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SKATES AND RAYS (CHONDRICHTHYES) FROM WATERS OFF THE LANGUEDOCIAN COAST (SOUTHERN FRANCE, NORTHERN MEDITERRANEAN): A HISTORICAL SURVEY AND PRESENT STATUS

Christian CAPAPÉ, Olivier GUÉLORGET, Yvan VERGNE, Adam MARQUÈS & 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

ABSTRACT

A literature review based on ichthyological papers published between 1860 and 1965 shows that 22 skate and rays species occurred off the Languedocian coast (southern France, northern Mediterranean). Investigations conducted since 1988 to date allow to state that only 12 species occurred in the area, 2 of which could be considered abundant and 3 relatively common. The other species were occasionally landed at fishing sites. The decline of captures may be due to fishing pressure.

Key words: Chondrichthyes, skates, rays, Languedocian coast, Mediterranean

RAZZE (CHONDRICHTHYES) AL LARGO DELLA COSTA DI LANGUEDOC (FRANCIA MERIDIONALE, MEDITERRANEO SETTENTRIONALE): REVISIONE STORICA E STATO ODIERNO

SINTESI

L'articolo presenta una revisione storica basata su articoli inerenti l'ittiologia, pubblicati fra il 1860 ed il 1965. Secondo tali articoli, 22 specie di razze sono state avvistate al largo della costa di Languedoc (Francia meridionale, Mediterraneo settentrionale). Studi condotti dal 1988 ad oggi confermano il ritrovamento di sole 12 specie nell'area in questione, delle quali 2 possono venir considerate abbondanti e 3 relativamente comuni. Le restanti specie sono occasionalmente arrivate nelle zone di pesca. Il declino nelle catture potrebbe essere dovuto a un'eccessiva pressione di pesca.

Parole chiave: Chondrichthyes, razze, costa di Languedoc, Mediterraneo

INTRODUCTION

A literature review showed that information on skates and rays from the Languedocian coast did not constitute the focus of a special report. Their occurrence in the area was only included in faunistic publications from Doumet (1860) to Quignard *et al.* (1962). It was only Quignard (1965) who provided observations on rajid species and Capapé *et al.* (2006c) who described the discovery of the speckled ray, *Raja polystigma* Regan, 1923.

However, recent investigations conducted since 1988 allow reporting observations carried out on sharks from waters off the Languedocian coast (Capapé *et al.*, 2000b). In this paper we present similar data on skates and rays concomitantly collected in the same area. Moreover, we propose herein a historical survey of species reported formerly and species collected recently in order to carry out a comparison between previous and recent occurrence.

Both general and local distribution, abundance, bio-ecological data and some available traits of their reproductive biology are given in the article.

MATERIAL AND METHODS

Data provided in this paper were collected in a literature review with special regard to the Languedocian coast. Investigations were conducted in the area especially at fish harbours of Sète, Le Grau du Roi and Aigues-Mortes, and at the fishing sites of Palavas-Les-Flots and Carnon (Fig. 1). The observed specimens were captured by trawling and/or commercial gill-nets. Moreover, research surveys were conducted in the same areas on board the oceanographic trawler 'Georges Petit', in November 1988 and 1990 and May 1992 and 1993.

For both, scientific and vernacular names (in English and French) were given, following Whitehead *et al.* (1984). Total length and/or disc width were measured to the nearest millimetre, following Clark (1926) and Capapé *et al.* (2004), mass was assessed to the nearest gram, when possible.

RESULTS

Family Pristidae

Pristis pristis (Linnaeus, 1794): common sawfish (En), poisson-scie commun (Fr)

According to Tortonese (1956), *Pristis pristis* was reported in the eastern Atlantic from Portugal to Angola. In the Mediterranean, it was also reported off Spain and Balearic Isles (Lozano Rey, 1928), off Sicily (Tortonese, 1956), but Tortonese (1987) considered its occurrence doubtful in the area.

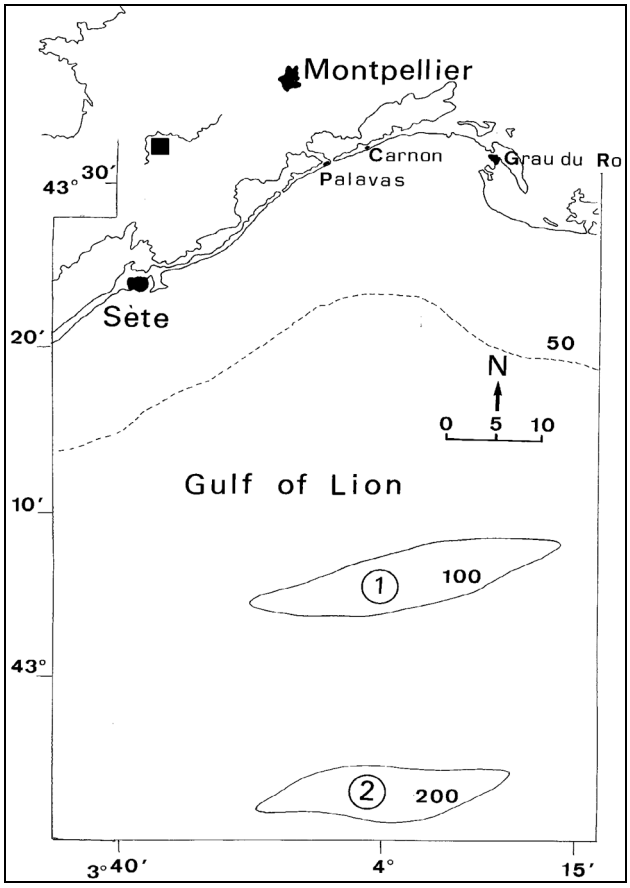

Fig. 1: Map of France with the coast of Languedoc and the 'pits' off Sète, where the small spotted catshark, *Scyliorhinus canicula* ***(1) and the blackmouth catshark*** *Galeus melastomus* ***(2) are the dominant elasmobranch species. (Redrawn from Capapé*** *et al.****, 2000b)***
Sl. 1: Zemljevid Francije z obalnimi vodami Languedoca in "votlinami" v bližini Sèteja, kjer sta navadna morska mačka *Scyliorhinus canicula* ***(1) in morska mačka*** *Galeus melastomus* ***(2) prevladujoči vrsti iz podrazreda morskih psov in skatov. (Narisano po Capapé*** *et al.****, 2000b)***

Off the Languedocian coast, the species was formerly cited by Moreau (1881) who has not recorded specimens and referred to previous observations. Granier (1964) noted that the species could reach about 4 metres in total length and was occasionally captured in the area. He added that the last common recorded sawfish (1,500 mm in total length) was captured in October 1959. No further capture has been made in the area to our knowledge, to date.

