INTERNATIONAL SYMPOSIUM ON ARTISANAL AND RECREATIONAL FISHING IN ISLANDS SYSTEMS

ISARFIS

ISMS 2022 LAS PALMAS DE GRAN CANARIA

VIII INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

I INTERNATIONAL SYMPOSIUM ON ARTISANAL AND RECREATIONAL FISHING IN ISLANDS SYSTEMS

LAS PALMAS DE GRAN CANARIA, JULY 06-08

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ISBN: PENDIENTE

Wednesday, 6th July 2022

09:00 **Marine Science Week Opening Ceremony**

09:30 **Plenary Session 1**
María Damanaki, Greece
Former European Commissioner Maritime Affairs and Fisheries

10:15 You can attend any of the Parallel Conference taking place on the Auditorio Alfredo Kraus: ISMS, BAMAR, SIQUIMAR

11:30 **COFFEE BREAK**

12:00 **You can attend any of the Parallel Conference taking place on the Auditorio Alfredo Kraus: ISMS, BAMAR, SIQUIMAR**

14:00 **Break**

15:30 **Plenary Session 2**
Lynne Talley, USA
Physical Oceanographer Scripps Institution of Oceanography

16:30 **Local Artisanal Fishermen Forum**
Speakers:
Gabriel Ocaña-Ortega, David Florido del Corral, Gabriel Mato-Adrover, José Pascual-Fernández
Hall: Sala Alegranza

18:30 **POSTER SESSION AND COFFEE**

08:45 **Plenary Session 3**
Julián Blasco, Spain
Department of Ecology and Coastal Management

Thursday, 7th July 2022

10:00 **ISARFIS Welcome Ceremony**

10:15 **Nestor Rodríguez**
Conclusions of the Artisanal fishermen forum

10:45 **ISARFIS-015**
Guerra-Marrero et al. EVALUATION OF THE BAIT CRABS RESOURCES EXPLOITED BY SHELLFISH GATHERING IN THE CANARY ISLANDS

11:00 **ISARFIS-017**
Sena et al. (MPA) BAÍA DO INFERNO E MONTE ANGRA PROTECTED AREA, CABO VERDE: A CASE OF COMMUNITY ENGAGEMENT IN AN AFRICAN ISLAND STATE

11:15 **ISARFIS-002**
Ramos-Sosa et al. CIGUATOXIN-LIKE TOXICITY IN FLESH AND LIVER OF FISHERY SPECIES FROM THE CANARY ISLANDS

11:30 **COFFEE BREAK**
Poster Session

12:00 **ISMS-325**
Sánchez-Utrilla et al. COLLABORATION BETWEEN FISHERMEN AND SCIENTISTS IN CALPE (ALICANTE) AS AN EXAMPLE OF A NEW MODEL FOR THE STUDY AND MANAGEMENT OF FISHERIES.

12:15 **ISMS-007**
Oribe-Pérez, I. FACTORS AFFECTING CATCH PER UNIT EFFORT OF RED GROUPER (EPINEPHELUS MORIO) CAUGHT BY SEMI-INDUSTRIAL FLEET IN THE CAMPECHE BANK, MÉXICO

12:45 **Opening Address**
Beatriz Morales Nin
RECREATIONAL FISHERIES MANAGEMENT.

13:15 **ISARFIS-005 - ONLINE**
Ana Gordoa et al. A NATIONWIDE COST-BENEFIT ECONOMIC APPROACH OF MARINE RECREATIONAL FISHING IN SPAIN

13:30 **ISARFIS-011 - ONLINE**
Martín-Sosa et al. IDENTIFYING PERSPECTIVES AND FRAMING ATTITUDES ON SPEAR FISHING IN THE CANARY ISLANDS (SPAIN): A Q-METHODOLOGY APPROACH

13:45 **ISARFIS-007**
Couce-Montero et al. IMPACT OF ARTISANAL AND RECREATIONAL FISHERIES IN NATURE 2000 NETWORK PROTECTED AREAS AND FUTURE PROJECTIONS INFLUENCED BY CLIMATE CHANGE

14:00 **BREAK**

15:30 **Plenary Session 4**
Penny Lindeque, United Kingdom
Head of Science: Marine Ecology and Biodiversity
University of Plymouth

16:30 **Opening Address**
Gilles van de Walle
ISLAND ARTISANAL FISHERIES MANAGEMENT & VULNERABILITIES.

17:00 **ISARFIS-030**
Riera et al. RISING TERMAPERATURES, FALLING FISHERIES: CONSEQUENCES OF CROSSING THE TIPPING POINT IN A SMALL-PELAGIC FISHERY.

17:15 **SARFIS-018**
Sena et al. THE UNITED NATIONS OCEAN DECADE OUTCOMES FOR CABO VERDE ARCHIPELAGO: LOCAL STAKEHOLDERS PERCEPTIONS

17:30 **ISMS-121**
Rodríguez-García et al. FISHING DISCARDS FROM TRAWLING IN THE GULF OF CADIZ. ANALYSIS AND CHARACTERIZATION

17:45 **ISMS-284**
Presa-Martínez et al. GRAVITY-DEPENDENT BUOYANCY OF PELAGIC FISH EGGS

18:00 **ISMS-184**
Cohen-Sánchez et al. FISHING Xyricthys novacula IN THE PITYUSIC ISLANDS: STATE OF THE FISHERY AND PROTECTION MEASURES

18:15 **ISMS-311**
Ouled-Cheikh et al. STRONGER TOGETHER: FISHERIES ENHANCE PRESSURE ON MEDITERRANEAN REGIONS AND PELAGIC SPECIES ALREADY IMPACTED BY CLIMATE CHANGE

