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Homogeneity of Age-Length Frequencies Among Months and Quarters of the Year for Haddock caught on Georges Bank, 1962

by R. C. Hennemuth

This study of age-length frequencies of haddock landings from Georges Bank, 1962, was undertaken to determine the degree of homogeneity among months and quarters within the calendar year. This is of some interest because of the economies in collection, analysis, and publication which can be achieved by condensation of sample age-length data.

The age-frequencies were aggregated by 5-cm length intervals, because expected values for the standard 2-cm intervals were, on the average, too low for valid analysis. The frequencies of the younger and older age were combined for the same reason.

Among Months within Quarters of Year

The expected age-frequency for each month within the quarter,

$$E_{ij} = (\Sigma_i 0_{ij} / \Sigma\Sigma_{ji} 0_{ij}) (\Sigma_j 0_{ij}), \text{ where}$$

0_{ij} = number of fish observed in the $i\underline{\text{th}}$ month of age j,

i = 1, 2, 3 months,

j = 1, 2, ... , m ages.

Noting that $\Sigma_i O_{ij} = \Sigma_i E_{ij}$, as required, the index of dispersion (Hoel, 1954)[1] for each month,

$$X^2 = \Sigma_i \Sigma_j ((O_{ij} - E_{ij})^2 / E_{ij}),$$

with m-1 degrees of freedom.

The data and calculations are summarized by quarters in Table 1. There were five quarters, out of 32 tested, for which the X^2 index was significant. Four of the five were associated with large deviations within the 2 and 3 year-old age groups.

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[1] Hoel, Paul G., Introduction to Mathematical Statistics, 2nd Ed., 1954. Wiley and Sons, New York, 331 pp.

Among months within the year

Using the above procedure with $i = 1, 2, \ldots, 12$ months, the dispersion among months within the year was calculated (Table 1).

The indices for six of the eight length groups were significant, the two nonsignificant indices being in the two largest length groups.

Conclusion

The rather low incidence of heterogeneity that was found among months within quarters, indicates agregating age-length frequencies by quarters of the years would not form biased age-length keys. The large amount of heterogeneity among months within the year precludes annual aggregation for purposes of estimating age composition of catch, unless, of course, proportional sampling was employed.

Table 1. Analysis of homogeneity of age distributions of haddock caught on Georges Bank in 1962 by 5 cm. intervals

Length class cm.	Age range	D. F.	X^2 values Months within quarter				Months within year
			1	2	3	4	
35-39	2-3	3	2.89	4.60	1.06	1.67	34.32*
40-44	2-4	6	4.90	31.30*	12.72*	6.84	187.02*
45-49	2-5	9	6.95	3.32	21.28*	11.38	141.35*
50-54	3-6	9	3.60	6.85	11.24	15.29	185.49*
55-59	3-7	12	10.38	21.72*	3.99	25.90*	193.52*
60-64	4-8	12	5.86	12.73	5.43	3.49	121.97*
65-69	6-8	6	5.22	5.64	4.84	6.90	25.31
70-74	7-9+	6	2.67	3.34	3.67	7.30	13.᠊᠊

* Indicates probability $(X^2) < .05$