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Supplementary Information for

Conservation success and challenges for wide-ranging sharks and rays

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Supplementary Information Text

Supplementary text 1. Additional information wide-ranging coastal sharks in US waters

In 1993, the large coastal shark management group was subjected to commercial quotas, recreational trip limit of four sharks per vessel and the requirement that all sharks not taken as part of a commercial or recreational fishery be released uninjured. Many species-specific management measures did not occur until some years later. However, many species already began to show recovery prior to that. White Shark recovery was likely initially due to the broad effort controls on the shark fishery. When the species was prohibited later in 1997 the species was then being granted some of the highest levels of protection of any shark species in US waters, coupled with the decline in recreational "kill" tournaments of the 1970s and 1980s and the increase of "catch and release" and a more positive view of sharks in general (1, 2). However, the trend did was slow to reverse, and some shark populations are still in the early stages of rebuilding. Sandbar Shark and Dusky Shark declines have only been halted recently, likely due to constraints from their life histories (3) and ongoing incidental bycatch mortality. For example, White Shark are not a significant proportion of commercial shark fisheries bycatch (0.7% of prohibited species) whereas Dusky Shark make up a significant amount (76.6% of prohibited species) (4). Dusky Shark suffer considerable at-vessel mortality estimated up to 70–81% in bottom longline and 34–40% in pelagic longline fisheries (5–7) and likely suffer similar rates in recreational fisheries. White Shark, however, are rarely caught in commercial longline fisheries due to bite-offs and although the species can be targeted the post release survivorship is high (100%; n=10; T. Curtis; pers. comm.). So, while both species are prohibited and caught as bycatch the likelihood that Dusky Shark suffer mortality even before being released is much higher than for White Shark. The Blacktip Shark and Lemon Shark populations do not show change in their trajectories, and have never been considered overfished. The decline in the Blacktip Shark population in the US east coast is due to the higher level of recreational fishery mortality compared to the Gulf of Mexico population (8). The Lemon Shark always represented a minor proportion of commercial shark landings and thus is less likely to be impacted by the regulations (9). Finally, although no shark major management action was directed at Dusky Smoothhound in 1993, its trajectory shows a similar pattern of decline prior to, then recovery after, 1993, like most of the other species. This response could be due to the fact that most Dusky Smoothhound are caught as bycatch in gillnet fisheries off the middle Atlantic US states for species such as Spiny Dogfish (*Squalus acanthias*), Scup (*Stenotomus chrysops*), and Summer Flounder (*Paralichthys dentatus*). These fisheries have also been increasingly regulated over the years (https://www.mafmc.org/). More limited access, tighter trips limits, effort restrictions were all concurrent with increased shark management since the 1990s and this likely impacted their recovery more so than the shark FMP. For example, the estimated commercial gillnet discards for Dusky Smoothhound was 66.1 metric tons in 1993 but in 2012 was 1.1 metric tons (10).

Supplementary text 2. Examples of evaluation methods to quantify management impact to address data limitations

The IUCN Green List process (11) is an encouraging optimistic framework, quantifying each species' progress towards standardized, evidence-based recovery targets. To-date this method has only been tested on 200 species and has barely been applied to exploited marine species, the challenge will be to develop these criteria to be applicable to exploited marine fishes. The M-risk framework (12), currently developed for sharks and rays, assess the fishery management and conservation measures of a nation to derive species or population of conservation risk in the absence of effective management measures. M-Risk assessment allows for prioritization of those species / stocks where management measures are critical and also identifies those stocks where improvements to management measures are needed.

Supplementary text 3. Other proxies for fisheries management engagement (not included in main analysis)

Port State Measures Agreement

Port State Measures Agreement to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) fishing is a binding international agreement to prevent vessels engaged in IUU fishing from using ports and landing their catches. Port State Measures Agreement is a binary covariate with current Parties to the Agreement were assigned a 1. Joint regime areas where at least one of the countries was not a party to the treaty were assigned a 0.

Marine Protected Areas

In order to calculate the total marine area protected in each region, we considered only the marine protected area (MPA) of category Ia - following the IUCN protected area management categories that classify protected areas according to their management objectives - where "human visitation, use and impacts are strictly controlled and limited". Shark Sanctuaries and similar areas that prevent only a partial shark or ray fishing specifically are not included. We downloaded the shapefiles from the World Database of Protected Areas at www.protectedplanet.net on October 28, 2021, and calculated the percentage of area covered by MPA category Ia in each region in our final spatial extent. Full implementation of the MPA is required prior to its inclusion in the World Database of Protected Areas.

Fishery subsidies

Fishery subsidies are "financial contributions" by a government or any public body to the private sector of fisheries (see (13)). 'Harmful subsidies' artificially increase the generated profit from fishing by reducing cost of fishing and/or providing additional income to fishers, leading to overcapacity and overfishing (13, 14). The covariate used in this manuscript is the average standardized 'harmful' or 'beneficial' subsidies spent per landed value (in US dollars) in each region. This proxy could act as an indicator for the likelihood of overfishing (assuming harmful subsidies are spent equally between all gears, domestic and high sea fleets, and that each harmful subsidies type is equally harmful) and indicator of conservation engagement ('beneficial'). Some other forms of subsidies that can be beneficial such as vessel buybacks to reduce fishing effort, fisher assistance to find alternative livelihood were not dealt with here as their consequences depend on the design (labeled as 'ambiguous' by (15)).

Two types of data were used here to calculate this covariate : (1) the amount of capacity-enhancing ('harmful') or 'beneficial' subsidies estimated following (15), no time-series exists so we used the latest year (2018), and (2) the total reconstructed catches and landed values from Sea Around Us for the same year (2018) - except subsistence and recreational fisheries (as they are not considered to be subsidized) - by fishing entity (known nations) and fished area (nations' EEZ or high-sea). The subsidies dataset was extracted by DJS and the total of 'harmful' subsidies spent amount was aggregated (summed) from the 7 types of subsidies: boat construction and renovation, fisheries development projects, fishing port development, market and storage infrastructure, tax exemption, fishing access, and fuel subsidies, and for 'beneficial' subsidies from the 3 types : fisheries management, fishery R&D, and MPAs. For each fishing entity (sovereignty or territory; $fishing\_entity$), amount of subsidies (Sub_spent) were divided by the total landed value (profit, $Landed\_value$) from the Sea Around Us data. Then, for each national EEZ in the Western Atlantic, the amount of subsidies spent per profit of landed values ($\mathrm{Sub\_per\_\$}_{EEZ}$) is obtained by summing the previous ratio of each fishing entity weighted by the proportion of catch of those fishing entity in the EEZ ($prop\_catch_{EEZ,fishing\_entity}$) . Note that the amount of subsidies is provided only for sovereignty, so subsidy ratios for territories are represented by the values of their sovereignty.

$$\mathrm{Sub\_per\_\$}_{EEZ} = \sum_{fishing\_entity} \frac{Sub\_spent}{Landed\_value} * prop\_catch_{EEZ,fishing\_entity}$$

