Green Status of Species: Supplementary information

American Horseshoe Crab (*Limulus polyphemus*)

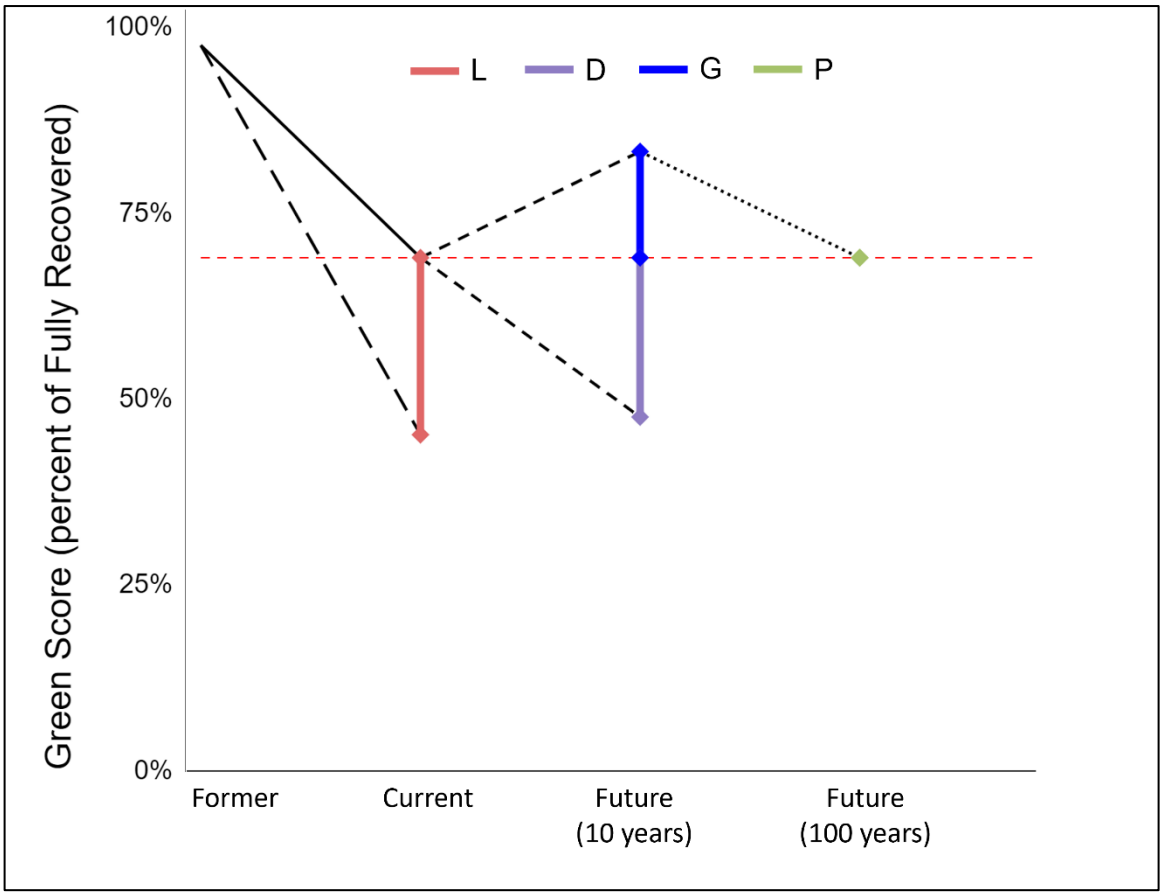
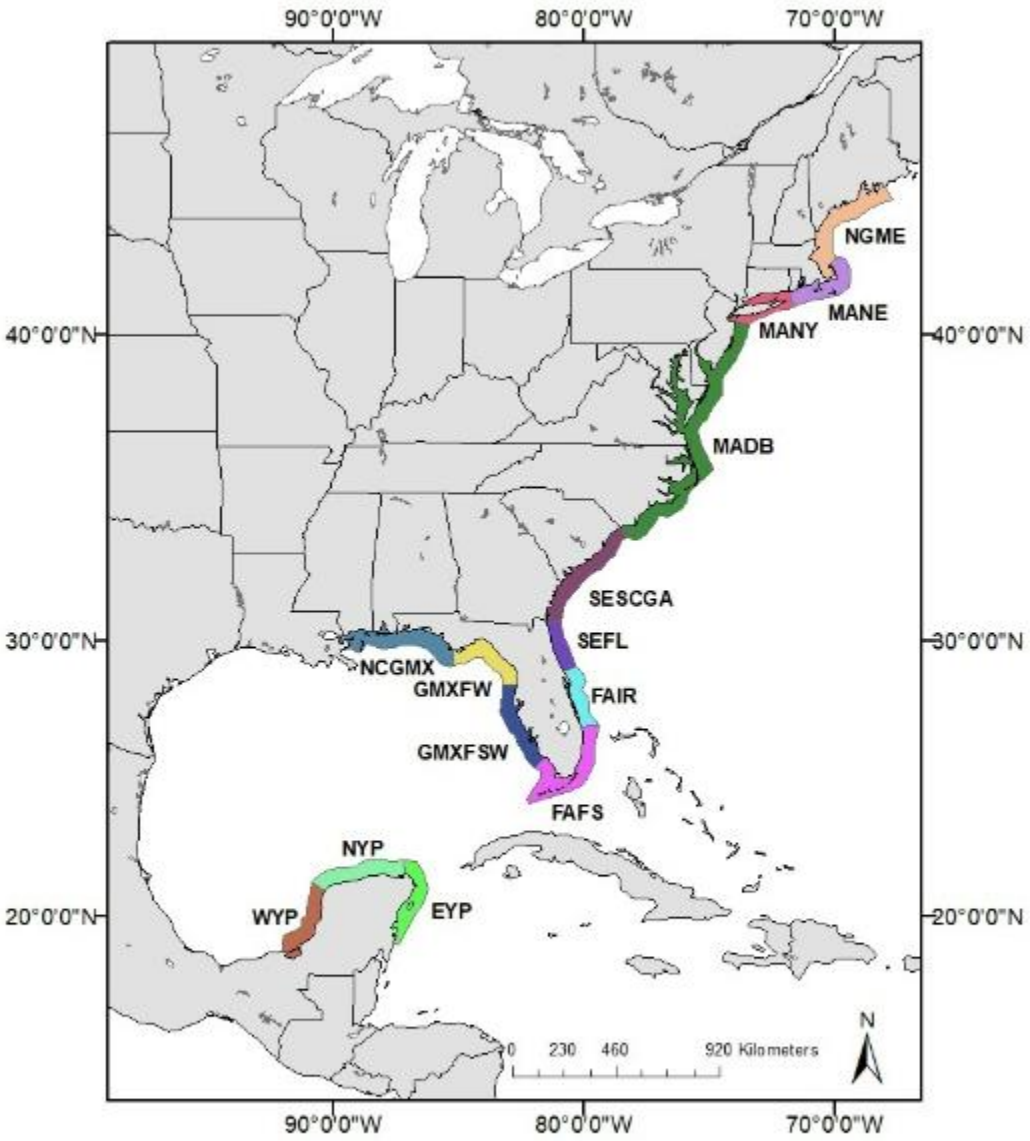


Figure S1. Graphical representation of the conservation metrics based on the Green Scores. Key: Vertical arrows represent the four conservation metrics: L – Conservation Legacy (may not appear if current and counterfactual states are the same); D – Conservation Dependence (may not appear if current and future-without-conservation states are the same); G – Conservation Gain (may not appear if current and future-with-conservation states are the same); P – Recovery Potential (may not appear if current and potential states are the same). Horizontal red dashed line represents the Current Green Score. Solid black line: observed change in the Green Score of the species

(ignore it if "Former" state is not specified). Long-dashed black line: (counterfactual) past change expected in the absence of past conservation efforts. Dashed black lines: future scenarios of change expected with and without current and future conservation efforts. Dotted black line: long-term potential change expected with future conservation innovation and efforts.



NGME	SU 1. Northern Gulf of Maine: Northern Gulf of Maine (USA)
MANE	SU 2. Mid-Atlantic (USA): Northeast
MANY	SU 3. Mid-Atlantic (USA): New York area
MADB	SU 4. Mid-Atlantic (USA): Delaware Bay area
SESCGA	SU 5. Southeast (USA): South Carolina and Georgia
SEFL	SU 6. Southeast (USA): Florida
FAIR	SU 7. Florida Atlantic (USA): Florida Indian River Lagoon System
FAFS	SU 8. Florida Atlantic (USA): Florida South

GMXFSW	SU 9. Eastern Gulf of Mexico (USA): Florida Southwest
GMXFW	SU 10. Eastern Gulf of Mexico (USA): Florida West
NCGMX	SU 11. North Central Gulf of Mexico (USA)
WYP	SU 12. Western Yucatán Peninsula (Mexico)
NYP	SU 13. Northern Yucatan Peninsula (Mexico)
EYP	SU 14. Eastern Yucatan Peninsula (Mexico)

Figure S2. Range map for American Horseshoe Crab (*Limulus polyphemus*) with indication of the geographic extent of its respective spatial units. Map maker: John Sweka, US Fish and Wildlife Service.

Table S1. Conservation Actions (list of action codes).