18:30 **POSTER SESSION** (including posters online) **AND COFFEE**

21:00 **Conference Dinner**

Friday, 8th July 2022

9:35	**Plenary Session 5** Gotzon Basterretxea, Spain Department of Ecology and Marine Resources IMEDEA (UIB-CSIC)
09:45	**You can attend any of the Parallel Conference taking place on the Auditorio Alfredo Kraus: ISMS, BAMAR, SIQUIMAR**
11:30	**COFFEE BREAK**
12:00	**You can attend any of the Parallel Conference taking place on the Auditorio Alfredo Kraus: ISMS, BAMAR, SIQUIMAR**
13:10	**Plenary Session 6** Ronald Benner, USA Carolina Distinguished Professor University of South Carolina
14:0	**Closing Ceremony**
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IMPACT OF ARTISANAL AND RECREATIONAL FISHERIES IN NATURE 2000 NETWORK PROTECTED AREAS AND FUTURE PROJECTIONS INFLUENCED BY CLIMATE CHANGE

Lorena Couce-Montero*[1], Airam Guerra-Marrero[1], David Jiménez-Alvarado[1], Ana Espino-Ruano[1], Ángelo Santana del Pino[2], Jorge Cabrera-Gámez[3], Antonio Domínguez-Brito[3], Irene del Toro Navarro[3], Diego Gamo-Campos[3] and José J. Castro-Hernández[1]

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Abstract: Traditionally, artisanal fishing in the Canary Islands has been managed through policies focused primarily on regulating professional fishing effort, but without considering the technological changes that have occurred within the fleets or the increase in recreational fishing licences, although these fishermen compete for the same resources.
Likewise, inadequate use of fishing systems, the lack of information, the oversizing of real fishing power, levels of fishing effort higher than the resilience of species, loss of ecosystems and water quality, together with the impacts derived from climate change, among others, are responsible for the decline and depletion presented by some of the main target species of fisheries. In this context, and to address this problem from a more comprehensive point of view, the use of new management methodologies based on an ecosystem approach to fisheries is considered the most suitable option. Through temporal and spatial models, exploitation patterns that guarantee the sustainability of resources in the future will be established. The ecosystem model developed for the island of Gran Canaria has served to determine the structure, functioning and status of the island's marine ecosystem, quantifying the impact of fishing activity, both professional and recreational, combined with climate change. The results obtained show the risk of continuing with the current fishing strategy, and the need to establish new management measures that limit the impacts of the extractive activity of artisanal and recreational fishermen.

Key words: artisanal fishing, recreational fishing, Canary Islands, Ecopath, climate change, Nature 2000 Network

Acknowledgments: The present work has been carried out as part of the MOIRA Project, co-financed by the Biodiversity Foundation within the framework of the PLEAMAR 2020 Call. The authors also wish to thank artisanal and recreational fishermen who participated in the development of this work as well as the Fishery Directorate of the Canary Islands Government for provide the catches and fishing effort data.

IDENTIFYING PERSPECTIVES AND FRAMING ATTITUDES ON SPEAR FISHING IN THE CANARY ISLANDS (SPAIN): A Q-METHODOLOGY APPROACH

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Abstract: Spearfishing regulation in The Canary Islands (TCI) has been subject to conflict for years since it restricts the activity in its spatial access to resources. The administration argues that a precautionary approach is necessary because of the potential environmental impact that the activity could have on the fragile fish populations. There is little scientific information assessing this impact. Understanding the range of perceptions among social groups is a key challenge for successful management of any activity and its development. Q-methodology is used to explore existing perceptions or lines of thought of five spearfishing-related key-stakeholder groups (recreational fishers -including spearfishers-, professional fishers, regional administration, scientists and representatives of civil society having to do with the sea) towards spearfishing in TCI in order to find out whether they are the result of differences between sectors and which are the differentiating and convergent aspects. The 30 participants were asked to sort 33 statements about environmental, socioeconomic and regulation aspects. The factor analysis identified three distinct factors, each representing a different perception. The results show that the main perception, influenced mostly by environmental and regulation topics, is not generated by differences between the professional and spearfishing sector but with the components of other sectors. In contrast, the second line of perception expressed by factor 2, influenced mostly by social aspects, segregated the professional and recreational sector. Within each sector there are also differences or differences in the magnitude of the perception of the activity depending on its scope of action and geographical area. This study contributes to the scarce scientific information on social research on spearfishing in The Canary Islands.

Key words: The Canary Islands, Spear Fishing, Q-methodology

Acknowledgments: Authors are grateful to interviewed people for this work.

EVALUATION OF THE BAIT CRABS RESOURCES EXPLOITED BY SHELLFISH GATHERING IN THE CANARY ISLANDS

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Abstract:

The assessment of populations of the bait crabs *Xantho* spp., *Pachygrapsus* spp. and *Percnon gibbesi* is carried out for the first time for Gran Canaria Island in order to establish their current status. Their respective reproductive periods are described and, according to this, is proposing a modification of the temporary closures of the gathering fishery. The study analysed 3 shellfish areas, at south, east and north of the island. The catch per unit of effort (CPUE) values for *Pachygrapsus* spp. and *Percnon gibbesi* were the highest in the north (81.88±67.66 and 26.69±32.63 individuals/hour/gatherer, respectively). However, the highest values for *Xantho* spp. were obtained in the east coast (27.13±19.92 individuals/hour/gatherer). To establish a correct estimation of the CPUEs by areas, season and fishing effort, a Generalized Additive Model (GAM) was applied to estimate the fishing pressure on this crab species in each area and globally.

