

Reduction of the impact produced by sea lions on the fisheries in Mexico

M. O. Maravilla-Chávez¹, S. Hernández-Vázquez², A. Zavala-González³ and A. Ortega-Rubio²

¹Instituto Nacional de Ecología, Programa de Investigación de los Mamíferos Marinos, Ocampo 1045. Centro, C.P. 23000. La Paz, B. C. S., Mexico, ²Centro de Investigaciones Biológicas del Noroeste, S. C. Mar Bermejo 195, Col. Playa Palo de Santa Rita, C.P. 23090 La Paz, B. C. S., Mexico, ³Dirección de la Reserva de la Biosfera islas del Golfo, Ensenada, B. C.

(Received: 28 January, 2005 ; Accepted: 5 December, 2005)

Abstract: Activities of fishermen in the Bay of La Paz, B. C. S. are focused to satisfy the local demand of fish and shellfish by using approximately 300 small outboard crafts equipped with gillnets. Sea lions in this Bay attack the fishes captured damaging both product and gear. We did experimental gillnet throws to determine the frequency and preferences of sea lions in fishing areas. 52 experimental gillnet throws with time averages of 2 hr were performed, rendering an average of 30 kg of fish captured and less than 10% of damages to the net. Traditional fishermen in this Bay usually left the net the whole night, (approximately 7.50 hr, obtaining an average of 50 kg of captured fish, but the damages to the nets is in average of 40%. The cost-benefit balance comparing our alternative fishing method, which includes the use of the gillnets during the afternoon, watching for sea lions and retiring the nets at their arrival, it is more sustainable and profitable than the traditional fishing method currently used by the local fishermen. This paper suggests how to minimize the harmful effects of the sea lions on the fishermen productivity and gear, maximizing the production and reducing the damage. Our alternative method is applicable to other regions where this harmful interaction is taking place. We conclude that the coexistence of sea lions–fisheries is feasible, by applying the simple measures that we propose.

Key words: Sea lions, Fisheries interaction, Gillnet, Maximum production, Minimum damage.

Introduction

The California sea lions (*Zalophus californianus californianus*), in Mexico, is one of the marine mammal species under special protection (NOM-059-ECOL-1994). However, sea lions interacts with several regional fishing activities (shrimp, small pelagics, artisan fisheries, etc.), causing damages to the fishing gear, and to the sea lions themselves. Sea lion's feeding habits place it as an opportunistic predator that takes advantage in time and space of the food available (Aurioles *et al.*, 1984; Lowry *et al.*, 1990; Lowry *et al.*, 1991; Aurioles *et al.*, 2003).

The objective of this study is to characterize and analyze the interactions between artisan fishing and sea lions in the Bay of La Paz, where fishing activities are carried out by fishermen that occupy camps in a semi-permanent way, as well as fishermen that travel daily from the City of La Paz, B.C.S. (Fig. 1).

On the other hand, in the northern part of the Espiritu Santo - Partida island in a well-known islets called Islotes, there is a breeding colony of sea lions with a permanent group of around 300 individuals (Fig. 1).

The interactions between sea lions and gillnets, can cause the partial or total consumption of the capture; damage to gear from sea lions, the incidental death of sea lions either by asphyxia in the nets, strangled net pieces or directly by the fishermen.

These interactions have been documented regionally by specific studies that allow us to know more about this problem. However, in those cases, the studies only report the complaints of fishermen (Fleischer and Cervantes, 1990), the

numbers of individuals with nets strangled in parts of the body (Harcourt *et al.*, 1994; Zavala-González and Mellink, 1997; Zavala-González, 1999). For La Paz bay, the more recent study, Aurioles *et al.* 2003, describes a comparative study of the feeding habits of the sea lions population from Los islotes, compared with the commercial capture reported to the authorities.

The traditional way of using gillnets consists on the use of these long rectangular nets (250 m) made with different materials (such as nylon and silk particularly) and mesh sizes (diagonal measure in inches of each square forming the net). Mesh size varies depending on the fishing wanted to obtain. The net catches fish by the highest point of the body that coincides with the gills; from where the net name comes. In Mexico, there are Federal regulations (Federal Fishing Law 1992) that limit the use of certain types of nets and mesh sizes considered as harmful to environment. These rectangular nets have a floating superior line and weights in the inferior line, as well as suspenders in both ends that make them to stay vertical and work as a barrier. Fishermen throughout the whole country use these nets in a traditional way with many habits and beliefs that not necessarily redound in commercial success.

Two traditional aspects of fishing with gillnet are: a). fishermen do not use or they diminish their activities in periods near to full moon or in full moon, and b). the nets are placed in well known sources and left for periods of approximately 8 hr or more starting at sunset and until before sunrise.

The purpose of our work is to place on its real dimension, the negative effects sea lions provoke to fisheries in the Bay of La Paz area, quantifying its economic and social

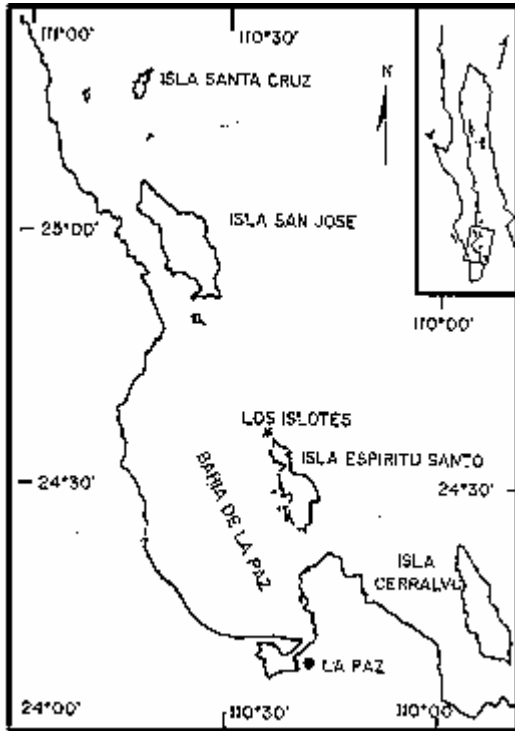


Fig. 1: Study area.

importance. The contribution of this work is to call the attention on this problem and to find alternatives to ameliorate it, minimizing the harmful effects of this negative interaction.