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
1.1	1.1 Land/water protection: Site/area protection	SU 1: Portions of Plum Island (MA) are preserved areas. SU 2: Monomoy NWR (MA) in SU 2. SU 3: Gateway NRA (NY and NJ). SU 4: Preserved areas along both the Delaware and New Jersey shores of Delaware Bay. SU 6–SU 10: National and state park protection provides considerable habitat for HC in this region. SU 12: Federal protected areas encompassing key embayments and wetland systems with critical habitats and horseshoe crab (HSC) subpopulations (Laguna de Términos flora and fauna protection area; Los Petenes Biosphere Reserve; Ría Celestún Biosphere Reserve). SU 13: Protected areas		SU 12–SU 14: Where available, implementation of Management Plans for the different protected areas.	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
		encompassing 80–90% of key embayments and wetland systems with critical habitats and HSC subpopulations (Federal: Ria Lagartos Biosphere Reserve, Yum Balam flora and fauna protection area; State Reserves: El Palmar, Ciénegas y Manglares Costa Norte de Yucatán, and Bocas de Dzilam). SU14: Federal protected areas encompassing ~90% key embayments and wetland systems with critical habitats and HSC subpopulations (Isla Contoy National Park, Isla Mujeres National Park; Manglares de Nichupté flora and fauna protection area; Mexican Caribbean and Sian Ka'an Biosphere Reserves). State reserves: Laguna Chacmochuch (southern portion of Chacmochuch Lagoon).			

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
1.2	1.2 Land/water protection: Resource & habitat protection		SU 4: In the state of Delaware, hardened structures (e.g., bulkheads, rip rap) parallel to the bay shoreline have been prohibited since the 1980s with periodic beach nourishment used to protect coastal property. In New Jersey, hardened shorelines are permitted but recently sand replenishment has been used to enhance particular beaches for horseshoe crab and shorebird habitat. SU 6–SU 10: The design of many restoration projects is taking nesting by horseshoe crabs and other beach species into account allowing these species access to the beaches. SU 11: There are no horseshoe crab specific conservation actions in this SU; but actions to protect other species and their habitats or resources of	SU 4: In the state of Delaware, hardened structures (e.g., bulkheads, rip rap) parallel to the bay shoreline have been prohibited since the 1980s with periodic beach nourishment used to protect coastal property. In New Jersey, hardened shorelines are permitted but recently sand replenishment has been used to enhance particular beaches for horseshoe crab and shorebird habitat. SU 6–SU 10: The design of many restoration projects is taking nesting by horseshoe crabs and other beach species into account allowing these species access to the beaches. SU 11: There are no horseshoe crab specific conservation actions in this SU; but continued actions to protect other species and	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			economic benefit may benefit horseshoe crabs in this SU. SU 12: There are no horseshoe crab specific conservation actions in this SU; but actions to protect other species and their habitats or resources of economic benefit may benefit horseshoe crabs in this SU. SU 13: There are no horseshoe crab specific conservation actions in this SU; but actions to protect other species and their habitats or resources of economic benefit may benefit horseshoe crabs in this SU. SU 14: Only HSC specific actions are in Manglares de Nichupté (identification of spawning beaches within the protected area polygon and temporary setting up of fences to avoid adult stranding during high tides of the spawning season).	their habitats or resources of economic benefit may benefit horseshoe crabs in this SU. SU 12: There are no horseshoe crab specific conservation actions in this SU; but continued actions to protect other species and their habitats or resources of economic benefit may benefit horseshoe crabs in this SU. SU 13: There are no horseshoe crab specific conservation actions in this SU; but continued actions to protect other species and their habitats or resources of economic benefit may benefit horseshoe crabs in this SU. SU 14: Protection and management (mainly prevention of mangrove encroachment) of spawning beaches within the	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
				Manglares de Nichupté protected area polygon and temporary setting up of fences to avoid adult stranding during high tides of the spawning season. Spawning event surveys. Adult tagging.	
2.1	2.1 Land/water management: Site/area management		SU 1: Portions of Plum Island (MA) are preserved areas. SU 2: Monomoy NWR (MA) in SU 2. SU 3: Gateway NRA (NY and NJ). SU 4: Preserved areas along both the Delaware and New Jersey shores of Delaware Bay. SU 6–SU 10: National and state park protection provides considerable habitat for HSC in this region. SU 12: Federal protected areas encompassing key embayments and wetland		

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			systems with critical habitats and HSC subpopulations (Laguna de Términos flora and fauna protection area; Los Petenes Biosphere Reserve; Ría Celestún Biosphere Reserve). SU 13: Protected areas encompassing 80–90% of key embayments and wetland systems with critical habitats and HSC subpopulations (Federal: Ria Lagartos Biosphere Reserve, Yum Balam flora and fauna protection area; State Reserves: El Palmar, Ciénegas y Manglares Costa Norte de Yucatán, and Bocas de Dzilam). SU 14: Federal protected areas encompassing ~90% key embayments and wetland systems with critical habitats and HSC subpopulations (Isla Contoy National Park, Isla Mujeres National Park; Manglares de Nichupté flora		

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			and fauna protection area; Mexican Caribbean and Sian Ka'an Biosphere Reserves). State reserves: Laguna Chacmochuch (southern portion of Chacmochuch Lagoon).		
2.2	2.2 Land/water management: Invasive/problematic species control		SU 12–SU 14: All federal protected areas are required to implement actions to prevent exotic species invasions and eradicate extant invasive species.	SU 12–SU 14: All federal protected areas are required to implement actions to prevent exotic species invasions and eradicate extant invasive species.	
2.3	2.3 Land/water management: Habitat & natural process restoration		(see 1.2)	(see 1.2)	
3.1.1	3.1.1 Harvest management	SU 7–SU 11: In Florida, Historically, HSCs were used for eel bait and were harvested by trawl, but in 2000, new regulations limited their harvest to hand or gig collection only, which reduced bait collection	Harvest for bait is regulated by Atlantic States Marine Fisheries Commission (ASMFC) and member states along the Atlantic coast since establishment of a fisheries management plan in 1998. Harvest regulations includes sex and age limits and	Continued work with the biomedical industry has cooperated to establish best management practices aimed at minimizing mortality associated with LAL harvest. SU 2: continued	

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		considerably (Gerhart 2007).	quotas, season closures, and daily take limits, which vary by state. ASMFC claims to have no authority to regulate harvest for LAL production (biomedical use) but has set a de minimis limit for mortality due to harvest, which has been exceeded routinely in recent years. The biomedical industry has cooperated to establish best management practices aimed at minimizing mortality associated with LAL harvest. But the BMPs are recommendations not regulations and adherence is voluntary. SU 2: Massachusetts has lunar closures, closed areas, size limits, permit restrictions, daily limits, quotas, and biomedical handling requirements (temp, max time out of the water, etc.). Some of these conservation measures are also in place in	enforcement of lunar closures, closed areas, size limits, permit restrictions, daily limits, quotas, and biomedical handling requirements (temp, max time out of the water, etc.) in Massachusetts . Some of these conservation measures are also in place in Rhode Island. SU 4: Continued enforcement of limited harvest by the states of New Jersey, Delaware, Maryland, and Virginia by annual quotas. SU 5: Continued practices of HSC management prior to bleeding for LAL production in South Carolina	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			RI. SU 4: Harvest is limited by the states of New Jersey, Delaware, Maryland, and Virginia by annual quotas. The quotas are the result of application of adding relative abundance data into an adaptive resource management model (McGowan *et al*. 2015a, b), with harvest levels recommended to the respective states. This process is overseen by the Atlantic States Marine Fisheries Commission (2022a), a non-governmental organization funded by the National Marine Fisheries Service. NOAA Fisheries established a 3,885 km^2 no-take zone (Carl N. Shuster Jr. Horseshoe Crab Reserve) in Federal waters outside the mouth of Delaware Bay where harvest or possession of horseshoe crabs aboard vessels is prohibited.		

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			SU 5: In South Carolina, HSC are held in ponds for up to six weeks prior to bleeding for LAL production with some loss of weight and condition. Harvest for bait is not regulated by the Gulf States Marine Fisheries Commission. SU 12–SU 14: Harvest of HSC is forbidden by Mexican federal law, due to their status as a species "in danger of extinction" according to the NOM-059 (Mexican Official Standard) list of species at risk.		
3.1.2	3.1.2 Trade management				

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
3.1.3	3.1.3 Limiting population growth				
3.2	3.2 Species recovery				
3.3.1	3.3.1 Species re-introduction: Reintroduction			SU 14: Reintroduction of adults from neighbouring embayments may be required to establish a viable subpopulation in the Nichupté Lagoon System, where HSC are estimated to be "present" according to Green Status Assessment criteria.	
3.3.2	3.3.2 Species re-introduction: Benign introduction				

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
3.4.1	3.4.1 *Ex situ* conservation: Captive breeding/artificial propagation	SU 1: Small-scale hatchery pilot programme and research. SU 4: a pilot HSC hatchery programme started in Delaware Bay by the NJ Aquaculture Innovation Center (Rutgers University); see Landau *et al*. (2015). However, this programme is not currently operating.	SU 2: Associates of Cape Cod rears and releases second instar juveniles from its facility in Falmouth, MA. The programme started in 2017 (Associates of Cape Cod Inc. 2021). SU 3: There is also an ongoing hatchery programme at CERCOM (Center for Environmental Research and Coastal Ocean Monitoring) based on Long Island, NY. But this is strictly for research purposes as current regulations from the NY State Department of Environmental Conservation prohibit the release of captive-reared HSC juveniles into natural waters.		
3.4.2	3.4.2 *Ex situ* conservation: Genome resource bank				

