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Technical Note

Improved Baited Remote Underwater Video (BRUV) for 24 h Real-Time Monitoring of Pelagic and Demersal Marine Species from the Epipelagic Zone

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Abstract: Bait-based remote underwater video (BRUV) systems are effective devices for remotely observing fish and other marine organisms in challenging environments. The development of a long duration (24 h) surface BRUV observation surveys allowed the monitoring of scarce and elusive pelagic sharks and the direct impact on non-targeted species of longline fishing in the Western Mediterranean. Technological limitations, such as the limited storage capacity and a single surface camera, were improved by (i) adding a deep camera equipped with light (below 80 m depth) and (ii) replacing Gopros with a multi-camera video surveillance system (surface and depth) with a storage capacity of several days and access to real-time observation. Based on a deployment effort of 1884 h video data, we identified 11 blue sharks (*Prionace glauca*) and one bluntnose sixgill shark (*Hexanchus griseus*), a deep-sea species that scarcely swims at the surface. The real-time observation capability was a powerful tool for reducing logistical costs and for raising environmental awareness in educational and outreach programmes.

Keywords: BRUV; remote; real-time observation; pelagic species; demersal species; blue shark *Prionace glauca*; bluntnose sixgill shark *Hexanchus griseus*; marine megafauna; Mediterranean sea

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1. Introduction

Bait-based remote underwater video (BRUV) is a technique used to attract mobile wildlife [1] into the field of view of cameras filming the area surrounding a bait [2,3]. The use of BRUVs has great advantages as a non-invasive technique, such as ease of use and replication, and relatively low costs. Since the mid-1990s [4], BRUV-based methods have been developed to assess the abundance, diversity, and behavior of different species [5,6] They are a cost-effective and safer alternative to other methods, such as underwater visual surveys (UVS), diver-operated video (DOV), or Remotely Operated Vehicles (ROVs) [4,7,8]. Most studies have focused predominantly on fish populations [4,7,9], but have also been applied to invertebrates [10] and large marine predators, such as bony fishes and elasmobranchs [8,11,12]. Shark stock assessment with BRUVs is effective due to their strong attraction to bait [13]. However, deployment issues and forecast conditions must be taken into account when designing and implementing monitoring surveys using BRUV techniques [14].

Scientific data for understanding shark biology and ecology have been obtained mainly from fisheries [15,16]. It is a highly invasive sampling technique as it involves species being injured or killed directly when caught or released. Stock depletion, overfishing, and by-catch have decimated elasmobranch populations in the Mediterranean [17–19], with most species caught as valuable bycatch in trawl and net multispecies fisheries [20–22]. Oceanic pelagic sharks are threatened by surface longlining targeting species, such as swordfish and tuna [23,24], worsening the situation of pelagic sharks, such as white sharks (*Carcharodon carcharias*) and blue sharks (*Prionace glauca*) [19]. Shark Med, a Mediterranean NGO based in Mallorca (Spain), has developed and published innovative, non-invasive, and extended-time sub-surface BRUVs that repeatedly recorded sharks in open waters around the Balearic Islands [25]. A pilot phase demonstrated the effectiveness of this BRUV to record, identify, and assess low densities of blue sharks and the existing problem with the by-catch in the area [22]. However, until recently, the sampling effort of the Shark Med team relied on surface cameras; thus, missing elasmobranch species that may remain in deeper water [25]. Moreover, the use of Gopro cameras with neutral density (ND) filters in these existing devices [25] requires a large storage capacity that becomes a limiting factor for implementing long-time surveys of >7 days.

Despite advances in technology, there are limitations, especially in the difficult-to-access deep sea to study the organisms that inhabit these ecosystems [26,27]. Deep trawling or other invasive sampling methods used to study the species inhabiting these habitats are destructive not only to the fish (bony and cartilaginous) but also to the benthic communities that suffer from these destructive methods [28]. In situ observations can improve our knowledge of the ecology and biology of deep-sea sharks. To promote research on these species, it is necessary to develop and promote non-invasive innovative technologies, such as the DeepBRUVS [29], BotCam [30], DEEPi [31], and Maka Niu [32]. Deep-sea shark research using BRUVs is becoming more widespread [32,33] allowing the observation of species never seen in situ before [34]. Moreover, it is important that innovative devices allow data to be recorded over long periods of time to gain a better scientific understanding of sharks in low-density areas [25,29].

The aim of this work was to set up and test an improved 24h BRUV device. We show here how the inclusion of a deep-sea camera and a new system of video capture and storage allowed us to obtain remote real-time videos both from the surface to sub-surface depths (0–80 m). This improved device has the potential to facilitate marine citizen science as a tool for social awareness and shark conservation in the Western Mediterranean Sea.

