Length-Specific Probabilities of Screen Entrainment of Larval Fishes Based on Head Capsule Measurements

(Incorporating NFPP Site-Specific Estimates)

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Introduction

State policy on the use of ocean and estuarine waters for power plant cooling requires power plants in California that utilize once-through cooling (OTC) to evaluate and significantly reduce, as achievable, losses of larval fishes and other planktonic organisms due to entrainment.[1] One of the options under consideration at existing facilities is the use of fine-mesh screening systems that either use active 'collect-and-transfer' designs that collect the small organisms from the intake screens and return them alive to the source water body, or passive designs, such as wedgewire screens (WWS) that take advantage of induced currents to move organisms off and away from the screens. Critical to the implementation of any fish protection technology is the need for additional information that can be used in evaluating the feasibility and/or physical performance of the screens, including an approximation of the potential reductions in entrainment for target organisms.

This report provides estimates of the expected effectiveness of fine-mesh or WWS systems at reducing entrainment of fish larvae via exclusion. The estimates are based on the length of the larvae and the corresponding width and depth of the head capsule. Although most of the body parts of fish larvae are soft and easily compressible at the early stages of development when they are susceptible to entrainment, the head capsule has harder cartilage and bone that is not compressible. Therefore, the smallest dimension (width or depth) of the head capsule can be used to represent the minimum size larva that could pass through a rectangular mesh or WWS slot opening. Percent survival or the viability of larvae following possible screen impingement is not assessed. The analysis resulted in probabilities of entrainment for different lengths of larval fishes that were commonly collected from entrainment studies along the coast of California. The entrainment studies represented in the analysis were among the studies that contributed to the data provided in Appendices E and F of the State Policy Final Substitute Environmental Document (California plant once-through cooling entrainment and impingement estimates).

Entrainment reduction estimates (not site-specific) are calculated based on six different rectangular mesh or slot opening dimensions: 0.75, 1.0, 2.0, 3.0, 4.0, and 6.0 mm. The results are then used to estimate the reductions in entrainment for the same six mesh or slot sizes at the Diablo Canyon Power Plant (DCPP) near Avila Beach, and the San Onofre Nuclear Generating Station (SONGS) in San Clemente. The estimates for the two state nuclear power plants were based on the taxonomic composition and measured or estimated length distributions of the larvae collected during plant specific entrainment studies.[2]

[1] http://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/

[2] As of June 2013 SONGS was no longer in operation and will likely be decommissioned without restarting.

Background on WWS Testing

Testing of non-conventional screening systems, such as fine-mesh or WWS systems, at coastal intakes in California has been limited to pilot-scale studies related to desalination facilities, and small volume industrial and water system intakes. A list of installed systems for one of the major WWS suppliers, Hendrick Screen Company, provides the range of facilities with WWS intakes.[3] Most of the installations are in freshwater lakes and rivers, although there are intakes with WWS in San Francisco Bay.

The only operational coastal (Pacific west coast) intake equipped with WWS at this time is a pilot desalination plant constructed and operated by the West Basin Municipal Water District (WBMWD) in Redondo Beach. The pilot studies on the effectiveness of the system expand on earlier pilot studies conducted in Santa Cruz for a planned desalination facility (Tenera 2010). The earlier studies in Santa Cruz used a small WWS module supplied by Hendrick Screen Company with a slot width opening of 2 mm. The diameter of the screen was 21.9 cm (8-5/8 in), overall length was 88.9 cm (35 in), and the outlet flange was 16.8 cm (6-5/8 in) diameter (**Figure 1**). The size of the module was designed to provide a through-slot velocity of less than 15 cm per second (0.5 feet per second [fps]) based on a nominal flow rate of approximately 1 m^3 (264 gal) per minute. The module was attached to pier pilings below the Santa Cruz Wharf at a depth of roughly 4.6–6.1 m (15–20 ft) depending on tidal stage.

Figure 1. Wedgewire screen module used for Santa Cruz desalination plant pilot studies testing.

[3] List available at http://www.hendrickscreenco.com/assets/docs/intakeinstall.xls

The primary goals of the Santa Cruz studies were to examine the effectiveness of the z-alloy construction of the screen module at reducing or eliminating fouling, and to examine the potential for small organisms and debris to become impinged on the screen. Although paired sampling from the WWS and an unscreened intake was done to examine the effectiveness of the screen at reducing entrainment, the sampling was only done once per month which resulted in considerable variation in the data due to changes in species composition and the size of larvae throughout the year. As a result, no statistical difference between the WWS and unscreened intake was detected. Video cameras that were set to monitor the screen surface showed that the WWS was very effective at reducing or even eliminating impingement. The video data showed that any organisms or debris on the WWS surface were quickly swept from, or moved off, the screen. Results also showed that the z-alloy was very effective at minimizing any corrosion or fouling during the one-year study.

The studies at the WBMWD facility in Redondo Beach were expanded from the Santa Cruz studies to include testing of larger modules with both 1-mm and 2-mm slot openings (**Figures 2a** and **2b**). These studies were still being conducted as of June 2013, but similar to the studies at Santa Cruz, samples were collected monthly from an unscreened intake and the two modules. A special study is also planned to collect a large number of samples during a period when larval fish abundances are high. This will increase the statistical power of the study to determine the effectiveness of the WWS at reducing entrainment.

Previous Analyses of Larval Morphology

A study on the relationship between head capsule (head depth [height] and width) and notochord length (NL) of larval fishes (**Figure 3**) was conducted by Tenera (2011). The larvae used in the study were collected during sampling near the intakes of eight power plants in central and southern California (**Table 1**). Larval length and head capsule dimension measurements were collected for the 15 taxa shown in **Table 2**, which represented a small subset of the larval fishes collected during larval entrainment studies at the eight plants. The number of specimens measured per taxon ranged from a high of 282 for anchovies to a low of 20 for Pacific barracuda. Although the numbers measured were roughly proportional to the abundances of the target taxa in the selected entrainment samples, the range of lengths shown in **Table 2** does not necessarily correspond to the complete size range collected during the studies. However, the sample length choices attempted to cover the range of lengths for each taxon to the greatest extent possible. For example, some larvae were damaged or contorted and head dimensions were not measured for these larvae.

The analysis of notochord length and head capsule dimensions was done using nonlinear allometric regression analysis where head capsule dimension is a power function of notochord length. This type of regression model is used to describe proportional changes in body shape with growth (e.g., Fuiman 1983, Gisbert et al. 2002, and Pena and Dumas 2009). All of the taxa were first analyzed with a single model using all of the measured individuals. However, kelpfishes (*Gibbonsia* spp.), anchovies (Engraulidae), and silversides (Atherinopsidae) showed a discontinuity in the growth relationship at lengths that corresponded approximately to the larval transformation phase or slightly smaller in the case of anchovies, when the larvae start developing into a juvenile and might begin to take on some adult characteristics (Moser 1996). Separate regression models were used for the two different stages of larval development for these three taxa. For example, separate models were developed for silverside larvae smaller than 15 mm (0.59 in) NL, and those larger than that size, which approximately corresponds to the length of transformation. The results of the analyses in Tenera (2011) are provided in **Appendix A** of this report.

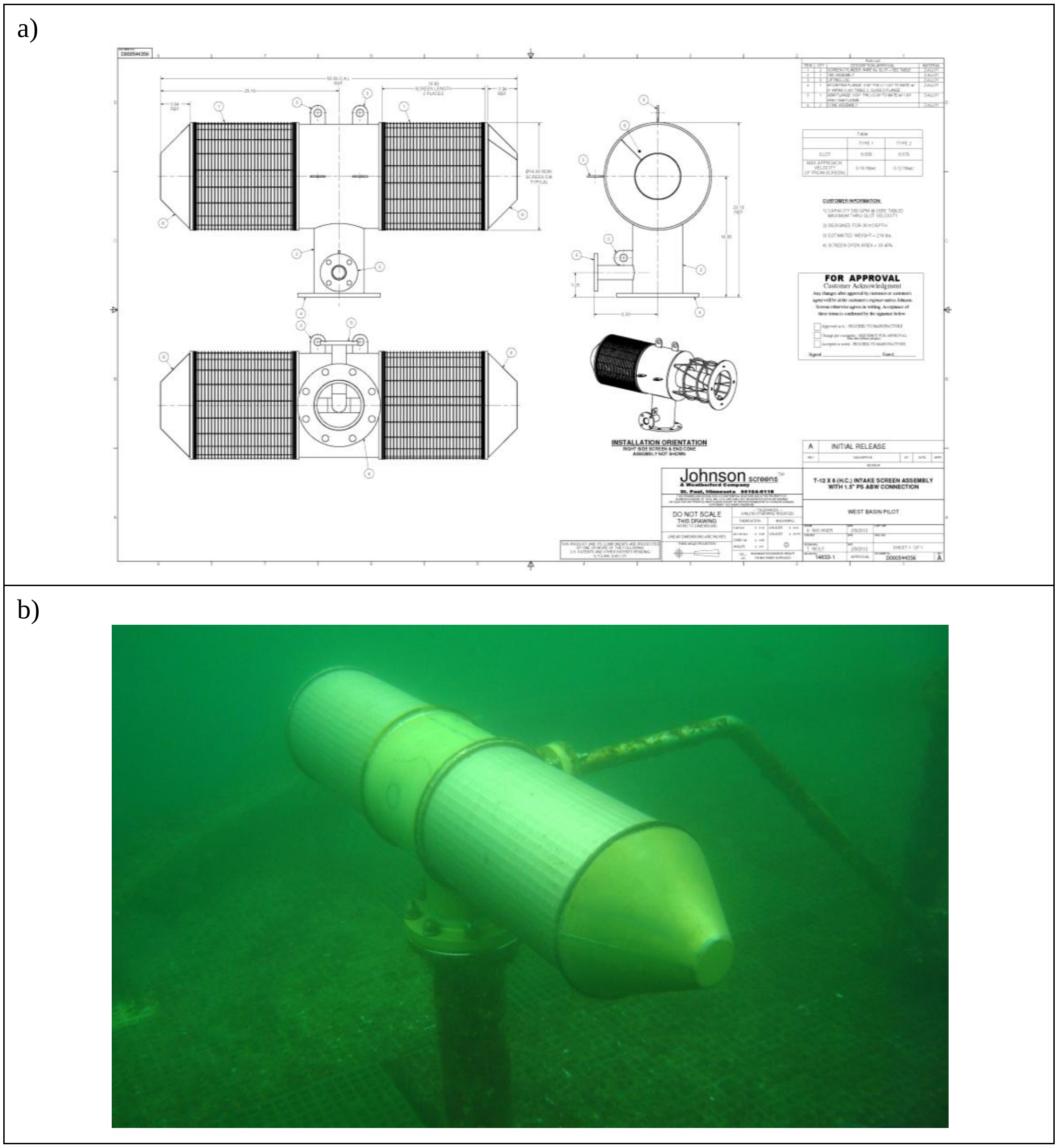

Figure 2. Figures showing a) technical diagram and b) underwater photo of wedgewire screen module used during the West Basin Municipal Water District pilot desalination study in Redondo Beach.

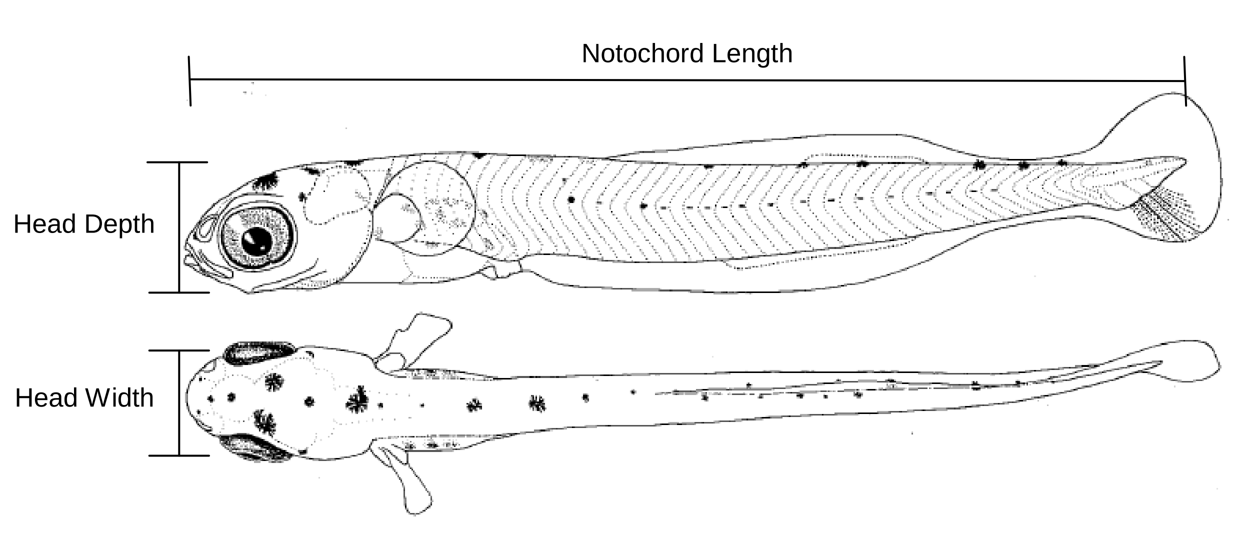

Figure 3. Illustration of the measurement locations for notochord length and head depth (height) and width of a preflexion stage larval fish. Larval fish is a jacksmelt from Moser (1996).

Table 1. Location of power plants and the years during which larval fish were collected.

Power Plant	Owner (present)	Intake Latitude	Intake Longitude	Sample Period
Moss Landing	Dynegy Inc.	36° 48.292' N	121° 47.130' W	1999–2000
Diablo Canyon	Pacific Gas and Electric Co.	35° 12.456' N	120° 51.407' W	1996–1999
Scattergood	LADWP	33° 54.985' N	118° 26.106' W	2006–2007
El Segundo	El Segundo Power, LLC	33° 54.433' N	118° 26.031' W	2006–2007
Redondo	AES Southland, LLC	33° 50.409' N	118° 23.718' W	2006–2007
Haynes	LADWP	33° 45.121' N	118° 06.556' W	2006–2007
Harbor	LADWP	33° 45.932' N	118° 15.790' W	2006–2007
South Bay	Dynegy Inc.	32° 36.869' N	117° 05.942' W	2001–2003

Table 2. Summary statistics (mean, maximum, minimum, and median dimensions) and standard deviations describing the sample composition of each taxon used in the analysis.

		Length (mm)					Head Depth (mm)					Head Width (mm)				
Common Name	N	Mean	Max	Min	Median	Std. Dev.	Mean	Max	Min	Median	Std. Dev.	Mean	Max	Min	Median	Std. Dev.
kelpfishes	75	10.40	25.91	3.46	10.22	4.9269	1.18	4.36	0.47	1.03	0.6755	1.09	3.23	0.45	0.98	0.5083
sculpins	84	5.77	11.05	2.48	5.33	2.2003	1.13	2.78	0.41	0.94	0.5774	1.04	2.95	0.43	0.87	0.5746
flatfishes	51	4.07	7.51	1.54	4.00	1.5158	0.85	2.83	0.18	0.65	0.6065	0.51	1.33	0.17	0.49	0.2552
monkeyface prickleback	55	10.41	17.65	4.86	10.40	3.1196	1.09	2.01	0.65	1.06	0.3159	0.97	1.64	0.50	0.93	0.2801
combtooth blennies	42	2.54	4.31	1.87	2.25	0.6579	0.49	1.10	0.35	0.44	0.1445	0.42	0.89	0.32	0.39	0.1152
clingfishes	37	4.59	6.76	2.87	4.42	1.0901	0.81	1.49	0.51	0.72	0.2406	0.82	1.55	0.51	0.70	0.2736
anchovies	282	14.10	31.01	1.51	14.23	8.1962	1.15	3.49	0.15	0.95	0.8155	1.16	3.10	0.19	1.13	0.6721
croakers	167	5.18	14.87	1.23	4.18	3.5911	1.29	4.31	0.15	0.89	1.0339	0.94	3.21	0.20	0.73	0.6911
gobies	204	7.88	22.14	1.90	6.46	4.9773	1.04	3.44	0.31	0.78	0.6885	0.92	3.90	0.25	0.71	0.6301
silversides	221	12.28	31.07	3.63	11.01	5.7681	1.54	4.37	0.34	1.14	0.9533	1.42	3.70	0.35	1.15	0.7105
Pacific barracuda	20	2.61	4.22	1.66	2.70	0.6178	0.52	1.07	0.24	0.50	0.2312	0.42	0.58	0.26	0.41	0.1002
rockfishes	25	4.16	6.57	2.71	4.01	0.7731	0.69	1.23	0.52	0.68	0.1390	0.52	1.02	0.33	0.46	0.1479
cabezon	33	5.30	6.40	3.58	5.16	0.8537	0.79	1.15	0.55	0.80	0.1557	0.70	0.95	0.51	0.73	0.1420
sea basses	34	2.34	9.47	1.23	1.77	2.0087	0.44	2.29	0.19	0.27	0.5352	0.40	1.83	0.20	0.28	0.3888
pricklebacks	48	10.08	16.39	5.83	9.55	2.9891	1.02	1.85	0.58	0.98	0.2413	0.99	1.59	0.62	1.00	0.1961

Methods

Estimates for Individual Fishes

A set of parameter estimates and their standard errors (Tenera 2011) are used in this report to estimate head capsule dimensions in relation to larval length for each taxon. In theory, individuals with head capsules larger than a specific screen mesh size would be excluded from entrainment, even if the approach vector was perpendicular (head-on) to the screen. Length-specific probabilities of entrainment for the taxa shown in **Table 2** were calculated for slot openings of 0.75 mm, 1 mm, 2 mm, 3 mm, 4 mm, and 6 mm, which have been proposed for wedgewire screens, although the results could also be used in determining the theoretical performance of screens with more conventional screen mesh.

The screen entrainment probabilities for the six slot widths were calculated using estimates of variability (standard errors) around the allometric regressions from the analysis in Tenera (2011) (**Table 3**). To describe the effects of this variation on head capsule dimensions, 10,000 estimates of head width and head depth for each millimeter size class of notochord length (from a minimum up to a maximum length determined for the taxon) were computer-generated using the estimated standard errors for each regression parameter. Errors were assumed to be normally distributed. For each set of 10,000 values, a length-specific probability of entrainment was calculated for head widths and depths. The probability of entrainment for each notochord length was determined as the larger value of either the head width entrainment probability or the head depth entrainment probability. The 10,000 estimates were calculated 1,000 times using randomly selected values within ±0.5 mm of each length. The average proportion and standard error were calculated from the 1,000 estimates calculated for each 1 mm length increment.

The probabilities were calculated over a size range that approximately corresponded to the range of the lengths of larvae that would be potentially entrainable. The minimum lengths for the taxa were based on the smallest larvae measured from the studies (**Table 2**). The maximum was set at either 20 or 25 mm depending on the fish taxon. Fishes larger than 20–25 mm generally have characteristics (e.g., presence of head and opercular spines) that would likely bias entrainment probabilities based only on larval head capsule measurements. Fishes at this size also have swimming abilities that allow them to potentially avoid entrainment, especially at reduced intake velocities that could be used at plants retrofitting with fine mesh or WWS.

The probabilities across the size range of entrainable larvae for a taxon can be used to assess the effects on population mortality when using a particular screen dimension for reducing the entrainment of larvae. Two simple assumptions to calculate the reduction of mortality are: 1) linear growth over time, and 2) constant exponential natural mortality. These assumptions are reasonable because the time period being evaluated is likely to be very short. The time period may only be a few days for fishes that are only subject to entrainment over a narrow size range, but would likely never extend beyond one or two months. By assuming linear growth, length becomes directly proportional to age. As a larval cohort progresses through consecutive length classes it follows an exponential decrease in numbers over time due to natural mortality. Under these assumptions, each length (or age) would result in an identical number of adult equivalents or fishes at an age where they are not subject to entrainment. Using these two assumptions, a first approximation of the reduction for each screen mesh dimension can be made by summing the length-specific entrainment probabilities, and dividing by the number of probability estimates. The subtraction of this value from one determines the reduction of mortality for the total cohort of larvae that would survive to the length or age when they are no longer subject to entrainment. The average reduction in mortality would need to be adjusted for the composition and size structure of the fish larvae for a specific location and sample year, but otherwise provides an estimate of population-level mortality identical to an adult equivalent model using constant growth and survival rates extrapolated to the length or age at which the fish are no longer subject to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis).

Estimates for DCPP and SONGS

Without site-specific studies on the efficiency of a specific screening system at reducing entrainment, Tenera biologists advocate that the best estimate is likely to be the population-level estimates described in the previous section. These estimates are preferred because few studies have adequate samples to provide estimates of entrainment across the complete size range of entrainable larvae. In general, as a result of natural mortality there should be orders of magnitude fewer larger larvae than smaller larvae. The data for this study were derived from larvae sampled from several sites over several years to provide estimates across the full size range of entrainable larvae. An exception to this is the entrainment studies at DCPP which started in October 1996 and continued through June 1999. For most of this period, entrainment sampling was conducted weekly at four stations in front of the intake structure. The sampling also occurred every three hours resulting in the collection of over 4,600 plankton samples. Many of the larvae collected from the entrainment samples were measured, resulting in a large number of length measurements for certain taxa that are likely representative of the size ranges of larvae entrained at the plant. In contrast, the entrainment sampling at SONGS and at many other coastal power plants occurred monthly or biweekly for 12 months. As a result, different approaches need to be taken when estimating the potential entrainment reductions resulting from different mesh or slot openings at the two plants.

