A REVIEW OF THE FISHES OF THE GENUS OSMERUS OF THE CALIFORNIA COAST.

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In the following paper, three species of the genus *Osmerus* are discussed. All three species formerly have been confused with *Osmerus thaleichthys*. One, *Osmerus starksi*, is a new species, and another, *Osmerus attenuatus*, has not been recognized since it was described in 1880,[1] by Lockington.

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The drawing of the new species is the work of Mr. W. S. Atkinson.

Key to the species of Osmerus.

a^1. Pectorals extending to origin of ventrals; ventrals reaching anus..... *thaleichthys*

a^2. Pectorals not extending to origin of ventrals; ventrals not reaching anus.

b^1. Body very slender, the depth 6½ to 7¼ in length; distance between origin of pectorals and origin of ventrals greater than length of head; pectorals extending one-half the distance to origin of ventrals; commissure of mouth nearly straight..... *attenuatus*

b^2. Body not very slender, the depth 5 to 5⅔ in length; distance between origin of pectorals and origin of ventrals equal to or less than length of head; pectorals extending more than one-half the distance to origin of ventrals, commissure of mouth curved..... *starksi*

OSMERUS THALEICHTHYS Ayres

This species may be known at once by the long pectoral and ventral fins. The former reach to or slightly beyond the origin of the ventrals, and the latter extend to the anus. As in *Osmerus starksi*, the commissure of the mouth is curved, in contrast to the almost straight jaws of *Osmerus attenuatus*. The gill rakers are longer, and more delicate and slender than in either of the other two species. The dentition is weaker than that of *Osmerus attenuatus*, and there is no prominent tooth on the tip of the tongue.

The head is contained in the total length, without caudal, a little more than 4 times. The snout is contained in the head 4 to 4¼ times. The maxillary is contained twice in the head, and reaches four-fifths the diameter of the eye to its posterior margin. The lower jaw projects slightly. The eye is contained 4 times in the head, and its diameter is slightly less than the interorbital width. The interorbital

[1] Proc. U. S. Nat. Mus., vol. 3, p. 66.

space is contained $3\frac{1}{3}$ to $3\frac{1}{2}$ times in the head. The opercle is faintly marked by two series of concentric rings, the upper overlapping and obliterating the lower. The gill rakers number 12 or 13+30 and the longest one is contained $1\frac{2}{3}$ times in the eye.

The depth, in the length without caudal, is 5 to 6 times. The depth of the caudal peduncle is contained $3\frac{1}{3}$ times in the length of the head. The number of scales along median line of back, from occipital region to caudal, is from 63 to 67.

The fin rays number: Pectoral, 11; ventral, 8; dorsal, 10 or 11; anal, 18 to 20. The pectoral is contained seven-eighths time in the head; the ventrals, $1\frac{1}{5}$ times; the dorsal, $1\frac{1}{4}$; the anal, $1\frac{2}{3}$; and the caudal, $1\frac{1}{5}$. All of the fins are longer, comparatively, than in either of the other two species. The distance of the dorsal from the tip of the snout is one-half the total length without caudal. The distance of the insertion of the ventrals from the chin is equal to the distance of the dorsal from the tip of the snout. The pectoral extends to or slightly beyond the origin of the ventrals. The ventrals reach to or slightly beyond the vent. The distance between the posterior insertion of the dorsal and the insertion of the adipose dorsal is a little less than the length of the head, greater than in *Osmerus starksi* or *Osmerus attenuatus*. The distance between the origin of the pectoral and the origin of the ventrals is equal to the length of the head. The anterior origin of the ventrals is two-thirds of the diameter of the eye in front of the anterior origin of the dorsal. The tip of the dorsal extends not quite to a point opposite the origin of the anal. The adipose dorsal is inserted slightly anterior to the posterior origin of the anal.

Here described from 10 specimens obtained in the market in San Francisco, California.

