SCIENCE & RESEARCH INTERNAL REPORT NO.122

SUPPLEMENTARY FEEDING OF KAKAPO ON LITTLE BARRIER ISLAND, MAY 1990 – JUNE 1991

by

Ralph Powlesland and Brian Lloyd

Published by
Head Office,
Department of Conservation,
P O Box 10-420,
Wellington
New Zealand

ISSN 01 14-2798
ISBN 0-478-01380-9

Keywords: kakapo, *Strigops habroptilus,* Little Barrier Island

CONTENTS

SUPPLEMENTARY FEEDING OF KAKAPO ON LITTLE BARRIER ISLAND, MAY 1990 - JUNE 1991

by

Ralph Powlesland and Brian Lloyd

Science and Research Division, Department of Conservation
P.O. Box 10-420, Wellington

ABSTRACT

This report describes the results obtained from the supplementary feeding programme for kakapo *(Strigops habroptilus*) on Little Barrier Island during May 1990 to June 1991. In addition to the original food station, consisting of a tray with a flap lid, a food hopper was developed which enabled sufficient nuts and seeds to be provided to meet the needs of a kakapo for two to three nights without the station having to be replenished daily. A 300 x 400 mm board placed for kakapo to stand on when at a station assisted personnel to clean up fragments of food left by a feeding bird. Baked and boiled potatoes, and pine nut and hazel nut kernels were presented to kakapo for the first time, but because they were tasted and then ignored these new foods were not supplied after a month or two. Females rearing chicks drank water from hoppers; during the same period other kakapo ignored provided water. A daily record of whether or not kakapo sign was found at each food station is provided. Once kakapo learnt the location of food stations and how to obtain food from them by raising the flap, they fed there almost nightly. The proportion of nights kakapo fed at stations was, for both sexes, highest in autumn and winter, and lowest in summer when males were at their track-and-bowl systems and females once mated, were incubating. The mean weight of each food type taken per night from each station is presented. These data are not an accurate indication of the quantity of each food type eaten by each bird because more than one kakapo may have fed at the station and, in addition, kiore ate food fragments dropped by kakapo. Trapping proved ineffective in eliminating kiore from food stations. Poisoning about stations and kakapo nests using an automatic poison-grain dispensing silo did reduce rat numbers for about a month in summer. An automatic weighing system was developed to weigh kakapo feeding at stations. At present the system is cumbersome to shift and further refinement is required to improve its ease of use. Nevertheless it has enabled kakapo weights to be recorded remotely without capture or human presence. The weights indicate that non-breeding birds taking supplementary food were significantly heavier than they were prior to the programme. In fact, the birds may be becoming obese because of the *ad libitum* supplies of protein-and fat-rich nuts, hence it is suggested that such foods should be regulated so as to maintain potential breeders in optimum condition.

1. INTRODUCTION

Supplementary feeding of kakapo (*Strogops habroptilus*) on Little Barrier Island began in September 1989 to determine whether the provision of protein-rich foods would induce and sustain kakapo breeding (Powlesland 1989). By April 1990 free-living kakapo regularly fed on the foods provided at specially built food stations (Powlesland & Lloyd 1990). Kakapo readily learnt to lift flaps to obtain food. Although two females regularly taking supplementary food by November 1989 nested in March 1990, neither raised a chick (Lloyd & Powlesland 1990). These two nests were the first found on Little Barrier Island since the birds were transferred there in 1982.

It was decided to continue the daily supplementary feeding programme through to at least March 1991. This would: enable further refinement of the food station design, encourage other females to feed regularly from stations, and determine whether the provision of food supplements would induce kakapo breeding in consecutive years. This report, for the period May 1990 to June 1991, details improvements to station design, frequency of kakapo visits to stations each month, amounts of each food type taken per night from stations seasonally, and the initial development of an automatic weighing system.

2. METHODS & RESULTS

2.1 Food Stations

By May 1990 at least nine kakapo were regularly taking food from eleven stations. Stations consisted of a 50 mm deep tray (300 mm diameter Teflon-coated frying pan minus the handle) supported 350 mm above ground by a pole (25 mm diameter thick-walled aluminium tube) through its centre (Fig. 1). A lid over the tray contained a hinged section or flap which kakapo had to raise to obtain food. A cover (c. 600 mm diameter black plastic dust-bin lid) 150 mm above the tray prevented rain falling directly on the lid. This design was moderately successful: the lid and cover prevented rain getting into the tray, kakapo quickly got used to raising the flap for food, and very few rats learnt to obtain the food.

Generally, the quantity of each food type provided exceeded the average taken nightly over the previous week, except when particularly large amounts of apple and kumara disappeared. The flap of each food station provided access to only part of the tray's surface and sometimes resulted in foods being placed on top of others in order to get the required amount under the flap. In such circumstances it seemed that some birds occasionally removed items to reach a preferred food. To reduce this food wastage a second flap was incorporated into the lids of some stations. As for the single flap lid, it was necessary to teach a kakapo that there were two flaps to operate by tying them half open until the bird was raising both to obtain food.

Figure 1. Kakapo food station

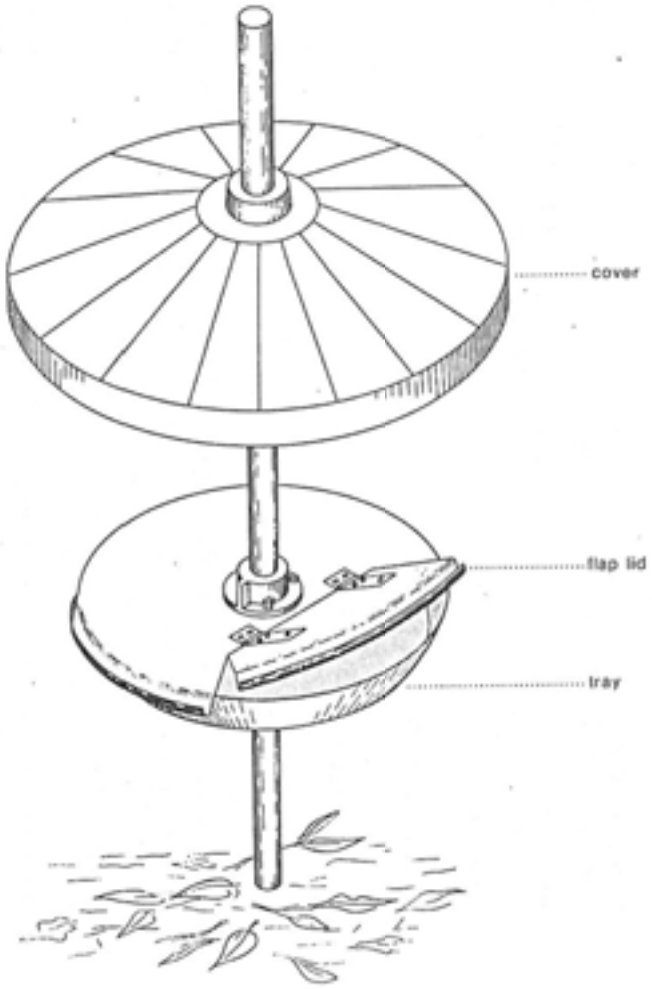
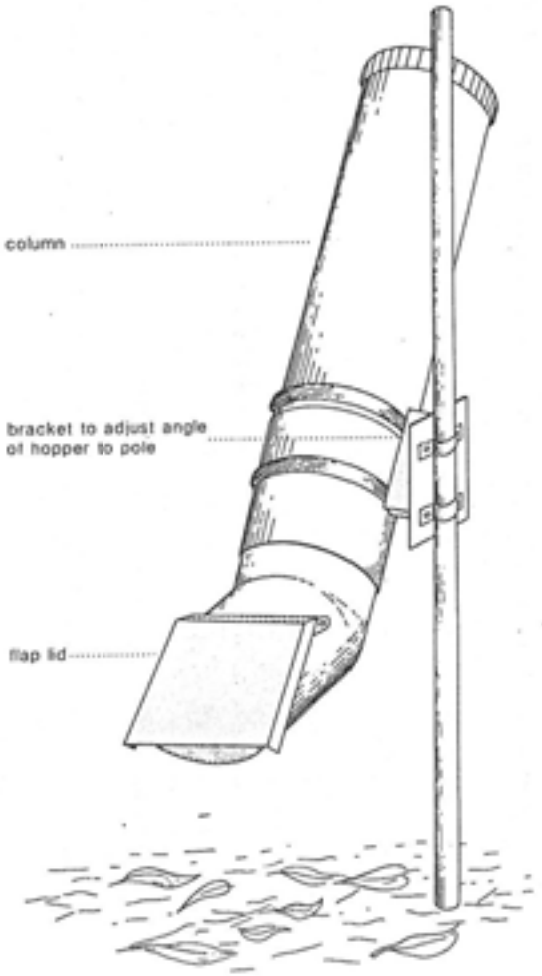


Figure 2. Kakapo food hopper



Food fragments left on the ground by kakapo had to be removed each day to prevent kakapo later eating the remains which may have become contaminated by mud, mould and rat faeces. To improve hygiene, a piece of marine plywood (c. 400 x 300 mm) was placed at each station for birds to stand on when feeding. When first introduced the boards were sprinkled with leaf litter to disguise them and they were accepted immediately by the birds. Most food fragments left by kakapo fell on the boards so next day they could be readily wiped into a bag, saving much time. However, large items, particularly apples and kumara, were often eaten away from the boards so that bits of skin and chews still had to be picked up.

To reduce the requirement for daily visits to each food station outside the breeding season a hopper was developed which held sufficient nuts to meet the requirements of a kakapo for two or three nights (Fig. 2). A 300 mm length of 80 mm diameter PVC 'Marley' downspout pipe forms the column of the hopper, which is covered with a plastic 'Agee' jar lid. Attached to the base of the column is a 112^{o} bend section of 'Marley' pipe (item no. SD36511). A portion of the bend is cut off and a flap attached so that kakapo on raising the flap gain access to food. The flap and its hinge are cut from plastic possum bait stations and attached with PVC glue. A flat PVC strip is glued over the end of the base section. A 'Marley' bracket (item no. SD36535) and pipe clamps are used to connect the column to a pole at an angle so that food readily moves down as kakapo remove it from the base. The bracket is designed so that the angle of the hopper to the pole can be altered depending on the ease of flow of each food type (sunflower seed versus brazil nuts).

This hopper design has proven suitable for dry, small items of food, such as nuts and seeds. However, it is not suitable for bits of apple and kumara because of their moisture content - these stick to the sides and go mouldy if left in a confined space for a few days, particularly in warm weather. Such foods are best provided in tray-type stations and replaced every second day. Hoppers were also used to provide water for kakapo, but only females raising young regularly drank from hoppers, however they took so much that hoppers with a larger capacity were required.

2.2 Foods Offered

Apple, kumara, and the kernels of almonds, brazil nuts, walnuts and sunflower seeds were offered at each station. Kakapo sampled all of these foods, but usually selected only a few types, their preferences sometimes changing.

A few foods not offered to kakapo in 1989-1990 (Powlesland & Lloyd 1990, Appendix 1), were provided. Boiled potato, baked potato, and pine nut and hazel nut kernels were offered, but significant amounts were not eaten so we stopped supplying them after a month or two.

'Roudybush' crumbles were supplied without success in 1989-1990, however we offered them again because they provide a balanced diet formulated for caged parrots. As before the birds tasted the crumbles but none bothered with them after a few nights. Thawed corn on the cob was a favoured food of some kakapo in 1989 with even the core being chewed into small fragments. However, that year the birds progressively ate

less of it until finally it was ignored. Since this, too, is a nutritious food and is included in many captive parrot diets, we again offered it, but without success. Free-living kakapo on Maud Island avidly ate this food (B. Rowe pers. comm.). It is possible that the thawing of the corn while in transit to Little Barrier Island and then re-freezing makes it unpalatable to kakapo.

In an effort to incorporate mineral and vitamin supplements into supplementary foods, a 'nut bar' was made by crushing equal portions of almond, brazil, walnut and sunflower seed kernels. The resultant coarse flour was then bound together with gelatine or egg white and gentle heat. Only one bird ate the bars and since fungi were evident on them within 48 hours at mild temperatures, their provision was stopped.

We doubted if we were providing a diet adequate for females to raise young on entirely and we did not know whether females would obtain any missing nutrients for proper chick growth from natural foods. As a consequence, a greater variety of foods was provided at stations frequented by females that had young. These included ripe fivefinger (*Pseudopanax arboreus*) fruit, nectarines, peaches, pears, figs, plums, unripe runner bean pods, silverbeet leaves, carrot, fresh corn on the cob, mixed grain bread and 'Roudybush' chick meal mixed with water to a 'peanut butter' consistency. Of these only figs, pears and plums were eaten and then usually in small quantities, the rest being ignored after being tasted for a few nights. Of note was that females with chicks drank much water from hoppers, whereas other kakapo over the same period ignored provided water.

