11 Attendance Behavior of Galapagos Fur Seals ≅ *F. Trillmich*

INTRODUCTION

Galapagos fur seals permanently live close to the equator. They are the only fur seals that experience constant day length and minimal fluctuations between seasons. Tropical conditions are ameliorated by the influx of a cold surface current from the east, by the Peru or Humboldt current, and by an upwelling of the Cromwell countercurrent on the west coasts of the archipelago. Strong east winds along the coast of South America drive the Peru current, and this in turn induces the flow of the Cromwell countercurrent. Massive influx of these cooler waters is restricted to the so-called *garua* (drizzle) season, from approximately June to December. From January to May these currents are weak or absent, and surface water temperatures then rise throughout the archipelago (Houvenaghel, 1978).

On land the fur seals live at the edge of a hot lava desert, where during the day they are forced to retreat into shade or the water. Rock surface temperatures may reach 60°C and sea temperatures are unusually high for a fur seal environment. One of the coldest places of the Galapagos is Cabo Hammond, on the exposed west coast of Fernandina Island, where sea surface temperatures averaged 19 ± 2°C (1977, measured every 5 days during the cold season, between 15 August and 13 November) and never dropped below 15°C. The highest sea temperature measured near a fur seal colony was 25°C at Pinta Island in May 1978.

Since the fur seals remain near their breeding colonies all year, they must cope with these high temperatures. Due to reduced upwelling, primary productivity is lowest during the warm season (Maxwell, 1974), and very likely the abundance of fur seal prey is also low.

I began to investigate the Galapagos fur seal to determine whether this species would show peculiar adaptations to its low latitude environment. I hoped that the study of this special case, through contrast with the better-known subpolar species, might produce insights into the feasibility of adaptive shifts in life history patterns.

Fig. 11.1. Female Galapagos fur seal with yearling on a balance mounted in the shade of a wooden tunnel.

METHODS

This study was done at Cabo Hammond (long. 91° W, lat. 0°28′ S) on the southwest corner of the westernmost island of the Galapagos archipelago (Fig. 1.12). The coast in the study area consisted entirely of lava—either lava flows or large boulders smoothed by wave action. Two small sand beaches interspersed in this lava were never used by adult fur seals.

Observations were made in 1977, 1979, 1980, and 1981 during the reproductive seasons, which lasted from approximately mid-August until mid-November. Individually marked female and pup pairs were followed for up to 72 days. A long period of dependence and movements out of the area by females with young of 60 days or older made it impossible for us to follow a mother and young pair continuously for the whole suckling period. Instead, the behavior of mothers with known-age pups, yearlings, and 2-year-olds was sampled during the reproductive periods. In 1979 observations were made on (1) four females with pups for 192 female-days (mean = 48 days; range = 34–72 days); (2) four females with yearlings for 161 female-days (mean = 40 days; range = 36–47 days); and (3)

TABLE 11.1. Amount of time budget data on fur seal females with young of various ages.

Age of young	*Total observ. time (h)*	*No. females observed*	*Sex of young male: female*
1 day	46.7	4	3:1
5 days	47.2	4	4:0
10 days	48.9	5	4:1
ca. 20 days	20.4	2	2:0
ca. 30 days	32.1	2	2:0
ca. 60 days	36.6	3	3:0
1 yr	106.5	8	4:4
2 yrs	117.9	9	4:5

four females with 2-year-olds for 203 female-days (mean = 51 days; range = 30–64 days). In 1980 observations were made on five females with pups for 257 female-days (mean = 51 days; range 42–59 days). In 1981 six females with pups were observed for 221 female-days (mean = 37 days; range = 32–41 days).

Females were weighed by placing wooden tunnels with false bottoms (40 x 120 cm) in the colony. These tunnels provided shade for the female, and the false bottom, which was supported at each end by a scale, gave a measure of the seal's weight. Fur seal females readily accepted these retreats, and some females with pups were weighed repeatedly (Fig. 11.1). Readings were taken when a female was resting in the middle of the false bottom without touching either wall.

Attendance of females was checked at least at dawn and dusk and usually five to ten times in between. On many days observation in the study area was continuous. Females not actually seen arriving or leaving were assumed to have arrived or left in the middle of the interval between observations. This rule was operational but introduced a bias, especially for females leaving or returning at night. Such females were calculated to have returned or arrived at about midnight, whereas limited night observations and the TDR records indicated departures shortly after dusk and returns shortly before dawn.

Activity budgets of females with pups, yearlings, or 2-year-olds were recorded using instantaneous sampling every minute on the minute (Altmann, 1974). Females in constant attendance with newborn pups (<1 week old) were observed continuously during all daylight hours. Females with older young were observed from their arrival until sunset, and again the next day if they were still present. A few protocols were made during moonlit nights. Observations were made from a distance of 2–10 m. As the animals were well accustomed to the observer, this proximity did not cause any noticeable disturbance. Most behavior categories were self-explanatory; "lying down while suckling" was recorded as "suckling." As most suckling occurred while the female was lying down, the category called "lying down" by definition decreased as suckling time increased. Total observation times for females with young of various ages are given in Table 11.1.

RESULTS

Seasonal, Lunar, and Daily Fluctuations of Female Numbers

SEASONAL. Based on four visits to the study colony that occurred outside the reproductive season (December 1976, February and June 1978, and April 1981), no strong seasonal changes were seen in female numbers that would suggest an annual migration. Corrected for the phase of the lunar cycle (see section below), the total number of fur seals ashore was about equal in the 1977 reproductive period as in February and June 1978. Individually known females and their young were observed in the colony on all visits. Some had moved several hundred meters away from the study area, but this also happened during the reproductive period.

