REPORT

from the meeting of redfish scientists and age reading specialists at IMR, Bergen, 4-14 March 1997

Participants:

Berntsen, Bjørn-Kåre	Norway
Drevetnyak, Konstantin	Russia
Nedreaas, Kjell Harald	Norway
Saborido Rey, Fran	Spain

A meeting between Norwegian, Russian and Spanish redfish scientists and age readers was held in Bergen 4-14 March 1997 as a part of the recommendations by the "Workshop on age reading of *Sebastes* spp." held in Germany in December 1995 (Anon. 1996).

The recommendations were as follows:

1. Requirements for scale/otolith comparisons

"Collections for such comparisons be made for the next two (2) years after which time the necessary analyses are carried out. The examination of material, and analysis of results should be done by small working groups of experts familiar with the stock/species in question. This must include those most familiar with the "traditional" age determination technique(s) applied to the different structures for the stock/species in question. It is possible that different degrees of usefulness may exist for the different stocks/species."

2. Future activities and timetable.

a. "The time limit for collection of material for comparison of scale and otolith interpretation is two years. During that time period, analyses of existing material should be ongoing. Small working groups of experts, as is appropriate for each stock/species in question should meet during the second half of 1998 to examine results and determine, to the extent possible from the data, possible conversions. These working groups should comment on the usefulness of any such conversions including limitations.
b. There is an ongoing requirement for those involved with age determinations (otoliths) of particular redfish stocks/species to meet and discuss their work. These small working groups should meet to examine interpretation consistency (within and between reader), bias and precision of their interpretations. These meetings should occur annually until such time as an acceptable level of ongoing agreement has been achieved after which time the meetings may be less frequent.
c. All institutes interested in age determinations of redfish should continuously be searching for information and opportunities to conduct age validation work."

Based on these recommendations an agenda was set up for the meeting:

1. Russian samples of otoliths and scales from the same fish from the Barents Sea, preferably *S .mentella*.

2. Discuss a Spanish sample of otoliths and scales from 89 specimens of oceanic *S. mentella* from the Irminger Sea.

3. Comparative readings to harmonize the otolith age determination.
 a) *S .mentella* in the Barents Sea.
 b) Oceanic *S .mentella* in the Irminger Sea.

4. Validation exercises, e.g., follow the relative strong 1988-1990 yearclasses (Petersen technique).

5. Other matters, e.g., "Giant redfish" from the Mid-Atlantic ridge = big *S. marinus* ??

Berntsen (Reader 1), Drevetnyak (Reader 2) and Saborido Rey (Reader 3) were all reading broken and burnt (or baked) otoliths, while only Drevetnyak had the necessary expertise to read scales. Information on fish length was available to the readers.

Russian sample of otoliths and scales from the same specimens of *S .mentella* from the Barents Sea (collected in April '96).

A sample of otoliths and scales from 25 *S. mentella* (24-36 cm) from the Barents Sea were read. First, a comparison of independent otolith readings was made. This was followed by a discussion and rereading of those specimen where the readers deviated. Then the modal (or mean) otolith ages determined by the three readers were compared with the Russian scale reading.

The results are shown in Table 1 and Figure 1. None specific trend can be observed in the differences between readers, except perhaps between reader 2 and 3, where reader 3 trend to read one year more in the older fishes. Against expected the deviations in young fish are more and less equal than those in older ones.

Comparative otolith/scale readings for this limited size range (24-36cm) showed scale readings well within the range of otolith readings for each length. In this size range all sets fit rather well to a linear regression and this technique was used for further comparisons. The fitted linear regression lines for otolith ages and scale ages versus fish length crossed each other at about 34 cm. The linear regression of otolith age versus scale age gave the following relationship: OTO = -1.83 + 1.12*SCALE (r^2 = 0.89). Results are presented in Table 2 and Figure 2 and Figure 3.

Conclusion: More comparable readings of young fish (1-10 years) is necessary since the discrepancy in otolith age determination of young fish may be proportionally higher than for older fish. Outstanding length-frequency modes may support the age determination (Petersen technique). Though age readings of scales and otoliths fit rather well it is necessary extend the analysis to young and older fishes.

