International Commission for the Northwest Atlantic Fisheries

Serial No. 5049
(D.c.2)

ICNAF Res.Doc. 77/VI/25

ANNUAL MEETING - JUNE 1977

An age-length key for silver hake in Divisions 4WX and comparison with length frequency modal analysis

by

J.J. Hunt
Department of Fisheries and Environment
Biological Station
St. Andrews, N.B., Canada

Introduction

Silver hake otoliths have been collected on Canadian research cruises for a number of years but have not been aged to date. However, otolith exchanges and results of at least two ageing workshops (Hunt, 1976a and 1977) have resolved many of the problems associated with ageing this species.

Materials and Methods

A sample of 742 silver hake otoliths collected in July of 1976 in ICNAF Divisions 4WX were examined for age following guidelines and recommendations presented at a recent ageing workshop (Hunt, 1977). These otoliths had been stored in glycerine and were examined whole in alcohol using reflected light. Hyaline (winter) zones were counted and age defined as the number of completed zones. Separate age-length keys by sex were then generated from these data.

Otoliths examined and for which agreed ages were obtained, as reported by Hunt (1977), were included in the age-length key for comparison.

To compare the accuracy of modal analysis, the catch length frequency of the same cruise as that from which otoliths were examined was resolved in age-groups and a calculated age-length key derived. This length frequency was then proportioned on the basis of otolith age-length key. The two independent keys were then examined for differences.

Results

The age-length key by sex derived from otoliths is presented in Table 1. These data indicate well defined age-groups at 1 and 2 years for both males and females, and some divergence in the mean length-at-age by sex is evident at age 2 and older. Age 3 and older males were poorly represented in the sample but age 3 plus females accounted for 22% of the total. Females at age 3 show a wide range in length (28-44 cm) which might be attributed to the proportion mature at age 3. Doubleday and Hunt (1976) found considerable variation in the percent mature at age 2 which could influence the size at age 3 (i.e., mature fish should be smaller when compared to mature fish at the same age).

Comparison of otolith ages from this sample with those aged by Hunt (1977) indicate good agreement and imply conformity with accepted criteria for ageing silver hake.

It is interesting to note that about 5% of the otoliths were identified as offshore hake (*M. albidus*) and were excluded from analysis. Otoliths from this species are easily recognized by a very broad anterior end, particularly in larger specimens (30+ cm).

Numbers at age derived from modal analysis and the age-length key are shown in Tables 2(a) and 2(b) for males and females. These data indicate very good agreement in the two methods for ages 1 and 2, but become less comparable at age 3. Percent composition of the three age-groups examined and mean length-at-ages 1 and 2 for the two keys are within limits of accuracy imposed by the relatively small sample size.

Conclusions

The age-length key presented here shows well defined age-groups with mean lengths-at-age consistent

Publ. in ICNAF Sel. Papers No. 3: 33-34

with those reported by Doubleday and Hunt (1976) and by Hunt (1976a and b, 1977). These data indicate a range in mean length from 20-21 cm at age 1 and 27-29 cm at age 2.

Comparison of numbers at length by age-group derived from modal analysis and from the present age-length key indicate very good agreement up to at least age 2.

References

DOUBLEDAY, W.G., and J.J. HUNT. 1976. A revised assessment of the 4VWX silver hake fishery. *Annu. Meet. int. Comm. Northw. Atlant. Fish.*, Res.Doc. No. 76/VI/160, Serial No. 4056 (mimeographed).

HUNT, J.J. 1976a. Report of the silver hake ageing workshop. *Annu. Meet. int. Comm. Northw. Atlant. Fish.*, Summ.Doc. No. 76/VI/21, Serial No. 3850 (mimeographed).

1976b. Age, growth, and distribution of silver hake from modal analysis. *Annu. Meet. int. Comm. Northw. Atlant. Fish.*, Res.Doc. No. 76/VI/164, Serial No. 4060 (mimeographed).

1977. Report of the Silver Hake Ageing Workshop, March 1977. *Annu. Meet. int. Comm. Northw. Atlant. Fish.*, Summ.Doc. No. 77/VI/13, Serial No. 5050 (mimeographed).

Table 1. Silver hake age-length key in Divisions 4WX for July 1976 from otoliths - data in parentheses from Hunt (1977).

