

Anonyx sarsi: a major unrecognized scavenger and predator in the intertidal zone

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Anonyx sarsi (Crustacea: Amphipoda) is a widely distributed scavenger and predator in shallow waters of northern seas. It was caught, often in large numbers, in baited traps in the intertidal in Iceland, especially during mid-winter. Although hitherto only sporadically recorded from the intertidal, the species is undoubtedly among the most important carrion feeders there, and probably an important predator as well.

The lysianassoid *Anonyx sarsi* Steele and Brunel is a common and widespread amphipod in shallow waters of northern seas (Steele, 1982). It is a voracious carrion feeder, easily attracted to baited traps from considerable distances (e.g. Sainte-Marie, 1986a). Although clearly often abundant subtidally it has only been sporadically recorded in the intertidal.

Records of animals in the intertidal zone are largely based on studies made at low tide. The distribution of mobile animals in this zone during high tide remains largely unknown except for a few species (e.g. Rangeley & Kramer, 1995). Therefore a study was initiated on the distribution of animals in the intertidal zone during high tide, principally by the use of traps. Here we report results for the lysianassoid *A. sarsi*.

Two sheltered rocky sites with fucoid vegetation were used. One was at Seltjörn near Reykjavik in south-western Iceland (64° 09.350' N 22° 01.875' W). Three stations on a transect were situated at 0.6 m (station 1), 1.6 m (station 2), and 2.2 m (station 3) above Chart Datum (CD). The horizontal distance was 59.0 m between stations 1 and 2 and 35.5 m between stations 2 and 3. The other site was at Geldinganes, Reykjavik (64° 09.675' N 21° 48.125' W). A similar transect was placed here with station 1 at approximately 0.7 m, station 2 at 1.6 m and station 3 at 2.4 m above Chart Datum. The horizontal distance was 6.5 m between stations 1 and 2 and 5.0 m between stations 2 and 3. The main tidal levels at Reykjavik harbour are as follows: MLWS at 0.2 m above CD, MLWN at 1.3 m, MTL at 2.1 m, MHWN at 3.0 m and MHWS at 4.0 (Anon., 1998).

The traps were of cylindrical Plexiglas, 25.5 cm long and had an outside diameter of 12 cm. A removable funnel with a 9-mm hole was fitted at one end while a hole covered with fine mesh was on the side of the trap near the closed end for air to escape. Two traps spaced 5–10 m apart were set at each station, each trap bolted to rocks with the funnel facing towards land. They were put in place at low tide near the time of spring tides, one trap at each level baited with a piece of fresh haddock fillet weighing 50–70 g, while the other trap was unbaited. The bait was pre-weighed and then weighed again when traps were emptied. Traps were emptied after ~25 h, after two periods of high tide, and left for another 25 hours. The treatment was reversed during the latter period, the previously baited traps left unbaited and the previously unbaited traps were baited with haddock. At the study sites high tide at springs occurs between 0700–0800 h in the morning and between 1900–2000 h in the

evening. Traps at Seltjörn were deployed twice monthly from February to November 1995 and then monthly to December 1996 (altogether 33 trapping sessions). At Geldinganes traps were operated monthly between July and December 1996 (7 trapping sessions). To obtain information on diurnal movements of *A. sarsi*, baited traps were deployed at station 2 at Seltjörn on 19 and 20 March 1997 for one period of night-time or day-time high tide. Four traps were emptied after submergence during daylight and four traps after submergence during night.

Anonyx sarsi was caught almost exclusively in the baited traps. The animals, which usually included both juveniles and adults, were most common in the middle of winter while none were caught in the summer months June, July, and August (Figure 1). In winter months many traps held more than 2000 animals, especially at Geldinganes. At Seltjörn the amphipods were most abundantly caught at station 1 (the lowermost station) but were not rare in traps at stations 2 and 3 in winter. A paired *t*-test on log-transformed numbers per trap reveals a significant difference between traps at stations 1 and 2 ($t=5.209$, $df=66$, (Bonferroni adjusted probability) $P<0.001$) and stations 1 and 3 ($t=6.623$, $df=66$, $P<0.001$), while there was no difference between stations 2 and 3. Along the steep shore of Geldinganes traps at different levels caught the animals in similar numbers and there was no statistically significant difference among stations.

Catches of other species in the baited traps were insignificant in comparison. During winter (November–March) the bait was usually much eaten and often only the skin of the fish was left. The reduction in weight of bait after two periods of high tide at Seltjörn tended to be greatest at station 1 (lowermost station) and least at station 3, but the difference among stations was only significant between stations 2 and 3 (paired *t*-test, $t=3.035$, $df=11$, $P=0.034$). No difference in this respect was seen at Geldinganes.

The four baited traps active at night in March 1997 at station 2, Seltjörn, all caught large numbers of *A. sarsi*, while four baited traps active in daylight at this time did not catch any.

