The following supplement accompanies the article

Overlap between highly suitable habitats and longline gear management areas reveals vulnerable and protected regions for highly migratory sharks

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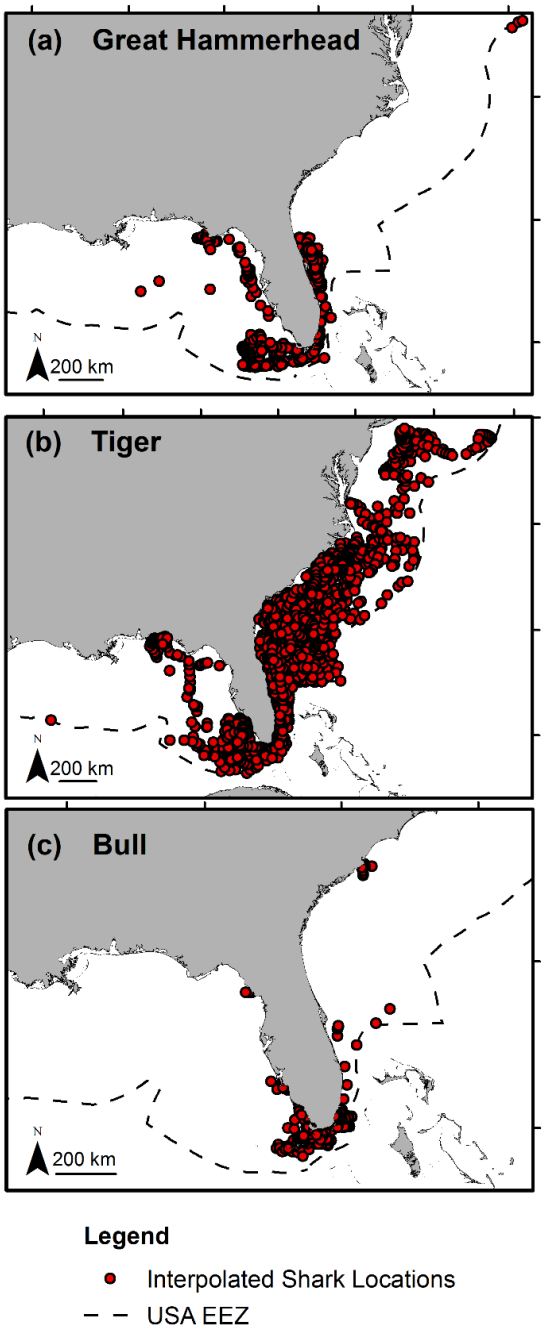

Fig. S1. Interpolated satellite tag locations for great hammerhead (A), tiger (B) and bull sharks (C) within the southeast region of the USA's EEZ year-round. This figure is displayed using projected coordinate system NAD 1983 UTM Zone 17N, see Fig. 1 for reference grid.

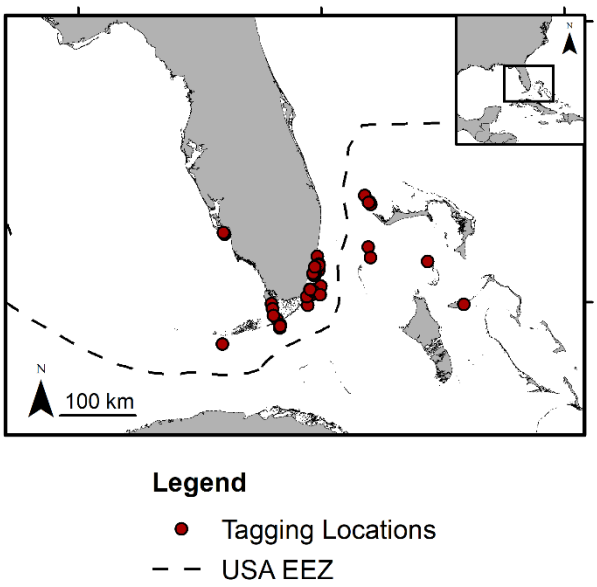

Fig. S2. Approximate tagging locations for each of the sharks included in this study. This figure is displayed using projected coordinate system NAD 1983 UTM Zone 17N, see Fig. 1 for reference grid.

