The efficiency of the Van Veen grab compared with the Reineck box sampler

J. J. Beukema

Netherlands Institute for Sea Research,
P. O. Box 59, Texel, Netherlands

To test the efficiency of the 0·2 m² Van Veen grab in sampling macrofaunal benthos, comparative hauls were made with a large-volume deep-penetrating corer, the Reineck 0·06 m² box sampler. The size, abundance and biomass of the animals caught were compared. The tests were made off the Netherlands coast in relatively fine sands, where the grab penetrated to only 5–6 cm. Depth levels of the species were observed from the undisturbed samples.

Numerical densities obtained from the grab samples equalled those from the box samples only in the species living exclusively in the top 5 cm of the sediment. The grab especially underestimated the large worms *Nephtys* and *Lanice*. Where such species predominate the fauna biomass estimates by means of the Van Veen grab can be far from correct.

Introduction

Although the Van Veen grab is one of the most commonly used samplers for the study of the benthos in the sea, its efficiency has not been properly determined. Only Lie & Pamatmat (1965) and Ursin (1956) have attempted to test the efficiency of the Van Veen grab. The former compared catches made at high tide with the 0·1 m² type with hand-dug samples from nearby places at low tide. Their results were inconsistent. Ursin (1956) performed a similar experiment by comparing catches of the 0·2 m² Van Veen grab with those of the much deeper burrowing Knudsen sampler. However, he obtained only eight pairs of hauls and had to group all species together to obtain meaningful figures.

As no firm predictions on the efficiency of the Van Veen grab appeared to be possible from these published data, it was considered worthwhile to calibrate this grab by making large numbers of comparative hauls with a sampler of known high precision and performance for sampling infauna. The Reineck box sampler (Kastengreifer, USNEL spade corer) was chosen for this purpose. Smith & Howard (1972) also used this large corer to estimate the efficiency of the Smith-McIntyre grab.

Materials and methods

The 0·2 m² Van Veen grab used weighed 90 kg. It differed from the original type (see the pictures in Thamdrup, 1938) in some details. It was used with a continuous warp rig running over pulleys at the ends of the arms (see Fig. 18 in Holme, 1964). Birkett (1958) gives evidence of the superiority of this rigging system over the original chains of fixed length. To minimize the force of the shock wave (Wigley, 1966), 2 × 336 cm² of the upper surface were covered by coarse gauze instead of the original small holes (2 × 143 cm²) covered by relatively heavy flaps.

The Reineck box sampler is pictured by Reineck (1963), and Holme (1971). It was used with 250 kg lead weights at the axis. The total weight of the sampler was about 900 kg. The box took samples of 0·06 m² to a depth of generally 15 to 25 cm.

Both instruments were operated from the RV "Willem Beukelsz" (length: 35 m). The vessel was anchored during calm weather at five stations off Texel at depths of 8 to 18 m. The mode of operation was as follows: after a sample had been taken, the anchor-chain was slackened for another 2 m. A series of ten grab samples alternated with series of ten box samples. At each of the stations 40 samples with each of the samplers were taken providing a total of 200 samples from each instrument.

Slackening the anchor-chain after each taking sample was necessary in order to avoid the risk of repeated sampling in the hole left by a preceding sample. Preliminary experiments with the Van Veen grab resulted in consistently downward trends in the numbers of specimen caught in successive hauls as long as the position of the vessel was fixed.

The samplers were emptied on a large sieve with round holes of 1·0 mm diameter. The volumes of deposit collected by the grab were measured in a graduated container. Occasional measurements of the height of the samples from the box sampler were made together with estimates of the distance between the upper surface of the sediment and the centre of readily visible animals when tearing the sample across.

After washing by a jet from a hose, the living animals were hand-sorted and counted by species and in some cases, also by apparent size class. The lengths of the shells of the living bivalves were also measured.

A species was omitted if nearly all individuals had a diameter well below 1·0 mm, e.g. the very numerous worm *Magelona papillicornis*. Fragmented worms were either reconstructed (as with *Nephtys* species) or only the heads were counted (as with *Lanice conchilega*).

At two stations, ash-free dry weights were determined for each species in a series of ten samples by subtracting ash weights (after 2 h at 600°C) from total dry weights (drying till constant weight, about 4 days, at 60°C in a well-ventilated oven).

