PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued *by the*

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 85 Washington: 1937 No. 3029

REDESCRIPTION OF THE CAPELIN MALLOTUS CATERVARIUS (PENNANT) OF THE NORTH PACIFIC

By Leonard P. Schultz [1]

Pallas (1826 [2], pp. 389–390) described as new *Salmo socialis*, a capelin from the islands situated between the continents of Asia and America. Additional specimens of capelin collected in the northeastern Pacific in recent years have made it possible to study the differences between the capelins of the North Atlantic and North Pacific Oceans. Since the publication in which Pallas's description appeared is rare, the following quotation is given:

269. SALMO *socialis*. TAB. LXXXI. *fig.* 2.
S. (Osmerus) fascia laterali ciliata, radiis pinnae ani 22.
Clupea (villosa) linea laterali prominula, hirta, *Müller prodr. Zool. Dan. p. 60. n. 125. Gmelin. syst. III, p. 1409. sp. 14.*

Pisces sunt gregarii et acervis innumerabilibus circa initium et usque ad medium Junii, maris fluctibus in littora egeruntur, tanta copia, ut instar aggeris ad dimidiae ulnae altitudinem coacervati jaceant. Observatur hoc tam in insulis inter Asiae et Americae continentes sitis, quam in Camtschatca, nullibi autem majori frequentia quam circa sinum Avatscha et ad ostia rivulorum Shupanova et Schemaetschik. Mirum autem quod, ope lineae lateralis ciliatae, pisces plerumque plures, duo, tres et usque ad denos ita firmiter cohaerent, ut sublato uno reliqui velut adglutinati sequantur. Videntur autem etiam in mari sic cohaerere natantes, et forte ad prolificationis negotium talis sexuum cohaesio requiritur. *Odorem* spargunt virosum, spermatis ranarum aemulum, ut Osmeri alii et cito

[1] The author was assisted by his former student George B. Garlick in obtaining data from specimens taken at Newfoundland and at Yakutat.

[2] The year 1826 instead of 1831 as usually cited by authors appears to be the date of publication as cited by Mertens and Lorenz (1928, p. 46) with some doubt. The title page was printed in 1831, according to Dr. L. Stejneger.

putrescunt, ac si prima vice comesti palato arriserint, altera tamen vice non appetuntur. Hinc exsiccari tantum solent pro canum pabulo, nec illis sunt salubres, quippe debilitatos inde alvi profluvium pati observatum est. Dira tamen fames etiam incolas harum regionum cogit ad tale nutrimentum recurrere.

Descr. Forma accedit ad Osmerum Spirinchum, quo major est; longitudinem tamen 7 poll. latitudine unum nunquam superant. *Caput* longum, compressum, rostro producto, vertice plano. *Maxilla inferior* superiore longior et angustior; *rictus* amplus; *nares* utrinque geminae contiguae, in fossula oblonga, medio inter oculos et rostri apicem spatio. *Oculi* ad verticem, a rostro remotiusculi, majusculi; *Iris* lata, aureo-argentea, *pupilla* versus rostrum ovata. *Lingua* acuta. *Dentes* min[u]tissimi, tactu tantum explorandi, in margine maxillarum, laminae mystaceae, areola linguae, et duplici stria palati.—*Opercula* branchiarum argentea, rotundata late hiantia; *Flabella branchialia* decemlamellata. *Corpus* compressum, microlepidotum, dorso subolivaceo opaco, cum relucente virore, lateribus secundum lineam lateralem subaureolis, infra eandem purissime argentea. *Linea lateralis* rectissima, dorso vicinior ⅓; supra eandem continua *fascia* 1 lineam lata, hispida, obsita *squamulis* subtilissimis, setaceoacutis, subarrectis. *Squamae* etiam *carinae ventralis* setaceae, acutae, serraturam efficientes (unde *Müllero Clupea* dictus); in reliquo corpore minutissimae, strictae, ut in Eperlano. *Pinnae pectorales* ad ipsa opercula oblique ortae, magnae, 18 radiorum, quorum duo an. teriores simplices; p. *ventrales* dorsali oppositae, itidem ortu obliquo, octoradiatae; *appendiculae* squamiformes, ut in Eperlano et Spirincho nullae. P. *ani* magna, lata, segmentum circuli referens, insidensque carinae carnoso-radiatae, valde prominulae, ipsa constans radiis 21 vel 22. P. *dorsi* subquadrata, radiorum 12; *adiposa* ante caudam tenuissima, arcuata, totaque longitudine adnata. *Cauda* argute forcipata, radiis 18. articulatis. *Vertebrae* 68.

