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MACROBENTHIC AND FISH COMMUNITIES ASSOCIATED WITH A SEWAGE PIPELINE IN GRAN CANARIA (CANARY ISLANDS)

COMUNITÀ MACROBENTONICHE ED ITTICHE DI UNA CONDOTTA FOGNARIA A GRAN CANARIA (CANARIE)

Abstract

We have evaluated through visual censuses the fish communities associated to a sewage pipeline in Gran Canaria. Likewise we have characterized the sessile macrobenthos using the percent cover of defined benthic Operational Taxonomic Units (OTUs). Ordination analysis and spatial distribution models have shown the influence of abiotic parameters over the considered OTUs assemblages.

Marine currents have caused the settlement of the sessile macrobenthos depending on the substrate orientation. Thus, there is a higher abundance of the feeders OTUs along the SE and NW sides of the pipeline, meanwhile protected sides (NE and SW) and the top of the substrate have presented a higher abundance of the Rhodophyta turfing.

The input of organic matter and the thicmotrophic stimuli generated have produced high values on the fish density, richness and diversity in relation to nearby sites and the average values obtained along the Canarian archipelago.

Key-words: *sewage pipeline, macroepibenthic communities, ichthyofauna, visual censuses, Canary Islands.*

Introduction

Sewage pipelines are artificial structures designed for residual (sewage) water management that have the potential to be colonized by benthic populations.

In order to take up and mineralize some of the organic and inorganic matter released from the pipeline as a mitigation action, and thereby reduce environmental enrichment serving as a biological filter, the National Government have planned the installation of an artificial reef associated to the pipeline. As a baseline study to compare future results we have evaluated the associated fish communities using the biodiversity indices, occurrence frequencies, densities and distribution patterns.

Since the macroepibenthos has been shown to be food for many of the fish populations recruited to artificial structures and a source of much of the structural elements to the artificial biotope (Bailey-Brock, 1989), the spatial distribution, structure and influence of abiotic factors (depth, substrate orientation and current speed and direction) over the macroepibenthos was observed.

Materials and methods

Location

The sewage pipeline is located off Gran Canaria Island (Canary Islands, 28°N), reaching 20 m deep. It is a 22 years old, 1305 m long concrete cylinder with an average diameter of 60 cm, assembled by 100 × 75 × 80 cm concrete modules each 5 m.

Macroepibenthos assemblages

We stratified sampling depending on depth. Three different *a priori* points (10, 15 and 20 m deep) were selected to carry out the study. In each point, the macroepibenthos associated to each module face (top, SW, NE, SE, and NW) was observed.

Colour photographs (225 cm^2) were used in subsequent point-count analysis of the sessile biota. They were taken with a Nikonos 35 mm underwater camera system equipped with a 28 mm close up lens and frame. Estimates of percent cover at each sampling point were obtained using the random point-count censusing technique described by Sutherland and Karlson (1977). Biota occupying areas on each photographed quadrant were scraped into mesh bags. Scrape samples were preserved in a buffered solution of 10% formalin-sea water. In the laboratory, sessile organisms were identified to the lowest feasible taxonomic level.

Since it was impossible to remove most of the organisms from the organisms to which they were attached and because many of the biota was fragmented while scraping, the macroepibenthic (sessile biota attached on the pipe, >0,5 mm) *taxa* were grouped into 7 Operational Taxonomic Units (OTUs) according to Kingsford and Battershill (1998). Selected OTUS were: (1) *Rhodophyta* turfing, (2) Macroalgae, (3) *Porifera* (sponges), (4) encrusting *Polychaeta*, (5) *Balanidae*, (6) *Bivalvia* and (7) *Briozoa*.

Fish assemblages

Thirty random visual censuses were carried out to obtain relative density estimates of the fish species. Diurnal exposed fish species were selected to avoid bias (Brock, 1982). According to Lincoln-Smith (1989) multispecies surveys were split into 2 counts. Conspicuous species were sampled by the stationary visual census technique (SVCT) (Bohnsack and Bannerot, 1986). Using underwater plastic slates, the species richness and the abundance of the fishes observed was recorded for those fishes that came within an imaginary cylinder around the SCUBA divers. Preliminary sampling suggested a radius = 8,6 m (200 m^2), height = 10 m, during a 10 min period. Several studies in the Canarian archipelago have employed this technique in order to asses fish assemblages (Bortone *et al.*, 1991; Falcón *et al.*, 1996; Herrera, 1998). Cryptic, small site attached fish species were sampled using a 50 × 2 (= 100 m^2) belt transect (BT) along the pipeline. SCUBA divers counted those species along holes and crevices within the pipeline. The descriptive statistics were finally complemented with the calculation of the Shannon-Weaver (H'), evenness (E), dispersion (I.D.) and the Green (G.I.) indices, following the instructions of Ludwig and Reynolds (1986).

