Northwest Atlantic Fisheries Organization

Serial No. N2093 NAFO SCR Doc. 92/42

SCIENTIFIC COUNCIL MEETING - JUNE 1992

Identification of Redfishes (*Sebastes*, Scorpaenidae) in the North Atlantic

(Some Recommendations)

by

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Introduction

The presented recommendations are intended for the species identification of larval, juvenile and adult redfish of the genus Sebastes in the North Atlantic. Identification of these species is complicated and time-consuming as compared to most of commercial fish species.

For initial identifications all control characteristics presented below should be considered (separately for pre-adults and adults, for juvenile and larvae). However if the great number of specimens are to be examined in short time, identification by the appearance is approprate. Nevertheless such identification is allowable only with wide experience gained, i.e. if such express -identifications (commonly used for other fish species) have been repeatedly confirmed by the control characteristics check.

Yet for each sample, irrespective of the aim it is intended for, control characteristics are to be examined at least in 10 specimens of each species, including the shortest and the longest specimen and all sizes, dominating in the sample.

A size of fish is usually expressed by its length. The following terms are used in ichthyology.

1. Total length (TL)

For the North Atlantic redfishes it means the length from the anteriormost part of the lower lip to the imaginary line connecting the end of the longest ray of the caudal fin upper part with the end of the longest ray of this fin lower part.

2. Fork length (FL)

For the North Atlantic redfishes it means the length from

the anteriormost part of the lower lip to the end of the shortest middle ray in the caudal fin.

3. Standard length (SL)

For redfishes it means the length from the anteriormost part of the upper lip to the caudal fin base in the cross - point with a lateral line.

In the North Atlantic redfishes average TL = I.I65FL = I.20SL In applied researches of redfishes the folk length is used most frequently, and in morphological studies standard length.

For specific identification of the North Atlantic redfishes each section with alphabetic indices should be examined from Part I to Part III. For the North American species Part I may be omitted, for species from the European coast, the Bear Island, Spitsbergen - Part II.

A. Identification of pre-adult and adult fishes of I2 cm FL and longer

I. Distinguishing Sebastes viviparus Kröyer

Oblique scale rows counts is the best control feature.

1/ Oblique scale rows count (Fig.1)

Oblique scale rows are counted from the posterior margin of the shoulder girdle upper part to the caudal fin base. In S.viviparus the number of the oblique scale rows is less than 55, in other species it is more than 55. In specimens with ripped off scales scale rows should be counted by scale pockets. In the case when the latter are damaged and the number of scale rows is not available, S. viviparus may be distinguished by other characteristics used in complex. The above complex is also useful to check the identification based on the oblique scale rows count.

2/ Pectoral rays count

Rays are counted by the bases, upper branchless, branched and lower brancheless together. (in non-fresh fishes the lower branchless rays often split into 2 parts: the inner one and the outer one,

which should not be counted separately).

3/ Anal soft rays count

Anal fin of redfishes always consists of 3 spines, which are not counted. The soft rays are counted by the bases, taken the last two rays with very close bases as one ray.

4/ Estimating the angle of slope of the lower spine on the preoperculum (Fig.2)

It is measured as an angle between the longitudinal body axis (i.e. the line drawn from the anterior point of the upper lip to the caudal fin base in the cross-point with the lateral line) and the line drawn along the middle of the spine (along the whole spine, if it is straight, and along its end, if it is curved). The intercept of longitudinal body axis behind its cross-point with the line along the spine is considered.

5/ Assessment of the state of the symphyseal knob development (Fig.3)

In S. viviparus the number of pectoral rays is up to I8 and anal rays up to 7, the angle of lower preopercular spine slope is less than 45°, symphyseal knob is poorly developed.

In other species the number of pectoral rays is more than I8 and the angle of the lower preopercular spine slope is more than 45°.

Specimens with only single characteristic differed from the above mentioned may be identified as S. viviparus. Specimens with two such characteristics should be recorded separately with indication the meanings of all control characteristics.

6/ Vertebrae counts (Fig.4)

Vertebrae are counted in gutted fish or on X-ray photograph of the whole fish. Vertebrae should be counted together with urostyle

In all redfishes (except rare anomalies), interneuralia with the first and the second spines of dorsal fin and interneuralia with the third spine intrude together between the neural appendages of the second and third vertebrae (interneuralias of the other spines, except the last one, always intrude individually). So for convenience, counting may be started from the third vertebra.

S. viviparus commonly have 30 vertebrae, rarely more or less. S. marinus and S. mentella usually have 3I vertebrae. Specimens with

30 vertebrae are more common for S. marinus than for S. mentella. Specimens with 32 vertebrae occur rarely.