The binominal name of Pallas, as defined above, has been accepted by all recent authors as the oldest name given to the capelin of the North Pacific. During his investigations of the life of Steller, however, Dr. L. Stejneger, head curator of biology of the United States National Museum, found a still older name—"*Salmo catervarius* of Steller"—which was published by Thomas Pennant [3] in his Arctic Zoology (1784, vol. 1, p. cxxvii), his description being quoted in full below:

The most singular is the Ouiki, or *Salmo Catervarius* of Steller. It belongs to the *Osmeri* of Linnaeus. Swims in immense shoals on the eastern coast of *Kamtschatka*, and the new-discovered islands, where it is often thrown up by the sea to the height of some feet, upon a large extent of shore: is excessively unwholesome as a food, and causes fluxes even in dogs. It never exceeds seven inches in length. Just above the side-line is a rough fascia, beset with minute pyramidal scales, standing upright, so as to appear like the pile of shag: their use is most curious—while they are swimming, and even when they are flung on shore, two, three, or even as many as ten, will adhere as if glued together, by means of this pile, insomuch that if one is taken up, all the rest are taken up at the same time.

To conclude this list of *Kamtschatkan* Salmon, I must add the *Salmo Thymallus*, or Grayling; the *S. Cylindraceus*, before described; the *Salmo Albula*, Lin. Syst. 512; and the *Salmo Eperlanus*, or common Smelt, to those which ascend the rivers.—For this account I am indebted to Doctor Pallas, who extracted it from the papers of Steller, for the use of this Work.

[3] Sherborn in his Index Animalium (1902, p. xliii) states that "no sp. nn.", no specific names, were given, which is an error.

Steller (1774, p. 149) also gives an account of the capelin, from which Pennant no doubt obtained most of his information given above. I quote below Dr. L. Stejneger's translation of this reference on the capelin:

> During June and July [old style Julian Calendar] such incredible numbers of a small fish, five or six inches long, are cast ashore about Avatcha [bay] and the mouth of the river Kamtchatka that they lie two to three feet high on the beach, two and two, male and female usually adhering together. In both Itelmänian [Kamtchadal] languages they are called Uiky. They are gathered in great quantities, dried in the open air on the sand or on straw mats, and in the winter these fishes are common food for the dogs at the Kamtchatka River. The people pound the dried fishes, skin and bone, in large wooden tubs or mortars and bake them like flour in many ways, and during famine times they become often of great importance. On June 5, 1742 [old style], such quantities were thrown up on Bering Island by northwest wind that they were lying on the beach two feet high.

Pennant took his account of *M. catervarius* from Steller but does not give the type locality. In Steller's account above "Bering Island", "Avatcha bay", and "the mouth of the river Kamtchatka" are given as the type localities of *catervarius*. Therefore, in the National Museum the following specimens are topotypes: U.S.N.M. nos. 33876, 47560, and 48856.

The description by Pallas of the capelin of the North Pacific did not furnish adequate data to make it possible to distinguish it from the Atlantic form, *Mallotus villosus* (Müller),[4] nor does the older one by Pennant. Ichthyologists have referred the capelin of the North Pacific to the synonymy of *Mallotus villosus*, which is now removed from the synonymy of that form and restored to the rank of a distinct species, *Mallotus catervarius* (Steller, *in* Pennant, 1784). The capelin of the North Atlantic, then, retains the name *Mallotus villosus* (Müller).

