Mediterranean Marine Science

early view

New findings of Isidella elongata (Esper, 1788) in the Levantine-Balearic demarcation (western Mediterranean Sea)

MARIA TERESA FARRIOLS, AIDA FRANK, FRANCESC ORDINES, BELÉN CALERO, AÍDA PAREJO, AINA DE MESA, AMANDA COHEN-SÁNCHEZ, BEATRIZ GUIJARRO, ENRIC MASSUTÍ

doi: [10.12681/mms.40030](https://doi.org/10.12681/mms.40030)

Research Article

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
www.hcmr.gr
DOI: https://doi.org/10.12681/mms.40030

New findings of *Isidella elongata* (Esper, 1788) in the Levantine-Balearic demarcation (western Mediterranean Sea)

Maria Teresa FARRIOLS[1], Aida FRANK[1], Francesc ORDINES[1], Belén CALERO[2], Aída PAREJO[1], Aina DE MESA[1], Amanda COHEN-SÁNCHEZ[1], Beatriz GUIJARRO[1] and Enric MASSUTÍ[1]

[1] Centre Oceanogràfic de les Balears (COB-IEO), CSIC, Moll de Ponent s/n, 07015 Palma, Illes Balears, Spain
[2] Centro Oceanográfico De Murcia (COM-IEO), CSIC, Varadero, 1, 30740, San Pedro del Pinatar, Murcia, Spain

Corresponding author: Maria Teresa FARRIOLS; mt.farriols@ieo.csic.es

Contributing Editor: Vasilis GEROVASILEIOU

Received: 15 January 2025; Accepted: 05 May 2025; Published online: 02 June 2025

Abstract

The bamboo coral *Isidella elongata* (Esper, 1788) is a near-endemic species of the Mediterranean Sea, which forms dense aggregations on bathyal muddy bottoms and contributes to the three-dimensional structure of bathyal environments. *Isidella elongata* populations have experienced a regression since the middle of the last century; it has been attributed to the impact of bottom trawling. In this work, we report the identification of *I. elongata* colonies, both dead and alive, during scientific surveys conducted in the western Mediterranean Sea. We also characterise the associated benthic and nekto-benthic assemblages and analyse the presence of the species relative to trawl fishing grounds. One field of *I. elongata* was identified off south-eastern Menorca, from photogrammetric sledge images. The presence of the species was also detected in beam trawl and experimental bottom trawl samples in the Ibiza Channel, and in several Remotely Operated Vehicle (ROV) and beam trawl sampling stations in Ses Olives seamount in the Mallorca Channel. The *I. elongata* field observed off south-eastern Menorca was one of the densest (with maximum values of 6.7 colonies/m^2) described thus far in the western Mediterranean Sea. The identification and location of these habitats are of high conservation interest, as they can be useful for an appropriate spatial planning of marine areas and ecosystem-based fisheries management; this information could be especially relevant for an adequate management of deep-water benthic habitats and living resources. The challenge is to combine the conservation of ecosystems with the sustainability of fisheries, which are both objectives of the Common Fisheries Policy and the Marine Strategy Framework Directive.

Keywords: *Isidella elongata*; Vulnerable Marine Ecosystems; Habitat-forming species; benthic habitats.

Introduction

The bamboo coral *Isidella elongata* (Esper, 1788) is considered a near-endemic species of the Mediterranean Sea, being also found in the adjacent areas of the Atlantic Ocean (Grasshoff, 1988; Rueda *et al.,* 2019). It is a cold-water coral usually distributed at depths over 200 m, so that the species is also referred to as a deep-water coral. It can form dense aggregations on bathyal muddy bottoms (Pérès & Picard, 1964; Bellan-Santini *et al.*, 2002; Sardà *et al.*, 2004) and is thus considered a habitat-forming species that shapes marine animal forests, which contribute to the three-dimensional structure of bathyal environments, enhancing their ecological functionality and providing essential habitat for species of fishing interest (Maynou & Cartes, 2011; Cartes *et al.*, 2013; Mastrototaro *et al.*, 2017). Species of the Isididae family have slow growth rates (Andrews *et al.*, 2009) and long lifespans reaching up to 400 years (Sherwood & Edinger, 2009), which makes them very vulnerable to disturbances, especially those produced by anthropogenic activities such as fishing.

The preference of *I. elongata* for sedimentary bottoms with a gentle, low slope (Pérès & Picard, 1964; Bellan-Santini, 1985; Maynou & Cartes, 2011; Bo *et al.*, 2015; Mastrototaro *et al*., 2017; Altuna & Poliseno, 2019; Rueda *et al*., 2019) makes this species particularly vulnerable to bottom trawling. For that reason, although in the middle of the last century, *I. elongata* was characteristic of deep-water ecosystems along the western Mediterranean Sea (Maurin, 1962, 1968), its populations have been experiencing a regression, which has been generally attributed to the impact of bottom trawling (Maynou & Cartes, 2011; Cartes *et al*., 2013; Fabri *et al*., 2014; Pierdomenico *et al.*, 2018; Carbonara *et al*., 2020). Since the 1970s, bottom trawling has progressively reached greater depths to exploit decapod crustaceans of high economic value (Sardà *et al.*, 2004). In fact, in the past, the presence of *I. elongata* was common in the by-catch of the bottom trawl fishery (Relini *et al.*, 1986; Gerovasileiou *et al*., 2019).

Bottom trawling on *I. elongata* fields has two effects. First, the direct damage produced by the mechanical action of the towing nets is even greater for this species due to its reduced flexibility (Lauria *et al.*, 2017). Second, deep-water coral forests are negatively impacted by the resuspension of sediments from the seabed, which can clog the filter-feeding mechanisms of these suspension feeder species (Rogers, 1999; Fosså *et al.*, 2002). These effects have not only negatively affected the abundance and habitat suitability of *I. elongata* (Lauria *et al.*, 2017; González-Irusta *et al*., 2022; Standaert *et al*., 2023; Georges *et al*., 2024) but have also affected the benthic and nekto-benthic assemblages associated with these bottoms, some of which contain species that are important fishing resources (Maynou & Cartes, 2011).

Isidella elongata is a species of high conservation value; it has been included in the IUCN Red List of Mediterranean anthozoans catalogued as critically endangered (Otero *et al.*, 2017). It also appears in Annex II of the SPA/BD Protocol of the Barcelona Convention, which includes endangered and threatened species. Deep-water corals are considered indicator species of Vulnerable Marine Ecosystems (VMEs; FAO, 2009), and are recognized internationally as ecologically important. They are physically and functionally very fragile against bottom trawling and other fishing activities, due to their low recovery capacity. The Resolution GFCM/43/2019/6 of the Report of the 42nd session of the General Fisheries Commission for the Mediterranean (GFCM) recognized the necessity to protect VMEs and encouraged the implementation of measures to prevent adverse impact of deep-water fisheries activities on VMEs formed by cnidarians, protected under Annex II of the SPA/BD Protocol. Almost two decades ago, a working group of the Scientific, Technical and Economic Committee for Fisheries of the European Commission included the *I. elongata* facies within the sensitive habitats of major relevance in the Mediterranean Sea (STECF, 2006). The GFCM also included this facies on its list of sensitive habitats, due to its rarity and environmental relevance for the fisheries targeting the deep-water shrimp *Aristeus antennatus* and *Aristaeomorpha foliacea* in the Mediterranean Sea (GFCM, 2009). The recent GFCM Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats has reaffirmed the importance of the bamboo coral (GFCM, 2023). This group has highlighted the role of this species as an ecosystem engineer, forming hotspots of biodiversity on deep-water soft bottoms in the Mediterranean Sea, which host and maintain Essential Fish Habitats (EFH) of vulnerable (e.g., sharks) and commercially important (e.g., red shrimps) species.

The identification, mapping, and characterisation of bamboo coral is highly relevant, not only for the conservation of marine biodiversity in the Mediterranean Sea, but also for the management of living resources within the framework of the Ecosystem Approach to Fisheries (STECF, 2006; GFCM, 2019, 2022). Within the European Union Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC of the European Parliament and of the Council of June 17th 2008 establishing a framework for community action in the field of marine environmental policy), the identification of habitats of conservation interest is also relevant to assess the environmental status of marine benthic communities. In this work, we report the findings of *I. elongata* colonies, both dead and alive, during scientific surveys conducted in the western Mediterranean Sea. We also characterised the associated benthic and nekto-benthic assemblages and analysed the presence of the species relative to trawl fishing grounds.

Materials and Methods

Biological data

Two types of complementary information, collected in several research surveys, have been used to detect the presence of *I. elongata*, and to estimate the abundance and size of its colonies: (i) images of the seafloor and its benthic communities, and (ii) samples of epibenthic and nekto-benthic biota (Table 1). These samples were

Table 1. Data of the stations sampled with ROV, rock dredge (DR), beam trawl (BT), and photogrammetric sledges (TASIFE and HORUS) along the Levantine-Balearic (LEBA) demarcation (western Mediterranean Sea) during CIRCA-LEBA and INTEMARES scientific surveys.