Discuss a Spanish sample of otoliths and scales from 89 specimens of oceanic *S .mentella* from the Irminger Sea (collected in September-October '95).

Results from the comparative otolith readings are given in Figure 4. For specimens older than 12-15 years, the discrepancies in age determination were too high. While the Norwegian and Spanish readers for some specimens deviated too much but unsystematically, the Russian reader was systematically assigning too low age to these fishes. This systematic deviation was investigated and the main reason was the exclusion of the annuli occurring within the lateral growth of the otolith. It was agreed upon that the Russian reader should read these otoliths once again before comparison with the scale readings. The lateral growth area in redfish otolith is founded in old fishes in Barents and Norwegian Sea as well in Western Atlantic. However otoliths with this particular growth area is found seldom and always in largest sizes in those regions. In the Russian surveys they are not common and hence they was not correctly interpreted due to the lack of experience on these kind of otoliths. However, in Irminger Sea call considerably the attention that otoliths with this lateral zone are often found in relative small fish (above 31 cm) which confused to readers. Thus, for example, two specimens of 34 cm were aging as 28 and 14 years old (Reader 1) and 29 and 15 (Reader 3) respectively; the former showed a lateral growth zone

Conclusion: The oceanic *S .mentella* in the Irminger Sea seem to be more heterogeneous with regard to age than could be expected from the length distribution. The age of a 35 cm fish could vary between 12 and 30 years. The different shape of the otoliths with clearly different degrees of lateral growth give us reason to believe in these different ages (and growth patterns), although this great variation in age at length seem to occur at a smaller fish size than has been seen in other areas/stocks. From this limited material, which also confirm what has been seen in other samples of the oceanic *S .mentella* (Working Documents to the North Western WG and Workshop on age reading of *Sebastes* spp. In Germany), this stock should be kept separate from other *S. mentella* stocks with regard to growth and comparisons/conversion of otolith/scale-ages.

Comparative readings to harmonize the otolith age determination.

a) *S. mentella* in the Barents Sea.
b) Oceanic *S. mentella* in the Irminger Sea.

This matter has been handled in connection with the other topics.

Validation exercises, e.g., follow the relative strong 1988-1990 yearclasses (Petersen technique) (collected in February '96).

The 1988-1990 yearclasses of *S. mentella* in the Barents Sea are from the length frequencies observed to be stronger than the surrounding ones. This may be taken advantage of when reading otoliths and validating the readings (Petersen technique). Figure 5 show the length distributions of *S. mentella* from the annual winter surveys in the Barents Sea in February 1989-1996. A sample of 33 *S. mentella* otoliths from the 1996-survey were read. Most of the otoliths were sampled from 16-25 cm fish which from the length distribution were believed to be 6-8 years old.
The results which are shown in Table 3 and Figure 6 were very similar among the readers and fitted very well with the ages expected from the length distributions.

Conclusion: The three readers corresponded very well. Also this exercise confirmed the need to conduct more comparative readings of young fish as the age of three specimens of 9,10 and 11 cm had to be discussed before a common understanding of the annuli was established. These discrepancies were caused by the difficulties in the interpretation of the annuli and false rings when only two or three annual growth zones have been formed and none other references of late annuli are present. In the first years, each annual growth zone are usually formed by two opaque zone with one annulus and one check. In winter surveys only the check have been formed and can be wrong interpreted as annulus. In those cases previous experience of the diameter of each annual growth zone in older otoliths can be a valuable help.

Age reading of "giant" Sebastes marinus from the Mid-Atlantic ridge (collected in July '96).

In 1996 a new longline (and one gillnet vessel) fishery started in international waters on the Mid-Atlantic ridge. Big, "giant" redfish, morphologically similar to *S .marinus*, made up a great part of the catches. In order to get some knowledge about the age of these fishes as quick as possible, 26 specimens were aged using broken and burnt (or baked) otoliths.
The results showed ages in the range of 30-50 years.