In July 1929, Fenton Drake sent the author a mature male of *Mallotus*, which measured 100 mm in standard length. This fish was collected near the Pillar Bay Cannery, Kuiu Island, southeastern Alaska. The small size of this mature capelin caused the author to search for additional specimens. He mentioned the probability of a new form of *Mallotus* to Dr. W. F. Thompson, director of investigations of the International Fisheries Commission, Seattle, Wash., who kindly turned over a collection of the same form, taken off the wharf at Yakutat, Alaska, U.S.N.M. no. 103127. Two additional specimens, U.S.N.M. no. 103128, collected by Ira Cornwall at Bentinck Island, British Columbia, winter of 1934–1935, were presented to the author by G. V. Wilby. All the specimens examined are listed in table 1.

---

[4] *Clupea villosa* Müller, 1776, p. 50.

TABLE 1.—*Specimens of* Mallotus catervarius (*Pennant*) *examined in this study*

U.S.N.M. no.	Locality	Date collected	Collector
27564	Plover Bay, Siberia	Aug. 12, 1880	T. H. Bean.
27579	do	Aug. 13, 1880	E. P. Herendeen.
27563	do	Aug. 12, 1880	T. H. Bean.
32949	Golofnin Bay, Alaska	June 1880	E. W. Nelson.
47560	Bering Island	June 1895	L. Stejneger.
24038	Bering Strait		John Rodgers and William Stimpson.
33876	Bering Island	June 19, 1882	L. Stejneger.
48856	do	1896	N. Grebnitski.
103127	Yakutat, Alaska	Feb. 3, 1927	International Fisheries Commission.
103128	Bentinck Island, British Columbia	Winter 1934–35	Ira Cornwall.
[Not in U.S.N.M.]	Kuiu Island, Alaska	July 1929	Fenton Drake.

Sleggs (1933, pp. 9–16), in his study of the capelin of the Newfoundland region, recognized but a single species, *Mallotus villosus* (Müller), although he states that certain evidence indicates the possibility of races or of specific differences. Sleggs's map of the geographical distribution of *Mallotus* shows it to have a wide range, occupying the northern seas of the Atlantic and Pacific Oceans. However, according to his map, and the apparent lack of records of its occurrence off the north coast of Siberia, its distribution is not known to be circumpolar. The capelin occurs as far south as the "climatic isotherm 45° F. (mean annual temperature)" (Sleggs, 1933), which indicates a range in the Pacific Ocean as far south as Vancouver Island, where it was collected and brought to my attention by G. V. Wilby. It has been taken as far south as Korea along the Asiatic Continent. Throughout this wide range it is to be expected that the species might have become differentiated into subspecies or species, as has been found for the halibut (Schmidt, 1930) and for the codfish (Schultz and Welander, 1935).

REDESCRIPTION OF MALLOTUS CATERVARIUS (PENNANT)

The genus *Mallotus* has 170 to 220 scales along the lateral line, more than in any other genus of osmerid fish, and because of the villous bands of scales along the lateral line on the breeding male (Hubbs, 1925, p. 51) it can not be confused with any other genus referred to the family Osmeridae. There is a superficial resemblance between the dilated bands of scale pockets on the sides of the breeding males of *Spirinchus dilatus* Schultz and Chapman (1935, p. 68) and the greatly elongate scales ("villous" scales) of *Mallotus* (Sleggs, 1933, fig. 8), but upon examination with a microscope the differences are at once apparent as described by Schultz and Chapman. The structure and shape of the villous scales of *M. catervarius* were found not to differ from those of *M. villosus*.

TABLE 2.—*Counts made on* Mallotus *from the North Pacific and the North Atlantic* [1]

