

## CHAETOGNATHA FROM THE NORTHERN ARABIAN SEA COLLECTED DURING THE CRUISES OF INS DARSHAK

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### ABSTRACT

Fourteen species of Chaetognatha belonging to the genera *Sagitta*, *Pterosa gitta* and *Krohnitta* found in the zooplankton samples collected from the Northern Arabian Sea, during the oceanographic expedition cruises of I.N.S. *Darshak* are reported and their distribution is discussed.

### INTRODUCTION

CHAETOGNATHA from the Northern Arabian Sea bordering the Arabian countries, Pakistan and India are less known, except the report by Nair and Rao (1973). However, the chaetognaths from the adjoining Red Sea, Gulf of Suez, Gulf of Aquaba (Ritter-Zahony, 1909; Burfield and Harvey, 1926; Schilp, 1941; Ghirardelli, 1947; Furnestin, 1958; Halim, 1969) and off the southwest coast of India (Silas and Srinivasan, 1969; Srinivasan, 1972, 1976, 1979; Nair, 1972, 1978; Rao and Nair, 1973) have been well studied. The availability of chaetognaths from the zooplankton samples off the northern Arabian Sea collected during the oceanographic expedition cruises of INS *Darshak*, has enabled the author to undertake this study.

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### MATERIAL AND METHODS

This study is based on 100 zooplankton samples from 77 stations (Appendix I) collected during the oceanographic expedition cruises of Indian Navy Ship *Darshak* in the northern Arabian Sea, between January and June, 1974. The samples were collected with ring net made of bolting silk (0.33mm mesh size) with a diameter of 1.13 metre, mostly from 900 metres to surface and 400 m to surface. The chaetognaths present in the entire samples were sorted out and studied.

### RESULTS

The following 14 species of Chaetognatha belonging to the genera *Sagitta* Quoy and Gaimard, *Pterosagitta* Costa and *Krohnitta* Ritter-Zahony are found in the samples.

#### Genus-I *Sagitta* Quoy & Gaimard

<i>S. bedoti</i>	Beraneck	364	specimens.
<i>S. decipiens</i>	Fowler	611	"
<i>S. enflata</i>	Grassi	5202	"
<i>S. ferox</i>	Doncaster	3	"
<i>S. hexaptera</i>	d'Orbigny	12	"
<i>S. lyra</i>	Krohn	2	"
<i>S. neglecta</i>	Aida	10	"
<i>S. pacifica</i>	Tokioka	355	"
<i>S. pulchra</i>	Doncaster	35	"
<i>S. regularis</i>	Aida	11	"
<i>S. robusta</i>	Doncaster	144	"

Genus-II *Krohnitta* Ritter-Zahony

<i>K. pacifica</i> (Aida)	7	specimens
<i>K. subtilis</i> (Grassi)	8	"

Genus-III *Pterosagitta* Costa

<i>P. draco</i> (Krohn)	52	specimens
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*Sagitta bedoti* Beraneck (Fig. 1)

This species forms 5.2% of the total chaetognaths in the samples. Among 77 sampling stations, this species is seen in the samples collected from 50 stations. Though this is found in more than 64% of the samples, numerically this is seen in less numbers. Maximum number (36) of specimens is seen in the sample collected at station 31/9. As this is a coastal form, this is not found

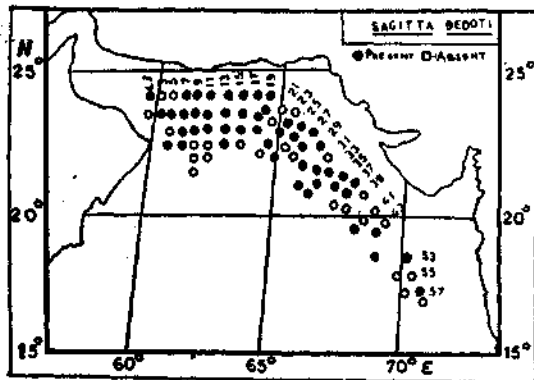


Fig. 1. Distribution of *S. bedoti* in northern Arabian Sea.

in greater number in these offshore samples. Among the 14 species present in the samples, this species occupies the third place in the order of abundance. Out of the 364 specimens found in the samples, 171 specimens (47%) are found in the samples collected during the day time and 193 (53%) specimens are from the samples collected during the night time.

