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Meristic And Morphometric Comparison Of Hakes, Urophycis-Chuss And Urophycis-Tenuis (Pisces, Gadidae)

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A MERISTIC AND MORPHOMETRIC COMPARISON OF THE HAKES, *UROPHYCIS CHUSS* AND *U. TENUIS* (PISCES, GADIDAE)[1, 2]

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ABSTRACT

Urophycis chuss and *U. tenuis* are shown to be statistically different for several meristic and morphometric characters. The ranges of the number of lateral line scales are distinct, *U. chuss* having 95 to 117 and *U. tenuis* having 119 to 148. The numbers of gill rakers on the epibranchial of the first gill arch are distinct, *U. chuss* having three and *U. tenuis* having two. The number of abdominal vertebrae and the regression of head length on standard length can be used to distinguish between the two species, with certain reservations. Two characters previously used in the literature to distinguish between the two species are not valid. These are: the relation of upper jaw length to the distance from the snout to the posterior margin of the orbit, and the relation of the distance from the origin of the pelvic fin to the anus to the length of the pelvic fin. Samples of *U. tenuis* from off New England and Nova Scotia appear to be morphometrically different from those from the Gulf of St. Lawrence.

The genus *Urophycis* Gill (1963) includes at least seven species of gadid fishes endemic to the western Atlantic Ocean (Svetovidov, 1948:105). The most abundant of these in the area north and east of Delaware Bay are *U. chuss* (Walbaum, 1792) and *U. tenuis* (Mitchill, 1814) which are difficult to distinguish (Figures 1 and 2). These two species have been repeatedly confused since *U. tenuis* was first described by Mitchill (1814), who recognized the meristic differences between them but apparently did not always recognize the species by sight, because he gave the maximum weight for *Gadus longipes* (= *U. chuss*) as 18 lb. *U. chuss* rarely, if ever, exceeds 6 lb, whereas *U. tenuis* may reach 40 lb or more, and often exceeds 18 lb (Musick, 1969). Among the long list of confused and misnamed accounts in the literature, the outstanding ones are Rafinesque-Schmaltz (1818), Storer (1839), Kaup (1858), Cornish (1907, 1912), and Vladykov and McKenzie (1934) who placed *U. tenuis* within the synonymy of *U. chuss*, after a "study of the literature."

Both *U. tenuis* and *U. chuss* are taken commercially throughout their ranges. The International Commission for the Northwest Atlantic Fisheries (ICNAF) has the responsibility of reporting the annual catch statistics for all major species, including *U. chuss* and *U. tenuis*, taken in the ICNAF area. Musick (1967)[4] pointed out that the statistics for *Urophycis* frequently were in error because of misidentification. Recently, Leim and Scott (1966:217) were compelled to discuss the biology, distribution, and commercial value of *U. chuss* and *U. tenuis* together because of the confused treatment of species in earlier Canadian literature.

The purpose of this paper is to test the validity of certain characters previously used in the literature to distinguish between *U. chuss* and *U. tenuis* and to examine additional characters of potential diagnostic value. Seven

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[2] Based on part of a doctoral dissertation presented to Harvard University.

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[4] Musick, J. A. 1967. Designation of the hakes, *Urophycis chuss* and *U. tenuis* in I.C.N.A.F. statistics. Int. Comm. Northwest Atl. Fish., Res. Doc. 67-76, No. 1872, 5 p. (Unpubl.)

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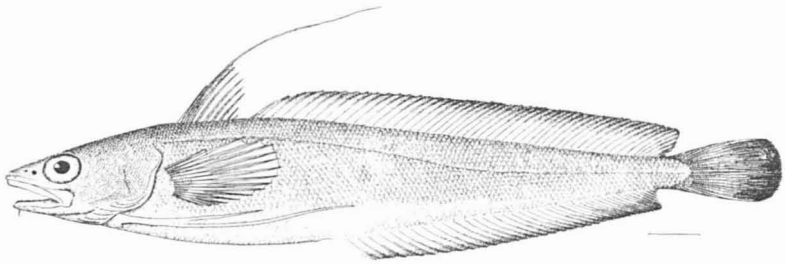

FIGURE 1.—*Urophycis chuss*, drawing from USNM 28707, courtesy of the Smithsonian Institution.

