Status Review Report of Two Species of Guitarfish: *Rhinobatos rhinobatos* and *Rhinobatos cemiculus*

Rhinobatos cemiculus caught in Mayumba Gabon, Credit: Godefroy De Bruyne, Wildlife Conservation Society

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Executive Summary

This report was produced in response to a petition received from WildEarth Guardians on July 15, 2013, to list 81 marine species as endangered or threatened under the Endangered Species Act (ESA). On February 24, 2014, NMFS announced in the *Federal Register* that the petition presented substantial information that listing may be warranted for five of the petitioned species of skates and rays and requested information on these species from the public (79 FR 10104). This report is the status review for two of the five species of skates and rays, namely, *Rhinobatos cemiculus* and *Rhinobatos rhinobatos*. On September 19, 2016, NMFS published in the *Federal Register* a proposed rule to list *R. rhinobatos* and *R. cemiculus* as threatened species under the ESA (81 FR 64094). At that time, we solicited comments on the proposed rule and draft status review report. This final report summarizes available data and information on these two guitarfish species, including information we received during the 60-day public comment period, and presents an evaluation of their status and extinction risk.

Rhinobatos rhinobatos, commonly referred to as the common guitarfish, historically occurred throughout all shores of the Mediterranean and along the coast of the eastern Atlantic from southern France to Angola, in shallow waters to 100m depth. The available information shows declines in this species throughout much of its range including extirpation from the Mediterranean waters of Spain, France, Italy, and likely the entire Adriatic Sea. In the Atlantic this species was abundant in West Africa prior to the beginning of targeted shark fishing in the region, but has become scarce in recent decades.

Rhinobatos cemiculus, commonly referred to as the blackchin guitarfish, historically occurred throughout most shores of the Mediterranean, with the likely exception of the coast of France, eastern Atlantic from southern Portugal to Angola, in shallow waters to 100m depth. The available information shows declines in this species throughout much of its range including extirpation from the Mediterranean waters of Spain, Italy, and likely the entire Adriatic Sea. In the Atlantic this species was abundant in West Africa prior to the beginning of targeted shark fishing in the region, but has become scarce in recent decades.

The decline of these *Rhinobatos* species is primarily attributed to the historical and current overutilization of these species by demersal fisheries. Throughout portions of their range they are targeted for their meat, fins, or both, and throughout their entire ranges they are susceptible to capture by various fishing gears used by demersal artisanal and industrial fisheries. As with many elasmobranch species, both species have a relatively low reproductive capacity, leaving them vulnerable to overutilization by fisheries. While there have been recent regulatory efforts to reduce the pressure of fishing on these and other elasmobranch species in portions of their ranges, many of these protections are either inadequate, or their efficacy is unknown at this time. Given the species' demographic risks and the present threats that continue to contribute to the decline of many of the existing populations, we conclude that *R. rhinobatos* and *R. cemiculus* are presently at a moderate risk of extinction throughout their respective ranges.

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Scope and Intent of Present Document

This document is the status review of two *Rhinobatos* species: the common guitarfish (*Rhinobatos rhinobatos*) and the blackchin guitarfish (*Rhinobatos cemiculus*). On July 16, 2013, the National Marine Fisheries Service (NMFS) received a petition to list 81 species, including these two species, as threatened or endangered under the Endangered Species Act (ESA) and to designate critical habitat. Under the ESA, if a petition is found to present substantial scientific or commercial information that the petitioned action may be warranted, a status review shall be promptly commenced (16 U.S.C. 1533(b)(3)(A)). The National Marine Fisheries Service (NMFS) determined the petition had sufficient merit for consideration and that a status review was warranted for 27 of the 81 species[1], including both *Rhinobatos* species.

This is the review of the best available scientific and commercial information on the biology, population status, and past, current, and future factors contributing to the extinction risk of these species. To find the best available information, the author of this document searched for relevant peer reviewed articles, reports, gray literature, and data using Google Scholar, FishBase, Research Gate, and the NOAA Central Library. The author also searched specific websites for information (e.g. relevant Food and Agriculture of the United Nations webpages), consulted NMFS Office of Protected Resources staff who had knowledge of similar species, and reached out to known experts on these species and their threats, including authors of publications that were either inaccessible or required clarification. Available information was only excluded in the rare instances that a reference only provided information that was adequately addressed in the status review (information from multiple field guides) or when we were unable to assess the quality of the reference (e.g. only an abstract was available). One NMFS biologist authored this status review report. However, this document was reviewed internally by other NMFS staff to ensure consistency with previous status reviews conducted by NMFS. Thus, this status review is a product of NMFS and reflects the collective knowledge and understanding that the agency possesses of these two species of guitarfish.

Life History and Ecology

Taxonomy and Distinctive Characteristics

Guitarfishes are cartilaginous fishes (class *Chondrichthyes*), in the subclass *Elasmobranchii* (which includes all cartilaginous fishes except chimaeras). They are part of the super order *Batoidea*, and members of the order *Rajiformes*, which also includes skates, sawfishes, electric rays, and rays. *Rajiformes* are characterized by a dorsoventrally depressed body with the anterior edge of the pectoral fin attached to the side of the head (Serena 2005). Guitarfishes are members of the family *Rhinobatidae*, which have a moderately depressed, elongated, shark-like body form, with pectoral fins barely enlarged (compared to other batoids except for sawfish), a subtriangular disk, two sub-equal, well-developed, and well-separated dorsal fins, and an elongated, wedge-shaped snout. Guitarfishes have a stouter tail than all other batoids except sawfishes and torpedo rays (Bigelow & Schroeder 1953; Capapé et al. 1981; Serena 2005).

[1] See http://www.nmfs.noaa.gov/pr/species/petition81.htm for the Federal Register notices.

Blackchin guitarfish (*Rhinobatos cemiculus*) have a brown dorsal surface with a white underside and usually a blackish blotch on the snout, especially in juveniles. Their rostral ridges are narrowly separated and nearly join in the front (see fig. 1). Their anterior nasal lobes extend little if any and their posterior nasal flaps are narrow. Their spiracle has two well-developed folds of about the same size. They have no anal or dorsal spine and have thorns present around the inner margin of their orbits, between their spiracles, on their shoulders, and along the midline of their disc and tail (Melendez & Macias 2007). This species is also referred to in some publications, including the International Union for Conservation of Nature (IUCN) status report for the species, as *Glaucostegus cemiculus* (Notarbartolo di Sciara et al. 2007a).

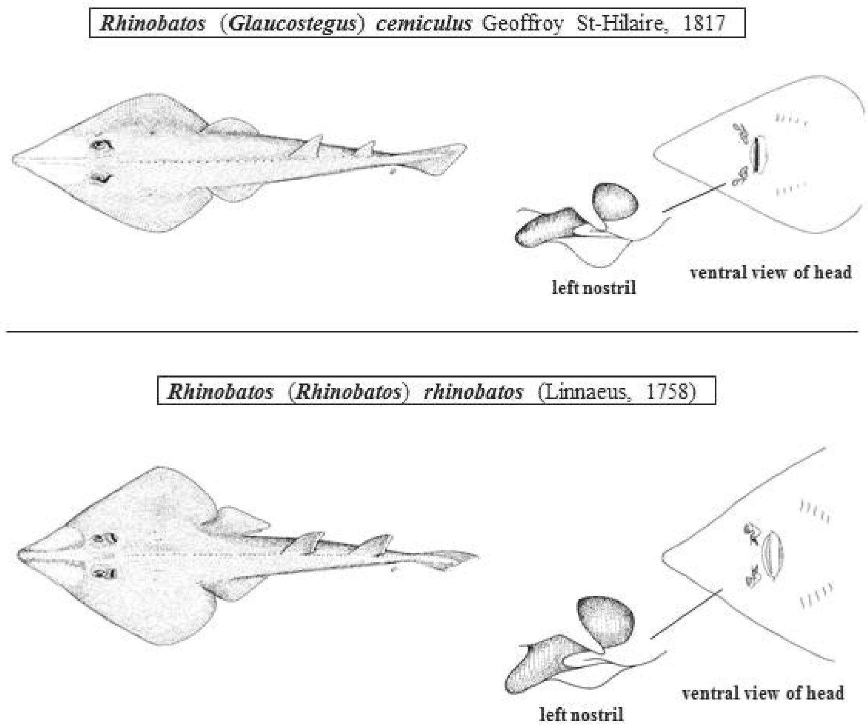

Figure 1: Dorsal and ventral view of *R. rhinobatos* and *R. cemiculus.* Modified from Serena (2005)

Common Guitarfish (*Rhinobatos rhinobatos*) are khaki-brown colored on their dorsal surface with a white underside (Melendez & Macias 2007). *R. rhinobatos* have rostral ridges that are widely separated over their entire length with the anterior of their nasal lobe level with the inner corner of their nostril (see fig. 1). They have a wide posterior nasal flap and spiracles with two moderately developed folds, with the outer fold more prominent. They have no dorsal or anal spines and relatively small thorns present around the inner margin of their orbits, between their spiracles, on their shoulders and along the midline of their discs and tails (Melendez & Macias 2007). Compared to the blackchin guitarfish, the common guitarfish has wider disk relative to body length (Capapé et al. 1981).

Historical Range and Habitat Use

Rhinobatos rhinobatos and Rhinobatos cemiculus are sympatric species with relatively wide, overlapping ranges in the subtropical waters of the eastern Atlantic and Mediterranean. In the Atlantic both species likely ranges' span from Spain south to Angola, with *R. rhinobatos* extending slightly farther north into the Bay of Biscay in south Atlantic France. Both species' ranges include all Mediterranean countries with the exception of Malta and France, which are only listed in the range of *R. rhinobatos*. Both species are primarily found in coastal and estuarine, sandy or muddy bottomed habitat from very shallow water to depths of approximately 100 m (Corsini-Foka 2009; Melendez & Macias 2007; Serena 2005). Information on distribution, abundance, life history, and biology throughout their ranges is incomplete but in the Mediterranean both species are more abundant in the warmer waters of the southern and eastern Mediterranean countries and they are represented, at least at the genus level, on historical checklists of the European Mediterranean countries (Capapé et al. 2006; Hadjichristophorou 2006; Psomadaki et al. 2012; Psomadakis et al. 2009). In the eastern Atlantic, both species appear to be more historically abundant in African waters than in European waters, as we were able to find almost no information on their occurrence or abundance off the Atlantic coasts of France, Spain, and Portugal. In parts of their ranges, both species have been found in hyperhaline waters (Capapé et al. 2004; Simier et al. 2004).

Historically, fisheries data on these species have often reported at the genus level (e.g. *Rhinobatos* spp. or guitarfish). In the Mediterranean the only other species that could possibly be reported at the general level of guitarfish is *Glaucostegus halavi*, which is known from one record and this record is in question (Bradai et al. 2012). If this record is found to be valid this species would be considered an alien, Lessepsian migrant (species that come through the Suez Canal) from the Red Sea (Ben Souissi et al. 2007; Lteif 2015). Therefore, it is safe to assume that reported catch of guitarfishes in the Mediterranean refers to the species of interest to this status review. In the Atlantic, *R. rhinobatos* and *R. cemiculus* co-occur with the white-spotted guitarfish (*Rhinobatos albomaculatus*) from Senegal to Angola (Séret & Valenti 2009a) and the spineback guitarfish (*Rhinobatos irvinei*) from Morocco to Angola (Séret & Valenti 2009b).

Rhinobatos rhinobatos inhabits coastal, sandy bottom habitat from the intertidal zone to about 100m throughout coastal subtropical waters in the entire Mediterranean Sea and the eastern Atlantic from the Bay of Biscay in France to Angola (Capapé et al. 1975; Melendez & Macias 2007; Serena 2005). In the Mediterranean they are most common along the southern and eastern coasts with the greatest concentrations occurring in Tunisia (Echwikhi et al. 2012), Libya (UNEP 2005), Egypt (Abdel-Aziz et al. 1993), southeastern Turkey (Ismen et al. 2007), Israel (Golani 2006), Lebanon (Lteif 2015), and Syria (Saad et al. 2006). Dating back to the 1950s and 1960s, *Rhinobatos rhinobatos* were caught as bycatch in fisheries in the Northern Mediterranean, but are now likely extirpated throughout the area (Baino et al. 2001; Capapé et al. 2006; Notarbartolo di Sciara et al. 2007b; Psomadakis et al. 2009; Séret & Serena 2002). In areas where they have been extirpated, overexploitation likely played a key role (Capapé et al. 2006; Psomadakis et al. 2009).

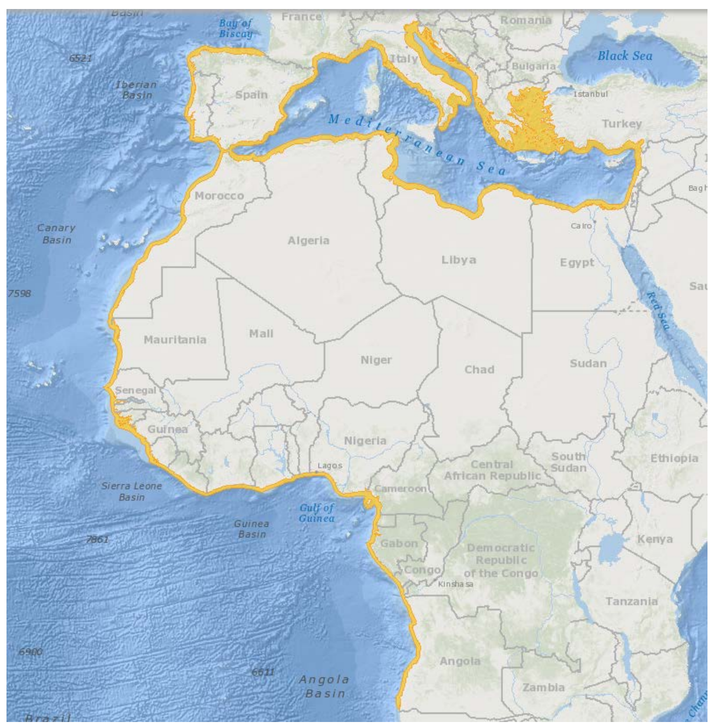

Figure 2: Likely historical range of *R. rhinobatos (IUCN 2007a)*

There is little information available on *R. rhinobatos* in the European portion of its Atlantic range but it was likely not common in this portion of its range (ICES 2016). Along the west coast of Africa *R. rhinobatos* was very frequently recorded from Mauritania to Sierra Leone (Diop & Dossa 2011). It is likely rare in Moroccan waters (Gulyugin et al. 2006), and it is present in Gabon, where it is currently less abundant that *R. cemiculus* . There is little information on the historical abundance of *R. rhinobatos* throughout the rest of its African range.

Figure 3: Likely historical range of *R. cemiculus* (IUCN 2007b). Note that this map includes the Mediterranean coast of France where no records of *R. cemiculus* have been reported (Akyol & Capapé 2014).

Rhinobatos cemiculus has a similar but more restricted range than *Rhinobatos rhinobatos,* inhabiting sandy and muddy bottom habitat from the intertidal zone to about 100m. In the Atlantic it occurs from northern Portugal to Angola, and in the Mediterranean it primarily occurs along the North African shore and the Eastern basin. Along the Mediterranean European shores it has been reported in Italian waters, especially in the south, and around Balearic Islands of Spain, but has not been reported in French waters (Akyol & Capapé 2014; Capape & Zaouali 1994; Notarbartolo di Sciara et al. 2007a). In the eastern Mediterranean, it has been rarely reported at the species level in the Aegean Sea (Akyol & Capapé 2014; Filiz et al. 2016) with one occurrence reported in the Sea of Marmara (C. Mancusi, ARPAT, pers. comm. to B. Newell, NMFS, 23 March, 2016), the small sea that connects the Aegean and Black Seas. In the eastern Mediterranean basin, it is historically common from Southeastern Turkey to Israel along the eastern Mediterranean shore (Golani 2006; Lteif 2015; Saad et al. 2006) and also is present in Egyptian waters (Capape & Zaouali 1994). Along the North African coast it is present in Morocco and northern Tunisia and historically abundant in bays along eastern Tunisia (Capape & Zaouali 1994). They are considered a commercially important species in Libya, indicating that they were at least historically abundant (UNEP 2005).

There is little information available on *R. cemiculus* in the European portion of its Atlantic range but it was likely not common in this portion of its range (ICES 2016). Along the west coast of Africa *R. cemiculus* was historically abundant from Mauritania to Sierra Leone (Diop & Dossa 2011) as well as in Gabon (De Bruyne 2015) and likely rare in Moroccan waters (Gulyugin et al. 2006; Litvinov & Kudersky 2004). We found little information on the historical abundance of *R. cemiculus* throughout the rest of its African range.

Feeding and Diet

Rhinobatos rhinobatos primarily consumes a variety of macrobenthic organisms, including crustaceans, fishes, and mollusks, throughout its life history (Basusta et al. 2007; Enajjar et al. 2007; Lteif 2015; Patokina & Litvinov 2005). Basusta et al. (2007) also found pelagic species in *R. rhinobatos* stomachs and concluded that these fish are indiscriminate predators, preying on species that are available regionally and seasonally. Basusta et al. (2007) did not discuss if the pelagic species were consumed alive or dead (e.g. scavenged from the bottom) but they did discuss the ability of some skates to feed in the water column, alluding to the possibility that *R. rhinobatos* may be capable of this behavior. One analysis of stomach contents in the Gulf of Gabès, Tunisia concluded that crustaceans were the most important prey for juveniles and crustaceans and fishes were the primary prey for adults (Enajjar et al. 2007). In Sierra Leone, crustaceans were the most important prey in sampled *R. rhinobatos* (Patokina & Litvinov 2005). In Senegal and southern Guinea Bissau, *Parapenaeopsis atlantica* and other species of shrimp made up 52.4% of the stomach contents in sampled *R. rhinobatos*.

Rhinobatos cemiculus has a similar diet and similar feeding habits to *Rhinobatos rhinobatos*, feeding all year without exhibiting seasonal variation between sexes or maturity stages (Capapé et al. 2004).

Reproduction and Growth

Both *Rhinobatos rhinobatos and Rhinobatos cemiculus* are aplacental viviparous species (giving birth to live, free swimming young with embryo nutrition coming from a yolk sac rather than a placental connection). They are characterized as having a partially defined annual reproductive cycle with one or two peaks in reproductive activity throughout the year. Specifically, vitellogenesis (the development of ovarian oocyctes) takes place while embryos develop in the uterus (Capape & Zaouali 1994; Çek et al. 2009; Seck et al. 2004). This reproductive strategy is one of three common strategies in elasmobranchs, along with reproducing throughout the year or exhibiting a well-defined annual cycle, with clearly defined periods of reproductive activity interspersed between periods of inactivity (Çek et al. 2009).

Both species aggregate seasonally to reproduce, with females visiting protected shallow waters to give birth (Capape & Zaouali 1994; Demirhan et al. 2010; Echwikhi et al. 2013; Ismen et al. 2007). As with many other elasmobranchs, females mature later and at greater sizes than males, females reach greater total length (TL), and female fecundity increases with TL (Capape & Zaouali 1994; Cortés 2000; Demirhan et al. 2010; Enajjar et al. 2008; Ismen et al. 2007). *Rhinobatos cemiculus* is more prolific than *R. rhinobatos*, likely because it reaches a greater size (Capape & Zaouali 1994). In some fishes, larger, more fecund individuals also produce higher quality offspring who are more resilient to ecosystem changes and food shortages (Birkeland & Dayton 2005) although we found no research on this correlation in guitarfishes.

There is some conflict in the literature regarding the rates of reproduction, growth, and time it takes for these species to mature. According to Çek et al. (2009) the concurrent ovarian and uterine cycles may result in relatively high reproductive potential. This conflicts with the results reported by Capape and Zaouali (1994), Enajjar et al. (2008), and Ismen et al. (2007), who each characterize either *R. rhinobatos* or *R. cemiculus* as having low reproductive rates. Regarding growth, a study using growth bands in vertebrae of *R. rhinobatos* estimated a von Bertalanffy growth parameter k value of 0.159 and characterized it as a “higher growing species” relative to other elasmobranch species (Başusta et al. 2008). Ismen et al. (2007) also used vertebral growth bands to estimate von Bertalanffy growth parameters in *R. rhinobatos*, estimating k = 0.29. Similarly, Enajjar et al. (2012) characterized *R. cemiculus* as a “speedy growing species” compared to other elasmobranchs, reporting a k value of 0.202 for females and 0.272 for males. All three of these studies assumed that the vertebral bands indicated one year of growth, which Başusta et al. (2008) cautioned has not been verified.

By comparison, Cortés (2000) examined the life history patterns and correlations between traits related to body size, reproduction, age, and growth in sharks and identified three general life history strategies (see Table 1). Cortés (2000) further explained how each life history strategy relates to reproductive potential. Strategy 1 species have a high investment in a large number of small young born at a low percentage of their maximum size, which are probably highly vulnerable to early life predation. Strategy 2 species produce a small number of large young, which, of the three categories, are the least vulnerable to predation. Strategy 3 species produce a small number of small offspring, but these offspring are born at a higher percentage of their maximum size and grow more quickly than those of the other two strategies to overcome juvenile mortality.

These categories should be applied cautiously to both species since the analysis was based on lamniform and carcharhiniform sharks, and these are general categories into which species may not fit cleanly. Based on the available (but limited) information (k = 0.159-0.29 for R. rhinobatos and 0.202-0.272 for R. cemiculus), these species have a growth rate that is somewhere on the continuum between "fairly slow" (strategy 1) and "generally fast" (strategy 3) as defined by Cortés (2000). Based on other life history traits (discussed in detail in the *Rhinobatos rhinobatos* and *Rhinobatos cemiculus* subsections below), both species align mostly with strategy 3 species that produce a few small but fast growing young. Regardless of how their productivity compares to shark species, elasmobranchs as a group have low reproductive and growth rates compared to most bony fishes and other vertebrates, making them vulnerable to fishing pressure and other threats (Cortés 2000; Dulvy et al. 2014). It is likely that there are regional differences in reproduction and other life history traits of both species (Çek et al. 2009; Ismen et al. 2007; Seck et al. 2004).

Table 1: **Shark Life History Strategies Identified by Cortés (2000)**

Strategy	Litter size	Longevity (years)	Body Size (TL in cm)	Offspring Size (TL in cm)	Growth Rate (von Bertalanffy growth parameter k)
1	Large	Variable but generally high	Intermediate to large	Small offspring	Fairly slow
1	Median n = 41	Median = 17	Median = 244	Median = 39	Median k = 0.117
1	Range = 31-135	Range = 9-53	Range = 155-450	Range = 20-78	K range = 0.07-0.25
2	Small	Generally high	Large	Large	Slow
2	Median n = 10	Median = 22	Median = 371	Median = 85	Median k = 0.08
2	Range = 2-14	Range = 14-39	Range = 234-640	Range = 62.5-174	K range = 0.04-0.12
3	Small	Low to moderate	Small to moderate	Small offspring	Generally fast
3	Median n = 8	Median = 9	Median = 152	Median = 35	Median k = 0.21
3	Range = 5-15	Range = 4.5-22	Range = 78-247	Range = 24 -67	K range = 0.11-1.01

Rhinobatos rhinobatos total length and weight data vary throughout their range (see table 2). The minimum total length reported for a juvenile specimen in any study was 15 cm by Ambrose et al. (2005), who collected two *R. rhinobatos* ranging from 15-28 cm while researching bycatch composition in coastal shrimp trawls fisheries in Nigeria. The maximum TL reported for an adult *R. rhinobatos* is 185 cm, which was recorded Israeli waters (Edelist 2014). According to Capapé et al. (1981), Collignon and Aloncle (1972)[2] reported a maximum TL of approximately 2 m, but we were unable to find the source publication. Females reach a greater maximum TL than males (Abdel-Aziz et al. 1993; Capapé et al. 2004; Enajjar et al. 2008; Lteif 2015). Compared to the available length data, there are fewer weight data reported in the literature (see table 2). The lowest reported weight for a free swimming juvenile specimen is 70g, reported by Başusta et al. (2012), although it should be noted that the smallest specimen reported in that study was 35 cm, larger than the minimum TL of 15 cm. The heaviest adult specimen of *Rhinobatos rhinobatos* recorded was 26.6 kg (TL 185 cm)(Edelist 2014).