The trapping results indicate that *A. sarsi* is foraging in the intertidal zone at high tide in Iceland in winter, extending its forays well above MTL. *Anonyx sarsi* is known to be a scavenger on large morsels, both of fish and other animals, as well as on smaller animals in shallow subtidal waters (Sainte-Marie &

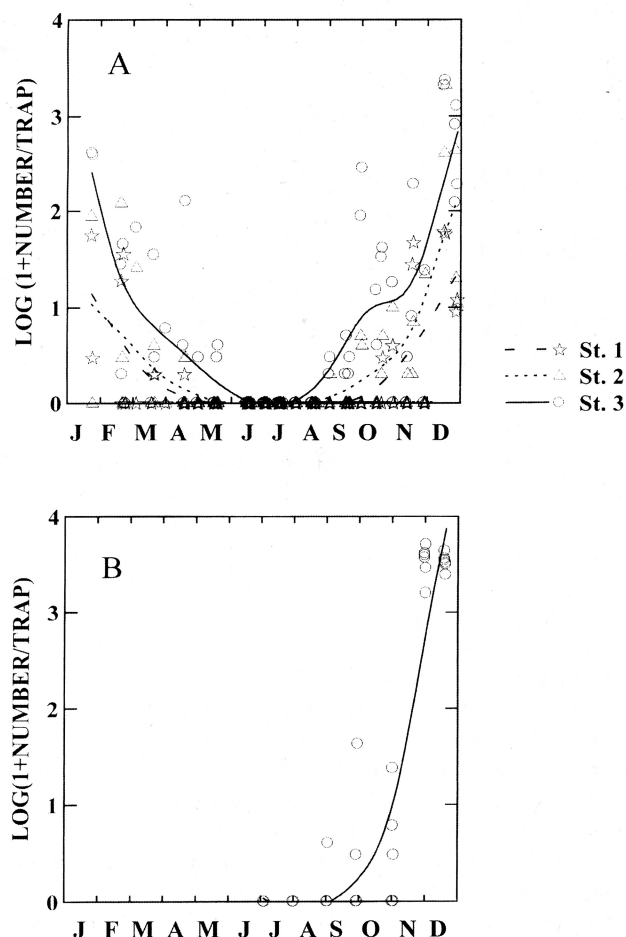


Figure 1. Catches of *Anonyx sarsi* in funnel traps in the intertidal zone according to time of year near Reykjavik, Iceland. (A) Catches at Seltjörn at each of three tidal levels studied, based on data from February 1995 to December 1996. Station 1 is lowermost. (B) Catches at Geldinganes from all three tidal levels studied, based on data from July to December 1996. Traps were deployed for approximately 25 h each. Curves are fitted in SYSTAT® by Distance Weighted Least Squares (tension=0.5).

Lamarche, 1985; Sainte-Marie, 1986a). It can therefore be assumed that soft parts of most dead animals will be removed quickly from the shore, especially the lower part, when this amphipod is abundant. The effects of *A. sarsi* on the upper intertidal are likely to be greatest on steep shores where swimming distances from the subtidal are short.

Predation of *A. sarsi* on calanoid copepods and polychaetes has been observed (Sainte-Marie & Lamarche, 1985) and Oliver et al. (1984) report predation on various dislodged or injured animals. These amphipods even attack divers and can produce open wounds (Oliver et al., 1984). In this study cannibalism has been observed in the confines of the traps, involving even large specimens as victims. Predation by closely related species of the genus *Anonyx* on euphausiids, gammaridean amphipods and mysids has also been reported (Sainte-Marie & Lamarche, 1985). Ojeda & Dearborn (1991) and others have pointed out that workers have largely ignored possible effects of mobile predators such as crabs, fishes, and birds in their experiments and sampling directed at elucidating the structure of intertidal communities, thereby possibly undermining the conclusions drawn. While there can be little doubt that *A. sarsi* is a highly

effective remover of carrion in the intertidal zone we also suggest that this amphipod should be added to the list of potential predators of importance in intertidal communities within its range.

The absence of *A. sarsi* from traps during summer was surprising as well as its abundance in the middle of the winter. Sainte-Marie et al. (1989) suggest a winter exodus of this species towards deeper waters at their study site at the north shore of Saint Lawrence Estuary, Canada, the opposite of what one might expect from the present results. Sainte-Marie et al. (1989) have demonstrated that females of *A. sarsi* cease feeding on bait shortly before or after oviposition in early spring, but there is no evidence that attraction to bait by males or immature females differs with seasons. Present results indicate that *A. sarsi* is primarily a nocturnal feeder in the intertidal. In summer at Reykjavik there is appreciable light throughout the night, which might prevent the amphipods from entering the surface layers of the sea. However, Sainte-Marie (1986b) found that *A. sarsi* was attracted to bait both during the day and night in summer at depths of 3.5–5 m of water at high tide, although larger individuals were more attracted to the traps during night. He was working at a much lower latitude (47° 57.50' N 69° 48.50' W).

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