FEEDING PATTERNS OF PELUSIOS CASTANEUS (CHELONIA: PLEURODIRA)

by

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ABSTRACT

The aim of this study is to describe the feeding patterns of the pleurodiran West African mud turtle Pelusios castaneus. The kinematics of feeding were studied for two types of prey (fish, snail) to provide a description of the feeding cycle and to determine whether kinematic patterns can be altered in response to prey size and type. High-speed film recordings (250 frames/s) of feeding cycles were evaluated. Five variables were measured and four velocities were calculated. The feeding cycle was divided into five phases: preliminar head fixation, final head fixation, final head approach, grasp followed by manipulation and a transport phase, and suction end position which is followed by swallowing. The turtle has the ability to modulate the feeding kinematics depending on prey type. Furthermore, two types of suction were distinguished, compensatory suction and inertial suction. While compensatory suction is used mainly for prey capture, inertial suction is needed during the manipulation and transport phase, and becomes more important the longer these phases last. A Ram-Suction-Index was used to show the relation between the ram and the suction component during the different phases of the feeding cycle. The results show that the smaller and less agile the prey, the more the turtles enhance the suction component of their feeding patterns. Hydrodynamically induced kinematic similarities in aquatic feeding of fish, larval aquatic salamanders and turtles were found, as well as differences that result from the fundamentally different morphological design of the feeding apparatus.

KEY WORDS: feeding, kinematics, turtle, pleurodires.

INTRODUCTION

Turtles are of special interest for investigations of the functional morphology and evolution of aquatic feeding mechanisms for two reasons. First, the existence of many aquatic-feeding turtles provides morphologists with a group of vertebrates that have evolved aquatic feeding convergently with anamniote feeding systems. Turtles may be used to test hypotheses and generalizations regarding morphological and functional patterns associated with aquatic feeding in lower vertebrates. Second, it is often stated that aquatic turtles use a suction mechanism during feeding but there are only few kinematic investigations.
In this paper we characterize the kinematics of prey capture and suction mechanism in the semiaquatic pleurodiran turtle *Pelusios castaneus* in order to provide a description of the feeding cycle. This is accomplished through an analysis of high-speed films of the feeding on fish and snails. A description of the anatomy of the feeding apparatus of the genus *Pelusios* has been done by ROMER (1956) and SCHUMACHER (1973), a short note on origin, insertion and course of some muscles of the jaw-hyoid-apparatus is given in the present study.

**MATERIALS AND METHODS**

**Animals**

*Pelusios castaneus* is a semi-aquatic freshwater turtle, which lives in a variety of habitats such as rivers, streams, marshes, swamps, lakes and shallow ponds. It occurs in Guinea, Senegal, Mauritania, Nigeria, Congo and western Zaire. Four specimens most similar in size (carapace-length about 10 cm) were selected for detailed analysis. *Pelusios castaneus* is an omnivorous turtle that feeds mainly on large pulmonate snails and floating water lettuce (BROADLEY, 1981). These turtles can not feed in a terrestrial habitat. If a prey item is seized on land it is transported into the water to allow proper intraoral transport and swallowing. The animals were fed with fishes, octopus-cubes, snails and gammarids. Fishes and snails turned out to be the best food for film-analysis. Anatomical observations of the cranial musculo-skeletal complex were made on two individuals of *Pelusios castaneus*.

**Film-analysis**

The turtles were filmed at 250 fr./s with a Kodak EXR500T 7298 16 mm film using a Locam high-speed camera. They were filmed under two Dedocool halogene spotlights (max 250W) and two Kobold lights (300W). Film shots were taken in a 40 × 16 × 25 cm aquarium with a grid in the background (gridsize 1cm²). Because of the high illumination the turtles were trained for several weeks to feed in the light needed for filming. The fish segments (max size 2.5 cm) and the snails (max size 1 cm) were put on the floor of the aquarium so that strikes only occurred at non-moving prey.

The film sequences were projected onto a graphic table using a Vanguard motion analyzer and copied for further evaluation. A frame defined as 'time zero' was selected for each of the sequences by locating the frame in which the distance between turtle and prey was 1 cm, just before rapid mouth opening. The following variables were measured: 1) gape distance: distance