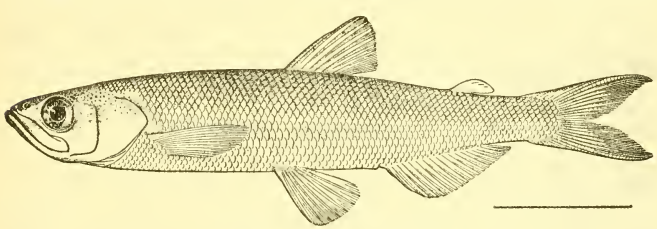
Measurements of Osmerus thaleichthys.

Total length of body in mm	105	97	96	95	94	98	97	94	83	82
Length of body without caudal in mm	86	76	77	83	79	82	82	79	70	67
Depth of body in hundredths of length without caudal	16	20	20	20	19	20	20	18	19	20
Depth of caudal peduncle	8	7+	8	8	8	8	7+	7+	7	7
Length of head	25	25	24	25	24	24	25	25	25	25
Longitudinal diameter of eye	6.5	6	6	6	7	6	7	6	6	6
Interorbital width	7	7−	7	7−	7	7	7−	7−	7	7
Length of maxillary	13	13	12	13	13	12	12	13	13	13
Length of snout to tip of upper jaw	6	6	6	6	6	6+	6	6+	6	6
Length of lower jaw	13	14	14	14−	14	13	13.5	14	14	14
Length of pectoral	27	26	26	27	26	26	26	26	27	26
Length of ventrals	21	21	22	19	19	20	20	20	20	19
Longest dorsal ray	18	18	18	16	16	17	19	18	18	17
Longest anal ray	14	13	14	11	11	11	12	13	13	12
Longest caudal ray	21	22	22	Broken.	20	20	20	21	20	21
Distance of dorsal from tip of snout	53	51	49	51	50	51	52	52	52	54
Distance of ventral from chin	51	51	51	50	49	48	51	51	50	50
Distance from tip of lower jaw to adipose fin	84	84	82	82	84	84	82	83	84	84
Distance from origin of pectoral to origin of ventrals	24	23	24	23	23	22	24	23	22	21
Number of dorsal rays	10	11	10	10	11	11	11	11	11	10
Number of anal rays	20	20	18	18	18	20	20	19	20	19
Scales in longitudinal series above lateral line	63	64	64	65	63	67	65	67	66	63
Gill rakers on first gill arch	13+30	13+29	13+28	13+28	13+29	13+30	13+29	13+30	13+28	13+30
Sex	Female.	Male.	Male.	Female.	Female.	Female.	Female.	Female.	Male.	Female.

OSMERUS STARKSI Fisk, new species.

This species may be distinguished from the other two here discussed by the difference in the length of the pectorals. These fins reach about three-fourths of the distance from their base to the origin of the ventrals, while in *Osmerus thaleichthys* they extend to or overlap the beginning of the ventrals, and in *Osmerus attenuatus* they extend only half the distance between their origin and the insertion of the ventrals. The depth is 5 to $5\frac{4}{5}$ in the total length without caudal (slightly less than that of *Osmerus thaleichthys*, but greater than in *Osmerus attenuatus*). The gill rakers are shorter, coarser, and heavier than those of *Osmerus thaleichthys*, but are longer and more slender than those of *Osmerus attenuatus*. The dentition is weaker than that of either of the other species, and there are two small teeth on the tip of the tongue, instead of a single large one, as in *Osmerus attenuatus*.

The head is contained 4 times in the total length without caudal. The length of the snout in the head is contained 4 to $4\frac{1}{5}$ times. The



OSMERUS STARKSI, NEW SPECIES.

maxillary is contained twice in the head, and reaches nearly to the posterior margin of the eye. The lower jaw is more blunt than in *Osmerus attenuatus*, and projects slightly. The eye is contained a little less than 4 times in the head, and its diameter is slightly less than the interorbital width. The interorbital space is contained $3\frac{1}{2}$ to $3\frac{3}{4}$ times in the head. The opercle is smooth, and slightly marked at its edge with weak longitudinal striæ. The gill rakers number 11 to 13 + 26 or 27 and the longest one is contained $1\frac{3}{4}$ times in the eye.