2. Materials and Methods

2.1. Improvement of the 24 h BRUV System

Building on the long-lasting BRUV design of Torres et al. 2020, changes have been introduced to improve its effectiveness. The video surveillance equipment (Network video recorder (NVR) Dahua IP 8mpx) replaces the Gopro cameras initially used and offers multi-camera capability. A surface camera (Camera bullet IP Dahua 2mpx in a specially designed and connected polyvinyl chloride (PVC) housing) and a depth camera (CM78IP 1080p −200 m waterproof, which already comes with its own stainless-steel camera case) at 80 m are incorporated. Subscriber identity module (SIM) routers (TP-Link TL-MR6400) installed directly in the BRUV have replaced the analogue transceivers used until 2020. The Digital Mobile Surveillance System Plus (DMSS Plus) application is used on smartphones to observe in real time what the cameras record, made possible by the extension of 4G coverage in the area that allows routers to have signal at great distances from the coast. The use of the DMSS Plus application for real-time BRUV observation was used both to check the correct functioning of the cameras and video lights at the time of set-up and during the campaign, saving deployment time and making it possible to find out the source of a possible malfunction. It also allows video recording and photo shooting to be saved on the smartphone used. The Global Positioning System (GPS) locators (Invoxia) have been incorporated to facilitate the recovery of BRUVs in the event that they are adrift. Through recording tests, it was observed that in order to obtain good quality videos with the depth camera, it was necessary to set up a stabilizing frame that would keep the camera horizontal to the bottom and hold the bait on the opposite side at a suitable distance for recording (Figure 1; Figure S1: Photographs of the different parts of the innovative BRUV design).

