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## Niche Separation in Three Species of Waterbirds

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This study examines niche separation in three species of water birds, Dusky Moorhen *Gallinula tenebrosa*, Purple Swamphen *Porphyrio porphyrio* and Eurasian Coot *Fulica atra* and was carried out on Sullivan's Creek in the Australian National University, Canberra, Australian Capital Territory.

Behavioural observations were carried out over two days; twelve hours from 06:00 to 18:00 hours on both days. Subsequent measurements of water depth, vegetation and other environmental and behavioural aspects in regard to feeding and breeding were noted and are presented in this report.

All three species under study had different living requirements within the study area. Moorhens fed in shallow water; coot, primarily a diving species, feed in deeper water whilst swamphens are a grazing species.

Breeding requirements for both swamphens and moorhens are discussed and future development and changes in species composition in the creek are considered.

### Introduction

Breeding biology of the American Coot *Fulica americana* has been studied in America by G. W. Gullion (1953) and the Coot *F. atra* in Britain by B. L. Sage (1969). Useful remarks on the food of this species in Australia are given by McKean (1967). Feeding techniques of the Purple Swamphen have been discussed by Bryant (1940). The Dusky Moorhen's behaviour patterns and nesting have been studied by Steven Garnett (1978) at Sullivan's Creek.

It was the aim of this study to compare the ecologies of the birds with regards to their feeding and breeding behaviour. In doing so it was hoped to examine niche separation between the three species of waterbirds.

### Study Area

The three species of waterbirds were observed in and around Sullivan's Creek within the

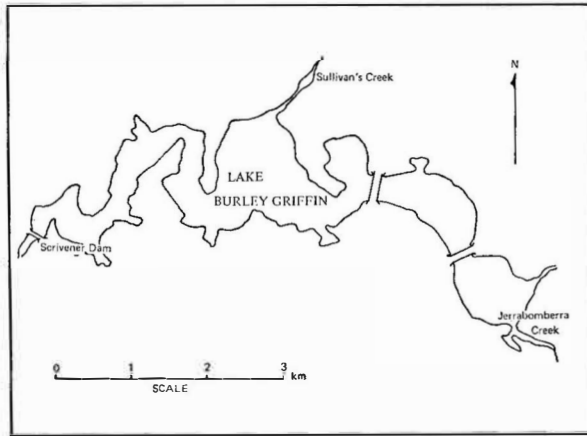
Australian National University campus, near Scrivener Dam and at Jerrabomberra Creek (Figure 1). Observations were made at the latter two areas for comparison with the Sullivan's Creek study area. The Sullivan's Creek study area is bounded by the causeway in the north-east and Ward Road Bridge in the south-east (Figure 2).

### Methods

#### Observation

The three species of birds were observed in and around Sullivan's Creek from 06:00 to 18:00 hours on two consecutive days, 21 and 22 September, 1977, a total of 24 hours of observations.

From the bank, numbers and positions of the birds were recorded every 15 minutes. Behaviour was observed throughout the day. By doing this it was hoped to determine separations in food



● Figure 1. Map of Lake Burley Griffin showing locations of observations mentioned in text.

preference, feeding technique and breeding requirements between the three species of birds.

For close observations a floating hide was constructed, consisting of a rubber dinghy with a wooden frame inside and hessian over the top. This proved to be extremely effective and versatile.

#### Other Information Recorded

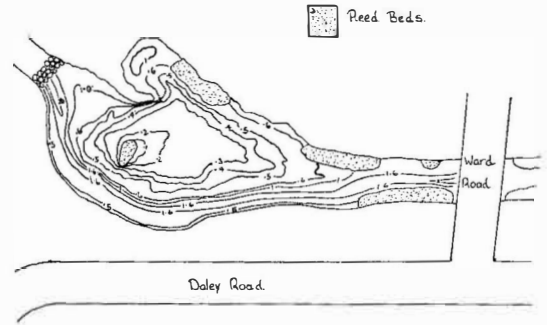
On 1 October 1977 we returned to the study area where measurements and other information relevant to the study were obtained.

Water depths were measured using the rubber dinghy and a weighted tape and results were plotted on a gridded map. Measurements were taken every seven metres along and two metres across the creek (Figure 2).

Plant specimens were collected in and around Sullivan's Creek and taken to the Canberra Botanical Gardens Herbarium for identification. Reed beds and other vegetation were then mapped.

Positions of nests and territories of the Dusky Moorhens and the Purple Swamphens were mapped. The heights of nests above water were measured.

