Characterization of the Nektonic Biota and Fishing Activities in the Colombian Caribbean with the Collaboration of Artisanal Fishing Communities

Caracterización de la Biota Nectónica y las Actividades de Pesca en el Caribe Colombiano con la Colaboración de Comunidades de Pesca Artesanal

Caractérisation du Biote Nectonique et des Activités Halieuthiques en Mer des Caraïbes Colombiennes avec la Collaboration des Communautés de Pêche Artisanale

ANA CRISTINA MARROQUIM[1], HERNAN SALAZAR[2], and FRANCISCO PINILLA[3]
[1]*Shell Upstream Americas, 150 N. Dairy Ashford Road, Houston, Texas 77094 USA.*
[2]*Shell Exploration and Production Colombia, Calle 100 No 7-33, Piso 20 - Bogotá, Colombia.*
[3]*ERM Colombia Ltda.,Carrera 16, No. 93A-36, Piso 6 - Bogota, D.C. Colombia.*

ABSTRACT

Over the past few years, the assessment of nektonic component has proved to be the most elusive to get sufficient amount of in situ data, mostly due to distance from shore, severe climate conditions and the natural distribution of oceanic fish in deep waters. Since this assessment is required for an Environmental and Social Impact Assessment Study, Shell is implementing a method that involves collaboration of artisanal fishing to collect both biological and social data on the species being caught and the fishing communities as an alternative to traditional nektonic surveys. Through the assessment of catch at coastal landing points and following fishing activities of artisanal fishing organizations, the project is collecting data on fishing zones, CPUE, richness and abundance, biometry & reproductive phase, fishing methods and resources, including number and type of vessels, type and duration of tasks, number of involved fishermen, operations cost and expenses, and prices obtained by species at landing points. Collaboration agreements with fishing organizations were made to train community individuals as supervisors to collect and register the data. Quality assurance and control field visits by specialized scientists are enhanced by the use of video cameras and GPS equipment. In this update the preliminary results of identified areas, fishing fleets and types of fishing will be presented. After a one year period the study is expected to obtain a robust data base on both biological and social aspects related to the nektonic biota and the communities that depend on them.

KEYWORDS: Nektonic assessment, environmental impact assessment, artisanal fishing, video cameras

INTRODUCTION

The requirement to prepare an Environmental Impact Assessment Study (EIA) as part of the environmental licensing process is a common practice in several countries. In Colombia, due to the relative shortage of baseline data for its oceans, and the novelty of the offshore oil industry in the country, these requirements usually involve recollection of primary data. In a more mature regulatory scenario, this data might have been focused on the main aspects of the ecosystem that are prone to impact to the oil and gas activities. Generally speaking, it is considered that marine mammals are the most sensitive communities to seismic sound, sediment quality, and biota are the most affected by drilling discharges, and the water quality is the most vulnerable to the production discharges (Cordes et al. 2016, IAOG 2016).

Shell Exploration and Production Colombia is preparing EIAs as part of the process to request environmental licenses to drill exploratory wells in the deep waters of the Colombian Caribbean Sea. The Terms of Reference issued by the National Environmental License Agency (ANLA) for the EIA request primary data for the nektonic communities in the area of the block. In fact, the development of offshore projects generally demands updated and credible information on the fishing sector and its main resources. However, attempts to collect this data with traditional oceanographic surveys have faced difficulty to overcome limitations due to distance from shore, unfavorable weather for most of the year, high exposure of people to risk, and the low efficiency of the fishing methods to capture these organisms in an oligotrophic environment. As a consequence, the results have been less than ideal, with few specimens captured, which impaired a useful statistical analysis of the data gathered. Consequently, it is necessary to generate alternatives to obtain valid and pertinent information on the characteristics of the nekton, to complement the existing cruises and comply with the requirements of the environmental authority in Colombia.

Presently, the information records about Where?, Who? and How? are the marine productive activities being developed are scarce, particularly about the artisanal fishing sector. Nevertheless, the artisanal fishermen are the most important social actors for the development of the offshore projects which are being carried out in the Colombian Caribbean. Social Baselines, often a mandatory part of EIAs, collect information on the artisanal fishing and its main characteristics, allowing, through the analysis of this information, identification, and characterization of locations, organizational structure of the fishermen and some of the main landing sites. Nevertheless, this information does not support drawing precise maps of location, spatial and seasonal variation of the fishing areas, nor identification of its economic indicators, profitability and associated effort.

