Genetic Assignment of:

Summer-run and Fall-run Chum Salmon Juveniles Utilizing Nearshore Habitat at the NAVBASE Kitsap Bangor, NAVMAG Indian Island, NAS Whidbey Island Lake Hancock

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Project Background

Puget Sound is home to four species of salmonids (Chinook Salmon, Hood Canal summer-run Chum Salmon, steelhead, and Bull Trout) that are afforded legal protection under the Endangered Species Act (ESA). In an effort to determine whether occurrence of these ESA-listed species has the potential to affect operations in the waters adjacent to the Naval Base (NAVBASE) Kitsap Bangor, Naval Magazine (NAVMAG) Indian Island, and Naval Air Station (NAS) Whidbey Island Lake Hancock, the Naval Facilities Engineering Command Northwest (NAVFAC NW) and the Washington Department of Fish and Wildlife (WDFW) entered into a cooperative agreement whereby the WDFW agreed to survey these waters with a beach seine to evaluate both the seasonal and resident presence of ESA-listed fish. For further details regarding the ESA-listed fish surveys conducted with a beach seine at Naval installations in 2015 and 2016, see the final reports for each location (Frierson et al. 2017a, 2017b, 2017c). The ESA-listed fish species stock within Puget Sound most relevant to this study is Hood Canal summer-run Chum Salmon (*Oncorhynchus keta*). Juvenile summer-run and fall-run Chum Salmon are known to co-occur in Hood Canal during their outmigrant period from January through May, with the summer-run juveniles consistently outmigrating from natal streams earlier than the fall-run juveniles (Small et al. 2011, 2012, 2013, 2014, 2015, 2016). Summer-run cannot be visually distinguished from fall-run Chum Salmon juveniles; therefore, this study provided genetic samples to differentiate run group assignment, and estimated their proportions at a given time during their outmigration period in the nearshore marine environment. These data could provide a useful method to differentiate Chum Salmon populations during their juvenile life history stage; as well as nearshore habitat utilization, overall population abundance and densities, and an understanding of migration timing (Fletcher et al. 2013).

Methods

A total of 328 tissue samples (1mm non-lethal caudal fin clips) were collected from juvenile Chum Salmon captured with a beach seine at Naval properties situated in Hood Canal and Admiralty Inlet (Figure 1, Table 1). Tissue samples were collected monthly during the winter-spring 2016 outmigration, and individual fork lengths were recorded with each sample number (Table 2).

DNA was extracted from fin clips with a silica membrane protocol following manufacturer's instructions (Macherey-Nagel). Genotypes were assessed at 16 microsatellite loci as detailed in Small et al. (2009). Microsatellite alleles were run on an AB3730 automated sequencing platform and scored and binned using GENOTYPER and GENEMAPPER software, both from Applied Biosystems.

Assignment tests

Juvenile Chum Salmon were assigned to a baseline consisting of summer- and fall-run Chum Salmon populations from Hood Canal (see Small et al. 2009) using the Rannala and Mountain (1997) algorithm implemented in GeneClass2 (Piry et al. 2004). Baseline collections were combined into reporting groups composed of all summer-run and all fall-run Chum Salmon collections from Hood Canal. Assignment likelihoods were calculated per reporting group (see Table 2).

Results

The majority of DNA samples (313/328) amplified at nine or more loci. Two sample tubes had no tissue (16AN0032 and 16AN0082), 10 samples failed at most or all loci suggesting either that the DNA quantity from the samples was too small or sample had degraded, and two samples failed at several loci and had alleles that were out of the size range for Chum Salmon, suggesting that they were not Chum Salmon. Two fish collected at Bangor had roughly equal likelihoods of assignment to summer-run and fall-run and were thus unassigned (16AN0147, 16AN0171). These fish may have had alleles that were common in both run groups or could have had parents from both run groups.

The genetic analysis of tissue samples for all locations combined revealed that ESA-listed Hood Canal summer-run Chum Salmon comprised 94% of all Chum captured in both January and February, while 81% of all Chum captured from March through May were fall-run fish (Figure 2). Totals and percentages of run group assignment varied by location and month, but the overall trend of summer-run Chum Salmon as the dominant species stock occurring in January and February was evident (Figure 3, 4, 5). Chum Salmon fork lengths generally increased for each run group assignment's cohort, as a consequence of seasonal growth after outmigration from local watersheds, from January through May (Figure 6). The mean fork length data for each run group assignment indicated pronounced overlap during each month, with the exception of March. A two-sample t-test assuming unequal variances was performed comparing the mean fork lengths of summer-run and fall-run Chum Salmon in March. The mean fork length for summer-run Chum Salmon ($M= 54.16$, $SD= 10.95$, $N= 19$) was significantly different than fall-run Chum lengths ($M= 43.47$, $SD= 6.34$, $N= 59$) in March, $t(22)= -4.0$, $p= 0.0005$, two-tailed.

Conclusions

Based on these results, future sampling of Chum Salmon with a beach seine in northern Hood Canal and northern Admiralty Inlet may apply conservative proportions of summer-run to fall-run group assignments by month. However, natural interannual variation in timing for spawning adults and juvenile outmigrants should be considered, and genetic analysis is still recommended for more accurate proportionality of run group assignments during the weeks suspected of having the most overlap

(typically in March). For all locations in 2016, the vast majority of sampled Chum Salmon were summer-run fish in January (97%) and February (92%); while the majority of sampled Chum were fall-run fish in March (75%), April (82%), and May (91%). The mean fork length for summer-run Chum Salmon was significantly different than the mean fork length for fall-run Chum in the month of March, where summer-run Chum could be up to 10mm longer than fall-run Chum. However, run group assignment based on length is not considered a precise method in this study due to high variation and potential sampling biases, and therefore needs to be refined with a larger dataset of samples collected across a greater area, over multiple years. These data will also supplement a concurrent study conducted by the WFC in 2016 to be released in a separate report (in progress), which sampled many more locations throughout Hood Canal, Admiralty Inlet, and Strait of Juan de Fuca.