The depth, in the length without caudal, is 5 to $5\frac{4}{5}$. The depth of the caudal peduncle is contained $2\frac{3}{4}$ to 3 times in the length of the head. The scales along median line of back, from occipital region to caudal, number 63 to 67.

The number of fin rays is: Pectoral, 11 or 12; ventral, 8; dorsal, 10 or 11; anal, 18 to 20. The pectoral is contained $1\frac{1}{4}$ to $1\frac{1}{3}$ times in the head; the ventrals, $1\frac{1}{2}$ times; the dorsal, $1\frac{1}{2}$ to $1\frac{2}{3}$; the anal, $2\frac{1}{2}$; and the caudal, $1\frac{1}{4}$. The distance of the dorsal from the tip of the snout is more than one-half of the total length without caudal.

The distance of the ventrals from the chin is less than the distance between the dorsal and the tip of the snout. The pectoral extends to a distance equal to the interorbital space, from the origin of the ventrals. The ventrals reach to within two-thirds of the diameter of the eye from the vent. The distance between the posterior insertion of the dorsal and the insertion of the adipose dorsal is contained $1\frac{1}{5}$ times in the head. As in *Osmerus thaleichthys*, the distance between the origin of the pectoral and the origin of the ventrals is equal to the length of the head. The anterior origin of the ventrals is one-half of the diameter of the eye in front of the anterior insertion of the dorsal. The tip of the dorsal extends to a point opposite the origin of the anal. The adipose dorsal is inserted slightly anterior to the posterior end of the anal, as in the other two species.

Here described from ten specimens found in the market in San Francisco. The type (Cat. No. 74834, U.S.N.M.) is deposited in the United States National Museum; cotypes are at Stanford University.

Measurements of Osmerus starksi.

Total length of body in mm.	121	111	Tail broken.	103	117	109	109	Tail broken.	Tail broken.	Tail broken.
Length of body without caudal in mm.	100	92	90	85	101	92	92	91	80	75
Depth of body in hundredths of length without caudal.	20	17	17	18	17	18	17	18	19	19
Depth of caudal peduncle	8	8	8	7	8−	8	8−	7+	8	8
Length of head	26	25	26	24	25	25	25	25	28	27
Longitudinal diameter of eye	6	6	7	6.5	6.5	6	6.5	6.7	8	7
Interorbital width	7	7	7	7	7	7	7−	7	7	7
Length of maxillary	13	13.5	14	13	12	13	13	14	15	14
Length of snout to tip of upper jaw.	6	7−	7	6	7−	6	7	6.5	7	7
Length of lower jaw	13	14	15	14	13	14	14	14.5	15	16−
Length of pectoral	19	20	20	18	18	19	20	19	Broken.	Broken.
Length of ventrals	15.5	17	15	14	14	14	15	Broken.	...do.....	16
Longest dorsal ray	16	17	Broken.	17	15	17	18	...do.....	...do.....	Broken.
Longest anal ray	9	10	...do.....	9	8	8	9	...do.....	...do.....	...do.....
Longest caudal ray	20	20	...do.....	20	19	20	20	...do.....	...do.....	...do.....
Distance of dorsal from tip to snout.	54	54	54	54	52	53	52	53	56	54
Distance of ventral from chin.	50	52	51.5	52	50	49	51	49	49+	53
Distance from tip of lower jaw to adipose fin.	82	82	84	83	82	81	82	83	83	84
Distance from origin of pectoral to origin of ventrals.	26	26	24	25	25	22+	26	22	21	26
Number of dorsal rays	11	10	11	11	11	10	11	10	11	10
Number of anal rays	18	18	18	18	20	18	18	Broken and missing.	19	Missing.
Scales in longitudinal series above lateral line.	72	73	.....	70	72	70	71	.....	.....	.....
Gill rakers on first gill arch.	11+26	12+26	12+26	13+26	12+26	12+26	12+26	13+26	13+27	Broken.
Sex	Male.	Male.	Male.	Male.	Male.	Male.	Male.	Male.	Male.	Male.

