FINAL REPORT

- 2024 -

Shark Foundation

www.isea.com.gr

By ElasmoCatch Project

Menidi - Aitoloakarnanias

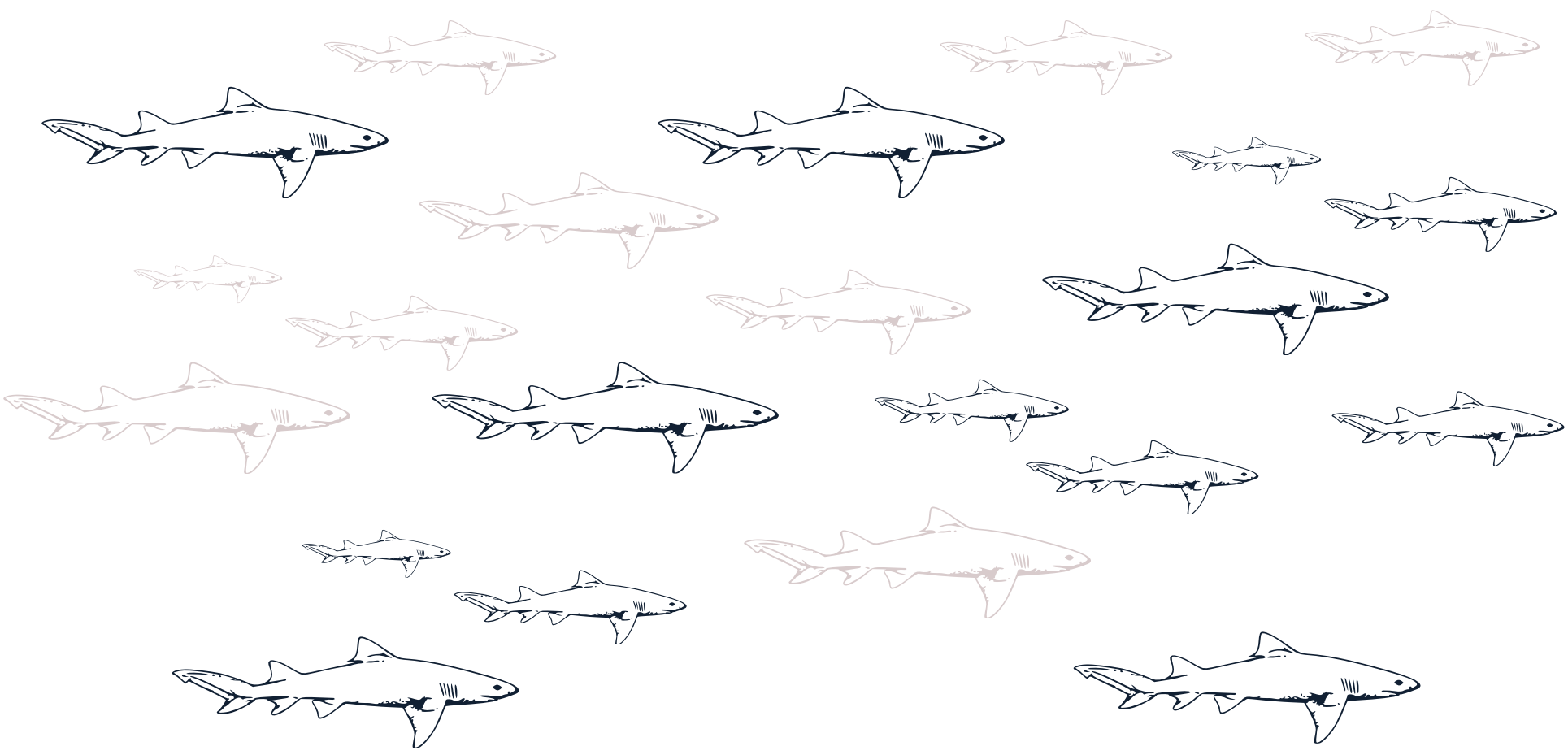
December 2024

Citation of this report:

Ciprian M., Chouliaras T., Manzoni C., Naasan Aga Spyridopoulou R., Giovos I. (2024). By ElasmoCatch Final Report. iSea, Environmental Organisation for the preservation of the Aquatic Ecosystems, Menidi, December 2024.

Photos:

iSea



Contact person:

Martina Ciprian
iSea, Environmental Organisation for the Preservation of the Aquatic Ecosystems
Menidi - Aitoloakarnanias, 30016, Greece
martina.ciprian@isea.com.gr
+39 3442456270

Table of contents

Summary -

By ElasmoCatch Project

The **By ElasmoCatch Project** focuses on studying the **biodiversity of elasmobranchs in Greece and its interactions with fishery**, as well as **their biology and ecology** with the final aim **to improve conservation of elasmobranchs in Greece and in the Mediterranean Sea**. The project is conducted in the Amvrakikos Gulf, western Greece, from February 2022. In addition to the **bycatch data** (fishing trips monitored in 2024 = 324, with a total of **132 collaborative fishers**), biological and ecological information are collected. During 2024 the iSea team used **spaghetti tags** (N = 45) for the different species present to assess the effects of capture to the health of individuals by estimating the **post release mortality**, the population size, as well as their movements inside and outside the Gulf thanks to tag retrieval. In addition, protocol to assess short-term post release mortality were carried out, by keeping individuals in tanks for 40 minutes (N = 90).

In the perspective to understand the **connectivity between the individuals of *Mustelus mustelus* inhabiting the Gulf with those in the Mediterranean Sea and Atlantic Ocean**, samples were collected from different partners and **population genetic analysis** are being carried out in collaboration with the University of Padova. **Results on the connectivity, as well as of the biology and ecology of the Amvrakikos Common Smoothhound population will be of fundamental importance to guide management of the species in the area.**

The study area

Amvrakikos Gulf is a **semi-closed bay** (405 km^2) that communicates with the Ionian Sea through the Preveza Channel; a narrow (minimum width of 370 m) and shallow (2–12 m deep) 3 km-long corridor. Due to its isolated nature, the **water quality is strongly influenced by man-made processes**. The two rivers are the main input source of organic matter and pollutants. Fish farms, livestock, and discharges of domestic sewage from coastal towns and villages further contribute to the nutrient enrichment of Ambracian waters, which are rather murky and highly eutrophic. **The Gulf is mostly muddy or sandy. On average it is approximately 30 m (maximum 60 m) deep.**

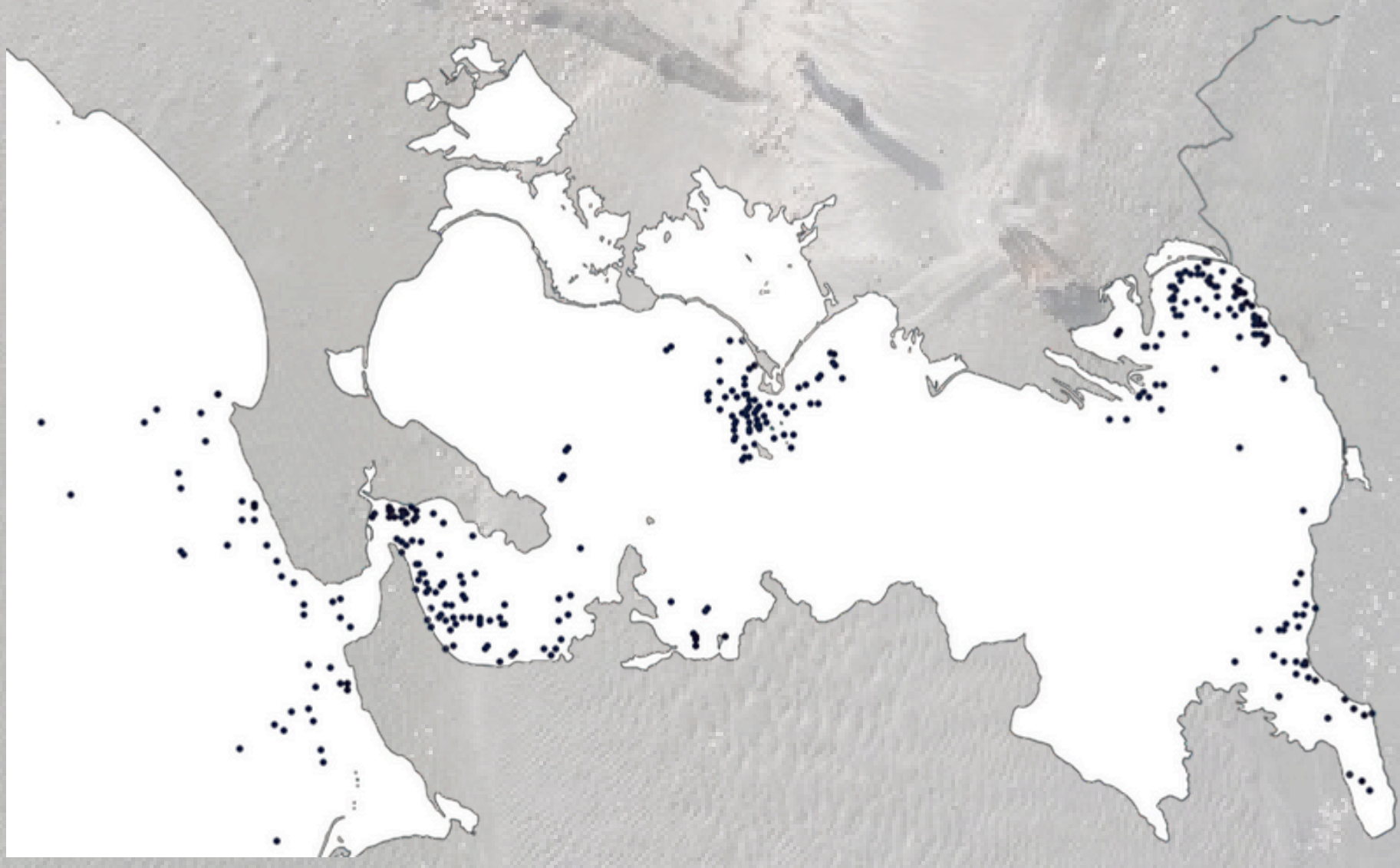
The active fishing fleet is estimated to be of 180 vessels, working primarily with **set nets** (i.e., trammel nets and gill nets) and a minority using longlines. The study area is one of the most important protected **wetlands** in Greece, and it is known to be a **biodiversity hotspot**. The area is included in **Natura 2000 sites**, **Ramsar sites** and is a **Key Biodiversity Area** of international importance. In addition, it has high ecological importance because of the presence of sea turtles, dolphins, and birds. In terms of elasmobranchs the presence of 9 species has been confirmed, among these **2 Critically Endangered** (IUCN Red List, Mediterranean region) **rays**: *Aetomylaeus bovinus* and *Gymnura altavela*.