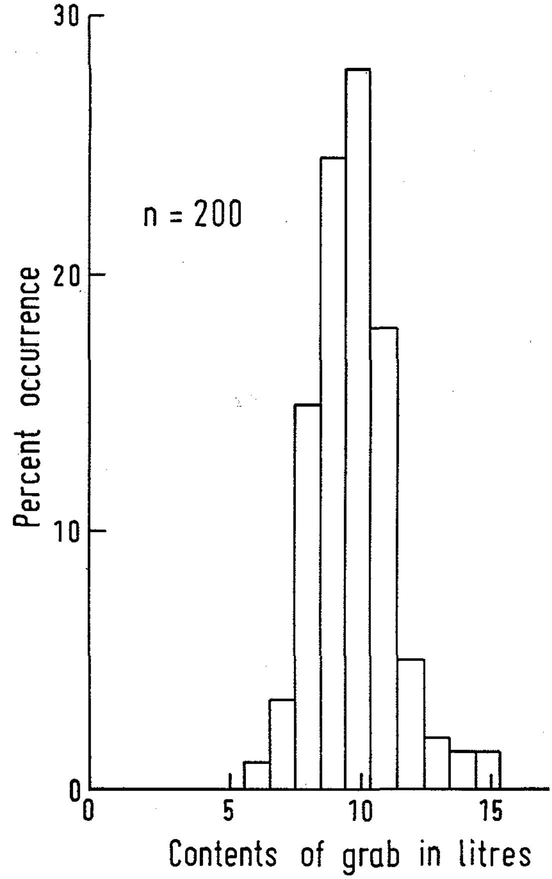

Figure 2. Frequency distribution of the contents of the 0·2 m² Van Veen grab during the comparison tests.

Results

a. Depth of penetration

In the Reineck box sampler the digging depth can be measured directly from the length of the column of sediment obtained. During the experiments it always penetrated at least 10 cm, but generally 15–25 cm into the bottom. The latter range was sufficient to catch specimens of such deep-living species as *Ensis* sp. and *Lanice conchilega*. With the box sampler the numbers per sample were not correlated with digging depth for any species and the results for *Nephtys* (open circles) shown in Figure 3 is a typical result. Thus the box sampler can be used as a standard to calibrate other infauna samplers which are suspected of insufficient penetration.

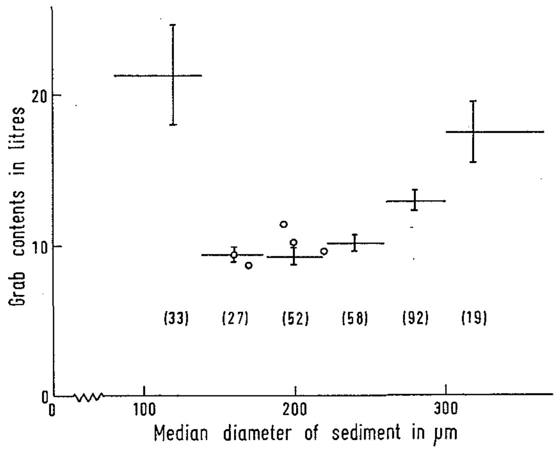

Figure 1. Relationship between the average sediment contents of the 0·2 m² Van Veen grab and the coarseness of the sediment. Vertical bars represent 95 % confidence limits. Circles represent stations where the samples used for the comparison with the Reineck box sampler were taken. The number of observations are indicated in parentheses.

With the Van Veen grab, the measurements of digging depth is less direct. A good estimate can be obtained from the volume of the deposit taken because the biting profile of this grab is very nearly rectangular (Gallardo, 1965; Lie & Pamatmat, 1965). This volume varied from somewhat less than 10 l in hard-packed sands to nearly 30 l in very soft muds. Figure 1 shows the relationship found between the sediment diameters and the average contents of the grab in 281 samples from various stations off the

