# DIET OF THE WHITE-FACED HERON ON MANAWATU PASTURES

# By P.L. LO

## ABSTRACT

White-faced Herons (Egretta novaehollandiae novaehollandiae) captured a wide variety of prey from pastures with transitory surface water. A total of 34 357 prey items were recorded, mainly from regurgitated pellets but also from observations of birds feeding. Major prey groups were insects, tadpole shrimps, earthworms, tadpoles and frogs. The diet depended on the seasonal availability of prey. In spring, earthworms, cosmopolitan diving beetles, tadpole shrimps, tadpoles and frogs were major prey. During the drier conditions of summer and autumn, terrestrial insects such as flies, damselflies, and grasshoppers became important. Earthworms and tadpole shrimps were the main prey in winter.

#### INTRODUCTION

Herons (Ciconiiformes: Ardeidae) feed opportunistically on a wide variety of animals. While many are specialised feeders, others such as the Whitefaced Heron (*Egretta novaehollandiae novaehollandiae*) are much more versatile. Recher & Recher (1980) described the White-faced Heron as a habitat generalist, found in many aquatic habitats as well as pastures and rough grazing land, hunting slowly and methodically for a variety of prey. Established in New Zealand only since the mid-1940s, it is now our most common ardeid and is found in both coastal and inland regions throughout the country (Carroll 1970).

Most studies of White-faced Herons have concentrated on the foraging behaviour of birds living on the coast (Spurr 1967a,b; Lowe 1983) or estuaries and harbours (Louisson 1972, Moore 1984). Except for three studies, dietary information consists mainly of incidental records of birds feeding. Carroll (1967) analysed the stomach contents of 89 birds most of which were collected from the Rotorua and Canterbury Districts of New Zealand, and Lowe (1983) collected 14 birds from mudflats and nearby pastures in Victoria, Australia. Moore (1982) identified animal groups in the diet of herons at Pauatahanui Inlet, Wellington, New Zealand, by direct observation and from 32 regurgitated pellets.

Little is known about seasonal changes in the diet of White-faced Herons and the relative importance of different prey, particularly for birds living inland. Moore (1982) compared the diet of herons in estuarine and farmland habitats in February and May. Lo (1982) and Lo & Fordham (1986) observed herons foraging over pasture and assessed their diet by recording the prey sought and sampling feeding areas for potential prey.

In this paper, regurgitated pellets, direct observations of prey captured and some regurgitated food and stomach contents were analysed to determine the year-round diet of herons foraging on pastures with permanent and transitory aquatic habitats.

# STUDY AREA AND METHODS

Herons living in the sand country of coastal Manawatu were studied between August 1979 and February 1981. The region comprises a complex of sand dunes, sand plains, peaty swamps and shallow lakes near the west coast of the southern North Island.

Developed pastures on the sand plains are farmed for sheep and cattle while the younger dunes are left in scrub or planted with pines (*Pinus* spp.) My main study area was the farmland around Pukepuke Lagoon, 30 km west of Palmerston North and 3 km from the sea ( $40^{\circ}20'$  S,  $175^{\circ}16'$  E). The fields were interspersed with stock ponds and drains and had extensive areas of surface water during winter and spring.

In assessing diet one should use several methods of analysis because all are subject to biases (Goss-Custard 1973). My main method was the analysis of regurgitated pellets. Bird pellets contain the indigestible portion of food items, and so are usually biased towards keratinous material such as insect exoskeletons, fur, feathers, beaks and claws. This material accumulates in the stomach and the bird regurgitates it in compact masses. I collected pellets regularly from nest and roost sites in stands of pines at Pukepuke and three other farms, except between May and August 1980. Complete pellets were measured and all pellets were dried at 80 °C to a constant weight. Recognisable skeletal fragments were extracted under a dissecting microscope and identified from a reference collection.

I noted the larger prey captured by herons foraging over pasture at Pukepuke Lagoon and 3 km south of Palmerston North (Lo 1982, Lo & Fordham 1986). Prey larger than about bill length (7 cm) was identifiable by this method. These larger items were held in the bill briefly before being swallowed, whereas small prey were swallowed immediately after capture. I also collected two masses of regurgitated food found under nests and the stomach contents of one heron from Pukepuke.