Even with the large sample sizes at DCPP, only the most abundant larvae were measured, therefore, detailed length-specific entrainment adjustments were only calculated for seven of the entrained taxa of fishes. For these seven taxa, the percentages of larvae at each length from the length frequency distribution of the larvae collected at DCPP were used with the annual entrainment estimates for a fish taxon to estimate the numbers entrained by length category. The probabilities of entrainment for the six mesh or slot openings were then used to determine the reductions in entrainment for each taxon. The estimated population-level reductions for these taxa, assuming constant growth and survival rates to the length or age at which the fish are no longer subject to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis), were adjusted for the range of sizes of larvae collected. For the remaining taxa and the SONGS data, estimating population-level reductions would be the best approach for estimating the reductions achieved by the six different size mesh or slot openings.

Results

Individual Taxa

The statistics and parameters resulting from the allometric regressions from Tenera (2011) are shown in **Table 3**, and dispersion plots of the data for each taxon are shown in **Appendix A**, which were also presented in Tenera (2011). The results for kelpfishes (**Figure A1**), anchovies (**Figure A8**), and silversides (**Figure A13**) showed discontinuities in the relationship that approximately corresponded to the larval transformation phase for kelpfishes and silversides (Moser 1996). Moser (1996) cites transformation sizes of 15 mm (0.59 in) for silversides and 21 mm (0.83 in) for kelpfishes. Anchovies (Engraulidae) appear to have a growth inflection at about 19 mm (0.75 in), which is less than the reported transformation size for northern anchovy (Moser 1996). Separate calculations for both growth phases (smaller and larger-sized groups) were calculated for these three taxa, and these relationships are plotted in the figures in **Appendix A** that follow the plot based on the model for the entire length range. The same approach was used by Gisbert et al. (2002), and Pena and Dumas (2009), in their analyses of allometric growth patterns in California halibut and spotted sand bass larvae, respectively. The allometric equations of body length to head depth for these two species are also presented in **Table 3**.

Parameters of allometric regressions and their standard errors that described head capsule dimensions as a function of notochord length were used to predict the proportion of 15 larval taxa that could be susceptible to entrainment through specific slot sizes of fine-mesh screens. **Appendix B** presents the estimated average length-specific entrainment probabilities for the larval taxa as a function of slot dimension. Tables of entrainment probabilities for larval kelpfishes less than 21 mm (0.83 in), anchovies less than and greater than 19 mm (0.75 in), and silversides less than and greater than 15 mm (0.59 in) follow the tables that present the results based on all the length data for those taxa. It should be noted that the results from the two models for the different size groups of anchovies and silversides are dissimilar at the inflection or transformation lengths due to the different allometric regressions for these taxa.

Extrapolated Population-Level Efficiency

The probabilities in **Appendix B** can be used to assess the effects on population mortality when using a particular screen dimension for reducing the entrainment of larvae. As previously noted in this report, this approach requires the assumptions of linear growth and a constant rate of exponential natural mortality over the short time period that the larvae are vulnerable to entrainment. Using the tabulated probabilities in **Appendix B**, and omitting the size-specific estimates for kelpfishes, anchovies, and silversides, mortality reductions to the population by taxa can be estimated (**Table 4**). The population-level mortality reductions shown in **Table 4** would apply to the total population where the larvae are at a length of 20 or 25 mm (0.79 or 0.98 in) size and no longer vulnerable to entrainment. The average reduction in mortality would need to be adjusted for the composition and size structure of the fish larvae for a specific location and sample year, but otherwise provides an estimate of population-level mortality identical to an adult equivalent model using constant growth and survival rates extrapolated to the size at which the larvae are no longer susceptible to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis).

Table 3. Allometric regression parameter statistics ($y = ax^b$) and standard errors describing the sample composition of each taxon used in the analysis, where x = notochord length (mm). Parameters for California halibut and spotted sand bass from Gisbert et al. (2002), and Pena and Dumas (2009), respectively. All stages (sizes) were used unless noted.

	Y Variable: Head Depth (Height)				Stage	Y Variable: Head Width			
Taxon	a	SE(a)	b	SE(b)		a	SE(a)	b	SE(b)
kelpfishes	0.0541	0.0079	1.2856	0.0533	all	0.0998	0.0091	1.0137	0.0344
	0.1175	0.0132	0.9680	0.0441	≤ 21 mm	0.1492	0.0103	0.8436	0.0274
sculpins	0.1237	0.0178	1.2479	0.0713		0.0877	0.0158	1.3810	0.0881
flatfishes	0.0502	0.0146	1.9182	0.1669		0.0824	0.0125	1.2811	0.0912
monkeyface prickleback	0.1422	0.0214	0.8724	0.0610		0.1199	0.0156	0.8927	0.0529
combtooth blennies	0.1833	0.0160	1.0427	0.0814		0.1777	0.0166	0.9231	0.0884
clingfishes	0.1475	0.0266	1.1139	0.1105		0.1281	0.0293	1.2111	0.1398
anchovies	0.0215	0.0023	1.4524	0.0342	all	0.0776	0.0046	1.0167	0.0195
	0.0964	0.0062	0.8739	0.0247	≤ 19 mm	0.1202	0.0054	0.8461	0.0173
	0.0104	0.0035	1.6831	0.1037	≥ 19 mm	0.0216	0.0054	1.4184	0.0784
croakers	0.2094	0.0129	1.0979	0.0276		0.1894	0.0148	0.9783	0.0356
gobies	0.1100	0.0073	1.0735	0.0258		0.0890	0.0068	1.1123	0.0297
silversides	0.0588	0.0035	1.2880	0.0206	all	0.1006	0.0038	1.0531	0.0135
	0.0908	0.0060	1.0730	0.0280	≤ 15 mm	0.1328	0.0073	0.9219	0.0236
	0.1400	0.0220	1.0089	0.0520	≥ 15 mm	0.1394	0.0171	0.9490	0.0406
Pacific barracuda	0.1216	0.0347	1.5004	0.2581		0.2057	0.0330	0.7505	0.1545
rockfishes	0.1867	0.0359	0.9164	0.1298		0.0936	0.0271	1.1971	0.1929
cabezon	0.1615	0.0417	0.9504	0.1511		0.1085	0.0231	1.1183	0.1240
sea basses	0.1468	0.0094	1.2305	0.0317		0.1516	0.0054	1.0968	0.0184
pricklebacks	0.2809	0.0561	0.5623	0.0839		0.3506	0.0599	0.4534	0.0723
California halibut	0.1310		1.2300		preflexion				
	0.0990		1.5200		postflexion				
spotted sand bass	0.1100		1.4570		preflexion				
	0.3700		0.8180		postflexion				

Table 4. Estimated percentage reductions (two standard errors in parentheses) in mortality (relative to an open intake) to the population surviving past the size where they would be subject to entrainment,[1] based on probabilities of screen entrainment for larvae from 15 taxonomic categories of fishes for six WWS slot widths.

Taxon	Size Range	Percentage Reduction in Mortality by Slot Opening Width [1]					
		0.75 mm	1 mm	2 mm	3 mm	4 mm	6 mm
kelpfishes	2–25 mm	73.3 (2.4)	64.6 (2.4)	24.9 (2.4)	1.4 (0.5)	0.0 (0.0)	0.0 (0.0)
sculpins	2–25 mm	85.9 (2.5)	81.1 (2.4)	64.4 (2.4)	49.7 (2.4)	36.0 (2.4)	14.1 (1.7)
flatfishes	1–25 mm	78.8 (2.3)	72.8 (2.3)	51.5 (2.3)	33.0 (2.2)	18.8 (1.8)	4.6 (0.8)
monkeyface prickleback	3–25 mm	75.7 (2.6)	62.1 (2.5)	12.8 (1.6)	0.5 (0.2)	0.0 (0.0)	0.0 (0.0)
combtooth blenny	2–20 mm	81.9 (3.1)	72.1 (3.1)	32.4 (2.8)	8.4 (1.4)	1.5 (0.4)	0.0 (0.0)
clingfishes	2–20 mm	83.0 (3.1)	75.8 (3.1)	48.8 (3.0)	26.9 (2.5)	13.1 (1.7)	2.6 (0.6)
anchovies	2–25 mm	55.4 (2.3)	45.1 (2.3)	5.5 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
croakers	1–20 mm	81.9 (3.0)	74.9 (3.0)	46.1 (2.9)	17.6 (2.7)	1.7 (0.7)	0.0 (0.0)
gobies	1–25 mm	74.6 (2.3)	66.5 (2.3)	35.7 (2.3)	8.3 (1.7)	0.2 (0.1)	0.0 (0.0)
silversides	2–25 mm	76.0 (2.5)	68.5 (2.5)	34.8 (2.4)	3.0 (1.5)	0.0 (0.0)	0.0 (0.0)
Pacific barracuda	1–20 mm	68.2 (2.9)	53.1 (2.8)	15.8 (1.5)	4.4 (0.6)	1.3 (0.2)	0.1 (0.0)
rockfishes	2–25 mm	77.7 (2.5)	69.7 (2.5)	43.4 (2.2)	22.3 (1.7)	10.6 (1.0)	2.4 (0.4)
cabezon	2–25 mm	79.1 (2.5)	70.1 (2.5)	39.3 (2.1)	20.6 (1.5)	10.6 (1.0)	2.9 (0.4)
sea basses	1–25 mm	84.8 (2.4)	79.6 (2.2)	59.9 (2.4)	41.0 (2.3)	22.7 (2.3)	0.1 (0.1)
pricklebacks	3–25 mm	80.4 (2.6)	58.2 (2.5)	3.9 (0.5)	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)
Average % Reduction		**77.1**	**67.6**	**34.6**	**15.8**	**7.8**	**1.8**

[1] - Extrapolated to the size at which the larvae are no longer susceptible to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis). Not the reduction in adult equivalents.

Estimated Effectiveness at DCPP and SONGS

The results for the individual taxa in **Table 4** were used to estimate reductions in entrainment at DCPP and SONGS, the two nuclear-fueled facilities in California. The results from entrainment studies at the two plants were summarized for the larval fish groups measured for this study to estimate the level of entrainment reduction for six screen slot sizes for each taxon. The results for the two plants are presented in the following sections. The results for both plants are based on the previously stated model with the assumption that the length distribution of entrained larvae for each taxon approximates a standard survival curve using a constant mortality rate.

DCPP

Entrainment sampling at DCPP was conducted from October 1996 through June 1999. Results for the fishes analyzed for this study from two consecutive 12-month periods emphasize the considerable annual variation that can occur in composition and abundance (**Table 5**). The difference between periods was likely attributable to the occurrence of a major El Niño that started developing in late 1997 and extended into 1998, which affected reproduction and larval survival during the 1998 spawning season. The fishes analyzed for this study accounted for approximately 72 and 69 percent, respectively, of the total estimated larvae from the two periods (**Table 5**).

Sculpins were the most abundant fish larvae collected in the July 1997 through June 1998 period, comprising 18.3 percent of the total by concentration, while rockfishes were the most abundant in the July 1998 through June 1999 period, comprising 22.6 percent of the total by concentration. The fishes analyzed for this report comprised 72 and 69 percent of the total by concentration for the two periods, respectively.

Table 5. Abundances of fish larvae collected during entrainment sampling annual entrainment estimates at DCPP for two year long time periods: **July 1997–June 1998** and **July 1998–June 1999** for the fishes analyzed for this report. The annual entrainment estimates were based on actual plant cooling water flow volumes during those periods.

	1997–1998			1998–1999		
Common Name	**Average Concentration (# / 1,000 m³)**	**Percent of Total Concentration**	**Total Annual Entrainment Estimate**	**Average Concentration (# / 1,000 m³)**	**Percent of Total Concentration**	**Total Annual Entrainment Estimate**
sculpins	80.57	18.3%	281,090,063	55.17	18.9%	276,345,912
rockfishes	65.27	14.8%	216,878,458	66.06	22.6%	374,596,029
kelpfishes	36.88	8.4%	121,977,076	23.36	8.0%	90,774,143
monkeyface prickleback	32.61	7.4%	118,960,221	24.30	8.3%	127,721,405
northern anchovy	31.02	7.0%	106,375,289	1.27	0.4%	3,209,133
gobies	22.45	5.1%	77,134,182	6.77	2.3%	22,413,173
croakers	18.03	4.1%	67,033,233	4.89	1.7%	21,431,357
flatfishes	12.11	2.8%	45,128,059	5.22	1.8%	19,245,735
pricklebacks	9.52	2.2%	35,579,099	5.76	2.0%	33,382,111
cabezon	3.90	0.9%	14,707,340	1.83	0.6%	9,189,686
clingfishes	0.28	0.1%	989,753	1.13	0.4%	4,728,863
combtooth blennies	2.03	0.5%	7,154,897	4.43	1.5%	10,673,514
silversides	0.18	0.0%	482,917	0.08	0.0%	97,072
sea basses	0.02	0.0%	64,552	0.00	0.0%	-
Subtotal	**314.87**	**71.6%**	**1,093,555,139**	**200.24**	**68.6%**	**993,808,134**
Other Taxa (54 and 40)	125.19		422,730,243	91.86		292,431,756
Total	**440.06**		**1,516,285,382**	**292.10**		**1,286,239,890**

Length measurements for several of the most abundant taxa of fish larvae were recorded during the DCPP studies. The data for several of the taxa were combined across taxonomic categories to match the taxa groups analyzed for this study. For example, the data for flatfishes combine length measurements on species and generic groupings of sanddabs with California halibut, English sole, and family-level groups such as Pleuronectidae, and the data for rockfishes are combined across species and species groupings that are distinguished based on larval morphology. The summary of the data shows that for all of the taxa except anchovies, almost all of the larvae (99th percentile) were much smaller than the range of lengths shown in Appendix Tables B1–B20 (**Table 6**). For example, the largest rockfish and cabezon larvae measured were only 10.2 (0.40 in) and 8.4 mm (0.33 in), respectively. The length frequency distribution of the larvae for these taxa show that for sculpins, rockfishes, cabezon, and flatfishes, over 90% of the larvae were 6 mm (0.24 in) or less (**Table 7**).

The estimated percentage of larvae from each length category (**Table 7**) were used to calculate the entrainment for each length category and the resulting reduction in entrainment based on the probabilities of entrainment provided for those seven taxa in Appendix B. The resulting estimates of entrainment for the two periods across the length categories for each taxa provided in **Table 7** are presented in **Table 8**. The results show that based on the number of larvae excluded across all length categories there would be very little reduction in entrainment for all but the smallest slot width relative to the total estimated entrainment for the two periods.

Whereas the estimated entrainment reductions in **Table 8** assume that all larvae contribute equally to the population, the estimated population-level reductions in entrainment mortality in **Table 4** assume that the screen is effective across all length classes up to the maximum lengths of 20 or 25 mm (0.79 or 0.98 in) used in the analysis. Neither of these analyses takes into account that the length frequency data from DCPP show that some fishes are not subject to entrainment at larger sizes (**Table 7**). As a result, the most reasonable approach is to adjust the effective population-level reductions for the six slot openings based on the length range of the larvae (**Table 9**) providing estimates of reductions by slot width that are larger than the estimates in **Table 8**, but less than the estimates in **Table 4**. The results show very little benefit of screen or slot openings larger than 2 mm (0.08 in) for these fishes.

Table 6. Summary of length measurements for seven taxa of larval fishes collected during entrainment sampling at DCPP from October 1996 through June 1999. Length measurements from fishes collected in entrainment samples. Only fishes up to 25 mm (0.98 in) length included in analysis.

Taxon	N	Mean Length (mm)	Standard Deviation	Upper 95% Confidence Interval (mm)	Minimum Length (mm)	Maximum Length (mm)	Median Length (mm)	99th Percentile Length (mm)
sculpins	10,173	3.5	0.7	3.5	1.6	11.8	3.3	6.1
rockfishes	13,105	4.1	0.5	4.1	1.7	10.2	4.1	5.3
kelpfishes	7,331	6.4	1.7	6.4	2.4	23.4	6.0	12.0
monkeyface prickleback	5,909	7.3	1.2	7.4	2.8	24.6	7.0	12.0
anchovies	2,527	6.0	4.9	6.1	1.6	25.4	3.7	23.4
cabezon	1,537	4.8	0.5	4.8	2.3	8.4	4.7	6.1
flatfishes	394	3.0	1.3	3.1	1.3	8.0	2.7	7.7

Table 7. Distribution of length measurements by number and percentage (in parentheses) for seven taxa of larval fishes collected during entrainment sampling at DCPP from October 1996 through June 1999. Only fishes up to 25 mm (0.98 in) length included in analysis.

Length (mm)	sculpins	rockfishes	kelpfishes	monkeyface prickleback	anchovies	cabezon	flatfishes
1	-	-	-	-	-	-	4 (1.0%)
2	128 (1.3%)	13 (0.1%)	1 (0.0%)	-	97 (3.8%)	1 (0.1%)	124 (31.5%)
3	6,134 (60.3%)	1,085 (8.3%)	7 (0.1%)	3 (0.1%)	914 (36.2%)	5 (0.3%)	204 (51.8%)
4	2,993 (29.4%)	10,101 (77.1%)	285 (3.9%)	5 (0.1%)	665 (26.3%)	394 (25.6%)	26 (6.6%)
5	692 (6.8%)	1,791 (13.7%)	1,938 (26.4%)	27 (0.5%)	162 (6.4%)	946 (61.5%)	6 (1.5%)
6	164 (1.6%)	91 (0.7%)	2,332 (31.8%)	591 (10.0%)	53 (2.1%)	188 (12.2%)	6 (1.5%)
7	40 (0.4%)	21 (0.2%)	1,499 (20.4%)	3,560 (60.2%)	38 (1.5%)	2 (0.1%)	17 (4.3%)
8	16 (0.2%)	1 (0.0%)	664 (9.1%)	1,056 (17.9%)	56 (2.2%)	1 (0.1%)	7 (1.8%)
9	5 (0.0%)	1 (0.0%)	307 (4.2%)	352 (6.0%)	73 (2.9%)	-	-
10	-	1 (0.0%)	125 (1.7%)	150 (2.5%)	69 (2.7%)	-	-
11	-	-	72 (1.0%)	76 (1.3%)	66 (2.6%)	-	-
12	1 (0.0%)	-	40 (0.5%)	48 (0.8%)	53 (2.1%)	-	-
13	-	-	13 (0.2%)	20 (0.3%)	37 (1.5%)	-	-
14	-	-	17 (0.2%)	10 (0.2%)	29 (1.1%)	-	-
15	-	-	2 (0.0%)	5 (0.1%)	27 (1.1%)	-	-
16	-	-	2 (0.0%)	4 (0.1%)	31 (1.2%)	-	-
17	-	-	4 (0.1%)	1 (0.0%)	27 (1.1%)	-	-
18	-	-	-	-	21 (0.8%)	-	-
19	-	-	5 (0.1%)	-	19 (0.8%)	-	-
20	-	-	6 (0.1%)	-	23 (0.9%)	-	-
21	-	-	5 (0.1%)	-	18 (0.7%)	-	-
22	-	-	6 (0.1%)	-	12 (0.5%)	-	-
23	-	-	1 (0.0%)	-	12 (0.5%)	-	-
24	-	-	-	-	12 (0.5%)	-	-
25	-	-	-	1 (0.0%)	13 (0.5%)	-	-
Totals	**10,173 (100%)**	**13,105 (100%)**	**7,331 (100%)**	**5,909 (100%)**	**2,527 (100%)**	**1,537 (100%)**	**394 (100%)**

Table 8. Estimated total entrainment for seven taxonomic categories of fishes at DCPP for two year-long time periods: **July 1997–June 1998** and **July 1998–June 1999,** and estimated entrainment and percentage reductions in entrainment for six WWS slot widths.

