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Preliminary report on the redfish caught by line
during the NORWESTLANT surveys, May to July, 1963.

by

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During the period of this survey line-fishing for redfish was carried out from two French and two British weather ships at Station Alfa as part of the trials being conducted by the Edinburgh Oceanographic laboratory. In addition, reports of successful fishing during NORWESTLANT cruises have been received from the research vessels ABGIR, DANA and EXPLORER. ANTON DOHRN fished unsuccessfully at one station. This preliminary report deals with 176 fish which were returned to the Edinburgh laboratory from the weather ships and DANA.

A summary of hours of fishing, number of fish caught etc. is given in Table I and the positions of fishing stations are shown in Figure 1.

1. Identification. All the fish returned to the Oceanographic laboratory are the large-eyed, beaked form and fit the criteria used by Andriiashev (1954) for Sebastes marinus mentella. For example, the lowest proportions of orbit diameter to head length were 30.2% (Station Alfa) and 30.4% (DANA); according to Andriiashev a proportion of more than 26% classifies the fish as S. marinus mentella. The frequency distribution of these proportions is shown in Table II.

2. Depth distribution. When using a rod and line it is impossible to make precise estimates of the depth at which fish are caught; the length of line used will always indicate a maximal depth and, in conditions of extreme drifting of the ship, this may be considerably in excess of the real depth of capture.

With these reservations in mind, it seems highly likely that the large catches during June and July came from depths of roughly 100-150 m. The 144 fish caught by WEATHER ADVISER at the end of June and in the first half of July were all taken within this range, although fishing was attempted at all depths from 50 to 400 m. The most successful fishing from WEATHER MONITOR (in June) occurred at a similar depth range during calm weather when there was little or no drifting of the ship. It seems that during May, at Station Alfa, the fish were lying deeper, as FRANCE II, fishing during calm weather, caught fish easily from 200 - 300 m. DANA, also during May, but further to the south and west (See Fig. 1), took fish from a depth range of 90-180 m (mean 126 m.) except at the most westerly successful station where the range was 90-300 m (mean 187 m). So few males were caught (see below) that it is impossible to make generalisations about their distribution within the range sampled (0-400 m). However, there did not appear to be any distinct separation of the sexes as the ranges overlapped and both males and females were caught on adjacent hooks.

Similarly, there is no evidence to suggest that different size groups were distributed at different depths.

During the period of the survey the amount of night-fishing was necessarily low and comparisons of depth distributions or ease of capture by day and night are difficult to assess. However, there is no evidence that any marked upward vertical movement of redfish occurs during the night and they have been caught at the shallowest depths (70-80 m) during daylight hours. On board the MONITOR in June, on two occasions when fishing was continued from daylight hours until after dark success was achieved at much the same depth throughout the period.

3. Shoaling /

3. Shoaling. Evidence collected during these trials suggests that during the three months following spawning (May, June and July) dense aggregations of redfish occur in the open ocean. On some occasions fish could be hauled in immediately a line was lowered and at these times catches were made at an average of approximately 6 fish per line per hour. On other occasions, under apparently similar conditions, fishing was very variable; long periods of unsuccessful fishing at all depths being relieved by occasional small catches.

4. Sex ratio, maturity and gonad conditions. Females were predominant in all the samples, particularly at Station Alfa where only 6 out of 116 were males. Amongst the 60 fish caught by the DANA there were 12 males.

From EXPLORER, two male S. mentella (36.0 and 37.4 cm overall length) were caught on one cast and one female (39.8 cm. overall length) on another. Eight S. mentella were landed by AEGIR and five of these were females; no lengths or weights were given for these fish.

Most of the females showed evidence of recent spawning by the retention of some larvae within the ovaries (see Table III). Of the others, practically all were mature spent fish as shown by the presence of empty follicles. The smallest female fish (weight 0.5 Kg., standard length 27.0 cms.) was found to be spent although its ovaries weighed only 1.0 gm.

Histological examinations of the testes to determine the state of ripeness and maturity have not yet been completed although all the males appear to be mature fish with ripening testes, as judged by the size of the testes and the proportion of gonad weight to body weight.

