 1955, two in Marlborough in 1957, and there were sightings at Bay of Plenty in 1959. It seems to be generally accepted that colonisation of Northland was the result of the successful 1958 invasion. The evidence of straggler records over so long a period and over so wide an area inclines me to the belief that the later colonisations were the result of further successful invasions which occurred over the years subsequent to 1958.

Such information as is available indicates that the population increase and spread of swallows in these southerly areas is proceeding more slowly than was the case in Northland.

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SHORT NOTE

GLOSSY IBISES NEAR CHRISTCHURCH

As far as I am aware, the Glossy Ibis *(Plegadis falcinellus)* has not been previously recorded near Christchurch. I therefore thought my two local records of this species might be of interest.

On 5/9/65 a Glossy Ibis was noticed along the edge of the Heathcote-Avon estuary near the South Brighton School. It was a vigorous feeder. When first seen it was probing with its beak into the saline mud-flats along the water's edge; later it concentrated its activity along the edges of a shallow freshwater stream. In contrast to its ungainly gait, it was a strong flier, with a quick take-off and a rapid wing-beat. There was intermittent gliding.

This ibis was subsequently seen by Miss M. Davis and Alan Wright on 30/9/65; and again by Miss Davis on 12/10/65.

An earlier record is of three Glossy Ibises which I watched feeding together just out from the Sumner lifeboat shed on 7/3/58. At this time there was a widespread drought in Australia; and Frith ex Hoogerwerf recorded a general increase in the wanderings of Australian waterbirds.

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— G. A. TUNNICLIFFE