BY ELASMOCATCH

FINAL REPORT

THESSALONIKI 2025

iSea, 2025

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CONTENTS

STUDY AREA

The **Amvrakikos Gulf** is one of the largest semi-enclosed embayment (405 km^2) in the Mediterranean Sea, located in north-western Greece. The Gulf is connected to the Ionian Sea by a narrow, shallow channel (~600 m wide), called Preveza Channel. At the norther border of the gulf, there are complex lagoon systems and an extensive delta formed by two main rivers (Arachthos and Louros) (Kountoura and Zacharias 2011). Amvrakikos Gulf is designated as a **Ramsar Site**, a **National Park**, and includes two **Natura 2000 sites**. The eastern mainland part of the gulf is also designate as a **Key Biodiversity Area** (Gonzalvo et al. 2015), **Important Bird Area** (IBA) and **Important Marine Mammal Area** (IMMA) (Giovos et al. 2023).

Eleven elasmobranch species have been recorded in the area during the By ElasmoCatch Project and MECO Project, in particular 2 shark species (Common Smoothened - *Mustelus mustelus*, Sandbar Shark - *Carcharhinus plumbeus*) and 9 ray species (Duckbill Eagle Ray - *Aetomylaeus bovinus*, Brown Stingray - *Bathytoshia lata*, Marbled Stingray - *Dasyatis marmorata*, Common Stingray - *Dasyatis pastinaca*, Tortonese's Stingray - *Dasyatis tortonesei*, Spiny Butterfly Ray - *Gymnura altavela*, Common Eagle Ray - *Myliobatis aquila*, Marbled Torpedo Ray - *Torpedo marmorata* and Ocellate Torpedo - *Torpedo torpedo*). The area seems to be used all year around by the species, and it has been confirmed to be of extreme importance during critical life-stages (e.g., parturition and nursery area). This evidence recently led to the delineation of Amvrakikos Gulf as a **Shark and Ray Important Area** (ISRA) by the IUCN Shark Specialist Group for three species (*A. bovinus*, *G. altavela* and *M. mustelus*) (IUCN SSC, Shark Specialist Group, 2023. Amvrakikos Gulf ISRA Factsheet).

THE PROJECT

The By ElasmoCatch Project focuses on studying the biodiversity of elasmobranchs in Greece and its interactions with fisheries. The project started in Amvrakikos Gulf (western Greece) during 2022 by collecting bycatch data including observations, measurements, and samples. All samplings regarding bycatch are done according to an adjusted protocol based on "Monitoring the Incidental catch of Vulnerable Species" produced by FAO. In addition to the bycatch data, biological information such as morphometrics, maturity, stomach contents, vertebrae, and genetic samples are collected. Protocols also include the evaluation of short-term Post Release Mortality through the use of survival tanks both onboard and in landing sites, as well as a health-behavioural scoring system, this is the first study of its kind implemented in Greece. In 2024, iSea started to conduct fishery-independent data in regards to abundance of the different species, using **Baited Remote Underwater Video Systems** (BRUVS) (n = 27). During the trials with BRUVs the species *A. bovinus*, *D. marmorata*, *D. pastinaca*, *D. tortonesei*, *G. altavela* and *M. aquila* have been identified repeatedly.

During 2025 we conducted a total of 60 BRUVS deployments doubling the effort of the previous year. All the species recorded in the gulf through fishery-dependent data collection have been identified with the exception of *T. marmorata* and *T. torpedo*. Of particular relevance were the sighting of *B. lata* and *M. mustelus* because the Brown Stingray has been only recorded three times during the fishery monitoring, while the sighting of the Common Smoothound occured in an area in which the species had never been recorded through fishery monitoring. Moreover, night deployments (n = 20) were conducted increasing our knowledge on species presence and habits during night and dawn hours. During October 2025, members of iSea attended the European Elasmobranch Association Conference (EEA) in Rotterdam, where the work carried out during 2024 and 2025 was presented to an international audience. Finally, we delineate a final standardised methodology for data collection through BRUVS to use in the following years (Annex).