The TL at which 50% of the population reached sexual maturity ranged from 68-78.57 cm for males and 69-87 cm for females (see table 3). The Ismen et al. (2007) study, which had the lowest TL at 50% maturity for females, included no adult females and only five subadult females out of a total of 225 specimens, which likely skewed the results. Lteif (2015) attributed the variations between length and maturity ranges to the lack of wide ranging, consistently collected data, and to regional differences in environmental and ecological conditions. Capapé et al. (1999) found that the max TL and size at maturity were lower for common guitarfish off of Senegal, compared to similar studies in Egypt and Tunisia. This result is notable because Capapé et al. (1996) found that six out of seven studied elasmobranchs that are found off both Senegal and Tunisia, including *R. cemiculus*, are larger off Senegal than Tunisia.

Throughout most of *R. rhinobatos'* range, it appears parturition occurs between August and November (see table 4). In Lebanese waters, based on the collection of one late term pregnancy specimen, parturition may occur after December (Lteif 2015). The available data show neonates and late term pregnant females were found up to at least 2005 in the Gulf of Gabès, Tunisia (Enajjar et al. 2008) and İskenderun Bay, Turkey (Çek et al. 2009), up until 1990 in Alexandria, Egypt (Abdel-Aziz et al. 1993), and up until 1998 off Ouakam, Senegal (Capapé et al. 1999). Capapé et al. (2004) synthesized information from different sources and fish market observations in the Bahiret El Biban (a lagoon south of the Gulf of Gabès). No specific dates were given for data collection, but, based on data from the 1980s and 1990s, neonates and pregnant females are known to occur in the area. The presence of neonates and pregnant females may indicate that these are nursery areas for young *R. rhinobatos* (Bradaï et al. 2006). Based on the length of the two specimens collected by Ambrose et al. (2005), neonates likely occur in Nigeria along the Lagos Coast, which is a nursey area for many species. In addition to these areas, the waters of Lebanon may be an important reproductive area for *R. rhinobatos.* In a small sample of *R. rhinobatos* from Lebanese waters (n = 67) collected from fishers from 2012-2014, a few pregnant females were found, including one late term pregnancy female with fully developed embryos (Lteif 2015).

One litter per year is likely (Capapé et al. 2004), although the possibility of two litters per year was suggested by the results of an early study (Capapé et al. 1975). Embryonic diapause, the delay of embryo development to time parturition with favorable environmental conditions such as warmer water temperatures, has been observed in *R. rhinobatos* in Tunisian waters (Capapé et al. 2004; Enajjar et al. 2008). In Tunisia and Egypt male and female *R. rhinobatos* have coordinated late-summer peaks in reproductive potential (Abdel-Aziz et al. 1993; Enajjar et al. 2008). Çek et al. (2009) and Demirhan et al. (2010) found no such coordination in Turkish waters, indicating that, in these waters, females may be storing sperm. Based on the available information there appears to be regional variations in reproductive strategies.

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[2] Collignon, J. & Aloncle, H., 1972. Catalogue raisonne des poissons des mers marocaines, I: Cyclostomes, selaciens, Holocephales. Bull. Inst. Peches marit. Maroc, 19, 1-164.

Only one study was found that estimates the relationship between length and age of *R. rhinobatos*. It was conducted by Başusta et al. (2008) in İskenderun Bay, Turkey and the maximum age recorded was 24 years old (see fig. 4). Comparing these data with the length at 50% maturity results from Demirhan et al. (2010), a study also conducted in İskenderun Bay that has results relatively consistent with the other length at maturity studies with adequate data, it is possible to estimate that *R. rhinobatos* matures between the ages of two and four years old. Males and females between one and three years old were the most abundant age groups in Başusta et al. (2008) (see fig. 5).

Table 2: **Total Length and Weight Data for *Rhinobatos rhinobatos***

TL range (cm)	Weight range (g)	Location	Months & years sampled	n	Reference
48-123 107 male max TL	Not reported	Gulf of Gabès, southern Tunisia	June-Sept 2007 & 2007	44	Echwikhi et al. (2013) *Longline fishery study
53-118 112 male max TL	Not reported	Gulf of Gabès	April-June 2007 & 2008	41	Echwikhi et al. (2012) *Gillnet fishery study
Range not given 100 male max 120 female max	Not reported	Gulf of Gabès	2001-2005 Year round	498	Enajjar et al. (2008)
140 male max 162 females max	Not reported	Tunisian coast, primarily Gulf of Gabés	1970-1990	648	Capapé et al. (1997)
24 – 181 172 male max	20,000 female max 16,000 male max	Waters off Alexandria, Egypt	Jan-Dec 1990	438	Abdel-Aziz et al. (1993)
50 – 143 TL 114 male max TL *Neonates likely excluded by gear	410 – 10,000 5500 male max weight	Waters off Lebanon	Dec 2012 – Jan 2014	67	Lteif (2015)
23-185 Largest specimen female	26,550 female max weight	Israeli continental shelf	Oct 2008 – Dec 2011	16	Edelist (2014)
35 – 125	70 – 5000	İskenderun Bay, Turkey	May 2010-July 2011	20	Başusta et al. (2012)
39-147 121 male max	121-13,042 5,586 male max	İskenderun Bay, Turkey	April 2004-Dec 2015	115	Başusta et al. (2008)
22.2 – 120 81 female max	4,600 male max weight 1300 female max weight	İskenderun Bay, Turkey	April 1999-Feb 2000	225	Ismen et al. (2007)
15-28	510 combined weight of two specimens	Waters off Lagos, Nigeria	Jan-Dec 2002	2	Ambrose et al. (2005)

Table 3: **Total Length at Maturity Data for *Rhinobatos rhinobatos***

TL at 50% maturity (cm)	TL range in which specimens reached sexual maturity (cm)	Location	Months & years sampled	n	Reference
68.96 male 79.1 female	All males with TL > 70 mature Smallest gravid female = 75	Gulf of Gabès, southern Tunisia	2001-2005 Year round	498	Enajjar et al. (2008)
Not reported	65-75 males 70-85 females	Tunisian coast, primarily Gulf of Gabés	1970-1990	648	Capapé et al. (1997)
70 male 87 female	65 – 76 male 74 – 98 female	Waters off Alexandria, Egypt	1990 Year round	438	Abdel-Aziz et al. (1993)
78.57 male 84.73 female	Not reported	Waters off Lebanon	Dec 2012 – Jan 2014	67	Lteif (2015)
70 male 86 female	Not reported	İskenderun Bay, Turkey	2005 Year round	114	Demirhan et al. (2010)
68 male 69 female	54-95 males	İskenderun Bay, Turkey	April 1999-Feb 2000	225[3]	Ismen et al. (2007)
Not reported	62-66 males 78 female	Ouakam, Senegal	1994-1998	239	Capapé et al. (1999)

[3] 191 of the 225 sampled individuals in Ismen et al. (2007) study were juveniles. 15 males and 5 females were subadults. 14 males and 0 females were adults. The authors state that the TL at 50% maturity is lower than most other studies likely due to the insufficient number of individuals caught in the larger length groups during the sampling period.

Table 4**: Select Reproductive Life History Traits of *Rhinobatos rhinobatos***

TL of mature females (cm)	Ovarian fecundity	Uterine fecundity	Gestation period	Spawning season	Location	Number of mature females	Reference
90-108	6	4-6 Mean 5.3	4 months	Not reported	Gulf of Gabès, southern Tunisia	11	Capapé et al. (1975)
75-120	2-25 Mean 8.95	1-13 Mean 5.34	10-12 months Parturition Aug.-Sept.	June-Aug	Gulf of Gabès	199	Enajjar et al. (2008)
80-162	6-12	4-8	9 months Parturition Aug.-Sept.	Not reported	Tunisian coast, primarily Gulf of Gabés	Not reported	Capapé et al. (1997)
86-181	8-27 Mean 18	8-14 Mean 12	9 months Parturition Aug.-Nov.	July –Sept	Waters off Alexandria, Egypt	49	Abdel-Aziz et al. (1993)
75-146	Not reported	Not reported	Not reported	Spring	İskenderun Bay, Turkey	n = 114 for all sexes	Demirhan et al. (2010)
78-153	4-10	4-8	10-12 months Parturition Oct.	Not reported	Ouakam, Senegal	87	(Capapé et al. 1999)

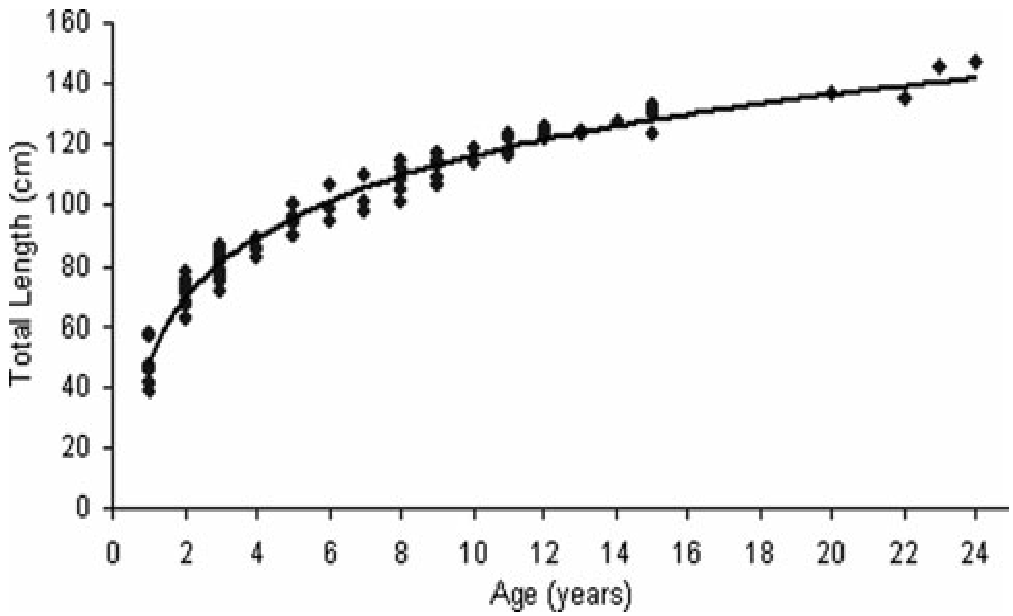


Figure 5: Von Bertalanffy growth curve for *R. rhinobatos* fitted from observed lengths-at-age with both sexes combined (Başusta, N. et al., 2008)

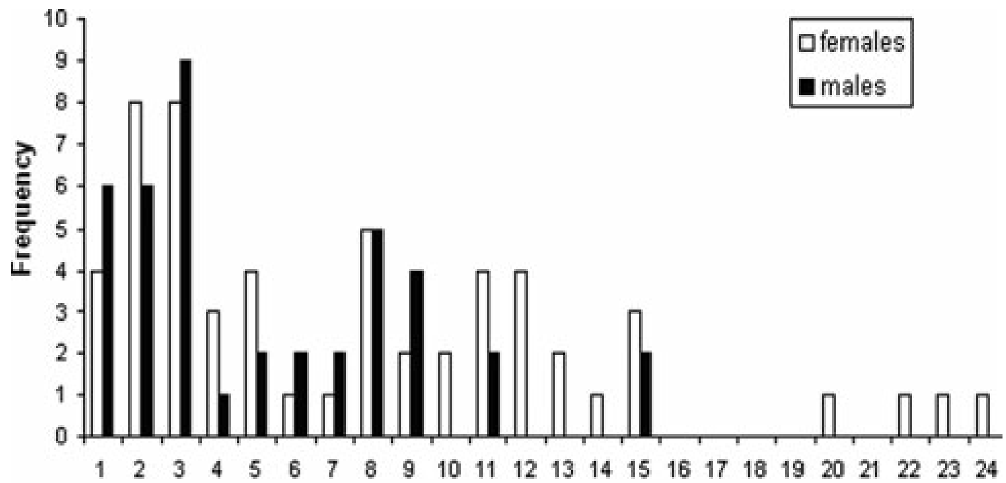


Figure 4: Age-frequency distribution of *R. rhinobatos* in İskenderun Bay, Turkey (Başusta, N. et al., 2008)

Rhinobatos cemiculus reaches a greater TL and weight (see tables 2 and 5) and matures at a greater TL (see tables 3 and 6) than *R. rhinobatos*. The maximum TL and weight data vary throughout their range (see table 5). The minimum TL reported for a juvenile *R. cemiculus* is 32 cm in İskenderun Bay (Başusta et al. 2012) and the maximum TL reported is 245 cm off the coast of Senegal (Seck et al. 2004). There are fewer available weight data than length data but the maximum reported weight was 26 kg in the Gulf of Gabès (Enajjar et al. 2012). Note that the maximum TL reported in Enajjar et al. (2012) is 202 cm TL, which is significantly smaller than the reported species maximum TL of 245 cm.

Relative to *R. rhinobatos*, there are fewer reproductive data available for *R. cemiculus* (see table 5). Based on the available data there are significant regional differences between *R. cemiculus* in the Mediterranean and West African Atlantic, with individuals reaching greater TL and TL at 50% maturity in the Atlantic (Başusta et al. 2012; Capape & Zaouali 1994; Echwikhi et al. 2013; Echwikhi et al. 2012; Enajjar et al. 2012; Lteif 2015; Seck et al. 2004; Valadou et al. 2006). In the Gulf of Gabès the TL for males and females at 50% sexual maturity is 111.8 cm and 138.1 cm, respectively, whereas in the Banc d'Arguin, these values were 138.1 cm for males and 153.3 for females. Enajjar et al. (2012) is the only study we found on the length – age relationships in *R. cemiculus*. This study in the Gulf of Gabès estimated the age at 50% maturity as 5.09 years old for females and 2.89 years for males, which is relatively young compared to many skate species. Similar to the age results reported for *R. rhinobatos*, young, immature individuals were more abundant than older, mature individuals and the maximum age recorded for females is much older than for males (see figs. 6 and 7) (Başusta et al. 2008; Enajjar et al. 2012).

Based on the limited data available, it appears that parturition occurs during August and September in the waters off Tunisia, Senegal, and Mauritania (see table 6). Data available up to the early 2000s show that neonates and late term pregnant females are found in the Gulf of Gabès (Bradaï et al. 2006), Bahiret El Biban (Capapé et al. 2004), coastal Senegal (Diatta et al. 2009; Seck et al. 2004) and in the waters of Banc d' Arguin National Park in Mauritania (Valadou et al. 2006), indicating that these may be nursery areas for young *R. cemiculus* (Bradaï et al. 2006). Neonates were also observed in İskenderun Bay, Turkey as recently as 2011 (Başusta et al. 2012; Çek et al. 2009). In Banc d'Arguin there are clear seasonal differences in sex ratio and maturity of individuals in coastal waters, with both males and females leaving the coastal area when mature. Mature females returned in July for the end of their gestation period and mature males returned in September to breed (Valadou et al. 2006). No embryonic diapause is suspected in *R. cemiculus* in Tunisian waters (Capapé et al. 2004; Capape & Zaouali 1994) but it has been observed in Senegalese waters (Seck et al. 2004) and in Banc d'Arguin (Valadou et al. 2006).

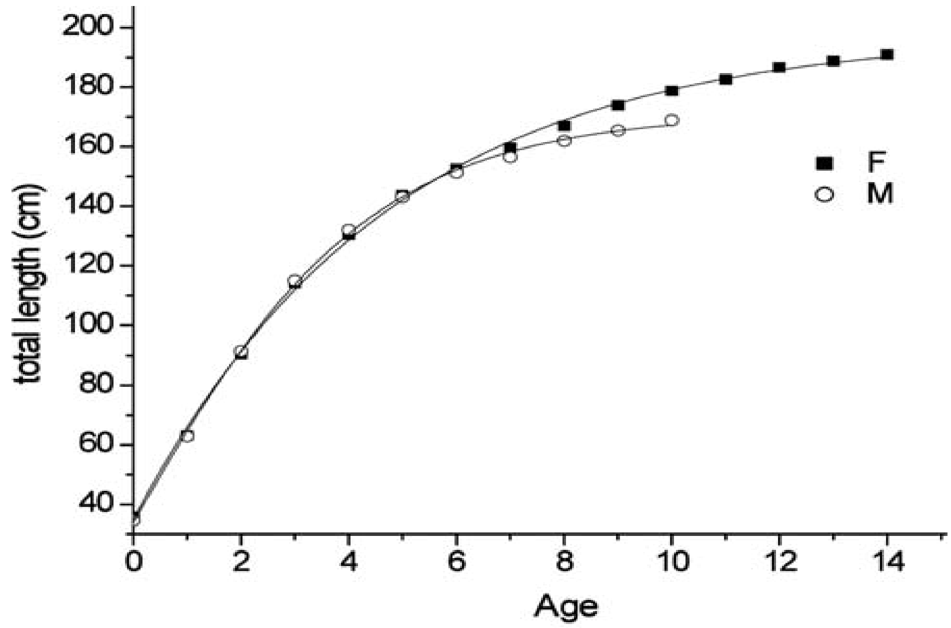


Figure 7: : Von Bertalanffy growth curves for *R. cemiculus* from the Gulf of Gabès, Tunisia, fitted from observed lengths-at-age data for females (F) and males (M) (Enajjar et al., 2012).

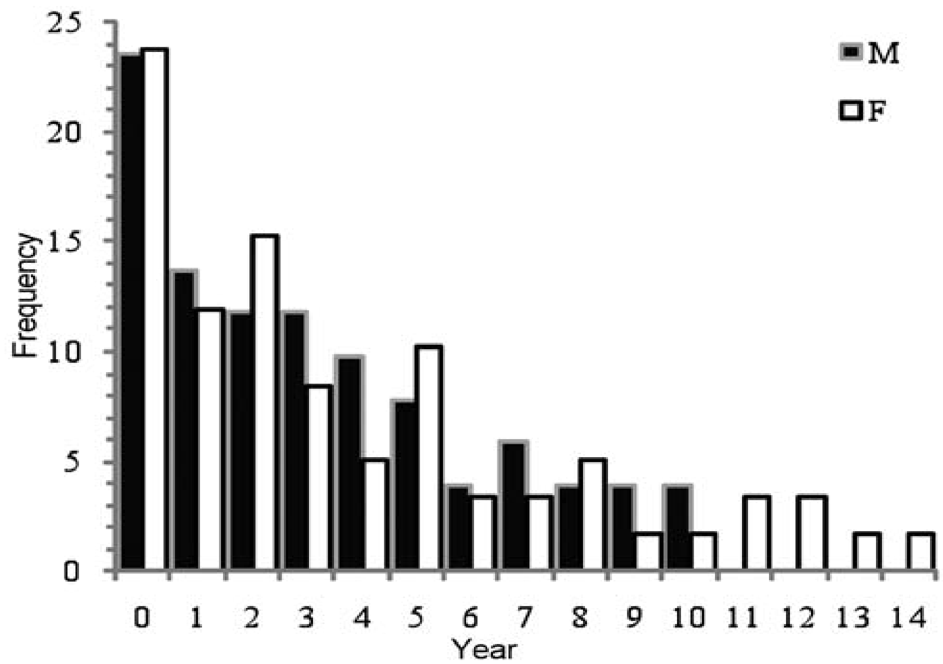


Figure 6: Age-frequency distribution of *R. cemiculus* in the Gulf of Gabès, Tunisia (Enajjar et al., 2012).

Table 5: **Total Length and Weight Data for *Rhinobatos cemiculus***

TL range (cm)	Weight range (g)	Location	Months & years sampled	n	Reference
32.36-230 192 male max TL	Not reported	Bahiret El Biban, southern Tunisia	All months 1970-1990	797	Capape and Zaouali (1994)
43-173 157 male max TL	Not reported	Gulf of Gabès, southern Tunisia	June-Sept 2007 & 2008	123	Echwikhi et al. (2013)
52-173 172 male max TL	Not reported	Gulf of Gabès	April-June 2007 & 2008	313	Echwikhi et al. (2012)
38-202 168 male max TL	180-26,000	Gulf of Gabès	2002-2004	513	Enajjar et al. (2012)
192 male max 215 females max	Not reported	Tunisian coast, primarily Gulf of Gabés	Not reported	238	Capapé and Zaouali (1981)
57.80-150	650-11,500	Waters off Lebanon	Dec 2012-Oct 2014	31	(Lteif 2015)
32-149	88-1,100	İskenderun Bay, Turkey	May 2010-July 2011	262	(Başusta et al. 2012)
40-245 234 male max TL *Neonates may have been discarded	145-5,500	Coastal Senegal	1994-2000 Year round	79	(Seck et al. 2004)
67-233 184 max female TL	Not reported	Waters off Ouakam, Senegal	Year round sampling for two years. Years not specified	39 (33 females)	Capapé et al. (1996)

Table 6: **Total Length at Maturity Data for *Rhinobatos cemiculus***

TL at 50% maturity (cm)	**TL range in which specimens reached sexual maturity (cm)**	**Location**	**Months & years sampled**	**n**	**Reference**
Not reported	≥112 females	Bahiret El Biban, southern Tunisia	1970-1990 Year round	797	Canapé and Zaouali (1994)
111.8 males 138.1 females	111-118 males 131-160* females *estimated	Gulf of Gabès, southern Tunisia	2002-2004	513	Enajjar et al. (2012)
Not reported	85-100 males 90-110 females	Tunisian coast, primarily Gulf of Gabés	Not reported	238	Capapé and Zaouali (1981)
Not reported	152-155 males ≥ 163 females	Coastal Senegal	1994-2000 Year round	79	Seck et al. (2004)
138.1 males 153.3 females	Not reported	Banc d' Arguin, Mauritania	1998-2002 Year round	2124	Valadou et al. (2006)

Table 7: **Select Reproductive Life History Traits of *Rhinobatos cemiculus***

TL of mature females	**Ovarian fecundity**	**Uterine fecundity**	**Gestation period**	**Spawning season**	**Location**	**Number of mature females**	**Reference**
112-230	6-16 Mean 9.16	5-12 Mean 7.52	Late winter/early spring-Sept 8 months	Not reported	Bahiret El Biban, southern Tunisia	170	Canapé and Zaouali (1994)
163 - 245	15-26	16-24	Spring-Aug 5-8 months	Not reported	Coastal Senegal	6	Seck et al. (2004)
Not reported	Not reported	2-4 typical 12 maximum	12 months Parturition in Sept	Sept.	Banc d' Arguin, Mauritania	Not reported	Valadou et al. (2006)

Distribution and Historical or Current Abundance

Mediterranean

The Mediterranean contains a diversity of habitat types and biogeographic regions. The two largest biogeographic regions are the eastern and western Mediterranean basins, which are roughly divided by the Straits of Sicily. This division is likely due to a combination of physical barriers, currents, and perhaps most importantly, temperature (Bianchi 2007). The Mediterranean has narrow continental shelves and limited area that is less than 100m depth, which is where these *Rhinobatos spp.* occur (see fig. 8d). The annual surface temperature shows high seasonality and regional features drive temporal thermoclines (Coll et al. 2010).

In the Mediterranean there is little quantitative information about guitarfish abundance over time, but there are some studies that qualitatively describe the abundance of these species. The best available information for both species comes primarily from studies that utilize specimens collected from fisheries. *Rhinobatos* spp. commonly occur in fishery landings, both as a target species and bycatch, from the east coast of Tunisia, east to Egypt, and along the eastern Mediterranean from Israel (and Palestine) north to southeastern Turkey (Abdel-Aziz et al. 1993; Capapé et al. 2004; Çek et al. 2009; Edelist 2014; ICES 2010; Lteif 2015; Saad et al. 2006). For species specific abundance information in these areas, see the ***Rhinobatos rhinobatos*** and ***Rhinobatos cemiculus*** subsections of this section. Both species' current core Mediterranean ranges appear to currently be restricted to the warmer southeastern Mediterranean and Levantine Sea. Bianchi (2007) reported that the 15º C winter isotherm (see fig. 9) likely restricts the range of many marine species. This isotherm corresponds roughly to these species' current known core ranges but we found no information on how this isotherm affects the distribution and abundance of guitarfishes.