Currents measurements

The speed and the direction of the current were measured along two different periods: strong north-trade winds intensity period (spring-summer) and weak north-trade winds intensity period (fall-winter). Autoregistered currentmeters *SD-6000*® were anchored during 14 days in a fixed point (3 m deep) at the pipeline with registration intervals of 10 min.

Data Analysis

The % cover for selected OTUs along the sampled points helped obtain a Pearson Product-moment correlation matrix. This data matrix was used to run a Principal Component Analysis (PCA) following that showed by Ludwig and Reynolds (1988). Multiple regression models helped explain the relationship and the significance between the first and second component and the abiotic parameters. A dendogram using Euclidean distance were also carried out. Information from both multivariate analysis were used to obtain a Hierarchical Ordination Analysis (HOA).

With the goal of obtaining a 2 dimensions spatial distribution lineal model for each OTU along the pipeline, multiple regression models were obtained for the % cover of each OTU and the abiotic parameters depth and substrate orientation, quantified by the parameters a (angle: current direction-module face) and b (angle: module face - a hypothetical horizontal surface). The Geographical Information System (GIS) *IDRISI for windows®* was used to graphically represent the spatial 2 dimensions distribution models of the % cover of each OTU depending on depth, a, and b (that is, the 5 sides of each module: NE, NW, SE, SW and top) for 3 modules at 20, 15 and 10 m deep.

The aim is to obtain a detailed benthic cartography for the selected OTUs along the pipeline using the information layers employed in the multiple regression models. With the goal of validating the model, simple regression models for the % cover of each OTU obtained by the multiple regression models (predicted values) and random *in situ* observed values were run.

The temporal series for current measurements were statistically processed by the *CORMAR®* system, using a Doobson filter. The results were presented as compass cards for both two periods.

Because 30 visual censuses were carried out to evaluate fish assemblages, the null hypothesis of adjusting to a Poisson distribution was checked using the d-statistic (Elliot, 1973).

All the statistical tests and the multivariate analyses were obtained using the statistical package *SPSS®*. P-values were selected at 0,05 for all statistical tests.

Results

Macrobenthic assemblages

Correlation analyses have shown negative significant relationships between some of the feeders OTUs and the *Rhodophyta* turfing. Thus there has been a negative correlation ($r_s = -0,64$, $p < 0,05$) between the *Balanidae* and the *Rhodophyta* turfing OTUs and between *Porifera* and *Rhodophyta* turfing OTUs ($r = -0,60$, $p < 0,05$). This fact shows the different colonization patterns of the selected OTUs.

Furthermore, HOA (Fig. 1) ordinate macroepibenthic samples depending on depth

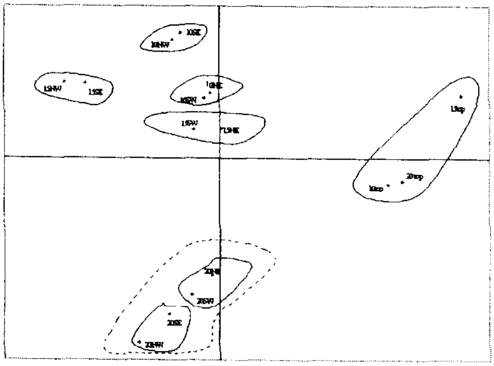

Fig. 1 - Hierarchical ordination analysis of the sampled macrobenthos.
Analisi delle componenti principali sul macrobentos campionato.

and module orientation. A significant relationship between the first Component (PC I, 34,7% of the variability within the data) and the orientation, and a significant negative relationship between the second Component (PC II, 33,0%) and depth were obtained. Both Components accumulated a 67,7% of the variability within the data.

