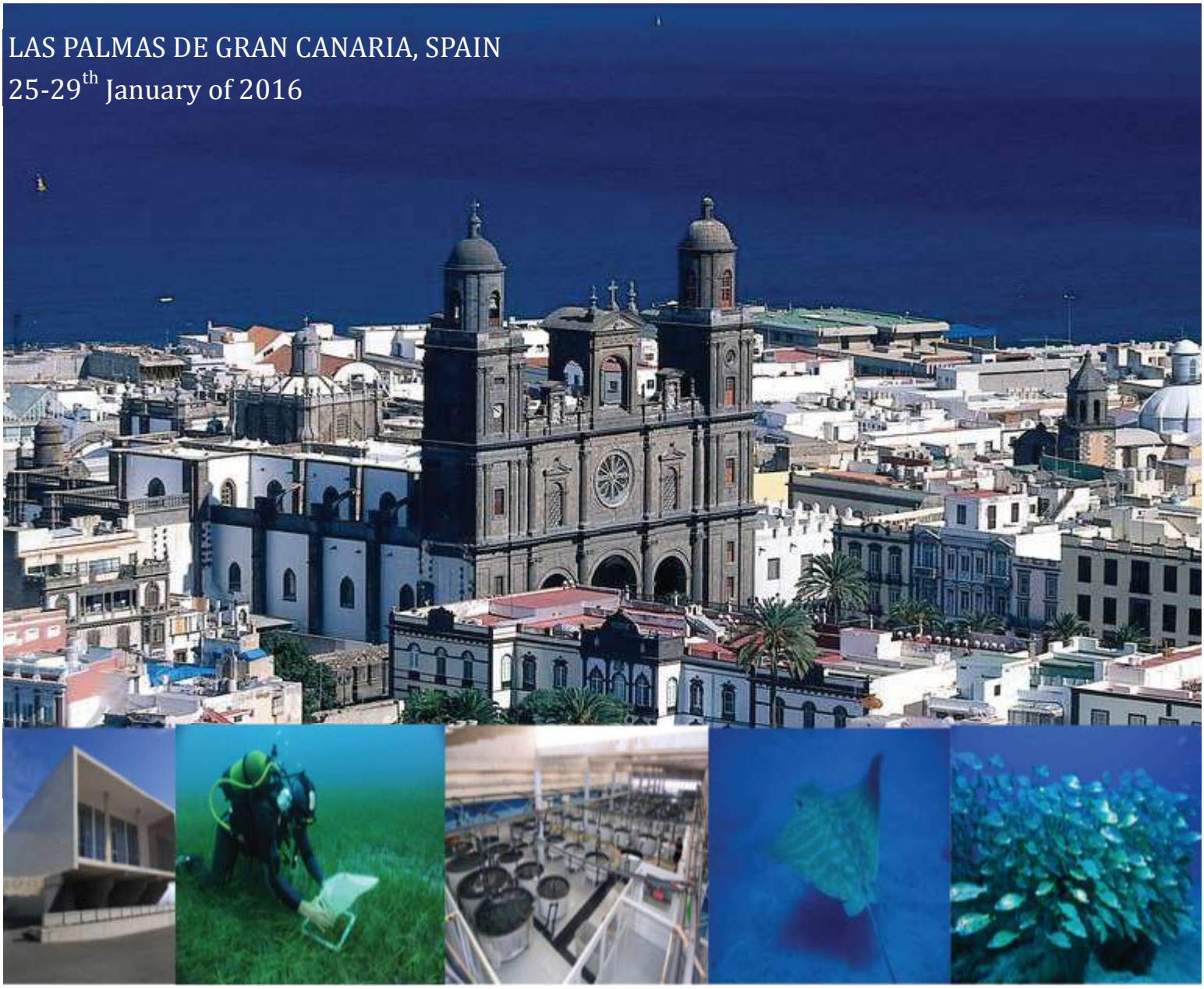
CECOMA 2016

Challenges in the Environmental Management of Coastal and Marine Areas



TOGETHER WE WILL BUILD A BETTER WORLD

ORGANIZED BY ECOAQUA
&
UNIVERSITY OF LAS PALMAS DE GRAN CANARIA

IN COLLABORATION WITH
IUCN

ECOAQUA
www.ecoaqua.eu

SEVENTH FRAMEWORK PROGRAMME

ULPGC

IUCN

Table of Contents

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

Pérez-G., Y*[1]., Bilbao A[1]. González, M[2]., Cedeño, V[2]., Suárez, B[2]., González, G[3]., Tello, O[4]., González, S[4]., Jiménez, S[3]., Santamaría, M.T.G[3]., Betancort, J[5]. & Pavón N[1]

[1] GMR Canarias S.A.U. c/Los Cactus 68, Polígono Industrial de Arinaga, 35118, Agüimes, Islas Canarias, Spain. *yeraypg@gmrcanarias.com
[2] Departamento de Análisis Económico Aplicado. Campus de Tafira, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria. Spain.
[3] Instituto Español de Oceanografía (IEO). Centro Costero de Canarias. Vía Espaldón, Dársena Pesquera PCL 8, 38180. Santa Cruz de Tenerife. Spain.
[4] Instituto Español de Oceanografía (IEO). Sede Central. Corazón de María 8, 28002. Madrid. Spain.
[5] Instituto Tecnológico de Canarias (ITC). Dpto. de Agua. Playa de Pozo Izquierdo s/n, 35119, Santa Lucía, Las Palmas, Spain.