The % maturity factors for both male and female fish (gonad weight/body weight x 100, Sorokin, 1961) have been calculated and the weekly means throughout the period of the NORWESTLANT Survey are shown in Table III.

5. Larvae. Any larvae retained in the ovaries or oviduct were removed and those in a good state of preservation were examined for the presence or absence of sub-caudal melanophores. Because of the natural breakdown of the tissues in retained larvae, and some inadequate preservation, only 243 larvae out of more than 1000 could be examined but in none of these were any sub-caudal melanophores found.

6. Fecundity. In conjunction with long-term studies on redfish from station Alfa, some estimates of fecundity have been made from all fish with developing eggs of a suitable size for counting.

The ovaries were weighed, subsamples were removed with a cork-borer and the weights of these were recorded. Samples were generally 2-3% of the weight of the pair of ovaries. All the developing eggs were counted in the sub-samples and, from these, an estimate was made of the number of potential eggs in both ovaries. Confirmatory counts on three whole ripe ovaries, made on the egg-counting machine at Aberdeen, showed a close agreement with the estimates from the sub-sampling method.

The results are listed in Table IV and, although some size groups are poorly represented, the overall mean fecundity of 67,932 is similar to that estimated from the material from Station Alfa during the last 3 years (59,426).

7. Morphometric data. The measurements listed in Table V were selected from those suggested by Kelly, Barker and Clarke (1961) as being among the most reliable aids to racial distinction. All the figures given here are from formalin-preserved material (a shrinkage of 1-2 cm. occurs in fish of a standard length range 28.0-37.0 cms.). Although the successful DANA Stations extend from longitude 32° - 40° W and are also from one to two degrees of latitude south of Station Alfa, no great differences show up in the measurements either between stations or between the DANA and Station Alfa samples. Plots of mean head length, body depth, snout to ventral fin and snout to anal fin against the log of standard length are given in Fig. 3. The eye-fitted straight lines indicate a close agreement in the proportional growth of the two samples, suggesting that they came from the same stock.

8. Parasites./

8. Parasites. In view of the suggested use of Sphyrion lumpi (Krøyer) in distinguishing stocks of redfish, this and other parasites of the oceanic stocks are being investigated. At present, for the material collected during the NORWESTLANT survey, only data concerning the incidence and positional distribution of Sphyrion lumpi have been obtained. These are summarised in Table VI: signs of active or previous infestation were found in 33.6% of the fish from Station Alfa and 30.0% of those from DANA. No male Sphyrion were found and subcutaneous examinations for recently settled stages have not yet been carried out.

All the fish have been examined for gill parasites but none have been found. The examination of the alimentary canal of 58 fish has produced only two mature cestodes and the examination of the heart of 50 fish has produced no evidence of parasitism. Larval nematodes occur frequently on the organs and mesenteries of the body cavity and a few adult nematodes have been found in the gut and, in one instance, in an ovary.

9. Black colouration. Areas of dense black colouration have been noted frequently on redfish returned to the laboratory. These vary in size from spots two or three mm. in diameter to areas covering most of the anterior part of the flank of a fish. Although the cause of these marks has not been determined, their presence has been recorded and the position and intensity of the marking has been noted according to five arbitrary grades. A summary of the data collected from the fish caught during the NORWESTLANT survey is given in Table VII. The majority of the patches are located on one or both flanks and may consist either of discrete spots or an unbroken area of black colouration, and may be a combination of the two. At present no pattern can be seen in the occurrence of the markings or their intensity but these studies are being continued.

The results of sampling during NORWESTLANT surveys will be incorporated into a detailed study of the oceanic stocks of redfish during the period 1962 to 1964.

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- KELLY, G.F., BARKER, A.M. and CLARKE, G.M., 1961. Racial comparisons of redfish from the western North Atlantic and the Barents Sea. ICNAF Spec. Publ., 3: 28-41.
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LEGENDS

- Fig. 1. Chart showing the positions of line-fishing stations. The small figures indicate the numbers of fish caught at each station during the NORWESTLANT surveys, 1963.
- Fig. 2. Four body measurements plotted against the log of standard length to demonstrate similar proportional growth between fish caught by DANA and fish caught at Station Alfa. Note that the abscissae for DANA samples are displaced one centimetre to the right of those for the samples for Station Alfa.