S. viviparus are never found at the North American coast and it is scarce off the Greenland coast. This species is fished commercially in small quantities by bottom trawls off Iceland, in the northern North Sea, in the eastern Norway Sea and in the west of the southern Barents Sea. It commonly distributes in shallower water as compared with other North Atlantic species (up to 120 m, rarely up to 600 - 700 m.).

II. Distinguishing S. fasciatus

The following control characteristics, besides the above mentioned, are required:

7/ The angle of slope of the third preopercular spine from the top

It is measured as an angle between longitudinal body axis and the line, drawn along the middle of the spine (as for the angle of slope of the fifth spine, Section 4, Fig. 2).

8/ The rate of isolation of parietal and nuchal ridges (Fig.5)

Those ridges are considered fused ones if only a single total ridge exists, ended with a spine or a knob. They are considered separated ones if these are two successive ridges or one more spine or knob on the common ridge precede the terminal spine or knob. In S. fasciatus symphyseal knob is strongly developed. (Fig. 3), the anal fin of 7 rays or fewer, the angle of slope of the third preopercular spine less than 40°, parietal and nuchal ridges separated at least at one side, 30 or fewer vertebrae. In S. marinus and S. mentella the anal fin of 8 rays or more, the angle of slope of the third preopercular spine more than 40°, pariental and nuchal fused, 31 or more vertebrae. For specimens found nothward to Newfoundland and off Labrador anal rays count is not necessary. In specimens from the Nova Scotian Banks assessment of the rate of parietal and nuchal ridges fusion is not obligatory. The latter two characteristics in redfish from above mentioned areas reveal excessive transitional values.

Specimens with only a single characteristic differed from the appointed values, should be regarded as belonging to S. fasciatus. Specimens with more than one such characteristic, should be recorded separately with indication of all control characteristic values. S. fasciatus never occurs off European coast, at the Bear Island and Shpitsbergen, and rarely occures off Iceland. It is less aboundant off the Greenland coast than S. maninus, and is rarely found outside fiords as compared with S. mentella. S.fasciatus is not found off the Baffin Land and is rarely fished commercially than S. mentella off Labrador.

Further to the south it becomes progressively dominating species among the redfishes. In the Gulf of Maine it dominates almost exclusively. This species divides into two subspecies. The first one (S. fasciatus kelly) inhabits the Gulf of Maine in the area of Eastport, near the shore at the depth of few meters. The second one is commonly occured S. fasciatus fasciatus with a similar to S. marinus depth distribution.

III. Distinguishing S. marinus L. and S. mentella Travin

The following control characteristics, besides the above mentioned, are required.

9/ Caudal peduncle depth

It is measured at the most narrow part of the caudal peduncle perpendicularly to the longitudinal body axis.

IO/ Number of seismosensory pores (Fig.6)

on the anterior margin of the occipital commissure between parietal ridges (Fig. 6). In large specimens those pores are distiguished visually, but microscope is more reliable.

In S. marinus symphyseal knob is not prominent (Fig. 3). Caudal peduncle depth is usually over 8,8% SL in specimens of II-I7 cm SL, over 9,0% SL in specimens of I7-25 cmSL and over 9,2% SL in specimens of 25-29 cm SL.

In specimens from the Barents Sea and adjacent areas the angle of slope of the lower preopercular spine is less than 80°, and in

specimens from Iceland and the North-West Atlantic it is less than 105°. There are 4 seismosensory pores between the parietal ridges on the anterior margin of the occipital commissure. Coloration is goldish-red or orange-red. In S. mentella symphyseal knob is fairly well developed. Caudal peduncle depth is commonly below 8,8% SL for specimens of 11-17 cm SL, below 9,0% SL for SL 17-25 cm and below 9,2% SL for SL 25-29 cm.

In S.mentella

The angle of slope of the lower preopercular spine is over 80° in specimens from the Barents Sea and the adjacent areas, and over 105° in specimens, occured off Iceland and in the North-West Atlantic. Between parietal ridges there are 2-3 seismosensory pores. The coloration is pink-red.

For specimens found in the Barents Sea and adjacent areas of the Norwegian Sea and Greenland Sea one more characteristic is very usefull. It is the number of the lower branchless pectoral rays found below branching rays. S. marinus from above mentioned areas usually have 9 lower branchless rays or more (rarely 8), and S. mentella have 8 rays or fewer (rarely 9). In specimens inhabited inshore areas of Iceland and the North-West Atlantic, the number of the lower branchless pectoral rays is averagely greater in S. marinus than in S. mentella, but the difference is not so prominent.

Diameter of orbit in S. marinus is in average smaller than in S. mentella of the same length. However the values of this measurement overlap significantly especially in smaller specimens ,slight overlapping of some characteristics in the range typical for other species should not interfere with identification. Complicated cases are to be mentioned separately with indication of all control characteristics values.

