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WINTER FLUCTUATIONS IN WATERBIRD NUMBERS ON A NORTHERN TABLELANDS' LAGOON OF NEW SOUTH WALES

Many Australian waterbirds move in response to seasonal and sudden climatic stimuli (Lamm 1964; Frith 1967; Briggs 1977). During the winter of 1975 I counted waterbirds at Dangars Lagoon on the northern tablelands of New South Wales to see if changes in numbers could be related to rainfall, water-level and temperature.

Dangars Lagoon is in *Eucalyptus nova-anglica–E. blakelyi* woodland four kilometres south of Uralla, 1,000 metres above sea-level, has an area of about fifty hectares when full and was formed when a stream was dammed last century. Natural drainage has altered and today Dangars relies on local rainfall for water. It dried out almost totally in 1969 (Gosper 1973) and was less than two metres deep in most places in 1975.

The soils round the lagoon were weathered from granite. An emergent rush, *Eleocharis sphacelata*, a submergent weed, *Vallisneria spiralis* and floating *Azolla* spp were the dominant vegetation. The margins were lined with *Juncus* spp and *Polygonum* spp. The range of mean summer and winter temperatures is 14-26 °C and 1-13 °C respectively. The Uralla area receives 762 millimetres of rainfall annually, sixty per cent in the summer and forty in winter. Winter snowfalls are light and there are fifty frosts a year.

I counted waterbirds one hundred times between March and September 1975, using 10 x 50 binoculars, while walking round the lagoon. I obtained rainfall and temperature data from the recording station at Laureldale Farm, University of New England, Armidale, and recorded water-level on a marked stake in the lagoon. Correlation coefficients (Snedecor and Cochran 1971) were calculated between bird numbers and climatic and water-level data.

RESULTS AND DISCUSSION

Mean numbers of thirty-four species of waterbirds observed between March and September 1975 are presented in Table I. Correlation coefficients between numbers and climatic and water-level data are in Table II. Changes in water-level, rainfall and temperature are presented in Figure 1.

TABLE I

Mean numbers of waterbirds at Dangars Lagoon, March to September 1975.

	Mar(6)*	Apr(8)	May(22)	Jun(16)	Jul(16)	Aug(17)	Sept(15)
DUCKS							
Grey Teal (100)**	45	93	109	114	38	98	114
Pacific Black Duck (100)	73	36	33	32	54	47	23
Black Swan (97)	8	4	2	5	24	19	13
Hardhead (94)	1	11	26	43	67	75	110
Musk Duck (91)	6	3	2	3	6	5	6
Australian Shoveler (57)		<1	1	7	15	10	1
Maned Duck (35)		9	14	12	2	2	1
Blue-billed Duck (16)				<1	2	1	2
Chestnut Teal (4)	<1						<1
Pink-eared Duck (1)	<1						
HERONS, SPOONBILLS AND IBISES							
White-faced Heron (43)	1	2	1	3	2	1	1
Yellow-billed Spoonbill (19)			<1	<1	<1	<1	<1
Sacred Ibis (15)	<1	1	<1				
Straw-necked Ibis (14)					7	37	7
Pacific Heron (12)			<1	<1	<1	<1	<1
Royal Spoonbill (5)		<1	<1				
Great Egret (3)		<1	<1				
RAILS							
Eurasian Coot (100)	540	412	415	442	517	630	813
Dusky Moorhen (100)	89	69	49	60	41	36	35
Purple Swamphen (100)	82	98	102	90	111	121	134
Baillon's Crake (1)						<1	
WADERS							
Black-winged Stilt (99)	9	10	4	4	4	6	7
Masked Lapwing (86)	3	3	5	4	9	12	3
Latham's Snipe						<1	
Black-fronted Plover***							
GREBES							
Australasian Grebe (100)	118	177	165	143	104	126	168
Hoary-headed Grebe (45)	<1	2	3	2	<1	<1	
Great Crested Grebe (3)							<1
CORMORANTS							
Little Pied Cormorant (90)	76	23	9	6	2	4	3
Great Cormorant (84)	6	4	4	3	3	7	5
Darter (18)	3	1	<1	<1	<1		<1
Little Black Cormorant (8)	<1					<1	<1
OTHER SPECIES							
Silver Gull (2)					2		
Australian Pelican (2)					<1		