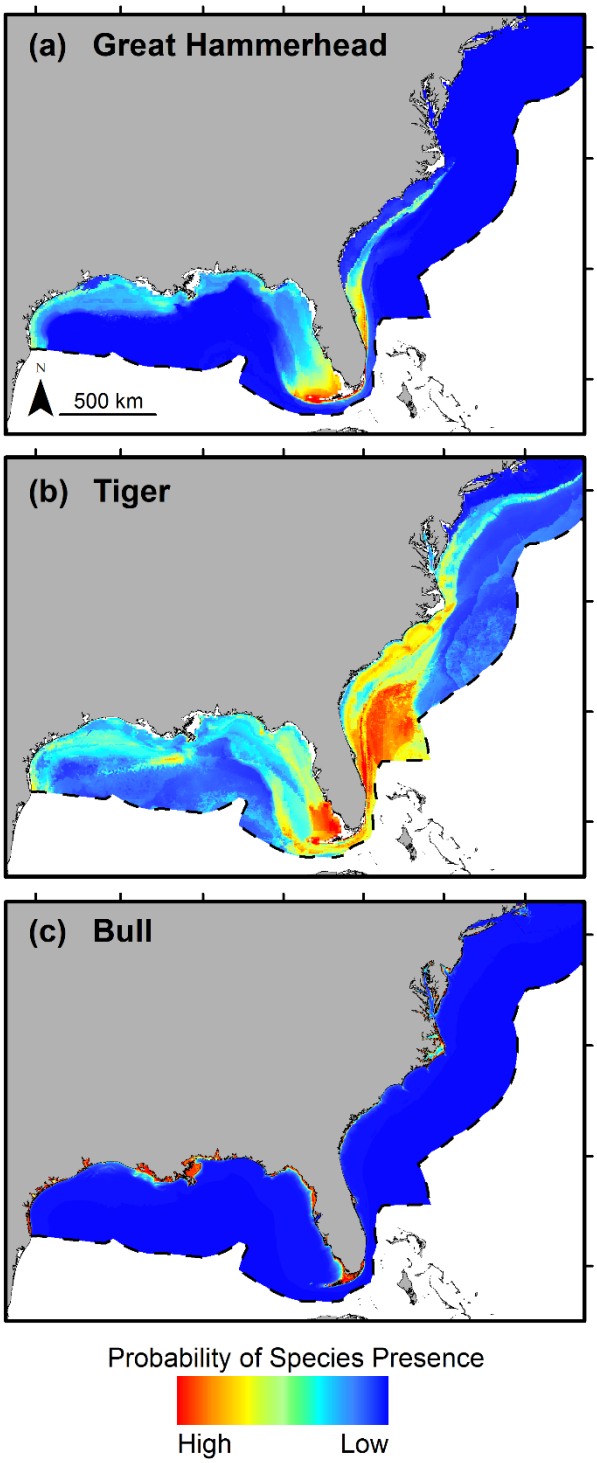

Fig. S3. Probability of great hammerhead (A), tiger (B), and bull shark (C) presence within the southeast region of the USA's EEZ year-round. This figure is displayed using projected coordinate system NAD 1983 UTM Zone 17N, see Fig. 1 for reference grid.