### RESULTS

# Pellets

I examined 106 complete pellets and 48 masses of broken material. Pellets varied greatly in size, density and composition. They averaged 39 mm in length (range 29-50 mm), 4.4 g in weight (0.8-23.6 g), and contained on average 165 food items (3-600) and 7.6 genera (1-15, a minimum number because some items were not identified to genus). Most pellets consisted predominantly of animal fragments. Sand or plant material was present in small amounts, although in a few cases they predominated.

A total of 32 762 arthropods from 10 orders were recorded (Table 1, Appendix 1). Over 70% of the items were insects, comprising mainly larval and adult cosmopolitan diving beetles (*Rhantus pulverosus*) (by far the most numerous species) striped dung flies (*Hybopygia varia*), backswimmers (*Anisops* spp.), caterpillars, and adult damselflies. Tadpole shrimps (*Lepidurus apus viridus*) were the second most common species and the only major noninsect component of pellets. Less frequently recorded prey included other aquatic and terrestrial beetles, flies (larval and adult), waterboatmen (*Sigara* spp.), grasshoppers (*Phaulacridium marginale*), crickets (*Metioche maoricum*)



FIGURE 1 — Monthly changes in orders of prey in White-faced Heron pellets from Manawatu (August 1979-February 1981), expressed as percentages of the monthly total number of items.

and spiders. No vertebrate or soft-bodied prey remains were recorded.

Monthly changes in the diet composition are shown in Figure 1. Between August and November, 95% of the prey items were aquatic species compared with 68% in December and January and 19% from February to April. Tadpole shrimps (Order Notostraca) were the main component of pellets collected in August and September, comprising almost 80% of prey items. Subsequently their proportion declined and by late November they were virtually absent from the diet.

The larvae of the cosmopolitan diving beetle (Order Coleoptera) became the dominant prey (20-68%) in pellets from October to January, but from then on were of minor importance. Adult cosmopolitan diving beetles were in all but five pellets and comprised 4-10% of prey in most months. Other aquatic beetles were recorded throughout the year with some terrestrial species being seasonally abundant. For example, the period October to December was important for various Scarabaeidae, Carabidae and Tenebrionidae (Appendix 1). Among other herons, the White-faced Heron is probably closest in feeding ecology to the Cattle Egret (*Bubulcus ibis*) (McKilligan 1984). Both species favour wet pastoral areas and share many foods, including grasshoppers, crickets, caterpillars, flies, beetles, spiders, earthworms and frogs (Siegfried 1971, 1972; McKilligan 1984).

#### Seasonality

The herons adjusted their feeding to take advantage of readily available prey as seasons and environmental conditions changed, particularly the level of the water table. The proportion of tadpole shrimps in pellets corresponded with their periods of abundance. They were common in temporary ponds within the study area during winter and spring, but died out as the pasture became dry (I. Stringer, pers. comm.). Carroll (1967) and Lowe (1983) also found tadpole shrimps were important prey items in August.

The larvae of the cosmopolitan diving beetle replaced tadpole shrimps as the main component of pellets in late spring, which presumably reflected their greater availability. Earthworms were abundant at this time of year (Lo & Fordham 1986), and were an important part of the diet while terrestrial insects were relatively scarce. Tadpoles and adult frogs were important foods for herons hunting around ponds and drains in spring and summer.

During summer, the change from diving beetles to flies, as the main food in pellets, represented a general change of diet from aquatic to terrestrial prey. The drier weather greatly reduced the extent of aquatic habitats and the availability of aquatic prey. Lo & Fordham (1986) showed that, in summer, herons sought mainly active, above-ground prey such as flies and took few earthworms, which corresponded with their relative availability. Moore (1982) also found flies to be important prey in summer whereas earthworms were more important in autumn for herons foraging on pasture. Carroll (1967) found fewest earthworms in herons collected between February and April, while Cattle Egrets similarly eat fewest earthworms during summer and most in the wetter winter months (Siegfried 1972).

