

"AURELIA"-CRUISE REPORTS  
ON THE BENTHIC FAUNA OF THE SOUTHERN NORTH SEA



REPORT 10  
THE EFFECT OF DIFFERENT NUMBERS OF TICKLER CHAINS  
ON BEAM-TRAWL CATCHES

F. CREUTZBERG, G.C.A. DUINEVELD AND G.J. VAN NOORT

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Report 10:

The effect of different numbers of tickler chains  
on beam-trawl catches

F. Creutzberg, G.C.A. Duineveld and G.J. van Noort

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(The "Aurelia"-cruise reports on the benthic fauna of the southern North Sea are edited by G.J. van Noort).

## I. INTRODUCTION

The categorie of animals which are, more or less selectively caught with a 5.5-m beam trawl as used in the 'AURELIA' cruises 1-8 (v. NOORT et al, 1979 a,b,c,d, 1981, 1982, 1983, 1984,) belongs to epibenthic predators, swimming near or crawling on the bottom. They comprise small demersal fishes, shrimps, crabs, asteroids, ophiuroids and gastropods, mainly feeding on the benthic infauna. Quantitative knowledge on this community, however, is scarce. A principal drawback in these studies is our poor knowledge on the efficiency of the fishing gear. Obviously, the efficiency will - for different species - show an extreme variety. The hermit crab Eupagurus bernhardus, for instance, may be caught reasonably well, whereas burrowing animals hardly occur in the trawl catches as compared to the numbers found in Van Veen bottom-grab samples. Likewise, the occurrence of large fish will poorly be recorded by the beam trawl.

The possibilities of escape from the trawl are threefold:

- a. through the meshes by juveniles and small species
- b. underneath the ground rope by species occasionally burrowing
- c. lateral escape as well as well as escape over the beam by fast swimmers.

In the present report the ground-rope effect is discussed. In 1977 a number of experimental hauls were carried out with different numbers of tickler chains, varying from 0 to 6. These experiments took place in three sandy areas and in one muddy area (Fig. 1.).

## II. MATERIAL AND METHODS

The surveys were made with a 5.5-m beam trawl (Fig.2) which is an adapted copy of the 6-m beam trawl used by the Netherlands Institute for Fishery Investigations, IJmuiden in the "Demersal Young Fish Survey" programme. The mesh size of the net decreases from  $17.5 \times 17.5 \text{ mm}^2$  at the front to  $5 \times 5 \text{ mm}^2$  at the cod end (or from 35 mm to 10 mm if stretched). The ground rope is equipped with 17 bobbins of 7 cm diameter and 10 cm length. In front of the ground rope different numbers of tickler chains (with links of  $5.5 \times 3.5 \times 1.2 \text{ cm}$ ) were fitted.

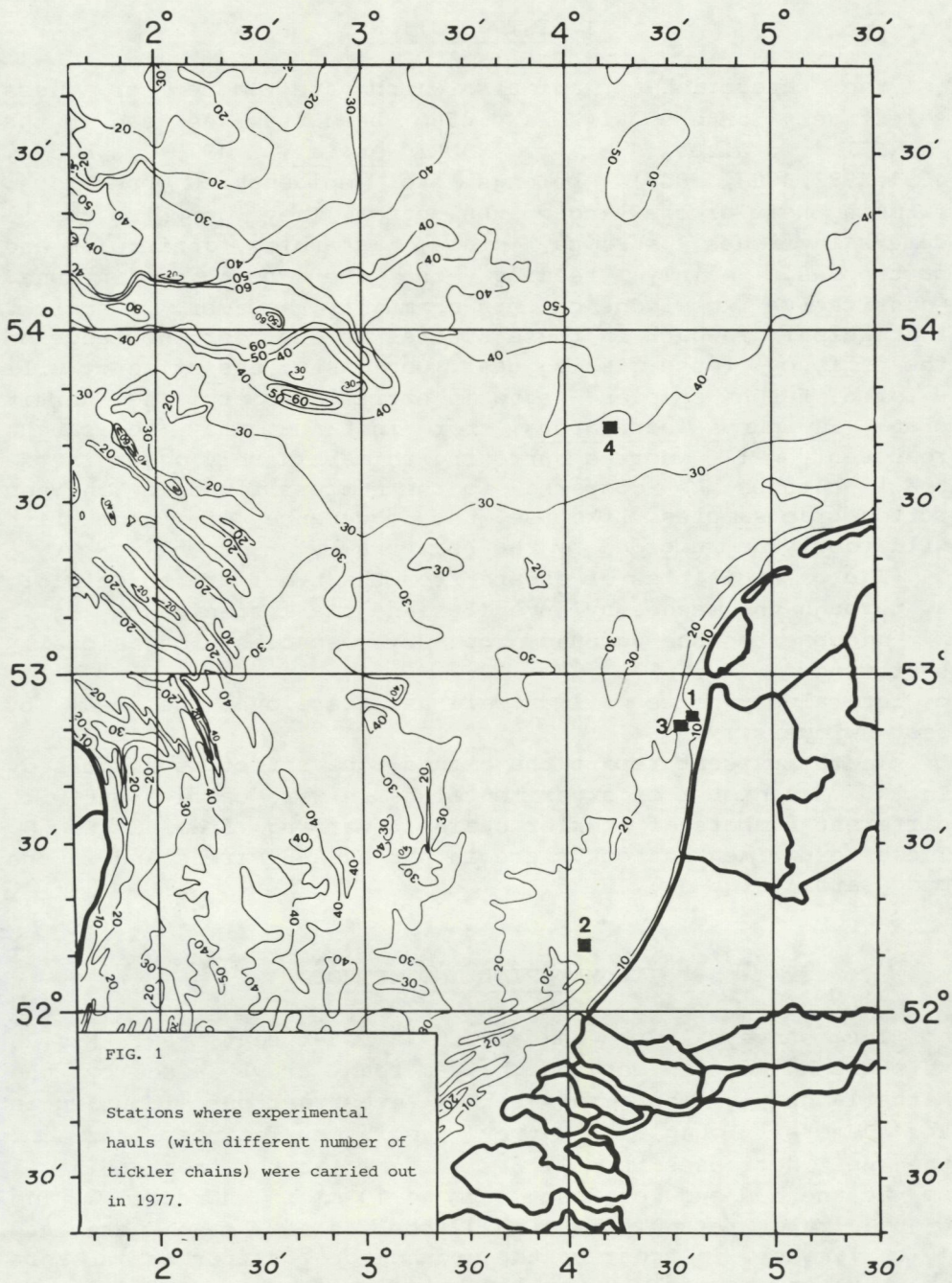


TABLE I. Date, time and location of experimental series of hauls carried out in 1977.

