THREE NEW WHITEFISHES FROM BEAR LAKE, IDAHO AND UTAH

By John Otterbein Snyder

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By JOHN OTTERBEIN SNYDER.

INTRODUCTION.

It is the purpose of this paper to direct attention to some little known but very important food fishes in Bear Lake, Idaho and Utah. Aside from their value as food, these fishes are of interest to ichthyologists, as they belong to previously unknown forms that have managed to survive as representatives of an ancient quaternary fauna, which was no doubt composed of numerous species of relatively wide distribution. At present they are confined to a single small lake, and they therefore remind us of the animals of certain oceanic islands which have been preserved under favorable conditions, while others of their kind less favored have long since passed away.

Bear Lake is a part of the drainage system of Great Salt Lake, the connection being through Bear River, which has its origin among the mountains of the eastern slopes of the Wasatch Ranges. Through the channel of its outlet, Bear Lake was at one time connected with the quaternary Lake Bonneville, the shore lines of which are still plainly traced along the sides of the bordering mountains. The outlet of Lake Bonneville carried its overflow into Snake River, and thus Bear Lake was for a time a part of the Columbia River system.

In the course of an investigation of the food fishes of the Great Salt Lake system, under the authority of the United States Bureau of Fisheries, the writer was attracted to Bear Lake principally because deep-water fishes were reported there. The lake, roughly estimated, measures about 9 by 25 miles in extent. It is deep and clear, the limpid water, always rich in reflected colors, reminding one of Lake Tahoe, although Bear Lake lacks to a degree the wonderful setting of mountains characteristic of the latter. Bear Lake and Bear River were found to contain most of the fishes indigenous to the Great Salt Lake system, and in addition three whitefishes of species heretofore undescribed. One of these belongs to *Leucichthys*, a genus not previously known to be represented in the West. This is a small fish, measuring about 7½ inches when mature. The others are species of *Coregonus*, which is represented also by *C. williamsoni*, a common fish of the streams. Of these, *Coregonus spilonotus* grows to large size, while the other, commonly known as the herring, is much smaller. They are excellent food fishes, and have long been known to ranchers near the lake, where they are taken in considerable numbers. Because of the limited supply, these fishes contribute to the local demand only. The writer has reason to believe, however, that they are of relatively great potential value, especially in the West, where there are many deep alpine lakes. These lakes are not known to contain similar fishes, and it is probable that the best of these might be introduced without seriously disturbing the native species.[a] As the introduction of

[a] Nothing is known of the habits, distribution, or abundance of Bear Lake whitefishes except that which is now recorded. Their life history should be carefully investigated before an attempt is made to introduce them elsewhere, and their artificial distribution should be preceded by experimental work to safeguard the possibility that their presence in a new locality may be detrimental to valuable native species.

eastern whitefish has been attempted in western lakes without success, it is worth considering that we have here one or more deep-water species which may prove to be better adapted. Two of the species here described are said to live and spawn in deep water, while the other species spawns near shore and returns to the depths immediately afterwards.[a] They are therefore only indirectly dependent upon the shore fauna of the lake, and they never enter the streams. In life they are all light green on the dorsal surface, silvery on the sides, and white beneath. Associated with them in deep water, and similarly colored, are large individuals of the trout, *Salmo utah*.[b] The sculpin, *Cottus semiscaber*, was also caught at the same depth. Examples of the latter were covered with prickles. They were pale ash gray in color, like the bottom, specimens of which adhered to the line anchors.

The immediate relationships of these whitefishes are not evident. Nothing like them occurs within the present confines of the Bonneville system, nor in the Columbia, which was its former outlet. In fact they appear to be widely separated from any possible allies, unless the latter remain to be discovered in the depths of other western mountain lakes of high altitude. It is quite probable that at some time, possibly during the high-water stage of Lake Bonneville, these species were much more widely distributed than at present. They were probably numerous in Lake Bonneville, and their range may have extended to other mountain lakes of the Columbia system, and even to Lake Lahontan and the quaternary lakes of eastern Oregon. If such were indeed the case, it is remarkable that they should not have been preserved in Lakes Chelan, Kaniksu, Tahoe, and others of similar character. The deep waters of these lakes have not been explored, and it is not altogether unreasonable to suspect that similiar fishes may now be found there.[c]

Descriptions of the species and brief notes on their habits follow:

SYSTEMATIC DISCUSSION OF SPECIES.

