Ann. Zool. Fennici 15: 182—185. 1978

Methods for sampling scavenging benthic Crustacea, especially the Isopod Mesidotea entomon (L.) in the Baltic[1]

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HAAHTELA, I. 1978: Methods for sampling scavenging benthic Crustacea, especially the Isopod Mesidotea entomon (L.) in the Baltic. — Ann. Zool. Fennici 15:182—185.

Sampling apparatus are described and instructions are given for their use. Dredging is the only method recommended where *Mesidotea entomon* occurs very sparsely, and whenever representative samples of the whole population are needed. Baited nets and traps are recommended where dredging is laborious or impossible, e.g. for sampling from under the ice or from stony bottoms, and whenever information about the structure of the population is not important.

Some *Mesidotea* leave the bottom to swim. They can be caught with midwater trawls and macroplankton nets.

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1. Introduction

Several methods were tried for obtaining large samples of *Mesidotea entomon* (L.) of representative composition. This large scavenging Isopod seldom occurs at a high density in the Baltic (BAGGE & SALO 1967). Dredging is the main traditional method, but cannot be used in all conditions. Advantage was taken of the scavenging behaviour of *Mesidotea entomon*: simple nets and traps were baited with fish.

2. Sampling with baited nets and traps

A. The gear

The gear chiefly used was an open net 45 cm in diameter, with a frame of copper tubing (Fig. 1A). Similar nets, but of 90 cm and 120 cm in diameter, were also used. They seldom caught larger samples than the smallest net, and were more difficult to handle in a rough sea and in deep water.

For sampling from under the ice a modification of the ø 45 cm net was used, with a frame of zinc rope instead of copper tubing. This net could be pushed and pulled through a hole only 15 cm in diameter even when the ice was 0.9 m thick (Fig. 1B—D).

The traps used were 50—60 cm long and about 12 cm in diameter (Fig. 1 E, F). The mouth is a funnel formed of rigid netting, which can be moved to bait and empty the trap. A more complicated version of the type E trap is built around a complete wire frame and provided with an upper door. Soft netting can be used. The simplest trap used was a roll of coarse netting wrapped around the bait.

B. The sampling method

The nets and traps were baited with fish, mainly with *Clupea harengus*, *C. sprattus*, *Osmerus eperlanus*, *Alburnus alburnus*, *Platichthys flesus* or *Rutilus rutilus*, which all attracted *Mesidotea* well. Small, fleshy specimens were tied inside the nets and traps as such, robust ones were cut in pieces or the body cavity opened (Fig. 1C, E, F). No difference in attractiveness was found between fresh, deep-frozen and nearly spoiled, bad-smelling or even salted fish, but the effectiveness was not tested.

In calm coastal areas the nets and traps were lowered to the bottom to depths of as much as 80 m without any anchor. They were tied on a string or a thin rope, and marked with a small float or in winter with a stick (Fig. 1C). In the open sea lead discs of several kilogrammes each anchored the system, which was marked with a large buoy (Fig. 1G, H). The nets apparently did not settle upside down, because they usually caught rich samples.

The nets were left in the water from one to several hours or even for days, depending on the locality, depth, season, and abundance of *Mesidotea* or simply on the time available. *M. entomon* is a dark-active species which avoids strong illumination. To obtain maximum samples, nets should be on the bottom at night and

[1] Report No. 579 from Tvärminne Zoological Station, University of Helsinki.

