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POST-FLEDGING PARENTAL CARE IN THE WESTERN GULL[1]

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Abstract. Post-fledging parental care of Western Gulls (*Larus occidentalis*) was examined by following in-colony and post-dispersing movements of marked adults and young. At a large offshore colony, parental care ceased when young dispersed at a mean age of 70 days, but at some mainland and nearshore Western Gull colonies parental care may last longer. At the latter sites competition for food appeared low, foraging territories and food items could be defended by adults, and food sources were near nest sites. A low incidence of prolonged parental care in this species may result from activities of a few well-adapted individuals who specialize in foraging techniques facilitating extended breeding efforts.

Key words: *Parental care; Western Gull;* Larus occidentalis; *Pacific coast.*

INTRODUCTION

Parental care in sea birds, including large larids, is difficult to study after postbreeding dispersal due to problems in following parents and offspring (Burger 1980, 1981). Nevertheless, studies on the phenomenon are of special interest because mortality is high during the postbreeding period as a result of starvation in young and breeding stress in adults (Harris 1963, Carrick and Murray 1964, Drury and Smith 1968, Coulter 1975). Thus, the duration of the reproductive period is likely a result of a balance between extension, which would increase offspring survival but decrease that of parents, and shortening, which would have the opposite effects (Lack 1954, 1966; Williams 1966; Ricklefs 1977).

Most information suggests that a range of 60 to 90 days of parental care prior to dispersal (when young cease visiting the colony) is the rule among large larids (review by Burger 1980; see also Briggs 1977, Burger 1981, Holley 1982, Bellrose 1983), and that parental care is infrequent after dispersal (Brown 1945, Lloyd 1945, Drost et al. 1961, Vermeer 1963, Fordham 1964, Ashmole and Tovar 1968, Drury and Smith 1968, Briggs 1977, Bourne 1979, Holley 1982). Nevertheless, Burger (1980:417), using evidence derived from band recoveries, suggested "extensive and extended" postfledging parental care in several species of large larids, which, in the Western Gull (*Larus occidentalis*) included the late fall, i.e., several months after young disperse and are 120 to 180 days old. Although parental care of longest duration might be expected where gulls have the most favorable food supply, Burger (1981:453) concluded that food was not an important factor affecting the duration of parental care in Herring Gulls (*L. argentatus*), and Ricklefs (1977) suggested that the length of the reproductive cycle is, in fact, relatively inflexible among avian species because of genetic factors.

To investigate the above hypotheses we studied postfledging (= flying) parental care in marked individuals of Western Gulls breeding on Southeast Farallon Island (SEFI), California. We also made extensive observations of Western Gulls at nearshore locations spanning most of this species' range, which extends from southern Baja California to northern Washington. Our objectives were to determine the duration of parental care in these gulls and factors that regulate the duration of this period.

STUDY AREA AND METHODS

The study area included the California, Oregon, and Washington coasts. Western Gulls were not studied in Baja California; and due to the sedentary behavior of southern populations (Coulter 1975), gulls from this area probably entered the study area only in small numbers. Among the 21,500 pairs of Western Gulls breeding on the California coast, 12,000 bred on SEFI (Sowls et al. 1980; correction of SEFI estimate, Ainley and Boekelheide, unpubl.) Another 4,950 and 4,000 pairs, respectively, bred on the Oregon and Washington coasts (Pitman et al., in press; Speich and Wahl, in press; with reference to Hoffman et al. 1978, for ratios of Western Gulls, Glaucous-winged Gulls, *L. glaucescens,* and their hybrids).

SEFI is located 42 km west of San Francisco, and 35 km from the nearest mainland point (Point Reyes). As a result of a banding program DGA began in 1971, 8% of the breeding adults were individually marked with numbered and/or color-coded bands in 1979. In that year LBS monitored breeding success of 188 pairs. At least one member of each pair was individually marked; 223 marked adults were involved. In 1980, LBS monitored 84 pairs including 104 marked adults. The chronology of egg laying (1979) and hatching (1980; egg laying was not monitored) among these pairs did not differ

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($G = 2.12$, df = 5, and $G = 3.02$, df = 4, log likelihood ratio test; Zar 1974) from gulls in SEFI study plots (Ainley and Boekelheide, unpubl.). Chronology was compared in units of weeks. Chicks were individually marked with picric acid at hatching and later banded on each leg with uniquely color-coded bands. During the two years, respectively, study pairs produced 229 and 110 young that were seen subsequent to fledging.