Key words: CPUE, fishing effort, Assessment, reproductive seasons.

Acknowledgments: Airam Guerra-Marrero was supported by a grant of the University of Las Palmas de Gran Canaria with a research staff training contract (PIFULPGC-2017-CIENCIAS-2).

BAÍA DO INFERNO E MONTE ANGRA PROTECTED AREA, CABO VERDE: A CASE OF COMMUNITY ENGAGEMENT IN AN AFRICAN ISLAND STATE

Naya Sena*[1], Ana Veiga[2], Adilson Semedo[3], Mara Abu-Raya[4], Rute Semedo[5], Iwao Fujii[6] and Mitsutaku Makino[7]

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Abstract: Cabo Verde archipelago is one of the most important marine biodiversity hotspots in the North Atlantic. One of the strategies for the conservation of endangered species and habitats has been the decreeing of protected areas. However, of the 47 protected areas enacted, only 24 are fully implemented and have a management team. The most recent protected area to be decreed was the Baía do Inferno e Monte Angra Natural Park, in April 2021, consisting of marine and terrestrial area. This was the first ever protected area to be proposed by a civil society initiative. Therefore, this study aims to provide management tools to support the Natural Park's implementation, by describing the local socio-ecological dynamics, understanding the communities' perceptions and expectations and identifying the possibilities of community engagement in management processes. Thus, a social survey was conducted in the three rural communities located within the Natural Park's boundaries, resulting in a total of 480 questionnaires and 9 semi-structured interviews to community leaders. The results show that local communities not only value biodiversity conservation (93.8% - conservation is important or very important), but are also willing to take part in decision-making processes (93.3% preferred a management model in which the community is included). Mainly supporting a co-management model (76.7 %), the population strongly agrees with the creation of the protected area (95%) and hopes that its implementation will bring benefits such as greater socio-economic development, biodiversity conservation, improvement in fishing practices, and eco-tourism development. It would be extremely important to extend local communities' role in the creation of the Natural Park and engage them in its implementation and management. This study lists some suggestions and guidelines that can facilitate the setting up of a co-management process.

Key words: Island protected areas, Co-management, Civil society initiatives, Communities perceptions, Socio-ecological dynamics

Acknowledgments: This study was support by the Uchida Research Grant, Atmosphere and Ocean Research Institute, The University of Tokyo, Japan and by Sasakawa Peace Foundation, through the Japanese Society of Ocean Policy, Japan.

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THE UNITED NATIONS OCEAN DECADE OUTCOMES FOR CABO VERDE ARCHIPELAGO: LOCAL STAKEHOLDERS PERCEPTIONS

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Abstract: In a small island country like Cabo Verde, where the marine area is almost 200 times larger than the land area, the ocean is certainly of great importance. The majority of Cabo Verde's population is settled in coastal areas (> 90%) and the most relevant socio-economic activities are directly linked to the sea: tourism, industrial activities and fishing. Moreover, the country's seas host great biodiversity and endemism. The UN Ocean Decade (2021-2030) initiative provides us with a common framework that allows stakeholders to coordinate efforts to generate data and produce science. Thus, contributing to a more sustainable use of the oceans and, consequently, achieving the 2030 Agenda for Sustainable Development. Cabo Verde is one of three African countries to have a fully established National Decade Committee, evidencing the importance of ocean health for the country. Therefore, this study aims to identify research needs in ocean science and analyze the UNDOS expected outcomes for Cabo Verde, from the perspective of local stakeholders. Ergo, semi-structured interviews were conducted with community leaders from three different coastal communities of Cabo Verde, in the past year, combined with literature review. Preliminary results show that some of the main expected outcomes are the improvement of marine ecosystems protection and management (Outcome 2 - a healthy and resilient ocean), greater scientific production and funding (Outcome 6 - an accessible ocean) and increased societal awareness on ocean's issues (Outcome 7 - An inspiring and engaging ocean). With the identification of outcomes and the definition of local research priorities, it will then be possible to effectively organize and coordinate the initiatives and projects of the different local stakeholders.

Key words: Ocean decade, UNDOS outcomes, Island coastal management, Stakeholders perception, Research priorities

Acknowledgments: This study was support by the Uchida Research Grant, Atmosphere and Ocean Research Institute, The University of Tokyo, Japan, and by Sasakawa Peace Foundation, through the Japanese Society of Ocean Policy, Japan.

RISING TEMPERATURES, FALLING FISHERIES: CONSEQUENCES OF CROSSING THE TIPPING POINT IN A SMALL-PELAGIC FISHERY

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Abstract: Ocean warming affects fisheries around the globe. Commercial fish respond to it depending on their preferences for certain temperatures. The small pelagic fish community responds faithfully to environmental changes, making it a good early warning system to understand and prevent the biological communities shift. Indeed, the occurrence of regime shift of the pelagic communities caused by environmental factors has catastrophic consequences on the society, causing changes in the economic and cultural dimensions. Here, we explored the causes of the regime shift that occurred in the small pelagic community on Madeira Island. To do so, we focused on the landings of four species that ensemble the small fish pelagic community, Boops boops, Scomber colias, Sardina pilchardus, and Trachurus picturatus, over a 40-year period (1980-2019).

On the environmental side, we collected information on Sea Surface Temperature Anomaly (SSTA) and North Atlantic Oscillation data (NAO), for each year of the time series. To shed light on the causes of shift landings, we performed a set of General Additive Models to fit the nonlinear trends. Our results showed that the regime shift of the small fish pelagic community occurred in 2002, with a transition period from 2000 to 2003. Where the simultaneous factors SSTA and NAO explained up to 88.2 % of the small fish pelagic community shift, both of which were significant. This trend was unyielding despite the implemented management actions to preserve these stocks. The present findings are further evidence of the major effects of ocean warming on small pelagic catch levels. An urgent need to consider ocean warming in the proper management of fish stocks is required. The economic consequences are devastating considering the importance of small pelagic by artisanal fishermen from several geographic areas.