Taxon	Year	Annual Entrainment Estimate	Entrainment with 0.75 mm Slot	Entrainment with 1.0 mm Slot	Entrainment with 2.0 mm Slot	Entrainment with 3.0 mm Slot	Entrainment with 4.0 mm Slot	Entrainment with 6.0 mm Slot
sculpins	97-98	281,090,063	250,963,525	272,928,200	280,905,488	281,077,740	281,088,820	281,090,063
	98-99	276,345,912	246,727,840	268,321,802	276,164,452	276,333,797	276,344,690	276,345,912
	Percent Reduction		**10.7**	**2.9**	**0.1**	**<0.1**	**<0.1**	**0.0**
rockfishes	97-98	216,878,458	184,049,464	207,640,578	216,852,906	216,877,448	216,878,392	216,878,458
	98-99	374,596,029	317,893,252	358,640,210	374,551,895	374,594,285	374,595,915	374,596,029
	Percent Reduction		**15.1**	**4.3**	**<0.1**	**<0.1**	**<0.1**	**0.1**
kelpfishes	97-98	121,977,076	99,498,869	116,388,842	121,704,903	121,972,683	121,977,076	121,977,076
	98-99	90,774,143	74,046,082	86,615,434	90,571,594	90,770,874	90,774,143	90,774,143
	Percent Reduction		**18.4**	**4.6**	**0.2**	**<0.1**	**0.0**	**0.0**
monkeyface prickleback	97-98	118,960,221	75,512,079	112,810,990	118,940,270	118,959,255	118,960,201	118,960,221
	98-99	127,721,405	81,073,394	121,119,296	127,699,985	127,720,367	127,721,383	127,721,405
	Percent Reduction		**36.5**	**5.2**	**<0.1**	**<0.1**	**<0.1**	**0.0**
anchovies	97-98	106,375,289	92,329,457	96,839,651	105,639,334	106,375,289	106,375,289	106,375,289
	98-99	3,209,133	2,785,398	2,921,462	3,186,931	3,209,133	3,209,133	3,209,133
	Percent Reduction		**13.2**	**9.0**	**0.7**	**0.0**	**0.0**	**0.0**
cabezon	97-98	14,707,340	10,576,147	13,674,113	14,705,082	14,707,330	14,707,340	14,707,340
	98-99	9,189,686	6,608,365	8,544,088	9,188,275	9,189,680	9,189,686	9,189,686
	Percent Reduction		**28.1**	**7.0**	**<0.1**	**<0.1**	**0.0**	**0.0**
flatfishes	97-98	45,128,059	42,009,412	43,464,849	45,114,887	45,128,059	45,128,059	45,128,059
	98-99	19,245,735	17,915,728	18,536,427	19,240,118	19,245,735	19,245,735	19,245,735
	Percent Reduction		**6.9**	**3.7**	**<0.1**	**0.0**	**0.0**	**0.0**
Average Percent Reduction in Entrainment			**18.4**	**5.2**	**0.2**	**<0.1**	**<0.1**	**0.0**

Table 9. Estimated percentage reductions (standard errors in parentheses) in mortality (relative to an open intake) to the population surviving past the size where they would be subject to entrainment,[1] based on probabilities of screen entrainment for larvae from seven taxonomic categories of fishes measured during DCPP entrainment studies conducted October 1996 through June 1999. Mortality adjusted from estimates in **Table 4** based on length range of larvae measured from the studies, except for anchovies.

	Percentage Reduction in Mortality by Slot Opening Width [1]					
Taxon	**0.75 mm**	**1 mm**	**2 mm**	**3 mm**	**4 mm**	**6 mm**
sculpins	69.2 (5.4)	58.7 (5.3)	24.3 (4.6)	5.5 (2.2)	0.5 (0.4)	0.0 (0.0)
rockfishes	46.2 (5.7)	32.0 (5.0)	5.2 (1.7)	0.5 (0.2)	0.0 (0.0)	0.0 (0.0)
kelpfishes	72.1 (2.5)	63.0 (2.5)	21.8 (2.4)	0.8 (0.3)	0.0 (0.0)	0.0 (0.0)
monkeyface prickleback [2]	62.8 (3.9)	42.2 (3.8)	0.9 (0.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
anchovies *	55.4 (2.3)	45.1 (2.3)	5.5 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
cabezon	36.3 (7.2)	19.0 (5.5)	0.6 (0.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
flatfishes	34.1 (7.1)	17.7 (6.0)	0.2 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Average % Reduction	**53.7**	**39.7**	**8.4**	**1.0**	**0.1**	**0.0**

[1] - Extrapolated to the size at which the larvae are no longer susceptible to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis). Not the reduction in adult equivalents.

[2] - 25 mm monkeyface prickleback in Table 7 not included as the length distribution shows the data point as an outlier.

* - percentage reductions are the same as the values in Table 4.

SONGS

Entrainment sampling at SONGS occurred approximately monthly from March 2006 through April 2007. Although entrainment sampling was also done inside the plant, the results presented here were from samples collected at a location in the vicinity of the offshore intake. The taxa that were measured for length and head capsule dimensions comprised over 83 percent of the total larvae collected from the offshore entrainment station (**Table 9**). Anchovies were the most abundant fish larvae collected, comprising over 65 percent of the total. The estimated percentage reductions for the six mesh or slot openings from **Table 4** provide the best estimates of screen effectiveness at SONGS due to the absence of extensive data on the lengths of larvae entrained.

Table 9. Concentrations of fish larvae collected during entrainment sampling at SONGS for the period from March 2006 through April 2007 for the fishes analyzed for this report.

Common Name	Entrainment Concentration (#/1,000 m^3)	Percent of Total
anchovies	1,285.37	65.4
croakers	157.70	8.0
combtooth blenny	108.78	5.5
flatfishes	23.26	1.2
Pacific barracuda	22.05	1.1
sea basses	15.68	0.8
silversides	11.32	0.6
kelpfishes	9.98	0.5
gobies	3.74	0.2
clingfishes	0.67	0.0
sculpins	0.45	0.0
Total for analyzed taxa	**1,638.80**	**83.4**
Minimum of 27 other taxa	243.73	16.6
Total	**1,882.53**	**100.0**

Conclusions

The results from the head capsule analysis indicate that mesh or slot openings larger than about 3 mm (0.12 in) will result in very little reduction in population-level mortality, especially for fishes that have been entrained in large numbers in southern California such as anchovies, croakers, and gobies. The results also show that the performance of screens will vary by location and also between years due to differences in the composition of entrained larvae and changes to their abundances and proportions over time. For example, due to the generally smaller size of the larvae entrained at DCPP, there is very little reduction in entrainment for any mesh or slot openings larger than about 1 mm (0.04 in). Overall, the methodology presented provides an initial means to evaluate, based on the morphology of the larvae, the potential for screen technologies to reduce larval fish entrainment through exclusion.

The data on the length distribution of larvae for the most abundant fishes collected at DCPP provide insight that would apply to any assessment of the potential effectiveness of screening technology. The results showed that the assumption that the screen would be effective across all length classes up to the maximum lengths of 20 or 25 mm (0.79 or 0.98 in), which was used in calculating the estimated population-level reductions in entrainment mortality presented in **Table 4,** was not valid for some of the most abundant fishes collected during entrainment sampling. The absence of larger larvae for those fishes in the entrainment sampling was likely due to behavioral differences among species that likely occur following transformation of the larvae when they begin taking on adult morphological characteristics and, as a result, develop increased swimming abilities that allow them to better avoid entrainment. Evidence from Beldade et al. (2006) showing that only small larvae occurred at the surface while the whole range of sizes was present at the bottom supports the role of behavior and indicates that larvae for some fishes may be completing the entire pelagic phase near the adult habitat. Although it is tempting to generalize regarding behaviors of nearshore rocky reef fishes that result in the larvae moving to the bottom at early stages of development to avoid transport long distances away from their natal habitat, kelpfishes, which are part of the rocky reef fish assemblage were entrained across a large range of sizes, while flatfishes, which are associated with soft bottom habitat, had a length frequency distribution similar overall to the rocky reef fish assemblage. Screening technologies using only smaller slot sizes would be effective at reducing entrainment for these fishes, but a shorter time of susceptibility likely results in very low population level effects of entrainment as larger larvae that have a disproportionately greater contribution to population sustainability appear to have low risk of entrainment.

The low numbers of larger larvae for some fishes would need to be taken into account during the design of any further pilot studies to determine the effectiveness of screening technologies at reducing entrainment. Studies would need to collect an adequate number of samples to account for the expected small numbers of large larvae. Such analysis as applicable should also focus on specific size classes as recommended by Weisberg et al. (1987). In testing of WWS with slot sizes of 1, 2, and 3 mm, Weisberg et al. (1987) were unable to detect any reductions in entrainment for smaller fish eggs and larvae, but did detect significant reductions for larger larvae. Even though the concentrations of the larger larvae were very low in that study, the analysis was able to detect statistically significant differences, which was a least partially due to the large differences in abundance between the open and screened intakes for the larger larvae.

The assessment presented in this report has several limitations, and should be considered in that context. The results from this study do not attempt to account for the potential effects of field flow (currents) around specific WWS module designs, which may increase the effectiveness of offshore screen modules at reducing larval entrainment. Additionally, the viability of larvae initially impinged on inshore fine mesh screens and then released to the source water body was not evaluated. Larval survival following impingement will be highly variable depending on the screen type and fish return systems employed, as well as the types of organisms susceptible to entrainment at a given location. The results presented would also not be directly applicable to fine mesh screens using square mesh configurations due to differences in larval head dimensions, specifically variation in head width versus depth. The smallest dimension (width or depth) of the head capsule is a reasonable approach for estimating the minimum sizes of larvae that could be entrained through a rectangular mesh or WWS slot opening. The dimensions of the head capsule, as well as the overall length and body shape, are all likely to contribute to the size of fish larvae that could be entrained through screens with square mesh openings. Therefore, the results of this study are best applied to WWS or fine mesh screens with rectangular openings.

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Appendix A

Regression Plots from Intake Screening Technology Support Studies: Morphology of Larval Fish Head Capsules (Tenera 2011)

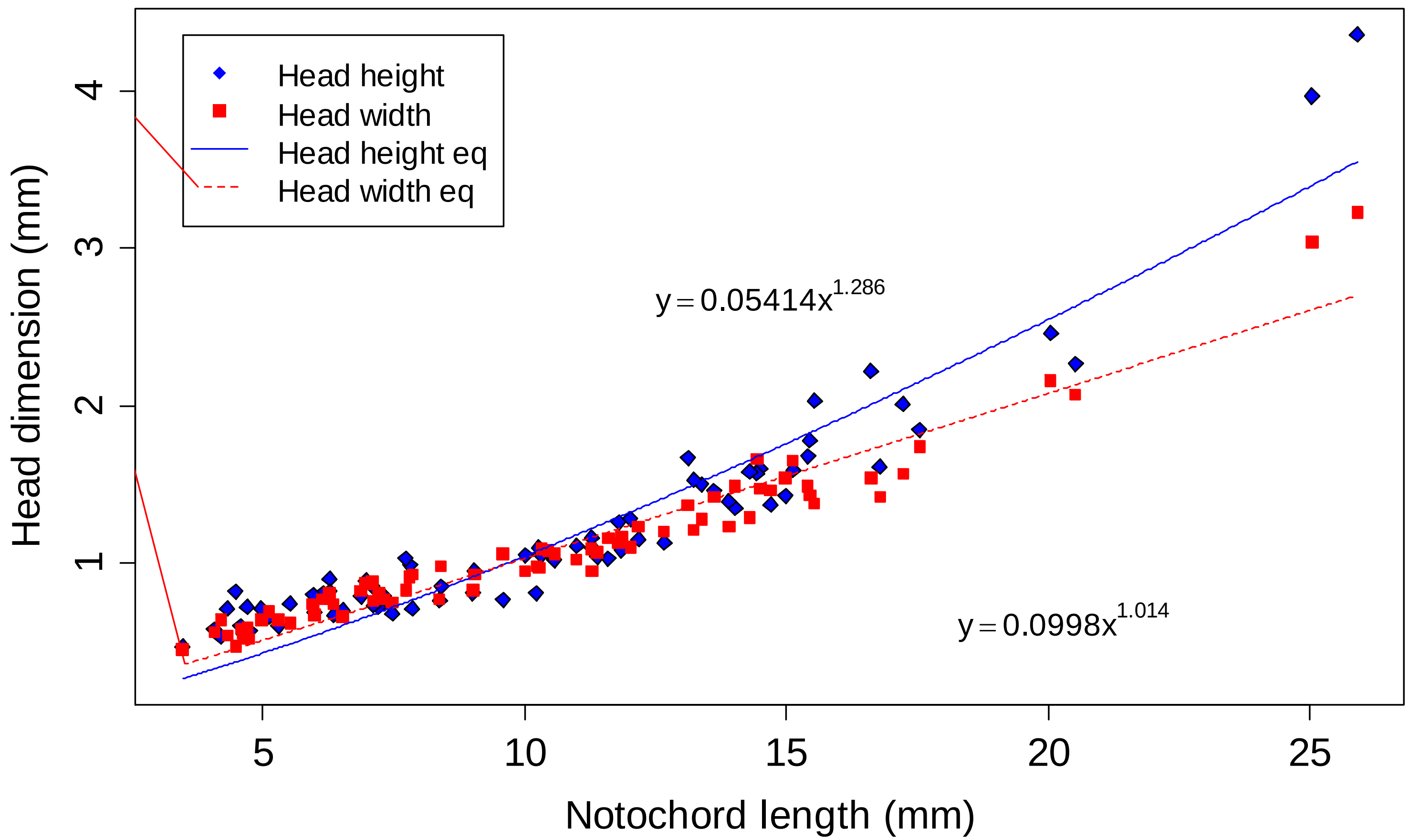

Figure A1. Kelpfishes (*Gibbonsia* spp.) allometric regression plots.

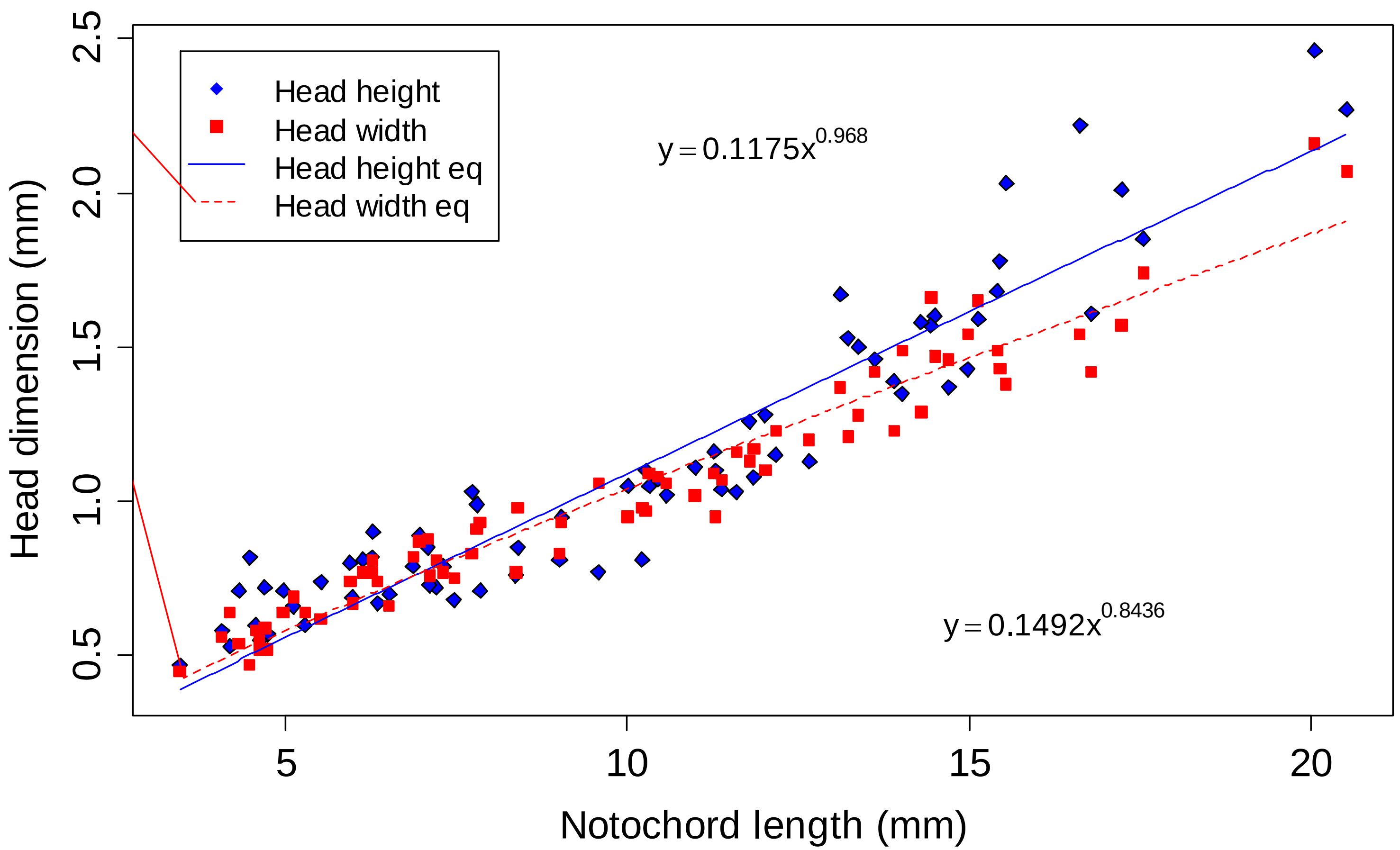

Figure A2. Kelpfishes (*Gibbonsia* spp.) allometric regression plots for fish less than or equal to 21 mm notochord length.

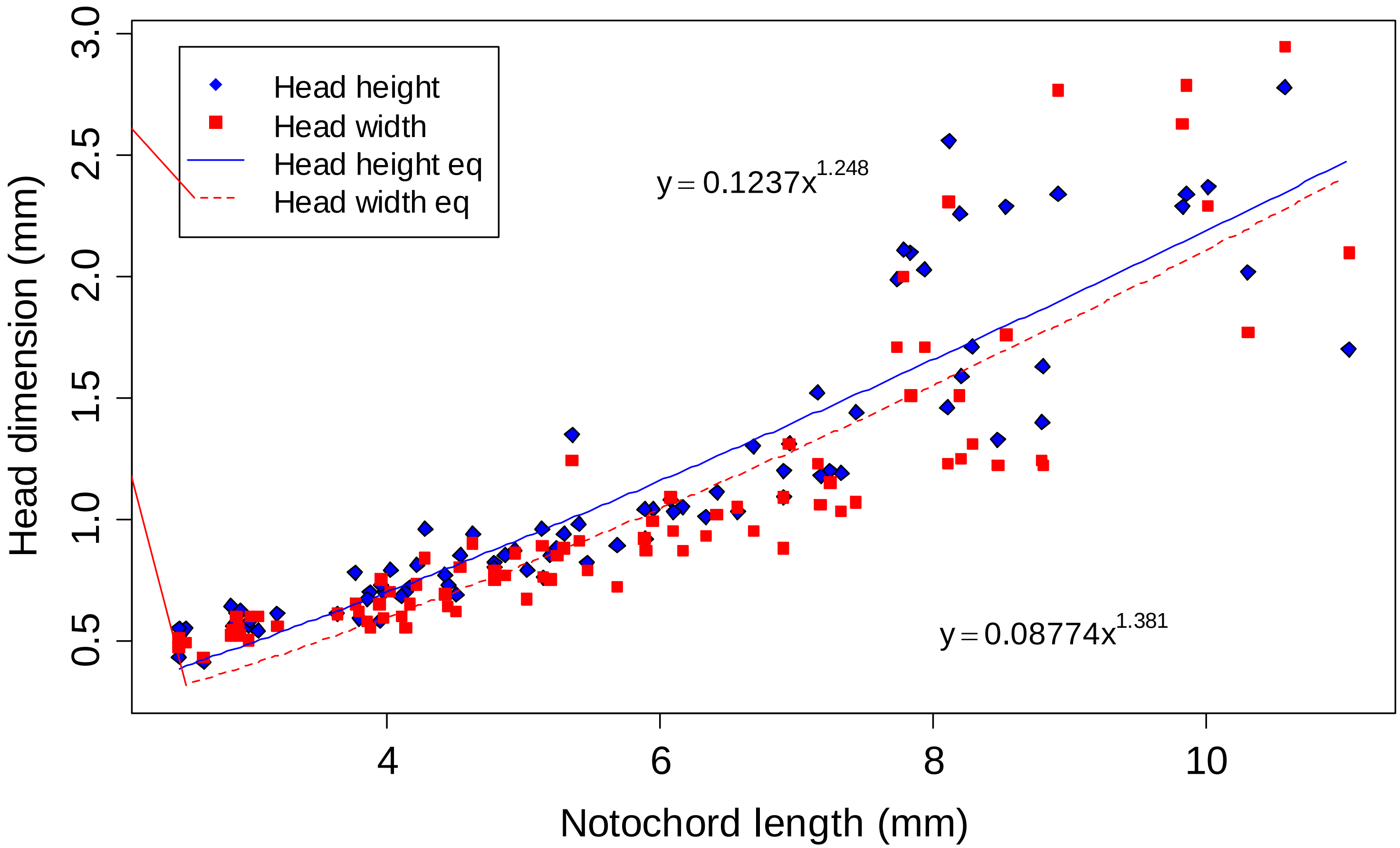

Figure A3. Sculpins (Cottidae) allometric regression plots.

