Summary of the results of a genetic-based investigation of blueline tilefish (*Caulolatilus microps*)

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Summary of the results of a genetic-based investigation of blueline tilefish (*Caulolatilus microps*)

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MATERIALS AND METHODS

Microsatellite Marker Development and Optimization

High molecular weight DNA from a blueline tilefish captured off the coast of Virginia was used to create a 400 base pair (bp) insert genomic library. The resulting fragments were sequenced using a PGM™ Hi-Q™ Sequencing Kit on an Ion Torrent PGM sequencer using an Ion 318™ chip (Ion Torrent Systems, Inc., Guilford, CT). The FastQC software (Andrews 2010) integrated into the Galaxy Project platform (Giardine et al. 2005, Goecks et al. 2010, Blankenberg et al. 2010) was used to assess the quality of the resulting sequences, and filters integrated into the Galaxy platform were used to remove sequencing artifacts and to filter out short sequences (below 50 bp). Sequences were trimmed to exclude positions 1-9 and all bases over 400 bp and then filtered by quality to exclude those in which 50% of the sequence length had a quality < 20 (base call accuracy <99%). Exported sequence files were filtered for the presence of perfect tetranucleotide repeats, resulting in the identification over 8,000 potential microsatellite loci using the Msatcommander 1.0.8 software (Faircloth 2008). Primers were designed for ~1500 of the identified loci using the Primer3 software (Koressaar and Remm 2007; Untergasser et al. 2012) and 65 primer pairs were ordered and tested for amplification of a product of the predicted length from blueline tilefish DNA isolated from samples from Virginia and South Carolina (two samples from each location). From the original 65 primer pairs, we identified 26 loci that amplified reliably across test samples.

All primer pairs were initially assessed and optimized using gradient PCR on a Bio-Rad C1000 thermal cycler (Bio-Rad, Hercules, CA) using standard protocols. Each 5 µl PCR reaction contained 1x PCR Buffer (Qiagen), 1.5 mM $MgCl_2$, 200 µM of each dNTP, 0.125 µM the forward primer, 0.125 of the reverse primer, 0.5 unit of *Taq* polymerase (Qiagen), and 0.5 µl genomic DNA. Four samples, two from VA and two from SC were used for testing. Samples were amplified with an initial denaturation temperature of 94 ºC for 3 min, followed by 35 cycles at 94 ºC for 1 min, 48-65 ºC for 1 min, 72 ºC for 1 min, with a final elongation step at 72 ºC for 7 min. Amplified products were visualized to confirm the presence of a single amplification product of correct size by agarose gel electrophoresis (1.5 % w/v), stained with ethidium bromide and viewed under a UV light source. Markers found to reliably amplify DNA samples from both Virginia and South Carolina were further evaluated using a panel of 8 samples each from Virginia and South Carolina to assess amplification consistency, levels of polymorphism and conformance to the expectations of Hardy-Weinberg Equilibrium (HWE). PCR reactions were carried out as above except for the addition of a T3-labeled fluorescent probe (either FAM, VIC, NED, PET). The resulting fluorescently labeled PCR products were separated on an ABI 3130*xl* Prism Genetic Analyzer (Applied Biosystems, Foster City, CA) with a GeneScan 500-Liz size standard (Applied Biosystems, Foster City, CA). The chromatic peaks for each microsatellite locus were sized using the GeneMarker AFLP/Genotyping Software, ver. 1.75 (SoftGenetics, State College, PA).

Sample Collection and DNA Isolation

Geographic sampling spanned the ends of the blueline tilefish U.S. east coast range from New York to the southern Florida Keys (Figure 1, Appendix 1). Fin clips were taken by cooperating commercial fishermen using one of three gear types: long-bottom longline (LBLL), short-bottom longline (SBLL), and vertical hook and line (VHL). All fin clips were stored in ethanol until DNA could be extracted and the pertinent collection information (date, fish sex, length, depth, location, vessel, etc.) was recorded on the accompanying data sheets (for specific details, see SEDAR50-DW02). A small sample (n=15) collected in the Gulf of Mexico off western Florida in 2011 was included for comparative purposes. DNA was extracted from archived tissue samples using either the DNeasy Tissue Kit (Qiagen, Valencia, CA) or the Quick-DNA™ Universal Kit (Zymo Research, Irvine, CA). Briefly, 2-3 mm fin clip sub-samples were incubated in lysis buffer (Longmire et al. 1997) for 2 hrs. at room temperature to facilitate removal of residual ethanol prior extraction following the manufacturers protocol. All DNA samples were quantified using a NanoDrop 2000 (Thermo Scientific, West Palm Beach, Florida), and stored at -20 °C.

Microsatellite Markers

Following optimization, primer pairs were multiplexed into panels using the Type-it® Microsatellite PCR Kit (Qiagen) and one of four unique fluorescent tails. Once optimized, samples from each location were amplified using the multiplexed primer sets and alleles were sized as above. Each multiplex reaction contained 1x Type-it Multiplex PCR Master Mix, 1x Q-Solution, 0.05 µM of the forward primer, 0.2 µM of the reverse primer, 0.2 µM of the fluorescent dye, 0.5 µl genomic DNA and water to a final volume of 6 µl. Amplifications were performed with an initial denaturation temperature of 95 ºC for 5 min, followed by 28 cycles at 95 ºC for 30 sec, Annealing for 90 sec, 72 ºC for 30 sec, with a final elongation step at 60 ºC for 30 min. The resulting fluorescently labeled PCR products were separated on an ABI 3130*xl* Prism Genetic Analyzer (Applied Biosystems, Foster City, CA) with a GeneScan 500-Liz size standard (Applied Biosystems, Foster City, CA). The chromatic peaks for each microsatellite locus were sized using the GeneMarker AFLP/Genotyping Software, ver. 1.75 (SoftGenetics, State College, PA). All alleles were sized 2x independently and results were compared to assess errors.

After alleles had been sized for each locus, the Micro-Checker 2.2.3 software (Van Oosterhout et al. 2004) was used to check for the presence of null alleles and evidence of scoring errors. The Genepop'007 software package (Rousset 2008) was used to test for deviations of genotypic distributions from HWE expectations (F_{IS}, exact tests, Guo et al. 1992). Summary statistics (number of alleles, allele frequencies and etc.), were generated using GenAlEx (Peakall and Smouse 2012). To evaluate evidence for the presence of population structure, the Arlequin software package v3.5.2.2 (Excoffier and Lischer 2010) was used to estimate (Weir and Cockerham's (1984) unbiased estimator of

Wrights F-statistics and to conduct an analysis of molecular variance (AMOVA) based on several alternate geographic groupings (Excoffier et al. 1992). Significance was assessed via 10 000 permutations of the data. A factorial correspondence analysis (FCA) was performed using Genetix ver. 4.05.2 (Belkhir et al. 1996). A discriminant analysis of principal components (DAPC) was performed using the Adegenet software (Jombart 2008; Jombart et al. 2010).

Mitochondrial DNA (mtDNA)

The mtDNA primers of Nohara et al. (2010) were used to amplify and sequence a 489 bp segment of the mtDNA control region from a subset of all collected samples (Table 3). Briefly, each 25 µl reaction contained 1x PCR Buffer (Qiagen) 1.5 mM $MgCl_2$, 200 µM of each dNTP, 0.125 µM of each primer, 0.5 unit of *Taq* polymerase (Qiagen), and 1 µl genomic DNA. Amplifications were performed with an initial denaturation temperature of 94 ºC for 2 min, followed by 35 cycles at 94 ºC for 1 min, 52 ºC for 1 min, 72 ºC for 2 min, with a final elongation step at 72 ºC for 5 min. Aliquots of amplified products were sized against a DNA ladder of known size using horizontal gel electrophoresis (1.5 % w/v agarose), stained with ethidium bromide and visualized under a UV light source to confirm the presence of a single amplification product of correct size. Amplification products were purified using a QIAquick PCR Purification Kit (Qiagen) following the manufacturers protocol and subsequently quantified using a NanoDrop 2000 prior to storage at -20 °C. Purified PCR products were bi-directionally sequenced using the Big Dye Terminator Cycle Sequencing Kit (Applied Biosystems) with the original amplification primers and 1/4 the recommended concentration of Big Dye. Sequencing reaction products were precipitated using ethanol/sodium acetate to remove unincorporated nucleotides and re-suspended in 16 µl of Hi-Di formamide (Applied Biosystems) and 10 µl of each cleaned reaction were electrophoresed on an ABI 3130*xl* Prism genetic analyzer (Applied Biosystems). The resulting forward and reverse sequences were imported into Sequencher (ver. 5.1) for trimming of low quality sequence and creation of consensus sequences. Consensus sequences were aligned in MacVector (ver. 12.5.1) and exported as an aligned FASTA file.

The FaBox software (Villesen 2007) was used to collapse sequences into haplotypes and create input files for the Arlequin software package (Excoffier and Lischer 2010). Arlequin was used to generate descriptive statistics (mean number of pairwise differences (k), haplotype diversity (H), and nucleotide sequence diversity (π)), perform analysis of population pairwise Φ_{ST}, AMOVA (Excoffier et al. 1992) and to estimate demographic parameters. Statistical sigificance was assessed based on 10 000 permutations of the data. The Popart software (Leigh and Bryant 2015) was used to reonstruct and visualize genealogical relationships among sequences using the Minimum Spanning Network algorithm of Bandelt et al. (1999) and the TCS algorith of (Clement et al. 2002).

RESULTS AND DISCUSSION

Microsatellite marker development

High throughput sequencing of a blueline tilefish DNA sample on an Ion Torrent sequencer resulted in approximately 4.8 million DNA sequences ranging in length from 25-587 bp with an average Phred (quality) score of 30. Filtering using the software programs integrated into the Galaxy Project platform resulted in the retention of 1.4 million high quality DNA sequences. The remaining sequences were subsequently queried for the presence of perfect tetra-nucleotide repeat loci, resulting in the identification over 8,000 microsatellite loci. Of the loci identified, primers were designed for ~1500 loci and 65 primer pairs were ordered and tested for amplification of a product of predicted length from blueline tilefish DNA samples from Virginia and South Carolina (two samples from each location). Of the original 65 primer pairs tested, we identified 26 loci that amplified reliably across test samples. Further testing of samples taken from Virginia and South Carolina (20 samples from each location) indicated that these loci were in conformance to the expectations of Hardy-Weinberg equilibrium (HWE). One of the primers failed to amplify successfully across multiple samples and was excluded from further analysis. The remaining 25 loci were combined into 8 multiplex marker panels.

Microsatellite Analysis

In total, 505 samples were analyzed across 25 polymorphic microsatellite loci; 490 samples from U.S. east coast range from New York to the southern Florida Keys and

15 from western Florida in the Gulf of Mexico (Figure 1). All loci were polymorphic, with the number of alleles ranging from 6 alleles at CM1787993 and CM1787993 to 21 at CM90501. Markers were in conformance to the expectations of HWE with the exception of CM931277 and CM4391826, both of which had significant global heterozygote deficits, most likely due to the presence of null alleles (Table 1). All subsequent analyses were done both including and excluding these loci. Results were consistent regardless of whether or not these loci were included. All results presented henceforth are based on the 23 loci that were in HWE. Overall, analysis indicated a genetically homogeneous population. All F_{ST} values were small; the largest value was 0.003 between the WF and NCN samples and most values were 0. There were no significant pairwise comparisons based on 10,000 permutations of the data (Table 2). An analysis of molecular variance (AMOVA, Excoffier et al. 1992) using multiple alternate groupings of sampling locations showed no significant genetic variance due to variation among any groups (data not shown). A factorial correspondence analysis did not indicate the presence of any discrete clusters that would suggest the presence of multiple populations (Figure 2). Likewise, the DAPC had a scree plot with eigenvalues that were flat across the plot.

mtDNA analysis

In total, of 188 control region sequences were examined across a subset of samples from all geographic locations. All sequences were edited to a final length of 407 bp, resulting in 72 haplotypes with 59 variable sites including 58 substitutions, 51 of which were transitions and 7 of which were transversions. A total of four indels were observed. The most common haplotype, haplotype 9, was recovered 39 times (20.7% of sequences) and was recovered in all locations with the exception of the WF sample (Table 3). The second most common haplotype was recovered 9 times (4.8% of all samples) and was recovered in all locations except DE. WF and DE had the smallest number of samples sequenced (8 and 13 respectively). Haplotype diversity (H) was 0.94 across all samples and was high in all geographic samples ranging from 0.89 in samples from NCN and 1.0 in DE. The mean number of pairwise differences between sequences (k) across all samples was 3.1 and ranged from 2.4 in NCN to 3.91 in SC. Likewise, nucleotide diversity (π) was low across all samples (0.008) and within samples from each geographic location ranging from 0.006 in NCN to 0.010 in SC., indicating that there were very few differences among haplotypes (Table 4). A minimum spanning network showed no division of haplotypes by sampling location (Figure 3).