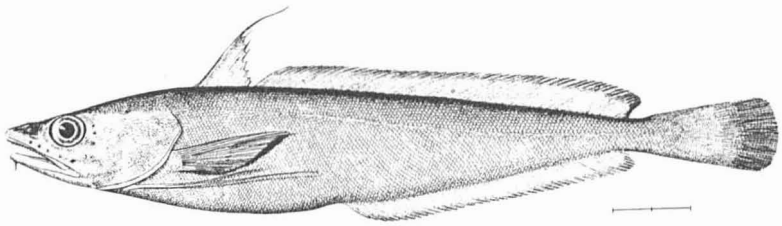

FIGURE 2.—*Urophycis tenuis*, drawing from USNM 21029, courtesy of the Smithsonian Institution.

meristic and 10 morphometric characters were examined on 136 *U. chuss* and 170 *U. tenuis*. Six meristic and four morphometric characters were chosen for statistical analysis.

METHODS

All samples were taken between the Gulf of St. Lawrence and the Virginia coast (Figure 3 and Appendix Table). Preliminary studies suggested that *Urophycis* of the *chuss-tenuis* complex from the study area could be readily placed into two morphs by body shape and scale size, thicker-bodied, small-scaled individuals being similar to published descriptions of *U. tenuis* and slim-bodied, larger-scaled specimens resembling descriptions of *U. chuss*. Thus specimens were tentatively identified. *U. tenuis* was present in the entire sampling area, whereas with the exception of a few Nova Scotian shelf specimens *U. chuss* was found in the Gulf of Maine and south and west of there. Samples of *U. tenuis* were available, by chance, from three geographic areas: the Gulf of Maine and southern New England waters (N.E.), the eastern coast of Nova Scotia from the vicinity of Halifax to the north and east (N.S.), and the Northumberland Straits in the Gulf of St. Lawrence adjacent to Prince Edward Island (P.E.I.). This geographic segregation of samples was maintained for statistical analyses because *U. tenuis* was predominant in Canadian waters where the species of *Urophycis* have been regarded with confusion for many years, especially in the Gulf of St. Lawrence. The data from all specimens of *U. chuss* were treated as one statistical sample.

Length in the rest of this paper refers to standard length unless designated otherwise. Specimens 50 mm long or less were cleared and stained following a method modified from Hollister (1934) to count the number of fin rays, gill rakers, and vertebrae. Fin rays on larger specimens were counted with the aid of a fine needle and occasionally by x-ray examination. All radiographs were taken on Picker "Pictronix 200"[5] x-ray equipment, using Gevaert D7 Structurix Industrial x-ray Safety Film (Unipac), and developed by the procedure outlined by Bartlett and Haedrich (1966). Vertebral numbers on specimens longer than 50 mm were determined from radiographs and, in two instances, by dissection. Lateral line scale rows were counted from a point directly above the upper corner of the opercular opening to the base of the midcaudal ray.