SERIES	DATE	TIME	LOCATION		
			POSITION	No. in fig. 1	SEDIMENT
1	Jan. 24th	10.15-12.12			
2	Jan. 24th	13.10-14.51	52° 51.5' - 52° 53.0' N	1	SAND
3	Jan. 25th	10.05-11.47	4° 35.0' - 4° 38.0' E		
4	Jan. 25th	11.56-13.56			
5	Oct. 11th	8.43-13.05	52° 11.0' - 52° 12.5' N	2	SAND
6	Oct. 11th	13.20-15.33	4° 03.5' - 4° 06.0' E		
7	Oct. 13th	9.56-11.48	52° 51.5' - 52° 53.0' N	1	SAND
			4° 35.0' - 4° 38.0' E		
8	Oct. 13th	13.16-14.59	52° 49.5' - 52° 51.5' N	3	SAND
			4° 32.5' - 4° 35.0' E		
9	Oct. 17th	15.27-16.37			
	Oct. 18th	8.30- 9.28	53° 42.5' - 53° 43.5' N	4	MUD
10	Oct. 18th	10.54-15.27	4° 11.0' - 4° 14.0' E		
11	Oct. 19th	8.27-10.55			

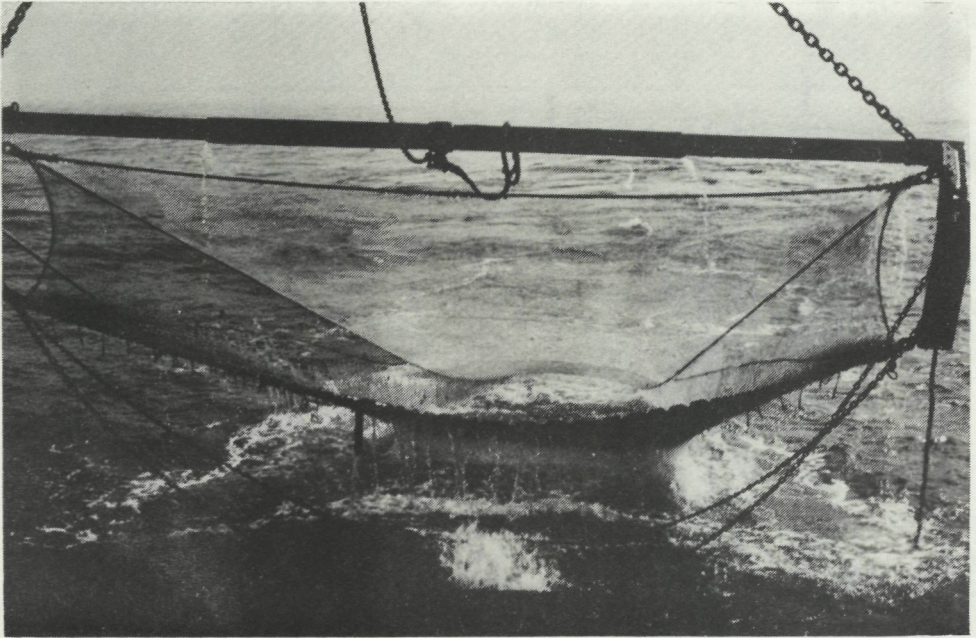


Fig. 2. 5½ m beam trawl with two tickler chains.

The hauls were of 5 minutes duration, and the distances covered by the fishing net were estimated with the aid of a Decca Track Plotter. The numbers of animals counted were converted into numbers of animals caught per 10,000 m<sup>2</sup>. The experimental series consisted of 7 hauls with 0-6 tickler chains, fitted in a randomly chosen sequence. Four series were performed in January 1977 and seven series in October 1977. The location, dates, times and the character of the sediment are mentioned in Table I. The positions are shown in Fig. 1.

### III. RESULTS

All catches of the separate species are summarized in the addendum, expressed in numbers caught per 10,000 m<sup>2</sup>.

For further considerations the numbers of specimens per 10,000 m<sup>2</sup>, caught during the separate hauls of one series, were converted into the percentage of the total catch of the complete series of seven hauls. In that way the relative effect of tickler chains on populations with different

densities could be compared. Eight series were made in three different sandy stations and three series in one muddy station (Fig. 1).

Unfortunately the variability of the catches was extremely high. For a surveyable review of the results, therefore, the counts of the three sandy stations were averaged as much as possible, but nevertheless the conclusions are - for a considerable part - not based on significant data. For a separate treatment of size classes the figures are far from sufficient.

The results are summarized in Figs. 3-10. In these diagrams the variability is - with vertical bars - expressed in 95% confidence limits computed after an arcsine transformation of the percentages mentioned above (SOKAL & ROHLF, 1969).

At first view there is a conspicuous difference between the series carried out in sandy and muddy areas. In the sandy stations there is, in general, a positive effect of tickler chains, whereas in the muddy station tickler chains seem to have few, or even an adverse effect on the catches. In the following considerations, therefore, the sand and mud series will be treated separately.

For the comparison between the species the tickler-chain effect has been expressed in linear regression parameters of the arcsine-transformed data, irrespective of the possible shape of the diverse specific curves. A test on linearity, however, showed that in only five (obvious) cases linearity had to be rejected. The linear regression parameter  $b$  (slope), therefore, provides us with a comparable measure of the effectiveness of tickler chains on different types of animal. In Tables II (sand stations) and III (mud station) the animals are arranged in decreasing order of the effect of the chains as measured by the parameter  $b$  (slope). Values of  $b$ , significantly different from zero, are marked with an asterix in tables II and III.

The arcsine-transformed percentages have also been treated with an analysis of variance. The results of the anova are in general consistent with those of the regression analysis. With Buglossidium luteum, Merlangius merlangus and Pleuronectes platessa in the sand stations anova yielded no significant differences among means, whereas regression analysis showed a significant regression. This is also the case with Limanda limanda in the mud stations. This difference is due to the fact that regression analysis is more powerful than anova in

testing the same null hypothesis, i.e. equality of means (SOKAL & ROHLF, 1969). In addition to anova a Student-Newman-Keuls test has been applied on the transformed means to locate non-significant ranges of means (SOKAL & ROHLF, 1969). In Figs. 3-10 non-significant ranges according to the S-N-K test are underlined.

#### IV. DISCUSSION SAND STATIONS

In Table II (sand stations) the animals show a fairly conceivable sequence. If, for instance, the fishes Solea solea and Buglossidium luteum (which are known to cling strongly to the bottom) are compared with the pelagically living horse mackerel Trachurus trachurus, their places in Table II are understandable. The same holds true for the comparison of burrowing invertebrates such as Crangon allmanni and the swimming crab, Macropipus holsatus with a not burrowing animal such as the hermit crab Eupagurus bernhardus.

For studies on efficiency of fishing gears it is of interest if, with the addition of still more tickler chains, the catches do not persist in growing. In other words, if the curves (Figs. 3-10) show (or show not) an asymptotic course, indicating a 100% ground-rope efficiency at a certain number of chains. For the sole, Solea solea and solenette Buglossidium luteum (Fig. 3) this is, apparently, not the case, even with the maximum number of 6 chains. Neither such an asymptotic course is found in invertebrates such as Crangon allmanni (Fig. 8), the swimming crab Macropipus holsatus (Fig. 7), and Ophiura texturata (Fig. 10). An obvious asymptotic course, on the other hand, is found in the curves of the dab Limanda limanda (Fig. 4) and the starfish Asterias rubens (Fig. 9). Also in other species like the dragonet Callionymus lyra (Fig. 5), the whiting Merlangius merlangus (Fig. 5), the gobies Pomatoschistus (Fig. 6), the shrimp Pontophilus trispinosus (Fig. 8) and the brittle-star Ophiura albida (Fig. 9) there is, apparently, a certain amount of chains beyond which no further increase of catches takes place.

