International Commission for   **the Northwest Atlantic Fisheries**

ANNUAL MEETING – JUNE 1978

Report of Silver Hake Ageing Workshop
Dartmouth, Nova Scotia, Canada, 28-31 March 1978

Introduction

In the report of the previous meeting (Summ. Doc. 77/VI/13)

participants recommended a workshop be held in the spring of 1978

to consider planned research and to continue discussion of otolith

interpretations. Mr. J. Hunt (Canada) was asked to co-ordinate the

1978 workshop and ICNAF member countries, as well as the USA, were

notified through Circular Letters 78/11 & 14 that the meeting would

be held March 28-31, 1978 at the Fisheries and Environment, Marine

Fish Division Headquarters in Dartmouth, Nova Scotia, Canada.

Participants

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Objectives

Previous workshops have reduced or resolved differences and problems in interpreting silver hake otoliths which might be attributed to bias or technique and have afforded an opportunity for age readers to discuss estimated of silver hake age. Recommendations and conclusions presented in Summ. Doc. 77/VI/13 were considered to reflect progress to date. It was the intent of this workshop to continue comparative reading of otoliths, to identify sources of difference, to review new research and to recommend specific studies related to ageing problems which would not be resolved by otolith interpretation.

Results

Several otolith samples, including one circulated prior to the meeting, were available for participants to examine. Age readers from Cuba had not aged silver hake prior to the workshop and it was agreed that their estimated of age be included in comparison table but not considered in determining overall agreement.

An exchange sample of 50 otoliths and sections collected in Division 4W was circulated to the USA and USSR prior to the workshop. Unfortunately, otoliths were not available for discussion but photographs were examined to consider differing interpretations. The sample consisted of both spring- and fall-caught fish and ages are summarized in Table 1 by country. Readers agreed on 36 of 46 otoliths (76%) and of the remaining 10 only one reader was at variance with the others. In most cases this disagreement was attributed to interpretation of weak hyaline zones and was apparently random. Since otoliths were not available and photographs did not provide sufficient resolution, differences could not be discussed in detail and further agreement was not possible.

The second sample was provided by the USSR and consisted of 48 otoliths collected in October 1977 from Division 4W and stored in glycerine. Prior to discussion, agreement on 42 ages by all readers (88%) was acheived and of the remaining 6 differences, 5 were resolved by discussion. Participants noted that the otoliths were very clear

and that differences appeared to be random variation in the classi-
fication of weak hyaline zones. Sections were not available but the
internal structure, pelagic zones and subsequent hyaline zones were
generally easy to distinguish.

The third sample of 56 otoliths and sections was collected
by the USA in SA 5 and 4 in April and May of 1976 from research cruise
data. Agreement was significantly poorer in this sample (64%) but
readers noted that the source of difference could be attributed to
several sources. First, the interpretation of weak hyaline zones and
second, possible variation in the size and location of the first and
second annulus. The former was considered to be random and could be
resolved by discussion. However, early growth was assessed to be more
basic to ageing problems and required subjective interpretation by
readers based on possible early or late spawning, environmental stress
and other factors. Lack of conclusive data on these factors restricted
agreement and was identified as the main limitation of interpretation.
In general, the section and whole otolith provided the same picture
of growth but in some cases they were in conflict, with the section
giving more detail of early growth. This detail did not facilitate
assigning an age from either the whole otolith or section but it was
considered an advantage to have both for the purpose of discussion.

The last sample consisted of 50 otoliths collected by Canada from
commercial catches in Division 4W in May and September 1977. Otoliths
had been stored dry and placed in glycerine about three weeks prior to
examination. Readers noted that the center of the otoliths was gener-
ally opaque and could not be considered equivalent to glycerine-stored
samples which demonstrates the need for properly prepared samples to
facilitate discussion. In many cases it was necessary to infer the
location of the first annulus as well as early growth. Differing esti-
mates of age were attributed to classification of weak hyaline zones,
size and location of the first annulus and the probable occurence of
a strong spring check in May which might be considered an annulus.
Resolution of different opinions about early growth was not possible
in many otoliths because of the opaque center and lack of data on
possible variation.

Of the 192 otoliths examined by readers from Canada, USA and USSR, agreement was reached on 140 (73%) and at least two readers agreed on 190 of the samples. Differences were generally plus or minus one year (56% and 44%, respectively) and there was not any apparent bias by any reader. As in previous exchanges, estimates of 3(4) and 4(3) were considered equivalent when determining level of agreement.