All measurements taken from specimens

[5] Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

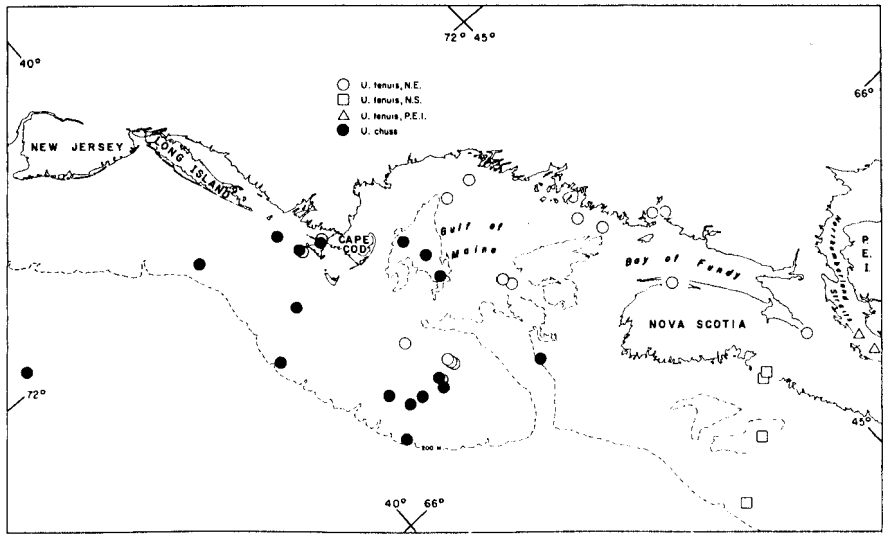

FIGURE 3.—Localities where *Urophycis* were collected for a study of meristics and morphometrics. *U. chuss* was compared with samples of *U. tenuis* from New England (N.E.), Nova Scotia (N.S.), and the Gulf of St. Lawrence (P.E.I.).

smaller than about 600 cm were made with fine-pointed dividers. Larger specimens were measured with calipers consisting of a meter stick and sliding brass "jaws." When possible, measurements were made on the left side of the specimens.

The number of fin rays in the second dorsal fin and in the anal fin, the number of abdominal vertebrae, and the total number of vertebrae were each subjected to an analysis of variance. (Snedecor, 1956:246). Abdominal vertebrae are those anterior to the caudal vertebrae. An analysis of variance of the number of lateral line scales was performed only among the three samples of *U. tenuis* because the ranges of variation of *U. chuss* and *U. tenuis* do not overlap. The gill rakers were counted on the epibranchial of the first gill arch. The raker found at the joint between the epibranchial and ceratobranchial was not included in the count.

The meristic data have been summarized in Figures 4 to 8, and the method of graphing follows that of Hubbs and Hubbs (1953). For each sample the range of variation is shown by a heavy horizontal line, the mean ($\bar{x}$) by a small narrow triangle. The blackened part of each bar comprises two standard errors of the mean ($2s_{\bar{x}}$) on either side of $\bar{x}$. One-half of each black bar, plus the white bar at either end, outline one standard deviation (s) on either side of $\bar{x}$; s indicates dispersion; $2s_{\bar{x}}$, reliability of $\bar{x}$.

Tests of significance were performed at the 1% level, and if no difference was found, at the 5% level. Statistical significance is designated as follows: NS = not significant; * = significant at the 5% level; ** = significant at the 1% level. If significance was found, Duncan's Multiple Range Test was conducted at the 1% and 5% probability levels (Duncan, 1955, 1957). The results of Duncan's test include within the same parentheses those samples which are not significantly different.

The effect of allometric variation on character validity in *Urophycis* has not been considered in the past. In the present study, an attempt was made to measure specimens of all sizes. All values were transformed to logarithms to reduce the correlation between the variance and the mean (Mottley, 1941), and regressions were computed for each character for each of the four samples. Every sample was tested against each of the others by an analysis of covariance (Steel and Torrie, 1960). Variances were tested for homogeneity. Hetero-

geneous variances in most instances could be attributed to disparities between the ranges of the independent variables of the regressions. Elimination of high or low independent values from one or both regressions usually resulted in homogeneity. When the variances were heterogeneous and the ranges of independent variables were about the same in both regressions, heterogeneity was attributed to intrinsic properties within the samples and they were considered significantly different. If the variances of the regressions were homogeneous, the analysis of covariance was continued and the slopes were tested. The adjusted means were tested if the slopes were not significantly different at the 1% level.

Analyses of covariance were performed between males and females in each sample before interarea comparisons were attempted. No sexual dimorphism was found.

Bigelow and Schroeder (1953:222) contended that the position of the rear of the upper jaw, relative to the position of the eye, was a dependable character for separating *U. chuss* from *U. tenuis*. This character may not be reliable because the position of the rear edge of the maxillary depends on the extent to which the mouth of the fish is open. A more accurate method of quantifying the character was used in this study. The distance from the snout to the posterior margin of the maxillary (upper jaw length) was compared to the distance from the snout to the posterior margin of the orbit. A second morphometric character used by many authors to distinguish between *U. chuss* and *U. tenuis* is the length of the ventral fin relative to the position of the anus. However, Bigelow and Schroeder (1953), Goode and Bean (1895), and others have pointed out that this character may not be dependable. An analysis was made of the regression of ventral fin length on the distance from the origin of the ventral fin to the anus.