On the same day Scrivener Dam and Jerrabomberra Creek were visited to compare differences between the three areas.



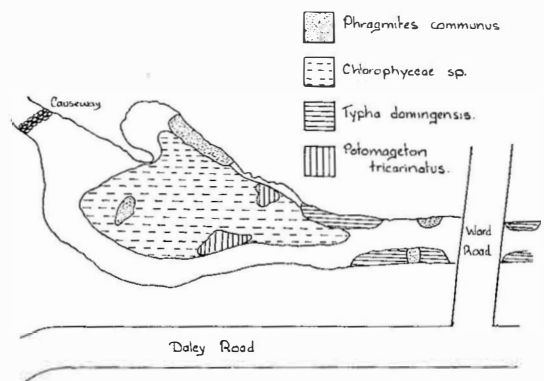
● Figure 2. Water depths of study area at Sullivan's Creek.

## Results

The depth of water in the study area is shown in Figure 2. A deep channel exists along the western edge of the water body whilst the area towards the centre is very shallow.

#### Sexing and Identification of Individual Dusky Moorhens

It was decided that since the Dusky Moorhens were dominant in terms of numbers and in occupation of the reeds and nesting area, an understanding of their behaviour and nesting strategies was essential. A previous study (Garnett *loc. cit*) examining the behaviour of this species on Sulli-



● Figure 3. Vegetation distribution in study area at Sullivan's Creek.

van's Creek was invaluable in this regard. Many of the birds retained the colour bands from the previous study facilitating the identification and sexing of many individuals.

*Vegetation*

The vegetation map (Figure 3) of the study area shows that there are two species of reeds present, *Typha domingensis* and *Phragmites communis*. In the shallow areas we found that a filamentous algae (*Chlorophyceae*) was present on the creek benthos and also as an epiphyte on *Potamogeton tricarinatus* which were noted as growing in two small patches. At the time of the study, *P. tricarinatus* was fully submerged and had no floating leaves present.

*Feeding*

Dusky Moorhen

The area over which this species was noted as feeding is shown in Figure 5. The water in the feeding area was to 30 cm in depth. In the feeding area it was not possible to accurately discern the species preferences for the different forms of vegetative growth i.e. algal growths and *Potamogeton*. However as the birds were observed feeding in areas where only algae was present, we may assume with some certainty that this was included in the diet.

The Moorhens were not observed diving during the duration of the study.

Eurasian Coot

Although the coot were able to feed in the shallow areas with the moorhens they were observed to feed more often in the deeper water where they dived to the benthic vegetation, plucked it and brought it to the surface to feed. In the study area, it was noted that this material was filamentous algae. This material, having been brought to the surface, was then picked through by the bird and only selected portions eaten, the remainder being discarded on the water surface. Small, floating patches of algae were often observed after the coot had fed in an area.

The feeding area has been shown on Figure 5. The birds dived to 80 cm to reach the algal growths. As shown by Figure 3 vegetation was



The Dusky Moorhen was observed feeding in shallow water, it did not dive for food. When feeding the tail always remained above water level.

Coots used two methods of feeding. In shallow water they fed in a fashion similar to the moorhen. However in deeper water they were observed to dive, re-appearing on the surface with vegetation, presumably plucked from the bottom.

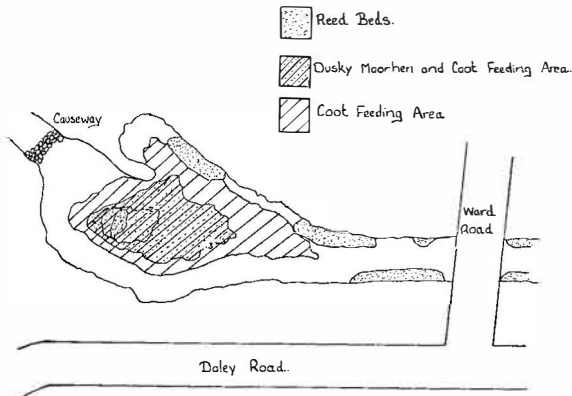


Totally Submerged.



● Figure 4. Observed feeding techniques of coot and moorhen at Sullivan's Creek.

not found to be present below this depth (probably because of the turbidity of the water) and so, the limit to, the coots' feeding area was imposed probably by the vegetation and not by the birds' inability to dive to a greater depth.



● Figure 5. Feeding areas of moorhen and coot at Sullivan's Creek.