TABLE I. Ships taking part in the Fishing Programme and details of their catches.

| Ship | Dates of Fishing | Total Hours fishing | Fish caught | Fish returned to Edinburgh |
|---------------------|------------------|---------------------|-------------|----------------------------|
| <u>STATION ALFA</u> | | | | |
| FRANCE I | 21/4 - 9/5 | 9 | 0 | 0 |
| FRANCE II | 15/5 - 22/5 | 19 | 60 | 10 |
| MONITOR | 5/6 - 27/6 | 350 | 63 | 62 |
| ADVISER | 29/6 - 16/7 | 39 | 140 | 44 |
| | | | Totals 263 | 116 |

NORWESTLANT CRUISES

| | | | | |
|-------------|-------------|----|-----------|----|
| AEGIR | 30/4 - 31/5 | ? | 9 | 0 |
| DANA | 20/5 - 24/5 | 14 | 62 | 60 |
| EXPLORER | 4/7 | ? | 3 | 0 |
| ANTON DOHRN | 6/6 | ? | 0 | 0 |
| | | | Totals 74 | 60 |

TABLE II. The percentage proportion of Horizontal Orbit Diameter (HOD) to Head Length (HL).

| (HOD/HL) x 100 | STATION ALFA | | DANA | |
|-------------------|----------------|------|----------------|------|
| | Number of fish | % | Number of fish | % |
| 30.0 - 30.9 | 1 | 0.9 | 2 | 3.3 |
| 31.0 - 31.9 | 10 | 8.6 | 4 | 6.7 |
| 32.0 - 32.9 | 11 | 9.5 | 10 | 16.7 |
| 33.0 - 33.9 | 26 | 22.4 | 15 | 25.0 |
| 34.0 - 34.9 | 23 | 19.8 | 16 | 26.7 |
| 35.0 - 35.9 | 22 | 19.0 | 7 | 11.7 |
| 36.0 - 36.9 | 11 | 9.5 | 4 | 6.7 |
| 37.0 - 37.9 | 8 | 6.9 | 1 | 1.7 |
| 38.0 - 38.9 | 2 | 1.7 | 1 | 1.7 |
| 39.0 - 39.9 | 1 | 0.9 | 0 | - |
| 40.0 - 40.9 | 1 | 0.9 | 0 | - |
| Total No. of fish | 116 | | 60 | |
| Mean figure | 34.5% | | 33.9% | |
| Range | 30.2% - 40.7% | | 30.4% - 38.1% | |

TABLE III. Weekly changes in Maturity Factor (% M.F.), and the number of fish with larvae retained in the ovaries.

STATION ALFA

| Dates | Mean % M.F. | ♀ Range | No. of fish | No. of fish with larvae retained | % M.F. ♂ | No. of fish |
|------------|----------------|-------------|----------------|---|------------|----------------|
| 18 - 24/5 | 1.41 | 1.07 - 2.00 | 10 | 10 | - | 0 |
| 25 - 31/5 | - | - | 0 | 0 | - | 0 |
| 1 - 7/6 | 1.26 | 1.06 - 1.44 | 3 | 0 | - | 0 |
| 8 - 14/6 | 1.02 | 0.79 - 1.68 | 7 | 5 | - | 0 |
| 15 - 21/6 | 1.03 | 0.79 - 1.50 | 18 | 15 | 0.71, 1.06 | 2 |
| 22 - 28/6 | 1.08 | 0.71 - 1.39 | 30 | 28 | 0.86, 0.93 | 2 |
| 29/6 - 5/7 | 1.12 | 0.50 - 1.50 | 29 | 26 | - | 0 |
| 6 - 12/7 | 1.16 | 0.95 - 1.45 | 9 | 8 | 0.64 | 1 |
| 13 - 19/7 | 1.24 | 0.88 - 1.59 | 4 | 4 | 0.75 | 1 |

DANA

| | | | | | Mean | Range | No. of fish. |
|-----------|------|-------------|----|----|------|---------------|-----------------|
| 18 - 24/5 | 1.17 | 0.20 - 2.45 | 48 | 40 | 0.66 | 0.31- 1.33 | 12 |

