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G. P. ENNIS

Fisheries Reasearch Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland, Canada A1C 5X1

CONVERSIONS BETWEEN TOTAL, FORK, AND STANDARD LENGTHS IN 35 SPECIES OF *SEBASTES* FROM CALIFORNIA

In recent years, the rockfishes (Scorpaenidae: *Sebastes*) of the northeastern Pacific Ocean have been investigated extensively. With many institutions studying diverse aspects of their biology and fisheries, a lack of standardized methods has hampered attempts to synthesize the data. A particular problem has been the reporting of different length measurements. To provide the means to convert one of these length measurements to another, we report here the linear regression statistics necessary for conversions in 35 species of *Sebastes*.

Specimens were collected from fishery catches between Cape Blanco, Oreg., and San Diego, Calif., during 1977-82. The sample included five fish for each centimeter of body length throughout the size range of each species. Measurements were taken on a meter board in millimeters on frozen, then thawed, carcasses. Standard length was measured from the anterior tip of the upper jaw to the posterior end of the vertebral column (Hubbs and Lagler 1970:25); fork length was measured from the anterior tip of the longest jaw to the median point of the caudal fin; and the total length was measured from the most anterior tip of the longest jaw to the most posterior part of the tail when the caudal rays are squeezed together (Holt 1959:71). Linear regressions were run on all combinations of the measurements of length. Outliers (± 3.0 standard deviations) from the line were noted by the computer program, then checked for data entry error and corrected when possible. If a data entry error was not found, an outlier was assumed to result from measurement error and the observation was deleted.

Statistics reported for each species are y-intercept (α), slope (β), standard error of estimate ($S_{y.x}$), correlation coefficient (r), range in length, and the sample size used in the regression (n) (Tables 1-3). Estimates of α imply impossible values for the dependent variable when the independent variable is zero. The impossible results could be caused by random error in estimation of α or nonlinearity for values less than those observed. The high values of r and examination of scattergrams indicate that the length relationships are linear over the observed range of values. The standard precaution of limiting the application of these regressions to the ranges of observed values is advised. To calculate the total length (TL) of *S. alutus*, given a standard length (SL) of 250 mm, the regression values from Table 1, total length on standard length, are used so that

TABLE 1.—Results of linear regressions of standard length versus total length for *Sebastes*. Measurements are in millimeters.

Species of *Sebastes*	n	r	Standard length Min	Standard length Max	Total length on standard length α	β	$s_{y \cdot x}$	Standard length on total length α	β	$s_{y \cdot x}$
alutus	49	0.995	232	361	1.454	1.249	3.746	2.056	0.792	2.984
auriculatus	116	1.000	72	426	−1.423	1.240	3.787	1.369	0.806	3.054
aurora	43	0.991	164	324	0.098	1.220	4.709	4.398	0.806	3.827
babcocki	74	0.999	185	532	6.478	1.196	4.833	−4.614	0.834	4.035
carnatus	105	0.999	75	292	3.676	1.201	2.206	−2.866	0.832	1.836
caurinus	113	0.997	111	443	3.873	1.209	5.769	−0.653	0.820	4.568
chlorostictus	107	0.999	107	382	5.316	1.202	3.636	−3.931	0.830	3.023
chrysomelas	60	0.998	77	316	1 007	1.211	3.161	−0.123	0.822	2.605
constellatus	105	0.999	148	365	4.497	1.175	3.119	−3.204	0.849	2.651
crameri	102	0.999	102	394	−0.304	1.266	4.153	0.737	0.788	3.278
diploproa	80	0.999	87	308	1.286	1.242	2.718	−0.740	0.804	2.188
elongatus	108	0.998	107	317	15.238	1.165	3.543	−12.144	0.855	3.036
entomelas	105	0.998	194	435	9.496	1.211	5.679	−6.296	0.822	4.679
flavidus	193	0.997	191	453	0.468	1.247	5.700	1.379	0.798	4.558
goodei	99	1.000	101	449	4.199	1.224	2.870	−3.196	0.816	2.344
hopkinsi	71	0.993	99	251	3.059	1.200	4.788	−0.195	0.822	3.964
jordani	145	0.998	77	260	4.610	1.216	2.903	−3.128	0.819	2.382
levis	31	1.000	190	717	−4.500	1.248	4.907	3.813	0.801	3.932
maliger	42	0.996	174	397	1.463	1.220	5.639	1.120	0.813	4.604
melanops	138	0.999	74	495	7.724	1.221	5.193	−5.596	0.817	4.247
melanostomus	87	0.994	207	421	−0.954	1.244	6.897	4.780	0.794	5.508
miniatus	109	0.994	237	550	9.629	1.229	9.765	−3.095	0.804	7.900
mystinus	163	0.998	102	387	2.930	1.238	5.694	−1.192	0.804	4.588
nebulosus	69	0.995	213	366	4.294	1.196	3.962	−0.731	0.828	3.296
ovalis	83	0.997	181	375	0.550	1.225	4.374	1.329	0.811	3.558
paucispinis	163	0.999	103	649	−5.035	1.262	7.550	4.882	0.790	5.974
pinniger	136	0.997	196	565	11.476	1.239	8.002	−7.447	0.803	6.443
rosaceus	83	0.996	132	263	3.917	1.199	2.867	−1.794	0.828	2.383
rosenblatti	104	0.999	132	428	9.567	1.182	3.653	−7.374	0.844	3.086
ruberrimus	118	0.996	203	565	5.856	1.202	9.465	−1.717	0.826	7.843
rufus	26	0.999	152	447	12.946	1.177	5.963	−10.316	0.848	5.061
saxicola	68	0.999	109	288	3.226	1.242	2.456	−2.252	0.804	1.976
semicinctus	31	0.979	101	147	8.179	1.170	3.617	−1.752	0.820	3.027
serranoides	129	0.995	190	441	8.292	1.209	7.277	−3.542	0.819	5.988
wilsoni	48	0.999	71	126	0.572	1.234	1.071	−0.231	0.808	0.868