S. marinus is common in the southern Barents Sea, off Norway, Iceland and Greenland. In the North American area it occures much rarely than S. fasciatus and S. mentella. It is frequently found in the area of the North and Grand Newfoundland Banks, on the Flemish Cap Bank and in the Gulf of St. Lawrence. South to the Cabot Strait it is extremely rare. This species occures mainly at the depth up to 300-370 m., but sometimes at 700-750 m.

S. mentella distributes actually in all areas, inhabited by the North Atlantic redfishes, except of the North Sea and the Gulf of Maine. It occures farther off-shore as compared with other species. It dominates among other redfishes in the areas of the Kopytov and RosenGarten Banks, off the Baffin Island. Near the bottom adults are common at the depth of 350-700 m, and young fishes distribute at the shallower depth. This species is fished up to II00 m. In the water column it is found up to 50 m or even closer to the surface.

B. Identification of fry of 5-I2 cm FL

Fry of that size range are pelagic-demersal, distributing usually close to the bottom. Vertical migration of the latter have not been properly studied yet. (for all adult redfishes in the North Atlantic, except S. viviparus, diurnal vertical migrations are typical).

I. Distinguishing S. viviparus

The best control characteristic still remains the oblique scale rows count (p.3). However the latter may be damaged though the scales are stronger fixed in this species as compared with others.

S. viviparus usually have I8 or fewer pectoral rays, 7 or fewer anal rays, 32 or fewer lateral line pores (excluding I-2 pores posterior the base of the caudal fin), 30 vertebrae. Fry of S. marinus and S. mentella have I8 or more pectoral rays and 3I (32) vertebrae. One of these characteristics deviation could be not considered. Fry with two deviated characteristics should be recorded separately with indication of all control characteristic values. Fry of S. viviparus and S. fasciatus only slightly differ by all above mentioned characteristics except the number of pectoral rays (S. viviparus usually have I8 rays). So in the coastal areas of Iceland and Greenland, where both species occured, the oblique scale rows count is especially significant.

In fry of S. viviparus the angle of the lower preopercular spine slope is similar to those of other species. Distinguishing features

develope later on. In growing-up fry of S. viviparus the preopercular spines turn from the radial direction to posterior one.

II. Distinguishing S. fasciatus

S. fasciatus have usually 7 anal rays or fewer, the angle of the third preopercular spine slope is less than 40°, parietal and nuchal spines separated at least at one side of the head, 30 vertebrae or fewer.

S. marinus and S. mentella have 8 anal rays or more, the angle of the third preopercular spine slope over 40°; parietal and nuchal spines fused; 3I vertebrae or more.

Specimens with only a single characteristic differed from above mentioned should be regarded as S. fasciatus. Specimens with two such characteristics should be recorded separately with indication of all control characteristic values.

One more characteristic is usefull in separation of S. fasciatus and S. mentella fry in the areas where S. marinus is rare or absent. Almost all fry S. fasciatus of 5-I2 sm FL have the longest dorsal fin spine (over I3% of SL) and in S. mentella this spine is less than I3% of SL. The spine length should be measured from the base under the skin to the tip.

III. Separation of S. marinus and S. mentella

In S. marinus the caudal peduncle depth is usually over 7,6% of SL for specimens of 4-6 cm SL; over 8,I% of SL for SL 6-7 cm, and over 8,7% of SL for SL 8-II cm. Usually the pointed symphyseal knob is visually detectable during embrionic stage. In specimens of 4-5 cm SL there are 2-4 seismosensory pores between parietal ridges on the posterior edge off occipital commissure. In specimens of 8-I2 cm SL there are 4 pores on the anterior edge.

In S.mentella the caudal peduncle is less than 7,6% of SL for specimens 6-7 cm SL ,less than 8,1% of SL for SL 6-7 cm and less than 8,7% of SL for 8-11 cm.Pointed symphysial beak rudiment is usually detectable visually.In specimens of 4-5 cm SL 1-2 seismosensory pores are between parietal ridges on the posterior edge off occipital commisure.There are 2-3 pores on the anterior edge in specimens of 8-12 cm SL S. marinus usually have

8 anal rays. Deviations from this value rarely exceed few percents, though in some samples the latter could reach a few dozens percents.

40-55% of all examined specimens S. mentella have 9 soft anal rays and the equal amount have 8 rays (specimens with 7 and I0 rays constitute only 2-3%).

Fry of S. marinus and S. mentella (5-I2 cm FL) are slightly distinguished by the angle of the fifth preopercular spine slope and relative diameter of orbit.