The tickler-chain effect on the catches of the whiting (Fig. 5) is strange, and difficult to explain. For fishes which are supposed to swim more or less pelagically, an effect as found in the horse mackerel Trachurus trachurus (Fig. 10) should have been expected.

## V. DISCUSSION MUD STATION

As shown in Table III the tickler chains have very few effect on the catches in the mud station. For a number of species, specially fishes, the chains seem even to have an adverse effect. For these mobile animals the disturbances in the mud caused by the chains might have resulted into the negative regression, occuring in all fish species except in the scald-fish Arnoglossus laterna (Fig. 6) and the sole Solea solea (Fig. 3). Also Crangon allmanni (Fig. 8), just as well a mobile animal, shows a negative regression with increasing number of tickler chains.

A positive effect of tickler chains is found in Astropecten irregularis (Fig. 10), Ophiura albida (Fig. 9) and Turritella communis (Fig. 10) These are all sedentary animals from which Astropecten and Turritella are burrowing. Very strange, however, is the drop of the catches with 6 chains in all three of the cases.

The highest density of Turritella, recorded with the beam trawl with 5 tickler chains, amounts to 4.4 (2-7) specimens per m<sup>2</sup>. With the van Veen bottom sampler, however, the density, recorded at about the same station, ranges from 25 to 50 specimens per m<sup>2</sup>. The efficiency of a beam trawl with 5 tickler chains for animals, as Turritella, living just below the water-sediment boundary, is, apparently about 13%.

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TABLE II. List of animals from the sandy stations in decreasing order of the effect of the chains as measured by the parameter  $b$  (slope). Values of  $b$  significantly differing from zero are marked with an asterix.

NAME OF THE SPECIES	$b$ (slope)	$r$ (corr.coeff.)	$N$ (no. obs.)
<i>Crangon allmanni</i>	0.0963*	0.8111	21
<i>Solea solea</i>	0.0963*	0.9002	28
<i>Macropipus holsatus</i>	0.0801*	0.7071	56
<i>Ophiura albida</i>	0.0759*	0.9121	14
<i>Ophiura texturata</i>	0.0711*	0.7722	56
<i>Buglossidium luteum</i>	0.0699*	0.7929	14
<i>Asterias rubens</i>	0.0496*	0.7143	42
<i>Merlangius merlangus</i>	0.0395*	0.4472	28
<i>Crangon crangon</i>	0.0380*	0.6508	56
<i>Limanda limanda</i>	0.0365*	0.6011	42
<i>Callionymus lyra</i>	0.0320	0.4431	28
<i>Pomatoschistus</i> sp.	0.0297*	0.5686	41
<i>Pleuronectes platessa</i>	0.0237*	0.3238	56
<i>Pontophilus trispinosus</i>	0.0228	0.2629	28
<i>Trachurus trachurus</i>	0.0101	0.1615	14
<i>Eupagurus bernhardus</i>	0.0066	0.0916	56

TABLE III. List of animals from the muddy station in decreasing order of the effect of the chains as measured by the parameter  $b$  (slope). Values of  $b$  significantly differing from zero are marked with an asterix.

NAME OF THE SPECIES	$b$ (slope)	$r$ (corr. coeff.)	$N$ (no. obs.)
<i>Astropecten irregularis</i>	0.0210	0.3171	21
<i>Eupagurus bernhardus</i>	0.0196	0.2713	21
<i>Ophiura albida</i>	0.0177	0.3189	21
<i>Arnoglossus laterna</i>	0.0072	0.1359	21
<i>Turritella communis</i>	0.0058	0.1026	21
<i>Macropipus holsatus</i>	0.0011	0.0225	21
<i>Solea solea</i>	0.0010	0.0083	21
<i>Buglossidium luteum</i>	-0.0039	-0.0905	21
<i>Callionymus lyra</i>	-0.0105	-0.2122	21
<i>Asterias rubens</i>	-0.0108	-0.1596	21
<i>Pleuronectus platessa</i>	-0.0159	-0.1355	21
<i>Pomatoschistus</i> spp.	-0.0212	-0.2690	21
<i>Limanda limanda</i>	-0.0236*	-0.4793	21
<i>Merlangius merlangus</i>	-0.0302	-0.4054	21
<i>Crangon almanni</i>	-0.0323	-0.2718	21
<i>Rhinonemus cimbrius</i>	-0.0326	-0.2919	21

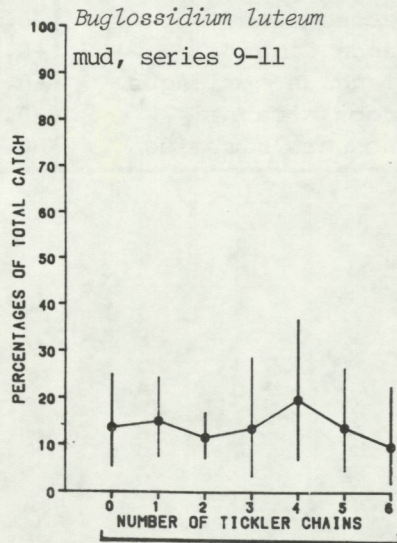
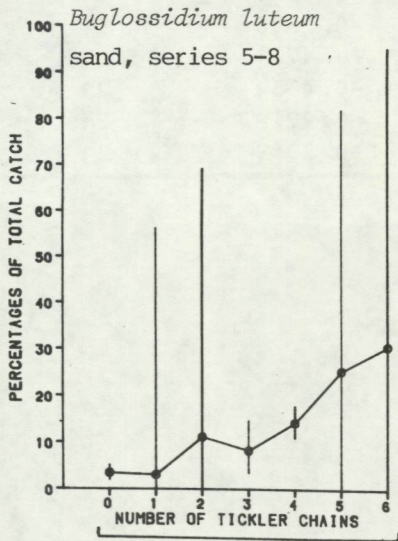
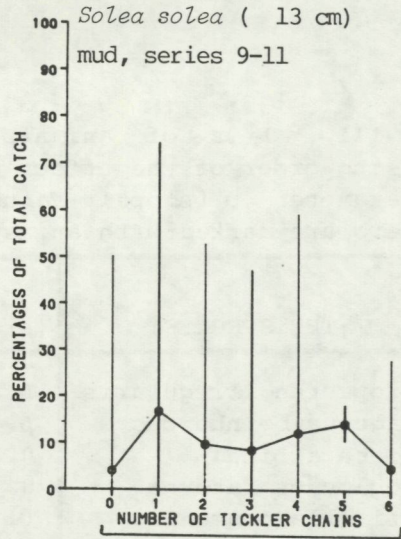
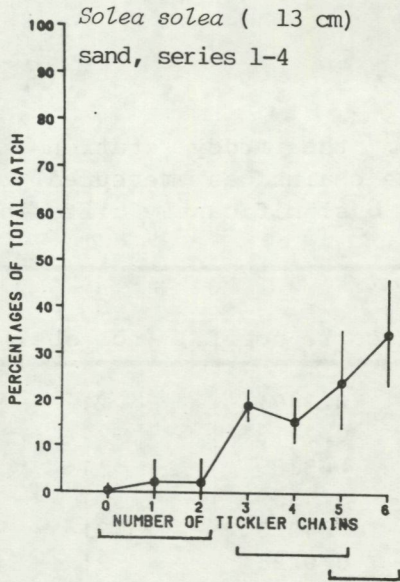


Fig.3 Relationships between the number of tickler chains and the number of animals caught, expressed in % of the total catch of a series, in sand and mud stations. Vertical bars are 95% confidence limits. Non-significant ranges according to the Student-Newman-Keuls test are underlined.

