Consequence Spatial Analysis (CSA) of the Blue shrimp (*L. stylirostris*) artisanal fishery in the Gulf of California Mexico, captured using “Suripera” nets (Cast nets)

October 2023

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Context

The Consequence Spatial Analysis (CSA) is a tool that requires information about the consequence of fishing activities and spatial distribution of habitat types and uses this information to individually score a set of attributes using pre-established CSA tables. Any attribute for which there are insufficient data is automatically assigned the highest risk score: at least some level of information is needed to demonstrate a lower risk in the fishery.

The Consequences attributes include:

- Habitat productivity
- Regeneration of biota
- Natural disturbance
- Gear habitat interaction
- Gear footprint
- Removability of biota
- Removability of substratum
- Substratum hardness
- Ruggedness of habitat type
- Seabed slope

While the Spatial attributes include:

- General depth range
- Depth zone and feature type
- Habitat rareness

Habitats in the UoA shall be categorized on the basis of their substratum, geomorphology, and (characteristic) biota (SGB) characteristics, followed by the biome, sub-biome, and its feature (Table PF10 of MSC Fisheries Certification Process v2.1). Meanwhile, the score of consequence attributes such as in Table PF11 of MSC Fisheries Certification Process (FCP) v2.1.

The attribute of regeneration biota shall be also scored on the basis of the rate of the recovery of biota associated with the habitat using information on age, growth, and recolonization of biota where available. Meanwhile, the natural disturbance attribute shall be scored on the basis of the natural disturbance that is assumed to occur at the particular depth zone in which the habitat and fishing activity occurs. Where information on disturbance is unavailable, proxies shall be used as outlined in Table PF13. Removability of biota shall be also scored on the basis of the likelihood of attached biota being removed or killed by interactions with fishing gear. This attribute shall also consider the removability and mortality of structure-forming epibiota and bioturbating infauna. On the other hand, removability of substratum shall be scored on the basis of clast (rock fragment or grain resulting from the breakdown of larger rocks) size and likelihood of the substratum being moved (Table PF14). Scoring of this attribute shall consider the gear type being assessed. Substratum ruggedness shall be scored on the basis of the extent to which available habitat is actually accessible to mobile gear given the ruggedness of the substratum. Scoring of this attribute shall consider the characteristics of the substratum and the gear type being used. Subsequently, seabed slope shall be scored on the basis of the impact to habitat that occurs as a result of slope steepness and mobility of substrata once dislodged. Scoring this attribute shall consider the degree of slope (Table PF15). Gear footprint is also shall be scored on the basis of the gear's potential for disturbance and the number of encounters required to produce an impact on a habitat, taking into account the size, weight, and mobility of individual gears and the footprint of the gears. This attribute is followed by

Spatial overlap attribute that shall be scored on the basis of spatial overlap between the habitat(s) distribution within the “managed area” and the distribution of areas fished by the UoA. Moreover, encounterability shall be scored on the basis of the likelihood that a fishing gear will encounter the habitat within the “managed area”, taking into account the nature and deployment of the fishing gear and the possibility of its interaction with the habitat.

As part of the assessment of the fishery against the MSC for the artisanal Blue shrimp, and as pertaining to Principle 2 about environmental impacts of the fishery, it was necessary to perform a risk analysis of the interactions of the fishery with the habitat. In this case, the method described in the MSC Fisheries Standard Toolbox v 1.1 was used (Conducting a consequence spatial analysis (CSA).

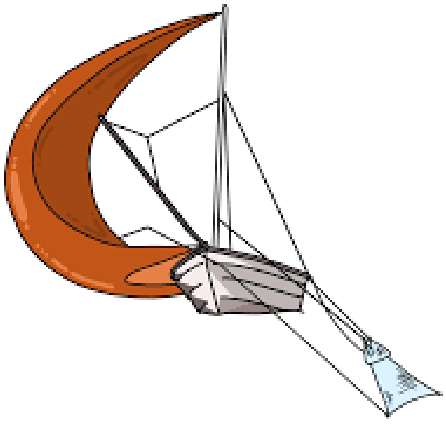
The analysis includes four steps and implies the allocation of scores to those attributes established by the standard, which are specified in each one of the tables that will appear throughout the document. The steps are the following:

- **Step 1: Defining the habitat:** The habitat is described including features such as type of substratum, geomorphology and biota characteristics.
- **Step 2. Scoring of Consequence Attributes:** The productivity of the habitat and the interaction of the fishing gear with the habitat are taken into account.
- **Step 3. Scoring of Spatial Attributes:** The fishing gear’s footprint, spatial overlap and the likelihood of the fishing gear encountering the habitat are considered here.
- **Step 4. Determine the CSA score and equivalent MSC score:** Once steps 1-3 have been performed, the scores of each attribute are included in the Excel spreadsheet approved by the MSC in order to obtain the final score – **PI 2.4.1 CS.**

1. Habitat definition

1.1 Define habitat according to type of substratum, geomorphology and biota characteristics.

The small-scale fishery assessed in this report, is developed inside the Gulf of California, which is a wide semi-enclosed sea between the mainland of Mexico and the Baja California peninsula (Lluch-Cota et al. 2007). The fishery under assessment takes place in the coastal lagoons that are distributed along the states of Sinaloa and Sonora. These are areas with high productivity, that support important commercial fisheries beyond the shrimp. Blue shrimp is captured using small boats, ranging from 20 to 25 feet in length in these coastal lagoons and estuaries, with suriperas (a modified cast net)(see image on the left). The small-scale fleet also operates in the open ocean (outside the lagoons) capturing adult shrimp, operating up to a depth of 18 fathoms, using "*changos*", a small-scale manual bottom trawl, but these are not evaluated in this report (Image from Blue Turtle Sustainable).