Conclusions and Recommendations:

i) The age readings should follow the Protocol worked out by the ICES Workshop on age reading of Sebastes spp. (Anon. 1996).
ii) Otoliths should not be read unless the date of capture is known. By convention the birthday of all redfish is 1 January, and the age should be assigned according to this birthday. In order to avoid misunderstanding the year when born may be written in parenthesis after the age, e.g., age 7 (1990-yearclass).
iii) Regarding the Barents Sea redfish we should as a convention use that the summer growth (opaque) at the edge of the otolith starts 1 June. Therefore, if it is impossible to tell the last annulus apart from the otolith edge, the edge itself should until 1 June (but not after this date) be counted as the most recent annulus. Until documentation is presented for the Irminger Sea, the same convention should be used for this area.
iv) All annuli at the lateral growth part of the otolith should by convention be included and counted as a yearly growth zone. Measurements of the diameter of the first annuli as an aid in the age reading will standardize the interpretations of the first annuli and should be encouraged (Nedreaas 1990, Anon. 1996).
v) By 1997 all material for otolith/scale comparisons should have been sampled. As agreed upon at the December 1995 workshop scientists and age readers involved in the research on *S. mentella* in the Barents Sea and Irminger Sea should meet at the end of 1998 to make a final conclusion about possible scale-otolith comparisons and conversions.
vi) The exercise from the present meeting put additional support to the hypothesis that the oceanic *S. mentella* stock seem to be composed of fish possessing a wide range of growth strategies.

Bergen, 14 March 1997

Table 1.- Age readings of the first Barents Sea collection (Russian samples)

		Otoliths			Scales
Number	Size	Reader 1	Reader 2	Reader 3	
1	35	12	14	14	
2	36	15	14	15	14
3	36	13	14	13	14
4	35	15	14	14	14
5	36	15	14	15	14
6	35	14	14	16	14
7	24	7	7	7	7
8	35	16	14	14	14
9	33	15	12	12	13
10	33	13	12	11	12
11	35	12	14	12	13
12	35	15	14	14	14
13	28	9	10	8	10
14	33	12	11	11	12
15	36	13	15	14	14
16	35	12	14	14	14
17	30	12	10	9	11
18	26	9	8	7	8
19	26	7	8	7	8
20	27	6	9	8	9
21	26	7	8	7	9
22	29	8	9	8	10
23	31	9	10	10	10
24	32	12	12	11	10
25	27	10	8	7	10

Table 2.- Linear regression results between scale age readings and the mode of the three otoliths age readings

STAT.	Regression Summary for Dependent Variable: MODE					
MULTIPLE	R= .94416166 R^2= .89144124 Adjusted R^2= .88650675					
REGRESS.	F(1,22)=180.66 p<.00000 Std.Error of estimate: .95113					
N=24	BETA	St. Err. of BETA	B	St. Err. of B	t(22)	p-level
Intercept			-1.82927	.986201	-1.8548	.077067
Scales	.944162	.070246	1.12195	.083474	13.4408	.000000

Table 3.- Age readings of the second Barents Sea collection (Norwegian samples)

Number	Size	Reader 1	Reader 2	Reader 3
1	34	13	13	13
2	20	6	6	6
3	23	7	7	7
4	20	6	6	6
5	19	6	6	6
6	19	5	5	6
7	18	6	5	6
8	16	4	5	5
9	33	12	12	13
10	25	8	8	8
11	24	7	7	7
12	23	7	7	6
13	22	7	7	7
14	19	5	6	5
15	20	7	6	7
16	16	5	5	5
17	17	5	6	5
18	24	7	7	7
19	19	5	6	5
20	20	6	6	6
21	22	7	7	6
22	21	7	6	6
23	23	7	7	7
24	22	7	7	7
25	24	7	7	7
26	18	5	6	5
27	33	12	12	13
28	17	5	6	5
29	21	6	7	6
30	19	6	6	6
31	9	2	2	2
32	11	3	3	3
33	10	2	2	2