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
4.1	4.1 Education and Awareness: Formal education	SU 10: NSF funded research on HSC at Seahorse Key, FL by University of Florida Biology 1990–2010	SU 5: SC Department of Natural Resources is conducting research on horseshoe crabs with a training component. SU 7: Research project in IRL to determine the cues that stimulate spawning and a project to track horseshoe crabs to determine their movements. SU 7: Marine Discovery Center in New Smyrna Beach has an ongoing programme to educate school children about horseshoe crabs. SU 9: Programme at Eckerd College to tag and study HSC; several undergrad theses on HSC. SU 10: Programme sponsored by Nature Coast Biological Station, SeaGrant and UF Biology to train volunteers in how to tag and survey nesting HSC.	SU 5: research on HSC will likely will continue. SU 7, SU 9, and SU 11: programmes likely to continue. SU 7: Marine Discovery Center in New Smyrna Beach has an ongoing programme to educate school children about horseshoe crabs. SU 9: Programme at Eckerd College to tag and study HSC; several undergrad theses on HSC. SU 10: Programme sponsored by Nature Coast Biological Station, SeaGrant and UF Biology to train volunteers in how to tag and survey nesting horseshoe crabs. SU 11: HSC education and outreach through the AL Aquarium and local	

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				university and research institutions; likely to stay the same or decline due to limited funding and perception of little local economic and ecological relevance.	
			SU 11: HSC education and outreach through the AL Aquarium and local university and research institutions		
			SU 12: No formal education efforts in institutions within the SU. Undergraduate and graduate thesis projects by students from the Mexico's Technology Institute (Chetumal and Tizimin units, in neighbouring Yucatan and Quintana Roo States).	SU 12: Undergraduate and graduate thesis projects by students from Anahuac Mayab University, Center for Research and Advanced Studies (Merida Unit), and Mexico's Technology Institute (Chetumal and Tizimin units, in neighbouring Yucatan and Quintana Roo States).	
			SU 13: Isolated outreach activities at public elementary and secondary schools in coastal villages. Undergraduate and graduate thesis projects by students from Yucatan State University, Center for Research and Advanced Studies Merida Unit, Mexico's Technology Institute (Tizimin Unit).	SU 13: Undergraduate and graduate thesis projects by students from Anahuac Mayab University, Yucatan State University, Center for Research and Advanced Studies Merida Unit, Mexico's Technology Institute (Tizimin Unit).	
			SU 14: Isolated outreach		

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			activities at public elementary and secondary schools in coastal villages. Undergraduate and graduate thesis projects by students from Center for Research and Advanced Studies Merida Unit and Mexico's Technology Institute (Tizimin and Chetumal Units).	SU 14: Undergraduate and graduate thesis projects by students from Anahuac Mayab University, Center for Research and Advanced Studies Merida Unit and Mexico's Technology Institute (Tizimin and Chetumal Units).	
4.2	4.2 Education and Awareness: Training		SU 1: The New Hampshire spawning survey is carried out with the help of citizens and they are trained and educated both in the process and the need to keep track of HSC. Furthermore, as part of this effort, a Facebook page on the topic has been created that is very popular and posters are placed at all the boat launches and favorite spawning localities to educate the users of the estuary. SU 3–SU 5: Annual training to support citizen science surveys to tag and count spawning horseshoe crabs.	SU 1: Continued surveys and use of social media to monitor HSC. SU 3–SU 5: Annual training to support citizen science surveys to tag and count spawning horseshoe crabs. SU 6–SU 11: Continued training and surveys of HSC; there are plans to expand the programme to additional areas along the coast particularly in South Florida SU 8. SU 6: Continued site surveys (Fort Clinch); SU 7: Continued site	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
				surveys	
			SU 6–SU 11: Florida Horseshoe Crab Watch citizen scientist volunteers tag and survey nesting horseshoe crabs at assigned localities throughout their range in Florida; they are trained prior to spring and fall surveys in how to handle the animals and collect data; SU 6: One site surveyed (Fort Clinch); SU 7: Florida Horseshoe Crab Watch actively surveys at seven localities; SU 9: Florida Horseshoe Crab Watch surveys conducted at eight localities; SU 10: Florida Horseshoe Crab Watch conducts surveys at six localities. In 2022 the first Chamber of Commerce sponsored HSC Festival in Cedar Key, FL with events including an art exhibit, art market, parade and local HSC themed drinks and activities. SU 13: Proyecto Mex	SU 9: Continued site surveys SU 10: Continued site surveys. SU 12–SU 14: Proyecto Mex (Anahuac Mayab University) continues offering technical workshops on field methods for the study of horseshoe crabs in the states of Campeche, Yucatán and Quintana Roo.	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			(Anahuac Mayab University) offers technical workshops on HSC biology and field methods for their study to staff of NGOs, federal and state environmental agencies and university students in the state of Yucatan. SU 14: Proyecto Mex (Anahuac Mayab University) offers technical workshops on horseshoe crab biology and field methods for their study to staff of NGOs, federal and state environmental agencies and university students in the state of Quintana Roo.		
4.3	4.3 Education and Awareness: Awareness & communications		SU 3–SU 5: Green Eggs and Sands public outreach and education targeted to educators (train the trainer approach). SU 4: In the Delaware Bay area there are programs to increase public awareness of the value of HSC's that send volunteers to beaches to rescue HSC's that become	SU 6–SU 11: Expansion of Florida Horseshoe Crab Watch to all coastal counties in Florida. SU 11: Horseshoe crab education and outreach through the AL Aquarium and local university and research institutions; likely to stay the same or decline due to limited funding and	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			stranded during mating activity ("Just Flip 'em" in DE, "Return the Favor" in NJ). SU 6–SU 11: Florida Horseshoe Crab Watch trains Citizen Scientists to collect data and report tagged individuals. Workshops for training trainers and training workshops held annually for volunteers. SU 11: Horseshoe crab education and outreach through the AL Aquarium and local university and research institutions; likely to stay the same or decline due to limited funding and perception of little local economic and ecological relevance. SU 12–SU 14: Mexican researchers keep a constant presence and raise awareness on horseshoe crab conservation issues in local and national media	perception of little local economic and ecological relevance. SU 12–SU 14: In collaboration with federal and state protected area officials/staff and NGOs, develop an outreach programme focused on local communities and local/national/ foreign tourists within the horseshoe crab Mexican distribution area, including the establishment of itinerant horseshoe crab museums.	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			(newspapers, radio, websites, TV, social media).		
5.1.1	5.1.1 Legislation: International level				
5.1.2	5.1.2 Legislation: National level		SU 12–SU 14: Federal law designed to protect Mexican horseshoe crabs and their habitats is weakly enforced.	SU 12–SU 14: Strengthen the enforcement of Federal law designed to protect Mexican horseshoe crabs; in particular, preventing poaching and use as bait by large-scale octopus fishing operations.	
5.1.3	5.1.3 Legislation: Sub-national level		Harvest regulations broadly set by coastwide fisheries commissions but are promulgated through state legislatures. Thus, harvest can be more restrictive at the state level. For example, NJ prohibits harvest of horseshoe	Harvest regulations broadly set by coastwide fisheries commissions but are promulgated through state legislatures. Thus, harvest can be more restrictive at the state level. For example, NJ prohibits	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			crabs within state waters for bait or biomedical use and SC prohibits harvest for bait but allows harvest for biomedical use.	harvest of horseshoe crabs within state waters for bait or biomedical use and SC prohibits harvest for bait but allows harvest for biomedical use.	
5.1.4	5.1.4 Legislation: Scale unspecified				
5.2	5.2 Policies and regulations				
5.3	5.3 Private sector standards & codes		Improved handling procedures implemented by biomedical harvest sector. ASMFC has established best practices for all biomedical bleeding. SU 5: In SC horseshoe crabs are held in ponds prior to bleeding for up to six weeks	Continue to implement improved handling procedures implemented by biomedical harvest sector. Continued following of ASMFC best practices for all biomedical bleeding. SU 5: Continued use of current practices.	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			with loss of weight and condition. SU 12–SU 14: Implement sustainability certifications applicable to the octopus fishery and its use of bait so that better practices are incorporated to maintain access to international markets.	SU 12–SU 14: Continuous application of sustainability certifications to the octopus fishery and its use of bait so that better practices are incorporated to maintain access to international markets.	
5.4.1	5.4.1 Compliance and enforcement: International level				
5.4.2	5.4.2 Compliance and enforcement: National level			SU 12–SU 14: See 5.1.2. and 5.3 / Promote a local stewardship scheme that complements protection by staff of federal environmental agencies.	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
5.4.3	5.4.3 Compliance and enforcement: Sub-national level		Enforcement effort varies by state depending on priorities. State conservation officers spot-check landings for possession of a harvest permit and sex ratios.	Continued monitoring and enforcement by conservation officers, including spot-check landings for possession of a harvest permit and sex ratios.	
5.4.4	5.4.4 Compliance and enforcement: Scale unspecified				
6.1	6.1 Livelihood, economic & other incentives: Linked enterprises & livelihood alternatives		SU 12–SU 14: See 5.1.2, 5.3 and 5.4.2.	SU 12–SU 14: See 5.1.2, 5.3 and 5.4.2. Promote alternative tourism activities among local communities, with horseshoe crab sighting and citizen science as key attractions.	
6.2	6.2 Livelihood, economic & other incentives: Substitution		SU 12–SU 14: See 5.1.2, 5.3 and 5.4.2.	Within 10 years, there is strong potential that US Government approval will be given to alternative endotoxin tests that do not rely on horseshoe crab blood. If accepted, this would reduce some of the mortality associated with	

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				the biomedical bleeding of HSC's for the currently approved LAL test. SU 12–SU 14: See 5.1.2, 5.3 and 5.4.2. Promote the use of fishery processing residues to produce artificial bait for octopus among local entrepreneurs, to reduce pressure on horseshoe crabs.	
6.3	6.3 Livelihood, economic & other incentives: Market forces		SU 12–SU 14: See 5.1.2, 5.3 and 5.4.2.	SU 12–SU 14: See 5.1.2, 5.3 and 5.4.2.	
6.4	6.4 Livelihood, economic & other incentives: Conservation payments				
6.5	6.5 Livelihood, economic & other incentives: Non-monetary values				

Table S2. Threats (list of threat codes).

