Sooty Shearwaters off California: diet and energy gain

by Ellen W. Chu[1]
Center for Coastal Marine Studies, University of California,
Santa Cruz, CA, USA 95064

1. Abstract

Sooty Shearwaters (*Puffinus griseus*) in Monterey Bay and off southern California fed primarily on juvenile rockfish (*Sebastes* spp.) from May through July and on northern anchovies (*Engraulis mordax*) in August and September; market squid (*Loligo opalescens*) and euphausiids were minor components of the diet. The change from rockfish to anchovies coincided with completion of moult and with pre-migratory weight gain and fattening. In May, fat content was only 8% of fresh weight; by September fat had increased to 42%. There was little monthly variation in water content or non-fat body components. A number of factors may enhance pre-migratory fattening off California, including the availability of high-calorie anchovies.

2. Résumé

Les Puffins fuligineux (*Puffinus griseus*) dans la baie de Monterey et au large du sud de la Californie se nourrissaient surtout de jeunes scorpenidés (*Sebastes* spp.) de mai à juillet et d'anchois du nord (*Engraulis mordax*) en août et en septembre. Le calmar commun du Pacifique (*Logigo opalenscens*) et les euphausiides étaient un apport secondaire au régime. Le passage des scorpenidés aux anchois coïncidait avec la fin de la mue ainsi qu'avec le gain de poids et l'engraissement prémigratoires. En mai, la graisse ne constituait que 8 % du poids frais; en septembre, elle était passée à 42 %. Il y avait très peu de variations mensuelles dans la teneur en eau ou dans les composantes corporelles non lipidiques. Un certain nombre de facteurs peuvent favoriser l'engraissement prémigratoire au large de la Californie dont la disponibilité en anchois riches en calories.

3. Introduction

Seabirds, because of their abundance, play an important role in the feeding and energy structure of marine communities (Ainley 1980, Brown 1980), but their actual impact has been hard to estimate. Part of the problem stems from the difficulty and expense of making metabolic measurements on free-ranging animals (Wiens and Scott 1975, Furness 1978, Dunn 1979). Models of seabird energetics lack such essential parameters as the kinds and quantities of food consumed, the efficiency of food-to-fat transfer, and the costs of basic maintenance, growth, reproduction, moult, and migration.

There have been many quantitative studies on seabird foods and feeding — studies on individual species, including shearwaters and other procellariiforms (e.g. Imber 1973, 1976; Brown *et al.* 1981; Ogi, this volume), and on whole communities (e.g. Ashmole and Ashmole 1967, Croxall and Prince 1980, Ainley and Sanger 1979). Work on avian metabolism and fat accumulation, however, has focused on passerines (e.g. Odum and Connell 1956, Blem 1976), game, and waterfowl (e.g. Raveling 1979); studies on seabirds are rare (Johnson and West 1973, Krasnow 1978).

From May through September, Sooty Shearwaters (*Puffinus griseus*) are among the most abundant seabird predators in the California Current system (Chu and Briggs, unpubl. data). They feed in immense flocks, often near shore with other seabirds and marine mammals (Sealy 1973, Hoffman *et al.* 1981). Shearwaters "pursuit dive" from the sea surface or "pursuit plunge" from the air, using their wings and feet to manoeuvre under water; they can dive to at least 5 m (Ashmole 1971; Brown *et al.* 1978, pers. obs.). This study examines diet and physiological condition simultaneously during the non-breeding season and identifies relationships among diet, moult, and pre-migratory fattening.

4. Study area and methods

Data were collected in the Southern California Bight (1975–78) during surveys of marine bird and mammal populations (Briggs *et al.* 1981) and in Monterey Bay (1978–79). Both areas are neritic habitats along the California coast (Fig. 1), characterized by spring–summer upwelling and an abundant coastal fauna (Bolin and Abbott 1963, Frey 1971, Jones 1971, Morejohn *et al.* 1978).

In June and August 1978 and from April through October 1979, 166 Sooty Shearwaters were collected by shotgun from Monterey Bay for analysis of gut contents, moult, and fat. Thirty-seven birds were also collected in southern California from May through September 1977.