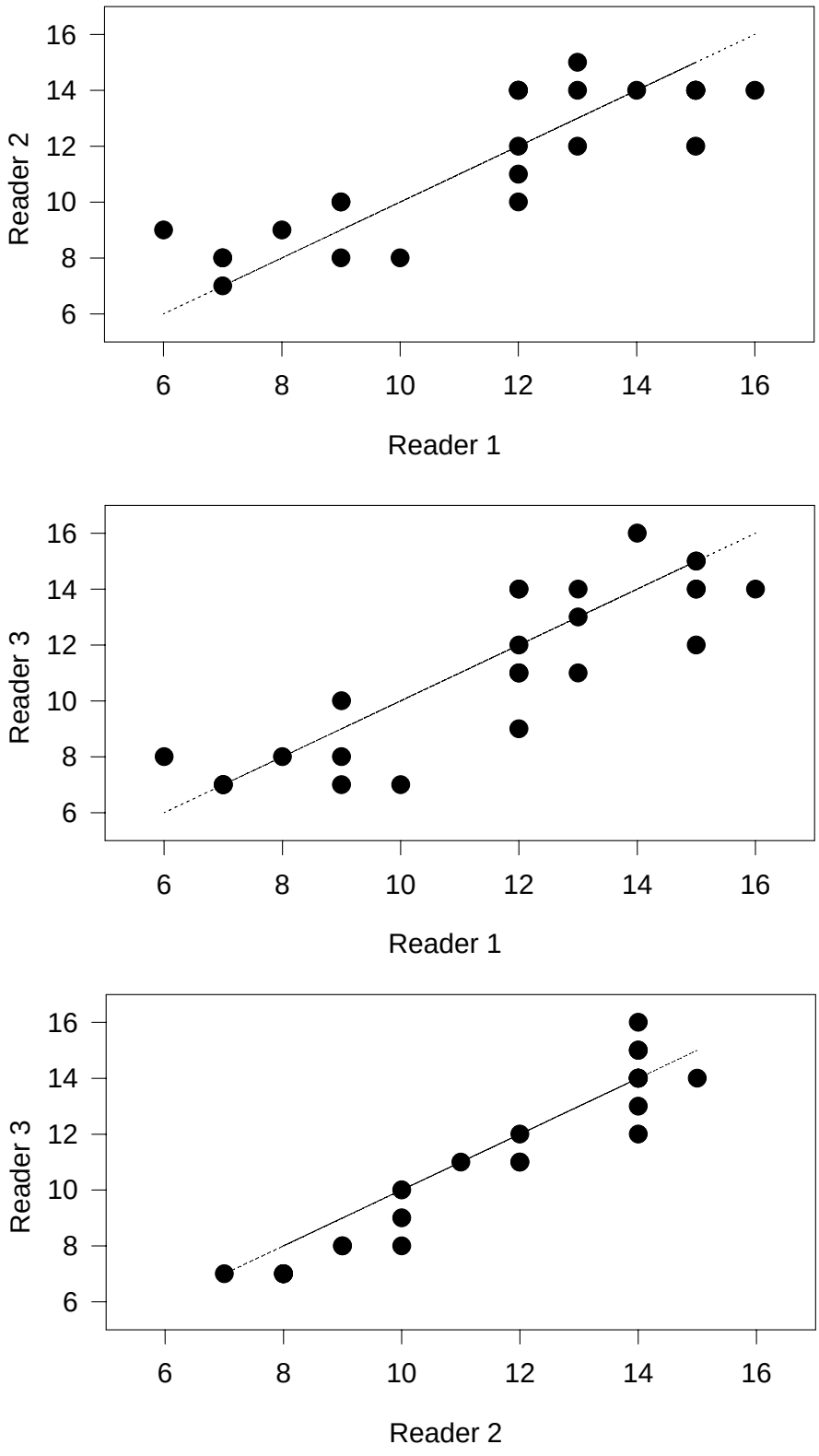

Figure 1.- Comparative plots of otolith age readings of 25 otoliths and scales collected in April 1996 in Barents Sea (Russian sample).