Survey	Year	Research vessel	Sampling tool	Depth range	Station/Dives
INTEMARES-0718	2018	R/V Ángeles Alvariño	BT	105-758 m	18
			DR	90-754 m	11
INTEMARES-1019	2019	R/V Ángeles Alvariño	BT	102-784 m	43
			DR	92-559 m	19
			TASIFE	87-708 m	48
INTEMARES-0720	2020	R/V Ángeles Alvariño	BT	102-702 m	24
			DR	102-1081 m	22
INTEMARES-0820	2020	R/V Sarmiento de Gamboa	ROV	89-1162 m	29
CIRCA-LEBA-1121	2021	RV/Ramon Margalef	BT	37-738 m	95
			HORUS	38-724 m	93
CIRCA-LEBA-1122	2022	RV/Ramon Margalef	BT	32-762 m	86
			HORUS	37-742 m	81

also used to characterise epibenthic and nekto-benthic assemblages, as well as fishing resources associated with *I. elongata* fields.

Within the MSFD project, the research surveys CIRCA-LEBA-1121 and CIRCA-LEBA-1122 were carried out onboard the R/V *Ramon Margalef* in November 2021 and November 2022, to sample benthic communities, off the Iberian Peninsula and around the Balearic Islands (western Mediterranean Sea), that belong to the Levantine-Balearic (LEBA) demarcation of the Marine Strategies in Spain (Bellas, 2014). This sampling was mainly based on the use of a photogrammetric benthic sledge to record videos of the seafloor and its benthic communities, and a beam trawl (BT) to sample epibenthic biota (Fig. 1).

Within the LIFE IP INTEMARES project, four research surveys were conducted in August 2018, October 2019, and July 2020, on board the R/V *Ángeles Alvariño* and in August 2020, on board the R/V *Sarmiento de Gamboa*. These surveys aimed to improve the scientific knowledge of the seamounts of the Mallorca Channel (Balearic Islands) and to include this area in the Natura 2000 network (Massutí *et al*., 2022). This sampling was based on the use of a photogrammetric sledge and a Remotely Operated Vehicle (ROV) to record videos of the seafloor and its benthic communities, together with a BT and rock dredge to take samples of epibenthic biota on sedimentary and rocky bottoms, respectively (Fig. 1).

Image samples were acquired by the HORUS photogrammetric benthic sledge during CIRCA-LEBA surveys, and by the TASIFE photogrammetric sledge and the ROV Liropus during INTEMARES surveys. The HORUS sledge was equipped with a 4k resolution camera and parallel linear lasers (separated by 7.5 cm) that captured high-quality video footage at a distance of 0.5 m from the seabed and an acquisition angle of 45º. A total number of 174 video transects were recorded from 37 to 741 m depth at a towing speed of approximately 0.5 knots (Fig. 1; Table 1). The effective duration of the transects varied between 15 and 45 min, depending on the depth. Video transects were georeferenced with a USBL (ultra-short baseline) acoustic beacon attached to the sledge structure, providing data through the R/V's HiPAP system. The TASIFE sledge was equipped with a Nano SeaCam piloting camera installed forward, a Nikon D800 video recording camera in the zenithal position, a spotlight system to illuminate the seafloor, and three green laser beams (separated by 10 and 24 cm). Transects were traced out with the vehicle moving at 0.5 knots at 0.5 to 2.5 m above the seafloor. The accurate location of the sledge over the bottom was also obtained from the HiPAP® acoustic positioning system of the R/V. A total of 48 transects from 15 to 20 min of duration were recorded with TASIFE, between 87 and 708 m depth (Fig. 1; Table 1). The ROV was equipped with a full HD colour camera and a PAL colour camera installed forward, and a mini camera at the rear. It was also equipped with a CTD SBE37Microcat, two laser pointers (separated by 10 cm), a dual frequency SONAR Seaking DST, an altimeter (LPA200), an acoustic beacon MST 324, and two hydraulic manipulators with a box system for sample collection and storage. The navigation

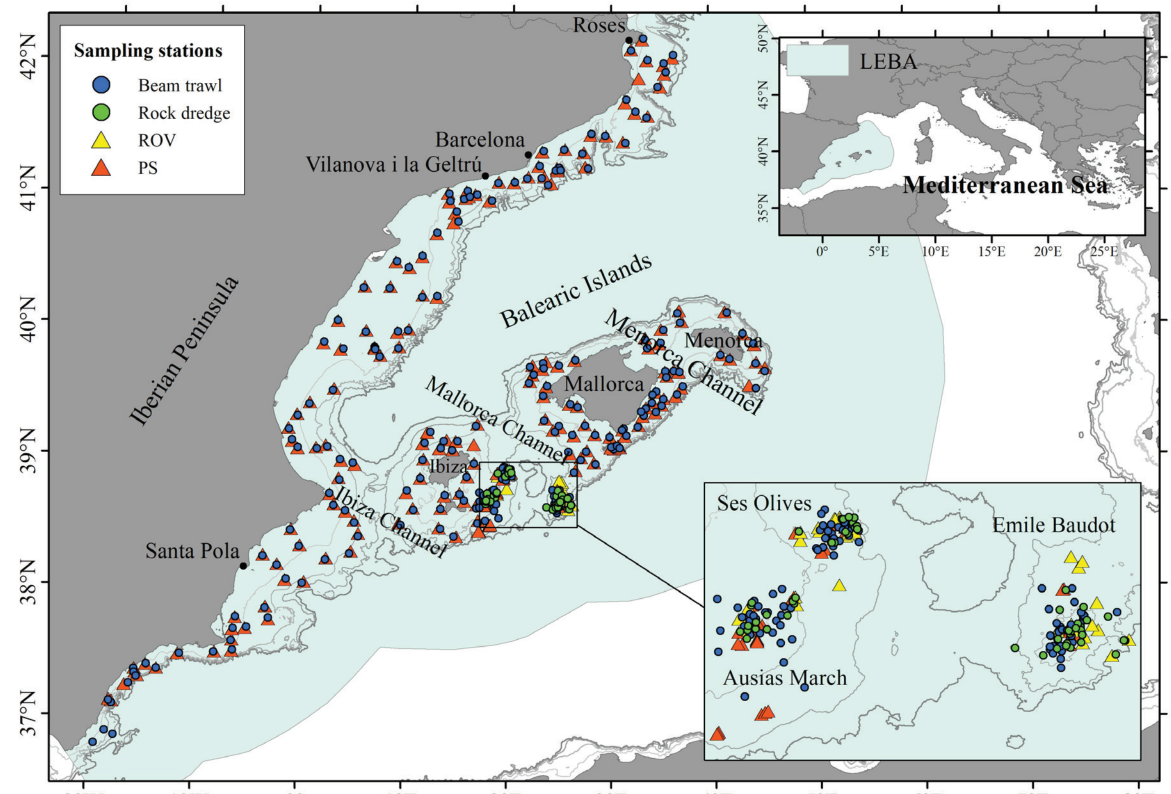

Fig. 1: Map of the study area showing the stations sampled with ROV, rock dredge, beam trawl, and photogrammetric sledges (PS) along the Levantine-Balearic (LEBA) demarcation (western Mediterranean Sea) during CIRCA-LEBA and INTEMARES scientific surveys. Isobaths represent 100, 500, 800, and 1000 m depth.

system of this ROV includes a Tether Management System (TMS) and a Launch and Recovery System (LARS). The TMS is equipped with an extra low-light back and white camera, a CTD, a Midas Valeport current metre, and an acoustic beacon MST 324. The ROV transects were carried out with the vehicle moving at <0.3 knots at 0.5 to 2.5 m above the seafloor. A total of 29 transects, ranging in duration from one to four hours, were recorded with the ROV from 89 to 1162 m dredge (Fig. 1; Table 1). Once ashore, the video footage obtained with HORUS, TASIFE, and ROV was meticulously reviewed using the OFOP (Ocean Floor Observation Protocol) software to conduct a thorough analysis of the transects to estimate the abundance and size of *I. elongata*.

The standard BT described by Jennings *et al.* (1999) was used to collect epibenthic species at the stations that were sampled by the photogrammetric sledge during the CIRCA-LEBA surveys, or at different stations, during the INTEMARES surveys. This BT is a small gear, with horizontal and vertical openings of 2 and 0.5 m, respectively, and a 5 mm diamond mesh cod-end, whose sampling efficiency was estimated by Reiss *et al.* (2006). The effective duration of hauls varied between 2 and 15 min, depending on the depth, at a towing speed ranging from 1.8 to 2.0 knots. The arrival and departure of the gear to and from the bottom were estimated using a SCANMAR system. Once the capture was on board, specimens were sorted, identified to species level, or the lowest taxonomic level possible, and individuals were then counted and weighed. Abundance and biomass were standardised to 250 m^2 using the horizontal opening of the gear and the distance covered by each haul. A total of 85 and 181 sampling stations were covered during INTEMARES and CIRCA-LEBA surveys, respectively, at depths ranging from 32 to 764 m (Fig. 1; Table 1).