By late summer, large prey had virtually disappeared and the herons were dependent on small terrestrial insects. This period may be the most difficult time of year for herons foraging over pasture to find food (Lo & Fordham 1986). Cattle Egrets, which have a similar diet, also face a food shortage at this time of year (Siegfried 1971, 1972).

Terrestrial insects continued to be a major part of the diet in autumn. As damselflies, grasshoppers and crickets were more abundant, the pellets were not dominated by one or two species as in previous months. Lowe (1983) similarly found that grasshoppers and crickets were major foods in autumn. The herons ate more earthworms than in summer, coinciding with their greater availability due to moister, cooler conditions at the soil surface.

Between autumn and winter earthworms became an important component of the diet. In winter, almost all bill strikes were aimed at slowmoving prey on or in the ground, and herons correspondingly captured the most earthworms (Lo & Fordham 1986). Pasture sampling confirmed that earthworms were readily available and that large insects were relatively scarce (Lo & Fordham 1986).

I found no pellets between May and July, partly because I was denied access to the main roost site during the duck shooting season. Other roost sites were used irregularly and no pellets were found during this period. Herons may produce fewer pellets in winter because worms have few indigestible parts.

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APPENDIX 1 -	Monthly total number of food items of White-faced Herons from
	regurgitated pellets collected in Manawatu, August 1979 - February
	1981