*Sagitta decipiens* Fowler (Fig. 2)

This being a meso-planktonic species and as the samples are from deeper waters, this is more abundant than *S. bedoti* and occupies the second place in the order of abundance. Out of the 77 sampling stations, this species is seen in the samples collected from 60 stations which constitutes more than 77% of the sampling stations. As in the case of *S. bedoti*,

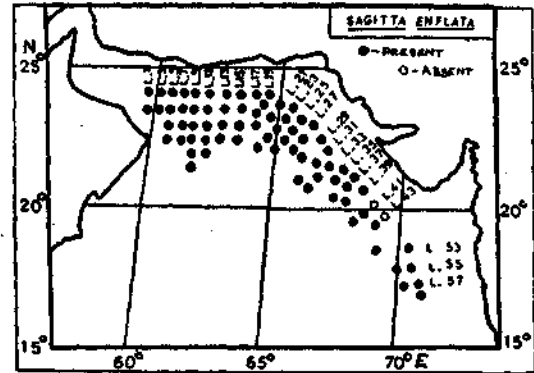


Fig. 2. Distribution of *S. enflata* in northern Arabian Sea.

this species is also found numerically in less numbers in the samples. Maximum number (26) is seen in the samples collected from the station 23/5. Among the 611 specimens, 300 are from the samples collected during the day time and the other 311 during the night time. This species forms 8.9% of the total chaetognaths.

*Sagitta enflata* Grassi (Fig. 3)

This is the most abundant species in this study and this tops the list in the order of abundance. This species alone forms 76.3% of the total chaetognaths in the samples. This species is seen in the samples collected from 75 out of 77 stations. This species is not only found in more than 97% of the sampling stations, but also seen numerically, in large numbers in the samples. Maximum number (276) is seen from the samples collected at the station 9/1 during the

night time (2235 hrs.). Among the 5202 specimens, more than 58.2% is from the samples collected during the night time and the rest 41.8% is from the samples collected during

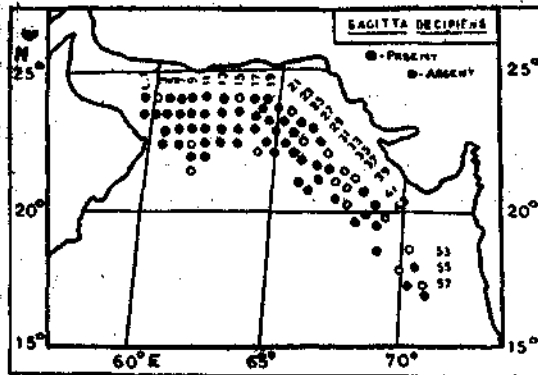


Fig. 3 Distribution of *S. decipiens* in northern Arabian Sea.

the day time. This species is more or less uniformly distributed in all the sampling stations.

#### *Sagitta ferox* Doncaster (Fig. 4)

One of the least abundant species in the present study and this is represented by only three specimens. Out of the 100 samples collected from 77 stations, this is found to

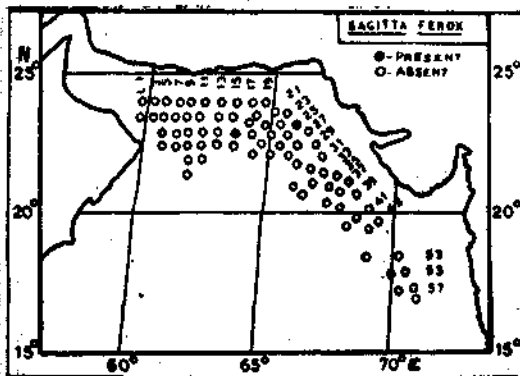


Fig. 4. Distribution of *S. ferox* in northern Arabian Sea.

occur only in two stations (15/5 and 25/3). As this being a coastal inhabitant and the samples are from offshore waters, this is not seen in abundance in the samples. Among the 14 species accounted in this study, this occupies the 13th place in the order of abundance.

