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FRANCESCO TIRALONGO, GABRIELE La MESA, FRANCESCO PALADINI De MENDOZA, FILIPPO MASSARI, ERNESTO AZZURRO

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Underwater photo contests to complement coastal fish inventories: results from two Marine Protected Areas in the Mediterranean

Francesco TIRALONGO[1,2], Gabriele La MESA[3], Francesco Paladini De MENDOZA[1], Filippo MASSARI[4], Ernesto AZZURRO[5]

[1] Department of Biological, Geological and Environmental Sciences, University of Catania, Italy
[2] Ente Fauna Marina Mediterranea, Avola, Italy
[3] Institute for Environmental Protection and Research (ISPRA), Rome, Italy
[4] Federazione Italiana Pesca Sportiva e Attività Subacquee (FIPSAS), Catania, Italy
[5] National Research Council, Institute of Marine Biological Resources and Biotechnologies (CNR IRBIM), Ancona, Italy; Stazione Zoologica Anton Dohrn, Napoli, Italy

Corresponding author: francesco.tiralongo@unict.it

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Abstract

Marine Protected Areas (MPAs) are particularly useful to assess fish assemblages and to obtain reliable fish inventories. In this study we demonstrate the value of underwater photo contests as complementary tools to achieve these goals. We examined 3513 underwater pictures taken by free divers and scuba divers participating in two photo contests organized by the Italian Federation of Sport Fishing and Underwater Activities (FIPSAS). The competitions were held in the Italian MPAs of Punta Campanella (Tyrrhenian Sea; 2017) and Capo Rizzuto (Ionian Sea; 2018). Altogether, 97 fish species, 89 at Punta Campanella and 75 at Capo Rizzuto, were identified in different coastal habitats (depth range, 0-19 m). Their number was considerably higher than the one obtained with other census techniques and was close to the maximum number of species described at the two locations, as shown by accumulation curves. Significant differences in species richness were demonstrated at the level of both location and habitat type. The reasons for such differences are discussed along with the advantages and limitations of underwater photo contests as a participatory tool to obtain regular updates on coastal fish inventories in MPAs and in wider areas.

Keywords: Mediterranean Sea; underwater photography; coastal fish; BioBlitz; cryptobenthic fish.

Introduction

Coastal ecosystems are among the most productive yet vulnerable ecosystems in the world. Fisheries, pollution, urbanization and other anthropogenic drivers have the potential to affect them severely; however, the institution of marine protected areas (MPAs) goes a long way towards mitigating their adverse effects (Sainsbury & Sumaila, 2003; Lester *et al*., 2009).

An increasing body of literature has been addressing MPAs and their biodiversity (Piazzi *et al*., 2012; Blowes *et al*., 2020). In this context, monitoring fish diversity has special relevance, since accurate inventories and assessments of fish communities are vital to devise protection measures (MacNeil *et al*., 2008) and to evaluate ecosystem changes (Seytre & Francour, 2008; Azzurro *et al*., 2019; Wang *et al*., 2015). Monitoring fish communities requires a considerable effort for data collection and analysis. Visual census is a common and useful method to evaluate fish abundance and diversity (La Mesa & Vacchi, 2003). Furthermore, being a non-destructive method, unlike fishing, it is particularly appropriate to monitor MPAs (Prato *et al*., 2017) and to assess the effects of conservation measures.

We report the results obtained by analysing the pictures of two underwater photo contests. Such competitions generate valuable information on the richness of marine coastal fish assemblages and have recently been proposed as a useful tool to complement scientific assessments (Gordoa *et al*., 2018). In Italy, an annual photo contest is organized by FIPSAS (Italian Federation of Sport Fishing and Underwater Activities), generally in an MPA, at a different location each year. Participants are experienced underwater photographers with a good knowledge of Mediterranean coastal fish species and habitats. Since higher scores are assigned to those who photograph the highest number of fish species (Gordoa *et al*., 2018), participants make very accurate searches, which results in detection of a considerable number of taxa, including some species that are elusive due to their cryptic behaviour and/or small size (Willis, 2001; Kovacic *et al*., 2012).

In this study, the data collected from the photographs submitted to the FIPSAS contests held in the Capo Rizzuto (2017) and Punta Campanella (2018) MPAs were analysed to assess differences in their assemblage composition and to demonstrate the value of this cost-effective and non-destructive method in complementing scientific inventories.

