

Notes on the foraging behaviour of Magellanic Flightless Steamer Ducks and Flying Steamer Ducks

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Introduction

Steamer Ducks *Tachyeres* are large, sexually dimorphic diving Anatidae which are restricted to southern South America (Weller 1976; Livezey and Humphrey 1984a). Four species are currently recognised: three allopatric flightless species which feed almost exclusively in the sea, and a flying species which occurs sympatrically with all three flightless species, and frequents fresh as well as salt water habitats (Johnsgard 1978; Humphrey and Thompson 1981). The behaviour of these ducks has attracted considerable scientific attention (Murphy 1936; Moynihan 1958; Pettingill 1965; Weller 1976; Livezey and Humphrey 1982, 1983), but surprisingly little has been reported on their foraging behaviour (Livezey and Humphrey 1984a, b).

Diet consists primarily of benthic molluscs and arthropods, as well as some other invertebrates and fish (Murphy 1936; Johnson 1965; Humphrey *et al.* 1970; Weller 1976). The underwater swimming action of a captive Falkland Flightless Steamer Duck *Tachyeres brachypterus* has been described (Livezey and Humphrey 1984b), but descriptions of foraging behaviour are largely anecdotal (Murphy 1936; Johnson 1965; Humphrey *et al.* 1970; Weller 1976; Johnsgard 1978). This study details the foraging behaviour of Magellanic Flightless Steamer Ducks *T. pteneres* and Flying Steamer Ducks *T. patachonicus* at two marine localities in Chile, noting inter-specific and inter-sexual differences in foraging behaviour.

Methods

A pair of *pteneres* was observed during November 1985 at Guabun, on the west coast of Chiloe Island, and another at Porvenir Bay, Isla Grande, in the Strait of Magellan. Three pairs of *patachonicus* were observed at Porvenir. Observations were made throughout the tidal cycle. Birds were sexed using bill and plumage features described by Humphrey *et al.* (1970) and Weller (1976).

The duration of each foraging bout and the habitat in which foraging occurred were recorded. Whenever possible, the durations of dives of both birds in a pair were recorded throughout a foraging bout. The frequency with which visible prey items were brought to the surface was recorded at Guabun for *pteneres* and at Porvenir for *patachonicus*.

Non-parametric statistics (contingency tables and Mann-Whitney U tests) were used to test the significance of differences in foraging behaviour.

Results

The pair of *pteneres* at Porvenir was separated from the *patachonicus* pairs by a small headland, although both species occurred in seemingly identical habitat. No interactions were seen between the two species and the three pairs of *patachonicus* maintained territories arranged linearly along the shoreline. Several boundary disputes were observed between these pairs.

Magellanic Flightless Steamer Duck

At Guabun, all foraging occurred within 50 m of the shore, over large jumbled boulders at the base of a low cliff on a moderately exposed shore. There were no beds of the kelp *Macrocystis pyrifera*. At Porvenir foraging occurred only in and around the kelp band, between 50 and 100 m from the shore.

We observed one foraging bout which had already started when observed, and four complete bouts, ranging in duration from 25 to 42 minutes. Foraging occurred during 14% of the observation period (17.4 hours), and all bouts occurred within three hours of low tide.

T. pteneres foraged exclusively by diving, dive-times ranging between 9 and 58 s (Figure 1). At Guabun dives were longer when the sea was rough (mean \pm S.D. dive duration 32.4 ± 13.3 s) than when the sea was calm (27.5 ± 10.9 s, $U_{23,63}=895$, 1-tailed $P<0.05$). Foraging occurred within 20 m of the shore, often around wave-