Length	1		2		3		4		5		6		7		8		9		10		Total		
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	
14	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1		1
	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2
16	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2
	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	2	9
18	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	8	14
	9(1)	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	13	22
20	27	25(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	25	52
	26	38(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	38	64
22	29(1)	35	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	36	66
	17	17(1)	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	19	37
24	5	8(1)	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	11	20
	2	3	7	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	6	15
26	2	1	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	11	23
	-	1	24(1)	34(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	35	59
28	-	-	24	29(1)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	30	54
	-	-	18(1)	50(1)	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	52	70
30	-	-	13	39(1)	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	45	58
	-	-	8	24(1)	2	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	31	41
32	-	-	1	18(4)	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	24	26
	-	-	2	9(1)	3	13	-	(1)	-	-	-	-	-	-	-	-	-	-	-	-	5	22	27
34	-	-	-	3	-	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9	10
	-	-	-	1	1(1)	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8	9
36	-	-	-	-	1	10(1)	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	12	13
	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10
38	-	-	-	-	-	3	-	2(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5
	-	-	-	-	-	6	-	1(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	7	7
40	-	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6
	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
42	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
44	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3
	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
46	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1
	-	-	-	-	-	-	-	-	-	1(1)	-	1	-	-	-	-	-	-	-	-	-	2	2
48	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1
	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1
50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	2	2
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
56	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2	2
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	133	153	113	225	8	87	1	11	-	5	-	3	-	1	-	-	-	2	-	-	255	487	742
Mean	20.9	21.1	27.9	29.1	33.0	34.7	34.0	39.9	-	48.8	-	53.0	-	56.0	-	-	-	56.0	-	-			
%	52.2	31.4	44.3	46.2	3.1	17.9	0.4	2.3	-	1.0	-	0.6	-	0.2	-	-	-	0.4	-	-	34.4	65.6	

Table 2(a). Comparison of number at age using modal analysis and age-length key (ALK).

Length	Frequency Obs.	Frequency Cal.	MALE 1 ALK	MALE 1 Cal.	MALE 2 ALK	MALE 2 Cal.	MALE 3 ALK	MALE 3 Cal.
14	1	-	-	-	-	-	-	-
	1	0.9	0.9	0.9	-	-	-	-
16	1	2.6	2.6	2.6	-	-	-	-
	9	6.4	6.4	6.4	-	-	-	-
18	9	13.1	13.1	13.1	-	-	-	-
	15	22.0	22.0	22.0	-	-	-	-
20	41	30.6	30.6	30.6	-	-	-	-
	39	35.1	35.1	35.1	-	-	-	-
22	42	33.3	32.2	33.3	1.1	-	-	-
	22	26.0	24.6	26.0	1.4	-	-	-
24	16	18.1	10.1	16.7	8.0	1.4	-	-
	20	20.9	4.6	8.9	16.3	12.0	-	-
26	67	58.4	9.7	3.9	48.7	54.5	-	-
	129	135.4	-	1.4	134.0	134.0	-	-
28	182	177.9	-	0.4	177.5	177.5	-	-
	114	127.1	-	-	126.8	126.8	-	0.3
30	52	52.6	-	-	48.9	48.9	-	3.7
	33	27.4	-	-	21.9	10.2	5.5	17.2
32	38	35.0	-	-	14.0	1.1	21.0	33.9
	19	28.3	-	-	-	-	28.3	28.3
34	12	10.0	-	-	-	-	10.0	10.0
	5	4.5	-	-	-	-	1.5	1.5
36	5	5.0	-	-	-	-	0.1	0.1
	1	1	-	-	-	-	-	-
38	1	1	-	-	-	-	-	-
	2	2	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-
Mean	-	-	21.11	21.21	22.03	28.00	32.72	32.29
Total	876	866.5	191.9	201.8	598.6	566.5	66.4	94.1
‰	-	-	22.4	23.4	69.9	65.7	7.8	10.9

Table 2(b). Comparison of number at age using modal analysis and age-length key (ALK).

Length	Frequency Obs.	Frequency Cal.	FEMALE 1 ALK	FEMALE 1 Cal.	FEMALE 2 ALK	FEMALE 2 Cal.	FEMALE 3 ALK	FEMALE 3 Cal.
14	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-
16	2	0.8	0.8	0.8	-	-	-	-
	5	3.4	3.4	3.4	-	-	-	-
18	12	10.7	10.7	10.7	-	-	-	-
	19	24.6	24.6	24.6	-	-	-	-
20	45	41.2	41.2	41.2	-	-	-	-
	56	50.7	50.7	50.7	-	-	-	-
22	51	45.8	44.5	45.8	1.3	-	-	-
	24	30.3	27.1	30.3	3.2	-	-	-
24	16	15.1	11.0	14.7	4.1	0.4	-	-
	10	7.9	4.0	5.2	3.9	2.7	-	-
26	12	13.8	1.3	1.4	12.5	12.4	-	-
	55	39.9	1.1	-	38.8	39.9	-	-
28	76	90.4	-	-	87.4	90.4	3.0	-
	149	143.5	-	-	138.0	143.4	5.4	0.1
30	154	160.3	-	-	138.9	159.7	21.4	0.6
	118	126.7	-	-	98.1	124.6	28.6	2.1
32	72	74.5	-	-	55.9	68.2	18.6	6.3
	61	40.6	-	-	16.6	26.2	24.0	14.4
34	35	32.5	-	-	10.8	7.0	21.7	25.5
	30	36.3	-	-	4.5	1.3	31.8	35.0
36	39	37.3	-	-	-	0.2	37.1	37.1
	35	30.5	-	-	-	-	30.5	30.5
38	18	19.4	-	-	-	-	19.4	19.4
	18	9.6	-	-	-	-	9.6	9.6
40	-	3.7	-	-	-	-	3.7	3.7
Mean	-	-	21.09	21.17	29.62	29.80	34.27	35.73
Total	1113	1089.5	220.4	229.3	614.0	676.3	254.8	185.8
‰	-	-	20.23	21.01	56.36	61.97	23.39	17.02