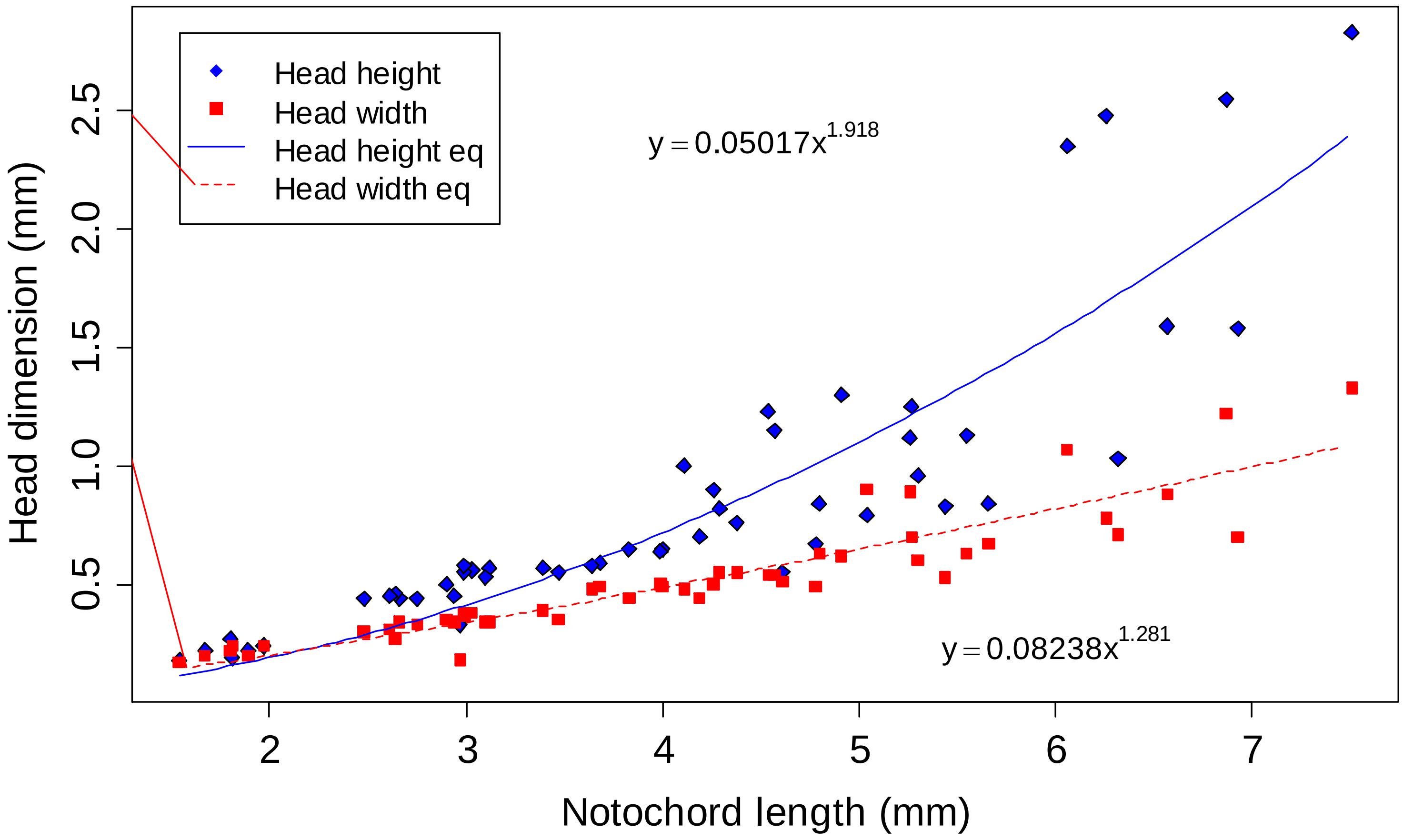

Figure A4. Flatfishes (Pleuronectiformes) allometric regression plots.

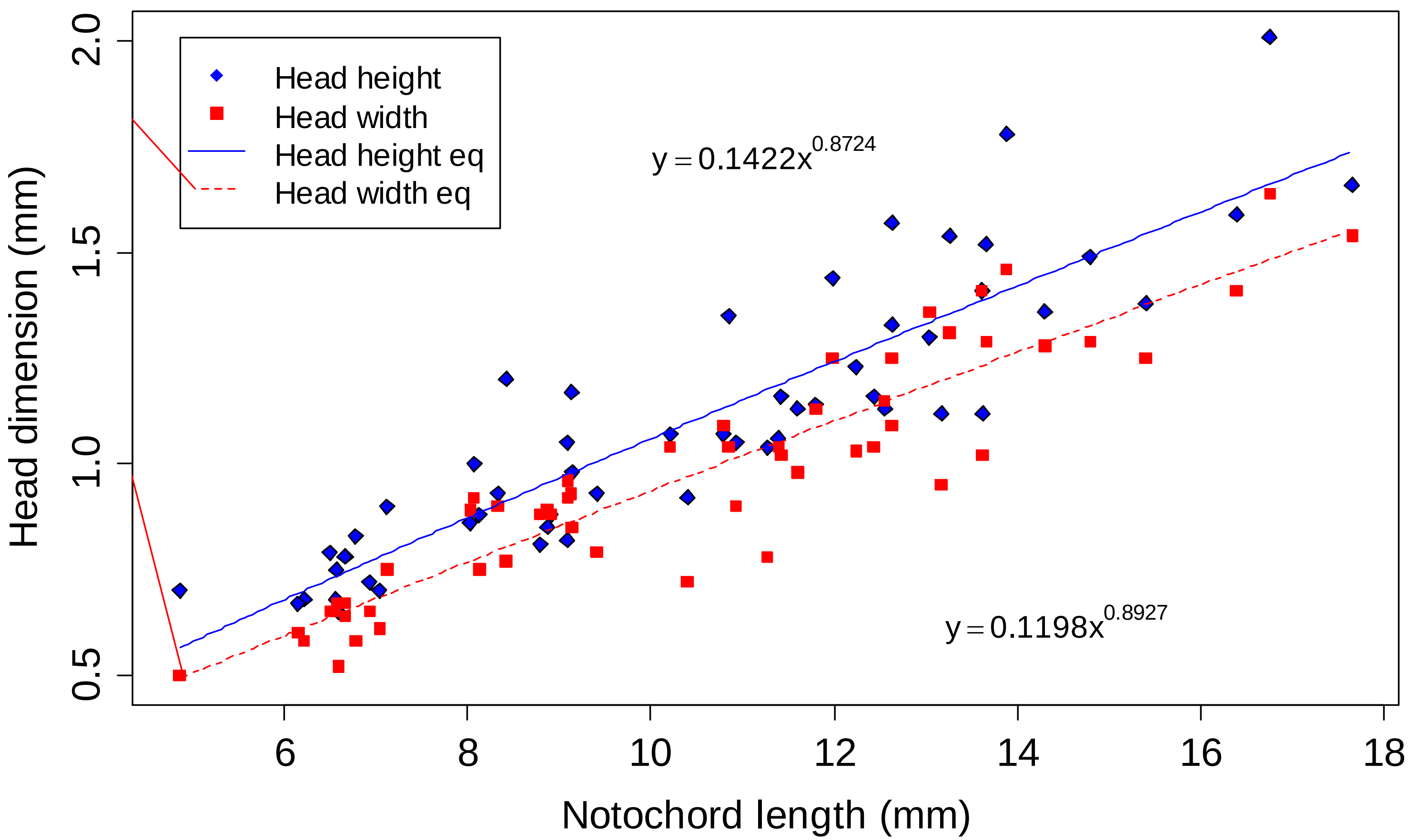

Figure A5. Monkeyface prickleback (*Cebidichthys violaceus*) allometric regression plots.

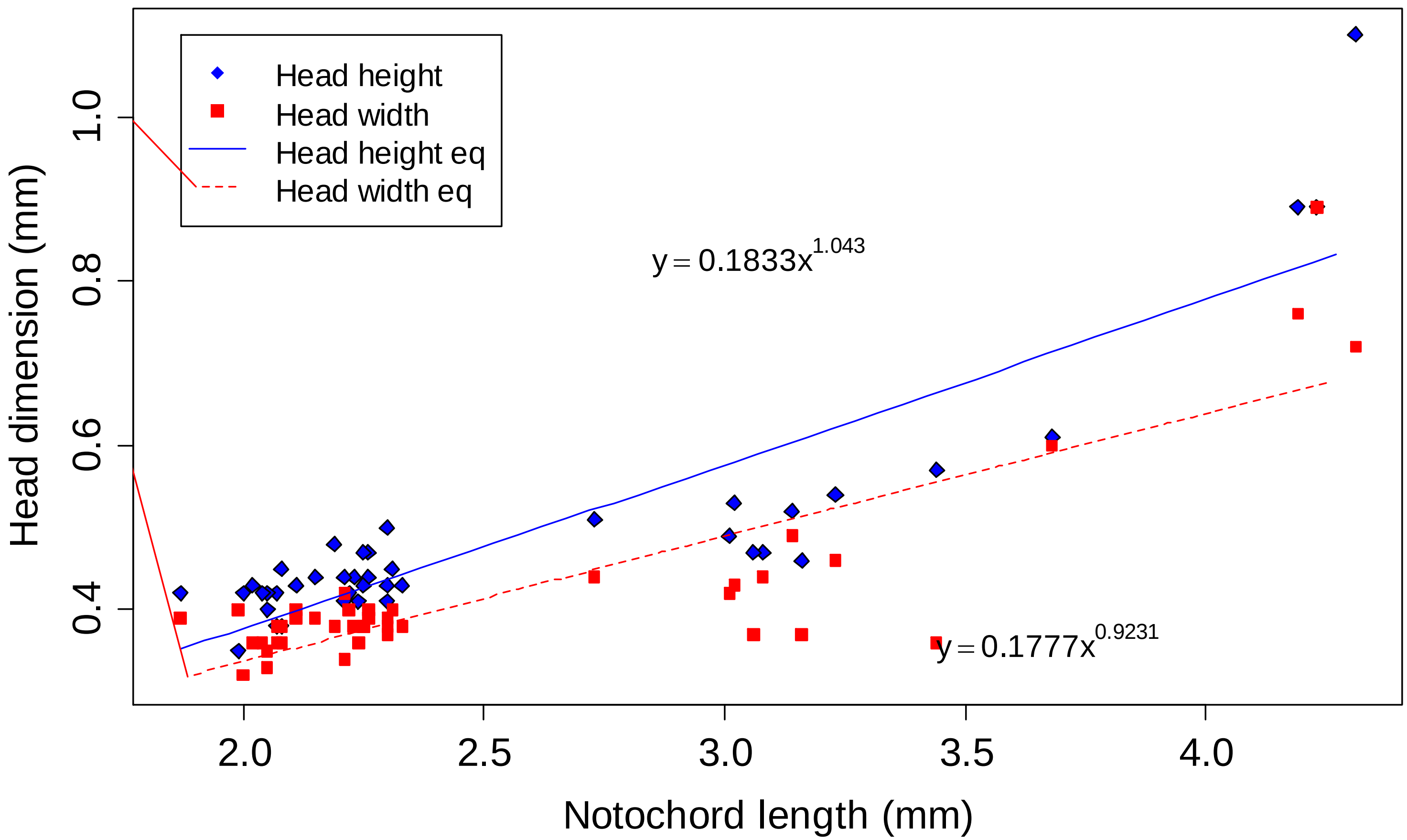

Figure A6. Combtooth blennies (*Hypsoblennius* spp.) allometric regression plots.

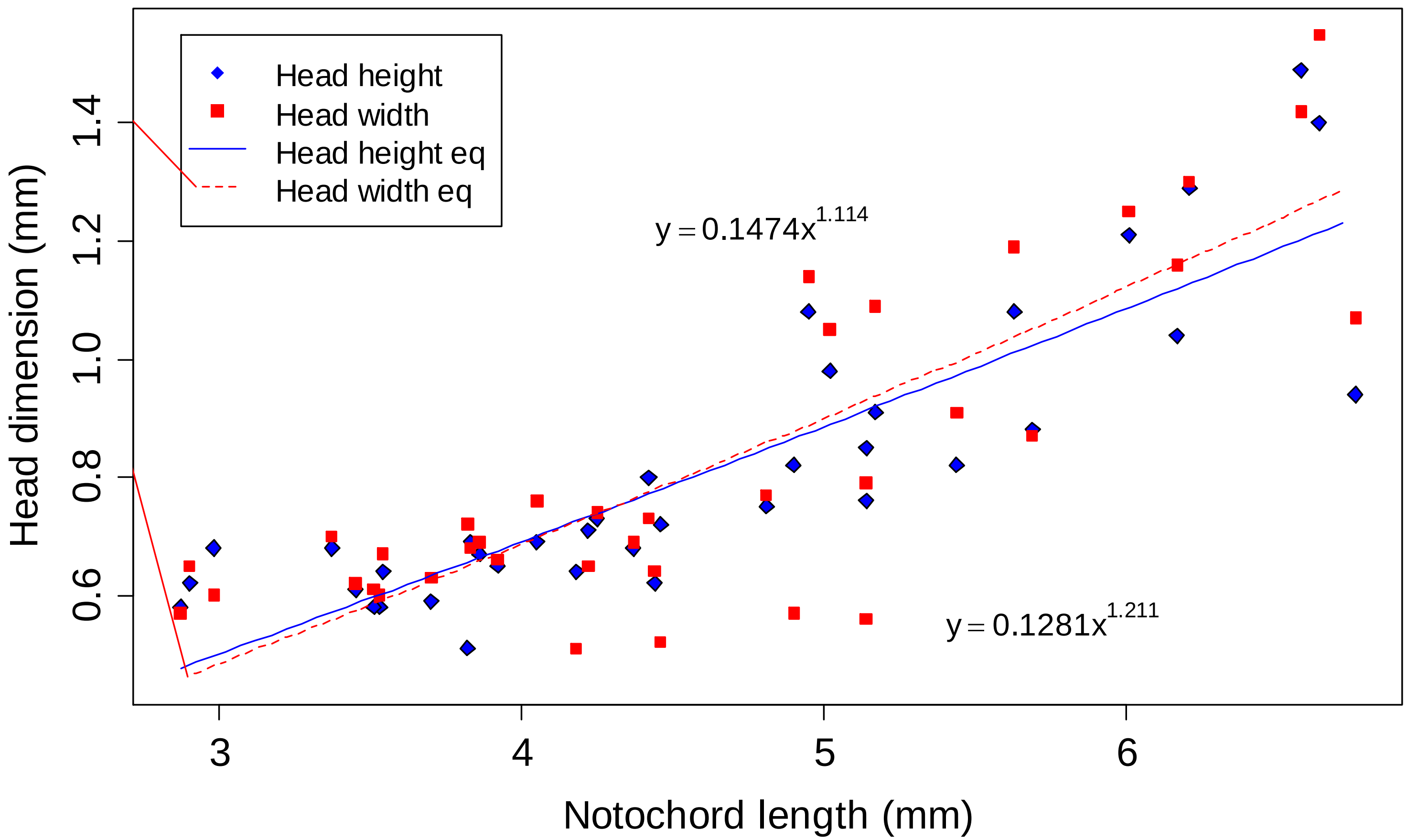

Figure A7. Clingfishes (*Gobiesox* spp.) allometric regression plots.

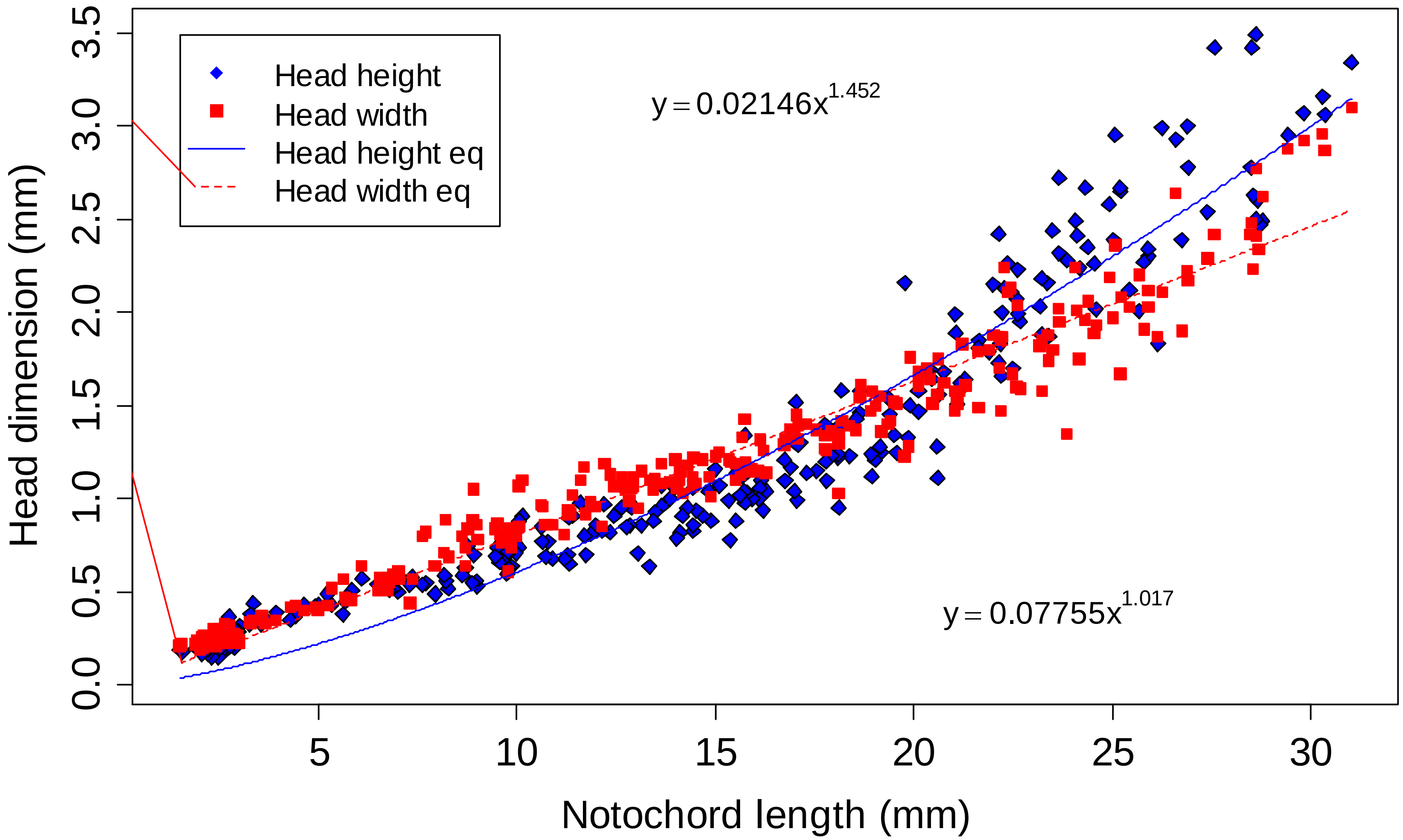

Figure A8. Anchovies (Engraulidae and *Engraulis mordax*) allometric regression plots.

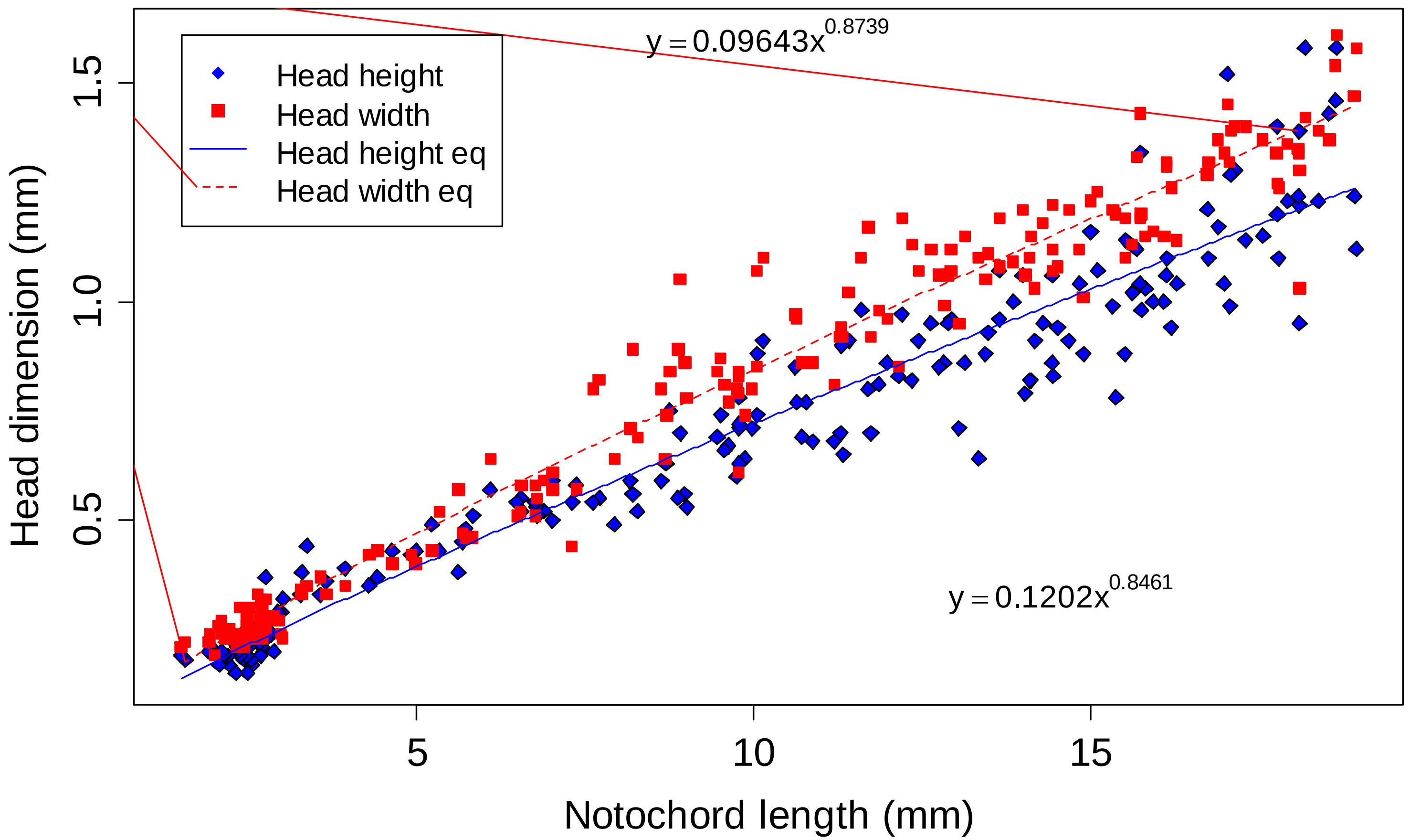

Figure A9. Anchovies (Engraulidae and *Engraulis mordax*) allometric regression plots for fish less than or equal to 19 mm notochord length.