A global test of differentiation among samples based on the distribution of haplotypes and 10 000 permutations of the data was not significant ($P = 0.144$). However, there were significant pairwise comparisons between the WF sample (the location with the smallest sample size) and the NY, DE and VA samples. Only the comparison with VA was significant after correction for multiple tests ($P = 0.003$). Population pairwise Φ_{ST} values were calculated based both on the number of pairwise differences and on a Tamura-Nei distance (Tamura and Nei 1993). No values were significant based on 10 000 permutations of the data. Values based on the number of pairwise differences between samples ranges from 0 between most pairs of sample collections examined to 0.039 between DE and WF, the two groups with the smallest sample sizes (Table 5).

As with the analysis of the microsatellite data, an AMOVA (Excoffier et al. 1992) using multiple alternate groupings of sampling locations showed no significant genetic variance due to variation among any grouping scheme (data not shown).

Overall, there was no evidence that blueline tilefish are comprised of genetically distinct populations along the U.S. east coast. Data is consistent with the suggestion that there is sufficient gene flow to prevent the accumulation of genetic differences. However this does not necessarily indicate that there is sufficient gene flow to overcome the effects of regional overfishing.

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Table 1. Sample Size (N), No. Alleles (N_a), No. Effective Alleles (N_e), Information Index (I), Observed Heterozygosity (H_o), Expected Heterozygosity (H_e), Probability of Conformance to HWE (P_{HWE}), and Unbiased Expected Heterozygosity (uH_e), and Fixation Index (F) for each locus. Bolded values are out of HWE (P < 0.0001). Detailed list of locus names is at the bottom of the table. New York (NY), Delaware (DE), Virginia (VA), North Carolina North of Cape Hatteras (NCN), North Carolina South of Cape Hatteras (NCS), South Carolina (SC), Florida Keys (FL), Western Florida (WF).

Location	Statistic	Loc1	Loc2	Loc3	Loc4	Loc5	Loc6	Loc7	Loc8	Loc9	Loc10	Loc11	Loc12	Loc13
NY	**N**	79	77	77	79	79	74	79	78	79	79	79	79	79
	Na	10	8	8	9	6	13	11	13	8	9	6	8	12
	Ne	4.080	3.885	2.836	3.797	1.809	6.602	7.456	4.952	4.733	4.613	2.170	3.751	5.249
	I	1.685	1.572	1.383	1.550	0.943	2.142	2.182	1.907	1.687	1.689	1.051	1.584	1.944
	Ho	0.810	0.805	0.662	0.722	0.481	0.446	0.861	0.808	0.734	0.671	0.557	0.810	0.810
	He	0.755	0.743	0.647	0.737	0.447	0.849	0.866	0.798	0.789	0.783	0.539	0.733	0.809
	uHe	0.760	0.747	0.652	0.741	0.450	0.854	0.871	0.803	0.794	0.788	0.543	0.738	0.815
	P_{HWE}	0.399	0.026	0.638	0.508	0.889	**0.000**	0.900	0.908	0.102	0.120	0.924	0.743	0.698
	F	-0.073	-0.084	-0.023	0.021	-0.076	0.474	0.006	-0.012	0.069	0.143	-0.033	-0.105	-0.001
DE	**N**	45	43	44	45	44	42	44	43	45	43	45	45	45
	Na	6	8	8	6	6	8	11	9	7	7	6	9	12
	Ne	3.540	3.594	2.505	3.325	2.251	4.612	7.854	5.561	4.731	4.037	2.259	3.395	4.799
	I	1.491	1.573	1.277	1.339	1.142	1.765	2.189	1.876	1.688	1.539	1.133	1.520	1.905
	Ho	0.644	0.674	0.705	0.667	0.568	0.429	0.909	0.814	0.822	0.814	0.644	0.800	0.844
	He	0.718	0.722	0.601	0.699	0.556	0.783	0.873	0.820	0.789	0.752	0.557	0.705	0.792
	uHe	0.726	0.730	0.608	0.707	0.562	0.793	0.883	0.830	0.798	0.761	0.564	0.713	0.800
	P_{HWE}	0.053	0.491	0.771	0.049	0.730	**0.000**	0.513	0.100	0.907	0.994	0.965	0.861	0.585
	F	0.102	0.066	-0.173	0.047	-0.022	0.453	-0.042	0.008	-0.043	-0.082	-0.156	-0.134	-0.067
VA	**N**	107	107	107	107	107	101	107	107	107	107	107	107	107
	Na	9	10	8	8	6	14	11	10	9	9	7	10	12
	Ne	3.437	3.528	2.710	3.278	2.256	7.204	6.793	5.155	4.384	4.501	2.278	4.197	5.188
	I	1.558	1.513	1.309	1.400	1.137	2.227	2.071	1.856	1.659	1.702	1.138	1.706	1.919
	Ho	0.720	0.682	0.561	0.664	0.542	0.564	0.850	0.766	0.776	0.822	0.598	0.766	0.850
	He	0.709	0.717	0.631	0.695	0.557	0.861	0.853	0.806	0.772	0.778	0.561	0.762	0.807
	uHe	0.712	0.720	0.634	0.698	0.559	0.865	0.857	0.810	0.776	0.781	0.564	0.765	0.811
	P_{HWE}	0.882	0.783	0.356	0.190	0.799	**0.000**	0.332	0.091	0.825	0.684	0.386	0.809	0.237
	F	-0.015	0.048	0.111	0.045	0.026	0.345	0.003	0.049	-0.005	-0.057	-0.066	-0.006	-0.054

NCN	**N**	56	56	56	56	56	53	56	55	56	56	56	56	56
	Na	8	7	8	7	6	13	11	11	8	10	7	7	12
	Ne	2.938	3.568	2.814	3.190	2.001	6.602	8.396	4.394	4.674	4.436	2.436	3.762	5.271
	I	1.356	1.487	1.359	1.365	1.061	2.141	2.252	1.813	1.686	1.747	1.168	1.545	1.926
	Ho	0.643	0.732	0.607	0.661	0.554	0.453	0.857	0.745	0.821	0.804	0.571	0.696	0.839
	He	0.660	0.720	0.645	0.687	0.500	0.849	0.881	0.772	0.786	0.775	0.589	0.734	0.810
	uHe	0.666	0.726	0.650	0.693	0.505	0.857	0.889	0.779	0.793	0.782	0.595	0.741	0.818
	P_{HWE}	0.896	0.660	0.116	0.888	0.235	**0.000**	0.024	0.917	0.093	0.903	0.149	0.313	0.798
	F	0.025	-0.017	0.058	0.038	-0.106	0.466	0.027	0.035	-0.045	-0.037	0.031	0.051	-0.036
NCS	**N**	66	66	66	66	66	63	66	66	66	66	66	66	66
	Na	7	8	7	7	6	11	11	12	9	8	7	8	11
	Ne	3.457	4.069	2.840	2.933	2.172	6.665	7.020	5.476	4.402	4.100	1.929	4.180	4.998
	I	1.454	1.626	1.308	1.299	1.117	2.103	2.102	1.945	1.655	1.624	1.018	1.683	1.912
	Ho	0.742	0.742	0.636	0.682	0.576	0.476	0.818	0.864	0.773	0.727	0.470	0.742	0.803
	He	0.711	0.754	0.648	0.659	0.540	0.850	0.858	0.817	0.773	0.756	0.482	0.761	0.800
	uHe	0.716	0.760	0.653	0.664	0.544	0.857	0.864	0.824	0.779	0.762	0.485	0.767	0.806
	P_{HWE}	0.3446	0.744	0.904	0.904	0.136	**0.000**	0.212	0.826	0.374	0.089	0.576	0.497	0.474
	F	-0.045	0.016	0.018	-0.034	-0.067	0.440	0.046	-0.057	0.000	0.038	0.025	0.024	-0.004
SC	**N**	74	76	76	76	75	72	76	75	75	75	76	75	76
	Na	8	8	7	7	6	15	12	10	9	8	6	9	12
	Ne	3.206	4.182	2.782	2.920	2.038	6.513	7.496	4.691	4.015	4.496	2.343	3.974	5.742
	I	1.452	1.629	1.361	1.245	1.037	2.157	2.158	1.759	1.588	1.652	1.179	1.647	2.014
	Ho	0.689	0.750	0.592	0.618	0.560	0.556	0.868	0.813	0.840	0.787	0.605	0.720	0.776
	He	0.688	0.761	0.641	0.658	0.509	0.846	0.867	0.787	0.751	0.778	0.573	0.748	0.826
	uHe	0.693	0.766	0.645	0.662	0.513	0.852	0.872	0.792	0.756	0.783	0.577	0.753	0.831
	P_{HWE}	0.820	0.369	0.535	0.535	0.496	**0.000**	0.365	0.050	0.629	0.666	0.762	0.094	0.090
	F	-0.002	0.014	0.076	0.060	-0.099	0.344	-0.002	-0.034	-0.119	-0.012	-0.056	0.038	0.060
FL	**N**	61	61	61	61	61	58	61	61	61	61	61	61	61
	Na	6	8	8	9	5	13	12	9	8	9	7	9	12
	Ne	3.316	3.607	3.229	3.369	2.059	5.721	8.278	4.829	4.289	3.834	2.056	3.917	5.782
	I	1.409	1.509	1.453	1.416	1.034	2.042	2.248	1.775	1.632	1.583	1.028	1.669	1.984
	Ho	0.721	0.705	0.574	0.836	0.459	0.414	0.885	0.820	0.738	0.803	0.508	0.656	0.885
	He	0.698	0.723	0.690	0.703	0.514	0.825	0.879	0.793	0.767	0.739	0.514	0.745	0.827
	uHe	0.704	0.729	0.696	0.709	0.519	0.832	0.886	0.799	0.773	0.745	0.518	0.751	0.834
	P_{HWE}	0.628	0.619	0.091	0.091	0.315	**0.000**	0.666	0.347	0.514	0.944	0.300	0.213	0.676
	F	-0.033	0.025	0.169	-0.189	0.108	0.499	-0.007	-0.034	0.038	-0.087	0.011	0.119	-0.070

WF	**N**	15	15	15	15	15	14	15	14	15	14	15	15	15
	Na	6	7	4	6	4	8	10	9	7	5	3	7	9
	Ne	3.982	4.839	2.027	2.980	1.230	4.962	7.258	5.521	3.947	3.806	1.737	4.412	5.488
	I	1.566	1.740	0.877	1.325	0.435	1.787	2.113	1.900	1.593	1.430	0.756	1.681	1.912
	Ho	0.733	0.800	0.533	0.733	0.200	0.786	0.867	0.786	0.733	0.714	0.467	0.867	0.800
	He	0.749	0.793	0.507	0.664	0.187	0.798	0.862	0.819	0.747	0.737	0.424	0.773	0.818
	uHe	0.775	0.821	0.524	0.687	0.193	0.828	0.892	0.849	0.772	0.765	0.439	0.800	0.846
	P_{HWE}	0.531	0.652	0.940	0.940	1.000	0.870	0.066	0.610	0.914	0.521	0.717	0.795	0.237
	F	0.021	-0.008	-0.053	-0.104	-0.071	0.016	-0.005	0.040	0.018	0.031	-0.099	-0.121	0.022

