

CECOMA 2016

Challenges in the Environmental Management of Coastal and Marine Areas

LAS PALMAS DE GRAN CANARIA, SPAIN

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Table of Contents

PROGRAMME CECOMA 25-29TH JANUARY 2016	1
LOCATION:	6
SESSION 1 - INTEGRATED MANAGEMENT OF COASTAL AND MARINE AREAS	7
INCLUDING AQUACULTURE IN THE MANAGEMENT OF COASTAL AND MARINE AREAS THROUGH THE DEVELOPMENT OF INTEGRATED MULTI-TROPHIC AQUACULTURE.....	8
WHY EXPERIENCE AND KNOWLEDGE MAY CHANGE OUR WAY TO APPROACH THE ENVIRONMENTAL CHALLENGES?	9
THE BIODIVERSITY DATABASE OF THE CANARY ISLANDS. ANALYTICAL TOOLS IN CONSERVATION.	10
MARINE PILOT - MSFD & INSPIRE EXPLORATORY PROJECT	11
ALIEN SPECIES IN THE BALTIC SEA: DANGER OR CHANCE?	12
REGULATING AND MANAGING MARINE LIVING RESOURCES: FIVE DECADES OF TRIUMPH AND FAILURE IN THE EUROPEAN UNION	13
SESSION 2: STRUCTURE AND FUNCTION OF COASTAL & MARINE ECOSYSTEMS	14
THE ROLE OF GLACIATION-RELATED SEA LEVEL OSCILLATIONS IN SHAPING THE PRESENT MACARONESIAN ISLAND BIOTAS	15
OPEN OCEAN FISH FARMING: SOME TECHNICAL CONSIDERATIONS FOR A BETTER UNDERSTANDING OF ENVIRONMENTAL THREATS AND ADVANTAGES.....	16
QUANTITATIVE ANALYSIS OF SEAWEEDS ON THE INTERTIDAL ROCKY COASTS OF SANTIAGO ISLAND, CAPE VERDE ARCHIPELAGO	17
AN 'ENDEMIC' FISH COMMUNITY ASSOCIATED TO SEAGRASS MEADOWS OFF THE CANARY ISLANDS	18
SEASONAL AND SPATIAL PATTERNS IN THE MORPHOLOGY AND LIFE STORY OF THE BROWN MACROALGAE <i>CYTOSEIRA ABIES-MARINA</i> (FUCALES, PHAEOPHYCEAE) IN THE ROCKY INTERTIDAL FROM GRAN CANARIA (EASTERN ATLANTIC): ENVIRONMENTAL DRIVERS OF VARIATION.....	19
SESSION 3 - RESPONSIBLE USE OF COASTAL & MARINE RESOURCES	20
BUILDING GLOBAL NETWORKS OF MPAS: CHALLENGES, ADVANCES AND OPPORTUNITIES	21
THE NEED FOR TECHNICAL AND LEGAL TOOLS TO SUPPORT A COMPETITIVE AND SUSTAINABLE ECOTOURISM ASSOCIATED TO MARINE FARMS AT SPAIN.	22
MODELING THE EFFECTS OF FISHING MANAGEMENT SCENARIOS ON THE GRAN CANARIA MARINE ECOSYSTEM	23
THE REAL IMPACT OF RECREATIONAL FISHERIES IN CANARY ISLANDS	24
FIRST STEPS TOWARDS ENVIRONMENTAL FISHERIES CERTIFICATION CONSIDERING THE STANDARD OF THE MARINE STEWARDSHIP COUNCIL (MSC): THE CASE OF OPTUNA & ISLATUNA, ARTISANAL LIVE BAIT TUNA FLEETS (CANARY ISLANDS, SPAIN)	25
PREPARATORY ACTION FOR THE IMPLEMENTATION OF THE INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT OF SHIPS' BALLAST WATER AND SEDIMENTS (BWM CONVENTION): IDENTIFICATION OF SPECIES IN LAS PALMAS PORT.	26
SESSION 4 - EFFECTS OF GLOBAL CHANGE IN COASTAL AND MARINE ECOSYSTEMS	27
RESPONSES OF NEARSHORE AND COASTAL BIODIVERSITY AND ECOSYSTEMS TO CLIMATE CHANGE: COMBINING LONG-TERM OBSERVATIONS, EXPERIMENTS AND MODELLING.....	28
LAND-SEA INTERACTIONS IN A CHANGING SCENARIO: NEW CHALLENGES IN THE ENVIRONMENTAL MANAGEMENT OF SHALLOW MARINE COSTAL AREAS.....	29
EFFECTS OF OCEAN ACIDIFICATION ON FEEDING RATES OF JUVENILES SEA URCHINS <i>PARACENTROTUS LIVIDUS</i> AND <i>DIADEMA AFRICANUM</i>	30