2.3 Frequency of Visits to Food Stations

Appendices 1 to 14 show whether kakapo fed at food stations each day from 1 May 1990 to 30 June 1991. Although kakapo are fairly sedentary and solitary, their home ranges often overlap. Thus it is possible that occasionally two birds fed from the same station during the same night. This was confirmed by direct observation from a hide using a night-vision scope at stations 3 and 10. Circumstantial evidence (radio-tagged birds roosting close to stations, individually distinctive feeding sign and the trapping of birds close to stations) suggests this occurred at other stations too. Also, it is possible that birds visited more than one station per night since radio-tagged kakapo have been tracked moving more than 500 m in a night and a few stations were less than this distance apart.

2.3.1 Johngirl

Radio-tracking Johngirl when she was rearing a chick confirmed that she often fed from both station 1 and 2 (c. 350 m apart) during a night. Although Bella-rose at least twice roosted close to station 1, there was no evidence that any kakapo other than regularly fed at either of these two stations.

During winter (June-August) fed most nights from at least one of stations 1 and 2 (Appendices 1-4, Table 1A). Throughout spring (September-November) and summer (December-February) her frequency of visits declined to about 70% of nights. During January she mated, laid a clutch of eggs and began incubation which continued throughout February (Lloyd & Powlesland 1992). When chick-rearing in autumn

Table 1 The proportion of nights per month that eight kakapo were each determined to have fed from food stations on Little Barrier Island during May 1990 to June 1991

		1990											1991		
	Station(s)	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Table 1A															
Johngirl	1 & 2	77	97	86	94	73	73	69	65	77	64	100	100	100	97
Bella-rose	3	97	90	100	94	97	87	86	53	37	50	97	100	97	-
Maggie	11	68	97	70	88	88	68	84	86	52	77	81	92	96	96
Wendy	14	-	-	-	-	-	-	-	-	-	-	100	100	100	100
Luke	4, 5 & 13	71	87	93	97	77	60	66	71	90	86	74	89	100	100
Arab	6	100	100	100	100	100	100	90	84	80	96	97	86	97	100
Pegasus	7	90	100	100	94	100	100	93	65	70	82	97	93	100	100
Snark	12	-	-	-	-	-	-	69	67	90	100	97	88	-	-
Table 1B															
Females		81	94	87	92	86	76	79	66	55	63	94	98	98	98
Males		88	96	98	97	92	87	79	72	82	91	91	89	99	100

(March-May) she fed from at least one of the stations every night (Table 1A). The proportion of nights she fed from both stations was similar in winter (5%), spring (3%) and summer (2%), but increased markedly in autumn (52%) when she was feeding a chick.

2.3.2 Bella-rose

In late October and during November 1990, radio tracking revealed that Bella-rose remained close to station 3. Throughout summer, however, she moved widely and was located roosting up to a kilometre away and within the home-ranges of neighbouring birds. When away no other kakapo fed from station 3. However, in June 1991 when Bella-rose was roosting about 500 m from station 3, an untagged bird (Rob) was seen feeding from the station (he was later trapped nearby). We do not known when Rob began feeding from station 3, but because the food types taken did not change until early April 1991, we assume Bella-rose fed exclusively from it from May 1990 to March 1991 inclusive. Thus, in winter, spring and autumn, Bella-rose fed from the station on 86-100% of nights, but in summer her visit rate dropped to 37-53% (Table 1A).

2.3.3 Maggie

No bird other than Maggie was seen or captured in the vicinity of food station 11 so we assumed that she alone fed from it. She fed at the station on 84-97% of nights from June to December 1990 (Table 1A), but her visit rate dropped to 52% in January when she went beyond her usual home-range boundary, presumably to mate, through to about the first 10 days of incubation. On 29 January her single infertile egg was removed (Lloyd & Powlesland 1992) and during February to May 1991 her visit rate increased from 77% of nights per month to 96% (Table 1A).

2.3.4 Heather

From observations made in 1989-90 (Powlesland & Lloyd 1990) it was evident that Heather fed from stations 9 and 10. However, because each of the two stations was fed at by at least one other kakapo, we were not able to determine how frequently she visited them from May 1990 to June 1991. But during January 1991 she probably had sole access to station 10 because Rob, who had fed from it, was at a track-and-bowl system (T&B). On 21 January, seven days after mating, she was located at the site where we subsequently found her nest. From then until 3 February when her clutch was removed to Auckland Zoo (Lloyd & Powlesland 1992), she visited station 10 every second or third night (Appendix 9).

2.3.5 Wendy

We knew from radio-tracking in 1982-84 (Moorhouse & Powlesland 1991) approximately where Wendy's home range was. When on 25 January 1991 she was found in a nest cavity near a frequented food station, we became aware that she had probably been feeding from stations 8 and 9 during winter and spring 1990. Her nest was located c. 300 m from station 9, but because it was up a steep slope from the nest and she rarely fed from it during incubation, station 14 was set up about 25 m from her nest in late February. During March-June 1991 when she raised a chick, Wendy fed from station 14 every night. In addition, she occasionally went to station 9 as well.

2.3.6 Luke
Stations 4, 5 and 13 were situated along a ridge track over a distance of about 600 m, within the range of a single kakapo. Radio-tracking in 1982-84 (Moorhouse & Powlesland 1991), and captures in 1986, 1989 and 1990 revealed that Luke was consistently in an area encompassing these three stations. A second bird, Lisa, was also captured (in 1986) on this ridge. Although she may have fed on food presented on wire stakes (Powlesland & Lloyd 1990) we obtained no evidence to suggest she took food from any of the three ridge stations.'Generally two, but sometimes only one, of these stations was operational at any one time (Appendices 1-14).

Assuming that Luke was the only kakapo using these three stations, the monthly proportion of nights he fed from at least one of them was 87-97% in winter, declining to 60-77% in spring (Table 1A). In summer, when he occupied his T&B (booming site 9, Lloyd & Powlesland 1992) almost nightly, his visiting rate increased to 71-90%. All his summer visits were to station 13 which was situated about 50 m from his (Appendix 8 & 9). From March to May, the proportion of nights that Luke fed at the stations increased from 74% to 100% (Table 1A).

2.3.7 Arab
The only occasion that kakapo scent was tracked from station 6 with a dog, led to the capture of Arab. No males were radio-tagged during the supplementary feeding project and no hide observations were made at station 6, however, we had no reason to suppose that a second kakapo fed from this station (such as an unusually large amount of food being taken occasionally or a particular food type previously ignored suddenly being taken in significant quantity). Thus, we assumed that only Arab fed at station 6 from May 1990 to June 1991; the T&B he used was only about 30 m away.

Arab fed every night from May to October 1990 (Table 1A). His visitation per month then declined to a low of 80% in January 1991, when he visited his nightly (booming site 8, Lloyd & Powlesland 1992). From February to June, he fed at the station on about 96% of nights. In February and March, he continued to occupy his T&B almost nightly, but in early April he deserted the system and began to moult.

2.3.8 Pegasus
Pegasus was caught in the vicinity of station 7 on 20 October 1990 and was trapped there on 25 February 1991. However, the large quantity of food occasionally taken from this station in winter and spring lead us to suspect that a second bird fed from it. From November 1990 to March 1991 though, only is believed to have used this station, which was located just 20 m from his

The proportion of nights per month that a kakapo fed from station 7 shows a similar trend to that for station 6 (Arab). Almost every day from May to October 1990 kakapo sign was evident at station 7, this declined to 65% in December, after which it increased to nearly 100% by autumn (March-May) (Table 1A).

2.3.9 Snark
Activity at T&B 21 started in late September in the 1990-91 booming season and booming was recorded there on 10 October, two months earlier than previously

recorded (Lloyd Powlesland 1992). Snark was captured close by on 25 October 1990. Because we believed that his early activity at the T&B was promoted by his taking supplementary food (probably from stations 8 and 9), and that if he fed from the nearest station (number 7) to his T&B he would come into conflict with Pegasus, a new station (12) was set-up about 50 m from Snark's T&B. Two nights later he began to feed from it. During November and December, the proportion of nights when food was taken was nearly 70% (Table 1A). In January, the proportion increased to 90%, and in February and March to almost nightly. The station was removed in early April.

2.3.10 Overall Results

Kakapo soon found food stations within their home ranges and learnt how to feed from them by raising the flaps. Both sexes visited the stations almost nightly to feed (Table 1B), particularly during winter (June-August 1990) and autumn (March-May 1991). For both sexes, the proportion of nights per month they fed at stations declined by about 10% in spring (September-November 1990) (Table 1B). The lowest visitation frequency occurred in summer (December-February 1991).

2.4 Amount of Food taken

We could not determine the weight of each type of supplementary food taken by each kakapo because we did not know the identity of every bird which fed at a station (not all birds were radio-tagged, some birds visited more than one station, and more than one bird visited single stations during the same night), and kiore ate unknown quantities of food fragments on most nights.

2.4.1 Kiore

Flap-lids fitted to trays and hoppers prevented most rats gaining direct access to the food, however, they did eat fragments dropped by kakapo. This included pieces of apple and/or kumara (c. 50 g) tossed from trays, partly eaten portions of all foods, and chews (compact pellets of residue spat out after a bird has swallowed the soft or liquid portion). Kakapo invariably formed chews when feeding on food with a high fibre content, such as foliage and bark (Powlesland 1989), but they were also produced by birds eating apple or nut kernels. Rats usually ate food fragments where they found them, but larger pieces were often taken to sheltered places some distance from stations before being eaten. Overall, the amount they took can be judged from food remaining at a station when no rats were present (Table 2). The amount left on the ground was a substantial portion (61%) of that provided.

Several measures were taken to keep rat numbers about each food station as low as possible. Any food scraps on the ground were collected the next morning. One to three Ezeset snap traps were placed under individual aluminium tunnels within three metres of each station. These were successful in killing young rats when baited with fresh food (kumara, nuts). However adults rarely fed from traps because, presumably, they had learnt that food would be available from stations being used by kakapo. Only when kakapo stayed away from stations for two or more successive nights did the number of rats trapped increase.

Table 2. Quantities (g) of four foods put out on 9 September 1990 and remaining the next day at station 5, Little Barrier Island. There was no sign of kiore about the station at the time.

Food type	Food weight (g)			Food weight available to rats
	Put out	Left by kakapo	Eaten by kakapo	
Kumara	88.5	80.0[1]	8.5	80.0 [90%]
Apple	56.5	47.0[1]	9.5	47.0 [83%]
Brazil kernels	97.5	33.0[2]		
		42.5[3]	56.0	42.5 [32%]
Almond kernels	35.5	1.5[2]		

[1]Uneaten food left on ground by kakapo
[2]Uneaten food left in tray
[3]Brazil and almond kernel chews, that could not be distinguished apart, left on the ground

Poisoning was tried to reduce the number of rats at food stations using automatic dispensing silos developed by McFadden (1984). The bait, supplied by 'Rentokil', was kibbled maize treated with the anticoagulant bromadiolone (0.005% by weight) and dyed green (McFadden & Towns 1991). Silos were modified by inserting 200 mm tubes of 80 mm diameter into the holes of the bucket so that they extended out from the bucket's edge. This prevented poisoned grain from being scratched out on to the ground by kiore, and also prevented any birds reaching through the holes to obtain the toxic bait. At three stations, a single silo was placed within three metres of the food tray and although non-toxic bait was supplied, kiore rarely visited these. Next, six silos were placed at 60° intervals 50 m from a food station. These silos were first filled with non-toxic kibbled maize as a pre-feed. Once kiore were feeding regularly the pre-feed was replaced with toxic bait. The silos were checked about every four days during this period to ensure ample toxic bait was present and to remove spilt and husked grain and rat droppings. Within three weeks there was very little rat activity at the silos and at the food station. Subsequently, silos were set up in this manner around two kakapo nests during the incubation period (Lloyd & Powlesland 1992). Food station 14, which was within 25 m of Wendy's nest, was situated within the circle of silos around her nest. Again this poisoning proved successful in that very few rats fed at this station during the early nestling period.

2.4.2 Trends in Amounts of Food taken from Stations

Even though it was understood that rats ate much food left by kakapo, managers requested information on the average amount of each food type taken seasonally from each station to see if there were any trends, for instance was more food taken when females were breeding? This information is presented with the qualification that **it is not an accurate indication of the quantity of supplementary foods eaten by kakapo.** The figures given in appendices 15 to 22 were derived from food stations which had been replenished and when checked the following day, there was evidence

that a kakapo had fed from them. Thus, data derived from a station that was checked two days later was not included in this analysis because we could not determine whether kakapo fed there during both intervening nights or just one.

2.4.2.1 Males
Appendices 15 to 18 show the mean weights of six food types taken per night from four food stations visited by males. At stations 6 (Appendix 15), 7 (Appendix 16), 4 and 13 (Appendix 17), all foods were under flap-lids (trays and/or hoppers), whereas at stations 5 (Appendix 17) and 12 (Appendix 18), nuts and seeds were provided in hoppers (flap-lids), but kumara and apple were presented on wires and so were directly available to rats.