#### *Sagitta hexaptera* d'Orbigny (Fig. 5)

In spite of the fact that the samples were collected from the offshore waters and this species is also an oceanic inhabitant, this

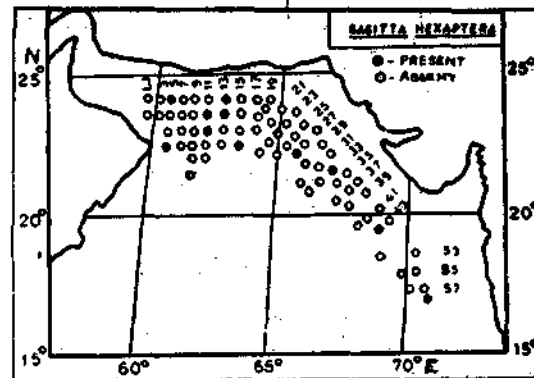


Fig. 5. Distribution of *S. hexaptera* in northern Arabian Sea.

species is found to occur only in 11 of the 100 samples and altogether 12 specimens are seen in the samples. Among the 14 species, this species occupies the 8th place in the order of abundance.

#### *Sagitta lyra* Krohn (Fig. 6)

This meso-planktonic species is seen only in two samples collected from the stations 25/5 and 41/8. Each sample has only one specimen. These two samples were collected from 400 metres to surface during the night time (0515, 2240 hrs). It is interesting to note that this meso-planktonic species is not found in more than 97% of the samples,

though the samples were collected from deeper waters in the offshore region. Among the

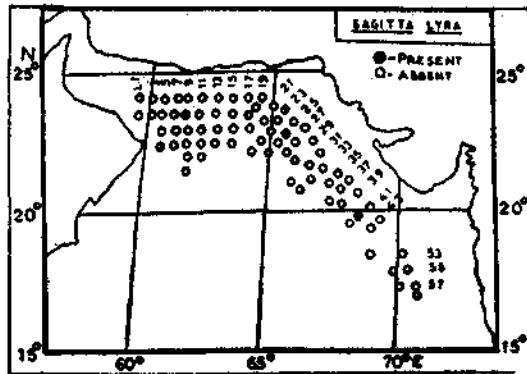


Fig. 6. Distribution of *S. lyra* in northern Arabian Sea.

14 species, this occupies the last place in the order of abundance.

***Sagitta neglecta* Aida (Fig. 7)**

This species is represented by only ten specimens from five stations. This may be due to the fact that this is a coastal inhabitant (Nair and Rao, 1973 a), whereas

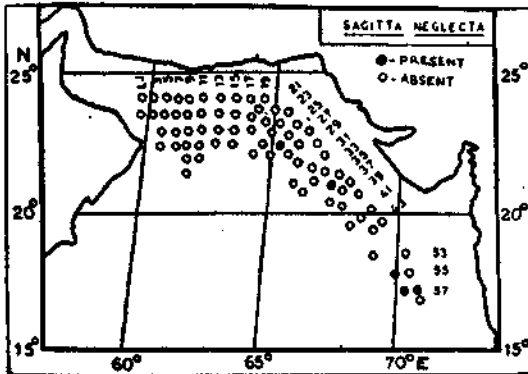


Fig. 7. Distribution of *S. neglecta* in northern Arabian Sea.

the samples are from offshore deeper waters. This occupies the 9th place in the order of abundance.

***Sagitta pacifica* Tokioka (Fig. 8)**

This species is very common in the samples collected and this comes fourth in abundance among the 14 species. Out of the 77 sampling stations, this is found to occur in 55 stations. As this being an offshore species (Srinivasan, 1976) and the samples are also from offshore deeper waters, this species is seen in more than 71% of the sampling stations. Though this is found in majority of the samples, numerically this is seen only in less numbers.

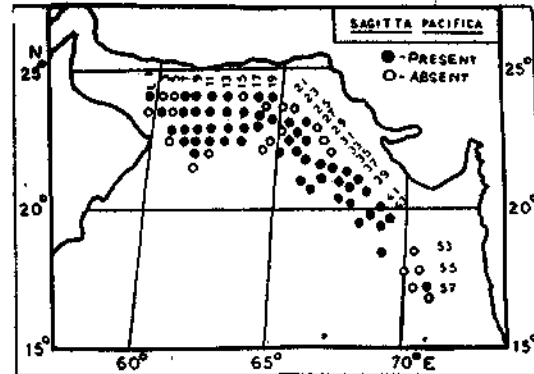


Fig. 8. Distribution of *S. pacifica* in northern Arabian Sea.

Maximum number (25) is in the sample collected from the station 35/9. There is not much difference between the night and day samples. 50.4% of the specimens is from the samples collected during the night time and 49.6% is from the day samples.