### Purple Swamphen

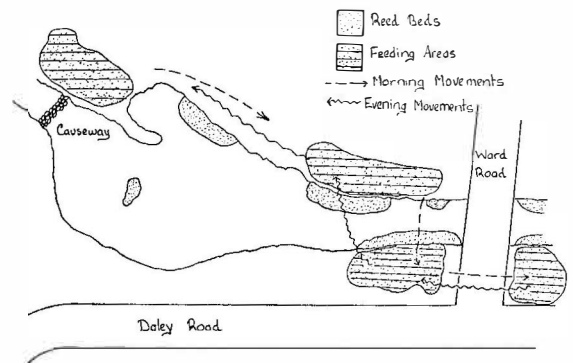
This species was observed to feed on the vegetation of the mown lawns and ovals surrounding the creek. Swamphens ranged over a wide area when feeding and it was observed that a clover (*Trifolium* sp.) was often eaten. They exhibited a definite pattern of movements on both days of the study. This is illustrated, together with the major feeding areas in Figure 6.

The swamphen's feeding technique is one that has been documented previously (Bryant 1940). The birds were observed to pick vegetation (clover) close to the base of the stem, the detached stem and leaves were then held aloft between two toes of the bird's foot. The bird then picked out and consumed the most succulent parts of the suspended material, discarding the remainder.

Swamphens also fed on the succulent stems of *Typha domingensis*. The feeding bird removed the centre of the young blades at water level, causing the rest of the blade to fall over onto the water's surface and eventually die.

### Breeding

At the time of the study, it was noted that two of the three species of birds under study, swamphens and moorhens, had established nesting territories and were beginning to breed. No eggs had been laid by either species at the time of the study; however on a revisit to the area seven days later, it was found that both species were incubating eggs.

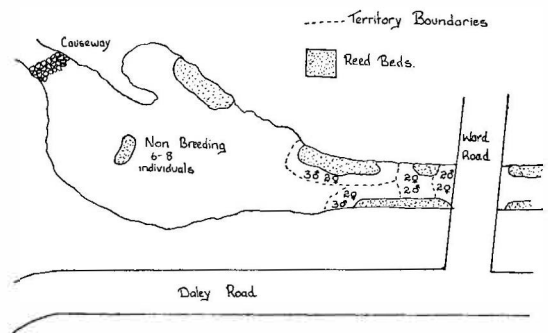


● Figure 6. Purple Swamphen feeding patterns and movements at Sullivan's Creek.

Swamphens were first observed feeding in the area near the causeway at sunrise. From this area the birds moved down towards Ward Road, crossing it at approximately 09:00 hours. A reverse movement occurred in the afternoon, the birds once again crossed Ward Road at 17:00 hours.

### Dusky Moorhen

It was found that these birds bred and maintained breeding territories in groups of up to five individuals. These groups were usually comprised of two females and two or three males. The territories and numbers of birds within the territories are shown in Figure 7. It was also observed that non-breeding (possibly immature) birds were present in the study area. They occupied an area outside the established territories (see Figure 7).



● Figure 7. Territories of Dusky Moorhens at Sullivan's Creek.

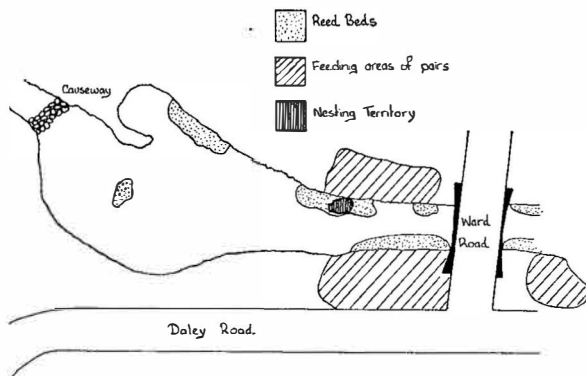
The territorial system of moorhens controlled the number of individuals around the *Typha* and thus regulated the density of the breeding population.

Defence of a territory by moorhens and consequent threat and aggressive behaviour was usually only directed towards other conspecifics. However on several occasions it was noted that coots were also chased from these territories. It is felt that this action was a result of misidentification on the part of the defending moorhen since it was observed that a defending bird would sometimes turn on members of its own breeding group. This action would result in a recognition display by the pursued bird and consequently end the defending bird's aggression.

### Purple Swamphen

This species was observed predominantly on the mown lawns around the creek, as has been previously discussed under 'Feeding'. The birds moved from the northern end of the study area to areas further down the creek and out of the study area for the greater part of the day.