TABLE IV. Fecundity, grouped according to the standard lengths of the fish and their date of capture during NORWESTLANT, 1963. Each count refers to one fish, means for each length-group being shown on the right.

| Length in cms. | Date | Fecundity | | Length in cms. | Date | Fecundity | |
|-------------------|---------|---------------|---------------|-------------------|---------|----------------------------|----------------|
| | | Count | Mean | | | Count | Mean |
| 29.0 | 22 June | 42,864 | | 33.0 | 22 June | 72,540 | <u>72,540</u> |
| | 10 July | 32,483 | | | 34.0 | 24 June | 72,226 |
| | 15 July | 38,880 | <u>38,076</u> | 24 June | | 77,124 | |
| 30.0 | 17 June | 35,629 | | 4 July | 93,130 | | |
| | 3 July | 65,820 | | 8 July | 90,759 | | |
| | 11 July | 43,639 | | 11 July | 109,410 | | <u>88,530</u> |
| | 16 July | 63,762 | <u>52,213</u> | 35.0 | 10 July | 62,125 | |
| 31.0 | 20 June | 54,706 | | | 15 July | 145,637 | <u>104,183</u> |
| | 15 July | 72,777 | <u>63,742</u> | 36.0 | 8 June | 78,771 | |
| 32.0 | 22 June | 48,500 | | | 17 June | 73,971 | <u>76,371</u> |
| | 2 July | 65,805 | | 37.0 | 24 June | 97,190 | <u>97,190</u> |
| | 10 July | 49,999 | | | | | |
| | 10 July | 67,366 | | | | | |
| | 10 July | 69,669 | | | | | |
| | 11 July | 40,315 | | | | | |
| 16 July | 68,455 | <u>58,587</u> | | | | Overall mean <u>67,932</u> | |

ROCKFISH - BODY MEASUREMENTS, INVESTIGATION 1963: STATION ALFA (A) and DATA (D)

The mean measurements are shown for each size category. The range of observations is shown at the right.