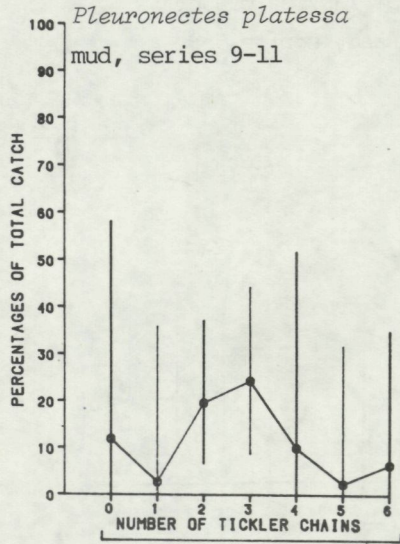
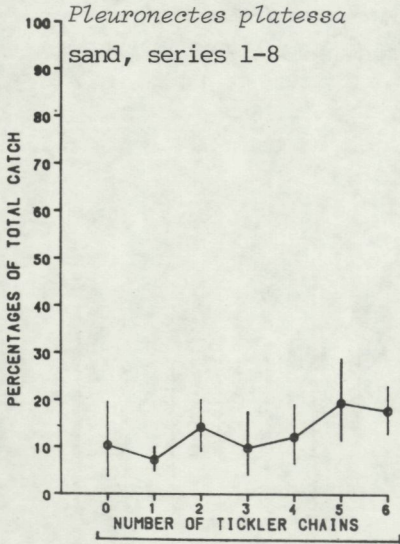
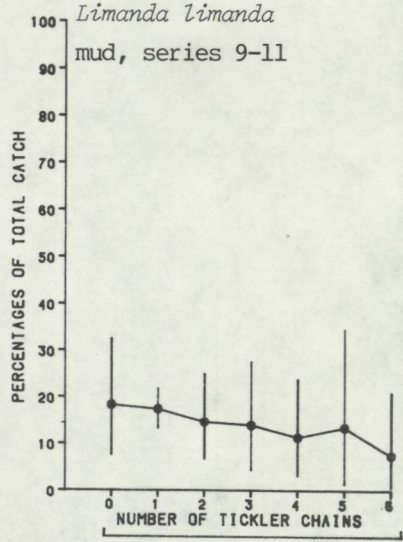
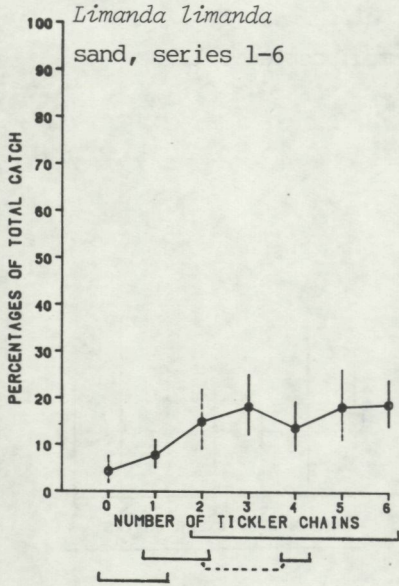


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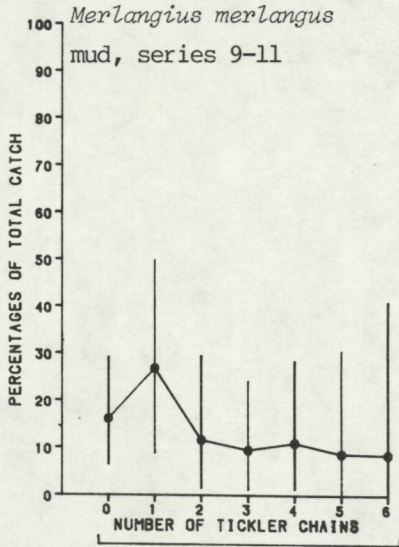
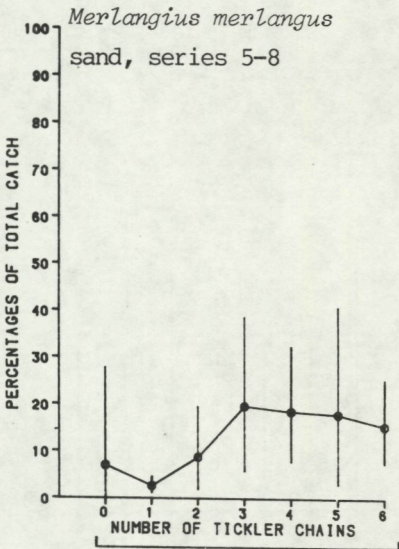
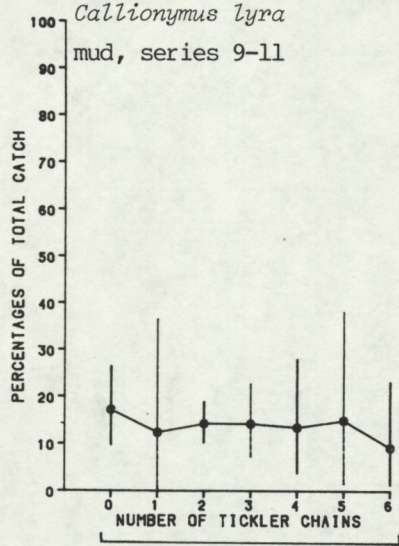
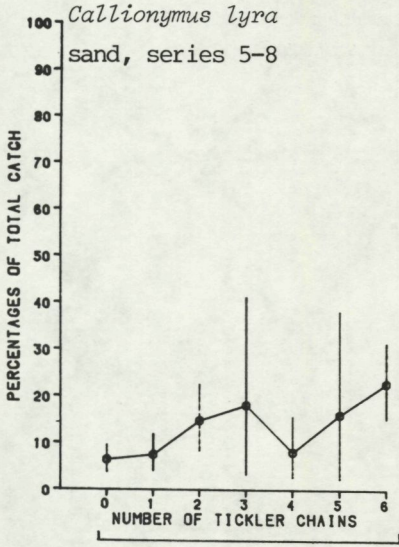