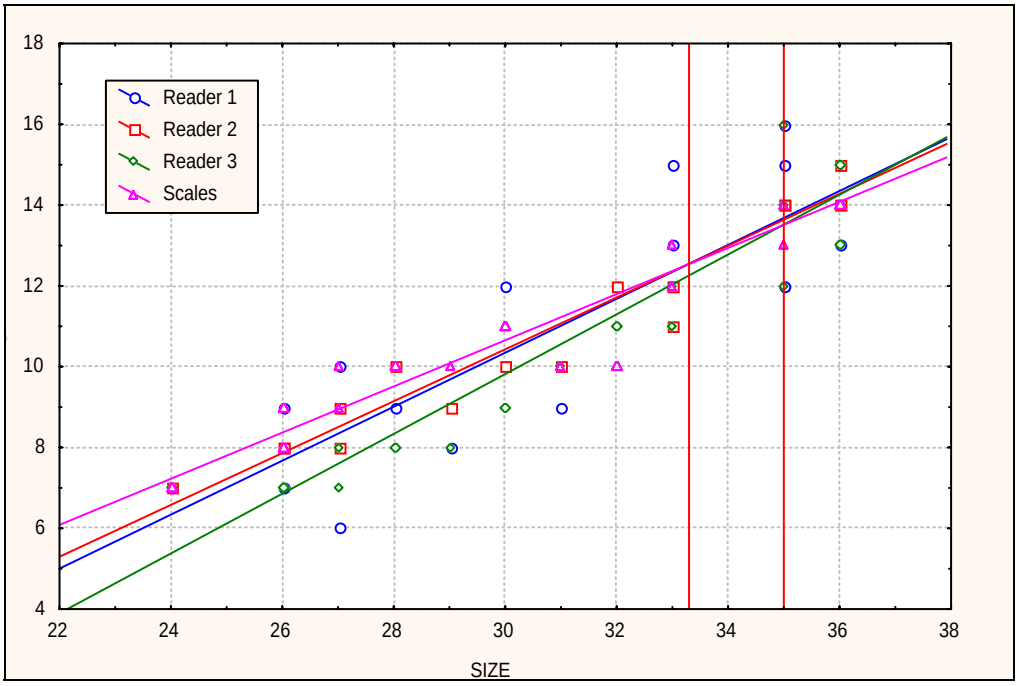

Figure 2.- Plot of size versus age readings (otoliths and scales). Fitted linear regressions of each set and cross points between scale and otolith lines. 25 otoliths and scales collected in April 1996 in Barents Sea (Russian sample).

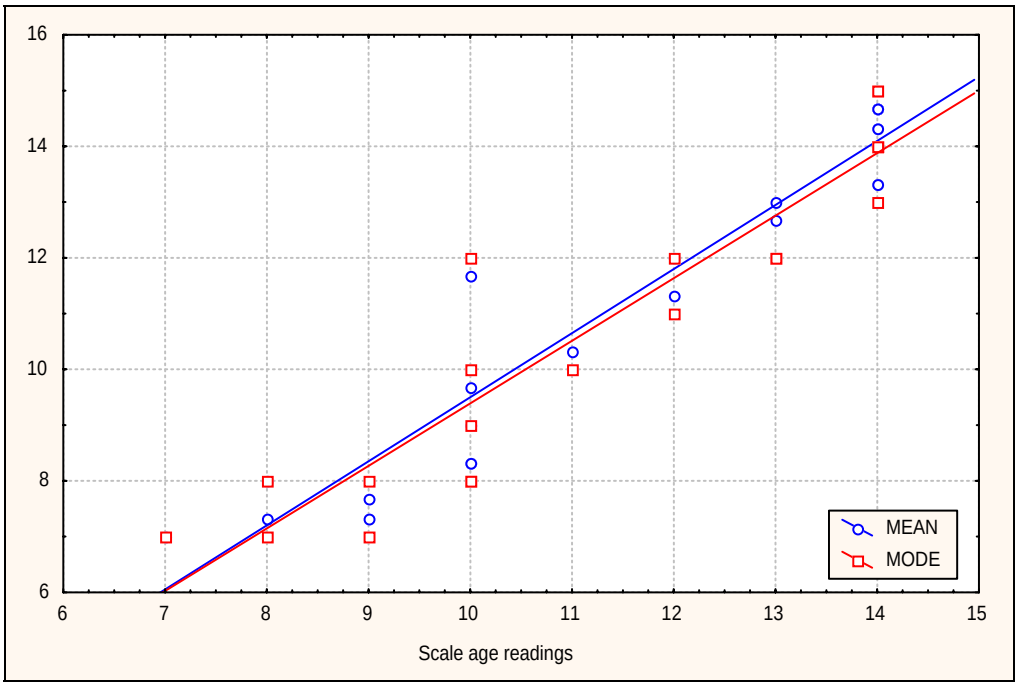

Figure 3.- Plot of scale age readings versus mode and mean of the three otolith age readings. Fitted linear regressions for each plot. 25 otoliths and scales collected in April 1996 in Barents Sea (Russian sample).