Amvrakikos Gulf has been delineated as a **Shark and Ray Important Area (ISRA) for one shark species (*M. mustelus*) and two ray species (*A. bovinus* and *G. altavela*)**. In particular, the Gulf is of fundamental importance as **reproductive area**, more specifically as parturition and nursery area.


Koronisia
Menidi
Preveza
Mpouka
Vonitsa
Amphilochia

Bycatch monitoring

The capacity of iSea has increased in the area now having a new office and three permanent staff working all year round in Amvrakikos. A systematic monitoring is carried out weekly. Seven ports of the Ambracian Gulf and one of the Ionian Sea are monitored twice a month. From January to October, thanks to the collaboration of 132 different fishers, we monitored 324 fishing operations. In particular 81.48% using trammel nets (targeting *Sepia officinalis*, fishes or *Penaeus kerathurus*), 16.98% using gillnets (targeting *Mullus* spp., *Sardina pilchardus* or *Umbrina cirrosa*) and 1.54% using gillnets targeting Common Smoothhound. One or more elasmobranchs were caught in 50% of fishing trips monitored. The species recorded in 2024 include 2 shark species (*Mustelus mustelus* and *Mustelus punctulatus*) and 9 ray species (*Aetomylaeus bovinus, Dasyatis marmorata, Dasyatis pastinaca, Dasyatis tortonesei, Gymnura altavela, Myliobatis aquila, Torpedo marmorata* and *Torpedo torpedo*).



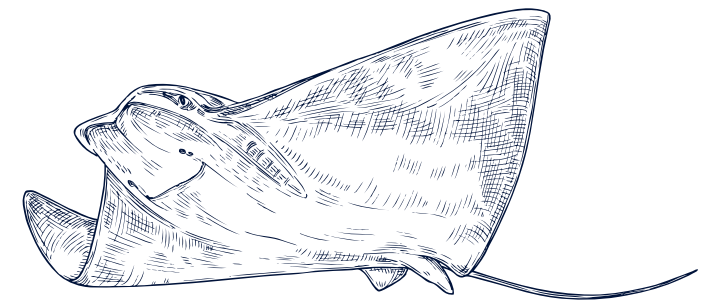
Map showing the coordinates of the fishing trips monitored (N = 324) from January to October 2024.

Summary Table of Data Collected

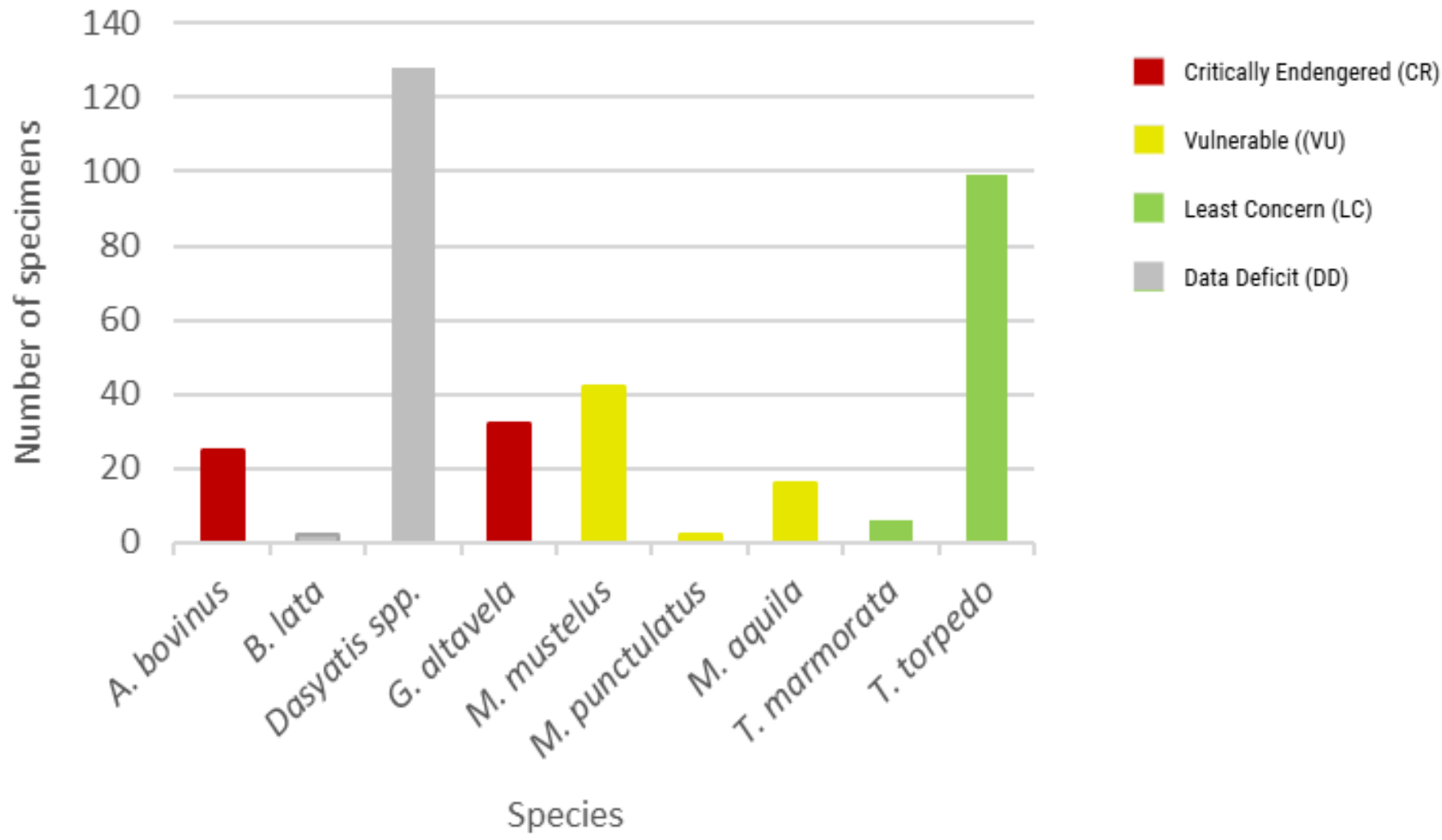
(January - October 2024)

Number of collaborative vessels	132
Total number of fishing trips monitored	324
Number of fishing trips monitored in Amvrakikos Gulf	279
Number of fishing trips monitored in the Ionian Sea	45
Fishing trips monitored (landing sites)	304
Fishing trips monitored (onboard)	20
Fishing trips using trammel nets (GTR) monitored	264
Fishing trips using gill nets (GNS) targeting small fishes monitored	55
Fishing trips using gill nets (GNS) targeting *M. mustelus* monitored	5
Fishing effort monitored in hours	2345:32
Fishing effort monitored in km of nets	321.1442
Species of elasmobranch recorded	11
Specimens of elasmobranchs recorded	514
Specimens of elasmobranchs sampled	352