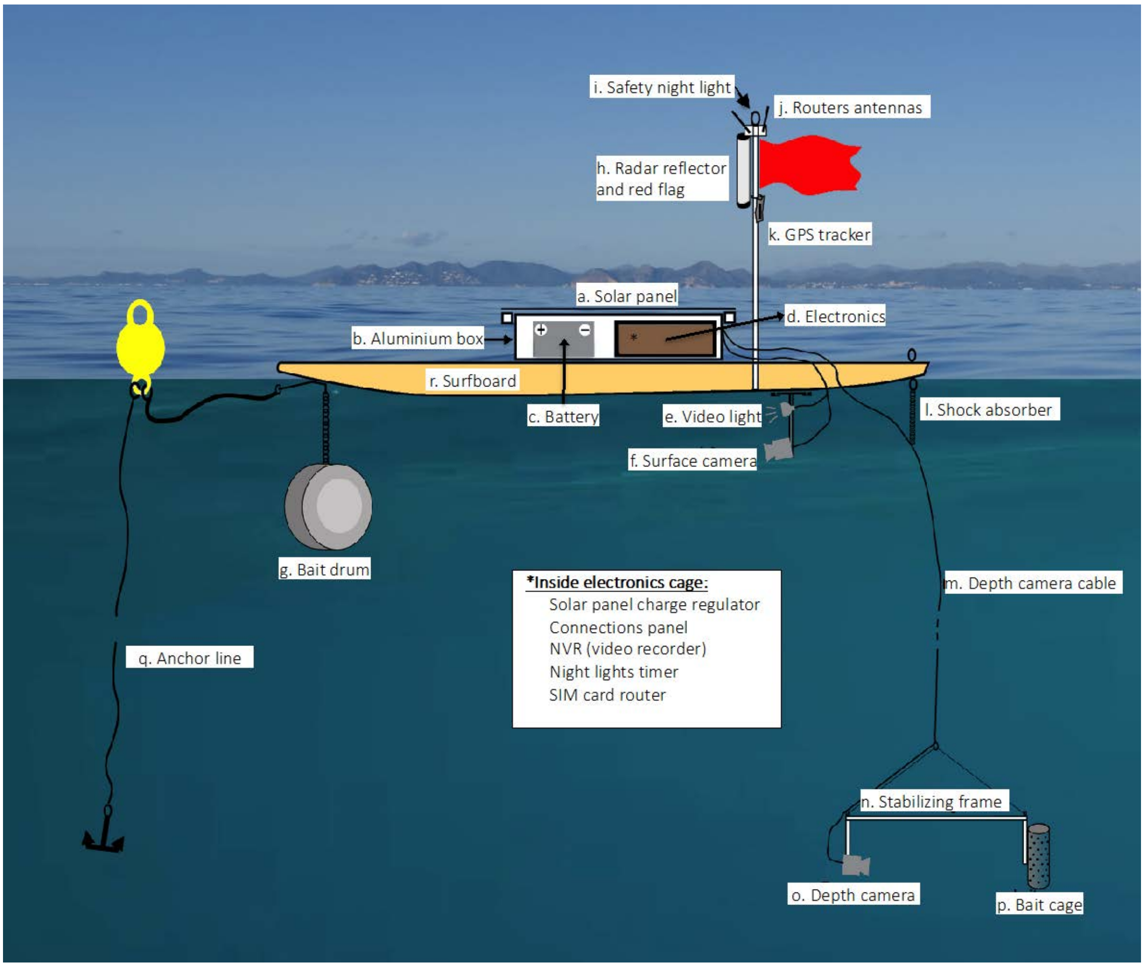

Figure 1. Design of the improved BRUV system with depth camera: (a) solar panel; (b) aluminium box; (c) battery; (d) electronics; (e) video light; (f) surface camera; (g) bait drum; (h) radar reflector and red flag; (i) safety night light; (j) router antennas; (k) GPS tracker; (l) shock absorber; (m) depth camera cable; (n) stabilizing frame; (o) depth camera; (p) bait cage; (q) anchoring line; and (r) surfboard; (*) Inside electronics cage: solar panel charge regulator, connections panel, NVR, night lights timer, and SIM card router.

2.2. Study Site and Sampling Effort

The Balearic Archipelago is located in the Western Mediterranean. The waters surrounding the archipelago are a biodiversity hotspot where twenty species of sharks have been documented, including endangered and rare species [20,35–38].

The sampling effort took place mainly around the island of Mallorca (Figure 2). Nine BRUV deployments were conducted between December 2021 and January 2023; thus, having fall-winter (n = 4) and spring-summer (n = 5) campaigns (Table 1). Each campaign lasted between 2 and 21 days (determined by weather conditions and technical problems) with a total recording time of 996 h 29 min on the surface and 887 h 33 min at depth. The average recording time per deployment was 110 h and 43 min at the surface and 98 h and 37 min at depth. The BRUV was anchored in epipelagic waters at an average distance from the coast of 10.14 Nm (sd = 8.1 Nm) and an average depth of 92.25 m (sd = 8.9 m; 80–110 m) in eight of the nine campaigns (the remaining one was a test in which the BRUV was anchored at a depth of 800 m), with the bait positioned just below the surface and at 80 m. The surface bait was mainly placed inside the bait drum, but two bait pieces were added and suspended from the board to study the behavior of sharks when the bait was available for feeding. The bait used was mainly tuna meat and viscera obtained through direct purchase or collaboration with recreational fishermen. In addition, the use of cetaceans as bait is widely used in fisheries to attract sharks [39], so skin and blubber from cetaceans stranded in the area were also used. Every 2–3 days, weather permitting, fresh bait was added to the BRUV inside the surface bait drum and in the depth bait cage to maintain effective attraction conditions in the area.