In general, samples from SA 4 were considered easier to interpret when compared to SA 5 and these otoliths tended to exhibit more uniform growth patterns when related to season and edge type. Readers from Cuba agreed on many of the otoliths and acknowledged that instruction and participation is discussion were prerequisite for establishing ability to age silver hake.

Conclusions

Participants agreed that improvement in initial reading of otoliths was apparent and that many differences could be resolved through discussion. Conclusions of previous workshops were considered valid, particularly with respect to geographic variation in early growth and techniques of viewing otoliths.

Sources of different estimates of age were attributed to two basically different causes. Classification of weak hyaline zones was considered an inherent problem in ageing any species and can account for a 10-15% variance both between and within readers. This type of difference appears to be random and it is doubtful that improvement beyond 10% could be achieved. Readers concluded that agreement at this level was within the limits of otolith interpretation and that it could be maintained at an acceptable level.

The second source of disagreement was more unique to silver hake and concerned early growth and probable size at age one or two. While it was recognized that geographic area is a factor in determining early growth, the potential for individual slow or fast growth within areas cannot be discounted. Readers tended to anticipate a pattern of early growth by area and frequently found it difficult to adjust when ageing fish from other areas with which they were not familiar.

Consequently, a bias for expecting either slow or fast early growth
can develop which is reflected in estimates of age. Discussion of
individual otoliths suggests that interpretation based on opposing con-
ditions of early growth can be equally valid when large or small pe-
lagic zones, check zones and a large or small first annulus are considered.
It was felt that such differences could not be removed without sup-
porting evidence with regard to spawning and growing season as well as
unbiased length frequency data for small (< 20 cm) fish. These data
would allow readers to be more confident in estimating early growth
and annulli from otolith patterns and would provide more accurate
estimates of range in size at age one and two by area.

All participants agreed that the workshop had been beneficial
in allowing them to express opinions, discuss differences and offer
suggestions for improving estimates of age in silver hake. However,
at this time it appears unlikely that further workshops could improve
agreement but that a continuing exchange of otoliths would be adequate
to monitor changes or developing bias by individuals.

Recommendations

1. An exchange of otoliths between readers should be continued. A
    sample of up to 50 otoliths and sections, if possible, including
    all available data (Length, sex, maturity, date, location and
    method of capture, etc.) would comprise an adequate sample. The
    USA will start the first exchange and other participants will
    send samples as soon as possible. Interpretations should follow
    guidelines of Summ. Doc. 77/VI/13 and be returned to the individual
    from which the sample originates - only otoliths and relevant data
    should be forwarded to the next reader. Comparison tables will be
    distributed when all readers have completed a sample and other
    countries wishing to particiapte should notify both the ICNAF
    Secretariate and Mr. J. Hunt of their intent.
2. Specific studies to determine the duration of silver hake spawning
    within geographic areas should be iniitated to provide estimates
    of the range of growing season in the first year of silver hake.
3. Unbiased estimates of length frequency distributions of small
    (< 20 cm) silver hake by area and narrow time intervals are required

to give estimates of modal length and growth. Ability to sample

lengths less than 10 cm is the most important aspect of the required

data.

4. Other age validation studies such as otolith-scale-vertebrae comparisons

have been started and should be reported as soon as possible.

5. Theoritical supporting studies to establish metabolic rates and

other factors effecting the early growth potential of silver

hake would be beneficial.

Table 1. Comparison age readings of silver hake. Sample 1 collected and distributed by Canada prior to workshop. ICNAF Division 4W.

Length	Sex	Date	Age Canada	Age USA	Age USSR
30	M	April	3	3	–
33	F	"	3	4	3
18	F	"	1(2)	2(1)	1(2)
21	F	"	2	2?	1(2)
32	M	"	3(4)	3	4
22	F	"	2	2	2
28	M	May	3	3	3
29	F	"	–	5(4)	–
31	M	"	3	4	3
32	M	"	4(5)	6	5(4)
32	F	"	4(3)	4(3)	3(4)
33	F	"	4(3)	4	4(3)
25	M	"	2	2	–
22	M	"	2	2	2
32	F	"	4	4	4
17	M	"	1(2)	1	1
22	M	"	2	2	2
31	F	"	3	3	3
40	F	"	4?	4(5)	4?
36	F	"	4	5	4
33	F	"	4	4	4
31	F	"	3(4)	4(5)	3(4)
30	M	"	3	4	3(2)
27	F	"	2(3)	2(3)	2
20	M	"	1	2	1