Results

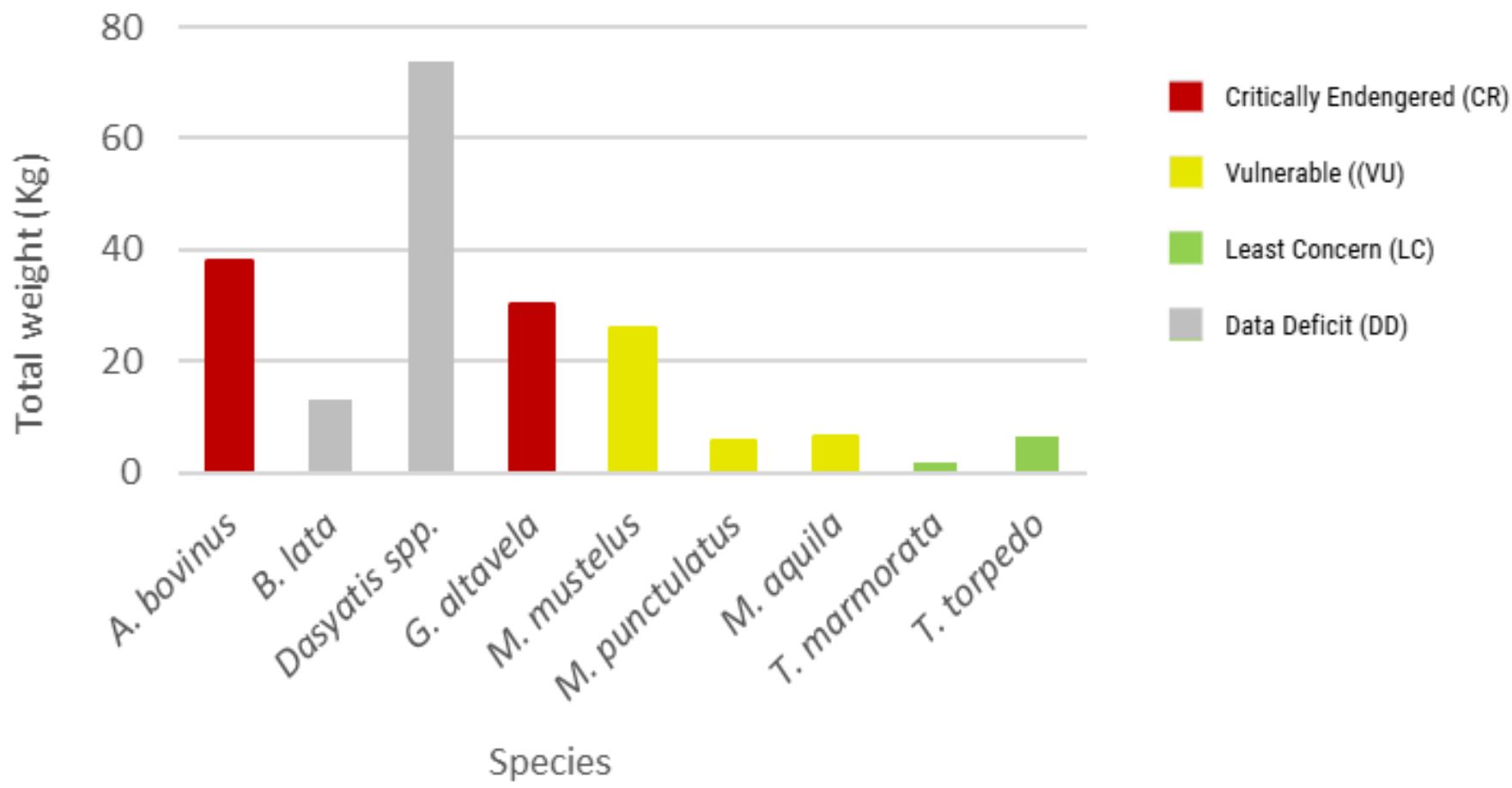


1. NUMBER OF ELASMOBRANCH SPECIMENS CAUGHT PER SPECIES

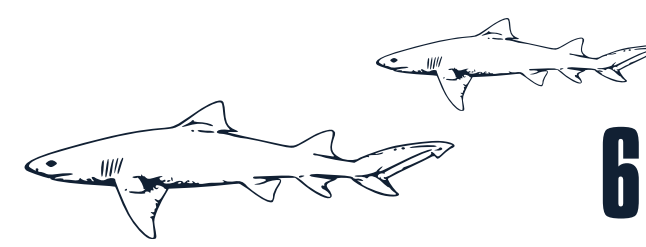


Number of elasmobranch specimens caught divided by species. Data were collected from January to October 2024. Different colours indicate the IUCN status to which each species belongs depending on the IUCN Red List (Mediterranean Sea). The total number of individuals caught is 352 divided per species as follows: *A. bovinus* (25), *B. lata* (2), *Dasyatis* spp. (128), *G. altavela* (32), *M. mustelus* (42), *M. punctulatus* (2), *M. aquila* (16), *T. mormorata* (6), *T. torpedo* (99).

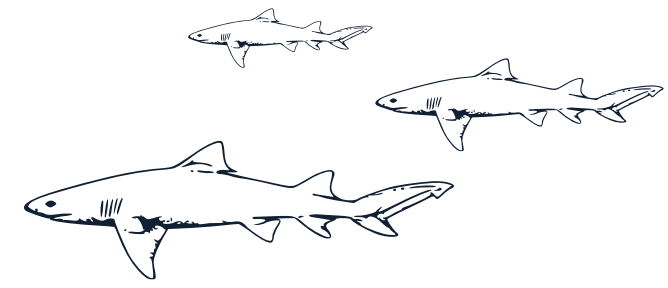
2. TOTAL WEIGHT OF ELASMOBRANCHS CAUGHT PER SPECIES



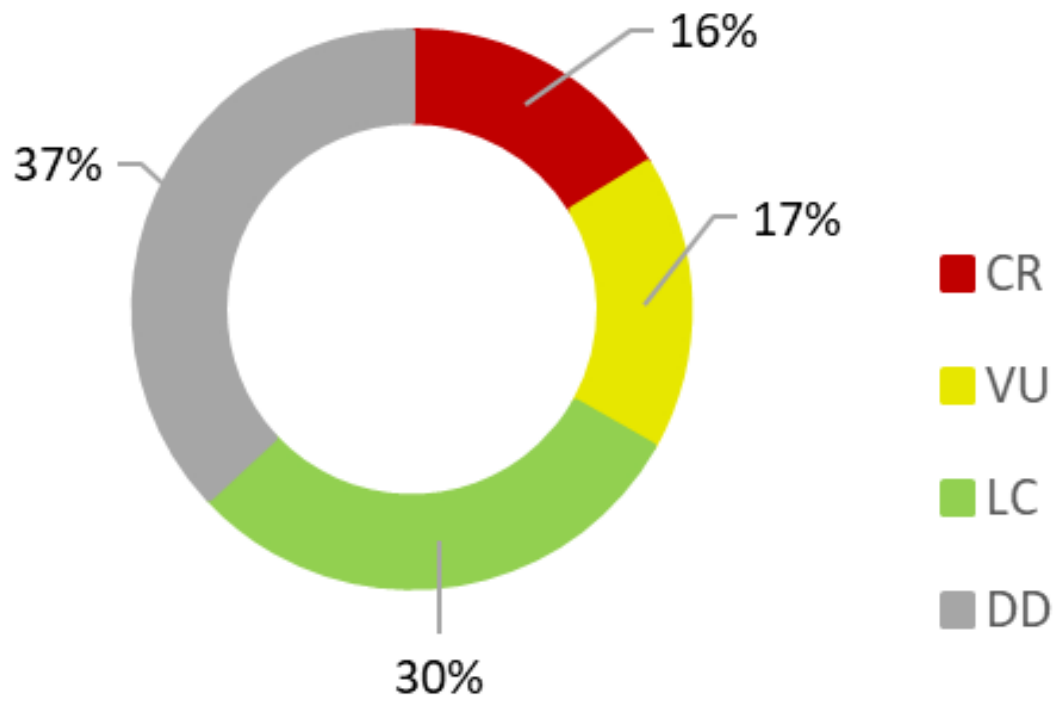
Total weight of elasmobranch specimens caught divided by species. Data were collected from January to October 2024. Different colours indicate the IUCN status to which each species belongs depending on the IUCN Red List (Mediterranean Sea). The total weight of individuals caught is 202.18 Kg divided per species as follows: *A. bovinus* (38.12 kg), *B. lata* (13.14 kg), *Dasyatis* spp. (73.67 kg), *G. altavela* (30.11 kg), *M. mustelus* (25.98 kg), *M. punctulatus* (5.94 kg), *M. aquila* (6.56 kg), *T. mormorata* (2.01 kg), *T. torpedo* (6.67 kg).



Results

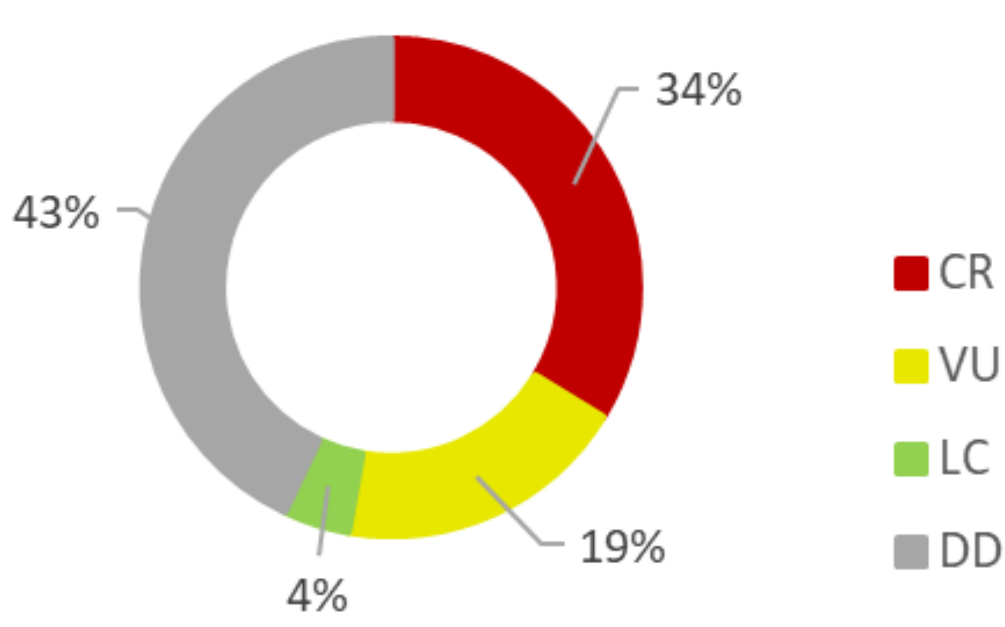


3. COMPOSITION OF CAUGHT ELASMOBRANCHS (IN NUMBERS) BASED ON THEIR MEDITERRANEAN IUCN RED LIST STATUS



Percentages of abundance (in numbers) of elasmobranch specimens caught depending on their conservation status in the Mediterranean sea (indicated by different colours). Critically Endangered (CR) in red includes *A. bovinus* and *G. altavela*; Vulnerable (VU) in yellow includes *M. mustelus, M. punctulatus* and *M. aquila*; Least Concern (LC) in green includes *T. mormorata* and *T. torpedo*; Data Deficit (DD) in grey includes *B. lata* and *Dasyatis* spp. Data were collected from January to October 2024.