Leucichthys gemmifer, new species. Bonneville cisco.

The Bonneville cisco is taken during the winter in large numbers. It is caught in gill nets set through the ice. It may also be taken in the summer, when it is not so numerously represented on the bottom. Large schools may then be seen near the surface. It is at no time found near shore.

Although of small size, it is an excellent food fish. It is largely used by the local fishermen as bait, and when so employed it seems to be selected in preference to other fish by both the larger whitefish and the trout.

This species, locally known as "peak-nose" because of its pointed snout, measures about 7½ inches when mature. It is pale moss-green above, with silvery sides which have a pearly iridescence. The under parts are white. The tip of the snout is pale pink, and a few scales on the base of the caudal are strongly tinged with purple.

Spawning occurs in deep water during the latter half of January. Examples of both males and females collected at that time by Mr. Stock have conspicuous pearly nodules on all the scales from head to tail except those of the ventral surface. These nodules are conical in shape, sharply pointed, and larger in the region of the lateral line. No trace of the nodules appears in summer specimens, when the mucous coating of the scales is rather thin, and the surface is bright and smooth. Similar nuptial ornaments have not been reported as occurring on other species of the genus.

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[a] Many specimens of two species were collected during the spawning period by J. P. Stock, of Fish Haven, Idaho. Notes on the habits of the fishes were also contributed by him.

The drawings are by W. S. Atkinson.

[b] Through some oversight the name *Salmo virginalis* has been wrongly applied to the trout of the Salt Lake basin, which should be called *Salmo utah*, the name given it by Suckley. *Salmo virginalis* is the trout of the Rio Grande.

[c] *Coregonus coulteri* Eigenmann was described from young examples of the species. Individuals of the year were collected also in Diamond Lake, Wash., where they may, perhaps, reach a large size.

An examination of a few stomachs revealed nothing.

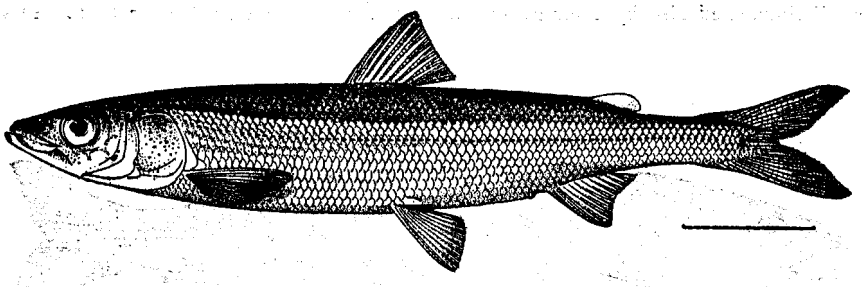
Forty specimens show a range in size from 162 to 180 millimeters in total length, and, unless the scale markings are wrongly interpreted, the ages of these examples are 4 and 5 years.

The species differs from others of the genus in the possession of a slender head with a long, sharply pointed snout, and a narrow maxillary which is entirely in front of the eye. The cisco does not resemble any other whitefish of the basin, and it will not be confused with any of them by the casual observer.

Type No. 83498, United States National Museum. Locality, Bear Lake, near Fish Haven, Idaho. Length 173 millimeters. Collectors, J. O. Snyder and C. L. Hubbs.

Head 4.4 in length to base of caudal; depth 5.6; depth caudal peduncle 3.8 in head; snout 3.2; eye 4.5; interorbital area 4.5; maxillary 3.4; scales lateral series 71; between occiput and dorsal 29; above lateral line 8; below lateral line 7; dorsal rays 11; anal rays 12.

Body elongate and slender, the head pointed; eye large; maxillary entirely in front of eye; no teeth; gill rakers long and slender, 14 to 27 on first arch; cæca 85; fins short, caudal lobe pointed, adipose small. Color dusky above, silvery on the sides; no spots.



Leucichthys gemmifer. Bonneville cisco.

MEASUREMENTS OF TEN EXAMPLES OF LEUCICHTHYS GEMMIFER.

