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42

The ducks of Macquarie Island

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THE DUCKS OF MACQUARIE ISLAND

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ABSTRACT

Early references to waterfowl on Macquarie Island and observations made by ANARE expeditioners between 1949 and 1985 are reviewed and discussed. Apart from a unique (perhaps erroneous) record of a mute swan Cygnus olor, information is restricted to the Pacific black duck Anas superciliosa, the grey teal A. gibberifrons and the alien mallard A. platyrhynchos and its hybrids.

Black duck and grey teal were seen by early visitors to the Island but despite the infrequent potential for escapes of domestic ducks, mallards were not recorded until 1949. Occasional teal, and mallards were seen in the years following the establishment of the permanent scientific station (1948) but mallards (and hybrids) have become more numerous in recent years. Though grey teal may disperse to Macquarie Island in times of drought on the Australian mainland, the source of mallards may be New Zealand or the less distant Campbell and Auckland Islands.

The few available records of breeding (eggs, ducklings and nests) for black duck suggest that laying begins in September and extends at least into January. Zooplankton is most abundant in spring and summer, but ducks may obtain high protein foods from the littoral and sublittoral areas and may also take seeds of terrestrial plants.

Available information does not allow separation of habitats used by black duck or mallards. However, most observations are around coastal areas. There is some indication that records have increased along the south-western and eastern sides of the Island, but generally there are few observations of either species on the higher, central plateau.

The intrusion of mallards onto the Island and the resultant hybridisation with black duck poses a threat for the future integrity of the latter native species.

1. INTRODUCTION

Macquarie Island (54°30'S, 158°57'E) lies some 1500 km to the south-east of Tasmania. Apart from stacks and neighbouring islets, the Auckland Islands (640 km) and Campbell Island (700 km) to the north-east are the nearest land masses. New Zealand is approximately 1100 km away. The Island was discovered in 1810. Fur seals (Arctocephalus sp.), elephant seals (Mirounga leonina), and later penguins (predominantly the royal penguin Eudyptes schlegeli) were harvested until 1919 (Cumpston 1968). Throughout the earlier years visits were regular and sealers remained ashore for extended periods. With the subsequent decline in seals visits reduced in frequency.

Few published records of the Island's fauna comment on anseriforms. There is a unique record of a white swan which was caught and provided an 'acceptable addition to the larder' (Rourke 1903), (presumably the mute swan Cygnus olor was intended, but perhaps the wandering albatross Diomedea exulans was involved). All other observations relate to Anas species. Raine (1822) recorded 'teal' on lagoons on the Island's 'top' in 1821, and distinguished them from 'wild duck' - a commonly used name for the Pacific black duck Anas superciliosa, later specifically identified by Hamilton (1895). Sealers too occasionally saw teal (Scott 1883) and others hunted ducks (Sinclair 1877, Thomson 1912, Tulloch 1916) or gave some details of their occurrence (Hamilton, and Blake in Cumpston 1968, Falla 1937, Taylor 1955, Villiers 1925). Gwynn (1953) reported a mallard A. platyrhynchos in 1949, and Keith and Hines (1958) discussed the incidence of grey teal A. gibberifrons in the 1948-57 period. More recently Warham (1969) discussed observations of black duck during 1959-61 and Merilees (1971) presented details for mallards seen in 1967.

Following the establishment of the ANARE station in March 1948 and the gradual increase in the number of biologists studying ornithology, from the 1950s onwards (Ingham 1984) and more particularly in later years, there exists a body of information on the birds of the Island. Included are observations on waterfowl not previously summarised. In this Research Note the author presents a review of the data available for black duck, mallard and grey teal collected from 1949 to January 1985. Such details are placed within a historical context and discussed in relation to other aspects of the Macquarie Island environment.