RELATIONSHIP INTERSPECIFIC AND ENVIRONMENTAL OF OCTOPUS VULGARIS AND PAGRUS PAGRUS THROUGH CATCHES OF THE GRAN CANARIA FISHING FLEET.....	31
OVEREXPLOITATION OF THE GALAPAGOS SAILFIN GROUPER: THE NEED FOR COMMUNITY BASED COLLABORATIVE EFFORTS TO ESTABLISH MANAGEMENT REGULATIONS.....	32
SESSION 5 - ECOSYSTEM CONSERVATION AND AQUACULTURE	33
HOLISTIC APPROACHES TO UNDERSTAND THE FUNCTIONING AND RESILIENCE OF COASTAL ECOSYSTEMS: FROM GENES TO ECOSYSTEM SERVICES PROVIDED BY SEAGRASS MEADOWS.....	34
DEVELOPMENT OF MARINE AQUACULTURE IN BRAZIL: INSIGHTS ON ENVIRONMENTAL INTERACTIONS.....	35
LARGE SCALE EFFECTS OF AQUACULTURE ESCAPEES ON FISHERIES LANDINGS: EVIDENCES FROM THE MEDITERRANEAN SEA.....	36
COMBINING ECOLOGY AND AQUACULTURE FOR <i>IN SITU</i> MARINE CONSERVATION INITIATIVES: SEAHORSE IN GRAN CANARIA ISLAND (NE ATLANTIC) - A CASE STUDY.....	37
A KINETIC ASSAY FOR NITRATE REDUCTASE (NR) IN <i>ULVA RIGIDA</i>	38
SEA URCHIN <i>DIADEMA AFRICANUM</i> POPULATIONS AT THE SELVAGENS ISLANDS	39
SUSTAINABLE PRODUCTION OF ABALONE <i>HALIOTIS TUBERCULATA COCCINEA</i> IN INTEGRATED MULTI-TROPHIC AQUACULTURE SYSTEMS.....	40
IDH ACTIVITY IN PLANKTONIC ORGANISMS: A NEW PROXY FOR POTENTIAL CO ₂ PRODUCTION AND RESPIRATORY METABOLISM AT THE BASE OF THE FOOD CHAIN	41
SECURING THE FUTURE OF CRITICALLY ENDANGERED ANGEL SHARKS THROUGHOUT THEIR NATURAL RANGE	42
POSEIDON PROGRAM: CITIZEN SCIENCE FOR THE STUDY OF MARINE BIODIVERSITY IN THE CANARY ISLANDS	43
BEST III AND THE CHALLENGES OF DEFINING COASTAL AND MARINE KEY BIODIVERSITY AREAS IN MACARONESIA.....	44
“BIO-BASED ECOSYSTEMS”: AN EUROPEAN CHALLENGE FOR THE 2016-2020 THROUGH SUSTAINABLE INNOVATION IN FOOD, FEED AND BIO-BASED INDUSTRIES WITHIN THE MARINE AND TERRESTRIAL SECTORS. THE CASE OF THE EUROPEAN AQUAPONIC HUB FA 1305.....	45
POSTER SESSION.....	46
P1 - COASTAL SUSTAINABILITY INDICATORS. A PROPOSAL FOR AGRICULTURE AND LIVESTOCK DEVELOPMENT WITHIN THE FRAMEWORK DPSIR (GRAN CANARIA, SPAIN).	47
P2 - COASTAL SUSTAINABILITY INDICATORS. A PROPOSAL FOR TOURISM AND URBAN DEVELOPMENT WITHIN THE FRAMEWORK DPSIR (GRAN CANARIA, SPAIN).....	48
P3 - FEASIBILITY OF DEVELOPMENT OF AN INDIVIDUAL BEHAVIOUR-BASED MODEL OF FERAL HORSES (<i>EQUUS FERUS CABALLUS</i>) IN SABLE ISLAND, NOVA SCOTIA, CANADA	49
P4 - ARE ZOOPLANKTON SECONDARY PRODUCTION MODELS ABLE TO PREDICT GROWTH IN THE MARINE MYSID <i>LEPTOMYSIS LINGVURA</i> (G.O. SARS, 1866)?.....	50
P5 - RESPIRATION OF PRIMARY AND SECONDARY PRODUCERS MEASURED BY DIFFERENT METHODOLOGIES.....	51
P6 - IMPACT OF INCREASING <i>pCO₂</i> ON MARINE POTENTIAL RESPIRATORY ACTIVITY	52
P-7 IMPACT OF RECREATIONAL FISHING ON FISH POPULATIONS DURING THE LAST 50 YEARS IN CANARY ISLANDS.....	53
P8 - SHELL ALLOMETRIC DIFERENCES IN BROWN MUSSEL UNDER LONGLINE CULTURE REGARDING WILD POPULATION (CANARY ISLANDS, SPAIN).....	54
P9 - DEFINING, ASSESSING AND VALORISING KEY MARINE HABITATS IN THE MACARONESIAN ARCHIPELAGOS.....	55