OSMERUS ATTENUATUS Lockington.

Osmerus attenuatus is a larger fish than either *Osmerus starksi* or *Osmerus thaleichthys*, and may be recognized by its comparatively slender body, its short pectorals, and the straight commissure of

the mouth. The dentition is stronger than in either *Osmerus thaleichthys* or *Osmerus starksi*, and on the tip of the tongue there is a single curved tooth not found in the other species.

The head is contained 4 times in the total length without caudal. The snout is more pointed than that of *Osmerus thaleichthys* or *Osmerus starksi*, and lacks the shallow indentation at its end which characterizes the other two. It is contained in the head $3\frac{1}{2}$ times. The maxillary is contained 2 to $2\frac{1}{3}$ times in the head, and reaches three-fourths of the diameter of the eye to a point opposite its posterior margin. The lower jaw is sharper and more slender than in the other two species, and projects rather strongly. The eye is contained $4\frac{1}{2}$ times in the head, and its diameter is slightly less than the interorbital width. The interorbital space is contained 4 times in the head. The opercle is somewhat translucent and bears striæ similar to those in *Osmerus starksi*. The gill rakers number 11 or 12+22 to 25, and the longest one is contained twice in the eye.

The depth, in the length without caudal, is $6\frac{1}{2}$ to $7\frac{1}{4}$. The depth of the caudal peduncle is contained 4 times in the length of the head. The number of scales along median line of back from occipital region to caudal is 70 to 74.

The fin rays number: Pectoral, 12; ventral, 8; dorsal, 11 to 12; anal, 15 to 16. The pectoral is contained $1\frac{2}{3}$ to $1\frac{4}{5}$ times in the head; the ventrals, $1\frac{2}{3}$ times; the dorsal, $1\frac{4}{5}$; the anal, 3; and the caudal, $1\frac{1}{3}$. The distance of the dorsal from the tip of the snout is $1\frac{3}{4}$ to $1\frac{4}{5}$ of the total length without caudal—greater than in either *Osmerus thaleichthys* or *Osmerus starksi*. The distance of the ventral from the chin is slightly less than the distance from the dorsal to the tip of the snout. The distance between the origin of the pectoral and the origin of the ventrals is contained $3\frac{1}{3}$ times in the length. The pectoral extends to a distance equal to twice the interorbital space from the origin of the ventrals. The ventrals reach to within $1\frac{1}{4}$ the diameter of the eye from the vent. The distance between the posterior insertion of the dorsal and the anterior insertion of the adipose dorsal is contained $1\frac{1}{2}$ times in the head—less than in *Osmerus thaleichthys* or *Osmerus starksi*. The distance between the origin of the pectoral and the origin of the ventrals is greater than in the other two species, as it equals $1\frac{1}{4}$ times the length of the head. The anterior origin of the ventrals is one-half the diameter of the eye in front of the anterior origin of the dorsal. The tip of the dorsal extends to a point one-half of the diameter of the eye in front of the origin of the anal. The adipose dorsal is placed slightly anterior to the posterior insertion of the anal.

Here described from 10 specimens taken from San Francisco Bay, collected by N. B. Scofield.

Measurements of Osmerus attenuatus.