Materials and Methods

Study area

The study areas were the MPAs of Capo Rizzuto (northern Ionian Sea, eastern Italy) and of Punta Campanella (central Tyrrhenian Sea, western Italy) (Fig. 1), for which data on coastal fish communities are very scarce (Guidetti *et al*., 2008) and, to the best of our knowledge, published inventories are not available. The two areas are characterized by different bottom features. At Capo Rizzuto, the largely mixed bottom hosting sand, rocks and patches of *Posidonia oceanica* gradually dips from 0 to 15 m; at the centre of the MPA, boulders are found at a depth of 0-2 m. At Punta Campanella the bottom depth reaches 30 m and is more heterogeneous: in the central zone, at 0-8 m, it is gravelly with small scattered rocks; at 8-13 m it is characterized by a steep area with a rocky bottom, whereas at 13-30 m the bottom is a mix of sand, scattered patches of *P. oceanica* and steep rocks. On the sides of the central area, two artificial reefs are found from 0 to 15 m of depth. The two areas share five habitat types: RB (rocky bottom), MB (mixed bottom), OW (open water), PO (*Posidonia* bed) and SB (sandy bottom).

Data collection

The contest methodology and rules were those adopted in similar photo contests in Spain (Gordoa *et al*., 2018). In brief, participants can take a maximum of 70 pictures; a single photograph *per* species is allowed, the higher the number of fish species pictured the higher the score assigned. During the contest (15–16th September 2017 at Capo Rizzuto and 11–12th October 2018 at Punta Campanella), photographs were taken both by free divers and scuba divers and the number of participants was equally distributed between the categories. At variance with the Spanish contests, to avoid misidentifications, hence incorrect evaluation of fish diversity, an expert ichthyologist (FT) verified the identification of the species submitted by each participant during species validation.

The contests began at 9:00 am and ended at 1:00 pm each day (8 hours overall). Participants were 39 at Capo Rizzuto and 37 at Punta Campanella. Altogether, 3513 photographs were analysed; nearly all specimens were identified at the species level; low photograph quality prevented identification in 41 cases. The depth and specific habitat features of each photograph were recorded by interviewing the participants as they submitted their pictures.

Data analysis

Statistical analysis was applied to the pictures taken in the depth range shared by both MPAs (0-19 m);

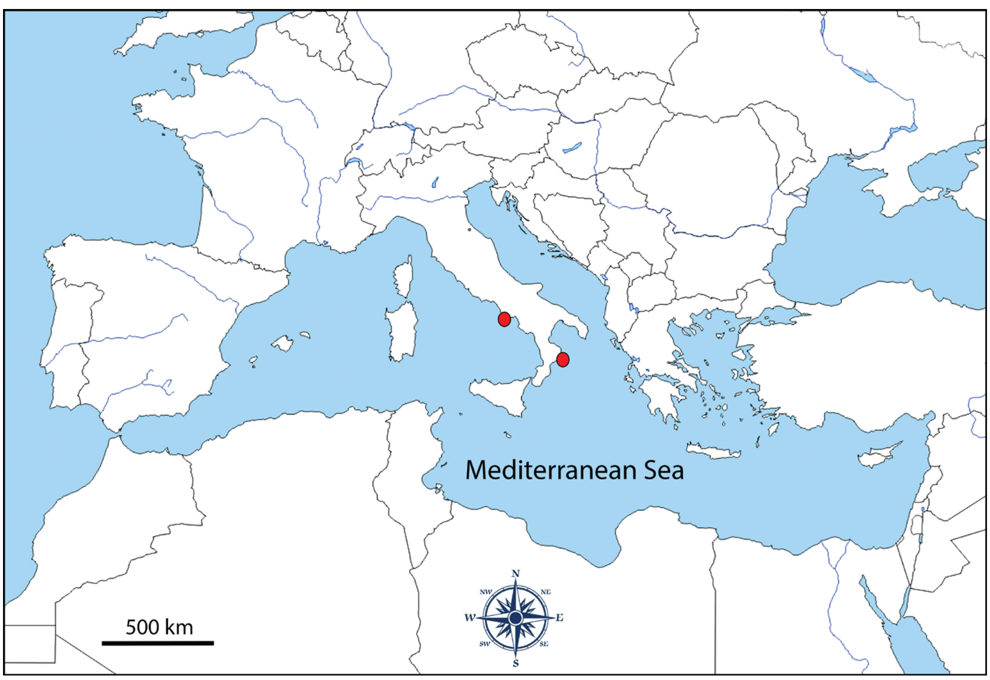

Fig. 1: Study areas: the MPA of Punta Campanella (Tyrrhenian Sea, western Italy) and the MPA of Capo Rizzuto (Ionian Sea, eastern Italy).

those taken beyond 19 m were excluded. All photographs relating to the same MPA, habitat and depth were considered as replicates of the same experimental unit. The individuals of each species photographed by the different divers within each replicate were pooled. Before running the analyses, to ensure comparability among habitat types and MPAs, abundance data were normalized. Within each experimental unit, the number of individuals of each species was divided by the total number of fish, to calculate species relative abundance.