Key words: Key: Regime shift, Resilience, Global change, Fisheries management

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CIGUATOXIN-LIKE TOXICITY IN FLESH AND LIVER OF FISHERY SPECIES FROM THE CANARY ISLANDS

María José Ramos-Sosa*[1], Natalia García-Álvarez[1], Andres Sanchez-Henao[1], Freddy Silva Sergent[1], Daniel Padilla[1], Pablo Estévez[2], María José Caballero[1], José Luis Martín-Barrasa[1,3], Ana Gago-Martínez[2], Jorge Diogène[4] and Fernando Real[5]

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Abstract: The Canary Islands have a strong fishing tradition, where the consumption of amberjack (*Seriola* spp.), dusky grouper (*Epinephelus marginatus*), black moray eels *(Muraena helena*), and common two-banded seabream (*Diplodus vulgaris*) is quite typical. This archipelago is an important hotspot of ciguatoxins (CTXs) with an established official monitoring program to detect these toxins in flesh (Sanchez-Henao et al., 2019; DG of Fisheries of the Canary Government, 2022). As the liver is one of the organs which reaches higher toxin levels, fish are usually sold gutted (Chan, 2017). Nevertheless, fish caught by recreational fishermen are not officially tested, leading to possible ciguatera poisoning (CP). The objectives of this study were to determine the presence of CTX-like toxicity in relevant species from the Canary Islands, to compare CTX levels in the liver and flesh, and to examine the possible factors that could be involved in the toxicity of these fish species. Sixty amberjack, 27 dusky grouper, 11 black moray eels, and 11 common two-banded seabream were analysed by cytotoxicity assay (CBA), and C-CTX1 was detected by liquid chromatography mass spectrometry (LC-MS/MS) in all these species. The liver showed higher CTX levels (> 8-fold as median) than its respective flesh in 91 out of 93 fish studied. In addition, 14 out of 16 individuals with no detectable CTX in flesh exhibited hepatic toxicity. None of the specimens with non-toxic liver showed toxicity in muscle. Results regarding black moray eels stand out because of the great difference between CTX concentration in both tissues. To the best of our knowledge, this is the first evidence of the presence of C-CTX1 in the common two-banded seabream and the first report of toxicity comparison between liver and muscle tissue from relevant fish species captured in the Canary Islands.

Key words: Ciguatoxins, Amberjack, Dusky grouper, Moray eel, Common two-banded seabream, Canary Islands

Acknowledgments: The authors thank the Directorate-General for Fisheries of the Canary Government as responsible of the official control program of ciguatera in the Canary Islands. This research was funded by the EuroCigua project, Spain ("Risk characterization of ciguatera food poisoning in Europe" (GP / EFSA / AFSCO / 2015 / 03)); and the CIGUARISK ("Food risks associated with ciguatoxins: monitoring and tracking the toxins and toxin-producing organisms in marine ecosystems" (PID2019-108781RR-C21-PID2019-108781RR-C22)). María José Ramos-Sosa acknowledges financial support from the Spanish Ministry of Education (FPU17/04022).

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DATA-LIMITED MIXED FISHERIES TARGETING DATA-POOR SPECIES: THE ARTISANAL PURSE-SEINE FLEET IN THE CANARY ISLANDS

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Abstract: In waters off The Canary Islands, small pelagic fish are targeted by an artisanal purse seine fleet. This fishery has been monitored within the *EU Data Collection Framework* since 2013. The status assessment of the most important commercial species (i.e. *Scomber colias*, *Trachurus* spp, *Sardinella* spp and *Sardina pilchardus*) are included in the Fishery Committee for the Eastern Central Atlantic (CECAF). However, the short time series and the limited knowledge of the life history traits of these species in the Archipelago had been considered too limited to perform any assessment exercise. In this context, a multi-model approach was attempted to assess the status of these species for the first time in the area, using the methods recommended by CECAF and the International Council for the Exploration of the Sea (ICES). Time series of landings and fishing effort includes data since 2009 to 2020, being less reliable at the beginning of the series. In addition, the biological and population information needed as input data in those models, are available depending on the species, this increasing the uncertainty of these analyses. A total of six data-limited (length- and catch-based) methods was applied. Results show that a quantitative assessment of the Canaries small pelagic stocks, with the final aim of providing scientific advice for management purposes, is not yet feasible. Therefore, it is necessary and urgent to address the current uncertainties around these species and fisheries, both by improving the knowledge of their life histories and by solving the shortfalls related to the data of this artisanal and multispecific fishery.

Key words: data limited, stock assessment, small pelagic fish, CE Atlantic

Acknowledgments: This project was partially funded by the EU through the European Maritime and Fisheries Fund (EMFF) within the Spanish National Program of collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy.