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Graphognathus leucoloma       0 <td>11</td> <td>(-) (a)</td> <td>ŝ</td> <td>ō</td> <td>č</td> <td>õ</td> <td>· č</td> <td>1</td> <td>õ</td> <td>ő</td> <td>ő</td> <td>1</td>	11	(-) (a)	ŝ	ō	č	õ	· č	1	õ	ő	ő	1
Irenimus spp.       1       0       <	Graphognathus leuco	loma	ŏ	Ő	ŏ	õ	Ō	2	2	4	Ď	- 8
Cecyropa spp.       0       0       1       0       0       0       0       0       1         Curculionidae       3       1       4       3       1       13       5       0       0       3       0 <td< td=""><td>Irenimus spp.</td><td></td><td>1</td><td>0</td><td>Ó</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></td<>	Irenimus spp.		1	0	Ó	0	0	0	0	0	0	1
Curculionidae       3       1       4       3       1       13       5       0       0       30         Coccinella       0       1       0       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       0       0       0       0       0       0       0       0       0       1       0       0       0       1       0       0       0       0       0       0       0       0       0       0       0       1       1       0       0       0       1       0       0       0       1       1       1       1       1       1       1       0       0       0       1       1       0       0       0       0       1       1       0       0       0       1       1       1	Cecyropa spp.		0	0	1	0	0	0	Э	0	0	1
Coccinella       0       0       0       0       0       3       2       0       0       5         undecimpunctata       Sarosites communis       1       0       0       15       1       0       0       0       1       7         Neccicindela       0       0       0       0       0       1       1       0       6         Thelyphassa spp.       0       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       1       0       0       0       1       1       0       0       0       0       0       1       1       0       0       0       0       0       1       1       1       0       0       0       0       0       0       0       1       1       0       1       0       1       0       1       0       1       0       1       1       1       0       0       1       0       1       0       1 <td>Curculionidae</td> <td></td> <td>3</td> <td>1</td> <td>4</td> <td>3</td> <td>1</td> <td>13</td> <td>5</td> <td>0</td> <td>0</td> <td>30</td>	Curculionidae		3	1	4	3	1	13	5	0	0	30
undecimpunctata         Sarrosites communis       1       0       0       15       1       0       0       0       17         Neccicindela       0       C       0       0       4       1       1       0       6         Thelyphassa spp.       0       0       0       1       0       0       0       1         Thelyphassa spp.       0       0       0       1       0       0       0       1         Unidentified       (1)       0       0       0       0       0       0       3       3         TOTAL       112       774       4468       6845       1592       520       384       139       40       14874         %       5.9       15.7       52.4       76.3       60.3       39.6       18.9       6.4       13.9       45.4         ORDER DIPTERA       Hybopygia varia       0       0       3       2       403       181       1018       561       2.6       2214         Lucilia sericata       0       0       1       7       7       23       163       18       282         Calliphoridae       C	Coccinella		0	0	0	0	0	3	2	0	0	5
Sarrosites communis       1       0       0       15       1       0       0       0       1       1       0       0       1       1       0       0       1       1       0       0       1       1       0       0       0       1       1       0       0       0       1       1       0       0       0       1       1       0       0       0       1       1       0       0       0       1       1       0       0       0       0       0       0       1       1       0       0       0       0       0       0       1       1       0       0       0       0       0       0       1       1       0       0       0       1       1       0       0       0       1       1       0       0       0       1       1       1       1       0       0       1       1       1       0       1       1       1       1       1       1       1       0       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	undecimpunctata											
Neccicindela       0       0       0       0       4       1       1       0       6         Thelyphassa spp.       0       0       0       0       1       0       0       0       4       1       0       6         Xylotoles spp.       0       0       0       0       1       0       0       0       1       0       0       0       1       1       0       1       1       1       0       1       0       0       0       1       1       0       0       1       1       0       0       0       0       0       0       1       1       1       0       0       0       0       0       0       1       1       1       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       1       1       1       0       0       0       0       1       1       0       1       1       1       0       1       1       1       0       1       1       1       0       1       1       0       1       1       1	Saprosites communis		1	C	0	15	1	0	0	0	0	17
Tuberculata         Thelyphassa spp.       0       0       0       0       1       0       0       0       1         Tenebrichidae       0       3       3       1       C       0       0       1       1         Unidentified       (1)       0       0       0       0       0       0       0       3       3         TOTAL       112       774       4468       6845       1592       520       384       139       40       14874         %       5.9       15.7       52.4       76.3       60.3       39.6       18.9       6.4       13.9       45.4         ORDER DIPTERA       Hybopygia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       17       47       23       13       163       18       282         Calliphoridae       (1)       0       1       8       190       269       0       1       0       46.9         Unidentified       (1)       0       1       8       100       0       0       23.7 </td <td>Neccicindela</td> <td></td> <td>0</td> <td>С</td> <td>0</td> <td>0</td> <td>0</td> <td>4</td> <td>1</td> <td>1</td> <td>0</td> <td>б</td>	Neccicindela		0	С	0	0	0	4	1	1	0	б