RESULTS & DISCUSSION

During 2025 a total of 60 BRUVS deployment were carried out, covering different areas of the gulf, and including both diurnal (N = 40) and nocturnal (N = 20) surveys (Figure 1, Table 1).

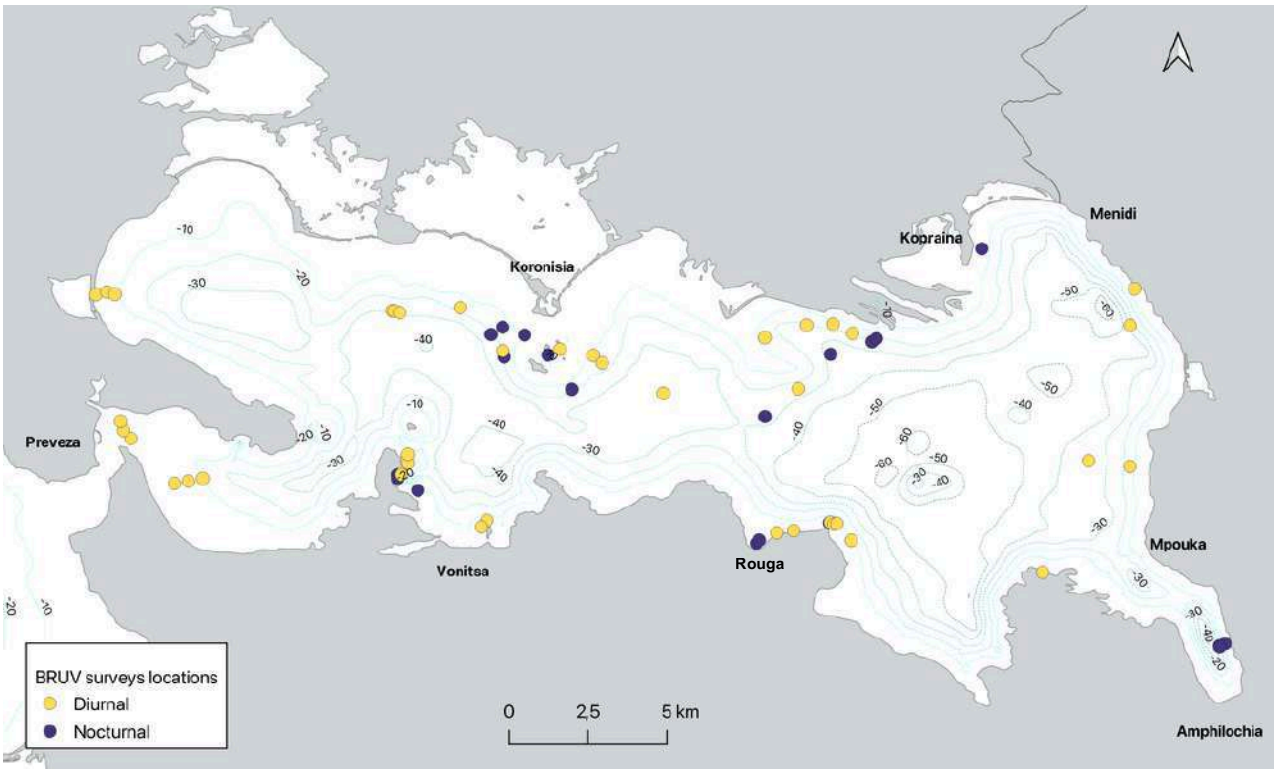

Figure 1: *Map indicating the location of the deployments in Amvrakikos Gulf (in yellow diurnal deployments, in purple nocturnal deployments).*

Type of deployment	Number of diurnal deployments	Number of nocturnal deployments
Shallow water (3 - 6 m)	7	6
Medium depth (6 - 15 m)	14	8
Deep water (15 - 32.5 m)	19	6
TOTAL	**40**	**20**

Table 1: *Type of deployment and number of deployment (diurnal and nocturnal) are indicated for the different depths (shallow water, medium depth and deep water).*

30 out of 47 deployments used in analysis with recordings of elasmobranchs (63.8%)