P2 - COASTAL SUSTAINABILITY INDICATORS. A PROPOSAL FOR TOURISM AND URBAN DEVELOPMENT WITHIN THE FRAMEWORK DPSIR (GRAN CANARIA, SPAIN).

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The OMARCOST project, "Strategy for environmental sustainability of cross-border coastal environment" carried out, among other activities, the selection of environmental indicators in the geographical area of the Canary Islands (Spain) and the Coast Region Souss Massa Drâa (Morocco). These indicators are presented as efficient and descriptive tools of phenomena, for it these are optimal for integrated coastal zone management (ICZM). DPSIR framework (Driving force, Pressure, State, Impact and Response) was used as a frame for selecting ICZM-indicators of sustainability on the island of Gran Canaria (Spain). DPSIR is useful in analyzing connections between socioeconomic trends, ecological phenomena and institutional responses in an integrated manner. This paper describes a proposal of indicators for tourism and urban or residential use, because both are very influential driving forces on the coast of the Canary Islands (Gesplan 2012). The selection was based on their suitability, data availability and ease of interpretation; by using the multi-criteria analysis (Saati, 2008). *In short, the main 7 selected indicators of territorial units for tourism were:* 1.Number of tourists entering in the period (driving force-socioeconomic), 2.Water consumption a night (driving force-eco efficiency), 3.Percentage of intertidal occupied by tourist infrastructure (pressure), 4.Percentage of beaches comply with the law quality of bathing water (state about tourism), 5.Number of negative references about the coastal environment carried out by intermediary organizations or representatives of companies that provide tourist services at a tourism unit (impact), 6.Percentage of treated and reused wastewater (response, material and percent) and 7.Percentage coastal marine area under some form of conservation (response-habitats and biodiversity-). *And the mean 8 selected indicators of territorial units for residential use:* 1.Resident and floating population per local government (driving force-population and activities-), 2. Urbanization index (driving forces-population and activities), 3. Energy consumption per inhabitant on household and accommodation units (driving forces-natural resources-), 4.Annual increase of urban land in hectares / year (pressure), 5.Mass of solid waste/inhabitant/year per local government (by type) (pressure), 6. Number of complaints and denunciations per year by local perceived impacts due to wastewater treatment plants, local and water pollution (impact), 7. Percentage of new buildings licences on old buildings over all residential building permits in a year (response- urban ordination) and 8.Indicator of inefficiency in the use of urban and urbanized land (depending on soil type) (response-urban ordination-). This work has been carried out with the support of the European Union (EU) and cofounded by European Regional Development Fund (ERDF) and POCTEFEX Programme.