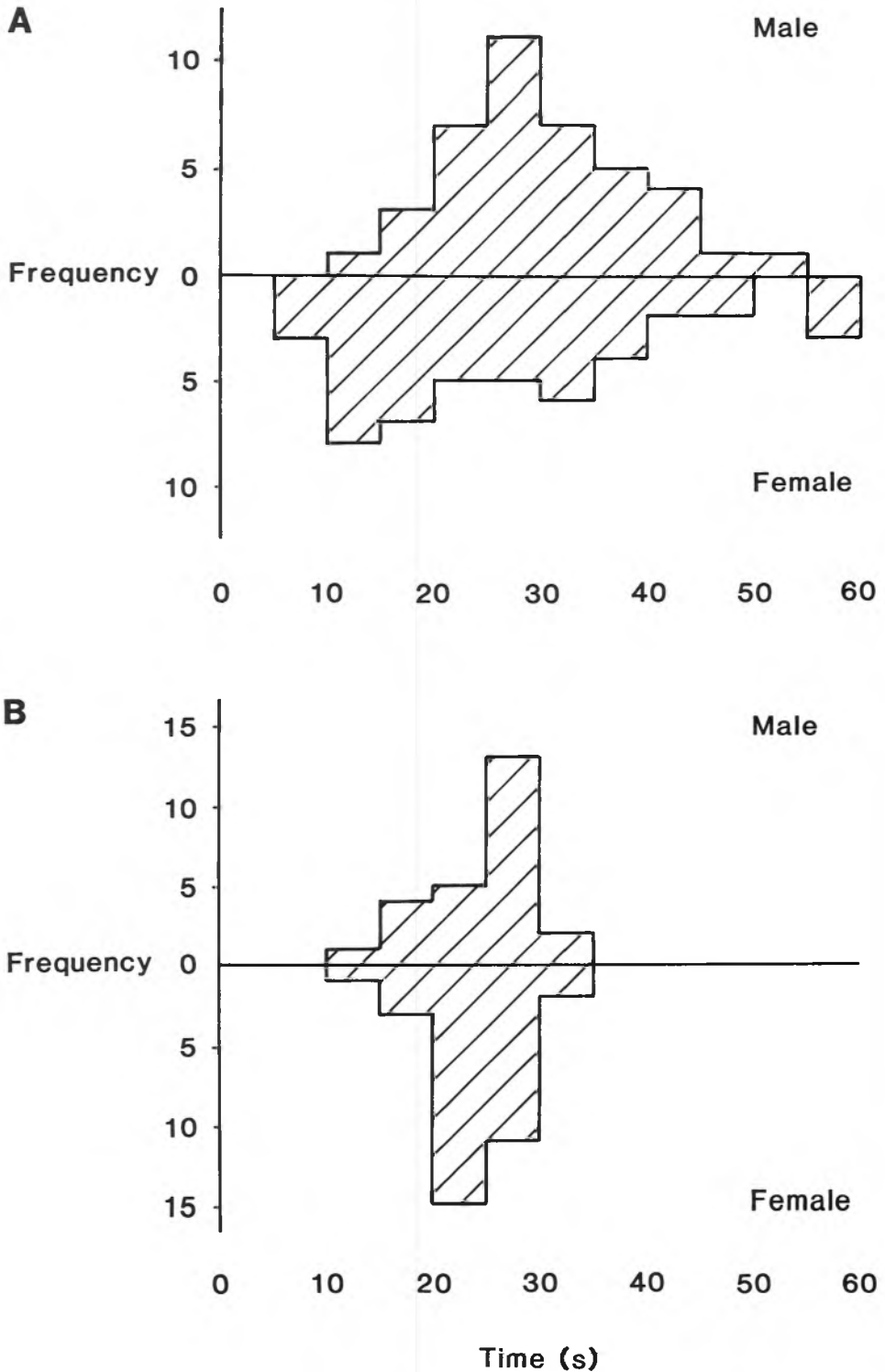


Figure 1. Dive-times of male and female Magellanic Flightless Steamer Ducks at Guabun (A) and Porvenir (B).

washed rocks, when the sea was calm, whereas when it was rough all foraging occurred between 20 and 50 m from the shore.

Dive-times at Guabun were more variable than those at Porvenir (Figure 1), presumably because foraging at the latter site was restricted to the offshore kelp bed where water depth was fairly uniform. At Guabun dive-times of the female were significantly shorter than those of the male ($U_{40,46}=1183.5$, $P<0.05$). The same trend was apparent at Porvenir, but the difference was not significant due to the narrow range of dive-times ($U_{25,32}=472.5$). Males brought prey items to the surface more frequently (33% of dives, $n=40$) than did females (13%, $n=45$, $X^2=4.48$, $df=1$, $P<0.05$).

Flying Steamer Duck

At Porvenir the pairs of *patachonicus* foraged in two distinct zones: in deep water in and around the kelp beds, between 50 and 250 m offshore; and inshore of the kelp band, in shallow water over a mud and pebble substratum, covered in places by a thick mat of filamentous green algae.

