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FISH DROPPED ON BREEDING COLONIES AS INDICATORS OF LEAST TERN FOOD HABITS

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Studies of seabird food habits are frequently based on stomach contents, direct observation of feedings performed at breeding colonies, or food remains contained in regurgitated or fecal pellets (Ashmole 1968, Pearson 1968, Lemmetyinen 1973, Nisbet 1973, Vermeer 1973, Ainley et al. 1981). However, some species neither regularly regurgitate food nor produce feces or pellets containing identifiable food remains and, in the study of small or threatened populations, collection of even limited numbers of individuals for analysis of stomach contents is precluded. Investigation of food habits in these cases requires either remote observation of feeding activities, which is often logistically difficult, or indirect, alternative approaches.

Although there has been considerable recent research on the breeding biology and population trends of the endangered California Least Tern (*Sterna antillarum browni*) (Massey 1974; Massey and Atwood 1978, 1981; California Department of Fish and Game, unpubl.) little has been published regarding its foraging ecology. Atwood and Minsky (1983) found that most feeding activity near three California breeding colonies occurred within 4 km of the sites in nearshore ocean waters; terns nesting at colonies located adjacent to viable estuarine areas appeared to feed mainly in marsh habitats. Massey (1974) found the diet of Least Terns in California to consist mostly of small fish, and others (Hardy 1957, Tompkins 1959, LeCroy 1976, Thompson 1982) have reported similar findings in various populations of this species and in its Old World counterpart, the Little Tern (*S. albifrons*) (Marples and Marples 1934, Meinertzhagen 1954, Schonert 1961, Dement'ev et al. 1969, Nadler 1976, Spaans 1978).

Swickard (1972) and Massey (1974) noted that various species of fish are often found on the ground in Least Tern breeding colonies in California, and suggested that such specimens may provide an indication of food eaten by adults and chicks. In this study we examine the relationship between the prey eaten by Least Terns and that dropped in the colonies, and use samples of dropped food items as indicators of inter-colony and year-to-year differences in the species' diet.

STUDY AREAS AND METHODS

Prey items dropped on 10 Least Tern breeding colonies were collected, identified and measured during the 1978–1983 nesting seasons (May–August); four colonies were repre-