Referencies

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Keywords: DPSIR, indicators, Integrated Coastal Zone Management (ICZM), multi-criteria analysis.

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Introduction

The coastal zone is an extremely complex social-ecological system that changes in relation to its environmental, socio-economic, cultural and governance factors (Diedrich et al., 2010). Integrated coastal zone management (ICZM) is a process that seeks to develop an integrated model for sustainable development, that is based on finding points of convergence among these factors (IOC, 2006; cited Diedrich et al., 2010). Indicators are presented as efficient and descriptive tools of anthropogenic and natural phenomena, which are optimal for ICZM (Diedrich et al., 2010). Indicators are defined as quantitative/qualitative statements or measured/observed parameters that can be used to describe existing situations and measure changes or trends over time (IOC, 2006), also in evaluating an isolated phenomenon (diagnosis) or in a monitoring system to evaluate processes and detect changes (Doménech-Quesada y Sanz-Larruga 2010). In ICZM, sustainability scenarios and indicators are no generic, rather they are specific to sites and restricted by political and local realities (Diedrich et al., 2010). In the context of these realities, the analytical framework used for an assessment helps to determine the variety of indicators that are chosen to communicate the outcomes of that assessment (Gabrielsen & Bosch, 2003). For its assessments of the relations between human activities and the environment, Environmental European Agency (EEA) uses the Driving forces-Pressures-State-Impact-Responses (DPSIR) framework (Figure 1; Gabrielsen & Bosch, 2003) and it has been used in this work.

The main goal of this work has been to show a proposal of sustainable indicators for the tourism and urban development (driving forces) in Gran Canaria. Since both are two important and influential driving forces the Canary Islands coast (Gesplan, 2012) and therefore they should be taken into account in a local ICZM system.

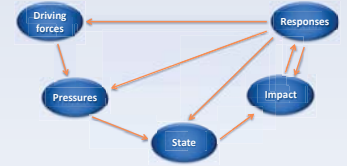


Figure 1. The Driving force, Pressures, State, Impact and Responses (DPSIR) framework scheme.

Methods

First, a shortlist of indicators was obtained according to the references, based on the established framework (DPSIR model) and the following four criteria: relevance, data availability, regular updating and ease of interpretation (criteria used by the public bank of environmental indicators of Ministry of Agriculture, Food and the Environment, MAGRAMA). Second, a DELPHI analysis was performed with four specialists in tourism and two in urban development, in order to decrease the number of preselected indicators. Third, the final weight of indicators was estimated by an Analytic Hierarchy Process (AHP; Saaty 1980). It was conducted in the two driving forces by the experts considered according to three criteria: relevance, data availability and ease of interpretation.

Results and discussion

The AHP set 32 (tourism) and 33 (urban development) indicators initially, divided into DPSIR categories. The experts observed the importance granted in parentheses (tourism // urban development) to the criteria of suitability (63% // 60%), data availability (26% // 20%) and ease of interpretation (11% // 20%). In driving force category of tourism, it was given a 40 % to "socioeconomic" and a 60 % to "eco-efficiency". Besides in responses category of tourism it was given a 40 % to "material and energy" and a 60 % to "habitats and biodiversity". In driving force category of urban development, it was given a 80 % to population and activities and a 20 % to natural resources. Besides, in response category of urban development, it was given a 52 % to "urban ordination", a 20% to "energy efficiency", a 20% to "transport system" and a 8% to "governance". There was not specific indicators to State category in urban development.