Subjective observations suggest that *U. tenuis* has a larger head and forebody than *U. chuss*. Therefore, regression analyses were made of the preanal length and head length on standard length. Hubbs and Lagler (1958:25) advocate measuring head length from the tip of the snout to the "most distant point of the opercular membrane," which may vary, depending on whether the fish's operculum is expanded or closed tightly against the head. Head length is defined here as the distance from the tip of the snout to the upper, inner angle of the opercular opening. Preanal length is defined here as the distance from the tip of the snout to the anus.

RESULTS

Meristic Analysis

Number of Rays in Second Dorsal and Anal Fins and of Abdominal Vertebrae (Figures 4-6)

The statistical analyses for these three characters yielded the same results for all comparisons. The analysis of variance showed heterogeneity at the 1% level, and the Duncan's test separated all samples of *U. tenuis* from *U. chuss*. There were no significant differences among the samples of *U. tenuis*.

Total Number of Vertebrae (Figure 7)

Heterogeneity of variance was shown at the 1% level. Duncan's test showed significant differences between *U. chuss* and both *U. tenuis* N.E. and *U. tenuis* P.E.I. However, there were no significant differences between *U. chuss* and *U. tenuis* N.S., nor among the samples of *U. tenuis*.

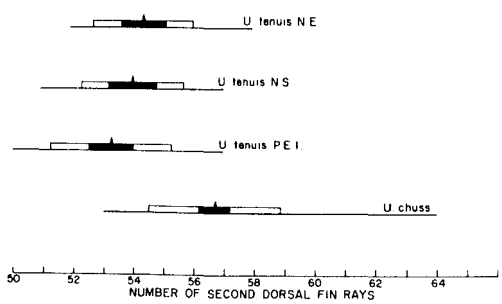

FIGURE 4.—Comparison of the number of rays in the second dorsal fin among three samples of *Urophycis tenuis* and one of *U. chuss*. Range—horizontal line. Mean ($\bar{x}$)—small narrow triangle. Two standard errors of the mean on either side of $\bar{x}$—blackened part of each bar. One standard deviation on either side of $\bar{x}$—one-half of each black bar, plus the white bar at either end.

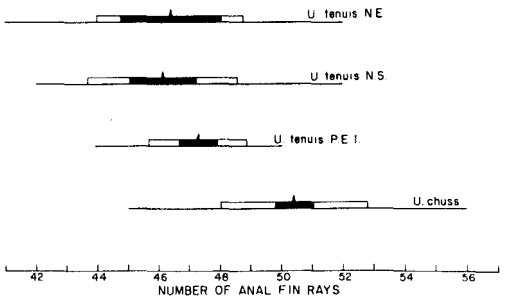

FIGURE 5.—Comparison of the number of rays in the anal fin among three samples of *Urophycis tenuis* and one of *U. chuss*. Explanation of parts of the graph is given in Figure 4 legend.

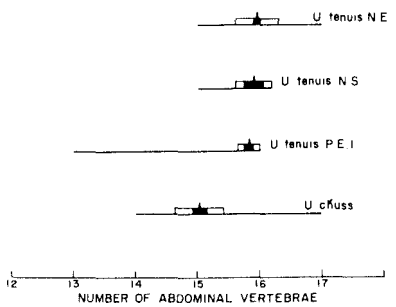

FIGURE 6.—Comparison of the number of abdominal vertebrae among three samples of *Urophycis tenuis* and one of *U. chuss*. Explanation of parts of the graph is given in Figure 4 legend.

Number of Lateral Line Scales (Figure 8)

The ranges of variation of the two species did not overlap. There were no significant differences among the samples of *U. tenuis*.

Number of Gill Rakers on the Epibranchial

The gill rakers of 56 *U. chuss* and 111 *U. tenuis* were counted. All *U. chuss* had three gill rakers on the epibranchial, and all *U. tenuis* had two.

Morphometric Analysis

Regression of Distance from Snout to Posterior Margin of Orbit on Upper Jaw Length (Figure 9, Table 1)

All regressions were linear. *U. tenuis* N.S.

