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## THE ELASMOBRANCH SPECIES FROM THE BAHIRET EL BIBAN (SOUTHERN TUNISIA, CENTRAL MEDITERRANEAN): A SURVEY

*Christian CAPAPÉ, Olivier GUÉLORGET & Jean Pierre QUIGNARD*

Laboratoire d'Ichtyologie, case 104, Université Montpellier II, Sciences et Techniques du Languedoc,  
F-34 095 Montpellier cedex 05, France  
E-mail: capape@univ-montp2.fr

*Amor EL ABED*

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*Jamila BEN SOUISSI & Jeanne ZAOUALI*

Département des Ressources animales, halieutiques et des Technologies alimentaires, Institut national agronomique de Tunisie, 43 avenue  
Charles Nicolle, 1082 Tunis, Tunisia

### ABSTRACT

*Ten elasmobranch species have been recorded in the Bahiret el Biban, a hyperhaline brackish area located in southeastern Tunisia and adjoined to the Gulf of Gabes. Five of them, which permanently inhabit the lagoon, are paralic species: Raja miraletus, R. radula, Rhinobatos rhinobatos, R. cemiculus and Dasyatis chrysonota. Permanent occurrence of the regular migratory species Scyliorhinus canicula and Torpedo torpedo requires further confirmation. Other records are probably due to fortuitous events. They concern Prionace glauca, Sphyrna zygaena and Raja clavata, which are strictly thalassic species.*

**Key words:** Elasmobranchs, distribution, reproductive biology, Bahiret El Biban, Tunisia, Mediterranean Sea

### SPECIE DI ELASMOBRANCHI A BAHIRET EL BIBAN (TUNISIA MERIDIONALE, MEDITERRANEO CENTRALE): INDAGINE

#### SINTESI

*L'articolo presenta dieci specie di elasmobranchi ritrovate a Bahiret el Biban, area salmastra iperalina situata nella Tunisia meridionale e confinante con il Golfo di Gabes. Cinque di queste specie abitano nella laguna in modo permanente: Raja miraletus, R. radula, Rhinobatos rhinobatos, R. cemiculus e Dasyatis chrysonota. La presenza permanente di Scyliorhinus canicula e Torpedo torpedo richiede ulteriori conferme. Gli altri avvistamenti nell'area vanno probabilmente attribuiti ad eventi fortuiti.*

**Parole chiave:** Elasmobranchi, distribuzione, biologia di riproduzione, Bahiret el Biban, Tunisia, mare Mediterraneo

## INTRODUCTION

According to Compagno & Cook (1995), 43 elasmobranch species "occur in fresh waters far beyond the tidal reaches of river mouths". They further state that "these occur in tropical and warm-temperate rivers and lakes and adjacent inshore marine waters or are confined to brackish or fresh waters".

Schwartz (1995) recorded 22 elasmobranch species occurrences "from low saline waters of north Carolina". The author states that dasyatids, such as the Atlantic stingray, *Dasyatis sabina* (Lesueur, 1824) and the blunt-nose stingray, *D. sayi* (Lesueur, 1817), frequent lower saline to freshwater during the summer.

To our knowledge, freshwater elasmobranchs have not been recorded in the rivers and/or lakes of the Mediterranean countries. However, in Algeria, Dieuzeide *et al.* (1953) reported that some species of the genus *Dasyatis* entered freshwater of coastal rivers at the time of parturition. In Tunisia, we observed numerous pregnant females of common stingray, *D. pastinaca* (Linnaeus, 1758) carrying near-term embryos, which were captured by gill nets in the estuary of the River Miliane, 15 km south Tunis. These observations are probably due to the

fact that female elasmobranch species move close to the coastal shore to lay eggs or to expel their neonates. They migrate into specific places called nurseries, where young specimens can find sufficient food to develop and avoid intraspecific and/or interspecific competition pressure and cannibalism (Muñoz-Chapuli, 1984; Castro, 1993; Compagno & Cook, 1995; Schwartz, 1995). The faunistic lists concerning Mediterranean lagoons rarely report elasmobranch catches in these areas. These captures are generally considered to be occasional by Paris & Quignard (1971) and Quignard & Zaouali (1980, 1981). Some species are generally found in lagoons as a result to unfavourable weather conditions. Sometimes, they are thrown into the lagoons by fishermen when they land elasmobranchs caught in close marine areas. Only two species are cited: the smallspotted catshark, *Scyliorhinus canicula* (Linnaeus, 1758), and the marbled electric ray, *Torpedo marmorata* Risso, 1810.