Throughout the Mediterranean, species specific data on abundance and trends are lacking, but elasmobranchs as a group are declining. The best available information describes declines in elasmobranch diversity and abundance throughout the entire Mediterranean (Cavanagh & Gibson 2007).

In Tunisia, both guitarfishes are commonly fished species, although there is not much information about their historical abundance (Bradaï et al. 2006). The shelf off southern Tunisia is one of the most expansive areas of seafloor less than 100m depth in the Mediterranean (see fig. 8d), which likely contributes to relatively high abundance of both *Rhinobatos* species in this area. In both the Gulf of Gabès (the most prolific elasmobranch fishing area in Tunisia) and along the coast of Zarzis, reported elasmobranch landings grew steadily in the 1990s before declining despite increased fishing effort. While in the Gulf of Gabès these landings are simply reported at the level of elasmobranchs, in the Zarzis area, batoids saw a sharper decline than sharks (see fig. 10) (Echwikhi et al. 2012). Seventy percent of these landings were from artisanal fisheries, including gillnets and demersal longlines, which primarily targeted both guitarfish species along with three shark species, *Carcharhinus plumbeus, Mustelus punctulatus,* and *M. mustelus* (Echwikhi et al. 2012). The demersal longline fishery shifted to targeting elasmobranchs because of declines of the target grouper species (Echwikhi et al. 2013). In a study of the Gulf of Gabès elasmobranch gillnet fishery in 2007 and 2008, *R cemiculus* and *R. rhinobatos* combined to make up over 58% of the elasmobranch catch (52% and 6.81% respectively) (Echwikhi et al. 2012). In a similar study of the Gulf of Gabès demersal longline fishery the two species combined made up 43% of the elasmobranch catch (*R. cemiculus* 31.7% and *R. rhinobatos* 11.3%). The percentages reported reflect the total number of individuals. While total weight was not reported for the longline study, in the gillnet study, the two species combined made up over 67% of the total elasmobranch weight. Combining these two studies, mature females that were either pregnant carrying near term embryos or postpartum dominated the catch, and the vast majority of both species were retained (Echwikhi et al. 2013; Echwikhi et al. 2012). Given the high proportion of these species, especially *R. cemiculus*, in these artisanal fisheries catches, it is likely that the abundance trends for these species are similar to the overall trend of declining elasmobranch catches in southern Tunisia.

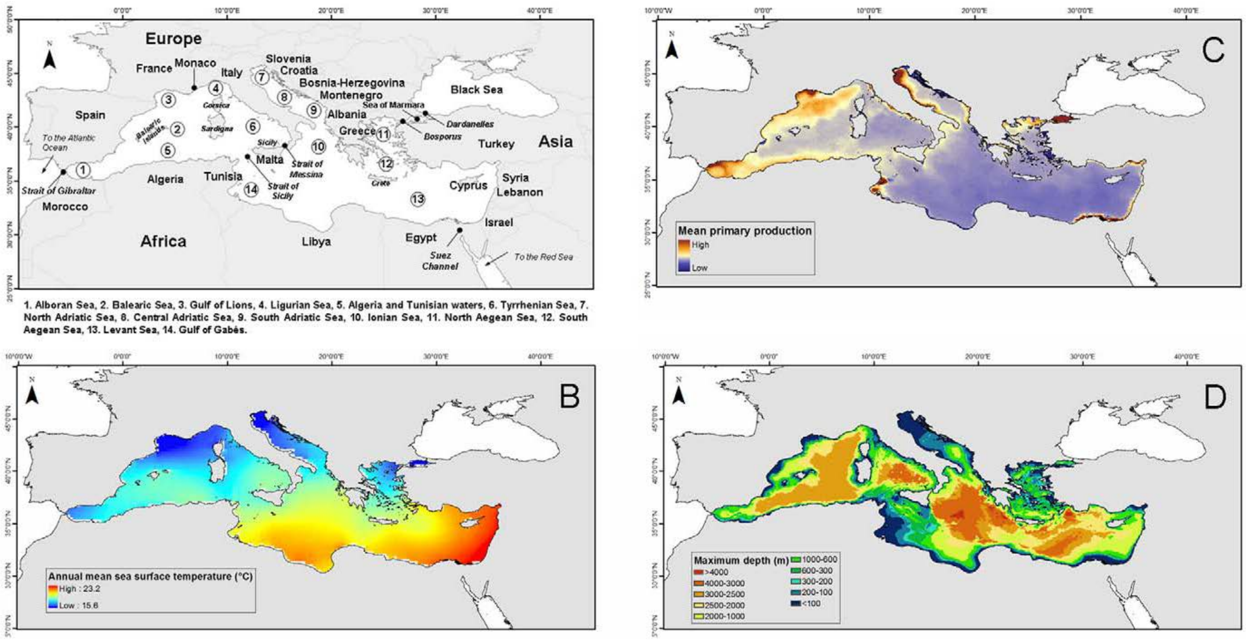


Figure 8: Biogeographic regions and oceanographic features of the Mediterranean Sea. (A) Main biogeographic regions, basins, and administrative divisions of the Mediterranean Sea, (B) Annual mean sea surface temperature (°C) (2003, NOAA), (C) Annual mean relative primary production (2002, Inland and Marine Waters Unit, Institute for Environment and Sustainability, EU Joint Research Centre, Ispra, Italy), and (D) maximum average depth (m) (NOAA)(Coll et al. 2014).

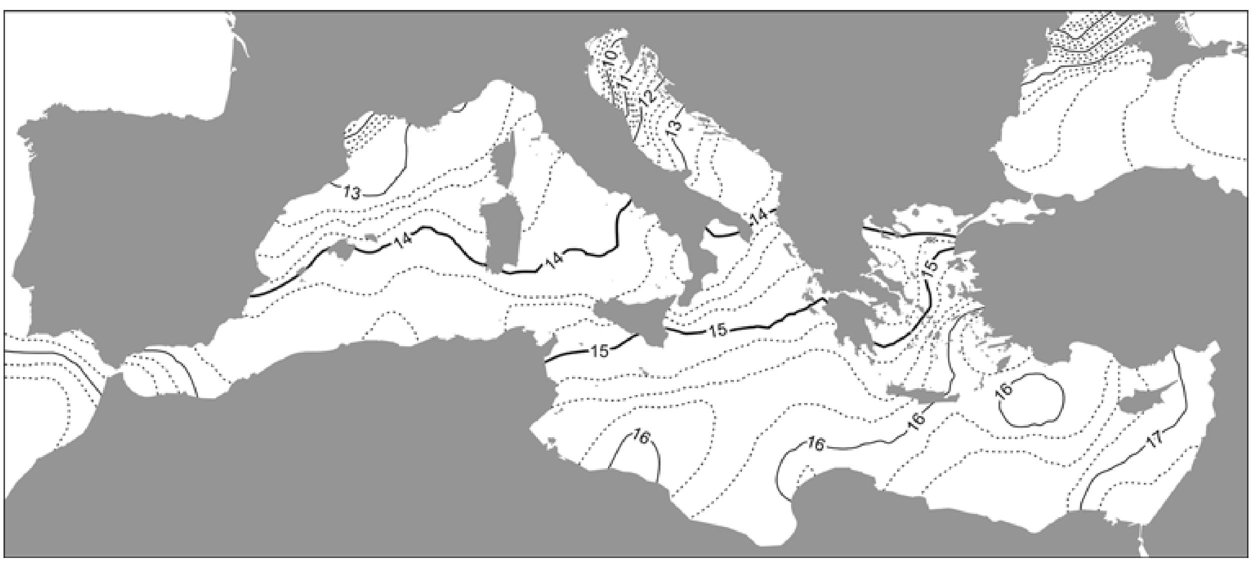


Figure 9: Surface isotherms of February (traced every 0.25°C) of the Mediterranean Sea (climatological means from the historical data set 1906–1995). The 14°C and the 15°C 'divides' are highlighted by a thicker tract. Modified after MEDATLAS (Brasseur et al., 1996). Source: Bianchi (2007)

Throughout the rest of the Mediterranean, both species are either far less abundant, their status is uncertain based on a lack of data, or their status is only described in qualitative terms. We could not find any data on either species in Algerian waters, although Algeria is included in their known ranges (Melendez & Macias 2007). Neither species was detected in any of the tows performed during the Mediterranean International Trawl Survey (MEDITS) survey, conducted from April-June, 1994 -2015. The areas of this survey (see fig. 11) included Mediterranean waters 10-800 m off Morocco, Spain, and France, the Tyrrhenian Sea including the coast of Corsica, Sardinia, and Sicily, and the Adriatic, Ionian, and Aegean Seas, as well as the coast of Cyprus (Bertrand et al. 2000; MEDITS 2016a). An analysis of the results of the MEDITS data generated from 6,336 tows from 1994 -1999 concluded that the data show clear signs of decline for many shark and ray species as well as an elevated risk of extirpation from the studied area for once common species (Baino et al. 2001).

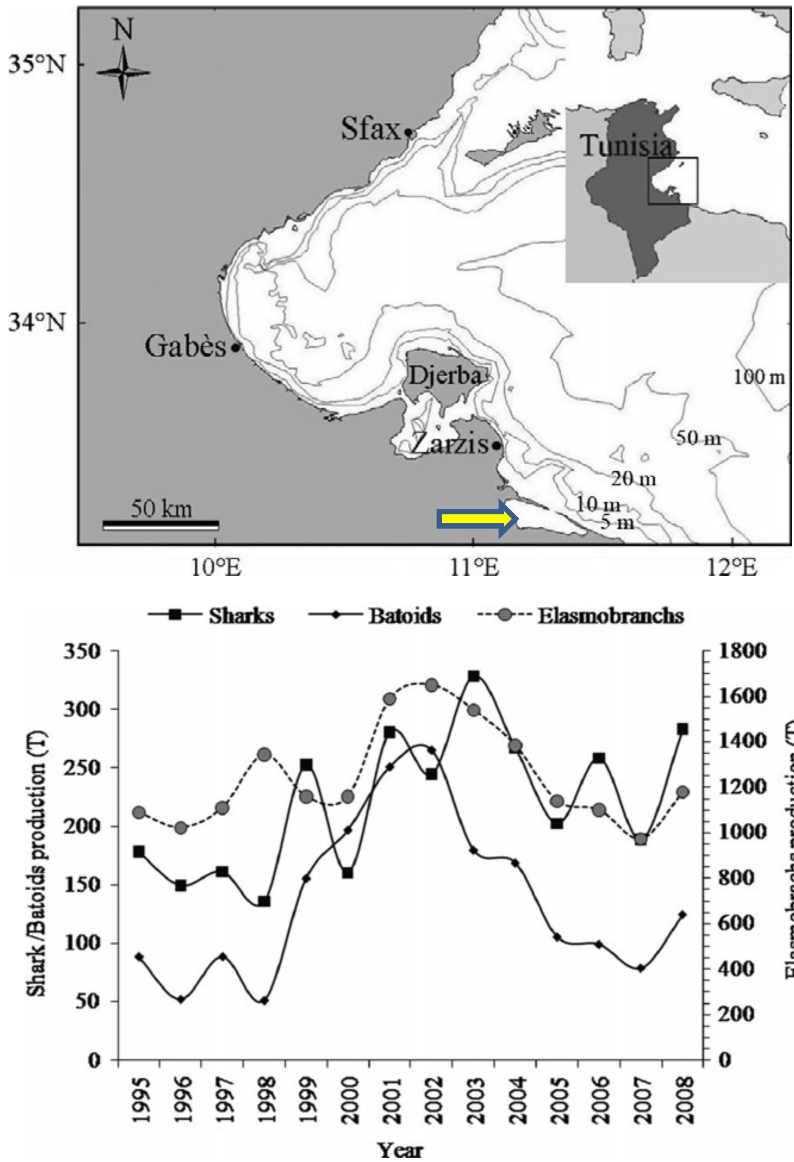


Figure 10: Map of Southern Tunisia (top) showing areas represented on the graph of reported elasmobranch landings in the Gulf of Gabès and shark and batoids landings off Zarzis (bottom). The yellow arrow on the map indicates where the Lagoon of the Bibans is, another important area for both *Rhinobatos* species. Figure modified from (Echwikhi et al. 2012)

Albania, which straddles the southern Adriatic Sea and the northern Ionian Sea, reported sporadic, low landings of *Rhinobatos spp.* to the Food and Agriculture Organization of the United Nations (FAO) from 1996 - 2008 (ICES 2010). 2008 is the last year these data are reported. Little context was provided in ICES (2010) so this data can simply be used to show that one or both of *R. cemiculus* and *R. rhinobatos* were present in Albania during this time period. Southeast of Albania, the historical abundance and current status of both species in Greek waters is very uncertain. ICES (2010) also reported Greek landings of *Rhinobatos spp.* from 1982-2008. These data showed a large growth in landings during the mid-1990s, peaking at 112 tons in 1996, and declining substantially starting in 2002 (see **Commercial Overutilization in the Mediterranean** for more information). As previously discussed, neither species were recorded in the MEDITS survey, which overlapped both spatially and temporally with the landings reported by ICES (2010).

Species-specific records from the entire Aegean Sea are sparse. Both species are present on historical Aegean Sea checklists (Bilecenoğlu et al. 2014). In the southeastern Aegean, off Rhodes, Greece (which is closer to mainland Turkey), Corsini-Foka (2009) characterized *R. rhinobatos* as "probably rare in the area under study as in the whole Mediterranean". The few records of *R. cemiculus* in the Aegean are relatively recent with the earliest being from 1995 off Rhodes (Corsini-Foka 2009), as well as the collection of two large *R. cemiculus* in İzmir Bay, Turkey in 2013 (Akyol & Capapé 2014), and one record in Kuşadası Bay, Turkey (Filiz et al. 2016). All of these occurrences were the first confirmed records of *R. cemiculus* in the Aegean and the status of this species in the area is poorly understood (Filiz et al. 2016). Neither species was recorded during a 2006-2007 survey of Saroz Bay, Turkey, in the far northeastern Aegean (Keskin et al. 2011). There is one recent record of *R. cemiculus* occurring in the Sea of Marmara, which connects the Aegean Sea to the Black Sea (C. Mancusi, ARPAT, pers. comm. to B. Newell, NMFS, 23 March, 2016). We found no other information indicating that either species occurs in the Sea of Marmara.

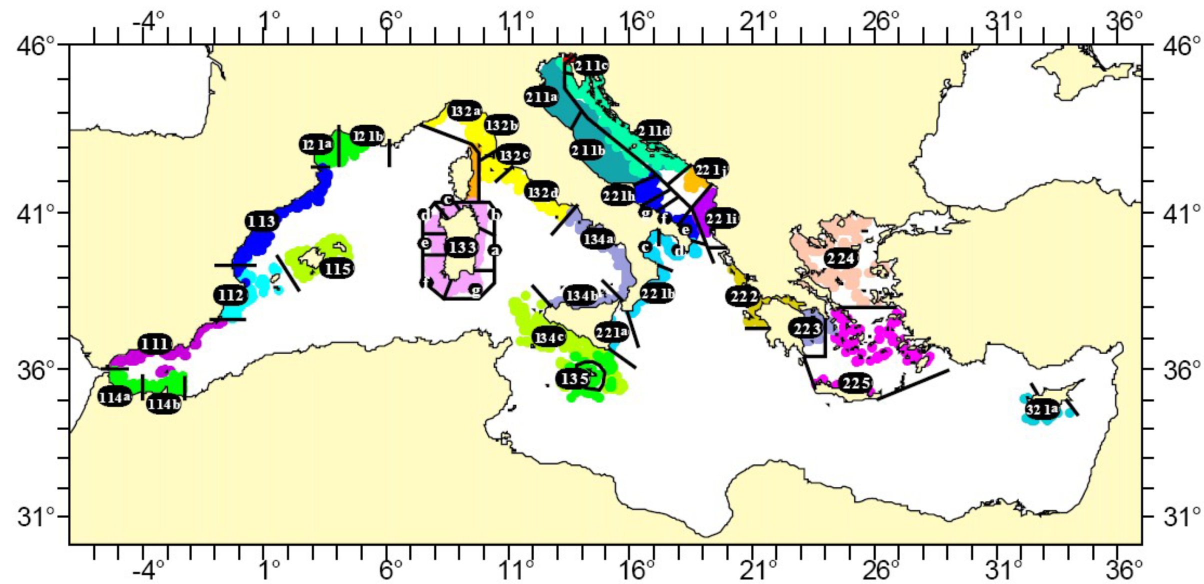


Figure 11: Map of Mediterranean with highlighted areas showing where MEDITS Survey trawls were conducted (MEDITS, 2016b)

In the Gulf of Lion off France, *R. rhinobatos* was historically caught occasionally by trawlers (Capapé et al. 2006; Capapé et al. 1975) but has since been extirpated (Capapé et al. 2006). Intensive fishing pressure in the Gulf of Lion has driven the local decline or extirpation of skate and ray species, many of which were once considered common in the area (Capapé et al. 2006). There are no records of *R. cemiculus* in Mediterranean French waters (Akyol & Capapé 2014) although France is considered part of its range (Melendez & Macias 2007). Both species were frequently recorded in the shallow waters around the Balearic Islands of Spain in the early 20th century, but have been extirpated (Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b)[4].

In the Tyrrhenian Sea, Psomadakis et al. (2009) concluded that *Rhinobatos* spp. had been extirpated from the Gulf of Naples, where *R. rhinobatos* specimens from the 19th century can be found at the Zoological Museum of Naples. *Rhinobatos cemiculus* is included on a historical checklist, and at least one of the two

[4] Both species abundance off the Balearic Islands is discussed in the IUCN Redlist assessment of these species. The reference for this information is a publication we could not find: de Buen, F. (1935). Fauna ictiológica: catálogo de los peces ibéricos: de la planicie continental, aguas dulces, pelágicos y de los abismos próximos, Imp. del Ministerio de marina

species was occasionally present in commercial trawl catches up until the 1960s (Fowler & Cavanagh 2005; Psomadakis et al. 2009). They are also extirpated from the Tyrrhenian waters of Sicily, where *Rhinobatos* spp. was landed more often than in the Gulf of Naples (Psomadakis et al. 2009). Doderlein (1884) describes *R. columnae* (a synonym of *R. rhinobatos*) as a common species in the waters of Sicily, especially in February, March, and April, most commonly appearing in the Palermo fish market in March. He also describes another, larger species of *Rhinobatos* spp. which has converging rostral ridges as opposed to the parallel ridges of *R. rhinobatos*, and that frequently occurred in the area, although it is less commonly than *R. rhinobatos*. He concludes that this species is *Glaucostegus halavi*, but based on the description and location it is far more likely he was describing *R. cemiculus*. The seasonal influx of *R. rhinobatos* and perhaps *R. cemiculus* described by Doderlein (1884) is similar to the seasonal shallow water congregation of breeding populations of both species throughout their ranges (see **Reproduction and Growth**) (Capape & Zaouali 1994; Demirhan et al. 2010; Echwikhi et al. 2013; Ismen et al. 2007). Based on the available information, of the portions of both species' ranges that they have been extirpated from, both species were likely most common in the waters around Sicily and the Balearic Islands. However, the historical abundance of these species in all of the areas where they have been extirpated is poorly understood.

Like the Gulf of Lion, the disappearance of *Rhinobatos* spp. and the decline in elasmobranch species in the Tyrrhenian Sea is attributed to intense fishing pressure and in this case, also the urbanization of the coastal zone (Psomadakis et al. 2009). A survey of old or retired fishermen in the Ligurian, Tyrrhenian, and Aegean Seas revealed that the majority of survey participants perceived that the importance of elasmobranchs to fisheries, both in terms of abundance and historical value, was at least two times higher that it is currently from the 1940s up until the end of the 1970s, with some surveyed individuals reporting much higher declines (Sartor et al. 2010). Similar trends are reported for the Adriatic Sea, which has seen an overall decrease in abundance and diversity of large elasmobranch species, although in this area *R. rhinobatos* has likely always been rare and *R. cemiculus* may have never been present (Akyol & Capapé 2014; Dulþiü et al. 2005; Jukic-Peladic et al. 2001).

Rhinobatos rhinobatos

Rhinobatos rhinobatos commonly occurs in fishery landings, both as a target species and bycatch from the east coast of Tunisia, along the north coast of Africa, and in the eastern Mediterranean from Israel to southeastern Turkey (Abdel-Aziz et al. 1993; Capapé et al. 2004; Çek et al. 2009; Edelist 2014; Lteif 2015; Saad et al. 2006). In Tunisia, it is fished throughout all of Tunisian waters. It is considered more adundant in the southeastern area around the Gulf of Gabès and the Bahiret el Biban, where it is less abundant than *R.* cemiculus, and known to use these areas during reproduction including for parturition (Capapé et al. 2004; Echwikhi et al. 2013; Echwikhi et al. 2012; Enajjar et al. 2008). *Rhinobatos rhinobatos* has become common in the Northern and Southern Lagoons in the Gulf of Tunis (near the city of Tunis on the northwest coast of Tunisia) since environmental restoration of the lagoons was completed in 2001 (Mejri et al. 2004; Noppen 2003). Little information was available for the status of *R. rhinobatos* in Libyan waters beyond the fact that they are targeted by fishers (Lamboeuf et al. 2000; Séret & Serena 2002). In a 2005 proposal for a research program focused on studying the cartilaginous fishes of Libya, the authors stated that some species, such as guitarfishes and angel sharks, which are now rare or extirpated in other parts of the Mediterranean, are still common in Libyan waters. Guitarfishes are consumed in Libya and *R. rhinobatos* and *R. cemiculus* were two of the eight species selected as priorities for research because of their commercial importance and interest in their conservation. In the 2005 proposal, *R. rhinobatos* is consistently present on checklists from Libyan waters dating back to 1973 (UNEP 2005). In neighboring Egypt, *R. rhinobatos* was a common occurrence in commercial fishery catches in 1990 (Abdel-Aziz et al. 1993).

Continuing along the coast, north of Egypt along the eastern coast of the Mediterranean, *R. rhinobatos* was considered common in Israeli waters as of 2006, with the largest TL for the species recorded from a female specimen in the area (Edelist 2014; Golani 2006). Lernau and Golani (2004) stated, "swarms of *Rhinobatos rhinobatos* are captured with purse seines." Although this statement is not connected to a specific fishing area it appears the authors are either discussing fishing activity along the Israeli coast or in the nearby Bardawil Lagoon on the Egyptian Sinai Peninsula. *Rhinobatos rhinobatos* is the most commonly observed elasmobranch in Lebanese fisheries, with intense fishing pressure in the northern part of the country potentially impacting the spatial distribution of elasmobranchs in the area (Lteif 2015). In a study of elasmobranch exploitation in Syria in the early 2000s *R. rhinobatos* was characterized as a "moderate economically important species either for being caught in little quantities with high efforts in fishing, or for their little demand for human consumption. Or maybe for both reasons." By comparison, *R. cemiculus* was characterized as "very economically important species being caught in plentiful quantities and highly consumable." (Saad et al. 2006). No clarification was given as to whether there is low catch with high effort, or low demand, but given that *R. cemiculus* has a high demand, it seems likely there would be a similar market for *R. rhinobatos.* Regardless, the fact that *R. rhinobatos* was characterized as "moderate" as opposed to "not" economically important indicates this fish is more than an occasional visitor to Syrian waters.

In the Levantine Sea waters of Turkey, *R. rhinobatos* is common in fisheries bycatch including in İskenderun Bay, where, as of 2012, it was less common than *R. cemiculus* (Başusta et al. 2012; Çek et al. 2009). West of İskenderun Bay, based on samples collected in the early 1980s, *R. rhinobatos* was also common in Mersin Bay (Gücü & Bingel 1994) and it was collected in a 2002-2003 survey of the Karataş Coasts (located between İskenderun Bay and Mersin Bay). *Rhinobatos rhinobatos* was not caught during a 2006 study of shrimp trawl bycatch in Mersin Bay (*R. cemiculus* was), although it should be noted that this study was limited to a few days of sampling (Duruer et al. 2008). In 2013 *R. rhinobatos* was also recorded in the Gulf of Antalya in 2013, which is west of Mersin Bay (C. Mancusi, ARPAT, pers. comm. to B. Newell, NMFS, 23 March, 2016). Individuals of all life history stages, including large quantities of pregnant females, have been captured in the Gulf of Gabès and the Bahiret el Biban (Capapé et al. 2004), Alexandria, Egypt (Abdel-Aziz et al. 1993), and İskenderun Bay (Çek et al. 2009).

