

## RESEARCH ARTICLE

# An investigation on the skate fishing at M'diq and Tangier ports (Northern Morocco)

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### Abstract

This study encompasses skate fishing at M'diq and Tangier ports (Morocco Mediterranean coast). It addresses the exploitation of these Chondrichthyans by analyzing skate landings during 2006-2010. Skates are usually recorded under general taxonomic groups in the Moroccan fishery statistics, being identified only to family (Rajidae) or genus (*Raja* spp.). This fact makes it difficult to obtain better knowledge of the stock of the species in commercial landings of rays and skates. Results show that skate landings at the M'diq port are greater than those recorded at the Tangier port.

**Keywords:** skate, exploitation, Mediterranean, Morocco

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### Introduction

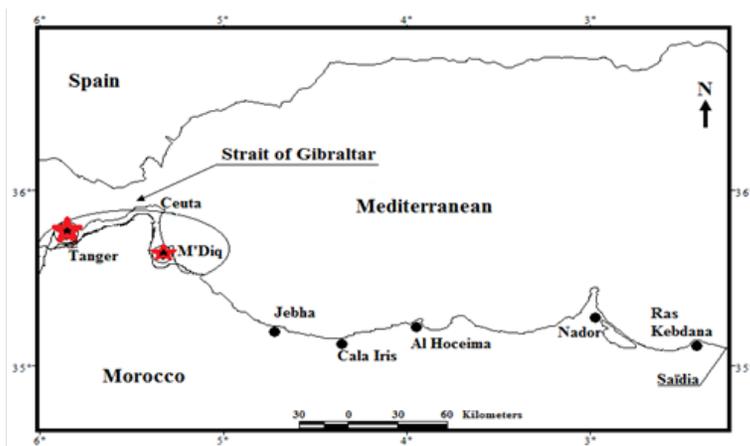
Skates are important benthic species in mid-temperate waters. These species inhabit shallow waters reaching the coast and deep sea up to 3000 m (Last *et al.* 2009). They are present in all oceans from the Arctic to Antarctic. Occasionally they are found in brackish waters, rarely in tropical waters (Last *et al.* 2009) but are absent in tropical reef areas such as Red Sea coral reefs (Bonfil *et al.* 2004). The impact of the fishing on cartilaginous fish, in marine ecosystems, is currently a subject of an increasing concern among international authorities (Stevens *et al.* 2000). Rajidae, like other elasmobranchs, are very sensitive to fishing activities (Hoenig *et al.* 1990) and fisheries can have severe negative effect on their abundance and distribution (Walker *et al.* 1996). At the northern Moroccan Mediterranean coast, skate fishing is an important artisanal fishing activity. Also, while these cartilaginous fish are not targeted by industrial fisheries, they are still a part of their bycatch. The present study aims to elucidate the impact of fishing on these Chondrichthyans and to understand the importance of Rajidae species

catch landed at M'diq and Tangier ports. We analyze the progression of Rajidae species landings during five years (2006-2010).

## Materials and Methods

### *Study area*

The study area is located on the western shore of the Moroccan Mediterranean Sea which lies between 35° N and 36° N (latitude) and between 2° W and 6° W (longitude). The exploitation of these resources is carried out primarily by the coastal fleet composed of trawlers, sardine, and longliner boats. The inshore fleet is preferentially registered to two major harbors in the region, Tangier and M'diq. Landings of coastal and artisanal fisheries mainly come from the fishing zone between the coast of Assila south of Cape Spartel and the coasts of Cape Mazari southeast of M'diq. This maritime area covers a coastline of about 150 km. During our study, we conducted surveys and recorded skate landings in Tangier and M'diq ports (Figure 1). This approach allowed us to evaluate the incidental catch and collect all landing data obtained from ONP (Office Nationale de Pêches) of M'diq and Tangier ports (Figure 1).