Family Rhinobatidae

Rhinobatos rhinobatos (Linnaeus, 1758): common guitarfish (En), guitare de mer commune (Fr)

Granier (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 the species has been recorded to date.

Family Torpedinidae

Torpedo marmorata Risso, 1810 (Fig. 2): marbled electric ray (En), torpille marbrée (Fr)

The marbled electric ray was reported in the eastern Atlantic from British Isles (Wheeler, 1969) to the Gulf of Guinea (Blache *et al.*, 1970). The species was recorded in tropical areas but landings are rather rare, especially off the coast of Senegal (Séret & Opic, 1990; Capapé *et al.*, 2001). In the area, males and females were adult over 270 mm and 380 mm in total length respectively (Capapé *et al.*, 2001). Southwards, the species is recorded off the coasts of Southern Africa (Smith & Heemstra, 1986). *T. marmorata* is reported throughout the Mediterranean, however, captures are more abundant in the western basin and off the northern shore. In Tunisian waters, the species is considered rare by Capapé (1979), who noted that the species was rather captured off Cape Bon, in northern areas, moreover, recent data allowed to show that the species was also captured in the Gulf of Tunis and also entered Tunis Southern Lagoon (Mejri *et al.*, 2004).

Off the coast of Languedoc, *T. marmorata* was reported by Doumet (1860), Moreau (1881), Calvet (1905), Euzet (1959) and Quignard *et al.* (1962). It was captured by gill-netters concomitantly with *T. torpedo*, but landings occurred abundantly every day. Observations bases on several hundred specimens, males and females, showed that in 221 males total length ranged from 160 to 400 mm and weighed from 40 to 1,000 g, while total length of females ranged from 210 to 500 mm and mass from 230 to 3,500 g.

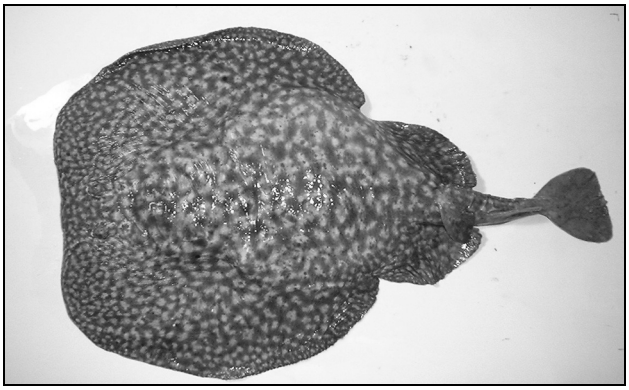

Fig. 2: *T. marmorata* ***captured off the Languedocian coast.***
Sl. 2: *T. marmorata****, ujet v obrežnih vodah Languedoca.***

Torpedo nobiliana Bonaparte, 1835 (Fig. 3): black torpedo (En), torpille noire (Fr)

Torpedo nobiliana is widely distributed and reported on both sides of the Atlantic (Bigelow & Schroeder, 1953). In the Mediterranean, it occurred off the coasts of its eastern basin (Capapé & Desoutter, 1980), in its eastern basin off Greece (Economidis, 1973) and Turkey (Kabasakal, 2002), whereas the species' easternmost border has been the Levantine basin (Golani, 1996, 2005).

Off the Languedocian coast, *T. nobiliana* was first recorded by Euzet (1960). Between 1952 and 1961, Quignard *et al.* (1962) recorded 29 specimens captured by trawlers especially in winter, at 100 m depth, off Sète. The total length ranged between 280 and 840 mm, the largest male and the largest female were 665 mm and 840 mm long, respectively.

From 1988 to 2005, observations at landing sites of the area allowed to collect 8 specimens, 4 males and 4 females. The males ranged from 170 to 755 mm in total length and weighed from 150 to 4820 g, three were juvenile and one adult. The females ranged from 350 to 1,020 mm total length and weighed from 1,200 to 20,000 g, a single specimen was juvenile, the three others were adult (see Capapé *et al.*, 2006a, Tab. 2, records 14, 16 and 19). The last specimen observed in the area was captured in 2002 (Capapé *et al.*, 2006a).

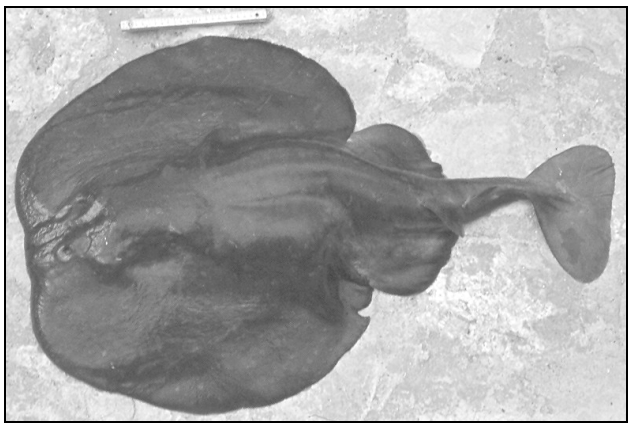

Fig. 3: *T. nobiliana* ***captured off the Languedocian coast.***
Sl. 3: *T. nobiliana****, ujet v obrežnih vodah Languedoca.***

Torpedo torpedo (Linnaeus, 1758) (Figs.4, 5): common torpedo (En), torpille ocellée (Fr)

The common torpedo is reported in the eastern Atlantic from the Bay of Biscay to Angola and it is commonly landed in tropical areas (Séret & Opic, 1990), especially off the coast of Senegal (Capapé *et al.*, 2000a). The species is recorded in the entire Mediterranean and