Materials and Methods

Study area: We selected several sites inside the Bay of La Paz, where fishermen use gillnets. Because of their relevance we chose to work closely to Espiritu Santo - Partida islands complex, located in the eastern side of the bay of La Paz, B. C. S. (Fig. 1).

Identification of the interactions: The fieldwork includes visits to fishermen camps for application of inquiries and information about the captures of fish, we also carried out experimental throws. We traveled monthly to the Espiritu Santo-Partida Island complex, registering number of boats working with nets, their areas and fish production. We also registered the number and type of interactions of sea lions affecting gear or capture. We identified the impacts, the areas where they take place and time of occurrence. We proceeded to quantify the damages, focusing in first instance to the material damage to gear, that implies time and expenses in the repair or recovery of these by fishermen.

During the same monthly visits to the islands we carried out a total of 52 experimental throws, using the same type of nets fishermen use, in the same geographical areas exactly under the same conditions. However, our 52 experimental throws, had differences in relation to the traditional method of fishermen: a.) in first place we started

Table – 1: Comparison between traditional and experimental fishing methods and sea lions interactions.

Fishing method	Traditional	Experimental
# Throws	34	52
Average time net was left (hr)	7.5 (2.2188)	2 (0.9315)
Average fish capture (Kg)	52.440 (9.6740)	32.93 (10.1650)
Mean catch incomes (USD)	100	60
Average costs of net and product damages (USD)	- 40	- 10
Average fuel costs (USD)	- 20	- 10
Mean total income (USD)	= 40	= 40

In parentheses, standard deviations.

placing the nets during the afternoon, not during sunset and b). we maintained a strict surveillance on our net and we retired it immediately at first indication of presence of sea lions. The traditional method fishermen use consists basically on placing their nets during the night and left them "working" during almost the whole night, recovering them just before sunrise.

Results and Discussion

From March 1999 to October 2001, we visited the study area 27 times both to monitor 34 traditional throws by fishermen and to perform 52 experimental throws by ourselves.

Table 1 summarizes the comparison between our alternative method and the traditional method used by fishermen. As we can observe, applying our proposed methodology, the profit is maximized and the negative interactions with sea lions are minimized. This proficiency is the result of the following combined factors: a). traditionally the fishermen made 2 trips to the fishing areas, one to set their nets in the afternoon, and another in the morning to pick up them. With our method we only made a single trip, going to the fishing area and stay there, watching over the net. Therefore, with our method they could use only half of gasoline. b). by leaving the net the whole night, chances to suffer damage to gear and product, are higher, what implies to fishermen the use of time and money to repair or buy a new gear. With our alternate method these chances decrease considerably.

Costs: As an important issue of this interaction, are the economic costs affecting the fishermen, the money they invest going fishing, goes from food supplies to gasoline and oil. With a mean price of 2.00 USD per gallon, they use ten gallons in each round trip. In the same conditions, we used instead, only five gallons each trip to set and survey our nets, duplicating our efficiency in terms of gasoline. Speaking about the quantity of product obtained in each fishing trip, our average catch was of about 30 Kg, while fishermen, got 50 Kg. Here, difference is on the quality of product in terms of damage. Our product was obtained without almost any damage from sea lions bites, whereas that from fishermen nets being attacked by sea lions results in about 30% of product lost and gear damaged.

Commercial price of kg of fish paid to fishermen was about 2 USD.

When balancing losses caused by sea lions on fishermen gear and product and expenses in gasoline, we obtained a more profitable income without any negative interaction.

Our proposed alternative method minimizes the negative interactions between sea lions and fisheries while maximizes the economic profit. Our method is applicable to other regions where this problem is present. Certainly, it will be required an intense work of environmental education towards fishermen, with the aim to convince them to change their traditional method for our proposal. However, we can conclude that a real coexistence among sea lions and fisheries is feasible, if simple measures are applied as those that we propose in this work.

Acknowledgements

This work was supported by INP, SEMARNAP, Mexico. We thank the Centro de Investigaciones Biológicas del Noroeste (CIBNOR) and the Consejo Nacional de Ciencia y Tecnología (CONACYT)-Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT) Project 2002-C01-0844. Octavio Maravilla-Chávez was a CONACYT doctoral fellow at CIBNOR. We also thank to Dr. R.C. Dalela and two anonymous Reviewers for their comments on an earlier version of our manuscript. We thank to all the fishermen who helped us to obtain information regarding this interaction. To Leonardo Mendez Lopez Nayo "our" fisherman, we used his own fish gear at no extra cost.

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Correspondence to:

Dr. Alfredo Ortega-Rubio

Centro de Investigaciones Biológicas del Noroeste
S. C. Mar Bermejo 195. Apartado Postal 128
Col. Playa Palo de Santa Rita, C. P. 23090
La Paz, Baja California Sur, México

E-mail: aortega@cibnor.mx

Tel.: (612) 12 38426

Fax: (612) 12 53625