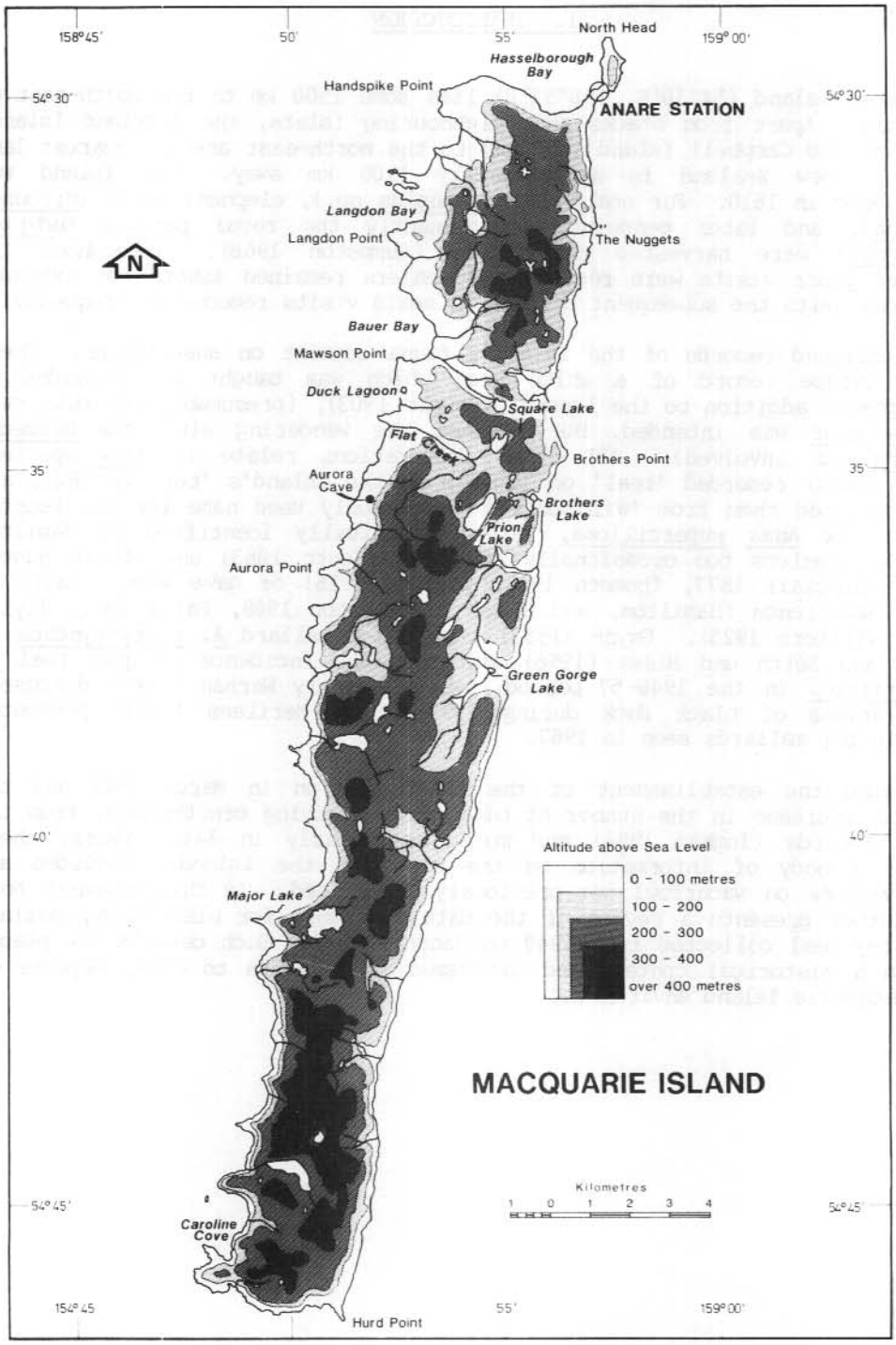

Figure 1. Map of Macquarie Island showing relief details and locations mentioned in the text.

2. CLIMATE, VEGETATION AND GEOGRAPHY

Macquarie Island lies just north of the Antarctic Convergence. It has a cold temperate climate which should be considered as sub-polar oceanic (Simpson 1976, Taylor 1955), with 70% of annual sunshine occurring during October-March (Copson 1984). The Island has relatively low, constant temperatures (annual mean 4.7°C, mean maximum 8.5°C in January, mean minimum 1.3°C in September), high relative humidity (annual mean 89%) and rainfall (861 mm) which is reasonably evenly distributed throughout the year (312 days). Winds average 8.3 m sec^{-1} and are near constant, strong and predominantly from the west to north-west (details from Copson 1984). These data are from the meteorological station (at 6 m) on The Isthmus and temperatures (2-4°C lower), wind speeds (25-30% greater) and rainfall are modified with increasing altitude across the plateau (Copson 1984, Taylor 1955).

Vascular vegetation on Macquarie Island is depauperate and restricted, basically, to five major formations: wet tussock grassland (dominated by Poa foliosa), herbfield (Pleurophyllum hookeri), fen (Juncus scheuchzerioides), bog and fellfield (Taylor 1955). Later authors (Ashton and Gill 1965; Seppelt, Copson and Brown 1984) have modified and extended the classification of the formations, as has Copson (1984), who noted that rabbits Oryctolagus cuniculus had seriously influenced not only the distribution of formations but also their composition.

Macquarie Island, is approximately 34 km long and 5.5 km at its widest and has an area of 12 700 ha (Copson 1984) of which about 2% is occupied by ponds and lakes varying from a few square metres to some 46 ha (Evans 1970). Peterson (1975) considered that the Island had some thirty or so lakes over 0.04 km^2, with eleven being more than twice that size. In the main, the Island is dominated by the central plateau (200-300 m) with its high isolated peaks. Raised beach terraces extend around approximately half of the Island, particularly behind the north-western coast (Figure 1), and like most of the coastline, are backed by steeply rising slopes.

Table 1. Logged records of black duck (+) and mallard including hybrids (*) at Macquarie Island, February 1963 - January 1985 (data from ANARE and Tasmanian National Parks and Wildlife Service files).

Years	Month											
	O	N	D	J	F	M	A	M	J	J	A	S
1962-63					+	+	+		+	+	+	+
1963-64					+							
1964-65			+*	+	+	+	+*					+*
1965-66	+*	+*	+									
1966-67			+			+						
1967-68	+						+	+				
1968-69								+				
1969-70			+	+	+	+	+	+	+		+	+
1970-71		*	+									
1971-72									+	+		+
1972-73			+									
1973-74			+*									
1974-75								+	+*	+*	+*	+*
1975-76	+	+*	+*	+*	+*	+*	+*	+*	+*	+*	+*	+*
1976-77	+*	+*	+*	+*	+		+	+		+		+
1977-78	+		+*	+*		+		+*		+*	*	+*
1978-79	+*	+*	+*	+*	+	+*	+*	+*	+*	+*	+*	+*
1979-80	+*		+					+				
1980-81	+	+*		+								
1981-82	+	*				+						
1982-83	+											
1983-84	+*	+*	+*	+*		+*		+	+	+*	+*	+*
1984-85	*	+*	*	+								

3. WATERFOWL OBSERVATIONS

Apart from literature records and observations made in December 1985, the summaries on individual species of waterfowl (and hybrids) presented below are derived from notebooks or biological logs held by the Antarctic Division and from files of the Tasmanian National Parks and Wildlife Service. Data are available from mid-1949 onwards and in this Research Note particular attention has been paid to February 1963 to January 1985, a period of 264 'individual' months in which details are relatively continuous and extensive. Records of black duck, mallard or black duck-mallard hybrids (when specifically recorded) have been summarised in Table 1. For extended periods, entries in logs were at the discretion of expeditioners whose interests were not always directed towards the Island's avifauna. The presence of biologists, particularly those of the Tasmanian National Parks and Wildlife Service in the later years, undoubtedly influenced the frequencies of observations.