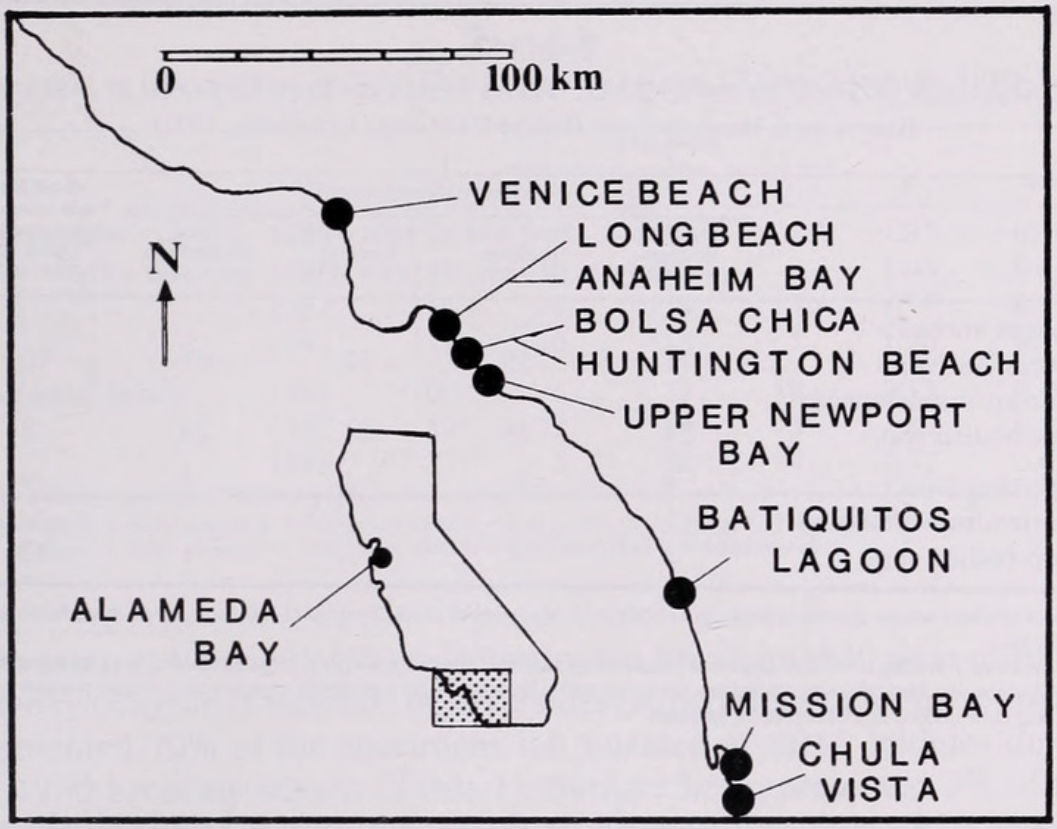

FIG. 1. Location of California Least Tern colonies represented by collections of fish dropped on substrate.

sented by samples obtained in at least two consecutive years. Colonies were distributed from the northern extreme of the Least Tern's California range south to the Mexican border (Fig. 1). Principal foraging habitats used by terns at different colonies varied somewhat, including: (1) nearshore ocean, harbors, and marina channels (Alameda Bay, Venice Beach, Long Beach, Huntington Beach), (2) tidal estuarine channels (Anaheim Bay, Bolsa Chica, Upper Newport Bay, Batiquitos Lagoon), and (3) sheltered, shallow bays (Mission Bay, Chula Vista).

To compare prey dropped and left in breeding colonies with food eaten by the terns, 131 feeding sequences between courting adults and 503 sequences involving adults feeding young were observed from May–July 1980 at colonies located at Venice Beach, Los Angeles County, and Huntington Beach, Orange County. Adult terns carrying prey were randomly selected as they approached a breeding colony and were observed until the food item had been transferred to another individual. The outcome of each feeding sequence was recorded in terms of whether the prey item was swallowed or dropped and left uneaten in the colony. Fish eaten during observed feedings were identified as to species whenever possible, and their body lengths placed in the following classes by comparison with the bill length of adult Least Terns: <2.5 cm; 2.5–5.0 cm; 5.0–7.5 cm; 7.5–10.0 cm. Prey items dropped and left uneaten at Venice Beach and Huntington Beach were collected during 1980 on 18 dates between 1 May and 20 June, and on 9 dates between 21 June and 1 August.

Clutch-size, shown to reflect variations in food availability in other *Sterna* spp. (Evans and McNicholl 1972, Nisbet 1973, Veen 1977), was monitored at Venice Beach during 1980–1983 and at Huntington Beach from 1981–1983. Only clutches initiated on or before 16 June were analyzed, thus eliminating from consideration the usually smaller clutches of

TABLE 1

COMPARISON OF FOOD EATEN BY LEAST TERNS WITH FISH LEFT UNEATEN AT VENICE BEACH AND HUNTINGTON BEACH BREEDING COLONIES, 1980

	% of fish observed eaten[a]				% of fish left uneaten on breeding colonies (N = 400)
	Courtship feedings (N = 130)	Small chick feedings (N = 107)	Large chick feedings (N = 392)	Total all feedings (N = 629)	
Northern anchovy/ silversides (spp.)	71	55	68	67	70
Unknown/miscellaneous slim-bodied spp.[b]	24	45	27	29	8
Surfperches (spp.)	4	—	3	3	9
Unknown/miscellaneous deep-bodied spp.	2	—	2	1	13

[a] Dates of observation: courtship feedings (15 May–25 May); small chick feedings (1–10 Jun.); large chick feedings (15 Jun.–25 Jul.).

[b] In columns referring to % fish observed eaten, this category includes mostly (>75%) unknown food items seen too poorly for specific identification. Northern anchovy and silversides (spp.) probably comprised a major portion of the unknown, slim-bodied fish observed to be eaten.

late-nesting individuals (Massey and Atwood 1981). Other possible indirect indicators of tern food availability, including frequency of egg abandonment, extent of non-predator related chick mortality and chick growth rates were also evaluated at these two colonies during 1980–1983; these data will be presented in detail elsewhere (Minsky, unpubl.; Collins and Atwood, unpubl.).

