

	Overall n (%)	Under 1 n (%)	1-3 n (%)	4-7 n (%)	8-12 n (%)	13-18 n (%)	19-34 n (%)	35 and Up n (%)	χ^2 p- value
Water Exposure									
Any water contact	13,568 (66.6)	55 (32.2)	857 (80.8)	1,562 (89.9)	1,901 (89.0)	1,342 (72.4)	3,427 (62.6)	4,514 (56.0)	<0.01
Males	6,210 (45.52)	34 (61.8)	412 (48.2)	789 (50.6)	942 (49.7)	567 (42.3)	1,437 (42.0)	2,029 (45.0)	<0.01
Females	7,432 (54.5)	21 (38.2)	442 (51.8)	771 (49.4)	955 (50.3)	775 (57.8)	1,985 (58.0)	2,483 (55.0)	<0.01
Body immersion	10,123 (49.4)	26 (15.2)	647 (61.0)	1,370 (78.8)	1,716 (80.3)	1,119 (60.3)	2,492 (45.5)	2,753 (34.2)	<0.01
Males	4,895 (48.4)	18 (69.2)	312 (48.5)	700 (51.2)	858 (50.1)	505 (45.1)	1,132 (49.8)	4,895 (48.4)	<0.01
Females	5,212 (51.6)	8 (30.8)	332 (51.6)	668 (48.8)	854 (49.9)	614 (55.9)	1,381 (50.2)	5,212 (51.6)	<0.01
Head immersion	7,142 (34.8)	15 (8.8)	418 (39.4)	1,127 (64.8)	1,540 (72.1)	882 (47.6)	1,635 (29.9)	1,525 (18.9)	<0.01
Males	3,853 (54.0)	12 (80.0)	205 (49.3)	581 (51.6)	788 (51.3)	442 (50.1)	903 (55.4)	922 (60.5)	<0.01
Females	3,276 (46.0)	3 (20.0)	211 (50.3)	545 (48.4)	748 (48.7)	440 (49.9)	728 (44.6)	601 (44.6)	<0.01
Water in mouth	4,036 (20.2)	11 (5.9)	411 (39.7)	849 (51.6)	985 (49.1)	468 (26.4)	704 (13.0)	609 (7.7)	<0.01
Males	2,170 (53.8)	8 (80.0)	191 (46.5)	444 (52.3)	516 (52.4)	250 (53.4)	393 (55.8)	368 (60.4)	<0.01
Females	1,866 (46.2)	2 (20.0)	220 (55.5)	405 (47.7)	469 (47.6)	218 (46.6)	311 (44.2)	241 (39.6)	<0.01
Swallow water	1,652 (8.1)	8 (4.7)	263 (24.8)	420 (24.2)	417 (19.5)	145 (7.8)	226 (4.1)	173 (2.2)	<0.01
Males	908 (55.0)	6 (75.0)	134 (51.0)	223 (53.1)	232 (55.6)	80 (55.2)	129 (57.1)	104 (60.1)	0.43
Females	744 (45.0)	2 (25.0)	129 (49.0)	197 (46.9)	185 (44.4)	65 (44.8)	97 (42.9)	69 (39.9)	0.05 ^b
Wear nose plugs	49 (0.24)	1 (0.6)	3 (0.3)	6 (0.4)	10 (0.5)	6 (0.3)	12 (0.2)	11 (0.1)	0.05 ^b
Males	18 (36.7)	1 (100.0)	0 (0.0)	4 (66.7)	1 (10.0)	4 (66.7)	3 (25.0)	5 (45.5)	0.05 ^b
Females	31 (63.3)	0 (0.0)	3 (100.0)	2 (33.3)	9 (90.0)	2 (33.3)	9 (75.0)	6 (54.5)	<0.01
Wear mask/goggles	753 (3.7)	1 (0.8)	20 (1.8)	204 (11.8)	323 (15.1)	61 (3.3)	55 (1.0)	89 (1.1)	<0.01
Males	396 (52.6)	1 (100.0)	9 (45.0)	104 (51.0)	163 (50.5)	35 (57.4)	27 (49.1)	57 (64.0)	0.26
Females	357 (47.4)	0 (0.0)	11 (55.0)	100 (49.0)	160 (49.5)	26 (42.6)	28 (50.9)	32 (36.0)	
Sand Exposure									
Digging in sand	8,975 (43.9)	56 (33.0)	915 (86.3)	1,523 (87.8)	1,641 (77.2)	764 (41.4)	1,891 (34.6)	2,185 (27.2)	<0.01
Males	4,187 (46.7)	38 (67.9)	438 (48.0)	767 (50.4)	828 (50.6)	361 (47.3)	773 (41.0)	982 (45.0)	<0.01
Females	4,773 (53.3)	18 (32.1)	474 (52.0)	754 (49.6)	809 (49.4)	403 (52.8)	1,114 (59.0)	1,201 (55.0)	<0.01
Body buried in sand	2,172 (10.6)	11 (6.4)	239 (22.6)	527 (30.4)	581 (27.3)	204 (11.0)	331 (6.1)	279 (3.5)	<0.01
Males	1,077 (49.7)	6 (54.6)	112 (47.1)	264 (50.3)	309 (53.2)	108 (53.0)	150 (45.3)	128 (45.9)	0.19
Females	1,092 (50.4)	5 (45.5)	126 (52.9)	261 (49.7)	272 (46.8)	96 (47.1)	181 (54.7)	151 (54.1)	
Algae/Seaweed Exposure									
Touched or had contact with algae/seaweed	370 (1.8)	0 (0.0)	27 (2.6)	63 (3.7)	110 (5.2)	34 (1.8)	55 (1.0)	81 (1.0)	<0.01
Males	184 (49.7)	0 (0.0)	12 (44.4)	37 (58.7)	50 (45.5)	18 (52.9)	25 (45.5)	42 (51.8)	0.57
Females	186 (50.3)	0 (0.0)	15 (55.6)	26 (41.3)	60 (55.5)	16 (47.1)	30 (55.5)	39 (48.2)	