Location	Statistic	Loc14	Loc15	Loc16	Loc17	Loc18	Loc19	Loc20	Loc21	Loc22	Loc23	Loc24	Loc25
NY	**N**	79	79	77	79	78	79	79	79	79	77	75	76
	Na	16	10	12	6	5	7	9	16	14	10	15	9
	Ne	6.566	4.500	7.822	2.181	2.475	5.487	3.382	5.482	8.201	3.707	4.676	4.247
	I	2.221	1.732	2.209	1.083	1.087	1.784	1.498	2.109	2.307	1.656	2.048	1.709
	Ho	0.848	0.823	0.857	0.595	0.564	0.861	0.722	0.797	0.873	0.740	0.507	0.789
	He	0.848	0.778	0.872	0.542	0.596	0.818	0.704	0.818	0.878	0.730	0.786	0.765
	uHe	0.853	0.783	0.878	0.545	0.600	0.823	0.709	0.823	0.884	0.735	0.791	0.770
	P_{HWE}	0.858	0.795	0.454	0.081	0.181	0.581	0.929	0.451	0.416	0.054	**0.000**	0.908
	F	0.000	-0.058	0.017	-0.099	0.054	-0.053	-0.024	0.025	0.005	-0.014	0.355	-0.033
DE	**N**	45	45	45	45	45	45	45	45	45	45	45	45
	Na	10	9	12	7	5	6	8	14	14	9	13	10
	Ne	6.072	4.748	7.656	2.318	2.399	5.179	3.320	4.480	9.332	3.406	5.219	4.592
	I	2.050	1.761	2.194	1.186	1.034	1.703	1.516	1.984	2.380	1.523	2.046	1.761
	Ho	0.867	0.711	0.889	0.533	0.644	0.889	0.644	0.756	0.889	0.756	0.489	0.800
	He	0.835	0.789	0.869	0.569	0.583	0.807	0.699	0.777	0.893	0.706	0.808	0.782
	uHe	0.845	0.798	0.879	0.575	0.590	0.816	0.707	0.786	0.903	0.714	0.817	0.791
	P_{HWE}	0.725	0.174	0.095	0.246	0.775	0.181	0.332	0.598	0.405	0.023	**0.000**	0.467
	F	-0.038	0.099	-0.022	0.062	-0.105	-0.102	0.078	0.027	0.004	-0.070	0.395	-0.023
VA	**N**	107	107	107	107	107	107	107	107	107	107	107	107
	Na	16	12	12	6	6	7	10	19	15	12	16	10
	Ne	6.529	5.297	7.437	2.158	2.336	5.134	3.492	4.428	8.210	3.635	6.122	4.925
	I	2.159	1.890	2.158	1.067	1.044	1.733	1.514	2.050	2.318	1.679	2.240	1.866
	Ho	0.832	0.822	0.907	0.570	0.607	0.804	0.729	0.776	0.841	0.692	0.561	0.804

	He	0.847	0.811	0.866	0.537	0.572	0.805	0.714	0.774	0.878	0.725	0.837	0.797
	uHe	0.851	0.815	0.870	0.539	0.575	0.809	0.717	0.778	0.882	0.728	0.841	0.801
	P_{HWE}	0.550	0.078	0.964	0.288	0.653	0.832	0.321	0.623	0.552	0.464	**0.000**	0.795
	F	0.018	-0.014	-0.047	-0.063	-0.062	0.002	-0.021	-0.002	0.042	0.046	0.330	-0.008
NCN	**N**	56	56	56	56	56	56	56	56	56	56	55	56
	Na	14	9	11	4	6	7	7	12	14	11	14	9
	Ne	5.934	4.129	7.538	1.889	2.524	5.435	3.702	3.841	8.363	3.324	6.464	4.900
	I	2.089	1.649	2.154	0.913	1.130	1.759	1.494	1.841	2.296	1.586	2.203	1.770
	Ho	0.750	0.804	0.946	0.464	0.500	0.804	0.750	0.732	0.875	0.732	0.655	0.821
	He	0.831	0.758	0.867	0.471	0.604	0.816	0.730	0.740	0.880	0.699	0.845	0.796
	uHe	0.839	0.765	0.875	0.475	0.609	0.823	0.736	0.746	0.888	0.705	0.853	0.803
	P_{HWE}	0.200	0.075	0.203	0.184	0.247	0.393	0.868	0.840	0.036	0.309	**0.005**	0.691
	F	0.098	-0.060	-0.091	0.013	0.172	0.015	-0.028	0.010	0.006	-0.047	0.226	-0.032
NCS	**N**	66	66	66	66	66	66	66	66	66	66	66	66
	Na	16	11	12	5	5	8	10	17	14	10	16	11
	Ne	7.352	4.624	7.135	2.094	2.442	5.143	3.270	4.689	6.892	4.151	7.164	5.556
	I	2.281	1.772	2.136	1.019	1.058	1.772	1.492	2.067	2.198	1.682	2.341	1.957
	Ho	0.788	0.818	0.833	0.561	0.682	0.833	0.727	0.742	0.848	0.727	0.576	0.864
	He	0.864	0.784	0.860	0.522	0.590	0.806	0.694	0.787	0.855	0.759	0.860	0.820
	uHe	0.871	0.790	0.866	0.526	0.595	0.812	0.700	0.793	0.861	0.765	0.867	0.826
	P_{HWE}	0.313	0.226	0.944	0.930	0.823	0.791	0.652	0.328	0.519	0.394	**0.000**	0.614
	F	0.088	-0.044	0.031	-0.073	-0.155	-0.034	-0.048	0.056	0.008	0.042	0.331	-0.053
SC	**N**	76	76	76	76	76	76	76	76	74	75	76	74
	Na	14	7	12	5	6	7	11	16	14	12	16	10
	Ne	6.616	4.036	6.955	2.360	2.506	5.583	3.445	5.208	8.583	3.575	5.383	5.132
	I	2.176	1.601	2.107	1.111	1.110	1.792	1.597	2.027	2.353	1.703	2.123	1.828
	Ho	0.895	0.645	0.789	0.632	0.592	0.868	0.684	0.855	0.905	0.720	0.592	0.811
	He	0.849	0.752	0.856	0.576	0.601	0.821	0.710	0.808	0.883	0.720	0.814	0.805
	uHe	0.854	0.757	0.862	0.580	0.605	0.826	0.714	0.813	0.890	0.725	0.820	0.811
	P_{HWE}	0.317	0.018	0.129	0.037	0.305	0.871	0.261	0.472	0.027	0.761	**0.000**	0.777
	F	-0.054	0.143	0.078	-0.096	0.015	-0.058	0.036	-0.058	-0.025	0.000	0.273	-0.007
FL	**N**	61	61	61	61	61	61	61	61	61	61	61	61
	Na	12	8	12	5	6	6	9	12	13	10	12	11
	Ne	6.399	4.605	7.368	2.197	2.371	5.175	3.375	4.040	8.116	3.923	6.045	4.845
	I	2.089	1.728	2.160	1.058	1.093	1.712	1.441	1.847	2.265	1.719	2.068	1.852
	Ho	0.885	0.754	0.902	0.590	0.492	0.885	0.689	0.672	0.951	0.721	0.590	0.803

	He	0.844	0.783	0.864	0.545	0.578	0.807	0.704	0.752	0.877	0.745	0.835	0.794
	uHe	0.851	0.789	0.871	0.549	0.583	0.813	0.710	0.759	0.884	0.751	0.841	0.800
	P_{HWE}	0.878	0.248	0.789	0.445	0.034	0.798	0.165	0.047	0.466	0.258	**0.000**	0.393
	F	-0.049	0.037	-0.043	-0.083	0.149	-0.097	0.022	0.107	-0.084	0.032	0.293	-0.012
WF	**N**	15	15	15	15	15	15	15	15	15	15	15	15
	Na	11	7	9	4	5	6	7	8	11	8	11	7
	Ne	7.143	4.500	6.818	2.406	2.778	5.294	4.167	5.172	7.627	3.782	7.500	4.891
	I	2.165	1.665	2.020	1.104	1.186	1.725	1.617	1.831	2.183	1.633	2.202	1.728
	Ho	0.867	0.800	0.867	0.667	0.600	0.867	1.000	0.800	0.933	0.867	0.600	0.867
	He	0.860	0.778	0.853	0.584	0.640	0.811	0.760	0.807	0.869	0.736	0.867	0.796
	uHe	0.890	0.805	0.883	0.605	0.662	0.839	0.786	0.834	0.899	0.761	0.897	0.823
	P_{HWE}	0.814	0.956	0.672	0.878	0.796	0.930	0.666	0.562	0.947	0.578	**0.000**	0.789
	F	-0.008	-0.029	-0.016	-0.141	0.062	-0.068	-0.316	0.008	-0.074	-0.178	0.308	-0.089

	Locus		Locus		Locus
Loc1	CM54794	Loc10	CM2660427	Loc19	CM732781
Loc2	CM2316467	Loc11	CM2212380	Loc20	CM2186404
Loc3	CM2352680	Loc12	CM2149957	Loc21	CM90501
Loc4	CM2492523	Loc13	CM459957	Loc22	CM1080088
Loc5	CM1787993	Loc14	CM2374475	Loc23	CM764003
Loc6	CM931277	Loc15	CM310413	Loc24	CM4391826
Loc7	CM4718692	Loc16	CM4591723	Loc25	CM1009046
Loc8	CM1065459	Loc17	CM2404273		
Loc9	CM1827829	Loc18	CM1191685		

Table 2. Population pairwise F_{ST} values based on 23 microsatellite loci (lower matrix). Population pairwise Φ_{ST} values based on the mitochondrial control region (lower matrix). New York (NY), Delaware (DE), Virginia (VA), North Carolina North of Cape Hatteras (NCN), North Carolina South of Cape Hatteras (NCS), South Carolina (SC), Florida Keys (FL), Western Florida (WF). There were no significant pairwise comparisons based on either class of molecular marker.

	NY	DE	VA	NCN	NCS	SC	FL	WF
NY	*	-0.00144	-0.00047	0.01391	0.00106	-0.00700	-0.00789	-0.01119
DE	-0.00151	*	0.00205	-0.00279	-0.00209	-0.02601	-0.00906	0.03915
VA	-0.00045	-0.00218	*	0.01045	-0.01496	-0.00513	-0.01110	-0.01307
NCN	-0.00056	-0.00112	-0.00025	*	-0.00291	-0.00734	-0.00519	0.01626
NCS	-0.00012	-0.00204	0.00082	0.00074	*	-0.00399	-0.00436	-0.00451
SC	-0.00066	-0.00166	-0.00084	0.00036	-0.00088	*	-0.01320	0.00110
FL	-0.00067	-0.00216	-0.00057	-0.00085	-0.00054	-0.00004	*	-0.01607
WF	-0.00073	-0.00277	0.00042	0.00014	0.00329	-0.00057	0.00023	*

Table 3. Distribution of mtDNA haplotypes. New York (NY), Delaware (DE), Virginia (VA), North Carolina North of Cape Hatteras (NCN), North Carolina South of Cape Hatteras (NCS), South Carolina (SC), Florida Keys (FL), Western Florida (WF).