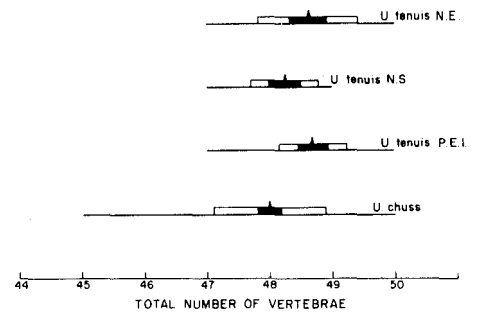

FIGURE 7.—Comparison of the number of vertebrae among three samples of *Urophycis tenuis* and one of *U. chuss*. Explanation of parts of the graph is given in Figure 4 legend.

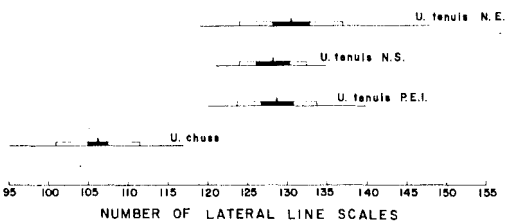

FIGURE 8.—Comparison of the number of lateral line scales among three samples of *Urophycis tenuis* and one of *U. chuss*. Explanation of parts of the graph is given in Figure 4 legend.

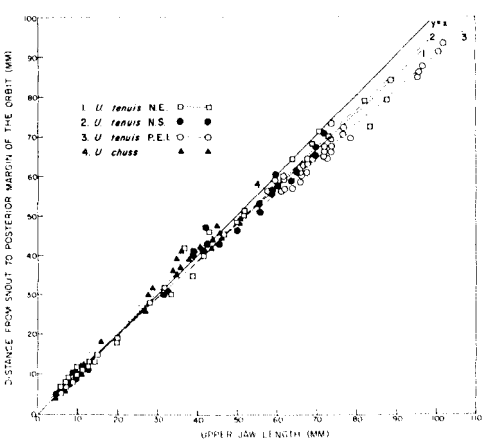

FIGURE 9.—Regression of the distance from the snout to the posterior margin of the orbit on upper jaw length from three samples of *Urophycis tenuis* and one of *U. chuss*.

TABLE 1.—Summary of all morphometric comparisons of *Urophycis tenuis* and *U. chuss*.

	U. tenuis[1]		*U. chuss*
	N.S.	P.E.I.	
U. tenuis:			
N.E.:[2]			
a.	NS	*	**
b.	*	—	**
c.	NS	**	**
d.	NS	*	**
N.S.:			
a.		NS	*
b.		—	**
c.		NS	**
d.		**	**
P.E.I.:			
a.			NS
b.			—
c.			**
d.			*

[1] N.S. = eastern coast of Nova Scotia from vicinity of Halifax to north and east.
P.E.I. = Northumberland Straits in Gulf of St. Lawrence adjacent to Prince Edward Island.
NS = not significant.
* = significant at 5% level.
** = significant at 1% level.
[2] N.E. = Gulf of Maine and southern New England waters.
Regression of:
a. distance from snout to posterior margin of orbit on upper jaw length.
b. length of pelvic fin on distance from origin of pelvic fin to anus.
c. head length on standard length.
d. preanal length on standard length.

was not significantly different from *U. tenuis* N.E. or P.E.I. Regression coefficients for the latter two samples were significantly different at the 5% level. The adjusted mean for *U. chuss* was significantly different from that of *U. tenuis* N.E. at the 1% level and from that of *U. tenuis* N.S. at the 5% level. No significant differences were found between *U. chuss* and *U. tenuis* P.E.I.

The contention of Bigelow and Schroeder (1953:223), that this character "can be relied on, even for very small fish," is not borne out. If true, all values of *U. tenuis* would be on or to the right of the line $y = x$, and those for *U. chuss* would be to the left of the line (Figure 9).