A rock dredge was used during INTEMARES surveys. It was composed of a metallic rectangular mouth with bevelled edges, equipped with a 1 cm mesh cod-end, protected by another net of 2 cm mesh and leather covers on the bottom and top sides. This dredge was towed in an upward direction over the seafloor, collecting rock fragments, together with the associated flora and fauna. Sampling was conducted at 0.5–1 knots, with an effective duration of 5 to 10 minutes. A total of 55 stations between 89 and 1191 m depth were sampled with the rock dredge (Fig. 1; Table 1).

Data on nekto-benthic species collected by bottom trawling were also used. This information comes from the MEDITS research surveys and regular sampling on board the trawling fleet by scientific observers throughout the year. Both data sources are part of the Data Collection Framework (Commission Regulation EC Nº 1639/2001) to support the scientific advice to the Common Fisheries Policy. The MEDITS surveys are carried out with the experimental bottom trawl GOC-73, designed to sample demersal species and fishing resources (Bertrand *et al.*, 2002; Specicato *et al.*, 2019). The effective sampling time was 60 min, and the towing speed was around 2.5 knots. The arrival and departure of the gear to and from the bottom were estimated using a MARPORT system. On board the R/V *Miguel Oliver*, catches were sorted, identified to species level, or the lowest taxonomic level possible, counted, and weighed. Abundance and biomass were standardised to one square kilometre using the horizontal opening of the net and the distance covered in each haul. Data collected on board the trawling fleet included information on the position of commercial fishing hauls, their duration, and their catches (weight and number of individuals by species or taxonomic group), including both landings and discards. These data were standardised to 30 min of fishing time.

Fishing grounds

The LEBA demarcation encompasses, totally or partially, three Geographical Sub-Areas (GSAs) that the GFCM has established in the western Mediterranean Sea: GSA1 (northern Alboran Sea), GSA5 (Balearic Islands), and GSA6 (northern Spain). Data from the Vessel Monitoring System (VMS) for all the Spanish trawl fleet that operated in this demarcation during the period 2015-2021 was used to identify the main fishing grounds exploited by the bottom trawl fleet in each GSA. Raw VMS data was cleaned and filtered to avoid duplicates and signals located on land or in harbours. Using QGIS, the depth of each VMS signal was extracted from the EMODNET bathymetry (https://emodnet.ec.europa.eu/en) to include the depth at which trawlers operate in the analysis. Then, VMS data were filtered by time (between 05:00 and 17:00), day (Monday to Friday), speed (2-3.6 knots), and depth (50-1000 m depth) to remove signals outside these established limits (Farriols *et al.*, 2017).

The following bathymetric strata, hosting different biological communities (e.g., Massutí & Reñones, 2005; García-Rodríguez *et al.*, 2011; García-Ruiz *et al.*, 2015), were also taken into account for analysis: shallow shelf (50-100 m), deep shelf (100-200 m), upper slope (200-500 m), and middle slope (500-1000 m). Trawlers exploiting these depth strata are targeted at different species: e.g., red mullet, European hake, Norway lobster, and red shrimp, respectively (Palmer *et al.*, 2009). A track for each trip was generated based on effective fishing signals; the midpoint was utilised as the trip position, with only one signal remaining per vessel and day. If the track spanned different depth strata, a midpoint was estimated for each stratum in the same fishing trip. VMS signals were assigned to a grid of 0.01º squares, and the different fishing grounds were inferred from VMS density contours assigned at each grid point. Expert knowledge of the bottom trawl fishery was then used to verify and distinguish adjacent fishing grounds, as well as to delimit fishing grounds with low signal densities (Farriols *et al.*, 2017).

Data analysis

To compare data obtained from different gears, the abundance of *I. elongata* colonies obtained from photogrammetric sledges, ROV, and BT samples during the CIRCA-LEBA and INTEMARES surveys was standardized to m², dividing the number of colonies by the whole area sampled in each transect. Video transects were analysed entirely by the same person because no conflicts in the identification of the species were expected. Only individuals located between laser pointers were taken into account, and laser beams were used as a metric scale in video transects. Maximum abundances per m² were also registered by each transect from photogrammetric sledges and ROV images. Large (>20 cm) and small (<20 cm) colonies were also counted, according to Pierdomenico *et al*. (2018).

The georeferenced positions of dead and live *I. elongata* colonies observed during the CIRCA-LEBA and INTEMARES surveys, together with the trawl fleet fishing grounds in the area, were mapped using the ArcGis Desktop 10.8 software. We also analysed the standardised abundance and biomass of epibenthic and nekto-benthic species, respectively, collected with BT and bottom trawl (both experimental and commercial gears) on fishing grounds adjacent to areas where *I. elongata* was detected.

Results

Several findings of *I. elongata* have been registered during scientific surveys in the LEBA demarcation (Fig. 2; Tables 2 and 3). One field of *I. elongata* was identified off south-eastern Menorca, from photogrammetric sledge images. The presence of *I. elongata* was also detected in BT and experimental bottom trawl samples collected in the Ibiza Channel, and in several ROV and BT sampling stations in Ses Olives seamount in the Mallorca Channel. These records of live *I. elongata* specimens are also complemented by data on leftovers of dead colonies collected with BT and rock dredge.

South-eastern Menorca

The south-eastern Menorca area was analysed in a single transect with a duration of 35 min (Figs. 2 and 3), between 499 and 534 m depth, at the edge of a trawl fleet fishing ground. The average density of *I. elongata* along the whole transect was 0.76 colonies/m² (Table 2), with a maximum value of 6.7 colonies/m². The numbers of col-

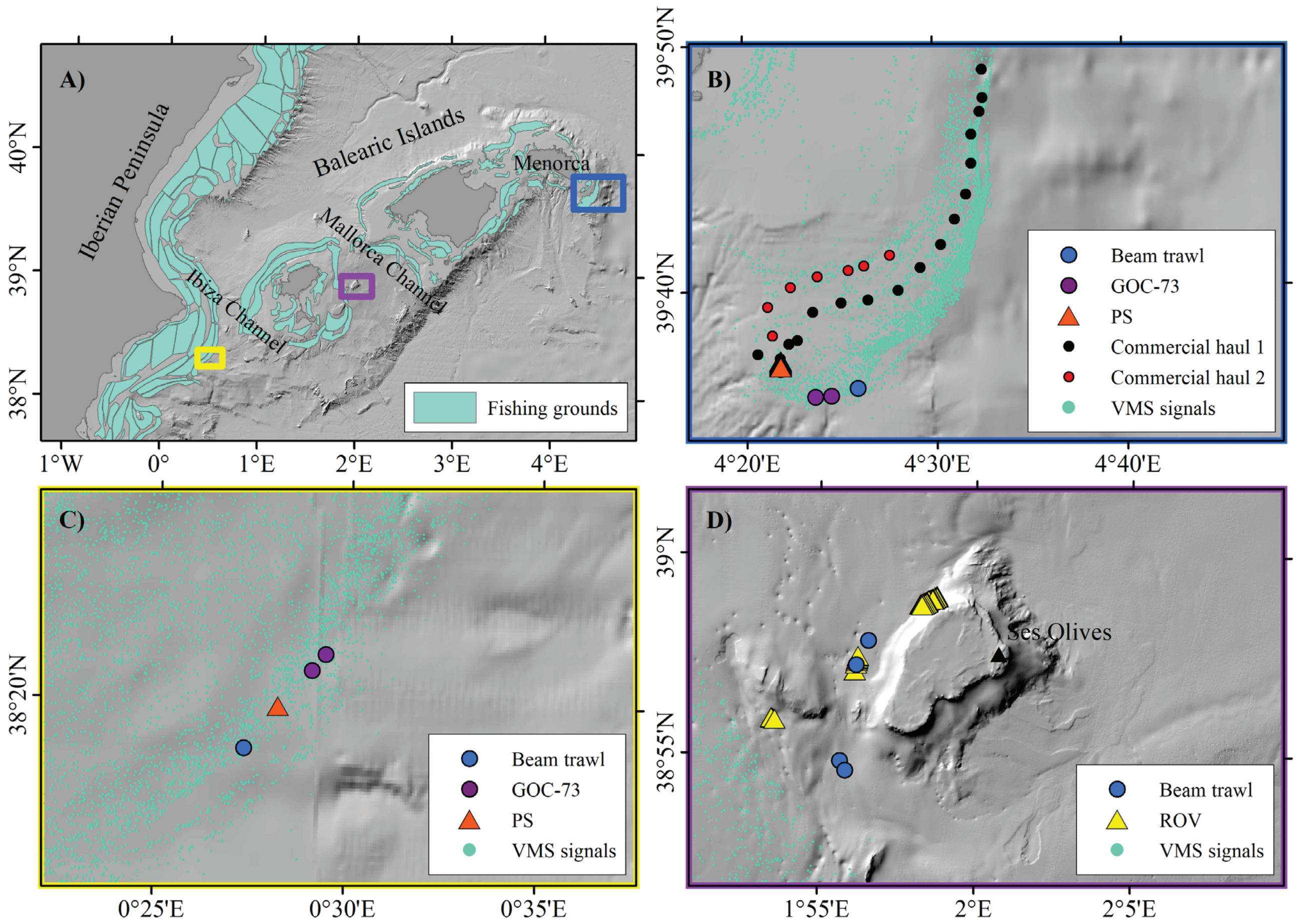

Fig. 2: Map of the study area showing the positions of *Isidella elongata* recorded during scientific surveys along the Levantine-Balearic demarcation (western Mediterranean Sea, A). The main fishing grounds of the bottom trawl fleet, estimated from Vessel Monitoring System (VMS) signals, are also represented. Detailed maps of the areas where the species was detected, southern Menorca (B), the Ibiza Channel (C), and in the seamounts of the Mallorca Channel (D), are also shown. These maps show the samples collected from the beam trawl and the images recorded from the photogrammetric sledge and ROV, as well as the samples collected from the experimental bottom trawl GOC-73 and the two commercial hauls sampled on board the trawling fleet by scientific observers.