As discussed in the **Mediterranean** subsection of the **Distribution and Historical or Current Abundance** section of this status review, throughout the rest of the Mediterranean, *R. rhinobatos* is either less abundant, or its status is unknown based on a lack of data. Based on the available data, *R. rhinobatos* occurred throughout all Mediterranean coasts (Capapé et al. 1975) but has now likely been extirpated from the Mediterranean coasts of Spain and France, as well as the Tyrrhenian, Ligurian, and Adriatic Seas (Bertrand et al. 2000; Capapé et al. 2006; MEDITS 2016a; Notarbartolo di Sciara et al. 2007b). Throughout these areas, the historical abundance of *R. rhinobatos* is uncertain, but the abundance and diversity of large elasmobranch species has declined (Baino et al. 2001).

In the Gulf of Lion, France, *R. rhinobatos* was likely rare until a few decades ago. Capapé et al. (2006) stated, "Grainer (1964) noted that the common guitarfish was occasionally captured by trawlers off the Languedocian coast. The captured specimens had 1m total length maximum. No recent capture of this species has been reported to date." Capapé et al. (1975) also report the occasional capture of *R. rhinobatos* by trawlers in the Gulf of Aigues-Mortes, which is in the Gulf of Lion. Intensive fishing pressure in the Gulf of Lion has driven the local decline or extirpation of skate and ray species, including many that were once considered common in the area (Capapé et al. 2006). *Rhinobatos rhinobatos* has also been extirpated from the Balearic Islands of Spain, where it was frequently recorded during the beginning of the 20th century (Notarbartolo di Sciara et al. 2007b).

Rhinobatos rhinobatos was likely always rare in the Adriatic where there has been an overall decrease in abundance and diversity of large elasmobranch species, with both *Rhinobatos* spp. considered rare dating back to at least 1948 and now considered extirpated (Dulþiü et al. 2005; Jukic-Peladic et al. 2001). In the Tyrrhenian Sea, Psomadakis et al. (2009) concluded that *Rhinobatos* spp. had been extirpated from the

Gulf of Naples, where *R. rhinobatos* specimens from the 19th century can be found at the Zoological Museum of Naples, and at least one of the two species was caught by fishers up until the 1960s (Fowler & Cavanagh 2005). In Italian waters, the only portion of *R. rhinobatos'* historical range where they may have once been common is the waters of Sicily, where *Rhinobatos* spp. were landed more often than in the Gulf of Naples (Capapé et al. 1975; Doderlein 1884; Psomadakis et al. 2009), but have since been extirpated (Psomadakis et al. 2009). Based on the available information, with the exception of the waters around Sicily and the Balearic Islands, the areas where *R. rhinobatos* has been extirpated were likely never part of their core range. However, because we found no information on how or if this species migrates or uses different parts of the Mediterranean at different times of the year (besides seasonally congregating to breed), it is unknown why these species were relatively rare in the area.

In the Aegean Sea, which is bound by the east coast of Turkey and the west coast of Greece, *R. rhinobatos* is rare (Corsini-Foka 2009), it is present on a checklist from 1969 (Bilecenoğlu et al. 2014), with one individual reported in 2008 and another in the 1970s (Corsini-Foka 2009), while no occurrences were detected during a 2006-2007 survey of Saroz Bay in the northeastern Aegean (Keskin et al. 2011).

Rhinobatos cemiculus

Rhinobatos cemiculus commonly occur in fishery landings, both as a target species and bycatch from the east coast of Tunisia, along the north coast of Africa, and in the eastern Mediterranean from Israel to southeastern Turkey (Capape & Zaouali 1994; Lteif 2015; Saad et al. 2006). In Tunisia, it is fished throughout all of Tunisian waters. Historically it is rare along the north coast and more adundant in the southeastern area around the Gulf of Gabès and the Bahiret el Biban, where this species is more abundant than *R. rhinobatos* and is known to use these areas during reproduction including for parturition (Capapé et al. 2004; Echwikhi et al. 2013; Echwikhi et al. 2012; Enajjar et al. 2008). In the Northern and Southern Tunis Lagoons, on the north coast of Tunisia, *R. cemiculus* has returned after a substantial environmental restoration effort (Mejri et al. 2004) and in recent years large numbers of *R. cemiculus* have been captured by fishers in northeastern Tunisia, indicating these fish are migrating north as the Mediterranean warms (Rafrafi-Nouira et al. 2015).

As with *R. rhinobatos*, little information is available on the status of *R. cemiculus* in Libyan waters beyond that this species is targeted by fishers and consumed by locals and that it may be more common in the area than in the greater Mediterranean (Lamboeuf et al. 2000; Séret & Serena 2002; UNEP 2005). *Rhinobatos cemiculus* is consistently present on checklists from Libyan waters dating back to 1939 (UNEP 2005). We found no information on the distribution of *R. cemiculus* in Egyptian waters but this fish occurs in this area (Capape & Zaouali 1994) and is likely less abundant than *R. rhinobatos* (A. Marbourk, NMFS, pers. comm. to B. Newell, NMFS, 26 July, 2016).

Continuing along the Mediterranean coast, north of Egypt, *R. cemiculus* is considered prevalent (although less common than *R. rhinobatos*), and is caught as bycatch by Israeli commercial fishers (Golani 2006). From December 2012 – October 2014, *R. cemiculus* was the second most common elasmobranch in Lebanese fisheries catches after *R. rhinobatos* (Lteif 2015). In a study of elasmobranch exploitation in Syria in the early 2000s, *R. cemiculus* was characterized as, "very economically important species being caught in plentiful quantities and highly consumable," whereas *R. rhinobatos* was characterized as a "moderate economically important species either for being caught in little quantities with high efforts in fishing, or for their little demand for human consumption. Or maybe for both reasons." (Saad et al. 2006). No clarification was given as to whether *R. cemiculus* is more common in the area or whether there is simply a higher demand for its meat.

North of Syria, *R. cemiculus* is one of the most common elasmobranchs in fisheries landings in İskenderun Bay, Turkey (and more abundant than *R. rhinobatos*) (Başusta et al. 2012; Keskin et al. 2011). West of İskenderun Bay, *R. cemiculus* was caught during a 2006 study of shrimp trawl bycatch in Mersin

Bay (Duruer et al. 2008). *Rhinobatos cemiculus* was not collected in a 2002-2003 survey of the Karataş Coasts which is located between İskenderun Bay and Mersin Bay (*R. rhinobatos* was collected) (Çiçek et al. 2014).

In the Aegean Sea *R. cemiculus* is rare (Corsini-Foka 2009; Filiz et al. 2016). In 2013 two large *R. cemiculus* were caught in trawls in İzmir Bay, Turkey (eastern-central Aegean), which the authors considered a range expansion for this species (Akyol & Capapé 2014). Further expanding the range of this species, one *R. cemiculus* was caught in the Sea of Marmara in October 2012 near Bursa, Turkey (C. Mancusi, ARPAT, pers. comm. to B. Newell, NMFS, 23 March, 2016), although this record has not been reported in peer-reviewed literature.

Throughout the remaining Mediterranean, the trends in *R. cemiculus* abundance generally mirror *R. rhinobatos* (Akyol & Capapé 2014; Baino et al. 2001; Bertrand et al. 2000). It is likely that the range of *R. cemiculus* in the north western Mediterranean was smaller than *R. rhinobatos,* as there are no records of this species off Mediterranean France (Akyol & Capapé 2014; Capapé et al. 2006). *Rhinobatos cemiculus* did occur in the Ligurian and Tyrrhenian Seas off Italy, especially around Sicily, but has been extirpated from these waters (Akyol & Capapé 2014). It has also been extirpated from the Balearic Islands of Spain, where it was frequently recorded in the early 20th century (Notarbartolo di Sciara et al. 2007a). There is doubt about whether *R. cemiculus* had occurred in the Adriatic Sea, where *Rhinobatos* spp. has been extirpated or is very rare (Akyol & Capapé 2014; Bertrand et al. 2000).

Atlantic

In the eastern Atlantic, both species' ranges are listed from northern Spain to Angola, with *R. rhinobatos* extending north into France's Bay of Biscay (Melendez & Macias 2007). We found very little information on both *R. rhinobatos* and *R. cemiculus* throughout their Atlantic range. For this reason, we have reported all information on both of these species in the Atlantic together in this section. Both species are included in a recent checklist from Galicia (northwestern Spain) although no additional information was provided in this checklist (Bañón et al. 2010). Both species are included on a checklist of marine fishes of Portugal, occurring in mainland waters but not around the offshore Archipelago of the Azores or the Madeira Archipelago. Preserved specimens of *R. cemiculus* are present in Portuguese museum collections (Carneiro et al. 2014). Neither species is reported in the International Council for the Exploration of the Sea (ICES) DATRAS, which is a database of 45 years' worth of survey data including from the Atlantic coasts of France, Spain, and Portugal (ICES 2016), indicating that they have likely historically been rare North of the Strait of Gibraltar.

Along the Atlantic coast of Africa both species range from Morocco to Angola. We were not able to find much information on these species from the Atlantic coast of Morocco, which, for the purposes of this report, includes disputed territory of Western Sahara. Serghini et al. (2008) surveyed southern Morocco, conducting 434 tows in 2002 and 2003, and reported that *R. rhinobatos* appeared in more than 5% of their tows while *R. cemiculus* did not. Gulyugin et al. (2006) reported the occurrence of both species in southern Moroccan waters, but that neither species is common.

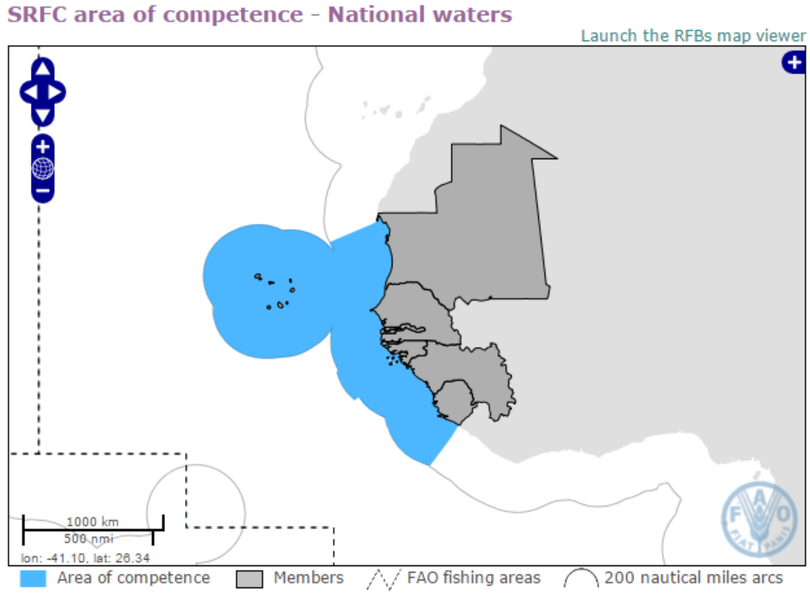


Figure 12: FAO Subregional Fisheries Commission Countries (FAO, 2016j). From north to south these countries are Mauritania, Cape Verde (offshore), Senegal, Gambia (surrounded by Senegal), Guinea-Bissau, Guinea, and Sierra Leone.

In the report, "30 Years of shark fishing in West Africa", Diop and Dossa (2011) provided an overview of elasmobranch exploitation in member countries of the Sub-Regional Fishing Commission (SRFC), which includes Mauritania, Gambia, Guinea, Guinea-Bissau, Senegal, Sierra Leone, and the island nation of Cape Verde (see fig. 12). According to this report, elasmobranchs had historically been extremely abundant in the area but have been rapidly declining over the past few decades. Throughout the region almost 100 different species of elasmobranchs are known to occur. *Rhinobaots rhinobatos* and *R. cemiculus* are the two most widely distributed guitarfishes and overall are two of the most widely distributed elasmobranchs.

Guitarfishes, once common in the area, have now become scarce (Diop & Dossa 2011; Ducrocq 2016). Prior to the 1970s elasmobranchs were caught primarily for local consumption. Starting in the 1970s, in response to the high demand for shark fins in eastern and southeastern Asia (primarily China), an unsustainable shark fishing industry developed and grew rapidly (Diop & Dossa 2011). Because of this new demand, in addition to being targeted for their meat, guitarfishes were targeted for their fins, which are regarded as highly valuable. The area has also seen rapid population growth as large numbers of people have migrated toward the coast in recent decades, with 78.4% of the population of SRFC member countries living within 100 km of the coastline as of 2011. This spike in the coastal population has put increased pressure on local marine resources and coastal resources. This pressure quickly resulted in the overexploitation of marine resources with significantly increasing fishing effort and decreasing yields beginning in the 1990s, including the overfishing of demersal species. Since 2003 there has been a significant decline in elasmobranch landings. (Diop & Dossa 2011). In the SRFC region, elasmobranch fishing was initially concentrated in Gambia and Senegal but it has spread to the other member countries as fishers migrate in response to areas becoming overexploited (Diop & Dossa 2011; Tous et al. 1998).

In Mauritania, *R. cemiculus* is one of the three main target species for artisanal fishers. Fishing pressure drove down the average size of *Rhinobatos* spp. landed in Banc d'Arguin National Park in Northern Mauritania (see fig. 13), and 95% of the *R. cemiculus* caught in the area are smaller than the size at 50% maturity (Diop & Dossa 2011). In a 2000-2004 survey of the expansive and extremely shallow (average depth of 2.5 m) littoral zone of the Banc d'Arguin neither species was captured and the authors noted the strange absence of predators given the abundance of juvenile fish (Gushchin & Fall 2012). In recent years, fishing restrictions in the Banc d'Arguin National Park allowed the guitarfishes population to recover, but these species are still targeted outside of the park (M. Ducrocq, Parcs Gabon, pers. comm. to J. Shultz, NMFS, 21 June, 2016).

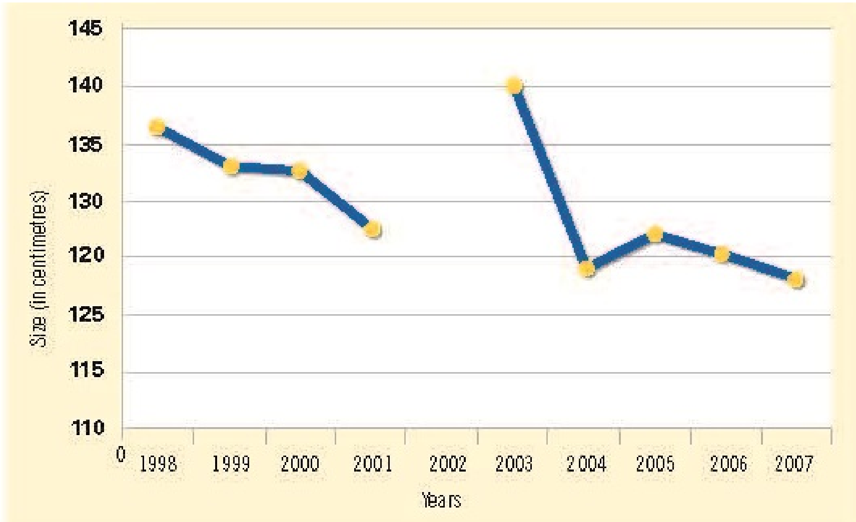


Figure 13: The declining average size of Rhinobatos spp. landed in Banc d' Arguin National Park, Mauritania (Diop&Dossa, 2011)

In Senegal, guitarfishes are some of the main targeted species of elasmobranchs (Diop & Dossa 2011). This heavy fishing pressure has had a negative impact on the local guitarfishes population (Ducrocq 2016). As discussed in the IUCN Redlist assessment of both species, according to unpublished data from the Senegalese Ministry of Maritime Economy and International Maritime Transportation, the landings of guitarfishes decreased substantially from the late 1990s to 2005 (Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b). *Rhinobatos rhinobatos* was the only guitarfish species caught in 13 trawl surveys of the Senegalese shelf from 1986-1999, although it is not clear what proportion of the 1,000 plus trawls conducted were from 0-100m (Jouffre et al. 2004). Both species are listed in an updated checklist of the marine fishes of Cape Verde, an island nation located about 600 km west of continental Africa's most western point, Dakar, Senegal. However, the authors considered the record of *R. rhinobatos* invalid stating that they do not know of any records of this species in the Cape Verde Islands (Wirtz et al. 2013).

Both species occur in the waters of Guinea-Bissau off the mainland and around the Bijagós Archipelago where they are targeted by fishers (Cross 2015; Fowler & Cavanagh 2005; Kasisi 2004; Tous et al. 1998). *Rhinobatos cemiculus* was one of the elasmobranch species taken in the highest numbers in 1989 during experimental fishing trips (Diop & Dossa 2011). In the late 1990s, rapid and substantial declines of *R. rhinobatos* and *R. cemiculus* were reported in the Bijagós Archipelago, as specialized and sophisticated fishing teams targeting fins migrated into the area, which previously had seen almost no elasmobranch fishing (Tous et al. 1998). In Guinea, just south of Guinea-Bissau, *R. cemiculus* is one of the most important fishery species (Diop & Dossa 2011) and it is likely that both species are experiencing similar declines here as in Guinea-Bissau, Senegal, and Gambia (M. Ducrocq, Parcs Gabon, pers. comm. to J. Shultz, NMFS, 21 June, 2016). In Sierra Leone, there are six ray species that are exploited. Of these, "*Rhinobatos* spp. and *Dasyatis* spp. are found in the highest numbers, both in terms of weight and number" (Diop & Dossa 2011). While the authors did not specify which *Rhinobatos* spp. are caught in the highest numbers, *R. rhinobatos* and *R. cemiculus* are the only two guitarfish species reported by Diop and Dossa (2011) in the waters of Sierra Leone. Both species were recorded from 2008-2010 in a survey by the Sierra Leone Ministry of Fisheries and Marine Resources as well as in industrial and artisanal fisheries data (Sierra Leone Ministry of Fisheries and Marine Resources 2016).

Throughout the SRFC region there has been a decline in many elasmobranch species. Diop and Dossa (2011) stated, "The overall decrease in catch in the West African subregion is an indication that this resource has decreased: there is an almost complete disappearance of some species (e.g. sawfish) and a scarcity of others, such as guitarfish and large hammerhead sharks." We found little information on either species southeast of the SRFC region. *Rhinobatos rhinobatos* but not *R. cemiculus* was present in a study of bycatch in the Nigerian coastal artisanal shrimp trawl fishery off the Lagos Coast (Ambrose et al. 2005). In the 62 landings sampled, two individual *R. rhinobatos* measuring 15-28cm were captured. Ambrose et al. (2005) discussed the importance of the coastal areas off Lagos as nursery grounds for many species. Based on the size of the specimens caught, these individuals were likely neonates, which indicates this may be a nursery area of *R. rhinobatos.*

Both species are present in the coastal waters of Gabon (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. Comm. to B. Newell, NMFS, 26 June, 2016). De Bruyne (2015) conducted a study of the artisanal fishery of Mayumba, Gabon, a village located on the Banio Lagoon near the northern border of the coast of the Republic of Congo. *Rhinobatos cemiculus,* as well as *R. albomaculatus* and *R. irvinei*, are listed as species that occur in the area, with *R. cemiculus* and *R. irvinei* reported as bycatch species landed from March 2013 to May 2015. *Rhinobatos rhinobatos* does not appear to currently be present in this area.

Local people have been practicing subsistence fishing in the Banio Lagoon for generations and while sharks and rays were "evident" in the Lagoon decades ago, today they are rare with some species extirpated. Based on interviews with members of the local fishing industry, the author found that water quality, noise barriers (from boat engines), and fishing at lagoon inlets are preventing the migration of sharks and rays into the Banio Lagoon, which is why these species remain rare. In addition to the subsistence fishing in the Banio Lagoon, there is a coastal artisanal fishery that primarily targets demersal resources while also seasonally targeting sardines. This coastal fishery is made up of fishers from Togo, Benin, and Ghana, who have settled in the area. Although these nations are north of Gabon, some of these fishers had been crowded out of fishing grounds south of Mayumba off Pointe-Noire, Republic of Congo. *Rhinobatos cemiculus*, most commonly mature females, are caught in highest numbers in April and May. This coincides with the seasonal sardine fishery and the rainy season, which increases water temperatures. Catch data indicates a relatively stable population of *R. cemiculus* since 2013, with no trend data available prior, and the author noted his concern regard the absence of pregnant females, suggesting this may be driven by fishing pressure since mature females are commonly caught as bycatch (De Bruyne 2015).

Finning has not traditionally be practiced in the Mayumba area, but the arrival of foreign fishers drove a boom in the harvest of sharks and other marine resources (De Bruyne 2015), including the development of a black market fin industry organized by West Africans that has operated across Gabon for approximately 30 years (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. Comm. to B. Newell, NMFS, 26 June, 2016). Shark populations around Mayumba seem to have rebounded due to some fairly recent regulatory efforts (**See Inadequacy of Existing Regulations**). Surveyed coastal fishers reported a higher abundance of sharks off the coast relative to 10-15 years ago. The primary reasons fishers gave for this increase are regulatory restrictions in fishing areas, behaviors, and gear types (specifically, the fishers say the nets used now allow the sharks to break free more often) and the current low regional economic value of shark meat. Trends in ray species abundance were not discussed (De Bruyne 2015).

In Ghana, fishing (primarily marine) employs 1/10 working people, and Ghanaian fishers and their techniques have spread out along the coast, including to the SRFC countries. A recent report characterized the demersal fisheries of Ghana as "operating under stress during the last decades". From January 2009 to December 2010 *R. rhinobatos* but not *R. cemiculus* was landed by artisanal fishers in Ahwiam (far eastern coast) and Elmina (central western coast) (Nunoo & Asiedu 2013). *Rhinobatos* spp. are known to artisanal fishermen in the villages of Tema (eastern coast) and Dixcove, Shama, and Busua (western coast) (D. Berces, University of Florida, pers. comm. to B. Newell, NMFS, 14 November, 2016). No information was given for Ghanaian industrial fisheries. We found no data for either species in the following countries, which have Atlantic coastline that is considered in both species' ranges: Liberia, Cote d'Ivoire, Togo, Benin, Cameroon, Equatorial Guinea, São Tomé and Príncipe, Republic of the Congo, Democratic Republic of the Congo, or Angola.

Analysis of the ESA Section 4(A)(1) Factors

The ESA requires NMFS to determine whether a species is endangered or threatened because of any of the factors specified in section 4(a)(1) of the ESA. These factors are: 1. Present or threatened destruction, modification, of curtailment of habitat or range, 2. Overutilization for commercial, recreational, scientific, or educational purposes, 3. Disease or predation, 4. Inadequacy of existing regulatory mechanisms and, 5. Other natural or manmade factors. The following provides information on each of these five factors as they relate to the status of these two guitarfish species. Since the ranges and life history of these species overlap, many of the threat issues overlap as well and are discussed generally for both species. When species-specific information is available, it is noted within the discussion.

Present or Threatened Destruction, Modification, of Curtailment of Habitat or Range

Curtailment of Range

As discussed in the **Distribution and Historical or Current Abundance** section of this status review, there has been a curtailment of *Rhinobatos* spp. range in the northwestern Mediterranean likely caused by overutilization from commercial fishing as well as modification of coastal habitat (Psomadakis et al. 2009). *Rhinobatos rhinobatos* has likely been extirpated from the Mediterranean coasts of Spain and France, as well as the Tyrrhenian, Ligurian, and Adriatic Seas (Bertrand et al. 2000; Capapé et al. 2006; MEDITS 2016a). *Rhinobatos cemiculus* may never have occurred in the Mediterranean waters of France but it has been extirpated from the Ligurian and Tyrrhenian Seas, the Balearic Islands, as well as the Adriatic if it ever occurred there (Akyol & Capapé 2014; MEDITS 2016a; Notarbartolo di Sciara et al. 2007a). Throughout the area where both species have been extirpated we found almost no information on the life history of either species, including no mention of the presence of different maturity stages or pregnant females, and based on the available information it seems that both species were rare throughout much of the areas where they have been extirpated. Thus the curtailment of this portion may not contribute significantly to the extinction risk of either species, although there is a significant amount of uncertainty associated with this conclusion.