Acknowledgements

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Figure 1. Map of Chum Salmon collection locations in Hood Canal (Bangor) and Admiralty Inlet (Indian Island and Lake Hancock).

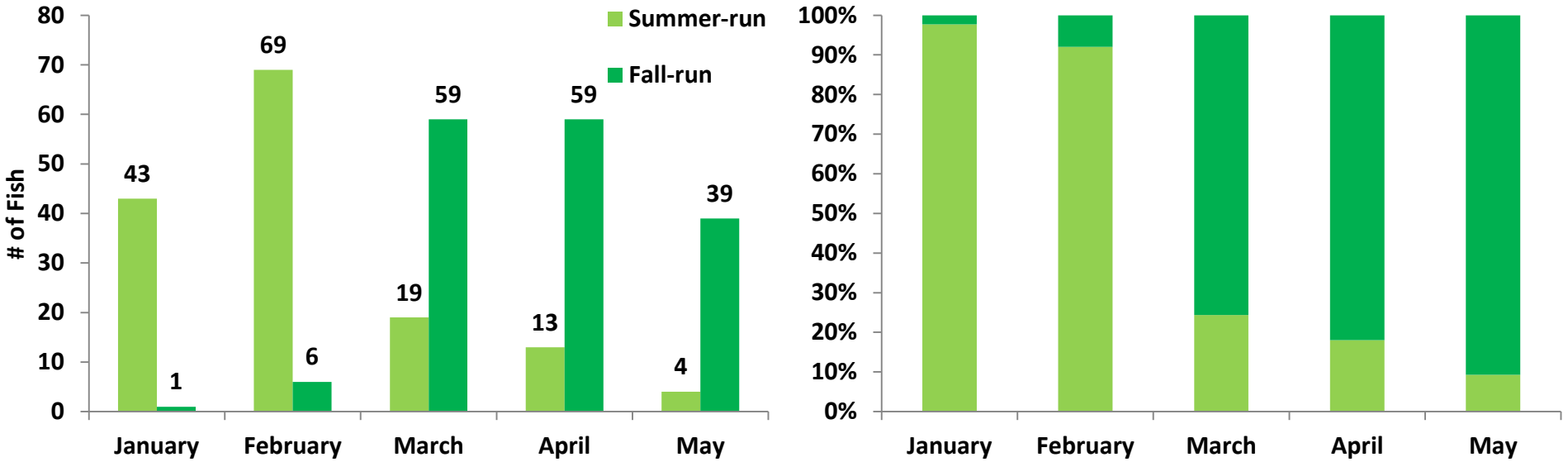

Figure 2. Run group assignment totals by month for all samples and locations combined (left), and run group assignment percentages by month for all samples and locations combined (right).

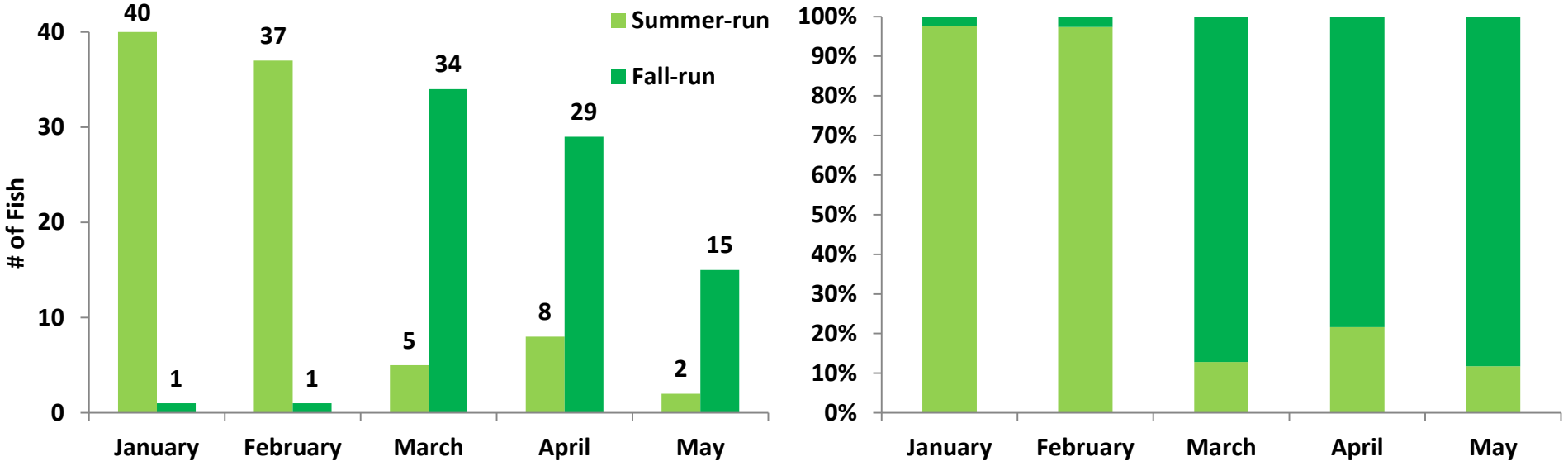

Figure 3. Run group assignment totals by month for all samples at Bangor (left), and run group assignment percentages by month for all samples at Bangor (right).