4. COMPOSITION OF CAUGHT ELASMOBRANCHS (IN KG) BASED ON THEIR IUCN RED LIST STATUS



Percentages of abundance (in kilograms) of elasmobranch specimens caught depending on their conservation status in the Mediterranean sea (indicated by different colours). Critically Endangered (CR) in red includes *A. bovinus* and *G. altavela*; Vulnerable (VU) in yellow includes *M. mustelus, M. punctulatus* and *M. aquila*; Least Concern (LC) in green includes *T. mormorata* and *T. torpedo*; Data Deficit (DD) in grey includes *B. lata* and *Dasyatis* spp. Data were collected from January to October 2024.

Biological and ecological data

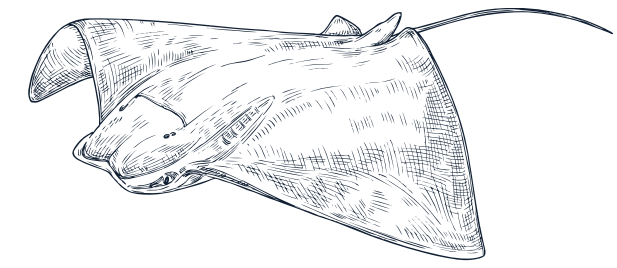
A total of 514 elasmobranchs has been recorded to be caught in different types of fishing gear, of this, 68.48% were measured by the iSea team during surveys in landing sites and on board of fishing vessels. The remnant individuals were not measured because discarded (dead or alive) by fishers before our interviews.

In addition to morphometric measures, in dead specimens DNA samples and stomachs were collected for all the species, moreover vertebras were taken. Reproductive organs were measured following a protocol that has been drafted by the iSea team and the professor Carlotta Mazzoldi (University of Padova).

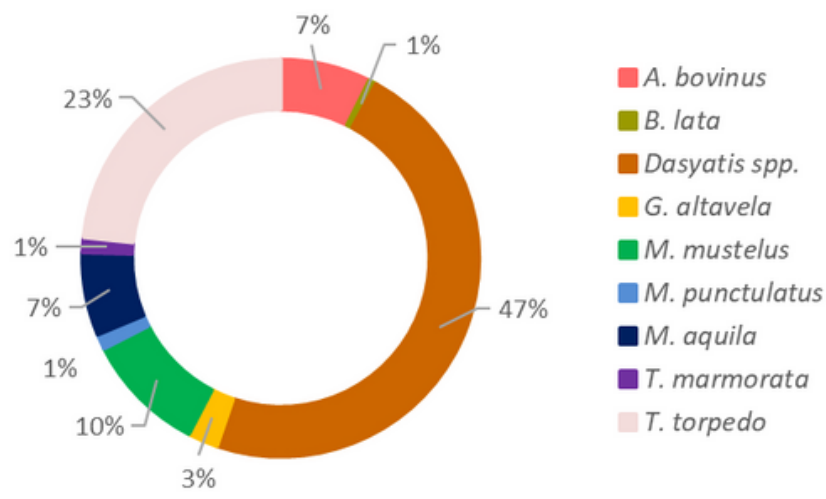
DNA samples obtained	**163**
Stomach obtained	**139**
Reproductive systems measured	**138**
Vertebras obtained	**124**

SUMMARY TABLE OF SAMPLES COLLECTED IN DEAD INDIVIDUALS (JANUARY TO OCTOBER 2024).

Results

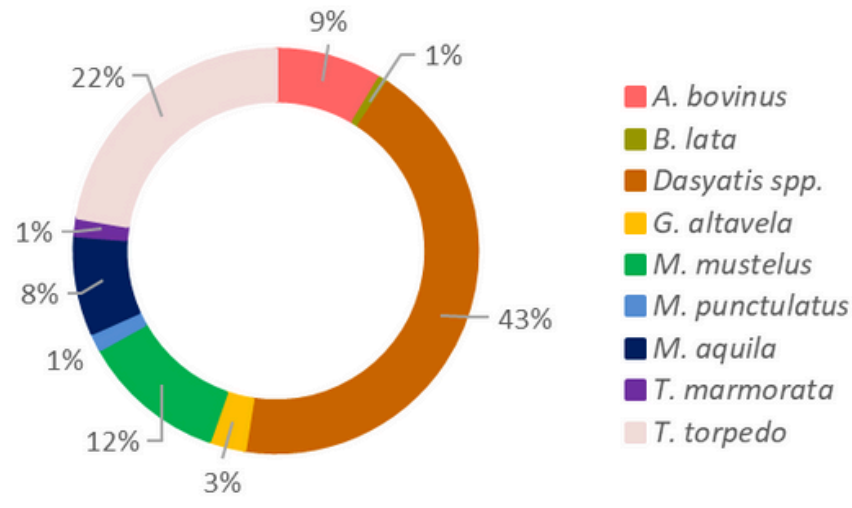


1. PERCENTAGES OF DNA SAMPLES PER SPECIES



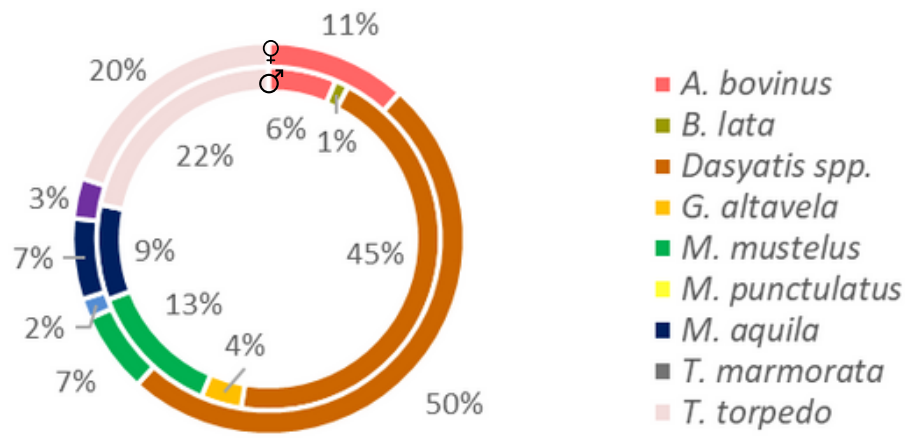
Percentages of DNA samples collected per species. Samples were collected from January to October 2024. The total number of DNA samples collected is 163 divided per species as follows*: A. bovinus (12), B. lata (1), Dasyatis spp. (77), G. altavela (4),* ***M. mustelus (16), M. punctulatus (2)****, M. aquila (11), T. mormorata (2), T. torpedo (38).*

2. PERCENTAGES OF STOMACHS COLLECTED PER SPECIES

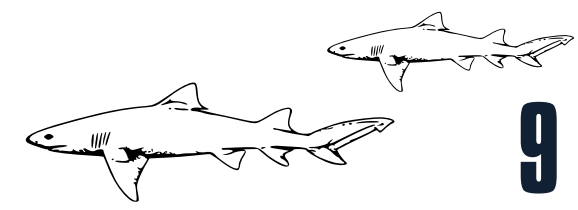


Percentages of stomachs collected per species. Samples were collected from January to October 2024. The total number of stomachs collected is 139 divided per species as follows*: A. bovinus (12), B. lata (1), Dasyatis spp. (60), G. altavela (4),* ***M. mustelus (16), M. punctulatus (2)****, M. aquila (11), T. mormorata (2), T. torpedo (31).*

3. PERCENTAGES OF REPRODUCTIVE SYSTEM MEASURED PER SPECIES, DIVIDED BY SEX



Percentages of reproductive systems measured per species. Samples were collected from January to October 2024. The total number of reproductive systems measured is 138 (78 males - 60 females), divided per species as follows*: A. bovinus (5 males - 7 females), B. lata (1 male - 0 females), Dasyatis* spp. *(35 males - 30 females), G. altavela (3 males - 0 females),* ***M. mustelus (10 males - 4 females), M. punctulatus (0 males - 1 female)****, M. aquila (7 males - 4 females), T. mormorata (0 males - 2 females), T. torpedo (17 males - 12 females).*



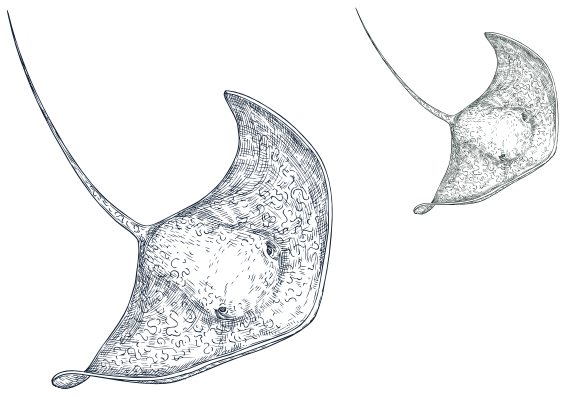
Alive specimens

1. Short-term post release mortality (StPRM)

A total of 90 individuals carried out the protocol to assess the Short-term Post Release Mortality (StPRM). The protocol was carried out by specimens found alive in both landing sites and during onboard surveys. Smaller individuals were selected not to constrain animals in small space, influencing their survival after capture. Each animal was kept in a tank for 40 minutes, during which, its health status has been assessed 3 times, as soon as it was put in the tank, after 10 minutes, and after 40 minutes. Among these, only one *M. mustelus* died by the end of the protocol.