C. Identification of fry 2,5-5 cm FL

I. Distinguishing S. viviparus.

S. viviparus usually have I8 pectoral rays or fewer; the total number of anal rays including developing spines is I0 or fewer. Within the appointed length range in smaller specimens parietal spine approximately equals the pupillary diameter; and the third preopercular spine equals double pupillary diameter (fig. 7). In other species there are usually I9 pectoral rays or more. In smaller specimens the length of parietal spine equals a half of the pupillary diameter or less, and the length of the third preopercular spine approximately equals the pupillary diameter. By the time when a length of appointed range is reached, those spines length show relative decrease in all species, and distinguishing features for larger specimens (about 2-4 cm) should be specified more exactly. The total number of anal rays, including developing spines, is usually II or more in S. marinus and S. mentella.

II. Distinguishing S. fasciatus

S. Fasciatus is distinguished from S. marinus and S. mentella by the number of anal rays (I0 or fewer) and vertebrae count (30 or fewer). Only a part of S. fasciatus fry with possible admixture of S. marinus and S. mentella could be distinguished by means of the above mentioned characteristics. However the significant part of fry remains mixed with two other species. For identification of S. fasciatus fry new specific characteristics should be found.

III. Separation of S. marinus and S. mentella

In S. marinus the third preopercular spine is longer than the second one from the top, or those spines are of the same length. Snout is blunt (fig. 3,7). In S. mentella the third preopercular spine is usually shorter than the second one. Snout is pointed (fig. 3,7). Other distinguishing characteristics are yet unknown.

Some differences of total anal rays count should be mentioned. S. marinus frequently have II rays and S. mentella have II and I2 rays (see the soft rays count in larger specimens, p. 3).

D. Larvae of I,5 - 2,5 cm TL

I. Distinguishing S. viviparus.

S. viviparus usually have I8 pectoral rays; parietal spine approximately equals the pupillary diameter; the third preopercular spine protrudes to the base of the abdominal fin or extends onto the main part of the distance between the spine base and the abdominal fin base; coloration is yellow - green.

In other species the number of pectoral rays is usually I9; the length of parietal spine is a half of the pupillary diameter or less; the distance between the third preopercular spine and the abdominal fin base equals the length of the former; the colour is greyish.

II. Distinguishing S. fasciatus

In S. fasciatus the length of parietal spine equals approximately a half of the pupillary diameter. Fine subsidiary spinulae on the base of the preopercular spine are not visible, no dark pigmentation on interbranchial space at posterior lower margin of orbit and at the base of anal fin, colour is yellow - greenish. In S. marinus and S. mentella the parietal spine is some times shorter than pupillary diameter. A fine subsidiary spinula is at the base of at least several preopercular spines; a dark pigmentation on interbranchial space at the posterior lower margin of orbit and at the base of anal fin is noticeable. Coloration is greyish.

III. Separation of S. marinus and S. fasciatus

Separation is not possible. Distinguishing characteristics are absent.

E. Larvae of I,0 - I,5 cm AL

I. Distinguishing S. viviparus

In S. viviparus the parietal spine length approximately equals the pupillary diameter, the third preopercular spine equals the diameter of orbit. A group of melanophores is present on the snout top, and several melanophores are at the base of the pectoral fin.

In other species the parietal spine length is considerably less than the diameter of the pupil and the length of the third preopercular spine is noticebly less than orbit diameter.

On rare occasions a single melanophore is on the snout top, but usually melanophores have not yet developed, which is also the case with melanophores at the base of the pectoral fin.

II. Distinguishing S. fasciatus

In S. fasciatus melanophores usually extend along the upper dorsal part of the back. In larger specimens the parietal spine length is not less than a half of the pupillary diameter, the number of preopercular spines is 5.

S. marinus and S. mentella have a space in the ahterior part of the back, lacking melanophores. The parietal spine length is several times shorter than the pupillary diameter. The number of preopercular spines never exceeds 2 - 3.

III. Identification of S. marinus and S. mentella

It is not possible yet. Distinguishing characteristics are to be searched.

F. Early larvae, pre- larvae and embryo just before hatching

Total length of hatching embryos of S. viviparus is usual-

ly 4-5 mm; S. fasciatus 5-7 mm, S. marinus 6-8 mm, and S. mentella 7-9 mm.

I. Distinguishing S. viviparus

In S. viviparus I- 4 melanophores are below notochord, at the base of caudal part of a fin fold (subcaudal melanophores, fig. 8), and the ventral row consists of I8-29 melanophores. Body is pigmented at lateral, dorsal and faintly at the ventral side.

Larva of the length 6 mm and more have a group of melanophores on the snout top, and a few melanophores at the pectoral fin base.