Table 2. Mean and maximum density of *Isidella elongata* (colonies/m^2), and number of colonies with total length below and over 20 cm, estimated from images recorded at different sampling stations during CIRCA-LEBA and INTEMARES scientific surveys. The minimum (Min) and maximum (Max) depths where the species were observed are also shown. In station TR_01, the HORUS photogrammetric sledge was used as a sampling method, while the ROV Liropus was used in the rest of the sampling stations.

Station	Survey	Study area	Depth (m)		Density (colonies/m^2)		Length	
			Min	Max	Mean	Maximum	<20 cm	>20 cm
TR_01	CIRCA-LEBA-1122	Menorca	499	534	0.76	6.7	182	118
ROV_01	INTEMARES-0820	Ses Olives	597	605	0.07	1.3	54	4
ROV_02	INTEMARES-0820	Ses Olives	603	618	0.02	1.3	11	1
ROV_03	INTEMARES-0820	Ses Olives	588	592	0.02	1.3	4	0
ROV_04	INTEMARES-0820	Ses Olives	579	589	0.01	1.3	18	0
ROV_05	INTEMARES-0820	Ses Olives	605	607	0.01	1.3	9	3
ROV_06	INTEMARES-0820	Ses Olives	598	619	0.31	6.7	41	16

Table 3. Density of *Isidella elongata* (colonies/m^2), estimated from beam trawl (BT) samples during CIRCA-LEBA and INTEMARES scientific surveys. The mean depth of the samples is also shown.

Station	Survey	Study Area	Depth (m)	Density (colonies/m^2)
BT_01	CIRCA-LEBA-1121	Ibiza Channel	554	0.001
BT_02	INTEMARES-A22B-0720	Ses Olives	715	0.001
BT_03	INTEMARES-A22B-0720	Ses Olives	607	0.004
BT_04	INTEMARES-A22B-1019	Ses Olives	609	0.002
BT_05	INTEMARES-A22B-1019	Ses Olives	680	0.107

onies below and over 20 cm were 182 and 118, respectively (Table 2). Other species observed in this transect were the fish *Chlorophthalmus agasizii*, and the shrimps of commercial interest *Parapenaeus longrostris* and *Aristeus antennatus*.

In a sample collected with BT at 659 m depth near this *I. elongata* field (Fig. 2), no live colonies of *I. elongata* were detected. Leftovers of dead colonies were present, with an estimated mean density of 37.5 g/250 m^2 (Table S1). This sample also showed that the crustaceans *Robustosergia robusta* and *Calocaris macandreae* were the most important species of epibenthic assemblages in terms of abundance. The cephalopod *Bathypolypus sponsalis* and the commercial crustaceans *A. antennatus* and *Geryon longipes* were the most important in terms of biomass (Table S1). The most important species of nekto-benthic assemblages, both in terms of abundance and biomass, estimated from two bottom trawl samples col-

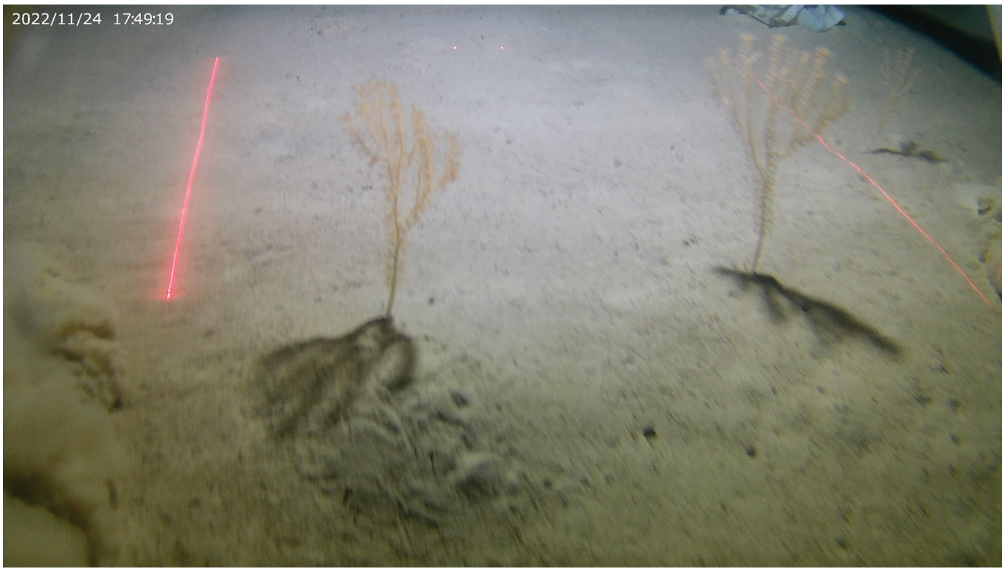

Fig. 3: Images of *Isidella elongata* colonies observed in south-eastern Menorca (Balearic Islands, western Mediterranean Sea) with the HORUS photogrammetric sledge during the CIRCA-LEBA-1122 scientific survey.

lected in this same station, at a mean depth of 670 m (Fig. 2), were the cephalopod *Todarodes sagittatus*, and the crustaceans *Plesionika martia*, *A. antennatus*, *Plesionika acanthonotus,* and *G. longipes*, (Table S2). The fish *Hymenocephalus italicus* and *Phycis blennoides* were the most important species in terms of abundance, and *Galeus melastomus* and *Lophius piscatorius* were the most important in terms of biomass.

I. elongata was observed in two commercial trawl hauls (170 and 500 g of *I. elongata* in the south-eastern Menorca area, Fig. 2) targeting Norway lobster (*Nephrops norvegicus*). In the first haul, between 398 and 512 m depth, the nekto-benthic species with higher abundance and biomass were the cephalopods *Illex coindetii* and *Loligo forbesii*, the crustaceans *P. longirostris*, *N. norvevicus,* and *P. martia,* and the elasmobranch *G. melastomus* (Table S3). *Lepidorhombus boscii*, *C. agasizii,* and *Coelorinchus caelorhincus* were also highly abundant. *Galeus melastomus*, *Leucoraja circularis,* and *L. piscatorius* showed high biomass. In the second haul, between 480 and 505 m depth, the cephalopod with the highest abundance was *B. sponsalis*, while the one with the highest biomass was *L. forbesii.* The crustaceans showing both higher abundance and biomass were *P. longirostris*, *P. martia*, *N. norvevicus,* and *Aristaeomorpha foliacea*. The fish with higher abundance were *G. melastomus*, *P. blennoides*, *L. boscii,* and the elasmobranch *Etmopterus spinax.* The fish with higher biomass were *G. melastomus*, *P. blennoides*, *C. caelorhincus,* and *L. boscii* (Table S3).

Ibiza Channel

Live specimens of *I. elongata* were detected in a BT sample from a mean depth of 554 m in a fishing ground of the bottom trawl fleet targeting the red shrimp *A. antennatus* (Fig. 2). Mean density of *I. elongata* was estimated at 0.001 colonies/m^2 (Table 3). In terms of abundance, the most important epibenthic species collected in this sample were the crustaceans *C. macandreae*, *Monodaeus couchii*, and *Processa canaliculata,* and the bivalve *Nucula sulcata.* In terms of biomass*,* the crustaceans *N. norvegicus* and *M. couchii*, the fish *Nezumia aequalis* and the bivalve *N. sulcata* were the most important (Table S1). No colonies of *I. elongata* were detected with the photogrammetric sledge at this sampling station.

Isidella elongata (422 g in the sampled area, 0.1208 km^2) was also detected at this sampling station in a bottom trawl sample from a mean depth of 582 m (Fig. 2). The most important species of the nekto-benthic assemblage were the crustaceans *A. antennatus*, *P. martia,* and *G. longipes*, which had higher abundance and biomass (Table S4). *Abralia veranyi*, *Histioteuthis reversa,* and *Histioteuthis bonnellii* were the cephalopods with the highest abundance. *H. bonnellii*, *Eledone cirrhosa,* and *T. sagittatus* showed the highest biomass. The fish *G. melastomus* and *H. italicus* showed the highest abundance, while *L. piscatorius*, *G. melastomus,* and *E. spinax* showed the highest biomass.