In Tunisia, Zaouali (1977) noted a total absence of elasmobranchs in the Lagoon of Tunis (northern Tunisia). By contrast, Zaouali (1982) reported three elasmobranch species at least in the Bahiret el Biban (southern Tunisia): *Raja* sp., the blackchin guitarfish, *Rhinobatos cemiculus* (Geoffroy Saint-Hilaire, 1817) and the common guitarfish, *R. rhinobatos* (Linnaeus, 1758). Further investigations conducted in this area, and observations made at Tunis fishmarket, along with information provided by fishermen allow us to complete these previous papers and to conclude that a larger number of elasmobranch species occur in the Bahiret el Biban than has previously been reported.

## MATERIAL AND METHODS

The Bahiret el Biban is located in southeastern Tunisia and adjoins the Gulf of Gabes (Fig. 1). It appears as an elongated ellipse with its major axis directed WNW-ESE (Fig. 2). Its surface area covers 230 km<sup>2</sup> approximately. Its volume reaches 0.81 km<sup>3</sup> at low tide. Its maximum depth exceeds 6 m in the middle part of the basin (Medhioub & Perthuisot, 1977; Denizot *et al.*, 1981; Guélorget *et al.*, 1982; Medhioub *et al.*, 1986; Perthuisot & Guélorget, 1987).

A narrow belt of 35-km long land remains between the Gulf of Gabes and the Bahiret el Biban (Fig. 2). This belt is broken in its mid-part and forms the islets of El Biban and two "slobs" (slope in Arabic); to the east the "slob ech chergui" and to the west the "slob el gharbi". The two "slobs" are not offshore bars but Tyrrhenian sand hills today partially sunken. Between the "slob ech chergui" and the "slob el gharbi", a fish trap was built (Fig. 3).

Much of the material we examined was collected from 1980 to 1990 at the fishmarket of Tunis. This material was not included among fishes caught in the close fishing areas. It was always and strictly labelled as

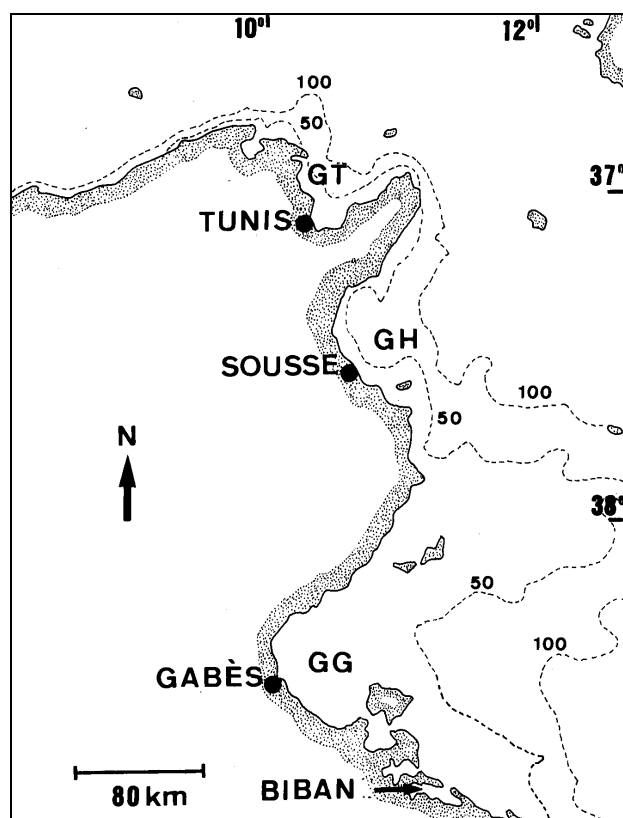


Fig. 1: Map of Tunisia showing the Bahiret el Biban.  
Sl. 1: Zemljevid Tunizije z vrisano laguno Bahiret el Biban.

"specimens fished in the Bahiret el Biban". So, their origin is considered to be certain. Other observations were made directly at the fish trapping built in the Bahiret el Biban. Fishermen of the lagoon also provided interesting information on elasmobranch species that inhabit and/or have been recorded in the lagoon.