In other species below notochord melanophores absent, or if present, their number in ventral row is 26-42.

Ventral side of the body is not pigmented. On the snout top only a single melanophore is to be found, but most commonly melanophores absent likewise at the base of the pectoral fin.

II. Distinguishing S. fasciatus

In S. fasciatus there are commonly 2 subcaudal melanophores, rarely more or fewer. Ventral row consists of 26-42 melanophores. In S. marinus and S. mentella subcaudal melanophores are lacking. S. marinus rarely have one melanophore. (it is found only in larvae from the North American coast). There are 5-24 melanophores in the ventral row.

In the process of growing up the ventral row of melanophores gradually becomes less distinct. The dissapearence progresses faster in S. marinus and S. mentella than in S. fasciatus.

III. Separation of S. marinus and S. mentella

In S. marinus the ventral row consists of 9-24 melanophores, the dorsal one of 8-2I melanophores. Melanophores of dorsal row are found above thirteen terminal myomeres or above most of them(Fig.9). S. mentella have 5-I0 melanophores in the ventral row, the same number is found in dorsal one. Melanophores of the dorsal row are above 6-I2 terminal myomeres(Fig.10).

* * *

The approach to adequate specific identification of early fry should be flexible. Early stages of fishes undergo particularly fast and apparent changes with age. For some species, in sertain length ranges, the distinctive characteristics have not been found yet or those are very few.

Morphological changes in growing up larvae and fry should be examined thoroughly, beginning with hatching, in order to check the above mentioned control characteristics in greater number of specimens, and to search some new characteristics.

In biochemical and other analysis one should begin comparison of species on specimens, disposed all control morphological characteristics values, typical for a given species. Specimens with some deviations from typical values of control characteristics should be examined separately. It is to be reminded that the possibility of existance of two different forms of S. marinus is not excluded. In one form symphyseal knob is less developed, rounded, maximum folk length is about I,0 m. Another form has better developed symphyseal knob (but not so prominent as in S. mentella), more or less pointed. Maximum length is up to 60 cm.

This problem has not been seriously studied yet.

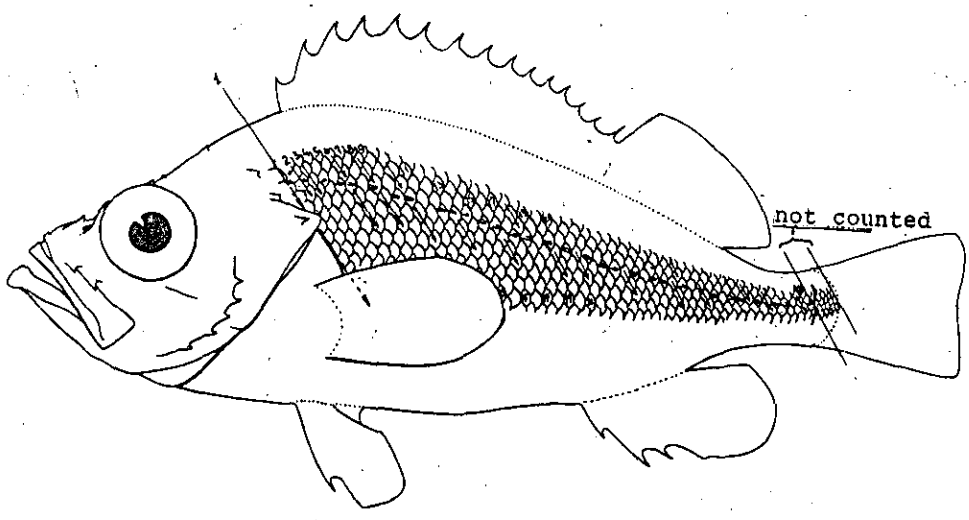

Fig.1. Oblique scale rows.
These are counted from the posterior margin of the shoulder girdle upper part to the caudal fin base where the last scale is with the lateral line pore.