All four males occupied T&Bs in summer and each had a food station within 50 m of his system. Snark began visiting his system regularly in early October, Arab and occupied their systems from mid-October, but it was not until mid-December that Luke occupied his system (Lloyd & Powlesland 1992). Each of these males visited their T&Bs almost nightly during January and February. Luke stopped making nightly visits in mid-March, Pegasus and Arab stopped in late March, and Snark in early April (Lloyd & Powlesland 1992).

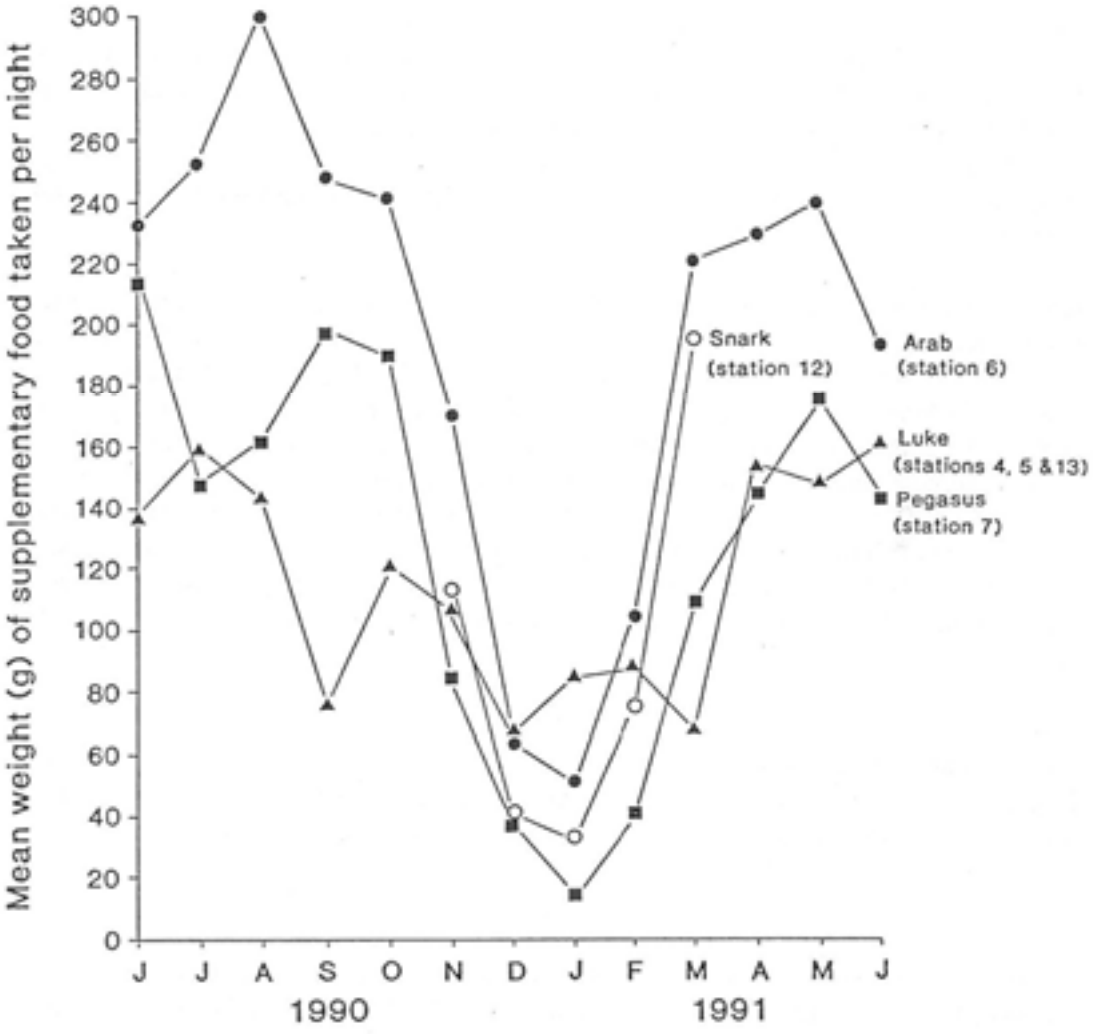
Overall, similar amounts of each food (Appendices 15-18) and in total (Figure 3) were taken each night from the food stations visited by males. More apple and kumara, and less walnut kernels were taken from station 6 (Appendix 15) than from the others. At stations 6 (Arab), 7 (Pegasus) and 4, 5 & 13 (Luke) the amount of each food type taken remained similar from June to October 1990, except for the reduced kumara, apple, walnut kernels and sunflower seeds taken from stations 4, 5 & 13 in September (Appendix 17). Through November and December the mean quantity of food taken declined to a minimum in January 1991 (Figure 3), particularly from stations 6 and 7 (Appendices 15 & 16). During February and March increasing quantities of the foods were taken, and by April the amounts removed were similar to those in June-July 1990 (Figure 3).

2.4.2.2 Females
All foods at station 3 (Appendix 19) were under a flap-lid, but at stations 11 (Appendix 1 2 (Appendix 21) and 9 & 14 (Appendix 22) kumara and apple were left in a tray without a lid. In addition, some nuts and seeds at station 14 were left in containers without lids for part of the study.

2.4.2.3 Heather
In late January, while incubating, Heather appeared to have sole access to station 10. Outside this period she fed from both stations 9 and 10 which were also used by other kakapo. Therefore, the quantities of food she took from these stations could not be determined.

2.4.2.4 Bella-rose
No evidence exists suggesting this female visited a male and mated, or laid a clutch. The mean weight of each food type taken per night from station 3 remained similar each month from June 1990 to March 1991, except that greater amounts of kumara were

Figure 3. Total mean weights (g) of six supplementary foods taken per night each month from food stations by four male kakapo between June 1990 to June 1991, Little Barrier Island. See appendices 15-18 for monthly mean weights of each food type taken by each male.



removed in most months from October onwards (Appendix 19). In total, the monthly mean weight of food taken remained similar from June 1990 to March 1991 (Figure 4).

2.4.2.5 Maggie
Maggie moved outside her usual range in early January and was found nesting on 21 January 1991; her single egg was removed on 29 January. At her station (no. 11) smaller quantities of most foods were taken from September to February than previously or subsequently (Appendix 20). In June 1991 no kumara or apple were taken although these were eaten in all other months. Overall, the monthly mean weight of food taken per night from her station was 150-200 g in June-August 1990 (winter) and March-April 1991 (moult period), but otherwise was 40-100 g per night (Figure 4).

2.4.2.6 Johngirl
Johngirl left her range and mated during 19-22 January, and was incubating from at least 28 January till about 2 March. The chick she raised left the nest on about 20 May, but continued to be fed by her until at least the end of June.

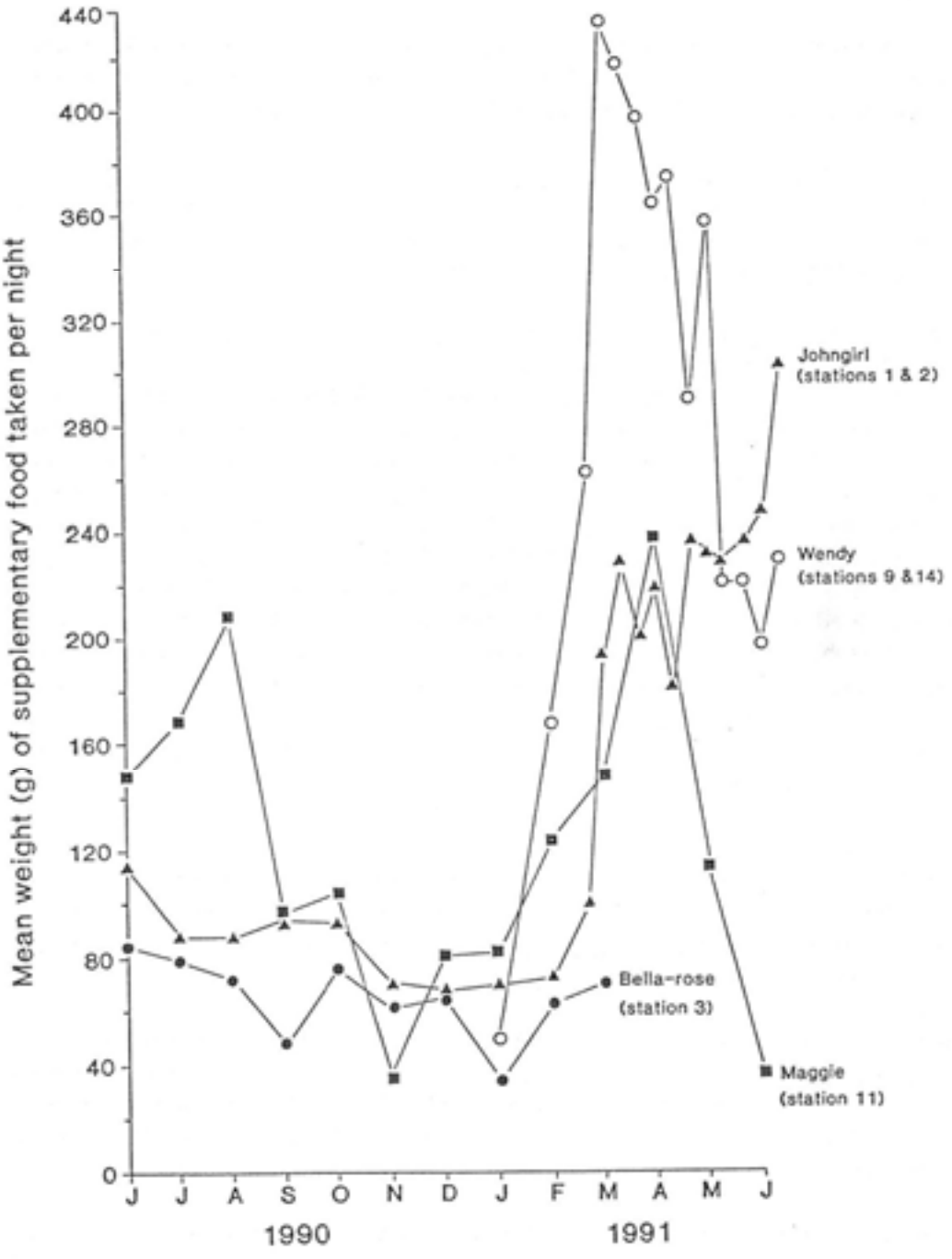
The mean weight of each food taken by her was similar from June to October 1990 (Appendix 21). Afterwards her consumption of nuts and seeds declined through to February, whilst that of kumara and apple increased. Once her chick hatched in March the amounts of nuts and seeds taken, particularly of sunflower seed, increased dramatically. The amount of kumara removed in April increased, while that of brazil, almond and walnut kernels declined markedly. Johngirl first took water in early March, but it was not until mid-April that it was measured. There was little change in the quantities of each food taken from 21 April to 20 May, except for an increase in apple. After the chick fledged (c. 20 May), the weights of brazil, almond and walnut kernels taken increased until early June and then remained fairly constant to the end of June. By comparison, the amount of apple removed increased through to the end of June, but sunflower seed and water removal decreased. The total quantity of food taken from stations 1 & 2 was 80-120 g per night in June 1990 to February 1991 (Figure 4), but doubled once the chick hatched and again increased by about 100 g early in the fledgling period (Figure 4).

2.4.2.7 Wendy
She was found in a nest on 25 January about 300 m from station 9. Because a chick about three days old was in the nest on 25 February, and assuming 30 days for incubation, Wendy probably began incubating on about 23 January. One chick fledged from the nest in early May.

Heather occasionally roosted near and probably fed from station 9 after her clutch was removed on 3 February 1991. However, all food removed from this station has been attributed to Wendy because on most occasions when food was taken water was as well. Water was taken at station 14 (Wendy's station close to her nest), but not from station 10 where Heather fed frequently.

The weight of each food, and in total, taken from stations 9 and 14 (Appendix 22, Figure 4) increased from January (mating and early incubation) to mid March (two chicks 3-4 weeks old). During April the amounts of kumara, and brazil and almond kernels taken

Figure 4. Total mean weights (g) of six supplementary foods taken per night each month from food stations visited by female kakapo between June 1990 and June 1991, Little Barrier Island. See appendices 19-22 for monthly mean weights of each food type taken by each female.



was similar to those of late March, but the weights of apple, walnut kernel and sunflower seed declined. In May and June the weights of some foods taken changed erratically from one ten-day period to the next. Overall, the total weight of food taken increased 167 g in February (incubation) to a high of 432 g for 11-20 March (two chicks present) (Figure 4). During late March, when one chick disappeared, to mid May the quantity of food removed declined to 290 g per night, and afterwards it was about 220 g.