RESULTS & DISCUSSION

A total of 8 species out of 11 present in Amvrakikos were identified during the BRUV footage analysis. Due to difficult identification of the three species of the genus Dasyatis, the three species present (*D. marmorata*, *D. pastinaca* and *D. tortonesei*) have been grouped together. The two species of the genus Torpedo (*T. marmorata* and *T. torpedo*) were never sighted (Table 2, Figure 2). The presence of electric rays in the gulf has been confirmed through fishery-dependent data collection. While presence of the Sandbar Shark (*Carcharhinus plumbeus*) has never been confirmed during landing sites surveys or BRUV surveys, but only through citizen science.

Species	No.of individuals	No. of sightings	Time on screen (HH:MM:SS)
Aetomylaeus bovinus	2	6	00:01:00
Bathytoshia lata	1	3	00:02:34
Dasyatis spp.	50	334	10:09:58
Gymnura altavela	16	37	00:31:32
Mustelus mustelus	2	6	00:00:55
Myliobatis aquila	4	8	00:01:51
Torpedo spp.	0	0	00:00:00
Unidentified	3	3	00:00:16
TOTAL	**78**	**397**	**10:48:06**

Table 2: *Species identified in footage obtained through BRUVS surveys, with number of individuals per species, number of sighting and total time on screen.*

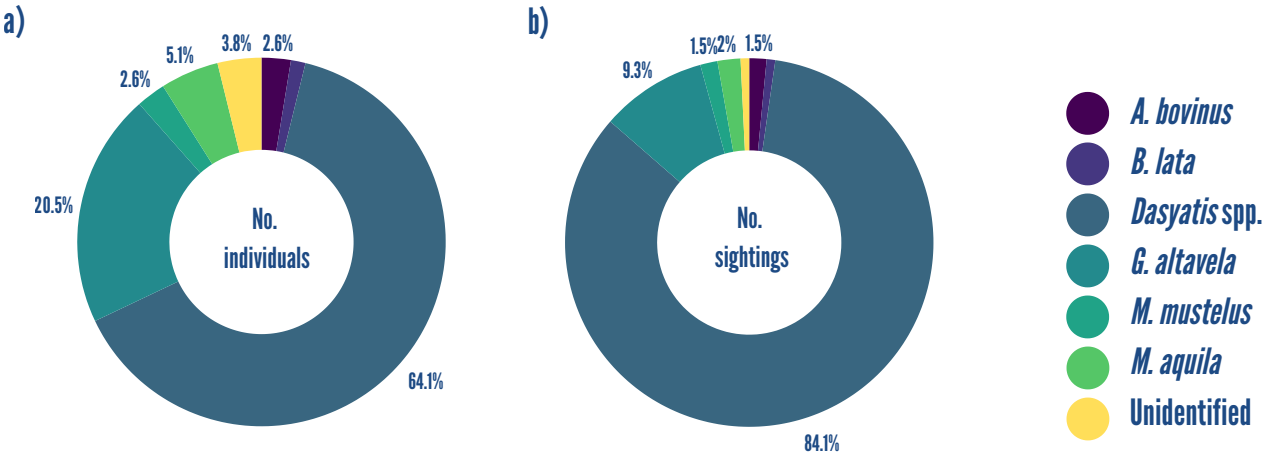

Figure 2: *Proportion of species identified, for* **a)** *number of individuals per species;* **b)** *number of sighting.*

RESULTS & DISCUSSION

The standardised number of elasmobranchs divided per hour has been calculated for each species in order to allow a comparison among the different deployments (Figure 3). To avoid underestimation of individuals, **MaxIND** (maximum number of individuals counted in each footage) has been used instead of MaxN (maximum number of individuals in a single frame). The identification of distinct individuals, even if not all visible in the same frame was possible because of unique marks (such as sex, spots, number of barbs or size). The three species of the genus *Dasyatis* have showed a higher presence in respect to the other species, followed by the Endangered *Gymnura altavela* and the Critically Endangered *Myliobatis aquila* (IUCN Global Assessment).