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.

References

Gesplan, 2012. Recopilación, análisis y evaluación de información territorial y ambiental. Proyecto LITOMAC, 166pp.

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

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

Pérez-G., Y*[1]., Bilbao A[1]. González, M[2]., Cedeño, V[2]., Suárez, B[2]., González-Lorenzo, G[3]., Tello, O[4]., González-Gil, S[4]., Jiménez, S[3]., Santamaría, M.T.G[3]., Betancort, J[5]. & Pavón, N[1].

[1] GMR Canarias S.A.U. c/Los Cactus 68, Polígono Industrial de Arinaga, 35118, Agüimes, Islas Canarias, Spain. *yeraypg@gmrcanarias.com
[2] Departamento de Análisis Económico Aplicado. Campus de Tafira, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria. Spain.
[3] Instituto Español de Oceanografía (IEO). Centro Costero de Canarias. Vía Espaldón, Dársena Pesquera PCL 8, 38180. Santa Cruz de Tenerife. Spain.
[4] IEO. Sede Central. Corazón de María 8, 28002. Madrid. Spain.
[5] Instituto Tecnológico de Canarias (ITC). Dpto. de Agua. Playa de Pozo Izquierdo s/n, 35119, Santa Lucía, Las Palmas, Spain.

CECOMA 2016 Challenges in the Environmental Management of Coastal and Marine Areas
Las Palmas de Gran Canaria, Spain.
25-29th of January 2016

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.

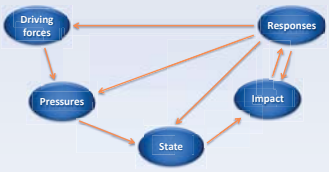


Figure 1. The Driving force, Pressures, State, Impact and Responces (DPSIR) framework scheme.

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 gave a 40 % to "socieconomic" and a 60 % to "eco-efficiency". Besides in responses category of tourism it was gave a 40 % to "material and energy" and a 60 % to "habitats and biodiversity". In driving force category of urban development, it was gave a 80 % to population and activities and a 20 % to natural resources. Besides, in response category of urban development, it was gave 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.

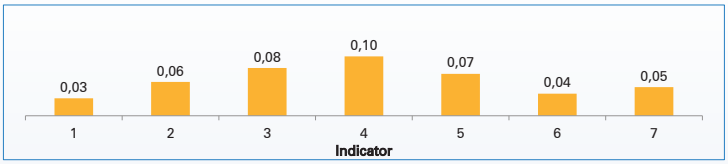


Figure 2. Normalized weights resulting from the Analytic Hierarchy Process (AHP) in tourism (these include a 42 % of the total weight of all DPSIR categories).

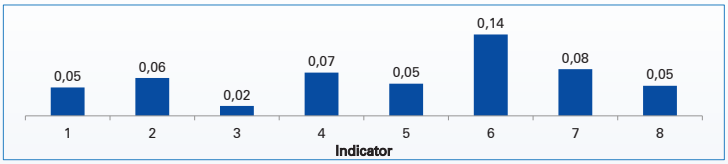


Figure 3. Normalized weights resulting from the Analytic Hierarchy Process (AHP) in urban development (these include a 52 % of the total weight of all DPSIR categories).

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-)

References

Diedrich, A, J. Tintoré & F. Navinés. 2010. Balancing science and society through establishing indicators for integrated coastal zone management in the Balearic Islands. *Marine Policy* 34: 772–781.
Doménech-Quesada, J.L. y F. J. Sanz-Larruga. 2010. *Guía para la implementación de un sistema de gestión integrada de zonas costeras*. Observatorio del Litoral de la Universidad de A Coruña. Netbiblo. S.L. 626 pp.
Gabrielsen, P. & P. Bosch, 2003. Environmental Indicators: Typology and Use in Reporting. *European Environment Agency*. 20 pp.
Gari, S.R., A. Newton & J.D. Icely. 2015. A review of the application and evolution of the DPSIR framework with an empashis on coastal social-ecological systems. *Ocean & Coastal Management* 103:63-77.
GESPLAN. 2012. Recopilación, análisis y evaluación de información territorial y ambiental. Proyecto LITOMAC, 166pp.
IOC. 2006 (Intergovernmental Oceanographic Commission of UNESCO). A handbook for measuring the progress outcomes integrated coastal ocean management, IOC Manuals and guides, nº 46; ICAM Diossier, 2. París, UNESCO, 2006.
OMARCOST. 2014. Propuesta de sistemas de indicadores de sostenibilidad ambiental del litoral. 586 pp.
Saaty, T.L. 1980. *The Analytic Hierarchy Process*. New York: McGraw Hill. International. Translated to Russian, Portuguese, and Chinese, Revised editions, Paperback (1996, 2000). Pittsburgh: RWS Publications.

Acknowledgments

The OMARCOST project (www.omarcost.org), "Strategy for environmental sustainability of cross-border coastal environment" was carried out with the support of the European Union (EU) and cofounded by European Regional Development and Spain-External Borders Cross-Border Cooperation Operational Programme (POCTEFEX) .

Unión Europea
Fondo Europeo de Desarrollo Regional
Invertimos en su futuro