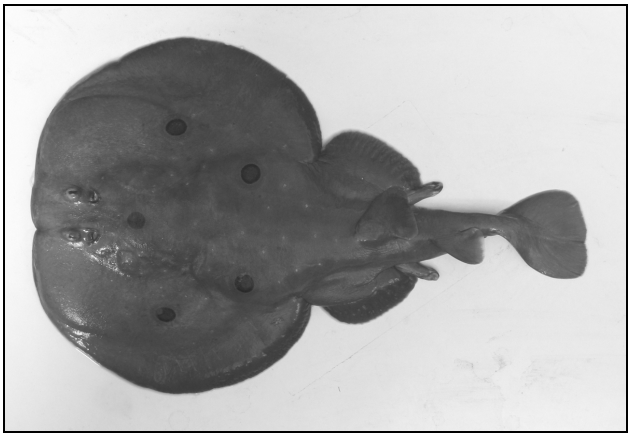

Fig. 4: Normal** T. torpedo **with five ocellae captured off the Languedocian coast (see Capapé** et al.**, 2006b).
Sl. 4: Normalen električni skat** T. torpedo **s petimi "očesnimi pegami", ujet v obrežnih vodah Languedoca (glej Capapé** et al.**, 2006b).

Fig. 5: Unusual** T. torpedo **with eight ocellae captured off the Languedocian coast.
Sl. 5: Nenavaden električni skat** T. torpedo **z osmimi "očesnimi pegami", ujet v obrežnih vodah Languedoca.

absent in the Black Sea (Capapé, 1989). Specimens from the Gulf of Tunis were studied by Quignard & Capapé (1974).

Off the Languedocian coast, the species was reported by Doumet (1860), Moreau (1881), Calvet (1905), Euzet (1959), Quignard *et al.* (1962) and Capapé *et al.* (2006b).

The common torpedo is rather rare in the area. Euzet (1959) recorded a single specimen, Quignard *et al.* (1962) 10 specimens, 2 males and 8 females between 1953 and 1961, ranging in total length between 140 and 365 mm. A female having 350 mm exhibited 7 ocellae on its dorsal surface.

Observations made at landing sites showed that all the specimens were caught by gill-netters, in shallow coastal waters, 20 m max. depth, on sandy bottoms. Twelve large specimens were recorded; of the 8 females, 2 were pregnant. Specimens of our sample were between 250 and 390 mm total length and weighed between 300 and 1,012 g, respectively. Capapé *et al.* (2006b) described 2 females exhibiting 6 and 9 ocellae, respectively, on their dorsal surface. The figure 5, included herein, shows a female, 305 mm in total length, with 8 ocellae on the dorsal surface.

Family Rajidae

Dipturus batis (Linnaeus, 1758): skate (En), pocheteau gris (Fr)

Dipturus batis is widely distributed in the northeastern Atlantic, from Scandinavia to northern Morocco (Muus & Dahlstrøm, 1964–1966), including the British Isles and, further south, the Strait of Gibraltar and the Island of Madeira (Blache *et al.*, 1970).

In the Mediterranean, *D. batis* is only known in the western basin, with the coast of Greece as its easternmost border (Economidis, 1973). Off the Maghrebin shore, *D. batis* is reported off the Algerian coast, but Bradaï *et al.* (2004) did not report it from Tunisian waters.

D. batis was reported by Doumet (1860), Moreau (1881), Calvet (1905), Euzet (1959), Granier (1964) and Quignard (1965) off the coast of Languedoc, where it was previously commonly recorded. No specimen was recorded since Quignard (1965).

Dipturus oxyrinchus (Linnaeus, 1758) (Fig. 6): longnosed skate (En), pocheteau noir (Fr)

Dipturus oxyrinchus was reported off Scandinavia (Muus & Dahlstrøm, 1964–1966), British Isles (Wheeler, 1969), the Bay of Biscay and off Portugal (Albuquerque, 1954–1956). South of the Strait of Gibraltar, *D. oxyrinchus* was reported around Madeira (Blache *et al.*, 1970).

D. oxyrinchus was reported throughout the Mediterranean, but captures were rather rare.

D. oxyrinchus was reported by Doumet (1860), Moreau (1881), Calvet (1905), Euzet (1959), Granier (1964) and Quignard (1965) off the coast of Languedoc, formerly commonly recorded in the area. No specimen was recorded since Quignard (1965). A single specimen was captured on 23 June 2006 by trawling, between Sète and Palavas, at depths between 80 and 100 m concomitantly with small spotted catsharks (see Fig. 1). It was a juvenile female having 345 mm in disc width and 480 mm in total length, and weighing 443 g.

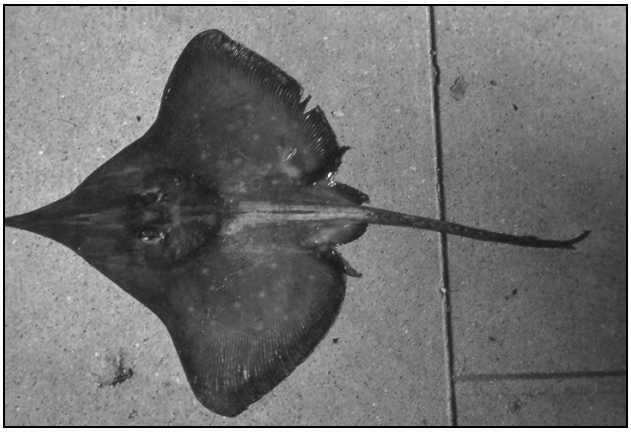

Fig. 6: *D. oxyrinchus* ***captured off the Languedocian coast.***
Sl. 6: *D. oxyrinchus****, ujet v obrežnih vodah Languedoca.***

Leucoraja circularis (Couch, 1838): sandy ray (En), raie circulaire (Fr)

Leucoraja circularis was reported off eastern Atlantic from Scandinavia to the northern coast of Morocco (Muus & Dahlstrøm, 1964–1966).

In the Mediterranean, the sandy ray was reported only in the western basin, its easternmost border being the northern coast of Greece (Economidis, 1973), and southernmost border the coast of Tunisia (Quignard & Capapé, 1971).

Moreau (1881) first reported the species off the coast of Languedoc, then by Quignard (1965) who considered it rather common in the area. No specimen has been found since Quignard (1965).

Leucoraja neavus (Müller & Henlé, 1841): cuckoo ray (En), raie fleurie (Fr)

Leucoraja neavus presented a distribution similar to that of *L. circularis*, in both the eastern Atlantic and the Mediterranean.

