

THE OCCURRENCE OF NEUSTOPHAGIA AMONG PODOCNEMINE TURTLES

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Belkin & Gans (1968) described an inertial feeding mechanism for the ingestion of fine particulate matter from the water's surface. They termed this behaviour neustophagia and noted its occurrence as part of the feeding repertoire of the podocnemine turtle *Podocnemis unifilis* as well as the emydine *Chrysemys picta*. The closely related *Podocnemis expansa* was not observed to feed by neustophagia. Legler (1976) described neustophagia as occurring in an Australian chelid, *Emydura* sp., though the observed behaviour differed markedly from the inertial mechanism originally described by Belkin and Gans. Briefly, inertial neustophagia is a coordinated feeding mechanism whereby the turtle opens its jaws at the water's surface, keeping the mandibular tomial edge 1-2 mm below and parallel to the surface, at the same time that rapid and maximal hyoidal pharyngeal expansion is taking place, thus creating a gravitational inertial sucking force that allows only surface water with fine particulate matter to flow into the wide open pharynx. Particulate matter from a considerable radius is thereby drawn into the mouth. When no more water can be taken in, pharyngeal contraction occurs against nearly-closed jaws, thus forcing the excess water out and retaining the ingested particulate matter through a process of filtration.

We have observed all eight species of turtles of the subfamily Podocneminae (Testudines: Pleurodira) in captivity. Neustophagia is a routine component of the feeding behaviour repertoire of *Podocnemis unifilis* and *P. vogli*, and an occasional occurrence in juvenile *P. erythrocephala* and *P. expansa*. It does not appear to occur in *P. lewyana*, *P. sextuberculata*, *Peltocephalus tracaxa* or *Erymnochelys madagascariensis*.

Our observations are as follows:

- (i) Two subadult specimens of *P. vogli* were kept in a 55 gallon aquarium for six months with a variety of chelid turtles. The water was kept at about 28°C and cleaned by a continuously operating power filter. The animals were fed a variety of chunk-sized foods, mainly beef and fish, and also ate lettuce leaves which floated on the surface. During this time no episodes of neustophagia were observed. Neustophagia was first observed immediately after the water in the tank was changed, and the filter was not in operation. With a still water surface, a film of fine particulate food matter formed on the surface, whereupon one of the *P. vogli* fed by neustophagia for approximately one hour. The mechanism was exactly as described by Belkin & Gans (1968). Flow currents on the surface distinctly converged on the open mouth, and particulate matter from a large distance around the mouth flowed into it. Neustophagia ceased shortly after the power filter was turned on and the surface became turbulent.
- (ii) The same two *P. vogli* plus a juvenile housed under the same conditions were fed fruit. The power filter was operating at a low level and the water was free of surface currents. After eating the chopped fruit, a film of particulate matter remained on the water surface. One of the subadults and the juvenile proceeded to feed by neustophagia over the next half hour.
- (iii) Of the other podocnemine turtles in this collection, neustophagia has been briefly observed in two juvenile *P. unifilis*, but never in two subadult *P. lewyana*, two juvenile *P. sextuberculata*, two juvenile *P. erythrocephala*, two adult and one juvenile *Peltocephalus tracaxa* and one adult *Erymnochelys madagascariensis*.
- (iv) Several observations of neustophagia have been made in the collection of F. Medem, which is housed in Villavicencio, Colombia in large outdoor pools through which there is only a very slow water flow. When pellets of dog food were fed to several podocnemines in a large pool, a film of particulate matter developed on the surface. Several juvenile *P. vogli*, *P. unifilis*, *P. expansa* and *P. erythrocephala* fed by means of neustophagia, with the *P. vogli* exhibiting the most prolonged episodes. Juvenile *P. lewyana*, *P. sextuberculata* and *Peltocephalus tracaxa* did not feed from the surface. In a larger pool where several adult turtles are kept, specimens of *P. vogli* and *P. unifilis* are the only species noted to have fed by neustophagia. This behaviour was regularly observed at times when there was heavy algae colonization on the water surface. Adult *P. erythrocephala*, *P. expansa*, *P. sextuberculata*, *P. lewyana* and *Peltocephalus tracaxa* were not observed to feed by neustophagia. Specific attempts at inducing neustophagia in adult *P. lewyana* were unsuccessful, despite providing a surface film of particulate food to evidently hungry animals.

The observations reported here indicate that neustophagia occurs in slow moving or stagnant bodies of water in which a film of particulate matter has a chance to accumulate on the surface. Within the subfamily of podocnemine turtles two species, *P. vogli* and *P. unifilis*, exhibit this behaviour regularly. These two species often occur in lagoons, oxbow lakes, and other such slow moving waters. Two species within the subfamily, *P. expansa* and *P. erythrocephala*, exhibit neustophagia as juveniles, but apparently not as adults. This may be related to choice of ecological niche, in that juveniles tend to inhabit areas of stiller water than that occupied by adults. However, virtually nothing is known of the niches occupied by juveniles of these or any other podocnemine species. Three species within the subfamily, *P. lewyana*, *P. sextuberculata* and *Peltocephalus tracaxa*, do not feed by neustophagia at all. *P. lewyana* inhabits mainly large fast-water rivers, and *P. sextuberculata* and *P. tracaxa* are primarily bottom-feeders. The final species in the subfamily, *Erymnochelys madagascariensis*, does not appear to exhibit neustophagia, but only one adult has been observed and no data is available on choice of habitat.

Belkin & Gans (1968) point out that inertial neustophagia is a specialized modification of the general pharyngeal expansile feeding mechanism of

pleurodire turtles, with the primary behavioural component in *Podocnemis* being the coordinated ability to hold the mandible open at the water's surface during pharyngeal expansion. Interestingly, only two species of podocnemine turtles have perfected the technique and two others appear to display it only as juveniles. Though Legler (1976) described "neustophagia" in the pleurodiran chelid turtle *Emydura* sp., this behaviour was simply one of striking and biting at small particles on the water surface. No component of inertial feeding was observed. We have never observed neustophagia in any species of pleurodiran chelid turtle, with observations having been made in captivity on the following: *Chelodina longicollis*, *C. novaeguineae*, *C. siebenrocki*, *C. parkeri*, *Elseya novaeguineae*, *Emydura subglobosa*, *Chelus fimbriatus*, *Hydromedusa tectifera*, *Phrynops dahli*, *P. gibbus*, *P. hildarii*, *P. geoffroanus*, *P. tuberosus*, *P. nasutus*, *P. wermuthi*, *P. vanderhaegei*, *Platemys platycephala*, *P. radiolata* and *P. spixii*.

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