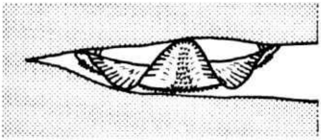

Fig. 1

Fig. 1: ***Stegnaster inflatus,*** **showing common field posture, wedged in a crevice. Lateral view showing margin of star thrown into folds.**

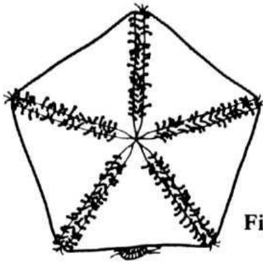

Fig. 2

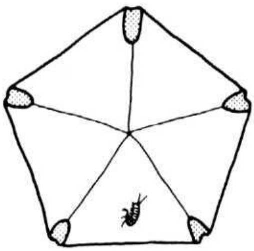

Fig. 3

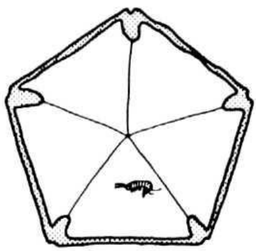

Fig. 4

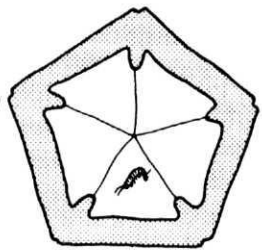

Fig. 5

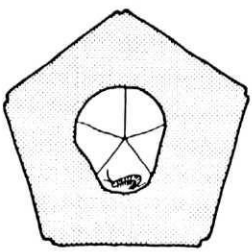

Fig. 6

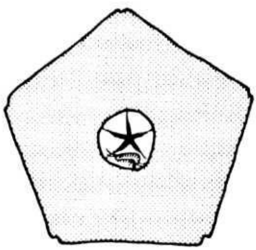

Fig. 7

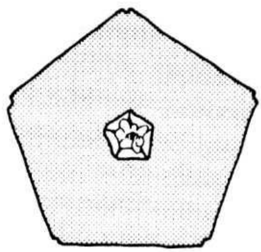

Fig. 8

Figs. 2 to 8: Sequence of ***Stegnaster inflatus*** **trapping and eating an amphipod, observed on the glass wall of an aquarium. Stippled areas are those parts pressed firmly on to the glass. For full explanation see text.**

FEEDING BEHAVIOUR OF STEGNASTER INFLATUS HUTTON. (CLASS: ASTEROIDEA, FAMILY: ASTERINIDAE).

Roger V. Grace*

SUMMARY

Feeding behaviour of *Stegnaster inflatus* Hutton, observed in the laboratory, is described, and related to the field behaviour of this starfish. A posture commonly adopted by *S. inflatus* in the field appears to be part of the sequence of feeding responses.

INTRODUCTION

Underwater field observations of *Stegnaster inflatus* at Army Bay, approximately 25 kilometres north of Auckland, show that during daylight hours this starfish lives mainly subtidally under ledges, usually attached to the roof or wedged in a crevice at the back of an overhang. In outline, *Stegnaster inflatus* is almost perfectly pentagonal, and is often brightly coloured; (for colour plate of this starfish, see Morton and Miller,[2] plate 23).

Frequently one or more of the inter-ambulacral edges of the starfish is raised above the rock surface to which the star is attached. A common pose when the starfish is wedged in a crevice is illustrated in Fig. 1. In this position the tips of the arms are the only points of attachment of the oral surface, and the central area of the aboral surface may be supported by the floor of the crevice. All five inter-ambulacral areas are held well away from the substrate. Laboratory observations suggest a reason for this posture.

LABORATORY OBSERVATIONS

Four *Stegnaster inflatus* were kept in an aquarium, and fed on amphipods collected from beneath detritus on the high tide drift line on sheltered Auckland beaches. A feeding reaction in *Stegnaster* was initiated when an amphipod crawled on the edge of the starfish, which was attached to the glass side of the aquarium. The feeding sequence is illustrated in Figs. 2 to 8, in which areas of the oral surface firmly adpressed to the glass are shown stippled.