Off the Languedocian coast, the species was first recorded by Euzet (1959), while Quignard (1965) considered the species as commonly recorded in the area. No specimen has been found since Quignard (1965).

Raja asterias Delaroche, 1809 (Fig. 7): starry ray (En), raie étoilée (Fr)

The starry ray was reported throughout the Mediterranean, where it is rather common in northern areas, and in the western basin rather than in the eastern. Off the Tunisian coasts, for instance, *Raja asterias* was only recorded from the Algerian border to Bizerte, but is unknown further south.

R. asterias was successively reported off the Languedocian coast since Doumet (1860) to Quignard (1965). The authors considered it very common in the area. *R. asterias* was captured by trawlers and gill-netters throughout the year, although not abundantly. Preliminary observations were carried out on 51 specimens, 25 males and 26 females. Size of males ranged between 220 and 390 mm disc width, size of females between 220 and 480 mm disc width. All observed males and females were adult over 330 mm and 360 mm disc width, respectively. Reproductive activity of females occurred throughout the year, but it was difficult to show in which seas. Measurements made on 12 egg cases gave the following data: length with horns between 9.6 and 105 mm (mean: 10.2 mm ± 1.1), length without horns between 43 and 47 mm (mean: 45.9 mm ± 1.4), width between 32 and 34 mm (mean: 33.2 mm ± 0.40) and they weighed between 9.2 and 9.7 g (mean: 9.48 g ± 0.5).

Fig. 7: *R. asterias****, male (left) and female (right), captured off the Languedocian coast.***
Sl. 7: *R. asterias****, samec (levo) in samica (desno), ujeta v obrežnih vodah Languedoca.***

Raja brachyura Lafont, 1873 (Fig. 8): blonde ray (En), raie lisse (Fr)

The blonde ray was reported in the eastern Atlantic from British Isles (Wheeler, 1969) to Portugal (Albuquerque, 1954–1956), south of the Strait of Gibraltar the species is reported off northern Morocco (Lloris & Rucabado, 1998). In the Mediterranean, *R. brachyura* was rarely recorded, with its distribution similar to those of *Leucoraja naevus* and *L. circularis* (see above).

Euzet (1959) recorded for the first time a single specimen off the Languedocian coast, while Quignard (1965) noted that the species was very rare in the area. A single specimen was recorded, was captured on 14 April 1992 by trawling, between Sète and Palavas, at depths between 80 and 100 m (see above, *D. oxyrinchus*). It was an adult male having 620 mm in disc width and 915 mm in total length, and weighing 5,450 g.

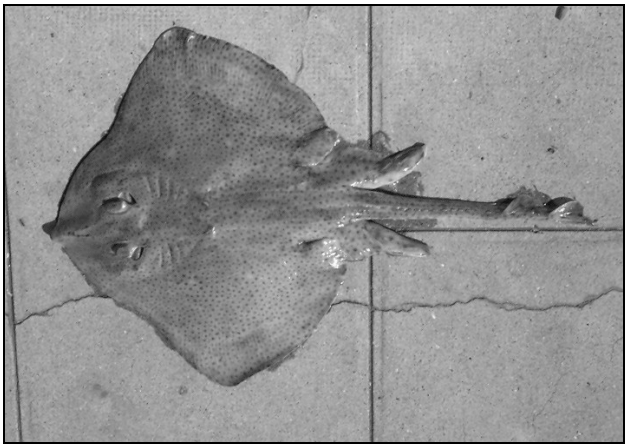

Fig. 8: *R. brachyura* ***captured off the Languedocian coast.***
Sl. 8: *R. brachyura* ***ujet v obrežnih vodah Languedoca.***

Raja clavata Linnaeus, 1758 (Fig. 9): thornback ray (En), raie bouclée (Fr)

The thornback ray presented a wide distribution in the Atlantic Ocean and the Mediterranean Sea. The species was reported in northern waters of the eastern Atlantic, from Scandinavia (Duncker, 1960), around British Islands (Wheeler, 1969) and Portugal (Albuquerque, 1954–1956). South of the Strait of Gibraltar, *R. clavata* was recorded off the Atlantic coast of Morocco (Collignon & Aloncle, 1972) and Mauritania (Maurin & Bonnet, 1970). The species was also recorded off the South African coast (Smith & Heemstra, 1986). The thornback ray is also reported from the Mediterranean (see Capapé, 1989) and entering the Black Sea according to Banarescu (1969) and Kabasakal (2002).

R. clavata was reported off the Languedocian coast from Doumet (1860) to Quignard (1965). The authors considered it very common in the area. A total of 257 specimens, 120 males and 137 females, were collected off the coast of Languedoc between 1988 and 2004. Samples were collected by gill-netters and trawlers at depths of up to 80 m, on sandy and muddy bottoms (see Fig. 1). They were generally landed in the harbours of Palavas-Les-Flots and Sète. Our results were summarized as follows (see Capapé *et al.*, *in press*). The smallest male and female adults had 420 mm and 540 mm disc width (DW), respectively, and weighed 2,130 g and 4,950 g,, respectively. The largest male and the largest female were 510 mm and 690 mm DW, respectively, and weighed 4500 g and 5980 g, respectively. There was a significant relationship total mass *versus* DW between males and females. Diameter of the largest yolky oocytes ranged from 24 to 27 mm (mean = 25.9 ± 0.9) and weighed from 3.2 to 3.7 g (mean = 3.5 ± 0.2). Vitellogenic activity occurred practically all year round, slightly less in April and August. Production of egg cases was observed throughout the year, except in April and August. Egg cases were between 122 and 127 mm (mean: 124.1 mm ± 1.3) in length with horns, and between 61 and 66 mm (mean: 63.6 mm ± 1.4) in length without horns, with their width between 50 and 56 mm (mean: 52.9 mm ± 1.5), and weighed between 19.5 and 22.5 g (mean: 20.9 g ± 1.4). Fecundity remained difficult to assess, an estimation based on production of egg cases and/or number of yellow yolky oocytes during the year counted in adult females, enabled us to consider it between 108 and 262.