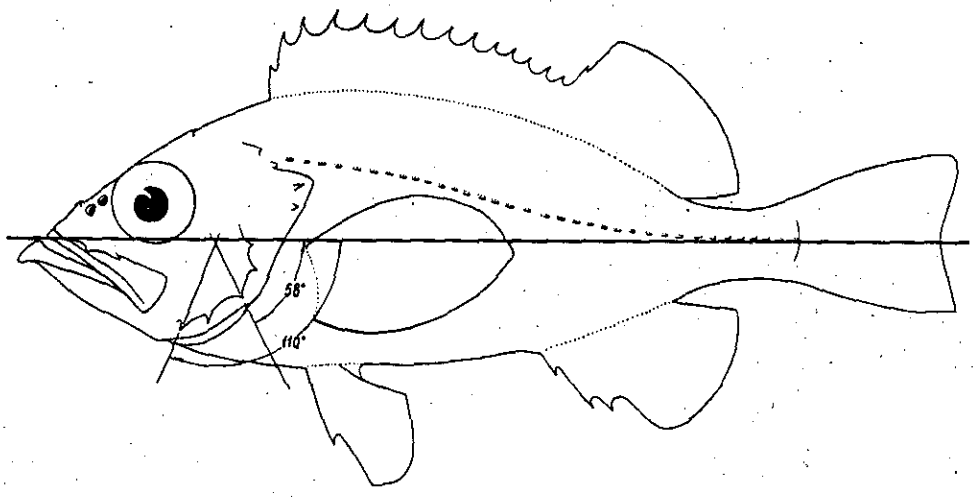

Fig.2. The slope angles of the third and the lowest preoperculum spines.

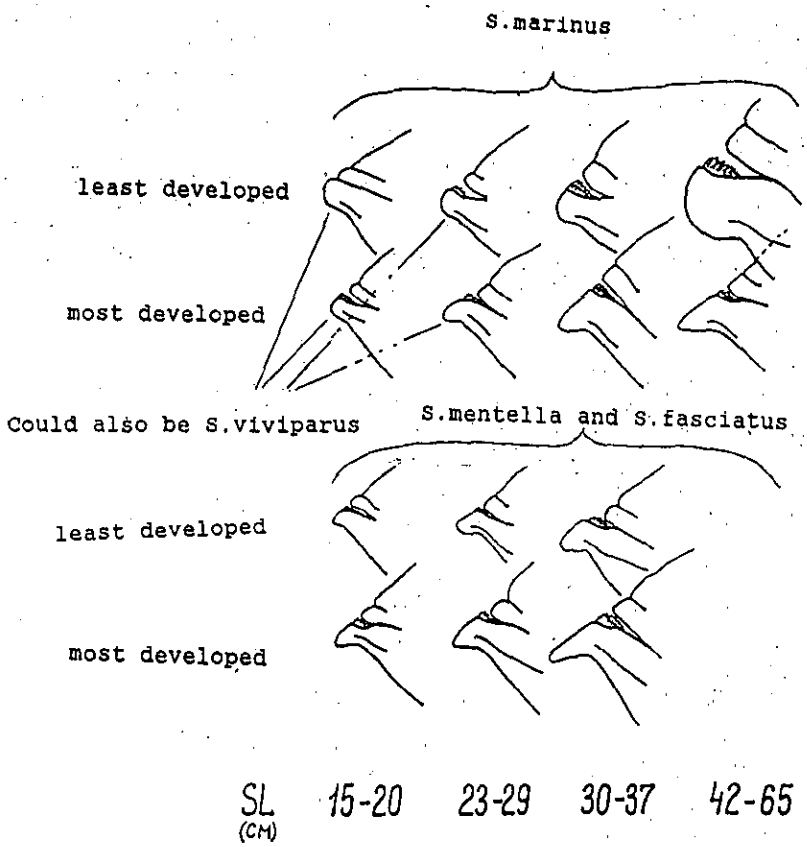

Fig.3. The symphysial knob(beak) development.

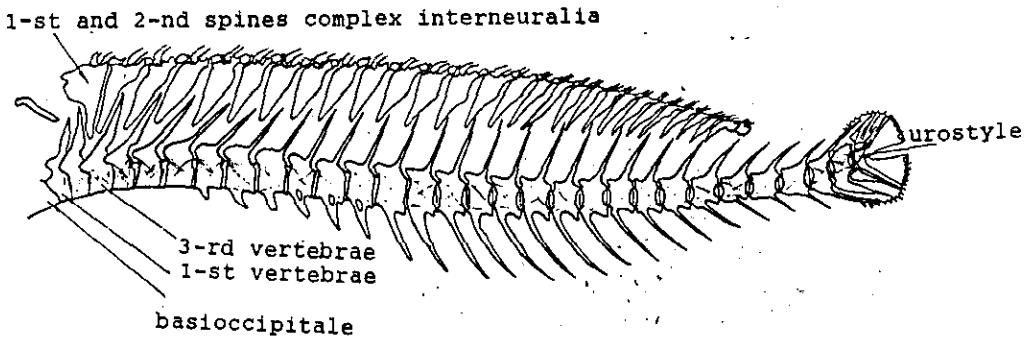

Fig.4. Vertebrae column and tail fin skeleton.