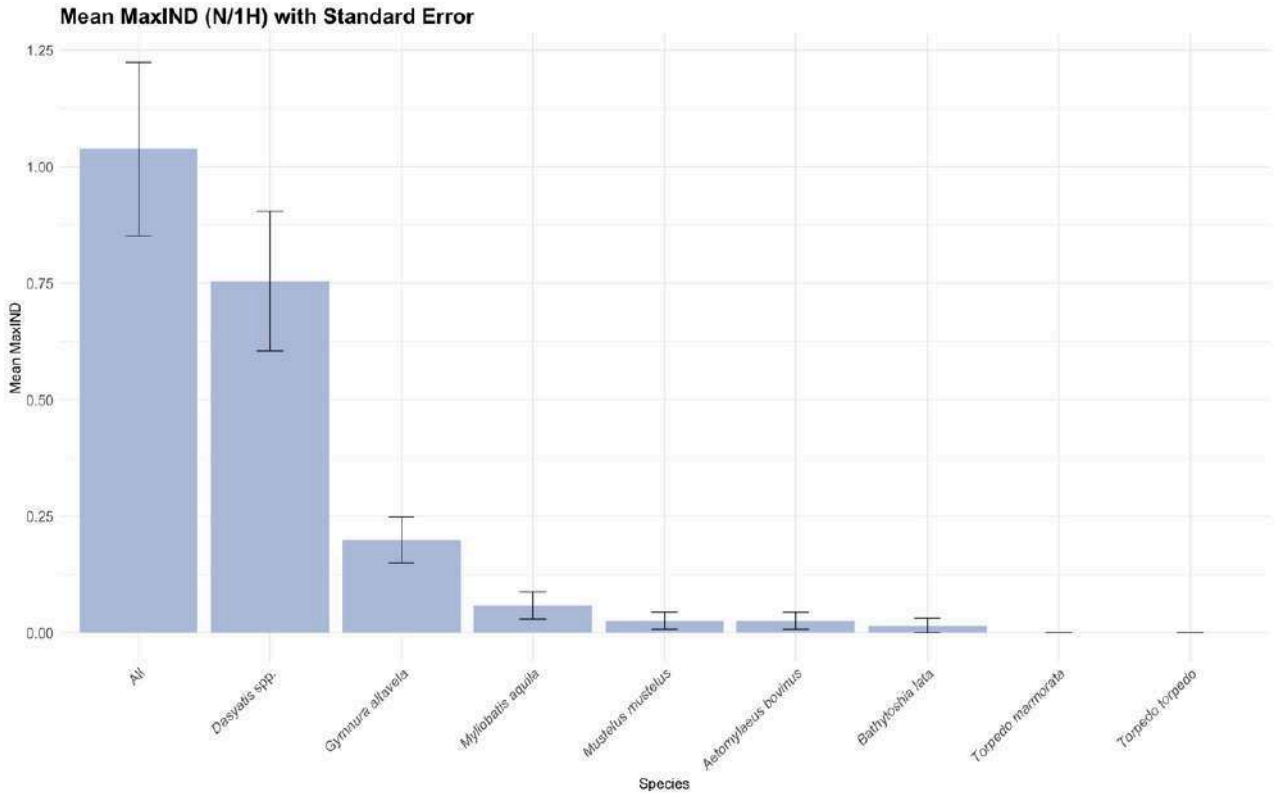

Figure 3: *Mean MaxIND per hour, divided by species. Bars indicate the standard error.*

For the two most abundant species (*Dasyatis* spp. and *G. altavela*) differences in abundance between day and night has been found, with the abundance of Spiny Butterfly Ray significantly more abundant during the night than during the day (Kruskal-Wallis test, p-value = 0.00025) (Figure 4), suggesting the species to be more active during the night than during the night.