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
1.1	1.1 Residential & commercial development: Housing & urban areas		SU 1–SU 3: habitat loss of minor scope and negligible severity; however, in some areas of south Cape Cod habitat loss has been more extreme, still likely affecting <50% of population with unknown severity. SU 4: Habitat loss due to erosion and armoring along spawning beaches in Delaware Bay affecting a minority of the population and unknown severity. But loss of high quality habitat for egg development due to truncated beaches or beach transgression into peat or mud substrate will lower carrying capacity of the population thus degrading species functionality. SU 5: Habitat loss of minor scope and negligible severity. SU6–SU 9: Habitat loss due to extreme coastal development in this area, sea-level rise and	SU 1–SU 3: Continued habitat loss from development described in current threats SU6–SU 9: Continued habitat loss from development described in current threats. SU 10: Continued climate based threats described in current. SU 11: Continued habitat loss from development and climate based threats described in current threats. SU 12–SU 13: Continued habitat loss from development and pollution described in current threats. SU 14: Continued habitat loss from	Throughout the species range: Continued habitat loss due to sea level rise. SU 5: the SC and GA coastlines are largely salt marshes and tidal creeks where development is unlikely but possible (as has happened in FL). SU6–SU 10: continued development likely; of unknown scope and severity. SU 11: habitat loss from coastal development and shoreline armoring of unknown scope and severity; high levels of freshwater discharge and associated low

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			armoring of the shoreline, shoreline restoration projects that harden or create barriers along the shoreline are common affecting a majority of the population and unknown severity. SU 10: There is less coastal development in this region than elsewhere in Florida (the least developed coastline in Florida), but storms, beach erosion and sea-level rise are sometimes a serious problem; climate change with an increasing number of mangroves encroaching on nesting beaches (and efforts to encourage mangroves); and beach restoration projects that harden or create barriers along the shoreline also reduce nesting and nursery habitat affecting a minority of the population and unknown severity. SU 11: Habitat loss from coastal development and shoreline armoring of unknown scope and severity; high levels of freshwater discharge and	development described in current threats	salinity in spring may limit spawning and distribution, particularly near Mobile Bay (Estes *et al*. 2021); storms/ hurricane activity, sea level rise, and beach nourishment activities are a concern and expected to continue and increase in magnitude and severity with climate change and on going urbanization in the region. SU 12–SU 14: Same as in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			associated low salinity in spring may limit spawning and distribution, particularly near Mobile Bay (Estes *et al*. 2021); storms/ hurricane activity, sea level rise, and beach nourishment activities are a concern. SU 12 and SU 13: Habitat loss from coastal development of unknown scope and severity; high levels of raw sewage discharges, boat fuel spills and solid waste from human population centers may alter spawning beaches. SU 14: Habitat loss from coastal development causing or likely to cause rapid declines in Nichupté Lagoon (Cancún) and Yalahau Lagoon (Holbox Island).		
1.2	1.2 Residential & commercial development: Commercial & industrial areas		SU 1–SU 10: Habitat loss in commercial and industrial areas of minor scope and negligible severity because these are areas where habitat has already been degraded. SU 11: Despite high commercial and industrial	SU 1–SU 10: Continued habitat loss in commercial and industrial areas of minor scope and negligible severity because these are areas where habitat has already been degraded.	SU 1–SU 10: Continued habitat loss in commercial and industrial areas of minor scope and negligible severity because these are areas where habitat has already been

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			areas nearby, likely minor scope and severity in areas where HSCs occur; may affect water quality with scope and severity unknown relative to HSCs. SU 12–SU 14: Habitat disturbance from port infrastructure of unknown scope and severity.	SU 5: Potential for wind-energy infrastructure to cause loss of habitat if not designed properly. SU 11: Despite high commercial and industrial areas nearby, likely minor scope and severity in areas where HSCs occur; may affect water quality with scope and severity unknown relative to HSCs. SU 12–SU 14: Habitat disturbance from port infrastructure of unknown scope and severity.	degraded. SU 5: Potential for wind-energy infrastructure to cause loss of habitat if not designed properly. SU 11: Despite high commercial and industrial areas nearby, likely minor scope and severity in areas where HSCs occur; may affect water quality with scope and severity unknown relative to HSCs. SU 12–SU 14: Continued habitat disturbance from port infrastructure of unknown scope and severity.
1.3	1.3 Residential & commercial development: Tourism & recreation areas		SU 2: Loss of unknown scope and severity. Human presence is an ongoing concern, particularly in south Cape Cod, where tourism is high in HSC habitats. SU 5: minimal tourism in this	SU 2: Loss of unknown scope and severity. Human presence is likely to be an ongoing concern, particularly in south Cape Cod, where tourism is high in horseshoe habitats.	SU 5 and SU 6: pressure from tourism, construction of beach homes and condominiums likely to continue. SU 11: Increased