To study postfledging behavior on SEFI, LBS read band numbers and color codes of young and parents daily from 12 August through 18 August 1979, in the colony and at club sites (= loafing areas of nonbreeders). He censused gulls in clubs on four evenings, and noted presence of individual young and parents at all nest sites each morning (0600 to 0900), evening (1800 to 2030), and on three afternoons (1130 to 1300). Colony observations were made from promontories and blinds. LBS conducted similar observations during one week each month from September 1979 through June 1980. During summer and fall 1979 and 1980, RPH observed marked parents and young on SEFI.

To study postdispersing behavior of Farallon Western Gulls, LBS observed marked young and adults at 326 sites monthly (July 1979 through May 1981, excluding June 1980) from the Mexico border to the Washington-Oregon border. Sites included all dumps and fishing ports and most creek and river mouths. At locations where gulls were not feeding, fish carcasses were used to attract them for closer observation. During the spring and summer, the Washington coast was also surveyed.

In 1980, additional information on the timing of dispersal from Oregon colonies was gained from casual observation at four colony sites: Table Rock (Bandon), Heceta Head, Haystack Rock (Cape Kiwanda), and Haystack Rock (Cannon Beach). We considered "extended parental care" as that occurring at least one month after the dispersal of Western Gulls breeding in respective areas; for breeding chronology see Coulter 1973, Hunt and Hunt 1975, Briggs 1977, Peters et al. 1978, Bayer 1983, Bellrose 1983, and this study.

RESULTS

POST-FLEDGING BEHAVIOR AT SEFI

By 12 August 1979, nearly all young had fledged; however, at least 69% of the study group had not dispersed from the island. We observed parents and young together only on territories. Although fledglings did not follow adults in flight, only an average 23% of the fledglings seen on territory during morning or evening censuses were on territory during afternoon censuses. Because few were seen elsewhere on the island, most were apparently at sea during much of the day. Some fledglings probably foraged; they were frequently observed up to 15 km from SEFI feeding on schooling prey in multiple species flocks, while others competed for fish offal discarded from commercial fishing boats. Small numbers foraged in intertidal areas, seabird colonies, and pinniped rookeries. In 1980, one fledgling seen at the mainland on 11 August reappeared on its territory on 21 August. This gull had been attracted to fish carcasses 45 km from SEFI. Although the fledgling's parents were also on territory on 21 August, it was not known if the fledgling was fed.

DISPERSAL FROM SEFI

We observed the first banded Farallon young at mainland sites on 2 August 1979 and on 1 August 1980. Nearly all young dispersed in August, and by September only 12 (3.5%) banded young were seen on SEFI. Most of the latter appeared weak, and at least six died on the island.

Burger (1981) and Holley (1982) noted that the amount of time Herring Gull young spent on territories declined abruptly a few days before dispersal, and that their visits usually occurred in the evening. Similarly, territory occupation by young Farallon gulls was highest in the evening, and territory attendance just prior to dispersal declined abruptly. Of 157 marked young observed on territory between 12 and 18 August 1979, 57 (36%) were seen only between 12 and 14 August. Of these 57, 14% were seen on all three evenings, 39% on two, and 47% on only one evening. Forty-five of the 57 were seen on the mainland or SEFI in later years, thus eliminating death as a cause of their disappearance. These 45 young averaged 65 ± 5.1 days (range: 57 to 77 days) of age when last seen on territory. The mean age at which territory occupation ceased was probably closer to 67 days because some young that visited territories briefly were probably missed during censuses.

Of the 57 young seen on territory between 12 and 14 August 1979, 25% were in SEFI clubs between 15 and 18 August, suggesting that many remained at the colony after territory attendance had become infrequent or had ceased. Two types of evidence, however, indicated that young attended clubs for only a few days before dispersing. First, occurrence of marked young decreased quickly. Of 15 banded young present at a major club on 12 August, the numbers of these gulls seen on 13, 14, 16, and 17 August were 10, 11, 5, and 2, respectively. None were found in other clubs.

TABLE 1. Observations of extended care by assumed parents at sites on the California (CA), Oregon (OR), and Washington (WA) coasts.[a]

Location	Date	Number of fledglings: Fed by adult	Number of fledglings: Sharing food w/adult	Distance to nearest nest (km)
Santa Cruz, CA	12 Sept. 1979	2		OBT[b]
Santa Cruz, CA	11 Sept 1980	1		OBT
Santa Cruz, CA	late Sept. 1984[c]		1	0.1
Bodega Bay, CA	21 Sept. 1979	1		OBT
Coquille Bay, OR	3 Oct. 1979		2	3.0
Coquille Bay, OR	27 Oct. 1979		1	3.0
Yaquina Bay, OR	2 Oct. 1979[d]		2	0.3
Yaquina Bay, OR	4 Oct. 1980[d]		1	0.3
Yaquina Bay, OR	28 Oct. 1980[d]		2	0.3
Yaquina Bay, OR	1 May 1983[e]	1		OBT
Pacific City, OR	30 Sept. 1979	1		8.0
Willapa Bay, WA	29 Sept. 1979		1	12.0