Fig. 2. The star is in its normal position with the tube feet attached to the glass, and the edge of the star loosely adpressed to the glass, or slightly raised in places. As the amphipod crawls on the edge of the star, the inter-ambulacral area is lifted in the vicinity of the stimulus.

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Fig. 3. The amphipod crawls under the edge of the star, apparently seeking shelter in the "crevice" formed between the starfish and the glass. The central area of the star is slightly raised so that the star is now supported only by the tips of the arms.

Fig. 4. With the amphipod well under the star, the edge of the star is sealed on to the glass, thus trapping the amphipod. This can occur very rapidly, taking only one second for the edge of the star to clamp down on to the substrate. The centre of the star is now raised above the substrate.

Fig. 5. The area sealed closely against the glass extends towards the mouth, confining the prey into a smaller area.

Fig. 6. The sealed area becomes still more extensive, reducing the area in which the prey can move. As the prey struggles, it is gradually forced to move towards the mouth of the star. Small spines on the oral surface of the star are directed towards the mouth, and help to influence the direction of movement of the prey.

Fig. 7. When the prey is confined to the oral area, the jaws of the star gape slightly and the stomach is extruded.

Fig. 8. About ten minutes after the prey is trapped, the stomach engulfs the prey, and is later retracted. If the prey is small, the stomach and prey are withdrawn immediately into the body of the star, but if the prey is large, digestion takes place extra-orally until the prey is reduced to a small enough size to enable the starfish to withdraw the stomach and remains of the prey through the jaws. After the stomach is retracted, the star resumes its normal position as illustrated in Fig. 2.

DISCUSSION

Feeding behaviour in *Stegnaster inflatus* was briefly described by Martin[1], and the independent observations described above largely corroborate, but also expand, his findings. Martin found that in the field and the laboratory, crabs are the commonest diet, with *Petrolisthes elongatus* being the preferred species. He also noted two instances in the field of *S. inflatus* feeding on dead *Acanthoclinus quadridactylus* (rock fish), implying they were dead before the starfish began feeding on them, since he later says that this species of starfish is unable to catch active prey. It would appear, however, that the speed with which *S. inflatus* can seal the margin of the disc on to the substrate would certainly allow this starfish to catch prey as active as living *Acanthoclinus*. This is supported by the fact that a small flounder about 3 centimetres long, and a common tide pool shrimp, *Leander affinis*, were captured alive and eaten by *S. inflatus* in the present study. Probably any suitable sized animal which sometimes seeks shelter in crevices, would serve as food for *Stegnaster inflatus.*

The sequence of events outlined in the laboratory observations above was seen on a number of occasions. A few times, more than one amphipod was trapped, with up to 5 amphipods trapped at one time. It is unlikely, however, that in nature more than a single prey animal is caught at one time.

Without a knowledge of the field habits of this species of starfish, it would seem unlikely that such a passive system of trapping prey could be effective in securing enough food for the starfish. Many small animals, however, seek shelter under ledges and in crevices, and could thus easily crawl into the trap when the edge of the starfish is raised. In addition, the smooth pentagonal outline of this starfish, in contrast to the longer-armed types of stars, enables it to make a very tight seal against the rock substrate. *Stegnaster inflatus* can thus effectively trap quite small prey animals, as well as larger active animals. The frequent habit of this starfish to lie in wait at the back of a crevice, with the oral surfaces of the inter-ambulacral areas held away from the rock surface, and the feeding behaviour outlined above, are very effective adaptations enabling this starfish to occupy an ecological niche unusual for an asteroid.

CONCLUSION

Stegnaster inflatus captures its food by simulating a small crevice into which prey animals may move for shelter, only to be trapped when the rim of the starfish is sealed tightly against the substrate. *S. inflatus* is thus well adapted to living under ledges and overhangs, and occupies an unusual niche for an asteroid.

REFERENCES

[1]Martin, R.B. 1970: Asteroid feeding biology. Unpublished M.Sc. thesis, University of Auckland.

[2]Morton, J.E., and Miller, M.C. 1968: "The New Zealand Sea Shore." Collins, London. 638pp.