| STANDARD LENGTH (cm.) | | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | COMBINED | |
|-----------------------------|---|------|------|------|------|------|------|------|------|------|------|------|----------|-------------|
| | | | | | | | | | | | | | Means | Range |
| No. of Fish | A | 0 | 0 | 7 | 17 | 28 | 25 | 14 | 19 | 3 | 2 | 1 | 31.92 cm | St. length |
| | D | 1 | 1 | 3 | 3 | 12 | 16 | 9 | 7 | 6 | 1 | 1 | 32.23 cm | |
| Weight (kg) | A | - | - | 0.63 | 0.70 | 0.77 | 0.81 | 0.87 | 0.97 | 1.03 | 1.00 | 1.2 | 0.82 | .6 - 1.2 |
| | D | 0.50 | 0.50 | 0.58 | 0.67 | 0.76 | 0.82 | 0.91 | 0.89 | 0.97 | 1.10 | 1.2 | 0.82 | .5 - 1.2 |
| Body Depth (cm) | A | - | - | 10.2 | 11.0 | 11.1 | 11.6 | 11.9 | 12.1 | 12.5 | 12.3 | 12.3 | 11.5 | 9.8 - 13.2 |
| | D | 9.0 | 9.6 | 10.0 | 10.5 | 11.0 | 11.3 | 11.7 | 11.7 | 11.9 | 13.3 | 12.6 | 11.3 | 9.0 - 13.3 |
| Head Length (cm) | A | - | - | 10.4 | 11.0 | 11.2 | 11.6 | 12.0 | 12.1 | 12.2 | 12.3 | 12.7 | 11.5 | 9.9 - 12.7 |
| | D | 9.1 | 10.2 | 10.6 | 10.9 | 11.3 | 11.5 | 11.9 | 12.0 | 12.3 | 12.9 | 13.5 | 11.6 | 9.1 - 13.5 |
| Snout to Ventral fin (cm) | A | - | - | 11.2 | 11.8 | 11.9 | 12.3 | 13.0 | 13.1 | 13.3 | 13.8 | 14.0 | 12.3 | 10.6 - 14.0 |
| | D | 11.2 | 11.5 | 12.5 | 12.2 | 12.5 | 12.7 | 13.8 | 13.9 | 13.8 | 14.5 | 14.4 | 13.1 | 11.2 - 15.6 |
| Snout to Anal fin (cm) | A | - | - | 18.9 | 19.9 | 20.5 | 21.0 | 21.8 | 22.6 | 22.7 | 22.8 | 23.5 | 21.1 | 18.3 - 23.5 |
| | D | 19.0 | 18.7 | 19.1 | 20.1 | 20.9 | 21.4 | 22.3 | 22.7 | 24.1 | 23.7 | 24.3 | 21.7 | 18.7 - 24.7 |
| Schnabel (mm) | A | - | - | 11.4 | 12.5 | 12.8 | 13.1 | 13.4 | 14.1 | 15.0 | 13.5 | 14.0 | 13.0 | 11 - 16 |
| | D | 10 | 10 | 11.0 | 11.3 | 12.4 | 13.1 | 13.8 | 13.7 | 13.5 | 15.0 | 14.0 | 12.6 | 10 - 16 |
| Orbit diam. vertical (mm) | A | - | - | 33.7 | 36.5 | 37.5 | 37.8 | 38.9 | 39.3 | 39.3 | 39.5 | 41.0 | 37.8 | 32 - 42 |
| | D | 29 | 31 | 31.7 | 35.7 | 35.7 | 37.3 | 38.7 | 39.9 | 40.0 | 43.0 | 39.0 | 37.1 | 29 - 44 |
| Orbit diam. horizontal (mm) | A | - | - | 35.3 | 38.5 | 39.2 | 39.8 | 40.5 | 41.1 | 41.0 | 41.0 | 44.0 | 39.6 | 33 - 45 |
| | D | 30 | 34 | 33.7 | 38.0 | 37.8 | 39.2 | 40.4 | 40.9 | 42.3 | 44.0 | 41.0 | 39.2 | 30 - 45 |
| Inter orbital distance (mm) | A | - | - | 21.1 | 21.4 | 22.3 | 23.0 | 23.2 | 24.8 | 25.0 | 26.0 | 26.0 | 22.9 | 18 - 26 |
| | D | 20 | 20 | 22.0 | 20.0 | 22.2 | 22.8 | 23.2 | 23.4 | 23.3 | 26.0 | 26.0 | 22.7 | 18 - 26 |
| Orbit area (sq. cm) | A | - | - | 11.9 | 14.2 | 14.7 | 15.1 | 15.8 | 16.3 | 16.2 | 16.2 | 18.0 | 15.0 | 10.6 - 19.8 |
| | D | 8.7 | 10.5 | 10.7 | 13.6 | 13.5 | 14.6 | 15.7 | 15.9 | 17.0 | 18.9 | 18.0 | 14.7 | 8.7 - 19.8 |

TABLE VI. Parasitization by Sphyrion lumpi

| <u>ACTIVE PARASITES.</u> | | | | |
|--------------------------|---|---------------------------------|--------------------------------------|--|
| | No. of fish with active <u>Sphyrion</u> | Mean no. of parasites per fish. | Range of nos. of parasites per fish. | Sites of infestation |
| STATION ALFA | 15 (12.9%) | 3.0 | 1 - 12 | Cloacal 86.7% Flank 20.0% |
| DANA | 6 (10.0%) | 1.8 | 1 - 5 | Cloacal 66.7% Dorsal 16.7% Ventral fin root 16.7% |

PREVIOUS INFESTATIONS (OLD HEADS).

| | No. of fish with old heads. | Sites of infestation |
|--------------|-----------------------------|---|
| STATION ALFA | 24 (24.7%) | Cloacal 50% Dorsal 39.2% Flanks 41.7% |
| DANA | 12 (20%) | Cloacal 30.8% Dorsal 30.8% Flanks 30.8% |