4.1. Diet

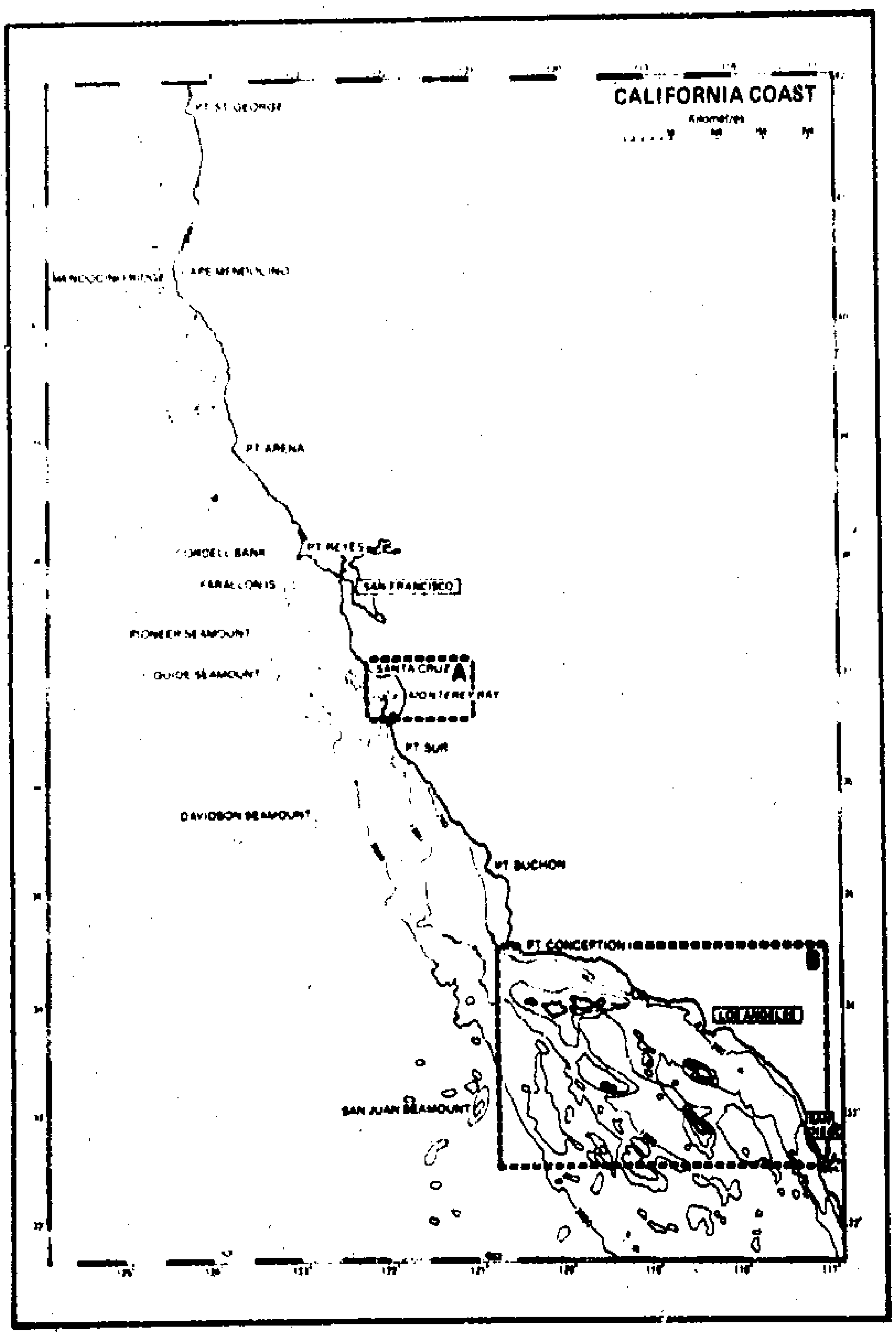
Each bird was tagged at collection and later weighed, measured, and dissected. If dissection could not be done on the day that birds were collected, the carcasses were refrigerated overnight or frozen; all carcasses were reweighed before further processing.

[1] Present address: The Writing Program, Massachusetts Institute of Technology, Cambridge, MA, USA 02139

I weighed the contents of the stomachs (including esophagus and proventriculus) and measured food volume by displacement. Gizzard (ventricular) contents, which were fragmented, were not weighed or measured volumetrically. Both stomach and gizzard contents were fixed in 10% buffered Formalin before being separately stored in 40% isopropyl alcohol. The preserved material was later sorted, and prey were identified to the lowest possible taxon; I measured the standard length (SL) (fish), mantle length (squid), or total length (euphausiids) of items whenever possible. I then counted individuals in each prey category and estimated for each bird the percent of total stomach volume represented by each category.

Many of the stomachs were empty, but gizzards often contained prey remains, such as cephalopod beaks and fish otoliths, or other items like pebbles and plastic. Although stomach contents undoubtedly reflect a bird's most recent feeding, it is not known how long remains of previous meals persist in the gizzard. In analysing the data, I therefore analysed stomachs separately from gizzards and whole prey separately from parts of prey.

Figure 1
Coastal California including major submarine topographical features. Sooty Shearwaters were observed and collected in Monterey Bay (A) and in the Southern California Bight (B). Depths in metres



4.2. Weight, moult, and fat content

In 1979, I followed moult progress and fat accumulation in the birds from Monterey Bay. I monitored the progress of moult throughout the season by counting new and growing primary and secondary wing feathers as well as new and growing tail feathers; I estimated the percentage of feathers that were new on other areas of the body. I then divided the number of new primaries plus secondaries by the total number of primaries plus secondaries to give the percentage of completed wing moult for each bird; the percentage of completed tail moult was similarly calculated. For each bird I averaged the figure for completed tail moult with the estimated percentage of completed moult on other body areas (except wings) for an overall percentage of completed body moult. To analyse changes in moult over time, I applied a one-way analysis of variance coupled with Duncan's *a posteriori* multiple range test to monthly mean values for completed moult and for the number of growing feathers.

I determined fat content by measuring visible fat on all specimens and by extracting body fat from a total of 12 birds collected on 25 May, 1 and 22 June, 7 and 31 August, and 21 and 24 September 1979. These birds were prepared for fat extraction by first removing their feathers with large scissors and animal clippers (McLandress 1979). After dissection, the carcasses were refrozen. For all specimens, I measured skin-fat thickness at the anterior and posterior tips of the sternum, and I estimated fat deposits around the viscera on a scale of 1–5 (almost no fat, 1; viscera almost totally obscured by fat, 5). For fat extraction, the 12 shaved carcasses were diced as finely as possible and freeze-dried to constant weight (3–7 days). The dried carcasses were extracted with petroleum ether for 4–5 days in a Soxhlet apparatus, redried under a heat lamp and vacuum for 24–48 h, and weighed again to give total lean dry carcass weight. The extracted fat was similarly dried and weighed. Subtracting lean dry weight from dry weight gave fat content; I used the weight of the extracted fat as a cross-check. For ease of comparison and because lean dry weight is a better indicator of metabolic rate than fresh weight, I have expressed both water and fat content in grams per gram of lean dry weight (Blem 1976).