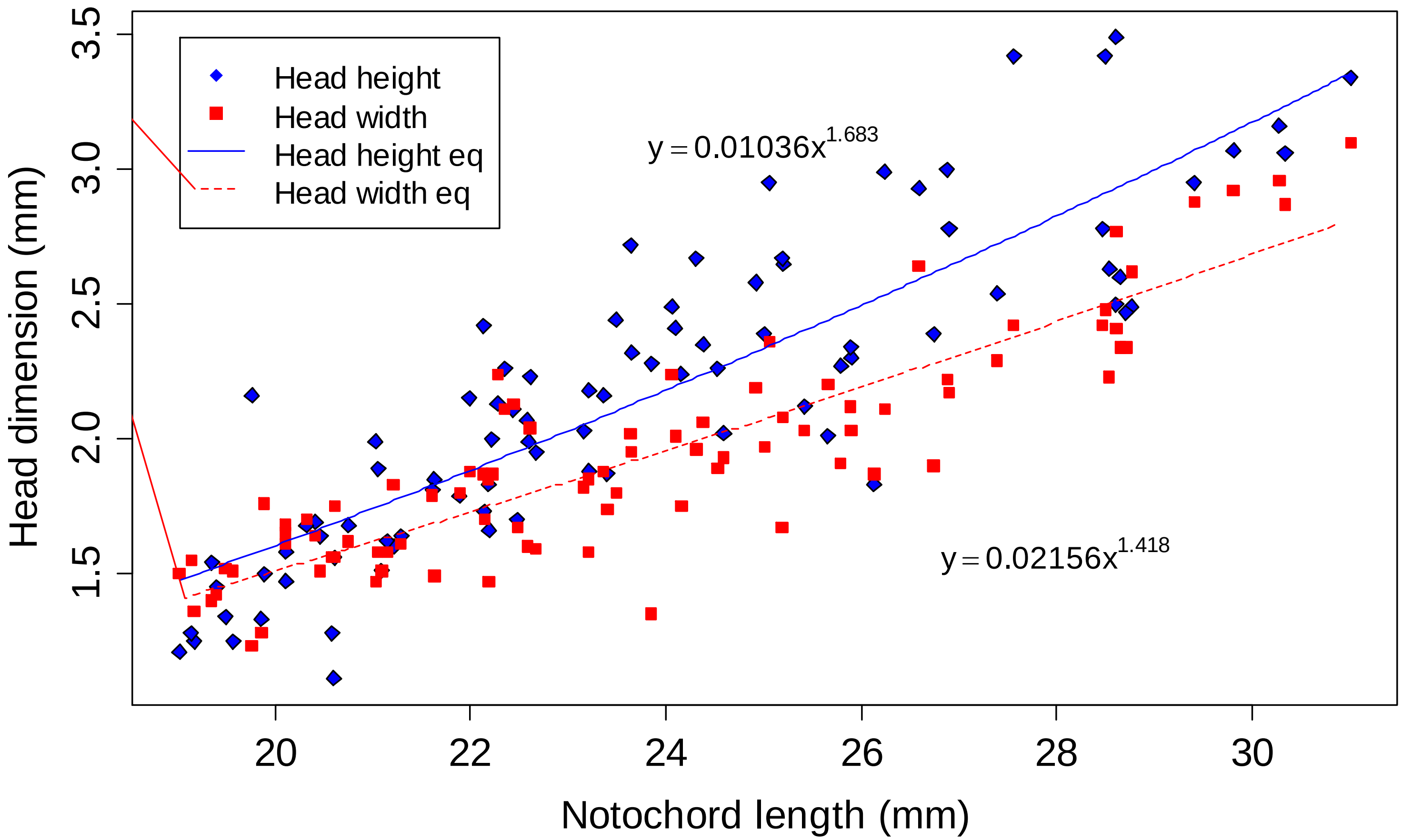

Figure A10. Anchovies (Engraulidae and *Engraulis mordax*) allometric regression plots for fish equal to or larger than 19 mm notochord length.

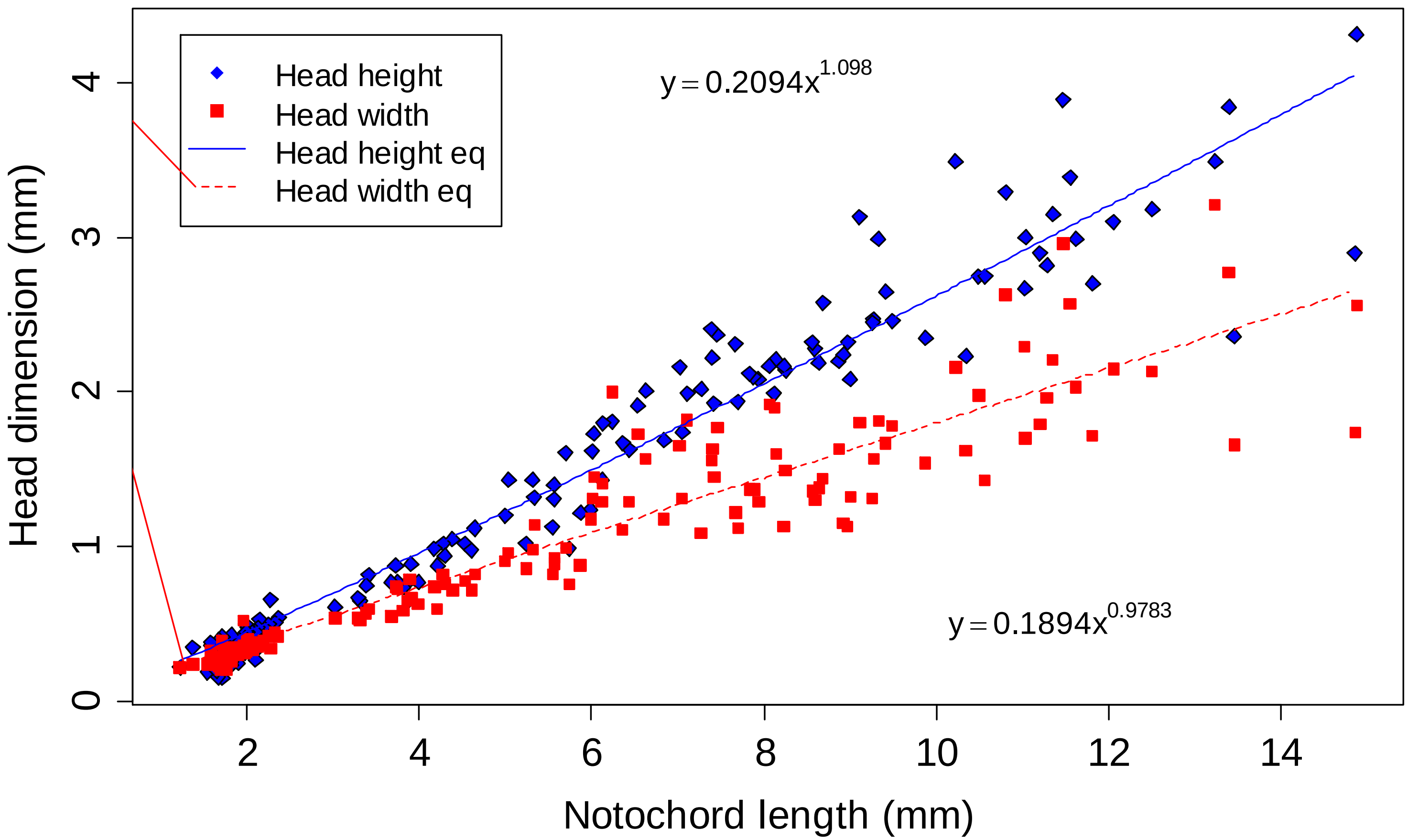

Figure A11. Croakers (*Seriphus politus* and *Genyonemus lineatus*) allometric regression plots.

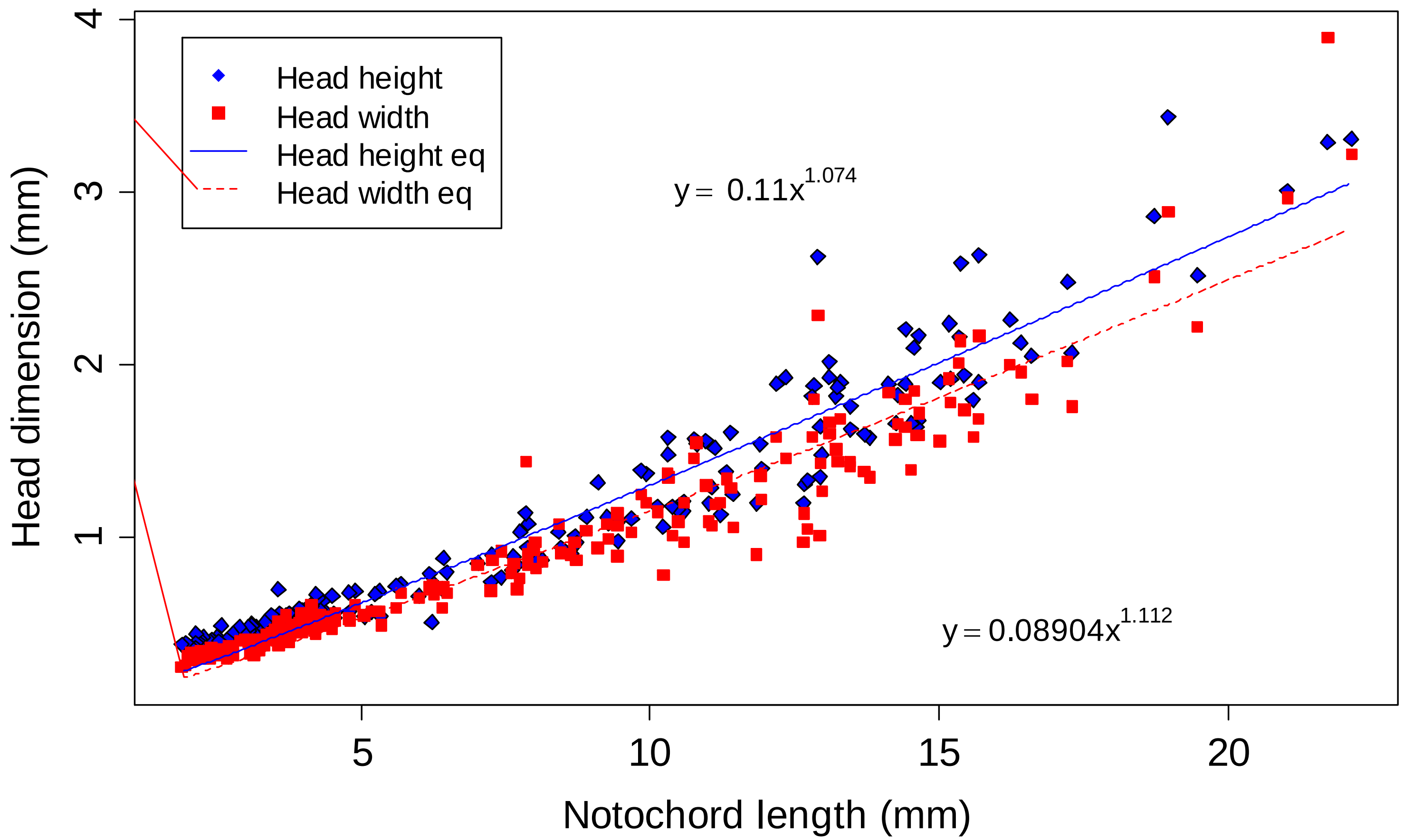

Figure A12. Gobies (*Acanthogobius flavimanus*, *Lepidogobius lepidus* and CIQ [*Clevelandia*, *Ilypnus*, *Quietula]* goby complex) allometric regression plots.

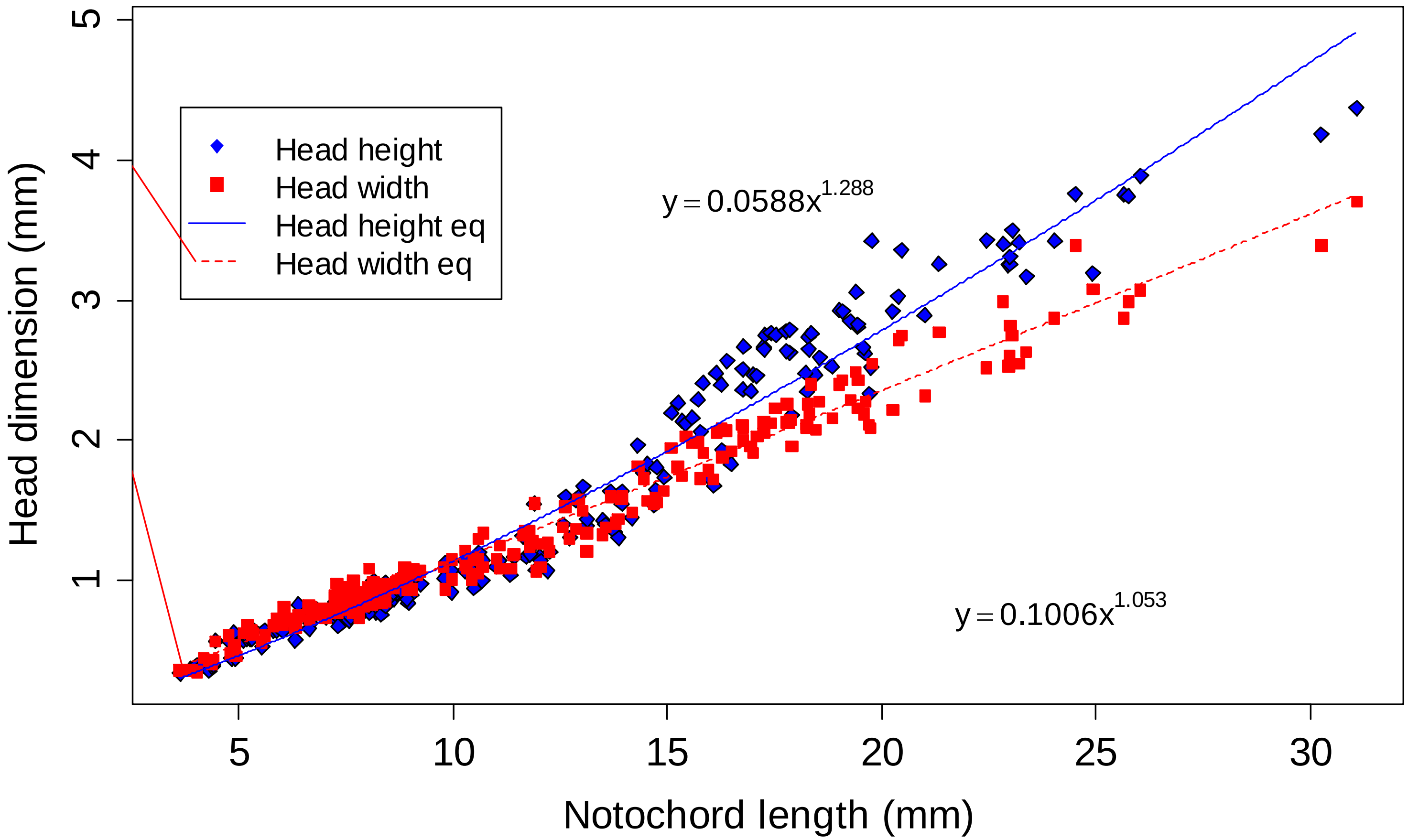

Figure A13. Silversides (Atherinopsidae, *Atherinopsis californiensis*, *Atherinops affinis*, and *Leuresthes tenuis*) allometric regression plots.

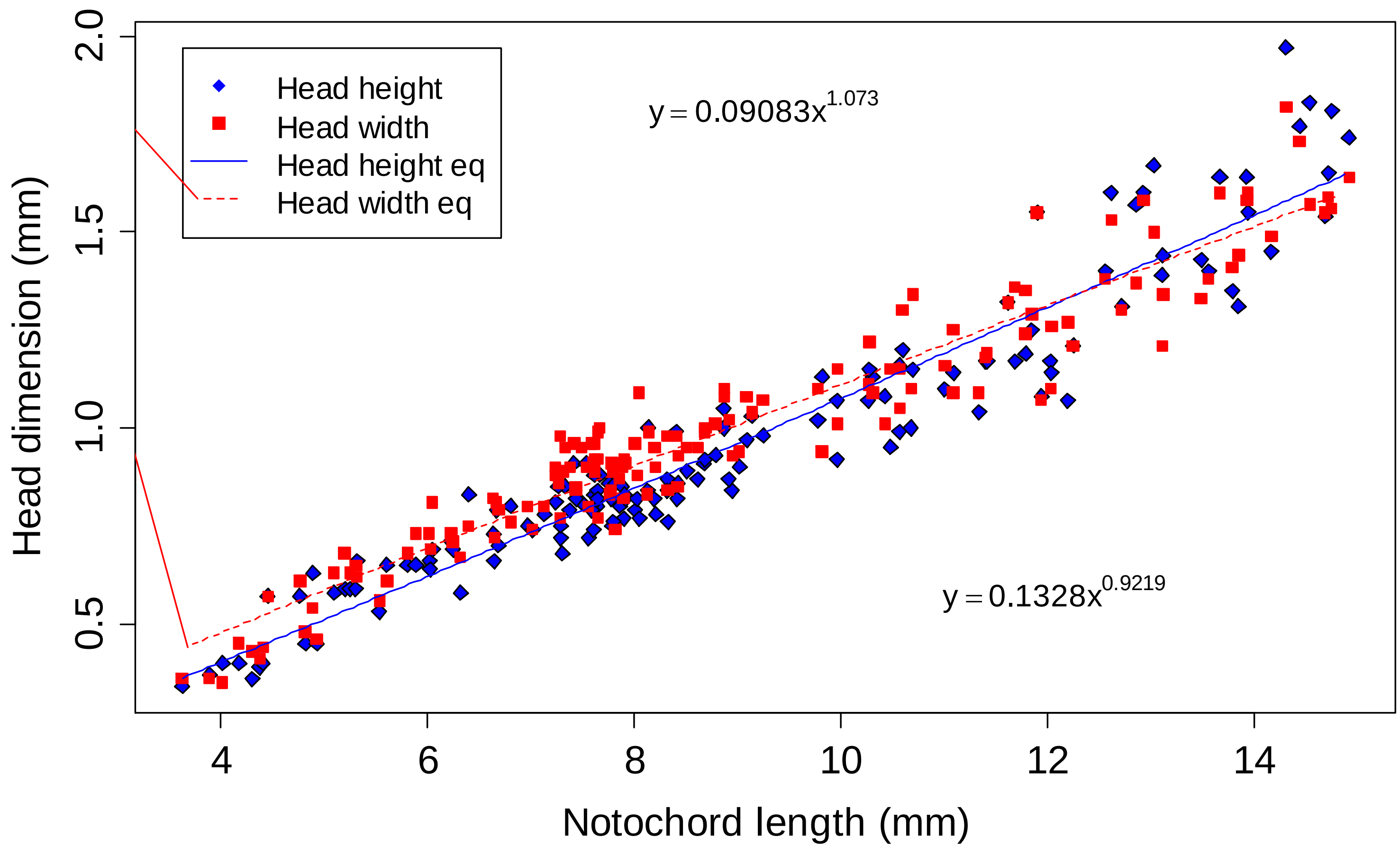

Figure A14. Silversides (Atherinopsidae, *Atherinopsis californiensis*, *Atherinops affinis*, and *Leuresthes tenuis*) allometric regression plots for fish smaller than 15 mm notochord length.