Length	Sex	Date	Age Canada	Age USA	Age USSR
23	M	May	2	2	2
25	F	August	–	4	4
20	F	"	1	1	1
23	F	"	2(3)	2	2(3)
33	M	"	3	3(4)	3(4)
35	F	"	3	3	3
32	F	"	4?	4(5)	4?
29	M	"	2	2	2
28	M	"	2	2	2
21	M	"	1	1	1
34	F	"	3	3(4)	3
29	F	"	2	2	2
28	F	"	2	2	2
32	F	"	2	2	2?
38	F	"	5?	5	5?
17	F	"	1	1	1
25	F	"	1	1	1
30	M	"	2	2(3)	2
29	M	"	2	2(3)	2
32	M	"	3	3	3?
22	M	"	1	1	1
19	M	"	1	1	1
25	M	"	2	2	2
27	M	"	2	2	2?
29	F	"	2	2	2

Table 2. Comparison age readings of USSR sample collected in October 1977 in ICNAF Division 4W.

Length	Sex	Age					Length	Sex	Age				
		Canada	USA	USSR	Cuba (1)	Cuba (2)			Canada	USA	USSR	Cuba (1)	Cuba (2)
29.9	F	2	2	2	2	2	30.3	M	3	3	3(4?)	3	2
31.5	F	2	2	2	2	2(3)	30.0	F	2	2	2	2	2
32.0	F	2	2	2	2	2	28.6	M	2	2	2	2	3
31.0	F	2	2	2	2	2(3)	31.6	F	2	2	2	2	2
26.7	M	2	2	2	2	2	31.6	F	3	3	3	2	2
34.0	F	3(4)	3	3	3	3	33.1	M	4	4	4	4	3
29.6	F	2	2	2	2	2	31.4	F	2	2	2	2	2
29.2	F	2	2	2	2	2(3)	26.3	M	2	2	2	2	2(1)
26.0	F	2	2	2	2(1)	2	27.5	M	2	2	2	1	2
27.9	F	2	2	2	2	2	19.3	F	1	1	1	2	1
15.4	-	1	1	1	1	1	32.8	M	2	2	2	2	2
19.8	-	1	1	1	1	1	27.4	F	2	2	3	2	2(3)
19.0	-	1	1?	1	1	1	32.3	F	3	2(3)	3	2	2
22.9	F	1	1	1	1	1	27.4	M	2	2	2	2	1(2)
30.0	F	2	2	2	2	2	26.1	F	3	3	3(4?)	3	3
29.1	F	2	2	2	2	2	35.0	F	2	2	2	2	2
31.5	M	3(4)	3	3	3	3	27.5	M	3	3	3	2	3
30.5	F	2	2	2	2	2	32.0	F	3	3	4	3	3
29.5	F	2	2	2	2	2	37.2	F	4	4	4	3	3
27.4	F	2	2	2	2	2?	36.5	F	3	3	3	3	5
27.1	F	2?	2	2	2	2	42.0	F	7(5)	7(5)	5	5	6
24.6	M	1	1	1	1	1(2)	49.7	F	7	7(6)	6(7)	6	6
19.6	-	1	1	1	1	1	40.5	F	6	6(7)	5(6)	6	6
36.7	F	3(4)	3	4(3)	3	3							
31.5	F	2	2	2	3	2							

Table 3. Comparison age readings of USA sample collected in April-May 1976 in ICNAF SA5 and 4.