Overall, for both Bella-rose (non-breeder) and Maggie (unsuccessful breeder), 80-200 g of food was taken in winter and then declined to about 60 g during spring and summer (Figure 4). During late summer and autumn the amount of food taken increased, and by April 1991 it was similar to the amounts taken in winter 1990 for Maggie. In contrast, for Johngirl and Wendy (successful breeders) the weight of food taken, particularly of nut kernels and seeds, increased dramatically in the first month of the chick period (March). While each was feeding a well-developed chick or fledgling the amount of food taken by each female stabilised at about 220 g per night (May & June) (Figure 4).

2.5 Automatic Scales

It was important to obtain weights of each of the supplementary fed kakapo to determine whether the *ab libitum* food supplies were having detrimental effects on the birds; either through weight loss because of digestive problems or through excessive weight gain. There has been no evidence of the supplementary foods causing weight loss. However, we are concerned that the food may have led to obesity in some birds because Bella-rose's weight reached 2.1 kg in October 1990 (a record for a female kakapo) and she was the only supplementary fed female that did not breed in the 1990-1991 breeding season. This result gave added impetus for the development of scales and data-logger which would automatically record time, weight and identity of kakapo.

A Sartorius balance, model QS16, was used to weigh kakapo at stations. A Toshiba lap-top computer connected to the balance acted as a data logger via an interface. The interface and programmes to record data (bird weight, time, date) were developed by Murray Douglas, electronics officer of Science & Research Division. The computer controlled the powering of the balance and the reception of weight data. The operator pre-set the weight deviation sensitivity for each recording session. Any weight change in excess of the pre-set amount was logged, up to four recordings per second.

The system was powered by a 12-volt lead acid battery, and the computer, interface and battery were enclosed in a weather-proof container in a hide or hidden in vegetation about three metres from the station. Cables from the scales to the computer were disguised in a shallow ditch covered with leaf litter. The stainless steel top of the scales was painted with non-skid latex, dark coloured paint. To get the birds used to stepping up on to the scales, boards stood on by kakapo feeding at stations were replaced with wooden platforms 60 mmhigh. When we wanted to weigh the bird at a particular station, the platform was replaced with the scales. Most kakapo stood on the scales the first night they were put in place. It seems that kakapo have now become fairly tolerant

of new objects appearing at their stations following various modifications to stations over the past two years.

There were problems due to moisture getting into the electronic components; these have been solved by improving the seals at joints. The size and weight of the equipment made it a strenuous task to take it from one station to another along the steep tracks. Also the heavy battery had to be replaced every four days. However, the equipment has enabled the automatic weighing of kakapo without the birds being handled. Figure 5 shows a plot of a data set from the scales. As well as giving the bird's weight (about 2575 g), it also indicates when the bird stepped on to the scales and how long it remained on them.

Weights of kakapo have increased significantly since supplementary food was provided. Weights of breeding birds were not used in the following analyses because they can change considerably over a short period, particularly for males. Figure 6 shows the weights of seven males before (n=34) and after (n=13) supplementary food was provided. Their mean weight increased from 1.75 kg (SD = 0.22) to 2.49 kg (SD = 0.21), a 42% increase. Using the paired-sample t test (Zar 1984), this increase in mean weight was found to be significant ($P < 0.0003$). The weights of five females before (n=45) and after (n=10) supplementary food was provided is shown in Figure 7. Their mean weight increased from 1.26 kg (SD = 0.14) to 1.72 kg (SD = 0.18), a 36% increase ($P<0.0005$). Generally, the weights of males and females prior to the provision of supplementary food on Little Barrier Island were similar to the weights of non-breeding males and females on Stewart Island (Figure 6 *in* Moorhouse & Powlesland 1991).

3. DISCUSSION

3.1 Food Station Design

A food tray with flap-lid (Figure 1) (for presenting apple and kumara) and a hopper with flap-lid (Figure 2) (for providing nuts and seeds) together under a covering lid has proven satisfactory. The food tray and hopper together hold sufficient food for two to three nights for male and non-breeding female kakapo, keep rain off the food and prevent rats reaching it. When we have put the structures in place gradually, over a few weeks, kakapo learnt to lift the flaps to obtain the food. For females raising chicks, one hopper for each favoured nut or seed type proved necessary in order to have enough of some types of food readily accessible (i.e. not mixed with or underneath other foods). In combination with a board, on which the feeding kakapo stood and which captured most chews and uneaten bits of food, this design enabled the equipment and surroundings to be kept reasonably clean.

3.2 Foods Offered

Foods offered to kakapo in a supplementary feeding programme need to be: readily available year round, preferably not too expensive, able to be stored for at least a fortnight, transportable to food stations without damage or loss of quality, and be acceptable to kakapo. Apple, kumara, and the kernels of almonds, brazil nuts, walnuts

Figure 5. A plot of a data set from the automatic scales at food station 3 on 1 July 1991, Little Barrier Island

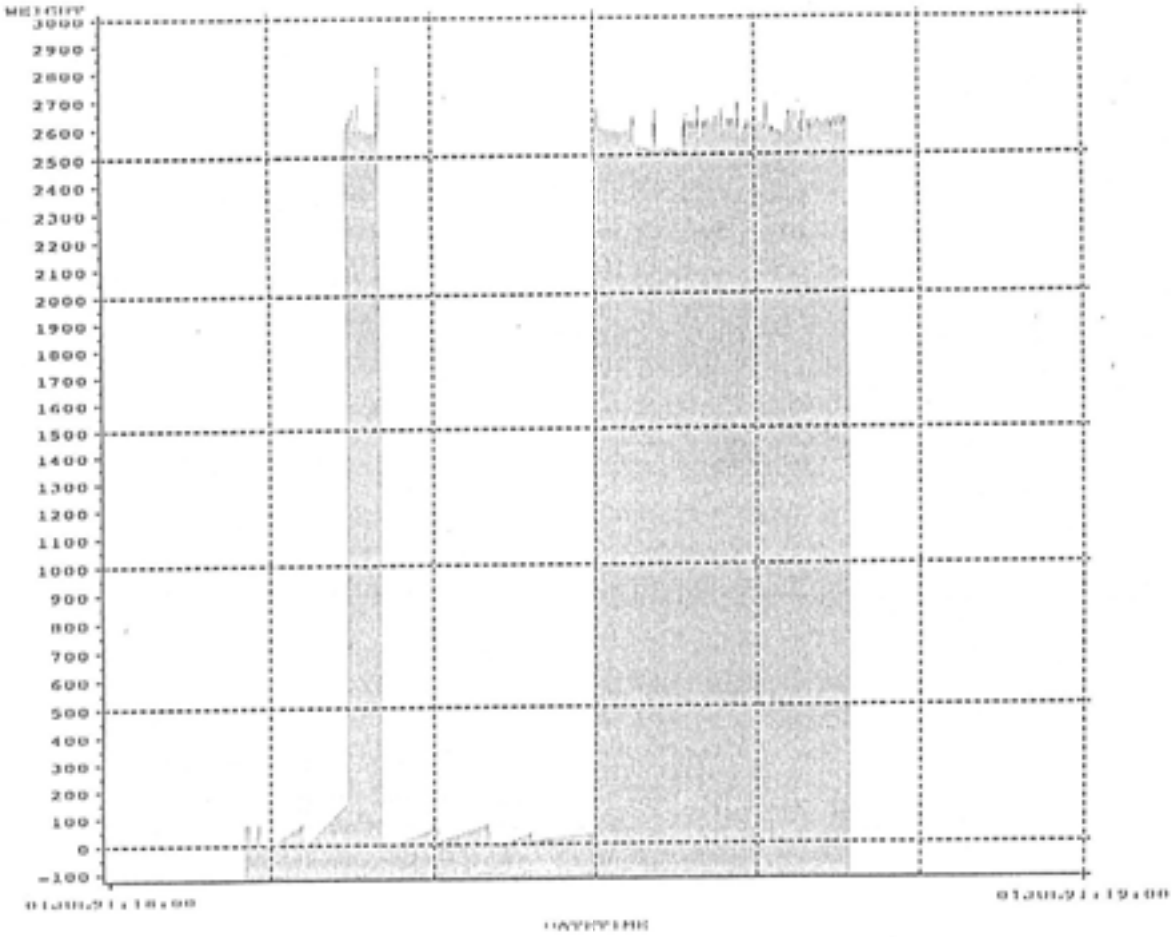


Figure 6. Weights (kg) of non-breeding male kakapo on Little Barrier Island before and after the provision of supplementary food started in September 1989 (indicated by vertical dashed line)

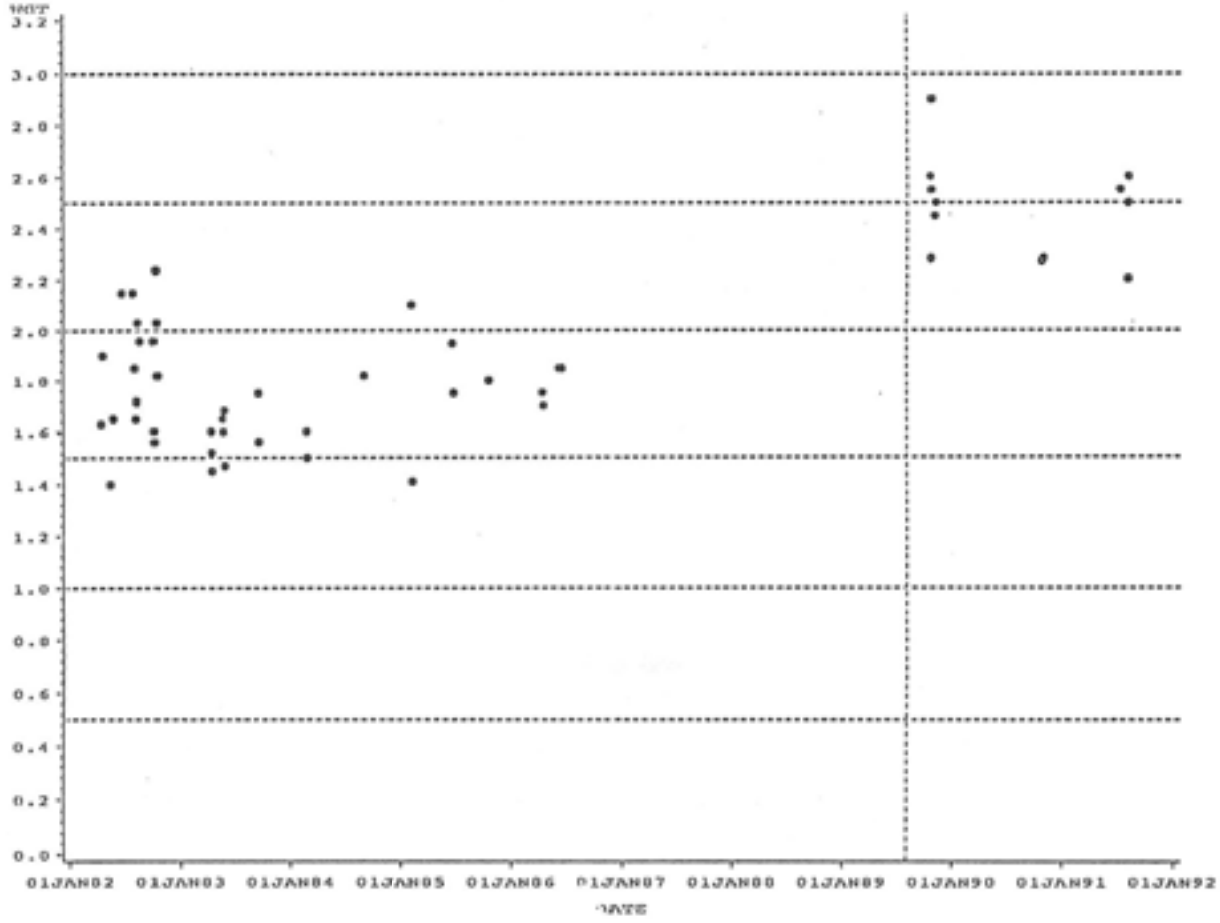
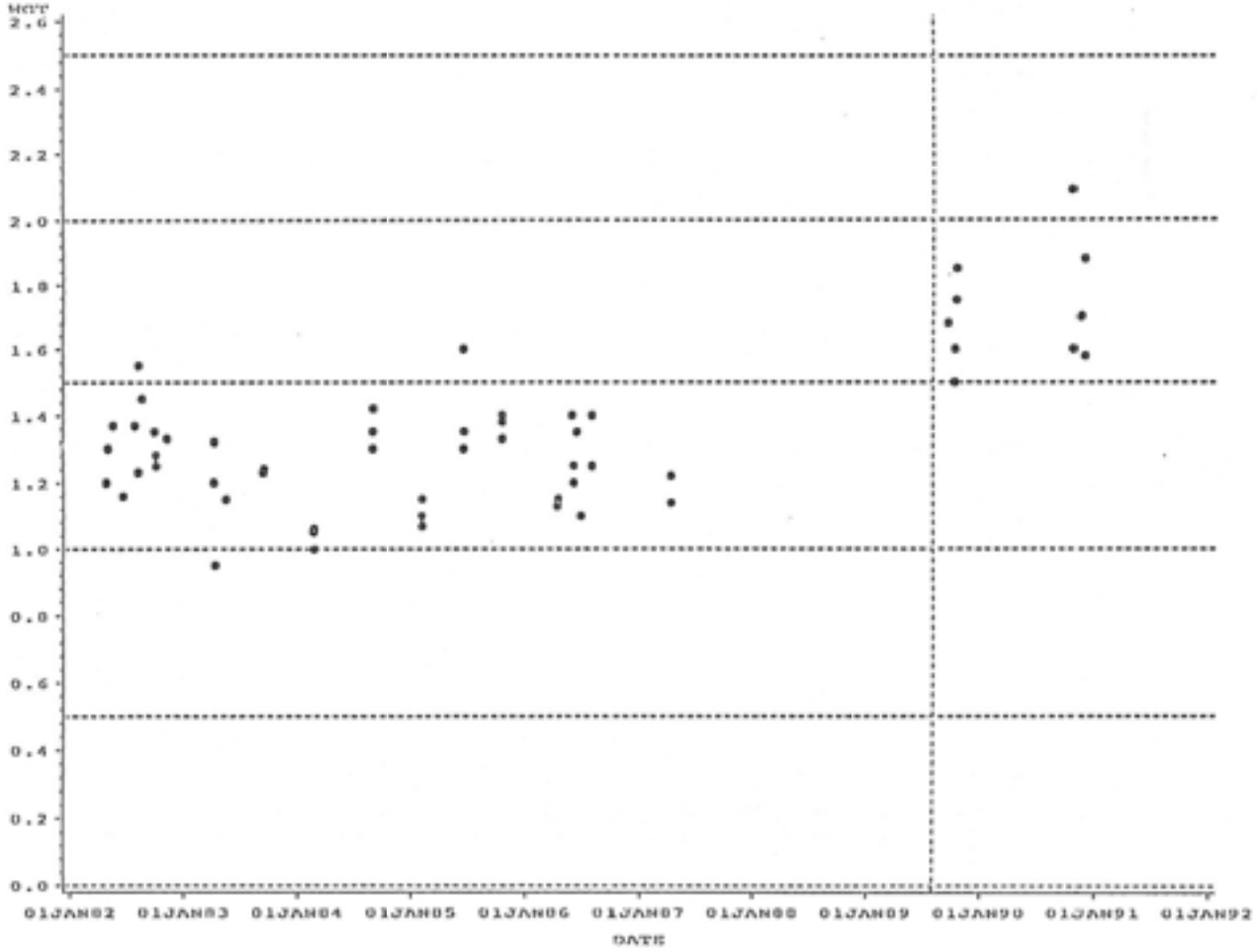