A common approach to determine whether the sample size is sufficient to represent a community is based on species accumulation curves (Gotelli & Colwell, 2001). Thus, curves were generated to evaluate the relationship between sample size and number of species observed at each location and in each habitat type within each location.

Multivariate differences in the species composition of fish assemblages among habitat types were evaluated by species relative abundance. The effect of habitat type was assessed by constrained ordination using Canonical Analysis of Principal coordinates (CAP) based on Bray-Curtis dissimilarities (Anderson & Willis, 2003). The canonical correlations were tested using 4999 random permutations of the raw data. Distinctness of groups was assessed using leave-one-out allocation success (Anderson & Robinson, 2003). The product-moment correlations of each species with the two canonical discriminant axes (ρ1 and ρ2) were calculated, and only those considered as valuable (with relatively strong correlations, *i.e.* $\sqrt{\rho1^2 + \rho2^2} > 0.50$) were included in the plot.

Univariate differences in fish species richness (S) and diversity (H'; according to the Shannon-Wiener index) between locations and among habitat types were assessed in the same dataset by one-way permutational analysis of variance (Permutational ANOVA) (Anderson, 2001a; McArdle & Anderson, 2001). The experimental design consisted of two factors, Location (2 levels, fixed) and Habitat type (5 levels, fixed). The analysis was based on a Bray-Curtis similarity matrix using 4999 unrestricted permutations of raw data (Anderson, 2001b).

All statistical analyses were made using PRIMER v6 + PERMANOVA (Plymouth Marine Laboratory, UK).

Results

Altogether, 101 fish species belonging to 28 families were photographed and taxonomically identified (Table 1). Of these, 97 species (89 at Punta Campanella and 75 at Capo Rizzuto) were recorded at a depth of 0-19 m and were retained for the analysis. Species distribution according to the different habitats was similar in the two MPAs (Fig. 2). Though not entirely asymptotic, all cumulative curves (except for MB habitats at Punta Campanella) approached an asymptote, suggesting that

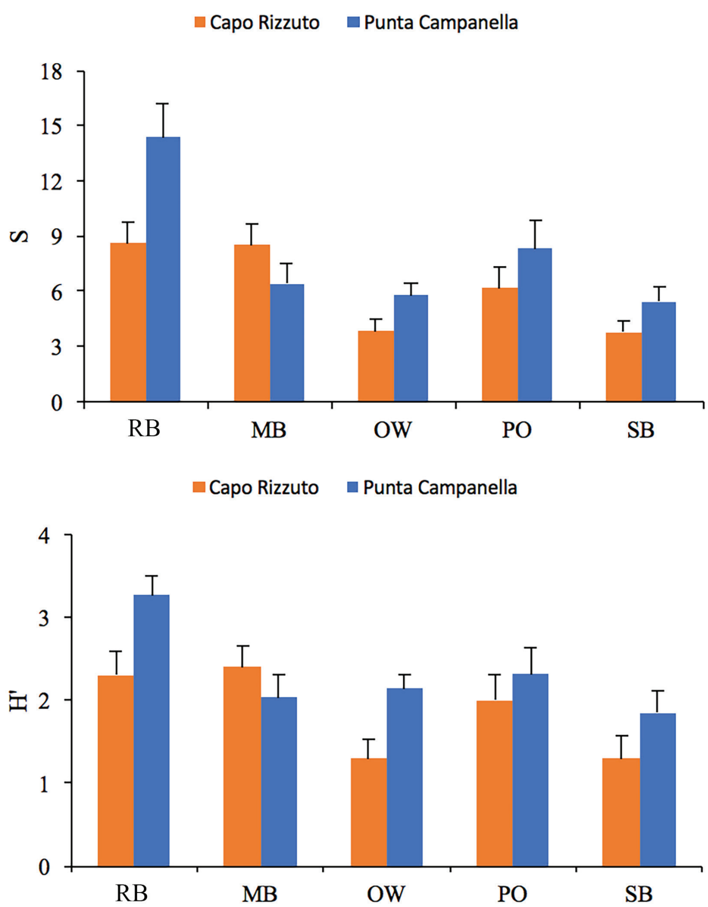

Fig. 2: Mean (± S.E.) richness (S) and diversity (H') of the fish species observed in each MPA and habitat type (RB=rocky bottom; MB=mixed bottom; OW=open water; PO=*Posidonia* bed; SB=sandy bottom).