Classification Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
		area except for SC beaches which are heavily used; human disturbance and beach driving. SU 6: high tide beach driving affects spawning; SU 6–SU 11: heavy use of all beaches; unknown scope and severity. SU 11: Loss of unknown scope and severity. Human presence on barrier islands that are primary spawning sites are a source of disturbance, but most populations are accessible only by boat, helping to limit foot-traffic to some extent. SU 12 and SU 13: Habitat loss from tourism industry infrastructure of unknown scope and severity. Uncontrolled tourism activities in main human population centers disturb neighbouring spawning beaches. SU 14: Main threats are related to the expansion of tourism industry and resulting habitat loss or degradation of unknown scope and severity.	SU 5: Pressure on beaches from tourism will continue including beach driving at high tide, which kills HC during spawning. SU6: Continued heavy use of beaches. SU 11: Increased emphasis on ecotourism, with growth in tourism exceeding that in fisheries is likely to increase human activity in habitat areas. SU 12 and SU 13: Habitat loss from tourism industry infrastructure of unknown scope and severity. Uncontrolled tourism activities in main human population centers disturb neighbouring spawning beaches. SU 14: Main threats are related to the expansion of tourism industry and	emphasis on ecotourism, with growth in tourism exceeding that in fisheries is likely to increase human activity in habitat areas. SU 12–SU 14: Same as in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			Plans for expansion of the tourism industry to Chacmochuch over the next five years. Nichupté is the site closest to a local extinction due to conversion of spawning beaches into boating infrastructure (piers, landing ramps, etc.) and mangrove growths.	resulting habitat loss or degradation of unknown scope and severity. Plans for expansion of the tourism industry in Holbox Island and Chiquilá (Yalahau Lagoon) and to Chacmochuch Lagoon over the next five years. Nichupté is the site closest to a local extinction due to conversion of spawning beaches into boating infrastructure (piers, landing ramps, etc.) and mangrove growths. Only three small suitable spawning beaches have been identified within the Nichupté Lagoon.	
2.1.1	2.1.1 Agriculture & aquaculture: Annual & perennial non-timber crops: Shifting agriculture				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
2.1.2	2.1.2 Agriculture & aquaculture: Annual & perennial non-timber crops: Small-holder farming				
2.1.3	2.1.3 Agriculture & aquaculture: Annual & perennial non-timber crops: Agro-industry farming				
2.1.4	2.1.4 Agriculture & aquaculture: Annual & perennial non-timber crops: Scale Unknown/Unrecorded				
2.2.1	2.2.1 Agriculture & aquaculture: Wood & pulp plantations: Small-holder plantations				
2.2.2	2.2.2 Agriculture & aquaculture: Wood & pulp plantations: Agro-industry plantations				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
2.2.3	2.2.3 Agriculture & aquaculture: Wood & pulp plantations: Scale Unknown/Unrecorded				
2.3.1	2.3.1 Agriculture & aquaculture: Livestock farming & ranching: Nomadic grazing				
2.3.2	2.3.2 Agriculture & aquaculture: Livestock farming & ranching: Small-holder grazing, ranching or farming		SU 11: May affect water quality. SU 12: Fertilizer seepage/runoff from pasture lands is carried via the aquifer/fresh water streams and results in eutrophication of Laguna de Términos. Effects of unknown scope and severity. SU 13: Fertilizer seepage from pasture lands in Northeast Yucatan is carried via the aquifer and results in eutrophication of Bocas de Dzilam Lagoons. Effects of unknown scope and severity.	SU 11–SU 13: Same as in previous columns.	SU 12 and 13: Same as in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
2.3.3	2.3.3 Agriculture & aquaculture: Livestock farming & ranching: Agro-industry grazing, ranching or farming				
2.3.4	2.3.4 Agriculture & aquaculture: Livestock farming & ranching: Scale Unknown/Unrecorded				
2.4.1	2.4.1 Agriculture & aquaculture: Marine & freshwater aquaculture: Subsistence/artisanal aquaculture		SU 11: No known interactions (little aquaculture, mostly suspended bags, not in spawning areas and not limiting resources).	SU 11: No known interactions (little aquaculture, mostly suspended bags, not in spawning areas and not limiting resources).	
2.4.2	2.4.2 Agriculture & aquaculture: Marine & freshwater aquaculture: Industrial aquaculture		SU 4: Intertidal oyster aquaculture along the NJ shoreline of Delaware Bay affects a minority of the population and based on studies is not expected to cause declines (Munroe *et al*. 2020). SU 11: No known interactions (little aquaculture, mostly suspended bags, not it	SU 4 and SU11, as is previous column.	SU 4 and SU11, as is previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			spawning areas and not limiting resources)		
2.4.3	2.4.3 Agriculture & aquaculture: Scale Unknown/Unrecorded				
3.1	3.1 Energy production & mining: Oil & gas drilling		SU 6–SU 11: drilling not allowed in Florida waters SU 11: High scope, unknown severity; possibility of oil spills; remediation and clean up activities also have effects on mortality and habitat quality. SU 12: Possibility of oils spills/remediation and clean up activities, causing effects of unknown scope and severity.	SU 11: High scope, unknown severity; possibility of oil spills; remediation and clean up activities also have effects on mortality and habitat quality. SU 12: Possibility of oils spills/remediation and clean up activities, causing effects of unknown scope and severity.	SU 11: possibility of oil spills; remediation and clean up activities also have effects on mortality and habitat quality. SU 12: Same as in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
3.2	3.2 Energy production & mining: Mining & quarrying				
3.3	3.3 Energy production & mining: Renewable energy	SU 7: clean water act of 2014 requires power plants to reduce their water usage and impingement of aquatic species.	SU 7: Power plant intakes have been an important source of mortality until 2015; Large numbers of HSC (but not other species) died off in 1999 (Brockmann *et al*. 2015) affects a minority of the population but could cause fluctuations. SU 10: Effect of power plant intakes of unknown scope and severity (Crystal River). SU 11: effect of power plant intakes of unknown scope and severity (not known in AL, MS; is this happening in FL panhandle?).	SU 4: Infrastructure development for off shore wind energy in the mid-Atlantic region is proposed to occur in areas used for wintering and migration by adults and in near areas used by juveniles. The scope and the severity are unknown. SU 7: Continued threat of mortality from power plant intakes. SU 10: Continued effect of power plant intakes of unknown scope and severity. SU 11: Continued effect of power plant intakes of unknown scope and severity (not known in AL, MS; is this	Same as in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
				happening in FL panhandle?).	
4.1	4.1 Transportation & service corridors: Roads & railroads		SU 12: Construction of coastal roads and bridges affects sediment granulometry in neighbouring areas and modifies seawater flow into coastal lagoon systems, causing effects of unknown scope and severity. SU 13: Construction of coastal roads affects sediment granulometry in neighbouring areas and modifies seawater flow into coastal lagoon systems, causing effects of unknown scope and severity.	SU 12: Construction of coastal roads and bridges affects sediment granulometry in neighbouring areas and modifies seawater flow into coastal lagoon systems, causing effects of unknown scope and severity. SU 13: Construction of coastal roads affects sediment granulometry in neighbouring areas and modifies seawater flow into coastal lagoon systems, causing effects of unknown scope and severity. SU 14: Construction of coastal roads affects sediment granulometry in neighbouring areas and modifies seawater	SU 12–SU 14: Same as in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
				flow into coastal lagoon systems, causing effects of unknown scope and severity.	
4.2	4.2 Transportation & service corridors: Utility & service lines				
4.3	4.3 Transportation & service corridors: Shipping lanes				
4.4	4.4 Transportation & service corridors: Flight paths				
5.1.1	5.1.1 Biological resource use: Hunting & collecting terrestrial animals: Intentional use (species being assessed is the target)				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
5.1.2	5.1.2 Biological resource use: Hunting & collecting terrestrial animals: Unintentional effects (species being assessed is not the target)				
5.1.3	5.1.3 Biological resource use: Hunting & collecting terrestrial animals: Persecution/control				
5.1.4	5.1.4 Biological resource use: Hunting & collecting terrestrial animals: Motivation Unknown/Unrecorded				
5.2.1	5.2.1 Biological resource use: Gathering terrestrial plants: Intentional use (species being assessed is the target)				
5.2.2	5.2.2 Biological resource use: Gathering terrestrial plants: Unintentional effects (species being assessed is not the target)				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
5.2.3	5.2.3 Biological resource use: Gathering terrestrial plants: Persecution/control				
5.2.4	5.2.4 Biological resource use: Gathering terrestrial plants: Motivation Unknown/Unrecorded				
5.3.1	5.3.1 Biological resource use: Logging & wood harvesting: Intentional use: subsistence/small scale (species being assessed is the target [harvest]				
5.3.2	5.3.2 Biological resource use: Logging & wood harvesting: Intentional use: large scale (species being assessed is the target)[harvest]				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
5.3.3	5.3.3 Biological resource use: Logging & wood harvesting: Unintentional effects: subsistence/small scale (species being assessed is not the target)[harvest]				
5.3.4	5.3.4 Biological resource use: Logging & wood harvesting: Unintentional effects: large scale (species being assessed is not the target)[harvest]				
5.3.5	5.3.5 Biological resource use: Logging & wood harvesting: Motivation Unknown/Unrecorded				
5.4.1	5.4.1 Biological resource use: Fishing & harvesting aquatic resources: Intentional use: subsistence/small scale (species being assessed is the target)[harvest]		SU 1: Few, if any, horseshoe crabs are harvested for any purpose in Maine and NH. However, in Massachusetts, ASMFC stipulated a state quota for bait in 2019 as ~300,000 HSCs but the state enacts a more restrictive quota of 165,000. The biomedical fishery is not subjected to a quota, but the number of permits is regulated by Massachusetts. Those	SU 1: Continued threat of bait harvest in Massachusetts described in current threats. SU 2: Continued threat of bait harvest in Massachusetts described in current threats. SU 3 and SU 4:	Same as in previous column/ SU 12–SU 14: Same as in previous columns. Poaching of HSC adults for octopus bait is a key target of future conservation efforts if aspirational conservation goals are to be achieved.

Classification Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
		numbers appear to have declined a bit in the past two years, but values are difficult to obtain, especially in terms of biomedical bleeding, due to confidentiality agreements. SU 2: Massachusetts is included in both SU 1 and SU 2, and it is hard to divide the available data into separate units. See SU 1, above, for mortalities in 2017 to present. Horseshoe crabs are also harvested for the same purposes in RI and Conn, but to a less extent than Mass. There is also some concern, in some states, that harvest numbers are underreported. SU 3 and SU 4: It is permissible for individuals to harvest small numbers of HSC for use as bait to catch eel. Scope is minor and severity is negligible. SU 7: A small eel harvest. A large marine life harvest, exceeding de minimis quota** (9,455) in some years (Brockmann *et al.* 2015); a	Continued threat of bait harvest described in current threats. SU 7: Continued threat of harvest described in current threats. SU 8: Continued threat of harvest described in current threats SU 10: Continued threat of harvest described in current threats. SU 11: Continued threat of harvest described in current threats. SU 12: Continued threat of harvest and poaching described in current threats. SU 13: Continued threat of harvest and poaching described in current threats. SU 14: Continued threat of harvest described in current threats.	Stakeholders need to be engaged and creative alternatives to guarantee octopus bait supply need to be developed (including a mix of alternative and even artificial baits).