Table S1: Exposure by age category and sex, Freshwater ^a

Table S2: Exposure by age category and sex, Marine ^a

^a Huntington, Silver, Washington Park, West

^b Fisher's exact test

	Overall n (%)	Under 1 n (%)	1-3 n (%)	4-7 n (%)	8-12 n (%)	13-18 n (%)	19-34 n (%)	35 and Up n (%)	χ^2 p- value
Water Exposure									
Any water contact	31,685 (67.1)	136 (38.9)	1,977 (73.6)	3,784 (88.8)	4,848 (89.8)	3,170 (78.8)	6,688 (62.0)	11,082 (56.1)	<0.01
Males	15,475 (49.0)	70 (51.5)	1,013 (51.5)	1,958 (51.9)	2,422 (50.3)	1,523 (48.2)	3,065 (45.9)	5,424 (49.0)	<0.01
Females	16,120 (51.0)	66 (49.5)	953 (48.5)	1,814 (48.1)	2,397 (49.7)	1,636 (51.8)	3,612 (54.1)	5,642 (51.0)	<0.01
Body immersion	24,516 (51.9)	77 (22.0)	1,411 (52.5)	3,122 (73.3)	4,292 (79.5)	2,749 (68.4)	5,016 (46.5)	7,849 (39.8)	<0.01
Males	12,459 (51.0)	44 (57.1)	739 (52.6)	1,638 (52.6)	2,156 (50.5)	1,360 (49.6)	2,353 (47.0)	4,169 (53.2)	<0.01
Females	11,987 (49.0)	33 (42.9)	665 (47.4)	1,474 (47.4)	2,110 (49.5)	1,380 (50.4)	2,656 (53.0)	3,669 (46.8)	<0.01
Head immersion	19,184 (40.6)	50 (14.3)	903 (33.6)	2,507 (58.9)	3,852 (71.4)	2,389 (59.4)	3,832 (35.5)	5,651 (28.6)	<0.01
Males	10,438 (54.6)	31 (62.0)	480 (53.6)	1,334 (53.3)	1,975 (51.6)	1,239 (52.1)	1,984 (51.9)	3,395 (60.2)	<0.01
Females	8,684 (45.4)	19 (38.0)	416 (46.4)	1,167 (46.7)	1,853 (48.4)	1,141 (47.9)	1,841 (48.1)	2,247 (39.8)	<0.01
Water in mouth	14,558 (31.0)	46 (13.2)	920 (34.6)	2,123 (50.2)	3,061 (57.2)	1,799 (45.1)	2,806 (26.2)	3,803 (19.3)	<0.01
Males	7,898 (54.4)	29 (63.0)	491 (53.5)	1,151 (54.3)	1,575 (51.8)	932 (51.9)	1,445 (51.5)	2,275 (59.9)	<0.01
Females	6,621 (45.6)	17 (37.0)	426 (46.5)	967 (45.7)	1,468 (48.2)	863 (48.1)	1,359 (48.5)	1,521 (40.1)	<0.01
Swallow water	6,458 (13.7)	34 (9.7)	594 (22.1)	1,167 (27.4)	1,532 (28.4)	764 (19.0)	1,069 (9.9)	1,298 (6.6)	<0.01
Males	3,518 (54.7)	20 (58.8)	311 (52.5)	644 (55.4)	815 (53.6)	408 (53.6)	552 (51.6)	768 (59.3)	<0.01
Females	2,918 (45.3)	14 (41.2)	281 (47.5)	519 (44.6)	707 (46.5)	353 (46.4)	517 (48.4)	527 (40.7)	<0.01