The information described above was combined with the comparative of indicators that are part of the AHP, and the resulting normalized weights (0 to 1) are observed in the Figures 2 (tourism) and 3 (urban development). The names of most relevant indicators and DPSIR categories appear in the Table 1 (tourism) and the Table 2 (urban development). This outcome has been delivered from the work agreed among the expert team of OMARCOST project (OMARCOST, 2014).

Notwithstanding DPSIR possess some drawbacks, the fact that the method is still in use more than three decades after its creation also attests to its robustness, and it has been concluded that the DPSIR framework is a useful tool that can still be refined (Gari et al., 2015). It links cause-effect relationships among the five categories of the framework (Figure 1) and has been used for analyzing and assessing the social and ecological problems of aquatic systems subject to anthropogenic influence, and it has been used to develop ICZM (Gari et al., 2015). We believe that DPSIR has successfully guided the selection of indicators for the drivers evaluated.

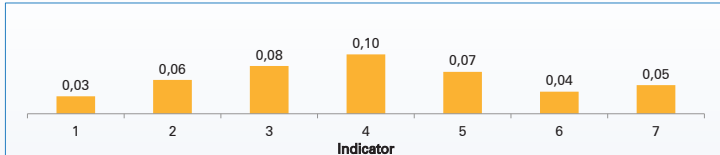


Figure 2. Normalized weights resulting from the Analytic Hierarchy Process (AHP) in tourism (these include a 42 % of the total weight of all DPSIR categories).

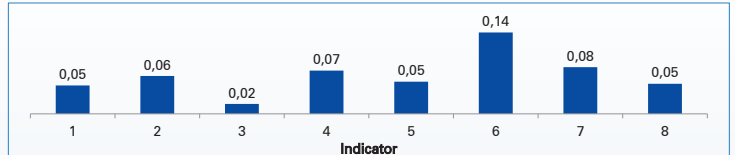


Figure 3. Normalized weights resulting from the Analytic Hierarchy Process (AHP) in urban development (these include a 52 % of the total weight of all DPSIR categories).

Table 1. Names of the 7 indicators as a result of the Analytic Hierarchy Process (AHP).

INDICATORS OF TOURISM
1. Number of tourists entering in the period (driving force-socioeconomic)
2. Water consumption per night (driving force-eco efficiency)
3. Percentage of intertidal occupied by tourist infrastructure (pressure)
4. Percentage of beaches comply with the law quality of bathing water (state about tourism)
5. Number of negative references about the coastal environment carried out by intermediary organizations or representatives of companies that provide tourist services at a tourism unit (impact)
6. Percentage of treated and reused wastewater (response, material and energy)
7. Percentage coastal marine area under some form of conservation (response-habitats and biodiversity-)

Table 2. Names of the 8 indicators as a result of the Analytic Hierarchy Process (AHP).

INDICATORS OF URBAN DEVELOPMENT
1. Resident and floating population per local government (driving force-population and activities-)
2. Urbanization index (driving forces-population and activities)
3. Energy consumption per inhabitant on household and accommodation units (driving forces-natural resources-)
4. Annual increase of urban land in hectares / year (pressure)
5. Mass of solid waste/inhabitant/year per local government (by type) (pressure)
6. Number of complaints and denunciations per year by local perceived impacts due to wastewater treatment plants, local and water pollution (impact)
7. Percentage of new buildings licences on old buildings over all residential building permits in a year (response- urban ordination)
8. Indicator of inefficiency in the use of urban and urbanized land (depending on soil type) (response-urban ordination-)

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