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First Observation of the Tope Shark, *Galeorhinus galeus*, in the Northern Patagonian Gulfs of Argentina
(Elasmobranch Fisheries – Poster)

by

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Abstract

The artisanal fishery in the gulfs of San Matías, San José and Nuevo, Argentina (42°-43°S; 64°-65°W), represents an important productive activity that accounts for 400 jobs (fishermen, factory workers, retail sellers, etc.) in the city of Puerto Madryn, of around 50 000 inhabitants. The objective of this study was to test a productive alternative for artisanal fishermen in order to increase their catches and profits. The aim of this paper is to provide the first information on general aspects about one of the target species, *Galeorhinus galeus*, in the northern Patagonian gulfs. The species mean lengths obtained in the San José and Nuevo Gulfs were similar ($L_t = 132$ cm). The individuals caught in the platform were larger ($L_t = 141$ cm) than those caught in the gulfs. Less than 10% of the total catches in all the fishing grounds were females, their total length ranged from 110 to 126 cm and their Hepatic Index values ranged between 0.7 and 0.9. These data show that females were an incidental catch and that they were all juveniles. The total length of the males ranged from 105 to 150 cm and the Hepatic Index values were between 0.7 and 1.1. The gonads showed males were adult with traces of maturity, according to a first maturity length of 112.5 cm. According to these results, a tope shark fishery in the Nuevo Gulf during summer would be a complement to artisanal purse seining and bivalve extraction.

The absence of gravid females allows to think of a sustainable exploitation, while the capture volumes stay relatively low. Chiaramonte (2000) mention the possible overexploitation of the resource in the fishery with base in the port of Quequén, also outlines the possible collapse of the fishery in terms of the economic profitability. The development of a longline fishery in the gulf Nuevo should maintain the character of artisanal and of small scale, in a such way of controlling the fishing effort and the number of hooks per boats.

Keywords: Sharks, longlines, artisanal fleet, Patagonia.

Introduction

The artisanal fishery in the gulfs of San Matías, San José and Nuevo, Argentina (42°-43°S; 64°-65°W), represents an important productive activity that supports around 400 jobs (fishermen, factory workers, retail sellers, etc.) in Puerto Madryn, a city of around 50 000 inhabitants.

The main target species for the shellfish fishers is a scallop (*Aequipecten tehuelchus*), harvested by hooka divers (Ciocco, 1998; Orensanz *et al.*, submitted). Fishing units are boats less than 10 m length equipped with outboard motors, typically operated by a crew of one deck assistant and two divers.

Fishing activities and therefore their economic potential are restricted in several ways.

- Shellfishing is limited in time due a biological and sanitary ban imposed by the fishery administration.
- The San José Gulf, designated as a Provincial Marine Park in 1974, is inserted in Peninsula Valdés, a very sensitive ecological region, due to its concentrations of marine mammals (southern right whale, sea elephants) and birds.

A project was designed to explore the feasibility of exploiting other natural resources in the neighbouring gulfs.

Between January 1994 and February 1996, experimental fishing was carried out using longlines in the gulfs and coastal zones of northern-Patagonia (Fig.1)

In 2000 and following the request of three artisanal boats to open an experimental longline fishery for the tope shark, *Galeorhinus galeus* in Nuevo Gulf, the Provincial Fishery Administration called upon the scientists to develop a monitoring program. Fishing took place during the summer of 2000-2001 and 2002.

This paper summarises the results of those experimental fishing seasons providing information on general aspects about the *Galeorhinus galeus*, captured in experimental and commercial fishing in the northern Patagonian gulfs.

Experimental fishing

Fishing was conducted over 37 journeys from 1994 to 1996 in the San Matías, San José and Nuevo gulfs, and open sea, at depths between 14 and 70 m. The fishing gear was a longline with a total of 1 000 m of head rope and an average of 550 hooks. In order to detect the presence of juveniles in the area, gillnets were set in shallow waters. Nets were made of monofilament of 40, 60, 80 100 and 120 mm between knots.