Wear nose plugs	136 (0.4)	0 (0.0)	6 (0.3)	15 (0.4)	28 (0.6)	20 (0.6)	28 (0.4)	39 (0.3)	0.06 ^b
Males	64 (47.8)	0 (0.0)	2 (40.0)	6 (40.0)	14 (50.0)	11 (55.0)	13 (48.2)	18 (46.2)	0.96
Females	70 (52.2)	0 (0.0)	3 (60.0)	9 (60.0)	14 (50.0)	9 (45.0)	14 (51.8)	21 (53.8)	0.96
Wear mask/goggles	2,401 (6.7)	4 (1.8)	33 (1.6)	406 (10.6)	699 (14.3)	333 (9.8)	307 (3.9)	619 (4.5)	<0.01
Males	1,329 (55.5)	4 (100.0)	20 (60.6)	236 (58.3)	346 (49.6)	194 (58.4)	156 (51.0)	373 (60.4)	<0.01
Females	1,067 (44.5)	0 (0.0)	13 (39.4)	169 (41.7)	352 (50.4)	138 (41.6)	150 (49.0)	245 (39.6)	<0.01
Sand Exposure									
Digging in sand	17,057 (36.4)	93 (26.8)	1,917 (71.8)	3,238 (76.4)	3,196 (59.6)	1,293 (32.4)	3,014 (28.2)	4,306 (22.0)	<0.01
Males	8,258 (48.6)	49 (52.7)	955 (50.1)	1,656 (51.3)	1,584 (49.9)	630 (48.9)	1,376 (45.5)	2,017 (46.9)	<0.01
Females	8,744 (51.4)	44 (47.3)	953 (49.9)	1,572 (48.7)	1,592 (50.1)	658 (51.1)	1,641 (54.5)	2,284 (53.1)	<0.01
Body buried in sand	2,390 (7.1)	8 (3.8)	291 (11.8)	634 (16.4)	611 (13.9)	233 (8.5)	301 (3.9)	312 (2.5)	<0.01
Males	1,198 (50.4)	6 (75.0)	149 (51.7)	320 (50.5)	306 (50.4)	109 (47.6)	153 (51.2)	155 (49.8)	<0.01
Females	1,178 (49.6)	2 (25.0)	139 (48.3)	314 (49.5)	301 (49.6)	120 (52.4)	146 (48.8)	156 (50.2)	<0.01
Sand in mouth ^c	4,693 (12.8)	83 (24.7)	867 (18.5)	886 (18.9)	732 (15.6)	345 (7.4)	781 (16.6)	999 (21.3)	<0.01
Males	2,279 (48.7)	42 (50.6)	450 (52.1)	490 (55.4)	380 (52.1)	183 (53.2)	309 (39.6)	425 (42.5)	<0.01
Females	2,405 (51.4)	41 (49.4)	413 (47.9)	395 (44.6)	350 (47.9)	161 (46.8)	471 (60.4)	574 (57.6)	<0.01
Was sand wet? ^c	6,640 (49.3)	37 (39.8)	712 (47.0)	1,430 (55.4)	1,369 (55.9)	502 (50.1)	874 (38.8)	1,716 (48.2)	<0.01
Males	3,219 (48.6)	26 (70.3)	353 (49.9)	722 (50.6)	703 (51.5)	248 (49.5)	369 (42.2)	798 (46.5)	<0.01
Females	3,410 (51.4)	11 (29.7)	355 (50.1)	705 (49.4)	663 (48.5)	253 (50.5)	505 (57.8)	918 (53.5)	<0.01
Eat/drink after playing in sand ^d	3,049 (57.2)	21 (51.2)	324 (60.1)	499 (57.0)	491 (56.8)	251 (58.8)	555 (54.2)	908 (58.1)	0.28
Males	1,412 (46.3)	13 (61.9)	159 (49.1)	267 (53.5)	237 (48.3)	126 (50.2)	227 (40.9)	383 (42.2)	<0.01