These coastal zones are highly productive areas, with great biological and biochemical activity with a strong exchange of matter and energy with the ocean (Carbajal et al 2018). In particular, these are important contributors of carbon, in addition to other nutrients, to adjacent ecosystems (Perez-Ruzafa et al., 2019). Coastal systems are important for their plant and animal resources; within the latter, there are a total of 350 species of fish (Castro-Aguirre, 1978).

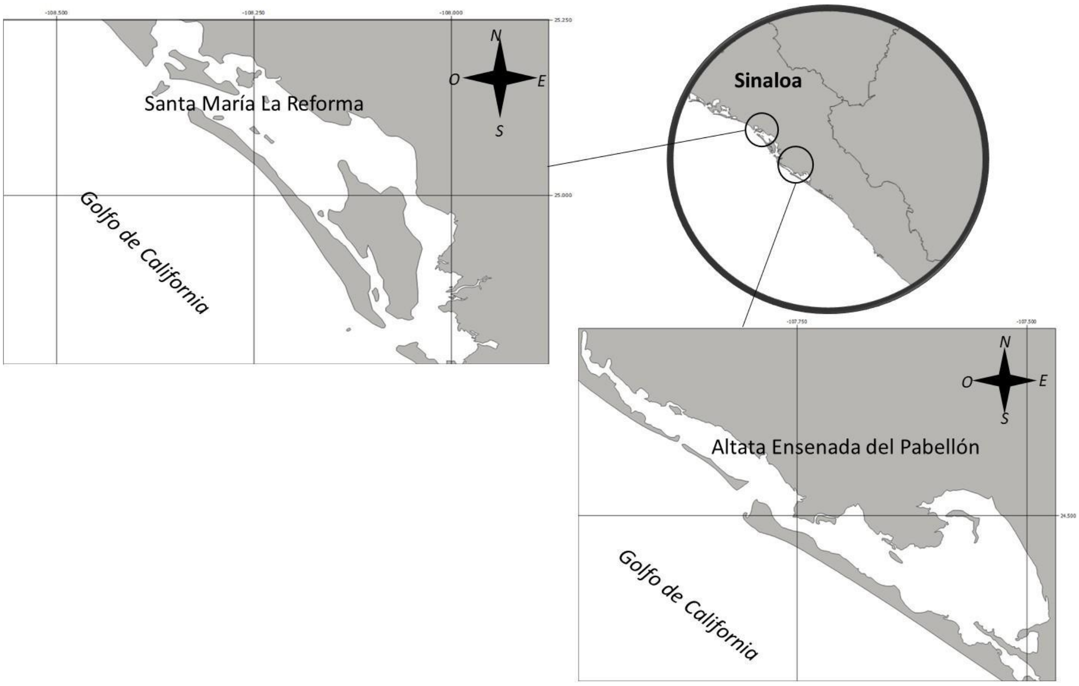
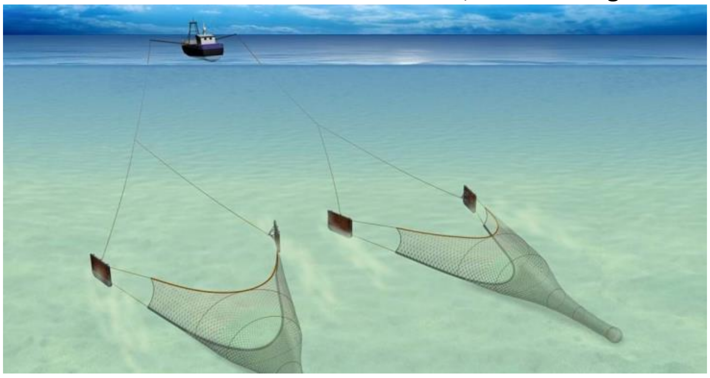


Figure 1. Coastal lagoons of Santa Maria and Ensenada del Pabellon in Sinaloa, Mexico.

The Gulf of California, have the largest number of coastal features and areas, with more than 97 systems and 837,900 ha (De la Lanza-Espino & Caceres-Martinez, 1994). According to the authors, in the dry season that runs normally from November to February, salinity increases, and some systems reach more than 60% (e.g., Huizache and Caimanero coastal lagoons). In addition to the ecological relevance, estuaries and coastal lagoons have economic importance that lies in the fact that they support fisheries, aquaculture and tourism.