Tab. 1 - Multiple Regression Models for selected benthic OTUs. Y_{obs}=observed values. Y_{pred}= pre- dicted values. z=depth. α, β=as defined in the text.
Modelli di regressione multipla per alcune OUT selezionate. Y_{obs}= valori osservati. Y_{pred}= valori previsti. z=profondità. α, β=come definiti nel testo.

OUT	Multiple Regression Spatial Model	Validation
Balanidae	%Cover=23.0-1.1z+27.66cosα r^2=0.62 n.s.	Y_{obs}= 8.95+0.45Y_{pre} r^2=0.68 ***
Rhodophyta turfing	%Cover=89.43-2.14z-28.16cosα+64.16cosβ r^2=0.91***	Y_{obs}= 12.15+0.69Y_p r^2=0.76 ***
Porifera	%Cover=-41.91+3.65z+9.33cosα r^2=0.84 *	Y_{obs}= 4.81+0.74Y_{pre} r^2=0.86 ***
Briozoa	%Cover=0.37+1.17z-8.83cosα r^2=0.68 *	Y_{obs}= 4.29+0.61Y_{pre} r^2=0.78 ***
Polychaeta	%Cover=3.16-0.1z r^2=0.80 **	Y_{obs}= 0.09+0.90Y_{pre} r^2=0.96 ***
Bivalvia	%Cover=4.33-0.2z r^2=0.86 **	Y_{obs}= 18.22-15.22Y r^2=0.42 *
Macroalgae	%Cover=9.83-0.5z r^2=0.99***	Y_{obs}= -0.05+0.95Y_{pred} r^2=0.99 ***

n.s.: non-significant
*: *$0.01<p<0.05$*
**: *$0.001<p<0.01$*
***: *$p<0.001$*

Multiple regression models, which characterize spatial distribution models for the selected OTUs (Fig. 2), show spatial distribution patterns depending on depth and the orientation of the substrate (measured as the defined a and b angles) (Tab. 1). All of them have been significant, with the exception of the *Balanidae* OTU (p>0,05). All the spatial distribution models have exhibited that all the OTUs are significantly influenced by depth. Thus with the exception of *Porifera* and *Briozoa*, the rest of the OTUs have exhibited a decrease in the % cover with depth. Furthermore the OTUs *Rhodophyta*, *Porifera* and *Briozoa* are influenced by the substrate orientation. The top of the modules have shown for all depths a 100% cover of the *Rhodophyta* turfing (Fig. 2), which can be attributable to the high sedimentation of the released organic matter from the pipeline. Despite the linear response of % cover for the selected OTUs to abiotic parameters, the spatial distribution models confidently represented those responses, which has been shown by the significance and the high r^2 values for the regression models between the predicted and observed values (Tab. 1).