Understanding that the collection of data on nektonic communities is a legal requirement of the environmental licensing process, Shell studied different approaches to reach this objective. The present efforts were planned to provide credible and useful nektonic information while covering the gaps left from the social baseline. Therefore, the objectives of this study are:

i) To characterize the nektonic biota through the evaluation of onboard and landing artisanal fishing. and
ii) To standardize this methodology for future impact assessment studies where a significant amount of data on

commercial species caught by local fishermen can be gathered and recorded, having the side benefit of improving our knowledge on the structure of these fishing communities and their dependence on the ocean where Shell's exploration activities will take place.

METHODS

The area of influence of this project covers the coastal zone of the Colombian Caribbean (Figure 1). Colombia has almost half of its territory in marine areas and is amongst the five countries with the highest marine biodiversity in the world (Invemar 2010). The tropical dry climate is more evident between the months of December and April, when the weather is drier, with trade winds and swelling. The Colombian Caribbean coast is characterized by the presence of several productive tropical marine ecosystems, with a great capacity to provide ecosystem services, including for the local communities (Invemar; ANH, 2010-2011:14). The larger populations are concentrated in the cities of Barranquilla, Cartagena, and Santa Marta (Departments of Atlantico, Magadalena y Bolivar). Fishing activities are one of the main uses of the marine resources in the region, and provide income, work and food for the local communities dedicated to this activity (Invemar; ANH, 2010 - 2011:10).

Aiming to cover the above mentioned gaps in information, the methodology used for this study includes assessment of two main components: fish landing sites on the coast and artisanal fishing on the vessels.

Assessment of Fish Landing Sites on the Coast

To assess the fish landing sites on the coast, a selection of the main sites recognized by the fishermen of the municipalities in the area of influence was identified and validated. The criteria for the selection of the landing sites were: diversity of species, objective of the capture, significant volumes at landings and higher numbers of gathering centers around the site. In this process, seven landing sites were identified in three Departments (Table 1).

At each landing site, local citizens dedicated to artisanal fishing were selected as supervisors. This selection was based on the identification of the most prominent fishermen in the landing sites, considering their leadership in the fishing associations / communities or their hold on a fishing site in the area of influence. Once selected, these local citizens were trained to collect and record the data. They were supplied with digital cameras, ictiometers, GPS and forms to fill in. A remuneration agreement was signed based on data forms filled to motivate engagement.

The data is being recorded through assessments being made every other day in the most frequent landing times (mornings, afternoons or nights) for each site. The variables being recorded are: capture and effort, landed capture per species, weight and number of individuals, fishing effort per type and/or method of fishing, times of fishing, area of fishing, costs for the fishing trips, value of each species, type of vessel, characteristics of the fishing method and propulsion characteristics of the vessels.