***Sagitta pulchra* Doncaster (Fig. 9)**

Though this species is seen both in the coastal and offshore areas, it is not abundant in the samples. In the present study, this species is found to occur only in 14 of the 77 sampling stations and a total of 35 specimens is seen in the samples. Maximum number (10 specimens)

is from the sample collected at the station 29/11. In spite of its uniform distribution in

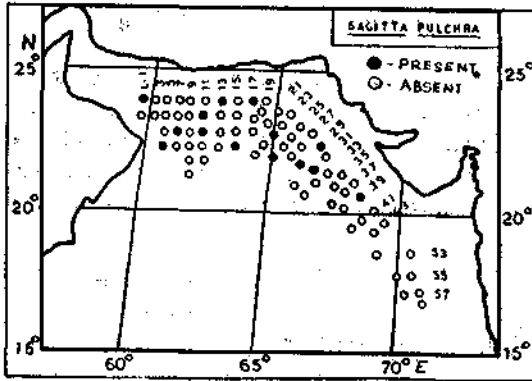


Fig. 9. Distribution of *S. pulchra* in northern Arabian Sea.

the coastal and offshore waters (Srinivasan, 1976), its absence in more than 80% of the sampling stations is interesting.

#### *Sagitta regularis* Aida (Fig. 10)

This is considered as a common species seen in abundance in the oceanic waters (Srinivasan, 1976) than in the coastal waters. On the contrary, in the present study, though the samples were collected from the offshore deeper waters, this species is seen only in two of the 77 sampling stations and

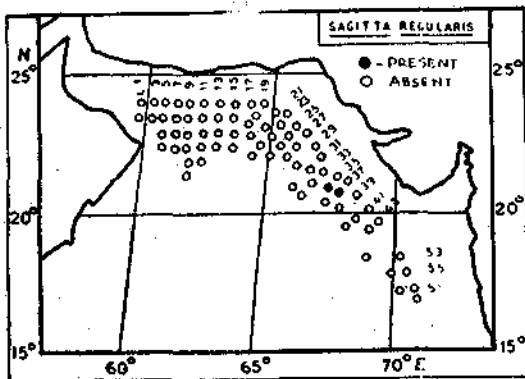


Fig. 10. Distribution of *S. regularis* in northern Arabian Sea.

altogether only 11 specimens were encountered in the samples. This occupies the 10th place in the order of abundance. The absence of this species in more than 97% of the sampling stations is interesting.

#### *Sagitta robusta* Doncaster (Fig. 11)

This species is fairly common in the samples and this is found to occur in 33 of the 77 sampling stations. This occupies the fifth place in the order of abundance. Numerically this is seen in less numbers in the samples and the maximum number (34) is from the sample collected at the

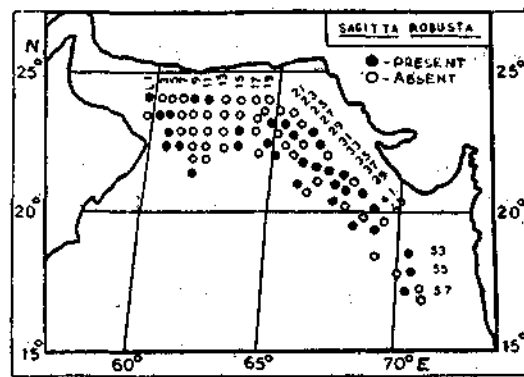


Fig. 11. Distribution of *S. robusta* in northern Arabian Sea.

station 21/5, during the night time (2045 hrs). This species is represented by 144 specimens in this study and it forms 2.1% of the total chaetognaths. Among the total number (144), 55.5% is from the samples collected during the night time and the rest 44.5% is from the day samples.

#### *Krohmita pacifica* (Aida) (Fig. 12)

This is an oceanic species, seen in less numbers in the offshore waters than in the coastal waters (Srinivasan, 1976). But in the present study, in spite of the samples were collected from the offshore waters, this

is seen only in five of the 77 sampling stations and this species is represented by only seven specimens. Among the 14 species, this occupies the 12th place in the order of abundance.

This species occupies the 11th place in the order of abundance among the 14 species.