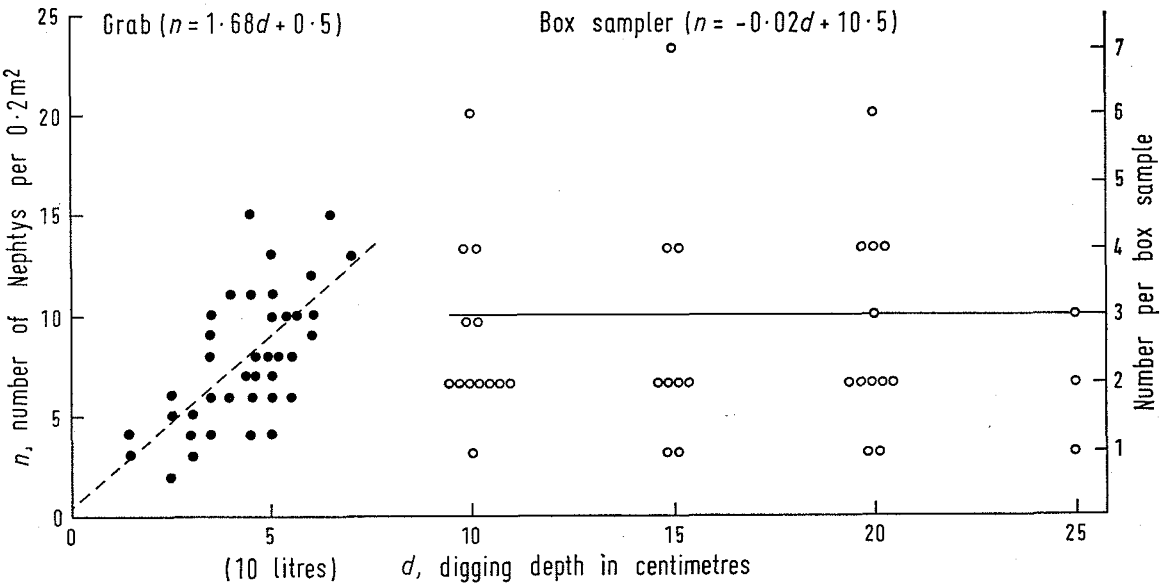

Figure 3. Relationship between digging-depth and numbers of *Nephtys* spp. caught in two sampling devices: the 0·2 m² Van Veen grab (solid circles, broken line for best fit) and the 0·06 m² Reineck box sampler (open circles, solid line). Numbers actually found in the box samples have been multiplied by 0·2/0·06, i.e. the ratio of grab/box areas. Penetration-depths in the grab were calculated from the sediment contents (1 l = 0·5 cm); 5 cm corresponding to 10 litre. The slope is significantly different from 0 only in the grab samples.

Netherlands coast. The samples were grouped at six levels of sediment diameter and the five stations where the comparative hauls were made are shown separately by circles. From these stations dried samples of sediment were sieved through an agitated series of graded screens to obtain accurate data on the median diameter of the sand grains.

Figure 1 shows that the grab dug relatively deep in both very fine (sand with a high proportion of mud) and very coarse sand (often mixed with gravel or shell fragments). On the other hand, relatively small volumes of sediment were obtained from fine sands that were free from mud or nearly so. At such positions, the comparisons with the box sampler were performed.

Ursin (1954) also observed the smallest depth of penetration in fine sands with better performance both in coarse sand and in sandy clay. There is, in fact, a striking similarity between his results and ours on depths of penetration of the Van Veen grab.

The average amount of sediment in the grab at the stations of the comparative hauls was 9·8 l with 95% confidence limits of 9·6 and 10·0 l ($n = 200$).

Figure 2 shows the variability of the grab contents. It may be concluded that the grab performed fairly consistently as 85% of the samples were between 8 and 11 l and more than 95% of all grab samples contained at least 8 l.

An average content of about 10 l is equivalent to an average digging depth of about 5 cm. In fact, these figures are slight underestimates, as some sediment was observed to be washed away through the sieve with the overlying water when the grab was opened on deck. Therefore, a minimal digging depth, in 95% of the samples, of 5 cm seems to be a fair estimate.

During preliminary tests, grab samples were made from a drifting vessel which showed a greater variability and a higher proportion of small samples. The mean contents of 40 such samples was 8·7 l (95% conf. limits 7·9 and 9·5 l). Also the variance was significantly higher ($F = 2{\cdot}7$, $P < 0{\cdot}01$). The common cause of the lower mean and the higher variance is most likely the fact that the grab was not always pulled exactly vertically.