Sharks, rhinobatids and the common torpedo were measured to the nearest millimetre in terms of total length (TL), skates and the blue stingray in terms of disk-width (DW).

The reproductive stages followed Bass *et al.* (1973). Males were considered to be adult when the claspers were elongated, rigid and calcified. By contrast, the claspers of juveniles are short and flexible. Females were considered to be adult when at least yellow yolked or ripe oocytes ready to be ovulated were present in the ovaries and the genital duct was fully developed.

Recognizable prey items from stomach content were generally identified to zoological group and family.

The species recorded in the Bahiret el Biban were separated into three categories following Guélorget & Perthuisot (1983, 1992).

The first category includes sedentary species of small size that were abundantly and regularly caught all year round in lagoons. They develop and reproduce only in confined area. They are strictly paralic species.

The second category comprises species that generally reach a larger size and occasionally enter lagoons as a consequence of fortuitous events such as a strong tide, or discarded alive by fishermen after landings, or turned out accidentally from migratory movements. They develop and reproduce only in offshore areas. They are strictly thalassic species.

The third category concerns species of which fry and

juveniles (0+) enter lagoons in order to find sufficient resources to develop and/or to reproduce during a period of their life, and consequently lagoons may be considered as trophic, reproductive or nursery areas. These species constitute a mid-term between thalassic and paralic species, they are "mixed species" or rather regular migratory species.

Furthermore, Guélorget & Perthuisot (1983, 1992) included both thalassic and regular migratory species in a supra category (named thalassoid species), which comprises all species born in sea in both inshore and offshore waters.

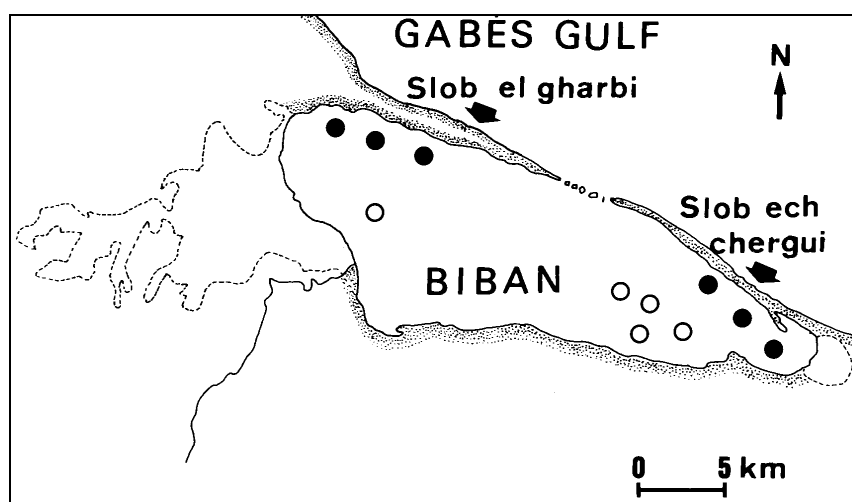
## RESULTS

### Family Scyliorhinidae Smallspotted catshark, *Scyliorhinus canicula* (Linnaeus, 1758)

This small shark is considered to be very common and abundant off the Tunisian coast and especially in the Gulf of Gabes (Capapé, 1977).

This author noted that in these areas males reached sexual maturity at 400 mm TL and females between 400 mm and 450 mm TL. Vitellogenetic activity and reproduction occurred all the year round.

At Tunis fishmarket, we found several specimens included in many other elasmobranch species, mainly dasyatids and rhinobatids, fished in the Bahiret el Biban. All were adult. Among them, 56 females and 44 males were measured. Size of females ranged from 450 mm to 500 mm TL; 24 specimens had encapsulated eggs in their genital tract. Size of males ranged from 440 mm to 460 mm TL.



**Fig. 2:** Map of the Bahiret el Biban (redrawn from Guélorget *et al.*, 1982) showing the places generally inhabited by *Rhinobatos cemiculus* (black circles) and *R. rhinobatos* (circles).

**Sl. 2:** Zemljevid lagune Bahiret el Biban (prerisano po Guélorget *et al.*, 1982) z lokacijami, ki jih naseljujejo vrste *Rhinobatos cemiculus* (črni krogi) in *R. rhinobatos* (krogi).