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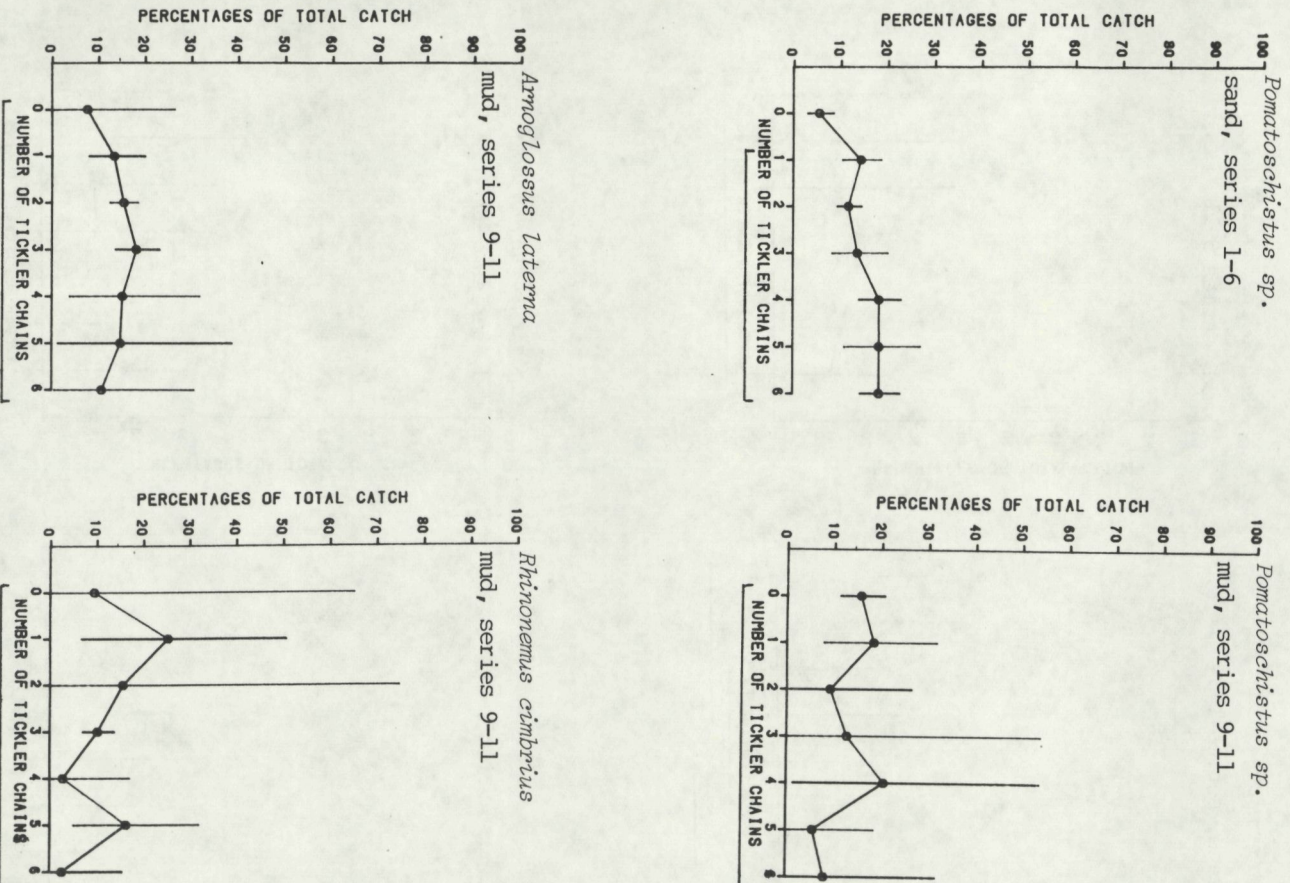


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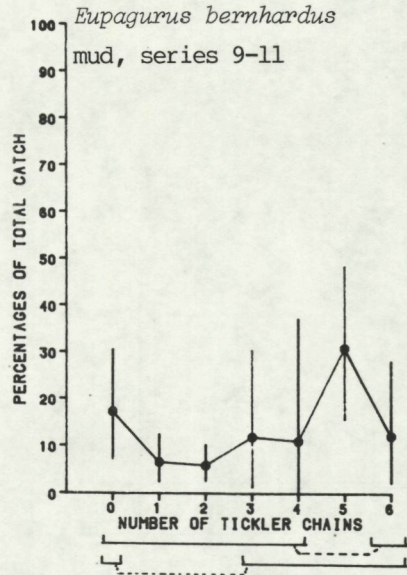
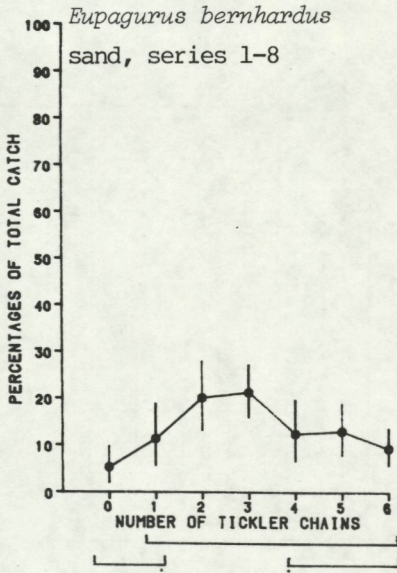
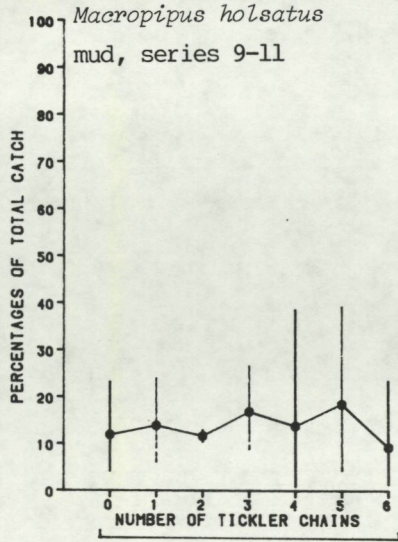
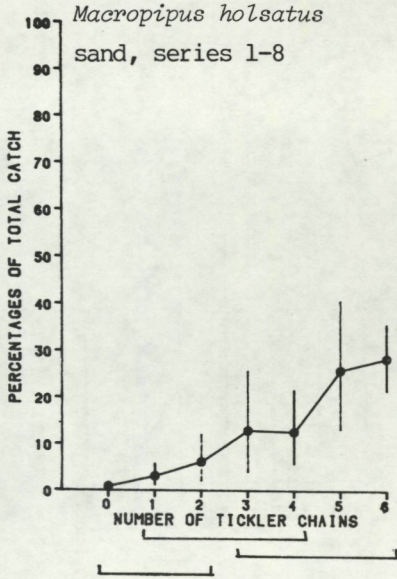