**Figure 1.** The study area  
(modified from centre INRH/Nador 2006)

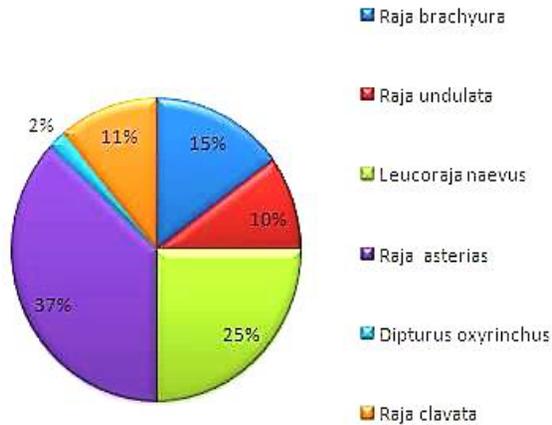
### *Sample collection*

Various samples were obtained from commercial catch landed at M'diq and Tangier ports. Species of skates were identified according to FishBase (FAO 1998; Serena 2005). All obtained samples were measured by ichthyometric approach with a purpose to determine the body size variation of captured individuals.

## Results and Discussion

### *Specific richness (SR)*

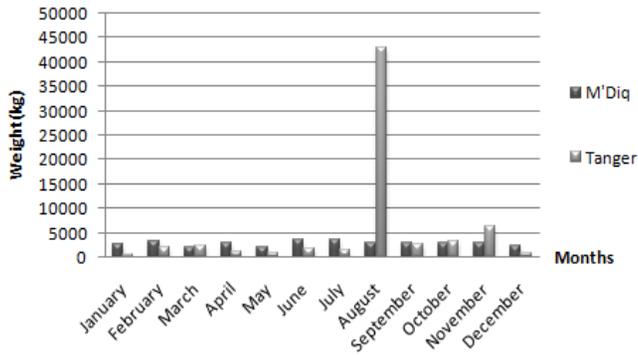
During our examination we identified six species of Rajiformes which represent the Rajidae community living along the coast of Tangier-Tetouan region: *Raja brachyura*, *Raja undulata*, *Leucoraja naevus*, *Raja asterias*, *Dipturus oxyrinchus* and *Raja clavata*. The SR data (Figure 2) of each commercial landed catch was different and as such should be used as a criterion when assessing relative conservation values of different habitats. The most dominant species in our sample was *Raja asterias* whereas the rarest or incidental one was *Dipturus oxyrinchus*. In the Mediterranean there is some doubt about the validity of historical identification. This species could be confused with *Dipturus batis*, despite morphological and colour differences (Ragonese *et al.* 2003).



**Figure 2.** The percentage of identified species

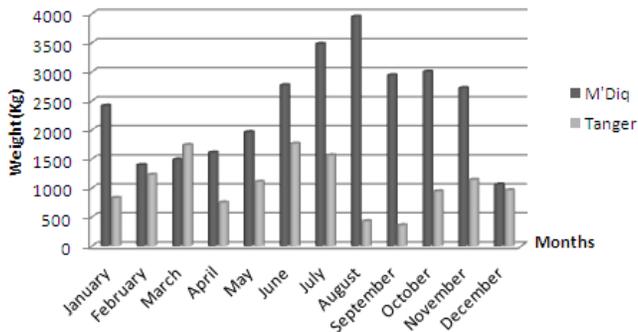
### *Landing analysis*

Landing analysis and comparison at M'diq and Tangier ports is an important tool for understanding the diversity of fisheries and skate habitats. The registered data allowed us to establish skate catch progression curves (Figures 3, 4, 5, 6, and 7). These plots are designed to analyze and compare landings from M'diq and Tangier ports during 2006-2010.