Regression of Length of Pelvic Fin on Distance from Origin of the Pelvic Fin to Anus (Figure 10, Table 1)

This relationship was linear for *U. chuss*, but the values for *U. tenuis* seemed to be curvilinear. The slope of the regression changed when the independent variable reached 150 to 160 mm. Most values for *U. tenuis* P.E.I. were

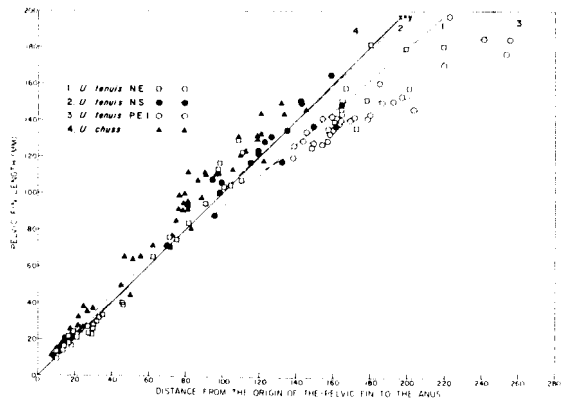

FIGURE 10.—Regression of pelvic fin length on the distance from the origin of the pelvic fin to the anus from three samples of *Urophycis tenuis* and one of *U. chuss*.

distributed above the change in slope and could not be compared to the other samples. An analysis of covariance was performed among the linear portions of the three remaining sample regressions. *U. tenuis* N.E. and *U. tenuis* N.S. were significantly different from *U. chuss* at the 1% level and from one another at the 5% level. The doubts of earlier workers concerning the validity of this character are borne out. If valid, all values for *U. chuss* would be on or to the left of the line $y = x$, and those for *U. tenuis* would be to the right of the line (Figure 10). Although most values for *U. chuss* do show this relationship, a few are to the right of the line, and many values for smaller specimens of *U. tenuis* are to the left.

Regression of Head Length on Standard Length (Figure 11, Table 1)

Regressions for all samples were linear. *U. tenuis* N.S. was not significantly different from *U. tenuis* N.E. or *U. tenuis* P.E.I. The adjusted means of the latter two were different at the 1% level. *U. chuss* was significantly different at the 1% level from all samples of *U. tenuis*. This character may be useful in distinguishing between *U. chuss* and *U. tenuis* longer than about 150 mm, particularly when used in addition to the gill raker and scale characters discussed above.

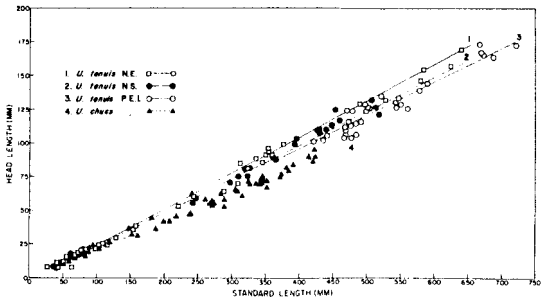

FIGURE 11.—Regression of head length on standard length from three samples of *Urophycis tenuis* and one of *U. chuss*.

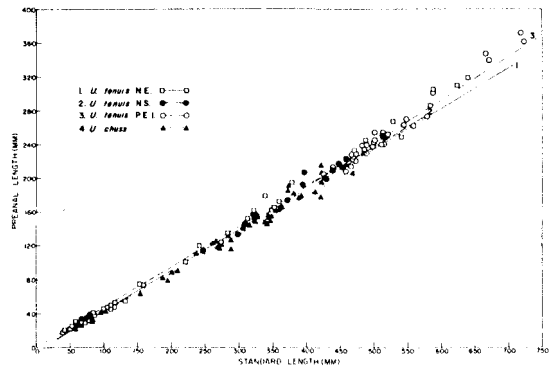

FIGURE 12.—Regression of preanal length on standard length from three samples of *Urophycis tenuis* and one of *U. chuss*.

Regression of Preanal Length on Standard Length (Figure 12, Table 1)

All regressions were linear. *U. tenuis* P.E.I. was significantly different from *U. tenuis* N.E. at the 5% level and from *U. tenuis* N.S. at the 1% level. There was no significant difference between the latter two samples. *U. chuss* was significantly different from *U. tenuis* N.E. and *U. tenuis* N.S. at the 1% level and from *U. tenuis* P.E.I. at the 5% level. Although *U. chuss* is statistically different from all samples of *U. tenuis*, there is much overlap between them and the character is not useful in species identification.

DISCUSSION

There were significant differences between *U. chuss* and all samples of *U. tenuis* for all meristic characters except the total number of vertebrae. The ranges of the numbers of lateral line scales of the two species did not overlap, and this character can be used with confidence to distinguish between them.