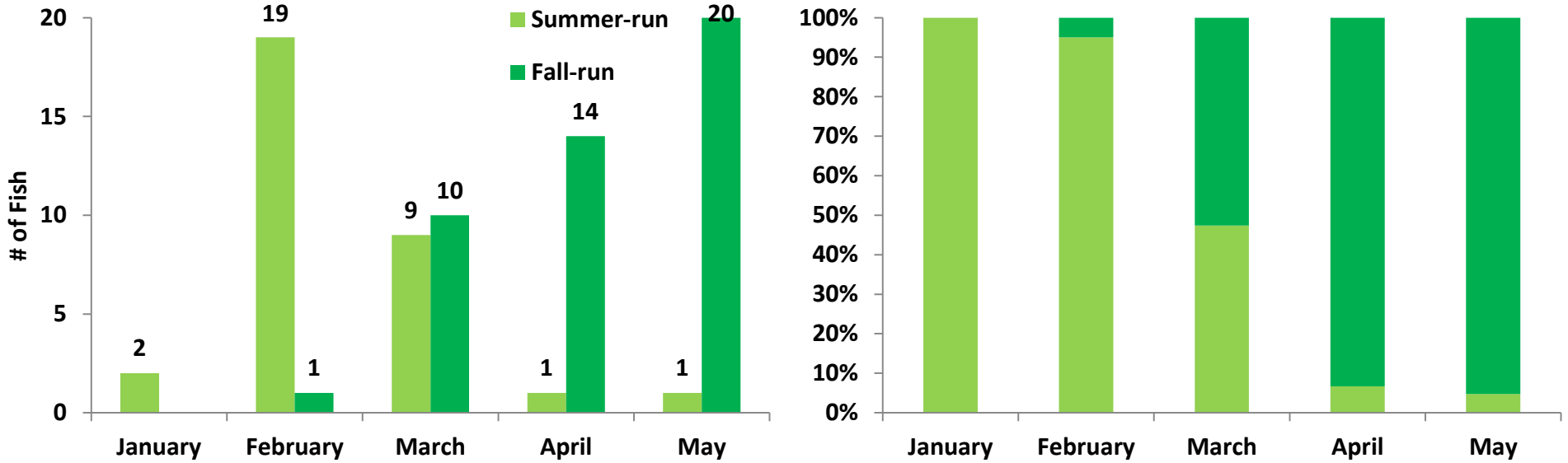

Figure 4. Run group assignment totals by month for all samples at Indian Island (left), and run group assignment percentages by month for all samples at Indian Island (right).

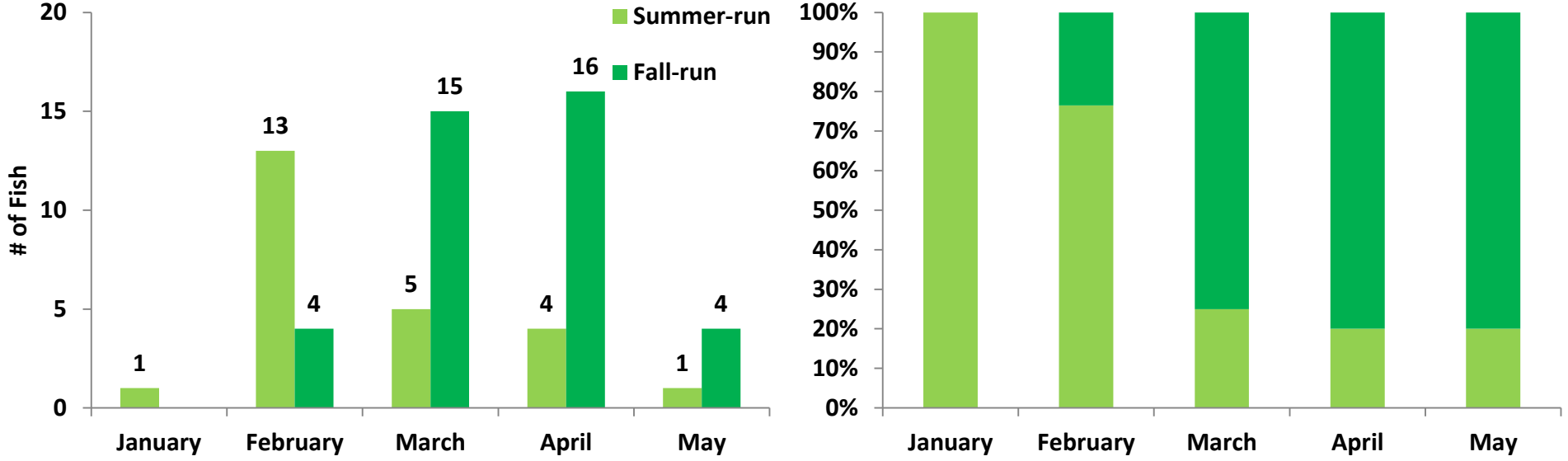

Figure 5. Run group assignment totals by month for all samples at Lake Hancock (left), and run group assignment percentages by month for all samples at Lake Hancock (right).