The ippnassa spp.       0       12       0       0       0       0       0       0       0       0       0       0       0       0       12       0       0       0       0       0       12       0       0       0       0       0       12       0       0       0       0       12       0       0       0       12       0       0       0       12       0       0       14674       \$       \$       5       9       15       7       52.4       76.3       60.3       39.6       18.9       6.4       13.9       45.4       45.4         ORDER DIPTERA       Hybopygia varia       0       0       1       1       0       0       5       5       5       0       0       0       0       5       5	tuberculata		•	~				-				
Aylobies Spp.       0       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       0       0       1       0       0       0       0       0       1       0       0       0       0       0       1       1       232         TorAL       112       774       4468       6845       1592       520       384       139       40       14874         (a)       10       15       42       39       70       26       18       11       1       232         TorAL       112       774       4468       6845       1592       520       384       139       40       14874         (a)       0       1       1       2       0       1       0       14874         (bypigia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       17       47       23       13       163       <	Thelyphassa spp.		0	0	0	0	4	U	0	C	0	4
Unidentified       0       3       6       3       1       0       0       0       0       0       0       0       1       1       232         Unidentified       10       15       42       39       70       26       18       11       1       232         TOTAL       112       774       4468       6845       1592       520       384       139       40       14874         %       5.9       15.7       52.4       76.3       60.3       39.6       18.9       6.4       13.9       45.4         ORDER DIPTERA       Hybopygia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       2       0       1       0       2       2214         Lucilia sericata       0       0       1       17       47       23       13       163       18       282         Calliphoridae       (1)       1       8       190       269       0       1       0       469         Eristalis tenax       0       0       3       1.8       101 <td>Aylocotes spp.</td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>C O</td> <td>0</td> <td>1</td>	Aylocotes spp.		0	0	0	0	1	0	0	C O	0	1
(1)       0       1       1       2       0       1       1       0       1       0       0       1       0       0       1       0       0       1       0       0       1       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       1       0       0       0       0       1       0	Unidentified	(1)	0	- J - J	8	د ت	L O	U O	0	U 2	0	12
(d)       10       15       42       35       70       20       18       11       1       232         TOTAL       112       774       4468       6845       1592       520       384       139       40       14874         %       5.9       15.7       52.4       76.3       60.3       39.6       18.9       6.4       13.9       45.4         ORDER DIFTERA       Hybopygia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       1       2       0       1       0       0       5         Muscoidea       C       0       1       17       47       23       13       163       18       282         Calliphoridae       (1)       0       18       190       269       0       1       0       426       91       20       237         TOTAL       0       8       26       304       740       311       1072       826       65       3352         %       0.0       0.2       0.3       3.4       28.0       23.7 <t< td=""><td>on identified</td><td>(⊥) (a)</td><td>10</td><td>15</td><td>42</td><td>0 20</td><td>70</td><td>0 26</td><td>19</td><td>11</td><td>1</td><td>נ ררר</td></t<>	on identified	(⊥) (a)	10	15	42	0 20	70	0 26	19	11	1	נ ררר
TOTAL112 $774$ $4468$ $6845$ $1592$ $520$ $384$ $139$ $40$ $14874$ %5.9 $15.7$ $52.4$ $76.3$ $60.3$ $39.6$ $18.9$ $6.4$ $13.9$ $45.4$ ORDER DIPTERAHybopygia varia003 $22$ $403$ $181$ $1018$ $561$ $26$ $2214$ Lucilia sericata0011201005MuscoideaC0117 $47$ $23$ $13$ $163$ $18$ $282$ Calliphoridae(1)018 $190$ $269$ 0100 $469$ Eristalis tenax00318 $101$ 1090 $132$ Unidentified(1)0CC0C2 $3$ 21 $8$ (a)0710 $73$ 64 $26$ $91$ $23$ $237$ TOTAL08 $26$ $304$ $740$ $311$ $1072$ $826$ $65$ $3352$ %0.00.20.3 $3.4$ $28.0$ $23.7$ $52.7$ $38.3$ $22.6$ $10.2$ ORDER HEMIPTERAAnisops spp.17 $24$ $49$ $30$ $32$ $38$ $39$ $78$ $3$ $310$ Cermatulus nasalis00010101 $4$ Lygaeidae </td <td></td> <td>(4)</td> <td>10</td> <td>13</td> <td>72</td> <td></td> <td>10</td> <td>20</td> <td>10</td> <td>11</td> <td>T</td> <td>2.72</td>		(4)	10	13	72		10	20	10	11	T	2.72
%       5.9       15.7       52.4       76.3       60.3       39.6       18.9       6.4       13.9       45.4         ORDER DIFTERA       Hybopygia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       1       2       0       1       0       0       5         Muscoidea       C       0       1       17       47       23       13       163       18       282         Calliphoridae       C       0       1       17       47       23       13       163       18       282         Calliphoridae       (1)       0       1       8       190       269       0       1       0       45.4         Unidentified       (1)       0       C       0       0       2       3       2       1       8         ORDER       (a)       0       7       10       73       6       4       26       91       20       237         TOTAL       0       8       26       304       740       311       1072       826	TOTAL	-	112	774	4468	6845	1592	520	384	139	40	14874