LUNAR. On a shorter time scale, numbers ashore showed a strong periodicity that correlated with the lunar month (Trillmich and Mohren, 1981). The data in Figure 11.2 were taken during the first month of the reproductive period. At the second new moon, female numbers ashore were higher than at the first because of the more frequent presence ashore of females with pups. The periodic changes in female behavior which produce these rhythmic fluctuations in numbers are documented below.

DAILY. Daily fluctuation of the shore population of fur seals varied with the lunar cycle. Except at full moon, when 90% or more of the individually marked females were found ashore, female numbers were always highest between 0800 and 1600 hours (Fig. 11.3), indicating that females preferred to be on land during the daylight hours and to forage at night. This pattern was most detectable at new moon and 3 days after full moon. It was hardly noticeable at half moon when minimal numbers were on shore at any hour of the

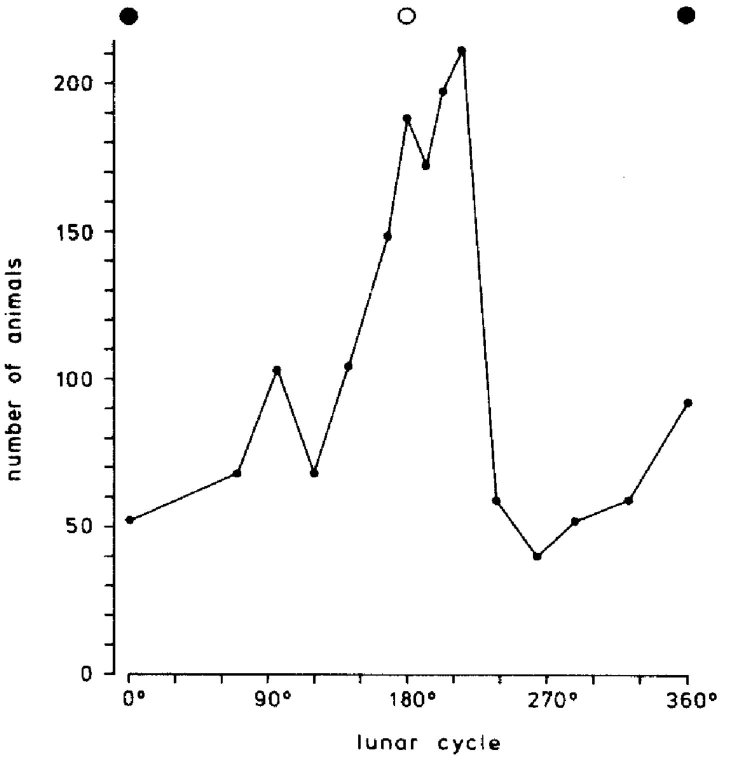

Fig. 11.2. Change in numbers of females over one lunar month (22 August to 20 September 1979). Censuses were made in the morning along 530 m of coastline at Cabo Hammond, Fernandina Island.

day. The full moon census represents a special case. At full moon the number of animals ashore exceeded the number of shaded resting sites; consequently, the numbers ashore dropped near noon as many females spent the noon hours resting near shore. The noontime decline occurred whenever the population was large, except on days with strong winds (the new moon census in Fig. 11.3 was such a day). Thus lunar and daily patterns were influenced by insolarization and wind speed. The full and new moon curves of females ashore were roughly symmetrical around noon, whereas the census of females ashore 3 days after full moon appeared asymmetric.

The Period of Dependence of Young

Births at Cabo Hammond occurred between August and November. Young regularly met with their mothers and suckled until about 2 years old or older. The birth of a new pup did not cause the weaning of dependent yearlings or, in many cases, of 2-year-olds. In such cases the newborn pup either starved to death within about a

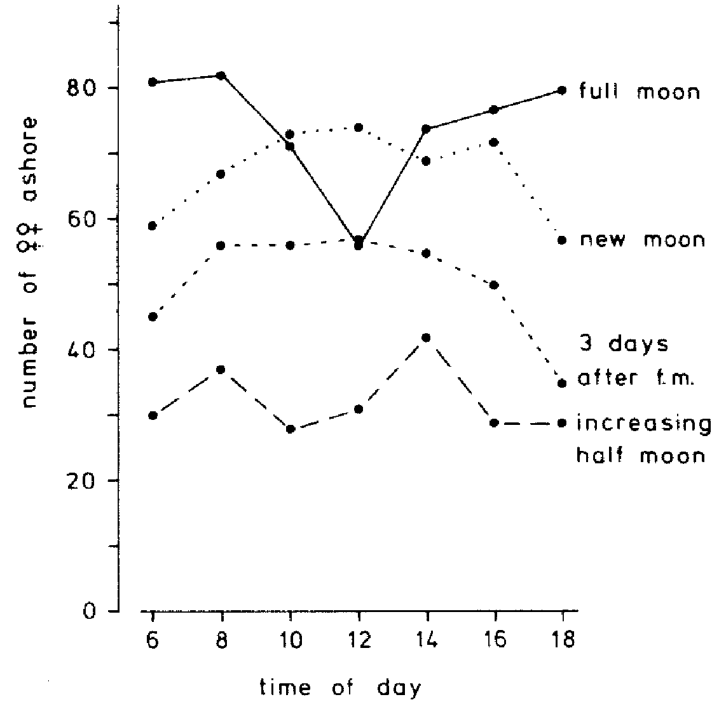

Fig. 11.3. Changes in female numbers ashore during the daylight hours at various stages of the lunar cycle. Counts made between 18 August and 9 September 1980 along 180 m of coastline. The new-moon census was made later in the reproductive season than the full-moon census (second new moon in Fig. 11.2); because of the constant presence of females with newborn pups, the numbers ashore were relatively high at this new moon.

month or was killed by its sibling (in about 5% of the cases). In about 20% of the cases, females temporarily suckled a pup and an older young together, but eventually the younger pup was outcompeted and starved to death. One exceptional case where two young were raised simultaneously is shown in Figure 11.4.