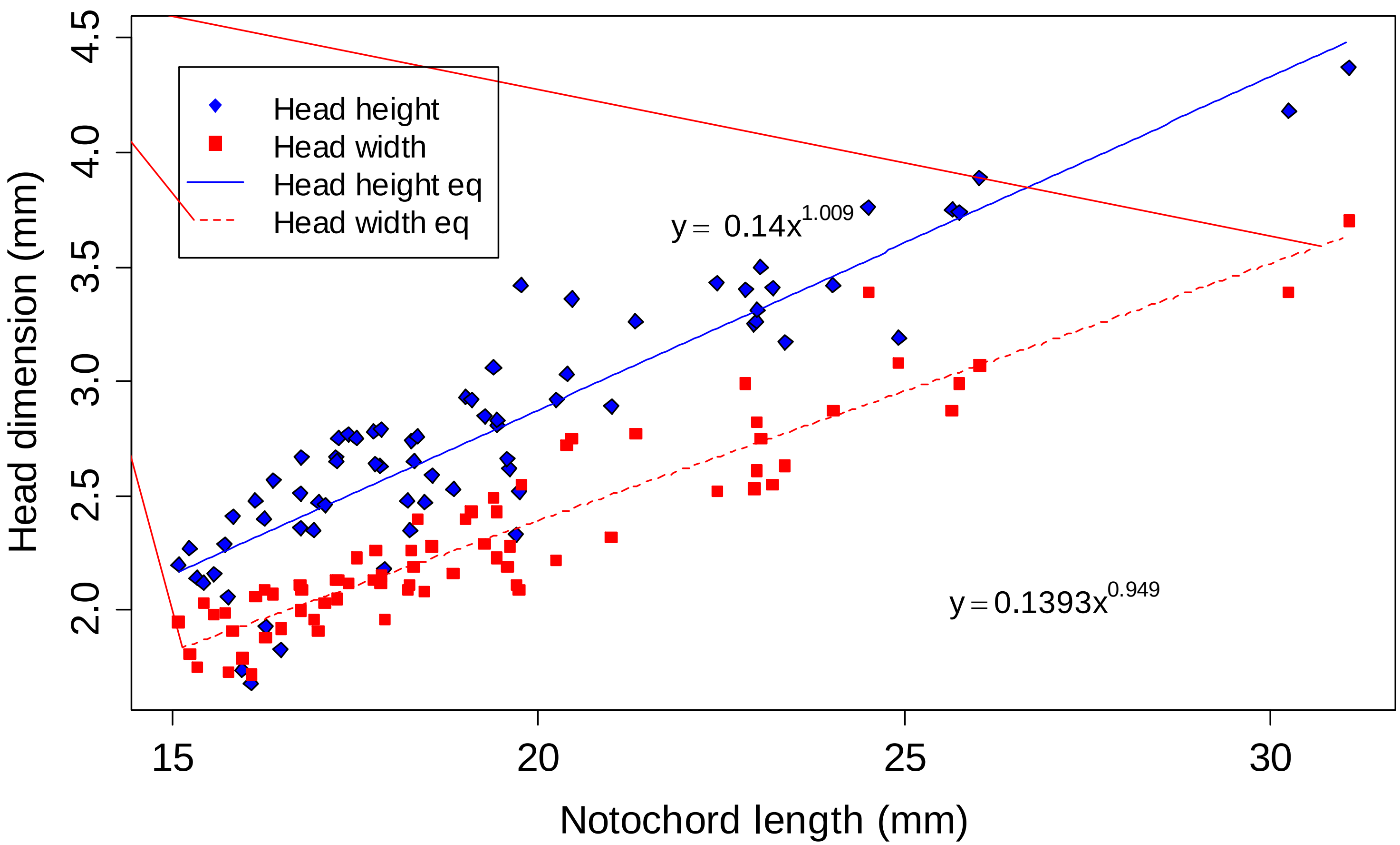

Figure A15. Silversides (Atherinopsidae, *Atherinopsis californiensis*, *Atherinops affinis*, and *Leuresthes tenuis*) allometric regression plots for fish larger than 15 mm notochord length.

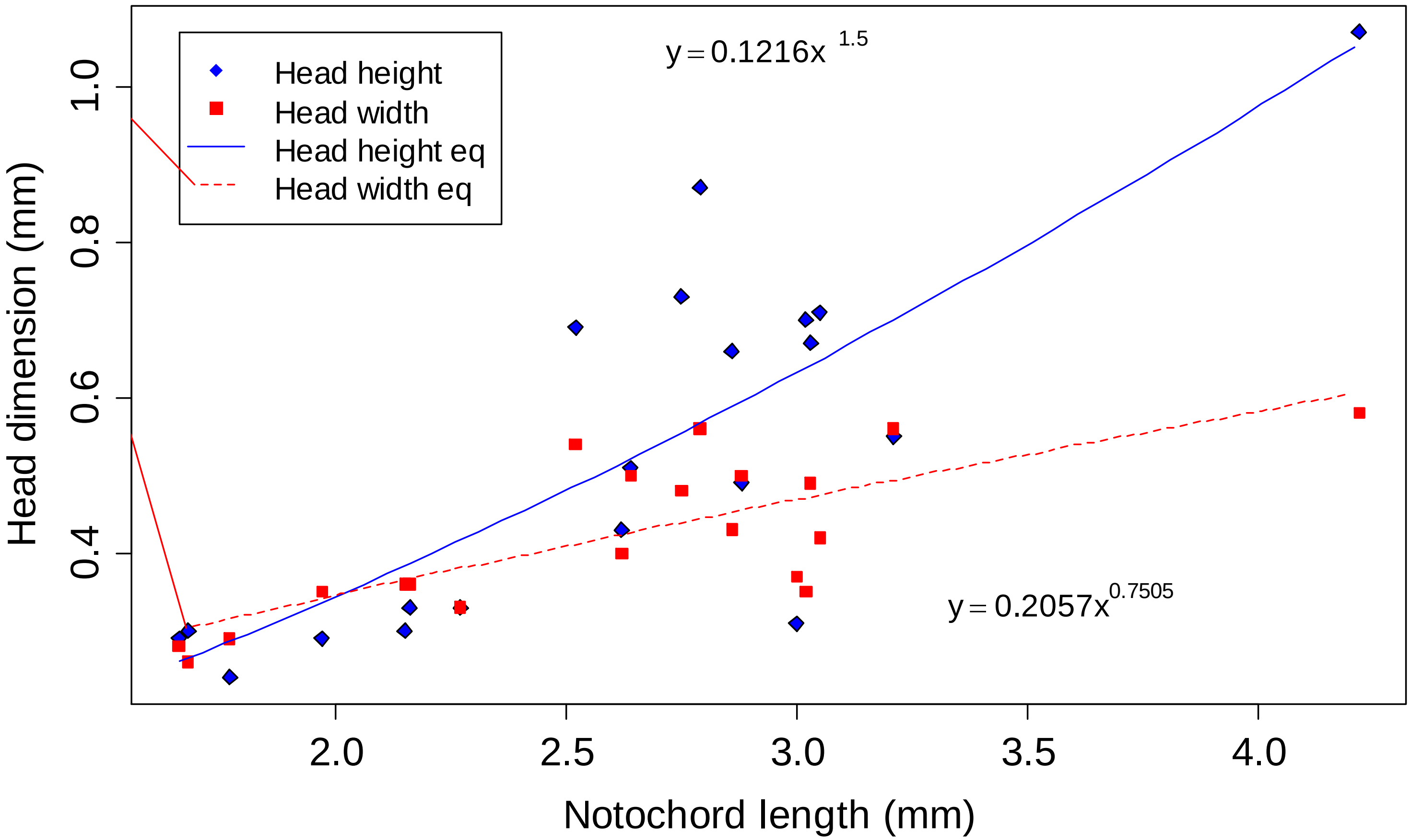

Figure A16. Pacific barracuda (*Sphyraena argentea*) allometric regression plots.

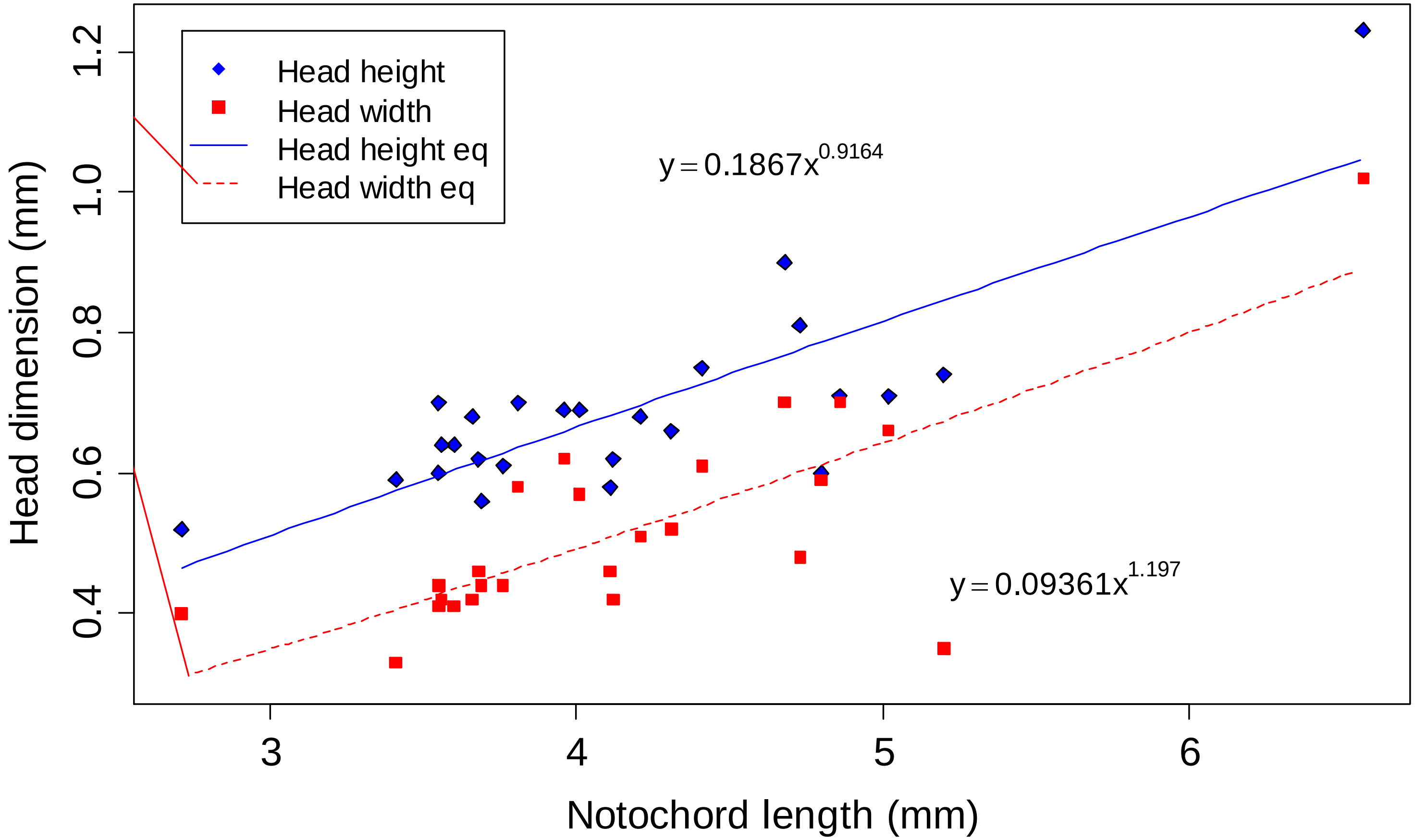

Figure A17. Rockfishes (*Sebastes* spp.) allometric regression plots.

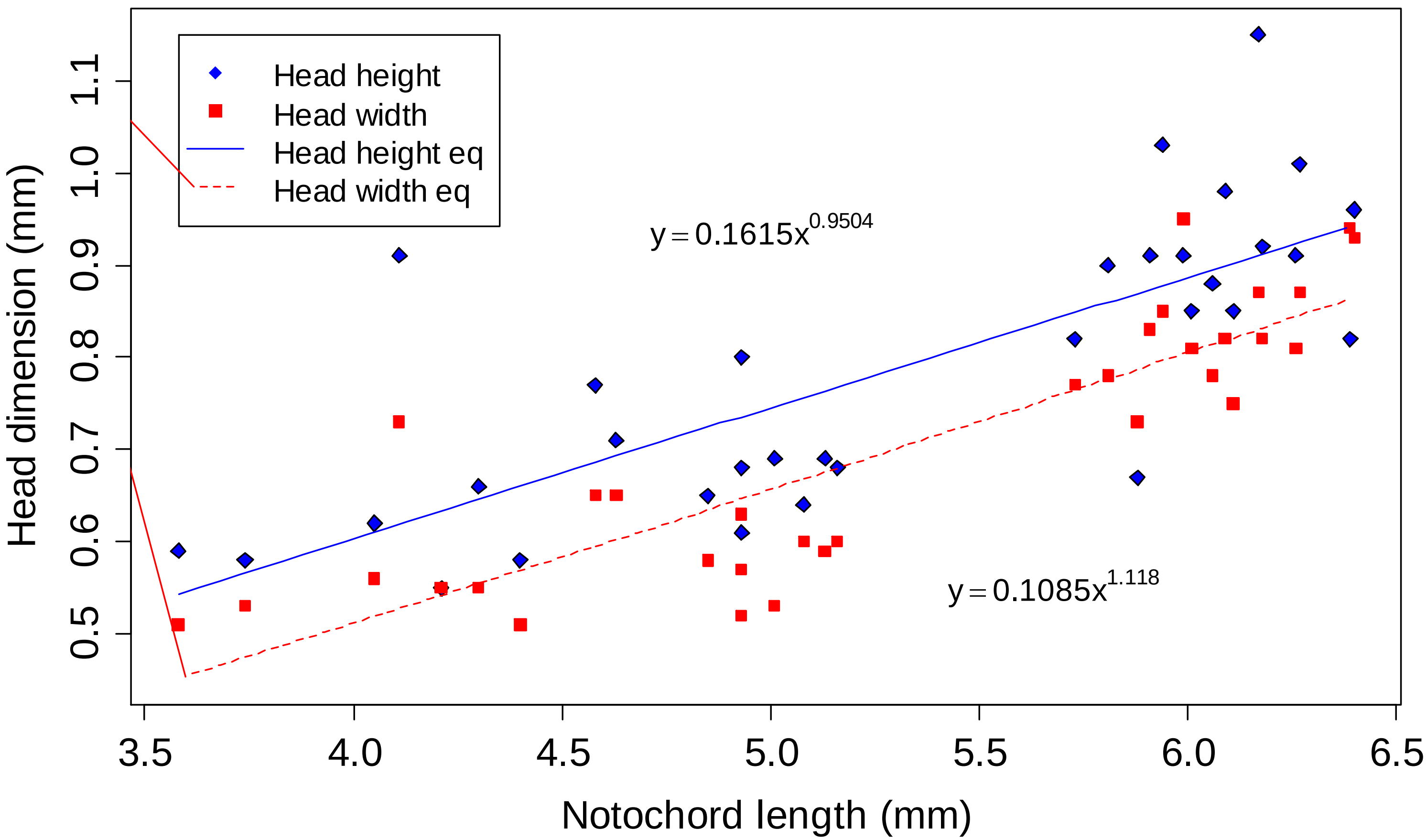

Figure A18. Cabezon (*Scorpaenichthys marmoratus*) allometric regression plots.

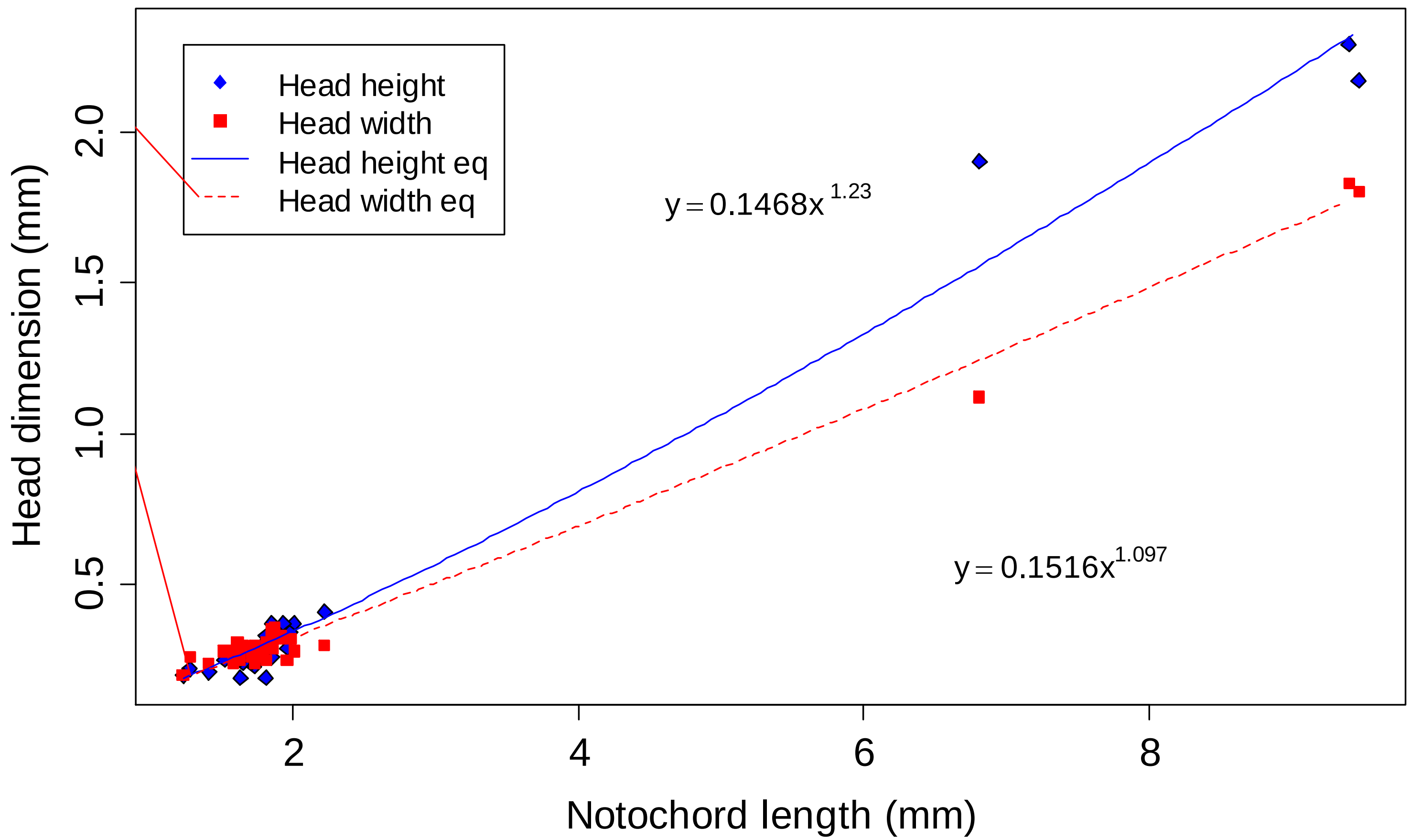

Figure A19. Sea basses (*Paralabrax* spp.) allometric regression plots.

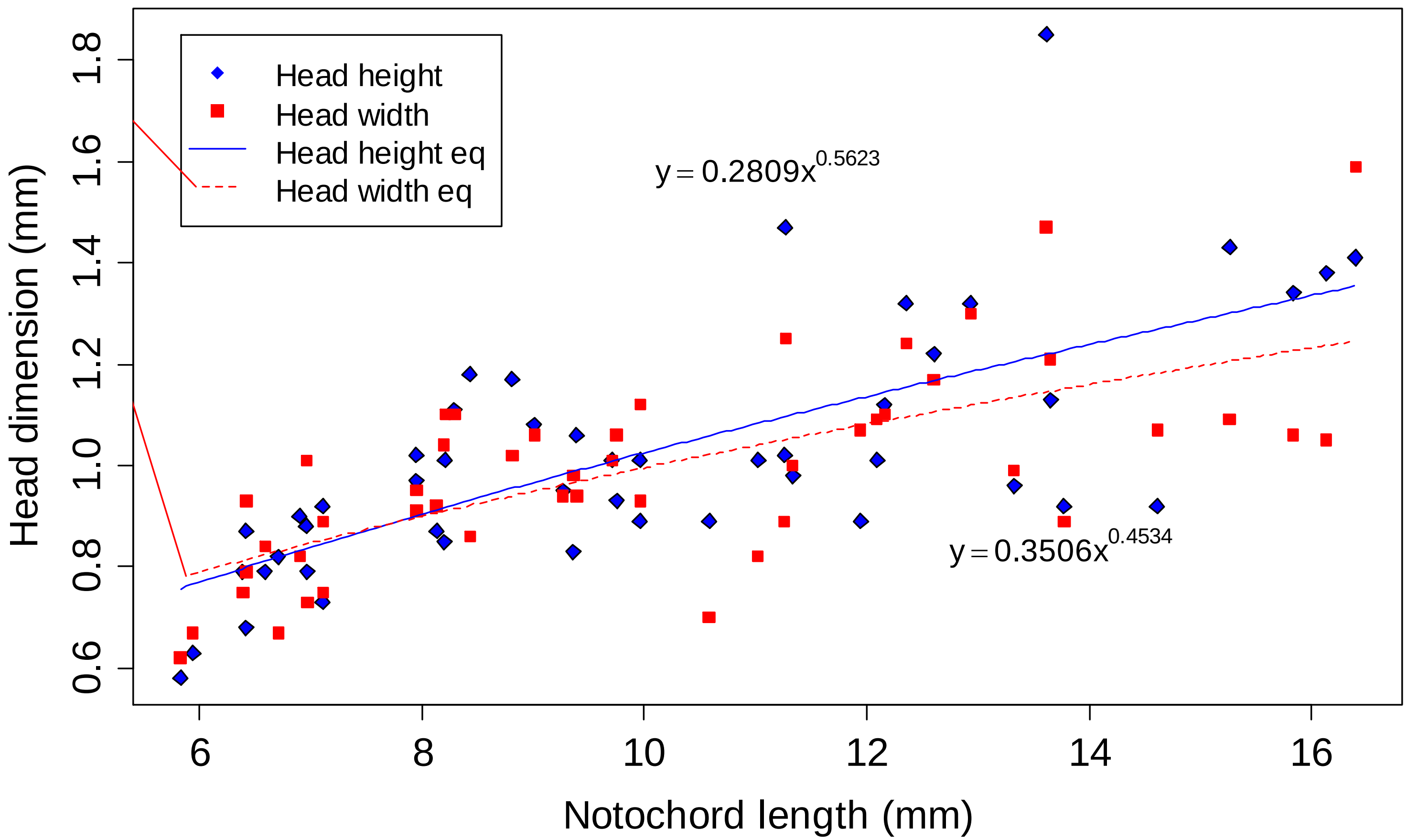

Figure A20. Pricklebacks (Stichaeidae) allometric regression plots.