Whilst months in which 'summering' biologists were on the Island show a slightly increased number of duck observations, ducks have been recorded throughout the year. Mallards and mallard-hybrids have been recorded in every month at a lower frequency than ducks generally. From the first logged record of ducks in May 1949 to January 1963 ducks were seen in 50.3% of 165 months. Apart from one record of mallards (August 1949) all were of black ducks. In the period February 1963 to January 1985 ducks were recorded in 109 months (41.3% of the total) and mallards specifically noted in 58 (22.0%). Months including mallard records formed 53.2% of all months with duck observations.

Between January 1974 and April 1975 no ducks were recorded. In the 131 months from February 1963 to December 1973 ducks including mallards were reported in 40 months (30.5%), with mallards and hybrids (once) being specifically mentioned in only 5.3% of the months. In contrast waterfowl were reported in 70 of the 133 months (52.6%) from January 1974 to January 1985; during this period mallards and hybrids were recorded in 36.8% of the months. Comparison of the early (pre-February 1963) records with those made in the later periods shows that monthly records of ducks declined between 1963 and 1973, but subsequently returned to about the level of early years. However, the incidence of mallard records rose substantially. Whilst the data may reflect an increased interest in or awareness of mallards and their hybrids, the reporting rates suggest that there has been an actual increase in their number and distribution.

4. INDIVIDUAL SPECIES

4.1 GREY TEAL

The early records of 'teal' (Raine 1822, 1824; Scott 1883) were presumably of grey teal as were those of ducks 'smaller in size and lighter in colour than the grey duck' reported by Keith and Hines (1958) as being seen occasionally between 1948-57. Perhaps too even the 'small duck waddling in the boggy patches' seen by Villiers (1925) were grey teal. The species was specifically identified in December 1957 by Keith and Hines (1958), who suggested that numbers were maintained by immigration. However, the species was not confidently identified or recorded again until 1979. In April, May and September 1979 up to 3 grey teal were seen on Green Gorge Lake and at a small lake to the north. No later records exist.

Both Australia and New Zealand have populations of the extremely nomadic grey teal (Frith 1982, Mills 1976). Influxes of grey teal occur in New Zealand (e.g. 1957, Mills 1976), presumably as a result of drought conditions in Australia. Drought conditions were prevalent in eastern Australia in 1957; teal moved widely at that time (Frith 1982) and were recorded on Macquarie Island in December. In 1979 drier conditions pertained in Australia and again a few grey teal appeared on the Island. Grey teal are both numerous and nomadic in Tasmania (Green 1977), but they have not been recorded on the Auckland Islands or Campbell Island (Bailey and Sørensen 1962; Falla, Sibson and Turbott 1966; Kinsky 1970). Kinsky (1970) thought that the species was a straggler to Macquarie Island.

4.2 PACIFIC BLACK (GREY) DUCK

Despite Carrick's (1957) assertion that black duck colonised Macquarie Island during the last century, one of the earlier recorders of the Island's avifauna (Raine 1822, 1824) distinguished between 'teal' and 'wild duck'. There seems no reason to assume that these wild ducks, hunted later by Thomson (1912) in 1877 and others, were other than black duck, specifically identified by Hamilton (1895). H. Hamilton (Falla 1937) thought that the ducks left the Island to return on occasion, migrating northwards in winter (when records were unavailable). Tulloch (1916) and his colleagues 'secured' 25 wild ducks during their time at Macquarie Island, and Falla (1937), who saw black ducks on the 'featherbed terrace' in 1930, suggested that they were seen reasonably frequently between 1911 and 1913. Hamilton and Ainsworth thought they had seen 'at least two hundred' along the coastal raised beaches (Mawson 1915). Oliver (1930) noted that black ducks were found on the Island. Taylor (1955) considered that the population was 'moderate' (100 to 300 individuals) during 1950-51; Law and Burstall (1956) recorded black duck as a breeding species, with small parties being seen in coastal bogs. Gwynn (1953) and Warham (1969) have also discussed the species' occurrence.

The Pacific black duck is found throughout Australia, New Zealand, Indonesia and southern New Guinea. Although often poorly-defined subspecies have been described (see Frith 1982), data are insufficient to support any supposed racial origin.

Black ducks (here taken to be all ducks not specifically noted as mallards or mallard-hybrids) have been recorded in every month throughout the years covered by this Research Note (Table 1). There is clearly no exodus from the Island. Ducks were reported in 50.3% of the months from May 1949 to January 1963 and in 41.3% of the months from February 1963 to January 1985. Records were more numerous in the spring and summer months, presumably a result of increased field activities, but no population estimate for black ducks exists in recent years and observations in general are of isolated reports along tracks or at specific wetlands. Maximum counts in the earlier records were often at Duck Lagoon (usually up to 35 to 50 birds) though occasionally a similar number were seen in the coastal areas from Hasselborough Bay to Flat Creek or at Square (= Stony Creek) Lake. More regular observations at Green Gorge Lake between June 1975 and December 1976 and from May 1978 to September 1979 suggest that totals there increased in the April-September period (49 in June 1976, 52 in April 1979) and subsequently declined. The only comparable totals were recorded from Bauer Bay to Handspike Point (66 in September 1977) and at Square Lake (up to 77, September-November 1957). Warham (1969) also found that numbers reached a 'post-nuptial peak' during June and July, and recorded at least 54 on Duck Lagoon in this period. Warham thought that the subsequent decline at Duck Lagoon, to one or two birds in November and December, was a result of birds dispersing to breed.