Some egg capsules were found in the lagoon. All were empty. Fishermen from the Bahiret el Biban informed us that numerous smallspotted catsharks had been caught after a strong tide occurring in the adjacent marine areas.

Capapé (1974a) showed that specimens from northern Tunisian areas are active predators that feed on cephalopods and teleosts and also on benthic invertebrates, chiefly crustaceans. The stomachs of all the specimens from the Bahiret el Biban contained remains of food, generally unidentified crustaceans and bony fishes.

A permanent presence of the species in the Bahiret el Biban remains questionable and further research is therefore required in order to confirm this presence.

#### Family Carcharhinidae

##### Blue shark, *Prionace glauca* (Linnaeus, 1758)

*Prionace glauca* is common off the Tunisian coasts and in the Gulf of Gabes, where it is captured by gill nets and by anglers (Quignard & Capapé, 1971; Bradaï, 2000).

A juvenile male, 790 mm TL, was captured when about to leave the lagoon. Its stomach content consisted important number of unidentified fishes.

According to Tortonese (1956), size at birth reaches 500–600 mm for specimens from the Mediterranean Sea. Stevens (1974) and Cadenat & Blache (1981) reported 450 mm; Compagno (1984) noted that size at birth ranges from 350 mm to 440 mm TL. Cailliet & Bedford (1983) indicated that "neonates nearly double in length in their first year". The male we have observed was certainly no more than a year old and was probably born in Tunisian marine areas, which could be considered as a possible nursery area for the blue sharks. This opinion was confirmed by records of neonates and near-term females in the Gulf of Gabes (Bradaï *et al.*, *in press*). The specimen caught in the Bahiret el Biban was small, this allowed it to take refuge through the passes. Moreover, since 1996, Hemida & Capapé (2003) reported a significant increase in blue shark captures along the Algerian shore, where the species was formerly considered as rare (see Dieuzeide *et al.*, 1953). Migration of blue sharks eastward and southward in the Tunisian waters could not be neglected as this was the case of other large migratory shark species (Capapé *et al.*, 2003; Capapé *et al.*, *in press*).

Furthermore, this was the first time that the blue shark was recorded in the lagoon. Fishermen informed us that "blue sharks of small size" were sometimes caught in the lagoon. However, this information could be subject to misidentification with other related species, such as carcharhinids, which are abundant in the close marine areas (Capapé, 1989; Bradaï, 2000; Capapé *et al.*, 2003; Bradaï *et al.*, *in press*; Capapé *et al.*, *in press*) and could accidentally invade the Bahiret el Biban.

#### Family Sphyrnidae

##### Smooth hammerhead, *Sphyrna zygaena* (Linnaeus, 1758)

The smooth hammerhead has been recorded off the Tunisian coast (Quignard & Capapé, 1971; Capapé, 1989).

A male 600 mm TL was captured in May 1980 through the passes of the lagoon. This specimen exhibited a conspicuous umbilical scar and residual internal vitellin vesicle (IVV), suggesting it was born that year. According to Bigelow & Schroeder (1948), Tortonese (1956) and Compagno (1984), *Sphyrna zygaena* size at birth ranged between 500 and 610 mm TL.

Between 1980 and 1990, six specimens were observed (four males and two females), at the fishmarket of Tunis, ranging from 580 mm to 1200 mm TL. These specimens were probably captured accidentally, when taking refuge in the Bahiret el Biban.