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			permit is required, daily limit of 25/person but no overall limit; enforcement weak. **Note: the de minimis quota is set by the Atlantic States Marine Fisheries Commission but only applies to bait harvest, so the State of Florida does not recognize this as a violation. SU 8: Possibly some marine life harvest. SU 10: Large, exceeding de minimis quota** (9,455) in recent years (Brockmann *et al*. 2015); a salt water license is required with daily limit of 25/person but no overall limit (per person, coast or statewide). Enforcement is weak. **Note: de minimis status is established by the ASMFC and not the GSMFC and only for bait harvest so the State of Florida does not recognize this as exceeding the quota. SU 11: Unknown scope and severity; marine life harvest; Minimal aquarium trade. SU 12: An unknown but		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			significant percentage of up to 1,500 small-scale fishers in Campeche illegally use poached adult HSCs as bait for octopus, especially when commercial bait species (*Cardisoma guanhumi, Libinia dubia, Callinectes sapidus*) are scarce or become expensive. HSC are harvested while spawning, as the HSC reproductive and octopus fishing seasons coincide. Given the relatively low local abundances of HSC and the fact that all fishermen concentrate on octopus during the season, this harvest can be expected to affect at least <50% of the HSC population and causes or is likely to cause fluctuations. SU 13: An unknown but significant percentage of up to 3,500 small-scale fishers in Yucatan illegally used poached adult horseshoe crabs as bait for octopus, especially when legal bait species (*Cardisoma guanhumi, Libinia dubia, Callinectes sapidus*) are		

Classification Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
		scarce or become expensive. HSC are harvested while spawning, as the HSC reproductive and octopus fishing seasons coincide. Given the relatively low local abundances of HSC and the fact that all fishermen concentrate on octopus during the season, this harvest can be expected to affect at least <50% of the HSC population and causes or is likely to cause fluctuations. SU 14: Tens of small scale fishers in Holbox (Yalahau Lagoon) illegally harvest and sell adult horseshoe crabs to large-scale vessel crews, as bait for the octopus fishery. Together with small scale harvest in SU 13, this can be expected to affect at least <50% of the HSC population and causes or is likely to cause fluctuations.		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
5.4.2	5.4.2 Biological resource use: Fishing & harvesting aquatic resources: Intentional use: large scale (species being assessed is the target)[harvest]	Harvest for fertilizer and livestock feed occurred in the Delaware Bay region from the mid-19th to mid-20th centuries (Kreamer and Michels 2009). Harvest for bait exploded in the 1990s as the market for welk expanded. Harvest declined with the implementation of interstate fisheries management, which began in 1998 (ASMFC 1998).	SU 1: No harvest. SU 2: Harvest for use as bait and for production of Limulus amoebocyte lysate (LAL) occurs in the Northeast spatial unit. Bait harvest is regulated by states in coordination with the Atlantic States Marine Fisheries Commission (ASMFC). The state quotas for bait harvest in 2019 were 165,000 in MA, 48,689 in CT, and 8,398 in RI. Biomedical harvest occurs in MA and RI. Recent assessment of stock status (ASMFC 2019) showed conflicting trends in population surveys. Although pressure from bait and biomedical harvest varies within the spatial unit, it is assumed that the whole population is affected by harvest and the severity of the harvest effect is unknown (ASMFC 2019). SU 3: Harvest for use as bait occurs in the New York spatial unit. Bait harvest is regulated by states in coordination with the Atlantic States Marine Fisheries Commission	SU 1: No harvest. SU 2: Continued biomedical and bait harvest described in current threats. SU 3: Continued bait harvest described in current threats. SU 4: Continued biomedical and bait harvest described in current threats. SU 5: Continued biomedical and bait harvest described in current threats. SU 6–SU 11: harvesting not expected to change. SU 12: Continued threat of poaching described in current threats. SU 13: Continued threat of poaching described in current threats.	Aspirationally, economically viable synthetic alternatives for LAL and bait alternatives will emerge. Thus, eliminating the HSC fishery.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			(ASMFC). The state quota for bait harvest in 2019 is 150,000 in NY. Recent assessment of stock status (ASMFC 2019) indicate decreasing population trends in the New York spatial unit. Although harvest pressure varies spatially within the spatial unit (Bopp *et al*. 2019), the whole population is affected. Although it is uncertain whether overfishing is occurring in the New York spatial unit (ASMFC 2019), there is a reasonable expectation that harvest is causing a slow but significant decline. SU 4: Harvest for use as bait and for production of Limulus amoebocyte lysate (LAL) occurs in the Delaware Bay spatial unit. Bait harvest is regulated by states in coordination with the Atlantic States Marine Fisheries Commission (ASMFC) under an adaptive resource management (ARM) plan, which aims for an ecologically functional abundance of 80% of carrying capacity to meet		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			multiple species objectives within the Delaware Bay ecosystem (ASMFC 2022). Although harvest levels vary within Delaware Bay, harvest affects the whole population because of widespread movement and migration. Harvest under the ARM is not expected to cause decline and is expected to be consistent with ecological functionality (ASMFC 2021). Harvest for LAL is monitored by ASMFC and practices for capture and handling of animals are guided by best practices developed by Federal Drug Administration and ASMFC. At current levels, based on recent assessments (Smith *et al*. 2020, ASMFC 2021) harvest for LAL in the Delaware Bay ecosystem affects the whole population but is not expected to cause declines or interfere with reaching ecological functionality. SU 5: Harvest for use as bait and for production of Limulus amoebocyte lysate (LAL) occurs in the Southeast spatial		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			unit. Bait harvest is regulated by states in coordination with the Atlantic States Marine Fisheries Commission (ASMFC). The state quotas for bait harvest in 2019 is zero in SC and 29,312 in GA but commercial harvest is currently prohibited in GA.. Biomedical harvest occurs in SC only where the HC are held in ponds for up to eight weeks prior to bleeding, which is known to have an adverse physiological effect (Hamilton *et al*. 2020). Recent assessment of stock status (ASMFC 2019) showed increasing trends in population surveys. Although pressure from harvest varies within the spatial unit, harvest at current levels is assumed that the whole population is affected by harvest and the severity of the harvest is not expected not cause declines (ASMFC 2019). SU 6: No harvest currently but harvest for biomedical would be allowed by permit if requested by a company		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			following ASMFC best practices; no marine life harvest currently. SU 7: Small eel harvest with license. No biomedical harvest currently but would be allowed by permit if requested by a company following ASMFC best practices. No marine life harvest in this area. SU 8–SU 10: the marine life harvest is a significant loss of HSC in Florida: Florida Statewide 196,537 have been harvested in the marine life fishery since 2013. SU 8: Up to 12,385 specimens have been collected annually since 2000. The number of trips, landings and CPUE (catch per unit effort) declined sharply after 2007; SU 9: large numbers of juveniles are collected in this region, 12,000–28,000 with little change in CPUE. No biomedical harvest currently but would be allowed by permit if requested by a company following ASMFC best practices;		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			SU 10: around 1,000 harvested annually with little change in CPUE. SU 11: low numbers in this area mean there are probably few collected in marine life or bait fishery. SU 12: Widespread poaching exclusively practiced by small-scale fishers to supply bait to the octopus fishery. No large-scale vessels seem to purchase HSC as bait in this unit. SU 13: Widespread poaching of adults during the spawning season for use as octopus bait is commonplace throughout the spatial unit. Anecdotal accounts in coastal villages throughout the Yucatan coast indicate that Yucatan's 450+ large vessel fleet routinely illegally purchase large amounts of adult horseshoe crabs from poachers to use as bait for octopus (in excess of 1,000 kg/boat/fishing trip, equivalent to ~3,300 adult males or ~1,100 females, on		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			the basis of average HSC weights in Yucatan). This is likely to affect the majority of the population (50–90%) causing or likely to cause rapid declines.		
5.4.3	5.4.3 Biological resource use: Fishing & harvesting aquatic resources: Unintentional effects: subsistence/small scale (species being assessed is not the target)[harvest]				
5.4.4	5.4.4 Biological resource use: Fishing & harvesting aquatic resources: Unintentional effects: large scale (species being assessed is not the target)[harvest]		Harvest as bycatch in fisheries that use bottom trawls, fixed nets, and hydraulic dredges. Bycatch is monitored by Atlantic States Marine Fisheries Commission and National Marine Fisheries Service and sometimes at by state agencies. Bycatch is accounted for in the stock assessments conducted by ASMFC (ASMFC 2019). Bycatch is proportional to the fishing effort and horseshoe crab abundance within the spatial unit. Bycatch affects the population susceptible to the gear. Severity is expected to vary by location, but has	SU 5–SU11: continued and increased human activities; high scope and unknown severity SU 11: Unknown scope and severity; possible impacts of shrimp and other collections (educational & fisheries monitoring) trawling in shallow waters (sediment disruption and bycatch). SU 12: Possible impacts of shrimp trawling in shallow waters (sediment disruption and	Aspirationally, improved fishing methods will decrease bycatch mortality. SU 11: Possible impacts of shrimp trawling and other collections in shallow waters (sediment disruption and bycatch) - likely to remain an issue. SU 12: The shrimp trawler fishery in the Southern Gulf of Mexico is facing