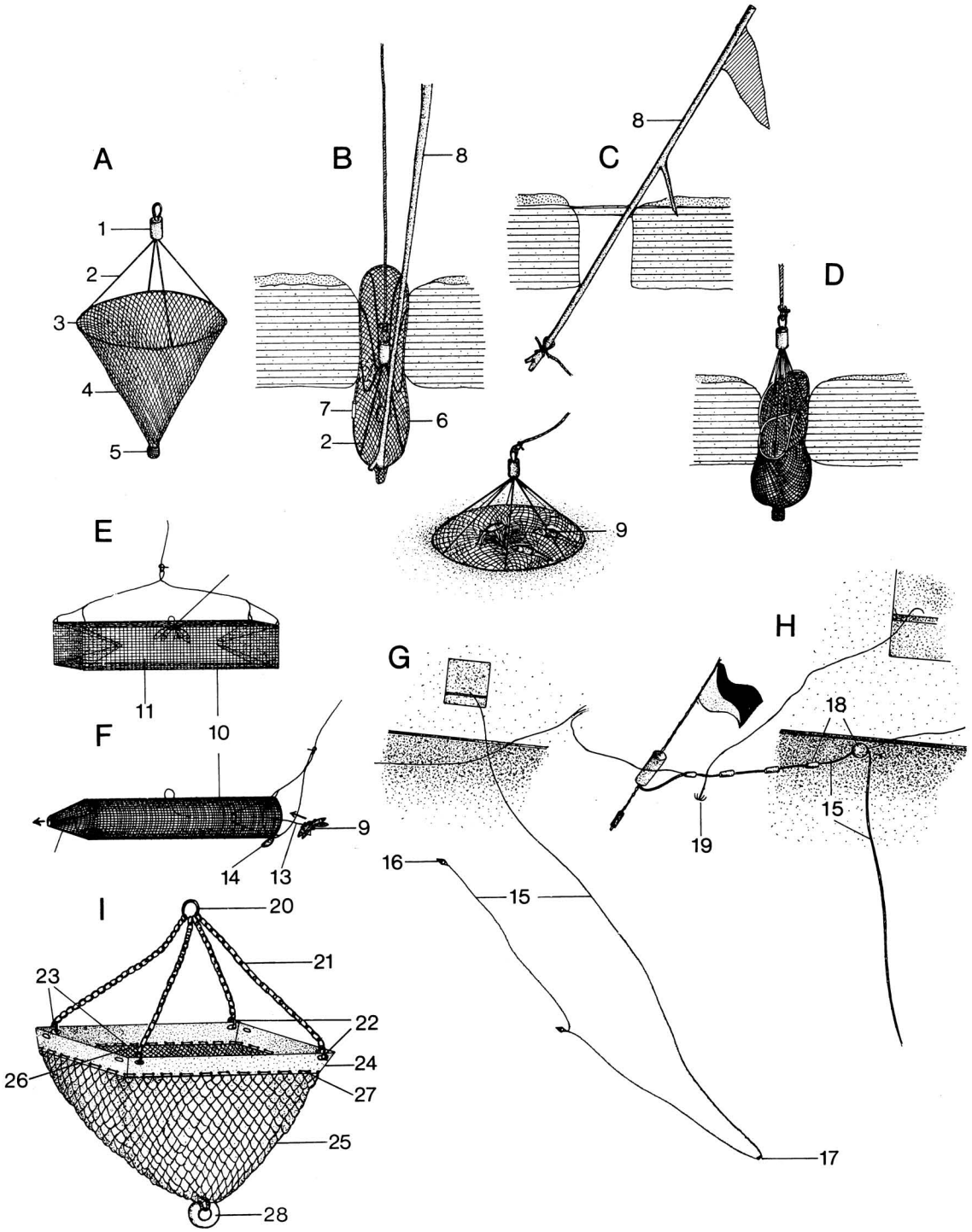

Fig. 1. Gear and methods for sampling of *Mesidotea entomon*. A: The standard net. — B — D: The winter net pushed down through the ice (B), in sampling position (C) and pulled up (D.). — E—F: Traps. — G: Set of two baited nets launched from the porthole of a ship. — H: Buoy system of the nets at the start of hauling up. I. Transportable *Mesidotea* dredge. Scale: A—F and I = 1:20, G = about 1:250, H = about 1:100. — 1: Pressure-resistant float, 2: nylon string (in B attached to the ring at eight points), 3: ring of Ø 6 mm copper tubing, 4: „Ruutu" knotless nylon netting of 5 mm mesh, 5: lead weight of at least 150 g, 6: ring of Ø 5—6 mm zinc rope, 7: copper tube to unite the ends of 6, 8: wooden or aluminium rod, 9: attached bait of fish, 10: brass wire of Ø 3—4 mm, 11: impregnated nylon netting of 2 or 4 mm mesh (made in Japan for use in basins to cultivate young fish) or the same as 4 but impregnated (less good), 12: the mouth funnel pulled out when emptying the trap. 13: string to attach the bait, 14: lead weight, 15: sisal or tanikalon rope of 1/4 to 3/8 inches (circumferential measure), 16: baited net, 17: lead discs of 2—3 kg each, 18: styrox floats, 19: grappling hook, 20: steel ring, 21: galvanized chain, 22: metal shackle, 23: wire or string to break in emergency (if the dredge gets stuck), 24: iron frame, thickness 4 mm, 25: strong knotted nylon netting of about 25 mm mesh, 26: inner bag, slightly larger than the previous, material as in no. 4, 27: plastic-covered wire to attach the net bag to the frame, 28 lead: weight of at least 1—2 kg.