Since I wished to use measurements of visible fat to predict extractable fat for all the birds collected, I regressed the fat content of extracted birds against each of their skin and perivisceral fat measurements in a stepwise multiple procedure. The best one- and three-variable equations (those giving the highest R^2) follow, where PREDFAT = estimated extractable fat in grams per gram of lean dry weight, SCANT = subcutaneous fat measured at the anterior tip of the sternum, SCPOST = subcutaneous fat measured at the posterior tip of the sternum, and PERI = perivisceral fat index:

$$\text{PREDFAT} = 0.218(\text{SCANT}) - 0.547, R^2 = 0.93, F_{[8]} = 99.11, P = 0.0001 \quad (1)$$

$$\text{PREDFAT} = 0.113(\text{SCANT}) + 0.026(\text{SCPOST}) + 0.169(\text{PERI}) - 0.363, R^2 = 0.96, F_6 = 49.04, P = 0.0001 \quad (2)$$

I was then able to apply the three-variable model to the larger sample of non-extracted birds. I identified differences in mean monthly weight, water content, and fat and tested them statistically using analysis of variance and

Duncan's multiple range test.

The following expression converted PREDFAT into predicted grams of fat:

$$\frac{\text{Mean PREDFAT}}{1 + \text{mean } H_2O + \text{mean PREDFAT}} \times \text{mean monthly weight} \qquad (3)$$

5. Results

5.1. Diet

The diet included 11 genera of fish, seven genera of cephalopods, and at least three genera of crustaceans (Appendix 1). Juvenile rockfish (*Sebastes* spp.), northern anchovy (*Engraulis mordax*), market squid (*Loligo opalescens*), and the euphausiid crustacean *Thysanoessa spinifera* predominated (Table 1), but in both locations diet varied monthly.

5.1.1. *Monterey Bay* — Eighty-seven (57%) of the 154 stomachs examined from Monterey Bay contained food; the rest were either empty or lined with a yellowish mucus. All but one of the gizzards contained identifiable prey parts, and nearly half of them contained small pieces of rigid coloured plastic (*cf.* Baltz and Morejohn 1976).

Fish (especially juvenile rockfish and northern anchovies) were the most important prey among Monterey Bay samples, both by volume and by frequency of occurrence; by number fish ranked second (Table 1). Fish or parts of fish occurred in as many stomachs as gizzards (about 95% of the birds).

By volume, the proportions of rockfish and anchovies were about equal, but anchovies occurred in almost twice as many birds. These two taxa dominated the diet in different months (Fig. 2B): in June, rockfish accounted for 93% of the diet by volume, 36% by number, and occurred in 20 of 23 full stomachs; anchovies first appeared in August when they comprised 90% of the diet by volume and 37% by number and occurred in 18 of 24 full stomachs. The rockfish averaged 70 mm SL; average weight was 5 g. The anchovies averaged 125 mm SL and 24 g in weight.

Cephalopods, primarily squids, were the second most important prey by volume and occurrence (Table 1). Although cephalopods were as common as fish, they only made up 5% of the total volume of stomachs containing food, and although 94% of the gizzards contained cephalopod beaks (as many as 73 sets of market squid beaks in one gizzard), only 36% of the stomachs had squid remains.

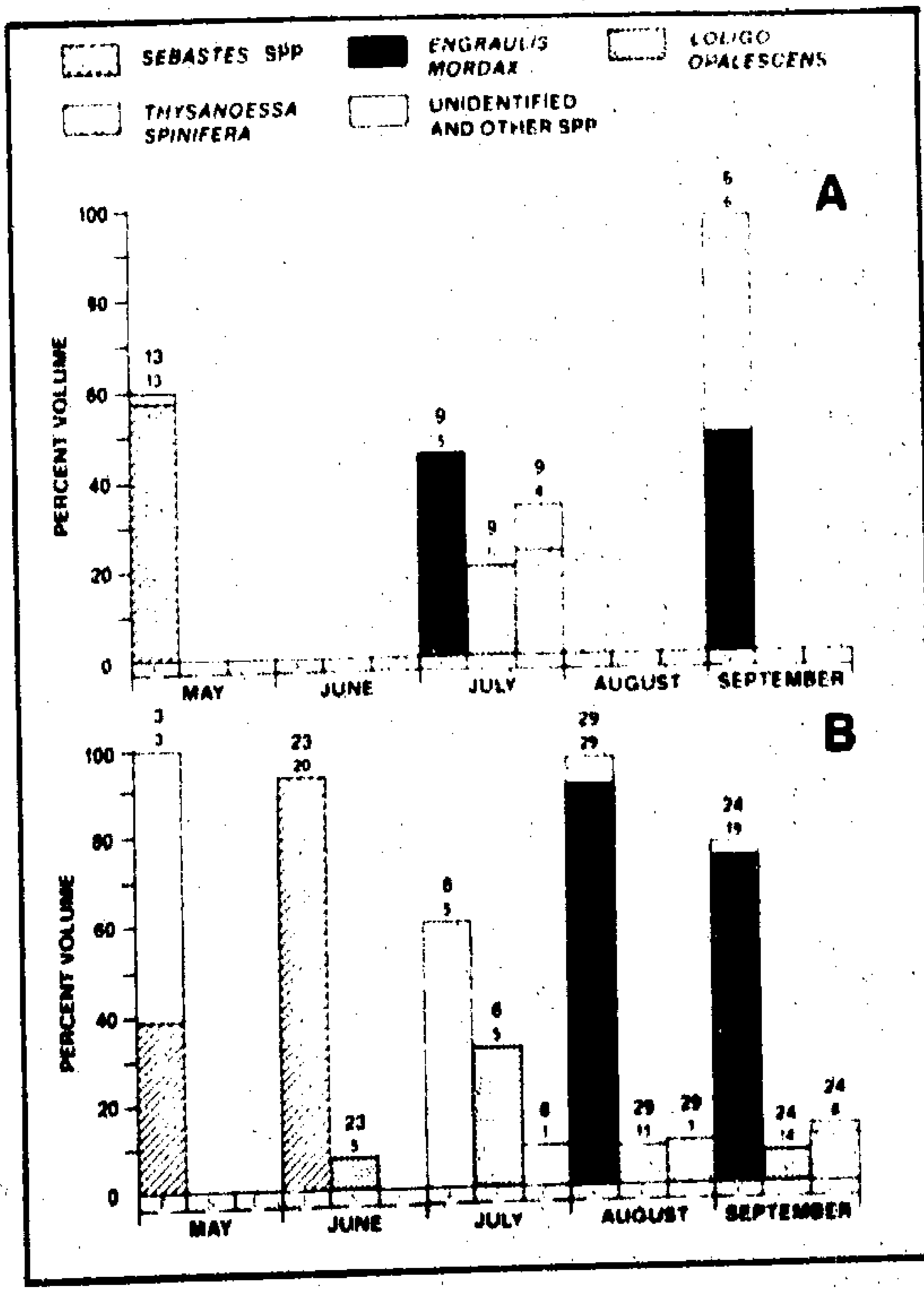
Market squid was the only cephalopod species found nearly whole in stomachs. As determined from regression equations of lower beak dimensions against body measurements, average dorsal mantle length was 109 mm (Kashiwada and Recksiek 1979), and average weight was 20 g (Clarke 1962). Beaks of the octopod *Octopus rubescens* and the squids *Onychoteuthis borealijaponicus* and *Gonatus* spp. occurred regularly in gizzards but rarely in stomachs. Measurements of two intact lower *Gonatus* beaks indicated that the whole animals weighed 48 g and 59 g (Clarke 1962).