4.2.1 Habitat use

Early authors noted that black duck were found around the coast and on a few inland lakes (Hamilton 1895); black ducks were frequently reported from the featherbed (Thomson 1912, Tulloch 1916, Falla 1937). Warham (1969) considered them common on small lakes and coastal marshes.

Records of black duck from May 1949 to January 1963 (Figure 2a), from February 1963 to January 1974 (2b), and later (2c), extend along the central west and northern coasts with birds being seen infrequently at Green Gorge Lake. Occasional black duck were also seen along the coast between Green Gorge and Hurd Point, including near or at Waterfall Bay, though locations were not always specified. Subsequent observations considerably increased the species' range on the Island, particularly along the south-western and eastern sides. Predominantly, records were in lowland, coastal areas and few have been seen on higher areas or the wetlands of the plateau. Exceptions include infrequent sightings on Wireless Hill and more often on Square Lake. Black ducks have also been recorded in littoral areas, beaches and tidal pools, as well as on the sea itself.

Almost all records of black duck have been in the bogs, fens, herbfield and tussock-dominated areas. Even the few areas on the plateau where sightings were made have been associated with the tussock grassland formation. For example in December 1985 when birds may have been dispersed during the breeding season, 78 wetlands (8 in fellfield, 33 in wet tussock grassland and 37 in herbfield) were examined on the plateau and coasts to the north of Bauer Bay and The Nuggets. No ducks were seen on the plateau where wetlands were devoid of cover and black ducks were seen only in tussock (2 wetlands) and herbfield (3) areas, including Duck Lagoon which was being used primarily for roosting.

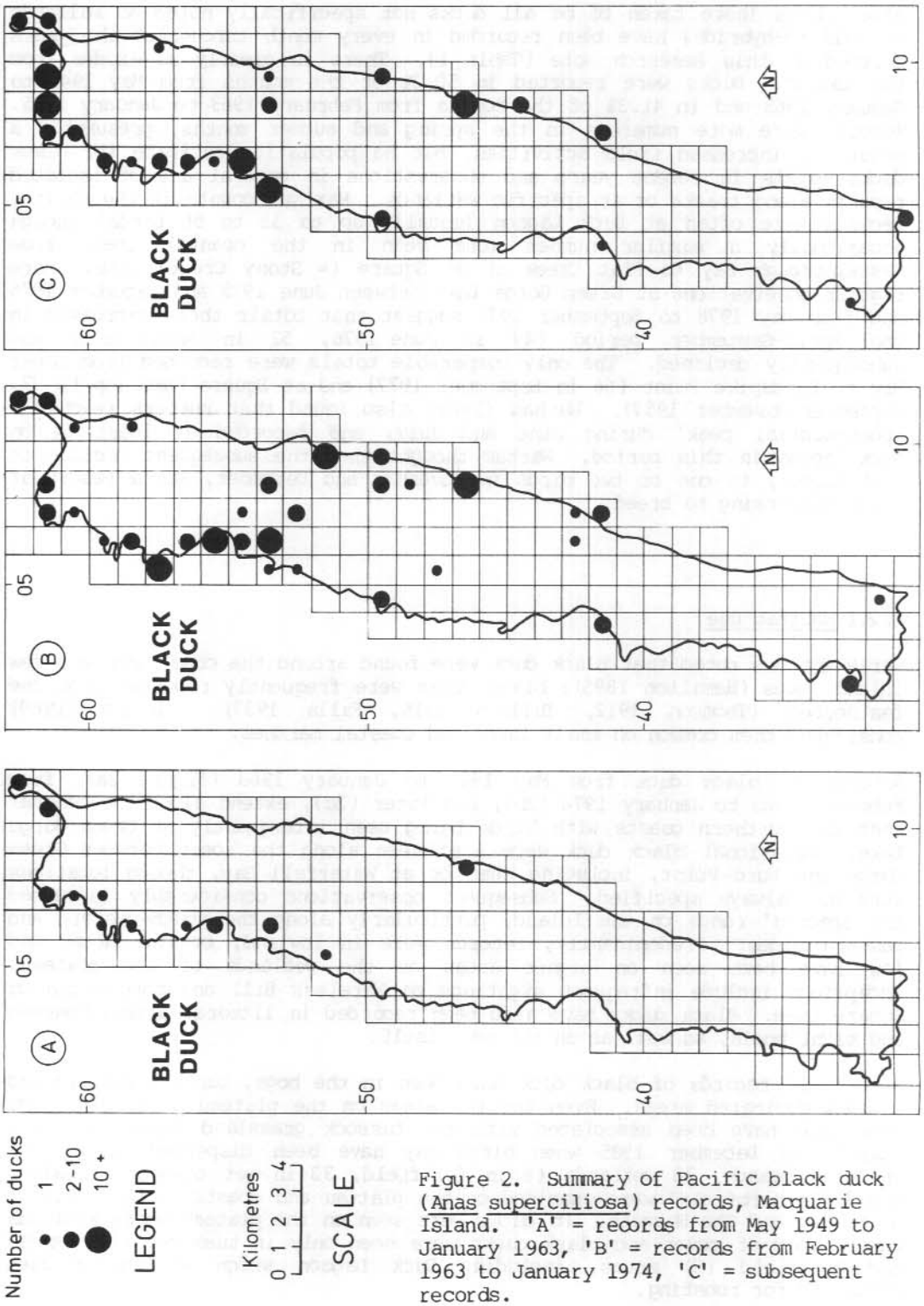

Figure 2. Summary of Pacific black duck (Anas superciliosa) records, Macquarie Island. 'A' = records from May 1949 to January 1963, 'B' = records from February 1963 to January 1974, 'C' = subsequent records.