**Pterosagitta draco (Krohn) (Fig. 14)**

This is a common species seen in more numbers in the oceanic waters than in the shelf waters. In this study this species is found to occur in 30 of the 77 sampling stations. Numerically this is found in the samples in

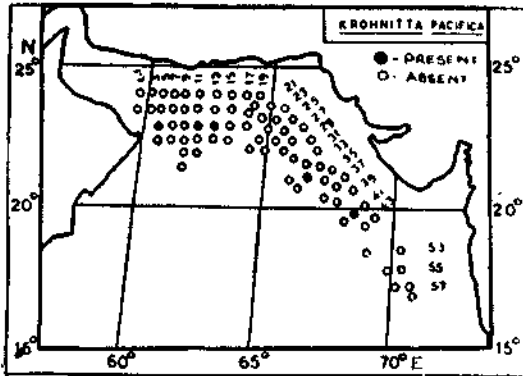


Fig. 12. Distribution of *K. pacifica* in northern Arabian Sea.

In spite of its oceanic habitat its absence in more than 87% of the sampling stations is obscure.

**Krohnitta subtilis (Grassi) (Fig. 13)**

In this study, only eight specimens were found in six of the 77 sampling stations. As all the samples are from offshore waters and this being a coastal inhabitant, it is found to occur only in less than 8% of the samples.

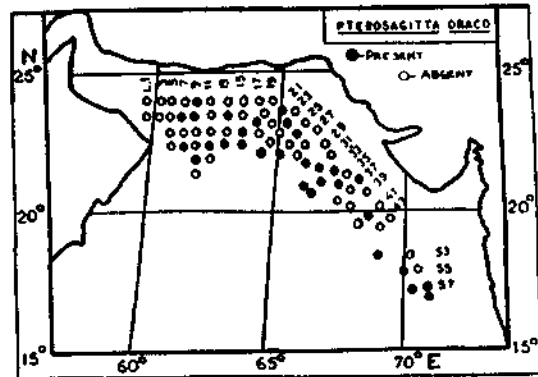


Fig. 14. Distribution of *P. draco* in northern Arabian Sea.

less numbers. In spite of the samples were collected from the offshore waters, this species is not found in more than 61% of the sampling stations. Only 52 specimens are noted from these 30 samples. This species occupies the sixth place in the order of abundance among the 14 species.

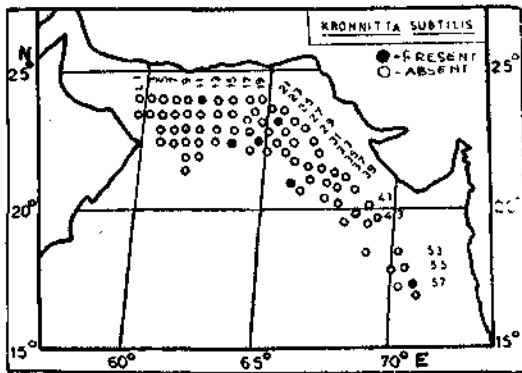


Fig. 13. Distribution of *K. subtilis* in northern Arabian Sea.

**DISCUSSION**

It is interesting to note that in spite of the fact that 19 samples are from 900 metres, not even a single specimen of the mesoplanktonic species such as *Eukrohnia fowleri* Ritter-Zahony and *E. minuta* Silas and Srinivasan, which are well known from the Arabian Sea (Silas and Srinivasan, 1969; Srinivasan, 1972) is seen in the samples. The mesoplanktonic species found in the samples are *S. deciptens* and *S. lyra*. Among these two species, *S. deci-*

*piens* is found in large numbers (611 specimens) and it forms 8.9% of the total chaetognaths, whereas *S. lyra* is represented by only two specimens. This may probably be due to the fact that *S. lyra* is generally found in the lower mesoplanktonic realms and hence not seen in the present samples in large numbers. On the other hand, *S. decipiens* normally occupies the upper mesoplanktonic region and seen in abundance below a depth of 150 metres.

Other than these two species, the remaining 12 species are epi-planktonic. *S. enflata* and *S. pulchra* are seen uniformly distributed both in the shelf and oceanic waters. *S. bedoti*, *S. ferox*, *S. neglecta* and *K. subtilis* are commonly seen either in less or more numbers, in the coastal waters than in the oceanic waters, whereas *S. hexaptera*, *S. pacifica*, *S. regularis*, *S. robusta*, *K. pacifica* and *P. draco* are found more in the oceanic waters than in the coastal waters.