U. chuss invariably had three gill rakers on the epibranchial of the first gill arch, *U. tenuis* had but two. The difference is diagnostic. Mujib (1967) was in error when he reported that the epibranchial of *U. chuss* was devoid of gill rakers.

The numbers of abdominal vertebrae for each of the species showed little variability, most *U. tenuis* having 16 and most *U. chuss* having 15. This character may be valuable in identifying collections of postlarval and juvenile hakes in which the scales have not yet formed and when the mean number of abdominal vertebrae may be computed for an entire sample (Robert Marak, pers. comm.) but should not be relied upon for identification of single specimens.

None of the meristic characters showed statistically significant differences among the samples of *U. tenuis*. Such differences may exist but could have been masked by the grouping of several year classes in each sample (Appendix).

Morphometric analyses (Table 1) show that *U. tenuis* N.E. and *U. tenuis* N.S. are quite similar. *U. tenuis* P.E.I. differs from both of the latter and, of the three, is the most similar to *U. chuss*. This pattern suggests character displacement in *U. tenuis* off New England where it is sympatric with *U. chuss*. However, final judgment on the existence of character displacement should be withheld until small specimens of *U. tenuis* from the Gulf of St. Lawrence are available for examination. Morphometric differences between *U. tenuis* in the Gulf of St. Lawrence and those from Nova Scotian and New England waters may have a strong biological basis. The Gulf of St. Lawrence group gathers in large spawning aggregations during June in the Northumberland Strait (Stephen Nepszy, pers. comm.), whereas the Nova Scotia-New England group probably spawns in the fall (Musick, 1969). Thus, the two groups may be reproductively isolated.

ACKNOWLEDGMENTS

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APPENDIX

All specimens examined are listed in the Appendix Table. Because of the relatively large size attained by both species, it was often impossible to preserve large samples of study material in Formalin, and many fresh or frozen specimens were examined and discarded. Fresh material was collected aboard the RV *Albatross IV*, RV *Cameron*, and the trawler *Cap'n Bill III*. Also, many fresh and frozen specimens were examined from commercial catches of hake landed at Souris, Prince Edward Island.

APPENDIX TABLE—Specimens of *Urophycis chuss* and *U. tenuis* examined.