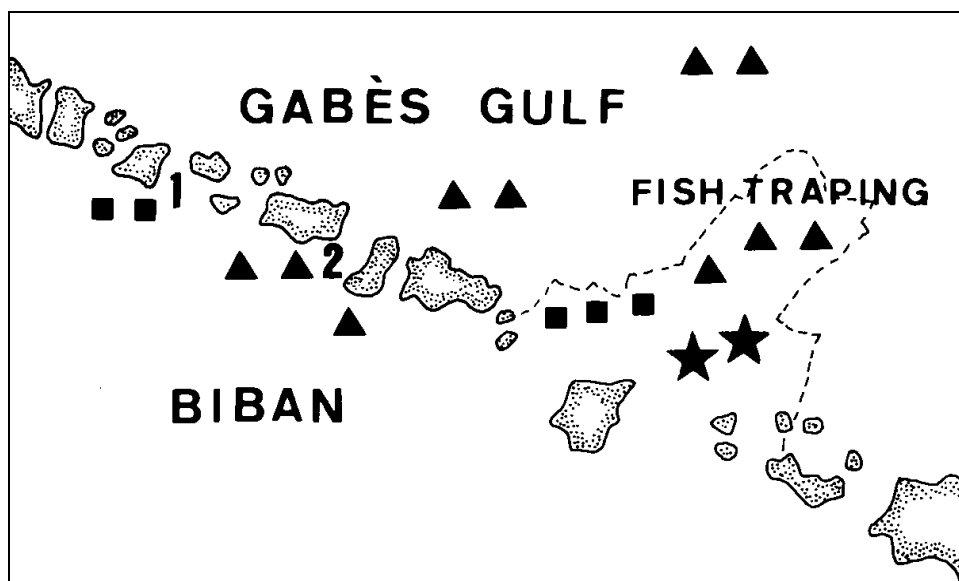
The stomachs of two specimens were empty. Those of the remaining four contained unidentifiable remains of crustaceans and teleosts.

#### Family Rhinobatidae

##### Common guitarfish, *Rhinobatos rhinobatos* (Linnaeus, 1758)

According to Quignard & Capapé (1971), the common guitarfish is normally fished in all Tunisian waters, although it is considered more abundant in the southeastern areas, such as the Gulf of Gabes and the Bahiret el Biban.

Zaouali (1982) considered the captures of the common guitarfish to be relatively less abundant than those of its congeneric species, *R. cemiculus*. Some aspects of the reproductive biology of the common guitarfish were partially described from specimens caught in this lagoon (Capapé *et al.*, 1997). Sizes during first sexual maturity were 750 and 850 mm TL for males and females, respectively, and the maximum size of males and females were 1400 mm and 1620 mm TL, respectively. Pregnant females with encapsulated eggs and embryos at different stages of development, but chiefly with fully developed foetuses were found in the lagoon. The smallest observed gravid female was 860 mm TL. Numerous small free-living specimens with residual IVV were found in the lagoon. Their sizes ranged from 290 mm to 400 mm. The average size of fully developed embryos was 289.9 mm. This suggests that *R. rhinobatos* normally lives and reproduces in this brackish area. An embryonic diapause was suspected because the eggs did not develop during unfavourable season. Their development is probably delayed. Similar patterns were described by Lessa (1982) for the Brazilian guitarfish, *Rhinobatos horkelii*, which inhabits brackish waters of Southern America. Moreover, in *R. rhinobatos* from the Bahiret el Biban, a litter per year remains a probable hypothesis.



**Fig. 3:** Detail of the islets (redrawn from Medhioub & Perthuisot, 1977) showing the places where elasmobranch species were caught: *Dasyatis chrysonota* (black triangles), *Raja miraletus* (black stars), *Torpedo torpedo* (black squares). Numbers 1 and 2 show the passes where *T. torpedo* and shark species such as *Prionace glauca* and *Sphyrna zygaena* were captured.

**Sl. 3:** Detajl otočkov (preisano po Medhioub & Perthuisot, 1977) z lokacijami, kjer so bile ujete naslednje vrste iz podrazreda Elasmobranchii: *Dasyatis chrysonota* (črni trikotniki), *Raja miraletus* (črne zvezde), *Torpedo torpedo* (črni kvadrati). Št. 1 and 2 ponazarjata prehoda, kjer so bili ujeti *T. torpedo* in morski psi (kot npr. *Prionace glauca* in *Sphyrna zygaena*).

Observations on feeding habits showed that all year round, *R. rhinobatos* fed on benthic invertebrates, bony fishes and occasionally, cephalopods. There are no quantitative and/or qualitative seasonal changes in the diet of the common guitarfish by sex and condition, among juveniles and adults (Capapé & Zaouali, 1979).

#### **Blackchin guitarfish, *Rhinobatos cemiculus* (Geoffroy Saint-Hilaire, 1817)**

*R. cemiculus* and *R. rhinobatos* are two sympatric species. They virtually inhabit the same areas in Tunisian waters (Quignard & Capapé, 1971).