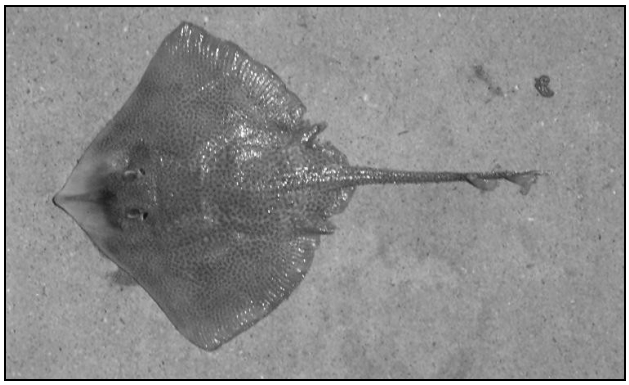

Fig. 9: *R. clavata* ***captured off the Languedocian coast.***
Sl. 9: *R. clavata****, ujeta v obrežnih vodah Languedoca.***

Raja miraletus Linnaeus, 1758: brown ray (En), raie miroir (Fr)

North of the Strait of Gibraltar, *Raja miraletus* was reported off Portugal (Albuquerque, 1954–1956), southwards from Morocco to South Africa (Séret & Opic, 1990). Off Senegal, *R. miraletus* is abundantly captured throughout the year in shallow coastal waters. The species is not locally used for human consumption as fresh or dried and is of no commercial interest, so specimens were generally discarded at sea by fishermen after their capture (Capapé *et al.*, 1995). The brown ray is found in the Mediterranean, where it is commonly caught off the southern shore and in the eastern basin (Capapé & Quignard, 1974; Golani, 1996, 2005).

R. miraletus was reported off the Languedocian coast from Doumet (1860) to Quignard (1965). Euzet (1959) and Quignard (1965) recorded only few specimens and considered the occurrence of the species very rare in the area. In contrast, Granier (1964) noted that the species was commonly reached at about 1,300 mm in total length; this measurement was no doubt excessive, as it did not exceed 600 mm according to literature. No specimen was recorded in the area since Quignard (1965).

Raja montagui Fowler, 1810: spotted ray (En), raie douce (Fr)

Raja montagui was considered relatively common in the eastern Atlantic, especially off the British Isles (Wheeler, 1969) and France (Du Buit, 1974). According to Du Buit (1974), the spotted ray occurred in the Bay of Biscay, while Lozano Rey (1928) reported it off Spain and Albuquerque (1954–1956), off Portugal. South of the Strait of Gibraltar, *R. montagui* was reported off Morocco (Lloris & Rucabado, 1998), with Mauritania as its southernmost border according to Maurin & Bonnet (1970).

In the Mediterranean, Tortonese (1956) and Bini (1967) reported the species from Italian waters, Šoljan (1963) from the Adriatic, Economidis (1973) from Greece, and Golani (2005) from waters off Israel.

The spotted ray was reported off the Languedocian coast by Euzet (1959), and, to date, no new records have been made in the area.

Raja polystigma Regan, 1923 (Fig. 10): speckled ray (En), raie tâchetée (Fr)

Raja polystigma is probably endemic to the Mediterranean Sea (Capapé, 1989), and was reported from some areas such as the Catalan Sea (Matallanas, 1977), off Toulon (southern France (Capapé, 1977), Italian seas (Tortonese, 1956; Arbocco, 1966), off Greece (Economidis, 1973; Kaspiris, 1974), Algeria (Dieuzeide *et al.*, 1953) and the Tunisian coast (Capapé & Quignard, 1978; Capapé *et al.*, 1980; Bradaï *et al.*, 2004).

Off the Languedocian coast, *R. polystigma* was only reported by Quignard (1965), however, no specimen was available for confirmation. The specimen described by Capapé *et al.* (2006b) confirmed the occurrence of the species in the area.

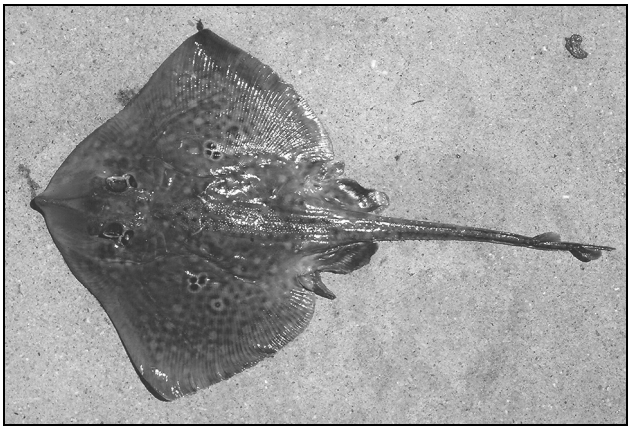

Fig. 10: *R. polystigma* ***captured off the Languedocian coast (see Capapé*** *et al.****, 2006c).***
Sl. 10: *R. polystigma****, ujeta v obrežnih vodah Languedoca (glej Capapé*** *et al.****, 2006c).***

Raja undulata Lacépède, 1802 (Fig. 11): undulate ray (En), raie brunette (Fr)

The undulate ray was found in the eastern Atlantic, south of the British Isles (Wheeler, 1969), off France (Du Buit, 1974), Spain (Lozano Rey, 1928) and Portugal (Albuquerque, 1945–1956). South of the Strait of Gibraltar, *Raja undulata* was known to occur off Morocco, and Mauritania could be its southernmost border according to Maurin & Bonnet (1970).

In the Mediterranean, *R. undulata* is reported in the western basin, off Spain (Lozano Rey, 1928), Italian seas (Tortonese, 1956; Bini, 1967) and in the Adriatic (Šoljan, 1963) down to Greece (Economidis, 1973). The species was recorded off Israel by Golani (2005).

R. undulata was reported off the Languedocian coast from Doumet (1860) to Quignard (1965), where it was considered rather common.

Two adult specimens were recorded, captured on 25 May 1992 by trawler between Sète and Palavas at depths between 80 and 100 m: one male and one female having 322 mm and 386 mm in disc width, 484 mm and 580 mm in total length, respectively, and weighing 765 g and 1,356 g, respectively.