Length of body.....mm..	149	157	157	149	141	141	155	143	146	142
	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
Length head	0.245	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.24	0.25
Depth body	.21	.19	.195	.195	.215	.24	.25	.23	.23	.225
Depth caudal peduncle	.07	.067	.07	.065	.07	.07	.065	.065	.07	.06
Length caudal peduncle	.155	.15	.16	.165	.165	.15	.16	.155	.155	.165
Length snout	.07	.075	.07	.075	.09	.08	.075	.075	.075	.085
Length maxillary	.065	.075	.075	.07	.078	.075	.075	.07	.072	.075
Diameter eye	.053	.055	.05	.055	.058	.055	.055	.057	.052	.05
Interorbital width	.053	.053	.055	.055	.055	.055	.05	.053	.055	.055
Depth head	.13	.13	.13	.14	.14	.14	.14	.14	.14	.14
Snout to occiput	.175	.175	.18	.175	.20	.185	.185	.19	.18	.185
Snout to dorsal	.48	.50	.48	.47	.51	.48	.49	.49	.47	.48
Snout to ventral	.55	.58	.54	.56	.56	.555	.575	.55	.555	.555
Length base of dorsal	.10	.095	.095	.09	.092	.11	.09	.10	.105	.10
Length base of anal	.095	.095	.09	.10	.095	.10	.09	.095	.10	.095
Height dorsal	.125	.12	.125	.12	.125	.13	.125	.115	.12	.12
Height anal	.095	.095	.09	.09	.09	.10	.095	.09	.09	.10
Length pectoral	.16	.145	.155	.145	.16	.15	.15	.14	.15	.15
Length ventral	.12	.115	.12	.115	.12	.115	.12	.115	.115	.115
Length caudal	.20	.19	.175	.19	.20	.20	.20	.18	.20	.20
Dorsal rays	10	11	11	11	9	11	11	11	11	11
Anal rays	11	11	11	12	12	12	11	11	12	12
Scales lateral line	77	73	71	71	72	72	73	73	74	72
Scales above lateral line	8	8	9	9	8	8	8	8	8	8
Scales below lateral line	7	7	7	7	7	7	7	7	7	7
Scales before dorsal	30	31	32	31	29	29	30	30	31	29

The color soon fades after death. An alcoholic specimen is brown to a point two scales above the lateral line, from where it is silvery to the midventral surface. Along the back the scales are dusky. The snout is black on the upper anterior half. The fins are without color.

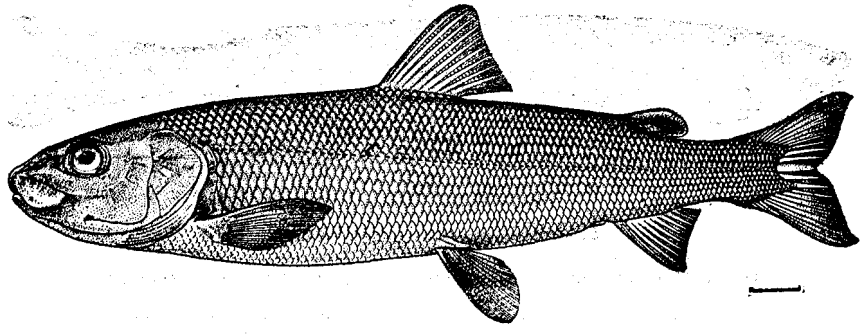
The intestinal canal is short and straight. There are 84 to 86 cæca just beyond the pyloris, the posterior 10 or 12 extending in a single row along the intestine. The gill rakers are longest near the center of the arch, about one-half the length of the maxillary. They number 14 to 16+27 or 28. Bran-

chiostegals 8. The air bladder is large, thin, and single lobed, extending the whole length of the visceral cavity. The peritoneum is somewhat silvery in places, but is without dark pigment. No teeth are found.

Coregonus spilonotus, new species. Bonneville whitefish.

Gill nets set at a depth of about a hundred feet in Bear Lake in August caught numbers of a spotted whitefish which measured from 155 to 200 millimeters in length. They were pale moss-green above, silvery on the sides, and white beneath. Spots, dusky in color, round, and somewhat larger than the pupil, extend from the occiput to the base of the caudal. These fishes differ from *C. williamsoni* in that the spots are smaller and more numerous, the scales are larger, and the heads longer. They were from 4 to 5 years old, and the condition of the ovaries seems to indicate that they were mature individuals.

At the same time and at the same depth large whitefish colored like the above, except that they were without spots, were taken on baited hooks. Besides being plain in color, these fish were much larger, 400 to 470 millimeters long; the heads were longer, the body deeper, the maxillary larger, and they were distinguished also by their general appearance. They were from 7 to 10 years old, and mature.



