

INVENTORY OF BIODIVERSITY IN THE BAY OF ANCÓN AND RESPONSIBLE FISHING

Hellen F. Blancas¹, Francisco J. Rivadeniera², Alex S. Armas³, Alejandro Mena⁴, Zanhly L. Valencia-Reyes⁵, Fiorella V. Güere⁶, Elías F. Armas⁷

^{1,2} National University of Education Enrique Guzmán y Valle, Lima, Perú

^{3,4,5} National University of San Marcos/ FIGMMG, Lima, Perú

⁶ National University of San Marcos/Industrial Engineering, Lima, Perú

⁷ National University of San Marcos/Faculty of Mathematical Sciences, Lima, Perú

Email: hblancas@une.edu.pe; frivapiza@gmail.com; aarmasb@unmsm.edu.pe; amena@unmsm.edu.pe; zvalenciar@unmsm.edu.pe; fgueres@unmsm.edu.pe; eliasfelixarmasgarcia@gmail.com

Abstract—The purpose of the project has been to carry out the inventory of the biodiversity of the ecosystems of the marine space of the Bay of Ancón, the number of species identified and reported for the five bioecological zones has been considered: a) Neritic zone, with 27 species, b) benthic zone, with 35 species, c) rocky intertidal zone, with 138 species, d) islands and islets zone, with 9 species and e) beach zone, with 40 species studied by specialists from different taxonomic groups, in said marine territory, a total of 249 species have been identified, of which 225 belong to marine fauna and 24 to marine flora. These biodiversity resources have constituted the sustenance for the health and well-being of the population of the District of Ancón and Metropolitan Lima, over time. The loss and degradation of these marine resources is accelerating at an unprecedented rate. Given this panorama, from 2012 to date, the application of self-control measures has begun to regulate overexploitation throughout the history of humanity. Therefore, the inventory and the identification guide prepared will be valuable documents for the knowledge of the variety of species in the marine space of the Bay of Ancón, which will facilitate managers to optimize their efforts at the level of the educational community and of the community involved in responsible fishing. □

Index Terms— Biodiversity, inventory, biology, education, innovation.

I. Introduction

The Ancón Association of Seafood and Spearfishing Extractors (AEMAPSA) considering the dynamics of local development and its advantages with the existence of marine resources in the area, its expertise for the development and processing of its resources and the commercialization to the markets of Metropolitan Lima, and seeing that the resources were depleted as of 2012, they established self-control mechanisms such as establishing caps for the capture of some species, after two years noticing that it was insufficient, in 2015 they began one of their key strategies as to close the fishing in some of the 11 existing Islands, until May 2016. When they returned to the fishing

activities, they witnessed how the abundance of the fish had returned. The last closure was in November 2019 and was implemented on all the islands until March 2020, a date that coincides with the beginning of the first infections of the coronavirus, a situation that prevented work and reduced demand for products in the markets. of Metropolitan Lima, caused a hard blow to the economy of the fishermen.

One of the favorable characteristics of the marine water in the area is having temperatures higher than the surrounding waters, which generates a good biodiversity, a situation that allows the presence of natural banks of marine invertebrates and important areas for the processes in some vitally important areas. reproductive of marine species, places of refuge for larvae, juveniles and indicator species such as the El Niño phenomenon, which allows the survival of the diversity of marine species in the Bay of Ancón.

An important factor, in addition to its biodiversity and ecosystems, is its strategic location near the Metropolitan Lima market. Likewise, it becomes a living laboratory, a source of learning for the educational community, and innovative research projects. Due to its importance, it is necessary to include the component aimed at institutional strengthening and knowledge services, a necessary condition to turn it into a Pilot Center on the Central Coast of Peru, launching educational innovation initiatives in favor of the educational community and management. efficiency of marine resources by the active agents of the production process.

In relation to the Biodiversity Inventory of the Lima Coast, Playa Ancón for the Teaching of Biology, has been organized considering the following ecosystems: Nephritic Zone, Benthic Zone, Rocky Intertidal Zone, Islands and Islets Zone and Beach Zone, in which that the species are included according to the taxonomic category starting from Phylum, Class, Order, Family, Genus and Species. The Phyla considered are the following: Cnidaria, Platyhelminthes, Nemertea, Sipuncula, Mollusca, Annelida, Arthropoda, Echinodermata, Divisions such as Chlorophyta, Ochrophyta, and Rhodophyta and the Classes Aves, Fishes, Mammals, and Sauropsida.

Considering the potential of their biodiversity and their ecosystems, it is necessary to protect them by avoiding the extinction of species in the next decade, a scenario that occurred in the previous decade at a global level due to what scientists call the sixth mass extinction caused by the humanity and promoted by overexploitation, pollution and climate change that has been accelerating at an unprecedented rate.

The objective of the research was to carry out the Inventory of the biodiversity of the Litoral Limeño, Playa Ancón, oriented to the educational community for the management of the learning process and for the knowledge of the actors of the fishing, tourist, gastronomic activity and community in general.