Supplementary text 4. Code for the Bayesian mixed-effect ordinal model used to analyze the effect of intrinsic sensitivity, and fishing exposure and fisheries management engagement on the IUCN Red List status of 26 wide-ranging coastal sharks

```
brm(
  formula = IUCN_satus ~ 1 + Intrinsic_sensitivity + Fishing_exposure +
Fisheries_management_exposure + (1 | species_ID) + (1 | FAO_region)
  , data = dataset_ordinal
  , family = cumulative("logit")
  , prior = c(set_prior(prior = "normal(0,10)", class = "Intercept"),
              set_prior(prior = "normal(0,10", class = "b"),
              set_prior(prior = "cauchy(0, 2)", class = "sd"))
  , control = list(max_treedepth = 25, adapt_delta = 0.99)
  , iter = 60000
  , warmup = 18000
  , thin = 6
  , chains = 3
)
```

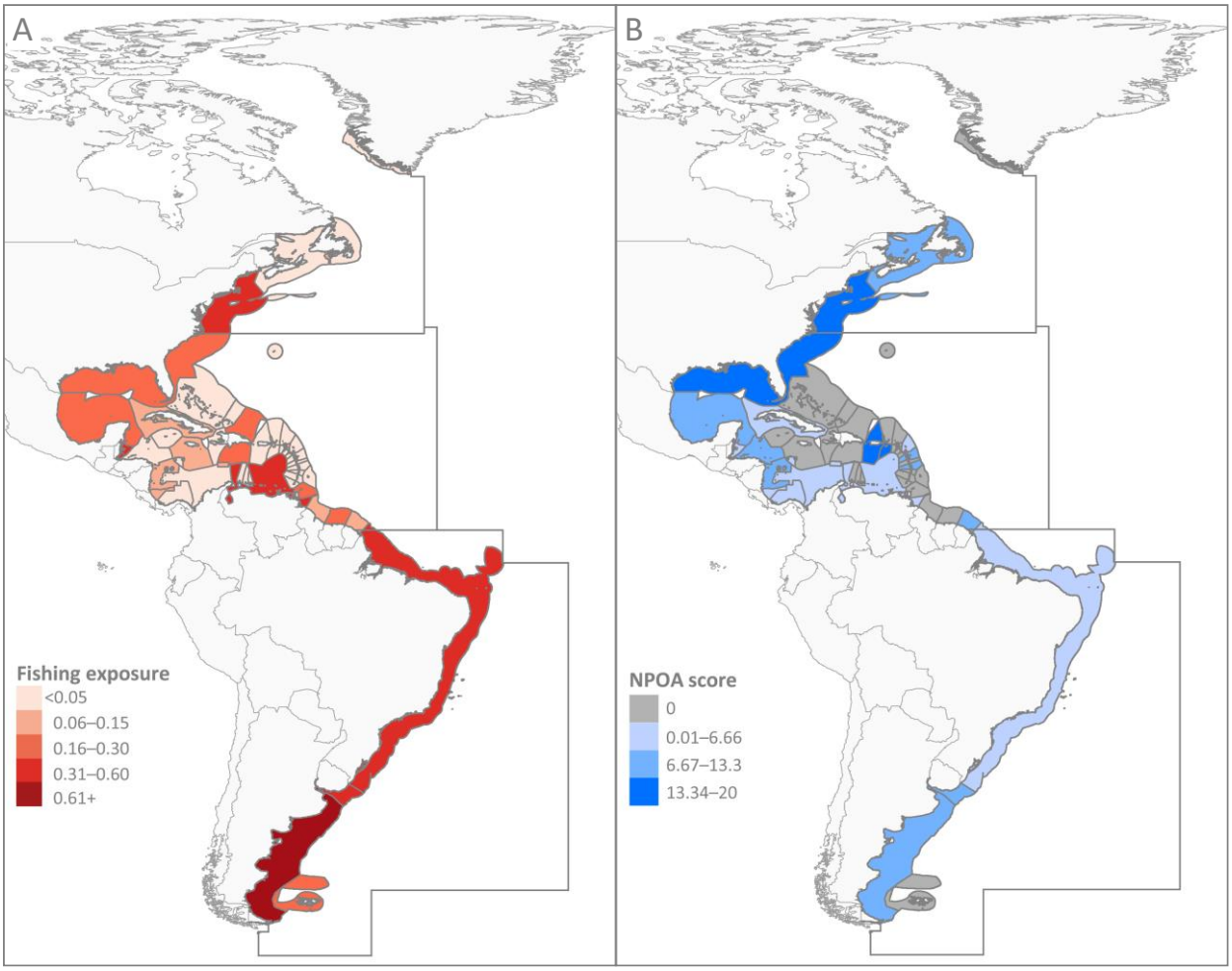

Fig. S1. Western Atlantic context for the twenty-six wide-ranging coastal sharks and rays. Maximum distribution range of the species within national Exclusive Economic Zones (EEZs) and national values for (A) fishing exposure (natural Jenks Break), and (B) fisheries management engagement (National or Regional Plan of Action for sharks and rays, 'Shark-Plan') (equal breaks). Fishing exposure is the total catch in metric tonnes km^{-2} over the last 18 years (2001-2018, spanning the average one generation length of our 26 species) of all sharks and rays expressed by the surface area of the EEZ of the fishing entity). Fisheries management engagement is the average Shark-Plan quality score (out of 20) over the last 18 years (2003-2020).