Foraging bouts of *patachonicus* were less discrete than those of *pteneres*, and were frequently disrupted by agonistic interactions. Foraging occurred during 19% of the observation period (12.4 hours), with more than 90% of foraging occurring in the early morning (before 9.00) and in the late afternoon (after 18.00), apparently independent of tidal cycle.

T. patachonicus foraged by diving in deep water (56% of foraging time), by dabbling and up-ending in shallow water (38%), and by picking prey items off floating kelp stipes (6%). Dive duration in deep water around the kelp beds ranged from 7 to 45 s (Figure 2a). Inshore, head submergence while dabbling and up-ending was shorter, ranging from 1 to 25 s (Figure 2b). Dive-times of males were significantly longer than those of females when feeding together in deep water ($U_{56,61}=2559$, $P<0.001$). Visible prey items were seldom brought to the surface by either sex while feeding in deep water (3% of dives, $n=117$), and no large items were brought to the surface while feeding in shallow water ($n=109$).

Pairs of both species generally dived synchronously, within five seconds of each

other. In some pairs the female normally dived first, whereas in others the male dived first.

Discussion

Weller (1976) suggested that Flying Steamer Ducks feed more frequently and at a lower intensity than do the flightless species. This has been interpreted as an adaptation to prevent full stomach loads from impeding flight in the former (Humphrey and Livezey 1982). Our data support Weller's observation, but foraging by *patachonicus* was not distributed evenly throughout the day. Observations were too limited to determine whether foraging was tidally or diurnally mediated, though *pteneres* did not forage at high tide (cf. Johnson 1965). The low frequency with which *patachonicus* brought large prey items to the surface compared with *pteneres* agrees with the observations that the flying species generally takes smaller and less robust prey than do the flightless ones (Murphy 1936; Johnson 1965; Humphrey *et al.* 1970; Weller 1976).

Where the two species occurred together *patachonicus* used a greater range of foraging habitats than did *pteneres*. Coupled with dietary differences, this represents a niche difference which may allow coexistence. However, the Falkland Flightless Steamer Duck has been reported to feed by dabbling and by picking prey off floating kelp stipes (Johnsgard 1978). *T. pteneres* may occasionally use these foraging techniques, reducing the inter-specific differences with *patachonicus*. Also, the diets of the chicks of the two species are likely to overlap greatly (Weller 1976), necessitating the maintenance of discrete territories between the two species. Both species are very aggressive, with the larger flightless species dominating the smaller flying one (Weller 1976; Livezey and Humphrey 1985; Neuchterlein and Storer 1985).

Water depth apparently was a major determinant of dive-time in both species. Dive-times of the two species were similar when feeding in the kelp beds at Porvenir, suggesting that there is little difference in diving ability between the two species. Longer dive-times were recorded for *pteneres* than for *patachonicus*, but this may have been because the flightless species foraged in deeper water at Guabun.