Haplotype	NY	DE	VA	NCN	NCS	SC	FL	WF	Total
Hap_1	0	0	0	0	0	2	0	0	2
Hap_2	0	0	1	0	0	0	1	0	2
Hap_3	0	0	1	0	0	0	0	0	1
Hap_4	0	0	0	0	0	2	1	0	3
Hap_5	2	0	1	0	0	1	0	0	4
Hap_6	0	0	2	0	0	1	0	1	4
Hap_7	0	0	0	2	2	0	2	3	9
Hap_8	1	0	1	0	0	2	1	0	5
Hap_9	4	1	13	4	8	4	5	0	39
Hap_10	1	0	1	0	1	1	0	2	6
Hap_11	1	0	1	1	1	1	2	2	9
Hap_12	0	0	0	0	1	0	0	1	2
Hap_13	0	0	0	0	1	0	1	2	4
Hap_14	1	0	0	0	0	1	0	1	3
Hap_15	0	0	0	2	1	0	1	1	5
Hap_16	1	0	1	0	0	0	0	0	2
Hap_17	0	0	1	0	0	0	0	0	1
Hap_18	0	0	2	0	0	0	0	0	2
Hap_19	0	0	1	0	0	0	0	0	1
Hap_20	0	0	1	1	0	0	0	0	2
Hap_21	1	0	0	1	2	0	0	0	4
Hap_22	0	0	0	0	1	0	0	0	1
Hap_23	0	0	0	0	1	0	0	0	1
Hap_24	0	0	1	0	1	0	0	0	2
Hap_25	0	0	0	0	1	0	0	0	1
Hap_26	0	0	1	0	1	0	1	0	3
Hap_27	0	1	1	0	1	2	0	0	5
Hap_28	0	0	1	0	1	1	0	0	3
Hap_29	0	0	0	0	0	1	0	0	1
Hap_30	0	0	0	0	0	1	0	0	1
Hap_31	0	0	0	0	0	1	0	0	1
Hap_32	2	0	1	1	0	1	1	0	6
Hap_33	1	1	0	0	0	1	0	0	3
Hap_34	0	0	0	0	0	1	0	0	1
Hap_35	0	0	0	0	0	1	0	0	1
Hap_36	0	0	2	0	0	0	0	0	2
Hap_37	0	0	1	0	0	0	1	0	2
Hap_38	0	0	2	0	0	0	1	0	3
Hap_39	0	0	1	0	0	0	0	0	1
Hap_40	0	1	1	1	0	0	0	0	3
Hap_41	0	0	1	0	0	0	0	0	1
Hap_42	0	0	0	0	0	0	1	0	1
Hap_43	0	0	0	0	0	0	1	0	1
Hap_44	0	0	0	0	0	0	1	0	1
Hap_45	2	0	0	1	0	0	1	0	4
Hap_46	0	0	0	0	0	0	1	0	1
Hap_47	0	0	0	0	0	0	1	0	1

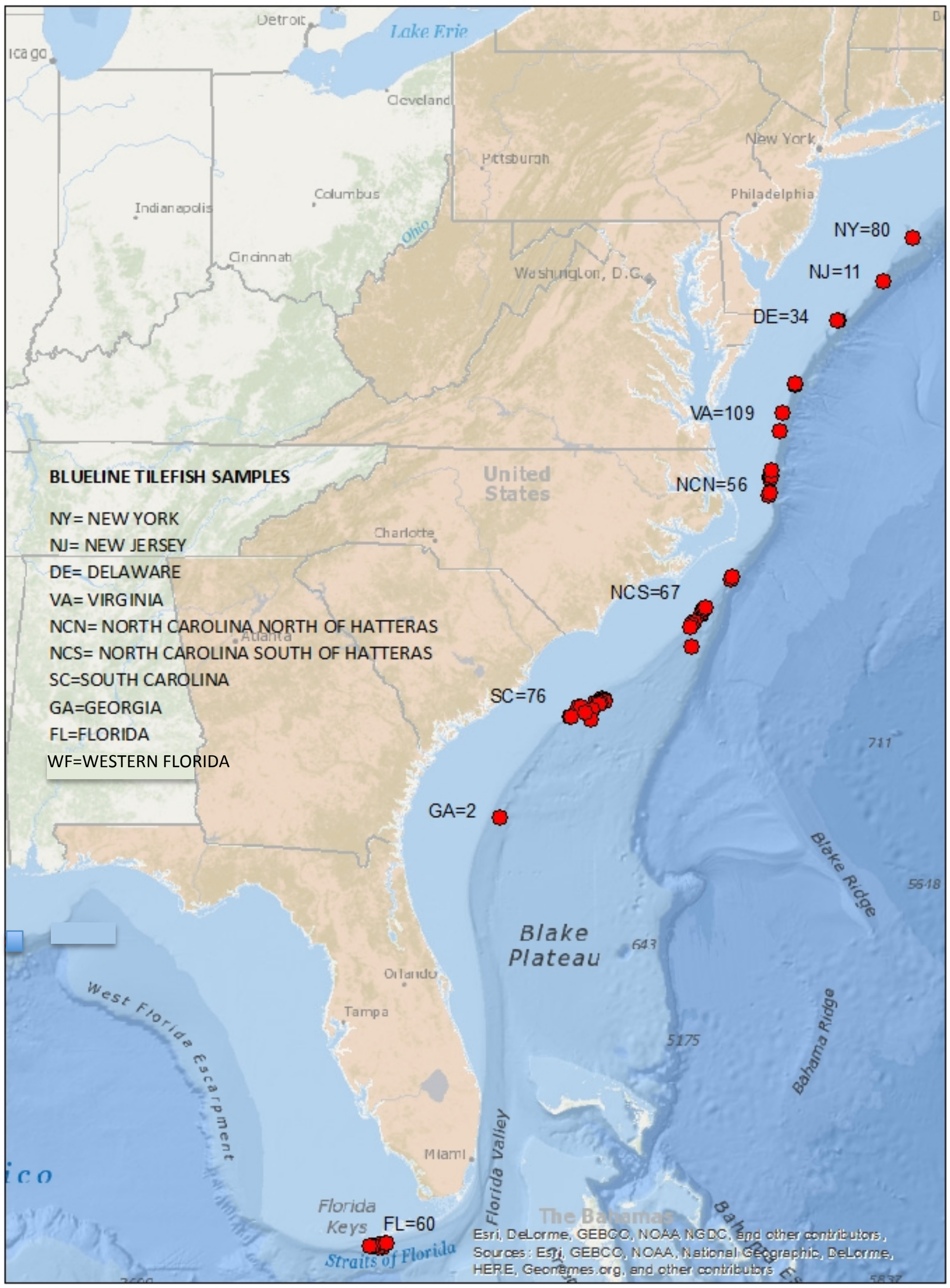
Hap_48	1	1	0	0	0	0	0	0	2
Hap_49	0	1	0	0	0	0	0	0	1
Hap_50	0	1	0	0	0	0	0	0	1
Hap_51	0	1	0	0	0	0	0	0	1
Hap_52	0	0	0	0	0	1	0	0	1
Hap_53	0	0	0	0	0	1	0	0	1
Hap_54	0	0	0	0	0	1	0	0	1
Hap_55	0	0	0	0	0	1	0	0	1
Hap_56	0	0	0	0	0	1	0	0	1
Hap_57	0	0	0	0	0	1	0	0	1
Hap_58	1	0	0	0	0	0	0	0	1
Hap_59	1	0	0	0	0	0	0	0	1
Hap_60	1	0	0	0	0	0	0	0	1
Hap_61	1	0	0	0	0	0	0	0	1
Hap_62	1	0	0	0	0	0	0	0	1
Hap_63	1	0	0	0	0	0	0	0	1
Hap_64	0	0	0	1	0	0	0	0	1
Hap_65	0	0	0	1	0	0	0	0	1
Hap_66	0	0	0	1	0	0	0	0	1
Hap_67	0	0	0	1	0	0	0	0	1
Hap_68	0	0	0	1	0	0	0	0	1
Hap_69	0	0	0	2	0	0	0	0	2
Hap_70	0	0	0	1	0	0	0	0	1
Hap_71	0	0	0	1	0	0	0	0	1
Hap_72	0	0	0	1	0	0	0	0	1
Total	24	8	40	24	24	31	24	13	188

Table 4. Mean number of pairwise differences (K), nucleotide diversity (π), haplotype diversity (H), Tajima's D, Probability of significance for Tajima's D (P_D), Fu's F, Probability of significance for Fu's D (P_F), values across all samples (All), New York (NY), Delaware (DE), Virginia (VA), North Carolina North of Cape Hatteras (NCN), North Carolina South of Cape Hatteras (NCS), South Carolina (SC), Florida Keys (FL), Western Florida (WF). All probabilities based on 10 000 permutations of the data.

Sample	K	π	H	Tajima's D	P_D	Fu's F	P_F
All	3.099 +/- 1.618	0.008 +/- 0.004	0.943 +/- 0.013	-2.101	0.001	-26.240	0.000
NY	3.409 +/- 1.807	0.008 +/- 0.005	0.967 +/- 0.024	-1.439	0.061	-13.112	0.000
DE	3.607 +/- 2.043	0.009 +/- 0.006	1.000 +/- 0.062	-1.336	0.097	-4.958	0.003
VA	2.931 +/- 1.569	0.007 +/- 0.004	0.894 +/- 0.04	-1.836	0.014	-19.816	0.000
NCN	2.754 +/- 1.511	0.007 +/- 0.004	0.967 +/- 0.024	-1.609	0.038	-15.451	0.000
NCS	2.442 +/- 1.370	0.006 +/- 0.004	0.891 +/- 0.057	-1.662	0.034	-10.239	0.000
SC	3.914 +/- 2.017	0.010 +/- 0.006	0.978 +/- 0.015	-1.903	0.010	-20.286	0.000
FL	2.953 +/- 1.601	0.007 +/- 0.004	0.956 +/- 0.031	-1.366	0.075	-14.667	0.000
WF	2.692 +/- 1.530	0.007 +/- 0.004	0.923 +/- 0.050	-0.657	0.278	-2.577	0.051

Figure 1a. Sampling locations and numbers of samples analyzed Hudson Canyon, NY-Key West, FL. 1b. Location of western Florida samples. Detailed collection information is in Appendix 1

a.



b.

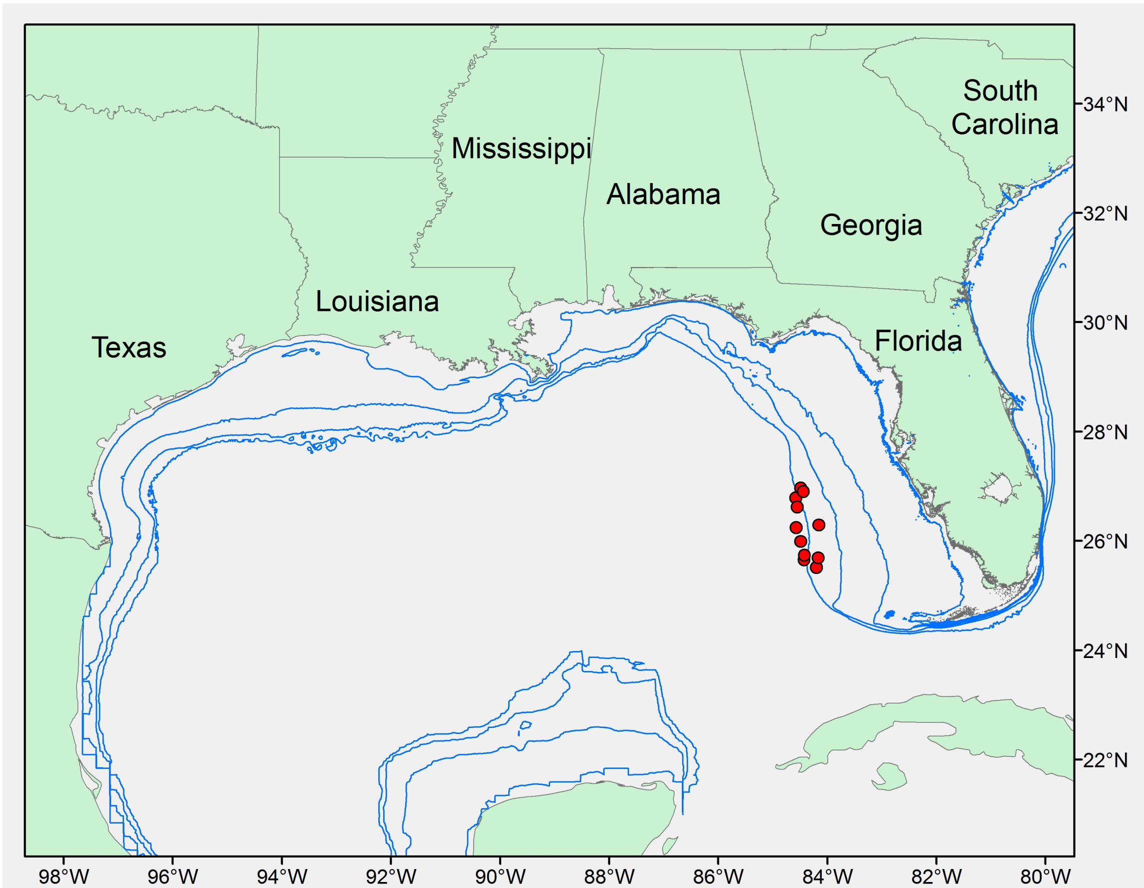

South
Carolina
Mississippi
Alabama
Georgia
Louisiana
Texas
Florida
34°N
32°N
30°N
28°N
26°N
24°N
22°N
98°W
96°W
94°W
92°W
90°W
88°W
86°W
84°W
82°W
80°W

Figure 2. Factorial correspondence analysis based on microsatellite data: a) Samples divided NY-NCN (yellow) and NCS-WF (blue) b) NY-DE (yellow), VA-NCN (blue) and SC-WF (white) and c) NY (yellow), DE (bright blue), VA (white) NCN (grey), NCS (pink), SC (green), FL (dark blue), WF (red).