RESULTS

Observations of feeding sequences.—Small fish were the only prey item recorded during feeding sequences at Venice Beach and Huntington Beach in 1980, as well as during casual observations of Least Tern foraging activity in southern California during 1977–1983. We obtained no evidence that invertebrate prey represent an important portion of this population's diet during the nesting season.

Fish were rarely dropped in breeding colonies during feedings, with only 16 instances noted in 634 sequences. Fourteen of these 16 instances (87%) involved suitable food items that were dropped accidentally or as a result of lack of hunger on the part of the recipient. Five of these 16 dropped fish, 4 of which were suitable food items, were left uneaten on the ground, and 11 were retrieved and eaten after being dropped.

Although the size of prey eaten by Least Terns at Venice Beach and Huntington Beach in 1980 varied according to the feeding context, with small chicks receiving smaller food items than adults or juveniles, we obtained no indication that the composition of prey species changed significantly during the nesting season (Table 1). At least 67% of fish observed

TABLE 2
VARIATION IN CLUTCH-SIZE AT TWO LEAST TERN BREEDING COLONIES DURING 1980–1983

Colony	Year	N	Clutch-size 1	2	3	$\bar{x}$	SD
Venice Beach	1980	36	3	31	2	1.97	0.38
	1981	110	10	92	8	1.98	0.41
	1982	156	39	114	3	1.77[a]	0.50
	1983	128	10	113	5	1.96	0.34
Huntington Beach	1981	100	6	75	19	2.13	0.49
	1982	89	22	64	3	1.80[b]	0.51
	1983	77	5	58	14	2.12	0.49

[a] Significantly smaller (*t*-tests, $P < 0.05$) than 1980 ($t = 2.41$), 1981 ($t = 3.89$) and 1983 ($t = 4.22$) values.
[b] Significantly smaller (*t*-tests, $P < 0.05$) than 1981 ($t = 4.65$) and 1983 ($t = 4.16$) values.

to be eaten at Venice Beach and Huntington Beach in 1980 were northern anchovy (*Engraulis mordax*) or silversides (Atherinidae), and these species represented 70% of the specimens left uneaten at these colonies during the 1980 breeding season (Table 1). Surfperches represented 3% of fish observed eaten at Venice Beach and Huntington Beach in 1980, but 9% of the dropped prey items collected from these colonies; other "deep-bodied" species of fish were similarly over-represented in samples collected from breeding colonies relative to their occurrence as actual food items (Table 1).

Seventy-three percent of northern anchovies and silversides eaten by Least Terns of all age classes at Venice Beach and Huntington Beach in 1980 were <5.0 cm in length; in contrast, 87% of the individuals of these species dropped at these colonies were >5.0 cm in length. We observed no instances of northern anchovies or silversides being left uneaten on the substrate as a result of inappropriately large size per se; however, larger individuals of these species were frequently alive and struggling when transferred from parent to juvenile, and thus were more likely to be accidentally dropped. Over-representation in dropped fish collections of large northern anchovies and silversides relative to food actually eaten probably also reflects the increased chances of small dropped specimens being overlooked by investigators.

Analysis of food availability.—Least Tern food resources near Venice Beach and Huntington Beach were indirectly evaluated during 1980–1983. Mean clutch-size at both colonies during 1982 was significantly smaller than in 1980, 1981, and 1983 (Table 2). Similarly, significantly lowered asymptotic weights of chicks (Collins and Atwood, unpubl.) and increased levels of egg abandonment and non-predator related chick mor-

tality (Minsky, unpubl.) suggest conditions of low food availability near Venice Beach and Huntington Beach during 1982.

Collections of prey dropped in breeding colonies.—Major collections of fish dropped at 10 California Least Tern nesting areas during 1978–1983 are analyzed in Table 3. A total of 49 species of fish were found, all represented by individuals <1 year old. Most (59%) of the overall diversity resulted from the presence of 29 rarely encountered species that comprised only 3% of the total individuals collected (N = 3347). Northern anchovy and silversides (especially topsmelt [*Atherinops affinis*] and jacksmelt [*Atherinopsis californiensis*]) combined represented 67% of the total sample.