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			been found to be negligible and not expected to cause declines in the Delaware Bay population (ASMFC 2019 and 2021). SU 5: some HSC bycatch from shrimp trawlers in both SC and GA. Unknown scope and severity. SU 11: Unknown scope and severity; possible impacts of shrimp and other collections (educational & fisheries monitoring) trawling in shallow waters (sediment disruption and bycatch). SU 12: Possible impacts of shrimp trawling in shallow waters (sediment disruption and bycatch), in particular in Laguna de Términos, Campeche.	bycatch), in particular in Laguna de Términos, Campeche.	ecological and market sustainability issues and it is uncertain whether it will subsist over the medium to long term.
5.4.5	5.4.5 Biological resource use: Fishing & harvesting aquatic resources: Persecution/control				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
5.4.6	5.4.6 Biological resource use: Fishing & harvesting aquatic resources: Motivation Unknown/Unrecorded				
6.1	6.1 Human intrusions & disturbance: Recreational activities		SU 2: Unknown scope and severity; higher impacts likely on south Cape Cod where human activities are high for camping, tourism, boating, beach driving and fishing. SU 4: Beach use during HSC spawning can disturb shorebird foraging on HSC eggs; thus, reducing the species functionality in Delaware Bay, which is a significant shorebird migratory stopover. SU 6: Beach driving at high tide. SU 11: High scope, unknown severity; Human activities; camping, tourism, beach driving. SU 12–SU 14: Unregulated beach tourism and nature	SU 2: Continued threats of human activity described in current threats. SU 4: Continued threats of human activity described in current threats. SU 6: Continued threats of human activity described in current threats. SU 11: Continued threats of human activity described in current threats. SU 12–SU 14: Continued threats of human activity described in current threats. .	Same as in previous column. SU11: likely to remain and increase; Human activities; camping, tourism, beach driving. SU 12, 13, 14: Same as in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			tourism activities may disrupt spawning events and result in trampling of buried spawners. Running ashore of small tourist boats (e.g., sport fishing or nature tours) near spawning sites crushes spawners buried in the sediment. Scope is unknown and causes or is likely to cause negligible declines. .		
6.2	6.2 Human intrusions & disturbance: War, civil unrest & military exercises				
6.3	6.3 Human intrusions & disturbance: Work & other activities				
7.1.1	7.1.1 Natural system modifications: Fire & fire suppression: Increase in fire frequency/intensity				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
7.1.2	7.1.2 Natural system modifications: Fire & fire suppression: Suppression in fire frequency/intensity				
7.1.3	7.1.3 Natural system modifications: Fire & fire suppression: Trend Unknown/Unrecorded				
7.2.1	7.2.1 Natural system modifications: Dams & water management/use: Abstraction of surface water (domestic use)				
7.2.2	7.2.2 Natural system modifications: Dams & water management/use: Abstraction of surface water (commercial use)				
7.2.3	7.2.3 Natural system modifications: Dams & water management/use: Abstraction of surface water (agricultural use)				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
7.2.4	7.2.4 Natural system modifications: Dams & water management/use: Abstraction of surface water (unknown use)				
7.2.5	7.2.5 Natural system modifications: Dams & water management/use: Abstraction of ground water (domestic use)				
7.2.6	7.2.6 Natural system modifications: Dams & water management/use: Abstraction of ground water (commercial use)				
7.2.7	7.2.7 Natural system modifications: Dams & water management/use: Abstraction of ground water (agricultural use)				
7.2.8	7.2.8 Natural system modifications: Dams & water management/use: Abstraction of ground water (unknown use)				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
7.2.9	7.2.9 Natural system modifications: Dams & water management/use: Small dams				
7.2.10	7.2.10 Natural system modifications: Dams & water management/use: Large dams		SU 11: Moderate to high scope, unknown severity; high freshwater inputs and opening of spillways, particularly in LA could keep populations limited westward.	SU 11: High scope, unknown severity; frequency and duration of opening spillways is increasing.	
7.2.11	7.2.11 Natural system modifications: Dams & water management/use: Dams (size unknown)				
7.3	7.3 Natural system modifications: Other ecosystem modifications		SU 6: mangroves are currently invading this region, reducing the availability of nesting beaches. SU 7: mangroves are prevalent now throughout the area; high scope, unknown severity. SU 11: High scope, unknown severity; Sea level rise reducing habitat.	SU 6–SU 11: low to high scope, unknown severity; Sea level rise (moderate to high scope) and mangrove growth (likely low to moderate scope for mangrove growth) may alter habitat. SU 12–SU 14: Continued threat of mangrove growth	Continued threats as described in previous columns.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			SU 12–SU 14: Mangrove growth (natural and managed) on small sandy beaches within coastal lagoons can eliminate suitable spawning habitat. Sea level rise can also make spawning beaches unsuitable and lead spawners to get stranded behind beach dunes after ebb tide.	described in current threats.	
8.1.1	8.1.1 Invasive & other problematic species, genes & diseases: Invasive non-native/alien species/diseases: Unspecified species				
8.1.2	8.1.2 Invasive & other problematic species, genes & diseases: Invasive non-native/alien species/diseases: Named species		SU 5: Hogs feed on eggs in beaches. SU 11: Unknown.	SU 5: Hogs feed on eggs in beaches. SU 11: Unknown.	
8.2.1	8.2.1 Invasive & other problematic species, genes & diseases: Problematic native species/diseases: Unspecified species				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
8.2.2	8.2.2 Invasive & other problematic species, genes & diseases: Problematic native species/diseases: Named species		SU 6, SU 7, SU 10, and SU 11: Predation by raccoons, sea turtles and alligators.	SU 6, SU 7, SU 10, and SU 11: Predation by raccoons, sea turtles and alligators.	
8.3	8.3 Invasive & other problematic species, genes & diseases: Introduced genetic material				
8.4.1	8.4.1 Invasive & other problematic species, genes & diseases: Problematic species/diseases of unknown origin: Unspecified species				
8.4.2	8.4.2 Invasive & other problematic species, genes & diseases: Problematic species/diseases of unknown origin: Named species				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
8.5.1	8.5.1 Invasive & other problematic species, genes & diseases: Viral/prion-induced diseases: Unspecified "species" (disease)				
8.5.2	8.5.2 Invasive & other problematic species, genes & diseases: Viral/prion-induced diseases: Named "species" (disease)				
8.6	8.6 Invasive & other problematic species, genes & diseases: Diseases of unknown cause		SU 7: Large numbers of HSC (but not other species) died off in 1999 (Brockmann *et al.* 2015) affects a minority of the population but could cause fluctuations		
9.1.1	9.1.1 Pollution: Domestic & urban waste water: Sewage		SU 7: Water quality issues, pollution and algal blooms are common in IRL and large portions of the seagrass beds have died which and may affect HSC and their food supply. SU 11: moderate to high scope, unknown severity; likely from freshwater discharge/diversion and urbanization.	SU 7: Continued water quality issues, pollution and algal blooms as described in current threats. SU 11: Continued threat of pollution as described in current threats. SU 12–SU 14: Continued threat of	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			SU 12–SU 14: Raw sewage from septic tanks connected to absorption wells reaches coastal lagoons through the aquifer. This is the standard sewage disposal method in coastal population centers in the Yucatan Peninsula, so scope can be expected to affect the majority of the HSC population and causes or is likely to cause fluctuations.	sewage as described in current threats.	
9.1.2	9.1.2 Pollution: Domestic & urban waste water: Run-off		SU 7: Water quality issues, pollution and algal blooms are common in IRL and large portions of the seagrass beds have died which and may affect HC and their food supply. SU 11: Likely freshwater discharge/ diversion. SU 12: Laguna de Términos: pollution from landfills and wastewater. SU 13: Pollution from landfills and wastewater from coastal cities and villages. SU 14: This site is exposed to	SU 7: Continued water quality issues, pollution and algal blooms as described in current threats. SU 11: Continued freshwater discharge/ diversion as described in current threats. SU 12: Continued pollution from landfills and wastewater as described in current threats. SU 13: Continued pollution from landfills and wastewater from	Continued threats as described in previous column. SU 11: Likely freshwater discharge/ diversion will increase; already occurring.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			pollution from landfills and wastewater.	coastal cities and villages as described in current threats. SU 14: This site is exposed to pollution from landfills and wastewater.	
9.1.3	9.1.3 Pollution: Domestic & urban waste water: Type Unknown/Unrecorded				
9.2.1	9.2.1 Pollution: Industrial & military effluents: Oil spills		If oil spill occurs during spawning season, water with floating oil will cover nests at high tide leaving oil on the beach as the tide falls. SU 1: Oil spills have occurred in some estuaries and if they occur during spawning season eggs could be damaged as the oil floating on top of the water will cover nests at high tide, and likely remain there as the tide falls. SU 4: Because Delaware Bay is a corridor for oil transport, oil spills are possible. Depending	SU 1: Based on previous occurrence of oil spills in this SU, threat remains in the future. SU 4: Continued threat of oil spills as Delaware Bay is a corridor for oil transport. SU 11: Continued threat of possibility of oil spills and high industrial discharges. SU 12: Continued threat of pollution from oil	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			on size and timing of the oil spill and effectiveness of response, the scope could be minor to major with negligible to significant severity. SU 11: High scope, unknown severity; possibility of oil spills and high industrial discharges. SU 12: Laguna de Términos: pollution from oil industry and possibility of spills.	industry and possibility of spills.	
9.2.2	9.2.2 Pollution: Industrial & military effluents: Seepage from mining				
9.2.3	9.2.3 Pollution: Industrial & military effluents: Type Unknown/Unrecorded				
9.3.1	9.3.1 Pollution: Agricultural & forestry effluents: Nutrient loads		SU 7: Frequent water quality issues in IRL; scope majority, severity unknown. SU 9: Red tide and other water	SU 7: Continued threat of water quality issues described in current threats. SU 9: Continued threat	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			quality problems. Scope majority, severity unknown. SU 11: moderate to high scope and severity; May affect water quality. SU12: Fertilizer seepage/runoff from pasture lands is carried via the aquifer/fresh water streams and results in eutrophication of Laguna de Términos. Effects of unknown scope and severity. SU 13: Fertilizer seepage from pasture lands in Northeast Yucatan is carried via the aquifer and results in eutrophication of Bocas de Dzilam Lagoons. Effects of unknown scope and severity.	of water quality issues described in current threats. SU 11: Continued threat of water quality issues described in current threats. SU 12: Continued threat of fertilizer seepage/runoff described in current threats. SU 13: Continued threat of fertilizer seepage/runoff described in current threats.	
9.3.2	9.3.2 Pollution: Agricultural & forestry effluents: Soil erosion, sedimentation		SU 11: Moderate to high scope, unknown severity; May affect water quality and habitat availability.	SU 11: Continued threat of erosion and sedimentation as described in current threats.	