ORDER DIPTERA         Hybopygia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       1       2       0       1       0       0       5         Muscoidea       C       0       1       17       47       23       13       163       18       282         Calliphoridae       C       0       0       0       5       0       0       0       5         Stratiomyiidae       (1)       0       1       8       190       269       0       1       0       0       469         Eristalis tenax       0       0       3       1       8       101       10       9       0       132         Unidentified       (1)       0       C       0       0       2       3       2       1       8         (a)       0       7       16       73       6       4       26       91       20       237         TOTAL       0       8       26       304       740       311       1072       826       65 <t< td=""><td>2</td><td></td><td>5.9</td><td>15.7</td><td>52.4</td><td>76.3</td><td>60.3</td><td>39.6</td><td>18.9</td><td>6.4</td><td>13.9</td><td>45.4</td></t<>	2		5.9	15.7	52.4	76.3	60.3	39.6	18.9	6.4	13.9	45.4
Hybopygia varia       0       0       3       22       403       181       1018       561       26       2214         Lucilia sericata       0       0       1       1       2       0       1       0       0       5         Muscoidea       0       0       1       17       47       23       13       163       18       282         Calliphoridae       0       0       0       5       0       0       0       5         Strationyiidae       (1)       0       1       8       190       269       0       1       0       0       469         Eristalis tenax       0       0       3       1       8       101       10       9       0       132         Unidentified       (1)       0       C       0       0       2       3       2       1       8         (a)       0       7       16       73       6       4       26       91       20       237         TOTAL       0       8       26       304       740       311       1072       826       65       3352         %       0.0 <td>ORDER DIPTERA</td> <td></td>	ORDER DIPTERA											
Lucilia sericata0011201005MuscoideaC011747231316318282CalliphoridaeC000500005Stratiomyidae(1)0181902690100469Eristalis tenax003181011090132Unidentified(1)0CC0C23218(a)07107364269120237TOTAL08263047403111072826653352 $\$$ 0.00.20.33.428.023.752.738.322.610.2ORDER HEMIPTERAAnisops spp.11925550552510322611935281915Sigara spp.17244930323839783310Cermatulus nasalis00010014Lygaeidae0000571120169Unidentified0000036009TOTAL136279554556137324277113	Hybopygia varia		0	0	3	22	403	181	1018	561	26	2214
MuscoideaC011747231316318282CalliphoridaeC000500005Stratiomyiidae(1)0181902690100469Eristalis tenax003181011090132Unidentified(1)0CC0023218(a)071C7364269120237TOTAL08263047403111072826653352%0.00.20.33.428.023.752.738.322.610.2ORDER HEMIPTERAAnisops spp.11925550552510322611935281915Sigara spp.17244930323839783310Cermatulus nasalis00010144Lygaeidae0000571120169Unidentified000003609TOTAL136279554556137324277113322408%7.15.76.56.25.224.713.65.2	Lucilia sericata		C	0	1	1	2	0	1	0	Ċ	5
Calliphoridae       0       0       0       5       0       0       0       5         Stratiomyiidae       (1)       0       1       8       190       269       0       1       0       0       469         Eristalis tenax       0       0       3       1       8       101       10       9       0       132         Unidentified       (1)       0       C       0       0       2       3       2       1       8         (a)       0       7       10       73       6       4       26       91       20       237         TOTAL       0       8       26       304       740       311       1072       826       65       3352         %       0.0       0.2       0.3       3.4       28.0       23.7       52.7       38.3       22.6       10.2         ORDER HEMIPTERA       Anisops spp.       119       255       505       525       103       226       119       35       28       1915         Sigara spp.       17       24       49       30       32       38       39       78       3       310 </td <td>Muscoidea</td> <td></td> <td>С</td> <td>0</td> <td>1</td> <td>17</td> <td>47</td> <td>23</td> <td>13</td> <td>163</td> <td>18</td> <td>282</td>	Muscoidea		С	0	1	17	47	23	13	163	18	282
Stratiomylidae       (1)       0       1       8       190       269       0       1       0       0       469         Eristalis tenax       0       0       3       1       8       101       10       9       0       132         Unidentified       (1)       0       C       0       0       2       3       2       1       8         (a)       0       7       10       73       6       4       26       91       20       237         TOTAL       0       8       26       304       740       311       1072       826       65       3352         %       0.0       0.2       0.3       3.4       28.0       23.7       52.7       38.3       22.6       10.2         ORDER HEMIPTERA       119       255       505       525       103       226       119       35       28       1915         Sigara spp.       17       24       49       30       32       38       39       78       3       310         Cermatulus nasalis       0       0       0       1       0       1       4       1       4       1<	Calliphoridae		C	0	0	0	5	0	0	0	0	5