Table 1
Major prey of Sooty Shearwaters from Monterey Bay (1978–79) and southern California (1977). Percent occurrence combines data from stomachs and gizzards; percentage volume and percentage number are based on full stomachs only (MBay, Monterey Bay; SoCal, southern California; *N*, number of birds)

	% occurrence		% volume		% number	
	MBay ($N = 154$)	SoCal ($N = 37$)	MBay ($N = 87$)	SoCal ($N = 29$)	MBay ($N = 87$)	SoCal ($N = 29$)
Fish*	97.4	94.6	91	84	33	28
Engraulis mordax	41.6	27.0	44	53	6	1
Sebastes spp.	22.7	62.2	44	17	20	25
Merluccius productus		51.4				
Scorpaenichthys marmoratus		8.1		<1		<1
Cephalopods*	94.8	74.8	5	6	4	2
Loligo opalescens	68.8	35.1	5	6	3	2
Onychoteuthis/*Gonatus* spp.	47.4	35.1				
Gonatus spp.	40.3	18.9				
Onychoteuthis borealijaponicus	29.2	8.1				
Octopus rubescens	19.5	2.7				
Histioteuthis heteropsis	9.1	2.7				
Crustaceans*	17.5	18.9	3	10	63	70
Thysanoessa spinifera	4.5	10.8	3	7	59	65

*Unidentified and identified material.

Figure 2
Monthly changes in volume of prey in three major categories (F, fish, S, squid, C, crustaceans) found in stomachs of Sooty Shearwaters from southern California (A) and Monterey Bay (B). Numbers above bars represent the number of full stomachs (top) and the number of stomachs containing that prey category (bottom). No birds were collected from southern California in June, and only one bird containing 100% *Engraulis mordax* was collected in August.



Euphausiids (*Thysanoessa spinifera* and *Euphausia* sp.), which occurred mainly in September (Fig. 2), were by far the most numerous prey, but their contribution by volume and frequency was small.

5.1.2. *Southern California* — Of 37 gut samples, 29 stomachs (78%) contained food, and eight were empty; altogether 30 gizzards contained identifiable prey parts. Over half contained plastic pieces.

As in Monterey Bay, fish were the most important prey by volume and frequency of occurrence and second by number (Table 1). Fish otoliths were more frequent in gizzards (80%) than were whole fish in stomachs (45%). Of the whole fish, northern anchovies and juvenile rockfish predominated although three birds collected in May contained juvenile cabezon (*Scorpaenichthys marmoratus*). In contrast to Monterey Bay, rockfish occurred more than twice as often as anchovies (primarily in May, and in July as otoliths) but their percent by volume was about one-third that of anchovies. In addition, the rockfish were smaller than those from Monterey Bay, averaging 31 mm SL. Otoliths from juvenile Pacific hake (*Merluccius productus*) were common in May and July samples, but intact animals were not found.

Cephalopod remains were also common, but nearly whole market squid occurred only in six of nine birds in July. Generally, cephalopod remains were less common than fish remains, and they were more common in gizzards (90%) than in full stomachs (45%). Beak fragments from the squids *Onychoteuthis borealijaponicus* and *Gonatus* spp. occurred regularly. Measurements of a whole lower beak from *O. borealijaponicus* indicated a live weight of about 45 g (Clarke 1962).

Euphausiids (*Thysanoessa spinifera*) occurred only in July (Fig. 2A), yet they outnumbered other prey taxa more than two to one. Their overall contribution to the diet by volume was comparable to that of market squid (Table 1).