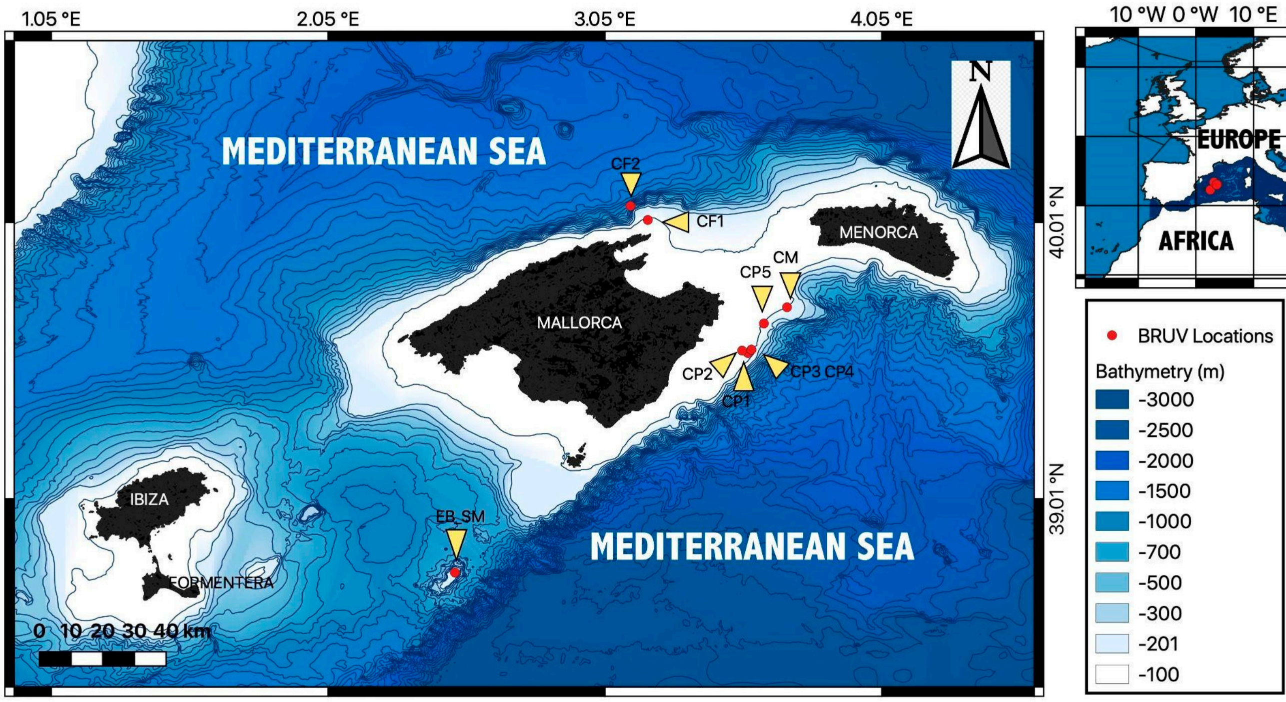

Figure 2. BRUV stations surveyed around the Balearic Islands (Red dots). Location codes (yellow triangles): (CP) Costa dels Pins; (CF) Cap Formentor; (CM) Canal de Menorca; (EB-SM) Emile Baudot Sea Mount.

Table 1. Details of BRUV sampling effort around Mallorca.

Location	Coordinates		Depth (m)	Average Temp. (°C)	Dist. to Coast (Nm)	Start Date	End Date	Surface Camera Total Hours	Depth Camera Total Hours
Cap Formentor_1	N 40°00.835′	E 3°12.277′	95	15.7	3.1	13 December 2021	19 December 2021	143:10:00	143:10:00
Costa dels Pins_1	N 39°31.987′	E 3°33.969′	90	15.0	8.1	31 December 2021	3 January 2022	77:30:00	77:30:00
Costa dels Pins_2	N 39°32.512′	E 3°32.700′	80	14.0	7.2	14 January 2022	20 January 2022	149:15:00	149:15:00
Costa dels Pins_3	N 39°32.717′	E 3°34.724′	90	20.2	8.4	16 May 2022	23 May 2022	169:32:20	169:32:20
Fort des Francès o Baix Emile Baudot	N 38°44.354′	E 2°30.477′	110	-	31	1 June 2022	2 June 2022	35:30:00	35:30:00
Costa dels Pins_4	N 39°32.717′	E 3°34.724′	90	24.1	8.37	12 June 2022	18 June 2022	124:25:04	122:44:20
Cap Formentor_2	N 40°03.868′	E 3°08.509′	800	26.2	6.63	11 July 2022	12 July 2022	10:06:28	28:34:14
Canal Menorca	N 39°41.907′	E 3°42.443′	97	28.2	10.6	2 August 2022	4 August 2022	34:45:29	35:16:51
Costa dels Pins_5	N 39°38.389′	E 3°37.432′	86	17.0	7.86	17 December 2022	6 January 2023	252:14:54	126:00:48
							Average	110:43:15	98:37:04
							Total	996:29:15	887:33:33

Note. N = north; E = east; m = meters; Nm = nautical miles.

During the visual analysis of videos, the sex of the animals was assessed according to the presence (for males) or absence (for females) of claspers and the size of the animals was visually estimated using the bait drum (50 cm diameter) as a reference when the animal passed within a short distance.

3. Results

3.1. Cost of the Device

In addition to the costs of the surfboard, anchor, and other materials that could be recycled at no cost, which are described in Torres et al., 2020 [25], the cost of the BRUV improvements increased by €2920 (Appendix A).

3.2. Shark Observation

A total of 1884 h of video were recorded with a total of twelve shark observations in 9 BRUV deployments (Table 2). Eleven Blue sharks (*Prionace glauca*) were recorded with the surface camera for an average duration between their first and last appearance of 3 h and 22 min (*sd*: 241 min), from a minimum of 2 min to 12 h. One bluntnose sixgill shark (*Hexanchus griseus*) was recorded with the deep camera for 1 min (Video S1: Video footage of a bluntnose sixgill shark).

Table 2. Description of the observed sharks.