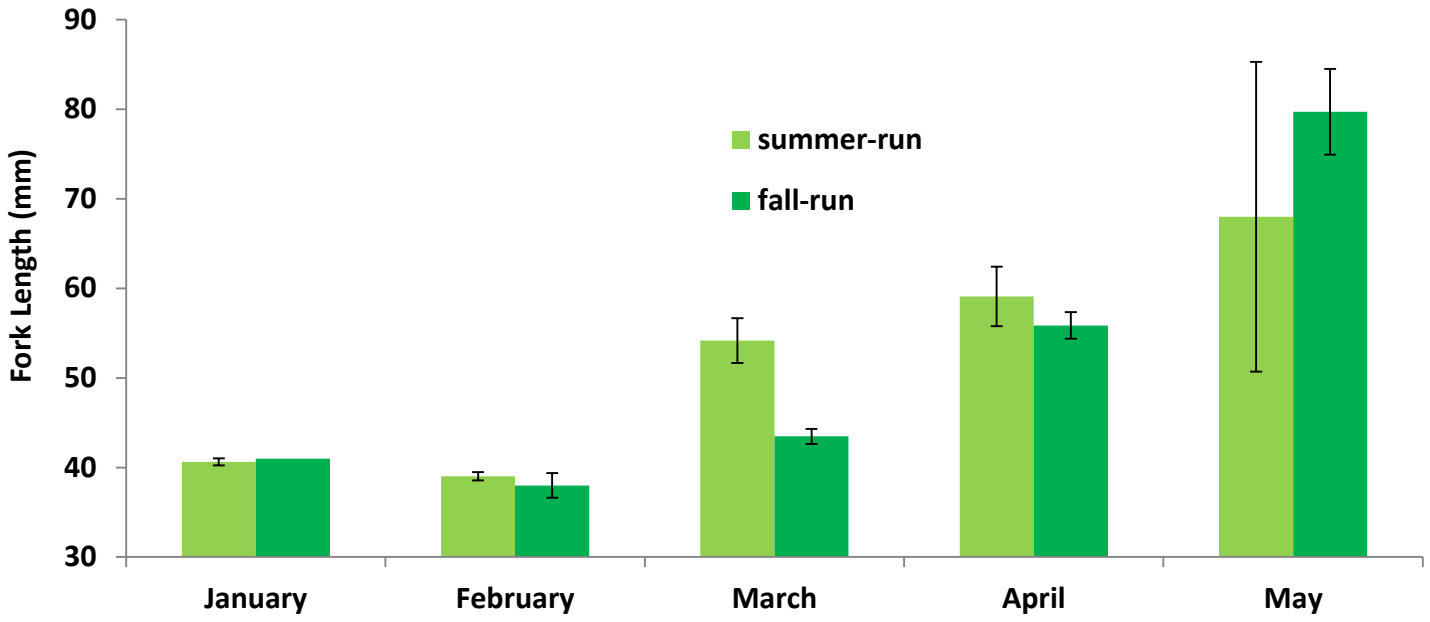

Figure 6. Mean fork length (± 1SE) for run group assignment, by month for all locations.

Table 1. List of Chum Salmon tissue samples, WDFW codes and collection locations.

WDFW code	Location	N
16AN	Bangor	182
16AO	Lake Hancock	63
16AP	Indian Island	83
	TOTAL	**328**

Table 2. Biological sample data for Chum Salmon juveniles and assignments based on genotypic data.

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Bangor	5-Jan-16	Ba-South	43	16AN_1	16AN0001	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	40	16AN_2	16AN0002	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	38	16AN_3	16AN0003	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	42	16AN_4	16AN0004	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	42	16AN_5	16AN0005	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	39	16AN_6	16AN0006	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	44	16AN_7	16AN0007	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	41	16AN_8	16AN0008	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	40	16AN_9	16AN0009	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	44	16AN_10	16AN0010	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	44	16AN_11	16AN0011	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	42	16AN_12	16AN0012	summer	99.99	0.01
Bangor	5-Jan-16	Ba-South	44	16AN_13	16AN0013	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	41	16AN_14	16AN0014	fall	5.32	94.68
Bangor	5-Jan-16	Ba-South	42	16AN_15	16AN0015	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	39	16AN_16	16AN0016	summer	99.98	0.02

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Bangor	5-Jan-16	Ba-South	41	16AN_17	16AN0017	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	38	16AN_18	16AN0018	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	41	16AN_19	16AN0019	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	40	16AN_20	16AN0020	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	39	16AN_21	16AN0021	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	40	16AN_22	16AN0022	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	39	16AN_23	16AN0023	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	41	16AN_24	16AN0024	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	42	16AN_25	16AN0025	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	38	16AN_26	16AN0026	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	46	16AN_27	16AN0027	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	42	16AN_28	16AN0028	summer	100.00	0.00
Bangor	5-Jan-16	Ba-South	39	16AN_29	16AN0029	summer	99.99	0.01
Bangor	5-Jan-16	Ba-South	39	16AN_30	16AN0030	summer	100.00	0.00
Bangor	5-Jan-16	Ba-North	36	16AN_31	16AN0031	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	36	16AN_32	no tissue in tube			
Bangor	5-Jan-16	Ba-West	40	16AN_33	16AN0033	summer	99.95	0.05
Bangor	5-Jan-16	Ba-West	34	16AN_34	16AN0034	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	42	16AN_35	16AN0035	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	39	16AN_36	16AN0036	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	41	16AN_37	16AN0037	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	37	16AN_38	16AN0038	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	43	16AN_39	16AN0039	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	38	16AN_40	16AN0040	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	44	16AN_41	16AN0041	summer	100.00	0.00
Bangor	5-Jan-16	Ba-West	37	16AN_42	16AN0042	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	38	16AN_43	16AN0043	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_44	16AN0044	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	38	16AN_45	16AN0045	summer	99.88	0.12
Bangor	2-Feb-16	Ba-South	39	16AN_46	16AN0046	summer	99.99	0.01
Bangor	2-Feb-16	Ba-South	35	16AN_47	16AN0047	summer	99.98	0.02
Bangor	2-Feb-16	Ba-South	37	16AN_48	16AN0048	summer	99.99	0.01
Bangor	2-Feb-16	Ba-South	36	16AN_49	16AN0049	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	38	16AN_50	16AN0050	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	38	16AN_51	16AN0051	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_52	16AN0052	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_53	16AN0053	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_54	16AN0054	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_55	16AN0055	summer	99.97	0.03
Bangor	2-Feb-16	Ba-South	39	16AN_56	16AN0056	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_57	16AN0057	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	38	16AN_58	16AN0058	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	36	16AN_59	16AN0059	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_60	no data			
Bangor	2-Feb-16	Ba-South	37	16AN_61	16AN0061	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_62	16AN0062	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_63	16AN0063	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_64	16AN0064	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_65	16AN0065	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_66	16AN0066	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_67	16AN0067	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_68	16AN0068	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	36	16AN_69	16AN0069	summer	100.00	0.00