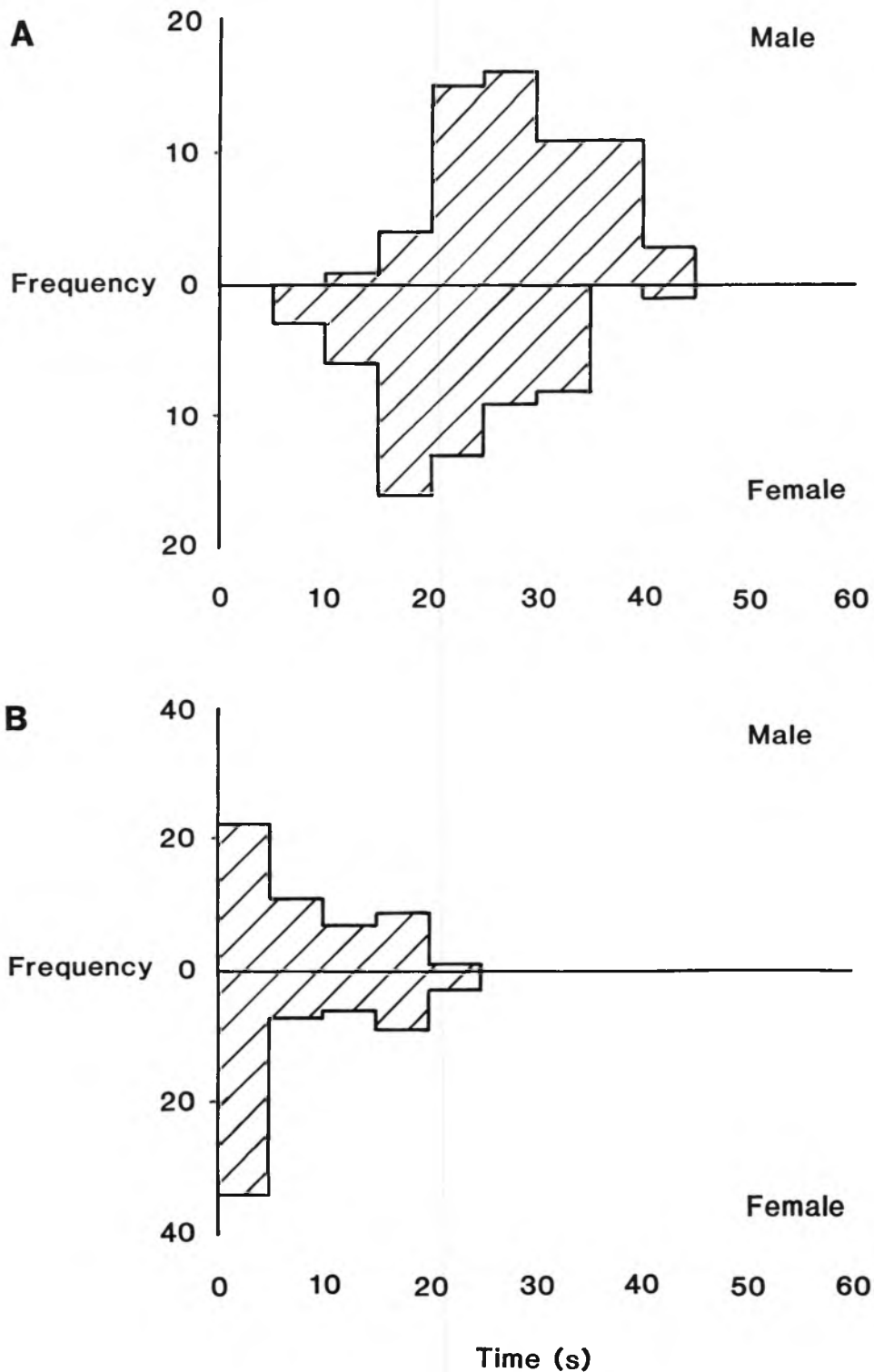


Figure 2. The durations of dives and dabbling by Flying Steamer Ducks in deep water in and around the offshore kelp band (A) and in shallow water inshore of the kelp band (B) at Porvenir.

Males in all the species are larger than females, weighing 1.2 to 1.3 times as much (Livezey and Humphrey 1984a). Cooper (1986) showed that large cormorants tend to dive for longer than small ones, and suggested that large animals can have larger oxygen stores and hence perform longer dives than small animals. Despite generally longer dive-times of male Steamer Ducks, the longest dives recorded were actually for one female *pteneres*. It seems unlikely that the sexes would dive to different depths (cf. Dewar 1924), when both members of a pair forage together, diving synchronously at the same place.

Livezey and Humphrey (1984a) noted that female Steamer Ducks had more bill lamellae than did males, and suggested that females are adapted to take smaller prey than males. This hypothesis is supported by the significantly greater number of large prey items brought to the surface by male *pteneres* than by females. We suggest that differences in underwater foraging behaviour, notably search patterns, resulting from the selection of different prey may account for inter-sexual differences in dive-

times. Sexual dimorphism in Steamer Ducks may be important in reducing competition between paired males and females (cf. Livezey and Humphrey 1984a) which, in the flightless species, maintain permanent feeding territories (Weller 1976).

Acknowledgements

We thank Claudio Venagas of the Patagonian Institute, Punta Arenas, for valuable comments and discussion. This study forms part of the FitzPatrick Institute's 25th Anniversary Expedition to Chile. Financial support was received from the South African CSIR and the University of Cape Town.

Summary

Marine foraging behaviour of Magellanic Flightless Steamer Ducks *Tachyeres pteneres* and Flying Steamer Ducks *T. patachonicus* is described from two localities in southern Chile. Paired birds feed together, diving synchronously. Maximum dive-times of 58 s in *pteneres* and 45 s in *patachonicus* were recorded. Males dived for longer than females, presumably as a result of dietary differences.

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