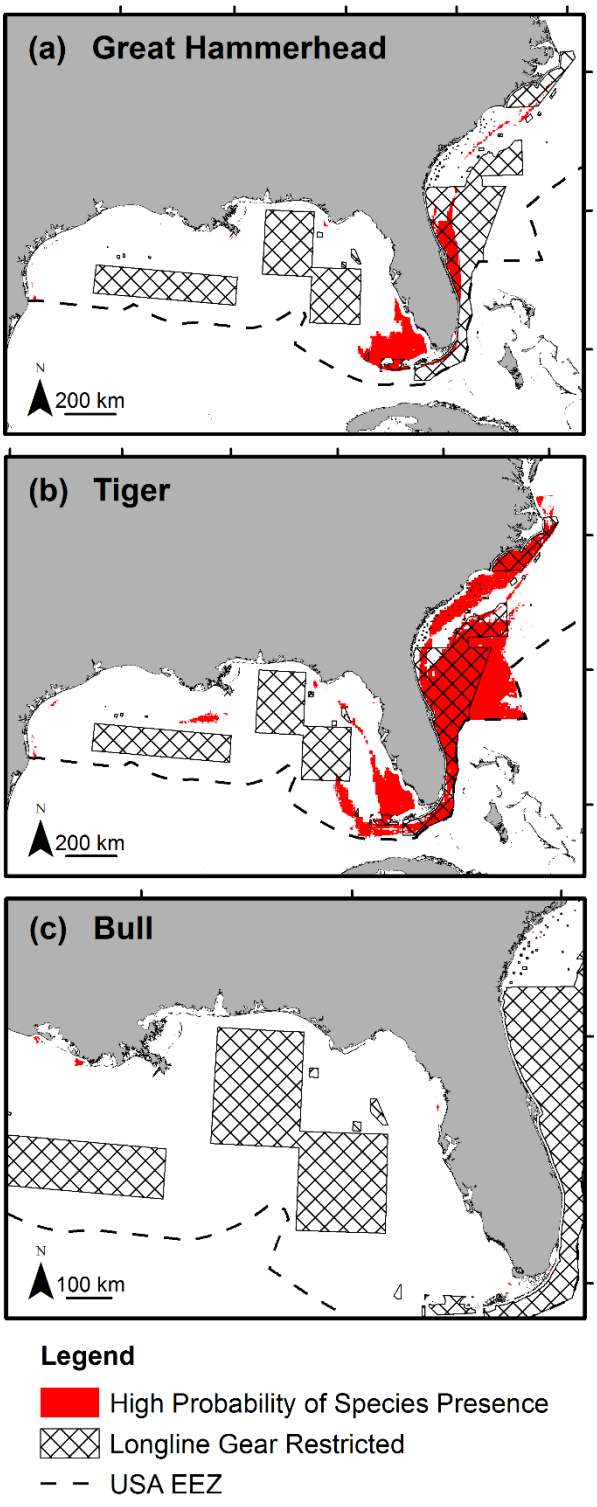

Fig. S4. Locations where highly suitable great hammerhead (A), tiger (B), and bull shark (C) habitats are protected from longline fishing gear in the southeast region of the USA's EEZ year-round. This figure is displayed using projected coordinate system NAD 1983 UTM Zone 17N, see Fig. 1 for reference grid.

Table S1. Descriptive statistics for each great hammerhead (GH), tiger (T) and bull (B) shark year-round model created during the step-wise model development process described in this study, and the results of the Mann-Whitney U tests used to identify the combination of variables that resulted in the highest AUC score with the least number of variables. Variables included in analysis were: bathymetry (bathy), chlorophyll a concentration (ChlA), surface current magnitude (CurMag), bathymetric slope (slope), and sea surface temperature (SST). The number of the model selected for further development and analysis is in bold and underlined. For example, the final model used to predict the probability of GH presence was model 3. While model 2 had a higher average AUC, model 2's replicate AUC values were not significantly higher than model 3's values (based on a p-value of 0.353), since model 2 had more variables than model 3, model 3 was chosen to avoid overfitting the model.

	Descriptive Statistics					**1-sided P-values from Mann-Whitney U Tests of AUC**					
	Model	**Avg. AUC**	**Avg. Regularized Training Gain**	**Avg. Test Gain**	**Variables Included in Model**	**Model Numbers**	**1**	**2**	**3**	**4**	**5**
GH Year-Round	1	0.9376	1.7139	1.7821	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.9443	1.7777	1.8894	Bathy, ChlA, CurMag, SST	2	0.912	X			
	3	0.9368	1.6727	1.7298	Bathy, CurMag, SST	**3**	0.579	0.353	X		
	4	0.9319	1.5931	1.6662	Bathy, SST	4	0.002	0.019	0.393	X	
	5	0.837	0.8544	0.8697	Bathy	5	<0.001	<0.001	<0.001	<0.001	X
T Year-Round	1	0.776	0.4731	0.5146	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.7812	0.4906	0.5353	Bathy, ChlA, CurMag, SST	**2**	0.684	X			
	3	0.7688	0.4454	0.489	Bathy, ChlA, CurMag	3	0.105	0.043	X		
	4	0.7509	0.3774	0.4099	Bathy, ChlA	4	0.01	<0.001	0.004	X	
	5	0.748	0.3934	0.427	Bathy	5	<0.001	<0.001	0.002	0.739	X
B Year-Round	1	0.9597	2.3206	2.2722	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.9614	2.2638	2.3344	Bathy, ChlA, Slope, SST	2	0.579	X			
	3	0.9605	2.2405	2.3147	Bathy, Slope, SST	3	0.529	0.971	X		
	4	0.9607	2.2579	2.329	Bathy, SST	4	0.684	0.853	0.853	X	
	5	0.9605	2.5803	2.6225	Bathy	**5**	0.796	0.631	0.912	0.796	X