Appendix B

Estimated Proportions and Standard Errors of Larval Fish Taxa Entrained Through Various Screen Slot Openings Based on Head Capsule Allometric Regressions on Notochord Lengths

Table B1. Estimated proportions (standard error) of **kelpfish** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.970 (0.026)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.766 (0.091)	0.998 (0.002)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.418 (0.092)	0.954 (0.030)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.171 (0.049)	0.747 (0.087)	1 (0)	1 (0)	1 (0)	1 (0)
10	0.057 (0.019)	0.426 (0.081)	1 (0)	1 (0)	1 (0)	1 (0)
11	0.018 (0.006)	0.213 (0.046)	1 (0)	1 (0)	1 (0)	1 (0)
12	0.006 (0.002)	0.098 (0.024)	1 (0)	1 (0)	1 (0)	1 (0)
13	0.002 (0.001)	0.041 (0.010)	0.999 (<.001)	1 (0)	1 (0)	1 (0)
14	0.001 (<.001)	0.017 (0.004)	0.995 (0.003)	1 (0)	1 (0)	1 (0)
15	0 (0)	0.007 (0.002)	0.976 (0.009)	1 (0)	1 (0)	1 (0)
16	0 (0)	0.003 (0.001)	0.927 (0.021)	1 (0)	1 (0)	1 (0)
17	0 (0)	0.001 (<.001)	0.831 (0.034)	1 (0)	1 (0)	1 (0)
18	0 (0)	0.001 (<.001)	0.698 (0.043)	1 (0)	1 (0)	1 (0)
19	0 (0)	0 (0)	0.543 (0.046)	0.999 (<.001)	1 (0)	1 (0)
20	0 (0)	0 (0)	0.397 (0.040)	0.997 (0.001)	1 (0)	1 (0)
21	0 (0)	0 (0)	0.271 (0.032)	0.991 (0.003)	1 (0)	1 (0)
22	0 (0)	0 (0)	0.175 (0.023)	0.976 (0.006)	1 (0)	1 (0)
23	0 (0)	0 (0)	0.108 (0.016)	0.948 (0.011)	1 (0)	1 (0)
24	0 (0)	0 (0)	0.065 (0.010)	0.905 (0.015)	1 (0)	1 (0)
25	0 (0)	0 (0)	0.037 (0.006)	0.842 (0.021)	0.999 (<.001)	1 (0)

Table B2. Estimated proportions (standard error) of **kelpfish** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **less than or equal to 21 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.998 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.875 (0.093)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.431 (0.116)	0.998 (0.002)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.155 (0.053)	0.946 (0.037)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.045 (0.017)	0.708 (0.100)	1 (0)	1 (0)	1 (0)	1 (0)
10	0.012 (0.005)	0.351 (0.094)	1 (0)	1 (0)	1 (0)	1 (0)
11	0.003 (0.001)	0.136 (0.033)	1 (0)	1 (0)	1 (0)	1 (0)
12	0.001 (<.001)	0.058 (0.015)	1 (0)	1 (0)	1 (0)	1 (0)
13	0 (0)	0.022 (0.006)	1 (0)	1 (0)	1 (0)	1 (0)
14	0 (0)	0.009 (0.002)	1 (0)	1 (0)	1 (0)	1 (0)
15	0 (0)	0.003 (0.001)	0.999 (<.001)	1 (0)	1 (0)	1 (0)
16	0 (0)	0.001 (<.001)	0.994 (0.003)	1 (0)	1 (0)	1 (0)
17	0 (0)	0.001 (<.001)	0.977 (0.008)	1 (0)	1 (0)	1 (0)
18	0 (0)	0 (0)	0.935 (0.017)	1 (0)	1 (0)	1 (0)
19	0 (0)	0 (0)	0.858 (0.028)	1 (0)	1 (0)	1 (0)
20	0 (0)	0 (0)	0.743 (0.037)	1 (0)	1 (0)	1 (0)
21	0 (0)	0 (0)	0.605 (0.041)	1 (0)	1 (0)	1 (0)

Table B3. Estimated proportions (standard error) of **sculpin** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	**1**	**2**	**3**	**4**	**6**
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.998 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.849 (0.108)	0.990 (0.012)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.393 (0.128)	0.823 (0.095)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.114 (0.044)	0.456 (0.104)	0.998 (0.002)	1 (0)	1 (0)	1 (0)
7	0.028 (0.011)	0.179 (0.053)	0.967 (0.020)	1 (0)	1 (0)	1 (0)
8	0.007 (0.003)	0.061 (0.019)	0.848 (0.049)	0.998 (0.001)	1 (0)	1 (0)
9	0.002 (0.001)	0.021 (0.006)	0.648 (0.062)	0.985 (0.008)	1 (0)	1 (0)
10	0.001 (<.001)	0.008 (0.002)	0.436 (0.057)	0.930 (0.024)	0.998 (0.001)	1 (0)
11	0 (0)	0.003 (0.001)	0.271 (0.040)	0.819 (0.041)	0.987 (0.006)	1 (0)
12	0 (0)	0.001 (<.001)	0.160 (0.025)	0.661 (0.048)	0.955 (0.014)	1 (0)
13	0 (0)	0.001 (<.001)	0.091 (0.015)	0.503 (0.043)	0.890 (0.024)	0.999 (<.001)
14	0 (0)	0 (0)	0.051 (0.009)	0.368 (0.035)	0.789 (0.033)	0.995 (0.002)
15	0 (0)	0 (0)	0.029 (0.005)	0.260 (0.027)	0.666 (0.036)	0.984 (0.005)
16	0 (0)	0 (0)	0.017 (0.003)	0.181 (0.020)	0.539 (0.037)	0.963 (0.009)
17	0 (0)	0 (0)	0.010 (0.002)	0.122 (0.014)	0.415 (0.033)	0.924 (0.013)
18	0 (0)	0 (0)	0.006 (0.001)	0.083 (0.010)	0.314 (0.027)	0.870 (0.018)
19	0 (0)	0 (0)	0.003 (0.001)	0.057 (0.007)	0.235 (0.020)	0.801 (0.022)
20	0 (0)	0 (0)	0.002 (<.001)	0.038 (0.005)	0.176 (0.015)	0.722 (0.025)
21	0 (0)	0 (0)	0.001 (<.001)	0.026 (0.003)	0.131 (0.012)	0.634 (0.026)
22	0 (0)	0 (0)	0.001 (<.001)	0.018 (0.002)	0.097 (0.009)	0.547 (0.025)
23	0 (0)	0 (0)	0.001 (<.001)	0.012 (0.002)	0.073 (0.007)	0.466 (0.023)
24	0 (0)	0 (0)	0 (0)	0.008 (0.001)	0.053 (0.005)	0.388 (0.022)
25	0 (0)	0 (0)	0 (0)	0.006 (0.001)	0.040 (0.004)	0.320 (0.019)

Table B4. Estimated proportions (standard error) of **flatfish** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	**1**	**2**	**3**	**4**	**6**
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.982 (0.020)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.753 (0.112)	0.978 (0.019)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.368 (0.097)	0.820 (0.074)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.131 (0.041)	0.521 (0.087)	0.999 (0.001)	1 (0)	1 (0)	1 (0)
8	0.041 (0.014)	0.262 (0.058)	0.986 (0.008)	1 (0)	1 (0)	1 (0)
9	0.013 (0.004)	0.118 (0.029)	0.937 (0.023)	0.999 (<.001)	1 (0)	1 (0)
10	0.005 (0.001)	0.049 (0.013)	0.828 (0.039)	0.994 (0.003)	1 (0)	1 (0)
11	0.003 (<.001)	0.021 (0.005)	0.683 (0.047)	0.978 (0.008)	0.999 (<.001)	1 (0)
12	0.002 (<.001)	0.009 (0.002)	0.521 (0.045)	0.939 (0.015)	0.996 (0.002)	1 (0)
13	0.002 (<.001)	0.004 (0.001)	0.379 (0.038)	0.874 (0.023)	0.986 (0.004)	1 (0)
14	0.001 (<.001)	0.002 (<.001)	0.263 (0.029)	0.782 (0.029)	0.965 (0.008)	0.999 (<.001)
15	0.001 (<.001)	0.002 (<.001)	0.180 (0.021)	0.678 (0.032)	0.929 (0.013)	0.998 (0.001)
16	0.001 (<.001)	0.001 (<.001)	0.121 (0.014)	0.571 (0.032)	0.877 (0.018)	0.995 (0.002)
17	0.001 (<.001)	0.001 (<.001)	0.080 (0.010)	0.466 (0.029)	0.809 (0.021)	0.988 (0.003)
18	0.001 (<.001)	0.001 (<.001)	0.053 (0.007)	0.372 (0.025)	0.731 (0.024)	0.975 (0.005)
19	0.001 (<.001)	0.001 (<.001)	0.035 (0.004)	0.296 (0.021)	0.651 (0.024)	0.957 (0.007)
20	0.001 (<.001)	0.001 (<.001)	0.023 (0.003)	0.230 (0.017)	0.568 (0.023)	0.930 (0.009)
21	0.001 (<.001)	0.001 (<.001)	0.016 (0.002)	0.178 (0.014)	0.489 (0.023)	0.896 (0.011)
22	0.001 (<.001)	0.001 (<.001)	0.011 (0.001)	0.137 (0.011)	0.416 (0.021)	0.854 (0.013)
23	0.001 (<.001)	0.001 (<.001)	0.007 (0.001)	0.105 (0.009)	0.351 (0.018)	0.807 (0.015)
24	0 (0)	0.001 (<.001)	0.005 (0.001)	0.080 (0.007)	0.293 (0.016)	0.755 (0.016)
25	0 (0)	0.001 (<.001)	0.003 (<.001)	0.061 (0.005)	0.243 (0.014)	0.700 (0.017)

Table B5. Estimated proportions (standard error) of **monkeyface prickleback** larvae entrained through six different size screen slot openings based on head capsule regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.995 (0.005)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.932 (0.038)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.722 (0.079)	0.992 (0.006)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.457 (0.073)	0.946 (0.023)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.250 (0.049)	0.831 (0.045)	1 (0)	1 (0)	1 (0)	1 (0)
10	0.122 (0.025)	0.655 (0.053)	1 (0)	1 (0)	1 (0)	1 (0)
11	0.057 (0.013)	0.468 (0.050)	1 (0)	1 (0)	1 (0)	1 (0)
12	0.027 (0.006)	0.312 (0.039)	1 (0)	1 (0)	1 (0)	1 (0)
13	0.012 (0.003)	0.198 (0.028)	0.998 (0.001)	1 (0)	1 (0)	1 (0)
14	0.006 (0.001)	0.122 (0.018)	0.994 (0.002)	1 (0)	1 (0)	1 (0)
15	0.003 (0.001)	0.074 (0.011)	0.984 (0.004)	1 (0)	1 (0)	1 (0)
16	0.002 (<.001)	0.044 (0.007)	0.964 (0.008)	1 (0)	1 (0)	1 (0)
17	0.001 (<.001)	0.026 (0.004)	0.931 (0.012)	1 (0)	1 (0)	1 (0)
18	0.001 (<.001)	0.016 (0.002)	0.886 (0.015)	1 (0)	1 (0)	1 (0)
19	0 (0)	0.010 (0.002)	0.829 (0.018)	0.999 (<.001)	1 (0)	1 (0)
20	0 (0)	0.006 (0.001)	0.762 (0.021)	0.997 (0.001)	1 (0)	1 (0)
21	0 (0)	0.004 (0.001)	0.689 (0.023)	0.994 (0.001)	1 (0)	1 (0)
22	0 (0)	0.003 (<.001)	0.613 (0.022)	0.989 (0.002)	1 (0)	1 (0)
23	0 (0)	0.002 (<.001)	0.539 (0.022)	0.981 (0.003)	1 (0)	1 (0)
24	0 (0)	0.001 (<.001)	0.468 (0.020)	0.969 (0.004)	0.999 (<.001)	1 (0)
25	0 (0)	0.001 (<.001)	0.402 (0.019)	0.952 (0.006)	0.999 (<.001)	1 (0)

Table B6. Estimated proportions (standard error) of **combtooth blenny** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 20 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.997 (0.005)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.842 (0.102)	0.997 (0.004)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.411 (0.117)	0.917 (0.050)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.134 (0.046)	0.659 (0.088)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.041 (0.014)	0.381 (0.071)	0.999 (<.001)	1 (0)	1 (0)	1 (0)
8	0.012 (0.004)	0.183 (0.040)	0.992 (0.004)	1 (0)	1 (0)	1 (0)
9	0.004 (0.001)	0.087 (0.020)	0.966 (0.012)	1 (0)	1 (0)	1 (0)
10	0.001 (<.001)	0.041 (0.009)	0.908 (0.022)	0.999 (<.001)	1 (0)	1 (0)
11	0.001 (<.001)	0.020 (0.004)	0.817 (0.029)	0.996 (0.002)	1 (0)	1 (0)
12	0 (0)	0.010 (0.002)	0.707 (0.034)	0.988 (0.004)	1 (0)	1 (0)
13	0 (0)	0.005 (0.001)	0.593 (0.033)	0.970 (0.007)	0.999 (<.001)	1 (0)
14	0 (0)	0.003 (<.001)	0.481 (0.031)	0.941 (0.011)	0.997 (0.001)	1 (0)
15	0 (0)	0.002 (<.001)	0.385 (0.026)	0.900 (0.014)	0.992 (0.002)	1 (0)
16	0 (0)	0.001 (<.001)	0.304 (0.022)	0.849 (0.017)	0.983 (0.003)	1 (0)
17	0 (0)	0.001 (<.001)	0.239 (0.017)	0.789 (0.018)	0.970 (0.005)	1 (0)
18	0 (0)	0 (0)	0.186 (0.014)	0.724 (0.020)	0.951 (0.007)	0.999 (<.001)
19	0 (0)	0 (0)	0.145 (0.011)	0.657 (0.020)	0.926 (0.008)	0.998 (<.001)
20	0 (0)	0 (0)	0.113 (0.009)	0.591 (0.019)	0.895 (0.010)	0.997 (0.001)

Table B7. Estimated proportions (standard error) of **clingfish** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 20 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	**1**	**2**	**3**	**4**	**6**
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.963 (0.040)	0.999 (0.001)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.652 (0.126)	0.943 (0.043)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.313 (0.070)	0.696 (0.092)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.141 (0.032)	0.396 (0.072)	0.990 (0.006)	1 (0)	1 (0)	1 (0)
7	0.068 (0.014)	0.221 (0.036)	0.947 (0.020)	0.999 (<.001)	1 (0)	1 (0)
8	0.035 (0.007)	0.127 (0.021)	0.850 (0.036)	0.993 (0.003)	1 (0)	1 (0)
9	0.019 (0.003)	0.074 (0.011)	0.712 (0.043)	0.973 (0.009)	0.998 (0.001)	1 (0)
10	0.011 (0.002)	0.046 (0.007)	0.568 (0.041)	0.932 (0.016)	0.993 (0.003)	1 (0)
11	0.007 (0.001)	0.029 (0.004)	0.436 (0.035)	0.866 (0.022)	0.979 (0.006)	1 (0)
12	0.004 (0.001)	0.019 (0.003)	0.328 (0.028)	0.783 (0.026)	0.953 (0.010)	0.998 (<.001)
13	0.003 (<.001)	0.013 (0.002)	0.243 (0.021)	0.689 (0.028)	0.913 (0.014)	0.995 (0.001)
14	0.002 (<.001)	0.009 (0.001)	0.181 (0.016)	0.598 (0.027)	0.863 (0.017)	0.990 (0.002)
15	0.002 (<.001)	0.006 (0.001)	0.135 (0.011)	0.509 (0.024)	0.802 (0.019)	0.979 (0.004)
16	0.001 (<.001)	0.005 (0.001)	0.104 (0.008)	0.429 (0.022)	0.735 (0.021)	0.963 (0.006)
17	0.001 (<.001)	0.004 (<.001)	0.082 (0.006)	0.360 (0.020)	0.667 (0.021)	0.942 (0.008)
18	0.001 (<.001)	0.003 (<.001)	0.065 (0.005)	0.301 (0.017)	0.600 (0.020)	0.915 (0.009)
19	0.001 (<.001)	0.002 (<.001)	0.053 (0.004)	0.250 (0.014)	0.535 (0.019)	0.882 (0.011)
20	0 (0)	0.002 (<.001)	0.043 (0.003)	0.208 (0.012)	0.475 (0.017)	0.845 (0.012)

Table B8. Estimated proportions (standard error) of **anchovy** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
8	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.997 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
10	0.943 (0.037)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
11	0.699 (0.099)	0.997 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)
12	0.350 (0.089)	0.956 (0.024)	1 (0)	1 (0)	1 (0)	1 (0)
13	0.125 (0.044)	0.803 (0.067)	1 (0)	1 (0)	1 (0)	1 (0)
14	0.033 (0.013)	0.530 (0.084)	1 (0)	1 (0)	1 (0)	1 (0)
15	0.007 (0.003)	0.268 (0.061)	1 (0)	1 (0)	1 (0)	1 (0)
16	0.001 (0.001)	0.109 (0.031)	1 (0)	1 (0)	1 (0)	1 (0)
17	0 (0)	0.037 (0.012)	1 (0)	1 (0)	1 (0)	1 (0)
18	0 (0)	0.011 (0.004)	1 (0)	1 (0)	1 (0)	1 (0)
19	0 (0)	0.003 (0.001)	0.999 (<.001)	1 (0)	1 (0)	1 (0)
20	0 (0)	0.001 (<.001)	0.993 (0.004)	1 (0)	1 (0)	1 (0)
21	0 (0)	0 (0)	0.968 (0.012)	1 (0)	1 (0)	1 (0)
22	0 (0)	0 (0)	0.900 (0.028)	1 (0)	1 (0)	1 (0)
23	0 (0)	0 (0)	0.765 (0.047)	1 (0)	1 (0)	1 (0)
24	0 (0)	0 (0)	0.590 (0.057)	1 (0)	1 (0)	1 (0)
25	0 (0)	0 (0)	0.401 (0.052)	1 (0)	1 (0)	1 (0)

Table B9. Estimated proportions (standard error) of **anchovy** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **less than or equal to 19 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.997 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.935 (0.042)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
10	0.673 (0.103)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
11	0.322 (0.092)	0.997 (0.002)	1 (0)	1 (0)	1 (0)	1 (0)
12	0.099 (0.039)	0.969 (0.017)	1 (0)	1 (0)	1 (0)	1 (0)
13	0.023 (0.011)	0.861 (0.050)	1 (0)	1 (0)	1 (0)	1 (0)
14	0.004 (0.002)	0.642 (0.073)	1 (0)	1 (0)	1 (0)	1 (0)
15	0.001 (<.001)	0.392 (0.068)	1 (0)	1 (0)	1 (0)	1 (0)
16	0 (0)	0.196 (0.045)	1 (0)	1 (0)	1 (0)	1 (0)
17	0 (0)	0.084 (0.023)	1 (0)	1 (0)	1 (0)	1 (0)
18	0 (0)	0.031 (0.010)	1 (0)	1 (0)	1 (0)	1 (0)
19	0 (0)	0.010 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)

Table B10. Estimated proportions (standard error) of **anchovy** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **between 19 and 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
19	0.107 (0.008)	0.230 (0.014)	0.868 (0.016)	0.993 (0.002)	1 (0)	1 (0)
20	0.085 (0.006)	0.186 (0.012)	0.810 (0.018)	0.985 (0.003)	0.999 (<.001)	1 (0)
21	0.069 (0.005)	0.151 (0.009)	0.746 (0.020)	0.973 (0.004)	0.998 (<.001)	1 (0)
22	0.056 (0.004)	0.124 (0.008)	0.679 (0.021)	0.956 (0.006)	0.996 (0.001)	1 (0)
23	0.046 (0.003)	0.102 (0.006)	0.609 (0.020)	0.933 (0.008)	0.992 (0.002)	1 (0)
24	0.039 (0.003)	0.085 (0.005)	0.541 (0.020)	0.903 (0.010)	0.986 (0.002)	1 (0)
25	0.033 (0.002)	0.071 (0.005)	0.477 (0.019)	0.868 (0.012)	0.977 (0.003)	1 (0)

