

# Saved and released - successful hatching of selected oviparous shark species with egg cases recovered from dead females



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## Introduction

*Scyliorhinus canicula* and *Scyliorhinus stellaris* are demersal elasmobranch species, commonly found [1] and fished [2] throughout the Mediterranean Sea. *Scyliorhinus canicula* is one of the most abundant elasmobranchs in the Mediterranean Sea, and hence of least concern in regard to its conservation status [3]. *Scyliorhinus stellaris*, on the other hand, are less abundant [1] and show scattered patches of occurrence [4,5]; therefore, are more vulnerable to exploitation [6]. The International Union for Conservation of Nature (IUCN) determines *S. stellaris* as near threatened [4]. As in many parts of the oceans, elasmobranchs in the Mediterranean are declining, particularly catsharks and skates [2]. Management plans and actions are required to combat this trend [7], but are often difficult to implement or too late [8]. New conservation approaches are needed to increase public engagement in marine policy in support of shark conservation [9]. The project of collecting egg cases from catsharks at the fish market in Valletta started in January 2012. The goal was to hatch the egg cases in an aquarium and then release the shark pups into the coastal waters of Malta to contribute to elasmobranch conservation, raise awareness and engage the public.

## Method

- 1) Examine for the presence of egg cases in the oviducts by sensing the female's abdomen.
  - It should be considered, that the capture method using hooks can be very destructive to the female and often fishers pull the hook back out of the captured shark removing the entire stomach. In these cases the oviducts generally remain intact and the egg cases can be easily felt by gentle examination of the ventral area of the stomach and organ cavity. This method has proved greater than 90% accuracy in identifying the presence of egg cases.
- 2) After removal egg cases are immediately placed into a sea-water filled container.
- 3) Within 24 hours the egg cases are placed in an aquarium, where they hatch after approximately 24 weeks.
- 4) Post hatching shark pups remain in the aquarium for another 5-6 months under controlled conditions.
- 5) Shark release organised as public awareness event. Underwater release at minimum depth of 20 metres.

**1** Temperature: 18°C

**2** Salinity: 30 PSU

**3** Mechanical H<sub>2</sub>O Filtration: 100-400 micron mesh protein skimmer

**3** Biological H<sub>2</sub>O Filtration: bio-tower with bio-balls

**4** Food supply

- Newly hatched: Mysid shrimp, cut krill, shrimp and squid
- After approximately 2 weeks: mackerel twice per week
- All food= frozen

➤ Released *Scyliorhinus canicula*

Photos courtesy of Rasmus Loeth Petersen and Pamela Mason

## Acknowledgements

We would like to express our deepest gratitude to the Malta National Aquarium for their continuous support, and all volunteers who supported our fish market research. The recovery and release project will continue and be extended to include the collection of skate egg cases.

## Results

- Increasing number of egg cases recovered from both species between 2012 - 2015 as shown in Figure 1, without any significant difference between months (Figure 2): (*S. stellaris*  $\chi^2(1)=0.271$ ,  $p=0.603$ ; *S. canicula*  $\chi^2(1)=0.290$ ,  $p=0.590$ ).
- The data indicates that breeding takes place all year around.
- A refined method on sensing the presence of egg cases in 2014 led to a significant increase ( $\chi^2(1)=85.671$ ,  $p<0.001$ ) in the recovery of egg cases from *S. canicula*.
- Egg case development seems to be successful even after 7 days post mortem of females.
- Within 4 years, 184 shark pups have been released (Table 1).
- The project initiated an 'Adopt a shark' campaign in October 2014, which shows continuous success (Figure 3).

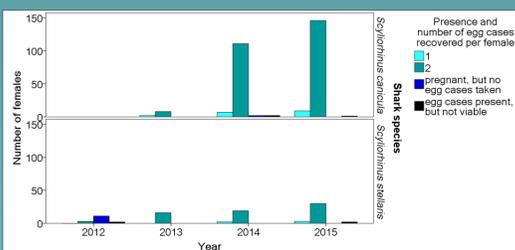


Figure 1: Egg case recovery data from 2012 - 2015.