In the southern portion of the area from which they have been extirpated both species where common around the Balearic Islands (Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b) and *R. rhinobatos,* and perhaps *R. cemiculus,* were common around Sicily prior to the middle of the last century. In the Tyrrhenian Sea, especially around Sicily, *Rhinobatos* spp. was common in commercial trawls in the northern Tyrrhenian as late as the 1960s (Doderlein 1884; Fowler & Cavanagh 2005; Psomadakis et al. 2009). The seasonal influx of *R. rhinobatos* in Sicilian waters (which may also apply to *R. cemiculus*) described by Doderlein (1884) is similar to the seasonal congregation of breeding adults reported in other portions of both species' ranges (see **Reproduction and Growth**). Additionally, the author reported specimens of *R. cemiculus* were 170, 180, and 230 cm TL (the largest being male), indicating that these individuals were likely mature (see Table 6). However, there was no discussion of pregnant females or reproduction so again there is significant uncertainty regarding the importance of the Sicilian waters to both species, and how the loss of this area contributes to their extinction risk. Both species were present daily at the Palermo (northwest Sicily) fish market in the late 19th century, where *R. rhinobatos* was likely more common than *R. cemiculus* (Doderlein 1884).

Although we found no other evidence of extirpations, the best available information indicates significant declines of elasmobranchs in West Africa with *R. rhinobatos* and *R. cemiculus,* which were once common, becoming scarce. This region has already seen the total or near extirpation of sawfishes and the African wedgefish (Diop & Dossa 2011; Fowler & Cavanagh 2005). Given the similarity of these species (relatively large, dorsoventrally flattened, coastal elasmobranchs) to *Rhinobatos* spp., and the significant fishing pressure these species face (see **Commercial Overutilization in the Atlantic**), it is reasonable to conclude that these two species could face the threat of range curtailment in West Africa in the foreseeable future.

Destruction or Modification of Habitat

Throughout these species' ranges there is not much information available on the species specific threats to *R. rhinobatos* and *R. cemiculus* habitat. However, in the Mediterranean, the decline of elasmobranch diversity and abundance is well documented and is attributed in part to habitat destruction and pollution (Carlini et al. 2002; Cavanagh & Gibson 2007; Melendez & Macias 2007; Psomadakis et al. 2009). Mediterranean ecosystems have been shaped by human actions for millennia, perhaps more so than anywhere else on earth (Bradai et al. 2012). Large species who utilize coastal habitat, especially those species that use these areas as nursery areas (e.g., *R. rhinobatos* and *R. cemiculus*), are particularly vulnerable in areas of intensive human activity (Cavanagh & Gibson 2007). The semi-enclosed nature of the Mediterranean increases the effects of pollution and habitat degradation on marine species and as a result the status of elasmobranchs in the Mediterranean may be worse than in other less enclosed seas (Melendez & Macias 2007; Séret & Serena 2002).

The Mediterranean Sea receives heavy metals, pesticides, excess nutrients, and other pollutants in the form of run-off (Melendez & Macias 2007; Psomadakis et al. 2009). As long-lived predators, large elasmobranchs are significant bioaccumulators of pollutants (Melendez & Macias 2007). No information is available on the bioaccumulation of pollutants in the tissues of *Rhinobatos* spp. in the Mediterranean Sea but other elasmobranchs such as the spiny dogfish and the gulper shark have shown high concentrations of toxins (Melendez & Macias 2007). A study of the accumulation of trace metals cadmium, copper, and zinc, in fish along the Mauritanian coast showed low levels of bioaccumulation of these metals in the tissues of *R. cemiculus* compared to bony fishes. It should be noted that the three *R. cemiculus* were the only elasmobranchs collected in this study, and that, in contrast with the Mediterranean, the trace metals in the area are thought to be primarily natural in origin (Sidoumou et al. 2005). Pollution, habitat degradation, and development in the coastal zone are also of concern in some African countries within these species' ranges (Kasisi 2004). For example, in Ghana, degradation of the coastal environment and fish habitats as a result of human activities has been reported, including pollution from agriculture and poor waste disposal practices, as well as excess sedimentation from fluvial discharge (Ateweberhan et al. 2012). While pollution is a concern in portions of both species' ranges, the effects of pollution on elasmobranchs and marine food webs are not well understood (Melendez & Macias 2007), and we found no information describing how marine pollution affects either species, so it is unknown how marine pollution contributes to these species' extinction risk at this time.

The significant demersal trawling that occurred and continues to occur throughout the Mediterranean range of the *Rhinobatos* species (Edelist 2014; FAO 2016b; Sacchi 2008), and to a lesser extent the Atlantic range (Diop & Dossa 2011), has likely altered seafloor morphology (Puig et al. 2012). In some important reproductive areas for *Rhinobatos* spp., such as the southeast coast of Turkey, intense trawling pressure has occurred over recent decades in depths less than 70 m (Çiçek et al. 2014). However, we found no information that this habitat modification has had a direct effect on the abundance of these two species, or is specifically responsible for the curtailment of range of any of the *Rhinobatos* species. Additionally, trawl fishing within three nautical miles of the Mediterranean coast has been prohibited since 2012 to protect coastal elasmobranch species (FAO 2016e).

In the SRFC region both species' habitats are potentially threatened by the rapid growth of human populations along the coast, which has put increased demand on marine and coastal resources. For example, one of the primary methods of processing elasmobranch meat and fins is to dry them. To provide wood fuel for processing there has been rapid clearing of mangrove forest (Diop & Dossa 2011). While *Rhinobatos* spp. are not known to use mangroves as habitat, this modification of the coastal habitat can impact water quality and food webs. Once again, we found no information directly linking mangrove loss, or other habitat modification, to threats to these species, so it is unknown how this modification of habitat affects the extinction risk of these species.

However, there is some information that shows these species are sensitive to habitat modification. Psomadakis et al. (2009) attributed the extirpation of *Rhinobatos* spp. from the northwestern Mediterranean to the combination of centuries of human development and fishing pressure. Additionally, both species returned to the Northern and Southern Tunis Lagoons in Tunisia after large scale restoration of the area (Mejri et al. 2004). Prior to restoration the lagoons had undergone significant anthropogenic hydrological modification and been extremely polluted from sewage input and industrial waste (Noppen 2003). After restoration was completed in 2001, *R. cemiculus* was recorded for the first time, and *R. rhinobatos,* which had previously been rare, became common (Mejri et al. 2004). Based on the available information, it is likely that pollution and modification of habitat contribute to the risk of extirpation of both species from portions of their range. However, because of the lack of information on pollution and habitat modification throughout their entire ranges, and because there is no information on the direct effects of these threats to either species, the degree of the contribution of these factors to the extinction risk of both species is unknown at this time.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Based on the available literature there is no threat to either of these species from overutilization for scientific or educational purposes. Shiffman et al. (2014) used *R. cemiculus* as an example species in a publication discussing the negative impacts of trophy fishing on slow growing species that show a positive correlation between size and reproductive capacity. The targeting of large fish species is known to impact both the number of young produced and the quality of larvae and neonates (Birkeland & Dayton 2005). A world record specimen of *R. cemiculus*, but not *R. rhinobatos,* is reported on the International Game Fish Association website (IGFA 2015). Recreational fishers also target *R. cemiculus* in Gabon (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. comm. to B. Newell, NMFS, 28 June, 2016). However, we found no additional information on the recreational utilization of either species so it appears unlikely that recreational fishing is contributing significantly to the extinction risk of *R. cemiculus* or *R. rhinobatos*.

The primary threat to both of these species is commercial overutilization. This threat is difficult to quantify as fisheries data on elasmobranch landings throughout both species' ranges has been drastically underreported (Clarke et al. 2006; Diop & Dossa 2011; FAO 2016a). When elasmobranch catches have been reported, the data were generally not reported at the species level (Bradai et al. 2012; Echwikhi et al. 2012). However, based on surveys of fishers' knowledge, museum records, and analysis of scientific surveys of the Northern Mediterranean, it appears that commercial overutilization has been the primary driver of these species' extirpation from the northwestern Mediterranean, and their decline in abundance in other regions (Baino et al. 2001; Bertrand et al. 2000; Capapé et al. 2006; Carlini et al. 2002; Diop & Dossa 2011; Echwikhi et al. 2012; Psomadakis et al. 2009).

The overutilization of these species is not concentrated in one area or fishery. Throughout portions of their ranges they are, or were until recently, targeted for their fins, meat, or both (Diop & Dossa 2011; Echwikhi et al. 2012). Throughout their entire ranges, there is great diversity in fisheries and gear types used (Diop & Dossa 2011; FAO 2016b). As bycatch, *R. cemiculus* and *R. rhinobatos* are particularly exposed to fishing pressure from demersal trawl, gillnet, and longline fisheries (Cavanagh & Gibson 2007; Echwikhi et al. 2013; Echwikhi et al. 2012; FAO 2016d). Although the retention of both species has been prohibited in the Mediterranean by Annex II of the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD protocol) of the Barcelona Convention (see **Regulatory Mechanisms in the Mediterranean)**, and some African nations have put protections for these species in place (see **Regulatory Mechanisms in the Atlantic**), based on the available information these regulations on commercial overutilization are likely currently under enforced (Diop & Dossa 2011; Echwikhi et al. 2013; Echwikhi et al. 2012; Lteif 2015; Samy-Kamal 2015).

Particularly in the west African portion of their range, both species have been targeted by the shark fin fishery (Diop & Dossa 2011; Fowler & Cavanagh 2005). The explosion of the Chinese middle class at the end of the last century led to a rapid increase in demand for shark fin soup, a traditional Chinese dish desired for its alleged tonic properties and, most importantly, because it has served as an indicator of high societal status for centuries. Finning, the practice of removing and retaining shark and shark-like elasmobranch fins before discarding the rest of the carcass, can lead to highly unsustainable fishing because vessels need less storage space for these high value products. Shark fins are one of the highest value seafood products in the world, especially compared to shark meat which is widely regarded as low value. Finning also leads to regulatory hurdles because without carcasses species identification is a challenge (Dulvy et al. 2014; Hareide et al. 2007b). The value and quality of shark fins are judged by the thickness and length of the ceratotrichia, or fin needles, and based on this valuation system, guitarfishes have some of the most valuable fins (Hareide et al. 2007b). The effects of commercial overutilization on the extinction risk of these species are further discussed in the **Commercial Overutilization in the Mediterranean** and **Commercial Overutilization in the Atlantic** subsections below.

Commercial Overutilization in the Mediterranean

We found very little quantitative data related to the commercial utilization of these species. ICES (2010) summarized the landings of the family *Rhinobatidae* reported to the FAO in the Mediterranean from 1980-2008. Guitarfish-specific landing data was clearly drastically underreported since only three countries, Albania, Palestine, and Greece, reported landings of these species, and no country reported landings at the species level. These data were also not available through the FAO Global Capture Production Online Query Panel, which allows users to query data on any species that has been reported to the FAO from 1950-2015, during this status review (FAO 2016). Albania reported sporadic landings from 1996-2008 ranging from 1-8 tons (t). Palestine consistently reported landings from 1997-2008 ranging from 1-8 t. Greece reported landings every year from 1982-2008. Greek landings ranged from 3-112 t, rising sharply in 1994 and generally declining until 2008 (see fig. 14). The location of these landings are reported as the Ionian and Aegean Seas. Location-specific data were unavailable for all three countries. The only Mediterranean fisheries data on either species available through the FAO Global Capture Production Online Query Panel

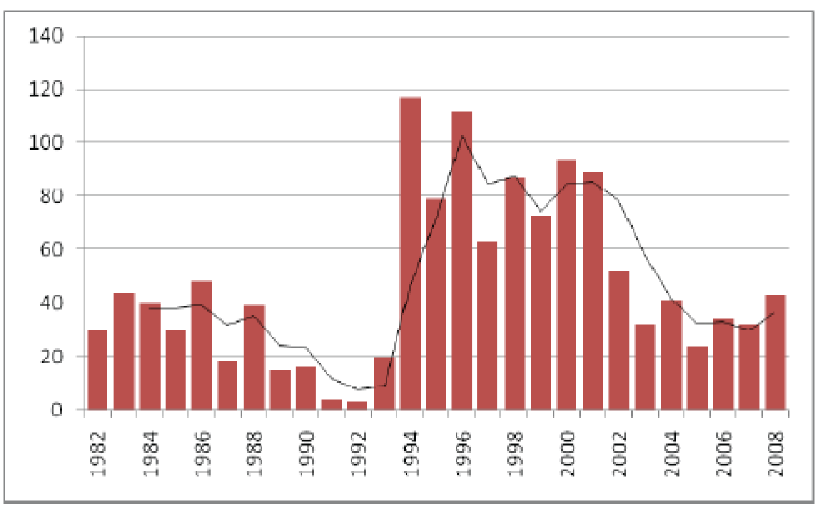
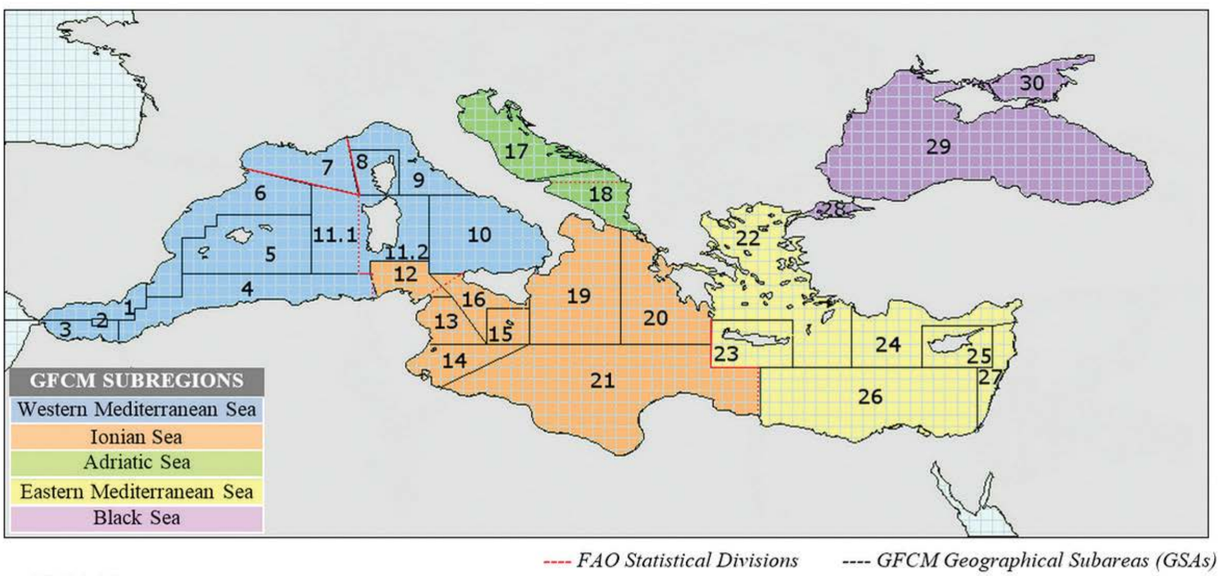


Figure 14: Greek landings (t) of guitarfish species from the Ionian and Aegean Seas, 1982-2008. Smoothed line is a 3-year moving average (ICES 2010)

were reported by Israel. Israel reported capturing *R. rhinobatos* in the following quantities: 90 t in 2009, 69 t in 2010, 44 t in 2011, 44 t in 2012, and 0 t in 2013 and 2014.

Since 2012, *R. rhinobatos* and *R. cemiculus* have been listed in Annex II of the SPA/BD protocol of the Barcelona Convention (see the **Inadequacy of Existing Regulation** section of this document). Because of this listing it is illegal to land these species in the Mediterranean and they “must be released unharmed and alive to the highest extent possible”. We found no studies on the survival rates of guitarfishes after being released from fishing gear interactions so it is unknown to what extent this requirement reduces the fishing related mortality of both species.

Annex II also prohibits trawling within three nautical miles of the shoreline, greatly reducing the likelihood that these coastal fish will be caught as bycatch, and finning and the landing of elasmobranchs without their heads and skins, thus protecting these fish from illegal sale (FAO 2016e). In contrast with European fishing fleets in Atlantic waters, finning was not widely practiced in the Mediterranean prior to the Annex II prohibitions (Hareide et al. 2007a; Serena 2005). We found no information on the current level of IUU fishing on these species in the Mediterranean so it is difficult to assess the impact of these prohibitions. Recent information from Tunisia, Lebanon, and Egypt indicates that the fisheries in these countries are inadequately regulated (Echwikhi et al. 2013; Echwikhi et al. 2012; Lteif 2015; Samy-Kamal 2015).



GFCM GSAs

01 - Northern Alboran Sea	07 - Gulf of Lion	13 - Gulf of Hammamet	19 - Western Ionian Sea	25 - Cyprus
02 - Alboran Island	08 - Corsica	14 - Gulf of Gabes	20 - Eastern Ionian Sea	26 - South Levant Sea
03 - Southern Alboran Sea	09 - Ligurian Sea and Northern Tyrrhenian Sea	15 - Malta	21 - Southern Ionian Sea	27 - Eastern Levant Sea
04 - Algeria	10 - South and Central Tyrrhenian Sea	16 - Southern Sicily	22 - Aegean Sea	28 - Marmara Sea
05 - Balearic Islands	11.1 - Sardinia (west) 11.2 - Sardinia (east)	17 - Northern Adriatic Sea	23 - Crete	29 - Black Sea
06 - Northern Spain	12 - Northern Tunisia	18 - Southern Adriatic Sea	24 - North Levant Sea	30 - Azov Sea

Figure 15: General Fisheries Commission for the Mediterranean (GFCM) area of application, subregions and GSAs (FAO, 2016a)

Regardless of the efficacy of the Annex II prohibitions, the historical fishing pressure on *R. rhinobatos* and *R. cemiculus* has driven declines in abundance throughout much of their ranges (Baino et al. 2001; Bertrand et al. 2000; Capapé et al. 2006; Diop & Dossa 2011; Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b; Psomadakis et al. 2009). The Mediterranean has a long history of fishing pressure, which has not abated in recent decades (Ferretti et al. 2008). Technological advancements and increased fishing effort, including increased benthic trawling on the Mediterranean continental shelf and slope over the last 50 years, has resulted in the decline of many elasmobranch species (Bradai et al. 2012). In the northwestern Mediterranean, sustained and intensive fishing pressure has been a main driver of the extirpation of *Rhinobatos* spp. (Bradai et al. 2012; Capapé et al. 2006; Psomadakis et al. 2009; Sacchi 2008). The highest concentration of fishing vessels in the Mediterranean occurs in the Eastern Mediterranean Sea and the Ionian Sea General Fisheries Commission for the Mediterranean (GFCM) subregions, the two areas that comprise the majority of the *Rhinobatos* spp. current Mediterranean ranges (see fig. 15). Turkey, which appears to have some of the largest concentrations of *R. cemiculus* along its southern coast, has the largest proportion of fishing vessels with 16,447 vessels (17.74%). However, some of these vessels fish in the Black Sea where neither species is found, or the Aegean Sea where these species are rare (FAO 2016b).

Between 1970 and 1985, reported Mediterranean and Black Sea chondrichthyan landings grew from 10,000 t to 25,000 t, and then declined to about 7,000 t annually in 2008 despite a growth in fishing effort. (Bradai et al. 2012; Cavanagh & Gibson 2007; Hareide et al. 2007). During this time Tunisia and Turkey were two of the most prolific Mediterranean elasmobranch fishing countries (see fig. 16). At the time of the 2007 publication of the IUCN report *Overview of the Conservation Status of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea*, there were six Mediterranean elasmobranchs affected by target fisheries. Historically many more species had been targeted or landed in large quantities, but this number was reduced because these fisheries are no longer commercially viable (Cavanagh & Gibson 2007; FAO 2016d; Ferretti et al. 2008). It is unclear if *R. rhinobatos* and *R. cemiculus* were two of the six targeted species referenced in this report. In a few areas in the Mediterranean, these fish were targeted or considered a valuable secondary catch. Additionally, the global demand for elasmobranch meat has grown rapidly in recent decades with the reported production of meat and fillets growing from approximately 40,000 tons in 1985 to 121,641 tons in 2004 (Clarke et al. 2007; Dent & Clarke 2015), potentially providing economic incentive to retain these species as targeted or incidental catch.

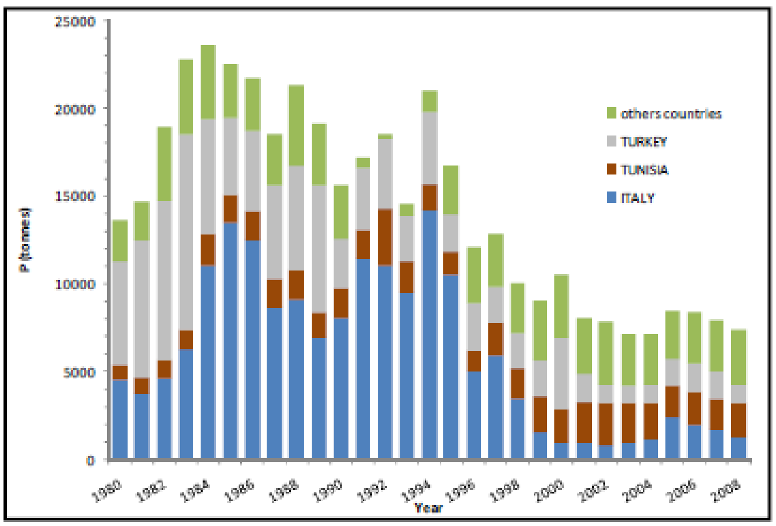


Figure 16: Contribution of Italy, Turkey and Tunisia in the elasmobranchs production in the Mediterranean 1980-2008 (Bradai et al., 2012)

The primary area where *R. rhinobatos and R. cemiculus* have been fished is the waters of Tunisia, where seasonal artisanal fishers target elasmobranchs with gillnets and longlines when they move into shallow waters in the spring and summer (Echwikhi et al. 2013; Echwikhi et al. 2012). *Rhinobatos* spp. meat is sold in local markets and the skin is used for drumheads by local players (Capape & Zaouali 1994). In Tunisian waters *R. cemiculus* is landed in greater numbers than *R. rhinobatos* (Capape & Zaouali 1994; Echwikhi et al. 2013; Echwikhi et al. 2012) although species specific data and reliable discard data are largely unavailable (Echwikhi et al. 2012). Data on fishing vessels are underreported, especially in Tunisia and Morocco. However, based on the available data, the Tunisian fleet is comprised of 12,826 reported vessels, or 14.91% of the 92,734 reported vessels reported in the Mediterranean and Black Sea, making Tunisia the third largest fishing fleet in the Mediterranean and Black Sea. Since 1970, when total fisheries landings in Tunisia were about 25,000 tons, there has been a steady increase in landings, reaching an average of 101,400 t from 2000-2013. Additionally, Tunisia has one of the youngest fishing fleets in terms of vessel age, indicating a relatively recent increase in fishing capacity. As is the case throughout the Mediterranean, the vast majority of the Tunisian fishery is comprised of artisanal vessels (FAO 2016b). While elasmobranch landings have dropped overall in southern Tunisia (see the **Mediterranean** subsection of **Distribution and Historical or Current Abundance**) (Echwikhi et al. 2013; Echwikhi et al. 2012), an assessment from the Workshop on Stock Assessment of Selected Species of Elasmobranches in the GFCM area found that the southern Tunisian *R. cemiculus* stock was actually underfished from 2001-2007 (GMFC:SAC 2012).