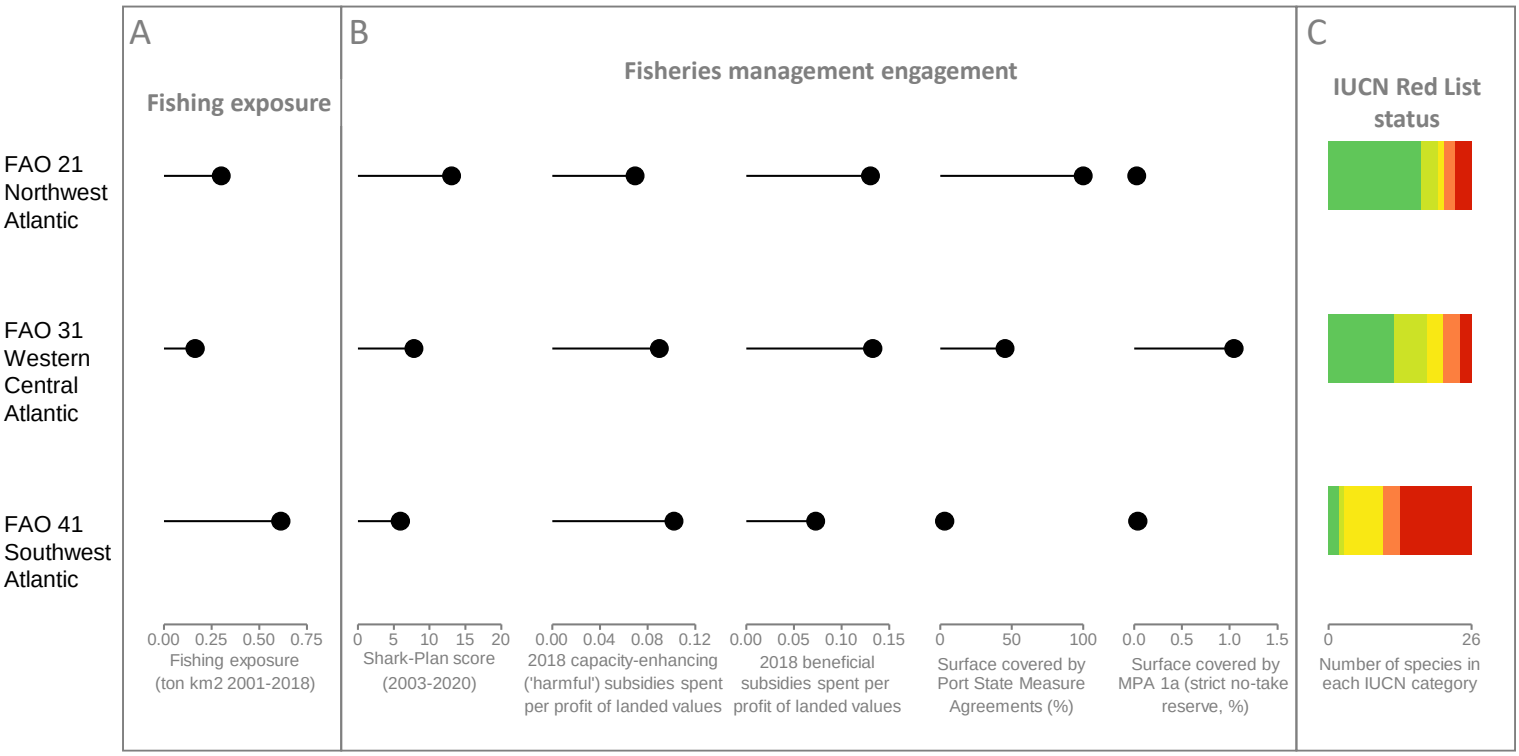

Fig. S2. FAO major fishing regions average values of (A) fishing exposure for sharks and rays, (B) fisheries management engagement (National or Regional Plan of Action for sharks and rays, 'Shark-Plan' score), standardized capacity-enhancing fisheries subsidies, surface covered by Port State Measure and Marine Protected Areas 1a), and (C) regional IUCN Red List status of all 26 species (from dark green to red: Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), and Critically Endangered (CR)).

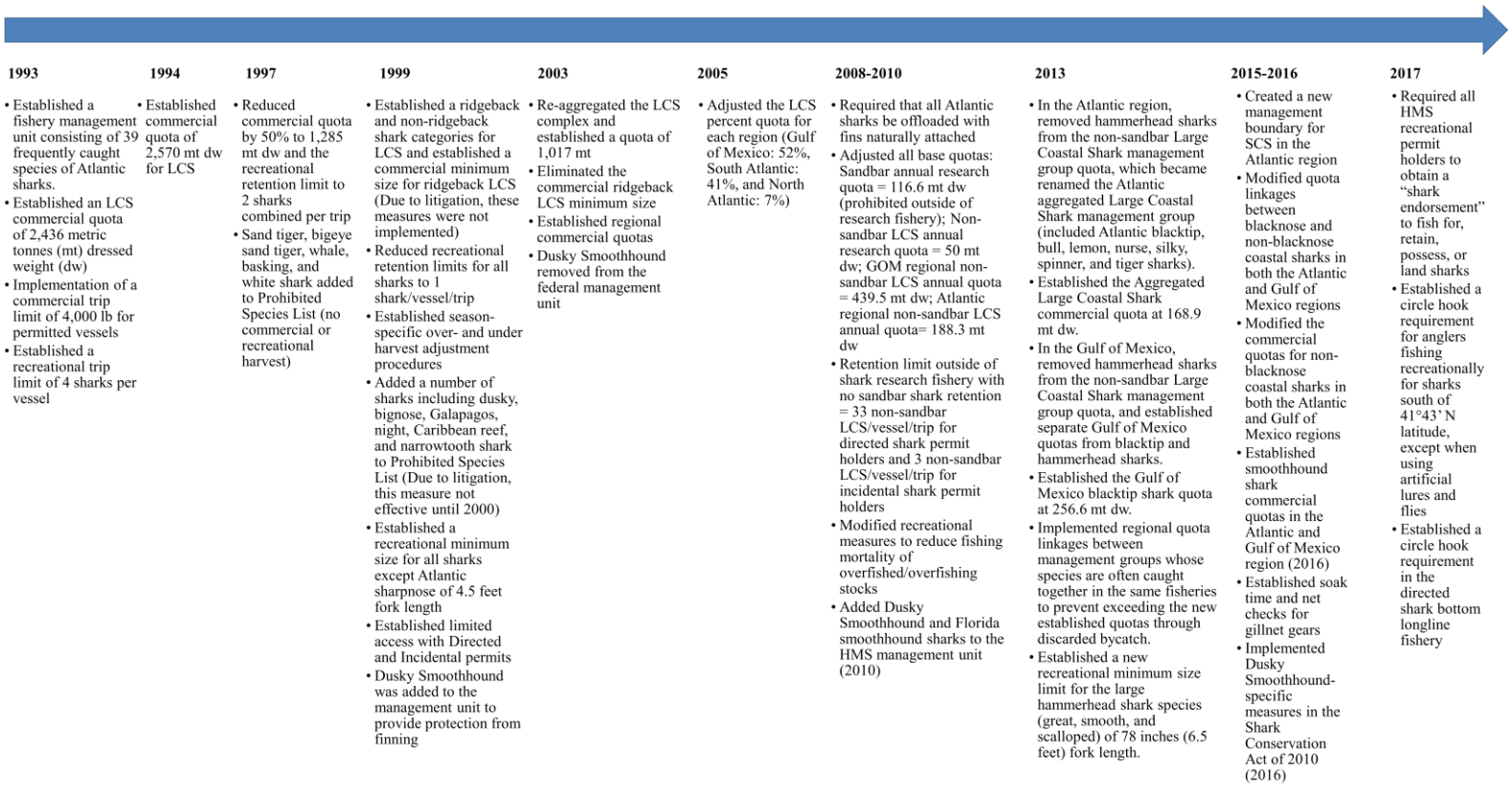

Fig. S3. Timeline of the Major Fishery Management Plan for Sharks of the Atlantic Ocean Initiatives.