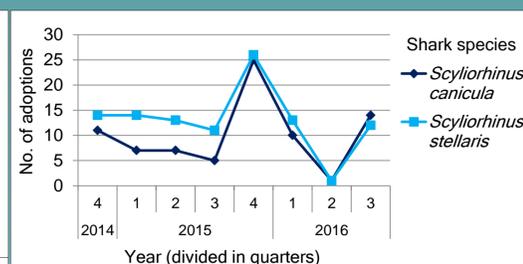


Figure 3: Time series of shark adoptions.

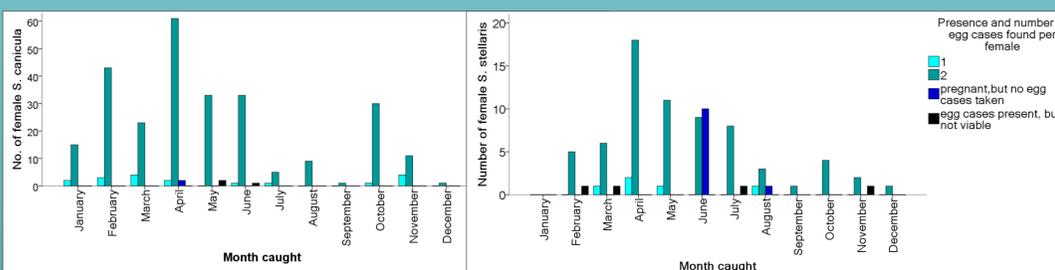


Figure 2: Monthly distribution of egg cases found in pregnant females.

Table 1: Dates, location and number of catsharks released between March 2013 - March 2016.

Date	No. of sharks and corresponding species	Location of release	Total No. of sharks released till then
06.03.2013	1 <i>Scyliorhinus canicula</i>	Armier Bay	1*
02.01.2014	3 <i>Scyliorhinus stellaris</i>	South Quay	4
14.06.2014	7 <i>Scyliorhinus stellaris</i>	South Quay	11
09.11.2014	6 <i>Scyliorhinus stellaris</i>	South Quay	17
10.01.2015	60 <i>Scyliorhinus canicula</i>	Cirkewwa	77
10.03.2015	2 <i>Scyliorhinus stellaris</i>	Cirkewwa	79
30.04.2015	8 <i>Scyliorhinus stellaris</i>	Cirkewwa	95
	8 <i>Scyliorhinus canicula</i>		
13.06.2015	6 <i>Scyliorhinus canicula</i>	South Quay	101
03.10.2015	60 <i>Scyliorhinus canicula</i>	South Quay	161
16.12.2015	3 <i>Scyliorhinus stellaris</i>	Cirkewwa	164
26.03.2016	2 <i>Scyliorhinus stellaris</i>	Cirkewwa	184
	18 <i>Scyliorhinus canicula</i>		

\*This shark came from egg cases found on a beached piece of rope in 2012

## Conclusions

- This project: +
- Is a unique approach to shark conservation and education.
  - Has the potential to be used for other oviparous species.
  - Initiated a successful 'Adopt a shark' campaign.
  - Increases public awareness and engagement through education [9,11].
  - Fosters cooperation between stakeholders (e.g. aquarium, fish broker).
  - Makes a difference for released shark pups.
  - While management strategies take time to be implemented, this conservation approach can be set up within a short period of time.
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- A study by Jacoby et al. (2012) [10] suggests that *S. canicula* hatched at the same time are likely to stay in groups after being released. However, the behaviour and fate of the released sharks have not been tracked.
  - Has a negligible impact on population status.
  - Cannot replace the need for management strategies and conservation measures for elasmobranchs in the Mediterranean.

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