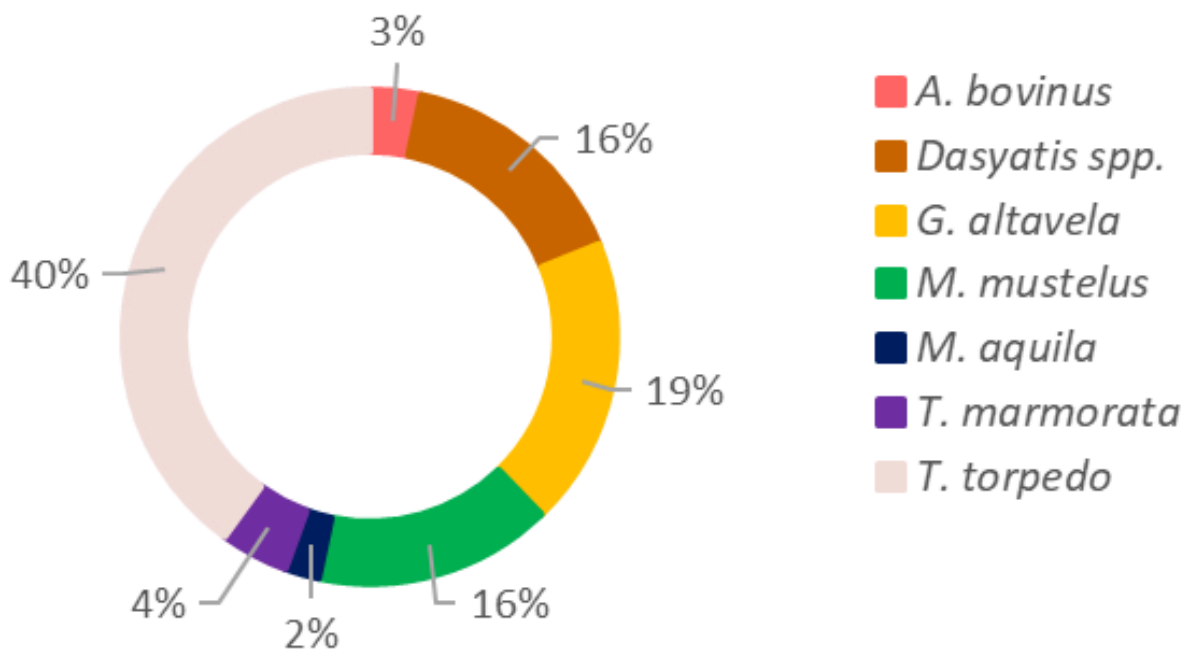
2. Tagging activity

The tagging program started in May 2022 and is continuing during the years. Movements and survival after capture of elasmobranchs present in Amvrakikos Gulf could be estimated thanks to recapture data (tag retrieval). Alive bycaught sharks and rays were tagged using spaghetti tags both onboard of fishing vessels and in landing sites, and consequently released using safe handling and release techniques according to the GFCM guide. In 2024 a total of 45 individuals have been tagged, reaching a total of 256 tagged animals. To ensure best recapture rate, posters have been put in every monitored port, and fliers containing steps to follow if catching a tagged were also distributed individually to fishers.



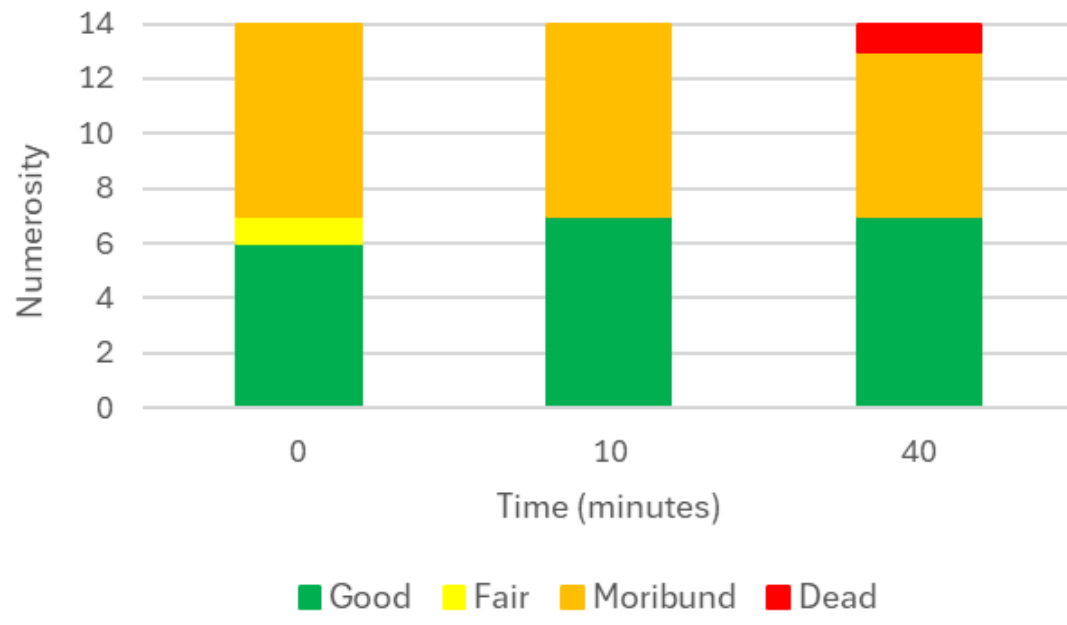
Results

1. PERCENTAGES OF INDIVIDUALS THAT CARRIED OUT THE STPRM PROTOCOL PER SPECIES



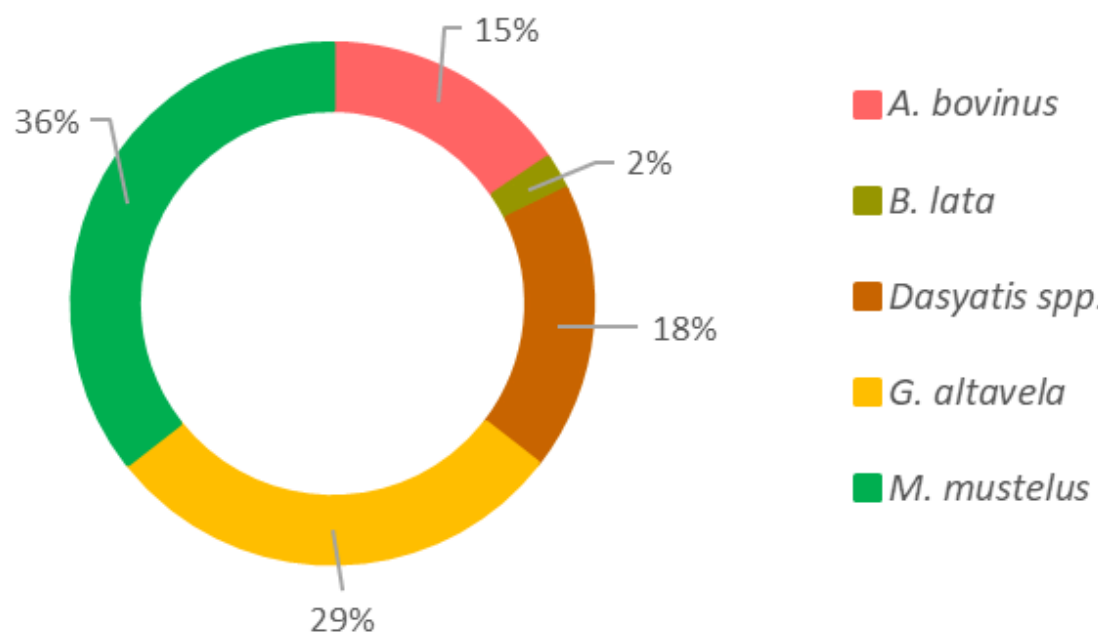
Percentages of individuals that carried out the stPRM protocol per species. Data were collected from January to October 2024.
The total number of individuals that carried out the stPRM protocol is 90 divided per species as follows: *A. bovinus (3)*, *Dasyatis* spp. *(14)*, *G. altavela (17)*, ***M. mustelus (14)***, *M. aquila (2)*, *T. mormorata (4)*, *T. torpedo (36)*.

1.1 SCORE DURING THE 40-MINUTES TANK MAINTEINANCE FOR THE COMMON SMOOTHHOUND SHARK

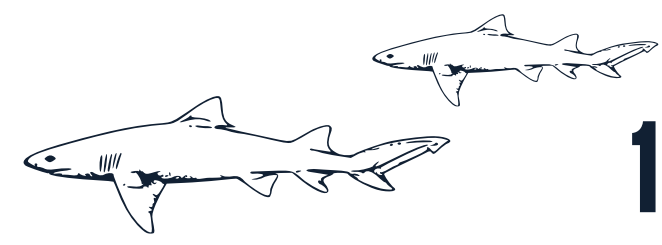


Trend of scores for 14 individuals of *M. mustelus* during short-term post release mortality assessment in tanks (total of 40 minutes). The conditions of the individuals were recorded as follows: **Good** = animal in the bottom or moving in the tank - Spiracles moving; **Fair** = swimming with the snout out of the water - Weak body movements and weak spiracle movements; **Moribund** = no obvious body movements, limited spiracular movements, minor or major injuries - Rigid parts of the body; **Dead** = no movement of body or spiracles.

2. PERCENTAGES OF TAGGED INDIVIDUALS PER SPECIES



Percentages of tagged elasmobranchs tagged per species. Samples were collected from January to October 2024. The total number of tagged individuals is 45 divided per species as follows: *A. bovinus (7)*, *B. lata (1)*, *Dasyatis* spp. *(8)*, *G. altavela (13)*, ***M. mustelus (16)***.