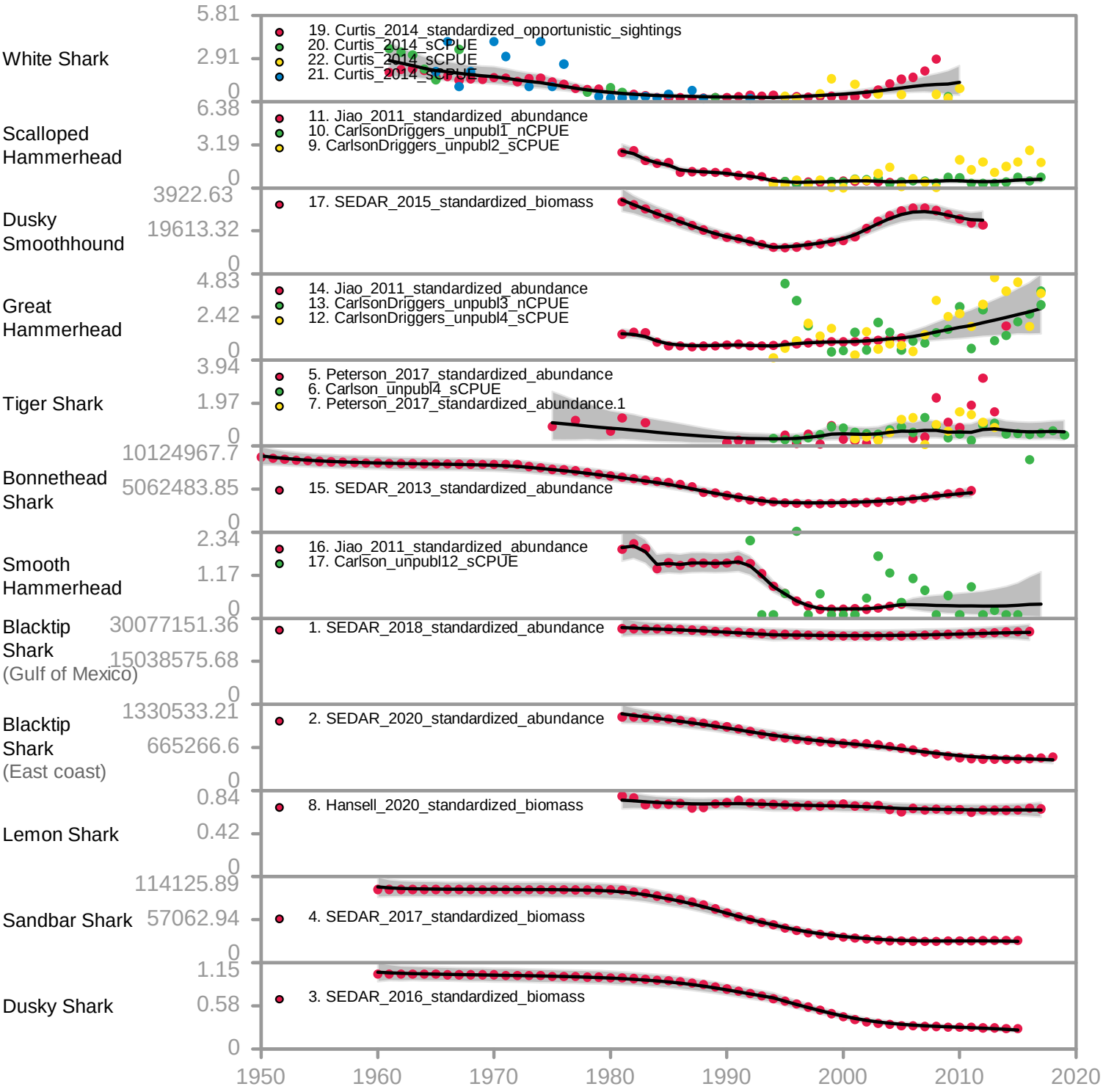

Fig. S4. Observed (colored dots indicate different time-series) and modeled (black line) abundance index for the eleven species in the USA waters obtained from the state-space population model. Shaded regions denote 95% credible intervals.

Table S1. Regional IUCN Red List Status of the 26 wide-ranging coastal sharks and rays in the Western Atlantic (Northwest, Western Central, and Southwest Atlantic, respectively FAO region 21, 31, and 41). CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern. Max. size: maximum size as total length, or *disc width in centimeters. NW: Northwest Atlantic, WC: Western Central Atlantic, SW: Southwest Atlantic.

Latin name **Common name**	**Max. size**	**2020 regional Red List Status**			**2005 regional Red List Status**			**1980 regional Red List Status**		
		NW	**WC**	**SW**	**NW**	**WC**	**SW**	**NW**	**WC**	**SW**
A. Carcharhiniformes: Carcharhinidae										
Carcharhinus brevipinna Spinner Shark	304	LC	VU	VU	LC	VU	VU	NT	NT	NT
Carcharhinus isodon Finetooth Shark	200	LC	LC	CR	LC	LC	CR	NT	LC	CR
Carcharhinus leucas Bull Shark	400	LC	LC	VU	LC	LC	VU	LC	LC	NT
Carcharhinus limbatus Blacktip Shark	286	EN	VU	VU	VU	VU	VU	NT	NT	NT
Carcharhinus obscurus Dusky Shark	420	CR	EN	EN	EN	VU	VU	NT	NT	NT
Carcharhinus plumbeus Sandbar Shark	240	EN	EN	EN	EN	EN	EN	VU	VU	VU
Galeocerdo cuvier Tiger Shark	740	LC	LC	NT	LC	LC	NT	LC	LC	LC
Negaprion brevirostris Lemon Shark	368	LC	LC	VU	LC	LC	VU	VU	LC	VU
B. Carcharhiniformes: Sphyrnidae										
Sphyrna lewini Scalloped Hammerhead	420	NT	NT	CR	EN	EN	CR	VU	VU	EN
Sphyrna mokarran Great Hammerhead	610	LC	NT	CR	EN	EN	CR	VU	VU	EN
Sphyrna tiburo Bonnethead Shark	150	NT	NT	CR	NT	NT	CR	NT	NT	CR
Sphyrna zygaena Smooth Hammerhead	400	LC	NT	CR	VU	VU	VU	NT	NT	NT
C. Carcharhiniformes: Triakidae										
Mustelus canis Dusky Smoothhound	150	LC	EN	EN	LC	EN	EN	LC	EN	EN
D. Lamniformes: Lamnidae										
Carcharodon carcharias White Shark	640	CR	CR	CR	CR	CR	CR	CR	CR	CR
E. Lamniformes: Odontaspididae										
Carcharias taurus Sand Tiger Shark	325	VU	VU	CR	VU	VU	CR	NT	NT	VU
F. Myliobatiformes: Dasyatidae										
Bathytoshia centroura Roughtail Stingray	220*	LC	NT	CR	LC	NT	CR	LC	NT	CR
Hypanus americanus Southern Stingray	150*	LC	LC	VU	LC	LC	VU	LC	LC	LC