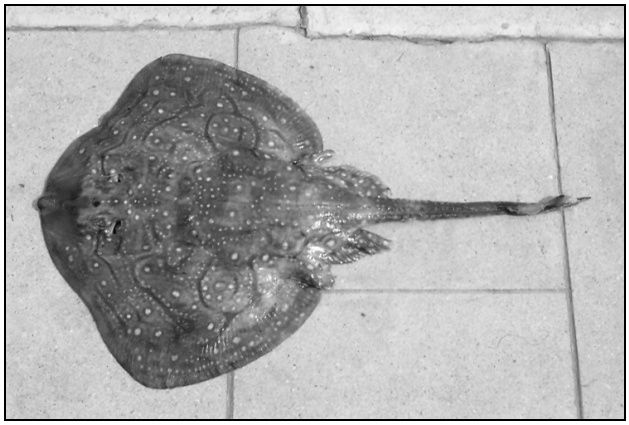

Fig. 11: *R. undulata* ***captured off the Languedocian coast.***
Sl. 11: *R. undulata****, ujeta v obrežnih vodah Languedoca.***

Raja rondeleti Bougis, 1959: Rondelet's ray (En), raie de Rondelet (Fr)

Bougis (1959a) showed that *Raja rondeleti* (= *Raja fullonica sensu* Rondelet) and *Leucoraja fullonica*, Linnaeus, 1758 were relatively close but distinct species. The Mediterranean occurrence of *L. fullonica* has never been proved; the description by Tortonese (1956), for instance, was based on one specimen from the Museum of Livourne, assigned by Bougis (1959a) to *R. rondeleti*. Dieuzeide & Novella (1952) noted that the species was very rare off Algeria, moreover, Roland (1952) added

that he had never recorded the species in the area. Wheeler (1969) observed *L. fullonica* off the British Isles, reporting on its restricted occurrence in the eastern Atlantic. Quignard (1965) considered *R. rondeleti* very rare off the Languedocian coast, where no record has been made since Bougis (1959a).

Two close but probably distinct species occurred in two different areas: *L. fullonica* in the eastern Atlantic, north of the Strait of Gibraltar, and *R. rondeleti* in some Mediterranean areas, such as the Languedocian coast and the Gulf of Genes.

Rostroraja alba (Lacépède, 1803): white skate (En), pocheteau blanc (Fr)

The white skate is known to occur in the eastern Atlantic south of Ireland and British Isles (Wheeler, 1969), off France (Du Buit, 1974), Spain (Lozano Rey, 1928) and Portugal (Albuquerque, 1954–1956). South of the Strait of Gibraltar, *Rostroraja alba* was reported off Morocco (Collignon & Aloncle, 1972) and Mauritania (Maurin & Bonnet, 1970). Cadenat (1950) reported the species off Senegal, but was not recorded there by Séret & Opic (1990) and Capapé *et al.* (1995). It remains absent in the Gulf of Guinea, but was sited further south, off South Africa, and probably occurred in the Indian Ocean off the southern part of Africa (Smith & Heemstra, 1988).

In the Mediterranean, the sandy ray was only reported in the western basin, its easternmost border being the northern coast of Greece (Economidis, 1793), and its southernmost border the coast of Tunisia (Quignard & Capapé, 1971).

R. alba was reported off the Languedocian coast from Doumet (1960) to Quignard (1965). No specimen has been recorded in the area since Quignard (1965).

Dasyatis pastinaca (Linnaeus, 1758): common stingray (En), pastenague commune (Fr)

The common stingray had a wide distribution in the eastern Atlantic from the North Sea (Muus & Dahlstrøm, 1964–1966) to Mauritania (Maurin & Bonnet, 1970). Moreover, the species has not occurred off Senegal, where its close relative, the marbled stingray, *Dasyatis chrysonota*, was abundantly caught according to Capapé *et al.* (1995).

D. pastinaca was reported throughout the Mediterranean and entering the Black Sea (Banarescu, 1969; Kabasakal, 2002).

D. pastinaca was reported off the Languedocian coast from Doumet (1860) to Quignard *et al.* (1962). Information provided by fishermen suggests that the species could occur in the area, although it has not been recorded there as yet.

Dasyatis violacea Bonaparte, 1832 (Fig. 12): pelagic stingray (En), pastenague violette (Fr)

According to Mollet (2002), the pelagic stingray is a species with a wide cosmopolitan distribution in several oceans and seas.

D. violacea is known in several areas of the Mediterranean, especially along the Maghrebin shore (Hemida *et al.*, 2003) and Italian coasts (Orsini Relini *et al.*, 2002), in the Adriatic Sea (Mavrič *et al.*, 2004) and off Israel (Golani, 2005).

D. violacea was reported from Doumet to Quignard *et al.* (1962). Some specimens were caught in the area, which allowed us to include them in the study of its reproductive biology based on specimens collected from three Mediterranean areas (Hemida *et al.*, 2003).

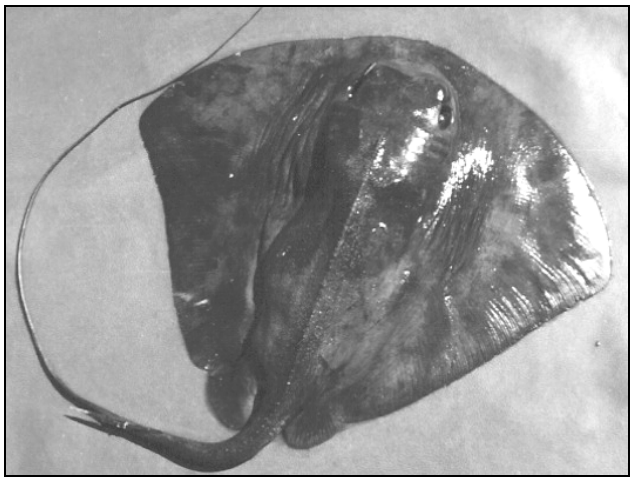

Fig. 12: *D. violacea* ***captured off the Languedocian coast.***
Sl. 12: *D. violacea****, ujet v obrežnih vodah Languedoca.***

Myliobatis aquila (Linnaeus, 1758) (Fig. 13): common eagle ray (En), aigle de mer commun (Fr)

The common eagle ray was reported in the eastern Atlantic from Scandinavia (Muus & Dahltstrøm, 1964–1966), off the British Isles (Wheeler, 1969), off France (Bougis, 1959b) and off Portugal, where recorded by Albuquerque (1954–1956). South of the Strait of Gibraltar, Postel (1959) reported on *Myliobatis aquila* from Cape Spartel to Cape Toxo, Collignon & Aloncle (1972) off Morocco and Maurin & Bonnet (1970) off Mauritania. Cadenat (1950) noted its occurrence off Senegal, but no specimens were observed from 1950 to date. In contrast, its close relative, the bull ray, *Pteromylaeus bovinus* (E. Geoffroy Saint-Hilaire, 1817), was rather abundant according to Seck *et al.* (2002) in the area. Sanchès (1991) registered *M. aquila* off Guinea-Bissau, which we are considering as its southernmost border. Its occurrence further south remains questionable.