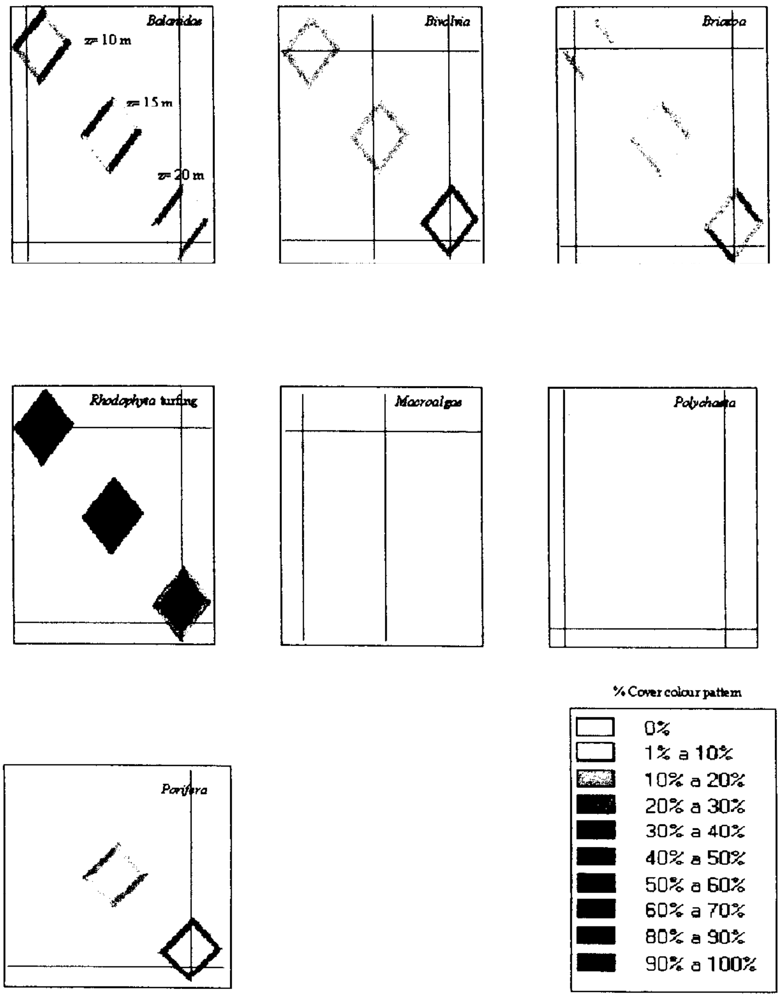

Fig. 2 - Spatial distribution models for the selected OTUs.
Modelli di distribuzione spaziale per alcune OUT (Unità Operazionali Tassonomiche) selezionate.

Fish assemblages

We have identified 32 *taxa* (genus and species) for the observed fish along the studied period, 7 of them using the BT census and 25 through the SVCT census. Inspection of the overall abundance data matrix (Tab. 2) indicates that the most abundant

Tab. 2 - Occurrence frequencies, mean abundance (ind 100 m^{-2} ± S.D.), and diversity indices for the fish community. G.I.: Green index. D.I.: dispersion index. The d-statistic for species distributions is also presented. n.s.: no significance, ** : p<0,01 , * 0,01<p<0,05.
*Frequenze di presenza, abbondanza media (individui per 100 m^2 ± S.D.), e indici di diversità per il popolamento ittico. G.I.: Indice di Green. D.I.: Indice di dispersione. Il test-d per la distribuzione delle specie è riportato nella 4° colonna. n.s.: non significativo. **: p<0.01 , * 0,01<p<0,05.*

