

DISCARDS AND SURVIVAL OF MARINE BENTHIC INVERTEBRATES FROM THE TRAWL METIER FOR THE EUROPEAN HAKE

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Abstract

The issue of the fishery discards is of great interest in fishery management from the new policy of the European Union 2013 ((EU) No 1380/2013) which proposes a gradual reduction of discards. In the framework of the European project "Science, Technology, and Society Initiative to minimize Unwanted Catches in European Fisheries" MINOUW (H2020-SFS-2014-2) a seasonal study between the years 2011-2012 was conducted in order to assess the discard composition and the invertebrate survival coming from the trawl metier for hake in the Catalan Coast (Palamós Port). Some of the main species discarded were *Alcyonium palmatum* and undersize *Merluccius merluccius*. Sessile invertebrates as *Alcyonium palmatum* showed high rates of survival, while species of echinoderms as *Astropecten irregularis* or crustaceans as *Pagurus excavatus* displayed lower rates.

Keywords: *Trawl surveys, Mortality, Fisheries, North-Western Mediterranean*

Four seasonal fishing samples were carried out in the fishing grounds adjacent of the Palamós port. In order to characterize the discards, species composition, abundance and biomass were directly assessed on board; the survival assessment, instead, were performed transferring invertebrates, coming from the fishing samples of Winter, Autumn and Spring, from the boat to an area of experimental aquariums, where the specimens were maintained in captivity during a 96 hours evaluation period (Wassenberg and Hill, 1993).

The most abundant discarded species was the soft coral *Alcyonium palmatum* with 128,75 animals/hour, followed by the crinoid *Antedon mediterranea*, 126,57 animals/hour, *Merluccius merluccius* 62,85 animals/hour and the starfish *Astropecten irregularis* 34,43 animals/hour.

The ascidian *Diazona violacea* and the shark *Scyliorhinus canicula* were the ones with the higher contribution to the discard biomass with 2366 gr/hour and 1474 gr/hour respectively, followed by the *Alcyonium palmatum* (1177,8 gr/hour) and the *Merluccius merluccius* (1070,36 gr/hour).

Simper analysis was carried out to assess the contribution of each species to the similarity in the composition of discards in four sampled season. (Table 1).

Tab. 1. Simper analysis of discard composition in the four seasons
 Average similarity: 37,70

Species	Av. Abund	Av. Sim	Sim/SD	Contrib%	Cum. %
<i>Alcyonium palmatum</i>	11,08	12,13	5,73	32,19	32,1
<i>Merluccius merluccius</i>	6,53	3,81	0,87	10,12	42,3
<i>Astropecten irregularis</i>	5,06	3,57	1,62	9,46	51,7
<i>Spicara sp.</i>	3,77	2,22	0,91	5,89	57,6
<i>Antedon mediterranea</i>	7,07	2,04	0,9	5,41	63,0
<i>Pteroide spinosum</i>	1,83	1,95	3,18	5,18	68,2
<i>Diazona violacea</i>	4,29	1,93	0,72	5,13	73,3
<i>Trigla sp.</i>	2,3	1,46	0,89	3,87	77,2
<i>Pagurus excavatus</i>	2,46	1,45	1,82	3,85	81,1

The average similarity between samples based on the Bray-Curtis distance was 37.7. The species which contributed more to the similarity between seasons was *Alcyonium palmatum*, which, together with *Merluccius merluccius* and *Astropecten irregularis* contributed to more than 50 percent of the similarity.

Discarded *Merluccius merluccius* was undersized, therefore the fishing zone could be a nursery area and an Essential Fish Habitat, where the presence of cnidarians as *A. palmatum* could play an important role due to their recurrent findings. The identification of nursery grounds and EFHs of exploited stocks is a key requirement for the development of spatial conservation of populations and ecosystems (Colloca et al, 2015).

Tab. 2. Survival of benthic invertebrates. Species selected for the experimentation divided into groups ; the number of individuals selected per season (N Aut=Number of individuals in Autumn; N Wint=Number of individuals in Winter; N Spr=Number of individuals in Summer); the number of surviving individuals per season after experimentation (N A96=Number of surviving individuals in Autumn; N W96=Number of surviving individuals in Winter; N S96=Number of surviving individuals in Spring); the total number of

individuals by species (Total Start); , the total number of surviving individuals (Total 96 h); the total percentage of survival by species (% total Survival).