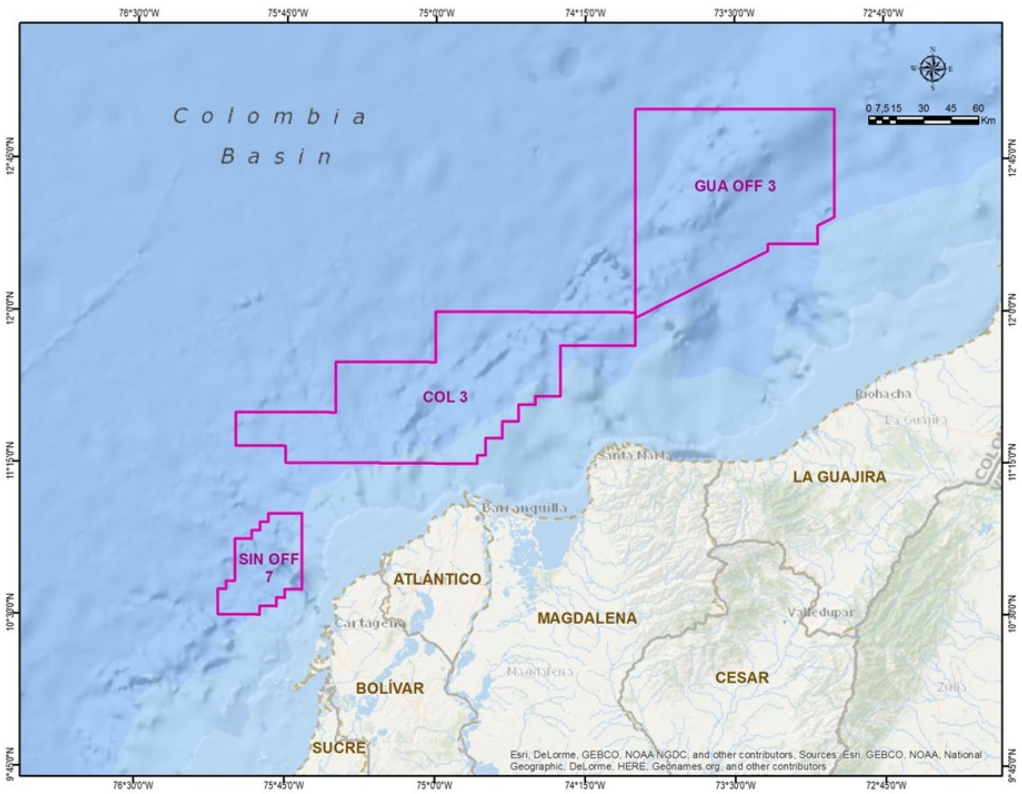

Figure 1. Area of the project.

Table 1. Fish landing sites selected for assessment

Number	Department	Location
1	Atlántico	Puerto Velero
2		Las Flores
3	Magdalena	Tasajera
4		Taganga
5		Bahía de Santa Marta
6	Bolívar	Loma Arena
7		Marbella

Assessment of the Artisanal Fishing on the Vessels

Meetings were held with the most representative fishing associations in the area of influence and six associations were identified, distributed over the three Departments (Table 2). The selection criteria were: how mature the association is, number of members it has, vessel capacity, types of fishing methods and fishing areas. Associates selected to be observers and register the collected data were trained by scientific experts from the project team to capture the desired data. They were supplied with digital cameras, ictiometers, GPS, and forms to fill in. A remuneration agreement was signed based on data forms filled to motivate engagement.

These trained observers are registering the information on the artisanal fishing practice. The data gathering is done during sailing and arrival times every other day for each monitored vessel (up to 15 monthly trips for each association). The variables being registered are: capture based on weight landed for each species and type of fishing method, the fishing areas (coordinates), duration of the activity, number of fishermen involved, type of propulsion of the vessel, type of vessel, the operational costs of the activity, size of the species captured, and their market value.

QUALITY CONTROL

A quality control assessment of the activity is being carried out quarterly in alternating landing sites and associations. The objective is such that, over the period of a year, each site has had at least three assessments. This assessment aims to review the data obtained, protocols and methods agreed, as well as parallel assessments to ensure the precision of the data registered.

In the case of the assessments on the vessels, due to their small size it was not feasible or safe to board the quality control personnel to audit the information gathered during the fishing trips. Therefore, an alternative method had to be developed to ensure the data being collected was accurate. This involved the use of 24-hour self-powered cameras and GPS tracker devices installed on the vessels (Figure 2).

Table 2. Fishing associations selected for assessment.

Number	Department	Location	Association
1	Atlántico	Puerto Colombia	COOMUSPESCOL
2		Las Flores	ASOPESCAR
3	Magdalena	Tasajera	ASOPESMAT
4		Taganga	FEPESARMAG
5	Bolívar	Arrollo de Piedra	ASOPAP
6		Loma Arena	ASOPESCAMAR

Figure 2. Quality control assessment with video recording.

The GPS information was then cross checked with the coordinates captured and registered by the observer to confirm accurateness. The camera videos are later observed in the office by the quality control personnel to confirm the methodology is being carried out in a correct and accurate manner and to stablish a standard error of the data collection.

RESULTS

The results presented herewith are based on the first four weeks of the study, which correspond to the month of September 2016. During this period, information was gathered on the 7 landing sites listed in Table 1, with a corresponding 88 forms for the same number of assessment efforts. Work also progressed with the six selected fishing associations (Table 2) over 90 fishing trips. In these, information was recorded on diversity and abundance of the species caught, coordinates of the fishing sites, types of fishing methods used and fishing efforts.

In the first four weeks of the study, 63 species, belonging to 23 families, were registered. The sites with highest diversity of species were Taganga, with 26 taxas, and Bahía de Santa Marta/ Marbella, both with 19 taxas. The overall most abundant species, both with relation to frequency and relative biomass in the captures, were: Cojinúa (*Caranx crysos*), Jurel (*Caranx hippos*), Sierra (*Scomberomorus cavalla*), Carite (*Scomberomorus* regalis) and Pargo (*Lutjanus* spp). The frequencies with which these species appeared in the captures are, respectively: 82%, 64%, 63%, 54%, and 46%. And they participate in the total caught biomass with 35%, 16%, 10%, 8% , and 2%, respectively (Table 3).