Ses Olives seamount (Mallorca Channel)

I. elongata was observed in Ses Olives seamount during three INTEMARES surveys (Fig. 2; Table 1). The density of *I. elongata* observed in ROV transects ranged from 0.01 to 0.31 colonies/m^2. The density of *I. elongata* obtained from BT samples ranged from 0.001 to 0.107 colonies/m^2 (Tables 2 and 3). The maximum density ranged from 1.3 to 6.7 colonies/m^2. The numbers of colonies below and over 20 cm were 137 and 24, respectively (Table 2). In this case, there were no bottom trawl samples in adjacent areas, because these findings were not made at, or near, trawl fishing grounds.

In addition to *I. elongata*, the species most frequently observed in ROV transects were the sponge *Thenea muricata*, the crustaceans *G. longipes* and others from the genus *Plesionika*, and the fish *Helicolenus dactylopterus* and *Hoplostetus mediterraneus*. In terms of abundance, the most important epibenthic species from BT samples were the bivalves *Bathyarca philippiana*, the crustaceans *C. macandreae*, *G. longipes*, and *Polycheles typhlops*, and the sponge *T. muricata* (Table S5). In terms of biomass, the most important species where the crustaceans *G. longipes*, *P. typhlops,* and *C. macandreae*, the fish *Nezumia aequalis* and *P. blennoides*, and the sponge *T. muricata*.

Dead I. elongata *colonies*

Leftovers of dead colonies of *I. elongata* were found from BT and rock dredge samples collected at fishing grounds of the bottom trawl fleet in areas near Santa Pola, Ibiza Channel, Barcelona, Vilanova i la Geltrú, and Roses, off the Iberian Peninsula, and north-western Mallorca, north-western Ibiza in the Balearic Islands (Fig. 4). They were also found in Ausias March and Emile Baudot, which are other seamounts of the Mallorca Channel.

Discussion

Of the three new findings of *I. elongata* reported in this paper, the one off south-eastern Menorca is one of the densest fields described in the western Mediterranean Sea. Despite its location at the boundary of a trawl fishing ground, both the mean (0.7 colonies/m^2) and maximum (6.7 colonies/m^2) standardised density values, estimated from the photogrammetric sledge transect, were higher than those reported in other areas of this basin (Table 4; Fig. 5). That is the case of Gioia Canyon in the southern Tyrrhenian (Pierdomenico *et al.*, 2018), the Ventotene basin in the northern Tyrrhenian Sea (Ingrassia *et al.*, 2019), and the Ebro River margin in the north-western Mediterranean Sea (Cartes *et al*., 2013). By contrast, our *I. elongata* density values were similar to those reported in Carloforte Shoal in south-western Sardinia (Bo *et al.*, 2015), Asinara Island in north-western Sardinia (Angiolillo *et al.*, 2024), and the Alboran Sea in the south-western Mediterranean Sea (Grinyó *et al.*, 2020). *Isidella elongata* has

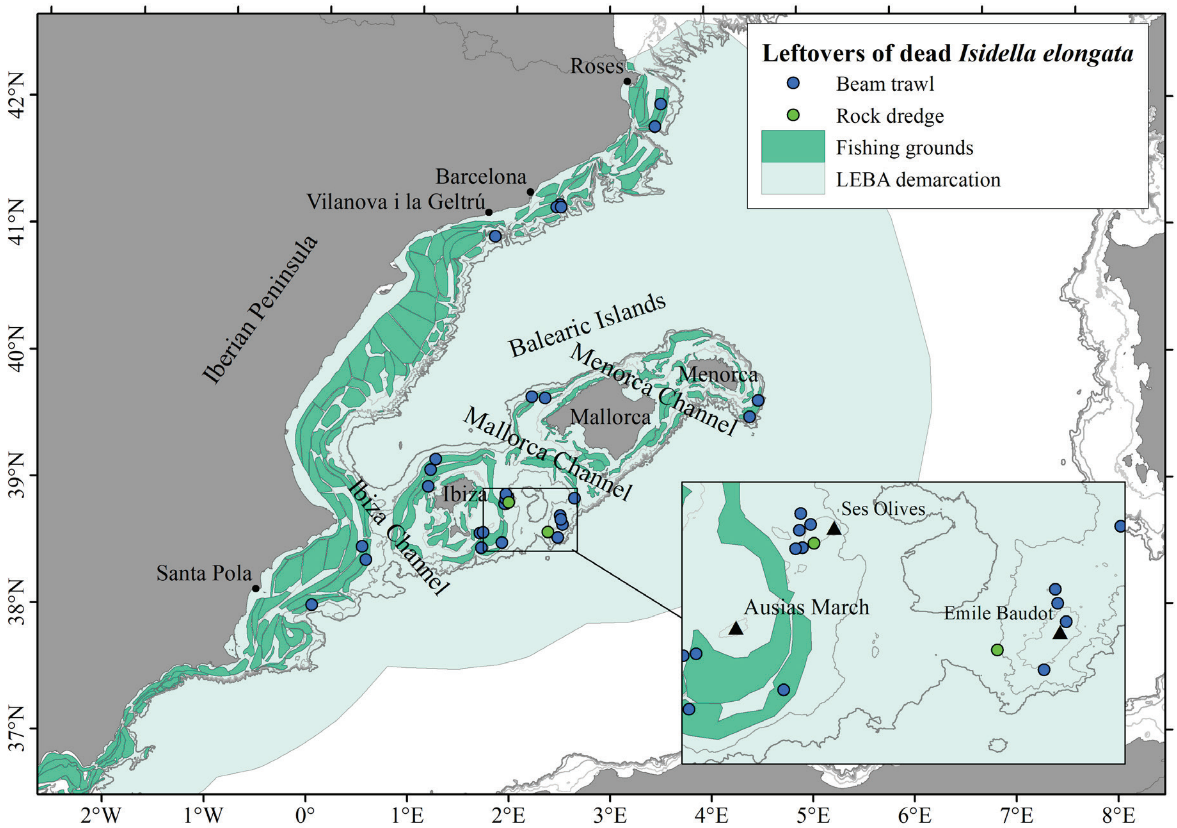

Fig. 4: Map of the study area, Levantine-Balearic demarcation (LEBA; western Mediterranean Sea), including a detailed map of the seamounts Ses Olives, Ausias March, and Emile Baudot of the Mallorca Channel. The position of the leftovers of dead *Isidella elongata* obtained from beam trawl and rock dredge samples during CIRCA-LEBA and INTEMARES scientific surveys is also shown. The main fishing grounds of the bottom trawl fleet, estimated from Vessel Monitoring System (VMS) signals, are also shown. Isobaths shown are 100, 500, 800, and 1000 m depth.

Table 4. Density and maximum density (colonies/m^2) of *Isidella elongata* from previous studies in the Mediterranean Sea. When average densities are presented, their corresponding deviation measures (SE: Standard Error; SD: Standard Deviation) are in brackets. The percentage of colonies over 20 cm in length is also presented.

Reference	Density	Max	Colonies >20 cm in length	Study area
Angiolollo *et al*. (2024)	0.01-2.54	8	30%	Asinara Island (north-western Sardinia)
Bo *et al*. (2015)	0.5 (SE: +-0.04)	2.7	20%	Carloforte Shoal (south-western Sardinia)
Cartes *et al*. (2013)	0.000052-0.000086	-	-	Ebro river margin (north-western Mediterranean Sea)
Grinyó *et al*. (2020)	1.5 (SD: +- 0.9)	7	-	Alboran Sea (south-western Mediterranean Sea)
Ingrassia *et al*. (2019)	0.13 (SE: +- 0.03)	0.32	36%	Ventotene Basin (northern Tyrrhenian Sea)
Mastrototaro *et al*. (2017)	0.23–0.27	-	-	Ses Olives seamount (Mallorca Channel)
Pierdomenico *et al*. (2018)	0.13-0.4	1.6	10.3%-49.2%	Gioia Canyon (southern Tyrrhenian Sea)
Present study	0.001-0.76	6.7	7%-39%	Levantine-Balearic Demarcation