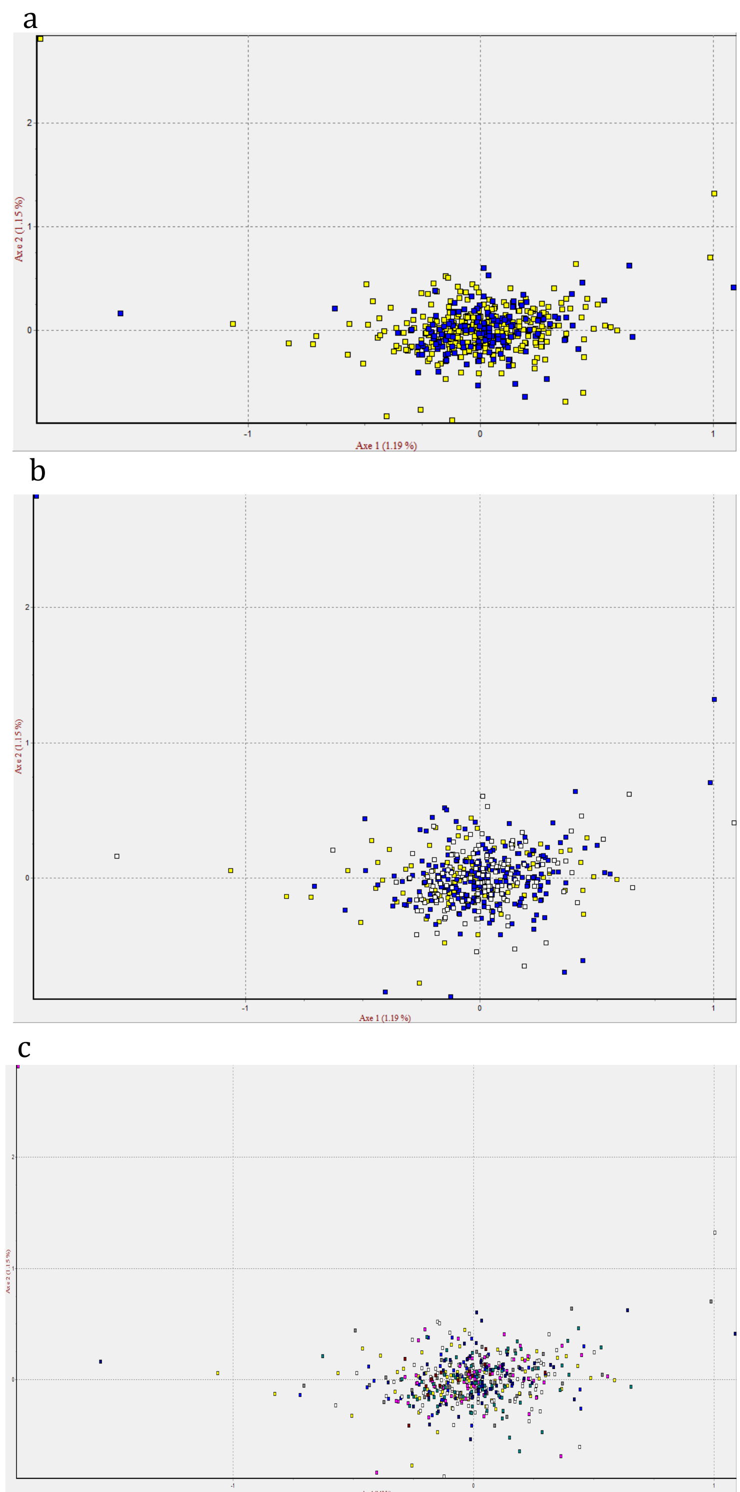
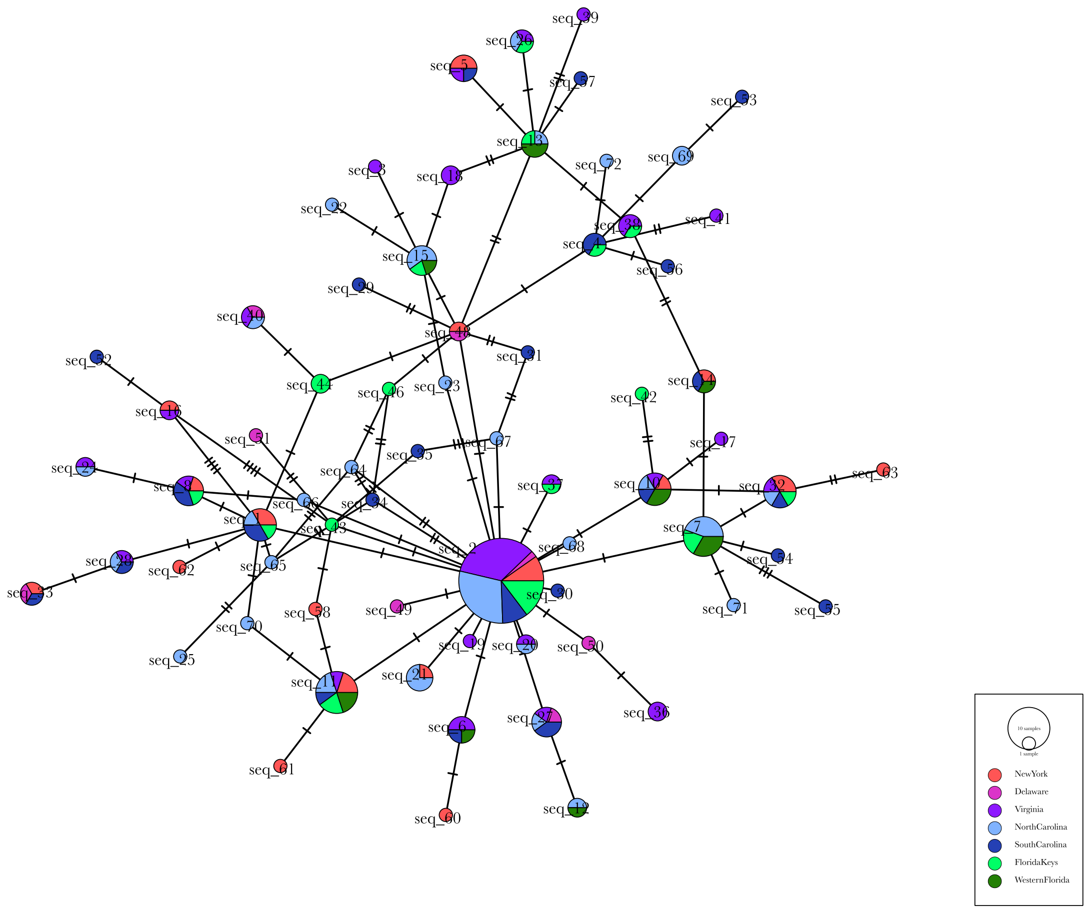


Figure 3. Minimum spanning network of the relationship among mtDNA haplotypes.



Appendix 1. Sample collection information.

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
MS-345-02	2011	U	U	Gulf of Mexico	26.97	-84.49
MS-345-03	2011	U	U	Gulf of Mexico	25.99	-84.49
MS-345-06	2011	U	U	Gulf of Mexico	26.79	-84.58
MS-345-08	2011	U	U	Gulf of Mexico	25.65	-84.43
MS-345-09	2011	U	U	Gulf of Mexico	25.51	-84.20
MS-345-11	2011	U	U	Gulf of Mexico	25.69	-84.17
MS-345-12	2011	U	U	Gulf of Mexico	25.74	-84.42
MS-345-13	2011	U	U	Gulf of Mexico	26.97	-84.49
MS-345-15	2011	U	U	Gulf of Mexico	26.90	-84.44
MS-345-16	2011	U	U	Gulf of Mexico	26.62	-84.55
MS-345-17	2011	U	U	Gulf of Mexico	26.25	-84.57
MS-345-18	2011	U	U	Gulf of Mexico	26.29	-84.16
MS-345-21	2011	U	U	Gulf of Mexico	26.97	-84.49
MS-345-26	2011	U	U	Gulf of Mexico	26.90	-84.44
MS-345-28	2011	U	U	Gulf of Mexico	26.90	-84.44
SC-346-01	8/30/12	U	61.5	South Carolina	32.82	-78.06
SC-346-02	8/30/12	U	59	South Carolina	32.83	-78.08
SC-346-03	8/30/12	U	56.1	South Carolina	32.84	-78.06
SC-346-04	8/30/12	U	59.6	South Carolina	32.85	-78.06
SC-346-05	8/30/12	U	55.4	South Carolina	32.86	-78.06
SC-346-06	8/30/12	U	65.7	South Carolina	32.76	-78.18
SC-448-01	7/23/14	U	58.6	South Carolina	32.25	-79.05
SC-448-02	7/23/14	U	60.5	South Carolina	32.25	-79.04
SC-448-03	7/23/14	U	64.2	South Carolina	32.25	-79.03
SC-448-04	7/23/14	U	53.1	South Carolina	32.25	-79.03
SC-448-05	7/23/14	U	42.9	South Carolina	32.25	-79.03
SC-448-06	7/23/14	U	58.3	South Carolina	32.26	-79.04
SC-448-07	7/23/14	U	58.6	South Carolina	32.26	-79.04
SC-448-08	7/23/14	U	53.2	South Carolina	32.26	-79.04
SC-448-10	5/14/13	U	69.3	South Carolina	32.26	-79.03
SC-448-16	7/23/14	U	61.6	South Carolina	32.25	-79.04
SC-448-17	7/23/14	U	60.8	South Carolina	32.25	-79.04
SC-448-18	7/23/14	U	61.4	South Carolina	32.25	-79.03
SC-448-19	7/23/14	U	63	South Carolina	32.26	-79.04
SC-448-20	7/23/14	U	66.5	South Carolina	32.26	-79.04
VA-434-01	4/18/15	U	59.69	Norfolk Canyon, VA	U	U
VA-434-02	4/18/15	U	46.99	Norfolk Canyon, VA	U	U
VA-434-03	4/18/15	U	41.91	Norfolk Canyon, VA	U	U
VA-434-04	4/18/15	U	65.405	Norfolk Canyon, VA	U	U
VA-434-05	4/18/15	U	36.83	Norfolk Canyon, VA	U	U
VA-434-06	4/18/15	U	43.18	Norfolk Canyon, VA	U	U
VA-434-07	4/18/15	U	52.07	Norfolk Canyon, VA	U	U
VA-434-08	4/18/15	U	46.99	Norfolk Canyon, VA	U	U