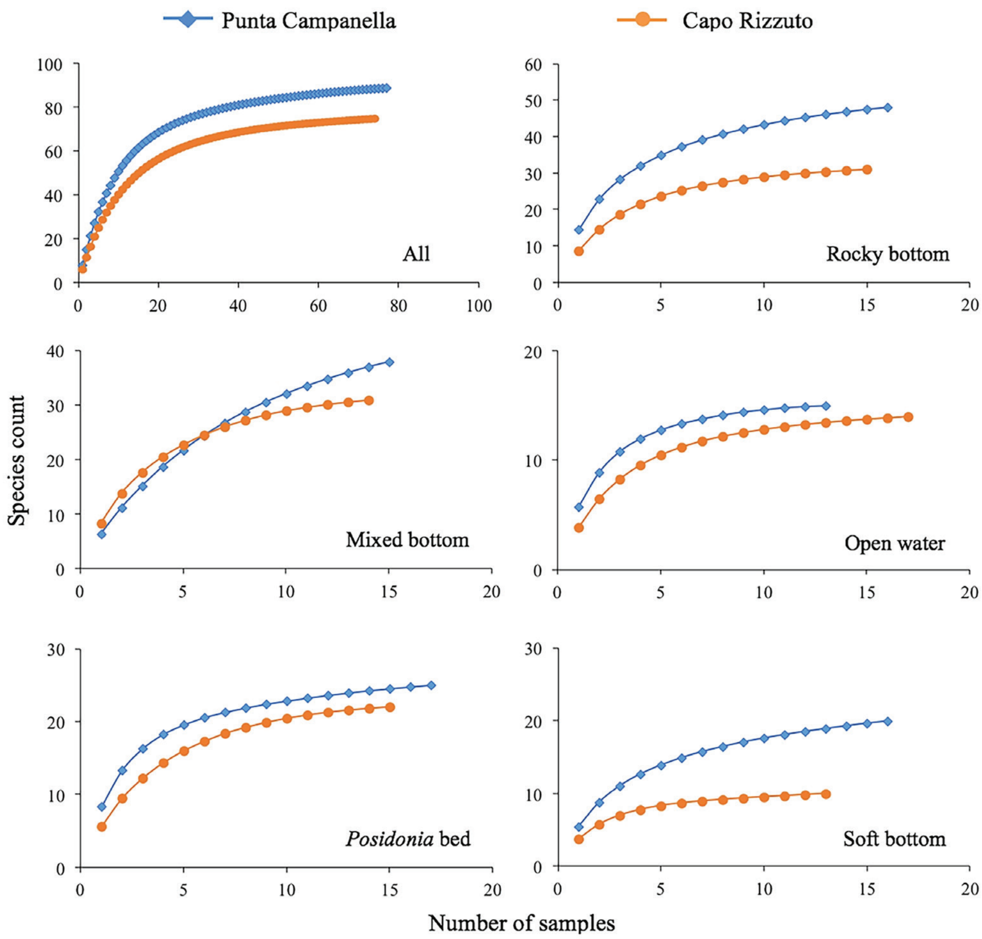

Fig. 3: Mean species accumulation curves calculated in each MPA according to the different habitat types. The accumulation curves are based on 999 random selections of replicate samples.

the sampling effort was very effective but not exhaustive in estimating total species richness (Fig. 3). The species accumulation rate in the lower part of the curves was always higher at Punta Campanella than at Capo Rizzuto, except in MB habitats.

CPA highlighted a clear segregation of the sampling units belonging to different habitat types, due to differences in fish assemblage composition (squared canonical correlations $\delta_1^2 = 0.96$ and $\delta_2^2 = 0.94$; $P = 0.0002$; 97.3% of sampling units correctly classified) (Fig. 4). Along the first axis, samples photographed in RB habitats were clearly discriminated from those pictured in MB, PO and SB habitats. Along the second axis, all these sample groups were separated from the sampling units recorded in OW habitats.