Capapé et al. (2004) discuss fishing for *Rhinobatos* spp. in Tunisia dating back to at least the 1970s. The majority of Tunisian elasmobranch catches are from the Gulf of Gabès (Bradaï et al. 2006; Echwikhi et al. 2013; Echwikhi et al. 2012), where general elasmobranch landings and batoid landings steadily increased during the 1990s, peaked in 2002, and decreased from 2003-2008 (trend data are not available after 2008) (Echwikhi et al. 2012). Guitarfishes were targeted with special gillnets called "garracia," with catches peaking in the spring and summer when females move into shallow waters to gestate and give birth. Adults and juveniles are also caught as bycatch in trawls targeting demersal fish and shrimp at depths of 30-100 m, while neonates are captured at depths between 10 and 20 m (Bradaï et al. 2006). In a study of elasmobranch gillnet fishing in the Gulf of Gabès from 2007 to 2008, *R. cemiculus* was the most abundant elasmobranch caught. *R. cemiculus* and *R. rhinobatos* composed 52% and 6.81% of the total elasmobranch catch, respectively. Female *R. cemiculus* (40% mature) and *R. rhinobatos* (48% mature) were more common than males. The authors of this study noted that *R. cemiculus* is particularly susceptible to capture in bottom gillnets because of its shape and schooling behavior (Echwikhi et al. 2012).

In recent years Gulf of Gabès fishermen who had targeted grouper using demersal longlines have shifted to targeting elasmobranchs as grouper abundance has declined (although in this fishery elasmobranchs were still classified as bycatch)(Echwikhi et al. 2013). The first study of elasmobranch catches in this longline fishery, conducted from 2007-2008, found that *R. cemiculus* was the most abundant elasmobranch at 31.7% of the elasmobranch catch, while *R. rhinobatos* composed 11.2%. In this study, mature, pregnant females dominated the *R. cemiculus* catch, while males and females were about equal for *R. rhinobatos*, with slightly more mature individuals caught. This study found that longline fishing effort during this time period was "considerable" (Echwikhi et al. 2013). Enajjar et al. (2008) found a decrease in the overall TL and TL at 50% maturity for male and female *R. rhinobatos* in southern Tunisia, compared to results reported by Capapé et al. (1975, 1997). The reported decrease in *R. rhinobatos*, compared to the relatively recent GMFC:SAC (2012) stock assessment that found *R. cemiculus* was underfished in this area may indicate that only *R. rhinobatos* is experiencing levels of fishing pressure that contribute to its risk of extinction in Tunisia. There is significant uncertainty with this conclusion because of the limited information available.

Just east of the Tunisian border, there is a small artisanal elasmobranch fishery based in Tarwah, Libya. Based on survey data from 2000, this fishery included vessels using *kellabia khannagah* (fixed gillnets for sharks). The target species for this fishery were sharks of the family *Carcharhinidae*, with *Rhinobatos* spp. and *Squatina squatina* (angelshark) listed as associated species. Also based in Farwah is a *bringali kelp* (bottom longline) fishery that targets *Carcharhinidae* in the spring (Lamboeuf et al. 2000). *Rhinobatos* spp. are likely also caught by these bottom longlines. This information was reported in Appendix VI of Lamboeuf et al. (2000), which provides an example of the a project's database printout, rather than a complete picture of guitarfish retention in Libya, and we found no additional information on guitarfish catch in this country. According to the UNEP (2005) research proposal guitarfishes have been traditionally consumed in Libya, and some species that have declined in the greater Mediterranean, like the guitarfishes and the angelsharks, were still relatively common in Libyan waters. This proposal called for the study of eight elasmobranch species, including both *Rhinobatos* spp., because of their importance to Libyan fisheries, conservation interest, or both. The extent and effects of targeted fishing in Libya on the extinction risk of these species are unknown at this time.

Along the eastern Mediterranean, guitarfishes were illegally targeted in Lebanon (see fig. 17) up until at least 2014 by artisanal fishers (see **Regulatory Mechanisms in the Mediterranean** for more information). From December 2012 – October 2014, *R. rhinobatos* was the most common elasmobranch in Lebanese fisheries catches followed by *R. cemiculus*, and both have significant economic value. Fishing pressure in Lebanon is greatest in the north where it has already impacted elasmobranch diversity (Lteif 2015). In a study of elasmobranch exploitation in Syria in the early 2000s, *R. cemiculus* was characterized as, "very economically important species being caught in plentiful quantities and highly consumable," whereas *R. rhinobatos* was characterized as a "moderate economically important species either for being caught in little quantities with high efforts in fishing, or for their little demand for human consumption. Or maybe for both reasons." (Saad et al. 2006). It is unclear if *R. cemiculus* is more common or if there is a higher demand for its meat over *R. rhinobatos*, but these data indicate that both species were either targeted or welcomed as secondary catch in Syria. Overall fisheries landings in Lebanon and Syria increased since the 1970s, but their reported landings only make a small fraction of the total Mediterranean catch (FAO 2016c).

Figure 17: Common guitarfish caught off the Lebanese coast (Lteif, 2015)

Throughout their entire Mediterranean ranges, *R. cemiculus* and *R. rhinobatos* have long been exposed to pressure as bycatch (Bradai et al. 2012). *Rhinobatos cemiculus* is one of the most commonly landed elasmobranchs in İskenderun Bay, Turkey (and more abundant than *R. rhinobatos*) (Başusta et al. 2012; Keskin et al. 2011), where the coastal area is heavily fished, exposing mature, breeding individuals to capture when they migrate to shallow waters (Başusta et al. 2008). After Egypt, Turkey has the highest number of registered trawlers, 599 vessels, in the Eastern Mediterranean (FAO 2016b). While some of these trawlers are concentrated in the Black Sea (FAO 2016b), the southeastern waters of Turkey, which includes İskenderun Bay, have been intensely fished for decades and have shown obvious signs of decline in biodiversity and fish abundance (Çiçek et al. 2014). Keskin et al. (2011) reported that *Rhinobatos* spp. are not commercially important species in Turkey while Çek et al. (2009) reported that *R. rhinobatos* has been exploited by bottom trawlers in İskenderun Bay since 1990 and is consumed locally. The same is likely true for *R. cemiculus.*

In Egypt, Mediterranean fisheries landings have generally been growing since the 1970s, as fishing technology has advanced and fishing effort increased (Samy-Kamal 2015). There have been periods where landings dropped despite continued increases in fishing efforts (FAO 2016c; Samy-Kamal 2015) and as a result there has been in increase in the landings of and demand for cartilaginous fishes bycatch, with guitarfishes (not reported at the species level) composing the majority of these landings, primarily as bycatch from shrimp trawls. Prior to 2005, shark and ray bycatch were usually discarded. From 2005 to 2006 landings of cartilaginous fishes jumped from around 500 tons to over 3,000 tons (see fig. 18). Over the last 10 years, this production has remained high, decreasing recently from over 3,000 tons annually in 2010 and 2011, to 1,843 tons in 2014 in spite of sustained fishing effort (A. Marbourk, NMFS, pers. comm. to B. Newell, NMFS, 21 July, 2016). Most of the landings in Egypt occur in the Nile Delta region, which includes Alexandria where *R. rhinobatos* aggregates in shallow waters to give birth (Abdel-Aziz et al. 1993; Samy-Kamal 2015). Within this region, almost 80 percent of the cartilaginous fish production is landed at two ports, Alexandria and Borg El Burullus (A. Marbourk, NMFS, pers. comm. to B. Newell, NMFS, 21 July, 2016). The expansive Nile Delta area is regarded as highly suitable for trawling. Wild caught fisheries in Egypt have been regulated for decades but these regulations have been under enforced as the government has focused on developing the booming aquaculture industry. Additionally, regulations have not been updated to reflect the GFCM recommendations, which are apparently also not being enforced. This lack of enforcement has resulted in rampant IUU fishing in Egyptian waters, including unsustainable trawling and the use of illegal fishing gear, such as nets with illegal mesh sizes (Samy-Kamal 2015). The lack of fishing regulations and enforcement has resulted in wide spread declines in Egyptian fisheries, including in elasmobranch populations, and is likely also affecting neighboring countries, as Egyptian fishers are known to illegally fish in Libyan waters (A. Marbourk, NMFS, pers. comm. to B. Newell, NMFS, 21 July, 2016).

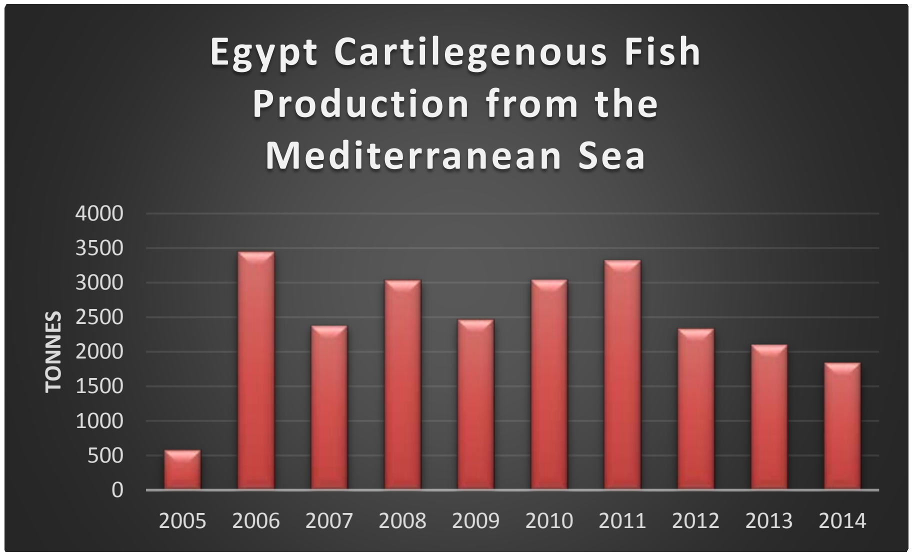


Figure 18: Annual Egyptian cartilaginous fish production from Egypt (A. Marbourk, NMFS, pers. comm. to B. Newell, NMFS, 21 July, 2016).

In the waters of Cyprus, there was a large increase in coastal trawl fishing effort in the late 1980s. From 1985-1990, there was a spike in elasmobranch capture, primarily dogfish, skates, and rays, followed by a sharp decline in capture after 1990. In response to a government fishing permit buy-back program, trawling effort has been substantially reduced since the early 2000s (Hadjichristophorou 2006). In Israel, reported landings are low, approximately at the levels of Syria and Lebanon, and have been decreasing for decades (FAO 2016c), although Edelist (2014) considered the soft-bottomed habitat off Israel to be under intensive fishing pressure. Guitarfish are caught as bycatch by local fishermen but there is little market for elasmobranch products because they are not kosher thus their consumption is forbidden by Jewish law. Elasmobranch species are primarily caught as by-catch by local fishermen using trawl and bottom long-line gear, and to a lesser extent, purse seines and trammel nets (Golani 2006). *Rhinobatos rhinobatos* are considered common in the area, while *R. cemiculus* is prevalent but less abundant than *R. rhinobatos* (Edelist 2014; Golani 2006).

The magnitude of the threat to *R. rhinobatos* and *R. cemiculus* from commercial overharvest by the Mediterranean fishing fleet is impossible to fully assess because of the lack of fisheries data, especially at the species level, from all of the countries in which these species occur. However, the available information shows fishery driven extirpation of *Rhinobatos* spp. from the northwestern Mediterranean (Capapé et al. 2006; Psomadakis et al. 2009), decreasing elasmobranch landings due to decades of technological advances and increased fishing effort (Cavanagh & Gibson 2007; Melendez & Macias 2007; Séret & Serena 2002), substantial fishing effort across gear types and fisheries concentrated in coastal areas where these species, especially pregnant females, are particularly vulnerable to capture (Çiçek et al. 2014; Echwikhi et al. 2013; Echwikhi et al. 2012; Samy-Kamal 2015), sustained targeting of these species as commercially important species (Echwikhi et al. 2013; Echwikhi et al. 2012; Lteif et al. 2016; Saad et al. 2006), and evidence of fishery driven size reduction (Enajjar et al. 2012). Based on this information we conclude that overharvest from industrial and artisanal commercial fisheries is contributing significantly to the extinction risk of both *R. rhinobatos* and *R. cemiculus* in the Mediterranean.

Commercial Overutilization in the Atlantic

In the Atlantic, *R. rhinobatos* and *R. cemiculus* range from the northwestern tip of Spain (with *R. rhinobatos* extending into the Bay of Biscay, France), south to Angola. We found no information on abundance, trends, or threats to either of these species in the European Atlantic. The majority of the commercial harvest information available for these species in the African Atlantic pertains to the FAO Subregional Fisheries Commission (SRFC) member countries: Mauritania, Senegal, Gambia, Guinea, Guinea-Bissau, Sierra Leone, and Cape Verde. Outside of the SRFC countries, we also found information on fisheries in Morocco and Gabon. We found no species specific data for either guitarfish in the following countries, which have Atlantic coastline that is considered in both species' ranges: Liberia, Cote d'Ivoire, Ghana, Togo, Benin, Cameroon, Equatorial Guinea, Republic of the Congo, Democratic Republic of the Congo, or Angola.

In the SRFC region elasmobranchs, including *R. rhinobatos* and *R. cemiculus,* have historically been extremely abundant. Prior to the 1970s elasmobranchs were primarily taken as bycatch and processed for sale to meet local demand. There was a small market for salted and dried elasmobranch meat (see fig. 19) based in Ghana that fueled trade for elasmobranch bycatch, including guitarfishes caught in Senegal and Gambia, throughout the SRFC subregion. However, compared to other fishery products, shark meat had very low value so there was little economic incentive to develop a targeted fishery. In the early 1980s, building on the elasmobranch trade network that already existed, a robust and unsustainable shark fishery quickly developed in response to the high demand for high value shark and shark-like ray fins in China, Taiwan, Singapore, and Japan. This demand has been the driving force behind the SRFC shark fishing industry for the last 20 years (Diop & Dossa 2011; Ducrocq & Diop 2006). The demand became so strong that fins were even taken off fetuses removed from harvested pregnant mothers (Diop & Dossa 2011). Furthering the economic incentive for shark fishing in Africa, the global demand for shark meat has also grown rapidly in recent decades (Clarke et al. 2007; Dent & Clarke 2015).

Figure 19: Drying of guitarfish at a processing site in Mauritania (Diop&Dossa, 2011)

In the SRFC subregion, this international industry is composed of both industrial and artisanal fishing vessels, coastal processing facilities, and a robust trade network. Vessels are owned either by local fishermen or foreign investors (primarily Spanish) who have financed improvements in fishing technology (e.g. more advanced boats and nets) as yields have declined. Elasmobranch fishing is not restricted to vessels. For example, guitarfishes are targeted with beach-based 'guitar lines' in Mauritania. In the SRFC region elasmobranch fishing effort has steadily increased since the 1970s, with landings peaking in the early 2000s (see fig. 20), and showing a significant and ongoing drop since. Throughout the region, with the exception of Cape Verde, an island nation where neither species are abundant, "resources seem to be fully exploited, if not overexploited, for almost all selachian species" (Diop & Dossa 2011; Ducrocq & Diop 2006). Because guitarfishes are also targeted for their highly valuable fins in this region, and have been heavily targeted for decades now, this status of full or overexploitation is likely also the case for guitarfishes in the SRFC region (Diop & Dossa 2011; Ducrocq 2016).

Elasmobranch fishing in the SRFC region began in Senegal and Gambia in the 1970s and has since become a migratory fishing industry where specialized shark fishing teams move into new areas along the coast or farther offshore, overexploit the resources in an area, and move on to fish unsustainably elsewhere (Diop & Dossa 2011; Ducrocq & Diop 2006). This need for increased effort has driven the need to maximize profits, further encouraging the unsustainable, wasteful practice of finning (Diop & Dossa 2011; Tous et al. 1998). As evidence of the scale of this industry and its level of waste, large piles of rotting shark carcasses have been found on beaches (Tous et al. 1998).

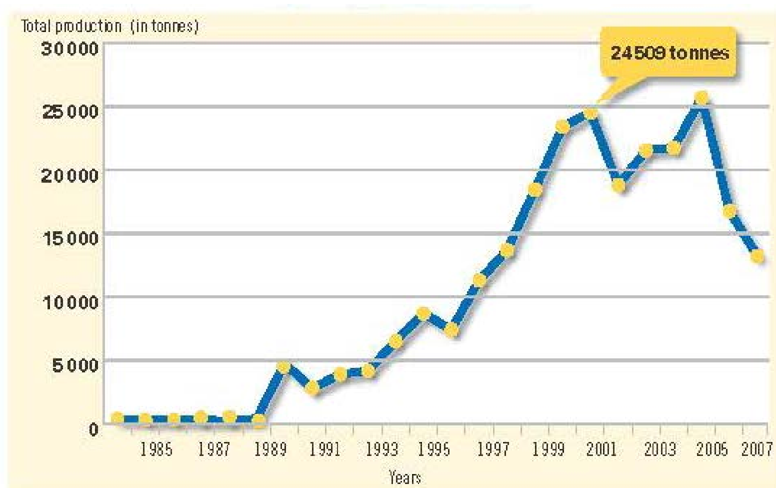


Figure 20: Trends in elasmobranch landings reported by artisanal fishers in the SRFC zone from 1984-2008 (SRPOA-Sharks data) (Diop&Dossa, 2011)

In the SRFC region, Diop and Dossa (2011) report the importance of one or both species to local elasmobranch fisheries in all member countries except Gambia and Cape Verde. Fishers throughout the subregion time their fishing activities with the migration patterns and reproductive behavior of species, including targeting guitarfishes when they return to the shallows to give birth (Ducrocq & Diop 2006). In Mauritania, *R. cemiculus* is one of the three elasmobranch species taken in highest numbers. In Guinea-Bissau and Guinea, *R. cemiculus* is one of the few elasmobranch species listed as "most important landings" and "taken in the highest numbers" respectively. In Sierra Leone "*Rhinobatos* spp. and *Dasyatis* spp. [stingrays] are [the elasmobranch groups landed in the] highest numbers, both in terms of weight and number". In Senegal both species, along with coastal sharks, are the main elasmobranch fisheries' targets (Diop & Dossa 2011). Diatta et al. (2009) also found that guitarfishes were some of the primary elasmobranchs targeted by the robust artisanal fishery in Senegal, where finning is prevalent, and that these fish were caught when they returned to shallow waters to breed.

Recent evidence suggests that the demand for shark fins has decreased in Hong Kong, China (the largest fin market in the world) since peaking in 2003-04, with a substantial decline occurring since 2011. A number of factors are likely contributing to this decline in reported imports including: increased chondrichthyan production by the domestic Chinese fleet, new regulations in China and abroad, increased monitoring, consumer backlash against artificial shark fin products, and growing conservation awareness (Clarke 2014; Dent & Clarke 2015). However, it is unclear if the decline in demand for chondrichthyan fins in China has or will reduce the threat from commercial overutilization to either guitarfish species for a few reasons: these trade statistics are not species-specific and we found no specific information on import trends for either guitarfish species; both species are also captured for their meat and the worldwide demand for chondrichthyan meat has grown steadily since the 1970s, roughly doubling since the late 1990s; and, there continues to be high demand for shark fin products in other countries such as Japan, Thailand, and Malaysia (Clarke 2014; Dent & Clarke 2015). Further adding to the uncertainty of how recent trends in chondrichthyan fin and meat trade have or will impact these guitarfishes, some of the reported trends may also be related to changes in how countries track fins and other shark products (Clarke 2014; Dent & Clarke 2015).

While the shark fin industry has been the major driver for elasmobranch declines in the SRFC countries it is not the sole driver of overutilization of *R. rhinobatos* and *R. cemiculus.* The region has also experienced heavy population shifts in recent decades, primarily from people migrating to the coast, and this has put increased demand on all marine resources. Additionally, fisheries reporting in the area is low and there is significant bycatch in the industrial fishing industry (Diop & Dossa 2011). In addition to reported harvest, the Atlantic coast has experienced extremely high rates of IUU fishing since 1980 (see **Regulatory Mechanisms in the Atlantic** in **Inadequacy of Existing Regulatory Mechanisms**), including in shallow areas where both guitarfish species are vulnerable to capture (Agnew et al. 2009; Greenpeace 2015).

As a result of the decades of sustained and widespread targeting of guitarfishes and other elasmobranchs in the SRFC region, combined with the increasing overall fishing effort, there has been an decrease in elasmobranch catch with some species, such as sawfishes, lemon sharks and African wedgefish, almost completely disappearing (Diop & Dossa 2011; Ducrocq 2016; Ducrocq & Diop 2006) and other species, including guitarfishes, becoming scare (Diop & Dossa 2011). Based on surveys of fishers conducted by the IUCN Guniea-Bissau Programme and the national Centro de Investigacao Pesqueira Applicada, both guitarfishes were the main targets of specialized fishing teams in Guinea-Bissau, but had declined substantially as of the late 1990s (Fowler & Cavanagh 2005; Tous et al. 1998). This fishing pressure also drove down the average size of *R. rhinobatos* landed (Notarbartolo di Sciara et al. 2007b). According to unpublished data from the Senegalese Ministry of Maritime Economy and International Maritime Transportation, guitarfishes' landings in Senegal have decreased from 4,050 t in 1998 to 821 t in 2005, with a reduction in the size of specimens landed (Notarbartolo di Sciara et al. 2007a). Diop and Dossa (2011) reported that in the Banc d'Arguin National Park in Mauritania, 95% of landed *Rhinobatos cemiculus* are smaller than their size-at-maturity, which is likely impacting the species' reproductive capacity. A ban on shark fishing in Banc d'Arguin National Park has allowed guitarfishes to recover within the parks boundaries, but both species are still heavily targeted outside of the park (M. Ducrocq, Parcs Gabon, pers. comm. to J. Shultz, NMFS, 21 June, 2016).

While Diop and Dossa (2011) characterize one or both species as important, or landed in high numbers in fisheries in Senegal, Mauritania, and Guinea-Bissau, the authors do not state a time period for these characterizations. As just discussed, significant declines in the overall abundance of guitarfishes are reported in all of these countries (Diop & Dossa 2011; Ducrocq 2016; Fowler & Cavanagh 2005; Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b) as well as substantial declines in the landings of larger, more fecund, individuals of both species in Guinea-Bissau, Senegal (Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b) and Mauritania (Diop & Dossa 2011). Similar trends are likely in Guinea and Gambia (M. Ducrocq, Parcs Gabon, pers. comm. to J. Shultz, NMFS, 21 June, 2016), and because of the migratory fisheries in the SRFC countries, and the reported scarcity of guitarfishes throughout the area (Diop & Dossa 2011), it is reasonable to assume similar declines have or will occur in Sierra Leone.

Outside of the SRFC countries we found little information on the specific impacts of commercial fishing on either species. North of the SRFC area, both species are likely rare in Morocco, where they are not targeted but at least *R. rhinobatos* occurs as demersal trawl bycatch (Notarbartolo di Sciara et al. 2007b). We found no species or genus specific information on the commercial exploitation of *Rhinobatos* spp. in Morocco but in general, Moroccan fisheries are likely overexploited after years of intense, and likely extremely underreported, fishing activity by foreign vessels (Belhabib et al. 2012b; Jouffre & Inejih 2005). East of the SRFC area in the Gulf of Guinea, there is also some evidence of overexploitation of both species. The demand for dried and salted elasmobranch meat in Ghana and parts of West Africa was an early driver of the regional elasmobranch industry, where the artisanal fishing industry is an important and entrenched part of the economy (Diop & Dossa 2011; Ducrocq & Diop 2006; Nunoo & Asiedu 2013) and *R. rhinobatos,* but not *R. cemiculus,* was recently reported in artisanal fisheries landings (Nunoo & Asiedu 2013). During an ethnographic study of pelagic artisanal fisheries in Ghana, which was conducted from September 2015 to September 2016, guitarfish were among the batoid species being dried and sold on tables in Tema, and when fishers were shown pictures of elasmobranchs in Dixcove, Shama, and Busua, guitarfish were recognized and well known. During this study the guitarfish were not identified to species level. While the species were not present at markets in Dixcove, Shama, and Busua, in these areas the fishers were largely using surface and mid-water gear, so guitarfish may not have been caught (D. Berces, University of Florida, pers. comm. to B. Newell, NMFS, 14 November, 2016). The demersal fisheries resources of Ghana have been "operating under stress during the last decades (Nunoo & Asiedu 2013) and there has been a near-complete removal of top predatory fish by overfishing in Ghana's coastal habitat (Ateweberhan et al. 2012). Artisanal fishers from Ghana, as well as from neighboring Togo and Benin, have migrated to other countries' fishing grounds along the west coast of Africa, likely because fishing grounds in these countries are overexploited, overcrowded, or both (De Bruyne 2015; Diop & Dossa 2011).