Population genetic analysis

1. Samples collection

A total of 197 samples were obtained by different institutions working with *Mustelus mustelus*. In particular from iSea, a total of 75 samples were collected in Amvrakikos Gulf (from 2022 to 2024) thanks to the By ElasmoCatch Project. In addition to these, other 7 samples were collected in other regions of Greece (Aegean Sea). Thanks to the collaboration with the University of Padova, 70 samples were collected for Common Smoothhound caught in the Nort-West Adriatic Sea. Samples were also obtained from partners working in the Canary Islands (Atlantic Ocean), for a total of 45 individuals.

The samples were sent to the University of Padova in September, when the genetic analysis also started, in collaboration with the laboratory of Professor Chiara Papetti.

2. Laboratory Analysis

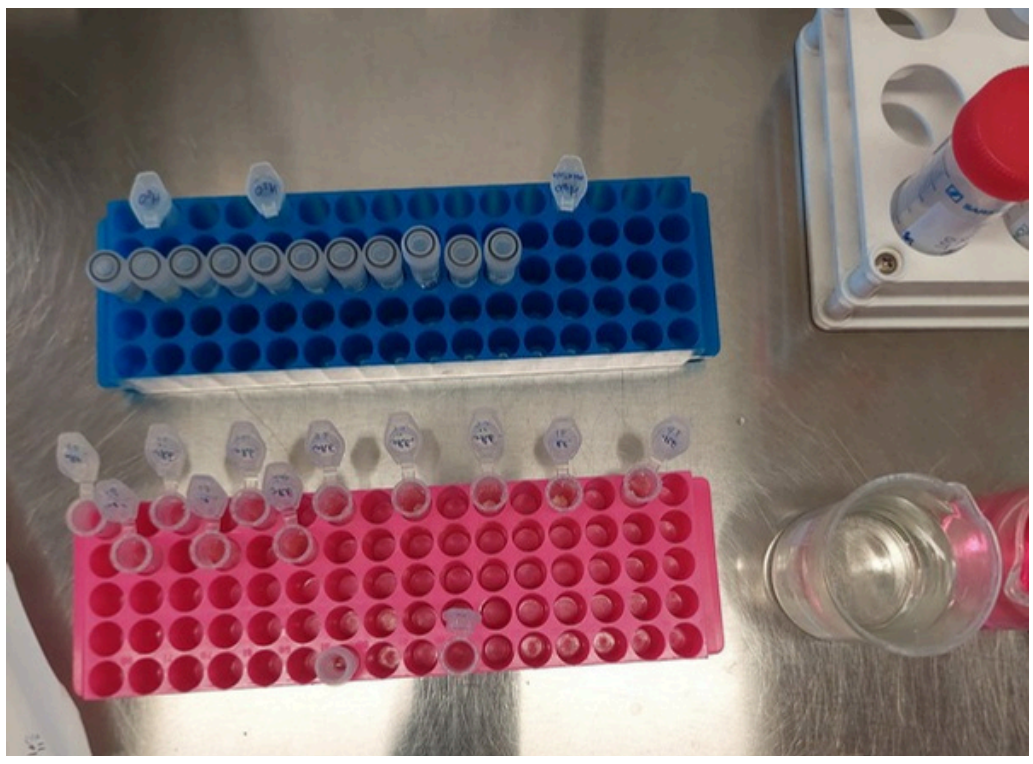
One member of iSea worked in the laboratory for a total of 4 weeks during September, October, November and December. All the analysis were done under the supervision of the technician of the genetic laboratory, ensuring no mistakes in the methodology were occurring.

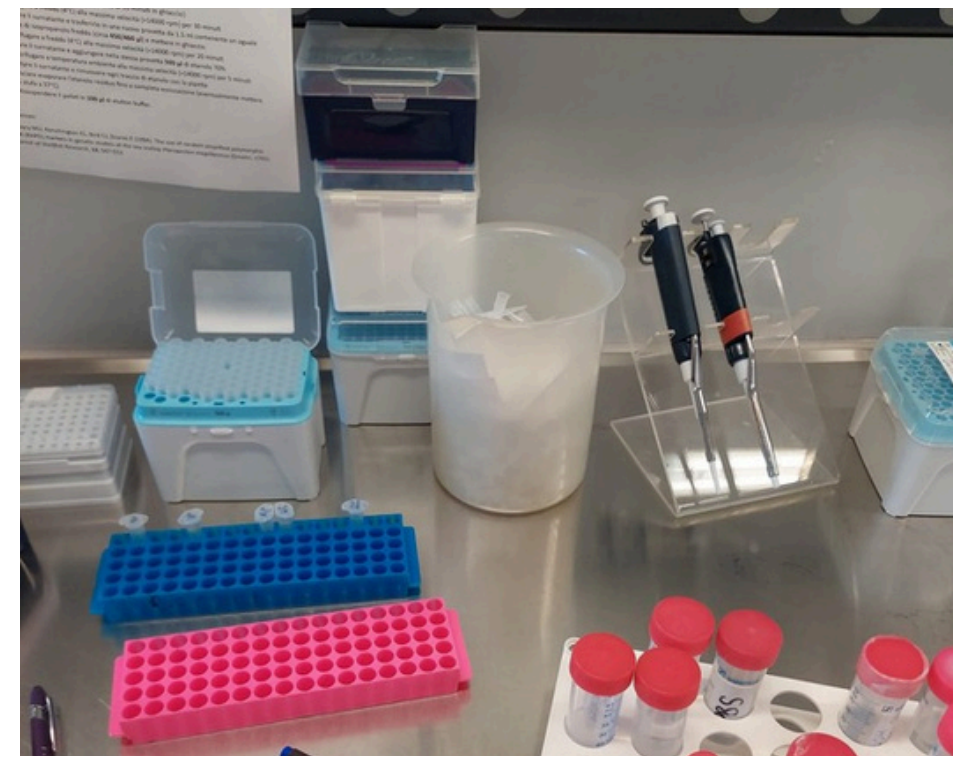
DNA extraction was performed for all the samples of Amvrakikos and Aegean Sea, 30 samples of the Canary Islands, and 14 samples from the North-West Adriatic Sea. After DNA extraction, the genetic identification was carried out through mitochondrial markers. However, during this procedure, markers that were previously used to differentiate *M. mustelus* from *M. punctulatus* did not work for samples collected in Greece and in the Canary Islands due to a modification in the site where the marker should have bound. For this reason, delays in the analysis occurred. For the aforementioned reason, in this study, the genetic identification of the species did not took place. This is not going to create any bias in the analysis because inidividuals were identified at the species level thanks to their morphological characteristics.

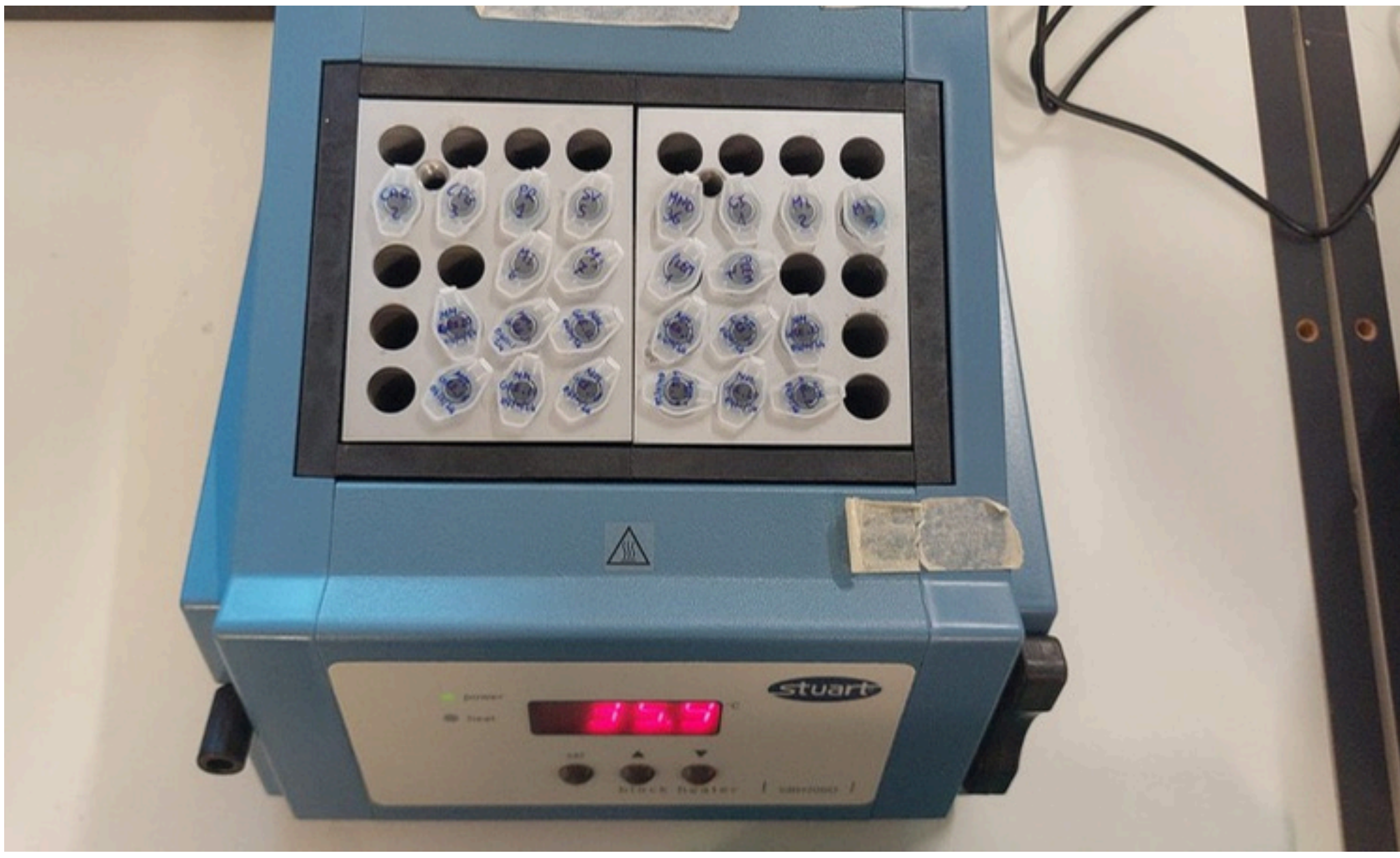
All the samples were diluted at a concentration of 20 ng/µl and a polymerase chain reaction (PCR), a fast technique used to "amplify" small segments of DNA was performed, using microsatellite markers. The products of the PCR were then send to an external entity (BMR Genomics) for their genotyping. Due to time and availability of the iSea member and laboratory technician, only 1 plate (containing 75 samples from Amvrakikos, 7 samples from the Aegean Sea and 14 samples from the Nort-West Adriatic Sea, total N = 96) was sent to genotyping.