RESULTS & DISCUSSION

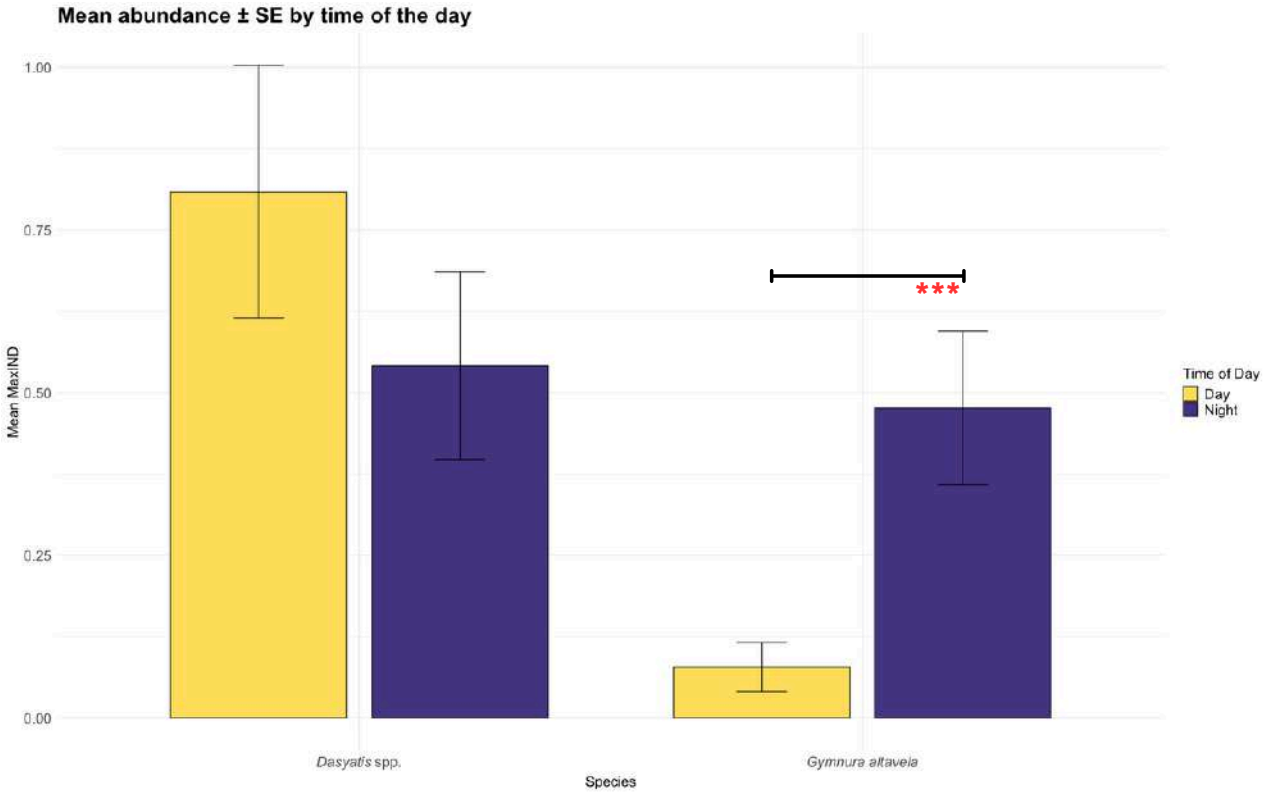

Figure 4: *Mean MaxIND per hour during the day and night for Dasyatis* spp. *and G. altavela. Bars indicate the standard error.*

The presence of the different species observed through BRUVS footages varies in the gulf. *Dasyatis* spp. and *G. altavela*, the two most abundant groups, have been detected in different areas of gulf, while the other species look more localised. This may not be representative of the true presence of the species in the different areas, but can reflect a lower capability of BRUV in detecting some of the species. Based on fishery-dependent data all the species have been found to be widespread, except of *M. mustelus* that had previously been identified in the central norther part of the gulf (Koronisia), while through BRUV surveys a new area (in the central southern area, Rouga) in which the Common Smoothhound is present has been identified. Specifically, Rouga has been identified as the main hotspot in which all the 8 species were recorded (Figure 5).