In Nigeria, Ambrose et al. (2005) reported the presence of a robust shrimp fishing industry composed of a limited access industrial fishery (266 otter board trawlers) and an open access artisanal fishery. The artisanal fishery operates in nearshore waters 1-2 nautical miles from the coast, and in coastal waterways. Ambrose et al. (2005) collected fishery dependent data and fishery independent data year round in 2002 to study bycatch in the artisan shrimp vessels fishing off the Lagos Coast. They found this fishery had the highest rate of bycatch in any Nigerian fishery. Two *R. rhinobatos* ranging 15-28 cm were caught during this study. The sizes of these individuals indicates that there are likely neonate *R. rhinobatos* in this area (see **Reproduction and Growth**), which is an important nursery area for many species. While the abundance of *R. rhinobatos* in the area is unclear, it seems likely that pregnant females and early life stage *R. rhinobatos* are vulnerable to bycatch in this area.

In Gabon, both species are present in coastal waters, and targeted by fishers for their meat and to supply the black market fin trade, which is connected to the West African fin trade (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. Comm. to B. Newell, NMFS, 26 June, 2016). In the area of the village of Mayumba in southwest Gabon, *R. cemiculus* was the most frequent batoid species captured by artisanal fishers from 2014-2015 (*R. rhinobatos* not present at this time). This catch included no mature females, which was noted by the author as an indicator that fishing has had a negative impact on the reproductive capacity of this species in the area. Although the author noted the absence of pregnant females, he only had recent data from the area and cannot say if pregnant females had previously been present (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. Comm. to B. Newell, NMFS, 26 June, 2016). "Sea fishing" began around Mayumba in the 1950s with the arrival of fishers from Ghana, Benin, and Togo, many of which had been crowded out of fishing grounds in the Republic of the Congo. Until recently this area experienced unsustainable industrial and IUU fishing. In this area there has also long been subsistence fishing by locals in the Banio Lagoon, where sharks and rays were prevalent 30 years ago but are almost impossible to catch today (De Bruyne 2015). Based on this information it appears that overutilization has caused a decline in abundance and possibly the reproductive capacity of

R. cemiculus in at least part of Gabonese waters. We found no species specific information for *R. rhinobatos* in Gabon.

Based on the evidence of both species becoming scarce in the SRFC countries due to widespread targeted fishing pressure, the reported fishery induced size reduction in many studied portions of these species ranges', and the migratory nature of the shark fisheries along the west African coast, we conclude that commercial overutilization is contributing significantly to the extinction risk of these species in this portion of their ranges'.

Disease or Predation

Rhinobatos spp. are consumed by large sharks such as the dusky shark, *Carcharhinus obscurus* (Camhi et al. 2005). We found no information on disease affecting either of these species. A number of studies, including Beveridge et al. (2004), Genç et al. (2006), Neifar et al. (2001a), Neifar et al. (2001b), Neifar et al. (2002), and Sprent (1990), showed that both species host parasites. Genç et al. (2006) stated that an infection by an anisakid nematode, *Hysterothylacium aduncum*, in the digestive tract of *R. rhinobatos*, "could be a serious threat to the common guitarfish," but did not elaborate how, or to what degree. Based on the best available information we conclude that disease or predation is not contributing significantly to the extinction risk of these species.

Inadequacy of Existing Regulatory Mechanisms

Regulatory Mechanisms in the Mediterranean

In 2009 both species were listed on SPA/BD Annex III: List of Species Whose Exploitation is Regulated, which was adopted under the Barcelona Convention in 1995 (Bradai et al. 2012). In 2012 both species were uplisted to Annex II: List of Endangered of Threatened Species (de Benedictis 2016). This protocol charges all parties with identifying and compiling lists of all endangered or threatened species in their jurisdiction, controlling or prohibiting (where appropriate) the taking or disturbance of wild protected species, and coordinating their protection and recovery efforts for migratory species, among other measures that are likely less relevant to both guitarfishes (RAC/SPA 1996). Currently all coastal Mediterranean countries where these species occur are contracting parties (European Commission 2016). Further, since 2012, both species have been protected by GFCM recommendation GFCM/36/2012/3. To protect elasmobranchs this recommendation prohibits the sale of sharks that cannot be identified before the first point of sale, such as those that have been finned, skinned, or beheaded, and it prohibits trawling in the first three nautical miles off the coast or up to the 50 m isobaths (whichever comes first). Additionally, Annex II and III species cannot be retained on board, transshipped, landed, transferred, stored, sold or displayed or offered for sale, and must be released unharmed and alive to the extent possible (GFCM 2012). Any capture of these species in the GFCM area of competence, which includes all national and high seas waters of the Mediterranean and Black Seas, is considered IUU fishing (de Benedictis 2016; FAO 2016f).

The efficacy of these and other protections is unclear, but it appears that countries have historically been slow to adopt and enforce SPA/BD Annex II and III protections (Serena 2005). Italy, Greece, and Lebanon have promulgated regulations in accordance with SPA/BD Annex II (Bradai et al. 2012; Lteif 2015). The Greek Hellenic Ministry of Rural Development & Food recently adopted and released Circular No. 4531/83795 / 20-07-2016 to inform all stakeholders of these regulations (Hellenic Ministry of Rural Development & Food, pers. comm. to B. Newell, NMFS, 18 November, 2016). Lebanon issued decision number 1045/1 on November 25, 2015 to adopt regulations related to SPA/BD Annex II (Carla Jazzar, Embassy of Lebanon, pers. comm. to D. Wieting, NMFS, 7 December, 2016). Lteif (2015) reported that regulations related to *Rhinobatos* spp. are neither being followed or enforced in

Lebanon, but the data this conclusion is based on appear to have been collected up until approximately the time that decision number 1045/1 was issued, so the enforcement of relevant regulations may now be effective. Tunisia has restricted the retention of rays and skates less than 40cm (Bradai et al. 2012) but, Echwikhi et al. (2012), in their study of Tunisian gillnet fisheries, described Mediterranean gillnet fisheries as "unregulated." This was echoed by Echwikhi et al. (2013) in their paper on elasmobranch longline fisheries in Tunisia, again describing the Mediterranean longline fisheries as "unregulated." All cartilaginous fishes are protected in Israel (Bradai et al. 2012). We found no information specific to the regulation of guitarfishes or elasmobranchs in Turkey. However, according to an undated note from the Organization for Economic Co-operation and Development, licensing of fishermen and their vessels is required in Turkey and new fishing licenses have not been issued since 1997, in an effort to control overfishing. Additionally, there is a seasonal ban on the use of trawls and purse seines between May and September to protect spawning stocks and the agency responsible for Turkish fisheries management, the Ministry of Agricultural and Rural Affairs, releases yearly circulars that describe restrictions for stock control in commercial and recreations fisheries (OECD undated).

Historically, monitoring of the Mediterranean fleet has been negligible (Séret & Serena 2002) and the data on cartilaginous fishes have not been reported at the species level (Echwikhi et al. 2012; Serena 2005). Vessel, bycatch, and discard data from artisanal fisheries, which primarily operate along the coast and make up 80% of the vessels in the Mediterranean, are difficult to obtain and likely underreported (FAO 2016c, 2016d). In Lebanon, Turkey, and Tunisia, the artisanal sector makes up well over 80% of the total vessels, and no data were available for Syria (FAO 2016c), increasing the likelihood that fisheries in these important portions of *Rhinobatos* spp. range are underregulated and catches are underreported. In Egypt, which is also an important part of the range of at least *R. rhinobatos*, the wild catch fisheries are underregulated as the government has focused most of its resources to supporting the booming aquaculture industry (Samy-Kamal 2015).

Based on the long history of underregulation and underreporting of *Rhinobatos* spp. catches in the Mediterranean, the abundance of difficult to regulate, coastal, artisanal fishers in both species ranges, combined with the high catchability and low reproductive potential of these species, we conclude that the inadequacy of existing regulatory mechanisms is likely significantly contributing to the extinction risk of both *R. rhinobatos* and *R. cemiculus*. The 2012 SPA/BD Annex II listing may in time provide sufficient protection to reduce these species' risk of extinction, but at this time the uncertainty associated with the enforcement of these restrictions is too great to conclude that these protections are adequate to prevent overutilization.

Regulatory Mechanisms in the Eastern Atlantic

France, Spain, and Portugal have all banned finning or abide by the European Union (EU) finning regulation (EC) 1 185/2003. ICES, which provides science-based fisheries management advice to its member countries, including France, Spain, and Portugal, has recommended that the total allowable catch for *Rhinobatos* spp. in these countries be set at zero (ICES 2010). France and Spain have signed the 2009 Port State Measures Agreement to Prevent, Deter and Eliminate Illegal, Unreported, and Unregulated Fishing and are awaiting ratification, while the EU has both signed and ratified the agreement. Portugal has a seasonal fisheries closure for skates and rays in May (Fischer et al. 2013). It is unknown how these regulations affect the extinction risk of *R. rhinobatos* and *R. cemiculus* because these species appear to be rare in the European Atlantic (See **Distribution and Historical or Current Abundance**).

In the Atlantic African countries, as in the Mediterranean, artisanal fishing makes up a huge, growing proportion of the fishing activity. This fishing sector has until recently lacked species specific data and strong management or regulations (De Bruyne 2015; Diop & Dossa 2011; Nunoo & Asiedu 2013). Along the Atlantic coast of Africa, all of the SFRC countries have passed regulations that offer some protection to either or both species. Beginning in 1998, specific management measures were put in place in Banc d'

Arguin National Park in Mauritania, including net size limitations and a seasonal closure from mid-September to January, when mating and birthing events take place (Notarbartolo di Sciara et al. 2007a), but *R. cemiculus* was still heavily targeted from 1998 to 2003, resulting in an apparent reduction in the species' size (Notarbartolo di Sciara et al. 2007a). The length of this seasonal closure increased up until 2003 when all shark fishing (including both species of guitarfish but excluding houndshark) was banned in Banc d'Arguin National Park (Diop & Dossa 2011; Notarbartolo di Sciara et al. 2007a; Notarbartolo di Sciara et al. 2007b).

Cape Verde, Guinea, Gambia, and Sierra Leone have all banned finning (Diop & Dossa 2011).Guinea and Sierra Leone have introduced shark fishing licenses. Guinea-Bissau dismantled shark fishing camps in the Bijagos Archipelago and banned shark fishing in all MPAs. Senegal established size limits for *R. cemiculus* (106 cm for males and 100 cm for females). However, all of the SRFC countries lack adequate technical and financial resources for monitoring and management, and regulations at the country level are not very strict and lack regional coordination (Diop & Dossa 2011). Whether these regulatory protections put in place in the SRFC countries are reducing the extinction risk of these species is unknown at this time.

Some other Atlantic African nations also have relevant regulations. In Ghana, some fisheries regulations exist but, according to Ateweberhan et al. (2012), Ghanaian management and policy has long overlooked coastal habitats and illegal and unsuitable fishing practices occur regularly (e.g. fishing out of season, fishing with poison). In Nigeria, the Nigeria Sea Fisheries Act (2011) prohibits the dumping of shark carcasses at sea (HSI 2016). Ambrose et al. (2005) reported that the industrial shrimp fishery in Nigeria was a limited access fishery with required vessel registration, but the artisanal shrimp fishery, which operates in nearshore and coastal waters, is open access and not regulated by the government. In 2002, the Nigerian artisanal shrimp fishery had the highest rate of bycatch of any fishery in the country (Ambrose et al. 2005).

In Gabon, there is a national marine planning effort called 'Gabon Bleu', which was established in 2012. This effort seeks to improve management of marine resources across different stakeholder groups, including artisanal and industrial fisheries. The country's 2005 Fisheries Code had established regulations that were not being followed, including the disconnection of vessel monitoring systems and the use of illegal monofilament nets by artisanal fishers. In 2012, under Gabon Bleu, all fishing activity was suspended and all fishers who wished to resume work were required to sign an agreement that clearly defined the regulations and required their participation in fisheries research. There was also a crackdown on IUU fishing in the area (De Bruyne 2015). Additionally, both species are considered "sensitive species" and cannot be target by fishers. Unfortunately, these regulations have not eliminated the black market for fins so guitarfishes are still being targeted by artisanal fishers in Gabon and continue to be illegally finned by demersal trawl fishers (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. Comm. to B. Newell, NMFS, 28 June, 2016). In Mayumba National Park, only artisanal fishers have been allowed to operate and sharks are no longer targeted (De Bruyne 2015). Recent efforts to improve monitoring of artisanal catches have also been made in Ghana (Nunoo & Asiedu 2013). Republic of the Congo (also called Congo-Brazzaville), which shares Gabon's southern border, banned all shark fishing along its entire coastline in 2001 (Marine Conservation Institute 2016), although we found no information on the enforcement of this ban.

IUU fishing by foreign fleets is also a major challenge for sustainable fishing in Africa. For decades, the west coast of Africa has experienced some of the highest amounts of IUU fishing in the world (Agnew et al. 2009). Historically EU vessels had fished unsustainably off African countries (Agnew et al. 2009; Belhabib et al. 2012a), but recent regulatory updates, such as the reform of the EU Common Fisheries Policy (CFP), have curbed these practices (Greenpeace 2015). Currently, the biggest source of IUU fishing in Atlantic African waters, in particular the SFRC region, is China, whose African distant water fishing fleet has swelled from 13 vessels in 1985, to 462 vessel in 2013 (Greenpeace 2015). Chinese vessels, which negotiate fishing agreements with African countries, have been documented trawling in shallow prohibited areas, underreporting catch, using illegal fishing gear, misreporting vessel specifications (including gross tonnage), and tampering with vessel monitoring systems (Greenpeace 2015). Currently it appears that many west African coastal states lack the regulatory and enforcement capacity to adequately deal with this issue (Greenpeace 2015).

We found no regulatory information for Morocco, Liberia, the Ivory Coast, Togo, Benin, Cameroon, Democratic Republic of the Congo, or Angola. We found little information on the effectiveness of the current regulations in countries along the west coast of Africa, so it is difficult to assess how these regulations are impacting the extinction risk of both species. However, based on the rapid growth of unregulated or underregulated exploitation of both species in the African Atlantic, still prevalent IUU fishing, and the novelty of efforts to regulate and manage fishers who have long been undermanaged, we conclude that the inadequacy of regulations in the past has likely contributed significantly to the extinction risk of both *R. rhinobatos* and *R. cemiculus* from Morocco to Angola. We also conclude that in this portion of these species' ranges, current regulations are likely inadequate to reduce the significant threat caused by commercial overutilization.

Other Natural or Manmade Factors

Climate Change

Because these species prefer subtropical waters (see **Distribution and Historical or Current Abundance**) it is possible that both of these species could experience a range expansion or shift in the future as waters warm in the eastern Atlantic and the Mediterranean. New occurrences of tropical fishes have been reported in Galicia, Spain, which is along the northern edge of both species' ranges Bañón et al. (2002), and alien tropical marine species are becoming increasingly common in the Mediterranean while indigenous subtropical species are expanding their ranges northward (Bianchi 2007; Psomadaki et al. 2012).

Akyol and Capapé (2014) suggested the recent occurrence of two large *R. cemiculus* in Izmir Bay, Turkey, which was the first report of this species in the area, may constitute a climate change related range expansion. Rafrafi-Nouira et al. (2015) attributed the 2011 capture of many *R. cemiculus* off northern Tunisia (where they are not typically common) to warming sea temperatures. Additionally, one *R. cemiculus* was recently reported in the Sea of Marmara for the first time, which would also be considered a northward range expansion (C. Mancusi, ARPAT, pers. comm. to B. Newell, NMFS, 23 March, 2016). Assuming these recent *R. cemiculus* range expansions are related to temperature, it is likely, given that the listed range of *R. rhinobatos* extends farther north than that of *R. cemiculus* (in the Bay of Biscay), that a similar range expansion is possible for *R. rhinobatos.*

Besides the possibility of a range expansion, the other effects of climate change and the associated phenomenon of ocean acidification and sea level rise are more uncertain and we found no information on specific impacts to either of these species. We found no information regarding the upper limit of temperature that these species will tolerate so at this time it is impossible to hypothesize if rising temperatures in the Mediterranean or eastern Atlantic could curtail portions of either species' range. We also found no information suggesting that these species use currents for any phases of their life history, so potential effects of climate induced shifts in ocean circulation are unknown. Despite the effects that ocean acidification will have on many crustaceans, which are one of the primary food sources for both species (see **Feeding and Diet**), *Rhinobatos* spp. are opportunistic feeders who consume a diverse diet throughout their ranges, so potential impacts to the food web may be a minimal threat to these species. Sea level rise will likely cause shifts in coastal habitat throughout both species' ranges, but we found no information on species specific impacts. Overall the contribution of climate change to the extinction risk of *R. rhinobatos* and *R. cemiculus* is highly uncertain and we found no information to indicate that it will contribute significantly to the extinction risk of these species in the foreseeable future.

Invasion by Alien Species

As discussed in the **Climate Change** section, rising sea temperatures in the Atlantic and Mediterranean are driving the range expansion of tropical and subtropical species. This shift in biodiversity is working in concert with the introduction of new species. We found no information about the introduction of species in the Eastern Atlantic portion of *R. rhinobatos* and *R. cemiculus* ranges. In the Mediterranean, new Atlantic species naturally actively travel into the Mediterranean through the Straits of Gibraltar or they are carried by currents. Additionally, species are introduced intentionally or unintentionally by humans including via the Suez Canal, a manmade structure that has connected the southeastern Mediterranean and the Red Sea since 1869. This phenomenon is called Lessepsian migration, named for the French engineer F. de Lesseps who promoted the cutting of the canal. The rate of Lessepsian migration has increased since the 1970s because of salinity changes induced by the construction of the Aswan Dam on the Nile River (Bianchi 2007; Gücü & Bingel 1994). Lessepsian migration has had a significant impact on the biodiversity and fisheries catch composition of the Levant Sea (Bianchi 2007; Golani 2006; Gücü & Bingel 1994; Keskin et al. 2011; Psomadaki et al. 2012; Yemisken et al. 2014) and species of Red Sea origin have recently been spreading to other parts of the Mediterranean (Bianchi 2007; Psomadaki et al. 2012). Golani (1996) found that Lessepsian migrant species disproportionately inhabit coastal sandy and muddy bottoms. Therefore, it is likely that many of these species interact with *R. rhinobatos* and *R. cemiculus*.

We found no information indicating that the invasion of alien species would affect the extinction risk of either of these species. Halave's guitarfish (*Glaucostegus halavi*), a resident of the Red Sea, was confirmed for the first time in the Mediterranean in 2004. This specimen, likely a Lessepsian migrant, was found in the Gulf of Gabès, Tunisia (Ben Souissi et al. 2007), indicating the potential for this species to disperse throughout the Mediterranean range of both *R. cemiculus* and *R. rhinobatos*. However, this record is in question and may not prove to be valid (Bradai et al. 2012). We found no other confirmed reports of this species in the Mediterranean or the potential threats to *R. cemiculus* and *R. rhinobatos*, such as competition for resources, should *R. halavi* become established in the Mediterranean. Based on the available information, we are unsure how the spread of alien species in the ranges of *R. rhinobatos* and *R. cemiculus* affects these species but at this time we do not believe this threat contributes significantly to the extinction risk of either species.

Extinction Risk Analysis

According to section 4 of the ESA, the Secretary (of Commerce or the Interior) determines whether a species is threatened or endangered as a result of any (or a combination) of the following factors: (A) destruction or modification of habitat, (B) overutilization, (C) disease or predation, (D) inadequacy of existing regulatory mechanisms, or (E) other natural or man-made factors. Collectively, the Services simply refer to these factors as “threats.” As part of this status review, we evaluated the impact of the above threats on the extinction risk of the species. To do this, we conducted a threats assessment in which we identified the present threats currently operating on the species and their likely impact on the biological status of the species. We also looked for future threats (where the impact on the species has yet to be manifested) and considered the reliability to which we could forecast the effects of these threats and future events on the status of the two *Rhinobatos* species.

To further inform our extinction risk determination, we conducted demographic risk analyses for the two species, evaluating population viability characteristics and their trends, such as abundance, growth rate/productivity, spatial structure and connectivity, and diversity, to determine the potential risks they pose to the species. These analyses provide an assessment of the biological response or manifestation of past factors for decline and present threats.

<table>
<tr><th colspan="2">Box 1: Qualitative ‘Reference Levels’ of Relative Extinction Risk</th></tr>
<tr><td>Continuum of decreasing relative risk of extinction ↑</td><td>Low risk: A species is at low risk of extinction if it is not at moderate or high level of extinction risk (see “Moderate risk” and “High risk” below). A species may be at low risk of extinction if it is not facing threats that result in declining trends in abundance, productivity, spatial structure, or diversity. A species at low risk of extinction is likely to show stable or increasing trends in abundance and productivity with connected, diverse populations.

Moderate risk: A species is at moderate risk of extinction if it is on a trajectory that puts it at a high level of extinction risk in the foreseeable future (see description of “High risk” below). For the foreseeable future defined for the purposes of this status review, see Box 2 below. A species may be at moderate risk of extinction due to projected threats or declining trends in abundance, productivity, spatial structure, or diversity. The appropriate time horizon for evaluating whether a species is more likely than not to be at high risk in the foreseeable future depends on various case-and species-specific factors. For example, the time horizon may reflect certain life history characteristics (e.g., long generation time or late age-at-maturity) and may also reflect the time frame or rate over which identified threats are likely to impact the biological status of the species (e.g., the rate of disease spread).

High Risk: A species with a high risk of extinction is at or near a level of abundance, productivity, spatial structure, and/or diversity that places its continued persistence in question. The demographics of a species at such a high level of risk may be highly uncertain and strongly influenced by stochastic or depensatory processes. Similarly, a species may be at high risk of extinction if it faces clear and present threats (e.g., confinement to a small geographic area; imminent destruction, modification, or curtailment of its habitat; or disease epidemic) that are likely to create present and substantial demographic risks.</td></tr>
</table>

Using this information, we evaluated the overall extinction risk of the two *Rhinobatos* species. Because species-specific information (such as current abundance) is sparse, a qualitative 'reference level' of relative extinction risk was used to describe the assessment of extinction risk for each species. The definitions of the qualitative 'reference levels' of relative extinction risk are provided in Box 1.

Recommendations as to whether the species should be listed as threatened or endangered were not part of this analysis. Rather, scientific conclusions about the overall risk of extinction faced by the species were based on an evaluation of the species' demographic risks and threats. Determination of the ESA listing status of each species is a decision that includes the above analyses as well as consideration of the certainty of implementation of future conservation efforts, the certainty of effectiveness of existing conservation efforts, as well as other management considerations.

Rhinobatos rhinobatos

Demographic Risk Analysis

Abundance

We found no species-specific quantitative historical or current abundance estimates described for *Rhinobatos rhinobatos.* However, where information is available, it appears that this species is declining in abundance. The best available information suggests that this species was once distributed along all Mediterranean coasts. With the exception of Sicilian waters and the Balearic Islands, it was likely rare in the northwestern Mediterranean, at least dating back to the 1940s, but it has since been extirpated from the coastal waters of Spain, France, and Italy because of long term intensive fishing pressure and habitat modification (Baino et al. 2001; Bertrand et al. 2000; Dulþiü et al. 2005; Notarbartolo di Sciara et al. 2007b; Psomadakis et al. 2009).