<i>Females</i>	1,637 (53.7)	8 (38.1)	165 (50.9)	232 (46.5)	254 (51.7)	125 (49.8)	328 (59.1)	525 (57.8)	
Wash hands after playing in sand ^c	4,437 (39.9)	31 (43.1)	524 (40.6)	885 (40.5)	790 (38.2)	338 (41.2)	689 (38.8)	1,180 (40.6)	0.50
<i>Males</i>	2,053 (46.3)	17 (54.8)	253 (48.4)	429 (48.5)	398 (50.4)	171 (50.6)	269 (39.0)	516 (43.8)	<0.01
<i>Females</i>	2,381 (53.7)	14 (45.2)	270 (51.6)	456 (51.5)	391 (49.6)	167 (49.4)	420 (61.0)	663 (56.2)	
Algae/Seaweed Exposure									
Touched or had contact with algae/seaweed	4,930 (10.5)	13 (3.8)	396 (14.9)	860 (20.4)	953 (17.8)	454 (11.4)	838 (7.9)	1,416 (7.3)	<0.01
<i>Males</i>	2,459 (50.0)	6 (46.2)	200 (50.5)	438 (51.1)	476 (50.2)	223 (49.1)	398 (47.6)	718 (50.8)	0.80
<i>Females</i>	2,460 (50.0)	7 (53.8)	196 (49.5)	419 (48.9)	472 (49.8)	231 (50.9)	439 (52.5)	696 (49.2)	
Seaweed/algae in mouth ^e	246 (1.3)	6 (3.7)	23 (2.3)	38 (2.1)	43 (2.0)	23 (1.4)	45 (1.0)	68 (0.8)	<0.01
<i>Males</i>	115 (47.1)	2 (33.3)	12 (52.2)	18 (47.4)	16 (38.1)	15 (65.2)	16 (36.4)	36 (52.9)	0.23
<i>Females</i>	129 (52.9)	4 (66.7)	11 (47.8)	20 (52.6)	26 (61.9)	8 (34.8)	28 (63.6)	32 (47.1)	
Wash hands after touching algae/seaweed ^f	1,257 (32.0)	3 (30.0)	107 (33.9)	255 (36.0)	250 (33.8)	100 (27.0)	178 (27.7)	364 (32.0)	0.01
<i>Males</i>	609 (48.6)	1 (33.3)	48 (44.9)	115 (45.1)	121 (48.8)	48 (48.0)	89 (50.0)	187 (51.5)	0.74
<i>Females</i>	645 (51.4)	2 (66.7)	59 (55.1)	140 (54.9)	127 (51.2)	52 (52.0)	89 (50.0)	176 (48.5)	