Character	*M. villosus*		*M. catervarius*			
	Newfoundland [2]	Murman coast	Alaska and British Columbia	Bering Sea and Okhotsk Sea	Korea [3]	Islands between Alaska and Asia [4]
Dorsal fin rays	12-14 (47) 12.85±0.37	13-14 (3) 13.67 ——	12-13 (54) 12.19±0.27	10-13 (14) 12.00±0.51	13 (1)	12 (1)
Anal fin rays	17-22 (47) 19.32±0.57	19-21 (3) 19.67 ——	17-20 (55) 18.84±0.53	17-20 (16) 18.62±0.63	20 (1)	21 and 22 (?)
Pectoral fin rays	18-20 (47) 19.19±0.41	---------- ----------	17-19 (53) 17.49±0.39	---------- ----------	16 (1)	18 (1)
Principal caudal fin rays	19 (36) 19	---------- ----------	19-20 (52) 19.02±0.09	---------- ----------	----------	18 (1)
Pelvic rays	8 (36)	----------	8 (56)	----------	----------	8 (1)
Scales in lateral line [5]	175-219 (46) 199.16±1.02	204-217 (3) 210.0 ——	175-209 (53) 189.08±0.97	170-191 (8) 185.37±4.95	----------	
Scales above lateral line	18-23 (28) 20.64±0.96	22-23 (2) 22.5 ——	15-19 (12) 16.84±1.21	19-22 (9) 19.78±0.62	----------	
Scales below lateral line	16-22 (43) 18.95±1.21	18-20 (3) 19.33 ——	15-17 (52) 15.73±0.48	14-18 (8) 15.25±0.81	----------	
Vertebrae	64-68 (33) 65.91±0.80	---------- ----------	63-68 (35) 65.86±0.76	---------- ----------	----------	68 (1)
Gill rakers on first arch above angle	8-11 (47) 9.23±0.53	10-11 (3) 10.33 ——	9-12 (56) 9.93±0.48	9-11 (17) 9.59±0.40	----------	
Gill rakers on first arch below angle	24-31 (45) 27.11±0.96	28-29 (3) 28.33 ——	28-31 (54) 29.50±0.55	26-30 (17) 27.83±0.70	----------	
Total number of gill rakers on first arch	33-42 (47) 36.45±1.29	38-39 (3) 38.67 ——	37-42 (53) 39.36±0.82	35-40 (17) 37.41±0.90	35 (1) ----------	

[1] The figures for each character show in the first line the minimum and the maximum count or measurement, and in parentheses the number of specimens counted or measured; in the second line the mean and probable error of the mean are given. The measurements are expressed as hundredths of the standard length. The last two rays of the dorsal and anal fins, often branching from a common base, were counted as one ray.

[2] These specimens from Newfoundland were obtained through the kindness of Dr. Harold Thompson.

[3] Data from Mori (1930).

[4] Data from Pallas (1831).

[5] The number of scales in the lateral line, counted, indicates the number of oblique rows from upper edge of gill opening along the side of the body to the base of the rays of the caudal fin.

Tamezo Mori (1930, p. 5) described as new *Mallotus elongatus* from the Tumen River mouth at Keiko, Korea. Since his description is abbreviated and apparently standard measurements and terminology were not used, few comparisons can be made. He says: "This specimen is closely related to *M. villosus* Cuvier, differing from it in having slenderer body and very minute scales without larger scales along lateral line." Obviously Mori did not know that only the males of *Mallotus* have the enlarged or villous scales along the lateral line. He did not give a scale count for his young female, 93 mm in total length. The slender body was given by Mori as "depth 8.2" in body length. There is no indication anywhere in his paper as to what "body length" means. However, if "body length" is the same as total length, then the depth of the body is 11.3 mm, or 12 percent of the total length. It was found that the length of the caudal fin rays of *Mallotus*, in both the Atlantic and Pacific, averages about 12 mm on specimens having

a total length of 93 mm, so if the standard length was used by Mori it would be about 81 mm on his specimen. Thus the depth would be 7 mm, which is 9 percent of the standard length. The depth of the body in specimens from both oceans varies from 12.1 to 21.6 percent

TABLE 3.—*Measurements made on* Mallotus *from the North Pacific and North Atlantic Oceans* [1]