Latin name Common name	Max. size	2020 regional Red List Status			2005 regional Red List Status			1980 regional Red List Status		
		NW	WC	SW	NW	WC	SW	NW	WC	SW
Hypanus say Bluntnose Stingray	78*	LC	LC	VU	LC	LC	VU	LC	LC	VU
G. Myliobatiformes: Gymnuridae										
Gymnura altavela Spiny Butterfly Ray	220*	LC	LC	CR	LC	NT	CR	LC	LC	EN
H. Myliobatiformes: Myliobatidae										
Myliobatis freminvillei Bullnose Eagle Ray	106*	LC	LC	CR	LC	LC	EN	LC	LC	EN
I. Myliobatiformes: Rhinopteridae										
Rhinoptera bonasus American Cownose Ray	110*	LC	LC	CR	LC	LC	CR	LC	LC	CR
J. Myliobatiformes: Urotrygonidae										
Urobatis jamaicensis Yellow Stingray	76*	LC	LC	LC	LC	LC	LC	LC	LC	LC
K. Orectolobiformes: Ginglymostomatidae										
Ginglymostoma cirratum Atlantic Nurse Shark	308	NT	NT	CR	NT	NT	CR	NT	NT	CR
L. Rhinopristiformes: Pristidae										
Pristis pectinata Smalltooth Sawfish	554	CR	CR	CR	CR	CR	CR	CR	CR	CR
M. Squaliformes: Squalidae										
Squalus acanthias Spiny Dogfish	200	LC	LC	VU	EN	VU	VU	VU	VU	VU
N. Torpediniformes: Narcinidae										
Narcine bancroftii Caribbean Numbfish	65	LC	LC	LC	LC	LC	LC	LC	LC	LC

Table S2. Description of the 15 time-series of the 11wide-ranging coastal sharks in United-States waters. CPUE: Catch Per Unit Effort.

Latin name Common name	Start	End	Data type	No.	References
A. Carcharhiniformes: Carcharhinidae					
Carcharhinus limbatus Blacktip Shark	1981	2016	Stock assessment (North Gulf of Mexico)	1.	SEDAR 2018. Update assessment to SEDAR 29 HMS Gulf of Mexico Blacktip Shark (p50t3.5.5; SSF)
	1981	2018	Stock assessment (USA East Coast)	2.	SEDAR. 2020. SEDAR 65 Atlantic Blacktip Shark Stock Assessment Report. SEDAR, North Charleston SC. 438 pp. available online at: http://sedarweb.org/sedar-65 Section III: Assessment Report (p116t3.9; Female spawning stock fecundity SSF (1,000s pups))
Carcharhinus obscurus Dusky Shark	1960	2015	Stock assessment	3.	SEDAR. 2016. Update assessment to SEDAR 21. HMS Dusky Shark. SEDAR, North Charleston, SC, USA. (p38t3.3; B/B0)
Carcharhinus plumbeus Sandbar Shark	1960	2015	Stock assessment	4.	SEDAR 2017. SEDAR 54 Stock Assessment Report HMS Sandbar Shark ; SECTION II (p70t3.2.5; Total Biomass)
Galeocerdo cuvier Tiger Shark	1975	2014	standardized_abundance	5.	Peterson, C. D., Belcher, C. N., Bethea, D. M., Driggers III, W. B., Frazier, B. S., & Latour, R. J. (2017). Preliminary recovery of coastal sharks in the south-east United States. *Fish and Fisheries*, *18*(5), 845-859. (p102fSS; Tiger Shark VIMS LL)
	1994	2019	Standardized CPUE	6.	John K. Carlson unpubl. data*
	2001	2013	standardized_abundance	7.	Peterson, C. D., Belcher, C. N., Bethea, D. M., Driggers III, W. B., Frazier, B. S., & Latour, R. J. (2017). Preliminary recovery of coastal sharks in the south-east United States. *Fish and Fisheries*, *18*(5), 845-859. (p102fSS; Tiger Shark SEFSC LL)
Negaprion brevirostris Lemon Shark	1981	2017	Stock assessment	8.	Hansell, A. C., Curtis, T. H., Carlson, J., Cortés, E., Fay, G., & Cadrin, S. X. (2021). Stock assessment of the lemon shark off the Southeast United States. North American Journal of Fisheries Management, 41(1), 35-48. (saturated scenario; B/B_{MSY})
B. Carcharhiniformes: Sphyrnidae					
Sphyrna lewini Scalloped Hammerhead	1994	2017	Standardized CPUE	9.	John K. Carlson and W.B. Driggers unpubl. data*
	1995	2017	Nominal CPUE	10.	John K. Carlson and W.B. Driggers unpubl. data*
	1981	2005	Stock assessment	11.	Jiao, Y., Cortés, E., Andrews, K., & Guo, F. (2011). Poor-data and data-poor species stock assessment using a Bayesian hierarchical approach. Ecological Applications, 21(7), 2691-2708.
Sphyrna mokarran Great Hammerhead	1994	2017	Standardized CPUE	12.	John K. Carlson and W.B. Driggers unpubl. data*
	1995	2017	Nominal CPUE	13.	John K. Carlson and W.B. Driggers unpubl. data*
	1981	2005	Stock assessment	14.	Jiao, Y., Cortés, E., Andrews, K., & Guo, F. (2011). Poor-data and data-poor species stock assessment using a Bayesian hierarchical approach. Ecological Applications, 21(7), 2691-2708.
Sphyrna tiburo Bonnethead Shark	1950	2011	Stock assessment	15.	SEDAR 2013. SEDAR 34 Final Stock Assessment Report: Bonnethead Shark; SECTION II (p113t3.5.11; N)
Sphyrna zygaena Smooth Hammerhead	1981	2005	Stock assessment	16.	Jiao, Y., Cortés, E., Andrews, K., & Guo, F. (2011). Poor-data and data-poor species stock assessment using a Bayesian hierarchical approach. Ecological Applications, 21(7), 2691-2708.
	1992	2017	Standardized CPUE	17.	John K. Carlson unpubl. data*
B. Carcharhiniformes: Triakidae					

Latin name **Common name**	**Start**	**End**	**Data type**	**No.**	**References**
Mustelus canis Dusky Smoothhound	1981	2012	Stock assessment	18.	SEDAR 2015. SEDAR 39: Stock Assessment Report HMS Atlantic Smooth Dogfish Shark, March 2015.; SECTION III (p108t4.10.b; B(mt))
D. Lamniformes: Lamnidae					
Carcharodon carcharias White Shark	1961	2008	Standardized opportunistic sightings	19.	Curtis, T. H., McCandless, C. T., Carlson, J. K., Skomal, G. B., Kohler, N. E., Natanson, L. J., ... & Pratt Jr, H. L. (2014). Seasonal distribution and historic trends in abundance of white sharks, Carcharodon carcharias, in the western North Atlantic Ocean. PloS one, 9(6), e99240. (p9f10B; dots)
	1961	2009	Standardized CPUE	20.	Curtis, T. H., McCandless, C. T., Carlson, J. K., Skomal, G. B., Kohler, N. E., Natanson, L. J., ... & Pratt Jr, H. L. (2014). Seasonal distribution and historic trends in abundance of white sharks, Carcharodon carcharias, in the western North Atlantic Ocean. PloS one, 9(6), e99240. (p7f6; NEFSC LL)
	1965	1992	Standardized CPUE	21.	Curtis, T. H., McCandless, C. T., Carlson, J. K., Skomal, G. B., Kohler, N. E., Natanson, L. J., ... & Pratt Jr, H. L. (2014). Seasonal distribution and historic trends in abundance of white sharks, Carcharodon carcharias, in the western North Atlantic Ocean. PloS one, 9(6), e99240. (p7f6; Tourn)
	1995	2010	Standardized CPUE	22.	Curtis, T. H., McCandless, C. T., Carlson, J. K., Skomal, G. B., Kohler, N. E., Natanson, L. J., ... & Pratt Jr, H. L. (2014). Seasonal distribution and historic trends in abundance of white sharks, Carcharodon carcharias, in the western North Atlantic Ocean. PloS one, 9(6), e99240. (p7f6; OBS LL)

* Data available on https://www.sharkipedia.org, (16).

