

Development of a Fatted Male Phenomenon in California Sea Lions

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Schusterman, Ronald J., and Gentry, Roger L. (1971). *Development of a Fatted Male Phenomenon in California Sea Lions*. DEVELOPMENTAL PSYCHOBIOLOGY, 4(4): 333-338. A captive colony of male sea lions (*Zalophus californianus*) living in northern California shows an annual weight fluctuation related to their reproductive season. Seasonal fattening, which is associated with an increase in territorial displays, starts developing at 5 years of age, when a sagittal crest first becomes apparent, and becomes more prominent as the males reach full maturity.

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The reproductive behavior of pinnipeds shows a strong seasonal cyclicity and in several species the males fast for prolonged periods while defending territories or interacting in dominance hierarchies (Peterson, 1968; LeBeouf & Peterson, 1969). An apparent weight gain in the male southern sea lion (*Otaria*) just prior to the reproductive season has been noted (Vaz Ferreira, 1959). However, this tendency has not been confirmed quantitatively since most pinnipeds are at sea prior to reproduction and are therefore inaccessible for observation.

Male squirrel monkeys (*Saimiri sciureus*) show a seasonal cyclicity of active spermatogenesis that is correlated with an increase in aggressive behavior and body weight. The seasonal acquisition of secondary sexual characteristics has been called the "fatted" male phenomenon (DuMond & Hutchinson, 1967). The present report shows quantitatively that a similar "fatted" condition has occurred seasonally for 4 years in a captive colony of male sea lions (*Zalophus californianus*), that the condition is associated with an increase in aggressive behavior, and that these seasonal changes start developing at approximately 5 years of age. Thus, fat deposition in *Zalophus* is associated with male social structure during the reproductive season.

Method

Over the past 6 years we have kept varying numbers of *Zalophus* males in our laboratory for use in a variety of behavioral experiments (Schusterman, 1968). Four of these animals came to us as juveniles, and for the past 4 years they have been kept in open-air, cement compounds containing pools of fresh water. These animals are fed once a day, usually 6 days per week, on a diet consisting of dead herring and mackerel. Each animal is given an amount of food sufficient to ensure a slow increase in body weight over time. This amount varies according to the size of the recipient; it ranges from less than 4 1/2 to more than 9 kg of food per feeding. All animals are weighed at irregular intervals, usually not more than twice a month. Of the animals for which data are reported here, only one (S) is housed with female *Zalophus*. All others are housed with other species of pinnipeds.

In June 1967 the approximate ages of males P, S, M and G were 2 years, 3 years, 5-6 years, and 5-6 years, respectively.

In 1969 at least 2 hr of observations were made on a monthly basis while M and G ranged freely with other *Zalophus* males in their holding compound. Behaviors including vocalizations and territorial boundary displays were recorded by 20-sec intervals. Boundary displays are characterized by stereotyped postures (including oblique staring, open mouth, head shaking, falling prostrate)

and rapid barking by the 2 combatants, usually with reference to some topographical reference point.

Results and Discussion

Figure 1 shows the weight records of the 4 males, plotted by the month, during the past 4 years. Males G and M have approached full maturity (8-9 years of age) during the Summer of 1970. Each had an obvious sagittal crest, a dimorphic feature that is characteristic of males of this species and that first appears on the skull of 5-yr-olds (Orr, Schoenwald, & Kenyon, 1970). The curves for these 2 animals show sharp increases in weight during the early Spring of each of 3 years, followed by a sharp decline in the Summer, except for male M in 1968. Note that these seasonal weight fluctuations become more prominent as the males approach full maturity.

Male S, who is not fully grown, has shown a constant weight gain during the past 3 years, but it was only during 1969, the same year in which his crest was first noticeable, that he showed a seasonal weight increase. This weight gain during the Spring of 1969 was similar to the weight gains of M and G during the Spring of 1967.

Until 1970 male P showed no seasonal increase in weight. However, in the Spring of 1970 he showed the first appearance of a sagittal crest and what appears to be his first season of a fatted condition.

In June 1969 the aggressiveness of the 2 largest males increased as it had in previous years (Schusterman & Dawson, 1968), and they established territories

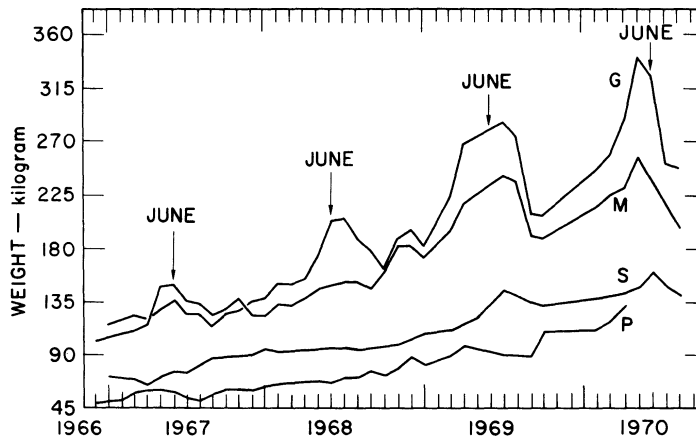


Fig. 1. Four year record of development of seasonal weight fluctuations in *Zalophus*.