Total length of body in mm	137	133	135	132	133	140	135	131	141	146
Length of body without caudal in mm	117	114	116	114	120	113	117	111	122	127
Depth of body in hundredths of length without caudal	15	15	14	15	15	14	15	15	16	16
Depth of caudal peduncle	○	6.5	6	7−	7−	6	6+	6+	6.5	7−
Length of head	24	26	25	25	24	25	25	26	25	25
Longitudinal diameter of eye	6	6.5	6	6	5.5	6	6	6	6	6
Interorbital width	6.5	7	6	7	7−	6	7	6.5	7	6+
Length of maxillary	12.5	13	12	12	11.5	13	12	13	12	12
Length of snout to tip of upper jaw	7	7	7	7−	7.5	7−	7	7−	7	7−
Length of lower jaw	14	15	14	14−	15	14	14	15	14	14
Length of pectoral	17	15	16	16	15	16	15	16	15	15
Length of ventrals	15	15	15	16	15	15	15	15	15	15
Longest dorsal ray	14	14	14	15	13	14	14	14	13	13
Longest anal ray	8	9	9	9	8	9	8	8	8	8
Longest caudal ray	20	19	19	18	20	20	18	20	19	19
Distance of dorsal from tip of snout	58	56	57	57	58	57	55	58	56	57
Distance of ventral from chin	54	56	53	56	57	55	53	57	54	53
Distance of tip of lower jaw to adipose fin	84	84	83	87	86	84	82	84	81	82
Distance from origin of pectoral to origin of ventrals	30	30	29	29	30	31	28	30	30	28
Number of dorsal rays	11	11	11	11	11	12	12	11	12	11
Number of anal rays	15	16	16	16	16	15	16	16	16	16
Scales in longitudinal series above lateral line	71	72	71	74	72	73	70	72	73	73
Gill rakers on first gill arch	10+25	12+24	12+25	11+24	11+22	10+24	12+25	11+25	11+24	12+24
Sex	Female.	Female.	Female.	Male.	Female.	Female.	Female.	Female.	Female.	Female.

The measurements of the 10 specimens at hand were compared with those of Mr. Lockington, in his original description of *Osmerus attenuatus*. They were found to correspond so closely as to prove without question that this species is referable to the species *Osmerus attenuatus*.

His table of measurements, from the original description, reduced to the terms employed in this paper, follows:

Measurements of Osmerus attenuatus.

Total length of body, in mm	104	114	133	145	128	152
Length without caudal, in mm	87	97	112	123	109	129
Depth of body, in hundredths of length without caudal	16	15	14	15	15	15
Depth of caudal peduncle	6	6−	6	6	6	6
Length of head	28	26	25	25	26	24
Diameter of eye	7	6	7	6	6	6
Interorbital width	6	5+	5+	7	6	7
Length of snout to tip of upper jaw	7	7	7	6	7	6
Length of lower jaw	16	15	15	14	14	Not given.
Length of pectoral	15	15	14	15	15	16
Length of ventrals	13	12	13	13	12+	13+
Longest dorsal ray	Not given.	15	15	15	14	13+
Dorsal from tip of snout	57	56	57	57	56	56
Ventral from chin	56	55	57	55	54+	55
Tip of lower jaw to adipose fin	85	79	82	85	83	85

A comparative table of average measurements, compiled from 10 specimens from each species:

Measurements.	*Osmerus thaleichthys.*	*Osmerus starksi.*	*Osmerus attenuatus.*
Length in mm	78.1	89.8	117.1
Head in hundredths of length	24.7	25.6	25
Eye	6.25	6.6	6
Maxillary	12.7	13.5	12.5
Depth	19.2	18	15
Pectoral	26.3	19.1	15.6
Ventrals	20.1	15	15.1
Longest dorsal ray	17.5	16.6	13.8
Longest anal ray	12.4	8.8	8.4
Longest caudal ray	20.8	19.8	18.6
Dorsal, from snout	51.5	53.6	56.9
Ventral, from chin	50.2	51.3	55.3
Number of dorsal rays	10.6	10.6	11.3
Number of anal rays	19.4	18.4	15.8
Interorbital width	7	7	6.6
Length of snout	6	6.6	6.9
Lower jaw to adipose fin	83.3	82.6	83.7
Length of lower jaw	13.7	14.2	14.3
Depth of caudal peduncle	7.6	8	6.4
Origin of pectoral to origin of ventrals	22.9	24.3	29.5
Number of scales	65	72	72
Gill rakers	13+28	11+26	11+24
Sex	3♂, 8♀	10♂	1♂, 9♀