Commercial fishing

The activities took place between October and April 2000-2001 and February and March 2002, only in Nuevo Gulf, boats operated within 15 nautical miles off the coastline at depths between 40 and 120 m. The average number of hooks utilized was 1 500 per boat.

Both total length (TL, cm) and sexual maturity were determined according to Peres (1991).

Results

Abundance and Depth

Tope shark is a seasonal migrant, in the study area mean catches were high from February to April (Fig.2a y b).

Tope shark represented 36% of the total commercial catch in numbers, the elephant fish (*Callorhynchus callorhynchus*) 33% and the argentine hake (*Merluccius hubbsi*) 23%.

Figure 3 shows the relative frequencies of the number of sharks captured, discriminated by sex and for strata of depth. The chi-square analysis indicates a highly significant association between the sex and the depth. ($P < 0.001$).

Body size and Total length - weight relationship

Total catches (experimental and commercial) involved 987 tope sharks. Gillnet catches (only experimental) were scarce, only 32 specimens were captured. Specimens caught by nets and longlines did not differ significantly in their lengths ($P > 0.05$).

The mean TL of males was significantly larger than for females ($P < 0.001$). The TL of males (mean + s.e. (range) was 132 ± 0.34 (105-150) cm, and of females was 121 ± 0.58 (92-148 cm) (Fig. 4).

The slopes of total length- eviscerated weight regressions between females and males did not differ significantly (ANCOVA $p = 0.069$ $df = 399$). Weight ranged between 3 000 to 12 000 g for females and between 4 500 to 13 500 g for males (Fig.5).

Sexual maturity

Females examined during the experimental fishing were all immature. Their total length ranged from 110 to 126 cm and their Hepatic Index values ranged between 0.7 and 0.9. Gonadosomatic index values of males captured in Patagonian waters during the experimental fishing showed that only the specimens captured during summer were sexually active, there was sperm in the seminal vesicle and testis were hemorrhagic.

The 33% of the total number of females caught in Nuevo Gulf during the commercial fishing were juveniles. The mature females belonged to two groups: first-year nongravid females (NGR-1), with light-yellow ovarian follicles from 0.5 and 1.5 cm in diameter and gonadal weight from 6 and 60 g, and second-year nongravid females (NGR-2) with golden-yellow follicles greater than 3.5 cm and gonadal larger than 150 g. (Fig. 6)

Stomach analysis

Of the 100 stomachs of female tope shark collected, 85% contained food and 15% were empty. Stomach contents included otolith of common hake (*Merluccius hubbsi*) (80%) and pink cuskeel (*Genypterus blacodes*) (20%). Similar proportions of empty (13%) and full (87%) were found for males but the diet showed a greater diversity. In addition to common hake (70%) and pink cuskeel (12%), there was silverside (*Odonsthestes spp.*) (6%) and raneya (*Raneya brasiliensis*) (6%).

Discussion and Conclusions

Tope sharks sampled from catches in the province of Buenos Aires from August to September (Menni (1981), Menni *et al.* (1986) and Chiamonte (2000)), from January to June and from August to December were smaller than those caught in Patagonia. Minimum lengths reported were 61 cm for females and 54 cm for males.

The slopes of total length - weight regressions did not differ significantly between males captured in Patagonian waters and those captured in Buenos Aires (Chiamonte, 2000). Body condition of females from Patagonia and from Buenos Aires appears to be different, probably because catches in Buenos Aires included gravid females, while in Patagonian waters, no gravid females were found.

Males caught in the gulfs during autumn did not showed signs of sexual activity like those caught during the summer; these had hemorrhagic testes and semen in their seminal vesicle.

Changes in sex ratio with depth strata of depth indicated that mature females in their first and second year nongravid preferred depths greater than 80 m. Elías (1998) in a selectivity study of this species revealed that males feed throughout the complete water column of waters, because they have been caught in mid water a bottom longlines. Analysis of stomach contents, in this study confirm this observations, the prey items of females were only demersal organisms, while male's preys were both, demersal and pelagics.