REFERENCE POINTS TO DETERMINE THE STATUS OF MOST IMPORTANT COMMERCIALLY EXPLOITED STOCKS OF THE SMALL-SCALE FISHERIES IN THREE MACARONESIAN ARCHIPELAGOS

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Abstract: Fish stocks should be maintained at levels that can produce the maximum sustainable yield (MSY); however, for many stocks, the available biological and fisheries information is not enough for such estimations. Although catch statistics are the most widely accessible fisheries data, very few stocks have reliable biomass assessments. Additionally, standardized data are not available for many fisheries, which prevents using catch per unit effort (CPUE) as an actual indicator of changes in abundance. This makes extremely difficult the estimation of strong biological and exploitation limits. Here, we describe a method for stock assessment of data-poor fisheries, including thirty-one representative species of the Macaronesian region, either because of the volume of their catches or because of their biological importance. The results obtained allow a preliminary evaluation of the status of these stocks based on the F/F_{MSY} and B/B_{MSY} criteria, which refer to the ratio of actual fishing mortality (F) to the level that would provide maximum sustainable yield (F_{MSY}) and the ratio of observed biomass (B) to the biomass that would provide maximum sustainable yield (B_{MSY}), respectively. The results suggest that almost all the stocks assessed are overexploited. However, they should be interpreted in the context of each Macaronesian archipelago in combination with other indicators wherever possible. This is because the model has limitations and uncertainties, and the robustness of the results therefore depends on the input data.

Key words: Data-poor fisheries, Canary Islands, Madeira, Azores, MSFD, Stock assessment.

Acknowledgments: The present work has been carried out as part of the PLASMAR Project (MAC/1.1a/030) and PLASMAR+ Project (MAC2/1.1a/347). These projects have been co-financed by the European Regional Development Fund (EDRF) and the INTERREG V-A

Spain-Portugal MAC 2014-2020 (Madeira-Azores-Canarias). The authors also wish to thank to the Fishery Directorate of the Canary Islands Government for provide the catches and fishing effort data.

CHARACTERISATION OF SHELLFISHING GATHERING ON THE NORTH COAST OF GRAN CANARIA

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Abstract: Shellfish gathering has been practised in the Canary Islands since pre-Hispanic times. Currently, there are regulations that limit it, both at professional and recreational level. However, there is no monitoring of the activity, especially of recreational gathering, which is why it is a data-poor fishery. In this study, a series of surveys were carried out among shellfish harvesters on the north coast of the island of Gran Canaria, with the aim of obtaining information on the state of these resources in order to improve the scarce knowledge of this fishery. It was found that the regulation is frequently not complied in several of its sections and that it is likely that some of the stocks of the target species (limpets in particular) could be fully exploited. Control of the activity and other measures are necessary to avoid the collapse of these resources.

Key words: limpets, common octopus, intertidal zone, recreational fishing.

Acknowledgments: The authors want to thank to the fishermen associations of Agaete and San Cristóbal for their collaboration and providing data. Thank are also given to Mr. Antonio M. García-Mederos (Fisheries Inspection Service of the Directorate General of Fisheries of the Government of the Canary Islands) and Mrs. María F. Marrero-Escudero (Agricultural Extension and Agricultural and Fisheries Development Service of the Island Council of Gran Canaria).

WHAT SCIENTIFIC OBSERVATIONS TELL US ABOUT THE ARTISANAL PURSE-SEINE FISHERY IN THE CANARY ISLANDS

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Abstract: In the Canary Islands, the small-scale fleet performs daily fishing trips, being the small pelagic species usually caught with purse-seines. In 2017, a monthly programme of scientific observations was launched to characterize the catches of the artisanal purse-seine fleet, whose discards were considered irrelevant. Here we present a summary of the species composition recorded during 61 fishing trips and the size structure of the main targeted species (i.e. *Scomber colias*, *Trachurus* spp., *Sardinella* spp. and *Sardina pilchardus*), including both the retained and discarded catches. In the period under study (2017-2021) discards reached noticeable values of around 25% of the total fish caught, attaining 40% if we look at the catches of *S. colias*. The main reasons observed for discarding fish are market demand and the mean size of the school caught, which generally lead to the net slipping (i.e. the process to open the purse-seine to release excess or unwanted catch into the sea), a regular practice that remains unrecorded and estimates are difficult to report.

Key words: small pelagic fish, small scale fishery, discards.

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IMPLEMENTATION OF D3 (MSFD) IN THE MACARONESIA ECOREGION: PRACTICAL CASE OF THE PARROTFISH, *SPARISOMA CRETENSE* IN THE CANARY ISLANDS

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Abstract: The EU Marine Strategy Framework Directive (MSFD) establishes a framework within which Member shall take the necessary measures to achieve or a maintain good environmental status in the marine environment (GES) in the EU marine waters.

The monitoring and evaluation of the GES involves eleven Descriptors, among which the Descriptor 3 (D3) specifically addresses the impact of fishing activities on target species. The GES of D3 is achieved when "Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock". It is assessed using three Criteria (C): C1 is the level of pressure of the fishing activity (F). C2 is a state criterion based on the reproductive capacity of the stocks (Spawning stock biomass). Finally, C3 is also a state criterion and considers whether age and size distributions of the populations of commercially-exploited stocks are indicative of a healthy population.

In the Canary Islands, a number of factors preclude the implementation of the MSFD D3 using the primary indicators of the two first criteria: fisheries are operated by a multi-gear small-scale fleet targeting different species over time, and direct stock evaluations are lacking. As a consequence, data are limited and fragmented. In this context, we analyse here the usefulness of the Criterion 3 as an input to assess the GES, using as a case study data coming from the parrotfish *Sparisoma cretense* in small-scale fishery, the most important demersal species in terms of landings.

For that purpose, we analyse time series of length distributions data and discuss the trends observed in the length-based indicators that are currently proposed to assess the Criterion 3 of D3.