Table S2. Descriptive statistics for each great hammerhead (GH), tiger (T) and bull (B) shark warm season model created during the step-wise model development process described in this study, and the results of the Mann-Whitney U tests used to identify the combination of variables that resulted in the highest AUC score with the least number of variables. The number of the model selected for further development and analysis is in bold and underlined. See Table S1 description for variable abbreviations.

	Model	**Avg. AUC**	**Avg. Regularized Training Gain**	**Avg. Test Gain**	**Variables Included in Model**	**Model Numbers**	1	2	3	4	5
GH Warm Season	1	0.9684	2.485	2.6035	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.9705	2.4988	2.6351	Bathy, ChlA, CurMag, SST	2	0.481	X			
	3	0.9667	2.3384	2.4607	Bathy, CurMag, SST	**3**	0.481	1.0	X		
	4	0.9407	1.7656	1.9054	Bathy, SST	4	0.009	<0.001	0.002	X	
	5	0.8724	1.0764	1.0897	Bathy	5	<0.001	<0.001	<0.001	<0.001	X
T Warm Season	1	0.7936	0.5218	0.5798	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.7961	0.5328	0.5915	Bathy, ChlA, CurMag, SST	2	0.436	X			
	3	0.7958	0.5202	0.5745	Bathy, ChlA, SST	**3**	0.684	1.0	X		
	4	0.7699	0.4325	0.477	Bathy, SST	4	<0.001	<0.001	<0.001	X	
	5	0.7241	0.2986	0.3409	SST	5	<0.001	<0.001	<0.001	<0.001	X
B Warm Season	1	0.9695	2.891	0.9695	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.9703	2.6862	2.7996	Bathy, ChlA, Slope, SST	2	0.481	X			
	3	0.971	2.7125	2.8363	Bathy, ChlA, SST	3	0.631	0.796	X		
	4	0.9694	2.5747	2.7208	Bathy, SST	4	0.436	0.796	0.796	X	
	5	0.9566	2.4726	2.5188	Bathy	**5**	0.063	0.19	0.143	0.143	X

Table S3. Descriptive statistics for each great hammerhead (GH), tiger (T) and bull (B) shark cool season model created during the step-wise model development process described in this study, and the results of the Mann-Whitney U tests used to identify the combination of variables that resulted in the highest AUC score with the least number of variables. The number of the model selected for further development and analysis is in bold and underlined. See Table S1 description for variable abbreviations.

	Model	**Avg. AUC**	**Avg. Regularized Training Gain**	**Avg. Test Gain**	**Variables Included in Model**	**Model Numbers**	1	2	3	4	5
GH Cool Season	1	0.9408	1.9184	2.003	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.9427	1.9192	2.0246	Bathy, ChlA, CurMag, SST	2	0.739	X			
	3	0.9421	1.8469	1.9476	Bathy, CurMag, SST	3	0.912	0.481	X		
	4	0.9346	1.697	1.7693	Bathy, SST	**4**	0.436	0.481	0.393	X	
	5	0.827	0.7187	0.8159	SST	5	<0.001	<0.001	<0.001	<0.001	X
T Cool Season	1	0.8782	1.0508	1.0959	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.8793	1.0527	1.1068	Bathy, ChlA, CurMag, SST	2	0.739	X			
	3	0.8796	1.037	1.0942	Bathy, CurMag, SST	**3**	0.739	0.912	X		
	4	0.8633	0.9402	0.9856	Bathy, SST	4	0.035	0.004	0.009	X	
	5	0.7683	0.5182	0.5281	SST	5	<0.001	<0.001	<0.001	<0.001	X
B Cool Season	1	0.9767	2.8741	2.8475	Bathy, ChlA, CurMag, Slope, SST	1	X				
	2	0.9757	2.7935	2.7975	Bathy, ChlA, Slope, SST	2	0.853	X			
	3	0.9751	2.7545	2.7801	Bathy, Slope, SST	3	0.165	0.436	X		
	4	0.9763	2.7868	2.8162	Bathy, SST	**4**	0.28	0.796	0.353	X	
	5	0.968	2.6818	2.7409	Bathy	5	0.009	0.023	0.005	0.002	X