Coregonus spilonotus. Bonneville whitefish.

Locally these two forms are regarded as distinct, but a considerable series of specimens collected by Mr. Stock supplies examples intermediate in size and age, and seems to demonstrate without much doubt that they belong to the same species. The question need not be considered as settled, however, until more complete data have been obtained.

This species appears to inhabit the deep water. It is to be found there as late as the month of August, and it is in the same region in January and February, when it feeds upon the eggs of other whitefish. In December, however, it migrates shoreward and spawns in shallow water. It does not enter the rivers.

Type No. 83499, United States National Museum. Locality, Bear Lake, near Fish Haven, Idaho. Length 425 millimeters. Collectors, J. O. Snyder and C. L. Hubbs.

Head 3.8 in length to base of caudal; depth 3.6; depth caudal peduncle 3.5 in head; snout 2.9; eye 4.8; interorbital area 3; maxillary 3.2; scales lateral series 80; between occiput and dorsal 34; above lateral line 11; below lateral line 9; dorsal rays 11; anal 11.

Body deep and rather heavy, the head very large, with a long snout and broad maxillary. Gill rakers short, thick, and pointed, 6+13 on first arch. Fins rounded; caudal small; adipose about equal in size to maxillary. Color dusky above, silvery on the sides, white below; no spots.

The spots disappear with age, the head grows relatively larger, the maxillary longer, and the body deeper. The lateral series of scales numbers from 74 to 81; series above lateral line 9 to 11; between occiput and dorsal fin 30 to 37. The dorsal has 10 to 12 rays; anal 9 to 11.

MEASUREMENTS OF COREGONUS SPILONOTUS.

	No spots; size large.							Spots subdued; size medium.					Spots very distinct; size small.									
Length of body.....mm..	365	322	408	390	405	374	375	214	200	212	208	202	153	158	175	170	160	153	162	156	150	132
Length head	0.245	0.275	0.27	0.26	0.255	0.265	0.255	0.253	0.25	0.25	0.255	0.25	0.22	0.225	0.23	0.215	0.22	0.22	0.23	0.22	0.23	0.23
Depth body	.25	.235	.215	.24	.28	.24	.26	.25	.22	.25	.23	.22	.23	.225	.23	.22	.21	.22	.23	.23	.23	.215
Depth caudal peduncle	.07	.075	.07	.08	.075	.075	.075	.075	.075	.075	.075	.072	.075	.08	.08	.075	.07	.07	.075	.07	.08	.07
Length snout	.075	.083	.086	.09	.083	.09	.09	.085	.075	.075	.08	.08	.07	.075	.065	.06	.065	.06	.065	.062	.057	.06
Length maxillary	.075	.095	.084	.085	.08	.085	.089	.08	.075	.075	.07	.075	.06	.06	.055	.055	.06	.06	.06	.055	.057	.06
Diameter eye	.055	.056	.057	.05	.05	.05	.05	.055	.06	.055	.055	.055	.065	.06	.06	.055	.06	.06	.064	.055	.06	.06
Interorbital width	.075	.08	.08	.075	.08	.085	.08	.07	.07	.07	.06	.07	.06	.065	.065	.065	.06	.065	.06	.064	.06	.06
Depth head	.18	.185	.165	.185	.182	.18	.18	.165	.165	.17	.175	.16	.155	.155	.16	.155	.15	.16	.152	.15	.15	.15
Snout to occiput	.20	.225	.205	.21	.195	.215	.21	.21	.205	.205	.205	.205	.185	.19	.185	.18	.18	.19	.19	.19	.19	.195
Snout to dorsal	.485	.51	.51	.50	.505	.505	.50	.50	.505	.51	.495	.495	.465	.47	.475	.46	.475	.47	.48	.465	.455	.46
Snout to ventral	.56	.55	.58	.575	.585	.575	.58	.56	.59	.56	.58	.555	.55	.52	.55	.55	.545	.545	.52	.53	.55	.56
Length base of dorsal	.12	.132	.115	.12	.115	.115	.115	.12	.125	.12	.12	.115	.11	.12	.115	.11	.115	.11	.12	.105	.11	.11
Length base of anal	.085	.095	.085	.085	.09	.085	.085	.075	.08	.09	.09	.08	.085	.085	.09	.085	.09	.08	.085	.08	.078	.08
Height dorsal	.155	.18	.15	.16	.16	.145	.145	.135	.16	.16	.165	.15	.16	.175	.17	.155	.16	.15	.175	.16	.17	.165
Height anal	.....	.14	.115	.115	.122	.115	.115	.11	.12	.105	.13	.12	.11	.12	.12	.11	.11	.10	.125	.115	.12	.11
Length pectoral	.175	.205	.18	.21	.19	.175	.185	.19	.18	.19	.19	.17	.195	.20	.19	.19	.19	.18	.205	.185	.195	.18
Length ventral	.15	.17	.13	.155	.14	.14	.145	.15	.15	.15	.15	.14	.135	.14	.15	.14	.13	.135	.15	.15	.15	.14
Length caudal	.....	.205	.175	.20	.185	.185	.18	.215	.21	.215	.21	.20	.24	.21	.24	.22	.22	.22	.22	.215	.23	.225
Dorsal rays	11	11	11	11	11	11	11	10	10	11	11	10	10	11	11	11	12	11	10	10	11	11
Anal rays	10	11	11	11	11	11	10	10	10	11	10	10	10	10	10	9	10	9	10	10	10	9
Scales lateral line	74	80	77	80	74	75	80	78	79	79	78	81	78	74	80	80	78	74	76	80	80	74
Scales above lateral line	11	10	10	10	10	10	11	11	10	11	11	10	10	9	10	11	9	10	10	10	10	10
Scales below lateral line	8	7	8	8	8	8	8	8	8	8	9	8	8	7	8	8	7	7	8	8	8	7
Scales before dorsal	30	33	34	34	31	31	34	33	33	33	32	33	30	30	30	30	31	30	33	31	32	31

