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SHORT COMMUNICATIONS

In situ observations of predatory feeding behaviour of the galatheid squat lobster *Munida sarsi* (Huus, 1935) using a remotely operated vehicle

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During remotely operated vehicle operations on the UK continental shelf to the West of Shetland (60°6′N, 4°4′W) at a depth of 400 m, *Munida sarsi*, a common benthic crustacean was observed actively preying on the Northern Krill *Meganyctiphanes norvegica*. Video footage shows the individual using its chelipeds to catch prey items as they swarm around its burrow. These initial observations indicate that predation forms a new feeding strategy for a species previously believed to be an active scavenger.

Munida sarsi (Huus, 1935), is the most abundant of the five species of *Munida* found in the northeast Atlantic (Hartnoll et al., 1992). It occurs from Norway and Greenland in the north to the Bay of Biscay in the south, at depths between 200 and 800 m (Rice & de Saint Laurent, 1986, Farina et al., 1997). Ecologically it is an important species, which in some habitats is found in densities of up to 20 m^{-2} (Freire et al., 1992). *Munida sarsi* is an opportunist, capable of handling and consuming a wide range of animal tissue. This species can also be a selective deposit feeder, sorting the sediment by organic quality and not by size (Garm & Høeg, 2000). When scavenging large food items (i.e. fish remains) the chelipeds are used to select and pass food to the specialized mouthparts. The three smaller maxillipeds are then used to hold and manoeuvre the food item towards the mandibles (Garm & Høeg, 2000).

It has been suggested (Garm & Høeg, 2000) that one reason for the success of this species, over a wide geographic and bathymetric range, is its ability to use many different food resources, largely dependent on the handling capability of the mouthparts. We suggest that this capability is further enhanced by the use of the chelipeds as an active tool for the capture of live prey.

The video footage was taken during a joint Southampton Oceanography Centre—BP remotely operated vehicle (ROV) mission in July 2002, within the Scheihallion and Foinaven oil fields to the West of Shetland. The water depth at this Shetland site (60°6′N, 4° 4′W) was 400 m and the record was taken from 0600 to 0700 GMT. This period corresponds to the return phase of nocturnally migrating swarms of *M. norvegica* (Mauchline, 1960) so that the single individual squat lobster within the field of view (~2 m^2) was constantly surrounded by swarming krill. These swarms may also be attracted to the lights of submersibles (Herring, et al., 1999) so that the presence of the ROV may also have contributed to the abundance of potential prey organisms and therefore to the behaviour of the squat lobster. Selected sequences from the record were transferred from SVHS to DVD-ROM format for frame-by-frame analysis.

During the observation period the squat lobster made 101 separate attempts to capture krill, each attempt consisting of a clear striking motion by the chelipeds involving a 'snapping' motion of the fingers. Only 10 attempts resulted in a krill being grasped between the fingers, and in two of these cases the prey quickly escaped or was released. The remaining 8 attempts were successful, in that the captured krill was transferred from the chelipeds to the maxillipeds (Figure 1B), which then manoeuvred it towards the mandibles.

The handling time of captured prey was also recorded, calculated from the time at which the item was passed to the maxillipeds until another attempt at catching a krill was made. Two distinct handling strategies were observed during the sequence and switching from one to the other had a dramatic affect on the duration of the prey handling time (Figure 2). Following the first successful capture the squat lobster passed the whole krill to the maxillipeds (Figure 1B). Using maxillipeds 1, 2 and 3 it attempted to manipulate the prey into a horizontal position and pass it lengthways to the mandibles (Strategy 1). With this approach the squat lobster struggled for over four minutes before it began to consume the krill, telson and abdomen first.

