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**EFFECT OF SOLITARY VS GROUP FEEDING ON INTAKE IN *PSEUDEMYX NELSONI*.**—Although there has recently been increased interest in herbivory in reptiles, rate of feeding, or intake, has been measured in only a few species of herbivorous turtles (Bjornal, 1985). Feeding rate is not only important as a measure of gross nutrient intake, but it also has a major effect on digestibility (the percentage of nutrients absorbed from digesta along the alimentary canal). For any diet, increased intake generally results in decreased digestibility (for review see Robbins, 1983).

It is difficult to measure feeding rates of captive reptiles in such a way that the results accurately represent feeding rates under natural conditions. Feeding rate is influenced by complex interactions of many variables, including amount of food offered; palatability and nutrient quality of the diet; passage rate; temperature; adjustment of the test animal to captivity; and the animal's physiological state, energy balance and level of activity (Schneider and Flatt, 1975; Parmenter, 1981; Robbins, 1983). My purpose was to test the effect on intake of another variable—solitary vs group feeding—in juvenile Florida red-bellied turtles, *Pseudemys nelsoni*, a primarily herbivorous species (Carr, 1952).

**Methods.**—Four-month-old *P. nelsoni* (mean weight =  $13.1 \pm 2.8$  g), which had hatched and been reared in captivity, were kept either singly or in groups of eight in plastic containers (38 cm long  $\times$  20 cm wide) holding 3 l of water. The containers were separated by strips of cardboard to prevent any visual contact between turtles. The turtles were maintained on a 12L-12D cycle; light was provided by two 150 watt bulbs. Basking platforms were supplied but never observed to be used. Thirty-two turtles—four groups of eight—were used. Two groups of eight turtles were tested simultaneously for two one-week periods. During the first week, one group was in one container while the individuals in the other group were isolated in eight containers; the groups were reversed in the second week. The procedure was then repeated with the third and fourth groups. The turtles were weighed at the beginning and end of each week. There was no significant weight change for any turtle.

The turtles were fed *Elodea densa*, a common aquatic plant in Florida ponds. Every morning, each solitary turtle was given 2 g (wet weight) *E. densa*, and the group of eight turtles was given 16 g. These amounts ensured that turtles were being fed ad libitum. A control tank was set up with the same water and light conditions as the other containers. Two g of *E. densa* were placed in the control tank daily. After 24 h, the remnants of *E. densa* left in the turtle tanks and control tank from the previous day were collected, dried at 105 C for 24 h, cooled in a desiccator and weighed to 0.1 mg. Total collection of remaining food was not difficult; *E. densa* is sufficiently resilient to prevent being fragmented and dispersed by the turtles' movements. Care was used to select similar pieces of *E. densa* to feed the turtles and to use in the control throughout the study. Water in the tanks was changed each morning prior to feeding.

The dry weight of the *E. densa* removed from the control tank each day was used as the measure of food offered. Daily intake was calculated by subtracting the dry weight of the food remaining each day from that week's mean daily dry weight of *E. densa* removed from the control tank.

Water and air temperatures were monitored with maximum-minimum thermometers. Water temperatures varied daily between 21 C and 26 C; air temperatures ranged from 20–27 C.

Activity levels of solitary and group turtles were compared by recording the number of minutes of activity (either moving or feeding), in 40 30-min periods, for a solitary turtle and a group turtle simultaneously. Measurements of activity were made throughout the day; no attempt was made to distinguish between intensities of activity.

**Results and discussion.**—The mean amount of *E. densa* ingested daily by solitary turtles was 2.8 mg dry weight per g live body weight (SD = 1.9). Grouped turtles consumed an average of 4.1 mg dry weight per g live body weight per day (SD = 0.9). The intake of grouped turtles was significantly higher than that of solitary turtles (randomization test for matched pairs,  $P < 0.01$ ). Both rates are in the range of feeding rates recorded for herbivorous turtles (Bjornal, 1985).

The increase in feeding rate in grouped turtles was apparently not a result of increased energy demand due to increased activity. There was no significant difference in the amount of

activity of solitary and grouped turtles ( $t = 1.285$ ,  $P > .10$ ). Solitary turtles were on average active for 1.95 min every 30 min ( $N = 40$ ;  $SD = 1.82$ ). Grouped turtles were active for 2.59 min ( $N = 40$ ;  $SD = 2.57$ ).

A similar effect of increased feeding rate in the presence of conspecifics has been reported in fish. Welty (1934), working with *Brachydanio*, *Carassius*, *Notropis* and *Macropodus*, found that in all cases fish in groups consumed more food than solitary fish. He attributed the stimulus for extra feeding to the sight of other individuals feeding. This supposition is supported by Keenleyside's (1955) findings that fish are more strongly attracted by the sight of a feeding fish than by either the food alone or a fish without food. However, Nikolsky (1965) reported that while planktophages generally feed more intensively in groups, predaceous fish consume more when alone. He also found that in both bream and cod, the young have higher consumption rates when concentrated, whereas the situation is reversed for adults.

It is possible that social interaction, in the form of a visual feeding stimulus, is also responsible for the increased intake in *P. nelsoni*. In a review of social behavior in turtles, Harless (1979) reported that although the literature contains many observations of social behavior, the stimuli for these interactions are poorly understood. References to social behavior during feeding were confined to reports of competitive interactions in which dominance determined which turtles gained access to a limited food resource (Harless, 1979).

As far as I am aware, this is the first report of positive social interaction during feeding in turtles. It remains to be determined whether the effect of group vs solitary feeding extends to other reptiles or to adult *P. nelsoni*. The effect may reverse with age in *P. nelsoni* as it does in bream and cod (Nikolsky, 1965). What role, if any, this social behavior plays in the ecology of wild *P. nelsoni*, and whether the increased intake results in increased growth rates, is not known.

The effect of this positive feeding interaction on feeding trials is two-fold. Herbivorous reptiles often refuse to feed on natural diets in captivity, which frustrates attempts to conduct intake and digestibility trials. Feeding the animals in groups, or in sight of each other, may stimulate feeding. However, a problem is also presented. Which feeding rate—that measured under solitary or under group conditions—more closely reflects natural feeding rates? For ac-

curate assessment of the data and for comparison with other values in the literature, the conditions under which the animals were fed—solitary, out of sight of conspecifics; solitary, within sight of conspecifics; or in groups—should be reported. Because intake affects digestibility, grouping of test animals needs to be taken into consideration even in digestibility trials in which intake is not measured.

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BEHAVIORAL NICHE EXPANSION IN *DESMOGNATHUS FUSCUS* (AMPHIBIA: CAUDATA: PLETHODONTIDAE).—In their spatial autocorrelation analysis of heterozygosity and geographic distribution in populations of *Desmognathus fuscus*, Karlin et al. (1984) concluded that their results were consistent with the corollaries of the niche width-variation hy-