Key words: MSFD, Descriptor 3, Canary Islands, small-scale fisheries, parrotfish, *Sparisoma cretense*

CATCH CHARACTERIZATION OF THE DEMERSAL ARTISANAL FISHERY IN THE CANARY ISLANDS

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Abstract: A long-term programme of scientific observations on board was launched in the Canary Islands in 2015. It is framed in the Multiannual Plans of the EU-Data Collection Framework, an instrument of the Common Fisheries Policy. Initially the programme covered the demersal fleet of Tenerife Island, being extended to the fleet operating in the Island of Gran Canaria in 2021. Here we present a first characterization of the catch (retained and discards) from the onboard observations: species composition and size structure are analysed, also considering their geographical distribution.

A total of 208 daily trips with 5313 fishing operations were sampled on board in the period 2015-2021. The 5313 fishing operations carried out represent practically the entire variety of minor gears allowed by this fleet: traps, gillnets and hook-and-line gears with live or dead bait. The most used gears in the sampled trips were fish traps and shrimp traps (targeting mainly *Plesionika* spp.). The results indicate a high variety of species, typical for small-scale fisheries of tropical ecosystems with high biodiversity: a total of 212 taxa, 98 of them corresponding to the retained catch. In addition, the species with the highest volume of catches was the parrotfish *Sparisoma cretense*, according to the official landing data since annually it is the most landed species in The Canary Islands.

Key words: artisanal fisheries, scientific observations on board, demersal resources.

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METALS IN COMMERCIAL FISH IN THE GALAPAGOS MARINE RESERVE: TOXIC RISK ASSESSMENT

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Abstract: Marine metal pollution can damage environments with exceptional biodiversity such as the Galapagos Islands. Fish is consumed locally, so the metal contamination in commercial fish and its toxic risk should be assessed. We sampled 20 individuals of demersal (*Caulolatilus princeps* and *Mycteroperca olfax*) and pelagic (*Thunnus albacares* and *Seriolella violacea*) species. Macroelements, microelements, trace elements (Ca, Cr, Fe, K, Li, Mn, Mo, Mg, Na, V and Zn) and toxic elements (Al, B, Ba, Cd, Ni, Pb and Sr) were analyzed by Inductively Coupled Plasma Optical Spectrometry (ICP-OES) in muscle. Demersal species showed higher concentrations of Cr, K, Mg and Mo, while pelagic species presented higher levels of Zn. An intake of 178 g of *T. albacares* supplies 10.6% of the recommended weekly intake for Zn (66.5 mg/week for a person of 70 kg). The consumption of *C. princeps* contributes to the intake of nutritional elements like Ca, Na, K, Mg, and Cr, but due to its high Cd concentrations we recommend not ingesting more than 443 g/week for a person of 70 kg. *M. olfax* showed the highest estimated weekly intake for Cd (0.452 mg/week), so we recommend not ingesting more than 72 g/week for a person of 70 kg. Ecuador does not have its own regulation for metals in edible fish species yet, so evaluation was made using the European Union legislation (CE/UE, 2006). According to the CE/UE, none of the species could be marketed in Europe because all Cd levels exceeded the limit of 0.05 mg/kg fresh weight (0.10 mg/kg fresh weight for *Thunnus* sp). Our results suggest the main source of metals in the studied fish to be the vulcanism of the islands rather than anthropogenic pollution. This is the first study that thoroughly estimates dietary metal contributions and risks of its consumption to human health.

Key words: Galapagos, Demersal fishes, Pelagic fishes, Metals, Toxic risk, ICP-OES.

Acknowledgments: We would like to thank to the Charles Darwin Foundation and the Galapagos National Park for their help in this study. We owe a special thanks to artisanal fishers Luis Bonilla, Jaime Ascencio, Jonathan Erazo and Nelson Ibarra who kindly contributed with samples for this study. The research was done under the Galapagos National Park Directorate permit PC-37-19. Finally, we would like to thank the Leona H. & Harry B. Helmsley Charitable Trust and the Gordon and Betty Moore Foundation for their support in funding this research. This publication is contribution number 2276 of the Charles Darwin Foundation for the Galapagos Islands.

EXPERIMENTAL ASSESSMENT OF THE VIABILITY OF DEEP-SEA TRAP FISHERY IN THE CANARY ISLANDS.

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Abstract:

A previous assessment of the deep-sea living resources of the Canary Islands is of vital necessity for future development of an artisanal trap fishery. In this exploratory study, the faunal composition between 300-2000 meters depth of the Canary archipelago was assessed. Through crustacean and fish traps, the fishing yield and risk of loss of traps were analysed by depth strata. Catch per Unit of Effort (CPUE) showed a considerable decrease with depth, with the highest yields found between 300 and 700 meters deep. Mean CPUE values for fish were 40.87 ± 70.42 g/h and 52.73 ± 82.13 g/h for crustaceans.

Paramola cuvieri, Cancer bellianus, Chaceon affins, Heterocapus spp., *Pleisionika* spp. and *Helicolenus dactylopterus Conger conger* were the species that could support a certain extractive activity, although their economic activity would be limited to the extractive costs. The low profit of the catches due to the risk of loss from the traps (10% per fishing campaign), and the adaptation of the vessels to operate at great depths makes the development of this trap deep-water fishery not an economically viable resource in the Canary Islands.

Key words: CPUE, archipelago, island system, effort, artisanal fishery, crabs, shripms.

ABSTRACT OF THE STUDY: DISSEMINATION AND AWARENESS-RAISING ACTIONS ON SEA TURTLE POPULATIONS IN THE WATERS OF TENERIFE, CANARY ISLAND (SPAIN).