5.2. Moult

All birds collected in Monterey Bay from May through July wore a mixture of old, new, and growing feathers, but by August, one-fourth of the birds had entirely new plumage; by September, over half the collected specimens had completed their moult. The number of wing and tail feathers in moult was greatest in July (Fig. 3). Wing moult progressed outward from the innermost primary and in both directions from the region of the fourth to sixth secondary; it progressed faster and was completed earlier than body moult. Ogi *et al.* (1981) observed similar patterns among Sooty Shearwaters collected in the northwestern Pacific.

5.3. Body weight, fat, and water content

Except for a 12% decrease in July, mean body weight (weight at collection minus gut contents) increased from May through September (Fig. 4); visible fat also increased. Skin fat thickened from less than 3 mm to 10 mm; it was usually several millimetres thicker at the furcula than over the abdomen and thinnest on the back. Early in the season, perivisceral fat was found only in the mesenteries, but by September it had surrounded the viscera (Fig. 5). The correlation among all the visible fat measurements was high (Pearson $r > 0.80$, $P = 0.0001$ for each paired comparison).

Fat — extracted and predicted from equation 2, section 4.2 — also increased from May through September (Fig. 4). The lightest extracted specimen, collected in May, had only 56.8 g of fat, equivalent to 8% of its body weight (corrected for plumage removal). In comparison, the heaviest specimen, collected in September, had 542.9 g or 41% of its body weight in fat. Using a two-way analysis of variance (unbalanced design, Helwig and Council 1979, pp. 242–263) on the data in Fig. 4, I compared the mean values of extracted and predicted fat for each month and also among months (Table 2). Differences between extracted and predicted fat content for each month were not significant, but there were significant differences among months. Duncan's multiple range test (df = 147, alpha = 0.05) revealed no significant differences from May through July, but significantly higher fat content in August and again in September; mean August and September values differed significantly from those of May, June, and July and also from each other. In contrast, there were no statistically significant changes in lean dry weight or water content (Fig. 4).

6. Discussion

6.1. Feeding habits and diet

Most Sooty Shearwater prey in this study either form large surface schools as adults (market squid, anchovies, and euphausiids) or have pelagic schooling juveniles (rockfish, hake, other squids, and *Octopus rubescens*); their distributions off California (Frey 1971, Young 1972, Roper and Young 1975, Anderson 1978) are closely tied to the seasonal distribution of Sooty Shearwaters (Chu and Briggs, unpubl. data). For example, the seasonal abundance of larval rockfish and hake in southern California (Ahlstrom *et al.* 1978, Parrish *et al.* 1981) matches the appearance of juveniles in the diet: the larvae are most abundant in January through March, and juveniles occur in shearwater stomachs April through July. Squids and euphausiids seem to be taken whenever they are available. It is unclear whether deep-water forms whose remains were occasionally present in gizzards, (e.g. *Histioteuthis heteropsis* and *Vampyroteuthis infernalis*) were actively preyed on or scavenged from the surface. These species may have been the prey of some other animal(s) subsequently eaten by the birds. Moreover, there are more cephalopod beaks in gizzards than cephalopod bodies in stomachs, suggesting that beaks persist longer in gizzards and are thus disproportionately represented in seabird diet studies.

The variety of prey found in this study and in the northwestern Pacific (Ogi, this volume), the northeastern Atlantic (Brown *et al.* 1981), and in Monterey Bay during other years (Baltz and Morejohn 1977, Morejohn *et al.* 1978) suggests that Sooty Shearwaters feed on any appropriately sized prey concentrated near the surface; in the North Pacific Ocean, fish predominate.

Table 2
Two-way analysis of variance on monthly means of fat content measured by extraction (total $N = 12$) and fat predicted from equation 2, section 4.2 (see Fig. 4)

Source of variation in predicted fat	df	*SS*	*MS*	*F*	*P*
Among months	5	41.5	8.4	50.9	0.0001
Predicted *vs.* extracted	1	0.01	0.01	0.1	0.8
Error	141	23.3	0.2		
Total	147	65.3			

6.2. Fat and energy gain

Sooty Shearwaters are lean and in moult when they arrive off California in May; they complete their moult between May and August and fatten before departing southward in late summer. During this study, heavy moult in July coincided with a 12% loss of body weight and stored fat (Figs. 3 and 4), suggesting that moult substantially affects energy balance.

The birds fatten rapidly once moult is complete. As in migratory passerines and waterfowl, water content and non-fat body components remain constant while fat increases (Odum *et al.* 1964, Raveling 1979). Minimum fat content (0.03 g/g lean dry weight, or 67 g; see Fig. 4 and equation 3) is similar to the minimum fat content reported for nearly grown, 800 g Herring Gull chicks (*Larus argentatus*) and of migratory passerines (Odum *et al.* 1964, Dunn and Brisbin 1980). This amount probably represents structural tissue that is not extractable with petroleum ether and may not be usable as fuel (Odum *et al.* 1964). Maximum Sooty Shearwater fat levels lie within the range observed by Odum *et al.* (1965) for "very fat fall migrant [passerine] species" (2.0–3.5 g/g lean dry weight).

Several interacting factors could be responsible for pre-migratory fattening. It may occur simply because the energy budget becomes positive after moult or because of a change in some cellular fat setpoint (W. Bennett, pers. comm.). Studies on caged passerines have shown that rapid pre-migratory fattening results from hyperphagia induced by changing day-length acting on the hypothalamus (Odum 1960, Farner *et al.* 1968). Among Shooty Shearwaters, increasing numbers of feeding flocks observed at sea or an increase in the proportion of full stomachs in August–September might signal increased feeding rates, but such changes did not occur during this study. Although hyperphagia may exist, increased prey abundance or availability could also cause fattening. Another possibility is that the available prey could be higher in calories.