Table S3. Description of country covariates. Shark-Plan : National or Regional Plan of Action for sharks and rays, 'Shark-Plan'. PSM : party to the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing.

					Fisheries Management engagement			
Exclusive Economic Zone	**Surface (km^2)**	**FAO area**	**Proportion of FAO area**	**Fishing exposure ($tonne.km^{-2}$)**	**Shark-Plan Total (Objectives + actions)**	**PSM**	**Standardized Harmful subsidies**	**Standardized Beneficial subsidies**
Anguilla	90546.3	31	0.0091	0.004	0 (0+0)	0	0.038	0.118
Antigua and Barbuda	112024.7	31	0.0071	0.008	5.83 (3.33+2.5)	0	0.130	0.291
Argentinean	1049244.4	41	0.2694	1.095	8.83 (4.67+4.17)	0	0.106	0.025
Aruban	29990.8	31	0.0047	0.044	0 (0+0)	0	0.145	0.076
Bahamas	620751.7	31	0.0966	0.030	0 (0+0)	1	0.048	0.15
Barbados	186065.2	31	0.0089	0.017	0 (0+0)	1	0.342	0.109
Belizean	34009.8	31	0.0053	0.557	7.22 (3.89+3.33)	0	0.205	0.062
Bermudian	435758.8	31	0.0067	0.000	0 (0+0)	0	0.038	0.118
Bonaire	13068.3	31	0.0020	0.007	0 (0+0)	0	0.109	0.039
Brazilian	44958.4	31	0.0020	0.440	5.06 (2.53+2.53)	0	0.094	0.088
Brazilian	2983909.2	41	0.6345	0.435	5.06 (2.53+2.53)	0	0.094	0.088
British Virgin Islands	81989.4	31	0.0127	0.000	0 (0+0)	0	0.038	0.118
Canadian	2253647.5	21	0.5281	0.041	9.28 (5.17+4.11)	1	0.054	0.103
Cayman Islands	118879.3	31	0.0185	0.036	0 (0+0)	0	0.038	0.344
Colombian (Bajo Nuevo)	1559.3	31	0.0002	0.007	7.33 (3.97+3.36)	0	0.092	0.166
Colombian (Quitasueño)	3711.2	31	0.0006	0.007	7.33 (3.97+3.36)	0	0.092	0.166
Colombian (Serrana)	2854.8	31	0.0004	0.007	7.33 (3.97+3.36)	0	0.092	0.166

Colombian (Serranilla)	1561.4	31	0.0002	0.007	7.33 (3.97+3.36)	0	0.092	0.166
Colombian	385093.0	31	0.0599	0.007	7.33 (3.97+3.36)	0	0.092	0.166
Costa Rican	37486.4	31	0.0058	0.075	7.78 (5+2.78)	1	0.050	0.137
Cuban	351673.2	31	0.0547	0.135	4 (2.17+1.83)	1	0.038	0.369
Curaçaoan	25505.3	31	0.0040	0.009	0 (0+0)	0	0.136	0.043
Dominican	28698.4	31	0.0034	0.001	0 (0+0)	1	0.529	0.174
Dominican Republic	345415.8	31	0.0530	0.184	0 (0+0)	0	0.036	0.177
French Guiana	127621.9	31	0.0121	0.122	10.33 (5.33+5)	1	0.060	0.046
French Guiana	4330.5	41	0.0014	0.122	10.33 (5.33+5)	1	0.060	0.046
Greenlandic	841775.3	21	0.0561	0.002	0 (0+0)	1	0.045	0.044
Grenadian	25691.4	31	0.0040	0.022	0 (0+0)	1	0.282	0.198
Guadeloupean	91245.1	31	0.0063	0.004	10.33 (5.33+5)	1	0.062	0.05
Guatemalan	1467.6	31	0.0002	0.256	8.22 (4.72+3.5)	0	0.057	0.047
Guyanese	135368.7	31	0.0147	0.163	0 (0+0)	1	0.030	0.008
Haitian	103434.5	31	0.0161	0.049	0 (0+0)	0	0.038	0.035
Honduran	208145.2	31	0.0324	0.002	8.22 (4.89+3.33)	0	0.043	0.1
Jamaican	258222.7	31	0.0402	0.065	0 (0+0)	0	0.481	0.208
Joint regime area Colombia / Dominican Republic	6527.0	31	0.0021	0.095	3.67 (1.99+1.68)	0	0.064	0.171
Joint regime area Colombia / Jamaica	15348.8	31	0.0024	0.036	3.67 (1.99+1.68)	0	0.287	0.187

Joint regime area Honduras / Cayman Islands	2086.7	31	0.0003	0.019	4.11 (2.44+1.67)	0	0.041	0.109
Martinican	47772.0	31	0.0055	0.011	10.33 (5.33+5)	1	0.062	0.05
Mexican	830082.5	31	0.1292	0.224	10.86 (8.5+2.36)	0	0.044	0.014
Montserrat	7213.1	31	0.0011	0.001	0 (0+0)	0	0.038	0.118
Nicaraguan	150279.1	31	0.0234	0.090	12.08 (8.33+3.75)	1	0.141	0.052
Overlapping claim Falkland / Malvinas Islands: UK / Argentina	548133.6	41	0.0654	0.338	0 (0+0)	0	0.187	0.115
Panamanian	142842.2	31	0.0222	0.012	7.22 (3.89+3.33)	1	0.059	0.044
Puerto Rican	155074.3	31	0.0241	0.000	20 (10+10)	0	0.094	0.18
Saba	9540.3	31	0.0015	0.000	0 (0+0)	0	0.148	0.044
Saint Kitts and Nevis	9516.5	31	0.0015	0.000	0 (0+0)	1	0.004	0.005
Saint Lucia	15466.9	31	0.0024	0.016	0 (0+0)	0	0.370	0.464
Saint Vincent and the Grenadines	36447.0	31	0.0057	0.010	0 (0+0)	1	0.153	0.088
Saint-Barthélemy	4201.9	31	0.0007	0.077	0 (0+0)	1	0.062	0.05
Saint-Martin	1105.4	31	0.0002	0.522	10.33 (5.33+5)	1	0.062	0.05
Saint-Pierre and Miquelon	12416.6	21	0.0066	0.131	0 (0+0)	1	0.062	0.05
Sint-Eustatius	2187.2	31	0.0003	0.000	0 (0+0)	0	0.148	0.044
Sint-Maarten	468.5	31	0.0001	0.191	0 (0+0)	0	0.325	0.344
Surinamese	133946.8	31	0.0149	0.185	0 (0+0)	0	0.039	0.069
Trinidad and Tobago	76920.6	31	0.0115	0.299	0 (0+0)	1	0.261	0.02

Turks and Caicos	91417.4	31	0.0132	0.009	0 (0+0)	0	0.038	0.118
United States	483293.2	21	0.4092	0.677	20 (10+10)	1	0.093	0.178
United States	1133409.1	31	0.1764	0.333	20 (10+10)	1	0.093	0.18
Uruguayan	121309.7	41	0.0293	0.641	10.78 (7.22+3.56)	1	0.067	0.083
Venezuelan	472756.0	31	0.0735	0.452	6.89 (4.44+2.44)	0	0.055	0.031
Virgin Islander	38462.2	31	0.0060	0.000	20 (10+10)	0	0.094	0.18

Table S4. National or Regional Plan of Action for sharks and rays, 'Shark-Plan' detailed score.