The greater range of digging depths of this series of grab hauls make these samples suitable for a study of the influence of the digging depth on the number of animals caught. Figure 3 shows this relationship for *Nephtys* spp. in which a significant positive correlation in the grab samples was found ($r_s = +0{\cdot}64$, $P < 0{\cdot}001$). Statistically significant correlations were not observed with any of the other abundantly occurring species (the bivalves *Cardium edule*, *Donax vittatus*, *Mactra corallina*, *Macoma baltica* and *Tellina fabula*), although the latter two species showed reduced numbers in samples containing less than 5 to 6 l of sediment. As mentioned earlier, significantly positive correlations were never observed in the box samples (see right hand part of Figure 3 for *Nephtys*).

b. Burrowing depth of the infauna

Few data seem to be available on burrowing depths of subtidal animals. From grab samples, Birkett (1958) found *Mactra corallina* to be restricted to a shallow depth (3 to 4 cm). Molander (1928) lists burrowing depths in soft bottoms, observed from the contents of corers. He found very few animals to occur below 10 cm and these were tube-building worms. In sand-clay mixtures his corer penetrated to only 5 to 7 cm. Such depths would have been too shallow to provide a reliable picture of the burrowing depth of all species. From observations in narrow cores, Jones (1961) gives a detailed account on the vertical distribution of various infauna species in a shallow area in California. He found several species to extend to about 10 cm below the surface and only few to deeper levels.

In our box samples a number of species were found to be restricted to the top 5 cm, viz. *Cardium edule*, *Donax vittatus*, *Mactra corallina*, *Echinocardium cordatum*, and by far the largest numbers of the Tellinidae (*Macoma baltica*, *Tellina tenuis* and *T. fabula*). The latter three species were especially numerous at about 3 to 5 cm. Large specimens of *T. fabula* were observed as deep as 10 cm, but this species was most numerous at depths of 5 to 7 cm. *Pectinaria* sp. were found down to 7 cm. Only two species were frequently observed at deeper levels, viz. the very mobile worms of the genus *Nephtys* (down to 10 to 12 cm) and the tube-builder *Lanice conchilega* (down to about 20 cm). The estimate for *Nephtys* may have been affected by their movement in the samples.

With sample volumes of at least 10 l, the 0·2 m^2 Van Veen grab may therefore be expected to sample the following species completely: *Cardium*, *Donax*, *Mactra*, *Echinocardium*, *Macoma* and small *Tellina*, and the following species almost completely: *Pectinaria* and large *Tellina*. With volumes less than 6 l, sampling of all Tellinidae will be incomplete. Significantly incomplete sampling even with volumes of 10 to 15 l is to be expected in *Nephtys* and *Lanice*. Too few observations were available in *Venus* and *Ensis* to estimate their depth directly.

c. Size selection

In certain species of bivalves (e.g. *Macoma baltica* in an intertidal area according to Vassallo (1971)) large specimens burrow deeper than small ones. Birkett (1958) observed an increasing maximum length in *Tellina fabula* with increasing penetration of the various grabs used. Specimens larger than 10 mm apparently lived below 3 cm on the Dogger Bank. In such species, samples from devices which penetrate deeper, usually contain on average larger animals than those from grabs that sample only the top few centimetres.

In the Van Veen grab this might be expected only with species that occur in significant numbers below the 5 cm level. In the area where the tests were carried out the only such species was the bivalve *Tellina fabula*. Selection for size is not to be expected in

Table 1. Numbers and mean lengths of bivalves in samples obtained from the Reineck box sampler and the Van Veen grab. In some species specimens were allotted to one of two size classes according to their greatest length.

Species	Size class	Total number in box	Total number in grab	χ^2	Average size in mm for box	Average size in mm for grab
Cardium edule		52	156		34·1	34·1
Donax vittatus	large	23	68		29·5	28·8
	small	7	25	0·0	11·9	12·1
Mactra corallina	large	21	55		45·2	46·7
	small	15	56	0·5	34·9	34·7
Macoma baltica	large	119	398		20·7	22·0
	small	32	105	0·0	9·0	10·1
Tellina tenuis		24	68		22·6	23·3
Tellina fabula	large	313	905		18·9	19·0
	small	66	242	9·1**	7·9	7·8
Venus gallina	large	14	12		25·5	25·5
	small	11	34	5·0*	11·4	11·2
Ensis phaxoides		9	8		59·0	62·2

* significant at the 0·05 level; ** significant at the 0·01 level.

species which live close to the surface, such as *Cardium edule*, *Donax vittatus*, *Mactra corallina*, *Macoma baltica* and *Tellina tenuis*.

