ARCTIC
VOL. 43, NO. 2 (JUNE 1990) P. 157-158

Does the Clam *Mya truncata* Regenerate Its Siphon after Predation by Walrus? An Experimental Approach

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(Received 5 June 1989; accepted in revised form 15 November 1989)

ABSTRACT. Walrus (*Odobenus rosmarus*) prey extensively on the bivalve *Mya truncata*, removing the siphons. We performed a simple experiment whereby the siphons from 27 *M. truncata* were removed, 33 controls were left intact, and the clams left on the sea bottom for a year. All the damaged *Mya* died; all but 2 controls lived. We conclude that *M. truncata* whose siphons have been grazed by walrus die, leaving over half the clam to predators or scavengers.

Key words: Arctic, benthos, bivalves, walrus, *Mya truncata*, energetics

RÉSUMÉ. Les morses (*Odobenus rosmarus*) se nourrissent en grande partie de bivalves de l'espèce *Mya truncata*, en lui enlevant ses siphons. On s'est livré à une expérience relativement simple dans laquelle on a enlevé les siphons de 27 *Mya truncata*, et laissé intacts 33 spécimens de contrôle. On a ensuite déposé les myes sur le fond marin. Au bout d'un an, aucune des *Mya* endommagées n'avait survécu alors que toutes les myes de contrôle sauf deux étaient encore vivantes. On en conclut que les *Mya truncata* dont les siphons ont été broutés par les morses ne survivent pas et que plus de la moitié de coquillage est laissée en pâture aux prédateurs et aux animaux nécrophages.

Mots clés: Arctique, benthos, bivalve, morse, *Mya truncata*, énergétique

Traduit pour le journal par Nésida Loyer.

INTRODUCTION

Walrus (*Odobenus rosmarus*) feed primarily on the bivalves *Mya truncata* and *Serripes groenlandicus* in the Western Arctic (Fay, 1982), north Baffin Bay (Vibe, 1950), and the eastern Canadian Arctic (Mansfield, 1958; Fisher, 1989). *M. truncata* lives deep in the sediment, its siphon is very long, and it is this organ that is found in walrus stomachs. The actual feeding process in the sea has not been observed and is in some doubt. Fay (1982) and Vibe (1950) both suggested that siphons could be sucked in and broken off by walrus, and our own observations indicate that this could be the case. The *in situ* siphons of *M. truncata* take 1-2 s to retract when touched; they are easily grasped in the gloved hand of a diver, and when pulled the siphons almost always break at the mantle unless the sediment is very soft, when occasionally the entire clam can be removed. It should be noted that Oliver *et al.* (1983) found that 83% of *Mya* shells associated with Pacific walrus feeding tracks had the periostracum (siphon sheath) still intact with the shell, suggesting that the soft parts had been sucked from the shell and the sheath left. This is inconsistent with the *Mya truncata* remains we find in eastern arctic walrus stomachs, which contain both siphons and sheaths but not the rest of the clam.

"If a walrus removes the siphon alone from a clam, can the clam regenerate its siphon?" (Fay, 1982). Other bivalves with relatively small siphons (a few percent of body weight) readily regenerate siphons that have been grazed by fish — for example, *Tellina tenuis* grazed by plaice (Trevallion, 1971), *Macoma balthica* grazed by plaice and other fishes (de Vlas, 1985), and *Protothaca stamina* and *Macoma* spp. grazed by several fish species (Peterson and Quammen, 1982). However, because the siphon and sheath constitute 45% of the soft body dry weight of *M. truncata*, regeneration in this species is less likely. To test the hypothesis that *M. truncata* may regenerate siphons after removal by walrus, we conducted a simple experiment by removing siphons from living clams and returning them to the sea floor for recuperation. The experiment took place at Resolute, 74°42′N, 94°50′W in the Canadian Arctic.

EXPERIMENT

On 31 July 1985, about 220 *M. truncata* were collected by hand from soft sediment at 10–15 m depth in Resolute Bay. The clams were held in a stainless steel tank with running sea water at ambient temperature (0°C) for 48 h, then placed in the holding array on 2 August and returned to the tank.

The holding array (Fig. 1) consisted of 60 PVC cylinders 12.7 cm high by 5.1 cm I.D. glued to a stainless steel tray. Clean quartz sand was placed in the bottom of each cylinder to a depth of 4.2 cm, a single clam placed upright inside, and a 50:50 mixture of sand and silty mud placed around the clam, the mud coming from the same habitat originally occupied by the clams. A range in clam sizes was selected (mean length 5.20 cm, range 3.52–6.70 cm; mean width 3.96 cm, range 2.72–4.77 cm), but placement in the array was random.