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Bangor	2-Feb-16	Ba-South	39	16AN_70	16AN0070	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	36	16AN_71	16AN0071	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	36	16AN_72	16AN0072	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	41	16AN_73	16AN0073	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	36	16AN_74	16AN0074	summer	99.29	0.71
Bangor	2-Feb-16	Ba-South	38	16AN_75	16AN0075	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	39	16AN_76	16AN0076	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	43	16AN_77	16AN0077	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	37	16AN_78	16AN0078	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	41	16AN_79	16AN0079	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	34	16AN_80	16AN0080	summer	100.00	0.00
Bangor	2-Feb-16	Ba-South	33	16AN_81	16AN0081	fall	0.01	99.99
Bangor	2-Feb-16	Ba-South	35	16AN_82	no tissue in tube			
Bangor	7-Mar-16	Ba-South	39	16AN_83	16AN0083	fall	1.78	98.22
Bangor	7-Mar-16	Ba-South	38	16AN_84	16AN0084	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	38	16AN_85	16AN0085	fall	5.15	94.85
Bangor	7-Mar-16	Ba-South	36	16AN_86	16AN0086	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	42	16AN_87	16AN0087	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	39	16AN_88	16AN0088	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	38	16AN_89	16AN0089	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	37	16AN_90	16AN0090	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	39	16AN_91	16AN0091	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	37	16AN_92	16AN0092	fall	0.01	99.99
Bangor	7-Mar-16	Ba-South	41	16AN_93	16AN0093	fall	0.01	99.99
Bangor	7-Mar-16	Ba-South	38	16AN_94	16AN0094	fall	0.02	99.98
Bangor	7-Mar-16	Ba-South	34	16AN_95	16AN0095	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	40	16AN_96	16AN0096	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	38	16AN_97	16AN0097	fall	15.06	84.94
Bangor	7-Mar-16	Ba-South	33	16AN_98	not Chum			
Bangor	7-Mar-16	Ba-South	39	16AN_99	16AN0099	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	35	16AN_100	16AN0100	fall	3.71	96.29
Bangor	7-Mar-16	Ba-South	38	16AN_101	16AN0101	fall	0.04	99.96
Bangor	7-Mar-16	Ba-South	37	16AN_102	16AN0102	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	41	16AN_103	16AN0103	fall	0.00	100.00
Bangor	7-Mar-16	Ba-South	35	16AN_104	16AN0104	summer	86.03	13.97
Bangor	7-Mar-16	Ba-South	43	16AN_105	16AN0105	summer	94.84	5.16
Bangor	7-Mar-16	Ba-North	47	16AN_106	no data			
Bangor	7-Mar-16	Ba-North	49	16AN_107	16AN0107	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	41	16AN_108	16AN0108	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	54	16AN_109	16AN0109	fall	0.36	99.64
Bangor	7-Mar-16	Ba-North	58	16AN_110	16AN0110	summer	100.00	0.00
Bangor	7-Mar-16	Ba-North	43	16AN_111	16AN0111	fall	0.01	99.99
Bangor	7-Mar-16	Ba-North	43	16AN_112	16AN0112	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	48	16AN_113	16AN0113	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	40	16AN_114	16AN0114	fall	0.58	99.42
Bangor	7-Mar-16	Ba-North	41	16AN_115	16AN0115	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	56	16AN_116	16AN0116	summer	100.00	0.00
Bangor	7-Mar-16	Ba-North	43	16AN_117	16AN0117	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	45	16AN_118	16AN0118	summer	99.94	0.06
Bangor	7-Mar-16	Ba-North	39	16AN_119	16AN0119	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	49	16AN_120	16AN0120	fall	0.11	99.89
Bangor	7-Mar-16	Ba-North	39	16AN_121	16AN0121	fall	0.00	100.00
Bangor	7-Mar-16	Ba-North	49	16AN_122	16AN0122	fall	0.00	100.00