Thirty of 49 species of fish collected from nesting areas were represented primarily or entirely by individuals unsuitable as food items for Least Terns (Table 3); these species comprised 27% of the total individuals collected. General morphological characteristics of unsuitable prey species included preopercular or fin spines and/or maximum body depth or rotundity exceeding the gape width (approximately 1.5 cm as measured on fresh specimens) of adult Least Terns. Of deep-bodied species such as surfperches which were collected at Venice Beach and Huntington Beach in 1980, 89% of the individuals (N = 73) had maximum body depths >1.5 cm, and 38% were >2.0 cm. In contrast, "slim-bodied" species such as northern anchovy and silversides were represented mostly by individuals suitable as food items for Least Terns; 72% of these specimens collected at Venice Beach and Huntington Beach in 1980 (N = 351) had body depths <1.5 cm, and 100% were <2.0 cm.

Samples of fish dropped on various Least Tern breeding colonies showed significant inter-colony differences in the relative abundance of certain species (Table 3), apparently reflecting different feeding habitats and potential prey species available near each site. For example, terns at Venice Beach foraged primarily in nearshore ocean waters (Atwood and Minsky 1983) where schools of juvenile northern anchovy occurred (Fitch and Lavenberg 1971), and this species comprised up to 70% of the fish left uneaten at this colony. By contrast, terns breeding at Anaheim Bay fished mainly in shallow saltmarsh channels adjacent to the colony, where Klingbeil et al. (1975) found topsmelt and California killifish (*Fundulus parvipinnis*) to be common but northern anchovy and surfperches to be rare or absent during the summer months. Topsmelt and California killifish combined represented 82% of the fish dropped at Anaheim Bay in 1981, while northern anchovy and surfperches comprised only 7% of the sample. Samples of fish dropped at colonies located at Bolsa Chica and Batiquitos Lagoon, where terns similarly foraged mainly in tidal estuaries, were also dominated by topsmelt and California killifish rather than northern anchovy (Table 3). Deepbody (*Anchoa compressa*) and slough anchovies (*A.*

delicatissima), more southerly in distribution than the northern anchovy (Miller and Lea 1972), were the most abundant species dropped on colonies at the southern limit of the study area, but were rare or absent from sites farther north (Table 3).

Fish dropped in breeding colonies also showed significant year-to-year changes in species composition (Table 3), probably reflecting fluctuations in abundance or availability of those fish. In 1979, when large numbers of mosquitofish (*Gambusia affinis*) were stocked weekly in ponds adjacent to the Huntington Beach colony, the artificial population increase of this food species was clearly reflected by the increased occurrence of mosquitofish in samples of prey dropped on the adjacent breeding colony (Table 3). Similarly, the relative abundance of northern anchovy in samples of fish dropped at Venice Beach and Huntington Beach declined from 1978–1981 (Fig. 2), probably reflecting a documented decline during these years in the local availability of juveniles (<1 year old) of this important prey species (Methot 1982).

DISCUSSION

Collection of fish dropped on breeding colonies provides a simple way of monitoring Least Tern food habits at these sites. However, for the technique to be effective, a relationship must first be established between food items eaten by the terns and prey dropped and left uneaten on the nesting substrate.

Theoretically, if only suitable food items were dropped (due to surplus food and/or accident), samples of fish collected from the substrate would closely reflect prey eaten by terns at the breeding colony. If only unsuitable fish were left uneaten on the ground (because of difficulties in swallowing caused by inappropriately large size, spines or bad taste), samples would be poor indicators of actual food habits. Variations in the frequency with which suitable prey species were left uneaten on breeding colonies would be expected to crudely reflect overall food availability, since under poor food conditions not only would suitable prey items be captured less frequently by the terns, but those suitable fish which were brought to a colony would be "wasted" less often than when surplus food was present.