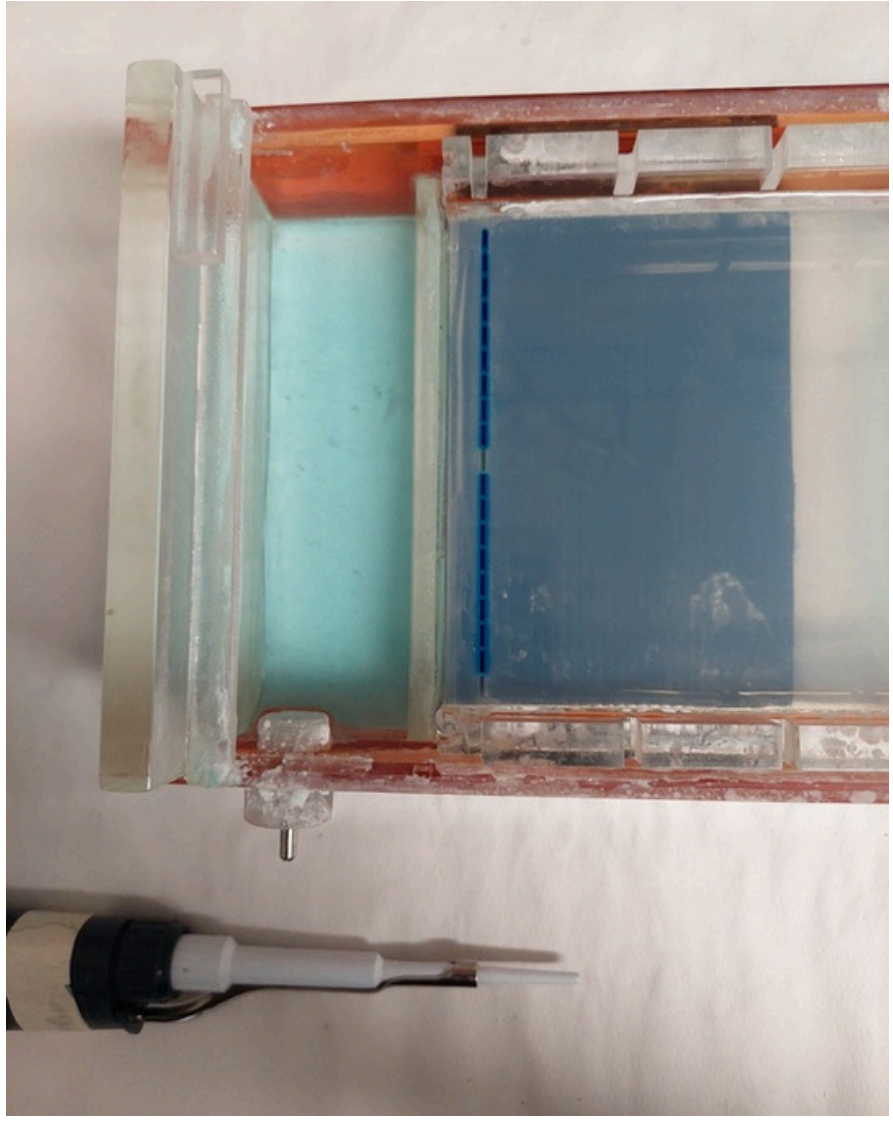
Results of the microsatellite loci amplified (loci = 8) have been received by BMR Genomics on December 2nd. Between 16th and 20th December, and after the 8th of January, the iSea member will go in person in the genetic laboratory in order to analyse the final results obtained from the first genotyping plate.

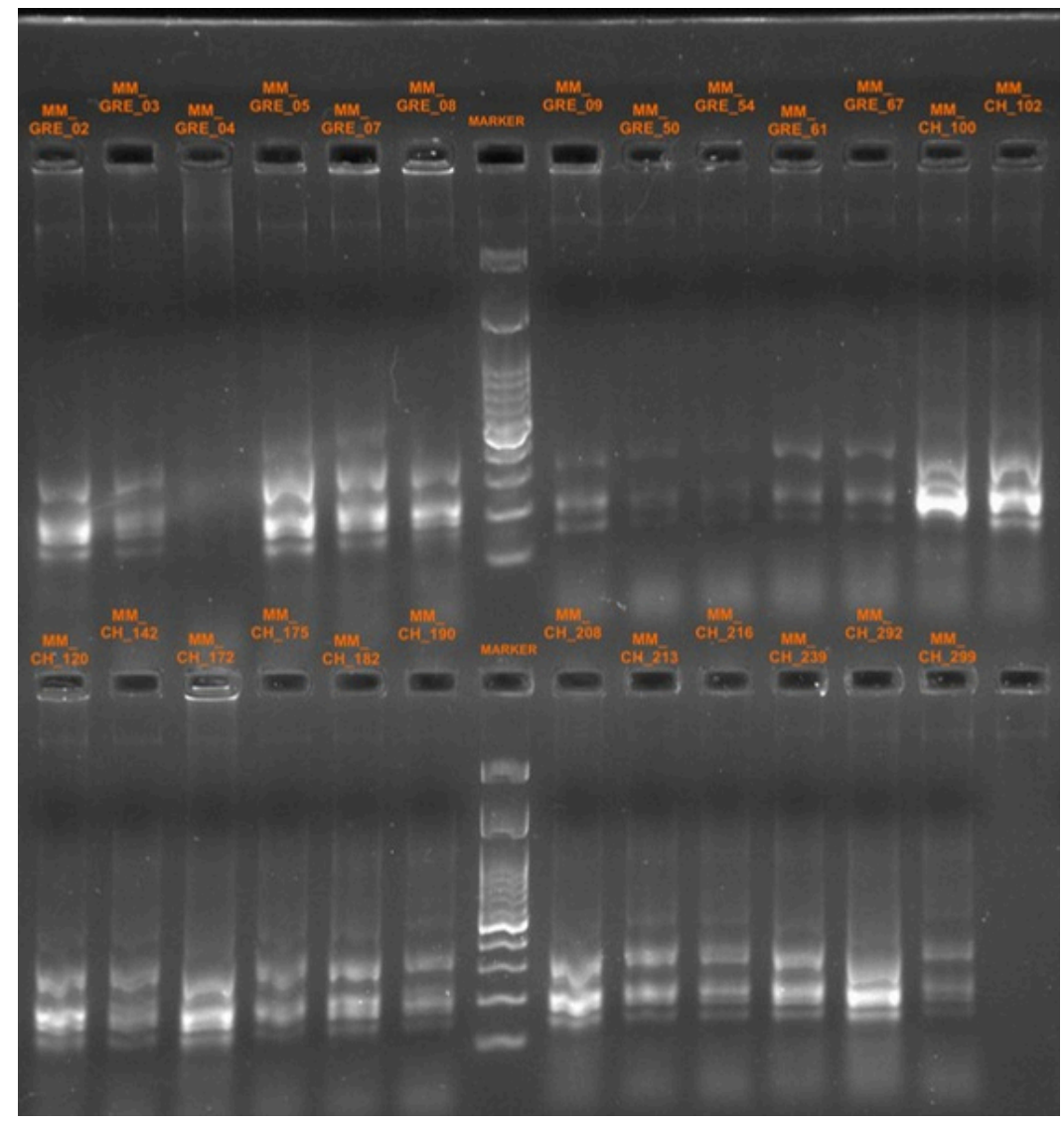
Results will give us insights on the possible mutations within the amplified microsatellite loci. These mutations, depending on their degree, may indicate differentiation between the populations coming from the different study-areas.






stuart
block heater




MM_GRE_02
MM_GRE_03
MM_GRE_04
MM_GRE_05
MM_GRE_07
MM_GRE_08
MARKER
MM_GRE_09
MM_GRE_50
MM_GRE_54
MM_GRE_61
MM_GRE_67
MM_CH_100
MM_CH_102
MM_CH_120
MM_CH_142
MM_CH_172
MM_CH_175
MM_CH_182
MM_CH_190
MARKER
MM_CH_208
MM_CH_213
MM_CH_216
MM_CH_239
MM_CH_292
MM_CH_299

Internships and educational activities

Graduate and undergraduate students coming from universities of different European countries joined the program for their internships, in particular, from University of the Basque Country (Spain); Maastricht University, Maastricht (Netherlands); Université Côte d'Azur, Nice (France); Imperial College of London (United Kingdom); University of Patras (Greece); University of Primorska (Slovenia); Nantes Université (France).
Reports and thesis produced at the end of the period were related to stomach content analysis; identification of nursery areas within the gulf; recreational fishers monitoring; fishery-independent data collection and analysis; illegal captures of *Gymnura altavela*; insights into management strategies through analysis of short-term and tagging data.