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Bangor	7-Mar-16	Ba-North	41	16AN_123	16AN0123	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	46	16AN_124	16AN0124	fall	0.04	99.96
Bangor	1-Apr-16	Ba-South	44	16AN_125	16AN0125	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	49	16AN_126	16AN0126	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	44	16AN_127	16AN0127	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	46	16AN_128	16AN0128	fall	0.01	99.99
Bangor	1-Apr-16	Ba-South	43	16AN_129	16AN0129	fall	0.72	99.28
Bangor	1-Apr-16	Ba-South	46	16AN_130	16AN0130	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	41	16AN_131	16AN0131	fall	0.06	99.94
Bangor	1-Apr-16	Ba-South	68	16AN_132	16AN0132	summer	100.00	0.00
Bangor	1-Apr-16	Ba-South	46	16AN_133	16AN0133	summer	62.82	37.18
Bangor	1-Apr-16	Ba-South	44	16AN_134	no data			
Bangor	1-Apr-16	Ba-South	43	16AN_135	16AN0135	fall	0.10	99.90
Bangor	1-Apr-16	Ba-South	70	16AN_136	16AN0136	summer	100.00	0.00
Bangor	1-Apr-16	Ba-South	41	16AN_137	16AN0137	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	56	16AN_138	16AN0138	fall	0.03	99.97
Bangor	1-Apr-16	Ba-South	42	16AN_139	16AN0139	summer	97.94	2.06
Bangor	1-Apr-16	Ba-South	42	16AN_140	16AN0140	fall	6.44	93.56
Bangor	1-Apr-16	Ba-South	44	16AN_141	16AN0141	fall	0.99	99.01
Bangor	1-Apr-16	Ba-South	45	16AN_142	16AN0142	fall	0.04	99.96
Bangor	1-Apr-16	Ba-South	47	16AN_143	16AN0143	fall	2.24	97.76
Bangor	1-Apr-16	Ba-South	42	16AN_144	16AN0144	fall	0.00	100.00
Bangor	1-Apr-16	Ba-South	44	16AN_145	16AN0145	fall	0.99	99.01
Bangor	1-Apr-16	Ba-South	43	16AN_146	16AN0146	fall	0.01	99.99
Bangor	1-Apr-16	Ba-South	40	16AN_147	16AN0147	unassign	52.00	48.00
Bangor	1-Apr-16	Ba-South	65	16AN_148	16AN0148	fall	0.43	99.57
Bangor	1-Apr-16	Ba-South	67	16AN_149	16AN0149	summer	84.74	15.26
Bangor	1-Apr-16	Ba-South	43	16AN_150	16AN0150	summer	84.63	15.37
Bangor	1-Apr-16	Ba-South	62	16AN_151	no data			
Bangor	1-Apr-16	Ba-South	55	16AN_152	16AN0152	fall	1.10	98.90
Bangor	1-Apr-16	Ba-South	50	16AN_153	16AN0153	fall	0.02	99.98
Bangor	1-Apr-16	Ba-South	40	16AN_154	16AN0154	fall	0.07	99.93
Bangor	1-Apr-16	Ba-South	52	16AN_155	16AN0155	summer	99.15	0.85
Bangor	1-Apr-16	Ba-South	43	16AN_156	16AN0156	fall	0.70	99.30
Bangor	1-Apr-16	Ba-South	47	16AN_157	16AN0157	fall	0.01	99.99
Bangor	1-Apr-16	Ba-South	52	16AN_158	16AN0158	summer	100.00	0.00
Bangor	1-Apr-16	Ba-South	53	16AN_159	16AN0159	fall	2.69	97.31
Bangor	1-Apr-16	Ba-South	50	16AN_160	16AN0160	fall	12.03	87.97
Bangor	1-Apr-16	Ba-South	45	16AN_161	16AN0161	fall	0.11	99.89
Bangor	1-Apr-16	Ba-South	72	16AN_162	16AN0162	fall	2.03	97.97
Bangor	1-Apr-16	Ba-South	41	16AN_163	16AN0163	fall	3.13	96.87
Bangor	13-May-16	Ba-South	52	16AN_164	16AN0164	fall	0.00	100.00
Bangor	13-May-16	Ba-South	44	16AN_165	16AN0165	fall	0.00	100.00
Bangor	13-May-16	Ba-South	62	16AN_166	no data			
Bangor	13-May-16	Ba-South	53	16AN_167	16AN0167	fall	0.00	100.00
Bangor	13-May-16	Ba-South	54	16AN_168	16AN0168	fall	0.00	100.00
Bangor	13-May-16	Ba-North	61	16AN_169	16AN0169	fall	4.18	95.82
Bangor	13-May-16	Ba-North	56	16AN_170	16AN0170	fall	0.00	100.00
Bangor	13-May-16	Ba-North	39	16AN_171	16AN0171	unassign	46.86	53.14
Bangor	13-May-16	Ba-North	36	16AN_172	16AN0172	fall	0.04	99.96
Bangor	13-May-16	Ba-North	39	16AN_173	16AN0173	summer	65.22	34.78
Bangor	13-May-16	Ba-North	44	16AN_174	16AN0174	fall	0.00	100.00
Bangor	13-May-16	Ba-West	47	16AN_175	16AN0175	fall	0.14	99.86