Dependence of the young sometimes extended beyond the second year. In fact, only in 1981 was weaning complete for the majority of 2-year-olds. Other observations indicated that young were often weaned in their third year of life. In three cases of known-age 3-year-olds (one male, two females), the male and one female were weaned before the onset of the reproductive period (at the end of their third year). The other female was weaned in a series of fights with the mother shortly after the latter had given birth again. If a female did not pup at the end of the third year, her 3-year-old sometimes continued suckling sporadically. One 4- or 5-year-old female

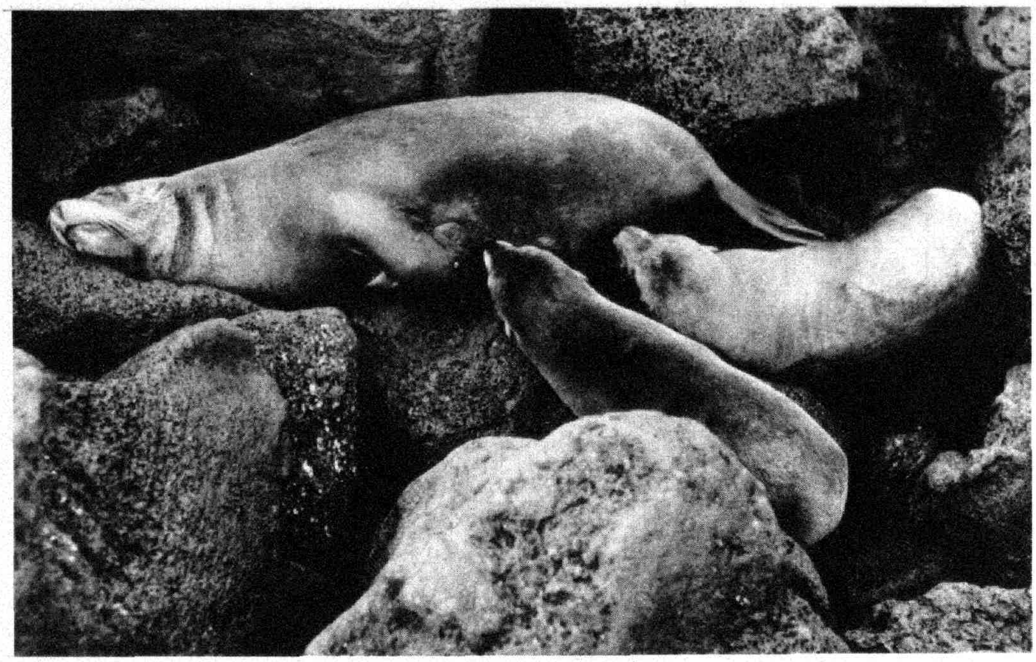

Fig. 11.4. Pregnant female suckling a yearling and a 3-year-old simultaneously.

was observed suckling even though it was about equal in body size to its mother.

The Feeding Pattern around Parturition

Before giving birth, females apparently stayed at sea for relatively long periods. One marked, pregnant female without dependent young was absent for 14, 10, and 9 days before coming ashore for parturition. This pattern closely corresponded with the attendance of one nonpregnant female without young, which was absent for 11, 10, and 9 days. Females appeared quite fat when they came ashore for parturition. They stayed in the colony for up to 2.5 days before giving birth.

After birth the females stayed with the newborn for the first 5–10 days (twelve mothers of male pups averaged 7.4 ± 1.2 days, ten mothers of female pups averaged 7.2 ± 1.2 days). During the first 2 days after birth, the mothers remained in almost continuous contact with their pups. Later on they sometimes left the pup for 5–20 minutes to cool off in the near-shore water.

During this time of continuous attendance, one female lost about 14% of her postpartum body weight of 32 kg (Fig. 11.5). This weight loss averaged 2% of body weight per day, or 0.64 kg/day.

After four foraging trips in a fortnight, she had regained 95% of her immediately postpartum weight. Judging from partial records obtained for three other individuals, this weight curve may be typical for females with newborn pups.

Females came into estrus 8.2 ± 1.9 days ($N = 25$) after birth of the pup. They usually copulated only once with a territorial male. Before copulation most observed females left their pup once for a night of foraging. Females left for these first foraging trips in the afternoon or evening and returned in the early morning. Soon after estrus, females established a regular schedule of feeding trips (Fig. 11.6). Only the first trip to sea and the first two periods of attendance thereafter were significantly shorter or longer, respectively (Table 11.2), than similar measures for females with older young for the same phase of the lunar cycle (see below). The tendency of females to make short feeding trips after parturition may be greater than this analysis suggests, since in some cases the first, short, nightly feeding trip may have gone unnoticed.