Out of these 100 samples, 54 were collected during the day time (0601 - 1800 hrs) and 46 were during the night time (1801 - 0600 hrs). Altogether 6816 specimens are found in the 100 samples and among these, 55% of the specimens (3728) is from the samples collected during the night time and 45% (3088 specimens) is from the day samples.

In the same manner more than 50% of the specimens of the species such as *S. bedoti*, *S. decipiens*, *S. enflata*, *S. lyra*, *S. pacifica* and *S. robusta* is from the samples collected during the night time. So, it is obvious that the chaetognaths in the samples collected during the night time are richer than in the samples collected during the day time.

Among the 14 species, *S. decipiens*, *S. enflata*, *S. hexaptera*, *S. lyra*, *K. subtilis* and *P. draco* are cosmopolitan whereas *S. bedoti*, *S. pacifica*, *S. pulchra*, *S. ferox*, *S. robusta*, *S. regularis*, *S. neglecta* and *K. pacifica* are seen only in Indian and Pacific Oceans. So, eight species are common to Indo-Pacific Oceans, but absent in the Atlantic Ocean. This clearly reveals the free mixing of waters between the Indian Ocean and Pacific Ocean. It is a known fact that the waters flow from the Pacific Ocean during the Northeast Monsoon into the Bay of Bengal through the Malacca Strait and during the Southwest Monsoon the reverse happens, resulting in the flow of the water from the Bay of Bengal into the Pacific Ocean through the same passage. Due to the free mixing of waters between the two oceans, there is a great similarity between the chaetognath fauna of these two oceans, whereas, the chaetognath fauna of Atlantic Ocean differs from that of Indian Ocean.

## APPENDIX I

Details of the stations list of Indian Navy Ship *Darshak*

Leg No/ Stn No.	Date	Time hrs	Position		Depth at Stn.	Depth of haul (m)
			Lat. N.	Long. E.		
1	2	3	4		5	6
1/1	9.2.1974	0630	24°01'	59°45'	3240	400-0
1/13	"	0055	23°30'	59°46'	3270	"
3/1	10.2.1974	0315	24°00'	60°21'	3250	"
3/3	"	1938	23°29'	60°17'	3240	"
5/1	"	1950	24°00'	60°51'	3000	"
5/3	11.2.1974	1850	23°23'	60°50'	3250	"

## APPENDIX I. (Contd).

Leg. No/ Stn No.	Date	Time hrs.	Position		Depth at Stn	Depth of haul, (m)
			Lat. No.	Long. E.		
1	2	3	4		5	6
5/5	"	0232	23°00'	60°50'	3254	"
"	"	0300	"	"	"	500-0
5/7	"	0910	22°30'	60°51'	3002	400-0
7/1	12.2.1974	1540	24°00'	61°23'	3246	900-0
"	"	1515	"	"	3246	400-0
7/3	"	0755	22°32'	61°23'	3270	"
7/5	"	2337	23°00'	61°22'	3250	"
7/7	"	1615	22°29'	61°22'	3130	"
9/1	"	2235	24°00'	61°55'	3244	"
9/3	13.2.1974	0551	23°29'	61°55'	3270	"
9/5	"	1255	23°01'	61°50'	3140	"
9/7	"	2020	23°30'	61°48'	3000	"
9/9	14.1.1974	0830	21°59'	61°52'	930	"
9/11	12.1.1974	0355	21°30'	61°56'	2180	"
11/1	15.2.1974	0044	24°00'	62°27'	3200	"
"	"	0107	"	"	"	900-0
11/3	14.2.1974	1715	23°29'	62°26'	3246	400-0
11/5	"	1015	23°00'	62°28'	2720	400-0
"	"	1215	"	"	"	900-0
11/7	"	0322	22°30'	62°26'	3740	400-0
11/9	"	0400	22°00'	62°28'	3160	"
13/1	15.2.1974	-	23°59'	63°00'	-	"
13/3	"	1650	23°29'	63°00'	2620	900-0
"	"	1530	"	"	"	400-0
13/5	"	2258	23°00'	63°01'	2840	"
13/7	16.2.1974	0612	22°30'	63°01'	4000	"
13/7	"	0632	22°30'	63°01'	4000	900-0
15/1	17.2.1974	1343	24°00'	63°33'	3160	"
115/3	"	0505	23°27'	63°32'	2240	400-0
5/5	"	-	23°00'	63°33'	4120	"
1	"	-	"	"	"	900-0
5/7	"	1520	22°31'	63°33'	2306	400-0
17/1	"	1938	24°00'	64°05'	3054	"
17/3	18.2.1974	0228	23°30'	64°05'	2500	"
17/5	"	0917	23°00'	64°05'	1980	"
19/1	9.4.1974	1108	24°00'	64°39'	2860	"
"	"	1028	"	"	2860	900-0
19/3	"	1622	23°44'	64°20'	2020	400-0
21/3	8.4.1974	1325	23°39'	65°00'	2880	"
21/5	"	2108	23°15'	64°33'	3140	"
"	"	2045	"	"	"	900-0
23/3	6.4.1974	1638	23°40'	65°44'	"	400-0
23/5	"	2243	23°19'	65°21'	-	"
"	"	2124	"	"	-	900-0
23/7	7.4.1974	-	22°58'	65°00'	-	400-0
23/9	"	0830	22°35'	64°35'	2330	"
"	"	0805	"	"	"	900-0
23/11	"	1347	22°20'	64°17'	2700	400-0