Table 1 shows for the bivalve species that were found in sufficiently large numbers, the distribution of the categories "small" and "large" in both the grab and box samples. The average sizes within these four categories are also given for each species (except for *Cardium edule*, *Tellina tenuis* and *Ensis phaxoides*, which were present only as large animals). There are neither significant nor consistent differences in average length within size categories between the samples from the two sampling devices. The numbers of large and small specimen shown for each of the sampling devices can be considered as 2 × 2 contingency tables for each species. The values of χ^2 are close to 0 in the species which live close to the surface, viz. *Cardium*, *Donax*, *Mactra* and *Macoma*. In these species, large and small specimens are sampled equally well with either sampling device. On the other hand it is not unexpected that *Tellina fabula* shows a significant χ^2. In *Venus* too, the larger specimens are significantly under-represented in the grab samples, indicating that the larger specimens are deeper, partly below 5 cm. Too few observations on the burrowing depth of *Venus* are available to confirm this.

It may be concluded that the Van Veen grab gives a fair impression of the size distribution of most bivalve species. Only in relatively deep-living species, like *Tellina fabula* (and probably also *Venus gallina*) does the grab underestimate the numbers of large specimens present. Within the group of large specimens, which for most species probably included all year classes except the 1 year class, no further size selection is apparent (mean lengths in "large" *Tellina fabula* 18·9 and 19·0 mm for the box and grab, respectively).

d. Comparisons of estimates of numerical densities

If two samplers work equally efficiently, both should yield essentially the same numbers of animals per m^2 in all species, i.e. in Figure 4 all the points should be scattered round the bisectors. This is in fact the case for the species which live close to the surface, viz. *Echinocardium* (Fig. 4a), *Cardium*, *Donax* and *Mactra* (Fig. 4b), and also for the shallow-lying species such as *Macoma*, *T. tenuis* and small *T. fabula* (Fig. 4c). In large *T. fabula* most points in Figure 4c lie below the bisector, pointing to a greater efficiency of the box sampler. This would be expected from their deeper level (see section b) and the relatively small proportion of "large" animals of this species in the grab (section c and Table 1). In *Venus* the situation is similar and even more convincing (see Table 1 and compare the solid and open circles in Fig. 4d). The points representing the worms (Fig. 4e) are all below the bisector as expected from their depth distribution (section b). It is significant that the deepest living species (i.e. *Lanice*) shows the greatest deviation from equal catchability in Figure 4e. Finally, Figure 4f shows the estimates for the epifauna species. These species were so scarce that they had to be lumped together into two groups, viz. the highly mobile Decapods (mainly *Carcinus maenas*) and the other species (mainly Echinoderms). Decapods were the only group that was more abundant in the grab samples than in those of the box sampler.

In Figure 4a a maximum of 5 points per species is shown, i.e. one for each sampling station. As 4 series (of 10 hauls each) were made on each station, 20 pairs can be compared for the more abundant species. The presence of many negative samples made a comparison of the full 200 pairs rather pointless. The "Wilcoxon" matched-pairs signed-ranks test with $n = 20$ revealed significant differences between the samples of grab and box sampler in *Nephtys* and *Lanice* (both $P < 0{\cdot}01$) but not for "large" *Tellina fabula* (P about 0·06, one-tailed). The other species (viz. "large" *Venus*, *Pectinaria* and epifauna-components), in which a difference between the samplers was suggested in Figure 4 were too scarcely represented to obtain significant results.

Table 2 gives the total number of the various species caught per 200 samples with the two sampling devices (i.e. 12 m^2 box sampler and 40 m^2 grab) and the ratio of the numbers per m^2. For the three species mentioned above, in which a significant or nearly significant difference between the efficiencies of the sampling devices was found, the 95%-confidence limits of the average ratio (from 20 separately calculated ratios) are also given.