The schools of tope shark that arrive to northern patagonian waters during the summer are formed by adults and mature males (64%), and the rest (36%) is conformed by immature females (33%) and matures in their first and second nongravid year (67%).

Chiamonte (2000) mention the possible overexploitation of the resource in the fishery with base in the port of Quequén, also outlines the possible collapse of the fishery in terms of the economic profitability. The development of a longline fishery in the Nuevo Gulf should maintain the character of artisanal and of small scale, in such way that fishing effort and the number of hooks per boat are controlled.

CPUE trend over the fishing season suggests that a single-species fishery based on the tope shark would not be profitable. The use of the whole catch, however, would result in greater income and would, in addition, diminish the fishing pressure on the sharks, by shifting from a fishery where tope shark is the target species to a multispecific fishery.

Controlled artisanal longline fisheries appeared to be biological and economically possible as a complement to the activities of fishers already holding a commercial diving permit. We caution that the number of longline permits should be limited.

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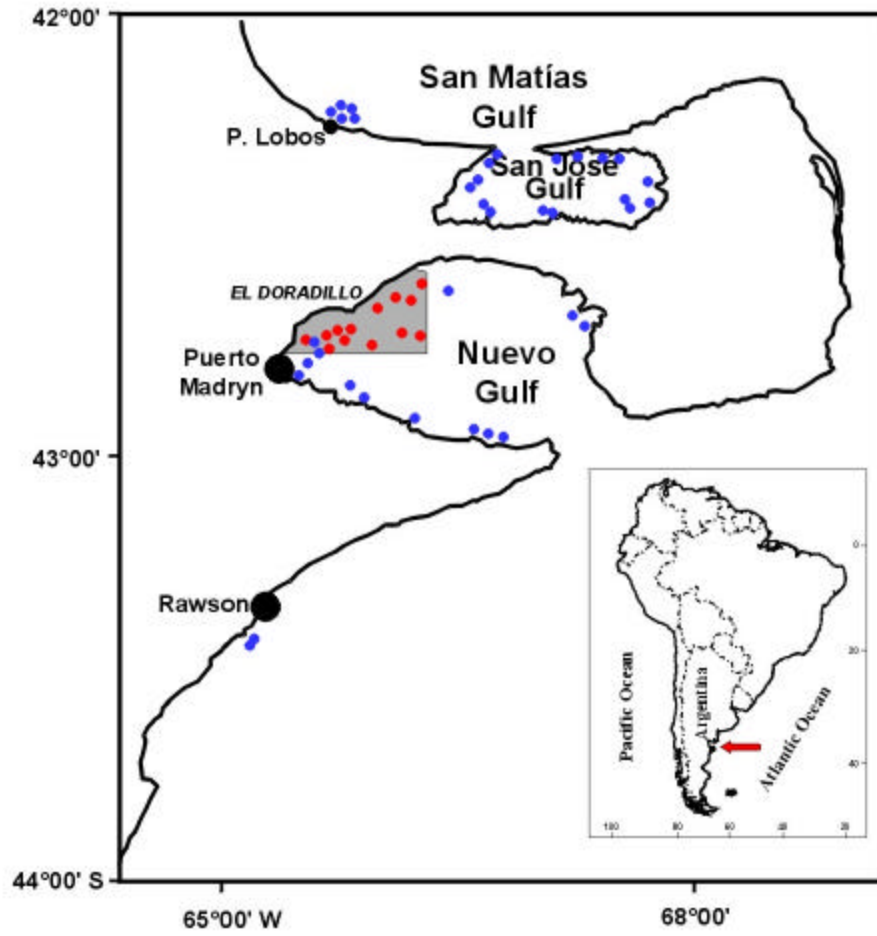


Fig. 1. Geographic location of the study area. · Experimental fishing. · Commercial fishing.