## CHAETOGNATH FROM NORTHERN ARABIAN SEA

139

## APPENDIX I. (Contd.)

Leg. No/ Sta No.	Date	Time hrs.	Position		Depth at Sta.	Depth of haul, (m)
			Lat. N.	Long E.		
1	2	3	4		5	6
24/3	27.3.1974	0028	22° 10'	65° 37'	1400	"
24/5	"	0515	22° 48'	65° 38'	1840	"
	"	0545	"	"	"	900-0
25/7	"	1101	22° 32'	65° 11'	2270	400-0
25/9	"	1808	22° 09'	64° 59'	2500	"
"	"	"	"	"	"	900-0
"	"	"	"	"	"	400-0
27/3	25.3.1974	0345	23° 02'	66° 35'	0455	"
27/5	"	0849	22° 37'	66° 08'	1780	"
27/7	"	"	"	"	"	"
"	"	"	"	"	"	"
29/7	23.3.1974	0550	22° 32'	66° 46'	1460	400-0
29/7	23.3.1974	0512	22° 32'	66° 46'	1460	900-0
29/11	"	1825	21° 43'	66° 00'	2300	400-0
	"	1739	"	"	"	900-0
29/13	"	2335	21° 27'	67° 37'	2460	400-0
31/7	20.3.1974	2240	22° 04'	67° 05'	1940	"
31/9	21.3.1974	0255	21° 42'	66° 39'	1879	"
	"	0232	"	"	"	900-0
31/13	"	1500	21° 00'	65° 59'	2148	400-0
	"	1530	"	"	"	900-0
38/8	18.3.1974	1455	21° 26'	67° 09'	2180	400-0
38/10	"	2140	21° 03'	66° 46'	2186	"
38/12	"	0305	20° 40'	66° 22'	2320	"
35/7	22.2.1974	1508	21° 18'	67° 46'	1444	800-0
	"	1444	"	"	"	400-0
35/9	"	0700	21° 02'	67° 25'	2414	"
37/6	23.2.1974	1958	21° 03'	68° 13'	2370	100-0
37/8	24.2.1974	0225	20° 41'	67° 51'	2860	"
37/10	"	1914	20° 16'	67° 28'	2930	"
	"	1930	"	"	"	900-0
38/9	25.2.1974	1122	20° 41'	68° 34'	3000	400-0
38/10	26.2.1974	-	20° 03'	67° 55'	3020	"
41/6	27.2.1974	1608	20° 24'	69° 01'	1340	900-0
41/8	"	2240	20° 03'	68° 38'	2540	"
43/10	"	0326	19° 42'	68° 18'	3100	"
43/7	26.1.1974	1538	19° 59'	69° 12'	2358	"
43/9	"	0850	19° 31'	68° 51'	2358	"
53/11	4.5.1974	1600	18° 28'	70° 12'	1600	"
"	"	0215	18° 30'	68° 40'	1230	"
55/10	6.5.1974	2230	18° 30'	70° 32'	1230	"
55/12	7.5.1974	0640	18° 01'	70° 01'	2830	"
57/9	9.5.1974	0925	17° 58'	70° 01'	2830	"
57/11	"	1633	17° 31'	70° 57'	2830	"
57/13	10.5.1974	0010	17° 31'	70° 27'	2900	"
			17° 20'	70° 56'	2910	900-0

— = Not located in the map.

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