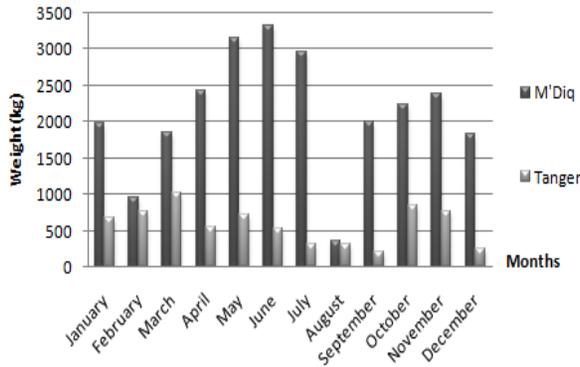
**Figure 3.** Comparison of monthly Skate catch at M'diq and Tanger ports in 2006

The landing is observed during the whole year 2006 with a low rate, however in the August month, we observed a peak at the M'diq port.



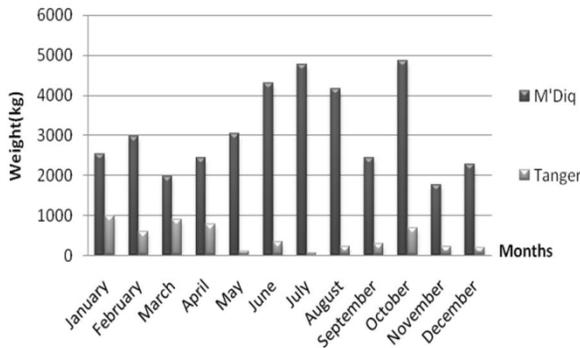
**Figure 4.** Comparison of monthly skate catch at M'diq and Tanger ports in 2007

In 2007, the landing record at M'diq significantly improved with catch of over 2400 kg starting from April and peaking with its maximum in June over 3200 kg before it decreased in August to less than 500 kg. The increase in fish production at this rich fishing area possibly depends on the species richness, season, climate and sea movements (calm or rough). Interestingly, the landing record from September to December shows gradual positive progression reaching a second annual maximum in August with around 4000 kg. In Tanger, catch was much smaller during the first six months of the year with a mass of less than 2000 kg. We can also distinguish a slight increase in landings during March, October and November months.



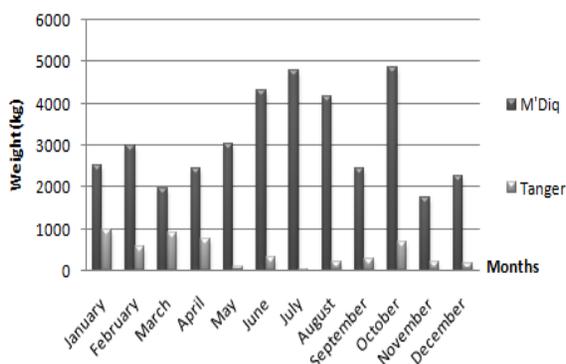
**Figure 5.** Comparison of monthly skate catch at M'diq and Tanger ports in 2008

Total catch for 2008 year was again greater for M'diq port when compared with Tanger. This marks a gradual positive progression at the M'diq port from March to its peak in June, after which followed a drop from September. At Tanger port, the progression was different and catch rates were relatively low. Nevertheless, a sizeable landing was recorded from January to March and a decrease in August, September in December.



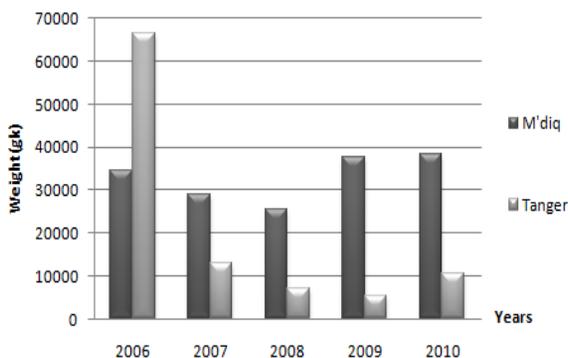
**Figure 6.** Comparison of monthly skate catch at M'diq and Tanger ports in 2009

In general, our data show that the catch at the M'diq was always greater from that of Tanger port. The increase in production was observed during the period from June to October after which followed a slight decrease between middle of October to early November. This increase may depend mainly on the area of fisheries, climate conditions and developments in fishing techniques.