Length	Sex	Age					Length	Sex	Age				
		Canada	USA	USSR	Cuba (1)	Cuba (2)			Canada	USA	USSR	Cuba (1)	Cuba (2)
13	-	1	1	1	1	1	34	F	4	3	4	4?	4
12	-	1	1	1	1	1	31	F	3	3	3	4	4
12	-	1	1	1	1	1	31	F	3	3	3	3	3
12	-	1	1	1	1	1	33	F	3(4)	3	3(4)	3(4)	4
13	-	1	1	1	1	1	27	M	3	2(3)	3?	3	3
16	-	1(2)	1	1	1	1	23	F	2	2	2(3)	3	2(3)
14	-	1	1	1	1	1	17	M	2	2	-	2?	2
14	-	1	1	1	1	1	19	F	2	2	2	2	2
15	-	1	1	1	1	1	43	F	5?	5(4)	5	5?	5(4)
15	-	1	1	1	1	1	34	F	3	3	3	3(4)	3(4)
17	-	1	1	1	1	1	31	F	3	3	4	3(4)	3
22	F	2	2	2	2	2	40	F	5?	4	4?	5	3
19	M	2(1)	2	2(1)	2(3)	2	49	F	6(5)	5	5	5(6)	5
17	M	2(1)	2	2	2?	2	41	F	5(6)	6(7)	5(6)	5?	5
23	M	2	2	2	3(2)	2(3)	41	F	5	6(5)	6	5(6)	3(5)
23	M	2	2	2	3(2)	2(3)	30	M	3(4)	3(4)	3	4	3
23	M	2	2	2	2?	2(3)	34	M	4	4	5	4?	3
24	M	3	3	3	2(3)	3	19	-	2?	2	2	2(1)	2
26	M	3	3	2(3)	2	2	27	F	3	3(2)	3?	3	3
34	M	6(7)	6(5)	7	5	5	19	-	2	2	2	2	2
32	M	3(4)	3	3	3(4)	4	32	F	3(4)	3	4	4?	3
31	F	3(4)	3	3(4)	3	3	32	M	3(4)	4	3(4)	4(3)	3
24	F	2	3	2	2	2	36	F	4	4	3(4)	4(3)	3
17	F	1(2)	2	2	1?	2	24	-	2(3)	3	2(3)	3	2
16	F	1	1	-	1	1	26	F	3	3	2(3)	3	2(2)
18	F	1	2	2	2?	2	24	M	2	2	2(3)	3?	3
20	F	2(1)	2	2	2?	2	29	F	2	2(3)	3(2)	3	3
34	F	4?	3	4	4	4	52	F	7(6)	7(8)	7	7(6)	6

Table 4. Comparison age readings of Canadian sample collected in May and September 1977 in ICNAF Division 4W.

Length	Sex	Date	Age Canada	USA	USSR	Cuba (1)	Cuba (2)	Length	Sex	Date	Age Canada	USA	USSR	Cuba (1)	Cuba (2)
30	M	May	4(3)	4	3(4)	3	3	33	M	Sept	3(4)	4	4(5)	3	3(4)
24	F	"	2	4(2)	2?	2	3	30	M	"	3	3(4)	3	1(2)	2
21	F	"	2	2	2(4)	2	2	26	M	"	2(1)	2	2	1	1(2)
20	F	"	2	2	2	2	2	25	F	"	2	2	2	2(1)	1
31	F	"	3	3	3	3	3	28	M	"	2	2	2	1	2
15	F	"	1(2)	2	1(2)	1	1(2)	32	M	"	3(4)	4	4	4(3)	4
25	F	"	2	2?	2(3)	2	2(3)	26	F	"	2	2	2	2(1)	1(2)
26	F	"	2(3)	2	2	2	2	22	M	"	1	1	2(1)	1	2
32	F	"	3	3	3	3	3	38	F	"	4	5	–	2	3
31	F	"	3	4	3	3	3	18	M	"	1	1	1	1	3
27	M	"	3(4)	4(3)	2(4)	3(4)	3(4)	36	F	"	3?	3	3(4)	2	3(4)
16	M	"	1	1	–	1	1(2)	34	F	"	3	3	3	2	1(2)
34	M	"	4	4	4	4(3)	3(4)	31	F	"	2	2	2	2	3(4)
18	M	"	1(2)	2	2	1	1(2)	33	M	"	3	3	3(4)	2	2
25	F	"	2	2	2(3)	2	2	31	M	"	3(4)	4	3(4)	4	3
29	F	"	3(2)	3?	2(3)	3(2)	2(3)	30	M	"	3	3	–	2	3
19	F	"	2	2	2	2	2	30	M	"	3	3(4)	3	4	4
23	F	"	2	2	–	2	2	34	M	"	4	4	–	2	2
35	F	"	4(3)	4	4(5)	4	4	28	M	"	2	3	2	3	3(2)
30	M	"	3	3	–	2(3)	3	28	F	"	2	2	–	2	2
32	F	"	3	4(3)	4?	2(3)	2(3)	28	F	"	2	2	1(2)	1	1(2)
28	F	"	3(2)	3	2(3)	2	3	22	M	"	1(2)	2	1(2)	1	1(2)
32	M	"	3(4)	4	4(3)	3	2(3)	32	F	"	3	3	3?	3	3
21	F	"	2	2	2	2	2	36	F	"	4(3)	4	–	3	3(4)
20	F	"	2	2	2	1(2)	1(2)	26	F	"	2	2(1)	–	2	2(3)