TABLE 2.—Results of linear regressions of standard length versus fork length for *Sebastes*. Measurements are in millimeters.

Species of *Sebastes*	n	r	Standard length Min	Standard length Max	Fork length on standard length α	β	$s_{y \cdot x}$	Standard length on fork length α	β	$s_{y \cdot x}$
alutus	48	0.996	232	361	−0.281	1.195	3.024	2.492	0.831	2.521
auriculatus	114	0.999	72	426	−0.369	1.228	4.126	0.575	0.813	3.358
aurora	44	0.993	164	324	−3.046	1.201	4.237	6.237	0.821	3.502
babcocki	76	0.999	185	532	9.034	1.153	5.190	−6.860	0.865	4.496
carnatus	104	0.999	75	292	4.601	1.194	2.425	−3.613	0.836	2.030
caurinus	117	0.996	111	448	5.896	1.187	6.764	−2.272	0.836	5.674
chlorostictus	107	0.999	107	382	5.289	1.171	3.719	−3.987	0.852	3.173
chrysomelas	58	0.997	77	226	1.137	1.209	3.209	−0.009	0.822	2.647
constellatus	107	0.999	148	365	3.883	1.152	2.964	−2.774	0.866	2.571
crameri	103	0.999	102	394	1.390	1.205	4.282	−0.565	0.828	3.550
diploproa	82	0.999	87	308	2.092	1.181	2.627	−1.460	0.845	2.223
elongatus	116	0.998	107	317	14.186	1.116	3.469	−11.724	0.892	3.102
entomelas	106	0.997	194	435	16.964	1.124	5.602	−13.326	0.885	4.970
flavidus	198	0.998	191	453	−0.918	1.213	5.367	2.363	0.820	4.412
goodei	99	1.000	101	449	1.515	1.159	3.085	−0.988	0.862	2.660
hopkinsi	72	0.994	99	251	3.011	1.153	4.465	−0.372	0.856	3.847
jordani	154	0.998	77	260	5.645	1.124	2.519	−4.418	0.887	2.238
levis	34	0.999	190	717	0.033	1.177	8.446	0.688	0.848	7.169
maliger	41	0.997	174	397	11.835	1.173	4.867	−8.202	0.848	4.138
melanops	135	0.999	74	495	7.149	1.197	5.042	−5.247	0.834	4.209
melanostomus	86	0.994	207	421	−0.828	1.201	6.853	4.912	0.822	5.670
miniatus	108	0.994	237	550	16.442	1.168	9.200	−9.445	0.847	7.836
mystinus	164	0.998	102	387	0.352	1.192	4.975	0.644	0.836	4.166
nebulosus	71	0.993	213	366	6.934	1.181	4.623	−1.852	0.835	3.888
ovalis	83	0.996	181	375	−3.554	1.187	4.677	5.130	0.836	3.925
paucispinis	162	0.999	103	649	−4.082	1.209	6.819	4.183	0.826	5.636
pinniger	138	0.998	196	565	12.880	1.164	7.440	−9.326	0.855	6.378
rosaceus	83	0.997	132	263	1.399	1.187	2.730	0.225	0.837	2.293
rosenblatti	104	0.999	132	428	9.938	1.147	3.347	−8.023	0.870	2.915
ruberrimus	118	0.996	203	565	6.665	1.181	9.028	−2.664	0.841	7.620

TABLE 2.— *Continued*

Species of *Sebastes*	n	r	Standard length		Fork length on standard length			Standard length on fork length		
			Min	Max	α	β	$S_{y.x}$	α	β	$S_{y.x}$
rufus	26	0.999	152	447	14.246	1.112	4.416	−12.392	0.898	3.969
saxicola	77	0.999	109	288	3.234	1.200	2.511	−2.315	0.831	2.090
semicinctus	31	0.978	101	147	6.486	1.128	3.562	−0.343	0.849	3.091
serranoides	126	0.995	190	441	4.422	1.184	6.779	−0.672	0.837	5.700
wilsoni	53	0.999	71	126	0.671	1.203	0.884	−0.372	0.830	0.734

TABLE 3.—Results of linear regressions of fork length versus total length for *Sebastes*. Measurements are in millimeters.