Groups	Specie	N Aut	N A96 h	N Wint	N W96 h	N Spr	N S96 h	Total Start	Total 96 h	% total Survival
Sessile and filter feeder's	<i>Phallusia mammillata</i>	0	0	9	9	0	0	9	9	100
	<i>Alcyonium palmatum</i>	13	13	15	15	5	5	33	33	100
	<i>Diazona violacea</i>	8	8	1	1	6	6	15	15	100
	<i>Ascidia mentula</i>	0	0	2	2	0	0	2	2	100
	<i>Ascidia virginea</i>	6	6	0	0	1	1	7	7	100
	<i>Microcosmus sp.</i>	2	2	1	1	0	0	3	3	100
	<i>Pteroide spinosum</i>	8	3	6	6	5	5	19	14	73.68
Molluscs	<i>Cassidaria thyrena</i>	1	1	0	0	0	0	1	1	100
	<i>Cassidaria echinofora</i>	2	2	1	1	3	3	6	6	100
	<i>Naticidae</i>	5	5	0	0	0	0	5	5	100
	<i>Calliostoma granulatum</i>	5	2	2	2	1	1	8	5	62.5
	<i>Maia sp.</i>	0	0	1	1	0	0	1	1	100
Crustaceans	<i>Macropodia longipes</i>	0	0	1	1	0	0	1	1	100
	<i>Liocarcinus depurator</i>	1	1	6	1	1	1	8	3	37.5
	<i>Pagurus excavatus</i>	4	4	12	0	1	1	17	5	29.41
	<i>Medoripe lanata</i>	2	2	1	0	0	0	3	2	66.67
	<i>Dardenus erosor</i>	2	2	12	10	0	0	14	12	85.71
	<i>Astropecten irregularis</i>	38	31	7	3	6	6	51	46	90.2
	<i>Echinus melo</i>	0	0	1	1	0	0	1	1	100
	<i>Marthasteria glacialis</i>	1	1	0	0	0	0	1	1	100
Echinoderms	<i>Brissopsis lyrifera</i>	1	1	0	0	0	0	1	1	100
	<i>Astropecten aranciaceus</i>	1	0	5	5	0	0	6	5	83.33
	<i>Ophiura texturata</i>	0	0	23	10	0	0	23	10	43.48

Almost all sessile and filter feeder's species except *Pteroide spinosum* (73,68%), have a 100% of survival after 96 hours. Molluscs have similar results and only the *Calliostoma granulatum* have a survival less than 100% (62, 5%). On the other hand, crustaceans and echinoderms show highest mortality, exceeding the 50% in some species, e.g. *Liocarcinus depurator* or *Ophiura texturata*. (Table2).

Chi-square tests were performed to assess if the differences observed in terms of survival of each group in the three survival experiments (executed in different seasons and depths) were statistically significant. No differences (p>0.05) were found for all groups except for Crustaceans (p-value<0.001, chi-squared value=25.398, df=2) with the lower value of survival observed in Winter (40%).

References

- 1 - Regulation (EU) no 1380/2013 of the European Parliament and of The Council of 11 December 2013 on the Common Fisheries Policy.
- 2 - Wassenberg, t. J. & hill, b. J. 1993. Selection of the appropriate duration of experiments to measure the survival of animals discarded from trawlers. Fisheries research, 17, 343-352.
- 3 - Colloca, F., Garofalo, G., Bitetto, I., Facchini, M. T., Grati, F., Martiradonna, A., Mastrantonio, G., Nikoliodakis, N., Ordinas, F., Scarcella, G., Tserpes, G., Pilar Tugores, M., Valavanis, V., Carlucci, R., Fiorentino, F., Follesa, M. C., Iglesias, M., Knittweis, L., Lefkaditou, E., Lembo, G., Manfredi, C., Massuti, E., Pace, M. L., Papadopoulou, N., Sartor, P., Smith, C. J. & Spedicato, M. T. 2015. The seascape of demersal fish nursery areas in the north Mediterranean Sea, a first step towards the implementation of spatial planning for trawl fisheries. Plos one, 10.