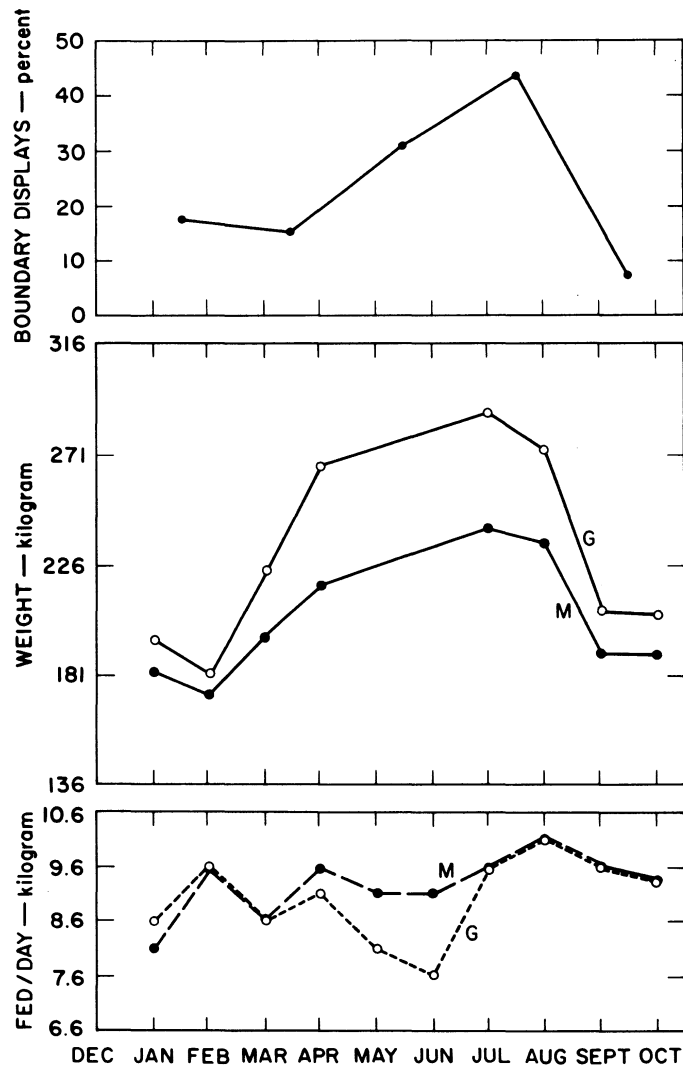


Fig. 2. (Top) Percent of 20-sec intervals in which sea lions G and M showed mutual boundary displays during the first 10 months of 1969. At least 2 hr of observations were made on a monthly basis while the animals ranged freely in their holding compound. (Middle and Bottom) Relationship between weight fluctuations of sea lions M and G and their food consumption during first 10 months of 1969.

in different parts of a holding compound. The territories were defended by increased amounts of barking and postural threat displays. Such behavior occurred most frequently between May and August (see Fig. 2). At other times of the year, male G was dominant over male M if both were forced into one small part of the compound. However, during the summer months, this relationship was accomplished only after intense aggressive behavior, and frequently both animals were territorial even when their space was reduced to

slightly less than half of its previous size. It should be noted that the general activity level of these captive sea lions is highest during the reproductive season.

Figure 3 shows male G before, during, and after his fatted condition in 1969. The fat accumulates over all parts of the body except the flippers, but is especially noticeable in the neck and head. For that reason the sagittal crest appears larger during the reproductive season than before or after.

The most rapid weight gains in our captive males occurred in early Spring of each of the 4 years, which is the period just preceding the time of reproductive and territorial activity among wild *Zalophus* (Peterson & Bartholomew, 1967). Despite the fact that these males were not in direct contact with *Zalophus* females and were kept about 300 mi north of their usual reproductive range, they showed behavioral changes of the same kind and at the same time of year as their wild counterparts. Thus, captivity and isolation from females of the same species do not appear to alter the temporal occurrence of aggressive behavior and probably do not alter the male's seasonal acquisition of secondary sexual characteristics.

Our data suggest that age is a critical variable in the development of the fatted condition, with the first period of fattening coinciding with the first appearance of the sagittal crest when males weigh about 115 kg, at the age of 5 years. The data in Figure 1 show that the first seasonal weight fluctuations average approximately 23 kg and increase approximately 23 kg each succeeding season to a possible maximum of 90 kg when adulthood is attained. Thus, at the height of the reproductive season, a territorial male *Zalophus* should weigh between 320 and 365 kg, decreasing to 225-270 kg during the months of September to December. Our captive *Zalophus* females have never shown any apparent seasonal weight gains not associated with pregnancy. The females reach an asymptotic weight of approximately 82-91 kg at 3-4 years of age.

The first appearance of the sagittal crest (since the crest is a secondary sex characteristic) and the first occurrence of annual fattening may be hormonally



Fig. 3. Photographs of male *Zalophus* G in December 1968 (left), June 1969 (center and October 1969 (right). Center photo shows G and M in a boundary display.

linked to the onset of sexual maturity. Furthermore, the timing of yearly episodes of fattening (and of aggressive behavior and territoriality) in the adult males is probably hormone-dependent and arises from yearly cycles of increased androgen production. However, both histological evidence and experimental manipulation of hormone levels in these animals are needed for verification of this hypothesis.

The adaptiveness of these yearly changes in behavior and morphology is clear. Fat deposition is most probably related to fasting and may have communicative value as well as increasing success in fighting among territorial males. Those males that can remain on territories for extended periods without incurring serious injury can impregnate more females, and the annual fattening would thus be selected for.

Note

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