Aspects of *R. cemiculus* reproductive biology were also described from specimens collected in the Bahiret el Biban (Capapé & Zaouali, 1994). Sizes during first sexual maturity of males and of females were 1000 mm and 1100 mm TL, respectively. Adult females are generally larger than males, maximal TL for males and females are 1920 mm and 2300 mm, respectively. The smallest gravid female observed was 1220 mm TL. All the year round, pregnant *R. cemiculus* were found in the Bahiret el Biban. Newborn specimens with IVV (mean TL = 323.6 mm) and small free-swimming specimens (400 mm < TL < 500 mm) with obvious umbilical scar on ventral face are regularly found in the lagoon. Oviposition and parturition occur during the winter and the

summer, respectively. A litter per year is a probable hypothesis. On the opposite, no embryonic diapause was clearly observed in this species.

Diet and feeding habits of both *R. cemiculus* and of *R. rhinobatos* are similar. Capapé & Zaouali (1979) found benthic invertebrates and bony fishes in stomach contents of the common guitarfish. The species fed all year round and did not exhibit seasonal changes between males and females as well as between juveniles and adults.

#### **Family Torpedinidae Common torpedo, *Torpedo torpedo* (Linnaeus, 1758)**

The common torpedo must be considered an Atlanto-Mediterranean species (see Quignard, 1978, 1979; Quignard & Tomasini, 2000), rather common in Tunisian waters (Quignard & Capapé, 1971; Capapé, 1989). It is mainly caught off the northern coast, in the Gulf of Tunis and in the Gulf of Gabes. It enters the lagoons where it is able to live and reproduce. This abundance allowed us to study some aspects of the reproductive biology of the species (Quignard & Capapé, 1974) and its morphology (Capapé & Desoutter, 1981; Ben Brahim & Capapé, 1997; Ben Brahim *et al.*, 1998).

*Torpedo torpedo* is abundantly captured in the Ba-

huret el Biban. However, it seems that specimens do not occur too far inside the lagoon. According to the fishermen, most are caught near the passes and fish traps. Captures of common torpedoes are seasonal. In winter, they enter the lagoon to take refuge, and in summer probably in order to breed. Several gravid females caught during the latter season contained fully developed embryos in the uteri.

Sexual maturity occurs at similar sizes in specimens caught in the Bahiret el Biban and in the Gulf of Tunis (Quignard & Capapé, 1974). All the males and females are adults when they are above 190 mm and 230 mm TL, respectively. However, in the close Gulf of Gabès, Ennajar *et al.* (2002) noted that both males and females were adult above 230 mm TL. In the Gulf of Tunis, Quignard & Capapé (1974) noted that females are larger than males. This was also the case for the Gulf of Gabès (Ennajar *et al.*, 2002). In the first area, maximum sizes for males and females are 390 mm and 410 mm TL, respectively, and in the second, 365 and 410 mm TL, respectively. Capapé & Desoutter (1981) emphasised that large females (> 400 mm TL) are relatively more abundant than males. The specimens captured in the Bahiret el Biban seem to be smaller than those of the Gulf of Tunis and Gulf of Gabès. The largest male and the largest female observed in this lagoon were 330 mm and 350 mm TL, respectively.

A total of 52 stomach contents were examined; all were empty.

#### Family Rajidae

##### Thornback ray, *Raja clavata* Linnaeus, 1758

*Raja clavata* is regularly caught off the Tunisian coasts and mainly in the Gulf of Tunis and Gulf of Gabès, where large quantities are caught by trawlers (Capapé, 1976a; Bradaï, 2000).

Fishermen informed us that small thornback rays were rarely found in the Bahiret el Biban. We have observed a single specimen from this lagoon. It was an adult male having 480 mm DW. Its stomach was empty.

This capture was probably accidental, since this skate does not inhabit the lagoon, although it is relatively common in the Gulf of Gabès (Quignard & Capapé, 1971; Bradaï, 2000).

##### Brown ray, *Raja miraletus* Linnaeus, 1758

The brown ray is rather common in the Tunisian marine areas (Capapé & Quignard, 1974). Numerous specimens from the Bahiret el Biban were collected at the fishmarket in Tunis. In all, 227 specimens were observed: 82 juveniles (45 males, 37 females) and 145 adults (66 males, 79 females). No biometrical differences were observed among the specimens from the Bahiret el Biban and those from the Gulf of Tunis (Capapé

& Quignard, 1974). Size at sexual maturity occurs at 220 mm and 240 mm DW by males and by females, respectively, in both areas.