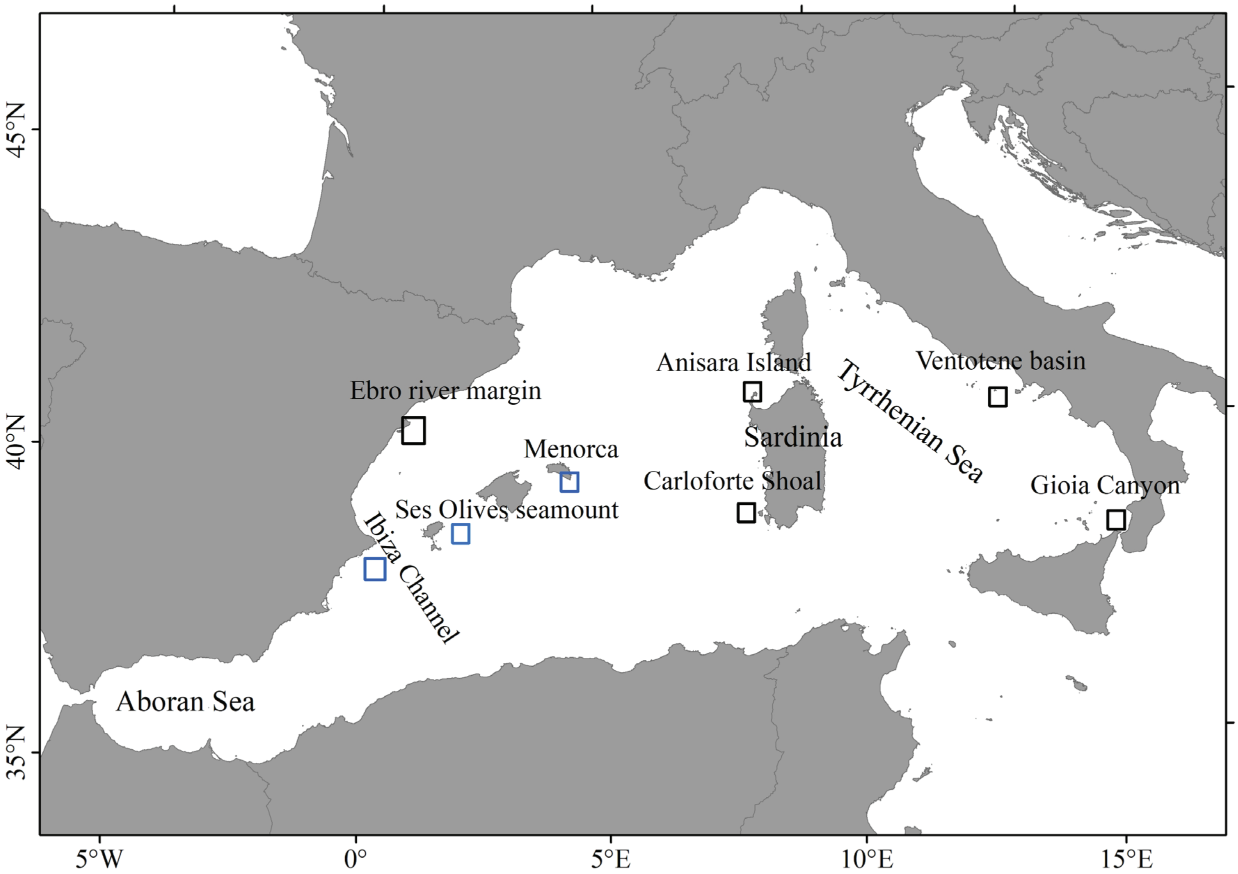

Fig. 5: Map with the approximate location of the areas sampled in previous studies reporting the density of *Isidella elongata* in the western Mediterranean Sea. The locations of *I. elongata* found in the present study are shown in blue.

also been reported in the eastern Mediterranean Sea (Gerovasileiou *et al*., 2019; Salomidi *et al*., 2022; Smith *et al*., 2022; Stamouli *et al*., 2022), but no density values are available for comparison.

It is worth noting that the density of *I. elongata* colonies at south-eastern Menorca is higher than in areas impacted by bottom trawling (Cartes *et al*., 2013; Pierdomenico *et al*., 2018; Ingrassia *et al*., 2019) or than in small muddy enclaves in the surroundings of rocky bottoms not impacted by bottom trawling (Bo *et al*., 2015). The percentage of colonies > 20 cm (39%) was also higher in this non-trawled area (Bo *et al*., 2015; Table 4 and Fig. 5). Relative to other exploited areas, this percentage is higher than that of Asinara Island (Angiolollo *et al*., 2024; Table 4 and Fig. 5), similar to that of Ventotene basin (Ingrassia *et al*., 2019; Table 4 and Fig. 5), and lower than some estimations at the Gioia Canyon (Pierdomenico *et al*., 2018; Table 4 and Fig. 5).

The density of *I. elongata* at south-eastern Menorca was also higher than in areas not exploited by bottom trawling, also analysed in the present work. For instance, at Ses Olives seamount *I. elongata* density ranged from 0.001 to 0.31 colonies/m^2, with maximum values ranging from 1.3 to 6.7 colonies/m^2. Except for one out of six transects, this density range is lower than that observed by Mastrototaro *et al.* (2017), also in the Ses Olives seamount (0.23-0.27 colonies/m^2).

The density of *I. elongata* recorded at the station from the Ibiza Channel was much lower than that at south-eastern Menorca and Ses Olives seamount. This could be due to the higher bottom trawl fishing effort observed in the area (Fig. 2). However, the lower density values obtained from the BT samples, compared to ROV transects in Ses Olives seamount during INTEMARES surveys, could indicate that the lower values from the Ibiza Channel are due to the lower efficiency of the BT (compared to ROV and photogrammetric sledges) for sampling sessile species like *I. elongata*. That is the case of the sea pens *Funiculina quadrangularis* and *Pennatula rubra*, whose sampling is easier through images (Chimienti *et al*., 2018; Farriols *et al*., 2024).

The absence of live colonies of *I. elongata* in the largest part of the LEBA demarcation area is in keeping with the regression of *I. elongata* fields that has been observed during the last decades in the Mediterranean Sea, which is due to bottom trawling (Maynou & Cartes, 2011; Cartes *et al*., 2013; Pierdomenico *et al*., 2018). Except for some areas of the Mallorca Channel seamounts, sampling in these surveys has been conducted in sedimentary areas exploited by the bottom trawl fleet. Thus, the low presence of *I. elongata* in the area is not a coincidence when taking into account the negative impact of this fishery on this sensitive species. The presence of dead *I. elongata* colonies in the vicinity of areas where the species is present, and in some fishing grounds where live colonies are not found, also supports this idea. What is more, leftovers of dead *I. elongata* have been found close to areas where live specimens were previously found (north-western Mallorca, northern Ibiza, Barcelona, and Tarragona) (González-Irusta *et al.*, 2022), but at lower depths than the live colonies. The difference in depth between live and dead *I. elongata* colonies (499-715 m and 126-755 m) could be explained by the progressive displacement of the trawl fleet towards greater depths, which started during the seventies of the last century, when the exploitation of the high valuable deep-water decapod crustaceans began in the western Mediterranean Sea (Oliver, 1993; Sardà *et al.*, 2004). In this context, the benthic habitats of shallower areas were the first to be explored and exploited; consequently, they have been impacted and transformed for longer than deeper areas. This observation reinforces the idea that bottom trawling is the cause of the disappearance of *I. elongata*. Finding leftovers of dead *I. elongata* in the Emile Baudot seamount, without any live colonies, also suggests that the recovery of this species is expected to be long. It should be noted that during the last decades of the 20th century and the beginning of the 21st century, this area was exploited by the bottom trawl fleet targeting red shrimp (Oliver, 1993); however, this fishery has not been developed in the last 20 years (Massutí *et al.*, 2022).

The benthic and nekto-benthic assemblages that have been found associated with *I. elongata* fields are very similar to those described previously (e.g., Maynou & Cartes, 2011; Mastrototaro *et al.*, 2017; Ingrassia *et al.*, 2019). Some of the accompanying species are of high commercial value, and include decapod crustaceans (*P. longirostrs*, *N. norvegicus*, *A. foliacea,* and *A. antennatus*), fishes (e.g., *L. piscatorius*), and cephalopod molluscs (*L. forbesii*). We did not have enough data to test for differences in density and diversity of these assemblages and fishing resources between areas with and without *I. elongata.* In any case, the ecological role that this species plays in bathyal environments of the Mediterranean Sea, increasing benthic biodiversity and biomass, promoting benthopelagic food webs and attracting high concentrations of commercially valuable species seeking refuge, providing feeding grounds and spawning areas, has been extensively reviewed (e.g., Laubier & Emig, 1993; Maynou & Cartes, 2011; Mytilineou *et al.*, 2014; Carbonara *et al*., 2022; Grinyó *et al*., 2020).

Identification and location of habitats of high conservation interest, like those reported in this study in the LEBA demarcation, can be useful for an appropriate spatial planning of marine areas and ecosystem-based fisheries management. The *I. elongata* field that we found in south-eastern Menorca is one of the most important fields found in the western Mediterranean Sea; it can be especially relevant for an adequate management of deep-water benthic habitats and living resources. The challenge is to develop strategies focused on both the conservation of ecosystems and the sustainability of fisheries, which are objectives of the Common Fisheries Policy and the MSFD.