One pair however stayed in the study area throughout the day. The area over which these two individuals moved is also shown on Figure 8. It was found that this pair were nesting in the adjacent *Typha*. The nesting site and several metres of *Typha* around the nest formed this pair's territory and it was defended by the birds from other swamphens moving to and from the feeding area in the north-east.



● Figure 8. Feeding and breeding territories of Purple Swamphen at Sullivan's Creek.

TABLE 1

Height of nests above water level.

Purple Swamphen	Dusky Moorhen
60 cm	1 cm
65 cm (Jerrabomberra)	25 cm
70 cm	30 cm
	32 cm
	40 cm

Our observations suggest there may be some vertical separation in nesting positions between swamphens and moorhens. The recorded height of the nests above water level are given in Table 1.

### Eurasian Coot

This species was observed in the study area on both days of the initial study. The birds were in pairs but did not enter the *Typha* or *Phragmites* and gave no indication that they were breeding in the area. On our revisit it was found that the coots had moved out of the study area. In another location near Scrivener Dam they were common and had commenced breeding. In this location the water was less turbid, allowing vegetation to grow to a greater depth. No moorhens were observed in this locality.

### Discussion

It is apparent that the two nesting species in the study area, Dusky Moorhen and Purple Swamphen have different feeding requirements. Our study indicates that swamphens are predominantly a land grazing species, moorhens feed largely in shallow waters whilst coots are able to feed in shallow water but were more often observed diving in the deeper waters of the study area. The reasons for the movement of coots out of the study area, however, are not certain.

Coots were observed to feed in water up to 80 cm deep in the study area. Since most water from 30 cm to 80 cm deep was in the territorial areas occupied by moorhens (as a comparison of Figures 5 and 7 will demonstrate) and since moorhens sometimes chased coots out of the

territories, the latter were in effect chased from their feeding areas. It is suggested that as breeding of moorhens progresses defence of territories will probably intensify when eggs are laid or chicks are present. Then the pressure on coots to move away from breeding areas of moorhens will probably increase.

Another factor which may have contributed to the movement of coots from the study area was the limitation on the size of a suitably deep feeding area (from 30 to 80 cm). This area may not have been large enough to support a group of nesting coot. In comparison, the area near Scrivener Dam where they were found to be nesting, along with the Musk Duck *Biziura lobata* and Australasian Grebe *Tachybaptus novaehollandiae* had large areas of deep water with an abundance of vegetation.

The two breeding species in the study area both use *Typha domingensis* for nesting purposes. As Table 1 indicates, there is a vertical separation in the positioning of nests.

Whilst moorhens approached the *Typha* by swimming, and, on reaching the vegetation, moved through it at water level or a little above water level, the swamphens more frequently approached the *Typha* from the bank than from the water. When entering the *Typha*, they ran or flew up into the top sections where dead *Typha* had been flattened into densely compacted platforms and walkways.

From our observations, both during the two day study and from subsequent visits to both the study area and to locations near Scrivener Dam and Jerrabomberra Creek, it appears that the nests of both species are the products of at least two seasons' activity by the birds. During summer, *Typha domingensis* grows rapidly to form clusters of new blades. These clumps die off during winter and are used by the birds for roosting and other activities. This results in the dead *Typha* being trodden down into platforms and depressions which are quite open. *Typha* begins to grow vigorously during spring and in a matter of several weeks new growth has concealed the already formed depressions. As soon as this happens, the birds begin egg laying.

It is interesting to note that, in the study area, moorhen nests were covered quickly with new vegetation since they were close to the water sur-

face, in contrast with the nests of swamphens which, being higher up in the *Typha*, were covered about one week later. Egg laying by moorhens was about one week in advance of that of swamphens in the study area.

The creek drains residential areas of Canberra, thus water in the creek is eutrophic. Water flowing into the creek also carries large amounts of silt and suspended matter. The combined effect of nutrient and silt flows into the study area have limited vegetative growth below 80 cm. However above 80 cm dense algal growths occur, especially where water depth is between 10 and 40 cm. The effect of this has been twofold.

- (1) Feeding areas of the coot in the deeper waters have been limited.
- (2) Feeding areas of the Dusky Moorhen have prolific vegetative growth.

It is possible that further eutrophication and silt accumulation will lead to a further decrease in the feeding areas of coot and to a certain extent favour moorhen feeding areas.

### Acknowledgements

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