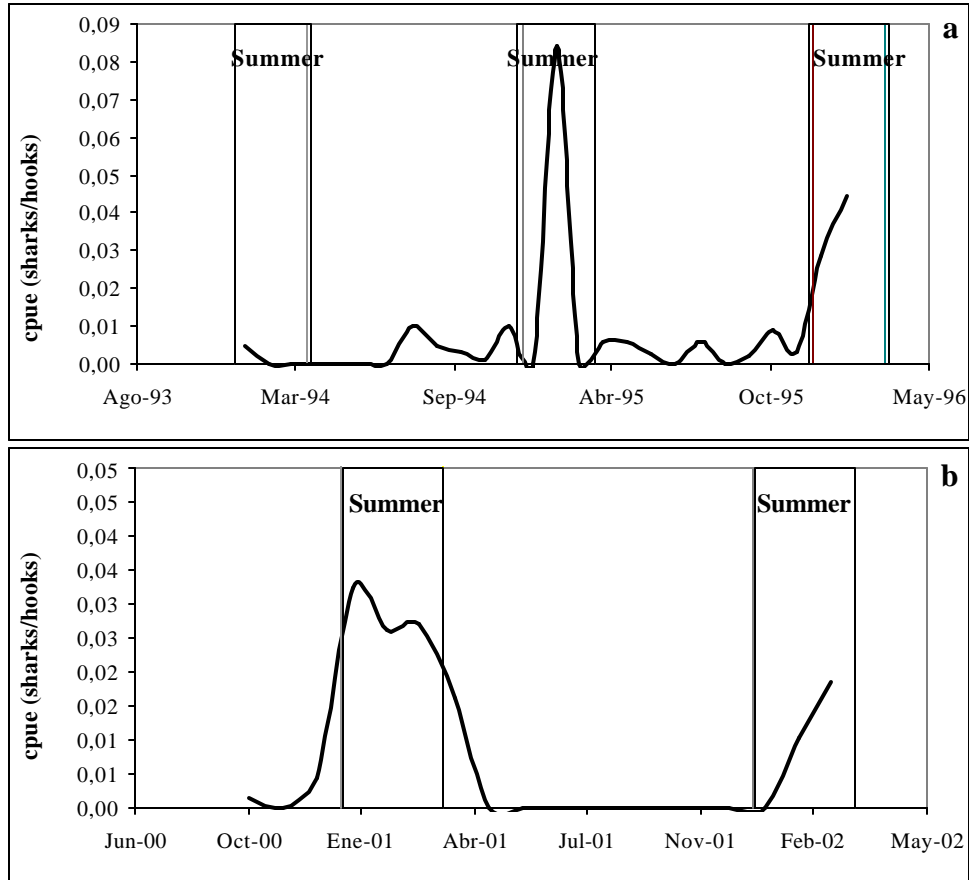


Fig.2. Changes of CPUE (sharks/hooks) in (a) experimental fishing and (b) commercial fishing.

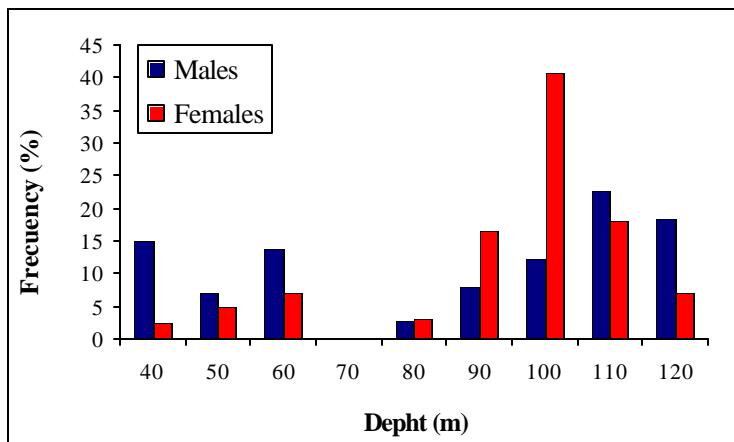


Fig. 3. Distribution abundance discriminated by sex for *Galeorhinus galeus* in Patagonian waters.