Figure 7. Weights (kg) of non-breeding female kakapo on Little Barrier Island before and after the provision of supplementary food started in September 1989 (indicated by vertical dashed line)



and sunflower seeds have been shown to meet these criteria. In addition, because two females have produced clutches in two successive years, and two chicks have been raised on these foods (plus unknown quantities of natural foods) the results indicate that these foods are suitable for the objective of the programme - to promote and sustain kakapo breeding. Females rearing chicks took water from hoppers nightly and in significant quantities (Appendices 21 & 22), presumably to assist chewing and regurgitation of the relatively dry nuts and seeds to their chicks.

3.3 Frequency of Visits to Food Stations

During autumn and winter, kakapo visited stations almost nightly, presumably because supplementary foods were a dependable food source of adequate nutritional quality and digestibility. The high nutrient requirements of body maintenance during the cool, wet weather of April to July may be why kakapo regularly visited stations then. Why kakapo visited stations slightly less often in spring than formerly is unknown. Suitable natural foods were, possibly, more available in spring than in winter. Cuticle analyses of faeces by Steven Trewick, Victoria University of Wellington, will indicate the species of natural foods eaten and give some indication of each food's importance to the birds seasonally.

The low frequency of visits to stations by females during summer (Table 1B) was partly because Bella-rose moved well away from her station for several nights at a time during that season (Table 1A). Also, both Maggie and Johngirl moved out of their home ranges in summer for two to three nights to mate, and subsequently while egg-laying and incubating visited their stations at only two-or three-nightly intervals. Once Johngirl and Wendy had chicks they became very dependent on the supplementary foods because they fed and drank nightly at their stations and took large quantities of food.

The decline in the proportion of nights males fed from stations in summer probably relates to the onset of breeding activity. Males, we expect, had excellent body reserves at the start of the booming season (December-January) and so did not need supplementary food each night. Feather clusters were found at T&Bs in January, indicating mating had occurred (Lloyd & Powlesland 1990, 1992). Presumably a male spends as much time as possible in January at his system to prevent another male usurping it and to ensure he is present to court and mate if a female appears.

3.4 Amount of Food Taken

The weights of foods taken per night from stations by kakapo were lowest in January when fewest visits were made. The four males had stations within 50 m of their T&Bs so had their prime motivation been hunger they, presumably, would have fed at the stations. The fact that they took little food per visit in January suggests that they had adequate bodily reserves or found sufficient food nearby their systems. In January-February females spent a few days beyond their home ranges to visit males for mating, and then visited their stations irregularly during incubation. Whether bodily reserves of females sustained them to some extent in incubation or whether natural foods were preferred over supplementary foods is unknown. Radio-tracking of incubating females at night suggested they ate very little natural foods.

After February the amount of food taken by non-breeding kakapo increased gradually to a peak in April and then remained similar during winter and spring. Food requirements increased in autumn presumably to meet the demands of moult, and then remained high to meet the maintenance needs in winter. However, only with regular detailed data of consumption of each food type and the weight changes of individuals will it be possible to get a better understanding of kakapo nutrient requirements. Obtaining such information is important to the proper management of supplementary-fed kakapo to ensure that the long-term health and breeding potential of the populations are not compromised by the provision of supplementary foods, and to determine whether we need to be involved in such a costly management regime year-round when perhaps it is needed for only part of the year.

It was evident from the amount of food and water taken each night from stations by chick-rearing females that they were very reliant on supplementary food to feed to their young. It is especially important that such females have ready access to *ad libitum* quantities of good quality foods and water each night until more is known about the dietary requirements of nesting kakapo.

3.5 Automatic Scales

While the scales and associated equipment are bulky and heavy to shift between stations, it seems that little can be done to overcome this problem at present. If the equipment could be switched off automatically when birds are absent, or during the day and then on at dusk, it would reduce the battery drain and therefore the regular replacement of the heavy battery. Work on these improvements is currently in progress. A useful additional refinement would be if the system could recognise individual kakapo. This would seem to be dependent on a transponder being implanted into each kakapo.

3.6 Weights of Kakapo eating Supplementary Food

Weights of non-breeding kakapo have increased significantly since the provision of supplementary food in September 1989. It seems that this increased weight has enabled males to occupy their T&Bs in October-November rather than in December, and to remain at their systems until late March (Lloyd & Powlesland 1992). The impact of supplementary food on females has been even more dramatic. Prior to the provision of the food there was no evidence that any females bred on Little Barrier Island (Lloyd & Powlesland 1990), but females have laid in both subsequently summers and in 1990-91 two females each raised a chick (Lloyd & Powlesland 1992).

However, it is possible that the provision of *ad libitum* supplementary food has resulted in one female becoming obese (Bella-rose, see section 2.5) and consequently not breeding. It has long been recognised that captive birds, particularly some species of parrots, are prone to becoming obese when provided with *ad libitum* fat-rich foods (Stroud 1964, Harrison & Harrison 1986). Some problems associated with obesity in captive parrots are:
a) bumblefoot -thinning, ulceration and general devitalization of the epithelium of the plantar foot tissue (Harrison & Harrison 1986).

b) liver disease - obesity is frequently accompanied by fatty infiltration of the liver and consequent liver malfunction (Harrison & Harrison 1986).
c) lipomas - these are fatty tumours in subcutaneous tissue that result in swellings of the skin, commonly on the sternum (Harrison & Harrison 1986). Fat degeneration occurs in the centre of these tumours.
d) cardiovascular degeneration - obesity is sometimes associated with heart and respiratory problems (Harrison & Harrison 1986).
e) poor reproductive performance -low fertility in males, and females are prone to becoming egg bound (Stroud 1964, S. Huntress, Wellington Zoo veterinarian, pers. comm.).

It appears that captive birds fed a high-fat diet as youngsters are more likely to become obese when exposed at a later date to high-fat items than are birds that have been raised on low-fat items (Harrison & Harrison 1986). Kakapo raised on supplementary foods, therefore, may be more susceptible to obesity than their parents. When supplementary fed kakapo are handled it will be important to check them for signs of obesity associated problems, such as bumblefoot and lipomas.

Mature kakapo presumably vary in lean weight owing to differences in skeletal size. Ideally, by determining an individual's size, such as from a standard limb measurement, we would then be able to calculate an optimum weight for the bird. Such a weight can only be derived after detailed studies of kakapo weights over several years, their reproductive performance and survival. Thus we are left with having to suggest what the optimum weight range for males and females might be. Probably the best indication is that kakapo on Stewart Island and on Little Barrier Island prior to supplementary feeding bred infrequently, but once provided with food supplements they gained weight and bred annually. Therefore, we suggest that the weights of supplementary fed kakapo on Little Barrier Island in the non-breeding season (April-October for males and breeding females, and August-October for females that have reared chicks) should be greater than the mean weight of non-breeding kakapo on Stewart Island. The weights of males on Little Barrier Island should be 2.1 - 2.6 kg and females should be 1.5 - 1.8 kg. These weight ranges should be reassessed annually with regard to the reproductive performance and weights of individuals since supplementary food has been provided.

Although we have no information about the nutrient requirements of moulting and moulting kakapo, we suggest that by not providing the relatively protein- and fat-rich nuts and seeds to non-moulting kakapo during winter and spring it may be possible to prevent kakapo exceeding the suggested weight ranges. The elimination of nuts and seeds from the diet of each kakapo once it has finished moulting should be gradual over a month, and its weight monitored fortnightly if possible. Also, the introduction of these items back into the diet in October should be gradual, reaching *ad libitum* levels in late November.

4. RECOMMENDATIONS

a) That each kakapo have a transponder implanted in it when next handled. Such a device and the regular placing of an appropriate reader attached to a data logger at each

food station on a regular basis would enable staff to determine which kakapo visits each station.

b) That the automatic weighing gear be positioned at each station at regular intervals so that the weight of each kakapo taking supplementary food is determined regularly and the weight of food provided altered promptly if need be.

c) That the weight of each food taken from stations on Maud Island be recorded in detail, and the birds weighed automatically so that an attempt can be made to determine the food requirements of kakapo of differing status and at various times of year.

d) That improvements to the covers over rat traps at stations be made to ensure that kakapo are unable to remove the covers and so reach the traps.

5. ACKNOWLEDGEMENTS

We thank Ian Flux, Terry Greene, Jane Maxwell, Don Merton, John McFadden and Hans Rook for leading some trips and helping on others during the supplementary feeding programme. We also thank the many Department of Conservation staff and volunteers who generously assisted with the programme in many ways, in particular to the Hauturu boat crew, Shaarina Boyd, Mike & Alex Dobbins, Murray Douglas and Chris & Robyn Smuts-Kennedy. Thanks to Kevin Collier, Ian Flux and Don Newman for constructive comments on drafts of this report.

6. REFERENCES

Harrison, G.J., and Harrison, L.R. 1986. *Clinical Avian Medicine and Surgery, including Aviculture*. W.B. Company, Philadelphia.

Lloyd, B.D., and Powlesland, R.G. 1990. Kakapo breeding activity on Little Barrier Island; 21 November 10 April 1990. Science and Research Internal Report 83. Department of Conservation, Wellington.

Lloyd, B.D., and Powlesland, R.G. 1992. Kakapo breeding activity on Little Barrier Island; November 1990 - May 1991. in prep.

McFadden, I. 1984. Composition and presentation of baits and their acceptance by kiore (*Rattus exulans*). New Zealand Wildlife Service Technical Report No. 7.

McFadden, I., and Towns, D. 1991. Eradication campaigns against kiore (*Rattus exulans*) on Rurima Rocks and Korapuki, northern New Zealand. Science and Research Internal Report 97. Department of Conservation, Wellington.

Moorhouse, R.J., and Powlesland, R.G. 1991. Aspects of the ecology of kakapo liberated on Little Barrier Island (Hauturu), New Zealand. Biological Conservation 56: 349 – 365.

Powlesland, R.G. 1989. *Kakapo recovery plan, 1989-1994.* Department of Conservation, Wellington.

Powlesland, R.G., and Lloyd, B.D. Progress report of the supplementary feeding of kakapo on Little Barrier Island, September 1989 -April 1990. Science and Research Internal Report 84. Department of Conservation, Wellington.

Stroud, R. 1964. *Stroud's digest of the diseases of birds.* T.F.H. Publications Inc., New Jersey, U.S.A.