The gill rakers numbered 6 to 8+12 to 14. The air bladder is large and extends the entire length of the abdominal cavity. The peritoneum is immaculate. There are 135 to 140 pyloric cæca, the posterior ones extending in a single series along the digestive tract. There are 8 branchiostegals.

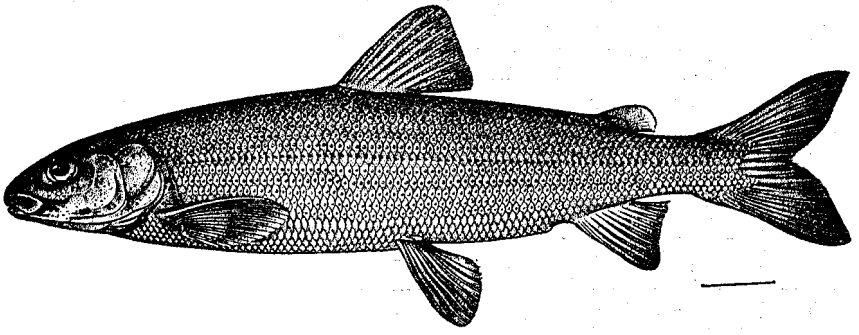
The growth appears to be about as follows:

	Length in millimeters.
4 years old	155 to 180
5 years old	200
6 years old	255 to 260
7 years old	280 to 437
8 to 10 years old	420 to 470

Old examples are fat and weigh 2½ pounds or more. Nothing was learned of the food of the species except that the stomachs of specimens caught during the mouths of January and February were stuffed with whitefish eggs. These were taken on the spawning grounds of *L. gemmifer* and *C. abyssicola*.

Coregonus abyssicola, new species. Bear Lake whitefish.

Small examples of this species (8 to 10 inches long) closely resemble those of *C. spilonotus* except that the latter are spotted. With increasing age the spots of *C. spilonotus* grow indistinct and finally disappear, while the maxillary and snout elongate, and the body becomes deeper. Consequently when the lack of spots fails to distinguish *C. abyssicola*, it may be easily separated from *C. spilonotus* by its much shorter maxillary.



Coregonus abyssicola. Bear Lake whitefish.

Local fishermen usually distinguish between spotted examples of *C. spilonotus* and this species, both of which they call herring, but they do not seem to suspect that the spotted fishes will grow to become the immaculate adults of *C. spilonotus*.

Mr. Stock reports that this species is taken in sufficient numbers to ship to near-by points.

It spawns from the latter part of January to early in March at a depth of about 100 feet.

Examples seen alive in August were moss-green above, silvery on the sides, and white beneath. These bleached in alcohol leaving very little dark pigment, while specimens taken during the breeding season are considerably darker, indicating that they are then much more highly colored.