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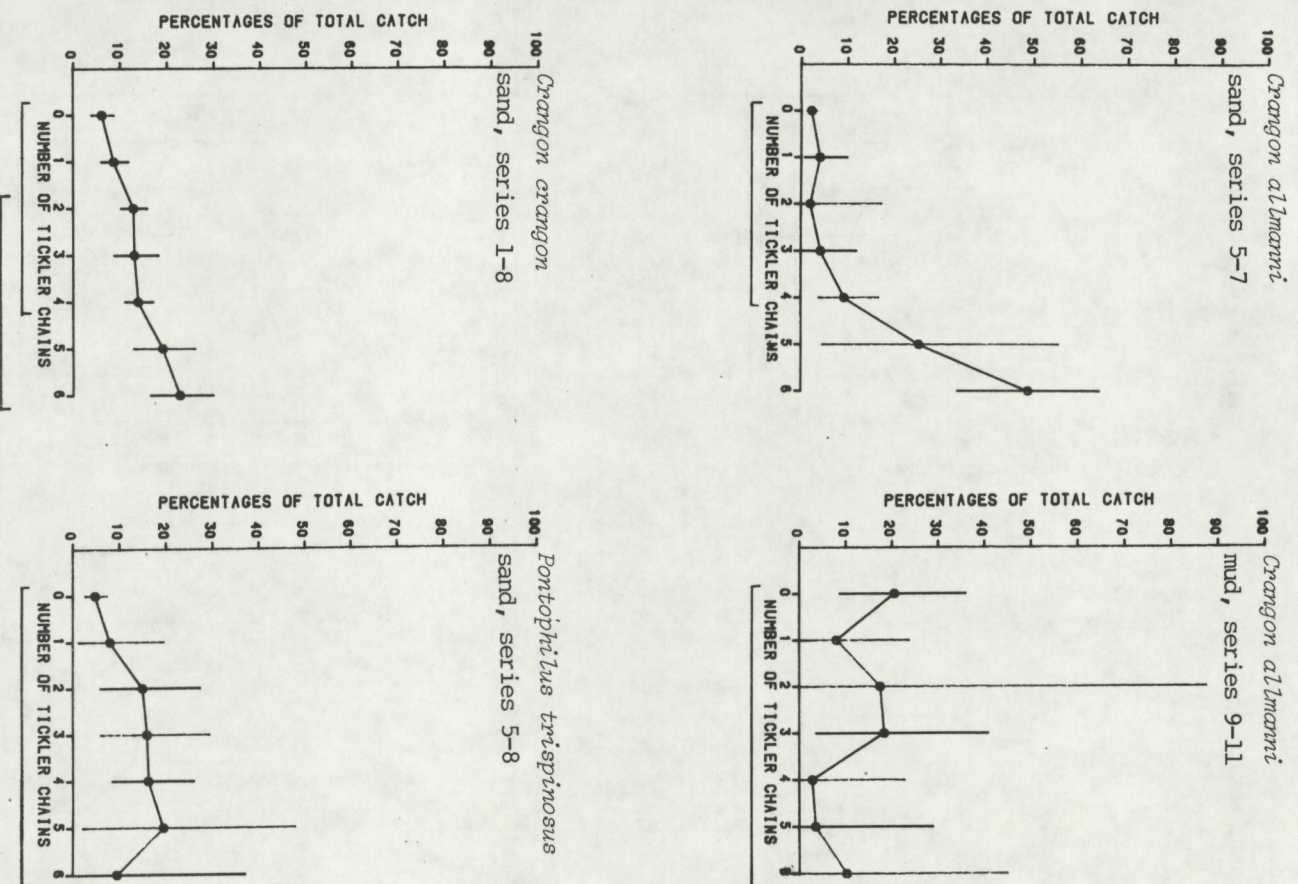


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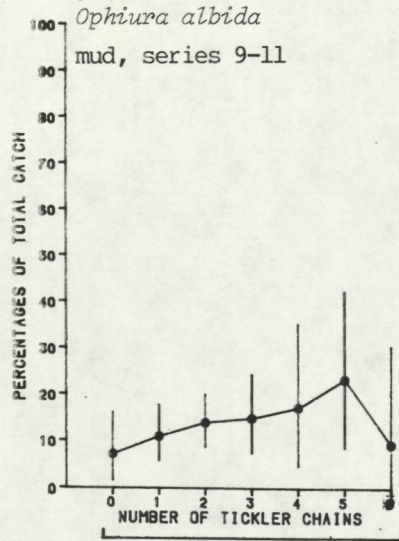
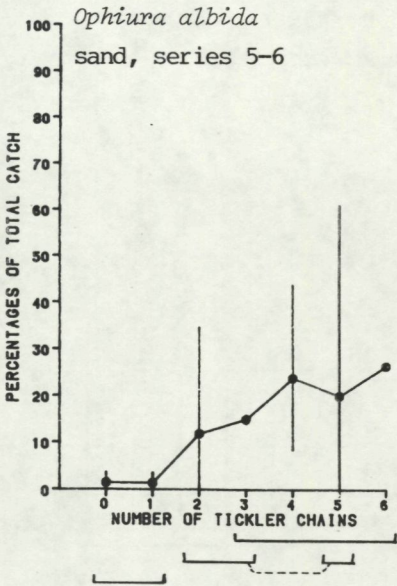
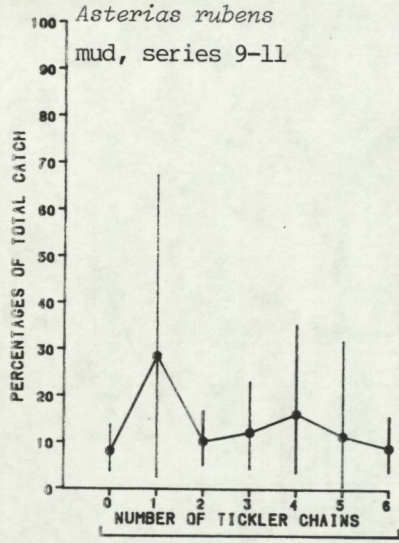
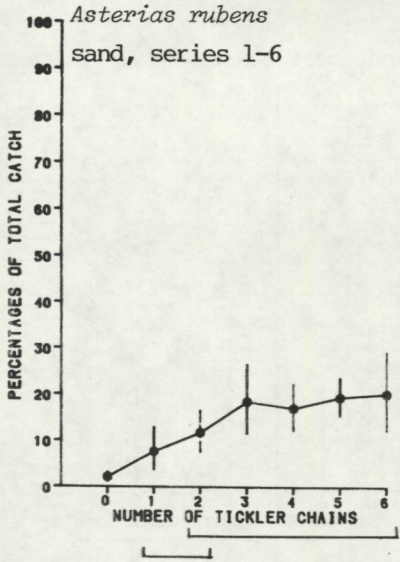