Timing of Arrivals and Departures of Mothers

Hourly arrival and departure times of females with pups, yearlings, and 2-year-olds showed no clear correlation with the lunar cycle. The distributions for mothers of pups were not significantly different among all 3 years (Chi-square test; $p > 0.1$) and have therefore been combined (Fig. 11.7A). Similarly, the distributions for mothers of yearlings and of 2-year-olds were indistinguishable (Chi-square test; $p > 0.1$) and were combined (Fig. 11.7B). Females with pups and females with older young, however, clearly differed from each other in their arrival and departure times (Chi-square test; $p < 0.02$ for arrivals; $p < 0.001$ for departures). While both groups of females arrived and departed in maximal numbers in the morning and evening, respectively, mothers of pups showed much broader distributions of arrival and departure times.

This preference for spending the day ashore and the night at sea was borne out again in the analysis of days when females made a choice between land and sea, i.e., days when they either left from or arrived at the colony or did both within one day. In 1979 and 1980 females with pups spent on average 59% of their time ashore in daylight and 41% during the night, whereas they spent 38% of their time at sea in daylight and 62% at sea at night.

This skew in the amount of day versus nighttime spent ashore or at sea was even more marked for females with yearlings, which spent 72% of their time ashore in daylight and 73% of their time at

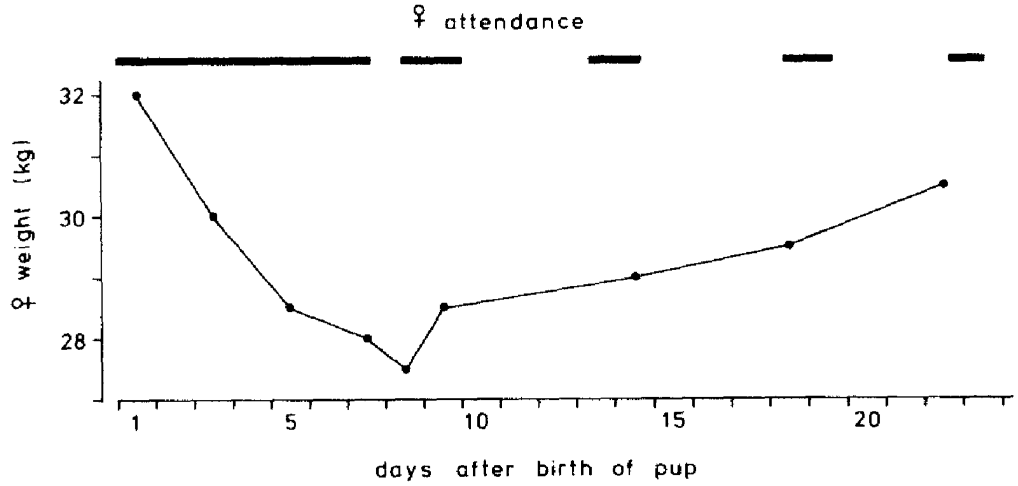

Fig. 11.5. Weight changes of a female over the first 22 days of her pup's life as related to her attendance ashore (days onshore indicated as black bars).

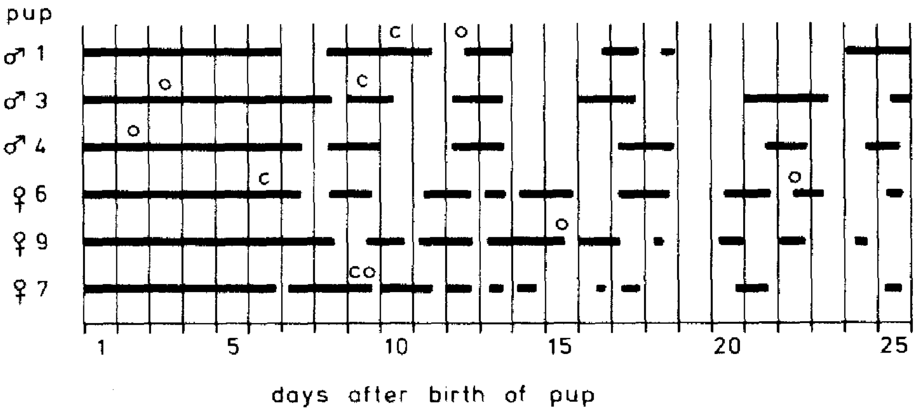

Fig. 11.6. Transition from permanent attendance ashore after birth of a pup (day 1) to the normal foraging routine. Circles are full moon; C is day of copulation (observed in only four cases). Key on the left indicates sex and number of pup.

sea during the night. The difference between females with pups and females with yearlings was significant (Mann-Whitney U-test; $p = 0.008$ for daytime on land, $p = 0.032$ for nighttime at sea). The TDR records also showed that females swam and dived most actively during the night (Chapter 12).

Time Ashore and Distribution of Attendance Duration

The partitioning of time between land and sea differed according to year and to the age of the female's offspring. For this analysis only