Location	Shark ID	Gender	Estimate Lenght (m)	Camera	Time at Site (h)	Bait	Special Markings
Cap Formentor	H_griseus1	-	-	Deep	00:01:01	Tuna	Poor quality video and no possibility to see special markings.
Costa dels Pins_3	P_glauca1	M	1.75	Surface	06:01:28	Tuna/Cetacean	No special markings.
	P_glauca2	M	-	Surface	01:24:25	Tuna/Cetacean	No special markings but different from P_glauca 24 in size and date.
	P_glauca3	M	-	Surface	01:33:30	Tuna/Cetacean	No special markings. Possibly P_glauca25 by date and time.
	P_glauca4	M	1.75	Surface	09:18:14	Tuna/Cetacean	Cuts on tip of left fin and 14–16 pilot fish (*Naucrates ductor*).
	P_glauca5	M	1.75	Surface	12:00:51	Tuna/Cetacean	Scar upper body at gill level and with wounds front part beginning of pectoral fins.
	P_glauca6	F	-	Surface	00:02:28	Tuna/Cetacean	Residual hook (right side) without nylon thread pulling out.
	P_glauca7	F	2	Surface	00:04:11	Tuna/Cetacean	Piece of swordfish sword stuck in the beginning of the caudal fin.
	P_glauca8	F	1.6	Surface	00:25:36	Tuna/Cetacean	Residual hook (right side) with a nylon leader of <50 cm and 5 pilot fish.
	P_glauca9	F	2.5	Surface	01:07:42	Tuna/Cetacean	Scars on both gills and 9 pilot fish
Fort des Francès o Baix Emile Baudot	P_glauca10	M	1.25	Surface	02:32:58	Tuna/Cetacean	Small slender shark and 1 pilot fish.
Costa dels Pins_4	P_glauca11	M	1.5	Surface	02:26:16	Tuna/Cetacean	Scar above left pectoral fin.
			Average		03:04:53		

One sixgill shark was observed in the "Cap Formentor_1" during a 7-day deployment (H_griseus1, December 2021). The blue sharks observed included five males and four females in the "Costa dels Pins_3" during an 8-day deployment (P_glauca 1 to 9, May 2022), one male in the "Fort des Frances" during 2-day deployment (P_glauca10, June 2022), and one male in the "Costa dels Pins_4" during 7-day deployment (P_glauca11, June 2022). The mean time to the first sighting of a blue shark in the surveys in which they were recorded was 24 h (*sd* = 10.8 h). Pearson correlation analysis indicated no significant difference in the number of sharks observed during short versus longer deployment periods. However, the season had a significant effect on the surface camera, as no sharks were detected in 667 h in the autumn-winter period and ten sharks in 329 h in the spring-summer period. The number of observations was not sufficient for the depth camera, where one shark was observed in 143 h in autumn out of a total of 887 h. A total of nine blue sharks could be accurately identified according to their sex, estimated size, and special markings (Figure 3; Video S2: Types of markings in blue sharks bodies to identify individuals), whereas the other two cases could not be distinguished as single individuals due to the absence of special markings and the disposition of the animal in relation to the camera. All the sharks were either juvenile or mature individuals.

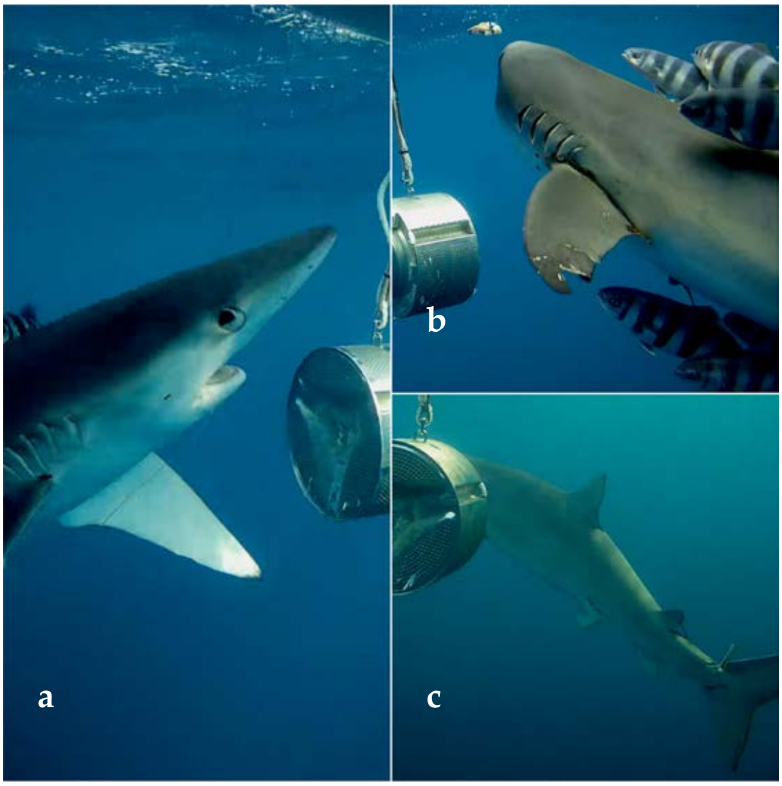

Figure 3. Photographs from video footage of three different types of markings in blue shark (*Prionace glauca*) bodies to identify individuals: (**a**) P_glauca31 with a nylon leader of <50 cm; (**b**) P_glauca27 with cuts on tip of left fin; and (**c**) P_glauca30 with a piece of swordfish sword stuck in the beginning of the caudal fin.