Zar, J.H. 1984. Biostatistical analysis. Second edition. Prentice-Hall, Inc. U.S.A.

APPENDICES 1 - 22

Appendix 1 Kakapo visits to food stations, May 1990, Little Barrier Island

May 1990	Food stations										
	1	2	3	4	5	6	7	8	9	10	11
1	Y	N	Y		Y	Y	Y	Y	N	N	Y
2	Y	N	Y		Y	Y	Y	Y	N	N	Y
3	Y	N	Y		Y	Y	Y	N	Y	N	Y
4	Y	N	Y		N	Y	Y	N	N	Y	Y
5	N	N	Y		Y	Y	Y	N	Y	Y	N
6	N	N	Y		Y	Y	Y	Y	N	Y	N
7	N	N	Y		Y	Y	Y	Y	N	Y	N
8	N	N	Y		N	Y	Y	Y	Y	Y	N
9	N	N	Y		N	Y	Y	Y	Y	Y	N
10	Y	N	Y		Y	Y	Y	Y	Y	Y	N
11	Y	N	Y		Y	Y	Y	Y	Y	N	N
12	N	Y	Y		?	Y	Y	Y	Y	Y	N
13	N	N	Y		?	Y	Y	Y	Y	Y	N
14	Y	N	Y		N	Y	Y	Y	Y	Y	N
15	Y	N	Y		N	Y	Y	Y	N	Y	Y
16	N	Y	Y	Set-	Taken	Y	Y	Y	Y	Y	Y
17	N	Y	Y	up	away	Y	Y	Y	?	Y	Y
18	N	Y	Y	n		Y	Y	Y	N	Y	Y
19	Y	Y	?	Y		Y	Y	N	Y	Y	Y
20	Y	N	Y	Y		Y	Y	N	N	Y	Y
21	Y	N	Y	Y		Y	Y	Y	?	Y	Y
22	Y	N	Y	Y		Y	Y	Y	?	Y	Y
23	N	N	Y	Y		Y	N	Y	N	Y	Y
24	Y	N	Y	Y		Y	N	Y	N	Y	Y
25	Y	N	Y	Y		Y	N	Y	N	Y	Y
26	?	Y	Y	Y		Y	Y	Y	N	Y	Y
27	N	Y	Y	-		Y	Y	Y	N	Y	Y
28	?	Y	Y	Y		Y	Y	Y	Y	Y	Y
29	N	Y	Y	Y		Y	Y	Y	N	Y	Y
30	?	Y	Y	Y		Y	Y	Y	Y	Y	Y
31	N	Y	Y	Y		Y	Y	Y	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 2 Kakapo visits to food stations, June 1990, Little Barrier Island

June 1990	Food stations										
	1	2	3	4	5	6	7	8	9	10	11
1	Y	N	Y	Y		Y	Y	Y	Y	Y	Y
2	Y	N	Y	Y		Y	Y	Y	?	Y	Y
3	Y	N	Y	Y		Y	Y	Y	Y	Y	Y
4	?	Y	Y	Y		Y	Y	Y	Y	Y	Y
5	N	Y	Y	Y		Y	Y	Y	Y	Y	Y
6	N	Y	Y	Y		Y	Y	Y	N	Y	Y
7	-	-	Y	Y		Y	Y	Y	Y	Y	Y
8	N	Y	Y	Y		Y	Y	Y	N	Y	Y
9	Y	N	Y	N		Y	Y	Y	Y	Y	Y
10	Y	N	Y	Y		Y	Y	Y	Y	Y	Y
11	Y	-	Y	Y		Y	Y	Y	Y	Y	Y
12	Y	-	Y	Y		Y	Y	Y	Y	Y	Y
13	Y	N	Y	Y		Y	Y	Y	Y	Y	Y
14	Y	N	Y	Y		Y	Y	Y	Y	Y	Y
15	Y	N	Y	Y		Y	Y	Y	Y	Y	Y
16	Y	N	Y	N		Y	Y	?	Y	Y	N
17	N	Y	Y	?	Set	Y	Y	N	Y	Y	Y
18	N	Y	Y	?	-up	Y	Y	N	Y	Y	Y
19	N	Y	N	Y	N	Y	Y	N	Y	Y	Y
20	N	Y	N	N	Y	Y	Y	N	Y	Y	Y
21	N	Y	N	N	Y	Y	Y	N	Y	Y	Y
22	N	Y	Y	?	Y	Y	Y	N	Y	Y	Y
23	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
24	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
25	N	Y	Y	?	Y	Y	Y	Y	Y	Y	Y
26	N	Y	Y	?	Y	Y	Y	Y	Y	Y	Y
27	N	Y	Y	?	Y	Y	Y	Y	Y	Y	Y
28	N	Y	Y	?	Y	Y	Y	Y	Y	Y	Y
29	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
30	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 3 Kakapo visits to food stations, July 1990, Little Barrier Island

July 1990	Food stations										
	1	2	3	4	5	6	7	8	9	10	11
1	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N
2	N	?	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	-	-	-	-	-	-	-	-	-	-	-
4	N	Y	-	-	-	-	Y	Y	Y	Y	Y
5	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
6	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y
7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
8	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
9	Y	?	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	Y	N	Y	N	N	Y	Y	Y	N	Y	Y
11	Y	N	Y	Y	N	Y	Y	Y	N	Y	Y
12	Y	N	Y	Y	N	Y	Y	Y	Y	Y	?
13	Y	N	Y	Y	N	Y	Y	Y	Y	Y	-
14	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y
15	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
16	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
17	N	N	Y	Y	N	Y	Y	Y	N	Y	Y
18	N	Y	Y	Y	N	Y	Y	Y	N	Y	-
19	N	Y	Y	Y	N	Y	Y	Y	Y	Y	-
20	N	Y	Y	Y	N	Y	Y	Y	Y	Y	?
21	N	Y	Y	N	Y	Y	Y	Y	N	Y	-
22	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y
23	N	?	Y	N	Y	Y	Y	Y	Y	Y	-
24	N	Y	Y	?	Y	Y	Y	Y	Y	Y	?
25	Y	N	Y	N	Y	Y	Y	N	Y	Y	-
26	N	N	Y	N	N	Y	Y	N	N	Y	?
27	Y	N	Y	N	Y	Y	Y	Y	N	Y	-
28	Y	N	Y	N	Y	Y	I	Y	Y	N	?
29	-	-	-	-	-	-	-	-	-	-	-
30	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
31	N	Y	Y	N	N	Y	Y	Y	?	?	-

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 4 Kakapo visits to food stations, aUGUST 1990, Little Barrier Island

Aug 1990	Food stations										
	1	2	3	4	5	6	7	8	9	10	11
1	N	Y	Y	Y	N	Y	Y	N	Y	Y	Y
2	N	Y	N	Y	N	Y	Y	Y	N	Y	-
3	N	Y	N	Y	N	Y	Y	Y	N	Y	Y
4	N	Y	Y	Y	N	Y	Y	?	N	Y	-
5	N	Y	Y	N	N	Y	Y	Y	?	Y	Y
6	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
7	N	Y	Y	Y	N	Y	Y	Y	N	Y	-
8	N	Y	Y	Y	N	Y	Y	N	N	Y	Y
9	Y	N	Y	Y	Y	Y	Y	N	Y	Y	-
10	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
11	Y	N	Y	Y	Y	Y	Y	Y	N	Y	-
12	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y
13	Y	N	Y	N	Y	Y	Y	Y	Y	Y	-
14	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y
15	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
16	-	-	Y	N	Y	Y	Y	Y	N	Y	-
17	Y	?	Y	N	Y	Y	Y	Y	N	Y	Y
18	N	Y	Y	N	Y	Y	Y	Y	Y	Y	-
19	N	Y	Y	N	Y	Y	N	N	N	Y	?
20	N	Y	Y	N	Y	Y	Y	N	Y	Y	-
21	N	N	Y	N	Y	Y	Y	N	N	Y	Y
22	Y	N	Y	N	Y	Y	N	N	Y	Y	-
23	Y	N	Y	?	Y	Y	Y	N	Y	Y	-
24	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y
25	Y	N	Y	N	Y	Y	Y	N	N	Y	-
26	Y	N	Y	N	Y	Y	Y	N	Y	Y	?
27	N	Y	Y	N	Y	Y	Y	N	N	Y	-
28	N	Y	Y	N	Y	Y	Y	N	Y	Y	Y
29	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	-
30	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
31	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 5 Kakapo visits to food stations, September 1990, Little Barrier Island

Sept 1990	Food stations										
	1	2	3	4	5	6	7	8	9	10	11
1	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y
2	Y	N	Y	N	Y	Y	Y	N	N	Y	Y
3	Y	N	Y	?	Y	Y	Y	Y	Y	Y	Y
4	Y	N	Y	?	Y	Y	Y	Y	Y	Y	Y
5	Y	N	Y	?	Y	Y	Y	Y	N	Y	Y
6	Y	N	Y	?	Y	Y	Y	Y	Y	Y	Y
7	Y	N	Y	?	Y	Y	Y	N	Y	Y	Y
8	N	Y	Y	?	Y	Y	Y	N	N	Y	Y
9	N	Y	Y	N	N	Y	Y	N	N	Y	Y
10	Y	N	Y	N	Y	Y	Y	N	N	Y	Y
11	N	N	Y	N	Y	Y	Y	N	Y	Y	Y
12	N	Y	Y	N	Y	Y	Y	N	N	Y	-
13	Y	N	Y	N	Y	Y	Y	N	N	Y	Y
14	Y	N	Y	N	Y	Y	Y	N	N	Y	Y
15	?	N	Y	N	Y	Y	Y	Y	Y	Y	Y
16	N	N	Y	N	N	Y	Y	Y	Y	Y	Y
17	N	N	Y	N	N	Y	Y	Y	Y	Y	Y
18	N	N	Y	N	N	Y	Y	?	Y	Y	?
19	N	N	Y	N	N	Y	Y	N	Y	Y	Y
20	N	N	Y	N	N	Y	Y	Y	Y	Y	Y
21	N	N	Y	N	Y	Y	Y	Y	Y	N	N
22	Y	N	N	N	Y	Y	Y	N	Y	Y	Y
23	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
24	N	Y	Y	N	Y	Y	Y	N	Y	Y	Y
25	N	Y	Y	N	N	Y	Y	N	Y	Y	Y
26	N	Y	Y	N	Y	Y	Y	N	Y	Y	-
27	N	Y	Y	N	Y	Y	Y	N	Y	Y	Y
28	N	Y	Y	N	Y	Y	Y	N	Y	N	-
29	N	Y	Y	N	Y	Y	Y	N	Y	Y	N
30	N	Y	Y	N	Y	Y	Y	N	N	Y	-

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 6 Kakapo visits to food stations, October 1990, Little Barrier Island

Oct 1990	Food stations											
	1	2	3	4	5	6	7	8	9	10	11	12
1	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	
2	N	Y	Y	N	Y	Y	Y	Y	N	Y	-	
3	Y	N	Y	N	Y	Y	Y	Y	N	Y	N	
4	N	N	Y	N	?	Y	Y	N	Y	Y	-	
5	Y	N	Y	N	N	Y	Y	Y	N	Y	N	
6	Y	N	Y	N	Y	Y	Y	Y	Y	Y	-	
7	Y	N	Y	N	Y	Y	Y	Y	N	Y	-	
8	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	
9	-	-	-	-	-	-	-	-	-	-	-	
10	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	
11	Y	N	?	Y	Y	Y	Y	Y	N	Y	N	
12	N	N	Y	Y	N	Y	Y	Y	N	Y	-	
13	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	
14	N	Y	Y	N	N	Y	Y	Y	?	Y	Y	
15	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	
16	Y	Y	?	N	Y	Y	Y	Y	Y	Y	Y	
17	Y	N	Y	N	Y	Y	Y	-	Y	Y	Y	
18	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	
19	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	
20	N	N	Y	N	N	Y	Y	N	Y	Y	?	
21	N	N	Y	N	Y	Y	Y	N	Y	Y	Y	
22	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	
23	N	Y	N	N	Y	Y	Y	N	Y	N	Y	
24	N	N	Y	N	N	Y	Y	N	Y	Y	Y	
25	N	N	Y	N	N	Y	Y	N	Y	Y	N	
26	Y	N	Y	N	N	Y	Y	N	Y	Y	Y	Set-
27	N	N	Y	N	N	Y	Y	N	Y	Y	N	up
28	N	Y	Y	N	N	Y	Y	N	Y	Y	Y	N
29	N	Y	Y	N	N	Y	Y	N	Y	Y	N	Y
30	N	N	Y	N	N	Y	Y	-	Y	Y	Y	Y
31	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 7 Kakapo visits to food stations, November 1990, Little Barrier Island