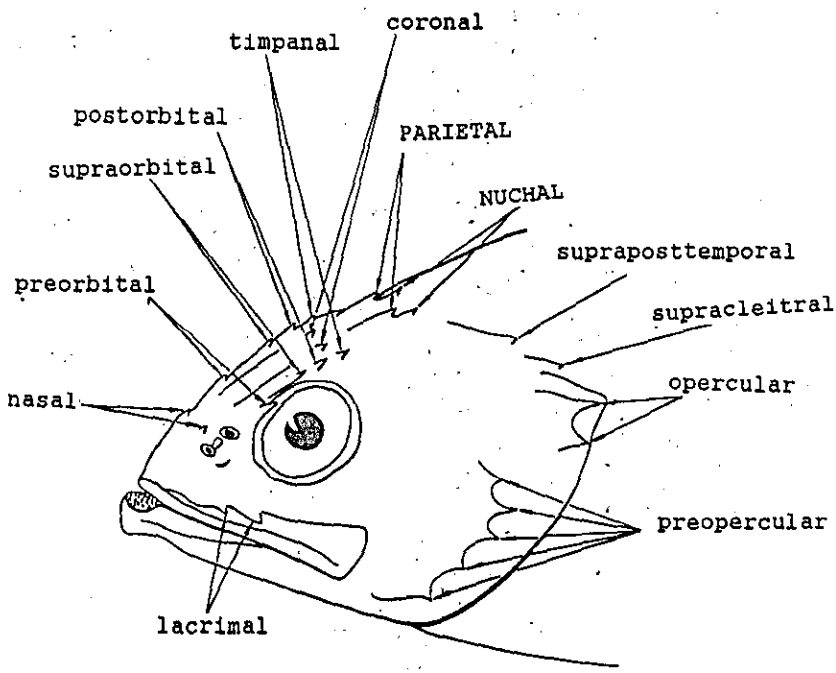

Fig.5. Position of the head spines important for identification.Not all spines shown here.

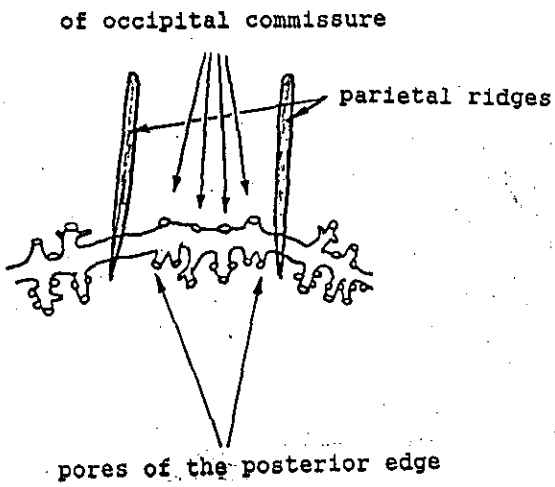

Fig.6.Seismosensory pores on the occipital commissure.

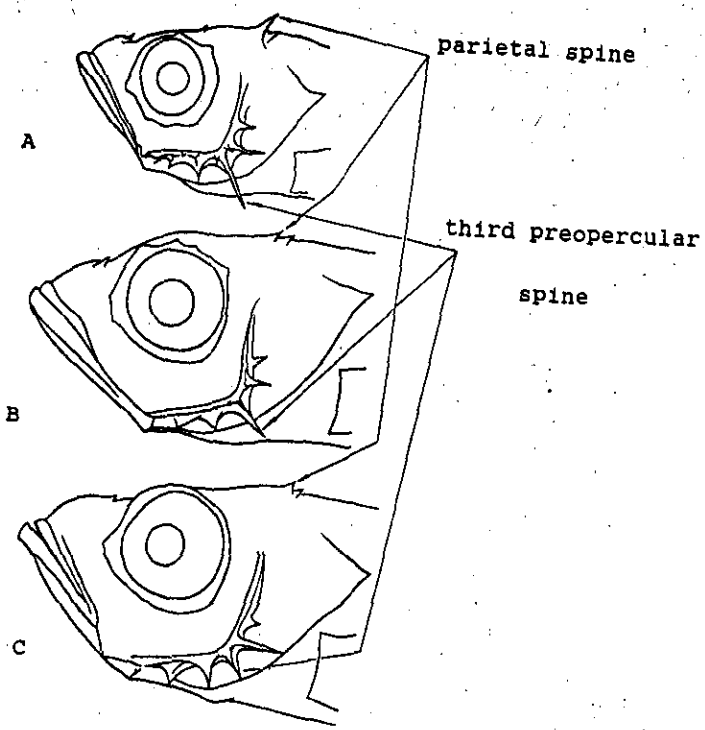

Fig.7. Redfish fry head : A - S.viviparus TL-25,5mm B - S.marinus TL-34,2mm.,C - S.mentella TL-35,2mm. (after J.Magnusson).