^a Avalon, Doheny, Edgewater, Fairhope, Goddard, Malibu, Mission Bay, and Surfside

^b Fisher's exact test

^c Only collected on a subset of samples from Avalon, Doheny, Edgewater, Fairhope, Goddard, Malibu, and Surfside

^d Only collected on a subset of samples from Fairhope, Goddard, and Surfside

^e Only collected on a subset of samples from Avalon, Doheny, Malibu, and Surfside

^f Only collected on a subset of samples from Avalon, Doheny, Fairhope, Goddard, Malibu, and Surfside

Table S3: Estimated volume (mL) of water swallowed per swimming event, among those who submerged their head

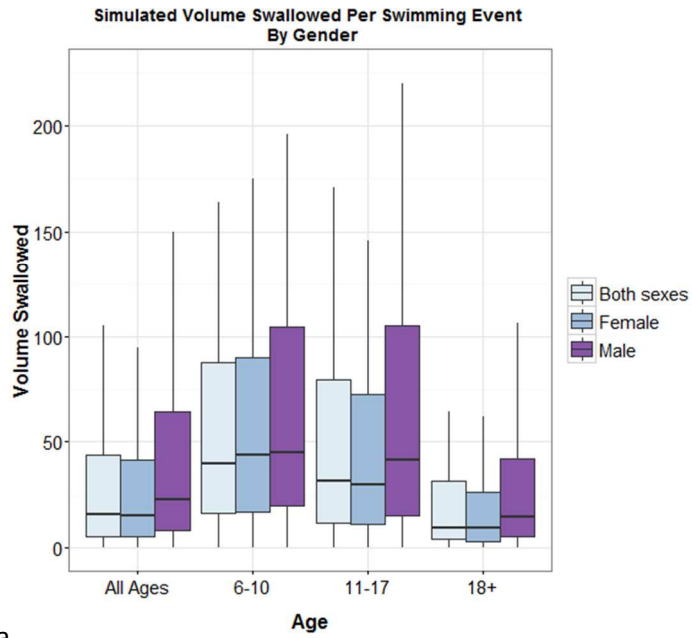
<i>All</i>	
All Ages	
Mean	56.4
Median	21.8
Standard Deviation	109.2
5 th percentile	1.3
10 th percentile	2.7
90 th percentile	134.0
95 th percentile	214.7
Children 6-12	
Mean	72.0
Median	42.7
Standard Deviation	91.9
5 th percentile	3.6
10 th percentile	7.0
90 th percentile	172.0
95 th percentile	240.0
Ages 13-18	
Mean	79.8
Median	36.7
Standard Deviation	122.3
5 th percentile	2.7
10 th percentile	4.7
90 th percentile	201.0
95 th percentile	304.5
Adults 19-34	
Mean	41.0
Median	15.3
Standard Deviation	89.2
5 th percentile	1.0
10 th percentile	2.0
90 th percentile	93.3
95 th percentile	156.0
Adults 35 and over	
Mean	41.1
Median	13.0
Standard Deviation	105.2
5 th percentile	0.9
10 th percentile	1.7
90 th percentile	88.0
95 th percentile	157.3

Table S4: Estimated volume (mL) of water swallowed per swimming event, by gender, with alternate age