3.3. Other Marine Megafauna Observed

In addition to sharks, other large pelagic animals difficult to observe in situ without affecting their behavior were recorded. A total of seven species were observed (Table 3; Figure 4; Video S3: Other marine pelagic species), including four giant devil rays (*Mobula mobular*) and one loggerhead turtle (*Caretta caretta*) in the "Costa del Pins_3" survey (May 2022); a group of more than 10 bottlenose dolphins (*Tursiops truncatus*), one pelagic stingray (*Pteroplatytrygon violacea*) and one loggerhead turtle (*Caretta caretta*) in "Costa dels Pins_4" survey (June 2022); and two pelagic stingray (*Pteroplatytrygon violacea*) and a oceanic puffer (*Lagocephalus lagocephalus*) in "Costa dels Pins_5" survey (December 2022). The depth camera recorded two sunfishes (*Mola mola*) and one swordfish (*Xiphias gladius*) in "Costa dels Pins_3" survey (May 2022).

Table 3. Description of other species observed.

Location	Date	Species	Camera	Total (n°)	Time at Site (h)
Costa dels Pins_3	16 May 2022	*Mola mola*	Deep	1	00:00:15
	16 May 2022	*Xiphias gladius*	Deep	1	00:00:15
	17 May 2022	*Mobula mobular*	Surface	4	00:00:26
	19 May 2022	*Caretta caretta*	Surface	1	00:00:46
	19 May 2022	*Mola mola*	Deep	1	00:02:49
Costa dels Pins_4	12 June 2022	*Tursiops truncatus*	Surface	>10	00:07:50
	14 June 2022	*Pteroplatytrygon violacea*	Surface	1	00:00:08
	14 June 2022	*Caretta caretta*	Surface	1	00:00:52
Costa dels Pins_5	27 December 2022	*Pteroplatytrygon violacea*	Surface	1	00:16:56
	28 December 2022	*Pteroplatytrygon violacea*	Surface	1	01:22:00
	28 December 2022	*Lagocephalus lagocephalus*	Surface	1	00:03:48

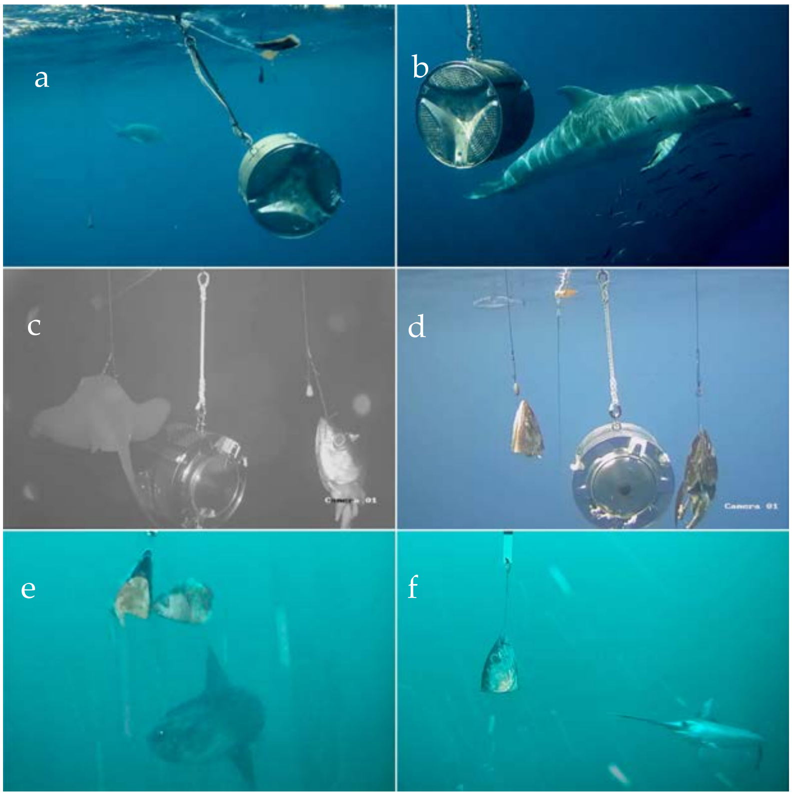

Figure 4. Photographs from video footage of other pelagic species observed: (**a**) loggerhead turtle (*Caretta caretta*); (**b**) bottlenose dolphin (*Tursiops truncatus*); (**c**) pelagic stingray (*Pteroplatytrygon violacea*); (**d**) oceanic puffer (*Lagocephalus lagocephalus*); (**e**) sunfish (Mola mola); and (**f**) swordfish (Xiphias gladius).