Box 2: Defining Foreseeable Future

For both *R. rhinobatos* and *R. cemiculus* there is limited information regarding their life history and abundance trends over time. Based on the available information these species produce a modest number of fast growing young and mature between approximately two and six years of age, with females maturing later than males, older females having higher reproductive capacity, and *R. cemiculus* likely maturing later than *R. rhinobatos* (see **Reproduction and Growth**). Additionally, the future effects of the principle threat to these species, overutilization, are difficult to quantify because of uncertainty associated with the effectiveness of recent regulatory and conservation efforts, and in the case of the eastern Atlantic, the migratory nature of the fisheries. However, based on the best available information, large numbers of mature females of both species have already been removed from the population by targeted fishing in shallow waters, and this threat is likely to continue in portions of their ranges in the future, at least until some recent regulations and conservation efforts can mature and their results can be evaluated (see **Inadequacy of Existing Regulations**). In some portions of their ranges' there is evidence of rapid declines in response to unsustainable fishing pressure (see **Overutilization for Commercial, Recreational, Scientific, or Educational Purposes**). The IUCN assessment of *R. cemiculus* stated: "It is suspected that there will be a projected decline of 50% within three generations (15 to 30 years) on the basis of the severe declines in other guitarfishes and wedgefishes, the continuation of fishing pressure in shallow coastal habitats, the potential for fishing effort to shift towards the further targeting of guitarfish in light of their highly valued fins, particularly in the absence of other sharks" (Notarbartolo di Sciara et al. 2007a). Based on all of this information, for the purposes of this status review we are defining "foreseeable future" as 15-20 years, which corresponds roughly to three generations of *R. cemiculus* (Enajjar et al. 2012) and is a reasonable amount of time to project the continued threat of overutilization as countries throughout both species' ranges develop and begin to enforce relevant regulations.

It is unclear how important this portion of the species range was, and to what degree it contributed to the overall abundance of *R. rhinobatos.*

Because of the lack of species specific catch reporting throughout most of this species' range, changes in *R. rhinobatos* abundance are difficult to assess. However, in key portions of this species' range, where they are historically among the most common elasmobranch species, there have been overall declines in elasmobranch abundance, which may provide insight into the status of *R. rhinobatos*. Targeted elasmobranchs, especially batoids, have experienced a recent decline in abundance in southern Tunisia (see the **Mediterranean** subsection of **Distribution and Historical or Current Abundance**) where *R. rhinobatos* has been one of the few elasmobranchs targeted by artisanal fishers for decades (Echwikhi et al. 2013; Echwikhi et al. 2012). Fishing pressure has caused declines in elasmobranch diversity in Lebanon where *R. rhinobatos* is targeted (Lteif et al. 2016). Decades of intensive trawling on the continental shelves of southeast Turkey has significantly altered the demersal fish community indicated by decreasing catch, increasing catch per unit effort (CPUE), and decreasing average size of landed species (Çiçek et al. 2014). In Cyprus, after a spike in landings of dogfish, skates, and rays by shallow water trawls and artisanal fishing there were sharp declines in landings of these groups, although this threat has likely diminished over the last decade due to regulatory efforts (Hadjichristophorou 2006).

In the SRFC countries of West Africa, which includes Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone, Diop and Dossa (2011) report that guitarfishes abundance has declined. Although they do not describe the status of each species in each country, *R. rhinobatos* and *R. cemiculus* appear to be the most historically abundant guitarfish species, and throughout the region guitarfishes are now described as scarce. In Guinea-Bissau, a spike in targeted fishing pressure beginning in the late 1990s caused substantial declines and size reductions of landed individuals in the *R. rhinobatos* population after just a few years. (Fowler & Cavanagh 2005; Notarbartolo di Sciara et al. 2007b; Tous et al. 1998). Similar declines are reported over this same time period in Senegal (Notarbartolo di Sciara et al. 2007b).

We found no information on abundance trends throughout the rest of this species' Atlantic range, but based on the migratory nature of the fisheries in this area, and the prevalence of IUU fishing, it is likely that *R. rhinobatos* is experiencing similar declines throughout this portion of its range.

With the notable exception of *R. rhinobatos* becoming common in the Tunis Northern and Southern Lagoons after a substantial environmental restoration effort (Mejri et al. 2004), we found no other evidence of *R. rhinobatos* increasing in abundance throughout any part of its range. It is unknown if the increase of *R. rhinobatos* in the Tunis Lagoons is the result of an increasing population or simply individuals migrating into what has become suitable habitat.

Growth Rate/Productivity

Compared to bony fishes and many other vertebrates, elasmobranchs are slow growing with low reproductive capacity (Cortés 2000; Dulvy et al. 2014). *Rhinobatos rhinobatos* likely matures between two and four years of age and may grow relatively fast compared to other elasmobranchs (Başusta et al. 2008; Ismen et al. 2007). The reproductive capacity and behavior of *R. rhinobatos* leaves it vulnerable to overexploitation. Older, larger females are the most productive (Capapé et al. 2004), and mature adults, primarily females, congregate seasonally in shallow areas to breed and give birth. These seasonal patterns are well known to fishers and have been exploited throughout portions of this species' range. Where data are available, pregnant females often make up a high percentage of the catch (Diop & Dossa 2011; Echwikhi et al. 2013; Echwikhi et al. 2012). This targeting of mature individuals has caused a decline of the average size at maturity and rate of maturity in guitarfish catches in Banc d'Arguin National Park in Mauritania (Diop & Dossa 2011), Guinea-Bissau (Notarbartolo di Sciara et al. 2007b), and the Gulf of

Gabés, Tunisia (Enajjar et al. 2008), likely indicating that the productivity of *R. rhinobatos* is negatively affected by overexploitation.

Spatial Structure/Connectivity
We found little information regarding the spatial structure of *R. rhinobatos* populations. ICES (2010) stated that the relationship between the Mediterranean and Atlantic stocks of *R. rhinobatos* is unclear. The Strait of Gibraltar does not act as a rigid barrier to species movement (Serena 2005). However *R. rhinobatos* has likely always been rare along the entire coast of Morocco and Gulyugin et al. (2006) detected a natural gap in many species ranges at 32-34°N (northern Morocco) potentially limiting mixing between *R. rhinobatos* in the Mediterranean and the Atlantic. We found no tagging studies or any other information that shows philopatry throughout the year or during the breeding season. However, given that *R. rhinobatos* has not returned to the northwestern Mediterranean after being extirpated decades ago, including from the waters around Sicily and the Balearic Islands where this species was likely common, there may be populations of *R. rhinobatos* with restricted ranges that are vulnerable to extirpation in other portions of their range.

Diversity
The loss of diversity can increase a species' extinction risk through decreasing a species' capability of responding to episodic or changing environmental conditions. This can occur through a significant change or loss of variation in life history characteristics (such as reproductive fitness and fecundity), morphology, behavior, or other genetic characteristics. *Rhinobatos rhinobatos* has shown differences in TL, size at maturity, and reproductive timing throughout its range (Ismen et al. 2007; Lteif et al. 2016). The decreasing abundance of this species throughout its range, combined with the potential for extirpation of populations that may have their own unique life history traits, indicates that there is potential for populations to become isolated. Thus, should further extirpations occur and this species become more fragmented, there may be increased risk of random genetic drift and recessive detrimental alleles could be fixed, reducing the overall fitness of the species.

Threats Assessment
As discussed in the **Analysis of the ESA Section 4(a)(1) factors** section, present threats to this species include commercial overutilization, inadequacy of existing regulatory mechanisms, and destruction or modification of coastal habitats. The long history of fishing in the Mediterranean has driven the extirpation of this species from Spain to Italy and likely led to declines in abundance throughout much of its remaining Mediterranean range, although it should be noted that the contribution of this portion of *R. rhinobatos* historical range to the health of the entire population is unknown. In the Atlantic, the sharp increase in the targeting of this species and other elasmobranchs to supply the shark fin trade has driven rapid declines in the abundance of *R. rhinobatos*, at least from Mauritania to Sierra Leone where some data are available. Throughout most of this species' range regulations on the demersal fisheries that have driven the decline of this species have only recently been put into effect. Based on the available information these regulations are likely inadequate or not well enforced in key portions of this species' range and many of the fisheries that impact this species are not well monitored. Additionally, areas of this species' range are experiencing increasing human populations and increased degradation of the coastal zone, although the magnitude of this threat to this species is unknown at this time. Thus the future threat posed by continued pressure from industrial and artisanal fishing likely contributes significantly to the extinction risk of *R. rhinobatos,* and there are not adequate regulations in place that are likely to reduce this threat and reverse the decline of this species.

Risk of extinction
Although there is no quantitative analysis of *R. rhinobatos* abundance over time, the best available information indicates that this species has been extirpated from large portions of its range and has experienced declines throughout other important portions. There is significant uncertainty regarding the

status of the current populations but this species may still be relatively common, although very likely less than it was historically, in Tunisia, Israel, Lebanon, Syria, and southeastern Turkey. However, given the evidence of fishery driven extirpation in this species, the continued growth of fisheries, particularly artisanal fisheries which are poorly monitored and regulated, and the substantial and relatively rapid declines in landings throughout much of its West African range, we conclude that throughout its range, this species is at a moderate risk of extinction.

Rhinobatos cemiculus

Demographic Risk Analysis

Abundance

There are no quantitative historical or current abundance estimates or trends described for *Rhinobatos cemiculus.* However, where information is available, it appears that this species is declining in abundance. The best available information suggests that this species was once widespread throughout most of the coastal Mediterranean, with the likely exception of the coast of France, but it has since been extirpated from the coastal waters of Spain and Italy because of long term intensive fishing pressure and habitat modification (Baino et al. 2001; Bertrand et al. 2000; Dulþiü et al. 2005; Psomadakis et al. 2009). With the exception of the waters around the Balearic Islands and Sicily, it was likely rare in the areas where it has been extirpated and the relative contribution of this now curtailed portion of their range to the overall abundance of the species is unknown.

Because of the lack of species specific catch reporting throughout most of this species range, changes in *R. cemiculus* abundance are difficult to assess. However, in key portions of this species' range where they are historically among the most common elasmobranch species there have been overall declines in elasmobranch abundance, which may provide insight into the status of *R. cemiculus.* Elasmobranchs, especially batoids, have experienced recent declines in abundance in southern Tunisia (see the **Mediterranean** subsection of **Distribution and Historical or Current Abundance**) where *R. cemiculus* is one of the most landed elasmobranchs targeted by artisanal fishers (Echwikhi et al. 2013; Echwikhi et al. 2012). Fishing pressure has caused declines in elasmobranch diversity in Lebanon where *R. cemiculus* is targeted (Lteif et al. 2016). Decades of intensive trawling on the continental shelves of southeast Turkey has significantly altered the demersal fish community, indicated by decreasing catch, increasing catch per unit effort (CPUE), and decreasing average size of landed species (Çiçek et al. 2014). In Cyprus, after a spike in landings of dogfish, skates, and rays by shallow water trawls and artisanal fishing there were sharp declines in landings of these groups (Hadjichristophorou 2006).

In the SRFC countries of west Africa, which includes Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone, Diop and Dossa (2011) report that guitarfishes abundance has declined. Although they did not describe the status of each species in each country, *R. rhinobatos* and *R. cemiculus* appear to be the most historically abundant guitarfish species, and throughout the region guitarfishes are now described as scarce. In addition to this regional description of both species' status, the authors reported a fishery driven decline in the average size of landed *R. cemiculus* in the Banc d'Arguin. Within the SRFC area, Tous et al. (1998) reported substantial declines of the *R. cemiculus* population in the Bijagos Archipelago in Guinea-Bissau.

Along the west coast of Africa, significant declines in *R. cemiculus* abundance have been reported in Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone (Diop & Dossa 2011). In Gabon, where guitarfishes are illegally targeted for fins (G. De Bruyne, Wildlife Conservation Society, Mayumba, pers. comm. to B. Newell, NMFS, 28 June, 2016), the lack of mature females in a recent study was noted as alarming and as a possible indicator of overexploitation (De Bruyne 2015). We found no information on abundance trends throughout the rest of this species' Atlantic range, but based on the migratory nature of the fisheries in this area, and the rampant IUU fishing, it is likely that *R. cemiculus* is experiencing similar declines in at least some of this portion of its range.

With the notable exception of *R. cemiculus* increasing in abundance in the waters of northeast Tunisia, likely due a combination of habitat restoration and warming seas (Mejri et al. 2004; Rafrafi-Nouira et al. 2015), and a few individuals being found for the first time in the northern Aegean (Akyol & Capapé 2014) and the Sea of Marmara (C. Mancusi, ARPAT, pers. comm. to B. Newell, NMFS, 23 March, 2016), we found no other evidence of *R. cemiculus* increasing in abundance throughout any part of its range. It is unknown if these local increases in *R. cemiculus* abundance are the result of increasing populations or simply individuals migrating into what have become suitable habitats.

Growth Rate/Productivity

Compared to bony fishes and many other vertebrates, elasmobranchs are slow growing with low reproductive capacity (Cortés 2000; Dulvy et al. 2014). *Rhinobatos cemiculus* likely matures between two and six years old and may grow relatively fast compared to other elasmobranchs (Enajjar et al. 2012). The reproductive capacity and behavior of *R. cemiculus* leaves it vulnerable to overexploitation. Older, larger females are the most productive (Capapé et al. 2004), and mature adults, primarily females, congregate seasonally in shallow areas to breed and give birth. These seasonal patterns are well known to fishers and have been exploited throughout portions of this species' range. Where data are available, pregnant females often make up a high percentage of the catch (Diop & Dossa 2011; Echwikhi et al. 2013; Echwikhi et al. 2012). This targeting of mature individuals has caused a decline of the average size at maturity and rate of maturity in guitarfish catches in Banc d'Arguin National Park in Mauritania (Diop & Dossa 2011) and may be reducing the reproductive potential of *R. cemiculus* in Gabon (De Bruyne 2015), indicating that the productivity of *R. cemiculus* is negatively affected by overexploitation.

Spatial Structure/Connectivity

We found little information regarding the spatial structure of *R. cemiculus* populations. ICES (2010) stated that the relationship between the Mediterranean and Atlantic stocks of *R. cemiculus* is unclear. The Strait of Gibraltar does not act as a rigid barrier to species (Serena 2005). However *R. cemiculus* has likely always been rare along the entire coast of Morocco and Gulyugin et al. (2006) detected a natural gap in many species ranges at 32-34°N (northern Morocco) potentially limiting mixing between *R. cemiculus* in the Mediterranean and the Atlantic. We found no tagging studies or any other information that shows philopatry throughout the year or during breeding season. However, given that *R. cemiculus* has not returned to the northwestern Mediterranean after being extirpated decades ago, including from the waters around Sicily and the Balearic Islands where this species was likely common, there may be populations of *R. cemiculus* with restricted ranges that are vulnerable to extirpation in other portions of their range.

Diversity

The loss of diversity can increase a species' extinction risk by decreasing a species' capability of responding to episodic or changing environmental conditions. This can occur through a significant change or loss of variation in life history characteristics (such as reproductive fitness and fecundity), morphology, behavior, or other genetic characteristics. *Rhinobatos cemiculus* has shown differences in TL, size at maturity, and reproductive timing throughout its range (Capapé et al. 1996; Seck et al. 2004). The decreasing abundance of this species throughout its range, combined with the potential for extirpation of populations that may have their own unique life history traits, indicate that there is potential for populations to become isolated. Thus, should further extirpations occur and this species become more fragmented, there may be increased risk of random genetic drift and recessive detrimental alleles that can be fixed, reducing the overall fitness of the species.

Threats Assessment

As discussed in the **Analysis of the ESA Section 4(a)(1) factors** section, present threats to this species include commercial overutilization, inadequacy of existing regulatory mechanisms, and destruction or modification of coastal habitats. The long history of fishing in the Mediterranean has driven the extirpation of this species from the northwestern Mediterranean and likely declines in abundance throughout much of its remaining Mediterranean range. In the Atlantic, the sharp increase in targeting of this species and other elasmobranchs to supply the shark fin trade has driven rapid declines in the abundance of *R. cemiculus*, at least from Mauritania to Sierra Leone where some data are available. Fishing pressure has also likely negatively impacted the reproductive capacity of this species in Gabon. Throughout most of this species' range the regulations on the demersal fisheries that have driven this species' decline have only recently been put into effect. Based on the available information these regulations are likely inadequate or not well enforced in key portions of this species' range and many of the fisheries that impact this species are not well monitored. Additionally, areas of this species' range are experiencing increasing human populations and increased degradation of the coastal zone, although the magnitude of this threat to this species is unknown at this time. Thus the future threat posed by continued pressure from industrial and artisanal fishing likely contributes significantly to the extinction risk of *R. cemiculus*, and there are not regulations in place that are likely to reduce this threat and reverse the decline of this species.

Risk of extinction

Although there is little quantitative analysis of *R. cemiculus* abundance over time, the best available information indicates that this species has been extirpated from portions of its range and has experienced substantial declines in West Africa. There is significant uncertainty regarding the status of the current populations but this species may still be relatively common, although very likely less so than its historical abundance, in Tunisia, Israel, Lebanon, Syria, and southeastern Turkey. However, given the evidence of fishery driven extirpation in this species, the continued growth of fisheries throughout its range, particularly artisanal fisheries which are poorly monitored and regulated, we conclude that throughout its range, this species is at a moderate risk of extinction.

Conservation Efforts

Throughout the ranges of *R. rhinobatos* and *R. cemiculus*, we found no efforts that are dedicated specifically to the conservation of either species. However, there are some efforts in portions of their ranges that may have a positive effect on the status of these species. These include recently developed management plans and protections from harvest and habitat modification in national parks and marine protected areas (MPAs).

All SFRC countries (see fig. 12) except for Gambia have adopted, or integrated into their fisheries management plans, a National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks) as part of the Sub-Regional Plan of Action for the Conservation of Sharks (SRPOA-Sharks) (Diop & Dossa 2011). These plans were developed under the recommendations of the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-SHARKS), which seeks to ensure conservation and sustainable management of sharks with emphasis on quality data collection for management purposes (IUCNSSG 2016). In the SFRC these plans are still in the early stages of implementation and it remains to be seen how effective they will be in reducing the extinction risk of *R. rhinobatos* and *R. cemiculus.* Additionally, all of the SRFC countries lack adequate technical and financial resources for monitoring and management, and regulations at the country level are not very strict and lack regional coordination (Diop & Dossa 2011). There are no NPOA-Sharks developed for the other African nations in these species' Atlantic ranges (IUCNSSG 2016). All European countries have adopted the EU Plan of Action (EUPOA Sharks) but we could find little information on conservation actions associated with this plan.

The GFMC is one of the only FAO Regional Fisheries Management Organizations allowed to adopt spatial management measures in the high seas. However, many of these protections have focused on the deep sea (FAO 2016e), offering little conservation value to either species. As discussed in the **Regulatory Mechanisms in the Mediterranean** subsection Recommendation GFCM/36/2012/3 established a permanent closure to fishing activities with trawl nets within three nautical miles of the coast for all Mediterranean countries (FAO 2016e), which has likely lessened the interactions these species have with the trawl fishery**.** An additional effort that likely reduced trawl impact on these species is a fishing license buy-back program in Cyprus initiated in the early 2000s (Hadjichristophorou 2006), although we found little information on both species status in this area so the conservation benefit to impossible to assess.

The Regional Activity Centre for Specially Protected Areas (RAC/SPA) and the Network of Marine Protection Area Managers in the Mediterranean (MedPAN) have been working with a diverse network of partners to establish a network of well-connected, well-managed MPAs that protect at least 10% of the Mediterranean Sea while representing the sea's biodiversity (Gabrié et al. 2012a). As of 2012, only 4.6% of the Mediterranean surface (114,600 km²) was protected by MPAs, with these areas mostly concentrated in the coastal zone (Gabrié et al. 2012a), predominantly in the northern basin where these species are rare or have been extirpated (see fig 21). Two Mediterranean ecoregions that are important to both species, the Tunisian plateau and the Levantine Sea, were found to be "markedly under-represented". Management of MPAs throughout the Mediterranean was found to be weak, with many MPAs lacking dedicated managers and management plans, a low surveillance level, and financial resources lacking, with only northwestern MPAs reporting a sufficient budget to effectively manage. Additionally, the level of ecosystem protection varies throughout the Mediterranean MPAs. For example, most are not "no-take" zones, so artisanal and recreational fishers still have access to many protected areas (Gabrié et al. 2012b).

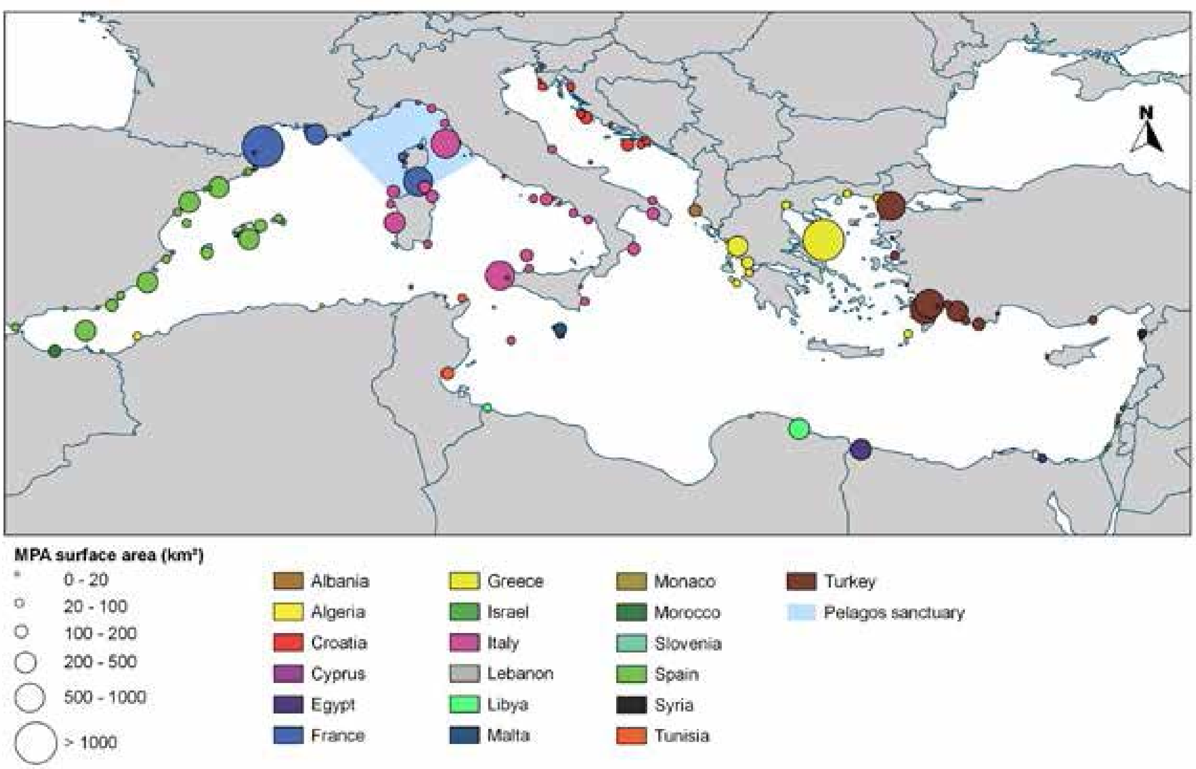


Figure 21: Distribution of Mediterranean MPAs by surface area and country as of 2012. Source: Gabrié et al. (2012b).

There are also MPAs on the West Coast of Africa that might impact or have already impacted the status of these two guitarfish species. In the Banc d'Arguin National Park in Mauritania, the use of specialized gear, such as guitarfish nets, as well as the targeting of shark and ray species has been prohibited since 2003 (Diop & Dossa 2011). This allowed the local populations of guitarfishes to recover, but both species are still targeted outside of the park (M. Ducrocq, Parcs Gabon, pers. comm. to J. Shultz, NMFS, 21 June, 2016). Guinea-Bissau has banned shark fishing in all of its MPAs, including the Bijagos Archipelago, which includes important areas for both species (Cross 2015; Diop & Dossa 2011). As discussed in the **Regulatory Mechanisms in the Atlantic** subsection, Mayumba National Park in Gabon, where at least *R. cemiculus* is found, has recently implemented gear restrictions and no longer allows industrial fishing (De Bruyne 2015). There are also other MPAs that dot the west coast of Africa, but they collectively cover only a small fraction of both species' ranges (MPAtlas 2016). At this time, we find that the conversation efforts discussed in this section are unlikely to significantly reduce the primary threat to these species, commercial overutilization, because these efforts either have inadequate resources or are not located in the most important portions of these species' ranges.

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