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Abstract: The commercial fishing fleet in Tenerife may be characterized by its small-scale and it employs handle-based gear, traps, and small gillnets. However, other fleets coming from the other Mediterranean Sea and from other Atlantic ports temporarily fish around the Canarian waters; these fleets use surface longlines more intensively. These surface longlines catch a certain amount of unwanted marine species, for example sea turtles. This study explores the main causes of sea turtle strandings in a collaborative way, working with small-scale fishers and conservationists. Small-scale fishers' gave us complimentary information for our analysis as well as a lot of information about the current situation of the sea turtle populations. We have also observed a lack of knowledge about how to act when they find a sea turtle stranding. These results reflect the importance of incorporating the local knowledge possessed by the main users of the sea, such as fishermen, given their constant contact with the sea and the marine resources. Finally, from this study the need has arisen to create a simple protocol to provide fishermen with a simple way of knowing how to act once they come across a stranded turtle and the implementation of informative campaigns are carried out on the correct handling of an encounter with one of these animals. The best way to do this is to try to solve the problems they face and, above all, to provide society with information about the problems and possible solutions. In this project, we worked with the main users of the sea, as they are one of the main sources of information on the situation, as well as those who can help us most in rescuing these stranded animals due to their constant contact with the sea.

Key words: Stranding, fishing gear, longline fisheries, sea turtle

Acknowledgments: This research was only possible by constructing collaborative knowledge between fishers, scientists, and local experts. We would like to thank all the fishers that collaborated with this study, especially the secretaries and leaders of the *cofradías* in Tenerife. We would also like to acknowledge the island government, *Cabildo de Tenerife*, and especially to Agustín Espinosa and the managers of Centro de Recuperación de Fauna Silvestre La Tahonilla, for their essential and valuable contribution as experts and for their advice and encouragement. This study was partially funded by Grupo de Acción Costera de Tenerife (GAC) through the project "Outreach and awareness actions on sea turtle populations in the waters of Tenerife," which was managed thanks to the Fundación General Universidad de La Laguna support.

FISHERY DATA OF THE CANARY ISLANDS: THE ROLE OF THE SPANISH INSTITUTE OF OCEANOGRAPHY

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Abstract: The Canary Islands Artisanal Fisheries are composed by around 750 units (source: Gobierno de Canarias) with a mean age of 42 years old. The fleet is also of small size in general terms (80% of vessels are smaller than 10 m in length), and targets more than one hundred different species with fishery interest.
First Sale Spots (FSS) of The Canary Islands government were fully established in 2006 and is the only official fishery information about landings. From that date on, the Report and Sampling Web (RSW) implemented and coordinated by the IEO provides length sampling data of the most landed species in the important landing sites and at-market, under EU-Data Collection Framework since 2013. The RSW for small pelagic and demersal species is made up of 12 people monitoring the FSS and a great part of other landing sites (Figure 1). Each reporter makes a minimum of 6 monthly visits to sample demersal species. Additionally, 6 monthly samplings on small pelagic species are made at Tenerife island. As a result of the analysis of this information, temporal trends of mean sizes and length classes of the species with more fishery interest are provided.
Landing biomass information from the FSS system is also checked with expert judgement looking for possible errors dealing with species, fishing gears and/or vessels. This information, after being checked, is uploaded to the IEO database "Integrated Monitoring of Ocean Natural Resources" (SIRENO, from its name in Spanish, *Seguimiento Integrado de los REcursos Naturales Oceánicos*). The analysis of this information brings about landings time series and length composition of the main species from a fishery perspective. These results are useful for the IEO staff advising tasks to the fishery administration in order to manage these fisheries.

Key words: The Canary Islands, Artisanal Fisheries, Fisheries Monitoring

Acknowledgments: Authors are grateful to every person once belonging to RSW, people in charge of FSS system, and to the collaborative attitude from the fishing sector.

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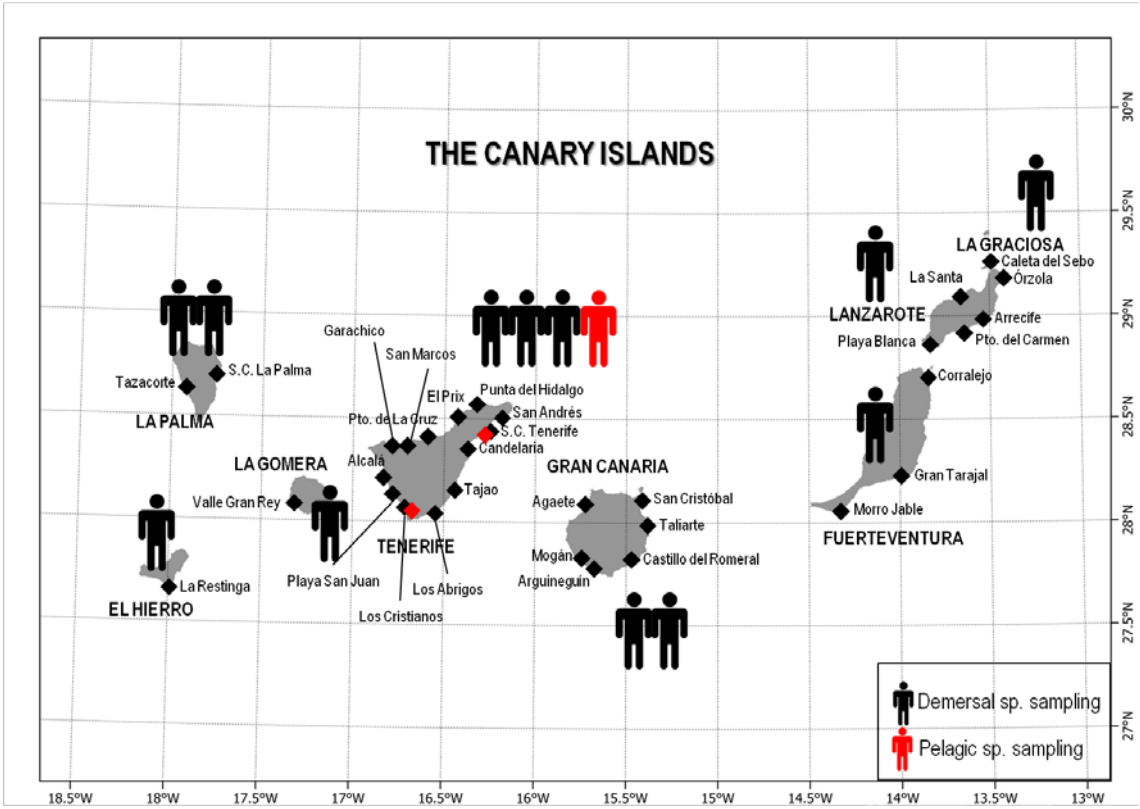