*Number of counts conducted each month
**Figures in parentheses are the percentage each species was present in the total number of counts
***Not counted

Ducks

Grey Teal *Anas gibberifrons* was a highly mobile species, being more abundant with colder temperatures, lower water-levels and low rainfall; however no significant (0.05) correlation coefficients were found between their numbers and these factors. Briggs (1977) reported the same trend for populations of Grey Teal and water-level on four lagoons near Guyra on the northern tablelands and Frith (1962) concluded that rainfall was the ultimate factor in determining movements of Grey Teal. This explains the mass exodus of Grey Teal between June and July after nearly seventeen days of continuous rain; a similar event was described by Frith (1962) for Grey Teal elsewhere.

Numbers of Pacific Black Duck *Anas superciliosa* significantly (0.05) declined with decreases in rainfall, water-level and temperature. Frith (1959) considered them less mobile than Grey Teal in inland New South Wales and Briggs (1977) found the same relation on

TABLE II

Correlation coefficients between numbers of some waterbirds and rainfall, water-level, and temperature, March – September 1975, at Dangars Lagoon.

Species	Rain-fall	Water Level	Max. Temp.	Min. Temp.
Grey Teal	−0.23	−0.29	−0.43	−0.30
Pacific Black Duck	0.53*	0.38	0.55*	0.62*
Black Swan	0.21	−0.04	−0.42	−0.50
Hardhead	−0.26	−0.27	−0.74**	−0.72**
Black-winged Stilt	0.11	0.94**	0.75**	0.76**
Eurasian Coot	−0.40	0.22	−0.49	−0.17
Dusky Moorhen	0.20	0.42	0.86**	0.85**
Purple Swamphen	−0.12	−0.02	−0.48	−0.58*
Masked Lapwing	0.51	−0.20	−0.59*	−0.55
Australasian Grebe	−0.55*	0.14	0.08	0.11
Little Pied Cormorant	0.06	0.62*	0.88**	0.94**
Great Cormorant	0.07	0.61*	0.29	0.38

*Significant at 0.05 level
**Significant at 0.01 level

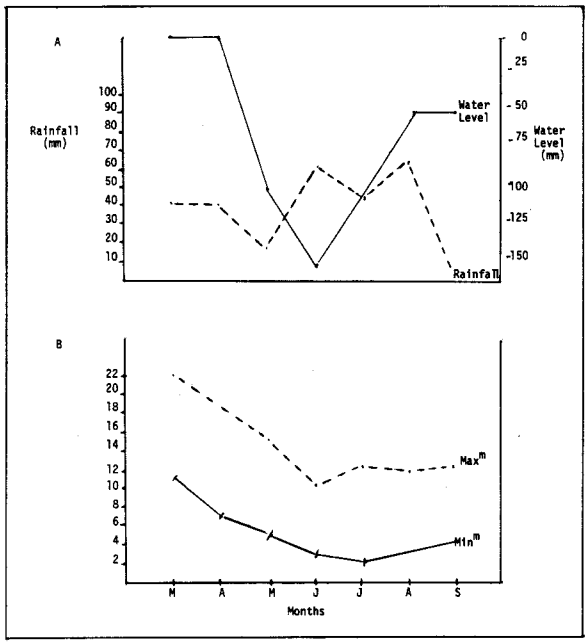

Figure 1. A. Mean monthly rainfall (mm) for Laureldale Farm, University of New England and mean monthly water-level (mm) of Dangars Lagoon, March - September 1975.
B. Mean monthly maximum and minimum temperatures (°C) for Laureldale Farm, University of New England, March - September 1975.

the northern tablelands. My results agree with Briggs (1977) because numbers of Pacific Black Duck at Dangars in 1975 and the Guyra lagoons in 1974 fell between March and June, increased between June and August and decreased in September. However, Briggs (1977) correlated their numbers with changes in water-level, whereas my data best correlate with temperature and rainfall.