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Bangor	13-May-16	Ba-West	38	16AN_176	16AN0176	fall	0.00	100.00
Bangor	13-May-16	Ba-West	38	16AN_177	16AN0177	fall	0.10	99.90
Bangor	13-May-16	Ba-Zelatched	47	16AN_178	16AN0178	summer	95.03	4.97
Bangor	13-May-16	Ba-Zelatched	56	16AN_179	16AN0179	fall	0.01	99.99
Bangor	13-May-16	Ba-Zelatched	52	16AN_180	16AN0180	fall	0.00	100.00
Bangor	13-May-16	Ba-Zelatched	74	16AN_181	16AN0181	fall	0.00	100.00
Bangor	13-May-16	Ba-Zelatched	42	16AN_182	16AN0182	fall	0.37	99.63
Lake Hancock	4-Jan-16	LH-South	38	16AO_1	16AO0001	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-North	39	16AO_2	16AO0002	fall	0.00	100.00
Lake Hancock	1-Feb-16	LH-North	38	16AO_3	16AO0003	fall	0.04	99.96
Lake Hancock	1-Feb-16	LH-North	37	16AO_4	16AO0004	summer	99.99	0.01
Lake Hancock	1-Feb-16	LH-North	36	16AO_5	not Chum	fall		
Lake Hancock	1-Feb-16	LH-North	39	16AO_6	16AO0006	fall	0.00	100.00
Lake Hancock	1-Feb-16	LH-North	34	16AO_7	16AO0007	summer	99.99	0.01
Lake Hancock	1-Feb-16	LH-North	37	16AO_8	16AO0008	summer	99.99	0.01
Lake Hancock	1-Feb-16	LH-North	37	16AO_9	16AO0009	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-North	48	16AO_10	16AO0010	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-North	39	16AO_11	16AO0011	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-North	40	16AO_12	16AO0012	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-North	39	16AO_13	16AO0013	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-North	36	16AO_14	16AO0014	summer	99.98	0.02
Lake Hancock	1-Feb-16	LH-South	46	16AO_15	16AO0015	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-South	48	16AO_16	16AO0016	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-South	37	16AO_17	16AO0017	summer	100.00	0.00
Lake Hancock	1-Feb-16	LH-South	39	16AO_18	16AO0018	summer	100.00	0.00
Lake Hancock	17-Mar-16	LH-South	49	16AO_19	16AO0019	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	37	16AO_20	16AO0020	fall	0.05	99.95
Lake Hancock	17-Mar-16	LH-South	41	16AO_21	16AO0021	fall	0.29	99.71
Lake Hancock	17-Mar-16	LH-South	57	16AO_22	16AO0022	summer	100.00	0.00
Lake Hancock	17-Mar-16	LH-South	48	16AO_23	16AO0023	fall	0.42	99.58
Lake Hancock	17-Mar-16	LH-South	44	16AO_24	16AO0024	summer	100.00	0.00
Lake Hancock	17-Mar-16	LH-South	41	16AO_25	16AO0025	fall	0.01	99.99
Lake Hancock	17-Mar-16	LH-South	42	16AO_26	16AO0026	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	41	16AO_27	16AO0027	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	58	16AO_28	16AO0028	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	47	16AO_29	16AO0029	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	61	16AO_30	16AO0030	summer	100.00	0.00
Lake Hancock	17-Mar-16	LH-South	56	16AO_31	16AO0031	summer	100.00	0.00
Lake Hancock	17-Mar-16	LH-South	46	16AO_32	16AO0032	fall	0.01	99.99
Lake Hancock	17-Mar-16	LH-South	51	16AO_33	16AO0033	fall	19.13	80.87
Lake Hancock	17-Mar-16	LH-South	48	16AO_34	16AO0034	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	38	16AO_35	16AO0035	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	36	16Ao_36	16AO0036	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	47	16AO_37	16AO0037	fall	0.00	100.00
Lake Hancock	17-Mar-16	LH-South	41	16AO_38	16AO0038	summer	99.90	0.10
Lake Hancock	14-Apr-16	LH-North	78	16AO_39	16AO0039	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	77	16AO_40	16AO0040	fall	0.07	99.93
Lake Hancock	14-Apr-16	LH-North	59	16AO_41	16AO0041	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	53	16AO_42	16AO0042	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	78	16AO_43	16AO0043	summer	100.00	0.00
Lake Hancock	14-Apr-16	LH-North	71	16AO_44	16AO0044	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	56	16AO_45	16AO0045	fall	14.72	85.28
Lake Hancock	14-Apr-16	LH-North	61	16AO_46	16AO0046	fall	17.10	82.90

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Lake Hancock	14-Apr-16	LH-North	57	16AO_47	16AO0047	fall	17.19	82.81
Lake Hancock	14-Apr-16	LH-North	62	16AO_48	16AO0048	summer	65.45	34.55
Lake Hancock	14-Apr-16	LH-North	71	16AO_49	16AO0049	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	57	16AO_50	16AO0050	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	58	16AO_51	16AO0051	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	49	16AO_52	16AO0052	fall	10.64	89.36
Lake Hancock	14-Apr-16	LH-North	56	16AO_53	16AO0053	fall	38.78	61.22
Lake Hancock	14-Apr-16	LH-North	55	16AO_54	16AO0054	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	75	16AO_55	16AO0055	summer	100.00	0.00
Lake Hancock	14-Apr-16	LH-North	75	16AO_56	16AO0056	fall	0.00	100.00
Lake Hancock	14-Apr-16	LH-North	55	16AO_57	16AO0057	summer	99.96	0.04
Lake Hancock	14-Apr-16	LH-North	58	16AO_58	16AO0058	fall	0.00	100.00
Lake Hancock	18-May-16	LH-South	61	16AO_59	16AO0059	fall	14.24	85.76
Lake Hancock	18-May-16	LH-South	56	16AO_60	16AO0060	fall	0.00	100.00
Lake Hancock	18-May-16	LH-North	60	16AO_61	16AO0061	fall	0.09	99.91
Lake Hancock	18-May-16	LH-North	70	16AO_62	16AO0062	summer	81.66	18.34
Lake Hancock	18-May-16	LH-North	63	16AO_63	16AO0063	fall	4.24	95.76
Indian Island	4-Jan-16	Ind-South	43	16AP_1	16AP0001	summer	98.42	1.58
Indian Island	4-Jan-16	Ind-North	46	16AP_2	16AP0002	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	49	16AP_3	16AP0003	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	40	16AP_4	16AP0004	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	37	16AP_5	16AP0005	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	39	16AP_6	16AP0006	summer	99.98	0.02
Indian Island	1-Feb-16	Ind-South	48	16AP_7	16AP0007	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	51	16AP_8	16AP0008	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	46	16AP_9	16AP0009	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	37	16AP_10	16AP0010	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	35	16AP_11	16AP0011	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-South	34	16AP_12	16AP0012	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	41	16AP_13	16AP0013	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	33	16AP_14	16AP0014	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	39	16AP_15	16AP0015	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	37	16AP_16	16AP0016	summer	99.99	0.01
Indian Island	1-Feb-16	Ind-North	43	16AP_17	16AP0017	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	37	16AP_18	16AP0018	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	43	16AP_19	16AP0019	fall	0.00	100.00
Indian Island	1-Feb-16	Ind-North	47	16AP_20	16AP0020	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	41	16AP_21	16AP0021	summer	100.00	0.00
Indian Island	1-Feb-16	Ind-North	41	16AP_22	16AP0022	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	74	16AP_23	16AP0023	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	63	16AP_24	16AP0024	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	59	16AP_25	16AP0025	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	51	16AP_26	16AP0026	fall	13.42	86.58
Indian Island	17-Mar-16	Ind-North	52	16AP_27	16AP0027	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	50	16AP_28	16AP0028	fall	0.11	99.89
Indian Island	17-Mar-16	Ind-North	47	16AP_29	16AP0029	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	44	16AP_30	16AP0030	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	53	16AP_31	16AP0031	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	47	16AP_32	16AP0032	fall	0.62	99.38
Indian Island	17-Mar-16	Ind-North	54	16AP_33	16AP0033	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	51	16AP_34	16AP0034	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	65	16AP_35	16AP0035	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	55	16AP_36	16AP0036	summer	100.00	0.00