Inspection of the significant mean ratios shows that the grab underestimates *Lanice* to such an extent (on average only 3% to 9% were caught) that obtaining a good estimate of its abundance seems impossible by grab-sampling. In *Nephtys* the situation is better. Numbers of this species from grab-samplers should be raised by about 25% only, viz. (1·00 − 0·80) /0·80, with confidence limits of about 15% and 35%. The correction for *Tellina fabula* is still smaller (if at all necessary). A large number of species are probably sampled correctly by the Van Veen grab. Ratios which deviate less than 10% from unity were obtained for "other species of epifauna", *Echinocardium*, *Cardium*, *Donax*, *Mactra*, *Macoma*, small *Venus* and also for a combined ratio for all *Tellina* sp. The rela-

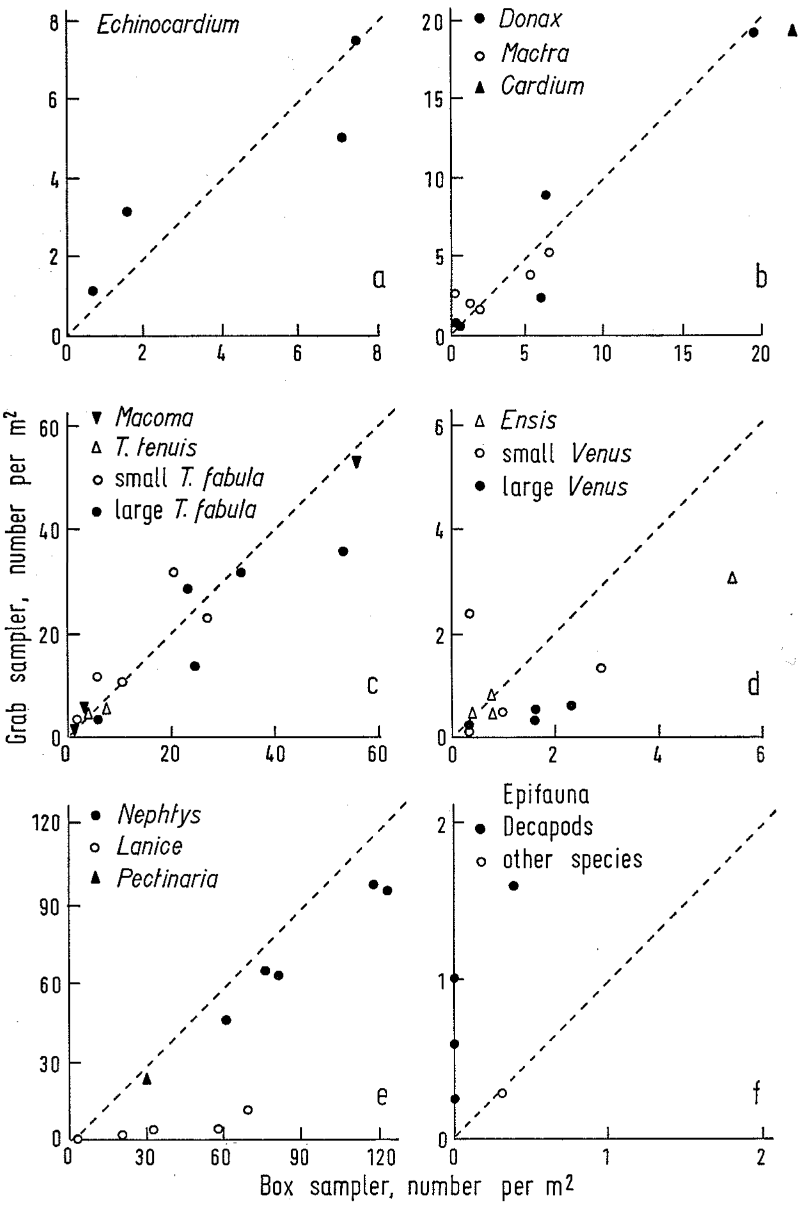

Figure 4. Relationships, for the various species, between the estimates of numbers per m² from the two sampling devices: the 0·2 m² Van Veen grab and the 0·06 m² Reineck box sampler. The bisectors indicate parity between the two samplers.

The species have been grouped according to both systematic group (a = Echinoderms, b – d = bivalves, e = Polychaetes and f = various) and depth (f = epifauna, a – b = top few centimeters, c = top layer up to about 7 cm, d = unknown and e = all levels, including 10–20 cm layer in *Nephtys* and *Lanice*).

Table 2. Total numbers and numbers per m² caught by the two sampling devices and ratios for the relative efficiency of the 0·2 m² Van Veen grab, by species.