The caloric content of Sooty Shearwater prey off California varies (Table 3); therefore the amount of a single prey type that would meet energy needs at various stages in the annual cycle would also vary. Unfortunately, a shearwater's daily energy use is unknown. Energy requirements can, however, be estimated from the following equation for

Figure 3
Progress of moult among Sooty Shearwaters collected in Monterey Bay. Upper plot shows the mean percent of wing and body moult completed per bird for each month; lower plot shows the mean percent of growing wing and tail feathers per bird for each month. Vertical lines are 95% confidence intervals; numbers are sample sizes

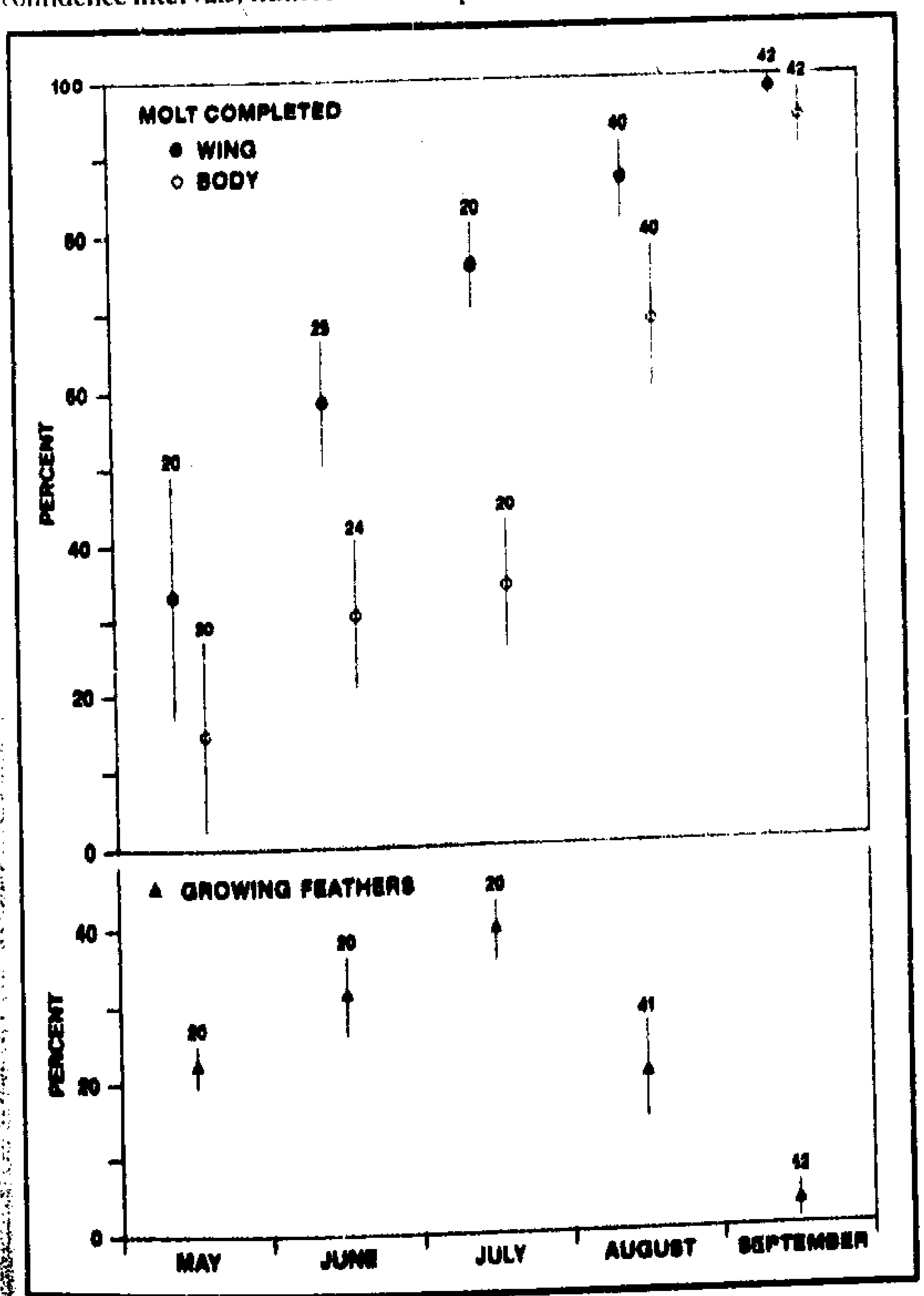
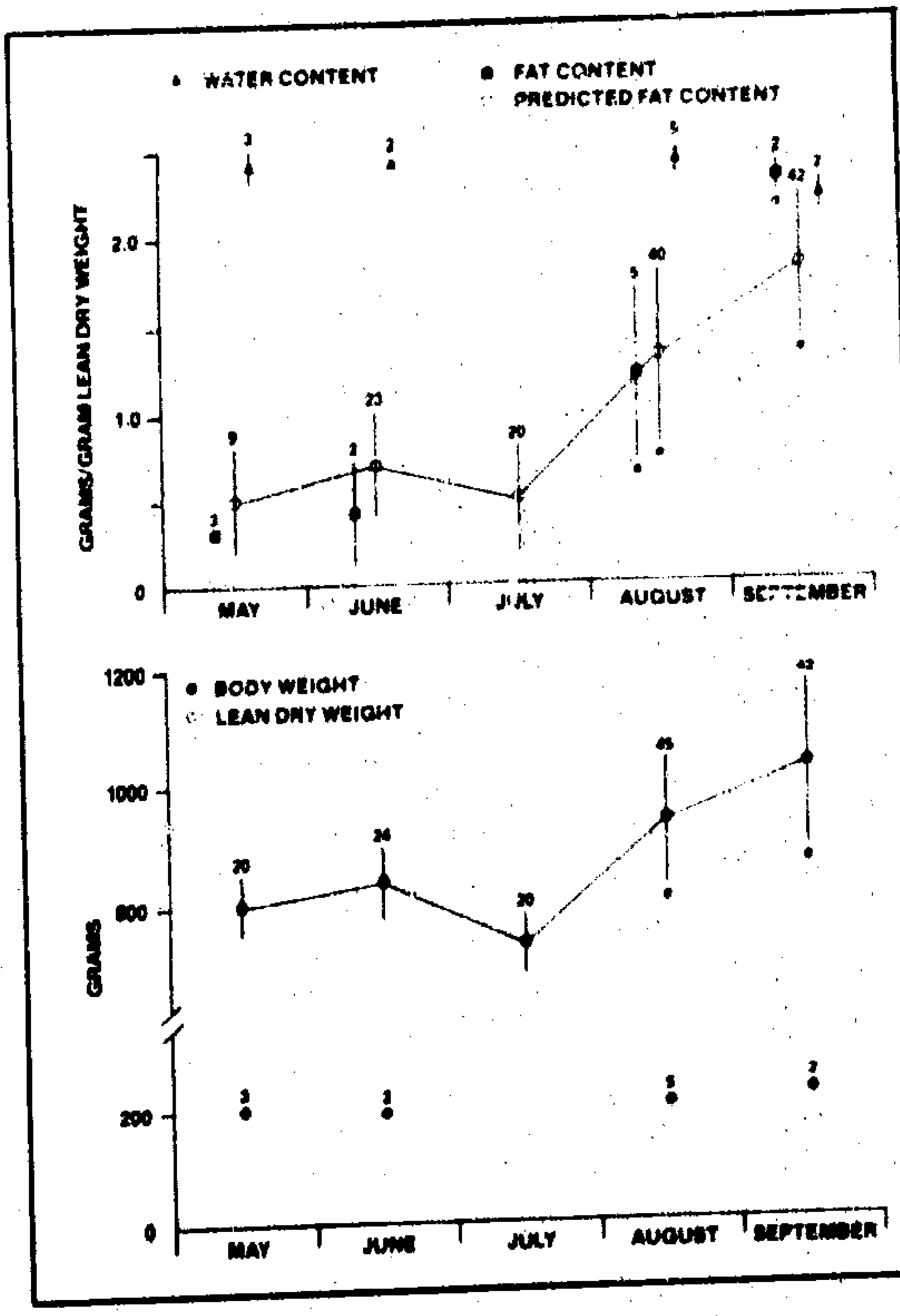