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
VA-434-09	4/18/15	U	38.1	Norfolk Canyon, VA	U	U
VA-434-10	4/18/15	U	39.37	Norfolk Canyon, VA	U	U
VA-434-11	4/18/15	U	37.465	Norfolk Canyon, VA	U	U
VA-434-12	4/18/15	U	59.69	Norfolk Canyon, VA	U	U
VA-434-13	4/18/15	U	72.136	Norfolk Canyon, VA	U	U
VA-434-14	4/18/15	U	44.45	Norfolk Canyon, VA	U	U
VA-434-15	4/18/15	U	50.8	Norfolk Canyon, VA	U	U
VA-434-16	4/18/15	U	39.37	Norfolk Canyon, VA	U	U
VA-434-18	4/18/15	U	49.53	Norfolk Canyon, VA	U	U
VA-434-19	4/18/15	U	71.12	Norfolk Canyon, VA	U	U
VA-434-20	4/18/15	U	49.53	Norfolk Canyon, VA	U	U
VA-434-21	4/18/15	U	48.26	Norfolk Canyon, VA	U	U
VA-434-22	4/18/15	U	53.34	Norfolk Canyon, VA	U	U
VA-434-23	4/18/15	U	47.625	Norfolk Canyon, VA	U	U
VA-434-25	4/18/15	U	41.91	Norfolk Canyon, VA	U	U
VA-447-01	6/11/15	U	48.895	Norfolk Canyon, VA	U	U
VA-447-02	6/11/15	U	48.26	Norfolk Canyon, VA	U	U
VA-447-03	6/11/15	U	39.37	Norfolk Canyon, VA	U	U
VA-447-04	6/11/15	U	48.895	Norfolk Canyon, VA	U	U
VA-447-05	6/11/15	U	39.37	Norfolk Canyon, VA	U	U
VA-447-06	6/11/15	U	48.895	Norfolk Canyon, VA	U	U
VA-447-07	6/11/15	U	52.07	Norfolk Canyon, VA	U	U
VA-447-08	6/11/15	U	41.275	Norfolk Canyon, VA	U	U
VA-447-09	6/11/15	U	45.72	Norfolk Canyon, VA	U	U
VA-447-10	6/11/15	U	39.37	Norfolk Canyon, VA	U	U
VA-447-11	6/11/15	U	38.735	Norfolk Canyon, VA	U	U
VA-447-12	6/11/15	U	38.735	Norfolk Canyon, VA	U	U
VA-447-13	6/11/15	U	36.83	Norfolk Canyon, VA	U	U
VA-447-14	6/11/15	U	40.005	Norfolk Canyon, VA	U	U
VA-447-15	6/11/15	U	35.56	Norfolk Canyon, VA	U	U
VA-447-16	6/11/15	U	38.1	Norfolk Canyon, VA	U	U
VA-447-17	6/11/15	U	38.735	Norfolk Canyon, VA	U	U
VA-447-18	6/11/15	U	53.34	Norfolk Canyon, VA	U	U
VA-447-19	6/11/15	U	43.815	Norfolk Canyon, VA	U	U
VA-447-20	6/11/15	U	38.1	Norfolk Canyon, VA	U	U
VA-447-21	6/11/15	U	45.085	Norfolk Canyon, VA	U	U
VA-447-22	6/11/15	U	44.45	Norfolk Canyon, VA	U	U
VA-447-23	6/11/15	U	52.07	Norfolk Canyon, VA	U	U
VA-447-24	6/11/15	U	43.815	Norfolk Canyon, VA	U	U
NC-469-03	10/1/15	U	49.5	North Carolina	34.16	-76.12
NC-469-04	10/1/15	U	62.2	North Carolina	34.16	-76.12
NC-469-05	10/1/15	U	56.9	North Carolina	34.16	-76.12
NC-469-09	10/1/15	U	45.5	North Carolina	34.16	-76.12
NC-469-10	10/1/15	U	62.2	North Carolina	34.16	-76.12

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
NC-469-12	10/1/15	U	49.5	North Carolina	34.16	-76.12
NC-469-13	10/1/15	U	43.5	North Carolina	34.16	-76.12
NC-469-14	10/1/15	U	52.5	North Carolina	34.16	-76.12
NC-469-15	10/1/15	U	53	North Carolina	34.16	-76.12
NC-469-16	10/1/15	U	52.2	North Carolina	34.16	-76.12
NC-469-17	10/1/15	U	46.2	North Carolina	34.16	-76.12
NC-469-19	10/1/15	U	40.9	North Carolina	34.16	-76.11
NC-469-20	10/1/15	U	47	North Carolina	34.16	-76.11
NC-469-21	10/1/15	U	57.6	North Carolina	34.16	-76.11
NC-469-22	10/1/15	U	44.8	North Carolina	34.16	-76.11
NC-469-23	10/1/15	U	53.3	North Carolina	34.16	-76.11
NC-469-24	10/1/15	U	42.6	North Carolina	34.16	-76.11
NC-469-25	10/1/15	U	59.2	North Carolina	34.16	-76.11
NC-469-42	10/1/15	U	56	North Carolina	34.16	-76.11
NC-469-43	10/1/15	U	49.5	North Carolina	34.16	-76.11
NC-469-44	10/1/15	U	40.4	North Carolina	34.16	-76.11
NC-469-45	10/1/15	U	34.9	North Carolina	34.16	-76.11
NC-469-46	10/1/15	U	51.2	North Carolina	34.16	-76.11
NC-469-47	10/1/15	U	60.3	North Carolina	34.22	-76.07
NC-469-59	10/8/15	U	48.1	North Carolina	34.23	-76.06
NC-469-60	10/8/15	U	47.2	North Carolina	34.23	-76.06
NC-469-61	10/8/15	U	40.5	North Carolina	34.26	-76.02
NC-469-62	10/8/15	U	40.5	North Carolina	34.26	-76.02
NC-469-63	10/8/15	U	50.9	North Carolina	34.26	-76.02
NC-469-64	10/8/15	U	61.7	North Carolina	34.23	-76.05
NC-469-65	10/8/15	U	48.4	North Carolina	34.23	-76.06
NC-469-66	10/8/15	U	58.2	North Carolina	34.23	-76.05
NC-469-67	10/8/15	U	47.9	North Carolina	34.23	-76.05
NC-469-68	10/8/15	U	60.5	North Carolina	34.24	-76.04
NC-469-70	10/8/15	U	42.5	North Carolina	34.25	-76.02
NC-469-71	10/8/15	U	47.8	North Carolina	34.25	-76.02
NC-469-72	10/8/15	U	62	North Carolina	34.25	-76.03
NC-469-73	10/8/15	U	56.2	North Carolina	34.25	-76.03
NC-469-74	10/8/15	U	58.2	North Carolina	34.25	-76.03
NC-469-75	10/9/15	U	55.9	North Carolina	34.25	-76.03
NC-469-78	10/9/15	U	55.2	North Carolina	34.04	-76.24
NC-469-79	10/9/15	U	50.6	North Carolina	34.05	-76.24
NC-469-80	10/9/15	U	56	North Carolina	34.05	-76.24
NC-469-82	10/9/15	U	60.6	North Carolina	34.03	-76.25
NC-469-83	10/9/15	U	63.1	North Carolina	34.03	-76.25
NC-469-88	10/9/15	U	39.1	North Carolina	34.01	-76.28
NC-469-89	10/9/15	U	47.5	North Carolina	34.01	-76.28
NC-469-90	10/9/15	U	37.6	North Carolina	34.01	-76.28
NC-469-95	10/9/15	U	56.4	North Carolina	34.01	-76.28

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
NC-469-96	10/9/15	U	46.2	North Carolina	34.01	-76.28
NC-469-102	10/9/15	U	58.5	North Carolina	34.01	-76.28
NC-469-103	10/9/15	U	46.6	North Carolina	34.01	-76.28
NC-469-104	10/9/15	U	45.6	North Carolina	34.01	-76.28
NC-469-107	10/9/15	U	46.3	North Carolina	34.01	-76.28
NC-469-108	10/9/15	U	42.1	North Carolina	34.01	-76.28
NC-469-112	10/9/15	U	47	North Carolina	34.01	-76.29
NC-469-126	10/12/15	U	52.6	North Carolina	33.67	-76.28
NC-469-127	10/12/15	U	66.7	North Carolina	34.04	-76.23
NC-469-128	10/12/15	U	66.1	North Carolina	34.00	-76.28
NC-469-129	10/12/15	U	52.1	North Carolina	34.66	-75.60
NC-469-130	10/21/15	U	65.1	North Carolina	34.66	-75.59
NC-469-131	10/21/15	U	63	North Carolina	34.69	-75.57
NC-469-132	10/21/15	U	68.5	North Carolina	34.69	-75.57
NC-469-133	10/21/15	U	43.5	North Carolina	34.69	-75.57
NC-469-134	10/21/15	U	60.9	North Carolina	34.69	-75.57
NC-469-135	10/22/15	U	70.9	North Carolina	33.97	-76.32
VA-478_01	10/15/15	U	54	Virginia	37.47	-74.45
VA-478_02	10/15/15	U	54	Virginia	37.47	-74.45
VA-478_03	10/15/15	U	50	Virginia	37.47	-74.44
VA-478_04	10/15/15	U	62	Virginia	37.47	-74.45
VA-478_05	10/15/15	U	48	Virginia	37.47	-74.45
VA-478_06	10/15/15	U	43	Virginia	37.47	-74.44
VA-478_07	10/15/15	U	43	Virginia	37.47	-74.45
VA-478_08	10/15/15	U	45	Virginia	37.47	-74.45
VA-478_09	10/15/15	U	38	Virginia	37.47	-74.44
VA-478_10	10/15/15	U	46	Virginia	37.47	-74.45
VA-478_11	10/15/15	U	80	Virginia	37.47	-74.45
VA-478_12	10/15/15	U	37	Virginia	37.47	-74.44
VA-478_13	10/15/15	U	38	Virginia	37.47	-74.45
VA-478_14	10/15/15	U	44	Virginia	37.47	-74.45
VA-478_15	10/15/15	U	37	Virginia	37.47	-74.44
VA-478_16	10/15/15	U	46	Virginia	37.47	-74.45
VA-478_17	10/15/15	U	42	Virginia	37.47	-74.45
VA-478_18	10/15/15	U	45	Virginia	37.47	-74.44
VA-478_19	10/15/15	U	43	Virginia	37.47	-74.45
VA-478_20	10/15/15	U	43	Virginia	37.47	-74.45
VA-478_21	10/15/15	U	49	Virginia	37.47	-74.44
VA-478_22	10/15/15	U	48	Virginia	37.47	-74.45
VA-478_23	10/15/15	U	51	Virginia	37.47	-74.45
VA-478_24	10/15/15	U	78	Virginia	37.47	-74.44
VA-478_25	10/15/15	U	47	Virginia	37.47	-74.45
VA-478_26	10/15/15	U	38	Virginia	37.47	-74.45
VA-478_27	10/15/15	U	42	Virginia	37.47	-74.44