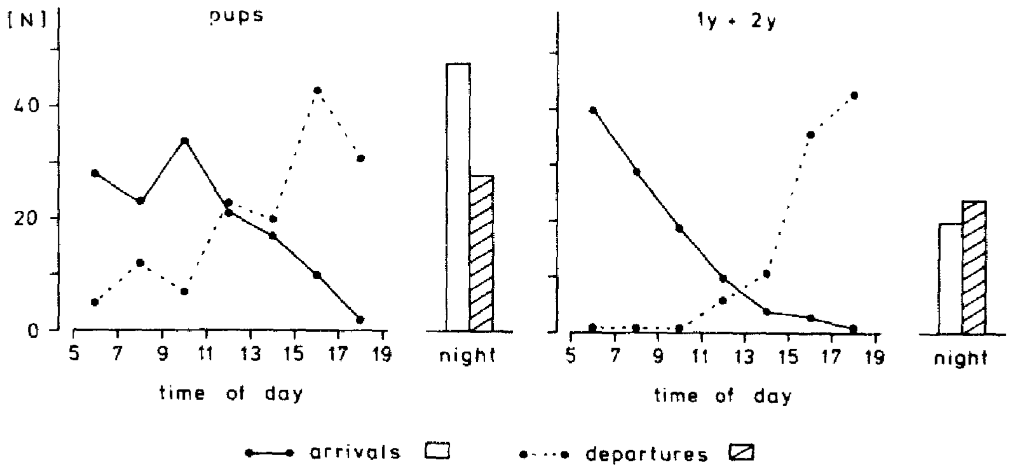

Fig. 11.7. Arrival and departure times of females. (A) Distribution of times for females with pups (data from four females in 1979, five females in 1980, and six females in 1981). (B) Distribution of times for females with yearlings and 2-year-olds (four each, 1979). Times are given as average times for 2-hour blocks (i.e., 6 = 0500–0659 hours). The columns give number of arrivals (a) and departures (d) during nighttime, i.e., between 1900 and 0500 hours.

TABLE 11.2. Relative duration of the first three absences and attendances of females after parturition.

Absence or presence	*Compared to average absence*			*Compared to average presence*		
	Shorter	*Longer*	p	*Shorter*	*Longer*	p
First	8	0	0.004	1	8	0.02
Second	6	3	n.s.	1	8	0.02
Third	5	4	n.s.	3	6	n.s.

Notes: The duration is compared to the average duration of absence or presence of females with older pups for the given lunar phase shown in Fig. 11.9 (Binomial test; one-tailed probabilities). n.s. = not significant.

records of females with young older than 10 days were used. In 1979–80 females with pups were ashore for 36.5 ± 4.4% of total observation time (nine females; 359 female-days), while in 1981 they spent 52 ± 6.4% of observation time ashore (six females; 161 female-days); this difference was highly significant ($p < 0.001$; Mann-Whitney U-test). In contrast to mothers of pups, females with yearlings and 2-year-olds spent only 31.4 ± 4.9% of their total time ashore (eight females; 364 female-days). This difference was significant even when only the 1979–80 data for mothers of pups were

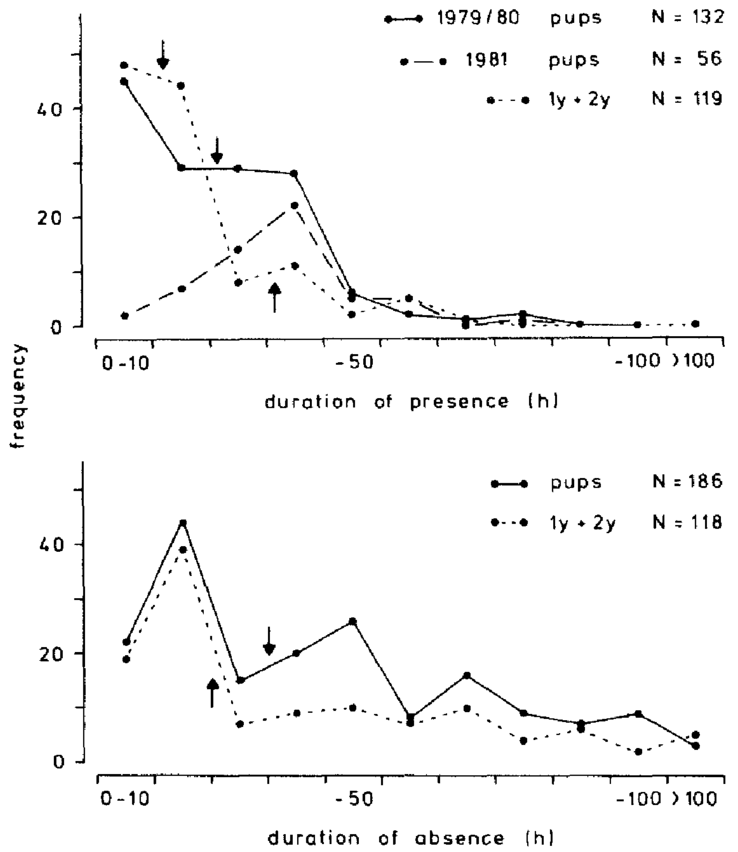

Fig. 11.8. Distributions of durations for attendance (above) and absence (below). For mothers of pups (left) distributions of attendance durations in 1979–1980 and 1981 are given separately. Vertical arrows point to medians of distributions. Total numbers of observations are indicated above the graphs.

tested against data from mothers of older young ($p < 0.025$; Mann-Whitney U-test).

The differences in time ashore for females with pups, yearlings, and older young were reflected in the distributions for the attendance durations (Fig. 11.8). The distributions for females with yearlings and 2-year-olds were not significantly different (Chi-square test; $p > 0.1$) and have therefore been combined. A greater sample of mothers of 2-year-olds may, however, reveal some differences. The distributions for females with pups in 1979–80 and in 1981 were very different from those of mothers with older young (Chi-square test; $p < 0.001$). Also, the median durations for mothers of pups (1979–80 = 21.5 hours; 1981 = 31.3 hours) were greater than for mothers of older young (only 12.0 hours).

Attendance times varied greatly both among mothers of pups (often about a day, but range = 1.5–72.5 hours) and mothers of older young (range = 2.5–59 hours). This great variability was correlated with the lunar cycle (Fig. 11.9). Clearly, all mothers remained ashore longest near full moon and spent the least time with their young at about decreasing half moon. Females with pups stayed ashore longer than females with older young ($p < 0.004$; randomization test) at all but one time (days 22–24) of the lunar cycle.