II. Materials and Methods

The research is of the qualitative type. The applied method is the transductive method. Some field activities were minimized because of the pandemic, it was resolved with important specialized publications in the biological sciences, giving high quality to the elaborated product.

III. Results

At the level of the marine space of the Bahía de Ancón, 249 species have been identified, of which 225 belong to marine fauna and 24 to marine flora.

Regarding the bioecological zones and the number of species in each of them, we can say the following:

Neritic zone with 27 species.

Benthic zone with 35 species

Rocky Intertidal Zone with 138 species

Islands and Islets Zone with 09 species

Beach area with 40 species

Table 1 shows the relationship to taxonomic groups at the Phylum, Class, and Species level.

TABLE I: TAXONOMIC GROUPS

Type	Taxonomic groups		
	phylum	Class	Species
1	cnidaria	01	04
2	platyhelminthes	01	01
3	Nemertean	01	01
4	sipunculida	01	01
5	Mollusca	04	64
6	Annelida	01	19
7	Arthropoda	02	37
8	echinodermata	04	12
9	Chlorophyta	02	07
10	ochrophyta	01	02
11	rhodophyta	02	15
12	Birds	01	48
13	Fish	01	30
14	mammals	01	07
15	Sauropsida	01	01

About resource management, AEMAPSA, seeing that marine resources were depleted from 2012 to 2020, implemented self-control strategies to avoid overexploitation. In 2016, when the fishermen returned to the extraction, they were able to verify the abundance of fish, mollusks, and crustaceans.

A relevant factor for the economy of the fishermen is the demand for marine products at the level of the markets of Metropolitan Lima, requiring said market the certification of the sanitary quality for which the sanitary evaluation of the resources is carried out every 15 days, proceeding

to extract samples of water, marine sediment and some species such as snails to see if there are biotoxins or some type of pathogen.

These facts and occurrences occur due to the changing nature of human behavior, the environment and technology, which is why it is necessary to implement 03 fundamental elements such as:

- Innovation to promote a state of permanent transformation in the organization.
- Educational to think differently and rethink the relationship of human beings with the marine space.
- Marine Space to unite and integrate the marine space aimed at converting the Bay of Ancón into a pilot living laboratory on the central coast of Peru.

IV. Discussion

In principle, an investigation of biodiversity has not been found with the characteristics proposed in this project and the development of an identification guide for the most representative species aimed at students and the public to facilitate the learning of the visitors to this marine ecosystem.

The biodiversity and ecosystems of the marine space of the Bay of Ancón constitute a valuable resource for the health and well-being of the inhabitants of the Ancón district and Metropolitan Lima.

Biodiversity loss, pollution, marine space degradation, resource depletion, and climate change are accelerating at unprecedented rates. Consequently, as of 2012, seeing that marine products were running out due, among other things, to the extraction of marine individuals from a population at a higher rate than their reproduction; when this happens, the population decreases since some species are more vulnerable than others due to their biological characteristics such as restricted distribution, high mortality rate and low reproduction rate.

The fishermen's organization (AEMAPSA) takes measures to self-control the capture of species by establishing limits, which, as they are not enough, are changed to the strategy that consists of closing some of the 11 islands for a while; The last closure of the islands was carried out in November 2019 until March 2020, a date that coincided with the start of the COVID 19 pandemic, a situation that did not allow us to continue working and not continue to supply marine products due to the lack of demand. in the markets of Metropolitan Lima.

The marine space of the Bay of Ancón is considered an important source for the active learning process of the educational community, and for carrying out research work by public and private entities, however no cooperation and collaboration mechanisms were established between the universities. and other entities with small and medium-sized companies, in this case it would be represented by AEMAPSA, which is why there is no scientific, technological, environmental and management information for its application in the marine space of the Bay of Ancón.

The activities of small and medium-sized local companies in the marine space are basically oriented towards the extraction of marine resources, reaching overexploitation and contamination by accumulation of waste in certain periods. Given this situation, it is important to put processes into practice. Innovative educational courses for the emergence of new individual and collective

skills and new ways of understanding the marine space of the Bay of Ancón, seeking harmony between human life, nature, and society.

The Inventory aims to make known the different species in the bioecological zones of the marine space of the Bay of Ancón. Knowledge of the species and their interrelation with their ecosystem will help managers optimize their efforts both for the educational community and for the fishing community.

Each bioecological zone considered in the inventory is fundamentally characterized by the number of taxonomic groups that develop in the marine space. Table 2 shows the aforementioned.

TABLE II: INVENTORY BY TAXONOMIC GROUP IN THE MARINE SPACE OF THE BAHÍA DE ANCÓN

Zone	<i>Phyla</i>	<i>Classes</i>	<i>Phylla % of total</i>	<i>Classes % of total</i>
rocky intertidal	11	20	44%	51%
benthic	05	09	20y%	23%
neritic	03	04	12%	10.3%
Islands and Islets	03	03	12%	7.5%
Beaches	03	03	12%	7.5%

In relation to the Bioecological Zones and the number of species by taxonomic groups, the most representative are the following.