Acknowledgements

This research was developed within the 18-ESMARES2-CIRCA project, included in the program "Asesoramiento científico-técnico para la protección del medio marino: Evaluación y seguimiento de las Estrategias Marinas, Seguimiento de los espacios marinos protegidos de competencia estatal (2018-2021)", funded by the General Directorate of Sea Protection of the Spanish Ministry for the Ecological Transition and the Demographic Challenge. The authors thank Raquel Sáez-Liante, who carried out the on-board sampling of the bottom trawl fleet of the Balearic Islands during the period 2021-2022; the participants of the MEDITS, CIRCA-LEBA, and INTEMARES surveys; and the crew of the research vessels on which they were performed (R/V Miguel Oliver, R/V Ramon Margalef, RV/Ángeles Alvariño, and RV/Sarmiento de Gamboa). The MEDITS surveys are co-funded by the European Union through the European Maritime and Fisheries Fund (EMFF), within the National Program of collection, management, and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy. INTEMARES surveys were funded by LIFE IP INTEMARES (Gestión integrada, innovadora y participativa de la Red Natura 2000 en el medio marino español) project, coordinated by the Biodiversity Foundation of the Ministry for the Ecological Transition and the Demographic Challenge and receiving financial support from the European Union's LIFE programme (LIFE15/IPE/ES/000012). AF is supported by BIODIV project: "Scientific and technical advice for the monitoring of marine biodiversity: protected marine areas and species of state competence (2022-2025)"; funded by the European Union – NextGenerationEU through the Recovery, Transformation and Resilience Plan; promoted by the Directorate General for Biodiversity, Forests and Desertification of the Ministry for Ecological Transition and the Demographic Challenge and CSIC, through the Spanish Institute of Oceanography (IEO). A C-S is supported by SosMed project (Improvement of the scientific and technical knowledge for the sustainability of demersal fisheries in the western Mediterranean Sea), funded by Next Generation European funds (Recovery, Transformation and Resilience Plan), from an agreement between the Spanish Ministry of Agriculture, Fisheries and Food and the Spanish National Research Council (CSIC), by means of the Spanish Institute of Oceanography (IEO).

References

Altuna, A., Poliseno, A., 2019. Taxonomy, genetics and biodiversity of Mediterranean deep-sea corals and cold-water corals. p. 121-156. In: *Mediterranean Cold-Water Corals: Past, Present and Future*. Orejas, C., Jimenez, C., (Eds). Springer, Cham.

Andrews, A.H., Stone, R.P., Lundstrom, C.C., De Vogelaere, A.P., 2009. Growth rate and age determination of bamboo corals from the northeastern Pacific Ocean using refined 210Pb dating. *Marine Ecology Progress Series*, 397, 173-185.

Angiolillo, M., Di Lorenzo, B., Izzi, A., Giusti, M., Nonnis, O. *et al*., 2024. Healthy assemblages of *Isidella elongata* unintentionally protected from trawling offshore of Asinara

Island (northwestern Sardinia, NW Mediterranean Sea). *Scientific Reports*, 14 (1), 1-18.

Bellan-Santini, D., Bellan, G., Bitar, G., Harmelin, J.-G., Pergent, G., 2002. *Handbook for interpreting types of marine habitat for the selection of sites to be included in the national inventories of natural sites of conservation interest*. RAC/SPA, Tunis, 169 p.

Bellan-Santini, D., 1985. The Mediterranean benthos: reflections and problems raised by a classification of the benthic assemblages. p. 19-48. In: *Mediterranean marine ecosystems*. Moraitou-Apostolopoulou, M., Kiortsis, V., (Eds). Plenum Press, New York.

Bellas, J., 2014. The implementation of the Marine Strategy Framework Directive: Shortcomings and limitations from the Spanish point of view. *Marine Policy*, 50 (Part A), 10-17.

Bertrand, J.A., Gil de Sola, L., Papaconstantinou, C., Relini, G., Souplet, A., 2002. The general specifications of the MEDITS surveys. *Scientia Marina*, 66 (S2), 9-17.

Bo, M., Bavestrello, G., Angiolillo, M., Calcagnile, L., Canese *et al*., 2015. Persistence of pristine deep-sea coral gardens in the Mediterranean Sea (SW Sardinia). *PLoS ONE*, 10 (3), 1-21.

Carbonara, P., Zupa, W., Follesa, M.C., Cau, A., Capezzuto, F. *et al*., 2020. Exploring a deep-sea vulnerable marine ecosystem: *Isidella elongata* (Esper, 1788) species assemblages in the western and central Mediterranean. *Deep Sea Research Part I: Oceanographic Research Papers*, 166, 103406.

Carbonara, P., Zupa, W., Follesa, M.C., Cau, A., Donnaloia, M. *et al*., 2022. Spatio-temporal distribution of *Isidella elongata*, a vulnerable marine ecosystem indicator species, in the southern Adriatic Sea. *Hydrobiologia*, 849 (21), 4837-4855.

Cartes, J.E., LoIacono, C., Mamouridis, V., López-Pérez, C., Rodríguez, P., 2013. Geomorphological, trophic and human influences on the bamboo coral *Isidella elongata* assemblages in the deep Mediterranean: To what extent does *Isidella* form habitat for fish and invertebrates? *Deep Sea Research Part I: Oceanographic Research Papers*, 76, 52-65.

Chimienti, G., Angeletti, L., Mastrototaro, F., 2018. Withdrawal behaviour of the red sea pen *Pennatula rubra* (Cnidaria: Pennatulacea). *European Zoological Journal*, 85 (1), 64-70.

Fabri, M.C., Pedel, L., Beuck, L., Galgani, F., Hebbeln, D. *et al*., 2014. Megafauna of vulnerable marine ecosystems in French Mediterranean submarine canyons: Spatial distribution and anthropogenic impacts. *Deep-Sea Research II*, 104, 184-207.

FAO, 2009. *Management of Deep-Sea Fisheries in the High Seas.* Rome (Italy), 2-6 March, 2009, 7 pp.

Farriols, M.T., Ordines, F., Somerfield, P.J., Pasqual, C., Hidalgo M. *et al*., 2017. Bottom trawl impacts on Mediterranean demersal fish diversity: Not so obvious or are we too late?. *Continental Shelf Research*, 137, 84-102.

Farriols, M.T., Serrat, A., Ordines, F., Frank, A., Parejo, A. *et al*., 2024. Improving the sampling efficiency of benthic species and communities using complementary gears: beam trawl and bottom trawl. *Mediterranean Marine Science*, 25 (2), 511-531.

Fosså, J.H., Mortensen, P.B., Furevik, D.M., 2002. The deep-water coral *Lophelia pertusa* in Norwegian waters: distribution and fishery impacts. *Hydrobiologia*, 471, 1-12.

García-Rodríguez, M., Abelló, P., Fernández, A., Esteban, A., 2011. Demersal Assemblages on the Soft Bottoms off the Catalan-Levante Coast of the Spanish Mediterranean. *Journal of Marine Biology*, 2011, 1-16.

García-Ruiz, C., Lloris, D., Rueda, J.L., García-Martínez, M.C., Gil de Sola, L., 2015. Spatial distribution of ichthyofauna in the northern Alboran Sea (western Mediterranean). *Journal of Natural History*, 49 (19-20), 1191-1224.

Georges, V., Vaz, S., Carbonara, P., Fabri, M.C., Fanelli, E. *et al*., 2024. Mapping the habitat refugia of *Isidella elongata* under climate change and trawling impacts to preserve Vulnerable Marine Ecosystems in the Mediterranean. *Scientific Reports*, 14 (1), 6246.

Gerovasileiou, V., Smith, C.J., Kiparissis, S., Stamouli, C., Dounas, C. *et al*., 2019. Updating the distribution status of the critically endangered bamboo coral *Isidella elongata* (Esper, 1788) in the deep Eastern Mediterranean Sea. *Regional Studies in Marine Science*, 28, 100610.

GFCM, 2023. *Report of the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-Essential Fish Habitats)*. GFCM, Rome, 41 pp.

GFCM, 2009. *Criteria for the identification of sensitive habitats of relevance for the management of priority species. Meeting of the Sub-Committee on Marine Environment and Ecosystems (SCMEE).* Malaga, Spain, 30 November–3 December 2009, 3 pp.

GFCM, 2019. *Resolution GFCM/43/2019/6 on the establishment of a set of measures to protect vulnerable marine ecosystems formed by cnidarian (coral) communities in the Mediterranean Sea*. GFCM, Rome, 7 pp.

GFCM, 2022. *Report of the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats (WGVME-Essential Fish Habitats)*. GFCM, Rome, 31 pp.

González-Irusta, J.M., Cartes, J.E., Punzón, A., Díaz, D., De Sola, L.G. *et al*., 2022. Mapping habitat loss in the deep-sea using current and past presences of *Isidella elongata* (Cnidaria: Alcyonacea). *ICES Journal of Marine Science*, 79 (6), 1888-1901.

Grasshoff, M., 1988. Die Gorgonaria der expeditionen von Travailleur 1880–1882 und Talisman 1883 (Cnidaria, Anthozoa). *Zoosystema*, 8, 9-38.

Grinyó, J., Lo Iacono, C., Pierdomenico, M., Conlon, S., Corbera, G. *et al*., 2020. Evidences of human impact on megabenthic assemblages of bathyal sediments in the Alboran Sea (western Mediterranean). *Deep-Sea Research Part I: Oceanographic Research Papers*, 165, 103369.

Ingrassia, M., Martorelli, E., Bosman, A., Chiocci, F.L., 2019. *Isidella elongata* (Cnidaria: Alcyonacea): First report in the Ventotene Basin (Pontine Islands, western Mediterranean Sea). *Regional Studies in Marine Science*, 25, 100494.