4.2.2 Breeding

Whilst black duck were frequently reported in twos, records of 'pairs' and more particularly of 'pairing' or pair formation are fewer. In the earlier reports pairs were specifically mentioned from August to November but later observers considered that pairing was taking place from June onwards. Warham (1969) noted an increase in numbers at one site in June and July; totals at Green Gorge Lake were highest in the April-September period and may have involved pre-breeding, courting parties which promote pair-formation. Displays associated with reproduction have, however, not been recorded.

Nests have been rarely described or commented on, even though occasionally found. One on North Head (1960) and 6 found between February 1963 and January 1985 were in deep tussock. Of the latter group at least 3 were on projecting rock stacks up to 6 m high, some of which were apparently isolated at high tide. All nests, apart from one at Caroline Cove, have been on west to northern parts of the Island, but ducklings have been seen on Brothers Lake, and one was found dead near The Nuggets.

Earlier observers found eggs in October (Tulloch 1916), November (Burton in Campbell 1900), December (Warham 1969) and January (Falla 1937). A bird shot in October 1949 contained a shelled egg. However, the presence of newly-hatched ducklings in October 1980 and 1982 indicates that laying begins in September at least in some years and small ducklings seen in March (1977) or April (1955) would have hatched from eggs laid in late January or early February (incubation periods being some 26 to 28 days, Frith 1982). There is also an anomalous record of 2 half-grown ducklings at the Flat Creek mouth in June 1984, which would extend the laying period into late February or early March.

Few records of clutch sizes of black ducks (here the number of eggs recorded in a nest) on Macquarie Island are available. Tulloch (1916) found a nest with 12 eggs, Falla (1937) reported a clutch of 9 and Warham (1969) 1 of 7. Since 1963 egg totals have been recorded in only 6 nests and averaged 8.5 ($\pm$ 2.17, range 5-11). In comparison Frith (1982) gave an average size of 8.4 for 208 clutches examined at mainland (Australia) sites. Seven eggs in a 1960 nest averaged 57.3 mm in length, and 40.2 mm in width, similar to the 58 and 41 mm found for a much larger series in Australia (Frith 1982). This nest was deserted. Two clutches of 10 and 11 eggs were destroyed by great skuas Stercorarius skua or deserted but another 2 (5 and 9 eggs) were thought to have produced 5 and 6 ducklings.

Ducklings have been seen from October to April and in June, with more than two-thirds of the records (including, no doubt, duplicates) being in the December-January period. The details of the numbers of ducklings in individual broods, and their ages, vary. The average number of ducklings in newly-hatched broods was 4.7 (2, 6, 8 and 3) whilst a 'half-grown' brood contained only 2 ducklings, and 3 broods of 'large' ducklings averaged 4.3 (2, 5, 6). Amalgamation of brood data suggests that the smaller, younger broods (newly-hatched to about 1 week old) averaged 3.9 ($\pm$ 2.55, 1-10, n = 18); older broods were of similar size (4.0, $\pm$ 1.87, n = 5) whilst those of unknown age averaged 3.4 ($\pm$ 2.16, n = 11). Brood habitat, other than that at Duck Lagoon or Green Gorge Lake, was usually noted as being seal wallows, pools in the tussocks or in the featherbed. In two instances predation, of perhaps human-disturbed broods, was observed: once a weka Gallirallus australis and once a skua took a single, 'fluffy' duckling.

4.2.3 Feeding

There are few observations of feeding activities available for the Island's waterfowl. Falla (1937) noted that ducks were sometimes on the shore feeding on larvae of the kelp fly, a suggestion repeated much later by several ANARE biologists. The only gizzard examined (December 1964) contained an orange 'paste' but other ducks have been seen on beaches or in tidal pools or inlets, along shorelines and around areas of rotting kelp Durvillea antarctica. Use of saline habitats has been recorded intermittently throughout the year although some observers suggested that it might be associated with the freezing of freshwater areas. Use of terrestrial plants appears restricted to observations of birds 'grazing' near the Bauer Bay hut, feeding on the featherbed, perhaps on Poa annua, or short grass (Waterfall Bay area) or being disturbed from an Acaena dominated area. However, in December 1985, black ducks (and mallards) were dabbling in Duck Lagoon as well as moving to and from the adjacent tidal zone and the sea. At that time a water sample taken from the area used by feeding ducks contained, apart from ten oribatid mites and a single collembolan, eleven copepods (Pseudoboeckella brevicaudata), thirty-two ostracods (Eucypris aff. kerguelensis) and four hundred and five cladocerans (Chydorus and Macrothrix spp.) together with masses of the green algae (? Rhizoclonium). One observer wondered whether the ducks were eating 'green slime', presumably chlorophycous algae, but it seems probable that they were obtaining zooplankton in or around it, as appeared to be the case at Duck Lagoon in 1985.

4.3 MALLARD AND MALLARD-HYBRIDS

On several occasions captive domestic ducks (presumably mallard derivatives) have been kept on Macquarie Island. Four birds (which laid 300 eggs) were present in 1915 (Tulloch 1916). Others were kept in the 1950s (G.W. Johnstone, pers. comm.) and in 1959-60 (Gillham 1967). Although the domestic ducks in 1915 were allowed to wander into the tussock, and were eventually given to sealers (Tulloch 1916) there is no evidence that they or later stock escaped. Mallards were not formally recorded on the Island until a male in full plumage was seen in August 1949, together with 25 black duck near Brothers Point (Gwynn 1953).