Character	*M. villosus*	*M. catervarius*
	Newfoundland [2]	Alaska and British Columbia
Length of head	21.3–24.8 (36) 22.71±0.52	23.6–26.3 (52) 24.94±0.44
Width of head	8.0–10.8 (32) 9.33±0.40	8.4–9.8 (53) 9.07±0.23
Length of maxillaries (tip of snout to posterior tip of maxillary)	9.6–11.6 (36) 10.69±0.30	10.8–12.5 (53) 11.72±0.29
Width of fleshy interorbital space	4.9–6.5 (35) 5.80±0.24	4.9–6.3 (53) 5.55±0.22
Diameter of eye	4.6–6.5 (32) 5.38±0.24	5.8–7.1 (53) 6.49±0.18
Greatest depth of body	13.6–21.6 (36) 17.88±1.90	12.1–15.0 (53) 13.47±0.60
Length of snout	7.0–8.6 (21) 7.76±0.25	7.3–8.9 (53) 8.17±0.22
Length of longest gill raker on first arch	3.1–4.3 (36) 3.65±0.18	3.2–4.4 (53) 3.76±0.19
Length of depressed dorsal fin	16.5–20.5 (32) 18.64±0.16	15.5–18.5 (53) 17.09±0.51
Length of longest caudal fin ray	13.5–17.5 (36) 15.3±0.59	14.0–18.0 (53) 16.10±0.57
Length of longest dorsal fin ray	10.3–13.9 (36) 12.19±0.56	11.1–14.8 (53) 12.99±0.57
Length of longest pectoral fin ray	10.5–15.5 (36) 12.64±0.88	11.0–16.5 (53) 13.94±0.81
Length of longest pelvic fin ray	11.5–16.0 (36) 13.80±0.88	12.0–16.0 (53) 14.43±0.67
Length of longest anal fin ray:		
Males	7.6–9.2 (19) 8.33±0.29	7.5–9.5 (46) 8.43±0.29
Females	5.2–7.9 (16) 6.16±0.41	5.6–6.3 (7) 5.95±0.17
Length from snout to insertion of anal fin	67.0–76.5 (36) 72.50±1.11	71.0–76.0 (52) 73.20±0.74
Length from snout to origin of adipose fin	78.5–83.5 (36) 81.17±0.84	79.0–83.5 (53) 80.78±0.57
Length from snout to origin of dorsal fin	50.6–57.6 (36) 54.00±1.41	52.9–58.2 (53) 55.28±0.74
Length from snout to insertion of pectoral fin	20.0–25.5 (36) 21.28±0.64	23.0–26.5 (53) 24.80±0.51
Length from snout to insertion of pelvic fin	50.0–57.5 (36) 53.95±1.35	52.0–56.5 (53) 54.14±0.67
Least depth of caudal peduncle	4.9–7.3 (36) 6.22±0.43	5.4–6.9 (52) 6.05±0.24
Length of caudal peduncle	8.9–12.1 (36) 10.38±0.55	8.3–11.7 (53) 10.25±0.52
Length from insertion of pectoral fin to pelvic fin	30.2–36.0 (36) 32.52±0.84	28.4–32.9 (52) 30.55±0.65

[1] See footnote 1 to table 2.

[2] See footnote 2 to table 2.

of the standard length. These were all mature fish and in a spawning condition. Young smelt are usually slenderer than the adults, which may explain the "slenderer body."

Tentatively,[5] *Mallotus elongatus* Mori is referred to the synonymy of *Mallotus catervarius* on the basis that the type locality, Korea, is in the North Pacific and the lack of characters separating it from species already described.

The specimens of *Mallotus catervarius* that were mature ranged in length from 89 to 109 mm (average 95.8 mm), while the mature specimens of *Mallotus villosus* from Newfoundland, measured by us, were 129 to 166 mm (average 150.7 mm) in standard length. Sleggs (1933, pp. 22–23) gives the lengths from 106 to 202 mm for breeding individuals. This indicates that the capelin of the North Pacific Ocean matures at a much smaller size than the capelin of the North Atlantic Ocean. Besides the smaller size at maturity, table 4 indicates that *M. catervarius* differs statistically from *M. villosus* in regard to the following characters: Number of pectoral fin rays; number of scales in the lateral line; number of scales above and below the lateral line; length of head; length of maxillaries; and length from snout to insertion of pectoral fin.

A single specimen of *M. catervarius* may be distinguished from a single specimen of *M. villosus* by means of the *character index*, which equals the number of fin rays in dorsal + anal + pectoral + the number of scales below the lateral line − the total number of gill rakers, for each individual specimen. When the numerical values of the character index are arranged in the form of a frequency table (table 5), no overlapping of the frequencies occurs for *catervarius* and *villosus*. The difference between the means of the character index for the two species is 7.84 and the ratio of this difference to the square root of the sum of the squares of the two probable errors is 4, indicating probable significance.