RESULTS & DISCUSSION

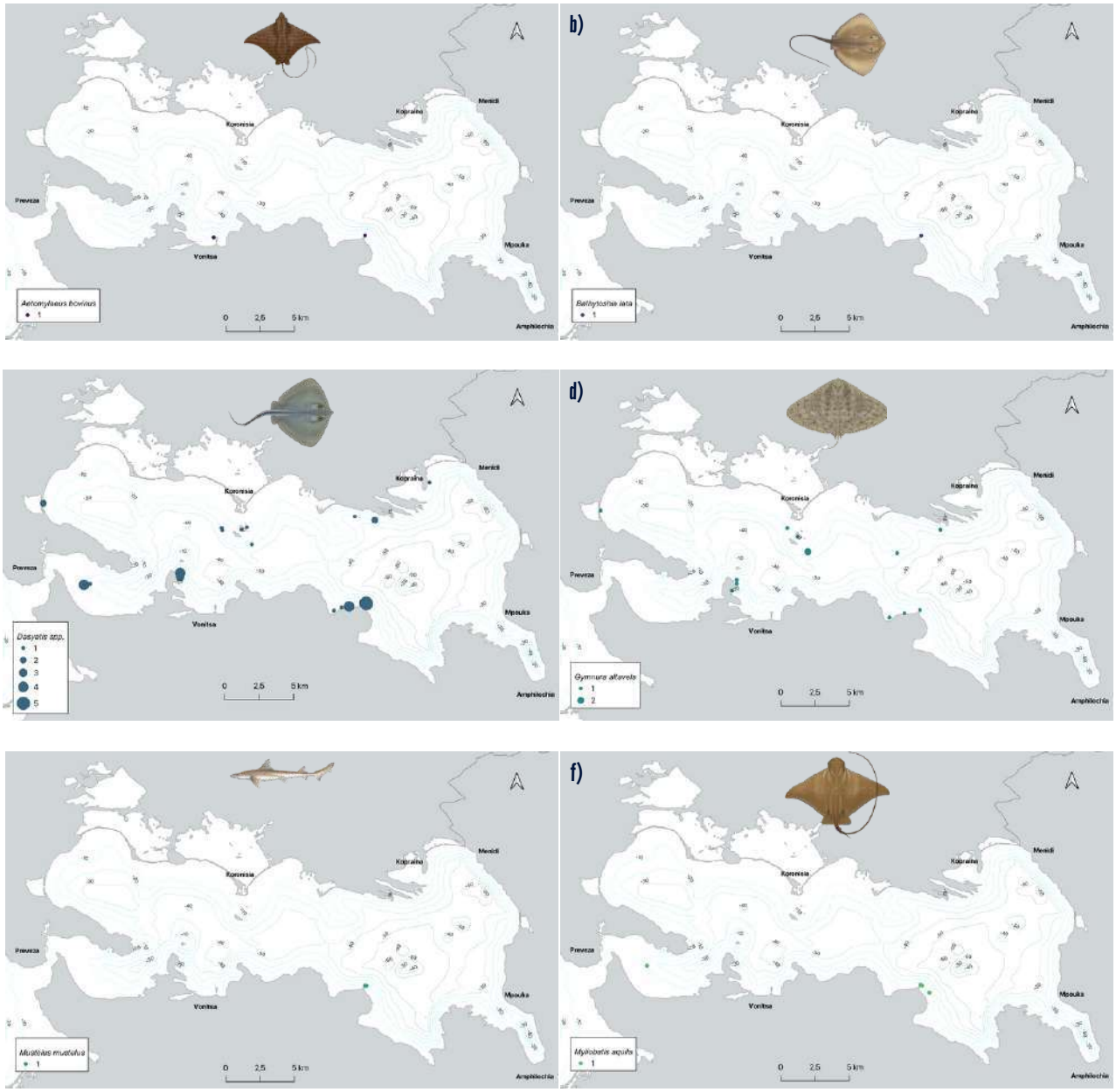

Figure 5: *Distribution map devided by species.* **a)** *Aetomylaeus bovinus;* **b)** *Bathytoshia lata;* **c)** *Dasyatis* spp.*;* **d)** *Gymnura altavela;* **e)** *Mustelus mustelus;* **f)** *Myliobatis aquila. Different sizes of the points indicate different number of individuals.*

The monitoring carried out during 2025 highlighted the effectiveness of BRUVS in Amvrakikos Gulf, with all the specie except the genus *Torpedo* identified in the footages. There are differences in proportions of the species observed between fishery-dependent and independent data collection.