Eristalis tenax003181011090132Unidentified(1)0C0023218(a)07107364269120237TOTAL08263047403111072826653352%0.00.20.33.428.023.752.738.322.610.2ORDER HEMIPTERAAnisops spp.11925550552510322611935281915Sigara spp.17244930323839783310Cermatulus nasalis000100014Lygaeidae0000571120169Unidentified00003609TOTAL136279554556137324277113322408%7.15.76.56.25.224.713.65.211.17.3	Stratiomyiidae	(1)	0	:	8	190	269	0	1	0	0	469
Unidentified $(1)$ 0CC0023218(a)07107364269120237TOTAL08263047403111072826653352%0.00.20.33.428.023.752.738.322.610.2ORDER HEMIPTERAAnisops spp.11925550552510322611935281915Sigara spp.17244930323839783310Cermatulus nasalis000100014Lygaeidae0000571120169Unidentified00003609TOTAL136279554556137324277113322408%7.15.76.56.25.224.713.65.211.17.3	Eristalis tenax		0	0	3	1	8	101	10	9	0	132
(a)07107364269120237TOTAL08263047403111072826653352 $\$$ 0.00.20.33.428.023.752.738.322.610.2ORDER HEMIPTERAAnisops spp.11925550552510322611935281915Sigara spp.17244930323839783310Cermatulus nasalis00010001Pentatomidae00011014Lygaeidae00000571120169Unidentified000003609TOTAL136279554556137324277113322408 $\$$ 7.15.76.56.25.224.713.65.211.17.3	Unidentified	(1)	0	С	С	0	С	2	3	2	1	8
TOTAL       0       8       26       304       740       311       1072       826       65       3352         %       0.0       0.2       0.3       3.4       28.0       23.7       52.7       38.3       22.6       10.2         ORDER HEMIPTERA         Anisops spp.       119       255       505       525       103       226       119       35       28       1915         Sigara spp.       17       24       49       30       32       38       39       78       3       310         Cermatulus nasalis       0       0       0       1       0       0       0       1       4         Lygaeidae       0       0       0       169       169       169       169         Unidentified       0       0       0       3       6       0       9       2408         %       7.1       5.7       6.5       6.2       5.2       24.7       13.3       32       2408		(a)	0	7	10	73	6	4	26	91	20	237
%       0.0       0.2       0.3       3.4       28.0       23.7       52.7       38.3       22.6       10.2         ORDER HEMIPTERA         Anisops spp.       119       255       505       525       103       226       119       35       28       1915         Sigara spp.       17       24       49       30       32       38       39       78       3       310         Cermatulus nasalis       0       0       0       1       0       0       0       1         Pentatomidae       0       0       0       1       1       0       1       4         Lygaeidae       0       0       0       0       57       112       0       169         Unidentified       0       0       0       0       3       6       0       9         TOTAL       136       279       554       556       137       324       277       113       32       2408         %       7.1       5.7       6.5       6.2       5.2       24.7       13.6       5.2       11.1       7.3	TOTAL		0	8	26	304	740	311	1072	826	65	3352
ORDER HEMIPTERAAnisops spp.11925550552510322611935281915Sigara spp.17244930323839783310Cermatulus nasalis000100011Pentatomidae00011014Lygaeidae0000571120169Unidentified00003609TOTAL136279554556137324277113322408%7.15.76.56.25.224.713.65.211.17.3	\$ to		0.0	0.2	0.3	3.4	28.0	23.7	52.7	38.3	22.6	10.2
Anisops spp. $119$ $255$ $505$ $525$ $103$ $226$ $119$ $35$ $28$ $1915$ Sigara spp. $17$ $24$ $49$ $30$ $32$ $38$ $39$ $78$ $3$ $310$ Cermatulus nasalis $0$ $0$ $0$ $1$ $0$ $0$ $0$ $0$ $1$ Pentatomidae $0$ $0$ $0$ $1$ $0$ $1$ $0$ $1$ $0$ $1$ Lygaeidae $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $169$ Unidentified $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $9$ TOTAL $136$ $279$ $554$ $556$ $137$ $324$ $277$ $113$ $32$ $2408$ % $7.1$ $5.7$ $6.5$ $6.2$ $5.2$ $24.7$ $13.6$ $5.2$ $11.1$ $7.3$	ORDER HEMIDTERA											
Sigara spp.17244930323839783310Cermatulus nasalis00010001Pentatomidae00011014Lygaeidae0000571120169Unidentified00003609TOTAL136279554556137324277113322408%7.15.76.56.25.224.713.65.211.17.3	Anisops spp.		119	255	505	525	103	226	119	35	28	1915
Cermatulus nasalis       0       0       0       1       0       0       0       1         Pentatomidae       0       0       0       1       1       0       1       0       1       4         Lygaeidae       0       0       0       0       0       57       112       0       169         Unidentified       0       0       0       0       0       0       3       6       0       9         TOTAL       136       279       554       556       137       324       277       113       32       2408         %       7.1       5.7       6.5       6.2       5.2       24.7       13.6       5.2       11.1       7.3	Sigara spp.		17	24	49	30	32	38	39	78	20	310
Pentatomidae00011014Lygaeidae00005711200169Unidentified000003609TOTAL136279554556137324277113322408%7.15.76.56.25.224.713.65.211.17.3	Cermatulus nasalis		0	ō	Ó	Ő	1	Ő	Ő	Ő	õ	1
Lygaeidae00005711200169Unidentified000003609TOTAL136279554556137324277113322408 $%$ 7.15.76.56.25.224.713.65.211.17.3	Pentatomidae		Ó	Ó	Ő	1	1	ō	1	õ	1	4
Unidentified         0         0         0         0         3         6         0         9           TOTAL         136         279         554         556         137         324         277         113         32         2408           %         7.1         5.7         6.5         6.2         5.2         24.7         13.6         5.2         11.1         7.3	Lygaeidae		0	0	0	0	0	57	112	0	Ó	169
TOTAL         136         279         554         556         137         324         277         113         32         2408           %         7.1         5.7         6.5         6.2         5.2         24.7         13.6         5.2         11.1         7.3	Unidentified		0	0	0	0	0	3	6	0	0	9
المريمة 10 1/2 100 100 100 100 100 100 100 100 100 10	<u>ምርም እ</u> ፤		126	270	551	507	1 2 7	- 224		112		
	101AD		7.1	279	554 6.5	556	±37 5.2	24.7	13.6	5.2	2د 1 <b>1.</b> 1	2408 7.3