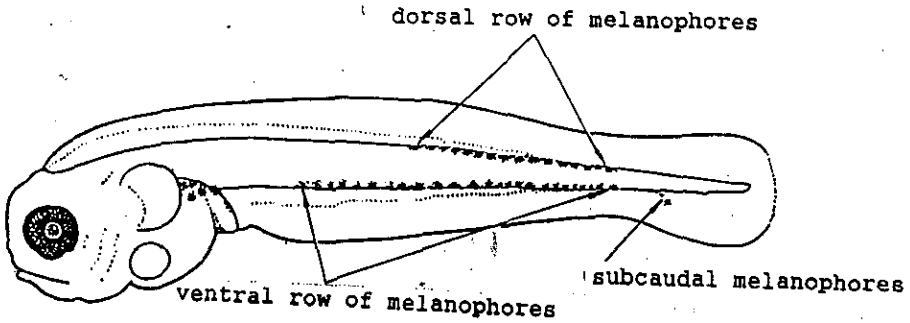

Fig.8. S.viviparus prelarvae TL-5,8mm before extrusion(after V.Tåning).

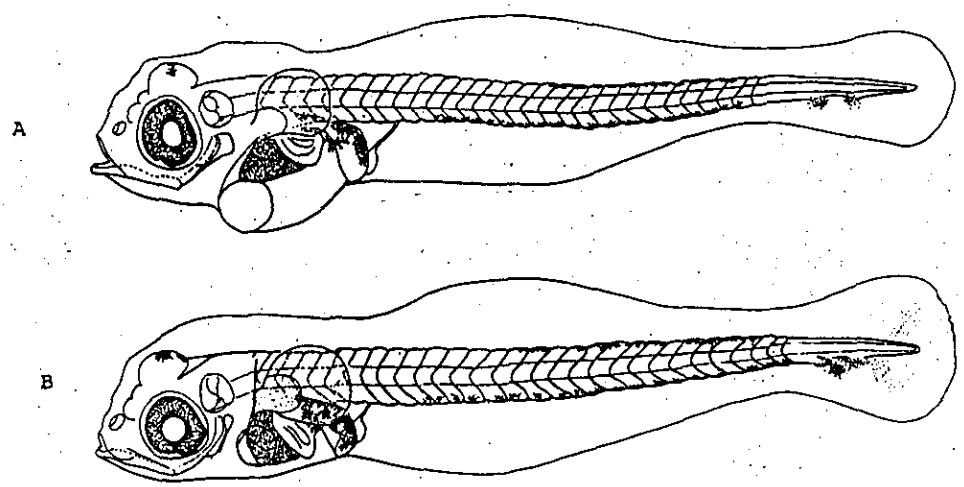

Fig.9. S.marinus preextrusion larvae(A) TL-6.25mm and larvae one day after extrusion(B) TL-7.19mm.

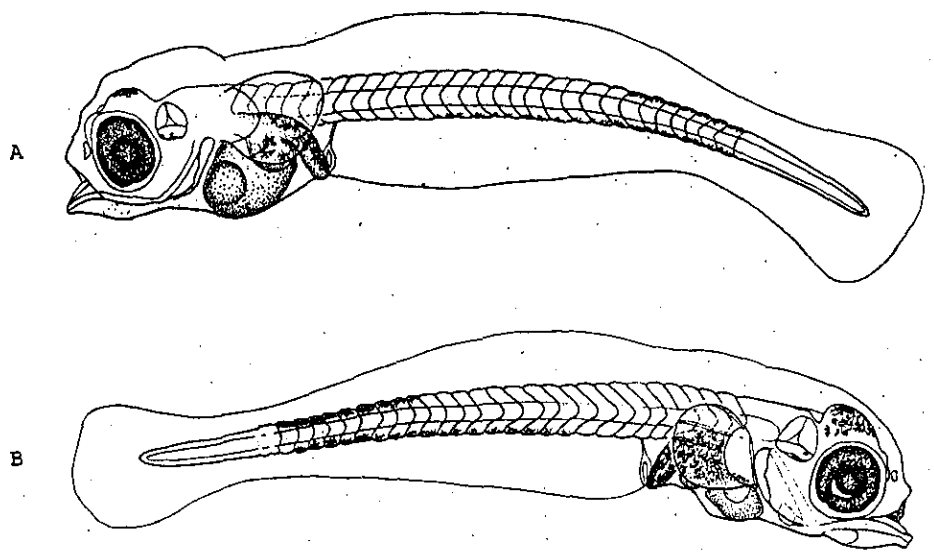

Fig.10. S.mentella preextrusion larvae(A) TL-8.15mm and one day after extrusion(B) TL-8.0mm.