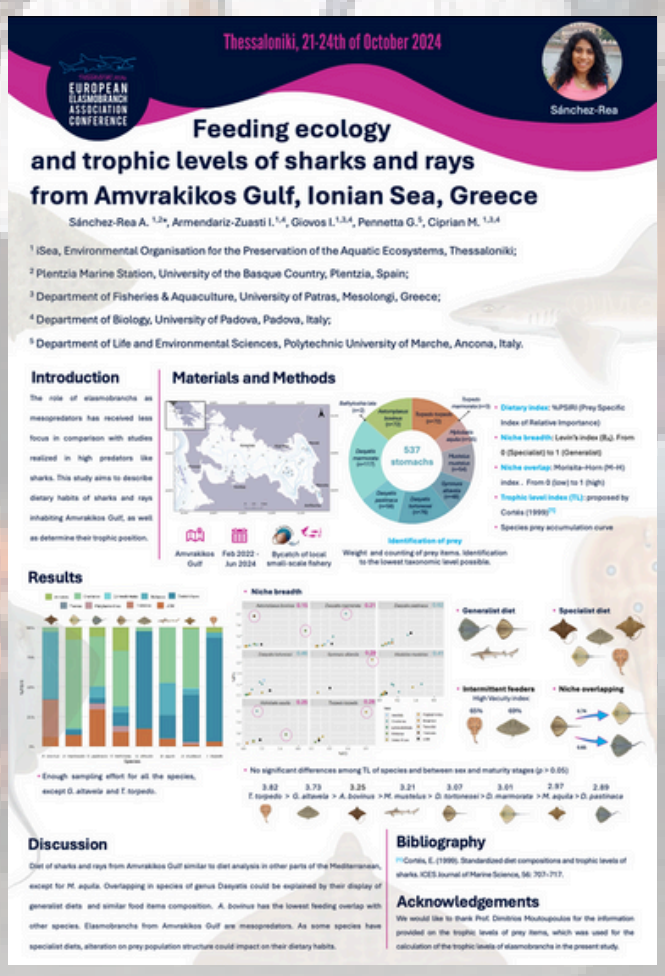
During July, two events were also organised with the local community in order to share the work we are doing in Amvrakikos. Specifically, one event took place in Menidi (where the fieldbase of iSea is located) during Shark Awareness day (July 14), and the other event took place in Koronisia (July 26) during the event “Save Amvrakikos”, in which iSea team was invited to present the projects and its related activities in the gulf.

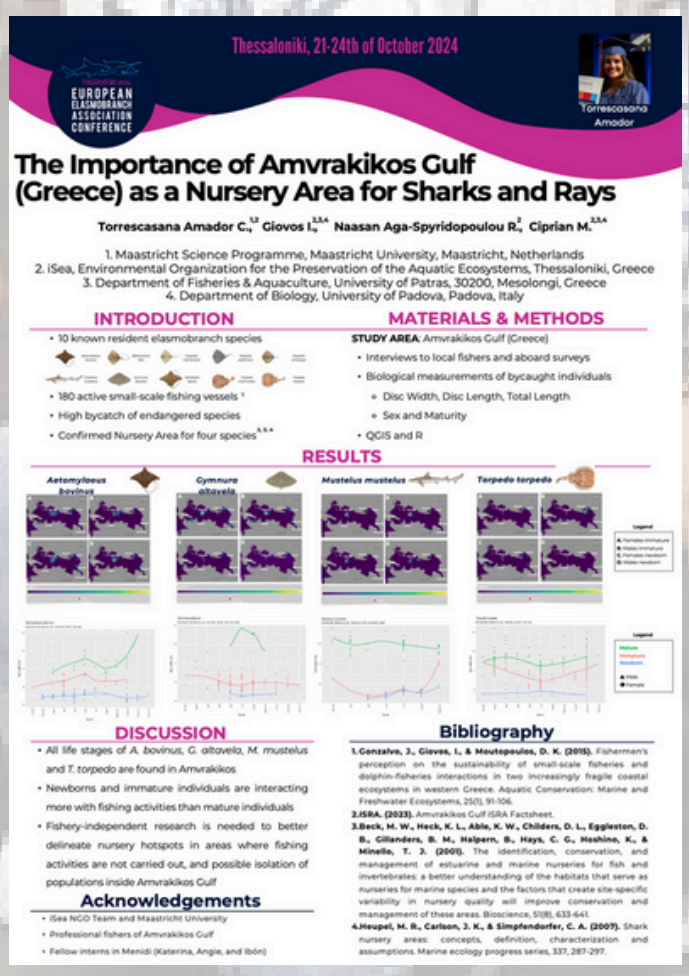
Conferences

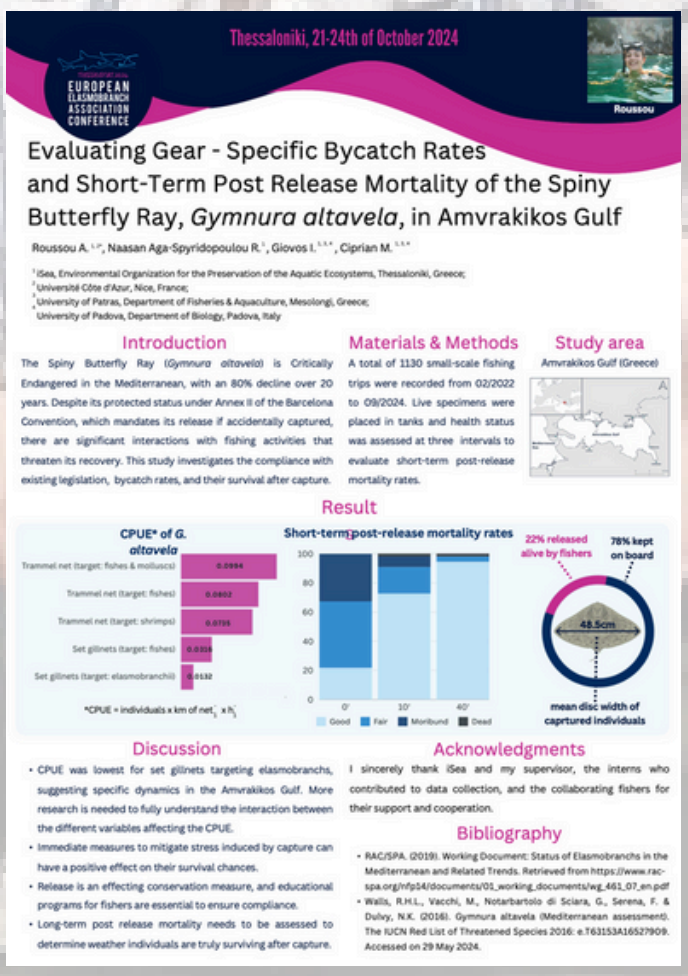
The iSea team had the pleasure to host the European Elasmobranch Association Conference at the end of October 2024, in Thessaloniki. During the conference, the “By Elasmocatch project” team presented 3 posters and 2 talks. Moreover the work carried out in Amvrakikos Gulf within the By Elasmocatch project was presented during the GFCM Subregional Committee for the central Mediterranean within the Vulnerable Species Working Group Session

Talk

Posters







Overview

iSea considers this project as a priority project and has strategically chosen to invest in the region for its ecological value, the species that have been recorded (that are understudied in Greece), and due to the opportunity, that arises for a change in fishing practises of the fleet. Three iSea employees are living all year round in Amvrakikos, and a new office has been rented in order to host them, as well as interns and volunteers during their whole practice.

During each visit, iSea invested time and energy to engage with the local community of fishers and the management body aiming at sensitising them towards their role in elasmobranch conservation. It is of outmost importance when conducting such projects to have fishers facilitating a good collaboration and subsequently data collection. It is noteworthy that the fishers, when not surveying onboard, keep the bycaught elasmobranchs in tanks for iSea team to obtain the morphometric measurements, tag and release them when they arrive at the port.

Since September, one iSea member, who is also carry on her PhD thesis in the context of the By ElasmoCatch project (in collaboration with the University of Padova and the University of Patras), has been monthly working at the genetic laboratory of the University of Padova. During this period, population genetic analysis were carried out. Delays in the results were due to technical problems in the laboratory, with some of the mitochondrial markers not working for the samples of Amvrakikos and Canary Islands. Results of the first genotyping plate are expected by the end of January, and of the other plates by the mid 2025. These results will give some insights on the degree of connectivity of the population of Amvrakikos with those of the Mediterranean Sea and Atlantic Ocean, helping us in the delineation of an effective Action Plan for the species. More data will be collected in 2025, with a focus on more adjacent areas to Amvrakikos. Comparison of microsatellite loci and their mutations will also take into consideration previously analysed samples collected in Montenegro and Nort-West Adriatic Sea.

From October 2024, a new project has started in Amvrakikos Gulf, the LIFE PROMETHEUS, and for this reason, iSea staff will remain in the area for the next 3 years at least. The By ElasmoCatch project will continue in 2025, and more funding requests are made to other funding bodies in order to cover the expenses of the staff and the costs of purchasing news and different tags and the modified fishing gear, as well as to ensure the presence of the team in the following 5 years.

Shark Foundation

iSea