Law and Burstall (1956) considered mallards to be casual visitors to the Island, but mallards were not reported in 1950-51 (Taylor 1955), 1956-57 (Keith and Hines 1958) or 1959-61 (Warham 1969), or in the unpublished logs. In December 1964 a male mallard was seen at Mawson Point and Duck Lagoon. Observed at Aurora Point in April 1965, a male was also present between September and November along the north-western coast from Aurora Point to Langdon Bay, perhaps with another one or two pairs on one occasion. Merilees (1971) stated that at least a pair of mallards was seen at Langdon Bay in July and November 1967 and noted that others had been seen from 1965 onwards. Merilees thought though that whilst the mallard was perhaps a resident species at that time, there was no evidence of breeding. A single male mallard near Langdon Point in September and November 1970 and a hybrid in November 1973 are the only other records in the second period considered here.

Since June 1975 mallards or their hybrids have been seen in most months in which duck observations were made (Table 1). Mallards were logged in about 71% of the months in which ducks were noted, compared with about 20%

in the period February 1963 to December 1973. Although at no time was the Island's mallard population estimated, and observers reported only odd males or at most 2 pairs in earlier reports, in the later period up to 15 or more were seen in one day's observations. Long-term, systematic observations at individual wetlands are lacking. However, Green Gorge Lake was visited frequently between June 1975 and December 1976, and again between May 1978 and September 1979. Though mallards were absent in several months, counts in both series of records reached a maximum from April to June (13 in June 1976; 11 in April 1979). Elsewhere on the Island numbers were usually restricted to occasional males with, much less frequently, presumptive females including birds in 'poorer' plumage. Of the 1267 sightings of black duck and mallards from December 1975 to December 1976, 243 (19.2%) were of mallards. Sex ratios of mallards were equal (103 males, 104 females, 36 undetermined) in the observations which clearly included many duplicated counts of birds.

Only one mallard, a female, has been collected at Macquarie Island. Details for this bird, examined on 24 December 1975, were within the ranges given by Gillespie (1985) for comparable measurements.

4.3.1 Hybrids

A hybrid male was reported at Handspike Point in November 1973 with an apparent female black duck. It is the first indication that breeding between the 2 species was taking place. Apparent hybrids were seen in January 1978, and observers later reported birds in 'poorer' plumage, perhaps in 'eclipse', 'not in full breeding plumage', with 'dark heads' and 'breasts' or with 'colours not so clearly defined'. One bird, presumed to be female, was recorded as being of a 'very light' plumage but other hybrids were simply not sexed. Occasionally, too, black ducks were noted with 'rusty' necks but the majority of waterfowl records relate to the two species separately.

In December 1985 observations at Duck Lagoon suggested that in that area at least, hybridisation was extensive. Thus 13 of the ducks present were scored using Gillespie's (1985) criteria; only 3 of these showed predominantly black duck characteristics whilst a further 8 birds had mainly mallard features, including one with 'khaki-campbell' colouring. In addition a male (here considered as a grey teal-mallard-black duck hybrid) and a female (probably a teal-mallard cross) was seen with a brood of young ducklings.

4.3.2 Habitat use

There are few data which adequately describe habitat preferences of mallards on the Island. Mallards have been seen on seal wallows, on Juncus or grass flats, at creeks or pools within tussocks, on tidal rock pools, on beaches and just offshore (Figures 3a and b). Most records were made on the north-western coast from ponds near Langdon Point and Aurora Cave, on the mid-eastern coast at Square and Brothers Lakes, and particularly at Green Gorge Lake. Since 1949 and more particularly since 1975 the mallard has consolidated its range on the west coast and extended it considerably along the eastern side of the Island. Few records are available for the higher parts of the Island including the central plateau.