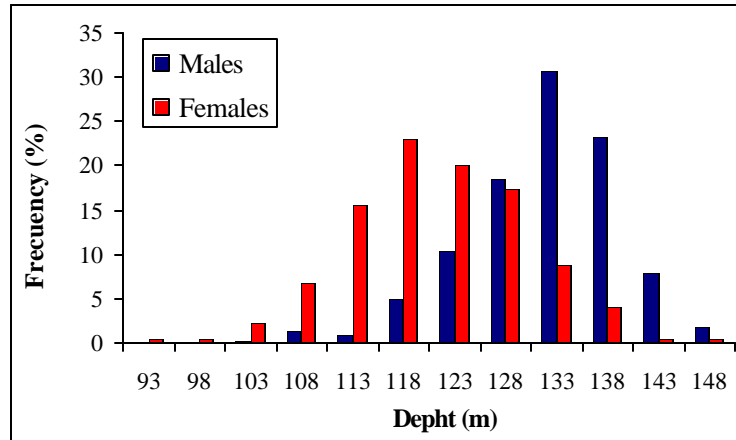


Fig. 4. Length frequency distribution for males (N = 579) and females (N = 408) *Galeorhinus galeus* caught in experimental and commercial fishing in Patagonian waters.

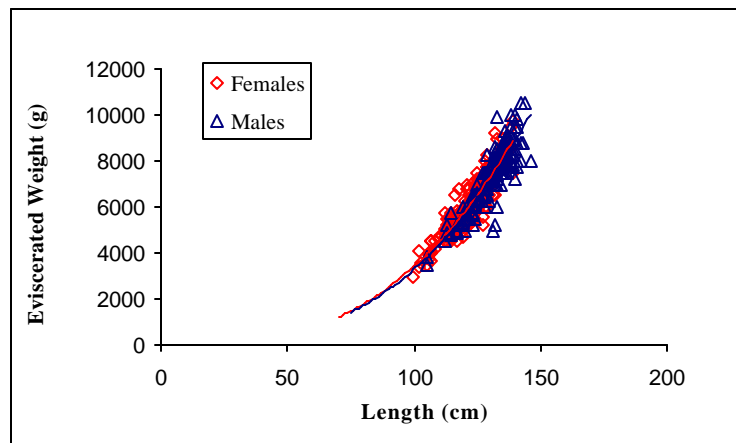


Fig. 5. Relationship between total body length and eviscerated weight for *Galeorhinus galeus*. For the equation $W = aL^b$, $a = 0.0063$, $b = 2.86$ ($n = 228$; $r^2 = 0.78$) for males, and $a = 0.0044$, $b = 2.93$ ($n = 172$; $r^2 = 0.81$) for females.

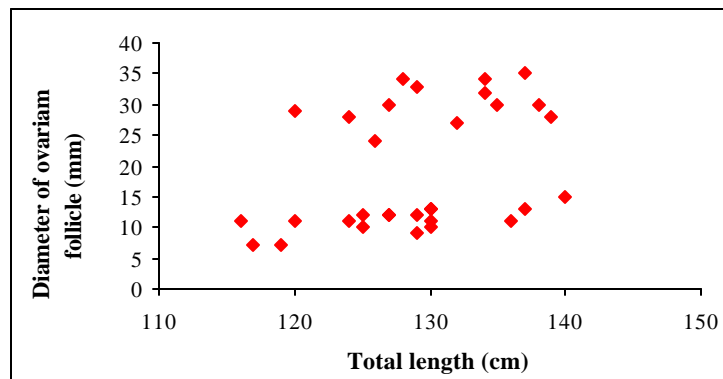


Fig. 6. Relationship between total body length and diameter of the largest follicle in tope shark females.