Species	Total numbers box	Total numbers grab	Numbers per m² box	Numbers per m² grab	Ratio (m²) grab/box	Mean ratio with 95% confidence limits
Decapods	1	26	0·1	0·7	7·80	
Other epifauna	4	11	0·3	0·3	0·82	
Echinocardium	40	133	3·3	3·3	1·00	
Cardium	50	156	4·2	3·9	0·94	
Donax	79	254	6·6	6·4	0·97	
Mactra	37	123	3·1	3·1	1·00	
Macoma	143	493	11·9	12·3	1·03	
Tellina tenuis	29	79	2·4	2·0	0·82	
Large *T. fabula*	340	921	28·3	23·0	0·81	0·86 (0·69 and 1·03)
Small *T. fab.*	157	616	13·1	15·4	1·18	
All *Tellina*	526	1 616	43·8	40·4	0·92	
Large *Venus*	14	12	1·2	0·3	0·26	
Small *Venus*	11	34	0·9	0·8	0·93	
Ensis	19	38	1·6	1·0	0·60	
Nephtys	1 097	2 878	91·4	72·0	0·79	0·80 (0.73 and 0·87)
Pectinaria	77	188	6·4	4·7	0·73	
Lanice	443	126	36·9	3·1	0·09	0·06 (0·03 and 0·09)

tively low ratios for "large" *Venus*, *Ensis* and *Pectinaria* point to a real deficiency of the grab in sampling these species (see section b and c), but the numbers were not sufficient to warrant quantitative conclusions.

e. Comparison of biomasses

It is clear that the Van Veen grab is a satisfactorily reliable instrument for biomass estimations in faunas predominated by animals that live in the upper bottom layers, like most Echinoderms and bivalves. However, if deep-burrowing worms form a significant proportion of the infauna, this grab may seriously underestimate the total biomass present.

At two stations, the total weight of each species caught was determined and Table 3 summarizes the results in grammes of ash-free dry weights per m². The various species have been taken together according to the level at which they live.

At the first station (6–4) relatively low densities of *Lanice* and *Nephtys* were encountered, half of the biomass consisting of *Cardium*. In this case both sampling devices caught the same total amounts because the deficit of deep infauna in the grab samples was nearly equal to the deficit of epifauna in the box samples. The estimate of the biomass of the infauna obtained by the grab should be multiplied by slightly less than 1·2 to get the proper figure.

At the second station (7–4) the deep-living *Nephtys* and *Lanice* together made up more than half of the weight in the box-samples. At this station the estimate from the grab should be multiplied by 1·6 to obtain the true estimate.

Discussion

The results of this study confirm and quantify the opinion of Holme (1964) that two categories of animals escape the normal quantitative samplers such as grabs: the fast moving and the deep-burrowing.

Table 3. Two comparisons of estimates of biomass (organic matter/m²) obtained from two sampling devices (0·2 m² Van Veen grab and 0·06 m² Reineck box sampler).

Group	Station 6–4 box	Station 6–4 grab	Station 6–4 Ratio grab/box	Station 7–4 box	Station 7–4 grab	Station 7–4 Ratio grab/box
Epifauna	0·7	2·9	4·0	0·0	1·0	(great)
Infauna:						
close to surface	9·2	8·7	0·9	5·3	4·8	0·9
Deeper bivalves	3·1	2·8	0·9	2·5	1·8	0·7
Worms	3·3	1·8	0·6	9·6	4·0	0·4
Total	16·3	16·2	1·00	17·3	11·6	0·67
Infauna only	15·6	13·3	0·85	17·3	10·6	0·61

Fast moving epifauna animals either avoid the samplers actively or are washed away by the shock wave. Wigley (1966) found a fairly strong shock-wave in his Van Veen grab which had only a small part of its upper surface covered by gauze (45 cm^2 as compared to 672 cm^2 in ours). Nevertheless, a possible washing-away effect cannot by excluded in the present tests. This may occur with both samplers. Active avoidance will be especially serious in the more mobile species. The larger crabs will not be washed away very easily. It is these species, however, which were underestimated by the sampler with the smallest surface (the box sampler), pointing to active avoidance. A quantitative estimate of the bias from active avoidance may be obtained by making comparative hauls with series of grabs of different sizes. Until such experiments are performed, the 0·2 m^2 Van Veen grab is suspected of underestimating the mobile part of the epifauna.