Time Absent and Distribution of Absence Duration

Time absent could not be considered a direct measure of foraging effort for these females since observations of absence times did not permit the conclusion that females indeed spent all this time at sea. Females carrying TDRs went ashore elsewhere after foraging in seven (22%) out of thirty-two cases. In four cases (13%) they spent a day resting in the water away from the study colony. Thus, when females were not foraging, they returned to their pups in only 65% of all cases, and rested elsewhere in 35%. Generally, females with pups (1979–80) spent less time away from their young than females with older young (63.5% and 68.6%, respectively; $p < 0.05$; Mann-Whitney U-test). In 1981 females with pups spent only 47% of their time away from the young, implying differences between years in attendance patterns. Females without young may have stayed at sea for long periods. One such female was observed with barnacles (*Conchoderma virgatum*) attached to her guard hair and vibrissae, indicating an uninterrupted stay at sea of at least 1 or 2 weeks.

Females with pups had a greater median duration of absence (32.5 hours, 1979–80; 30.6 hours, 1981) than females with older young (20.5 hours). This difference was not as clearly reflected in the distribution of absence duration as was the case with attendance times. In fact, the two distributions (Fig. 11.8) were not significantly different, nor were the distributions for mothers of pups in 1981 compared to mothers of older young in 1979 (Chi-square test; $p > 0.1$).

Since females with yearlings or 2-year-olds spent more total time at sea than females with pups, the latter obviously went to sea less frequently. The average number of foraging trips per 700 hours (ca. one lunar month) was 10.6 for females with pups in 1979–80, 10.3 in 1981, and 13.4 for females with yearlings and 2-year-olds ($p = 0.026$; Mann-Whitney U-test).

Time at sea also showed a strong phase relationship with the lunar cycle (Fig. 11.9). Females made the shortest foraging trips

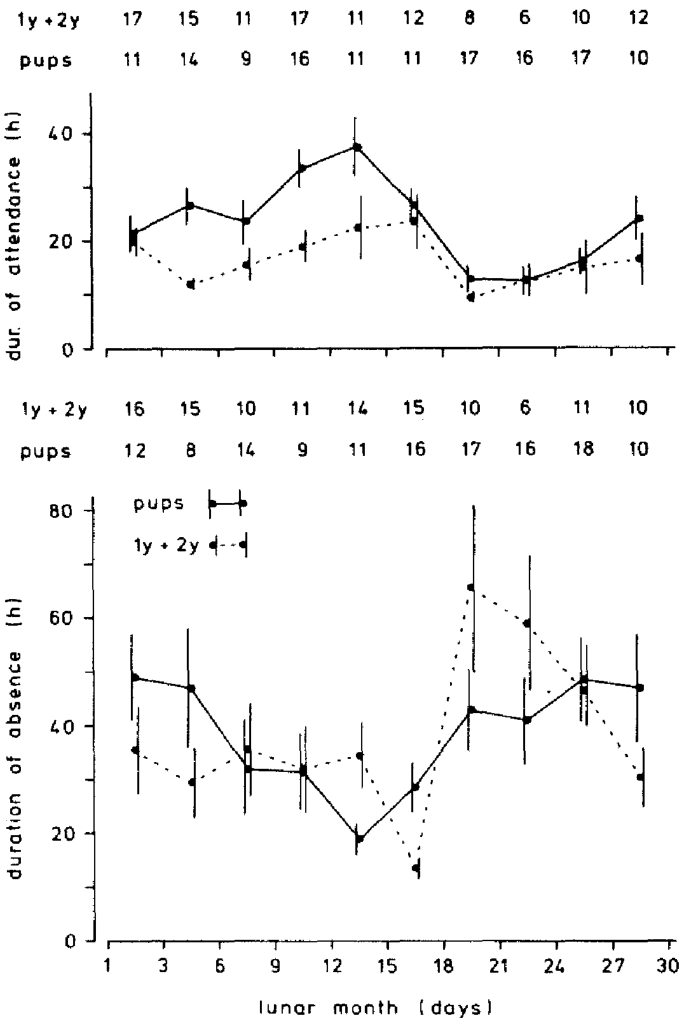

Fig. 11.9. Lunar periodicity in duration of attendance (above) and absence (below) for females with pups and females with yearlings or 2-year-olds. Note the differences in attendance times between females with pups and females with older young. Data were averaged for 3-day intervals. Bars are Standard Error of the mean; numbers above curve are number of observations per 3-day period. Days 1 and 30 are new moon.

around full moon and the longest between decreasing half moon and new moon. In this respect females with pups and with older young were not significantly different.

Female Time Budgets on Shore

Females were essentially resting when on land. Walking occupied 1.7% and grooming 1.9% of their time ashore. Females with young older than about 5 days regularly defecated and, around noon, cooled off in the water. Time in the water amounted to 2.5% of their attendance time. Pups did not accompany their mothers when they went to cool off, but yearlings and 2-year-olds often did. Social interactions with fur seals other than their own young took very little of a female's time (0.9%), attesting to the low density in the colonies. The few interactions between females occurred mostly in competition for preferred resting places in the shade; interactions with males consisted mainly of aggressive defense against subadult males and relatively few interactions with territorial males. No interspecific interactions occurred on land.