Taxa	Mean Abundance (ind 100 m^{-2} ± SD)	Occurrence Frequency (%)	D.I.	d -statistic	G.I.	Distribution
Species observed by the SVCT						
Prionace glauca (Linnaeus, 1758)	0.13 ± 0.35	6.67	0.90	-0.33 n.s	-0.034	Random
Dasyatis pastinaca (Linnaeus, 1758)	1.03 ±1.27	50	1.57	1.98 *	0.018	Clumped
Serviola dumerilii (Linnaeus, 1758)	7.67 ± 14.32	16.67	26.70	31.80 **	0.112	Clumped
Pomatosus saltator (Linnaeus, 1766)	26.93 ± 17.31	100	11.12	17.84 **	0.012	Clumped
Pseudocaranx dentex (Bloch & Schneider, 1801)	0.17 ± 0.38	6.67	0.86	-0.47 n.s.	-0.034	Random
Trachinotus ovatus (Linnaeus, 1758)	0.33 ± 1.27	6.67	4.83	9.18 *	0.425	Clumped
Sphyrarena viridensis (Cuvier, 1829)	8.43 ± 14.21	33.33	23.94	29.71 **	0.091	Clumped
Tunnus spp.	6.47 ± 15.74	33.33	38.31	39.58 **	0.193	Clumped
Bothus podas (Delaroche, 1809)	1.43 ± 1.33	83.33	1.24	0.91 n.s.	0.005	Random
Canthigaster rostrata (Bloch, 1786)	1.83 ± 1.84	83.33	1.85	2.79 **	0.015	Clumped
Sparisoma cretense (Linnaeus, 1758)	2.8 ± 1.63	100	0.96	-0.14 n.s.	-0.001	Random
Thalassoma pavo (Linnaeus, 1758)	8.3 ± 4.68	100	2.64	4.83*	0.01	Clumped
Chromis limbatus (Valenciennes, 1833)	8.73 ± 5.77	100	2.64	4.83 **	0.006	Clumped
Abudefuf luridus (Cuvier, 1830)	5.13 ± 2.34	100	1.07	0.33 n.s.	0.0005	Random
Synodus synodus (Linnaeus, 1758)	1.33 ± 1.52	83.33	1.72	2.45 *	0.018	Clumped
Diplodus sargus cadenati (Bauchot & Daget, 1974)	4.4 ± 3.43	100	2.67	4.90 **	0.012	Clumped
Diplodus vulgaris (E. Geoffroy Saint-Hilaire, 1817)	3.57 ± 1.41	83.33	0.55	-1.87 n.s.	-0.004	Random
Pagellus acarne (Risso, 1826)	102.33 ± 45.08	100	19.86	26.38 **	0.006	Clumped
Boop boops (Linnaeus, 1758)	141.67 ± 109.92	100	85.29	62.78 **	0.019	Clumped
Lithognathus mormyrus (Linnaeus, 1758)	6.47 ± 8.86	93.33	12.14	18.98 **	0.057	Clumped
Sarpa salpa (Linnaeus, 1758)	0.2 ± 0.41	13.33	0.83	-0.62 n.s.	-0.034	Random
Oblada melanaura (Linnaeus, 1758)	0.8 ± 1.32	33.33	2.19	3.71 **	0.051	Clumped
Dentex spp	0.13 ± 0.35	13.33	0.90	-0.33 n.s.	-0.034	Random
Pomadasys incisus (Bowdich, 1825)	786.67 ± 202.97	100	52.37	47.56 **	0.002	Clumped
Umbrina canariensis (Valenciennes, 1833-44)	11.13 ± 8.99	100	7.26	12.96 **	0.018	Clumped
Species observed by the BT						
Ephinephelus marginatus (Linnaeus, 1758)	1.00 ± 0.64	100	0.41	-2.65 n.s.	-0.02	Uniform
Mycteroperca fusca (Bloch, 1793)	0.77 ± 0.43	100	0.24	-3.80 n.s.	-0.034	Uniform
Serranus atricauda (Linnaeus, 1758)	1.4 ± 0.89	100	0.57	-1.79 n.s.	-0.010	Random
Apogon imberbis (Linnaeus, 1758)	51.00 ± 12.96	100	3.29	6.26 **	0.001	Clumped
Scorpaena spp.	3.8 ± 1.32	100	0.46	-2.93 n.s.	-0.004	Uniform
Muraena helena (Linnaeus, 1758)	0.63 ± 0.49	60	0.38	-2.85 n.s.	-0.034	Uniform
Heteroprianthus cruentatus (Lacepede, 1801)	0.73 ± 0.45	66.67	0.28	-3.55 n.s.	-0.034	Uniform
Total number of individuals	1197.43 ± 226.22					
H'	1.28 ± 0.18					
E	0.41 ± 0.05					

species having > 10 ind 100 m^{-2}, were the schooling pelagic species *Pomatosus saltator* and *Boop boops,* and epibenthic species that formed loosely aggregated schools such *Pomadasys incisus, Pagellus* spp. and *Apogon imberbis.* The highest number of individuals per species recorded for the study was 786,67 for *P. incisus.* Twelve species were never represented by more than 3 ind 100 m^{-2} in any sample. Fourteen species were presented along all samples (100% of occurrence frequency). The average number of species per sample was consistently between 19 and 24, while the overall average number of species per sample was 22,53 for the entire study. The average number of individuals per sample was 1197,43, with a maximum of 1507 and a minimum of 925.

Species diversity (H') have reached an overall average value of 1,28 for the studied pipeline, while the evenness (E) have obtained a lower average value of 0,41 (Tab. 2). Species detected through the BT census have generally presented uniform distribution patterns. These are elusive cryptic territorial predatory species such the *Serranidae* groupers *Ephinephelus marginatus* or *Mycteroperca fusca.* These populations have found shelter and protection in microhabitats and holes along the pipeline. Nevertheless species sampled by means of the SVCT census have presented random and clumped patterns. These are schooling pelagic or non-cryptic conspicuous epibenthic species. *Seriola* spp., *Pomatosus saltator* and *Trachinotus ovatus* are the 3 species with the highest aggregation levels according to the obtained Green index. These are 3 patchy schooling pelagic species (Brito, 1991).

Current measurements

Both compass cards (August 97 and December 97 for the lower level) have shown directional peaks associated with some cardinal areas, which differ 180° respectively (Fig. 3). This explains the current flow, which have presented a dominant direction within the W-WSW quadrant in August 97, while in December 97 it was in the ENE-E quadrant. As a consequence, the current direction during the all year is the same, only changing the way with seasons. The current speeds oscillate between 0-5 cm s^{-1}, with average value of 1,67 cm s^{-1} in August 97 and 1,80 cm s^{-1} in December 97.