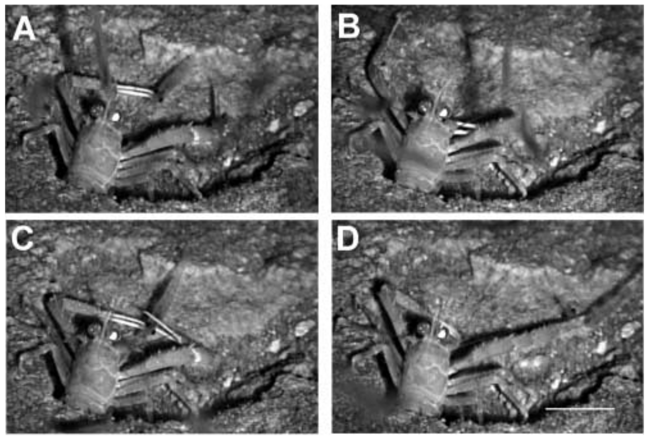

Figure 1. Representative images depicting the feeding strategies of *Munida sarsi*. Bar=2 cm. (A) The successful capture of *Meganyctiphanes norvegica* between the 'fingers' of the left cheliped of *Munida sarsi*. The prey item is being manoeuvred towards the maxillipeds. (B) A prey item is being passed by the right cheliped to the maxillipeds in a horizontal position; this action was common to feeding strategy 1. (C) Alternatively the prey item may be gripped by both chelipeds immediately before being ripped into two separate pieces. (D) The final movements of strategy 2 ('grip and rip'), as the head section of the prey item is passed to the mouth while the abdomen and telson are held in the outstretched right cheliped.

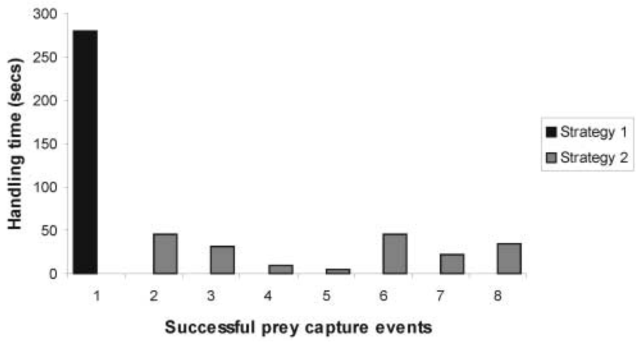

Figure 2. Prey handling time for eight successive captures of the Northern Krill, *Meganyctiphanes norvegica*, by *Munida sarsi*. Strategy 1=capture and manipulation of a whole prey item (N=1). Strategy 2='grip and rip' of prey item resulting in manipulation of smaller pieces of the prey item (N=7).

The strategy was used on two occasions, both resulting in the loss of the captured prey.

During subsequent successful captures the squat lobster altered its handling strategy. Once a prey item was held firmly between the fingers of one cheliped, the other cheliped was used to grip and tear the krill into two or more pieces (Figure 1C). Smaller pieces of krill were then passed to the maxillipeds (Strategy 2), where they were manipulated more effectively (Figure 1D). This approach freed the chelipeds to make further attempts at krill capture. Using this new 'grip and rip' strategy the squat lobster was observed to capture new prey items while still holding food in its maxillipeds. The new prey item was still passed to the mouthparts even if they were full, often resulting in the loss of one or both of the prey items. On one occasion the squat lobster was observed actively discarding the head of a krill from its mouthparts before passing over the tail portion of a second prey item to be gripped and held by maxilliped 3. This switch in strategy coincided with an increase in the swarm density of the krill surrounding the animals' burrow. The loss of krill and discarded prey items may provide an additional input of organic matter to the seafloor, which may promote the activity of other scavenging fauna.

The use of the chelipeds in food gathering and aggressive behaviour by *Munida sarsi* is not unknown (Berril, 1970). The collection of dead fish remains, sea urchin spines and sediment all involve the use of the chelipeds (Garm & Høeg, 2000). Our observations suggest that the chelipeds, previously described as weak (Berril, 1970), can be used by *Munida sarsi* as an active tool for predation, in this case on swarming *M. norvegica*. We suggest that the development of this apparently opportunistic predatory strategy has the potential to greatly enhance the quality of the diet of this squat lobster. If this strategy were not used *Munida sarsi* would exist on a more characteristic scavenging/deposit feeding diet (Nicol, 1932). *Munida sarsi* in the same locality were observed actively deposit feeding in apparently muddier sediments indicating that this predatory strategy is an addition to, and not a replacement of the traditionally observed feeding strategies of this genus.

The novel predatory feeding behaviour observed for *Munida sarsi* indicates that its range of feeding strategies is not so limited and that habitat specific factors, i.e. the diel migration of large swarms of *M. norvegica*, may have led some *Munida sarsi* to develop a method of feeding which relies on its chelipeds for active prey capture.

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