Palmer (1941) suggested that fish found dropped on Common Tern (*Sterna hirundo*) colonies were indicative of an abundant food supply, implying that many of the fish were surplus, but otherwise suitable, food items. However, he also noted that some fish had evidently been left uneaten as a result of excessively large size. Hulsman (1981:29) stated that "the width or depth of body of prey often limits the size of prey eaten (by terns) before its length does"; Courtney and Blokpoel (1980) found that although deep-bodied or rotund species were over-represented,

TABLE 3

RELATIVE ABUNDANCES OF FISH DROPPED ON CALIFORNIA LEAST TERN BREEDING COLONIES, 1978–1983

Species[b]	Breeding colony and year[a]																				
	AL	VB						LB			AB		BC	HB				NB	BL	MB	CV
	81	78	79	80	81	82	83	78	79	81	80	81	81	79	80	81	82	78	81	81	81
Clupeidae																					
Dorosoma petenense	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–
**Clupea harengus*	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Engraulidae																					
**Engraulis mordax*	11	70	53	47	28	17	65	60	33	25	2	5	5	59	41	19	13	71	13	22	8
**Anchoa compressa*	–	–	–	–	–	1	–	2	11	–	–	2	–	+	–	–	2	–	–	–	1
**A. delicatissima*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
**A. compressa/ A. delicatissima*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	43	27
Salmonidae																					
**Oncorhynchus tshawtscha*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Osmeridae																					
**Hypomesus transpacificus*	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hemiramphidae																					
Hyporhamphus rosae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Belonidae																					
Strongylura exilis	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–
Scomberesocidae																					
Cololabis saira	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cyprinodontidae																					
Fundulus parvipinnis	–	1	2	2	3	5	–	2	–	–	22	16	17	+	1	3	–	–	7	6	8

TABLE 3
CONTINUED

Species[b]	Breeding colony and year[a]																				
	AL	VB						LB			AB		BC	HB				NB	BL	MB	CV
	81	78	79	80	81	82	83	78	79	81	80	81	81	79	80	81	82	78	81	81	81
Atherinidae																					
**Leuresthes tenuis*	–	?	–	2	1	?	1	?	–	–	–	–	1	–	1	1	?	?	–	–	–
**Atherinopsis californiensis*	47	?	4	5	11	?	?	?	4	–	2	–	–	6	9	12	?	?	–	–	–
**Atherinops affinis*	7	?	16	17	16	?	?	?	4	42	52	64	42	14	12	37	?	?	78	25	19
*Atherinidae (spp.)	–	15	–	–	5	24	14	15	–	–	17	–	–	–	4	–	31	19	–	–	–
Gasterosteidae																					
Gasterosteus aculeatus	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Centriscidae																					
Macrorhamphosus gracilis	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Scorpaenidae																					
Sebastes serriceps	–	–	+	+	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S. paucispinis	–	–	+	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
S. spp.	–	1	+	5	1	2	1	–	–	–	–	–	–	+	12	1	2	–	–	–	–
Anoplomatidae																					
**Anoplopoma fimbria*	–	–	–	+	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Hexagrammidae																					
**Hexagrammos decagrammus*	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cottidae																					
Scorpaenichthyes marmoratus	–	1	+	2	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Leptocottus armatus	–	–	1	–	–	–	–	–	4	–	–	–	–	–	2	–	–	–	–	–	–

TABLE 3
CONTINUED

Species[b]	Breeding colony and year[a]																				
	AL	VB						LB			AB		BC	HB				NB	BL	MB	CV
	81	78	79	80	81	82	83	78	79	81	80	81	81	79	80	81	82	78	81	81	81
Carangidae																					
Trachurus symmetricus	–	–	–	–	+	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Pristipomatidae																					
Anisotremus davidsonii	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sciaenidae																					
**Seriphus politus*	–	–	–	–	+	1	–	–	–	–	–	–	–	+	–	–	–	–	–	2	–
Genyonemus lineatus	–	–	–	–	+	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Girellidae																					
Girella nigricans	–	–	+	–	16	2	1	–	–	–	–	1	–	–	–	2	2	–	–	–	–
Scorpididae																					
Medialuna californiensis	–	2	–	–	–	–	–	–	–	–	–	–	–	1	–	+	–	–	–	–	1
Embiotocidae																					
Amphistichus argenteus	–	–	–	–	+	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–
Hyperprosopon argenteum	1	1	4	4	2	7	2	24	7	–	–	–	–	5	2	–	6	–	–	–	–
Cymatogaster aggregata	16	5	7	7	2	5	4	–	15	17	–	2	1	13	2	17	42	9	2	–	9
Micrometrus minimus	–	+	5	1	4	2	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Phanerodon furcatus	3	2	4	–	–	1	–	–	22	–	–	–	–	+	–	–	–	–	–	–	–
Embiotocidae (spp.)	–	–	–	–	3	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pomacentridae																					
Chromis punctipinnis	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 3
CONTINUED