Deep-burrowing species were present at all 5 stations. As Molander (1928) found, most of them are worms. These species are underestimated by the Van Veen grab if they are living below the digging-depth of the grab. The latter depends on the type of substrate (see Fig. 1). The vertical distribution of part of the infauna species may also depend on properties of the substrate. Consequently, predictions for any specific sampling station are hardly better than a guess. Only species that are known to be limited to the top 5 cm of sediment may be expected to be sampled without bias by the grab in sandy sediments. In muddy sediments and in very coarse sand this depth may be increased to 10 cm. A significant proportion of large tube-building worms like *Lanice* will always escape. Where such species are numerous, biomass estimates may be seriously affected.

Some earlier tests on the efficiency of the Van Veen grab have been published. Birkett (1958) demonstrated the inadequacy of the grab, observing in most species a dependence of the number of animals on the amount of sediment obtained by the grab. Ursin (1954) found the same dependence for all species together. In some cases both authors found that the relationship disappeared with large amounts of sediment. In *Mactra* this independence started at about 6 l with the 0·2 m^2 grab (Birkett, 1958), pointing to a vertical distribution in this species that is limited to the top 3 cm. In the case of the grouped species (Ursin, 1954), two of the four relationships disappeared at volumes greater than about 10 to 16 l, i.e. at 5 to 8 cm penetration depth. Although any estimate of the true densities of the species involved is lacking in these studies, it may be assumed that the infauna was sampled adequately as soon as the numbers became independent of the volume of the sediment, i.e. of the digging-depth of the grab. Thus Birkett's samples, which nearly all contained less than 10 l of sediment, would have been too shallow for most species. Ursin's largest samples were adequate when they penetrated more than 5 and 8 cm. This way of judging the efficiency of grabs is valid only if no exceptionally deep-digging species are present which are limited to deep layers below the penetration-depth of any of the samples obtained.

Ursin (1956) made an experiment similar to ours by using a Knudsen sampler as a deep-digging (18–26 cm) standard device. The penetration-depth of his Van Veen grab exceeded 5 cm in nearly all cases. He found only slight differences in numbers per m^2 in favour of the Knudsen sampler. Unfortunately, the number of samples available for comparison was small.

Lie & Pamatmat (1965) made 37 comparisons to test the 0·1 m^2 Van Veen grab against hand-dug samples, eight of which were found to be significantly different. Half of the latter were in favour of the grab. They noted, that part of these differences may not have reflected differences between the sampling devices, but may have arisen from tidal migrations (the grab samples were taken at high tide, the hand-dug samples at low tide on an exposed beach). Moreover, they found significant differences in both directions in the same species. For these reasons, their results are difficult to evaluate.

Summary

1. To test the efficiency of the 0·2 m^2 Van Veen grab, 200 comparative samples at 5 stations off the Netherlands coast were taken with this grab and with the 0·06 m^2 Reineck box sampler.
2. Numbers and size of the macrofaunal benthos species and at two stations, also biomasses, were compared. Burrowing depth of the various species could be observed from the undisturbed box samples.
3. Depth penetration in the box sampler was invariably more than 15 cm. This was sufficient to catch all infaunal species completely.
4. Depth penetration in the grab depended on the type of the sediment. The tests were made in the sediment with the worst penetration, viz. 5–6 cm in relatively fine sand.
5. Most species were restricted to the top 5 cm of the sediment and were sampled equally well with both instruments: *Echinocardium cordatum, Cardium edule, Donax vittatus, Mactra corallina, Macoma baltica, Tellina tenuis*, small specimens of both *Tellina fabula* and *Venus gallina*.

6. Individuals of some species were also found at depths between 5 and 10 cm. The numbers of the following species needed a relatively small correction to obtain good estimates of their densities from grab samples: large specimens of both *Tellina fabula* and *Venus gallina*, *Ensis phaxoides*, *Pectinaria* spp., and *Nephtys* spp.
7. The rear ends of the tube building *Lanice conchilega* were found as deep as 20 cm. A very small proportion of these worms actually present were sampled by the grab.
8. The epifaunal species may have been underestimated by both instruments. The highly mobile species were sampled in relatively higher numbers by the grab.
9. It is concluded that the reliability of biomass estimates by means of grab sampling depends on the faunal composition.

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