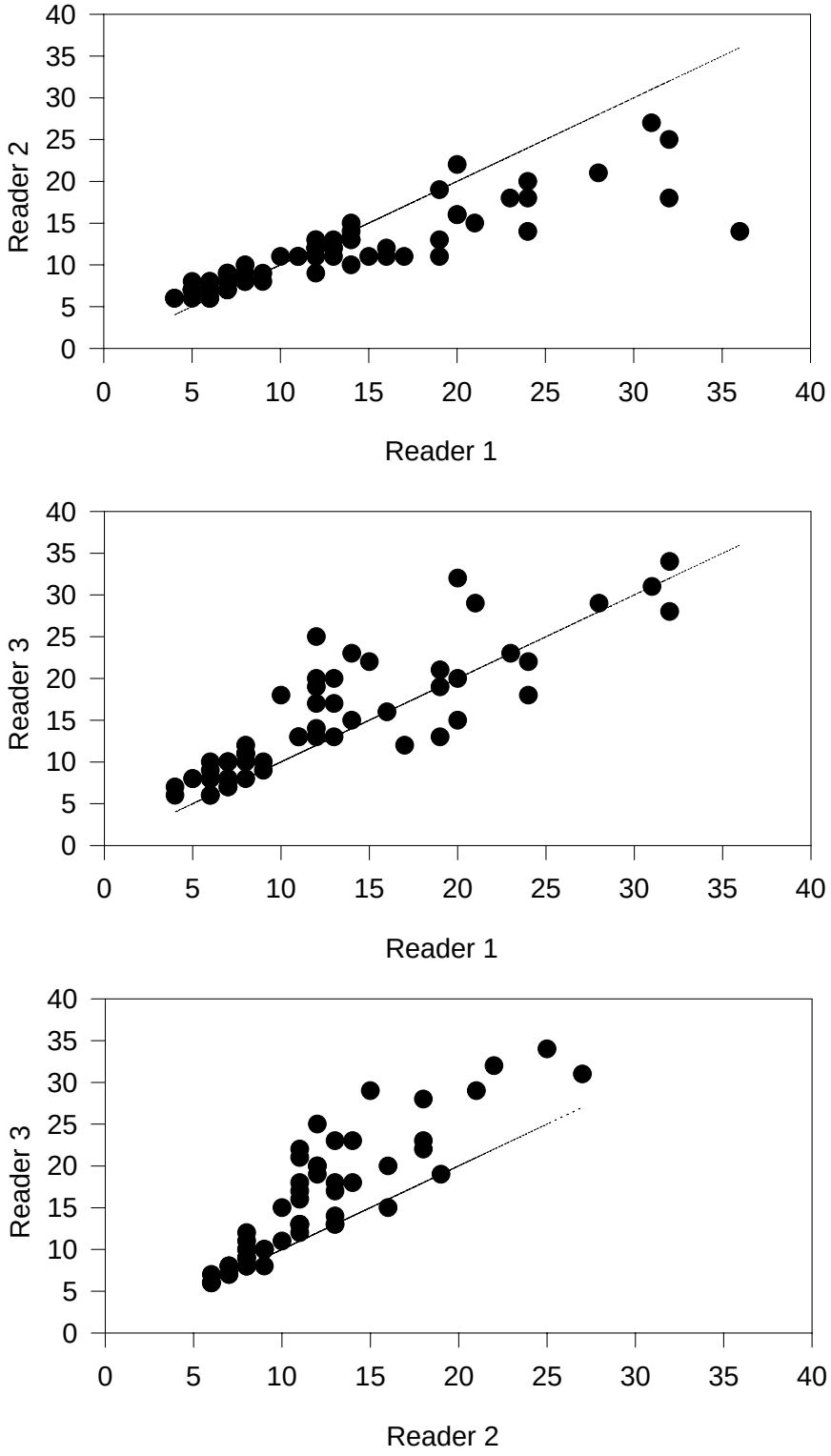

Figure 4.- Comparative plots of otolith age readings of 89 otoliths from Irminger Sea in 1995.