4. Discussion

No studies, except those based on fisheries, have been carried out to assess the presence and abundance of various pelagic or demersal elasmobranch species in the area focused by our study. Thus, it increases the relevance of the present study as a non-invasive and extensive audiovisual monitoring method, ideal for environments with a low probability of occurrence, also allowing information from sub-surface layers (down 80 m). Besides information about the animal itself, it also allowed with no stress the data collection about species' behavior, body condition, threats, and ecology.

The long-lasting 24/24 h improved BRUV system presented in this study has allowed the observation of pelagic and deep-sea species that are difficult to observe due to their habitat and low population densities [25,28]. Compared to the previous version [25], innovation in design has allowed for a multi-camera system, which together with increased storage capacity, now allows data to be recorded for periods of 10 days or more, reducing costs associated with logistics and recording scientific data that was previously out of reach. Tests are currently underway to improve the BRUVs' resistance to adverse weather conditions that directly affect the duration of the deployment. To this end, the inclusion of a skid has been designed to prevent the BRUVs from capsizing and withstanding waves of more than 2 m, and the addition of another solar panel to give more charging capacity to the battery at times of the year when daylight hours are reduced (in particular winter time).

The surface camera has provided data on pelagic surface species, such as blue sharks, improving our knowledge of their densities and the problem of by-catch in the area [22]. As all individuals were at least juvenile animals, our results show that the area seems not to be a pupping area for this species as shown by other recent studies in the Mediterranean [40]. It should also be noted that previously unobserved pelagic marine species have also been observed with the new system, such as the oceanic puffer (*Lagocephalus lagocephalus*). The next challenge is to record other pelagic shark species found in the Mediterranean that are threatened with extinction and of important ecological interest, such as the white shark (*Carcharodon carcharias*), the shortfin mako shark (*Isurus oxyrinchus*), and the porbeagle shark (*Lamna nasus*) [17,18].

The 80 m-depth camera, located in areas with a deep drop-off has, for the first time, allowed the observation of deep-sea species. An example is the bluntnose sixgill shark (*Hexanchus griseus*), which is abundant in the Mediterranean by direct observation of by-catch by the trawl fleet in the area [21], but still very difficult to study and observe in situ. The challenge is now to obtain more in situ images and contribute to a better knowledge of these and other rare species, such as the seven-gill shark (*Heptranchias perlo*) [38] in the Balearic Island waters.

The real-time observation was a great advantage in terms of saving unnecessary travel and fuel costs. The use of web applications was also of high value when approaching the study area to anticipate the presence of animals around the BRUV. In the case of sharks in the vicinity, it allows choosing the right moment to work underwater, avoiding influencing the behaviour of the species that might be around. This system can also be used as an innovative outreach tool with great benefits in terms of citizen science through the participation of volunteers in the BRUV surveys and the analysis of the data obtained [41]. Real-time observation of everything that happens around the BRUV keeps volunteers and staff alert during the survey time. It allows volunteers to show sharks in real time to the people around them, to raise awareness of the importance of these animals in the ecosystem, and to awaken their interest in the oceans. During talks and presentations of the work done by Shark Med, a mock-up of the BRUVs was created; the participants easily understood how the BRUVs work and showed good engagement. It is a tool with enormous potential for remote dissemination in schools, diving centres and professional sectors, which allows live images and real-time videos of everything that happens around the BRUV to be shown. It can also be used in the future, as in other areas of the Iberian Peninsula, to carry out sustainable snorkeling trips with pelagic species, such as blue sharks in the area around the BRUV, avoiding having to fish them in order to observe them.

Marine citizen science is indeed a promising avenue for improving engagement and efforts for marine conservation worldwide [42,43]. This is an important tool for collecting high-quality scientific data that can be used in decision-making and in developing cost-effective [44,45] conservation and resource management policies [46,47]. Citizen science directly engages the public and allows them to learn, disseminate, and raise awareness among wider social networks [48,49]. There are many examples of using citizen science to study rare and endangered species [50,51] and it is of great importance for the study of large pelagic sharks in areas such as the Mediterranean Sea [41]. In this context, access to real-time video would be a tremendous asset to develop public ownership and awareness of shark conservation.