Females with ripe oocytes ready to be ovulated in the ovaries, and/or encapsulated eggs in their oviducts were found all year round. Moreover, egg cases containing embryos at different phases of development were regularly found in the Bahiret el Biban according to fishermen. This suggests that the species is able to reproduce in the lagoon.

The diet of specimens from this lagoon is similar to those from the Gulf of Tunis (Capapé, 1976b). *Raja miraletus* feeds on benthic invertebrates (mainly crustaceans and polychets) and some bony fishes. It does not appear to undergo seasonal changes according to sex and sexual condition (juveniles and/or adults).

##### Rough ray, *Raja radula* Delaroche, 1809

The rough ray is considered to be an endemic Mediterranean species, frequently caught off the Tunisian coast (Capapé, 1987). *Raja radula* and *R. miraletus* are two sympatric species. *R. radula* inhabits and reproduces in the Bahiret el Biban, where it seems to be relatively more abundant than *R. miraletus* according to our observations and information provided by fishermen. Some of the specimens studied were directly observed in the lagoon, but most of them were collected at Tunis fishmarket.

In an earlier article, Capapé (1974b) noted that male and female *R. radula* caught in the Gulf of Tunis attained sexual maturity at 320 mm and 340 mm DW, respectively, and the largest male and female observed were 400 mm and 420 mm DW, respectively.

Several hundred *R. radula* captured in the Bahiret el Biban were observed at Tunis fishmarket. Among them, 126 males and 158 females were measured. Sexual maturity occurred for males and for females at 280 mm and 310 mm DW, respectively. The largest male and female were 340 mm and 360 mm DW, respectively. All the females bore simultaneously ripe oocytes and encapsulated eggs. Fishermen informed us that egg capsules were frequently found in the lagoon.

The feeding habits of the rough ray from the Bahiret el Biban are very similar to those of specimens caught in the Gulf of Tunis (Capapé, 1976b) and to those of the brown ray.

#### Family Dasyatidae

##### Blue stingray, *Dasyatis chrysonota* (Smith, 1828)

In the Mediterranean, the blue stingray has been to our knowledge recorded only in southern Tunisia, especially in the shallow coastal waters of the Gulf of Gabès, in the Bahiret el Biban (Capapé, 1989) and off the coast

of Israel (Golani & Capapé, 2004). Aspects of the reproductive biology of the blue stingray were previously reported by Capapé & Zaouali (1995). These authors noted that size at sexual maturity for males and females is reached at about 300 mm and 320 mm DW, respectively. The largest male and the largest female observed were 400 mm and 440 mm DW, respectively. Estimated size at birth is 118 mm DW. Gestation period lasts for about three months. The relative abundance of juveniles of both sexes and of females at the end of gestation in the Bahiret el Biban and of adults of both sexes in the Gulf of Gabes provides suggestions about *Dasyatis chrysonota* genesic movements through Tunisian waters. Females enter the lagoon to expel near-term embryos, which leave as adults to return into the Gulf of Gabes. Mating, fertilization of ripe oocytes and the greater part of embryonic development probably occur in this latter area. Records of juveniles outside the Bahiret el Biban are of accidental significance.

*D. chrysonota* is voracious and feeds all year round. The young feed mainly on benthic invertebrates, adults mainly on teleosts (Capapé & Zaouali, 1992).

## DISCUSSION

Eighty-six elasmobranch species have been recorded in the Mediterranean (Capapé, 1989; Bradaï *et al.*, *in press*) and 60 in Tunisian waters (Capapé, 1987; Bradaï *et al.*, *in press*). Of the forty-one species reported in southern Tunisian waters (Bradaï, 2000; Bradaï *et al.*, *in press*), ten have been recorded in the Bahiret el Biban.

Following Guélorget & Perthuisot (1983, 1992), of these ten species, recorded in the lagoon, five are paralic species: *R. miraletus*, *R. radula*, *R. rhinobatos*, *R. cemiculus* and *D. chrysonota*; two are regular migratory species: *S. canicula* and *T. torpedo*; three are thalassic species: *P. glauca*, *S. zygaena* and *R. clavata*. In all, five thalassoid species (*sensu* Guélorget & Perthuisot, 1983, 1992) were recorded.