Three species groups provided the largest contribution to the pattern observed in the CAP plot. One group of 4 species – *Atherina boyeri* Risso 1810*, Oblada melanura* (Linnaeus, 1758), *Boops boops* (Linnaeus, 1758) and *Chelon labrosus* (Risso, 1827) – showed a negative correlation with the second axis (*i.e.*, arrows pointing to the lower side of the plot) and typically occurred in OW. A group of 5 species – *Bothus podas* (Delaroche, 1809), *Xyrichtys novacula* (Linnaeus, 1758), *Trachinus draco* (Linnaeus, 1758), *Synodus saurus* (Linnaeus, 1758) and *Lithognathus mormyrus* (Linnaeus, 1758) – plotted in the upper left quadrant due to their strong preferences for SB habitats. The species of the third group showed positive correlations with both axes (*i.e.* arrows pointing to the upper right quadrant) and were exclusively – *Apogon imberbis* (Linnaeus, 1758), *Muraena helena* Linnaeus, 1758 and *Parablennius gattorugine* (Linnaeus, 1758) – or preferentially - *e.g., Scorpaena porcus* (Linnaeus, 1758), *Scorpaena maderensis* Valenciennes, 1833 and *Epinephelus marginatus* (Lowe, 1834) – recorded in RB habitats.

The patterns of S and H' variation across locations and habitat types are reported in Figure 2. The values of S and H' were higher at Punta Campanella than at Capo Rizzuto in each habitat type except MB. The results of permutational ANOVA indicated significant S differences only among habitats (Table 2). The S values of RB and MB habitats were significantly higher than those reported in OW and SB habitats. Significant H' differences were detected at the level of both location and habitat type (Table 2). Pairwise comparisons between locations showed that H' value at Punta Campanella was significantly higher than at Capo Rizzuto. Comparisons applied between habitat evidenced that H' value of rocky bottom was significantly higher than those recorded in open water, *Posidonia oceanica* bed and sandy bottom.

Small benthic and cryptobenthic fish, such as blennies

Table 1. List of taxa and number of specimens photographed during the photo competitions held in the MPAs of Capo Rizzuto (15-16th September 2017) and Punta Campanella (11-12th October 2018).

Family	Capo Rizzuto	Punta Campanella	Total
Apogonidae	**38**	**37**	**75**
Apogon imberbis	38	37	75
Atherinidae	**39**	**35**	**74**
Atherina boyeri	30	22	52
Atherina hepsetus	6	12	18
Atherina sp.	3	1	4
Belonidae	**27**	**19**	**46**
Belone belone	27	19	46
Blenniidae	**151**	**281**	**432**
Aidablennius sphynx	23	27	50
Coryphoblennius galerita	2	9	11
Lipophrys trigloides	15	12	27
Microlipophrys canevae	6	26	32
Microlipophrys dalmatinus		2	2
Microlipophrys nigriceps	5	18	23
Parablennius gattorugine	21	17	38
Parablennius incognitus	22	22	44
Parablennius pilicornis		37	37
Parablennius rouxi	3	30	33
Parablennius sanguinolentus	29	35	64
Parablennius tentacularis	1		1
Parablennius zvonimiri	24	29	53
Scartella cristata		17	17
Bothidae	**32**	**37**	**69**
Arnoglossus thori		1	1
Bothus podas	32	36	68
Callionymidae	**11**		**11**
Callionymus pusillus	10		10
Callionymus sp.	1		1
Carangidae	**61**	**46**	**107**
Caranx crysos	24	10	34
Seriola dumerili	1		1
Trachinotus ovatus	36	35	71
Trachurus sp.		1	1
Clupeidae	**3**	**9**	**12**
Sardina pilchardus	3	9	12
Congridae	**1**	**11**	**12**
Ariosoma balearicum	1		1
Conger conger		11	11
Engraulidae		**1**	**1**
Engraulis encrasicolus		1	1
Gobiidae	**91**	**143**	**234**
Gobiidae	1	1	2
Gobius incognitus		28	28
Gobius cobitis	6	2	8
Gobius cruentatus		11	11
Gobius fallax	8	21	29
Gobius geniporus	6	28	34
Gobius incognitus	31	2	33
Gobius niger		1	1
Gobius paganellus	2	12	14
Gobius roulei		17	17
Gobius sp.	1		1
Gobius xanthocephalus		1	1