DISCUSSION & CONCLUSIONS

This difference is understandable because of the different type of methodology, as well as a lower number of BRUVS deployments in respect to fishing trips monitored. BRUVS in fact, on the contrary of fishing practices, are non-extractive, non-invasive, non-destructive, reliable and repeatable and cost effective.

The difference in abundances of the different species can be explained by the fact that BRUVS can be more effective on some species than others. For example, BRUVS are surely effective on *Dasyatis* spp. and *Gymnura altavela*, but not so effective for *T. marmorata* and *T. torpedo*. The latter species has been recorded as one of the main species caught as bycatch in small-scale fishing vessels of Amvrakikos Gulf. The highlighted differences can depend on the biology of the species, electric rays in fact are slower swimmers and less mobile in respect to *Dasyatis* spp., but also display a different predatory strategy. Torpedo rays in fact, are ambush predators, waiting for their prey buried in the substrate to attach and stun it with an electric discharge (Belbenoit and Bauer, 1972). This characteristic predatory behaviour is the most likely reason why Torpedinidae are less attracted of the bait of the BRUVS compared to more motile opportunistic species such as Dasyatis.

- More deployments have to be carried out in order to complete the picture obtained during 2024 and 2025. BRUVS have showed high efficacy in the area, allowing to us to discover new hotspots for some species in the gulf (such as the central southern area for Mustelus mustelus).
- Nocturnal deployments have shown a higher abundance for the Spiny Butterfly Ray. Increasing the number of samplings during the night time in different areas can highlight differences in abundance for other species that have been described more nocturnal such as the Common Smoothhound.
- Seasonal data have not been collected yet. In other areas elasmobranch species abundances and distribution has been found different depending on the season (Ferreira et al. 2023; Koval et al. 2025; Sherman et al. 2020). For this reason future deployments should be carried out seasonally.

INTERNSHIPS & PROJECT OUTREACH

Graduate and undergraduate students coming from universities of different European countries joined the programs carried out in Amvrakikos Gulf for their internships. In particular, interns were joining from University of Padova and University of Sassari (Italy); Université Côte d'Azur, Nice (France); Nantes Université (France); University of Thessaloniki (Greece) and University of Gothenburg (Sweden). Reports and thesis produced at the end of the period were related to bycatch and post-release mortality of sharks and rays after capture; Mustelus mustelus habitat use in the Amvrakikos Gulf; genetic population structure of Mustelus mustelus in the Mediterranean Sea (including Amvrakikos Gulf); comparison of fishery-dependent and independent data to estimate biodiversity, abundance and habitat use of sharks and rays.

During the year, a total of 4 events were organised with the local community in order to share the work we are doing in Amvrakikos. Among these, one event took place in Koronisia in the context of “Save Amvrakikos” events. During the event videos obtained through BRUVS were showed to the local community.

BRUVS videos were used in social media with the aim to increase awareness of the sharks and rays species present in Amvrakikos Gulf, reaching more than 3000 people.

As a fundamental step in order to highlight the importance of the area and of the data that have been collected during the years, iSea is participating to international conferences. In particular iSea participated to the European Elasmobranch Association Conference in Rotterdam during October 2025. The work conducted with BRUVS in 2024 and 2025 was presented and compared with data collected through fishery-dependent survey. Moreover, iSea submitted an abstract to Shark International Conference that will take place in Sry Lanka during May 2026. The abstract includes the work carried out in Amvrakikos Gulf with BRUVS and its application in other regions of Greece.