According to Medhioub & Perthuisot (1977), Zaouali (1982) and Zaouali & Beaten (1985), the Bahiret el Biban is a nursery for several species of benthic invertebrates and for bony fishes of economic interest, especially mullets, soleids and sparids. The elasmobranch species could find sufficient food in the lagoon. Moreover, the size of each species is different, so the interspecific competition pressure between them is probably reduced to a minimum. The biometrical measurements and reproductive data do not show significant intraspecific variations among the specimens caught in the lagoon and those recorded in other Tunisian marine areas except *R. radula* and *T. torpedo*. Population of this latter species from the Gulf of Tunis and from the Bahiret el Biban and other

Tunisian areas may be different. However, this hypothesis needs to be confirmed.

*S. canicula* and *T. torpedo* are frequently caught in the Bahiret el Biban. Nevertheless, their captures only occur in winter during strong tides, and in spring and/or summer, probably to breed. This second aspect chiefly concerns the common torpedo.

The other inside records may be attributed to fortuitous event. Small specimens of *P. glauca* and *S. zygaena* probably lose their way. The occurrence of *R. clavata* in the lagoon was consequently due to a strong tide.

Nevertheless, the number of species recorded in the Bahiret el Biban is not very high and most of the species observed were batoids.

Some factors may account for these characteristics. First, the waters of the Bahiret el Biban are hyperhaline (41–45 ‰). They could reach 52 ‰ during the dry season (summer) in the eastern side of the lagoon (Medhioub & Perthuisot, 1977; Medhioub *et al.*, 1986). Salinity increases with the distance of the passes, which could explain why the common torpedo does not enter too far inside the lagoon.

Second, outside the Bahiret el Biban, the bottom slowly slopes down and 5 m depth is reached 4–5 km off the slob (Medhioub & Perthuisot, 1977). This topography suggests that the lagoon is a habitat suitable only for batoids and small sharks.

Third, a fish trap was built between the slob and partially blocked the free access to fishes in the Bahiret el Biban (Medhioub & Perthuisot, 1977; Denizot *et al.*, 1981; Guélorget *et al.*, 1982; Medhioub *et al.*, 1986; Perthuisot & Guélorget, 1987). Figure 3 globally shows the difficulties for elasmobranchs to reach the lagoon through the passes.

These factors could partially explain the rarity of inside records of sharks, skates and rays in the Bahiret el Biban, although its waters are frequently sampled year round.

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## PREGLED POJAVLJANJA MORSKIH PSOVI IN SKATOV (ELASMOBRANCHII) V LAGUNI BAHIRET EL BIBAN V JUŽNIH TUNIZIJSKIH VODAH

Christian CAPAPÉ, Olivier GUÉLORGET & Jean Pierre QUIGNARD

Laboratoire d'Ichtyologie, case 104, Université Montpellier II, Sciences et Techniques du Languedoc,  
F-34 095 Montpellier cedex 05, France  
E-mail: capape@univ-montp2.fr

Amor EL ABED

Institut des Sciences et Technologies de la Mer, 2025 Salammbô, Tunisia

Jamila BEN SOUISSI & Jeanne ZAOUALI

Département des Ressources animales, halieutiques et des Technologies alimentaires, Institut national agronomique de Tunisie, 43 avenue  
Charles Nicolle, 1082 Tunis, Tunisia

### POVZETEK

V laguni Bahiret el Biban ob Gabeškem zalivu v južnih tunizijskih vodah se pojavlja deset vrst iz podrazreda morskih psov in skatov (Elasmobranchii). Pet izmed njih, ki stalno naseljujejo to morsko območje z rahlo primesjo sladke vode, sodi med evhaline vrste: *Raja miraletus*, *R. radula*, *Rhinobatos rhinobatos*, *R. cemiculus* in *Dasyatis chrysonota*. Stalno pojavljanje rednih selečih se vrst *Scyliorhinus canicula* in *Torpedo torpedo* pa terja še dodatno potrditev. Podatki o pojavljanju drugih vrst so bržkone posledica golih naključij, saj gre za vrste *Prionace glauca*, *Sphyrna zygaena* in *Raja clavata*, ki so izključno morske.

**Key words:** Elasmobranchii, razširjenost, reprodukcijska biologija, Bahiret El Biban, Tunizija, Sredozemsko morje

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