Specimen designation or catalog number	Number of specimens	Standard length (mm)	Date	Position or location		Name of vessel	Cruise number	Station number
				Lat. N	Long. W			
Urophycis chuss								
Frozen	23	237-376	27 May 1964	40°03′	69°36′	*Cap'n Bill III*		
Frozen	29	130-413	9 July 1964	3 miles S of Gay Head, Mass.		*Cap'n Bill III*		
Frozen	8	255-306	3 Aug. 1964	40°37′	67°06′	*Albatross IV*	64-10	65
Frozen	7	210-426	27 July 1964	41°09′	71°17′	*Albatross IV*	64-10	2
Frozen	11	180-470	5 Aug. 1964	41°27′	68°23′	*Albatross IV*	64-10	75
Frozen	4	371-478	16 Aug. 1964	43°08′	69°49′	*Albatross IV*	64-10	125
Frozen	2	298-519	10 Aug. 1964	Wilkinson's Basin, Gulf of Maine		*Albatross IV*	64-10	
Frozen	9	300-482	6 Aug. 1964	42°19′	69°45′	*Albatross IV*	64-10	86
Frozen	2	372-378	20 Aug. 1964	42°37′	66°34′	*Albatross IV*	64-10	162
Cleared and stained	14	19-31	15 Nov. 1960	37°27′	72°16′			
Cleared and stained	22	21-48	20 Aug. 1961	40°41′	70°06′	*Eugenie VIII*	8	
MCZ[1] 45420	1	119	27 Nov. 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45421	4	59-105	22 Dec. 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45422	1	154	4 Aug. 1964	41°29′	67°29′	*Albatross IV*	64-10	71
MCZ 45423	1	385	25 Feb. 1966	43°59′	62°49′	*Cameron*		
Cleared and stained	1	104	20 July 1966	40°59′	67°33′	*Albatross IV*	66-9	152
Cleared and stained	3	83-87	19 July 1966	40°48′	67°57′	*Albatross IV*	66-9	119
MCZ 45426	2	33-37	9 July 1965	42°23′	68°40′	*Albatross IV*	65-6	7
MCZ 45427	1	67	1 Nov. 1964	41°10′	67°31′	*Albatross IV*	64-13	72
MCZ 45428	1	54	28 Oct. 1964	50°07′	71°47′	*Albatross IV*	64-13	28
Urophycis tenuis								
New England:								
Frozen	1	269	9 July 1964	3 miles S of Gay Head, Mass.		*Cap'n Bill III*		
Frozen	2	278, 325	5 Aug. 1964	41°27′	68°23′	*Albatross IV*	64-10	75
Frozen	3	490-542	16 Aug. 1964	43°08′	69°49′	*Albatross IV*	64-10	125
Frozen	3	490-1,030	19 Aug. 1964	44°13′	67°54′	*Albatross IV*	64-10	150
Frozen	1	562	19 Aug. 1964	44°24′	67°33′	*Albatross IV*	64-10	151
Frozen	3	580-625	17 Aug. 1964	42°59′	68°01′	*Albatross IV*	64-10	136
MCZ 45412	12	81-273	5 Aug. 1964	41°45′	67°37′	*Albatross IV*	64-10	72
MCZ 45413	2	44-116	4 Aug. 1964	41°29′	67°29′	*Albatross IV*	64-10	71
Cleared and stained	3	51-65	21 July 1965	41°45′	67°37′	*Albatross IV*	65-10	
MCZ 45414	4	221-360	14 July 1965	43°31′	69°49′	*Albatross IV*	65-10	60
Cleared and stained	1	62	11 July 1965	41°45′	67°38′	*Albatross IV*	65-10	27
Cleared and stained	1	53	21 July 1965	41°45′	67°39′	*Albatross IV*	65-10	
MCZ 45187	1	1,119	12 July 1965	43°00′	67°55′	*Delaware*	65-6	42
MCZ 45414	2	54-58	25 May 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45415	3	38-85	4 June 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45416	1	78	7 July 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45417	1	55	14 June 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45418	1	154	24 July 1962	Great Harbor, Woods Hole, Mass.				
MCZ 45419	2	50, 68	17 May 1962	Great Harbor, Woods Hole, Mass.				
ROM[2] 4289	1	50	17 June 1927	St. Andrews, N.B.				
ROM 23088	1	59	25 July 1923	Shubenacadie River, N.S.				
ROM 9828	10	70-125	17 June 1936	Head of St. Mary's Bay, N.S.				
ROM 4291	1	51	29 June 1927	Birch Cove, N.B.				
ROM 12224	2	67, 72	9 July 1928	Passamaquoddy Bay, N.B.				
ROM 6600	1	85	5 Aug. 1915	St. Andrews, N.B.				

APPENDIX TABLE—Specimens of *Urophycis chuss* and *U. tenuis* examined.—*Continued.*

Specimen designation or catalog number	Number of speci-mens	Standard length (mm)	Date	Position or location		Name of vessel	Cruise number	Station number
				Lat. N	Long. W			
Urophycis tenuis—*Continued*								
Nova Scotian shelf:								
MCZ 45429	21	242-537	25 Feb. 1966	43°59′	62°49′	*Cameron*		
ROM 7070	4	38-50	16 June 1938	43°11′	62°08′			
ROM 7071	4	60-65	4 July 1938	Northeast Cove, Bedford Basin, Halifax, N.S.				
ROM 11495	4	71-80	16 June 1934	Halifax Harbor off Dartmouth, N.S.				
ROM 7072	2	65, 68	5 July 1938	Stevens Island, Bedford Basin, Halifax, N.S.				
Gulf of St. Lawrence:								
Fresh	38	422-725	July 1966	4 miles NW of Arisaig Point, Northumberland Strait by a Danish seiner				
Frozen	34	395-571	Aug. 1964	Northumberland Strait, from filleting house, Souris, P.E.I.				

[1] MCZ = Museum of Comparative Zoology at Harvard University, Cambridge, Mass.
[2] ROM = Royal Ontario Museum, Toronto, Ontario, Canada.