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
9.3.3	9.3.3 Pollution: Agricultural & forestry effluents: Herbicides & pesticides		SU 11: Unknown scope and severity; may affect water quality.	SU 11: Continued potential threat of herbicides and pesticides as described in current threats.	
9.3.4	9.3.4 Pollution: Agricultural & forestry effluents: Type Unknown/Unrecorded		SU 13: Chemical pollution from dry and wet docks		
9.4	9.4 Pollution: Garbage & solid waste		SU 11: High scope, unknown severity; illegal dumping, litter, marine debris (outboard dumping, storms, tourism, fishing). SU 12: Open landfills, clandestine dumps, and lack of adequate solid waste processing facilities lead to large amounts of solid waste (mainly plastic and dumped fishing gear) accumulating in coastal lagoons and, specifically, spawning beaches. This affects the majority of the population and causes or is likely to cause fluctuations.	SU 11: Continued threat of illegal dumping, litter, marine debris described in current threats. SU 12: Continued threat from waste disposal and processing as described in current threats. SU 13: Continued threat from waste disposal and processing as described in current threats. SU 14: Continued threat from waste disposal and processing as described in current threats	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			SU 13: Open landfills, clandestine dumps, and lack of adequate solid waste processing facilities lead to large amounts of solid waste (mainly plastic and dumped fishing gear) accumulating in coastal lagoons and, specifically, spawning beaches. This affects the majority of the population and causes or is likely to cause fluctuations. SU 14: Open landfills, clandestine dumps, and lack of adequate solid waste processing facilities lead to large amounts of solid waste (mainly plastic and dumped fishing gear) accumulating in coastal lagoons and, specifically, spawning beaches. This affects the majority of the population and causes or is likely to cause fluctuations.		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
9.5.1	9.5.1 Pollution: Air-borne pollutants: Acid rain				
9.5.2	9.5.2 Pollution: Air-borne pollutants: Smog				
9.5.3	9.5.3 Pollution: Air-borne pollutants: Ozone				
9.5.4	9.5.4 Pollution: Air-borne pollutants: Type Unknown/Unrecorded				
9.6.1	9.6.1 Pollution: Excess energy: Light pollution				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
9.6.2	9.6.2 Pollution: Excess energy: Thermal pollution				
9.6.3	9.6.3 Pollution: Excess energy: Noise pollution				
9.6.4	9.6.4 Pollution: Excess energy: Type Unknown/Unrecorded				
10.1	10.1 Geological events: Volcanoes				
10.2	10.2 Geological events: Earthquakes/tsunamis				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
10.3	10.3 Geological events: Avalanches/landslides				
11.1	11.1 Climate change & severe weather: Habitat shifting & alteration		Sea level rise will affect habitat by flooding beach habitats used for spawning. The scope covers the species range; all spatial units will be affected. However, the severity of the effects will vary depending on the extent that beach habitat can transgress with the rising sea level while maintaining good substrate for nesting or will be truncated by armored shoreline or limited by sediments and soils. Habitat squeeze. SU 1: In the northern portion of their range, optimal nesting beaches are much less abundant and therefore, if they are reduced due to development or natural processes, such as the expansion of peat beds, many of these vital habitats could be lost. Moreover, because these	SU 1: may see changes in phenology of life history events such as spawning; distributions not yet changed, but may in the future; serious concerns for these marginal populations. SU 4: Sea-level rise may cause beach erosion and alteration or loss of existing spawning areas. SU 11: Continued threat of storms/ hurricane activity, beach erosion, variation in freshwater discharge patterns, and sea-level rise and climate change, as described in current threats; may see changes in phenology of	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			potential spawning sites are narrow, as sea levels rise, the high tides will reach above the available spawning areas, into solid rocks and ledge. SU 5: Sea level rise has resulted in HSC nesting more often along creeks and in salt marshes but there is good evidence that the eggs develop in these habitats (Kendrick *et al*. 2021). SU 6 and SU 7: Climate change (and efforts to encourage mangroves) is causing an increase in the number of mangroves encroaching on nesting beaches. SU 10: Storms, beach erosion and sea-level rise are serious problems; climate change (and efforts to encourage mangroves) are causing an increase in the number of mangroves encroaching on nesting beaches. SU 11: High scope, unknown severity; Storms/ hurricane	life history events such as spawning; distributions not yet changed, but may in the future. SU 12–SU 14: Storms, beach erosion and sea-level rise, climate change and efforts to encourage mangroves continue to threatened nesting beaches; continued threat of variation in freshwater discharge patterns from the aquifer may alter salinity patterns within coastal lagoons creating unsuitable conditions for spawning.	

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			activity, beach erosion, variation in freshwater discharge patterns, and sea-level rise are serious problems; climate change, may see changes in phenology of life history events such as spawning; distributions not yet changed, but may in the future. SU 12–SU 14: Storms, beach erosion and sea-level rise are serious problems; climate change (and efforts to encourage mangroves) are causing an increase in the number of mangroves encroaching on nesting beaches; variation in freshwater discharge patterns from the aquifer may alter salinity patterns within coastal lagoons creating unsuitable conditions for spawning. Scope and severity are unknown.		

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
11.2	11.2 Climate change & severe weather: Droughts				
11.3	11.3 Climate change & severe weather: Temperature extremes		Increasing water temperatures will affect the phenology of spawning. Extreme temperatures could affect juvenile habitat. The scope covers the range of the species. However, the severity will vary depending on temperature increase relative to baseline. In some spatial units, shifts in spawning phenology will affect interspecific relationships and interfere with achieving ecological functionality, e.g., shorebird and horseshoe crab relationship in Delaware Bay. May see changes in phenology of life history events such as spawning; distributions not yet changed, but may in the future; serious concerns for these marginal populations.	SU 5: The much larger more northern and genetically distinct population may be replaced by the smaller and more southern population that is better adapted to temperature and salinity extremes. SU 12–SU 14: Continued threat of potential disruption to spawning associated with warmer winter temperatures described in current threats.	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			SU 5–SU 6: shifts in temperature may result in the invasion of the genetically different population to the south. SU 12–SU 14: Spawning in the Yucatan Peninsula is associated with a ~2°C drop in average water surface temperature during winter months (in contrast to spring spawning in the US populations). Increase in winter temperatures may result in disruptions to the phenology of spawning affecting all the population with unknown severity. Extreme temperatures in shallow coastal lagoons may increase salinity due to evaporation and affect juvenile habitat, affecting the whole population with unknown severity.		
11.4	11.4 Climate change & severe weather: Storms & flooding		Increasing frequency of storms could disturb spawning migration and timing. Flooding could cause freshwater intrusion affecting juvenile habitat. The scope covers the range of the species. However, the severity will vary	SU 1: Continued threat of altered water temperature affecting spawning as described in current threats. SU 5–SU 6: Continued threat of storms and	Continued threats as described in previous column.

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			depending on temperature increase relative to baseline. In some spatial units, shifts in the patterns of spawning could disrupt interspecific relationships and interfere with achieving ecological functionality, e.g., shorebird and horseshoe crab relationship in Delaware Bay (Smith *et al*. 2011). SU 1: We have demonstrated the thermosensitivity of horseshoe crabs and their tendency in the northern end of their range to seek warmer water in the spring. Therefore, we are somewhat concerned that, if water temperatures increase, it will alter the location and timing of spawning. SU 5–SU 6: storms and flooding can be significant but highly variable throughout the range. SU 5–SU 11: In particular major storms affect spawning beaches; scope highly	flooding as described in current threats SU 5–SU 11: Continued threat of major storms affecting spawning beaches as described in current threats. SU 12–SU 14: Continued threat of major storms and increasing temperatures affecting spawning beaches as described in current threats	

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			variable; but effect can be severe. SU 12–SU 14: Same as above, but consider that in Mexico spawning seems to be triggered by cooler water temperatures (mainly caused by polar masses moving south across the Gulf of Mexico). A temperature increase may result in reduced reproductive activity altogether and/or in poor conditions for the development of eggs and juveniles.		
11.5	11.5 Climate change & severe weather: Other impacts				
12.1	12.1 Other threat				

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Appendix 1. Assessor Self-Review

1. **Disclose any potential conflicts of interest, which could bias the assessment**.

   None

2. **Is there any discrepancy between this assessment and the Red List assessment for the species? If so, comment on the likely reason for this discrepancy.**

   No

3. **Review the impact that you assigned to the various threats and conservation actions. Would the trajectory of the species be very different if other choices were made? If so, review your justification for these choices. If appropriate, widen the bounds on tabs 4 and 5-8 (change the lower and upper plausible values) to reflect the uncertainty introduced by the possibility of these other choices. How, if at all, did this review question cause this assessment to change? If no changes were needed, please write "no changes".**

   Our judgement on the projected impacts are based on underlying assumptions. Undoubtedly, impacts would vary under different assumptions. However, we worked to provide empirical justifications for underlying assumptions based on current state of knowledge. The range of possible impacts reflects the uncertainty in the state of knowledge.