[a] Mean dates of fledging are mid-July in CA, late July in OR, and early August in WA (see Methods for references on breeding chronology).
[b] OBT = on breeding territory, but see Results: Observations of extended care.
[c] Pers. comm., B. Tyler.
[d] Same adult involved in each observation; this gull could be recognized by a deformed tarsus.
[e] The young (1983 hatching year) was fed by one member of a pair of adults (R. D. Bayer, pers. comm.).

Second, evening counts of young in clubs failed to account for the number absent from territories. In 1979, 72 (31%) of the marked young were not seen on territory during 12 to 18 August. All were alive because they were seen later. It follows then that if 31% of all fledglings on SEFI had stopped attending territories but remained at the island, club counts of about 5,280 would be expected (an estimated 17,040 chicks fledged in 1979, based on a 1.42 chick/pair fledging rate; Ainley and Boekelheide, unpubl.). The average count, however, was only 613 ± 46 ($n = 4$), or 12% of the expected number. This indicates that the great majority of young had dispersed. Supporting this was the low proportion (8%) of the 72 marked young not seen on territory but sighted in SEFI clubs during thorough daily surveys.

Therefore, with an average period of about 3 days spent in the vicinity of SEFI after cessation of territory occupation, we suggest that young dispersed at an average age of approximately 70 days.

Young from Oregon colonies also dispersed primarily in August. At four major colony sites a few young remained into early September, but none were seen in late September.

POSTDISPERSING BEHAVIOR OF FARALLON WESTERN GULLS

We saw 99 (29%) of the marked Farallon fledglings on the mainland from August through October (both years included). None accompanied adults. Similarly, in 12 of 14 cases where locations of the two parents and their offspring were known during August and September, parent-young separations were greater than 85 km, which is probably greater than the daily foraging range (Hunt et al. 1979). Separation distances averaged 369 ± 291 km, (range = 0 to 943 km; $n = 28$). There was no evidence of association between parents and offspring that foraged less than 85 km apart.

OBSERVATIONS OF EXTENDED CARE

We observed what appeared to be extended care by unmarked (with one exception) Western Gull parents at six locations (Table 1). Observations occurred in September (6), October (5), and May (1) when most young would be older than 75 days. We assumed that adults providing food to young were their parents, and that the young were not adopted (see Discussion).

At Santa Cruz and Bodega Bay, young and adults were seen together on known nest sites and flew together to foraging areas. At Bodega, the adults defended a territory that included a navigation marker (nest site) and foraging area on the tide flat surrounding the marker. At the Santa Cruz wharf, gulls nested on roofs and family groups foraged on the wharf where, in at least one year, an adult defended a foraging territory that it shared only with its young (B. Tyler, pers. comm.). At Coquille and Yaquina Bays, fledglings followed adults that provided preferential care when other young were near. Adults attending young chased intruding gulls and sometimes stopped feeding to stand guard while young fed. More often, young and adults fed together. Twice at Yaquina Bay (in two different years) an adult that was recognized by a foot deformity was attracted to offal and fed up to 15 min before the young arrived. The young landed 1 to 2 m from the adult and, showing no fear, rushed forward and fed with it although it chased all other intruders, including other fledglings. At Willapa Bay, two adults also gave preferential care to a fledgling.

The first adult was attracted to offal and fed several minutes before the second adult and fledgling arrived together. The two birds landed within 1 m of the first and began feeding with it. The first (largest) adult was not aggressive towards the two, but chased other intruders before and after their arrival. No comment can be made about the Pacific City observation (Table 1) because little other behavior was observed before all gulls were scared from the dump.

Except at Santa Cruz and Bodega Bay, locations of nests of gulls described above were not known. The (known) adult at Yaquina Bay was consistently present at the harbor during all seasons, however, suggesting that it nested nearby. It is also noteworthy that observations at Pacific City, Coquille and Willapa Bays occurred within 12 km of gull colonies (Table 1), and clinal variation in body size and mantle color known of Western Gulls (see McCaskie 1983) corroborated our suspicion that the adults involved were local nesters.