On 17 August, 15 days after placement in the holding array, the array was taken from the tank and every second clam was artificially "grazed" by holding the shell down in the cylinder with one hand and pinching off the siphon between thumb and forefinger with the other. The amount of siphon removed ranged from about half to all. There were 27 experimentals and 33 controls. The array was then returned to the tank.

Five days later on 22 August the clams were assessed. All 33 controls had their siphons exposed and reacted to touch. Of the 27 experimentals, 14 had the damaged siphon end exposed and reactive to touch; 6 were exposed and not reactive; 2 had the end of the shell exposed with no flesh visible; and in 5 cylinders there was no sign of the clam in the

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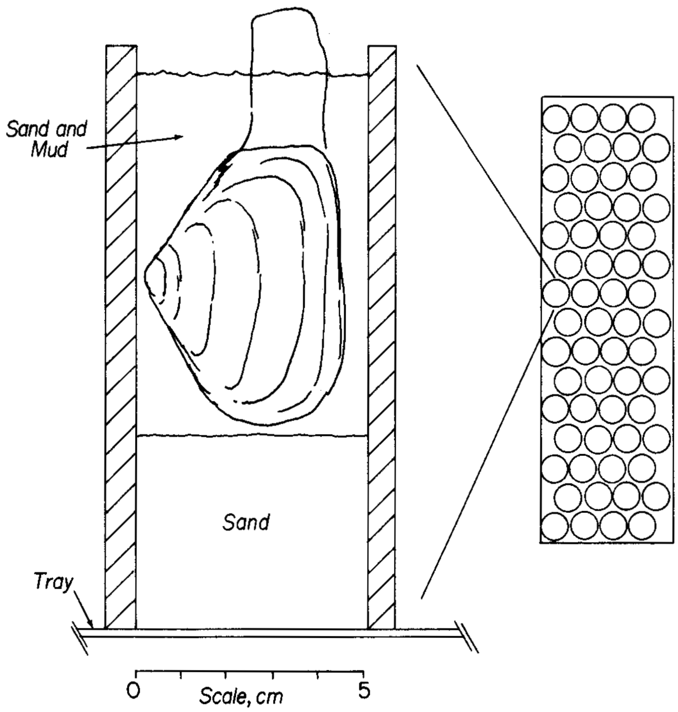

FIG. 1. Experimental holding array for *Mya truncata*. Sixty plastic cylinders 12.7 cm high by 5.1 cm I.D. were glued to a stainless steel tray and a single clam held in each.

unbroken sediment surface. The array was then lowered slowly to the bottom at 10 m depth at the collection site, where it remained until removed a year later, on 15 August 1986.

When removed, the sediment in the cylinders was in place. All 27 of the experimentals were dead; only the shells were left. All but 2 of the 33 controls were alive and appeared to be healthy and normal.

DISCUSSION

From this simple experiment we conclude that *M. truncata* whose siphons are grazed by walrus die shortly after predation. It is possible that clams in this experiment were stressed by handling and habitat change and that *M. truncata* predated by walrus live and regenerate their siphons, but we consider it highly unlikely.

The siphon of *M. truncata* constitutes 45% of the soft body dry weight, or 38% of the total energy content (Table 1).

TABLE 1. Weights and energy contents of *Mya truncata* from Barrow Strait[a]

	Siphon	Body	Shell	Total
Wet wt. (g) (N=100)	6.422	10.86	10.44	27.72
Dry wt. (g) (N=100)	1.199	1.459	9.284	11.94
Kilojoules·g^{-1} (N)	13.13(10)	17.94(27)	—	—

[a]Clams collected from south coast of Cornwallis Island and north coast of Somerset Island. Mean valve length 4.48 mm.

Assuming walrus ingest only the siphons, they consume about 38% of the clam's energy, with the remainder going to feed scavengers such as lysianassid amphipods of the genus *Onisimus* and whelks (Buccinum spp.), both abundant in Barrow Strait. The impact on the bivalve population may be considerable, depending upon the density of walrus. The daily intake of *Mya* siphons by an adult walrus is on the order of 4500 to 6500 per day (Fisher, 1989, and calculated from Fay, 1982), leaving 50–70 kg clam flesh per day available for immediate consumption by other species in the food web.

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