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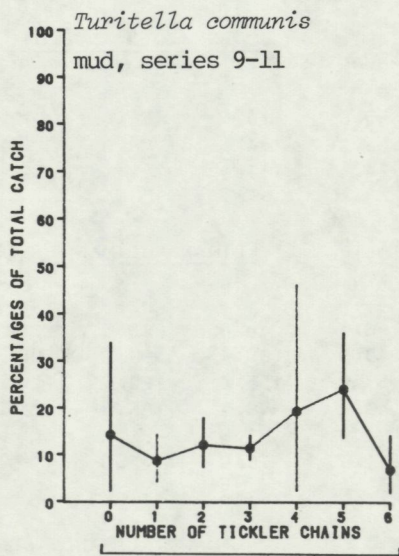
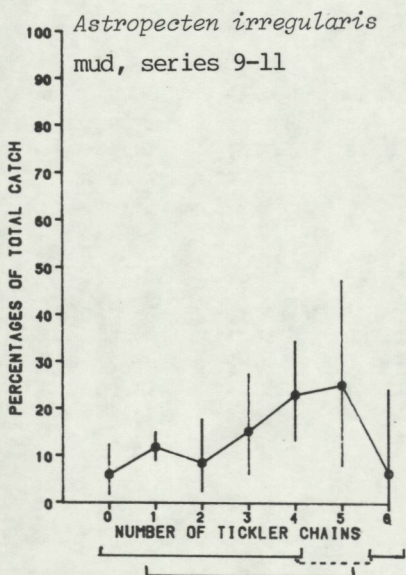
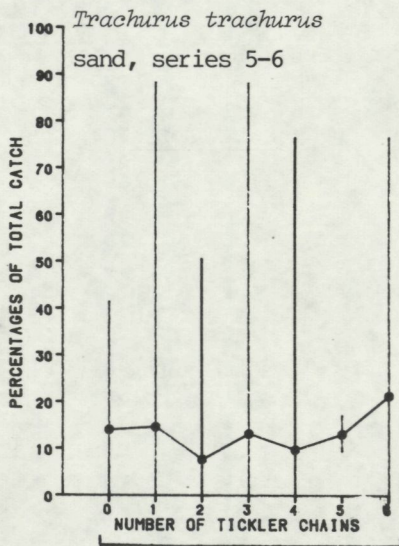
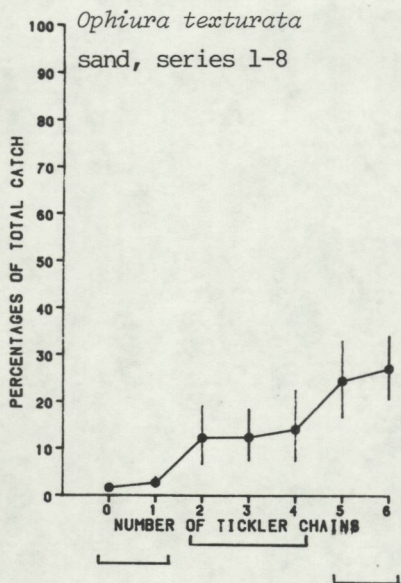


Fig.10 See legend of figure 3

## ADDENDUM

Numbers caught per 10,000 m<sup>2</sup> with 0-6 tickler chains

<u>SOLEA SOLEA (&lt;13 CM) SERIES 1-4 SAND</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
.0	.0	8.8	40.0	39.2	23.7	77.8
2.3	5.6	8.0	30.9	25.2	52.1	37.6
3.3	14.8	.0	46.7	33.3	76.8	137.9
.0	6.2	4.1	37.0	28.4	51.7	55.2

<u>SOLEA SOLEA (&gt;13 CM) SERIES 9-11 MUD</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
.0	10.0	.0	3.0	7.0	4.4	1.8
3.5	.0	1.4	2.9	.0	1.5	1.6
.0	7.2	6.9	.0	5.8	2.8	.0

<u>BUGLOSSIDIUM LUTEUM SERIES 5-6 SAND</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
18.3	2.7	32.3	53.3	85.8	101.5	285.0
8.4	17.7	41.9	17.0	31.5	78.2	34.2

<u>BUGLOSSIDIUM LUTEUM SERIES 9-11 MUD</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
95.9	210.0	166.4	72.0	297.5	202.4	86.9
155.3	134.6	88.3	118.3	80.6	54.7	136.9
224.4	163.9	150.0	348.0	403.2	295.4	91.0

<u>LIMANDA LIMANDA SERIES 1-6 SAND</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
66.1	46.4	219.5	203.1	121.0	166.1	190.6
13.9	135.1	93.8	247.0	117.6	507.2	192.3
53.0	155.8	182.7	411.0	122.1	203.4	236.6
49.4	58.7	186.3	327.0	385.5	209.4	220.8
22.9	51.9	88.4	117.0	149.5	157.5	277.5
71.7	75.9	178.0	48.8	72.6	66.7	102.6

<u>LIMANDA LIMANDA SERIES 9-11 MUD</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
129.7	127.5	172.8	75.0	66.5	204.6	86.9
268.3	191.8	149.0	115.3	79.5	42.6	122.3
186.2	248.2	129.4	315.0	270.7	215.8	27.1

PLEURONECTES PLATESSA SERIES 1-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
12.4	12.7	20.5	53.3	19.4	20.3	46.7
4.6	33.8	16.1	17.2	8.4	85.3	24.3
13.2	14.8	31.5	46.7	44.4	90.4	61.2
13.2	6.2	28.4	30.9	47.4	19.0	29.4
9.2	8.2	8.5	13.8	36.8	24.5	33.8
2.1	5.1	24.4	.0	4.8	23.0	13.2
77.4	13.9	47.3	8.6	6.5	14.3	51.1
10.4	2.6	3.7	2.9	4.4	3.9	1.6

PLEURONECTES PLATESSA SERIES 9-11 MUD

0	1	2	3	4	5	6
====	====	====	====	====	====	====
.0	2.5	3.2	1.5	.0	2.2	1.8
3.5	.0	1.4	4.4	2.2	.0	1.6
2.6	.0	2.3	3.0	2.9	.0	.0

CALLIONYMUS LYRA SERIES 5-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
126.0	196.6	639.2	665.6	340.6	710.5	1083.8
160.4	273.2	481.6	260.8	307.3	264.5	344.5
12.6	12.7	21.8	86.4	17.2	4.8	34.1
59.6	41.3	65.5	34.6	15.5	277.8	205.9

CALLIONYMUS LYRA SERIES 9-11 MUD

0	1	2	3	4	5	6
====	====	====	====	====	====	====
90.2	20.5	102.4	73.5	77.0	165.0	85.1
180.0	195.8	113.2	87.6	57.1	39.5	99.4
137.7	125.3	113.2	195.0	216.0	161.9	29.5

MERLANGIUS MERLANGUS SERIES 5-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
4.6	10.9	5.1	12.0	53.9	143.5	86.3
.0	2.5	34.9	42.4	65.3	20.7	15.8
75.4	14.5	29.1	103.7	36.6	16.7	48.3
28.5	2.6	15.0	40.3	20.0	27.6	20.3
0	1	2	3	4	5	6

MERLANGIUS MERLANGUS SERIES 9-11 MUD

====	====	====	====	====	====	====
67.7	107.5	123.2	46.5	42.0	158.4	199.1
208.3	373.3	167.0	52.6	75.0	19.8	68.5
165.8	257.9	32.3	168.0	195.8	65.3	4.9

<u>POMATOSCHISTUS SP. SERIES 1-6 SAND</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
1416.6	3222.4	3454.5	5194.8	2246.5	2088.0	4048.0
914.1	5976.2	3626.0	6914.9	5764.5	11380.7	6132.8
1741.9	6921.0	4417.3	7341.2	9934.5	7837.7	6258.7
1288.0	3287.8	3317.0	3998.2	5763.8	4569.6	7676.5
1020.0	676.0	765.0	929.0	1820.0	2756.0	-----
427.0	1811.0	1248.0	297.0	1728.0	757.0	1473.0

<u>POMATOSCHISTUS SP. SERIES 9-11 MUD</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
340.0	500.0	50.0	5.0	762.0	85.0	99.0
180.0	186.0	254.0	321.0	115.0	24.0	312.0
348.0	342.0	215.0	594.0	377.0	295.0	42.0

<u>ARNOGLOSSUS LATERNA SERIES 9-11 MUD</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
9.4	65.0	49.6	55.5	84.0	81.4	21.7
63.5	36.7	52.4	62.8	23.5	13.7	78.2
28.1	65.1	94.7	114.0	97.7	122.1	34.4