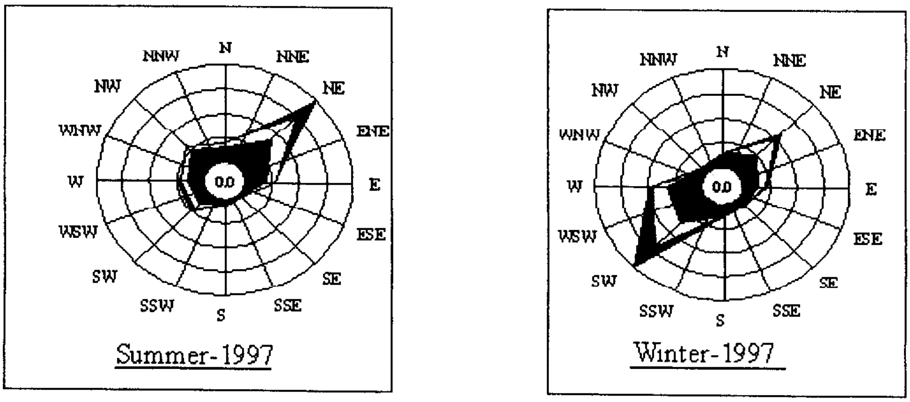

Fig. 3 - Compass cards for current measurements for the two studied periods.
Direzione ed intensità delle correnti misurate nei due periodi di studio.

Discussion

Macroepibenthic assemblages

As the HOA and the spatial distribution models have shown, the abiotic parameters substrate orientation (as a factor depending on current direction) and depth produce significant fluctuations in the % cover of the selected macroepibenthic OTUs. Oceanographic patterns, which are characterized by ENE-E and W-WS dominant currents depending on the season, structure sessile biota settlement depending on module orientation, as Wendt *et al.* (1989) observed. Obstacle or island module effect, produce flux acceleration on the SE and NW module sides along the pipeline. This helped explain the grouping of the SW and NE and the SE and NW faces of the HOA within the PCA. As a consequence, the feeders OTUs *Balanidae* and *Porifera* have dominated the high turbulent faces (SE and NW). Their presence could supply secondary substrate for other communities, which allowed an increase in the colonization rate as Osman (1982) suggested. On the other hand, low turbulent faces (SW and NE) have shown a high abundance of *Rhodophyta* turfing. All of which were shown to be between high and low turbulent OTUs within the correlation model. The decrease of the % cover of the all OTUs (excepting *Porifera* and *Briozoa*) with depth, is attributable to the release of the sewage organic matter from the discharge mouths along the pipe.

Benthic cartography has been usually implemented by means of *in situ* measurements of the variable of interest. Therefore a grid is obtained in order to interpolate data along study area. This work shows how we can obtain a detailed benthic cartography of an artificial habitat through 2 easily measured information layers (depth and orientation), using multiple regression models. Further the validation of the proposed model of cartography has been carried out comparing the expected and random observed values using simple regression models.

Fish assemblages

The descriptive statistics on the fish community parameters obtained for the analyzed pipeline indicate that the associated fish fauna is reasonably diverse and abundant when we compare results with other locations within the archipelago. The studied area has presented approximately half of the species detected along a broad range of subtidal environments in the Canarian Archipelago, using the SVCT showed in this study (Falcón *et al.*, 1996). Fish richness is not different from other nearby natural areas in Gran Canaria, but it is lower than adjacent artificial structures (Herrera, 1998), which can be caused by the lower complexity and heterogeneity within the pipeline, since richness increase with complexity (Kingsford and Battershill, 1998). Although some common fish species in the archipelago have not been found along the study, neither of those detected species have shown significantly lower abundances in relation to the average abundant values obtained by Falcón *et al.* (1996) for the Canary Islands, Bortone *et al.* (1991) in El Hierro island and Falcón *et al.* (1993) for Alegranza island.