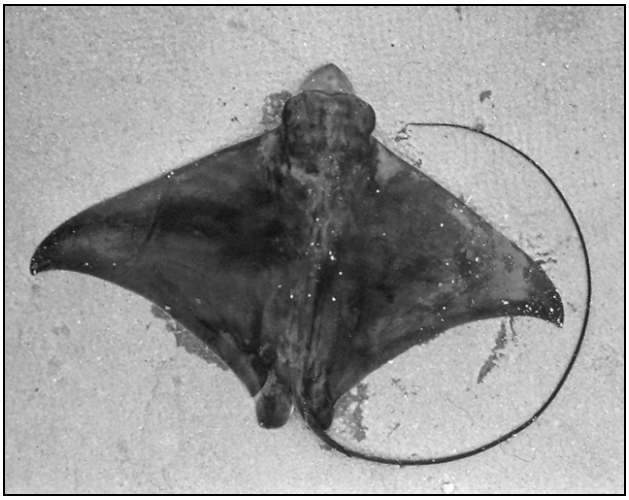

Fig. 13: *M. aquila* ***captured off the Languedocian coast.***
Sl. 13: *M. aquila****, ujet v obrežnih vodah Languedoca.***

The common eagle ray was reported throughout the Mediterranean and it was abundantly caught in Tunisian waters (Capapé & Quignard, 1974; Capapé, 1989).

M. aquila was reported off the Languedocian coast from Doumet (1860) to Quignard *et al.* (1962). Captures made in the area between 1990 and 2004 allowed us to present some traits of its reproductive biology, summarized below as unpublished data. In all, 73 common eagle rays were observed, 41 males and 32 females. They were captured by demersal gill-nets at depths from ca. 30 to 40 m between Sète and Le Grau-du-Roi, from 1990 to 2004. The smallest male and female adults had 500 mm and 730 mm disc width, respectively, and weighed 2,000 g and 6,100 g. The largest male and the largest female had 720 mm and 1,140 mm disc width, respectively, and weighed 5,250 g and 29,400 g, respectively. There was a significant relationship total mass *versus* disc width between males and females. Diameter of the largest yolky oocytes ranged from 26 to 32 mm, number of yolky oocytes counted in five females ranged between 8 and 10. Fertilized eggs were enveloped in a diaphanous capsule. Each capsule contained six eggs weighing between 4.5 and 5.3 g (mean: 4.9 ± 0.9). The breeding period probably lasted from August to September. The common eagle ray possibly reproduced in alternate year, with the length of embryonic development not exceeding one year. Ovarian fecundity and uterine fecundity were rather low, both between 8 and 12.

Tab. 1: List of the 22 skates and rays reported from Doumet (1860) to date off the Languedocian coast.
Tab. 1: Seznam 22 vrst skatov iz obrežnih voda Languedoca, o katerih so poročali od Doumeta (1860) dalje.

Species	Doumet (1860)	Moreau (1881)	Calvet (1905)	Euzet (1959)	Quignard *et al.* (1962)	Granier (1964)	Quignard (1965)	This study
Pristis pristis	–	+	–	–	–	+	–	–
Rhinobatos rhinobatos	–	–	–	–	–	+	–	–
Torpedo marmorata	+	+	+	+	+	+	–	+
T. nobiliana	–	–	–	+	+	–	+	+
T. torpedo	+	+	+	+	+	+	–	+
Dipturus batis	+	+	+	+	–	+	+	–
D. oxyrinchus	+	+	+	+	–	+	+	+
Leucoraja circularis	–	+	–	–	–	–	+	–
L. naevus	–	–	–	+	–	–	+	–
Raja asterias	+	+	+	+	–	+	+	+
R. brachyuran	–	–	–	+	–	–	+	+
R. clavata	+	+	+	+	–	+	+	+
R. miraletus	+	+	+	+	+	+	+	–
R. montagui	–	–	–	+	–	–	–	–
R. polystigma	–	–	–	–	–	–	+	+
R. undulate	+	+	+	+	+	+	+	+
R. rondeleti	–	–	–	–	–	–	+	–
Rostroraja alba	+	+	+	+	+	+	+	–
Dasyatis pastinaca	+	+	+	+	+	+	+	–
D. violacea	+	+	+	+	+	+	+	+
Myliobatis aquila	+	+	+	+	+	+	+	+
Mobula mobular	–	–	–	–	–	+	–	+

Family Mobulidae

Mobula mobular (Bonnaterre, 1788) (Fig. 14): devil ray (En), diable de mer (Fr)

The devil ray is defined as an Atlantic-Mediterranean species (Fischer *et al.*, 1981, 1987; Mc Eachran & Capapé, 1984; Celona, 2004). However, its occurrence in the eastern Atlantic waters remains hypothetical according to Notarbartolo di Sciarra & Bianchi (1998); misidentifications with the close related species *M. japonica* could not be occulted.

In the eastern Atlantic, a single capture of *M. mobular* was reported by Lozano Rey (1928) off Cadix. Moreover, south of the Strait of Gibraltar, *M. mobular* was not reported off Mauritania (Maigret & Ly, 1986) and off Guinea-Bissau (Sanchès, 1991). Off Senegal, several species of the genus *Mobula* were abundant and regularly caught during some periods of the year, but Cadenat (1960), among others, did not record *M. mobular* there. In contrast, Capapé *et al.* (1994, 1995) recorded some specimens off Oukam, fishing site located at Cape Verde Peninsula.

These considerations and recent captures of *M. mobular* in the central and eastern areas of the Maghrebin coast suggest endemicity of the species in the Mediterranean, which agrees with Notarbartolo Di Sciara & Bianchi (1998). However, migrations through the Strait of Gibraltar could not be excluded.