**Figure 7.** Comparison of monthly skate catch at M'diq and Tanger ports during 2010

In 2010, the fishing activity at M'diq was always greater compared to that at Tanger port. However, during that year the catch at Tanger port increased when compared to all previously studied years.



**Figure 8.** Comparison of annual skate catch at Tanger and M'diq ports during 2006 -2010

In summary we note that the Tanger port recorded a substantial catch in the beginning of 2006 which was followed by a considerable decrease until the beginning of 2007 (Figure 8). During the 2008-2009 year period, a slight catch increase was observed at M'diq port. Compared to previous years, during 2010 we observed a significant increase of catch at the Tanger port. As opposed to the Tanger port, the catch at the M'diq port was much higher and prominent during the last three years (2008, 2009 and 2010). This may be explained by an advance in fishing techniques and more sophisticated engines used by M'diq's fishermen who namely use large trawler and longliner boats which can go to deep rich areas favored by skates (skate feeding zones). Increase in capture may also depend on consumer needs. The fishermen's ports are more interested in fish that have high commercial value such as sharks and teleosts. However, catching skates and other fish additionally depends on factors such

as weather conditions (e.g. rain and wind). This increase may be due to the area of fisheries, climate conditions and development in fishing techniques. These results at the M'diq port are different from those reported by FAO (2008) who noted global catches of skates and rays (batoids) have more than doubled since 1970, with >200,000 t caught in 2006. Constant increase in trawl fishing effort appears to have contributed to a decline in biodiversity of the Mediterranean elasmobranchs (stock and habitat) (Aldebert 1997; Jukic-Peladic *et al.* 2001). Triakidae and Rajiiformes (without distinction of species) represent, on average, 70% and 87%, respectively, of sharks and batoids captured during the last 30 years in the Mediterranean and the Black Sea (Bradai 2012). On the other hand, FAO (2007) mentioned that skates are important elements of marine biodiversity, but they are highly vulnerable to commercial exploitation. Ellis *et al.* (2010) reported that skates (Rajidae) are vulnerable to overfishing because they are long-lived, slow-growing, late to mature, have protracted breeding cycles, and produce few young, which, coupled fisheries with their generally large size, morphology, and aggregating nature renders them susceptible to capture in large numbers: Several rays and skates have also declined in numerous areas due to fishing (Aldebert 1997; Jukic-Peladic *et al.* 2001; Dulvy *et al.* 2002; Lotze *et al.* 2011), and few are considered locally extinct (Dulvy *et al.* 2000; Ferretti *et al.* 2010). Nowadays, they are one of the most vulnerable groups of marine fishes (Dulvy *et al.* 2003), and only few species still remain in highly impacted sites (Aldebert 1997; Jukic-Peladic *et al.* 2001; Ferretti *et al.* 2008; Abdul *et al.* 2011). In addition, data availability on elasmobranchs in the Mediterranean Sea is scarce since most of the species are not primary targeted by fishing fleets, but they are caught as accessory species or by-catch and are either commonly discarded at sea or non-officially commercialized or unreported (Bradai *et al.* 2012).

## **Conclusion**

The skate populations along the west Moroccan Mediterranean sea coast (M'diq and Tangier ports) are heavily impacted by the ongoing activity of fisheries. This study shows that landing of skates at the M'diq port is greater than those recorded at the Tangier's port. The specific richness was revealed by the presence of six species in commercial catch. Despite the importance of Rajidae species captured along northern Moroccan Mediterranean coast, ecological studies of these species are rare in this area. This underlines a need to make preliminary studies which will create a basis for establishing better protection and conservation plans for this marine ecosystem.

## **Acknowledgements**

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