Numbers of Hardheads *Aythya australis* were significantly (0.01) correlated with temperature. My data are inconsistent with the literature. Hardheads prefer large areas of deep water with accompanying emergent vegetation (Frith 1967) and only small areas of Dangars fit this requirement. Further, Briggs (1977) reported increases in early winter and decreases in late winter in numbers of Hardhead on the Guyra lagoons. Frith (1967) admitted that little was known about environmental stimuli for movements of Hardheads and I find it difficult to explain the winter congregations of Hardheads at Dangars.

Numbers of Black Swans *Cygnus atratus* rose substantially between June and July. Briggs (1977) noted a similar trend in mid- to late winter on only one of the Guyra lagoons (Llangothlin). Frith (1967) believed suitable habitats support small resident populations of Black Swans, with many more individuals being nomadic and moving erratically and widely according to weather and habitat distribution. By marking individuals, Braithwaite and Wilson (1969) showed that Black Swans move regularly and total numbers of residents vary slightly. The increase of Black Swans at Dangars in June to July could have resulted from an influx of nomads.

Herons, spoonbills and ibises

White-faced Herons *Ardea novaehollandiae* were the most common heron and other species were infrequent and usually few. I could not find any trends from the data.

Waders

Numbers of Black-winged Stilts *Himantopus himantopus* were significantly (0.01) correlated with temperature and water-level. Cold winter temperatures from May to July froze the mudflats exposed by receding water-levels. According to Cayley (1967). Black-winged Stilts forage on mudflats for aquatic animals and I observed no feeding by Black-winged Stilts in mid-winter. Frozen mud would reduce availability of food, causing some of the Black-winged Stilts to leave Dangars during the coldest months. Masked Lapwings *Vanellus miles* remained few until congregations built up in July and August,

before dispersing in September, apparently to breed.

Rails

Four species of rails were permanent residents. The small secretive Baillon's Crake *Porzana pusilla* was recorded only once, going unsighted in the rest of the counts. Numbers of Eurasian Coots *Fulica atra* tended to increase with decreases in rainfall and temperature (maximum). This trend contradicts Briggs (1977), who found that numbers on one Guyra lagoon (Little Lagoon) positively correlated with water-level. Past studies (Sharland 1960; Lamm 1964) failed to relate fluctuations in numbers of Coots to any environmental stimuli.

Dusky Moorhens *Gallinula tenebrosa* increased while Purple Swamphens *Porphyrio porphyrio* decreased. Both species are large rails and competition for food and roosting requirements may favour Purple Swamphens over Dusky Moorhens. Numbers of Purple Swamphens on the Guyra lagoons fluctuated simultaneously, leading Briggs (1977) to conclude that the species was less mobile than most waterbirds on the northern tablelands. Consequently, the winter increase in Purple Swamphens at Dangars probably involved a movement of locals from elsewhere on the tablelands, with only small numbers arriving from outside areas.

Grebes

Australasian Grebes *Podiceps novaehollandiae* were present in large numbers and fluctuations were significantly (0.01) correlated with rainfall. Whereas I found that they decreased with increasing rainfall, Briggs (1977) found an increase with falling water-level. The relation between movements of the Grebes, rainfall and water-level on the northern tablelands is unclear.

Cormorants

Little Pied Cormorants *Phalacrocorax melanoleucos* and Great Cormorants *P. carbo* decreased in numbers with falling water-levels. Also, numbers of Little Pied Cormorants were significantly (0.01) correlated with temperature, suggesting that both stimuli caused the decline. Gosper (1973) assumed that fluctuations in numbers of cormorants on Dangars and Racecourse Lagoons were related to changes in water-level. Lamm (1964) and Gosper (1973) each described sharp declines in numbers of cormorants after the discovery of dead fish on the banks of Lake George and the two Uralla lagoons. I found no dead fish at Dangars in 1975.

In conclusion, Frith (1967) questioned the role of temperature in determining movements of ducks but the effects of temperature on ducks and other waterbirds in areas experiencing cold winters has not been established. My study presents correlations between numbers and temperature for several species and I suggest the need for further research.

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