							Relative Likelihood	
Location	**Date**	**Site Code**	**Length (mm)**	**GEN_ID**	**Code**	**Assignment**	**Summer**	**Fall**
Indian Island	17-Mar-16	Ind-North	40	16AP_37	16AP0037	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	50	16AP_38	16AP0038	fall	0.00	100.00
Indian Island	17-Mar-16	Ind-North	72	16AP_39	16AP0039	summer	99.97	0.03
Indian Island	17-Mar-16	Ind-North	50	16AP_40	16AP0040	summer	100.00	0.00
Indian Island	17-Mar-16	Ind-North	58	16AP_41	no data			
Indian Island	17-Mar-16	Ind-North	68	16AP_42	16AP0042	summer	98.29	1.71
Indian Island	14-Apr-16	Ind-South	71	16AP_43	no data			
Indian Island	14-Apr-16	Ind-South	64	16AP_44	no data			
Indian Island	14-Apr-16	Ind-South	61	16AP_45	16AP0045	fall	0.10	99.90
Indian Island	14-Apr-16	Ind-South	72	16AP_46	no data			
Indian Island	14-Apr-16	Ind-South	75	16AP_47	no data			
Indian Island	14-Apr-16	Ind-South	70	16AP_48	16AP0048	fall	0.04	99.96
Indian Island	14-Apr-16	Ind-South	64	16AP_49	16AP0049	fall	0.02	99.98
Indian Island	14-Apr-16	Ind-South	66	16AP_50	no data			
Indian Island	14-Apr-16	Ind-South	76	16AP_51	16AP0051	fall	0.00	100.00
Indian Island	14-Apr-16	Ind-South	69	16AP_52	16AP0052	fall	0.00	100.00
Indian Island	14-Apr-16	Ind-South	74	16AP_53	16AP0053	fall	8.61	91.39
Indian Island	14-Apr-16	Ind-South	66	16AP_54	16AP0054	fall	9.16	90.84
Indian Island	14-Apr-16	Ind-North	67	16AP_55	16AP0055	fall	0.00	100.00
Indian Island	14-Apr-16	Ind-North	68	16AP_56	16AP0056	fall	0.00	100.00
Indian Island	14-Apr-16	Ind-North	58	16AP_57	16AP0057	fall	0.00	100.00
Indian Island	14-Apr-16	Ind-North	67	16AP_58	16AP0058	fall	0.00	100.00
Indian Island	14-Apr-16	Ind-North	69	16AP_59	16AP0059	fall	0.18	99.82
Indian Island	14-Apr-16	Ind-North	62	16AP_60	16AP0060	fall	0.13	99.87
Indian Island	14-Apr-16	Ind-North	58	16AP_61	16AP0061	summer	100.00	0.00
Indian Island	14-Apr-16	Ind-North	67	16AP_62	16AP0062	fall	10.01	89.99
Indian Island	25-May-16	Ind-South	103	16AP_63	16AP0063	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	107	16AP_64	16AP0064	fall	0.95	99.05
Indian Island	25-May-16	Ind-South	106	16AP_65	16AP0065	fall	1.06	98.94
Indian Island	25-May-16	Ind-South	106	16AP_66	16AP0066	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	110	16AP_67	16AP0067	fall	1.51	98.49
Indian Island	25-May-16	Ind-South	***No length***	16AP_68	16AP0068	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	111	16AP_69	16AP0069	fall	5.42	94.58
Indian Island	25-May-16	Ind-South	114	16AP_70	16AP0070	fall	1.36	98.64
Indian Island	25-May-16	Ind-South	112	16AP_71	16AP0071	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	94	16AP_72	16AP0072	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	117	16AP_73	16AP0073	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	115	16AP_74	16AP0074	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	110	16AP_75	16AP0075	fall	0.96	99.04
Indian Island	25-May-16	Ind-South	110	16AP_76	16AP0076	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	115	16AP_77	16AP0077	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	116	16AP_78	16AP0078	summer	100.00	0.00
Indian Island	25-May-16	Ind-South	115	16AP_79	16AP0079	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	96	16AP_80	16AP0080	fall	6.59	93.41
Indian Island	25-May-16	Ind-South	109	16AP_81	16AP0081	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	94	16AP_82	16AP0082	fall	0.00	100.00
Indian Island	25-May-16	Ind-South	98	16AP_83	16AP0083	fall	0.02	99.98