Figure 4
Changes in body weight, lean dry weight, water, and fat content among Sooty Shearwaters from Monterey Bay (means ± SD; numbers are sample sizes. Asterisks indicate mean weights and fat levels that differ significantly from the rest (for further explanation, see text)



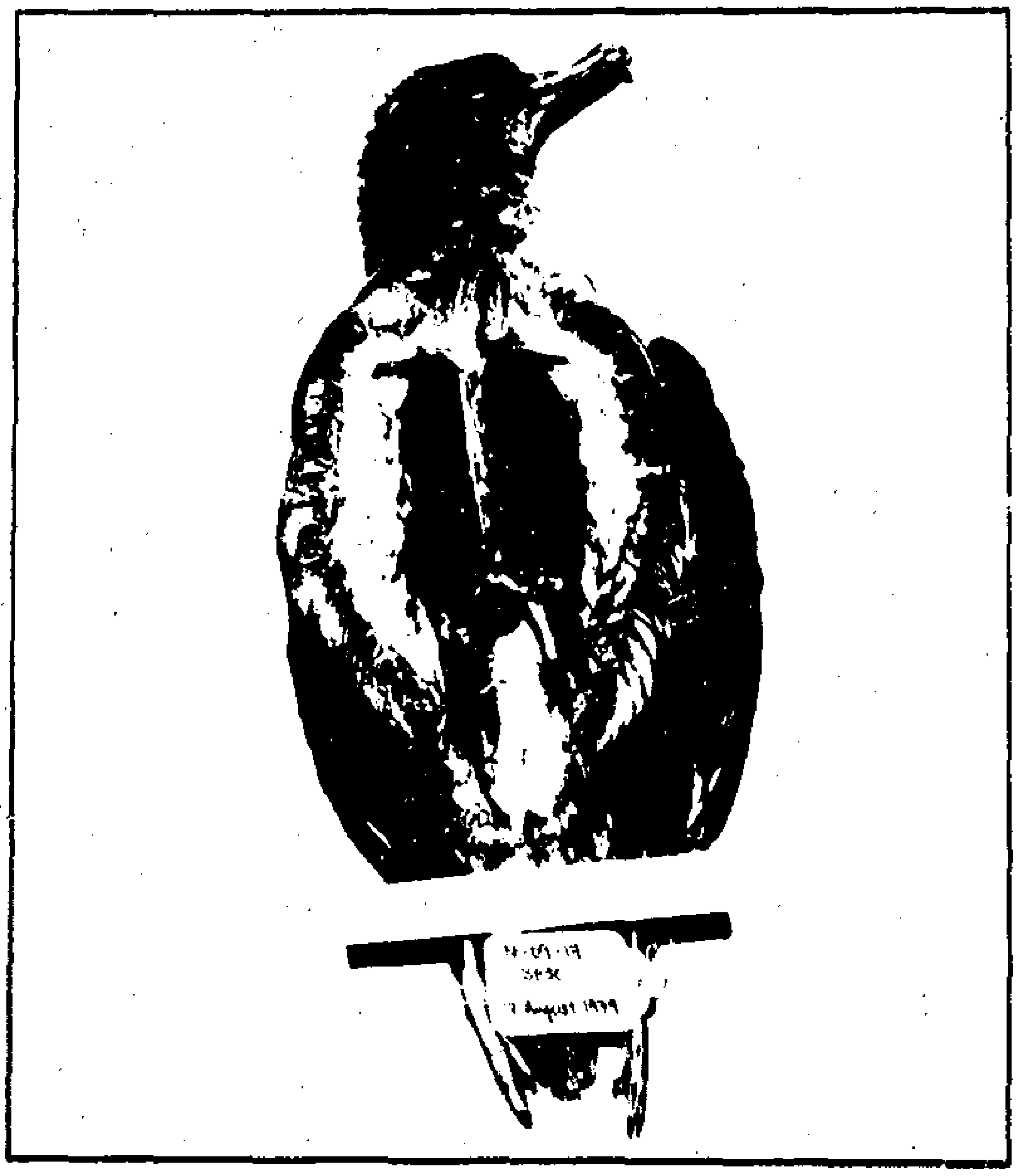
the daily energy expenditure (*DEE*) of a free-living non-passerine:

$$\log DEE = \log 317.7 + 0.7052 \log W,$$

where *DEE* is in kcal/day and *W* is body weight in kilograms (J.R. King 1974:39). From May through July, an average Sooty Shearwater weighs about 800 g and would therefore require 271 kcal/day to maintain its body weight (*cf.* Krasnow 1978). With more fat in August and September, however, mean weight exceeds 1000 g. In Monterey Bay fat increases averaged 142 g per bird in August and an additional 115 g in September. Since the caloric value of one gram of stored fat is approximately 9.0 kcal (Odum *et al.* 1965), August and September fat gains corresponded to 1278 kcal and 1035 kcal, respectively. Assuming an 81% assimilation efficiency for fish and 80% for squid and euphausiids (Krasnow 1978), the number of kcal needed per day would be

$$\text{kcal per day} = \frac{\text{kcal of fat increase per month}}{\text{assimilation efficiency}} \times 30 \text{ days/month}$$

Figure 5
Heavy skin and perivisceral fat



Sooty Shearwaters must have consumed at least 324 kcal per day from July to August and 367 kcal per day from August to September to put on the additional fat. The number of "meals," or full stomachs, per day that would meet these caloric requirements would equal

$$\text{kcal required / (kcal/meal)} \times \text{assimilation efficiency}$$

Changes in diet coincided with these changes in fat. In May–July, the diet consisted of 92% rockfish and 8% market squid, but in August–September when fat was increasing, oily anchovies made up 89% of the diet. Perhaps the late-summer abundance of anchovies in Monterey Bay facilitates pre-migratory fattening in Sooty Shearwaters there. Birds eating an average of 2.7 rockfish meals per day in May–July (Table 3) would be able to store fat in August–September on about the same number of meals per day of anchovies. Reduced anchovy availability might require a shift to lower-calorie prey such as squid or euphausiids. If these species were not available, or if the energetic cost of feeding longer or more often were disproportionately high, fat deposition could decrease substantially. Sooty Shearwaters are believed to feed little or not at all during the long return migration to the southern hemisphere (W.B. King, 1974; Imber, pers. comm.). If true, the amount and efficiency of fat deposition off California could determine migratory success.

7. Acknowledgements

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Table 3
Caloric value and estimated "meal" size for prey captured by Sooty Shearwaters in Monterey Bay and southern California

Prey	Wet wt, g	Wet wt, kcal/g*	Meal,† g	kcal/meal	No. of meals per day May–July 271 kcal	August 324 kcal	September 367 kcal
Engraulis mordax	25*	1.54	100	154	2.2	2.6	2.9
Sebastes spp.	5*	1.35	90	122	2.7	3.3	3.7
Loligo opalescens	20‡	1.23	80	98	3.5	4.2	4.7
Thysanoessa spinifera	0.15‡	0.98	33	32	10.6	12.6	14.2

*Wiens and Scott (1975), Brown *et al.* (1981).
†This study: mean number of prey per full stomach times wet weight.
‡This study.

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Appendix 1
Prey taxa identified from beaks, otoliths, or eye lenses in Sooty Shearwaters collected off California

Location and prey taxa	% occurrence	Number
A. Monterey Bay (N = 154)		
Fish*	97.4	4485
Clupea harengus	0.6	2
Engraulis mordax	41.6	266
Ophiodon sp.	0.6	1
Sebastes spp.	22.7	1007
Cephalopods*	94.8	1582
Gonatus spp.	40.3	125
Histioteuthis heteropsis	9.1	21
Loligo opalescens	68.8	942
Onychoteuthis borealijaponicus	29.2	117
Octopus rubescens	19.5	85
Vampyroteuthis infernalis	1.3	2
Polychaetes	4.5	
Plastic pieces	48.7	381
Other†		
B. Southern California (N = 37)		
Fish*	94.6	1275
Citharichthys sp.	8.1	13
Engraulis mordax	27.0	7
Merluccius productus	51.4	649
Otophidium scrippsi	2.7	1
Sebastes spp.	62.2	580
Tarletonbeania crenularis	5.4	23
Triphoturus mexicanus	5.4	2
Cephalopods*	78.4	140
Gonatus spp	18.9	12
Histioteuthis heteropsis	2.7	2
Loligo opalescens	35.1	54
Onychoteuthis borealijaponicus	8.1	13
Onychoteuthis/*Gonatus* spp.	35.1	46
Octopus rubescens	5.4	2
Polychaetes	2.7	
Plastic pieces	51.4	121
Other†	5.4	

*Includes unidentified material.
†Includes feather lice, algae, sand, pebbles, charcoal.