In the Department of Bolívar, the most frequently captured species were Sierra, Jurel, Cojinúa, Juancho (*Sphyraena* sp.), and Ronco (*Conodon nobilis*). In the Department of Magdalena, the most captured were Cojinúa, Carite, Jurel, Albacora (*Thunnus albacares*) y Medregal (*Seriola durmerili*). And lastly, in the Department of Atlántico the predominant species were Jurel, Cojinúa, Carite, Sierra y Chivo (*Sciades proops*) (Table 4). Table 5 shows the diversity of species by site.

During this recollection period, fishermen travelled for an average of 11.5 nautical miles from their sailing site to their fishing zones, with ranges varying from 3.5 to 22 miles. The exception is the fishing community in Taganga, who fish in deep waters of the Guajira, traveling up to 60 miles per fishing trip. The depth of the fishing zones varies significantly, from 2 – 150 meters, with an average of less than 50 m (Figures 3 and 4). The deeper areas are used by the fleet from Puerto Colombia, with an average of 100 m, and the shallower (less than 50 m) are used by the Arrollo de Piedra, Loma Arena and Tasajera. The fishing area used by the Taganga fleet in the Guajira is considerably deeper, with an average depth of 200 m.

The fishing arts most used in the study area are the Longline, Handline fishing, Trammel net, Dragnet fishing, Purse seine fishing and fishing pots/creels. Regionally, Longline, Handline and Trammel net are more used in the Atlántico, Handline, Dragnet, Trammel and fishing pots/ creels in Magdalena and Purse seine fishing Handline, Longline and Trammel net in Bolívar.

With respect to the quality control, both the observers at the landing sites and the ones on the vessels are carrying out their work accordingly with the training received. Some adjustments were made with relation to the photo documentation and the filling out of the forms. In addition, there was some work done on standardizing the units being used, such as crates. No significant difference was noted between the data recorded by the observers and the quality control team. The camera recording system proved to be successful and promises to be efficient for the remote supervision of these activities.

DISCUSSION

It can be concluded that the methodology is providing promising results with relation to the quality and precision expected. The data obtained in this first month allows a better understanding of the diversity and relative abundancy of the nekton in the area of study, as well as the spatial distribution of this resource and the dynamics of the artisanal fishing efforts. A first glimpse is also given on the temporal behavior of this activity and its possible interactions with other activities and projects in the area. It provides up to date information to fill in the gaps identified in the environmental and social baselines for the impact assessment studies. Furthermore, the information generated is regional and is relevant to support most offshore projects off the coast of the Colombian Caribbean.

Table 3. Species with the higher number of occurrences.

Species with the higher number of occurrences	Frequency (%)	% of total capture
Cojinúa (*Caranx crysos*)	82%	35%
Jurel (*Caranx hippos*)	64%	16%
Sierra (*Scomberomorus cavalla*)	63%	10%
Carite (*Scomberomorus regalis*)	54%	8%
Pargo (*Lutjanus* spp.)	46%	2%

Table 4. Species with the higher number of occurrences per site

Site	Species with the higher frequency of occurrences	Species with the higher abundancy of occurrences
Loma Arena	Cojinúa, Juancho y Sierra	Sierra, Jurel y Cojinúa
Marbella	Casabito, Juancho y Ronco	Cojinúa, Casabito y Ronco
Las Flores	Chivo grande, Jurel y Róbalo	Jurel, Carite y Macabí
Puerto Velero	Cojinúa, Pargo y Sierra	Cojinúa, Sierra y Picúa
Tasajera	Carite, Cojinúa y Róbalo	Cojinúa, Carite y Bonito
Bahía de Santa Marta	Albacora y Cojinúa	Albacora, Ojo Gordo, Pez vela y Cojinúa
Taganga	Cojinúa, Medregal y Carite	Cojinúa, Marlin y Medregal

Table 5. Species diversity per landing site.

Fish Landing site	Total number of species	% compared with total number of species in the area
Arrollo de Piedra	12	19%
Loma Arena	22	35%
Puerto Velero	18	29%
Las Flores	6	10%
Tasajera	24	38%
Taganga	28	44%

ACKNOWLEDGEMENTS

We would like to thank AUNAP for their continuous support for this project. We would also like to recognize the field team of observers for their dedication and enthusiasm.

LITERATURE CITED

Cordes, E.E., O.B. Jones, T.A. Schlacher, et al. 2016. Environmental impacts of the deep-water oil and gas industry: A Review to guide management strategies. *Frontiers in Environmental Science* **4**(58):1-26.