Females lay in any position while suckling, but they rarely suckled while sitting. Lying down and suckling accounted for 70%–96% of a female's time ashore. The amount of time spent suckling increased with the age of the young up to 1 year, then declined again in 2-year-olds (Fig. 11.10). Yearling and 2-year-old males suckled consistently more than female young of the same ages ($p < 0.025$; Mann-Whitney U-test; Fig. 11.11). Suckling time corresponded with average weight, since in both age categories males were significantly heavier than females (t-test; $p < 0.02$ for 2-year-olds; $p < 0.001$ for yearlings).

If a female stayed ashore for more than a day, which happened most around full moon, then on the second day ashore time spent suckling decreased (Fig. 11.11). This effect was very obvious among young from 30 days to 2 years of age. On the mother's second day ashore, young pups (15–60 days old) often left their mothers for extended periods, but older young, especially yearling males, remained in almost constant contact with the mother. Second-day suckling bouts for these older young became increasingly shorter and pauses between bouts increased gradually, thus reducing total suckling time.

Despite the enormous suckling time of yearlings, they must have foraged for themselves occasionally since their feces quite often were not the color of pure milk-feces. Two-year-olds often foraged for themselves, suckled much less than yearlings (Fig. 11.11), and separated more often from their mothers. However, a 2-year-old female wounded by a shark regressed to near total dependence on its mother's milk.

DISCUSSION

The observational data on the timing of female attendance (Fig. 11.7) and the direct data on swimming and diving times from the TDRs show that females forage almost exclusively at night. Because

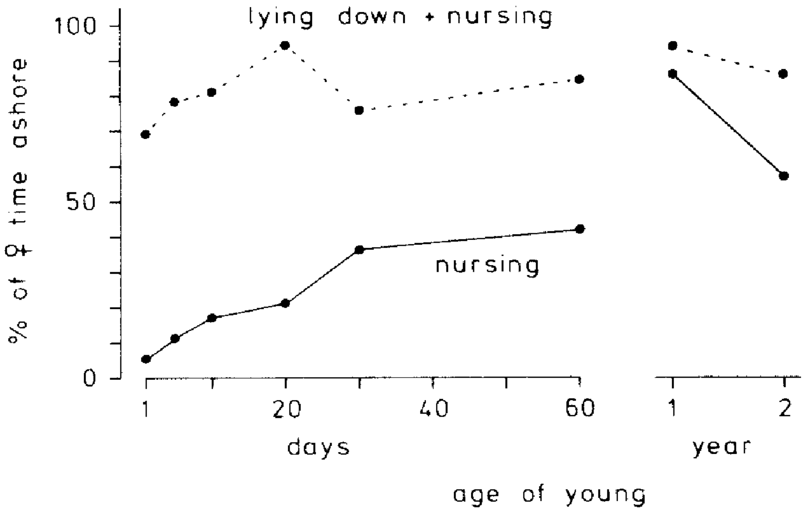

Fig. 11.10. Increase in proportion of time spent suckling with age of the young. Data from male young and from the first day of a female's attendance only.

we know from the TDR records that almost all of this foraging is done near the surface (Chapter 12), two hypotheses suggested earlier (Trillmich and Mohren, 1981) appear to account for the observed relation between lunar phase and time spent at sea (Figs. 11.2, 11.9).

First, food availability might vary due to changing patterns of vertical migration by the fur seal's major food organisms, cephalopods (mainly onychoteuthids; Clarke and Trillmich, 1980) and small schooling fish. Lunar illumination apparently inhibits the upward migration of some commercial fish stocks (e.g., *Trachurops crumenophthalma* in Colombia; F. Köster, pers. commun.) and of the larger larvae of the rock lobster, *Panulirus cygnus* (Rimmer and Phillips, 1979). If prey of the Galapagos fur seal also stayed deeper at higher illumination levels, the benefit of feeding might be exceeded by the metabolic cost of the deep diving and searching effort, thus making a rest ashore the better strategy (Chapter 15). A similar cost to benefit reasoning has been applied to the observation (Chapter 6) that the Antarctic fur seal feeds mostly at night, adjusting its diving depth to the nightly rise of krill (see also Iwasa, 1982).

A second hypothesis is that feeding fur seals silhouetted against the moonlit surface may be in greater danger from shark attacks than seals feeding at new moon. However, the prey of fur seals would also be silhouetted against the surface, making feeding easier. In this conflict situation, constant alertness to potential preda-

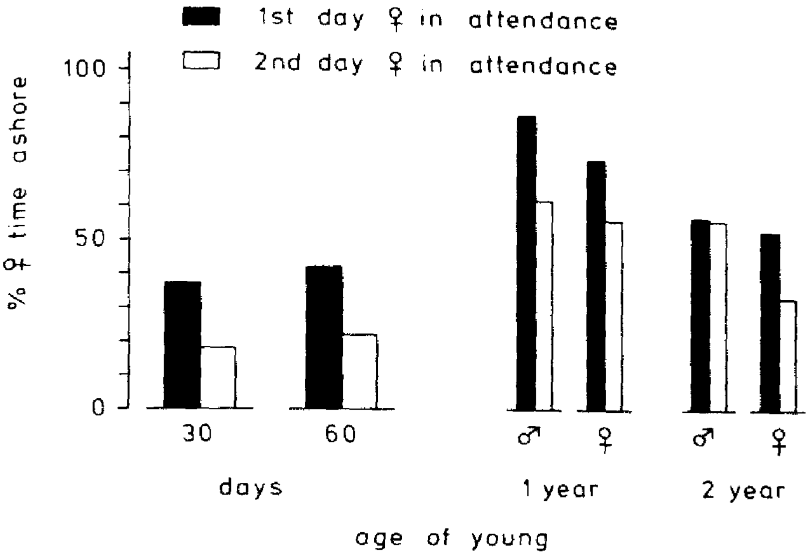

Fig. 11.11. Change in proportion of time spent suckling during the first and second day of a female's attendance with young of various ages and both sexes.

tory attacks might reduce foraging efficiency (Grubb and Greenwald, 1982; Milinski and Heller, 1978) to the extent that staying ashore during moonlit nights might be the better strategy.