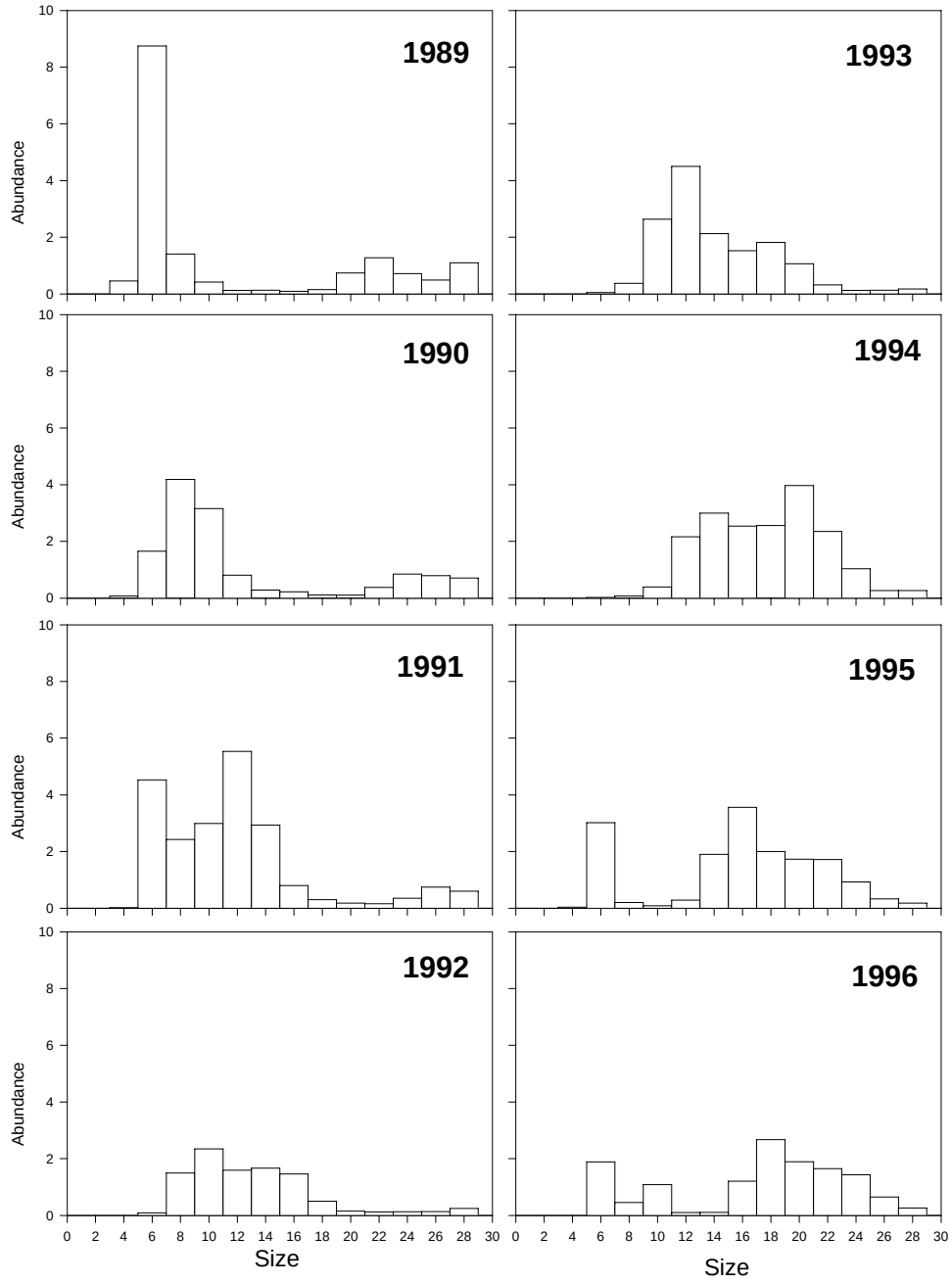

Figure 5.- length distributions of S.mentella *from the annual winter surveys in the Barents Sea in February 1989-1996*