<u>RHINONEMUS CIMBRIUS SERIES 9-11 MUD</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
3.8	10.0	38.4	10.5	3.5	13.2	3.6
7.1	6.1	.0	1.5	.0	1.5	.0
.0	9.6	6.9	3.0	2.9	8.5	2.5

<u>TRACHURUS TRACHURUS SERIES 5-6 SAND</u>						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
9.0	14.0	2.0	2.0	2.0	7.0	15.0
6.0	3.0	7.0	15.0	10.0	7.0	8.0

## MACROPIPUS HOLSATUS SERIES 1-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
.0	4.2	42.5	782.6	13.1	33.9	354.6
4.6	157.6	92.5	329.3	163.8	298.6	419.9
14.9	83.5	97.4	163.5	1480.0	734.5	860.9
23.0	123.6	54.7	49.4	230.7	350.9	967.8
11.0	8.0	34.0	139.0	417.0	1442.0	632.0
21.0	78.0	660.0	187.0	348.0	377.0	684.0
100.0	317.0	1117.0	784.0	1024.0	1905.0	1804.0
666.0	292.0	305.0	1161.0	555.0	9064.0	2299.0

## MACROPIPUS HOLSATUS SERIES 9-11 MUD

0	1	2	3	4	5	6
====	====	====	====	====	====	====
124.0	208.0	210.0	299.0	567.0	425.0	100.0
180.0	214.0	126.0	132.0	110.0	85.0	191.0
214.0	181.0	196.0	372.0	92.0	449.0	106.0

## EUPAGURUS BERNHARDUS SERIES 1-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
62.0	313.8	521.5	253.1	39.2	101.7	110.9
104.4	205.5	273.4	202.4	42.0	109.0	116.0
40.6	434.1	146.2	336.2	336.7	221.5	49.0
52.6	200.9	164.0	302.3	309.7	84.3	36.8
11.0	90.0	286.0	213.0	206.0	648.0	304.0
68.0	104.0	654.0	391.0	612.0	237.0	350.0
44.0	58.0	408.0	255.0	166.0	153.0	216.0
922.0	103.0	294.0	1630.0	228.0	518.0	273.0

## EUPAGURUS BERNHARDUS SERIES 9-11 MUD

0	1	2	3	4	5	6
====	====	====	====	====	====	====
147.0	30.0	40.0	35.0	42.0	337.0	157.0
364.0	99.0	63.0	337.0	78.0	372.0	212.0
368.0	347.0	305.0	426.0	991.0	943.0	178.0

## CRANGON ALLMANI SERIES 5-7 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
62.0	137.0	37.0	52.0	421.0	1673.0	1485.0
53.0	172.0	244.0	186.0	126.0	273.0	1262.0
19.0	13.0	.0	32.0	84.0	167.0	364.0

## CRANGON ALLMANI SERIES 9-11 MUD

0	1	2	3	4	5	6
====	====	====	====	====	====	====
38.0	5.0	179.0	18.0	4.0	4.0	2.0
176.0	58.0	30.0	138.0	.0	.0	170.0
113.0	99.0	2.0	177.0	92.0	119.0	60.0

## CRANGON CRANGON SERIES 1-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
6193.4	4045.0	12111.6	19544.8	5886.1	4147.5	12413.0
1040.4	15755.0	8729.3	12645.6	17435.3	27417.3	18207.6
5978.9	17091.5	12513.9	18039.0	20170.9	21000.8	20553.0
4730.6	9685.3	11619.5	15334.9	11791.6	14243.0	19469.9
1442.7	915.9	2580.6	1651.2	1416.1	4359.3	7425.0
854.6	1599.0	2687.3	1632.4	2777.0	1891.8	5365.2
1632.8	924.4	3756.5	1458.0	2795.0	4149.0	7180.0
3216.8	1795.7	1991.6	2488.3	5372.4	10835.0	2340.0

## PONTOPHILUS TRISPINOSUS SERIES 5-8 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
238.0	197.0	712.0	370.0	588.0	2520.0	4.0
90.0	676.0	789.0	280.0	380.0	514.0	321.0
75.0	49.0	95.0	411.0	254.0	241.0	829.0
360.0	377.0	813.0	1374.0	1352.0	217.0	156.0

## ASTERIAS RUBENS SERIES 1-6 SAND

0	1	2	3	4	5	6
====	====	====	====	====	====	====
243.7	394.3	1148.6	1984.7	480.7	1467.9	1031.8
113.7	1542.6	663.3	1756.2	1530.8	2810.8	1500.6
176.3	1667.7	986.6	2713.3	2094.2	1584.3	1277.0
353.7	707.6	1160.3	2319.9	1971.8	1485.1	1957.8
44.0	139.0	372.0	330.0	1088.0	872.0	2155.0
51.0	66.0	412.0	246.0	407.0	396.0	387.0

## ASTERIAS RUBENS SERIES 9-11 MUD

0	1	2	3	4	5	6
====	====	====	====	====	====	====
60.0	228.0	166.0	119.0	273.0	191.0	136.0
159.0	940.0	123.0	143.0	116.0	50.0	180.0
140.0	200.0	134.0	258.0	282.0	253.0	71.0

<u>OPHIURA ALBIDA</u> SERIES 5-6 SAND						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
2917.0	1908.0	16218.0	26832.0	37375.0	45938.0	47250.0
717.0	1042.0	9693.0	9683.0	17525.0	9729.0	17253.0

<u>OPHIURA ALBIDA</u> SERIES 9-11 MUD						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
3760.0	6969.0	9936.0	5550.0	8271.0	18058.0	3200.0
3212.0	3566.0	3400.0	4021.0	2634.0	3408.0	5910.0
2270.0	4627.0	7207.0	12870.0	18432.0	16813.0	2288.0

<u>OPHIURA TEXTURATA</u> SERIES 1-8 SAND						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
16.5	101.8	758.9	268.4	179.9	271.2	1118.4
53.4	123.9	751.7	493.9	556.5	962.2	1464.1
117.5	241.2	349.2	1737.2	333.0	1805.7	954.7
162.9	160.7	623.7	1338.9	1826.5	1001.0	813.3
2638.0	4431.0	20732.0	33024.0	52920.0	66517.0	105000.0
1319.0	2196.0	26873.0	9461.0	63191.0	33835.0	33664.0
214.0	414.0	1689.0	632.0	545.0	1957.0	2113.0
202.0	93.0	112.0	484.0	488.0	4009.0	2379.0

<u>ASTROPECTEN IRREGULARIS</u> SERIES 9-11 MUD						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
113.0	313.0	108.0	555.0	763.0	713.0	94.0
115.0	155.0	121.0	197.0	188.0	156.0	200.0
113.0	263.0	312.0	231.0	645.0	966.0	57.0

<u>TURRITELLA COMMUNIS</u> SERIES 9-11 MUD						
0	1	2	3	4	5	6
====	====	====	====	====	====	====
15792.0	18750.0	32832.0	27750.0	38813.0	67162.0	7530.0
26616.0	11725.0	11476.0	10486.0	8028.0	20626.0	10623.0
24965.0	13188.0	21344.0	24024.0	78151.0	44531.0	16472.0