Nov 1990	Food stations											
	1	2	3	4	5	6	7	8	9	10	11	12
1	Y	N	Y	N	Y	Y	Y	-	N	Y	Y	W
2	N	N	Y	N	?	Y	Y	N	Y	N	Y	W
3	Y	N	Y	N	N	N	Y	-	Y	N	Y	Y
4	N	N	Y	N	N	Y	Y	N	Y	Y	N	Y
5	Y	N	Y	N	N	Y	Y	-	Y	Y	Y	Y
6	?	Y	Y	N	Y	Y	Y	-	Y	N	Y	Y
7	N	N	N	N	Y	Y	Y	N	Y	?	N	Y
8	Y	N	N	N	?	Y	Y	N	Y	?	-	Y
9	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y
10	N	N	Y	N	?	Y	Y	Y	Y	Y	-	Y
11	Y	N	N	N	Y	N	Y	?	N	Y	N	Y
12	-	-	-	-	-	-	-	-	-	-	-	-
13	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
14	Y	N	Y	Y	N	N	Y	N	Y	Y	-	Y
15	N	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y
16	N	Y	Y	Y	N	Y	Y	?	Y	Y	-	Y
17	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	Y
18	N	N	Y	N		Y	Y	N	Y	Y	-	Y
19	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	N
20	Y	N	Y	Y	Y	Y	Y	Y	N	Y	-	N
21	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y
22	?	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
23	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	N
24	N	N	Y	N	N	Y	Y	Y	Y	Y	-	N
25	N	N	Y	N	N	Y	Y	Y	N	Y	Y	N
26	N	N	Y	N	Y	Y	N	Y	N	Y	-	N
27	N	N	Y	N	N	Y	Y	N	Y	N	Y	Y
28	Y	N	Y	N	Y	Y	Y	N	Y	?	-	Y
29	N	Y	Y	N	N	Y	Y	N	Y	Y	Y	N
30	Y	Y	Y	N	Y	Y	N	N	Y	Y	-	N

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, --- = station not checked

Appendix 8 Kakapo visits to food stations, December 1990, Little Barrier Island

December 1990	Food stations												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	N	
2	N	N	Y	N	Y	Y	Y	?	Y	Y	-	N	
3	N	N	-	-	-	Y	Y	N	Y	Y	-	Y	
4	N	N	Y	N	Y	Y	Y	N	N	Y	Y	N	
5	Y	N	Y	N	Y	Y	Y	N	N	Y	-	Y	
6	N	N	Y	N	N	Y	Y	N	Y	Y	Y	Y	
7	N	N	Y	N	N	Y	Y	N	Y	Y	-	Y	
8	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	N	
9	Y	N	Y	N	Y	Y	Y	N	Y	N	-	Y	
10	Y	N	Y	N	N	Y	Y	N	Y	Y	Y	-	
11	Y	N	Y	N	Y	Y	N	N	Y	Y	-	Y	
12	Y	N	N	N	Y	Y	N	N	Y	Y	Y	Y	
13	N	Y	Y	N	Y	Y	Y	N	Y	Y	-	Y	
14	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	
15	N	N	N	N	Y	Y	Y	Y	N	Y	-	Y	
16	N	N	?	N	Y	Y	Y	N	N	Y	-	Y	
17	N	N	N	N	N	N	N	N	N	Y	Y	N	
18	Y	N	N	N	N	Y	?	N	N	Y	-	Y	
19	N	Y	?	-	Y	N	N	N	Y	Y	Y	N	
20	N	Y	N	N	?	Y	N	-	Y	Y	Y	Y	Set
21	N	Y	N	N	?	Y	N	-	Y	Y	Y	Y	-up
22	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
23	Y	N	N	N	N	Y	Y	-	N	Y	Y	Y	Y
24	N	N	N	N	N	N	Y	-	Y	Y	Y	N	Y
25	Y	N	N	-	-	Y	Y	N	?	Y	N	Y	Y
26	Y	N	N	N	N	Y	N	-	Y	Y	Y	Y	Y
27	?	N	Y	N	N	N	Y	-	N	N	N	N	N
28	Y	N	N	N	N	Y	Y	-	Y	N	Y	N	Y
29	N	Y	Y	-	-	Y	Y	N	Y	Y	Y	Y	Y
30	N	Y	Y	N	N	Y	N	-	N	N	N	Y	Y
31	N	Y	Y	N	N	Y	N	-	Y	Y	Y	N	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, - = station not checked

Appendix 9 Kakapo visits to food stations, January 1991, Little Barrier Island

January 1991	Food stations											
	1	2	3	4	6	7	8	9	10	11	12	13
1	N	N	N	N	Y	Y	-	Y	Y	Y	Y	Y
2	Y	N	Y	N	Y	Y	-	Y	?	N	Y	Y
3	Y	N	N	N	Y	N	-	N	Y	N	Y	Y
4	N	Y	Y	N	?	N	Y	N	N	Y	Y	Y
5	N	Y	Y	N	Y	Y	N	Y	Y	Y	?	Y
6	Y	Y	Y	N	Y	N	N	N	Y	Y	Y	Y
7	Y	N	N	N	Y	Y	N	N	Y	Y	Y	Y
8	Y	N	Y	N	Y	N	N	Y	Y	N	Y	Y
9	N	Y	Y	N	Y	Y	N	Y	?	Y	Y	Y
10	N	Y	Y	N	N	Y	N	N	Y	Y	Y	Y
11	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y
12	Y	N	N	N	N	N	N	Y	N	Y	Y	Y
13	N	Y	N	N	Y	Y	N	N	Y	N	Y	N
14	N	Y	N	N	Y	N	N	Y	N	N	Y	Y
15	Y	N	N	N	Y	Y	N	N	N	Y	Y	Y
16	Y	N	N	N	-	-	-	N	N	N	-	Y
17	N	N	N	N	Y	Y	N	N	N	N	Y	Y
18	Y	N	N	N	N	Y	N	N	N	Y	Y	N
19	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y
20	N	N	Y	N	Y	N	N	N	Y	Y	N	Y
21	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y
22	Y	N	N	N	N	Y	N	N	N	N	Y	N
23	-	-	-	-	Y	N	N	N	?	N	Y	-
24	N	Y	N	N	Y	Y	N	N	N	N	Y	Y
25	N	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
26	Y	N	Y	N	N	Y	N	N	N	N	N	Y
27	Y	N	N	N	Y	Y	N	N	N	Y	Y	Y
28	N	Y	Y	N	Y	?	N	N	Y	N	Y	Y
29	N	N	N	N	Y	Y	N	N	N	N	-	Y
30	Y	N	N	N	Y	Y	N	Y	Y	N	Y	Y
31	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, - = station not checked

Appendix 10 Kakapo visits to food stations, February 1991, Little Barrier Island

February 1991	Food stations											
	1	2	3	6	7	8	9	10	11	12	13	14
1	Y	N	N	Y	Y	N	N	N	N	Y	Y	
2	Y	N	N	Y	N	N	N	?	Y	Y	Y	
3	N	N	N	Y	N	N	N	N	Y	Y	Y	
4	Y	N	N	Y	Y	N	N	Y	Y	Y	Y	
5	Y	N	N	Y	Y	N	N	Y	Y	Y	Y	
6	N	N	Y	Y	N	N	?	Y	Y	Y	Y	
7	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	
8	N	N	N	Y	Y	N	Y	N	Y	Y	Y	
9	Y	N	N	Y	Y	-	N	Y	Y	Y	Y	
10	N	Y	N	N	N	N	Y	N	Y	Y	N	
11	N	N	Y	Y	N	-	N	Y	Y	Y	Y	
12	Y	N	Y	Y	Y	-	N	N	Y	Y	N	
13	N	N	N	Y	Y	-	N	Y	Y	Y	Y	
14	Y	N	N	Y	Y	N	N	Y	N	Y	Y	
15	N	N	N	Y	Y	-	N	Y	Y	Y	Y	
16	Y	N	N	Y	Y	-	Y	?	Y	Y	Y	
17	N	N	N	Y	Y	N	-	Y	Y	Y	Y	
18	N	Y	Y	Y	Y	N	-	Y	Y	Y	Y	
19	N	N	Y	Y	Y	N	Y	N	Y	Y	Y	
20	Y	N	Y	Y	Y	N	Y	N	Y	Y	N	
21	N	N	Y	Y	Y	-	Y	N	Y	Y	Y	
22	Y	N	Y	Y	Y	-	N	?	N	Y	Y	
23	Y	N	Y	Y	Y	-	Y	N	N	Y	?	Set
24	Y	N	Y	Y	Y	-	Y	N	N	Y	Y	-up
25	Y	N	Y	Y	Y	Y	Y	-	-	Y	Y	N
26	N	Y	Y	Y	Y	-	Y	N	N	Y	Y	N
27	?	N	Y	Y	Y	N	Y	N	-	Y	Y	Y
28	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, - = station not checked

Appendix 11 Kakapo visits to food stations, March 1991, Little Barrier Island

March 1991	Food stations												
	1	2	3	4	6	7	8	9	10	11	12	13	14
1	Y	N	Y		Y	Y	N	Y	N	N	Y	N	Y
2	Y	N	Y		Y	Y	N	Y	N	Y	Y	Y	Y
3	Y	N	Y		Y	Y	-	Y	?	Y	Y	Y	Y
4	Y	N	Y		Y	Y	N	Y	Y	N	Y	Y	Y
5	Y	Y	Y		Y	Y	N	Y	Y	Y	Y	Y	Y
6	Y	Y	Y		Y	Y	N	Y	Y	Y	Y	Y	Y
7	Y	Y	Y		Y	Y	N	Y	Y	N	Y	Y	Y
8	Y	N	Y		Y	Y	-	Y	N	N	Y	N	Y
9	Y	N	N		Y	Y	-	N	N	Y	Y	N	Y
10	Y	Y	Y		Y	Y	-	Y	N	Y	N	Y	Y
11	Y	Y	Y		Y	Y	N	Y	N	Y	Y	N	Y
12	Y	N	Y		Y	Y	-	Y	N	Y	Y	Y	Y
13	Y	Y	Y		Y	Y	-	Y	N	Y	Y	Y	Y
14	Y	N	Y		Y	Y	N	Y	N	Y	Y	N	Y
15	Y	N	Y		Y	Y	N	Y	N	Y	Y	Y	Y
16	Y	Y	Y		Y	Y	N	Y	N	Y	Y	N	Y
17	Y	Y	Y		Y	Y	N	Y	Y	Y	Y	Y	Y
18	Y	Y	Y		Y	Y	N	Y	Y	Y	Y	Y	Y
19	Y	N	Y		Y	N	-	Y	Y	?	Y	Y	Y
20	Y	N	Y		Y	Y	N	N	Y	Y	Y	Y	Y
21	Y	N	Y		Y	Y	-	Y	Y	Y	Y	Y	Y
22	Y	N	Y		Y	Y	-	Y	N	Y	Y	N	Y
23	Y	Y	Y		N	Y	N	Y	?	?	Y	Y	Y
24	Y	N	Y		Y	Y	-	Y	N	Y	Y	N	Y
25	Y	N	Y	Set	Y	Y	N	Y	N	Y	Y	Y	Y
26	Y	Y	Y	-up	Y	Y	-	Y	Y	Y	Y	Y	Y
27	Y	N	Y	Y	Y	Y	-	N	Y	Y	Y	Y	Y
28	Y	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y
29	Y	Y	Y	N	Y	Y	-	Y	Y	Y	Y	Y	Y
30	Y	Y	Y	N	Y	Y	-	Y	Y	Y	Y	Y	Y
31	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, - = station not checked

Appendix 12 Kakapo visits to food stations, April 1991, Little Barrier Island

April 1991	Food stations												
	1	2	3	4	6	7	8	9	10	11	12	13	14
1	Y	N	Y	N	Y	Y	-	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	N	N	Y	-	Y	Y	Y	Y	N	Y
3	Y	Y	Y	-	Y	Y	N	Y	Y	Y	Y	N	Y
4	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y
5	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y
6	Y	Y	Y	N	Y	Y	-	Y	N	Y	Y	Y	Y
7	Y	Y	Y	Y	Y	Y	-	Y	N	Y	Y	Y	Y
8	Y	N	Y	N	Y	Y	-	Y	N	Y	?	Y	Y
9	Y	Y	Y	Y	N	Y	N	Y	N	Y	Taken	Y	Y
10	Y	Y	Y	Y	N	Y	Y	Y	N	Y	away	N	Y
11	Y	N	Y	Y	N	Y	N	Y	N	Y		Y	Y
12	Y	N	Y	N	Y	Y	N	Y	-	-		Y	Y
13	Y	N	Y	Y	Y	Y	N	Y	N	Y		Y	Y
14	Y	N	Y	Y	Y	Y	N	Y	N	Y		N	Y
15	Y	N	Y	Y	Y	Y	N	Y	N	Y		N	Y
16	Y	N	Y	N	Y	Y	-	Y	N	-		Y	Y
17	Y	N	Y	N	Y	Y	N	Y	Y	Y		Y	Y
18	Y	Y	Y	N	Y	Y	-	Y	Y	Y		Y	Y
19	Y	N	Y	N	Y	Y	N	Y	-	-		Y	Y
20	Y	Y	Y	Y	Y	Y	N	Y	Y	Y		Y	Y
21	Y	Y	Y	N	Y	Y	Taken	Y	Y	?		N	Y
22	Y	N	Y	Y	Y	Y	away	Y	Y	Y		N	Y
23	Y	Y	Y	Y	Y	Y		Y	Y	Y		N	Y
24	-	-	-	-	-	-		-	-	-		-	-
25	Y	Y	-	-	Y	-		Y	-	-		-	Y
26	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y	Y
27	Y	N	Y	Y	Y	Y		Y	Y	?		N	Y
28	Y	Y	Y	Y	Y	Y		Y	Y	-		N	Y
29	Y	Y	Y	Y	Y	Y		N	Y	Y		N	Y
30	Y	N	Y	N	Y	Y		Y	Y	Y		Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, - = station not checked