Continued

Table 1 continued

Family	Capo Rizzuto	Punta Campanella	Total
Pomatoschistus bathi		14	14
Pomatoschistus marmoratus	31		31
Pseudaphya ferreri		2	2
Labridae	**253**	**358**	**611**
Coris julis	39	36	75
Labrus merula	2	2	4
Labrus sp.	3		3
Labrus viridis		1	1
Symphodus cinereus	33	28	61
Symphodus doderleini	7	24	31
Symphodus mediterraneus	6	34	40
Symphodus melanocercus		32	32
Symphodus ocellatus	19	27	46
Symphodus roissali	33	37	70
Symphodus rostratus	34	36	70
Symphodus tinca	37	37	74
Thalassoma pavo	39	37	76
Xyrichtys novacula	6	30	36
Moronidae	**31**	**37**	**68**
Dicentrarchus labrax	30	37	67
Dicentrarchus sp.	1		1
Mugilidae	**72**	**54**	**126**
Chelon labrosus	10	9	19
Liza aurata	14	2	16
Mugilidae	12	7	19
Oedalechilus labeo	36	36	72
Mullidae	**39**	**37**	**76**
Mullus barbatus	2	2	4
Mullus surmuletus	37	35	72
Muraenidae	**12**	**23**	**35**
Muraena helena	12	23	35
Ophichthidae		**3**	**3**
Ophisurus serpens		3	3
Pomacentridae	**39**	**36**	**75**
Chromis chromis	39	36	75
Scaridae	**35**	**2**	**37**
Sparisoma cretense	35	2	37
Sciaenidae		**4**	**4**
Sciaena umbra		4	4
Scorpaenidae	**49**	**81**	**130**
Scorpaena maderensis	26	30	56
Scorpaena notata	1	24	25
Scorpaena porcus	22	25	47
Scorpaena scrofa		2	2
Serranidae	**125**	**178**	**303**
Anthias anthias		12	12
Epinephelus aeneus		3	3
Epinephelus caninus		1	1
Epinephelus costae	31	24	55
Epinephelus marginatus	17	29	46
Mycteroperca rubra		1	1
Serranus cabrilla	38	38	76
Serranus hepatus		34	34
Serranus scriba	39	36	75

Continued

Table 1 continued

Family	Capo Rizzuto	Punta Campanella	Total
Sparidae	**367**	**343**	**710**
Boops boops	36	25	61
Dentex dentex	6		6
Diplodus annularis	35	37	72
Diplodus puntazzo	35	30	65
Diplodus sargus	39	37	76
Diplodus vulgaris	37	37	74
Lithognathus mormyrus	39	28	67
Oblada melanura	38	35	73
Pagellus acarne	1		1
Pagellus erythrinus	1		1
Pagrus pagrus	2	19	21
Spicara maena	24	22	46
Spicara smaris	19	8	27
Sarpa salpa	39	37	76
Spondyliosoma cantharus	16	28	44
Sphyraenidae	**9**	**4**	**13**
Sphyraena sp.	9		9
Sphyraena viridensis		4	4
Syngnathidae		**3**	**3**
Hippocampus guttulatus		2	2
Syngnathus typhle		1	1
Synodontidae	**6**	**36**	**42**
Synodus saurus	6	36	42
Trachinidae	**33**	**20**	**53**
Trachinus draco	33	20	53
Tripterygiidae	**70**	**82**	**152**
Tripterygion delaisi	12	12	24
Tripterygion melanurum	18	33	51
Tripterygion tripteronotum	39	38	77
Total number	**1593**	**1920**	**3513**

Table 2. Results of permutational ANOVA (PERMANOVA) testing for differences in species richness and diversity among locations and habitat types. The test was performed on the basis of Bray-Curtis similarities using 4999 unrestricted permutations of raw data. *P<0.05, ** P < 0.01, *** P < 0.001, ns: not significant (P > 0.05).

Effect	df	Richness		Diversity	
		MS	Pseudo-F	MS	Pseudo-F
Location (L)	1	2373.7	22.3ns	686.2	57.0*
Habitat (H)	4	5175.9	48.7***	454.2	37.7**
L x H	4	1764.0	16.6ns	204.8	17.0ns
Residual	140	1062.8		120.4	
Total	149				

(Blenniidae) and gobies (Gobiidae), and bentho-pelagic species such as Labridae and Serranidae, were recorded in higher number at Punta Campanella (Table 1). Furthermore, the highest level of biodiversity was seen in RB habitats at Punta Campanella, whereas MB and RB habitats shared the highest biodiversity values and levels at Capo Rizzuto.

The species recorded most frequently included *A. imberbis*, *B. podas*, *Chromis chromis* (Linnaeus, 1758), *Coris julis* (Linnaeus, 1758), *Mullus surmuletus* Linnaeus, 1758, *O. melanura*, *Oedalechilus labeo* (Cuvier, 1829), *Sarpa salpa* (Linnaeus, 1758), *S. cabrilla*, *Serranus scriba* (Linnaeus, 1758), *Symphodus roissali* (Risso, 1810), *Symphodus rostratus* (Bloch, 1791), *S. tinca*, *Thalassoma pavo* (Linnaeus, 1758), *Trachinotus ovatus* (Linnaeus, 1758), *Tripterygion tripteronotum* (Risso, 1810) and all the species of the genus *Diplodus* Rafinesque, 1810 except *D. cervinus*, *i.e., Diplodus annularis* (Linnaeus,