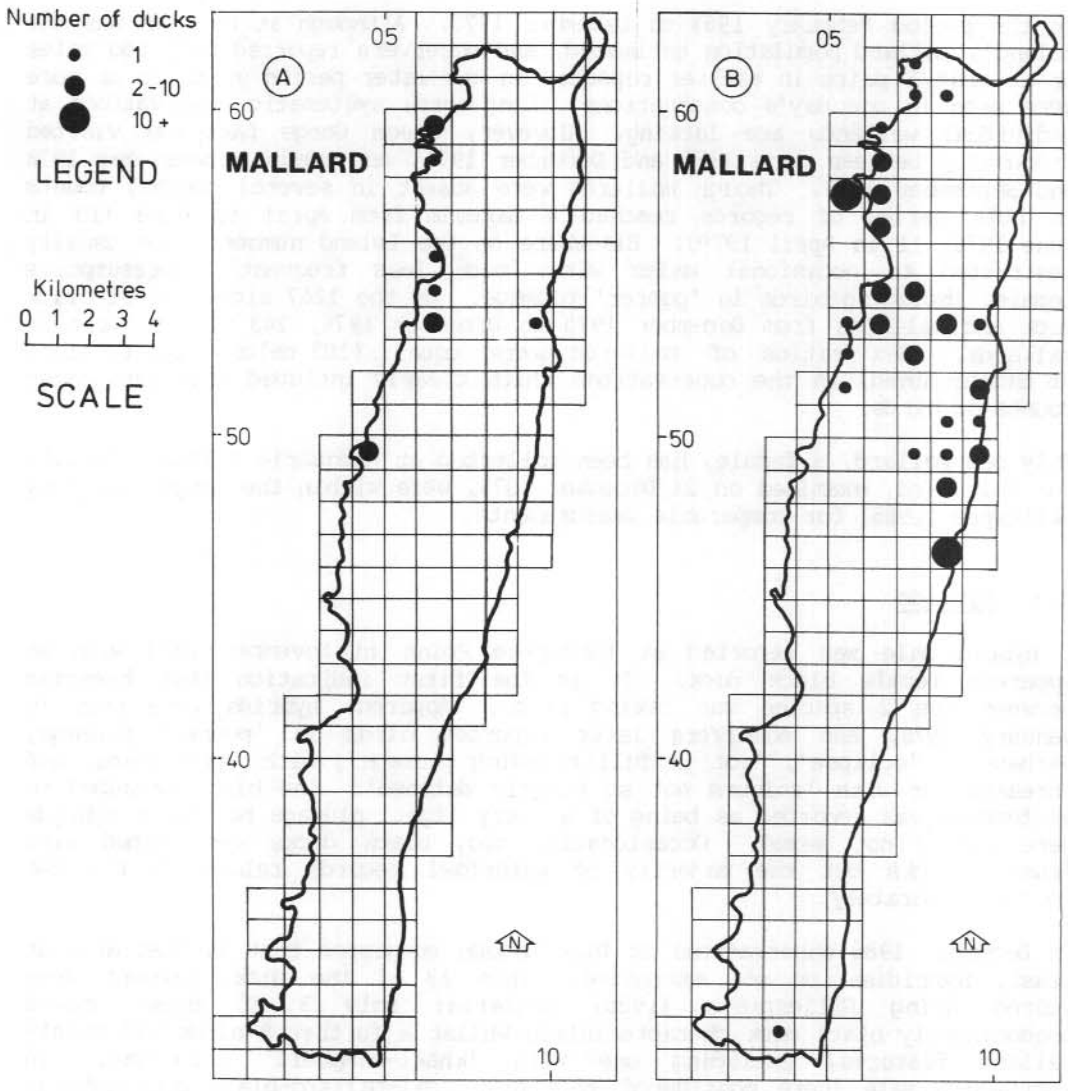

Figure 3. Summary of mallard (A. platyrhynchos) records, Macquarie Island. 'A' = observations to and including January 1974, 'B' = subsequent records.

4.3.3 Breeding

Only 1 nest attributed to mallards has been found during the 35 years since a mallard was first recorded on Macquarie Island. The nest was under Poa foliosa, on a small rock about 5 m from shore in a pond near Langdon Bay. The 12 eggs present, considered fresh on 25 September 1979, were 59.0 mm (S.D. ± 1.57, range 54.6-60.3) long and 42.6 mm (± 0.59, 41.0-43.2) wide. Similarly only 1 brood of hybrid ducklings (interspecific parents), 9 one-two days old, has been previously reported (in December 1975). The brood of 6 hybrid ducklings seen at Duck Lagoon in December 1985 remained along the southern edge, keeping under cover of Poa foliosa fronds for all but 18 of 152 observations at 1 minute intervals. The ducklings moved through the tussock bases in channels which allowed passage in almost any direction and for any distance. The 'alert' male performed a 'broken-wing' display when disturbed, and its behaviour was generally atypical for a 'pure' mallard male.

'Pairs' of mallards were noted by observers relatively infrequently, mainly from July to September. An adult was in moult in January 1979 and other birds were in apparent eclipse in February 1976.

4.3.4 General

In Tasmania mallards are uncommon and nomadic (Green 1977). On the mainland it is moderately common, and feral particularly on ponds in parks and gardens in south-eastern Australia (Braithwaite and Miller 1975, Frith 1982). Hybridisation with black duck occurs in Tasmania, as elsewhere, and hybrids involving chestnut teal A. castanea (Norman, unpublished data) are also known.

Kinsky (1970) considered mallards as stragglers to Macquarie and Auckland Islands, but being possibly established on Campbell Island. Westerskov (1960) reported no black duck-mallard hybrids at Campbell Island, and Bailey and Sørensen (1962) thought that the arrival of mallards there had been recent, in late 1959 and early 1960 when a hybrid may also have been seen. More recently (1984) it was considered that mallards were the most common duck on Campbell Island as indeed they are at the Antipodes and Auckland Islands (M.J. Williams, pers. comm.).

5. DISCUSSION

It appears that black duck were resident on Macquarie Island from the earliest days and there is little evidence to suggest that they pioneered in recent times (cf. Carrick 1957 and subsequently Weller 1980) for Raine (1822, 1824), and others later, saw and shot 'wild duck'. In contrast the 'white' swan, caught and eaten on Macquarie Island in 1903 (Rourke 1903), if accurately identified, may have originated in either Australia or New Zealand where the species was introduced in the nineteenth century (Thomson 1922), for Tasmanian records of mute swans apparently do not pre-date 1944 (Green 1977).

The presence of teal on the Island has been noted intermittently from 1821 onwards, when it was distinguished from wild duck (Raine 1822). Sealers too were aware of their presence (Scott 1883); there is no need to consider that an unrecorded species disappeared (cf. Carrick 1957, Falla 1937), for there seems little doubt that such records relate to the nomadic grey teal, a species which may have been present in 1948-57 and was definitely identified both in late 1957 (Keith and Hines 1958) and later in 1979.