Exclusive Economic Zone	Type	Year	Total score (objectives + actions)	Detailed score per objective objective+action										Citation
				Obj.1	Obj.2	Obj.3	Obj.4	Obj.5	Obj.6	Obj.7	Obj.8	Obj.9	Obj.10	
Antigua and Barbuda	National	2015	17.5 (10+7.5)	1+0.5	1+0.5	1+1	1+1	1+1	1+0.5	1+0.5	1+1	1+1	1+0.5	Antigua and Barbuda. 2015. National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks).
Argentina	National	2009	11.5 (6.5+5)	1+0.5	1+1	1+0.5	0.5+0.5	0+0	1+0.5	0+0	0+0	1+1	1+1	Argentina. 2009. PLAN DE ACCIÓN NACIONAL PARA LA CONSERVACIÓN Y EL MANEJO DE CONDRICTIOS (TIBURONES, RAYAS Y QUIMERAS) EN LA REPÚBLICA ARGENTINA
Argentina	National	2015	13 (6.5+6.5)	1+1	1+1	1+1	0.5+0.5	0+0	1+1	0+0	0+0	1+1	1+1	Consejo Federal Pesquero. 2015. PLAN DE ACCIÓN NACIONAL PARA LA CONSERVACIÓN Y EL MANEJO DE CONDRICTIOS (TIBURONES, RAYAS Y QUIMERAS) EN LA REPÚBLICA ARGENTINA - REVISIÓN 2015. Argentina.
Argentina	National	2017	16 (8+8)	1+1	1+1	1+1	0.5+0.5	0.5+0.5	1+1	1+1	0+0	1+1	1+1	el Grupo de Asesoramiento Técnico. 2017. PLAN DE ACCIÓN NACIONAL PARA LA CONSERVACIÓN Y EL MANEJO DE CONDRICTIOS (TIBURONES, RAYAS Y QUIMERAS) EN LA REPÚBLICA ARGENTINA. Consejo Federal Pesquero,, Argentina
Brazil (and Trindade)	National	2014	13 (6.5+6.5)	1+1	1+1	0.5+0.5	1+1	1+1	0.5+0.5	0+0	0+0	1+1	0.5+0.5	Instituto Chico Mendes. 2016. Plano de Ação Nacional para a conservação dos Tubarões e Raias Marinhos Ameaçados de Extinção. Brasilia, Brasil.
Canada	National	2007	10 (6+4)	1+0.5	0.5+0.5	1+0.5	0.5+0.5	1+1	0.5+0.5	0+0	0+0	1+0.5	0.5+0	Fisheries and Oceans Canada. 2007. National Plan of Action for the Conservation and Management of Sharks. Cat. No. Fs23-505/2007, Fisheries and Oceans Canada (DFO), Ottawa, Canada.
Canada	National	2012	13 (7+6)	1+1	0.5+0.5	1+0.5	1+1	1+1	0.5+0.5	0.5+0.5	0+0	1+1	0.5+0	Department of Fisheries and Oceans. 2012. Canada's Progress Report on the Implementation of Key Actions Taken Pursuant to the National Plan of Action on the Conservation and Management of Sharks (March 2007). Department of Fisheries and Oceans Canada, Ottawa, Canada.
Colombia (and Bajo Nuevo, Quitasueño, Serrana, Serranilla)	National	2010	12 (6.5+5.5)	0.5+0.5	1+0.5	1+1	1+1	0+0	0.5+0.5	0.5+0.5	0+0	1+0.5	1+1	Aristizábal, J. P. C., E. Castro-González, V. Puentes, M. Rueda, C. Lasso, L. O. Duarte, M. Grijalba-Bendeck, F. Gómez, A. F. N. López, P. A. Mejía-Falla, S. Bessudo, M. C. Diazgranados, and L. A. Z. Padilla. 2010. Plan de Acción Nacional para la Conservación y Manejo de Tiburones, Rayas y Quimeras de Colombia (PAN- Tiburones Colombia). Instituto Colombiano Agropecuario, Secretaria Agricultura y Pesca San Andrés Isla, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, Instituto de Investigaciones Marinas y Costeras, Instituto Alexander Von Humboldt, Universidad del Magdalena, Universidad Jorge Tadeo Lozano, Pontificia Universidad Javeriana, Fundación SQUALUS, Fundación Malpelo y otros Ecosistemas Marinos, Conservación Internacional, WWF, Colombia.
Costa Rica	National	2011	14 (9+5)	1+1	1+0.5	0.5+0.5	1+1	1+1	1+0	1+0	1+0	1+1	0.5+0	Comisión Nacional para la Conservación y Ordenación de los Tiburones. 2010. Plan de Acción Nacional para la Conservación y Ordenación de los Tiburones en Costa Rica (PANT-CR) Primera edición. San José, Costa Rica.
Cuba	National	2015	12 (6.5+5.5)	1+1	1+0.5	1+1	0.5+0.5	1+1	0+0	0+0	0.5+0.5	1+1	0.5+0	NPOA-Sharks. 2015. National Plan of Action for the Conservation and Management of Chondrichthyes in the Republic of Cuba. Ministry of the Food Industry, Havana, Cuba
Guatemala	National	2008	6 (5+1)	0.5+0	0.5+0	0.5+0	0.5+0	0+0	0.5+0	0+0	1+1	1+0	0.5+0	Asunción, G. d. I. 2008. Plan de Acción Nacional para la Conservación y Ordenación de Tiburón. Guatemala. AUTORIDADES NACIONALES DE PESCA Y ACUICULTURA UNIDAD DE MANEJO DE LA PESCA Y ACUICULTURA, Guatemala de la Asunción
Honduras	National	2005	3 (3+0)	0.5+0	0.5+0	0.5+0	0+0	0.5+0	0+0	0+0	1+0	0+0	0+0	Honduras. 2005. Plan de Acción Nacional para la Conservación y Manejo de Tiburones. TEGUCIGALPA, M.D.C.
Mexico	National	2004	11.5 (9+2.5)	1+0	1+1	1+0	1+1	1+0	1+0	1+0	1+0	1+0.5	0+0	CONAPESCA-INP. 2004. Plan de Acción Nacional para el Manejo y Conservación de Tiburones, Rayas y Especies Afines en México. Comisión Nacional de Acuacultura y Pesca e Instituto Nacional de la Pesca, Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, Mazatlán, México.
Nicaragua	National	2006	14.5 (10+4.5)	1+0	1+0.5	1+1	1+0	1+0.5	1+0.5	1+0.5	1+0.5	1+1	1+0	Nicaragua. 2006. PLAN DE ACCION PARA LA CONSERVACIÓN Y ORDENACION DE LOS TIBURONES DE NICARAGUA. (PAN-Tiburones Nicaragua). Nicaragua.
Panama	National	2009	1 (1+0)	0+0	0.5+0	0+0	0+0	0+0	0+0	0.5+0	0+0	0+0	0+0	Rodriguez-Arriatti, Y. 2010. Plan de Acción Nacional para la Conser- vación y Ordenación de las Pesquerías de Tiburones. Autoridad de los Recursos Acuáticos de Panamá (ARAP), Ciudad de Panamá, Panamá.
Panama	National	2017	12.5 (6.5+6)	1+1	1+0.5	1+1	1+1	0.5+0.5	0+0	0.5+0.5	0+0	0.5+0.5	1+1	Ministerio de Ambiente de Panamá. 2017. Plan de Acción Nacional para la Conservación y Ordenación de las Pesquerías de Tiburones y Rayas en Panamá. Ministerio de Ambiente de Panamá, Ciudad de Panamá, Panamá.
United States (and Puerto Rico, Virgin Islands)	National	2001	20 (10+10)	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	Department of Commerce, National Oceanic and Atmospheric Administration, and National Marine Fisheries Service. 2001. United States National Plan of Action for the Conservation and Management of Sharks. Silver Spring, MD, USA.
Uruguay	National	2008	14 (10+4)	1+0	1+0	1+1	1+0.5	1+1	1+0	1+0.5	1+0.5	1+0.5	1+0	Domingo, A., R. Forselledo, P. Miller, and C. Passadore. 2008. Plan de Acción Nacional para la Conservación de Condrictios en las Pesquerías Uruguayas (PAN - Condrictios Uruguay). ISBN: 978-9974-563-44-5, DINARA, Montevideo, Uruguay.
Uruguay	National	2015	16 (10+6)	1+1	1+1	1+1	1+0.5	1+1	1+0	1+0.5	1+0.5	1+0.5	1+0	Domingo, A., R. Forselledo, and S. Jiménez. 2015. Revisión de Planes de Acción Nacional para la conservación de Aves Marinas y Condrictios en las Pesquerías Uruguayas. MGAP-DINARA, Montevideo, Uruguay.
Venezuela	National	2013	15.5 (10+5.5)	1+0.5	1+0.5	1+1	1+0.5	1+0	1+0	1+1	1+1	1+1	1+0	Ministerio del Poder Popular para la Agricultura y Tierras. 2013. PLAN DE ACCIÓN NACIONAL PARA EL APROVECHAMIENTO SUSTENTABLE DE TIBURONES EN VENEZUELA. Instituto Socialista de la Pesca y Acuicultura, Gerencia de Ordenación Pesquera, Caracas, Venezuela.
French Guiana, Guadeloupe, Martinica, Saint-Barthélemy, Saint-Martin, Saint-Pierre and Miquelon	Regional	2009	15.5 (8+7.5)	1+1	0.5+0	1+1	1+1	1+1	0.5+0.5	1+1	0+0	1+1	1+1	European Community Action Plan for the Conservation and Management of Sharks. 2009. COM(2009) 40 final. Commission of the European Communities. Brussels. Retrieved from: https://www.fao.org/3/bl360e/bl360e.pdf
Belize, Guatemala, Honduras, Panama, Costa Rica, Nicaragua	Regional	2011	13 (7+6)	1+0.5	1+1	0.5+0.5	1+1	1+1	0.5+0	0+0	0.5+0.5	1+1	0.5+0.5	OSPESCA, 2011. Plan de Acción Regional para la Ordenación y Conservación de los Tiburones en Centroamérica (PAR-TIBURON). Grupo Técnico Regional de Tiburones (GTRT) de la Organización del Sector Pesquero y Acuícola del Istmo Centroamericano (OSPESCA), 26 p.