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
VA-478_28	10/15/15	U	45	Virginia	37.47	-74.45
VA-478_29	10/15/15	U	46	Virginia	37.47	-74.45
VA-478_30	10/15/15	U	45	Virginia	37.47	-74.44
VA-478_31	10/15/15	U	43	Virginia	37.47	-74.45
VA-478_32	10/15/15	U	48	Virginia	37.47	-74.45
VA-478_33	10/15/15	U	50	Virginia	37.47	-74.44
VA-478_34	10/15/15	U	49	Virginia	37.47	-74.45
VA-478_35	10/15/15	U	46	Virginia	37.47	-74.45
VA-478_36	10/15/15	U	45	Virginia	37.47	-74.44
VA-478_37	10/15/15	U	44	Virginia	37.47	-74.45
VA-478_38	10/15/15	U	48	Virginia	37.47	-74.45
VA-478_39	10/15/15	U	44	Virginia	37.47	-74.44
VA-478_40	10/15/15	U	54	Virginia	37.47	-74.45
VA-478_41	10/15/15	U	53	Virginia	37.47	-74.45
VA-478_42	10/15/15	U	50	Virginia	37.47	-74.44
VA-478_43	10/15/15	U	38	Virginia	37.47	-74.45
VA-478_44	10/15/15	U	38	Virginia	37.47	-74.45
VA-478_45	10/15/15	U	46	Virginia	37.47	-74.44
VA-478_46	10/15/15	U	44	Virginia	37.47	-74.45
VA-478_47	10/15/15	U	42	Virginia	37.47	-74.45
VA-478_48	10/15/15	U	48	Virginia	37.47	-74.44
VA-478_49	10/15/15	U	55	Virginia	37.47	-74.45
VA-478_50	10/15/15	U	60	Virginia	37.47	-74.45
VA-478_51	10/15/15	U	60	Virginia	37.47	-74.44
VA-478_52	10/15/15	U	41	Virginia	37.47	-74.45
VA-478_53	10/15/15	U	56	Virginia	37.47	-74.45
VA-478_54	10/15/15	U	72	Virginia	37.47	-74.44
VA-478_55	10/15/15	U	46	Virginia	37.47	-74.45
VA-478_56	10/15/15	U	50	Virginia	37.47	-74.44
VA-478_57	10/15/15	U	42	Virginia	37.47	-74.45
VA-478_58	10/15/15	U	56	Virginia	37.47	-74.45
VA-478_59	10/15/15	U	43	Virginia	37.47	-74.44
VA-478_60	10/15/15	U	48	Virginia	37.47	-74.45
VA-478_61	10/15/15	U	47	Virginia	37.47	-74.45
VA-478_62	10/15/15	U	55	Virginia	37.47	-74.44
FL483-01	10/9/15	M	74	Key West, FL	24.42	-81.71
FL483-02	10/9/15	M	79	Key West, FL	24.41	-81.76
FL483-03	10/10/15	U	51	Key West, FL	24.42	-81.74
FL483-04	10/10/15	U	62	Key West, FL	24.40	-81.86
FL483-05	10/11/15	F	47	Key West, FL	24.37	-81.78
FL483-06	10/11/15	F	50	Key West, FL	24.37	-81.78
FL483-07	10/11/15	F	49	Key West, FL	24.37	-81.78
FL483-08	10/11/15	F	49	Key West, FL	24.37	-81.78
FL483-09	10/11/15	M	63	Key West, FL	24.37	-81.78

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
FL483-10	10/11/15	F	68	Key West, FL	24.35	-81.84
FL483-11	10/11/15	F	47	Key West, FL	24.35	-81.84
FL483-12	10/11/15	F	51	Key West, FL	24.35	-81.84
FL483-13	10/15/15	F	53	Key West, FL	24.38	-81.96
FL483-14	10/15/15	F	52	Key West, FL	24.38	-81.96
FL483-15	10/15/15	M	72	Key West, FL	24.38	-81.96
FL483-16	10/15/15	M	73	Key West, FL	24.38	-81.96
FL483-17	10/15/15	F	55	Key West, FL	24.38	-81.96
FL483-18	10/15/15	M	75	Key West, FL	24.38	-81.96
FL483-19	10/15/15	F	54	Key West, FL	24.38	-81.97
FL483-20	10/15/15	M	71	Key West, FL	24.38	-81.97
FL483-21	10/15/15	F	54	Key West, FL	24.38	-81.97
FL483-22	10/15/15	F	55	Key West, FL	24.38	-81.97
FL483-23	10/15/15	U	53	Key West, FL	24.38	-81.97
FL483-24	10/15/15	F	54	Key West, FL	24.38	-81.97
FL483-25	10/15/15	M	73	Key West, FL	24.38	-81.97
FL483-26	10/15/15	F	53	Key West, FL	24.38	-81.97
FL483-27	10/15/15	F	51	Key West, FL	24.38	-81.96
FL483-28	10/15/15	F	58	Key West, FL	24.38	-81.95
FL483-29	10/15/15	F	58	Key West, FL	24.38	-82.00
FL483-30	10/15/15	U	74	Key West, FL	24.38	-82.00
FL483-31	10/15/15	F	50	Key West, FL	24.38	-82.00
FL483-32	10/15/15	F	56	Key West, FL	24.38	-82.00
FL483-33	10/15/15	F	55	Key West, FL	24.38	-82.00
FL483-34	10/15/15	F	54	Key West, FL	24.38	-82.00
FL483-35	10/16/15	M	53	Key West, FL	24.38	-81.93
FL483-36	10/16/15	U	49	Key West, FL	24.38	-81.93
FL483-37	10/16/15	F	47	Key West, FL	24.38	-81.93
FL483-38	10/16/15	F	55	Key West, FL	24.38	-81.93
FL483-39	10/16/15	M	68	Key West, FL	24.38	-81.93
FL483-40	10/16/15	M	63	Key West, FL	24.38	-81.93
FL483-41	10/16/15	F	55	Key West, FL	24.38	-81.95
FL483-42	10/16/15	F	57	Key West, FL	24.38	-81.95
FL483-43	10/16/15	F	47	Key West, FL	24.38	-81.95
FL483-44	10/16/15	F	54	Key West, FL	24.38	-81.95
FL483-45	10/16/15	F	57	Key West, FL	24.37	-82.01
FL483-46	10/16/15	F	56	Key West, FL	24.37	-82.01
FL483-47	10/16/15	F	56	Key West, FL	24.37	-82.01
FL483-48	10/16/15	U	73	Key West, FL	24.37	-82.01
FL483-49	10/16/15	U	76	Key West, FL	24.37	-82.01
FL483-50	10/16/15	M	59	Key West, FL	24.38	-81.94
FL483-51	10/16/15	M	62	Key West, FL	24.38	-81.94
FL483-52	10/16/15	F	52	Key West, FL	24.38	-81.95
FL483-53	10/16/15	F	58	Key West, FL	24.37	-82.01

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
FL483-54	10/16/15	F	57	Key West, FL	24.37	-82.01
FL483-55	10/16/15	F	57	Key West, FL	24.37	-82.01
FL483-56	10/17/15	F	62	Key West, FL	24.42	-81.71
SC483-01	9/26/15	U	65	South Carolina	32.78	-78.31
SC483-02	9/26/15	U	59	South Carolina	32.77	-78.25
SC483-03	9/26/15	M	57	South Carolina	32.85	-78.01
SC483-04	9/26/15	M	71	South Carolina	32.85	-78.01
SC483-05	9/26/15	F	47	South Carolina	32.85	-78.01
SC483-06	9/26/15	F	47	South Carolina	32.85	-78.01
SC483-07	9/26/15	M	74	South Carolina	32.85	-78.01
SC483-08	9/26/15	M	58	South Carolina	32.85	-78.01
SC483-09	9/27/15	M	55	South Carolina	32.85	-78.00
SC483-10	9/27/15	F	49	South Carolina	32.85	-78.00
SC483-11	9/27/15	F	44	South Carolina	32.85	-78.00
SC483-12	9/27/15	M	55	South Carolina	32.85	-78.00
SC483-13	9/27/15	M	58	South Carolina	32.85	-78.00
SC483-14	9/27/15	M	55	South Carolina	32.85	-78.00
SC483-15	9/27/15	F	49	South Carolina	32.85	-78.00
SC483-16	9/27/15	F	51	South Carolina	32.83	-77.96
SC483-17	9/27/15	M	67	South Carolina	32.83	-77.96
SC483-18	9/27/15	M	54	South Carolina	32.83	-77.96
SC483-19	9/27/15	F	45	South Carolina	32.83	-77.96
SC483-20	9/27/15	F	52	South Carolina	32.83	-77.96
SC483-21	9/27/15	F	50	South Carolina	32.83	-77.96
SC483-22	9/27/15	F	57	South Carolina	32.83	-77.96
SC483-23	9/27/15	F	51	South Carolina	32.83	-77.96
SC483-24	9/28/15	M	48	South Carolina	32.90	-77.86
SC483-25	9/28/15	F	62	South Carolina	32.89	-77.85
SC483-26	9/28/15	M	58	South Carolina	32.89	-77.85
SC483-27	9/28/15	M	70	South Carolina	32.89	-77.85
SC483-28	9/28/15	F	54	South Carolina	32.89	-77.85
SC483-29	9/28/15	F	51	South Carolina	32.88	-77.83
SC483-30	9/28/15	M	70	South Carolina	32.87	-77.83
SC483-31	9/28/15	M	68	South Carolina	32.87	-77.83
SC483-32	9/28/15	F	44	South Carolina	32.86	-77.81
SC483-33	9/28/15	F	42	South Carolina	32.89	-77.85
SC483-34	9/28/15	M	73	South Carolina	32.84	-77.88
SC483-35	9/28/15	F	60	South Carolina	32.81	-77.93
SC483-36	9/28/15	M	73	South Carolina	32.81	-77.93
SC483-37	9/28/15	F	56	South Carolina	32.81	-77.93
SC483-38	9/28/15	M	70	South Carolina	32.81	-77.93
SC483-39	9/28/15	F	61	South Carolina	32.81	-77.93
SC483-40	9/28/15	F	56	South Carolina	32.81	-77.93
SC483-41	9/29/15	F	60	South Carolina	32.74	-78.04

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
SC483-42	9/29/15	F	43	South Carolina	32.60	-78.08
SC483-43	9/30/15	M	50	South Carolina	32.77	-78.24
SC483-44	9/30/15	M	53	South Carolina	32.77	-78.24
SC483-45	9/30/15	M	57	South Carolina	32.70	-78.16
SC483-46	9/30/15	M	65	South Carolina	32.70	-78.16
SC483-47	10/1/15	M	72	South Carolina	32.63	-78.46
SC483-48	10/1/15	M	70	South Carolina	32.63	-78.46
SC483-49	10/1/15	M	47	South Carolina	32.63	-78.46
SC483-50	10/1/15	M	60	South Carolina	32.62	-78.43
SC483-51	10/1/15	M	58	South Carolina	32.62	-78.43
SC483-52	10/8/15	F	56	South Carolina	32.64	-78.42
SC483-53	10/8/15	F	62	South Carolina	32.62	-78.44
SC483-54	10/8/15	F	61	South Carolina	32.62	-78.44
SC483-55	10/8/15	F	58	South Carolina	32.62	-78.44
SC483-56	10/8/15	F	57	South Carolina	32.62	-78.44
NG483-01	10/14/15	F	67	Nags Head, NC	36.12	-74.89
NG483-02	10/14/15	M	69	Nags Head, NC	36.12	-74.89
NG483-03	10/14/15	M	67	Nags Head, NC	36.12	-74.89
NG483-04	10/14/15	M	69	Nags Head, NC	36.12	-74.89
NG483-05	10/14/15	M	66	Nags Head, NC	36.12	-74.89
NG483-06	10/14/15	M	58	Nags Head, NC	36.12	-74.89
NG483-07	10/14/15	M	67	Nags Head, NC	36.12	-74.89
NG483-08	10/14/15	F	53	Nags Head, NC	36.12	-74.89
NG483-09	10/14/15	M	66	Nags Head, NC	36.12	-74.89
NG483-10	10/14/15	M	72	Nags Head, NC	36.12	-74.89
NG483-11	10/14/15	M	67	Nags Head, NC	36.17	-74.88
NG483-12	10/14/15	M	67	Nags Head, NC	36.17	-74.88
NG483-13	10/14/15	F	63	Nags Head, NC	36.17	-74.88
NG483-14	10/14/15	F	55	Nags Head, NC	36.16	-74.86
NG483-15	10/14/15	M	69	Nags Head, NC	36.16	-74.86
NG483-16	10/14/15	F	52	Nags Head, NC	36.16	-74.86
NG483-17	10/14/15	M	69	Nags Head, NC	36.16	-74.86
NG483-18	10/14/15	M	71	Nags Head, NC	36.16	-74.86
NG483-19	10/14/15	M	66	Nags Head, NC	36.16	-74.86
NG483-20	10/14/15	M	63	Nags Head, NC	36.16	-74.86
NG483-21	10/14/15	M	66	Nags Head, NC	36.16	-74.86
NG483-22	10/14/15	M	58	Nags Head, NC	36.16	-74.86
NG483-23	10/14/15	F	51	Nags Head, NC	36.16	-74.86
NG483-24	10/14/15	M	66	Nags Head, NC	36.24	-74.87
NG483-25	11/29/15	F	53	Nags Head, NC	35.88	-74.92
NG483-26	11/29/15	F	53	Nags Head, NC	35.88	-74.92
NG483-27	11/29/15	M	69	Nags Head, NC	35.88	-74.92
NG483-28	11/29/15	M	72	Nags Head, NC	35.88	-74.92
NG483-29	11/29/15	F	58	Nags Head, NC	35.88	-74.92