Jennings, S., Lancaster, J., Woolmer, A., Cotter, J., 1999. Distribution, diversity and abundance of epibenthic fauna in the North Sea. *Journal of the Marine Biological Association of the United Kingdom*, 79, 385-399.

Laubier, L., Emig, C.C., 1993. La faune benthique profonde de Méditerranée. p. 397-428. In: *Symposium Mediterranen Seas 2000*. Della Croce, F.R., (Ed). Istituto di Scienze Ambientali Marine, S. Margherita Ligure.

Lauria, V., Garofalo, G., Fiorentino, F., Massi, D., Milisenda, G. *et al*., 2017. Species distribution models of two critically endangered deep-sea octocorals reveal fishing impacts on vulnerable marine ecosystems in central Mediterranean Sea. *Scientific Reports*, 7 (1), 1-14.

Massutí, E., Sánchez-Guillamón, O., Farriols, M.T., Palomino, D., Frank, A. *et al.*, 2022. Improving Scientific Knowledge of Mallorca Channel Seamounts (western Mediterranean) within the Framework of Natura 2000 Network. *Diversity*, 14 (1), 4.

Massutí, E., Reñones, O., 2005. Demersal resource assemblages in the trawl fishing grounds off the Balearic Islands (western Mediterranean). *Scientia Marina*, 69 (1), 167-181.

Mastrototaro, F., Chimienti, G., Acosta, J., Blanco, J., García, S. *et al*., 2017. *Isidella elongata* (Cnidaria: Alcyonacea) facies in the western Mediterranean Sea: visual surveys and descriptions of its ecological role. *The European Zoological Journal*, 84, 209-225.

Maurin, C., 1962. Etude des fonds chalutables de la Méditerranée occidentale (écologie et pêche) «Président-Théodore-Tissier» 1957 à 1960 et «Thalassa» 1960 et 1961. *Revue des Travaux de l'Institut des Pêches Maritimes*, 26, 163-218.

Maurin, C., 1968. Ecologie ichthyologique des fonds chalutables atlantiques (de la Baie Ibero-Marocaine a la Mauritanie) et de la Mediterranee occidentale. *Revue des Travaux de l'Institut des Pêches Maritimes*, 32, 1-144.

Maynou, F., Cartes, J.E., 2011. Effects of trawling on fish and invertebrates from deep-sea coral facies of *Isidella elongata* in the western Mediterranean. *Journal of the Marine Biological Association of the United Kingdom*, 92 (7), 1501-1507.

Mytilineou, C., Smith, C.J., Anastasopoulou, A., Papadopoulou, K.N., Christidis, G. *et al*., 2014. New cold-water coral occurrences in the Eastern Ionian Sea: Results from experimental long line fishing. *Deep-Sea Research Part II: Topical Studies in Oceanography*, 99, 146-157.

Oliver, P., 1993. Analysis of fluctuations observed in the trawl fleet landings of the Balearic Islands. *Scientia Marina*, 57, 219-227.

Otero, M.M., Numa, C., Bo, M., Orejas, C., Garrabou, J. *et al*., 2017. *Overview of the conservation status of Mediterranean anthozoans*. IUCN, Malaga, x+73 pp.

Palmer, M., Quetglas, A., Guijarro, B., Moranta, J., Ordines, F. *et al*., 2009. Performance of artificial neural networks and discriminant analysis in predicting fishing tactics from multispecific fisheries. *Canadian Journal of Fisheries and Aquatic Sciences*, 66 (2), 224-237.

Pérès, J.M., Picard, J.,1964. Nouveau manuel de bionomie benthique de la Méditerranée. *Recueil des Travaux de la Station Marine d'Endoume*, 31, 1-37.

Pierdomenico, M., Russo, T., Ambroso, S., Gori, A., Martorelli, E. *et al*., 2018. Effects of trawling activity on the bamboo-coral *Isidella elongata* and the sea pen *Funiculina quadrangularis* along the Gioia Canyon (western Mediterranean, southern Tyrrhenian Sea). *Progress in Oceanography*, 169, 214-226.

Reiss, H., Kröncke, I., Ehrich, S., 2006. Estimating the catching efficiency of a 2-m beam trawl for sampling epifauna by removal experiments. *ICES Journal of Marine Science*, 63 (8), 1453-1464.

Relini, G., Peirano, A., Tunesi, L., 1986. Osservazioni sulle comunità dei fondi strascicabili del Mar Ligure Centro-Orientale. *Bollettino Degli Istituti Di Biologia Della R. Università Di Genova*, 52, 139-161.

Rogers, A.D., 1999. The biology of *Lophelia pertusa* and other deep-water reef forming corals and impacts from human activities. *International Review of Hydrobiology*, 84, 315-406.

Rueda, J.L., Urra, J., Aguilar, R., Angeletti, L., Bo, M. *et al*., 2019. Cold-water coral associated fauna in the Mediterranean Sea and adjacent areas. p. 295-334. In: *Mediterranean Cold-Water Corals: Past, Present and Future*. Orejas, C., Jimenez, C., (Eds). Springer, Cham.

Salomidi, M., Gerovasileiou, V., Stamouli, C., Drakopoulou, V., Otero, M.M. *et al*., 2022. Deep-sea vulnerable benthic fauna. p. 123-144. In: *Deep-sea Atlas of the Eastern Mediterranean Sea.* Otero, M., Mytilineou, C. (Eds). IUCN-HCMR DeepEastMed Project, IUCN, Gland and Malaga.

Sardà, F., Calafat, A., Flexas, M.M., Tselepides, A., Canals, M. *et al*., 2004. An introduction to Mediterranean deep-sea biology. *Scientia Marina*, 68 (S3), 7-38.

Sherwood, O.A., Edinger, E.N., 2009. Ages and growth rates of some deep-sea gorgonian and antipatharian corals of Newfoundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences*, 66, 142-152.

Smith, C.J., Gerovasileiou, V., Mytilineou, C., Jimenez, C., Papadopoulou, K. *et al*., 2022. Revisiting underwater surveys to uncover sites of conservation interest. p. 146-171. In: *Deep-sea Atlas of the Eastern Mediterranean Sea*. Otero, M., Mytilineou, C. (Eds). IUCN-HCMR DeepEastMed Project, IUCN, Gland and Malaga.

Spedicato, M.T., Massutí, E., Mérigot, B., Tserpes, G., Jadaud, A. *et al*., 2019. The MEDITS trawl survey specifications in an ecosystem approach to fishery management. *Scientia Marina*, 83 (S1), 9-20.

Stamouli, C., Zenetos, A., Kallianotis, A., Voultsiadou, E., 2022. Megabenthic invertebrate diversity in Mediterranean trawlable soft bottoms: a synthesis of current knowledge. *Mediterranean Marine Science*, 23 (3), 447-459.

Standaert, W., Puerta, P., Mastrototaro, F., Palomino, D., Aguilar, R. *et al*., 2023. Habitat suitability models of a critically endangered cold-water coral, *Isidella elongata*, in the Mallorca Channel. *Thalassas: An International Journal of Marine Sciences*, 39 (2), 587-600.

STECF, 2006. *SGMED-06-01 sub-group meeting on Sensitive and Essential Fish Habitats in the Mediterranean*. Rome (Italy), 6-10 March 2006, 48 pp.

Supplementary Data

The following supplementary information is available online for the article:

Table S1. Abundance (n/250 m^2) and biomass (g/250 m^2) of epibenthic species estimated through beam trawl during the CIRCA-LEBA-1122 scientific survey, in an area adjacent to the station south-eastern Menorca (mean depth of the sample was 659 m) and during the CIRCA-LEBA-1121 scientific survey, in the station at the Ibiza Channel (mean depth of the sample was 557 m) where *Isidella elongata* was detected.

Table S2. Mean abundance (n/km^2) and biomass (g/km^2) of nekto-benthic species estimated with the experimental bottom trawl GOC-73 during the MEDITS scientific surveys from 2021 and 2022 in the fishing ground adjacent to the station south-eastern Menorca, where *Isidella elongata* was detected. The mean depth of these samples was 670 m.
Table S3. Abundance (n/30 min) and biomass (g/30 min) of nekto-benthic species captured together with *Isidella elongata* in two commercial bottom trawl hauls conducted on June 30th 2021 in south-eastern Menorca (in commercial haul 1 the depth ranged from 398 to 512 m) and on June 2nd 2022 in south-eastern Menorca (in commercial haul 2 the depth ranged from 480 to 505 m).
Table S4. Mean abundance (n/km^2) and biomass (g/km^2) of nekto-benthic species estimated with the experimental bottom trawl GOC-73 during the MEDITS scientific surveys from 2021 and 2022 at the station in the Ibiza Channel, where *I. elongata* was detected. The mean depth of these samples was 582 m.
Table S5. Mean abundance (n/250 m^2) and biomass (g/250 m^2) of epibenthic species estimated with a beam trawl during the INTEMARES scientific surveys from 2019 and 2020 at stations in Ses Olives seamount (Mallorca Channel) where *Isidella elongata* was detected. The mean depth of the samples was 664 m.