Figure 1. Distribution of the members of RSW along the Canary Archipelago.

MARINE RECREATIONAL FISHERY IN THE CANARY ISLANDS: A LEGISLATIVE HISTORICAL JOURNEY

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Abstract: In Spain, the maritime jurisdiction for fisheries extends up to the territorial sea and, in addition, the location of internal waters is defined (Law 20/1967; Royal Decree 2510/1977). After the Spanish Constitution (1978), the Statute of Autonomy of the Canary Islands (1982) and Royal Decree 1938/1985, maritime fishing is divided between the Canary Islands Autonomous Government (CIAG) (internal waters) and the National Spanish one (territorial sea), except for shellfish that is of exclusive competence of CIAG. Due to the complexity and dynamism of the fisheries, its legislation is often included in various regulations. A general reading of the main rules governing fisheries issues developed by both administrations reflects a degree of similarity which favours their application. However, some differences are identified which may lead stakeholders to encounter difficulties in understanding their application. In order to know the evolution and the degree of divergences between regional and national competences in marine recreational fishing, more than 40 rules contained in the national and regional official law gazettes have been revised since the 20th century, being the first reference from 1936. However, in those in force, some differences have been found, for example: regarding minimun catch lenght (MCL) not exactly the same species are regulated and in some cases the MCL differs; daily catch volume (fishing from land or boat); permitted or prohibited species; minimum distances between recreational fishermen and other activities (e.g. professional fishing) and the limitation for spearfishing to specific days. The results are presented as a milestone timeline detailing the divergences found, that will be useful for legislators, fisheries managers and fishermen, as they provide a temporary overview of changes in the framework of the current fisheries regulatory convergence process. In this sense, considering the "principle of legal certainty", the legislator should pursue regulatory clarity.

Key words: marine recreational fisheries, legislation, the Canary Islands

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ANALYSIS OF HISTORICAL FISH CAPTURE PHOTOS FROM ANGLERS OFF GRAN CANARIA

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Abstract

Photographs taken by recreational fishermen, displaying the specimens caught, are a source of information that can help to evaluate the changes that have occurred in fish populations, as well as in the dominance of species in the catches as a sign of changes or alternations in coastal marine ecosystems. The analysis of xxx photographs obtained on the island of Gran Canaria shows that over the last 50 years there has been an important change in the species targeted by recreational fishing, with an increase in the number of species frequentlyand their relative importance in catches in recent decades. Moreover, it is highlighted that the great majority of these species have suffered a significant decrease in the average size of the catch, possibly as a consequence of the chronic overfishing that the marine ecosystems in the Canary Islands have been suffering.

Key words: Mean length variation, catch composition variation, Canary Islands

Acknowledgments: To all the fishermen that give us the photographs, especially for "Club de Pesca Oleaje"

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FECUNDITY STRATEGY OF THE HIGHLY EXPLOITED LIMPET, *PATELLA ORDINARIA*, FROM AN OCEANIC ARCHIPELAGO

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Abstract:

Limpet harvesting dates back to the 15th century in Madeira archipelago (NE Atlantic Ocean), when the archipelago was colonized by the Portuguese. This activity is size-selective, removing older and larger individuals with greater commercial value. It can lead to a lower reproductive output as individual fecundity is size-dependent. The sharp decrease of intertidal limpet populations has led to the implementation of various management measures including the establishment of a closed season from November to March to avoid disturbance during the reproductive season. So far, sizes and the reproductive parameters size and age at first maturity have been previously used to determine the exploitation status of the limpet *Patella ordinaria* in Madeira Island, with no study performed on the reproductive strategy of these limpets. This is pivotal to comprehend the population dynamics of any species, being fecundity one of the reproduction parameters that should be analysed. Improved understanding of these features will provide new info of the population sustainability to harvesting. This work aims to provide new information on the fecundity of *P. ordinaria*, an issue included in a broader study that explores complex life cycles in metacommunities in order to predict future scenarios in human-exploited and fragmented ecosystems. An average of 17 females per month were randomly collected over the spawning season of 2021-2022 from the subtidal zones of the rocky shores of the Madeira archipelago, by snorkeling. Histological analysis and visual image analysis system were used to study the four main criteria applied for fecundity type

determination: (i) presence of a hiatus between pre-vitellogenic and vitellogenic oocytes; (ii) number of standing stock of advanced vitellogenic oocytes over the spawning season; (iii) mean size of standing stock of advanced vitellogenic oocytes over the spawning season; and (iv) the incidence of atresia over the spawning season.

Key words: *Patella ordinaria*, fecundity type, Madeira Island, Northeastern Atlantic Ocean.

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