#### ORDER LEPIDOPTERA Wiseana spp. (1) 165 Ω Ο Ω (a) Unidentified (1)TOTAL ş 8.6 0.4 4.1 0.3 0.1 1.4 2.6 8.6 1.7 2.5 ORDER ODONATA Austrolestes colensonis Xanthocnemis zealandica Zygoptera (nymphs) TOTAL 0.0 0.0 0.0 0.6 0.1 3.4 23.3 3.0 2.1 1.4 ORDER ORTHOPTERA Phaulacridium marginale Ω Metioche maoricum Unidentified TOTAL % 0.0 0.0 0.0 0.0 0.2 0.1 3.5 4.5 27.1 0.8 ORDER HYMENOPTERA Ω Ó Ω Apis mellifera Epipompilus spp. Unidentified TOTAL % 0.0 0.0 0.0 0.2 0.2 0.6 0.2 0.5 0.3 0.2 ORDER NOTOSTRACA Lepidurus apus viridus 1495 3758 2814 1007 78.1 76.4 33.0 11.2 3.0 0.0 0.0 0.0 0.3 27.8 ORDER ARANEAE Unidentified % 0.0 0.5 2.0 0.5 2.6 1.1 0.9 1.3 1.7 1.1 ORDER DECAPODA Unidentified 0.0 0.0 0.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0 UNIDENTIFIED ş 0.3 1.2 1.6 1.1 3.3 2.9 3.8 11.8 20.1 2.5 TOTAL ITEMS 1913 4921 8527 8966 2642 1313 2036 2156 No. of pellets

(1) larvae (a) adult

WHITE-FACED HERON DIET