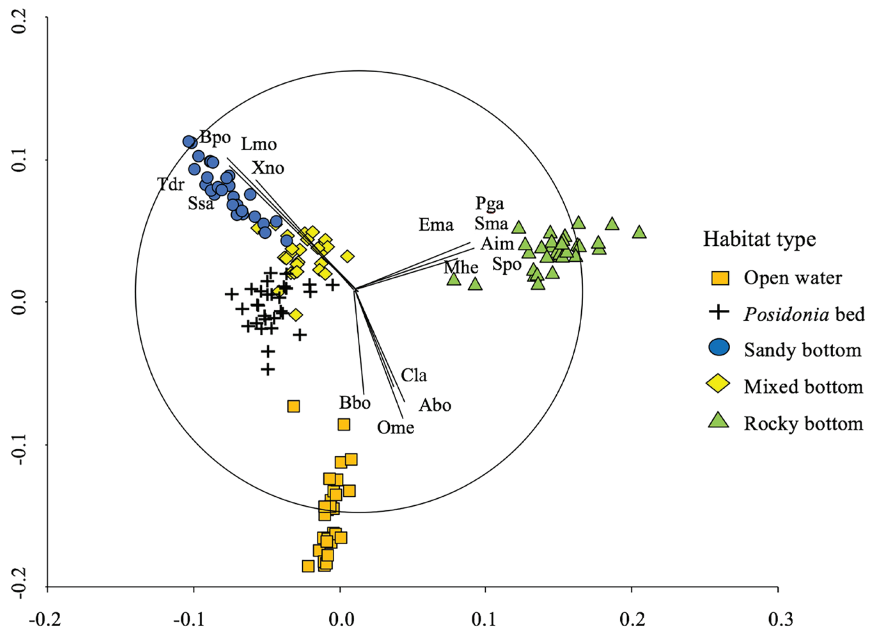

Fig. 4: Scatter plot of the canonical discriminant analysis of the effects of habitat type. Species contribution to the patterns is shown with directional vectors. See the Table 1 for species codes: the first letter indicates the genus, the second and third letters indicate the specific epithet (example: Ome = *Oblada melanura*).

1758), *Diplodus puntazzo* (Walbaum, 1792), *Diplodus sargus* (Linnaeus, 1758) and *Diplodus vulgaris* (Geoffroy Saint-Hilaire, 1817) (Table 1). Other species, such as *Serranus hepatus* (Linnaeus, 1758) and *Sparisoma cretense* (Linnaeus, 1758), were photographed by most participants in a single area (Table 1). However, some were markedly more abundant in or exclusive to one MPA. For instance, *A. boyeri*, *Belone belone* (Linnaeus, 1760), *Caranx crysos* (Mitchill, 1815), *Pomatoschistus marmoratus* (Risso, 1810) and *Sparisoma cretense* (Linnaeus, 1758) were more abundant at Capo Rizzuto, whereas *Microlipophrys canevae* (Vinciguerra, 1880), *Microlipophrys nigriceps* (Vinciguerra, 1883), *Parablennius pilicornis* (Cuvier, 1829), *Scartella cristata* (Linnaeus, 1758), *Gobius incognitus* Kovačić & Šanda, 2016, *Gobius cruentatus* Gmelin, 1789, *Gobius roulei* de Buen, 1928, *Symphodus doderleini* Jordan, 1890, *Symphodus mediterraneus* (Linnaeus, 1758), *Symphodus melanocercus* (Risso, 1810), *Scorpaena notata* Rafinesque, 1810, *E. marginatus*, *S. hepatus* and *Pagrus pagrus* (Linnaeus, 1758) were more abundant at Punta Campanella.

Discussion

Our study confirms that underwater photo contests – where skilled photographers compete to portray the highest number of species in a designated area – efficiently complement common census techniques. The number of species recorded in the FIPSAS photo contests of 2017 and 2018 (101 from 28 families, with 97 species considered for analysis) was comparable to the one described in other Mediterranean MPAs (Gordoa *et al.*, 2018) and considerably higher than the one obtained with other census techniques such as ROV (Remotely-Operated Vehicle) (Consoli *et al.*, 2016), cabled observatories (Marini *et al.*, 2018) and standard visual census methods (Molinari & Bava, 2011; Piazzi *et al.*, 2012). The photo contest, which resembles a BioBlitz – an intense biological survey that tries to record all the species living in a given area (Karns *et al.*, 2006; Baker *et al.*, 2014) – differs significantly from standard visual census methods, since it involves an active search for species, including small benthic and cryptobenthic fish which are usually underestimated in scientific surveys (Willis, 2001).