Further development of the BRUV is, however, needed in the near future to obtain more valuable scientific data. The implementation of instrumentation to monitor the current will allow the assessment of the olfactory plume of the bait, which is necessary for a correct evaluation of the BRUV sampling effort. In addition, the development of an acoustic attraction technology to avoid reliance on bait (olfactive stimulus) is of interest. Acoustic signal dispersion could be wider and attract different species depending on the sound frequencies and interval pulse signals used [52,53]. For this, it will be essential to explore ways that do not harm any of the exposed species, in particular cetaceans. Real-time observation will also strengthen the opportunity to optimize the timing to approach BRUV for potential satellite and acoustic tagging of sharks.

Complementary approaches to video are also being developed by the Shark Med team to better assess the presence of sharks. The equipment of BRUVs with an acoustic receiver to detect signals from pelagic species tagged with acoustic transmitters, such as sharks, tuna, swordfish, turtles, etc., could potentially increase the detection success of tagged species in scientific studies done by different international scientific organizations. This approach will be complementary to the 2022 Shark Med campaign for water collection to implement environmental deoxyribonucleic acid (e-DNA) around the Balearic Islands in terms of better assessing the species diversity among elasmobranchs still present in these waters exposed to very high anthropogenic pressure.

5. Conclusions

Although it could still be improved this new device presents a very interesting potential in terms of gathering images to boost both elasmobranchs observation (in places where densities are very low) and public awareness (which is paramount to gaining more ownership on shark conservation challenges). In the future, new data acquisition tools have to be implemented in the BRUV, such as an acoustic receiver or current assessment and sound attraction systems that still have to be developed.

Supplementary Materials: The following supporting information can be downloaded at: https://doi.org/10.5281/zenodo.7878497 (accessed on 29 April 2023), Figure S1: Photographs of the different parts of the innovative BRUV design); Video S1: Video footage of a bluntnose sixgill shark (*Hexanchus griseus*); Video S2: Types of markings in blue sharks (*Prionace glauca*) bodies to identify individuals; Video S3: Other marine pelagic species.

Author Contributions: Conceptualization, A.T., A.-M.A. and E.E.G.C.; methodology, A.T. and E.E.G.C.; software, A.T.; validation, A.T., A.P.-V. and E.E.G.C.; formal analysis, A.P.-V.; investigation, A.T., A.P.-V., D.C., M.A.-B., A.-M.A. and E.E.G.C.; resources, A.T., A.-M.A. and E.E.G.C.; data curation, A.P.-V. and E.E.G.C.; writing—original draft preparation, A.P.-V. and E.E.G.C.; writing—review and editing, A.P.-V., A.T., M.A.-B., D.C., A.-M.A. and E.E.G.C.; visualization, A.P.-V.; supervision, E.E.G.C.; project administration, A.T. and E.E.G.C.; funding acquisition, A.T. and E.E.G.C. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Not applicable.

Data Availability Statement: All data generated or analyzed during this study are included in this article.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Average cost of innovative electronic BRUV system components included in this study (does not include production cost and know-how).

Quantity	Concept	Details	Cost €/u	Total Cost
1	Surface camera with underwater case	Camara bullet IP Dahua 2mpx	167.00 €	167.00 €
1	Night light for surface camera	3W waterproof light	50.00 €	50.00 €
1	Deep camera with 50 m cable	CM78IP 1080p −200 m waterproof	664.00 €	664.00 €
2	NVR (video recorder up to 4 cameras)	NVR Dahua IP 8mpx	101.25 €	202.50 €
2	480 Gb SSD memory	Sandisk 480 Gb SSD	60.00 €	120.00 €
1	Sim card router with external antenae	TP Link TL-MR6400	67.99 €	67.99 €
1	100 W Solar pannel		214.00 €	214.00 €
1	Solar charger	12V/24V 10A PWM Must Solar	29.00 €	29.00 €
1	Waterproof gel battery 12 V 100 Ah		259.00 €	259.00 €
1	Smart battery charger		108.00 €	108.00 €
1	Battery support		30.00 €	30.00 €
1	Waterproof case for electronics		56.90 €	56.90 €
8	Waterproof cable glands	Mangrove cable gland PG9	18.00 €	144.00 €
1	Support arm for surface camera		50.00 €	50.00 €
1	Support arm for deep camera		120.00 €	120.00 €
1	Aluminum container and solar pannel support		220.00 €	220.00 €
1	Safety navigation mast: flag, light and radar reflector		45.00 €	45.00 €
1	Stainless-steel screws, rivets and other fasteners		50.00 €	50.00 €
1	GPS tracker			105.00 €
2	Portable 5 Tb hard disk for back up	WD 5 Tb external HDD	109.00 €	218.00 €
		Total cost electronics		2920.39 €

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