Species[b]	Breeding colony and year[a]																				
	AL	VB						LB			AB		BC	HB				NB	BL	MB	CV
	81	78	79	80	81	82	83	78	79	81	80	81	81	79	80	81	82	78	81	81	81
Sphyraenidae																					
**Sphyraena argentea*	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Clinidae																					
Heterostichus rostratus	–	–	–	–	+	1	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–
Gobiidae																					
**Gillichthys mirabilis*	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	2	9
Acanthogobius flavimanus	1	–	2	5	2	1	2	–	–	4	–	8	–	–	–	1	–	–	–	–	–
**Clevelandia ios*	–	+	–	–	+	–	1	–	–	–	–	–	8	–	–	–	–	–	–	–	3
**Quietula y-cauda*	–	1	–	–	2	29	6	–	–	–	5	–	3	–	–	+	2	–	–	–	12
Scombridae																					
Scomber japonicus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Centrolophidae																					
**Icichthys lockingtoni*	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Stromateidae																					
Peprilus simillimus	–	–	–	+	+	+	1	–	–	–	–	–	–	+	–	–	–	–	–	–	–
Centrachidae																					
Lepomis sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–
Poecilidae																					
**Gambusia affinis*	–	–	–	–	+	–	–	–	–	–	–	–	–	12	1	2	–	–	–	2	–

TABLE 3
CONTINUED

Species[b]	Breeding colony and year[a]																				
	AL	VB						LB			AB		BC	HB				NB	BL	MB	CV
	81	78	79	80	81	82	83	78	79	81	80	81	81	79	80	81	82	78	81	81	81
Cichlidae																					
Tilapia sp.	–	–	–	–	–	–	–	–	–	–	–	–	21	2	3	–	–	–	–	–	–
Cyprinidae																					
Cyprinus carpio	–	–	–	–	–	–	–	–	–	–	–	–	1	2	2	–	–	–	–	–	–
**Notemigonus crysoleucas*	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sample size (N)	73	379	267	230	545	181	123	126	27	24	102	91	118	250	170	312	48	66	46	63	106

[a] Percentage of each year's total sample (N) is provided; (+) = value less than 1%, (?) = species included in more general category of identification such as Atherinidae (spp.). Colony abbreviations as follows: AL = Alameda Bay, VB = Venice Beach, LB = Long Beach, AB = Anaheim Bay, BC = Bolsa Chica, HB = Huntington Beach, NB = Upper Newport Bay, BL = Batiquitos Lagoon, MB = Mission Bay, CV = Chula Vista.

[b] Family and species names based on Miller and Lea (1972).

* Species represented mostly (>50%) or entirely by individuals considered to be suitable food items for Least Terns.