At Santa Cruz, Bodega Bay, and Yaquina Bay, 6 to 25 pairs nested on man-made structures (Bayer 1983, Spear, pers. observ.), while colonies nearest Coquille Bay and Pacific City were on nearshore islands and each consisted of several hundred pairs (Pitman et al., in press). Fish processing facilities were within several km of four of the locations (not Pacific City), and available food during the summer probably exceeded that being consumed. This was indicated by two years of monthly censuses showing winter counts of gulls at these facilities far exceeding summer counts (Spear, unpubl.), although winter supplies of offal remained stable or decreased because of reduced fishing effort during winter storms. A similar pattern was found during censuses at the Pacific City dump where the supply of refuse was constant and summer counts were low. These events were concurrent with a decrease in availability of oceanic food during the winter (reviewed by Coulter 1975).

Up to 1,000 pairs (Western Gulls, Glaucous-winged Gulls, and their hybrids), may have bred on Willapa Bay islands (Speich and Wahl, in press). Numbers breeding at these colonies have shown marked annual variation because of instability of shoal island nesting habitat (Speich, pers. comm.), a situation that should result in variable exploitation of local food sources.

DISCUSSION

As in other sea birds (Burger 1980), data on the duration of postfledging parental care of Western Gulls at breeding territories has heretofore been sparse, although available evidence suggested that it is uncommon after August. Based on the low frequency of adoption in Western Gulls (Hunt and Hunt 1975; Carter and Spear, in press), we assumed that the observed adult-young associations away from colonies involved parents and their offspring. Our evidence suggested that the few instances of extended parental care occurred where competition was low and stationary foraging territories or food items could be defended by parents, thus allowing young to forage or be fed while relatively undisturbed by other gulls. Proximity of food sources also appeared to be related.

In view of the above, the lack of extended parental care in Farallon Western Gulls is not surprising. On SEFI, gulls used foraging territories infrequently, and the maintenance of such territories on the mainland was impossible during the breeding season because of long commuting distances. Although oceanic food is generally abundant near SEFI during the breeding season, the Farallon gull colony is large and densely settled, and the high rate of kleptoparasitism (Pierotti 1981) suggests that competition is intense. Food items were regurgitated to young only on breeding territories where maximum safety from conspecifics is achieved.

Herring Gulls seem to respond to the environment similary to Western Gulls at the Coquille, Yaquina, and Willapa estuaries. In Maine, Drury and Smith (1968) noted that Herring Gulls extended care by establishing foraging territories in the intertidal zone. Each day they and their supposed young flew to these areas where the young foraged and were also fed. In New Jersey (Clam Island), Herring Gulls fed on an abundant nearby food source and completed foraging trips in an average 2.3 min (Burger 1981), compared to an average 2.5 hr for SEFI Western Gulls (Pierotti 1981). Clam Island gulls exhibited extended care only on breeding territories. The latter feeding situation and response resembled that of some Western Gulls at Santa Cruz and Bodega Bay. Holley (1982) noted that most Herring Gulls at a large, dense colony (Stert Island) had shorter, more consistent periods of parental care than young at a small rooftop colony (see also Bourne 1979). Foraging habits were not discussed, but more foraging competition would be expected at the large colony (Lack 1968). This range of situations was likely similar to that existing between the large Farallon colony, where competition for food appeared high and parental care short, and the smaller nearshore or mainland colonies having less competition and some instances of extended parental care.

The gull at Yaquina Bay that provided extended care during two consecutive years is of special interest. Holley (1982) found that certain Herring Gulls also extended parental care consistently longer than did others, and Briggs (1977) found the same in Western Gulls that maintained foraging territories in pinniped rookeries, compared to individuals that did not. Along these lines, Skokholm Island Herring Gulls that foraged on beaches, where foraging territories and food items could be defended, sometimes maintained relationships with young after dispersal (Davis 1975). Alternately, marked Skokholm adults specializing in foraging at local fish docks, where competition was high, were not seen at the docks with their (marked) young although some of the young were seen elsewhere.

Thus, besides a general response to the local environment, the duration of parental care seems to reflect types of foraging behavior. It follows that foraging specializations of certain gulls may preclude the extension of parental care beyond the population norm, whereas specializations of others may facilitate it. Although well-adapted individuals may become skilled at certain foraging techniques, competition from gulls specializing in similar foraging techniques at localized food sources would probably reduce or preclude their chance of extending the period of parental care where densities of conspecifics are high. The greatest range in duration of parental care could therefore be expected within gull colonies not fully exploiting available food sources, e.g., newly established and growing colonies, or colonies limited in size by predation, disturbance, or breeding space. This could explain the tendency for longer, but widely varying durations of parental care among members of colonies nesting on ephemeral habitat, compared to shorter, more consistent periods among members of colonies nesting on stable habitat.

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