taken up not much after sunrise. In winter and in deep water even sampling in daylight was successful. In areas where *M. entomom* was abundant several hundreds or even thousands[1] of specimens were caught with a couple of nets (HAAHTELA 1962a, 1962b).

Traps were used in areas where *Mesidotea* is sparse or where the sampling gear had to be left in the sea for longer periods. Usually some dozens of specimens, occasionally more than a hundred, were caught when traps were left *in situ* for more than one day.

Both nets and traps are selective gear. Males of *Mesidotea*, which grow much larger than females (HAAHTELA 1975), dominated in the samples, especially if the sampling period was short. Small, i.e. young, specimens were caught in numbers only after intermittent sampling for at least one night. Individuals less than 15 mm long were never abundant.

Now and then a few Amphipods (*Gammarus* sp.), large larvae of *Phryganea* sp. (Trichoptera) and eel pouts (*Zoarces viviparus*) shared the bait with *Mesidotea*. Mysids from midwater were caught abundantly in the nets. In the open sea non-scavenging animals were recorded in the nets, when these were dragged along the bottom during heaving. Most samples were, however, free from bottom deposits.

Several benthic fish feed on *Mesidotea* (APSTEIN 1909, HAAHTELA 1962a, 1962b), but only on rare occasions have I suspected them to be responsible for a poor catch.

3. Dredging and minor sampling methods

A beam trawl, modified by Dr. K. J. Purasjoki from a West German original model (VON BRANDT 1959: 260), proved the best sampling gear on soft bottoms near the coast. The width of the beam and the opening of the net bag is 300 cm, height 80 cm. The bag 10.5 m long, is made of 25 — 4 mm mesh net, the smallest at the cod end. A steel rope on which 21 plastic wheels are attached forms the lower horizontal side of the opening. The trawl does not penetrate deep into the bottom, except in soft muddy areas. A fairly large vessel and a strong winch are necessary. Iron-manganese concretions prevent the use of this dredge in large areas of the open Baltic (WINTERHALTER 1966).

An easily transportable dredge with an opening of 34×54 cm was designed for sampling in the open sea (Fig. 1I). It took large samples of *Mesidotea*, and only small amounts of bottom deposits when dragged carefully at a very low speed and on as short a steel rope as possible. An identical dredge with an opening of 54×100 cm did not sample better, and was more difficult to handle.

A naturalist's dredge with an opening of 22×60 cm and a dense (mesh about 1 mm) cotton bag took rich hauls of *Mesidotea* of all sizes on soft bottoms. D-type dredges proved less effective.

The largest samples caught in dredges were smaller than those caught with the nets. With a tow of 500—1000 m a good sample was usually one to two hundred specimens. Occasionally one haul of the beam trawl caught several hundred *Mesidotea*.

In 1961—1967 about 100 adult *Mesidotea* were caught with herring trawls from mid-water in the open sea, and some dozens of newborn specimens at Tvärminne with a closable macroplankton net.