Formerly, the captures of giant devil ray off the Algerian coast were accidental and rather considered as ichthyological events (Dieuzeide & Novella, 1952). They generally concerned one or two exemplars. The specimens reported in this paper and information provided by fishermen suggest that the species is commonly caught in the area. Similar observations were made in Tunisian waters. The first specimen, a gravid female containing a fully developed foetus, was previously recorded by Capapé & Zaouali (1976) along the northern coast, off Sidi-Daoud., Between 1999 and 2000, however, Bradaï & Capapé (2001) reported the captures of five large specimens, in the Gulf of Gabès, southeastern Tunisia. So, captures of *M. mobular* were made in a restricted area, which extends from the central area of the Algerian coast to the Gulf of Gabès. In the Mediterranean, the recorded captures occurred in the western basin. They were made in winter off the southern coast, mostly in spring off the northern coasts. Captures of specimens of both sexes and of different sizes suggest trophic migrations through the area, but genesic migrations cannot be excluded (Hemida *et al.*, 2002).

Off the Languedocian coast, Granier (1964) observed four juvenile specimens having between 1.80 and 2 m in disc width, swimming off Le Grau-du-Roi. Capapé *et al.* (1990) observed one adult male with 2.20 m in disc width captured by gill-nets off Le Grau-du-Roi. No specimen has been captured to date.

Fig. 14: *M. mobular* ***captured off the Languedocian coast (see Capapé*** *et al.,* ***1990).***
Sl. 14: *M. mobular****, ujet v obrežnih vodah Languedoca (glej Capapé*** *et al.,* ***1990).***

DISCUSSION

A literature review based on historical and recent papers show that 22 skate and ray species were reported off the Languedocian coast between Doumet (1860) and this study according to Table 1. Of the 12 species recently recorded from Quignard *et al.* (1962) and Quignard (1965) to date, more than four decades ago, only five were regularly landed at the area's fishing sites (Tab. 2): *Torpedo marmorata*, *T. torpedo*, *Raja asterias*, *Dasyatis violacea* and *Myliobatis aquila*. *R. asterias* has a commercial value and is locally sought after for consummation, *M. aquila* slightly less, whereas the three other species are generally discarded at sea by fishermen. With special regard to the capture of *R. polystigma,* Capapé *et al.* (2006c) noted that it did not suggest a recovery of the species in the area, but it occurred in deep biotope previously unexploited by usual fishing methods according to information provided by fishermen. Other similar records cannot be excluded. *D. violacea* was formerly recorded more or less along the northern African shore, while the recent occurrence of the species in northern Mediterranean areas, such as the Tyrrhenian and Northern Adriatic Seas, could be related to the phenomena of tropicalisation.

A decline of skate and ray captures is the result of an intensive fishing pressure. As a consequence, formerly abundant species, such as the thornback ray and the speckled ray, are now considered rare exceptions off the Languedocian coast. Other abundant species, such as the brown ray, the cuckoo ray, the white ray and the common stingray, have completely disappeared from the area. Similar patterns were reported for sharks (see

Tab. 2: Previous and present status of the 12 skates and rays reported to date from the coastal waters of Languedoc.
Tab. 2: Prejšnji in današnji status 12 vrst skatov, zabeleženih vse do danes v obrežnih vodah francoske regije Languedoc.

Species	Last record	Previous status	Present status
Torpedo marmorata	2006	A	A
T. nobiliana	2002	R	R
T. torpedo	2006	C	C
Dipturus oxyrinchus	2006	C	R
Raja asterias	2006	A	A
R. brachyura	1992	C	R
R. clavata	2006	A	R
R. polystigma	2006	R	R
R. undulata	1992	C	R
Dasyatis violacea	2006	C	C
Myliobatis aquila	2006	C	C
Mobula mobular	1991	R	R

Capapé *et al.*, 2000b). Soldo (2003) noted that sharks are strong *K* selected species; this is also the case of skates and rays. Du Buit (1989) noted that landings of large rays, such as *Dipturus batis* and *Rostroraja alba*, were particularly important off the Atlantic coast of France. Captures of the former reached 863 t in 1965 and 75 t in 1986, while the latter has completely disappeared. Du Buit (1989) added that skates and rays are especially vulnerable with respect to their morphology: soon after hatching, the disc width of skate species is larger than the authorized mesh net size, and consequently the mortality of juveniles is very high, more than in other fish species, including sharks and teleosts. Unfortunately, no statistical data are available concerning especially skates and rays of the Languedocian coastal waters. The risk of extinction of some species in the area cannot be excluded. Moreover, skates and rays are not considered in the FAO status evaluation. Consequently, it appears that skates and rays could not present a stable biomass at any sites of the area. *T. marmorata* and *T. torpedo* constitute two exceptions, probably because they inhabit shallow coastal waters, sometimes less than one metre deep, where they are rarely fished. They entered protected areas, such as some brackish lagoons along the Languedocian shore (Paris & Quignard, 1971). Moreover, they have no commercial value and are discarded, generally alive, by fishermen when caught.

SKATI (CHONDRICHTHYES) V OBREŽNIH VODAH LANGUEDOCA (JUŽNA FRANCIJA, SEVERNO SREDOZEMLJE): ZGODOVINSKI PREGLED IN NJIHOV SEDANJI STATUS

Christian CAPAPÉ, Olivier GUÉLORGET, Yvan VERGNE, Adam MARQUÈS & 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

POVZETEK

Pregled ihtioloških člankov, objavljenih med letoma 1860 in 1965, kaže, da je bilo v tem obdobju v vodah francoske regije Languedoc (južna Francija, severno Sredozemlje) zabeleženih 22 vrst iz reda skatov. Raziskave, ki so potekale od leta 1988 dalje, pa kažejo, da je bilo v tem območju opaženih samo 12 vrst, 2 od katerih bi lahko opisali kot številne, 3 pa razmeroma pogoste. Druge vrste so se le tu in tam ujele v mreže lokalnih ribičev, kar gre bržkone pripisati pretiranemu izlovu teh hrustančnic v preteklosti.

Ključne besede: Chondrichthyes, skati, obalne vode Languedoca, Sredozemlje

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