SI References

1. T. H. Curtis, *et al.*, Seasonal distribution and historic trends in abundance of white sharks, *Carcharodon carcharias*, in the western North Atlantic Ocean. *PLoS One* **9**, e99240; 1–12 (2014).
2. A. J. Gallagher, N. Hammerschlag, A. J. Danylchuk, S. J. Cooke, Shark recreational fisheries: Status, challenges, and research needs. *Ambio* **46**, 385–398 (2017).
3. E. Cortés, Perspectives on the intrinsic rate of population growth. *Methods in Ecology and Evolution* **7**, 1136–1145 (2016).
4. A. Morgan, P. W. Cooper, T. Curtis, G. H. Burgess, Overview of the US east coast bottom longline shark fishery, 1994–2003 (2009).
5. A. Morgan, G. H. Burgess, At-vessel fishing mortality for six species of sharks caught in the Northwest Atlantic and Gulf of Mexico (2007).
6. H. Marshall, G. Skomal, P. G. Ross, D. Bernal, At-vessel and post-release mortality of the dusky (Carcharhinus obscurus) and sandbar (C. plumbeus) sharks after longline capture. *Fisheries Research* **172**, 373–384 (2015).
7. J. A. Sulikowski, *et al.*, Observing post-release mortality for dusky sharks, Carcharhinus obscurus, captured in the US pelagic longline fishery. *Fisheries Research* **221**, 105341 (2020).
8. Southeast Data, Assessment, and Review (SEDAR), *SEDAR 65 Atlantic Blacktip Shark Stock Assessment Report* (SEDAR, North Charleston, SC, USA, 2020).
9. NMFS, Stock assessment and fishery evaluation report for Atlantic highly migratory species. *National Marine Fisheries Service. Atlantic Highly Migratory Species Management Division, Silver Spring, MD* (2019).
10. Southeast Data, Assessment, and Review (SEDAR), *SEDAR 39 HMS Atlantic Smooth Dogfish Shark* (SEDAR, North Charleston, SC, USA, 2015).
11. H. R. Akçakaya, *et al.*, Quantifying species recovery and conservation success to develop an IUCN Green List of Species. *Conservation Biology* **32**, 1128–1138 (2018).
12. C. S. Sherman, *et al.*, M-Risk: A framework for assessing global fisheries management efficacy of sharks, rays, and chimaeras. *bioRxiv*, 2022.05.29.493344 (2022).
13. U. R. Sumaila, *et al.*, Updated estimates and analysis of global fisheries subsidies. *Marine Policy* **109**, 103695 (2019).
14. R. Martini, J. Innes, Relative effects of fisheries support policies (2018).
15. U. R. Sumaila, *et al.*, A global dataset on subsidies to the fisheries sector. *Data in brief* **27**, 104706 (2019).
16. C. G. Mull, *et al.*, Sharkipedia: a curated open access database of shark and ray life history traits and abundance time-series. *Sci. Data* **9**, 1–7 (2022).