Appendix 13 Kakapo visits to food stations, May 1991, Little Barrier Island

May 1991	Food stations										
	1	2	3	4	6	7	9	10	11	13	14
1	Y	Y	Y	N	Y	Y	Y	Y	-	Y	Y
2	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
4	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
5	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y
6	Y	N	Y	N	Y	Y	Y	Y	-	Y	Y
7	?	Y	Y	N	Y	Y	N	Y	Y	Y	Y
8	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
9	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
10	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
11	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
12	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y
13	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
14	Y	Y	Y	N	Y	Y	Y	Y	-	Y	Y
15	Y	Y	Y	N	Y	Y	Y	Y	-	Y	Y
16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
17	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
18	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y
19	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
20	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
21	Y	Y	Y	Y	Y	Y	Y	?	Y	N	Y
22	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y
23	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y
24	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y
25	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
26	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y
27	Y	N	Y	Y	Y	Y	N	N	N	N	Y
28	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
29	Y	N	N	Y	Y	Y	N	-	-	N	Y
30	Y	Y	Y	Y	N	Y	N	N	Y	N	Y
31	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y

Key: Y = kakapo fed from tray, N = did not feed from tray, ? = may have fed from tray, - = station not checked

Appendix 14 Kakapo visits to food stations, June 1991, Little Barrier Island

June 1991	Food stations										
	1	2	3	4	6	7	9	10	11	13	14
1	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y
2	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y
3	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
4	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y
5	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
6	-	-	-	-	-	-	N	-	-	-	Y
7	?	N	Y	Y	Y	Y	N	Y	Y	N	Y
8	Y	Y	Y	?	Y	Y	Y	Y	Y	Y	Y
9	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y
10	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y
11	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y
12	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y
13	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y
14	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y
15	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y
16	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y
17	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y
18	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
19	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
20	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
21	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
22	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y
23	Y	Y	Y	Y	Y	-	Y	Y	Y	N	Y
24	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
25	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
26	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
27	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
28	Y	N	Y	N	Y	Y	Y	?	Y	Y	Y
29	Y	N	-	-	-	-	-	-	-	-	Y
30	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y

Key: Y = kakapo fed from tray, N = did not feed from tray,
? = may have fed from tray, - = station not checked

Appendix 15 Mean weights (g) of six foods taken per night each month from food station 6 (Arab), Little Barrier Island, June 1990-June 1991

Year & month	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower kernel
1990							
Jun	30	90.3	101.0	25.2	1.0	1.4	13.9
Jul	26	98.8	113.7	30.4	0.5	0.6	8.8
Aug	31	128.0	126.3	36.8	0.5	1.2	7.1
Sep	29	100.0	103.3	35.8	0.6	0.7	6.9
Oct	29	114.8	77.4	25.0	2.6	3.3	18.0
Nov	25	71.4	61.6	8.5	16.9	1.0	10.8
Dec	27	16.1	26.7	2.8	10.9	0.7	5.9
1991							
Jan	24	10.2	31.9	0.5	0.1	0.2	7.5
Feb	27	29.3	59.0	2.2	1.5	0.1	12.3
Mar	30	93.0	88.8	6.8	13.1	0.6	17.5
Apr	24	65.5	102.8	15.5	14.3	2.7	27.9
May	30	85.9	110.8	9.8	12.5	1.0	18.7
Jun	26	61.1	93.6	9.7	9.6	2.8	15.4

Appendix 16 Mean weights (g) of six foods taken per night each month from food station 7 (Pegasus), Little Barrier Island, June 1990-June 1991

Year & month	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower kernel
1990							
Jun	30	63.6	88.3	24.3	16.0	13.1	9.3
Jul	26	34.1	72.8	8.9	11.3	9.0	12.0
Aug	29	47.8	63.0	17.9	14.6	5.5	13.1
Sep	30	52.4	66.0	27.7	34.1	6.2	11.0
Oct	29	72.3	57.9	20.5	18.8	8.8	12.6
Nov	26	34.1	19.7	2.7	21.3	1.4	5.1
Dec	22	16.3	4.1	1.1	8.6	3.4	5.4
1991							
Jan	23	0.8	5.4	0.0	2.6	2.2	2.1
Feb	23	9.8	14.3	1.5	6.0	5.1	3.9
Mar	30	49.8	25.2	3.9	13.1	10.4	5.3
Apr	27	44.6	40.6	9.5	19.3	16.7	13.7
May	31	61.0	56.2	14.2	19.5	14.1	9.6
Jun	24	27.7	72.3	5.1	16.2	7.2	13.7

Appendix 17 Mean weights (g) of six foods taken per night each month from food stations 4, 5 and 13 (Luke), Little Barrier Island, June 1990-June 1991

Year & month	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower kernel
1990							
Jun	26	27.7	52.2	22.1	22.9	1.8	11.8
Jul	24	35.6	43.4	33.5	23.3	7.3	17.7
Aug	30	37.8	23.7	43.2	25.6	2.7	10.0
Sep	23	6.5	11.2	30.1	22.9	0.2	3.8
Oct	18	44.1	24.6	30.7	15.1	1.2	5.6
Nov	20	47.3	19.6	21.6	12.2	1.2	5.1
Dec	22	12.6	25.5	15.8	10.8	0.5	2.2
1991							
Jan	26	8.7	48.5	9.6	10.1	1.0	6.8
Feb	24	7.4	45.1	7.8	15.2	0.3	10.4
Mar	23	1.5	16.1	11.5	14.7	4.1	18.2
Apr	24	25.9	43.3	26.5	23.4	8.6	25.4
May	31	40.1	38.8	19.5	18.9	9.5	20.0
Jun	26	35.8	57.8	19.5	17.9	11.0	17.8

Appendix 18 Mean weights (g) of six foods taken per night each month from food station 12 (Snark), Little Barrier Island, November 1990-March 1991*

Year & month	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower kernel
1990							
Nov	17	56.1	23.3	16.3	6.9	9.6	---
Dec	19	0.6	7.7	13.7	11.8	2.1	2.7
1991							
Jan	15	0.6	9.4	3.7	11.4	3.4	4.1
Feb	28	4.1	44.1	3.7	11.9	5.1	5.7
Mar	30	63.9	85.2	10.7	18.6	4.3	11.9

*This station was set up near a recently occupied track-and-bowl system on 27 October 1990 and removed on 9 April 1991, by which time there was little activity at the system.

Appendix 19 Mean weights (g) of six foods taken per night each month from food station 3 (Bellarose), Little Barrier Island, June 1990-April 1991*

Year & month	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower seed
1990							
Jun	31	1.2	51.0	13.7	14.1	3.6	0.2
Jul	24	4.5	41.1	25.4	5.8	2.0	0.1
Aug	29	4.0	40.3	20.9	5.8	2.5	0.3
Sept	29	2.2	22.4	10.7	9.5	2.1	0.2
Oct	27	13.1	38.8	8.2	5.4	10.9	0.0
Nov	24	5.8	31.1	7.7	11.0	5.8	0.0
Dec	16	18.2	23.3	2.6	14.8	6.1	0.0
1991							
Jan	11	4.4	8.8	0.8	15.2	3.8	1.3
Feb	14	16.4	24.9	7.9	8.1	5.2	0.0
Mar	29	14.8	25.7	8.2	11.6	9.2	0.3

*From 7 April 1991 the amount of kumara, brazil kernels and sunflower seeds taken from this station markedly increased, suggesting that another kakapo was feeding from it. On 30 June 1991 Rob was trapped near the station.

Appendix 20 Mean weights (g) of six foods taken per night each month from food station 11 (Maggie), Little Barrier Island, June 1990-June 1991

Year & month	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower kernel
1990							
Jun	29	55.0	63.2	7.4	6.5	0.6	15.0
Jul	6	55.0	86.0	7.6	8.1	0.0	12.2
Aug	3	66.0	110.3	9.6	11.6	4.2	5.8
Sep	22	45.7	32.5	2.1	4.2	2.2	9.1
Oct	13	32.1	48.5	7.6	7.9	2.9	4.5
Nov	5	6.2	10.0	4.5	6.2	2.9	5.2
Dec	9	42.0	27.7	0.0	7.2	0.9	3.9
1991							
Jan	16	12.0	54.5	3.8	2.7	1.8	7.2
Feb	19	51.0	47.8	3.2	5.7	2.8	12.8
Mar	27	53.7	61.0	4.7	5.0	8.4	15.5
Apr	19	106.6	89.6	7.8	8.5	5.6	19.1
May	21	26.6	46.5	3.0	20.6	6.6	10.0
Jun	25	0.0	0.0	5.9	17.4	4.2	9.4

Appendix 21 Mean weights (g) of six foods and water taken per night each month from food stations 1 and 2 (Johngirl), Little Barrier Island, June 1990-June 1991

Year & month	Days	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower seed	Water
1990									
Jun	--	28	57.5	16.1	18.0	8.3	4.3	10.4	--
Jul	--	23	39.7	9.7	22.7	3.5	1.5	10.2	--
Aug	--	28	36.3	10.6	19.7	8.6	3.6	9.8	--
Sep	--	21	49.6	12.9	13.4	8.7	3.9	7.2	--
Oct	--	21	44.5	5.9	14.7	9.1	6.8	12.3	--
Nov	--	19	27.2	8.4	10.6	6.8	6.3	10.2	--
Dec	--	21	33.9	6.3	7.5	10.3	5.1	4.5	--
1991									
Jan	--	22	36.2	13.6	4.7	5.3	3.3	6.9	--
Feb	--	18	40.4	18.2	3.5	3.6	1.0	6.2	--
Mar	1-10 11-20 21-31	10 10 10	56.4 60.9 36.9	14.6 24.4 22.4	4.4 21.6 23.4	6.9 21.2 45.0	4.0 13.1 25.1	13.1 50.8 75.7	--
Apr	1-10 11-20 21-30	10 10 8	44.9 109.8 83.4	18.9 20.5 7.0	16.7 2.9 3.1	24.0 3.3 1.3	26.3 1.7 0.6	68.7 80.3 84.1	-- 93.7 92.3
May	1-10 11-20 21-31	10 10 11	122.6 95.7 65.7	29.3 60.8 60.9	3.6 3.8 15.1	2.1 3.2 11.5	2.6 5.0 10.4	76.1 64.1 63.9	58.0 41.0 63.9
Jun	1-10 11-20 21-30	8 10 10	37.6 72.8 103.3	91.8 106.9 103.5	21.3 9.5 24.5	15.3 12.4 19.5	13.4 5.9 13.7	57.4 38.6 36.8	63.6 39.4 --

Appendix 22 Mean weights (g) of six foods and water taken per night each month from food stations 9 and 14 (Wendy), Little Barrier Island, January-June 1991

Year & month	Days	N	Kumara	Apple	Brazil kernel	Almond kernel	Walnut kernel	Sunflower seed	Water
1991									
Jan	--	6	33.5	4.7	1.2	7.3	3.3	0.2	--
Feb	--	4	59.0	67.5	17.7	11.5	9.9	1.8	--
Mar	1-10	10	75.5	105.0	41.3	17.1	15.6	6.6	--
	11-20	10	128.4	186.1	34.4	49.9	22.0	10.9	--
	21-31	11	178.7	132.4	42.1	43.4	19.1	0.4	--
Apr	1-10	10	133.1	116.3	34.8	39.8	51.8	20.2	--
	11-20	10	130.5	46.6	61.0	46.0	40.4	38.7	277
	21-30	8	177.0	56.7	66.6	39.2	27.1	7.4	238
May	1-10	10	88.3	53.0	56.0	51.2	35.4	5.8	119
	11-20	10	72.5	135.3	40.0	53.2	21.5	33.8	53
	21-31	11	12.4	90.6	36.6	33.9	32.5	13.7	108
Jun	1-10	10	45.5	48.2	50.8	32.3	33.6	10.4	68
	11-20	10	16.1	76.5	27.5	36.4	24.9	15.3	47
	21-30	8	56.9	44.6	51.0	36.6	23.1	17.6	--