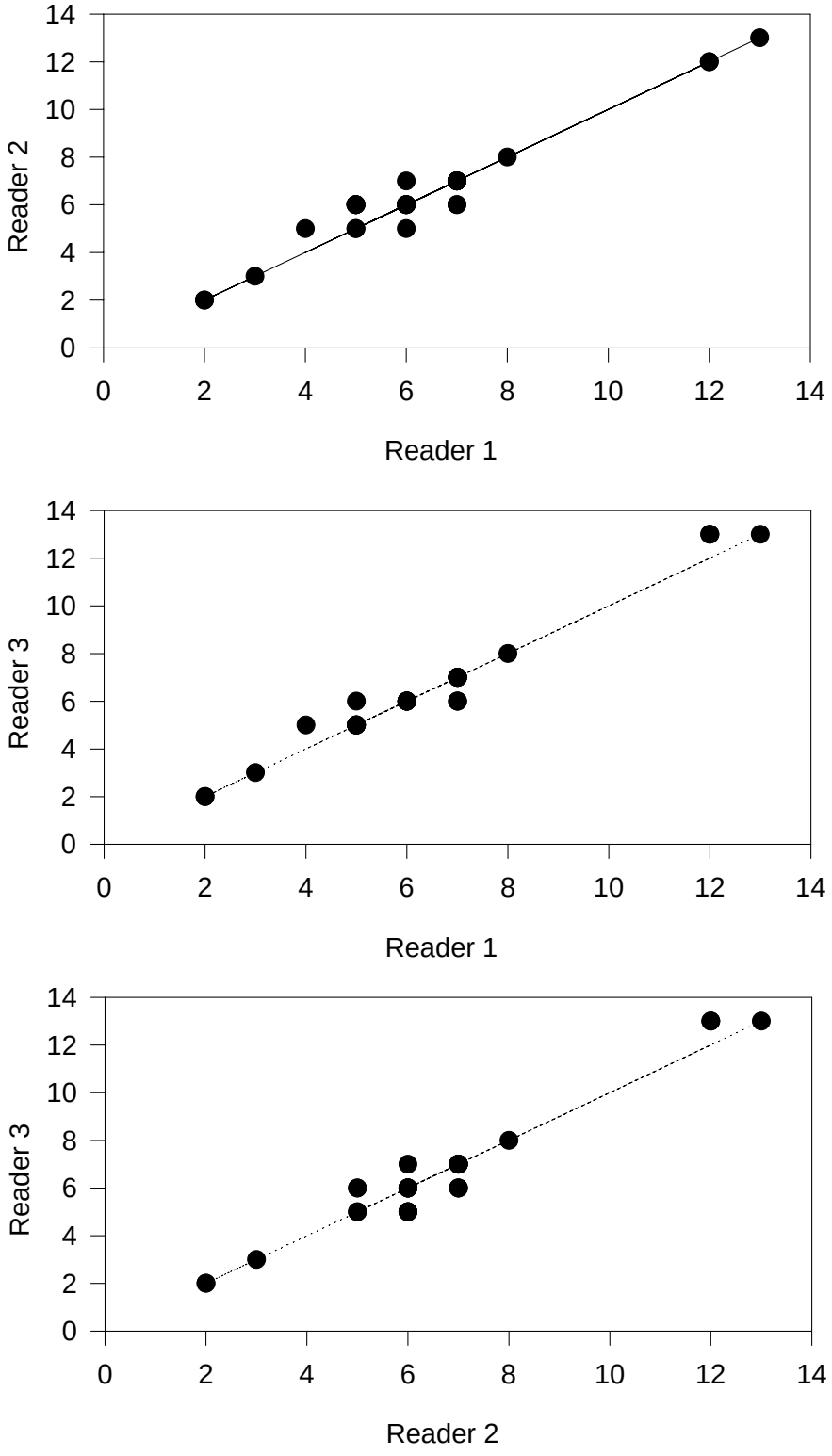

Figure 6.- Comparative plots of otolith age readings of 33 otoliths from Barents Sea in 1996 (Norwegian collection).