IOGP (International Association of Oil and Gas Producers). 2016. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. Report 543, version 1. March 2016.

Rueda, M., O. Donce, E.V. Viloria, D. Mármol, et al. *Atlas de la Pesca marino-costera de Colombia: 2010-2011. Tomo Caribe*. INVEMAR y ANH. Serie de publicaciones de INVEMAR. Santa Marta, Colombia. 104 pp.

INVEMAR. 2010. *Informe del Estado de los Ambientes y Recursos Marinos y Costeros en Colombia: Año 2009*. Serie de Publicaciones Periódicas No. 8. Santa Marta.

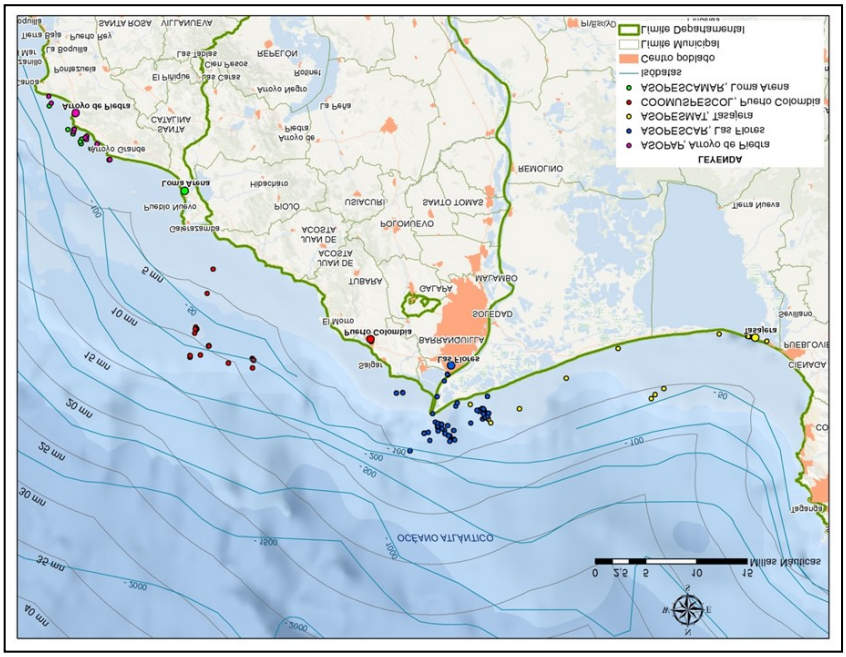

Figure 3. Fishing areas.

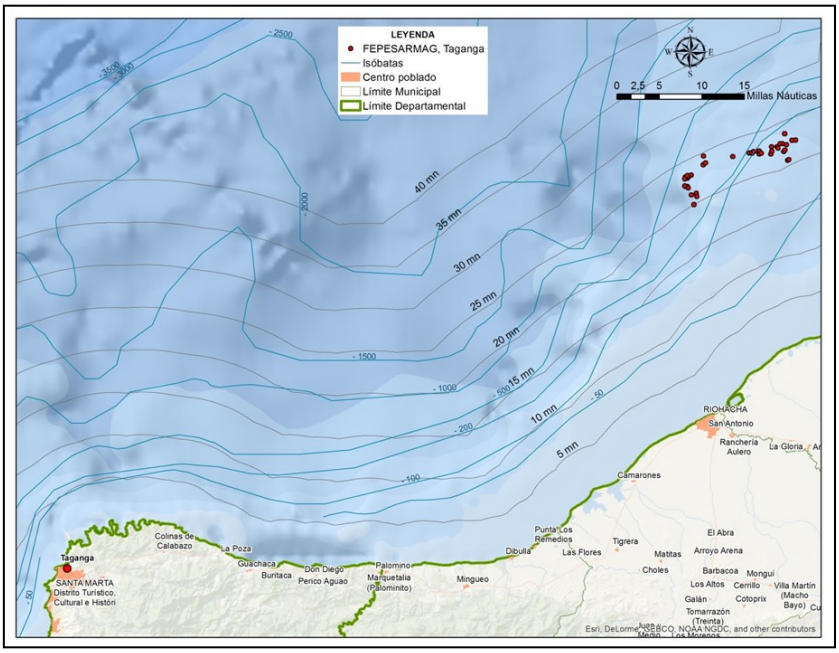

Figure 4. Fishing areas of the Taganga community.