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
NG483-30	11/29/15	M	71	Nags Head, NC	35.88	-74.92
NG483-31	11/29/15	F	52	Nags Head, NC	35.88	-74.92
NG483-32	11/29/15	F	53	Nags Head, NC	35.88	-74.92
NG483-33	11/29/15	F	53	Nags Head, NC	35.88	-74.92
NG483-34	11/29/15	F	54	Nags Head, NC	35.88	-74.92
NG483-35	11/29/15	F	54	Nags Head, NC	35.88	-74.92
NG483-36	11/29/15	F	50	Nags Head, NC	35.88	-74.92
NG483-37	11/29/15	M	63	Nags Head, NC	35.88	-74.92
NG483-38	11/29/15	F	49	Nags Head, NC	35.88	-74.92
NG483-39	11/29/15	F	58	Nags Head, NC	35.88	-74.92
NG483-40	11/29/15	M	69	Nags Head, NC	35.88	-74.92
NG483-41	11/29/15	M	66	Nags Head, NC	35.88	-74.92
NG483-42	11/29/15	F	56	Nags Head, NC	35.88	-74.92
NG483-43	11/29/15	F	55	Nags Head, NC	35.92	-74.89
NG483-44	11/29/15	F	55	Nags Head, NC	35.92	-74.89
NG483-45	11/29/15	F	56	Nags Head, NC	35.92	-74.89
NG483-46	11/29/15	F	57	Nags Head, NC	35.92	-74.89
NG483-47	11/29/15	F	64	Nags Head, NC	35.92	-74.89
NG483-48	11/29/15	F	52	Nags Head, NC	35.92	-74.89
NG483-49	11/29/15	F	53	Nags Head, NC	35.92	-74.89
NG483-50	11/29/15	F	54	Nags Head, NC	35.92	-74.89
NG483-51	11/29/15	F	52	Nags Head, NC	35.92	-74.89
NG483-52	11/29/15	M	63	Nags Head, NC	35.92	-74.89
NG483-53	11/29/15	F	53	Nags Head, NC	35.92	-74.89
NG483-54	11/29/15	F	52	Nags Head, NC	35.92	-74.89
NG483-55	11/29/15	F	51	Nags Head, NC	35.92	-74.89
NG483-56	11/29/15	F	57	Nags Head, NC	35.92	-74.89
DE484-01	12/30/15	M	61	Lewes, DE	38.37	-73.70
DE484-02	12/30/15	F	53	Lewes, DE	38.37	-73.70
DE484-03	12/30/15	U	55	Lewes, DE	38.37	-73.70
DE484-04	12/30/15	F	60	Lewes, DE	38.37	-73.70
DE484-05	12/30/15	U	52	Lewes, DE	38.37	-73.70
DE484-06	12/30/15	F	59	Lewes, DE	38.37	-73.70
DE484-07	12/30/15	M	65	Lewes, DE	38.37	-73.70
DE484-08	12/30/15	F	55	Lewes, DE	38.37	-73.70
DE484-09	12/30/15	F	55	Lewes, DE	38.35	-73.70
DE484-10	12/30/15	F	57	Lewes, DE	38.35	-73.70
DE484-11	12/30/15	M	62	Lewes, DE	38.37	-73.68
DE484-12	12/30/15	M	60	Lewes, DE	38.37	-73.68
DE484-13	12/30/15	M	57	Lewes, DE	38.37	-73.68
DE484-14	12/30/15	M	63	Lewes, DE	38.37	-73.68
DE484-15	12/30/15	U	60	Lewes, DE	38.37	-73.68
DE484-16	12/30/15	M	57	Lewes, DE	38.37	-73.68
DE484-17	12/30/15	M	59	Lewes, DE	38.37	-73.68

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
DE484-18	12/30/15	M	60	Lewes, DE	38.37	-73.68
DE484-19	12/30/15	F	54	Lewes, DE	38.35	-73.70
DE484-20	12/30/15	F	58	Lewes, DE	38.35	-73.70
DE484-21	12/30/15	F	57	Lewes, DE	38.35	-73.70
DE484-22	12/30/15	F	50	Lewes, DE	38.37	-73.68
DE484-23	12/30/15	F	54	Lewes, DE	38.37	-73.68
DE484-24	12/30/15	M	67	Lewes, DE	38.37	-73.68
DE484-25	12/30/15	M	60	Lewes, DE	38.37	-73.68
DE484-26	12/30/15	M	63	Lewes, DE	38.37	-73.68
DE484-27	12/30/15	F	56	Lewes, DE	38.37	-73.68
DE484-28	12/30/15	M	59	Lewes, DE	38.37	-73.68
DE484-29	12/30/15	M	60	Lewes, DE	38.37	-73.68
DE484-30	12/30/15	F	50	Lewes, DE	38.37	-73.68
DE484-31	12/30/15	F	58	Lewes, DE	38.37	-73.68
DE484-32	12/30/15	M	55	Lewes, DE	38.37	-73.70
DE484-33	12/30/15	F	52	Lewes, DE	38.37	-73.70
DE484-34	12/30/15	F	57	Lewes, DE	38.37	-73.70
NJ483_01	9/17/2015	U	63	New Jersey	38.91	-72.89
NJ483_02	9/17/2015	U	51	New Jersey	38.91	-72.89
NJ483_03	9/17/2015	U	58	New Jersey	38.91	-72.89
NJ483_04	9/17/2015	U	62	New Jersey	38.91	-72.89
NJ483_05	9/17/2015	U	53	New Jersey	38.91	-72.89
NJ483_06	9/17/2015	U	41	New Jersey	38.91	-72.89
NJ483_07	9/17/2015	U	56	New Jersey	38.91	-72.89
NJ483_08	9/17/2015	U	56	New Jersey	38.91	-72.89
NJ483_09	9/17/2015	U	63	New Jersey	38.91	-72.89
NJ483_10	9/17/2015	U	50	New Jersey	38.91	-72.89
NJ483_11	9/17/2015	U	53	New Jersey	38.91	-72.89
NY498_01	4/21/16	U	44	Hudson Canyon, NY	Stat. Area	616.00
NY498_02	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	616.00
NY498_03	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_04	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_05	4/21/16	U	58	Hudson Canyon, NY	Stat. Area	537/616
NY498_06	4/21/16	U	40	Hudson Canyon, NY	Stat. Area	537/616
NY498_08	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_09	4/21/16	U	41	Hudson Canyon, NY	Stat. Area	537/616
NY498_10	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_11	4/21/16	U	47	Hudson Canyon, NY	Stat. Area	537/616
NY498_12	4/21/16	U	45	Hudson Canyon, NY	Stat. Area	537/616
NY498_13	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_14	4/21/16	U	45	Hudson Canyon, NY	Stat. Area	537/616
NY498_15	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_16	4/21/16	U	43	Hudson Canyon, NY	Stat. Area	537/616
NY498_17	4/21/16	U	63	Hudson Canyon, NY	Stat. Area	537/616

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
NY498_18	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_19	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_20	4/21/16	U	47	Hudson Canyon, NY	Stat. Area	537/616
NY498_21	4/21/16	U	50	Hudson Canyon, NY	Stat. Area	537/616
NY498_22	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_23	4/21/16	U	64	Hudson Canyon, NY	Stat. Area	537/616
NY498_24	4/21/16	U	50	Hudson Canyon, NY	Stat. Area	537/616
NY498_25	4/21/16	U	43	Hudson Canyon, NY	Stat. Area	537/616
NY498_26	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_27	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_28	4/21/16	U	50	Hudson Canyon, NY	Stat. Area	537/616
NY498_29	4/21/16	U	35	Hudson Canyon, NY	Stat. Area	537/616
NY498_30	4/21/16	U	62	Hudson Canyon, NY	Stat. Area	537/616
NY498_31	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_32	4/21/16	U	63	Hudson Canyon, NY	Stat. Area	537/616
NY498_33	4/21/16	U	44	Hudson Canyon, NY	Stat. Area	537/616
NY498_34	4/21/16	U	42	Hudson Canyon, NY	Stat. Area	537/616
NY498_35	4/21/16	U	60	Hudson Canyon, NY	Stat. Area	537/616
NY498_36	4/21/16	U	50	Hudson Canyon, NY	Stat. Area	537/616
NY498_37	4/21/16	U	47	Hudson Canyon, NY	Stat. Area	537/616
NY498_38	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_39	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_40	4/21/16	U	39	Hudson Canyon, NY	Stat. Area	537/616
NY498_41	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_42	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_43	4/21/16	U	51	Hudson Canyon, NY	Stat. Area	537/616
NY498_44	4/21/16	U	60	Hudson Canyon, NY	Stat. Area	537/616
NY498_45	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_46	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_47	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_48	4/21/16	U	51	Hudson Canyon, NY	Stat. Area	537/616
NY498_49	4/21/16	U	56	Hudson Canyon, NY	Stat. Area	537/616
NY498_50	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_51	4/21/16	U	54	Hudson Canyon, NY	Stat. Area	537/616
NY498_52	4/21/16	U	44	Hudson Canyon, NY	Stat. Area	537/616
NY498_53	4/21/16	U	41	Hudson Canyon, NY	Stat. Area	537/616
NY498_54	4/21/16	U	44	Hudson Canyon, NY	Stat. Area	537/616
NY498_55	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_56	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_57	4/21/16	U	45	Hudson Canyon, NY	Stat. Area	537/616
NY498_58	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_59	4/21/16	U	45	Hudson Canyon, NY	Stat. Area	537/616
NY498_60	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_61	4/21/16	U	50	Hudson Canyon, NY	Stat. Area	537/616

Sample ID	Collection Date	Sex	Length (cm)	Sampling Location	Lat	Lon
NY498_62	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_63	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_64	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_65	4/21/16	U	60	Hudson Canyon, NY	Stat. Area	537/616
NY498_66	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_67	4/21/16	U	60	Hudson Canyon, NY	Stat. Area	537/616
NY498_68	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_69	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_70	4/21/16	U	53	Hudson Canyon, NY	Stat. Area	537/616
NY498_71	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_72	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_73	4/21/16	U	56	Hudson Canyon, NY	Stat. Area	537/616
NY498_74	4/21/16	U	47	Hudson Canyon, NY	Stat. Area	537/616
NY498_75	4/21/16	U	49	Hudson Canyon, NY	Stat. Area	537/616
NY498_76	4/21/16	U	46	Hudson Canyon, NY	Stat. Area	537/616
NY498_77	4/21/16	U	50	Hudson Canyon, NY	Stat. Area	537/616
NY498_78	4/21/16	U	52	Hudson Canyon, NY	Stat. Area	537/616
NY498_79	4/21/16	U	48	Hudson Canyon, NY	Stat. Area	537/616
NY498_80	4/21/16	U	51	Hudson Canyon, NY	Stat. Area	537/616

U=unknown. Stat Area=Statistical Area.