Even if these hypotheses, singly or in combination, account for the periodically changing average duration of female attendances and absences, a great variance still exists around the means for each phase of the lunar cycle (Fig. 11.9). This variance must relate to the regulation of foraging effort in response to female needs (e.g., trying to maintain body weight; Fig. 11.5) and to the changing demands of her young when the abundance of prey is variable and its distribution is patchy.

Variability of prey abundance can at present only be inferred. For example, during the second of the two lunar half-months shown in Figure 11.12, many feeding frenzies of Blue-footed Boobies, *Sula nebouxii*, and one massive stranding of *Sardinops sagax* and *Scomber japonicus* were observed. Prey abundance near the colony was probably high. This proximity of food enabled the female to return more frequently to her yearling. Thus short-term increases in food availability apparently induce a female to return more often to her young.

In years of unusually good feeding conditions (such as 1981, when yearlings of both sexes were almost as heavy as 2-year-olds in previous years), females apparently regulated feeding effort by

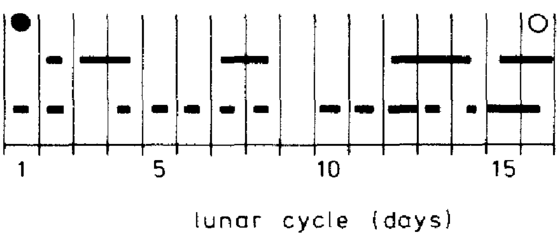

Fig. 11.12. Attendance (black lines) and absence (open) of one female with a yearling in two consecutive lunar half-months.

staying ashore longer (Fig. 11.8) rather than by shortening their foraging trips. This comparison between years also suggests that females may spend less time ashore and make more foraging trips per month during the warm season (January to May) if the fur seal's food supply is, indeed, lower then (Chapter 15).

Yearlings made greater energy demands on their mothers because they suckled much longer than pups (Figs. 11.10, 11.11) and obtained more milk from their mothers during a given stay ashore (unpubl. data). To facilitate this higher energy transfer, mothers of yearlings shortened their stays ashore, went to sea more frequently, and spent more of their total nighttime foraging, but they did not significantly lengthen individual foraging trips (Fig. 11.8).

In conclusion, females apparently responded to short-term fluctuation of food abundance by adjusting the length of individual foraging trips. They responded to long-term changes either in energy demands of the young or in food abundance at sea by changing the durations of visits to shore.

By extrapolation, a mother weaning her young at the end of its second year will probably have made about 300 foraging trips and spent about 3,000 hours suckling. These are crude estimates because we lack information on the feeding pattern during the warm season, and because age at weaning, which fluctuates between 1.5 and 3.0 years, appears to depend on the sex of the young and on feeding conditions.

Young of the Galapagos fur seal remain dependent longer than young of any other fur seal; the reasons for this are unknown. While the nonmigratory habit of the species makes the mother-young bond easy to maintain, this habit does not explain why young do not become independent earlier. Perhaps a seasonally reduced food level makes it difficult for yearlings or 2-year-olds to find sufficient food independently. However, food abundance in Galapagos waters is unknown. The feeding niche, which is restricted in both time and space (Chapter 12), may also contribute to longer dependence. Finally, predation pressure by sharks might tend to make prolonged maternal investment profitable. By prolonged suckling, females may significantly diminish the need of young to forage for themselves, and thereby reduce the risk of losing young through predation.

SUMMARY

Attendance behavior of the Galapagos fur seal was studied in three seasons between 1977 and 1981 at Cabo Hammond, Fernandina Island, Galapagos archipelago. This colony site is the coldest in the archipelago. The emphasis of this study was on the apportionment of females' time while raising pups, and on the influence of some environmental factors on females' activity budgets. The reproductive season extended from August to November; animals attended the breeding sites throughout the year with no evidence of an annual migration. Weaning occurred at 18 to 36 months of age, depending on environmental conditions, although in one year (1981) weaning was complete for the majority of 2-year-olds. The mother initiated weaning, which was a slow process. Some mothers suckled older young and newborn pups simultaneously. Before parturition, females stayed at sea for several long periods (9–11 days each). The interval from parturition to copulation was 8.2 days, during which time females usually made a brief trip to sea at night. A rough estimate of total maternal effort devoted to raising one young would be about 300 foraging trips to sea and about 3,000 hours of suckling. Postpartum visits to land lasted 0.5 to 1.3 days, depending on the age of the young being suckled. Suckling time increased with the age of the young and reached a maximum of 70%–80% of attendance time among mothers of yearling males. Females departed for foraging trips in the evening hours and returned in the morning. However, this pattern was altered by the lunar cycle; many females stayed onshore during full moon nights. Foraging-trip duration varied as a function of the lunar cycle. It was longest (50–70 hours) around new moon and shortest (10–20 hours) during full moon; stays ashore followed the reverse pattern. Mothers of yearlings spent less time ashore than mothers of young pups (10 days to 3 months) by making more foraging trips per unit time, but individual foraging trips were of about equal duration for both groups of mothers.