The participants in FIPSAS contests know that portraying small and uncommon benthic and cryptobenthic species, which are harder to detect and photograph, earns more points and can make the difference between winning and losing. They recorded more than 30 small benthic and cryptobenthic species, far exceeding the systematic scientific censuses conducted in the Mediterranean over considerably longer periods of time (*e.g.*, Macpherson, 1994; La Mesa *et al.*, 2006; Kovacic *et al.*, 2012; Azzurro *et al.*, 2013). Another major aspect of such contests is that photographic evidence enables the more experienced photographers to distinguish among similar species with great accuracy.

In the Mediterranean Sea, assessments of the diversity of coastal marine fish by visual census or professional small-scale fishery approaches usually focus on specific groups, commercial species, MPAs or habitat types (La Mesa & Vacchi, 1999; La Mesa *et al.*, 2006; Seytre & Francour, 2008; Seytre & Francour, 2013; Tiralongo *et al.*, 2016). Although the final annual FIPSAS contest is generally held in an MPA, the year-round qualifications are also held in non-protected areas. Therefore, after appropriate validation, the data thus produced can supply novel information to complement species inventories in MPAs and in wider areas. In the long term, these data can generate an exhaustive and comprehensive spatio-temporal record of species diversity, enabling comparison between areas managed by different protection measures. The approach also provides an effective and inexpensive tool to monitor fish diversity. Supporting FIPSAS contests therefore allows monitoring fish diversity in MPAs, where a thorough knowledge of fish species is particularly useful. The collaboration between researchers and FIPSAS athletes is a great opportunity to collect regular, detailed and documented data on coastal fish species at nearly zero cost and should be encouraged.

The approach can also be used to obtain biodiversity comparisons among MPAs. The greater fish richness at Punta Campanella can be explained by its more complex and different habitats. In particular, the steep rocky bottoms allowed recording several rocky bottom and cryptobenthic species that were not detected in the more homogenous and less complex bottoms at Capo Rizzuto, which is mostly characterized by a mixed bottom (sand and rocks) with some patches of *P. oceanica*. An important result at Punta Campanella was the depiction of *G. roulei*. Due to its morphological similarity to *Gobius niger* Linnaeus, 1758, this species is considered rare in the Mediterranean and has never been reported in the Tyrrhenian Sea (Patzner, 2020). However, some characteristics, such as the absence of the dark spot on the first dorsal fin and the clearly marked dark transverse stripes on the first ray of the first dorsal fin, can be considered as key traits, distinguishing it from *G. niger*. Notably, The fact that *G. roulei*, which unlike *G. niger* avoids polluted areas, was observed in an MPA corroborates the identification (Patzner, 2020).

The species reported most frequently in underwater photography contests along the north-eastern Spanish coast were *C. julis*, *S. roissali*, *S. tinca*, *S. cabrilla*, *D. vulgaris* and *C. chromis* (Gordoa *et al*., 2018). Nearly all participants in our contests photographed these species in both MPAs. In addition, most of them portrayed several other species, including all the species of the genus *Diplodus* (*D. annularis*, *D. puntazzo*, *D. sargus* and *D. vulgaris,* though not *D. cervinus*), *O. melanura*, *S. salpa*, *A. imberbis*, *B. podas*, *M. surmuletus*, *O. labeo*, *S. scriba*, *S. rostratus*, *T. pavo*, *T. ovatus* and *T. tripteronotum*. Species such as *G. incognitus*, *G. cruentatus*, *G. roulei*, *P. pilicornis*, *P. marmoratus*, *S. cristata*, *S. hepatus, S. cretense* and *S. melanocercus* were abundant in a single MPA (Table 1).

The underwater photo contest proved very useful to complete species inventories and to document the occurrence of rare or overlooked species. Clearly, this approach cannot be used to provide quantitative data on species abundance since, especially in the case of territorial species such as groupers and eels, the same specimens may be photographed by multiple participants and the same participant usually takes a single picture of a species. Nevertheless, it does provide direct information of the species that can be seen in a given area and habitat at a given depth, which is valuable for MPA management. Considering the amount and quality of the information generated by this study and the ongoing monitoring initiatives in the different Mediterranean MPAs (*e.g.,* Garrabou *et al*., 2019), we advocate collaboration of any type among MPA managers, researchers and underwater photo contests. Such sustainable participatory actions can be harnessed to provide regular updates on coastal fish inventories, thus broadening our understanding of MPAs and lending support to their funding and role.

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