Table B11. Estimated proportions (standard error) of **croaker** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 20 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.996 (0.009)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.575 (0.252)	0.998 (0.004)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.041 (0.043)	0.780 (0.155)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.001 (0.001)	0.224 (0.123)	1 (0)	1 (0)	1 (0)	1 (0)
7	0 (0)	0.019 (0.015)	1 (0)	1 (0)	1 (0)	1 (0)
8	0 (0)	0.001 (0.001)	0.998 (0.002)	1 (0)	1 (0)	1 (0)
9	0 (0)	0 (0)	0.969 (0.020)	1 (0)	1 (0)	1 (0)
10	0 (0)	0 (0)	0.826 (0.067)	1 (0)	1 (0)	1 (0)
11	0 (0)	0 (0)	0.546 (0.086)	1 (0)	1 (0)	1 (0)
12	0 (0)	0 (0)	0.280 (0.064)	0.998 (0.002)	1 (0)	1 (0)
13	0 (0)	0 (0)	0.113 (0.032)	0.983 (0.008)	1 (0)	1 (0)
14	0 (0)	0 (0)	0.039 (0.013)	0.932 (0.024)	1 (0)	1 (0)
15	0 (0)	0 (0)	0.012 (0.004)	0.823 (0.041)	0.999 (<.001)	1 (0)
16	0 (0)	0 (0)	0.003 (0.001)	0.657 (0.051)	0.997 (0.001)	1 (0)
17	0 (0)	0 (0)	0.001 (<.001)	0.478 (0.052)	0.987 (0.005)	1 (0)
18	0 (0)	0 (0)	0 (0)	0.315 (0.042)	0.960 (0.011)	1 (0)
19	0 (0)	0 (0)	0 (0)	0.191 (0.030)	0.906 (0.020)	1 (0)
20	0 (0)	0 (0)	0 (0)	0.108 (0.018)	0.821 (0.029)	1 (0)

Table B12. Estimated proportions (standard error) of **goby** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.907 (0.086)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.379 (0.167)	0.994 (0.008)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.051 (0.037)	0.851 (0.093)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.003 (0.002)	0.420 (0.131)	1 (0)	1 (0)	1 (0)	1 (0)
10	0 (0)	0.100 (0.049)	1 (0)	1 (0)	1 (0)	1 (0)
11	0 (0)	0.014 (0.009)	1 (0)	1 (0)	1 (0)	1 (0)
12	0 (0)	0.001 (0.001)	1 (0)	1 (0)	1 (0)	1 (0)
13	0 (0)	0 (0)	0.992 (0.005)	1 (0)	1 (0)	1 (0)
14	0 (0)	0 (0)	0.947 (0.023)	1 (0)	1 (0)	1 (0)
15	0 (0)	0 (0)	0.817 (0.052)	1 (0)	1 (0)	1 (0)
16	0 (0)	0 (0)	0.603 (0.069)	1 (0)	1 (0)	1 (0)
17	0 (0)	0 (0)	0.375 (0.061)	1 (0)	1 (0)	1 (0)
18	0 (0)	0 (0)	0.194 (0.042)	0.996 (0.002)	1 (0)	1 (0)
19	0 (0)	0 (0)	0.089 (0.022)	0.983 (0.006)	1 (0)	1 (0)
20	0 (0)	0 (0)	0.036 (0.010)	0.946 (0.016)	1 (0)	1 (0)
21	0 (0)	0 (0)	0.013 (0.004)	0.872 (0.029)	1 (0)	1 (0)
22	0 (0)	0 (0)	0.004 (0.001)	0.750 (0.039)	0.999 (<.001)	1 (0)
23	0 (0)	0 (0)	0.001 (<.001)	0.604 (0.045)	0.996 (0.001)	1 (0)
24	0 (0)	0 (0)	0 (0)	0.454 (0.043)	0.989 (0.004)	1 (0)
25	0 (0)	0 (0)	0 (0)	0.313 (0.037)	0.970 (0.008)	1 (0)

Table B13. Estimated proportions (standard error) of **silverside** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.997 (0.005)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.687 (0.225)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.068 (0.068)	0.969 (0.040)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.001 (0.001)	0.528 (0.202)	1 (0)	1 (0)	1 (0)	1 (0)
10	0 (0)	0.065 (0.055)	1 (0)	1 (0)	1 (0)	1 (0)
11	0 (0)	0.002 (0.002)	1 (0)	1 (0)	1 (0)	1 (0)
12	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
13	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
14	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
15	0 (0)	0 (0)	0.994 (0.006)	1 (0)	1 (0)	1 (0)
16	0 (0)	0 (0)	0.896 (0.062)	1 (0)	1 (0)	1 (0)
17	0 (0)	0 (0)	0.545 (0.127)	1 (0)	1 (0)	1 (0)
18	0 (0)	0 (0)	0.175 (0.076)	1 (0)	1 (0)	1 (0)
19	0 (0)	0 (0)	0.027 (0.017)	1 (0)	1 (0)	1 (0)
20	0 (0)	0 (0)	0.002 (0.002)	1 (0)	1 (0)	1 (0)
21	0 (0)	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)
22	0 (0)	0 (0)	0 (0)	0.993 (0.005)	1 (0)	1 (0)
23	0 (0)	0 (0)	0 (0)	0.949 (0.025)	1 (0)	1 (0)
24	0 (0)	0 (0)	0 (0)	0.799 (0.062)	1 (0)	1 (0)
25	0 (0)	0 (0)	0 (0)	0.537 (0.082)	1 (0)	1 (0)

Table B14. Estimated proportions (standard error) of **silverside** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **from 2 to 15 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.977 (0.028)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.616 (0.185)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.110 (0.074)	0.963 (0.033)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.007 (0.006)	0.679 (0.132)	1 (0)	1 (0)	1 (0)	1 (0)
10	0 (0)	0.238 (0.099)	1 (0)	1 (0)	1 (0)	1 (0)
11	0 (0)	0.042 (0.024)	1 (0)	1 (0)	1 (0)	1 (0)
12	0 (0)	0.005 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)
13	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
14	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
15	0 (0)	0 (0)	0.995 (0.003)	1 (0)	1 (0)	1 (0)

Table B15. Estimated proportions (standard error) of **silverside** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **from 15 to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
15	0 (0)	0.001 (<.001)	0.724 (0.039)	0.999 (<.001)	1 (0)	1 (0)
16	0 (0)	0.001 (<.001)	0.585 (0.041)	0.997 (0.001)	1 (0)	1 (0)
17	0 (0)	0 (0)	0.449 (0.038)	0.991 (0.003)	1 (0)	1 (0)
18	0 (0)	0 (0)	0.330 (0.031)	0.978 (0.006)	1 (0)	1 (0)
19	0 (0)	0 (0)	0.235 (0.025)	0.953 (0.010)	1 (0)	1 (0)
20	0 (0)	0 (0)	0.161 (0.018)	0.913 (0.014)	0.999 (<.001)	1 (0)
21	0 (0)	0 (0)	0.110 (0.013)	0.858 (0.018)	0.998 (0.001)	1 (0)
22	0 (0)	0 (0)	0.073 (0.009)	0.789 (0.022)	0.994 (0.001)	1 (0)
23	0 (0)	0 (0)	0.048 (0.006)	0.711 (0.025)	0.988 (0.003)	1 (0)
24	0 (0)	0 (0)	0.031 (0.004)	0.625 (0.026)	0.977 (0.004)	1 (0)
25	0 (0)	0 (0)	0.020 (0.003)	0.539 (0.024)	0.960 (0.006)	1 (0)

Table B16. Estimated proportions (standard error) of **Pacific barracuda** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 20 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.976 (0.020)	0.999 (0.001)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.836 (0.058)	0.980 (0.013)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.628 (0.058)	0.903 (0.031)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.452 (0.044)	0.781 (0.038)	0.998 (0.001)	1 (0)	1 (0)	1 (0)
7	0.326 (0.029)	0.650 (0.036)	0.992 (0.003)	1 (0)	1 (0)	1 (0)
8	0.241 (0.021)	0.536 (0.032)	0.979 (0.006)	0.999 (<.001)	1 (0)	1 (0)
9	0.183 (0.014)	0.441 (0.024)	0.955 (0.008)	0.997 (0.001)	1 (0)	1 (0)
10	0.143 (0.010)	0.366 (0.020)	0.924 (0.010)	0.993 (0.002)	0.999 (<.001)	1 (0)
11	0.113 (0.008)	0.306 (0.016)	0.886 (0.012)	0.987 (0.003)	0.998 (<.001)	1 (0)
12	0.092 (0.006)	0.258 (0.013)	0.844 (0.013)	0.977 (0.004)	0.996 (0.001)	1 (0)
13	0.076 (0.005)	0.220 (0.011)	0.801 (0.013)	0.964 (0.004)	0.993 (0.001)	1 (0)
14	0.064 (0.004)	0.190 (0.009)	0.757 (0.013)	0.948 (0.005)	0.989 (0.002)	0.999 (<.001)
15	0.054 (0.003)	0.166 (0.007)	0.715 (0.013)	0.930 (0.006)	0.983 (0.002)	0.999 (<.001)
16	0.047 (0.003)	0.145 (0.006)	0.673 (0.013)	0.909 (0.007)	0.975 (0.003)	0.998 (<.001)
17	0.041 (0.002)	0.128 (0.006)	0.633 (0.012)	0.887 (0.007)	0.966 (0.003)	0.997 (0.001)
18	0.036 (0.002)	0.114 (0.005)	0.597 (0.011)	0.865 (0.007)	0.956 (0.004)	0.995 (0.001)
19	0.032 (0.002)	0.103 (0.004)	0.563 (0.011)	0.842 (0.008)	0.945 (0.004)	0.993 (0.001)
20	0.028 (0.002)	0.092 (0.004)	0.531 (0.010)	0.817 (0.008)	0.932 (0.004)	0.990 (0.001)

Table B17. Estimated proportions (standard error) of **rockfish** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.989 (0.012)	0.999 (0.001)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.871 (0.054)	0.972 (0.018)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.663 (0.062)	0.868 (0.041)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.466 (0.048)	0.708 (0.046)	0.994 (0.003)	1 (0)	1 (0)	1 (0)
7	0.328 (0.033)	0.556 (0.041)	0.973 (0.010)	0.999 (<.001)	1 (0)	1 (0)
8	0.232 (0.022)	0.427 (0.032)	0.927 (0.017)	0.997 (0.001)	1 (0)	1 (0)
9	0.169 (0.015)	0.332 (0.024)	0.862 (0.022)	0.989 (0.003)	0.999 (<.001)	1 (0)
10	0.126 (0.011)	0.258 (0.019)	0.780 (0.025)	0.974 (0.006)	0.997 (0.001)	1 (0)
11	0.096 (0.008)	0.204 (0.014)	0.696 (0.025)	0.949 (0.009)	0.993 (0.002)	1 (0)
12	0.075 (0.006)	0.164 (0.011)	0.614 (0.024)	0.916 (0.011)	0.985 (0.003)	1 (0)
13	0.060 (0.004)	0.133 (0.008)	0.535 (0.022)	0.875 (0.013)	0.972 (0.005)	0.999 (<.001)
14	0.049 (0.003)	0.110 (0.007)	0.467 (0.019)	0.829 (0.014)	0.955 (0.006)	0.997 (0.001)
15	0.040 (0.003)	0.092 (0.005)	0.409 (0.016)	0.781 (0.015)	0.933 (0.007)	0.994 (0.001)
16	0.034 (0.002)	0.078 (0.005)	0.362 (0.014)	0.731 (0.015)	0.908 (0.009)	0.991 (0.002)
17	0.028 (0.002)	0.066 (0.004)	0.321 (0.011)	0.681 (0.015)	0.879 (0.009)	0.985 (0.002)
18	0.024 (0.002)	0.057 (0.003)	0.287 (0.010)	0.632 (0.015)	0.847 (0.010)	0.977 (0.003)
19	0.021 (0.002)	0.049 (0.003)	0.257 (0.009)	0.587 (0.014)	0.814 (0.010)	0.968 (0.003)
20	0.018 (0.001)	0.043 (0.003)	0.231 (0.008)	0.542 (0.013)	0.779 (0.011)	0.957 (0.004)
21	0.016 (0.001)	0.038 (0.002)	0.209 (0.007)	0.502 (0.013)	0.745 (0.011)	0.944 (0.005)
22	0.014 (0.001)	0.034 (0.002)	0.189 (0.007)	0.464 (0.011)	0.711 (0.011)	0.930 (0.005)
23	0.013 (0.001)	0.030 (0.002)	0.172 (0.006)	0.429 (0.011)	0.676 (0.011)	0.914 (0.006)
24	0.011 (0.001)	0.027 (0.002)	0.157 (0.005)	0.397 (0.010)	0.644 (0.010)	0.897 (0.006)
25	0.010 (0.001)	0.024 (0.002)	0.144 (0.005)	0.368 (0.010)	0.612 (0.010)	0.879 (0.006)

Table B18. Estimated proportions (standard error) of **cabezon** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	0.998 (0.003)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.926 (0.048)	0.995 (0.006)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.690 (0.081)	0.934 (0.033)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.431 (0.066)	0.776 (0.057)	0.999 (0.001)	1 (0)	1 (0)	1 (0)
7	0.250 (0.038)	0.572 (0.056)	0.992 (0.004)	1 (0)	1 (0)	1 (0)
8	0.165 (0.016)	0.396 (0.042)	0.968 (0.011)	0.999 (<.001)	1 (0)	1 (0)
9	0.119 (0.011)	0.289 (0.023)	0.918 (0.019)	0.996 (0.002)	1 (0)	1 (0)
10	0.087 (0.008)	0.224 (0.016)	0.842 (0.025)	0.986 (0.004)	0.999 (<.001)	1 (0)
11	0.066 (0.006)	0.177 (0.013)	0.753 (0.028)	0.966 (0.008)	0.996 (0.001)	1 (0)
12	0.052 (0.004)	0.141 (0.010)	0.659 (0.026)	0.934 (0.011)	0.990 (0.003)	1 (0)
13	0.041 (0.003)	0.114 (0.007)	0.587 (0.019)	0.891 (0.014)	0.978 (0.004)	0.999 (<.001)
14	0.033 (0.003)	0.094 (0.006)	0.526 (0.018)	0.838 (0.017)	0.960 (0.007)	0.998 (0.001)
15	0.027 (0.002)	0.079 (0.005)	0.475 (0.015)	0.785 (0.015)	0.936 (0.008)	0.995 (0.001)
16	0.023 (0.002)	0.066 (0.004)	0.426 (0.014)	0.737 (0.013)	0.904 (0.010)	0.990 (0.002)
17	0.019 (0.002)	0.056 (0.003)	0.383 (0.012)	0.693 (0.013)	0.868 (0.011)	0.983 (0.003)
18	0.016 (0.001)	0.048 (0.003)	0.346 (0.011)	0.652 (0.013)	0.833 (0.010)	0.974 (0.004)
19	0.014 (0.001)	0.042 (0.003)	0.313 (0.010)	0.614 (0.012)	0.803 (0.010)	0.961 (0.005)
20	0.012 (0.001)	0.036 (0.002)	0.284 (0.009)	0.576 (0.012)	0.772 (0.010)	0.946 (0.006)
21	0.011 (0.001)	0.032 (0.002)	0.259 (0.008)	0.542 (0.011)	0.742 (0.010)	0.928 (0.006)
22	0.009 (0.001)	0.028 (0.002)	0.236 (0.007)	0.508 (0.010)	0.711 (0.009)	0.909 (0.006)
23	0.008 (0.001)	0.025 (0.002)	0.216 (0.007)	0.477 (0.010)	0.682 (0.010)	0.891 (0.006)
24	0.007 (0.001)	0.022 (0.002)	0.198 (0.006)	0.449 (0.009)	0.653 (0.009)	0.874 (0.006)
25	0.007 (0.001)	0.020 (0.001)	0.182 (0.006)	0.422 (0.009)	0.626 (0.009)	0.856 (0.006)

Table B19. Estimated proportions (standard error) of **sea bass** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths to 25 mm.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
1	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
2	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
3	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.792 (0.278)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.013 (0.027)	0.947 (0.091)	1 (0)	1 (0)	1 (0)	1 (0)
6	0 (0)	0.151 (0.187)	1 (0)	1 (0)	1 (0)	1 (0)
7	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
8	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
9	0 (0)	0 (0)	0.997 (0.005)	1 (0)	1 (0)	1 (0)
10	0 (0)	0 (0)	0.804 (0.143)	1 (0)	1 (0)	1 (0)
11	0 (0)	0 (0)	0.220 (0.137)	1 (0)	1 (0)	1 (0)
12	0 (0)	0 (0)	0.012 (0.012)	1 (0)	1 (0)	1 (0)
13	0 (0)	0 (0)	0 (0)	0.997 (0.004)	1 (0)	1 (0)
14	0 (0)	0 (0)	0 (0)	0.923 (0.052)	1 (0)	1 (0)
15	0 (0)	0 (0)	0 (0)	0.597 (0.128)	1 (0)	1 (0)
16	0 (0)	0 (0)	0 (0)	0.202 (0.084)	1 (0)	1 (0)
17	0 (0)	0 (0)	0 (0)	0.032 (0.020)	0.994 (0.005)	1 (0)
18	0 (0)	0 (0)	0 (0)	0.003 (0.002)	0.941 (0.033)	1 (0)
19	0 (0)	0 (0)	0 (0)	0 (0)	0.751 (0.080)	1 (0)
20	0 (0)	0 (0)	0 (0)	0 (0)	0.429 (0.094)	1 (0)
21	0 (0)	0 (0)	0 (0)	0 (0)	0.167 (0.054)	1 (0)
22	0 (0)	0 (0)	0 (0)	0 (0)	0.044 (0.019)	1 (0)
23	0 (0)	0 (0)	0 (0)	0 (0)	0.009 (0.004)	1 (0)
24	0 (0)	0 (0)	0 (0)	0 (0)	0.001 (0.001)	0.997 (0.002)
25	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.983 (0.008)

Table B20. Estimated proportions (standard error) of **prickleback** larvae entrained through six different size screen slot openings based on head capsule allometric regressions on notochord lengths **to 25 mm**.

Length (mm)	Screen Slot Dimension (mm)					
	0.75	1	2	3	4	6
3	0.964 (0.025)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
4	0.826 (0.053)	0.991 (0.006)	1 (0)	1 (0)	1 (0)	1 (0)
5	0.639 (0.054)	0.952 (0.017)	1 (0)	1 (0)	1 (0)	1 (0)
6	0.472 (0.042)	0.878 (0.025)	1 (0)	1 (0)	1 (0)	1 (0)
7	0.348 (0.030)	0.787 (0.028)	1 (0)	1 (0)	1 (0)	1 (0)
8	0.260 (0.022)	0.692 (0.028)	1 (0)	1 (0)	1 (0)	1 (0)
9	0.195 (0.015)	0.599 (0.025)	1 (0)	1 (0)	1 (0)	1 (0)
10	0.151 (0.012)	0.520 (0.023)	0.999 (<.001)	1 (0)	1 (0)	1 (0)
11	0.119 (0.009)	0.450 (0.020)	0.998 (<.001)	1 (0)	1 (0)	1 (0)
12	0.094 (0.006)	0.389 (0.016)	0.996 (0.001)	1 (0)	1 (0)	1 (0)
13	0.076 (0.005)	0.338 (0.014)	0.992 (0.001)	1 (0)	1 (0)	1 (0)
14	0.063 (0.004)	0.296 (0.012)	0.988 (0.002)	1 (0)	1 (0)	1 (0)
15	0.052 (0.003)	0.260 (0.011)	0.981 (0.002)	1 (0)	1 (0)	1 (0)
16	0.043 (0.003)	0.229 (0.009)	0.973 (0.003)	1 (0)	1 (0)	1 (0)
17	0.037 (0.002)	0.203 (0.008)	0.964 (0.004)	1 (0)	1 (0)	1 (0)
18	0.032 (0.002)	0.181 (0.007)	0.953 (0.004)	0.999 (<.001)	1 (0)	1 (0)
19	0.027 (0.002)	0.161 (0.006)	0.940 (0.004)	0.999 (<.001)	1 (0)	1 (0)
20	0.024 (0.002)	0.145 (0.006)	0.927 (0.005)	0.999 (<.001)	1 (0)	1 (0)
21	0.021 (0.001)	0.130 (0.005)	0.912 (0.005)	0.998 (<.001)	1 (0)	1 (0)
22	0.019 (0.001)	0.118 (0.005)	0.896 (0.005)	0.997 (<.001)	1 (0)	1 (0)
23	0.017 (0.001)	0.107 (0.004)	0.880 (0.006)	0.996 (0.001)	1 (0)	1 (0)
24	0.015 (0.001)	0.098 (0.004)	0.864 (0.006)	0.995 (0.001)	1 (0)	1 (0)
25	0.013 (0.001)	0.089 (0.004)	0.846 (0.006)	0.994 (0.001)	1 (0)	1 (0)