Table S4. Longline gear management areas that prohibit or restrict the use of pelagic longline (PLL) or bottom longline (BLL) gear within the southeast region of the USA's EEZ during a portion of each year. All locations were identified based on the US Code of Federal Regulations: Title 15 Part 922 – National Marine Sanctuary Program Regulations, Title 50 Part 622 – Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic, or Title 50 Part 635 – Atlantic Highly Migratory Species. Table S4 continued on next page.

Location	**When Gear is Prohibited**	**Type of Longline Gear Restricted**
Gulf of Mexico Management Areas		
Madison-Swanson	All Year	PLL & BLL
Steamboat Lumps	All Year	PLL & BLL
Edges 40 Fathom Contour	Jan. 1 – April 30	PLL & BLL
Flower Garden Banks National Marine Sanctuary	All Year	PLL & BLL
East and West Flower Garden Banks HAPC	All Year	BLL
North and South Tortugas Marine Reserves HAPC	All Year	PLL & BLL
Florida Middle Grounds HAPC	All Year	BLL
Gulf of Mexico Deepwater Coral HAPCs: Pulley Ridge, Stetson Bank, McGrail Bank	All Year	BLL
DeSoto Canyon Closed Areas	All Year	PLL
Spring Gulf of Mexico Gear Restricted Areas	April 1 – May 31	PLL
South Atlantic Management Areas		
Gray's Reef National Marine Sanctuary	All Year	PLL & BLL
Florida Keys National Marine Sanctuary	All Year	PLL & BLL
East Florida Coast Closed Area	All Year	PLL
Charleston Bump Closed Area	Feb. 1 – April 30	PLL
Cape Hatteras Gear Restricted Area, with Conditional Access	Dec. 1 – April 30	PLL, however conditional access can be granted
Mid-Atlantic Shark Closed Area	Jan. 1 – July 31	BLL
South Atlantic Deepwater Coral HAPCs: Cape Lookout Lophelia Banks, Cape Fear Lophelia Banks, Stetson – Miami Terrace, Blake Ridge Diapir, Oculina Bank, Pourtales Terrace	All Year	BLL
South Atlantic MPAs: Snowy Grouper Wreck, Northern South Carolina, Edisto, Charleston Deep Artificial Reef, Georgia, North Florida, St. Lucie Hump, East Hump	All Year	BLL
Snapper-Grouper Fishery of the South Atlantic Region Special Management Zones (n = 51)	All Year	BLL & PLL, except Ft. Pierce inshore reef, Ft. Pierce Offshore reef, and Key Biscayne Artificial Reef H, where only BLL is prohibited

Table S5. Summary statistics of the sharks included in this study. All animals were tagged between March 2010 and December 2015. For the interpolated satellite tag locations and the number of days tagged, the sum, range, and mean values are provided stacked from top to bottom, respectively, within each temporal range for each species.

Species		Interpolated Satellite Tag Locations			Number of Days Tagged		
		Year-Round	Warm	Cool	Year-Round	Warm	Cool
Great Hammerhead	*Sum:*	557	272	285	609	241	268
	Range:	1-127	1-79	3-111	1-155	1-83	1-85
	Mean:	23.2	17	23.4	25.4	15	19.1
Tiger	*Sum:*	3310	2321	989	6043	4389	1722
	Range:	1-266	1-220	1-93	1-1527	1-1507	1-368
	Mean:	73.6	66.3	35.3	134.3	125.4	61.5
Bull	*Sum:*	793	326	467	2368	968	1578
	Range:	1-94	1-81	1-64	1-567	1-401	1-514
	Mean:	30.5	27.2	20.3	91.1	80.7	68.6