Spawning fishes measure from 200 to 310 millimeters in length. The males are darker than the females, and the scales from the middle of the back to near the ventral surface bear mucous nodules. The females are smooth in most cases, an occasional one having small nodules on two or three rows of scales above and below the lateral line.

Type No. 83500, United States National Museum. Locality, Bear Lake near Fish Haven, Idaho. Length 310 millimeters. J. P. Stock collector.

Head 4.6 in length to base of caudal; depth 4.5; depth caudal peduncle 2.8 in head; snout 3.7; eye 5.2; interorbital width 3.4; maxillary 4.1; scales lateral series 78; between occiput and dorsal 30; above lateral line 8; below lateral line 7; dorsal 10; anal 11.

The body is relatively slender, head short, snout short and rounded, maxillary just reaching a perpendicular through anterior margin of orbit, the latter being very angular anteriorly, and extending well forward of the iris. Gill rakers 7+11, short, thick and pointed. Fins large, the pectorals and ventrals bluntly pointed; dorsal with a straight edge; adipose much larger than maxillary; caudal deeply cleft, the lobes pointed.

Color dusky above, silvery on the sides and below; no spots; scales on sides and below outlined with fine blackish dots; fins dusky, the caudal dark edged. Sex male. Each scale from the back to the level of the pectoral fin with a round, pearly mucous nodule.

In a series of specimens the scales in the lateral series number from 69 to 78; between occiput and dorsal fin 25 to 30; above lateral line 8 or 9; dorsal rays 10 or 11; anal 9 to 11.

MEASUREMENTS OF TEN EXAMPLES OF COREGONUS ABYSSICOLA.

Length of body.....mm.	258	234	211	235	233	245	213	223	180	206
	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
Length head	0.22	0.225	0.22	0.22	0.215	0.225	0.23	0.215	0.24	0.205
Depth body	.24	.24	.23	.235	.24	.25	.26	.25	.25	.24
Depth caudal peduncle	.08	.075	.07	.075	.075	.074	.072	.07	.08	.07
Length caudal peduncle	.13	.15	.145	.14	.16	.16	.16	.16	.155	.15
Length snout	.07	.08	.07	.075	.07	.075	.07	.075	.08	.07
Length maxillary	.05	.05	.05	.05	.052	.052	.05	.05	.055	.05
Diameter eye	.046	.05	.048	.045	.05	.047	.052	.046	.055	.05
Interorbital width	.065	.06	.065	.065	.063	.06	.06	.06	.06	.06
Depth head	.155	.16	.15	.15	.14	.155	.155	.15	.16	.14
Snout to occiput	.19	.21	.19	.19	.19	.19	.19	.19	.195	.18
Snout to dorsal	.495	.51	.48	.48	.475	.49	.48	.47	.47	.485
Snout to ventral	.54	.55	.54	.54	.535	.56	.55	.55	.54	.55
Length base of dorsal	.12	.125	.105	.10	.115	.10	.115	.10	.12	.10
Length base of anal	.095	.085	.08	.085	.10	.09	.08	.085	.085	.08
Height dorsal	.18	.18	.165	.16	.16	.16	.155	.155	.16	.16
Height anal	.13	.12	.105	.12	.12	.12	.115	.115	.11	.105
Length pectoral	.205	.21	.19	.185	.18	.20	.19	.17	.19	.19
Length ventral	.155	.15	.135	.14	.15	.15	.14	.13	.135	.13
Length caudal	.215	.215	.195	.20	.21	.20	.22	.195	.20	.21
Dorsal rays	11	11	10	10	11	10	11	10	11	10
Anal rays	11	10	10	10	10	10	9	11	10	10
Scales lateral line	76	71	74	75	75	75	72	69	71	72
Scales above lateral line	8	8	9	8	8	8	8	8	9	9
Scales below lateral line	7	7	7	7	7	7	6	6	7	7
Scales before dorsal	30	28	27	28	27	27	25	25	27	28

As indicated by the scales, the rate of growth appears to be as follows:

	Length in millimeters.
5 years old	180
7 years old	210 to 240
8 years old	250
9 years old	265
10 years old	300
13 years old	310

The gill rakers number 6 to 8+13 to 15 on the first arch; the cæca 73 to 78; branchiostegals 7 or 8.