Rocky Intertidal Zone represented by:

- Phylum Mollusca with 54 species that represents 84% of the total.
- Phylum Arthropoda with 32 species representing 84% of the total
- Phylum Annelida with 19 species that represents 100% of the total
- Phylum Echinodermata with 12 species representing 100% of the total
- Division (Macroalgae) with which it represents 58% of the total.

Benthic zone represented by:

- Phylum Mollusca with 10 species that represents 15.6% of the total.
- Phylum Arthropoda with 05 species that represents 16% of the total.
- Fish class with 14 species representing 47% of the total.

Neritic Zone represented by:

- Fish class with 16 species representing 53% of the total.

Beach Zone represented by:

- Aves class with 33 species representing 69%

Islands and Islets Zone represented by:

Class Aves with 07 species that represents 14% of the total.

To promote responsible fishing practices along with regulations, we recommend that fisheries managers use a blended outreach program to effectively communicate and engage with this part of the community until more targeted studies can be conducted (Capizzano et al, 2022).

Therefore, for efficient management it is important to consider the interrelation of biodiversity with its ecosystems, which will allow us to rethink the relationship of human beings with the marine space, which also requires rethinking their understanding and therefore their education based not only on the protection, conservation of the marine space, but in the implementation of innovative educational processes.

V. Conclusion

The inventory identified and reported for the five biotechnological zones: a) neritic zone, with 27 species, b) benthic zone, with 35 species, c) rocky intertidal zone, with 138 species, d) islands and islets zone, with 9 species and e) beach area, with 40 species studied by specialists from different taxonomic groups, in said marine territory, a total of 249 species have been identified, of which 225 belong to marine fauna and 24 to marine flora.

Responsible fishing practices together with regulations, it is recommended to be complemented with a dissemination program, therefore, the inventory is relevant for the knowledge of the variety of species in the marine space of the Bay of Ancón, which will strengthen the community education and the community involved in responsible and sustainable fishing.

Conflict of Interest

"The authors declare no conflict of interest".

Author Contributions

The first author and second author conducted the research.

The third and fourth authors analyzed the data.

The fifth. Sixth and seventh authors wrote the article.

All the authors approved the final version.

Acknowledgment

The authors wish to thank the National University of Education "Enrique Guzmán y Valle" for the support to carry out the research.

References

- [1] V. Alamo and V. Valdivieso. Systematic list of mollusks of Peru. Institute of the Sea of Peru. Second Edition revised and updated. Callao – Peru. 1997.
- [2] Y. Hooker. Fauna associated with the warm waters present in the Bay of Pucusana during the El Niño current 1997 – 1998. IMARPE. 1999.
- [3] GEF – UNIDO – IMARPE – IFUP. Project integrated management of the Great Marine Ecosystem of the Humboldt Current. Module II: Resources and Fisheries. 2002.
- [4] Carbajal P. and Santamaría J. Illustrated guide for the recognition of brachyuran and anomuro crustaceans with commercial value in Peru. Lima, Institute of the Sea of Peru (Imarpe). 2017.

- [5] Fish Identification Guide / Peru LNG - [Lima] Melchorita Peru LNG - 81 pp. 2012.
- [6] ION-GX-TECHNOLOGY - GEOLAB SRL. (2009). EIA – Regional 2D and 3D Seismic Survey Project of the Tumbes – Tacna Coastal Strip of Peru. Part B: Biological Environment.
- [7] Duarte, C. et al. The exploration of marine biodiversity: Scientific and technological challenges. BBVA Foundation. Spain. ISBN: 84-96515-26-5. 2006.
- [8] Velasquez, K. (2018). Microturbellaria of the littoral zone of the San Francisco - Ancón beach, Lima. [Undergraduate thesis, Universidad Nacional Mayor de San Marcos, Faculty of Biological Sciences, Professional School of Biological Sciences]. Institutional repository Cybertesis UNMSM.
- [9] Capizzano, CW, Jones, EA, Scyphers, SB, Zemeckis, DR, Danylchuk, AJ, & Mandelman, JW (2022). Understanding Recreational Angler Diversity and Its Potential Implications on Promoting Responsible Fishing Practices in a Multispecies Gulf of Maine Fishery. *Marine and Coastal Fisheries*, 14(1). <https://doi.org/10.1002/mcf2.10196>
- [10] Paredes, C., Cardoso, F., & Tarazona, J. (1999). Invertebrates of the rocky intertidal of the department of Lima, Peru: An annotated list of species. *Peruvian Journal of Biology*, 6(2), 143–151. <https://doi.org/10.15381/rpb.v6i2.8309>
- [11] Guide to Crustaceans of the Peruvian Coast. IMARPE [Online]. Available: <https://repositorio.imarpe.gob.pe/handle/20.500.12958/2194>