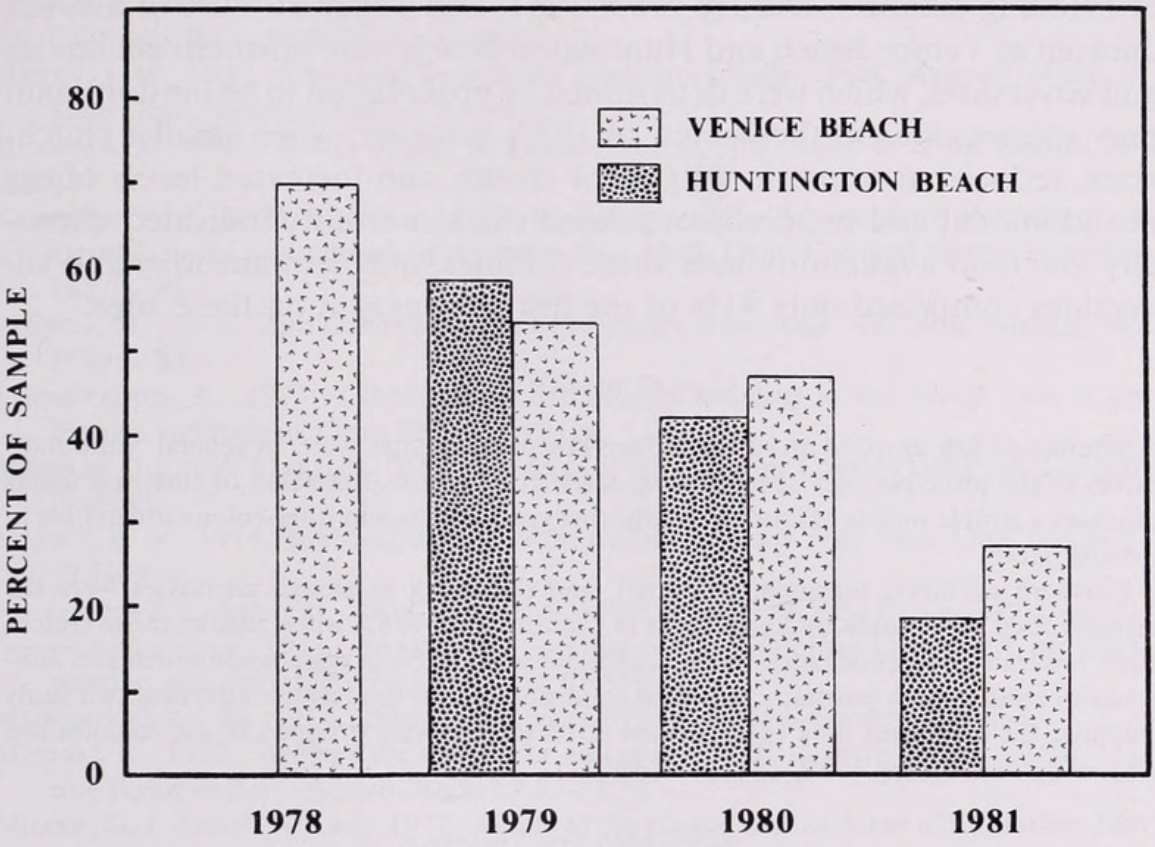

FIG. 2. Relative abundance of northern anchovy in collections of fish dropped at two study colonies.

samples of fish dropped in nesting areas accurately reflected the principal prey species eaten by Common Terns.

Collections of prey dropped by Least Terns appeared to correctly indicate the principal fish species eaten at breeding colonies in this study; however, various biases made samples of dropped fish inaccurate indicators of the size of prey eaten. Although unsuitable (especially deep-bodied) prey species were over-represented in collections of dropped fish relative to their use in observed feedings, in all cases samples obtained at the colonies were composed of primarily suitable food items that probably had been dropped as a result of accident or lack of hunger.

Northern anchovy was the dominant prey species in nine samples, silversides (especially topsmelt and jacksmelt) in seven, and deepbody or slough anchovies in two. These species appear to be the main food items eaten by Least Terns at California breeding colonies. This conclusion is consistent with an analysis of 11 stomach contents obtained from adult and juvenile Least Terns found dead in southern California (Kelly, unpubl.).

The relative abundance of the principal prey species in collections of dropped fish generally reflected overall food conditions in the vicinities

of breeding colonies. During 1980, 1981, and 1983, 61–70% of fish left uneaten at Venice Beach and Huntington Beach were northern anchovies and silversides, which were determined by observation to be the dominant prey species eaten at these sites. In 1982, however, when smaller clutch-sizes, reduced asymptotic weights of chicks, and increased levels of egg abandonment and nonpredator related chick mortality indicated unusually low food availability near these colonies, northern anchovy and silversides comprised only 41% of the fish left uneaten on these sites.

SUMMARY

Samples of fish dropped at 10 Least Tern breeding colonies were, in general, valid indicators of the principal prey species being eaten at a colony. Collection of such specimens provides a simple means of crudely monitoring year-to-year and inter-colony differences in feeding habits.

Northern anchovy, topsmelt, jacksmelt, and deepbody or slough anchovies were the primary food items eaten by Least Terns in California. In 1982, when smaller mean clutch-sizes, lowered asymptotic chick weights, and increased levels of egg abandonment and nonpredator related chick mortality indicated conditions of low food availability near two study colonies, the dominant prey species eaten at these sites were dropped in the colonies less frequently than during 1980, 1981, and 1983.

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