Species of *Sebastes*	n	r	Fork length		Total length on fork length			Fork length on total length		
			Min	Max	α	β	$S_{y.x}$	α	β	$S_{y.x}$
alutus	48	0.999	278	430	−0.003	1.050	1.483	1.321	0.949	1.272
auriculatus	113	1.000	90	529	−0.586	1.007	1.637	0.634	0.993	1.626
aurora	43	0.998	198	388	2.293	1.019	2.349	−0.917	0.977	2.300
babcocki	72	1.000	222	635	−1.146	1.032	2.392	1.336	0.968	2.316
carnatus	101	1.000	92	351	−0.759	1.005	0.510	0.768	0.995	0.507
caurinus	107	0.999	135	538	0.629	1.010	3.022	0.005	0.988	2.988
chlorostictus	106	1.000	127	449	−0.723	1.028	1.905	0.858	0.972	1.852
chrysomelas[1]										
constellatus	104	1.000	174	422	−0.134	1.023	1.504	0.301	0.977	1.470
crameri	99	1.000	124	480	−1.700	1.051	2.002	1.756	0.951	1.904
diploproa	80	1.000	106	364	−0.558	1.049	1.704	0.669	0.953	1.625
elongatus	102	1.000	129	360	−0.552	1.047	1.449	0.701	0.954	1.383
entomelas	100	0.999	231	496	−6.845	1.072	3.251	6.954	0.931	3.029
flavidus	191	1.000	226	551	2.358	1.025	2.439	−1.906	0.974	2.377
goodei	96	1.000	122	527	2.468	1.057	2.647	−2.096	0.945	2.503
hopkinsi	70	0.999	115	292	0.002	1.041	1.917	0.428	0.959	1.840
jordani	140	0.999	89	296	−1.872	1.086	1.885	2.036	0.920	1.735
levis	34	1.000	228	855	−3.335	1.055	4.452	3.369	0.947	4.219
maliger	40	0.999	215	480	−8.696	1.034	2.782	9.075	0.965	2.687
melanops	132	1.000	91	599	1.595	1.017	2.099	−1.421	0.983	2.063
melanostomus	82	0.999	247	519	−0.635	1.036	2.181	1.065	0.964	2.103
miniatus	103	0.999	293	654	−7.857	1.054	4.638	8.665	0.946	4.394
mystinus	158	1.000	122	463	2.495	1.039	2.329	−2.164	0.962	2.241
nebulosus	71	1.000	256	498	0.854	1.001	1.423	−0.487	0.998	1.420
ovalis	78	0.999	225	438	3.914	1.033	1.996	−3.311	0.967	1.931
paucispinis	157	1.000	123	781	−0.870	1.045	2.273	0.930	0.956	2.174
pinniger	132	1.000	235	586	−4.107	1.070	2.822	4.108	0.934	2.638
rosaceus	79	0.999	158	316	1.409	1.015	1.173	−1.085	0.984	1.155
rosenblatti	103	1.000	155	497	−0.453	1.030	2.026	0.692	0.970	1.966
ruberrimus	118	1.000	243	680	−0.758	1.018	3.640	1.296	0.981	3.573
rufus	24	1.000	182	517	−2.197	1.057	1.659	2.135	0.946	1.569
saxicola	69	0.999	136	347	−0.669	1.038	2.009	0.921	0.963	1.935
semicinctus	29	0.998	119	174	−0.422	1.050	1.178	1.010	0.949	1.120
serranoides	125	0.999	222	518	1.419	1.029	2.623	−0.862	0.971	2.548
wilsoni	45	1.000	86	151	−1.141	1.035	0.560	1.182	0.966	0.541

[1]No regression was run because total length and fork length are equal.

$$TL = \alpha + \beta\,(SL)$$
$$TL = 1.454 + (1.249)\,(250)$$
$$TL = 313.7 \text{ mm.}$$

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TINA ECHEVERRIA
WILLIAM H. LENARZ

Southwest Fisheries Center Tiburon Laboratory
National Marine Fisheries Service, NOAA
3150 Paradise Drive
Tiburon, CA 94920