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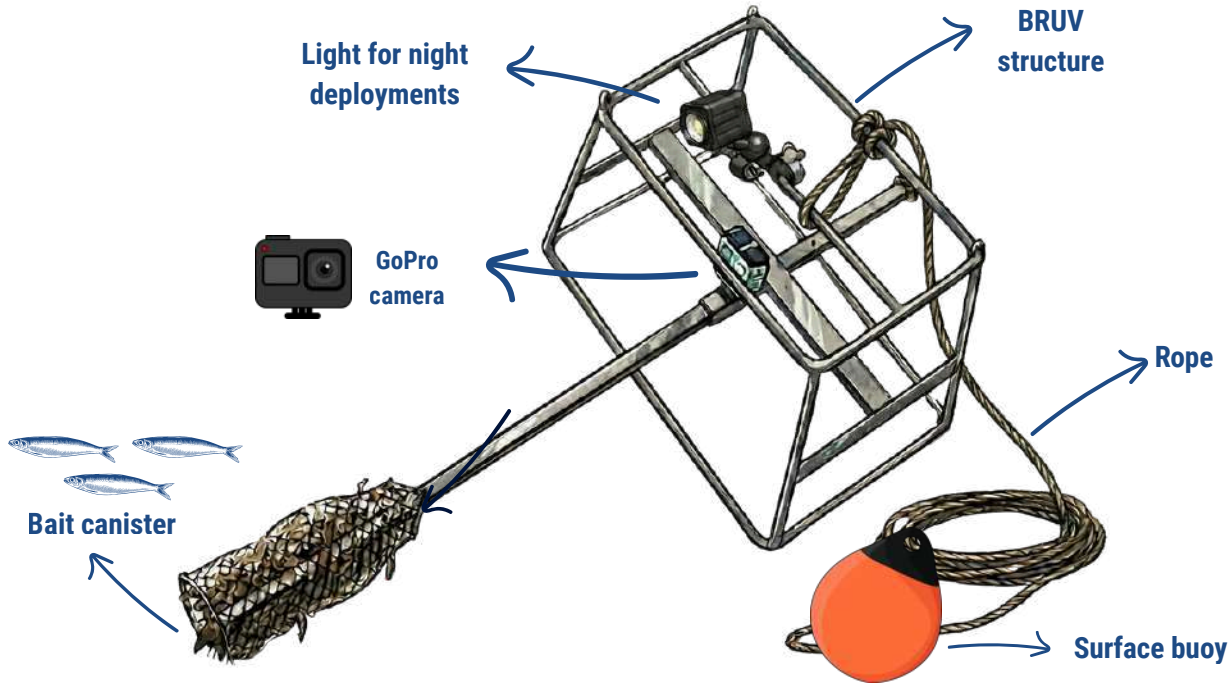
ANNEX

Standardised protocol



EQUIPMENT SET UP:

- Demersal Baited Remote Underwater Video System (BRUV).
- GoPro - with video reocrding settled in a linear field of view (to avoid fisheye). The camera is attached to the structure in middle part, facing at the bait canister.
- Bait canister filled with 500 grams of smashed small-pelagic fish to better release oil and odor.
- BRUV connected through a rope to the surface buoy to signal its presence.
- For the night deployment connect the light to the top part of the BRUV and set it on white light with medium intensity.

DEPLOYMENT PROCEDURE:

- Identify the pre-selected point on the map and use the boat GPS to get the exact location of the deployment.
- Measure the depth of the deployment from the boat, using a bathymeter.
- Record environmental data as: air and water temperature, visibility in the water (meters), cloud cover (0-25%, 25-50%; 50-75%, 75-100%), habitat type (sandy, muddy, rocky, seagrass meadows).
- Record data as: depth, GPS coordinates, time of deployment, time at the bottom, time of retrieval, light ON or OFF, scientific operator.
- Keep the BRUV in the bottom for at least 60 minutes.

VIDEO ANALYSIS:

- Video analysed at 1x speed.
- Count and identification of sharks and rays, for MaxN (maximum number of individuals observed in a single frame) and MaxIND (total number of unique individuals observed per species), and the total number of its appearances.
- Record for each individual the total time in which it appears in the footage.
- Assess behaviour of the individual (swimming, approaching the bait, eating on the bait).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