4. Discussion and recommendations

In the Baltic *M. entomon* has been recorded in quantitative bottom samples and dredge hauls. Except in my own studies (HAAHTELA 1962a, 1962b, 1969, 1975), I have found no mention of the use of baited nets or traps in this area. In the Western Canadian Arctic Ocean the species has been sampled with bottom trawls or dredges, e.g. the otter trawl, and with minnow traps (MCCRIMMON & BRAY 1962, PERCY 1976), in Alaska with a pelagic tow net and coincidentally with fish in gill nets, bottom trawls and fyke nets (NARVER

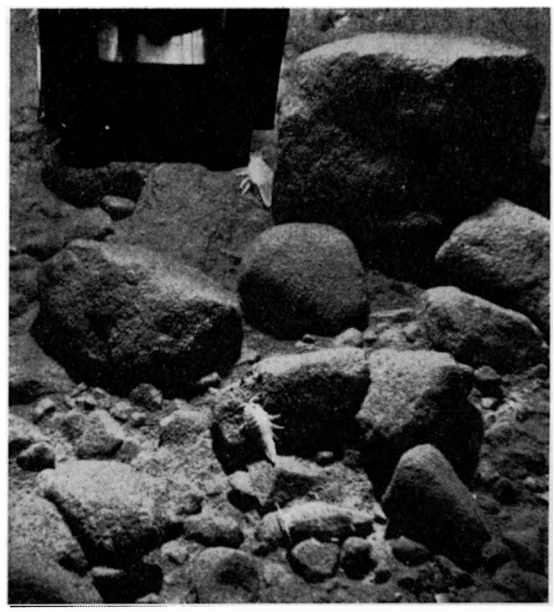

Fig. 2. A habitat of *Mesidotea entomon*, not uncommon in the Baltic, where the only effective sampling gear would be baited nets and traps. Locality about 59°30' N 21°20' E, depth about 68 m. Photographed with an automatic camera by Dr. B. Winterhalter (see Winterhalter 1970).

[1] The largest catch ever obtained with the apparatus described weighed 12 kg and comprised about 3500 specimens of *M. entomon*. The nets, 1×45 cm and 1×90 cm in diameter, were baited with *Clupea harengus*. Locality: 61°52,5' N 19°19' E, depth 62 m, grey ooze. Sampling period: 15—16 August 1965, from 16.34 to 06.00 h.

1968). The following methods are recommended for sampling of *M. entomon* or other scavenging bottom-dwelling Crustaceans.

A dredge or bottom trawl as large as is practicable gives representative samples of the whole population for studies on the life cycle, population structure, diet or juvenile stages. The mesh at the cod end of the bag should not exceed 5 mm. A large boat furnished with a strong winch is necessary and sampling and sorting are laborious. Dredging is possible from under the ice (HAAHTELA 1973). Bottom topography or rich concrete deposits may interfere with this sampling technique (Fig. 2). The proportion of juveniles (body length $<$ 20 mm) caught with any kind of dredge was lower than expected.

Sampling with baited nets and traps is a good and easy method if *Mesidotea* is abundant or if effective dredging is difficult or impossible. The samples will not be representative of the whole population. This technique can be used to study the relative abundance, maximum size and phase of reproduction, and it provides undamaged material. The bait can be enclosed in a roll of dense netting, which will prevent *Mesidotea* making contact with it. At great depths it would be worth trying the free vehicle method (PHLEGER & SOUTAR 1971).

In the benthos of the Baltic *M. entomon* is the only large scavenging invertebrate present in abundance. In most parts of the world lobsters, crabs and even shrimps would greatly complicate or invalidate sampling with baited open nets or even with baited traps.

Large mid-water trawls or tow nets with a dense mesh are necessary to record that part of the population of *M. entomon* which sometimes ascends to swim.

Acknowledgements. I wish to thank Mr. V. ARASTO, master fisherman, who made the first *Mesidotea* nets, Mr. E. TUPPURAINEN of Oulu for skilful preparation of most of the nets, traps and transportable dredges, Prof. H. HYVÄRINEN, Dr. K. J. PURASJOKI, Mrss. E. LINDGREN, M.Sc., T. SONCK, M.Sc. and B. SJÖLUND, who did most of the sampling with me. This study was supported by a grant from the Nordic Council for Marine Biology and the Academy of Finland, for which I am greatly indebted. The English of the manuscript was revised by Mrs. Jean Margaret Perttunen, B.Sc. (Hons.), to whom my sincere thanks are due.

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Received 10. III. 1978
Printed 30. IX. 1978