Nevertheless there has been some fish species in significant higher abundant than those average values obtained by the above cited authors. Thus *P. saltator, Pagellus* spp., *Umbrina* spp., *Muraena* spp., *Scorpaena* spp. and *P. incisus* have shown higher abundance than those studies. Furthermore *E. marginatus, Dentex spp.*, and *A. imberbis* have presented higher abundance than 2 of the above cited studies, while *B. boops*, *Serranus* spp. and *Diplodus vulgaris* have shown higher abundance than solely one study. Further, the abundance of *P. incisus, Umbrina* spp., *Diplodus* spp., *C. limbatus,* *Seriola* spp., *P. saltator, L. mormyrus*, is higher than natural nearby areas (Herrera, 1998). All of them (excepting the pelagic species *P. saltator* and *Seriola* spp.) are benthic/epibenthic fish species, which currently present economic importance to local fisheries (Brito, 1991).

Diversity (H'), total number of species per survey and total fish abundance per survey are higher than those average values obtained by Falcón *et al.* (1996) for the Canarian Archipelago. However there are no differences with the average values calculated by Falcón *et al.* (1993) for Alegranza Island. This fact is attributable to protection of this island by National Laws against fishing. Furthermore H' is not different from that value given by Bortone *et al.* (1991) for El Hierro island and it is lower than that obtained by Herrera (1998) which oscillated between 2-3 depending on the season.

This is explained because although the number of species is relatively high along the pipeline, there are dominant species in abundance, which has been shown by the low value obtained for the J' index. Evenness is lower than those calculated by Falcón *et al.* (1993) and Herrera (1998). These dominant species (e.g. *Pagellus* spp., *Umbrina* spp., *C. limbatus, Diplodus* spp, *B. boops*, etc.) are most suitable for the appropriate trophic niches created by the input of organic matter.

On the other hand, pelagic macrophages predatory species (e.g. *Seriola* spp. *Tunnus* spp., *P. saltator, S. viridensis*, etc.) are attracted by the *edge effect* or the *thicmotrophic stimuli* (*sensu* Bredger and Nigrelli, 1938) generated by the presence of the pipeline along a homogeneous environment. The presence and high abundance of benthic predatory economically important species (*Serranus* spp., *M. rubra, E. marginatus, Scorpaena* spp., *Muraena* spp.) in this artificial habitat could suggest that these populations are limited by habitat availability and not by recruitment along the South coast off Gran Canaria. The habitat could be limited by food availability and shelter occupation (Bohnsanck, 1989).

Riassunto

Quali studi di base preliminari alla costruzione di una barriera artificiale con funzione di protezione e di riciclaggio della materia organica versata in mare tramite condotte sono stati esaminati il macrobenthos ed i pesci associati ad una condotta fognaria alla Gran Canaria (Oceano Atlantico Centro Orientale). La condotta, lunga 1.305 m, è costituita da tubi di cemento di 60cm di diametro, intercalati ed assemblati tramite moduli di 100×75×80cm ogni 5 m; la parte terminale raggiunge i 20 m di profondità. I pesci sono stati studiati tramite visual census determinando le densità e le frequenze di presenza e gli indici di biodiversità. Il macrobenthos sessile è stato studiato utilizzando gli indici percentuali di ricoprimento di alcune varietà operazionali tassonimiche (OTU,). Le varie analisi hanno dimostrato l'influenza di tre parametri abiotici (profondità, orientamento del substrato, situazioni oceanografiche) sulle associazioni degli OTU considerati.

Le correnti marine hanno influenzato l'insediamento del macrobenthos sessile in relazione all'orientamento del substrato. Così c'è una maggiore abbondanza dei filtratori OTU (Balani, poriferi) lungo i lati SE e NO della condotta quale risultato di un incremento del flusso dovuto ad una perturbazione della corrente causata dalla presenza stessa della condotta. Da un'altra parte i lati protetti (NE, SO) sulla parte superiore del substrato presentano una maggiore presenza dei ciuffi di *Rhodophyta*. L'introduzione di materiale organico e l'effetto tigmotrofico hanno attratto un'alta densità, ricchezza e diversità di pesci, in confronto ai siti circostanti ed ai valori medi conosciuti nell'arcipelago delle Canarie. Inoltre alcune specie bentoniche di pesci di interesse economico hanno tratto vantaggio dalla presenza di microhabitat lungo le condotte che fungono da nascondigli ed anfratti protetti. Tutto ciò suggerisce che la maggioranza di queste specie bentoniche siano localmente limitate non dal reclutamento ma dalla disponibilità di habitat adatto.

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