TABLE VII. Black Colouration

| | STATION ALFA | | DANA | |
|-----------------------------|--------------|------|-------|-------|
| | No. | % | No. | % |
| Total no. with marks | 58/116 | 50.0 | 24/60 | 40.0 |
| No. marked both sides | 9/58 | 15.5 | 8/24 | 33.3 |
| No. marked one side only | 49/58 | 84.5 | 15/24 | 62.5 |
| No. marked on flanks | 53/58 | 91.4 | 22/24 | 91.7 |
| No. marked left flank only | 20/49 | 40.8 | 7/16 | 43.8 |
| No. marked right flank only | 29/49 | 59.2 | 8/16 | 50.0. |
| * No. in grade 4 | 4/58 | 6.9 | 2/24 | 8.3 |
| " " " 3 | 7/58 | 12.1 | 7/24 | 29.2 |
| " " " 2 | 17/58 | 29.3 | 5/24 | 20.8 |
| " " " 1 | 29/58 | 50.0 | 8/24 | 33.3 |
| " " " P | 1/58 | 1.7 | 2/24 | 8.3 |

* Where both sides are marked the highest grade only is counted.

Arbitrary grades of colouration.

p. A few small spots.

1. One or two areas 5-10 mm. diameter

2. An unbroken area up to 25 mm. in diameter or discrete spots covering a larger area.

3. An unbroken area up to 50 mm. in diameter or discrete spots covering a larger area.

4. Unbroken and/or discrete areas larger than the above.

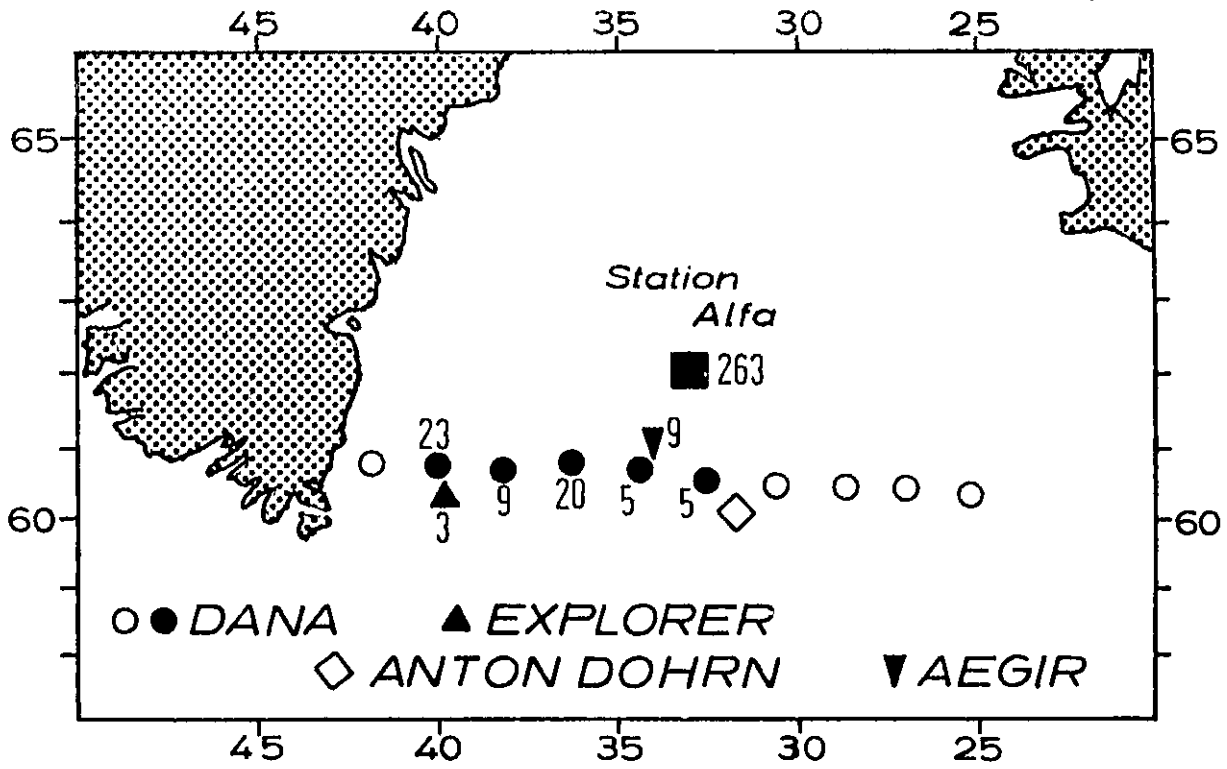


Fig. 1

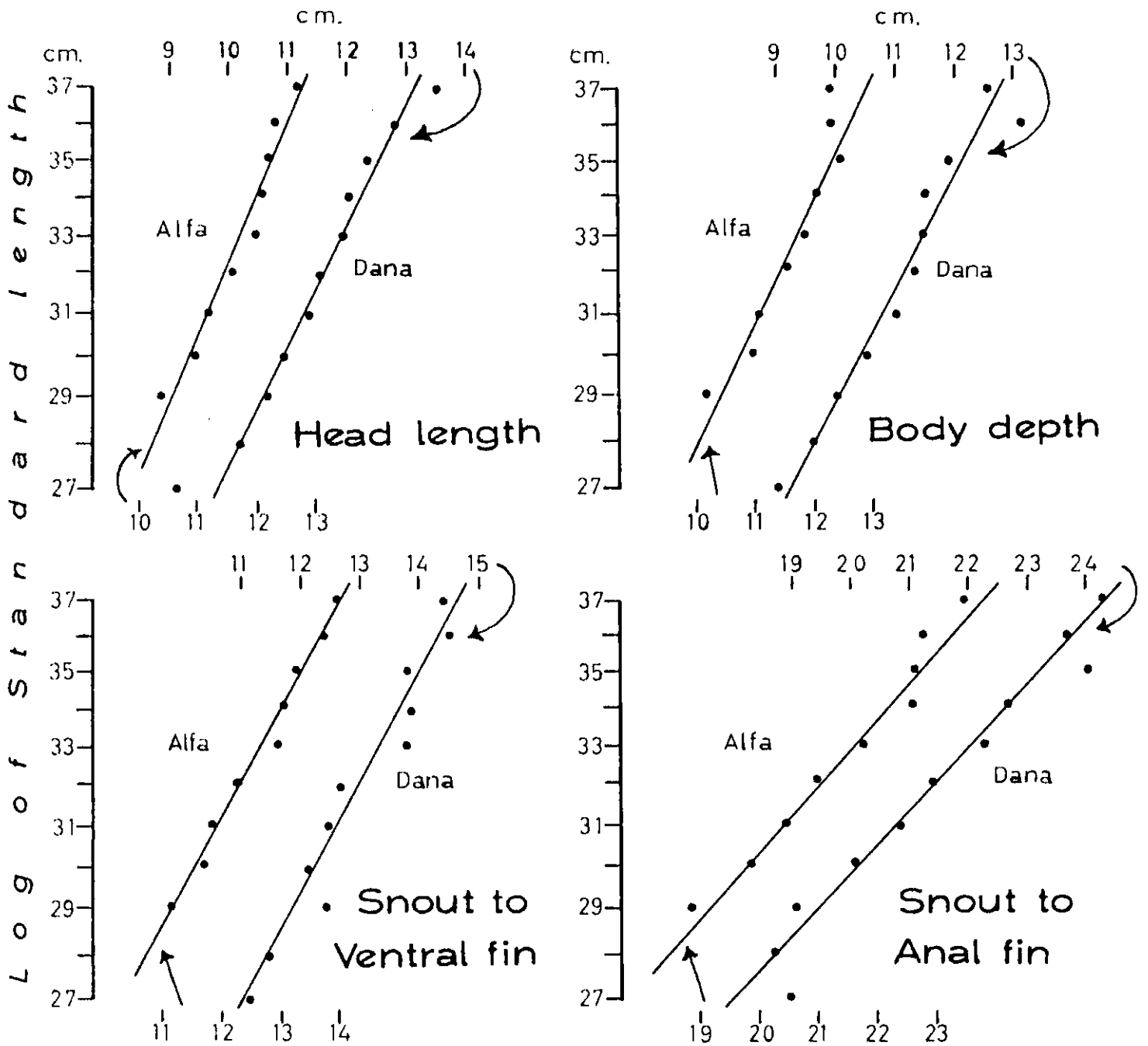


Fig. 2