Such self-introduction, perhaps drought-induced from Australia or by drift from New Zealand (where the species is widely distributed and mobile (Mills 1976)), is also indicated for the mallard. In this case, despite the early possibility of escapes of domestic ducks no records exist prior to 1949 when a single male mallard was seen. Others were not reported again until 1964-65 (1, possibly 4), and then in late 1970 and 1973. Whilst occasional birds may have been missed by earlier observers, these early records appear to have been of a few, pioneering individuals which were not thought to have bred (Merilees 1971). However, the 'frequency' of mallard records has increased substantially since mid 1975 and hybrids (including perhaps both black duck and grey teal) were recorded in 1973 and from 1978 onwards. Accepting that hybridisation started in 1973, sight records suggest that the proportion of mallards (and ? hybrids) reached about 20% by 1976. Whilst mallards may have arrived from Tasmania or the Australian mainland it seems more likely that occasional invasions have occurred from New Zealand, the Auckland Islands or particularly from Campbell Island where the species and its hybrids are common. Birds involved could well be assisted by the (relatively infrequent) strong N to NE winds associated with particular weather patterns (De Lisle 1965). Self-introductions to Macquarie Island need not necessarily originate from the west and north, as apparently is often the case for ducks on some subantarctic islands (Weller 1980), for redpolls Carduelis flammea have established themselves there from New Zealand, via presumably Campbell Island where they are very common (e.g. Westerskov 1960). However, though not yet recorded on Macquarie Island, Australian shelduck Tadorna tadornoides have recently (1985) appeared at Campbell, Auckland and Snares Islands (M.J. Williams, pers. comm.).

Interspecific hybrids in anatid species are well known (Johnsgard 1960) and in Australia (Braithwaite and Miller 1975), and New Zealand (e.g. Williams 1981, Haddon 1984, Gillespie 1985), fertile hybridisations between black duck and mallards are well documented. Though its extent in Australia is not known, hybridisation in New Zealand is now considerable with the proportion of pure black (grey) duck there declining to the point where doubts have been expressed about the future of the black duck as a distinct species (Gillespie 1985). Haddon (1984) thought that if successful pairing

between black duck and mallard occurrred in the wild, reproductive success would not prevent introgressive hybridisation between the 2 species (cf. Williams and Roderick 1973). At Macquarie Island, though mallards were seen first in 1949, hybrids were not reported for over 20 years. Introgression was not, therefore, rapid and indeed it seems more that later, perhaps small but frequent invasions took place. Forced copulations by mallards presumably occurred at a later date with the larger and more aggressive mallard males (Gillespie 1985) fertilising female black ducks, perhaps at sites when concentrations occur (such as Duck Lagoon or Green Gorge Lake). Such sites may resemble 'captive' situations, and involve any species in forced fertilisations including occasional vagrant grey teal. The resultant hybrids and back crosses may have been difficult to recognise, a consequence both of the dominance of the mallard plumage characters in males and the variable female plumage (Gillespie 1985).

The black duck in Australia shows regular breeding patterns; the winter-spring breeding in southern Australia may be modified by rain and subsequent flooding, or delayed in colder areas (Frith 1982). In New Zealand the black duck breeds between September and December (Falla et al. 1966). On Macquarie Island, where rainfall is constant throughout the year and average temperature variations are minimal, it is probable that day length may act on endogenous systems as a proximate factor initiating and perhaps maintaining breeding (Murton and Westwood 1977). Courtship displays may take place in black duck in the autumn and winter (Frith 1982), the period when numbers increased at some sites on the Island. Records of eggs in nests, and of ducklings, indicate that egg-laying at Macquarie Island can start in September in some years and continue into January and beyond.

At this time day lengths are about maximum, as are temperatures, and direct sunlight is more frequent (Copson 1984). Within some of the extensive wetlands on the Island, which range from small 'ponds' to large and deep open freshwaters such as Prion and Major Lakes, chlorophyll a increases with day length and water temperature. The highest concentrations have been recorded at Square Lake (an atypical plateau wetland) and at Duck Lagoon, and the presence of Myriophyllum elatinoides appears to be the 'single most important factor in contributing to the high productivity' (Evans 1970). The density of Pseudoboeckella brevicaudata, the dominant copepod, varies considerably but the number of reproductive adults is highest in mid-summer when chlorophyll is near a maximum; certainly zooplankton biomass is greater in spring and summer (Evans 1970).

If egg producing female ducks rely on zooplankton for increased protein requirements at this time, then conditions in fresh waters are appropriate, as they are in the sea (Simpson 1976). However, the obligatory high invertebrate diet during egg laying (Krapu 1974) may not always be present; decreasing protein availability will then limit egg laying (Drobney and Fredrickson 1985). Certainly zooplankton densities are low (Evans 1970) and breeding success, at least in some years, may be reduced leading to increased inbreeding.

Breeding on the plateau is presumably negligible; not only is food and cover there generally absent but potential predators (skuas) are numerous. In some years too the wetlands of the apparently productive featherbed may be drought-affected (Gillham 1967). Nevertheless black ducks, like Anas species in Australia (Norman 1983) and elsewhere (Delacour 1956), may use saline areas to obtain food as they do on Campbell Island (Bailey and

Sørensen 1962) and as black ducks do on Auckland Island (M.J. Williams, pers. comm.). Thus records of birds on tidal pools and similar areas are relatively frequent and observers have reported them as (possibly) taking kelp flies (Diptera: Coelopidae) which, with their larvae, are available throughout the year (McQuillan and Marker 1984). The day-flying moth Eudoria mawsoni and seeds of plants may also provide food.

The historical records for Macquarie Island together with more recent observations show that, apart from the single, perhaps apocryphal, mute swan and the infrequently occurring grey teal, the Island has a resident black duck population which has recently been invaded by the alien mallard. Hybridisation has been noted and now represents a potential threat to the perpetuation of the black duck as a distinct species there. Since the black duck appears to have a relatively restricted breeding period in an environment which may not always provide obligatory food requirements for successful breeding, the importance of hybridisation should not be ignored.

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