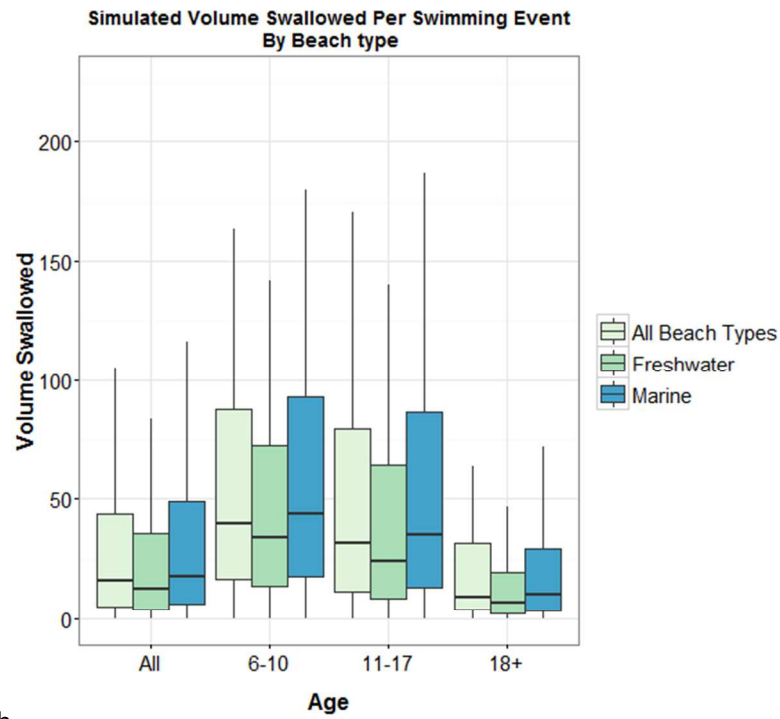
	<i>All</i>	<i>Females</i>	<i>Males</i>	<i>Freshwater</i>	<i>Marine</i>
All Ages					
Mean	44.5	32.0	57.3	35.4	48.3
Median	16.0	12.0	21.3	12.7	18.0
Standard Deviation	93.9	69.5	110.0	74.6	99.3
5 th percentile	1.0	0.7	1.4	0.8	1.2
10 th percentile	2.0	1.3	2.7	1.3	2.0
90 th percentile	105.0	76.0	140.0	84.0	116.0
95 th percentile	174.0	121.3	232.0	140.0	186.7
Children 6-10					

categories

Mean	69.8	66.9	73.5	58.9	74.4
Median	40.0	37.0	42.0	34.0	43.7
Standard Deviation	91.3	93.7	85.2	77.0	96.2
5 th percentile	3.0	3.0	2.7	2.5	3.3
10 th percentile	6.3	5.8	7.0	5.3	6.7
90 th percentile	164.0	154.0	184.0	142.0	180.0
95 th percentile	230.0	216.0	241.5	200.0	245.0
Ages 11-17					
Mean	70.4	47.9	82.1	55.5	75.6
Median	32.0	24.0	37.3	24.3	35.0
Standard Deviation	111.3	66.8	125.3	89.1	117.3
5 th percentile	2.4	1.6	3.0	1.7	2.7
10 th percentile	4.0	2.9	5.3	3.1	4.9
90 th percentile	170.7	122.7	204.0	140.0	186.7
95 th percentile	272.0	177.6	312.0	212.0	289.8
Adults 18 and over					
Mean	29.1	20.4	41.8	21.9	32.4
Median	9.3	6.7	13.3	6.7	10.5
Standard Deviation	76.0	55.8	100.5	58.5	83.9
5 th percentile	0.7	0.4	0.9	0.4	0.7
10 th percentile	1.1	0.8	1.8	0.9	1.3
90 th percentile	64.0	43.3	90.7	46.7	72.0
95 th percentile	116.0	78.0	174.0	85.3	121.3



a



b

Figure S1: Estimated volume (mL) of water swallowed for each age category per swimming event by (a) sex and (b) water type (freshwater and marine), with alternate age categories