MACRO-EPIBENTHIC ASSEMBLAGES ON THE TRAWLING GROUNDS ALONG THE SHALLOW CONTINENTAL SHELF OFF THE BALEARIC ISLANDS (WESTERN MEDITERRANEAN)

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Abstract
The contents of 183 experimental bottom trawl hauls off the Balearic Islands at depths of 38 to 255 m were analyzed. The macro-epibenthic species assemblages of the shallow and deep shelf appear well separated. On the shallow shelf, soft red algae bottoms had a much higher biomass of non commercial species, mostly echinoderms, than maërl beds and sandy-muddy bottoms.
Keywords : Algae, Biomass, Trawl Surveys, Continental Shelf, Balear Islands.

Introduction
Red algae dominate soft bottoms fishing grounds on the shallow shelf off the Balearic Islands [1, 2]. It is assumed that this habitat may be the source of much of the discards reported by the trawl fisheries [3]. The present study characterizes the macro-epibenthic assemblages and their commercial and non-commercial species.

Materials and methods
The present work analyzed data collected during the BALAR surveys (2001 - 2005) on the continental shelf off the Balearic Islands (38 to 255 m). Sampling scheme and gear were identical to the MEDITS surveys. Biomass and abundance were based on the swept area method. Cluster, MDS and similarity percentage (SIMPER) were used to analyze the data. ANOVA was applied to test for differences between mean biomass of macro-epibenthic assemblages.

Results
A total of 183 hauls were analyzed. Cluster and MDS analyses of demersal resources (individuals/km^2) and macro-epibenthic species biomass (kg/km^2) separated hauls carried out on the shallow shelf (between 38-96 m and 38-91 in both analyses, respectively) from those on the deep shelf (between 79-255 m and 90-255 m, respectively) at very low levels of similarity (15 and 25%, respectively). Cluster and MDS analysis of macro-epibenthic species yielded three groups on the shallow shelf at 30-35% of similarity. A SIMPER analysis identified three macro-epibenthic assemblages:
- Soft Red Algae bottoms (SRA), with the highest biomass indices, dominated by the echinoderms *Spatangus purpureus* and *Astropecten aranciacus*, the algae *Codium bursa*, *Phyllophora nervosa* and Corallinacea, the ascidian *Ascidia mentula* and the sponge *Suberites domuncula*. Other important species within this group were the alga *Peysonellia squamaria*, the echinoderms *Echinaster sepositus*, *Stichopus regalis* and *Sphaerechinus granularis*, the ascidians *Phallusia mammillata*, *Microcosmus vulgaris* and *Diazona violacea*, and the crustacean *Dardanus arrosor.*
- Maërl Beds (MB), dominated by Corallinacea. Other important species were *S. domuncula*, *A. mentula*, *D. arrosor* and *D. violacea*, the echinoderms *Luidia ciliaris*, *S. purpureus*, *A. aranciacus* and *E. sepositus*, and the alga *Laminaria rodriguezii.*
- Sandy-Mud bottoms (SM) with the lowest biomass indices and very low biomass of red algae.
The biomass of non-commercial species were higher ($F_{2,75}$= 48.78 p<0.001) in SRA bottoms (10535±2534 kg/km^2) than in MB (1377±452 kg/km^2), or SM bottoms (519±96 kg/km^2). No significant differences were found for commercial species yields, 935±88, 801±181, 689±124 kg/km^2 respectively. The average composition of the hauls is detailed on Table 1.

Discussion
The trawl fishery off the Balearic Islands often operates on SRA bottoms, consisting of *Peysonellia* spp. in the basal layer (and lower biomass of Corallinacea) and *Phyllophora nervosa* in the erect stratum [1, 2]. Invertebrates, mainly echinoderms (up to 52%), and rodophyte algae constitute much of the high percentage of discards reported for the trawling fleet operating on the shallow shelf [3]. These bottoms presented the highest biomass of non-commercial species. Although the commercial fraction showed different compositions for the three types of bottoms examined, no significant differences were found for the mean biomass of commercial species, which highly increases the percentage of the non-commercial fraction on SRA bottoms. The analysis confirms that the exploitation of SRA bottoms, which have been considered of special importance in other areas [4, 5], results in the removal of large amounts of non-commercial biomass, without increasing commercial yields. A responsible ecosystem-based management of the shallow shelf trawl fishery off the Balearic Islands should take those results into account.

Tab. 1. Average composition (% of the biomass ±S.E) of commercial and non-commercial fractions from hauls corresponding to each macro-epibenthic assemblage. SRA: Soft red algae bottoms; MB: Maërl beds; SM: Sandy-mud bottoms.

Commercial	SRA	MB	SM
Cephalopod molluscs	25.1±3.1	43.3±6.6	26.1±4.1
Decapod crustaceans	0.2±0.2	0.3±0.4	0.6±0.4
Chondrichthyes	30.4±2.9	26.7±2.2	25±5.5
Teleosts	44.3±2.7	29.7±5.2	48.3±6.7
Non-comercial	**SRA**	**MB**	**SM**
Algae	34.9±4.7	63.3±10.1	22.2±5.6
Posidonia oceanica	2.8±2.5	-	-
Sponges	1.6±0.4	5.4±0.9	8.8±2
Cnidarians	0.2±0.1	0.1±0.1	0.3±0.1
Molluscs	-	0.4±0.3	0.2±0.1
Crustaceans	1.1±1.1	0.4±0.2	1.6±0.7
Echinoderms	52.2±5.4	13.1±7.7	32.3±5.7
Ascidians	5.2±1.1	10.3±5.8	15.3±4.4
Chondrichthyes	0.9±0.4	6.4±4.8	4.2±5.8
Teleosts	1.0±0.5	0.5±0.4	14.6±4.8
Other invertebrates	-	0.1±0.1	0.5±0.3

References
1 - Ballesteros E., 1994. The deep-water *Peyssonnelia* beds from the Balearic Islands (W Mediterranean). *P.S.Z.N. Mar. Ecol.*, 15: 233-253.
2 - Massutí E. and Reñones O., 2005. Demersal resource assemblages in the trawling grounds off the Balearic Islands (W Mediterranean). *Sci. Mar.*, 69: 167-181.
3 - Carbonell A., Martín P., De Ranieri S. and WEDIS team, 1998. Discards of the western Mediterranean trawl fleets. *Rapp. Comm. Int. Mer Médit.*, 35: 392-393.
4 - Norkko A., Thrush S. F., Cummings V.J., Funnell G.A., Schwarz A-M., Andrew N.L. and Hawes I., 2004. Ecological role of *Phyllophora antarctica* drift accumulations in coastal soft-sediment communities. *Polar Biol.*, 27: 482-494.
5 - Zaitsev Y.P., 1992. Recent changes in the trophic structure of the Black Sea. *Fish. Oceanogr.*, 1: 180-190.