TABLE 4.—*The differences between the means of certain characters of* Mallotus catervarius *and* M. villosus *and the ratio of these differences to their probable error*

Character	Difference between means (with probable error)	Ratio of difference to probable error
Number of rays in pectoral fin	1.70±0.57	3.0
Number of scales in lateral line	10.08±1.41	7.1
Number of scales above lateral line	3.80±1.55	2.5
Number of scales below lateral line	3.22±1.30	2.5
Length of head	2.23±0.68	3.3
Length of maxillaries	1.03±0.41	2.5
Length from snout to insertion of pectoral fin	2.52±0.82	3.1

[5] During the past four years I have tried repeatedly to obtain capelin from Korea, but without success. When a large series of *Mallotus* from Korea are studied, *M. elongatus* may prove to be a valid species.

TABLE 5.—*Frequency distribution of the character index* [1]

Species	Character index																	Total	Mean	Probable error
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38			
Mallotus catervarius	3	8	9	14	4	11	2	---	---	---	---	---	---	---	---	---	---	51	25.96	±1.09
Mallotus villosus	---	---	---	---	---	---	---	---	4	4	3	4	7	3	4	4	2	35	33.80	±1.62

[1] For definition see text, p. 19.

LITERATURE CITED

HUBBS, CARL LEAVITT.

1925. A revision of the osmerid fishes of the North Pacific. Proc. Biol. Soc. Washington, vol. 38, pp. 49–56.

MERTENS, ROBERT, and MÜLLER, LORENZ.

1928. Liste der Amphibien und Reptilien Europas. Abh. Senck. Naturf. Ges., vol. 41, no. 1, pp. 1–62.

MORI, TAMEZO.

1930. On the freshwater fishes from the Tumen River, Korea, with descriptions of new species. Journ. Chosen Nat. Hist. Soc., no. 11, pp. 1–11, 2 figs., 1 pl.

MÜLLER, OTTO FREDERIK.

1776. Zoologiae Danicae prodromus, seu animalium Daniae et Norvegiae indigenarum characteres; nomina, et synonyma imprimis popularium, xxxii+282 pp. Havniae.

PALLAS, PETER SIMON.

1826. Zoographia Rosso-Asiatica . . ., vol. 3, vii+428+cxxv pp., 6 pls. Petropoli.

PENNANT, THOMAS.

1784. Arctic zoology, vol. 1, cc+index+185 pp. London.

SCHMIDT, PETER.

1930. On the Pacific halibut. U. S. S. R. Acad. Sci. Comptes Rendus, ser. A, vol. 8, pp. 203–208.

SCHULTZ, LEONARD PETER, and CHAPMAN, WILBERT MCLEOD.

1934. A new osmerid fish, *Spirinchus dilatus*, from Puget Sound. Ann. Mag. Nat. Hist., ser. 10, vol. 13, pp. 67–78, 2 pls.

SCHULTZ, LEONARD PETER, and WELANDER, ARTHUR DONOVAN.

1935. A review of the cods of the northeastern Pacific with comparative notes on related species. Copeia, 1935, no. 3, pp. 127–139, 9 figs.

SHERBORN, CHARLES DAVIES.

1902. Index animalium sive index nominum quae ab A. D. MDCCLVIII generibus et speciebus animalium imposita sunt, sect. 1 (1758–1800), lix+1,195 pp. London.

SLEGGS, GEORGE FREDERICK.

1933. Observations upon the economic biology of the capelin (*Mallotus villosus* O. F. Müller). Rept. Newfoundland Fishery Res. Comm., vol. 1, no. 3, 66 pp., 10 figs., 2 maps, 11 pls.

STELLER, GEORG WILHELM.

1774. Beschreibung von dem Lande Kamtschatka . . ., 24+384+71 pp., illus. Frankfurt and Leipzig.

U. S. GOVERNMENT PRINTING OFFICE: 1937