Impacts on common habitats

The artisanal fleet that operates within the coastal lagoons, is authorized to only use the suripera. The gear uses enough light led pieces to keep the net submerged, and for these reasons, it has a limited dragging operation and limited interaction with the substrate. However, and although there are several studies focused on the industrial shrimp fishery impact on habitats (De Biasi, 2004; Hansson et al., 2000; Jennings et al., 2001; Kaiser et al., 2003), these are mostly focused on the industrial fleet. That operates with heavy larger, and with bigger impact trawling nets (see figure on the right)(image from Seafish)[1].



Based on those impact, measures have been recommended and actions have been taken to reduce those impacts (Aguilar-Ramirez, 2001; Bourillon and Torre; 2012; INAPESCA/WWF, 2010). The studies suggest that although trawling impacts the benthic substrate, most ecosystems affected by the fishery recover quickly. Other studies have determined that trawling modified the marine ecosystem both in abundance (Diamond et al., 1999) and the species diversity; modifying succession processes (Hansson et al., 2000) although the population dynamics of some affected fish species did not change significantly while other species were affected (Diamond et al., 1999).

In Mexico, and particularly in the Gulf of California, research carried by managers evaluated the impact of bottom trawlers on the bottom substrates. Despite the changes in sediment structure due to the suspension and redisposition of organic matter, the study did not find significant changes in benthic communities affected by bottom trawls (López-Martínez et al. 2010). The study suggested that this was due to the high energy process in this area where benthic communities are capable of absorbing the impact of the bottom trawls (Sanchez et al. 2009). However, similar studies that focus on the suripera are not available.

Common habitats and Vulnerable Marine Ecosystems (VME)

It has been well documented that marine species rely on different habitats during their life-cycle stages. Juveniles often confine themselves to structurally complex habitats where they can find shelter and/or feed, moving further offshore when they are large enough to evade common predators. The knotted, complex roots systems of mangrove forests provide sanctuary for the juveniles of many commercial species, which migrate to rocky reefs during their adult lives (Aburto-Oropeza et al., 2015; Costa et al., 2015). For species following this life-cycle pattern, the abundance and health of such habitats, including Sargasso beds, are directly linked to adult population numbers and are echoed clearly in fisheries catches. A healthier habitat means more healthy fish and

[1] https://www.seafish.org/responsible-sourcing/fishing-gear-database/gear/out-rig-trawling/

therefore more opportunities for productive fisheries. This ultimately leads to better local and regional livelihoods and economies.

Johnson, et al., (2016) developed a map for the marine habitat distributions in the Gulf of California. Out of the habitats they mapped, several could be considered VMEs, including the rocky reefs that dominate the Gulf of California, the majority of them occurring along the Baja Peninsula. Seamounts are sparse but appear mainly in the southeast of the Gulf, whilst sargassum is present largely in the northeast. In the particular case of the shrimp fishery, that occurs in coastal lagoons and bays in shallow water, where the fishery impacts are smaller in scale and intensity when compared with commercial trawls. however, the interaction with the seafloor still produces some sediment disturbances and possibly affecting the benthic habitat and community. The commonly encountered habitat by the artisanal fleet in the coastal lagoons is the sandy substrate habitat. Several studies carried out on sandy substrates show that trawling could continually impact this type of habitat (Jones, 1992; Brusca et al., 2005; Padilla-Arredondo et al., 2012), but trophic relationships and biodiversity are not affected greatly and recovery is achieved after a reasonable period (De Biasi, 2004; Diamond et al., 1999; Jennings et al., 2001). To this end, the most extensive review of shrimp trawl net impacts on habitats in the Gulf of California was undertaken by López-Martínez and Morales-Bojórquez (2012) who found that the trawling activity occurs along flat to gently sloping sandy marine substrates. The fishery's impacts to benthic communities of organisms living on theses sandy surfaces is not irreversible as their populations rejuvenate in as little time as a year or less if left undisturbed.

Trawling activity, according to these same authors' review, also removes sediments, including organic material, from the local substrate leaving it devoid of these particles. The passing of a trawl net over sandy marine floors creates a plume of sediment in the water column that is subject to currents until it settles out of the water column and back onto the sea floor in 24-48 hours. According to Padilla Arredondo et al. (2012), simulations suggest that after one hour of trawling 92.5% of the fine sand is deposited within the trawling area, while the remaining 8.5% is deposited outside the trawling area. The limited evidence available (Amezcua et al 2006)(Amezcua and Amezcua-Linares 2014) suggests that suripera nets do not harvest significant bycatch, have no effect on ETP species, and have only a minimal effect on soft sediments. Therefore, it is unlikely that they disrupt ecosystem structure and function.

Assessment of the Blue shrimp suripera

Classification of Biome, Sub-biome and their features

Based on the available information, and the tables 1 and 2, the biome types suggested by the standard are determined by the depth at which the catch of the target species occurs. In the case of the assessed shrimp fishery, the species is caught within one biome: a) **coast** (0-25m), and one sub-biome: a) the **coastal margin** that includes the first 25 m depth (<25m)(Serrano et al 2013). In terms of features of these biome and sub-biome are of the sediment plains type, according to the reports generated by local researchers (Serrano et al 2013)(Rivera-Hernández y Green-Ruiz 2016)(Amezcua et al 2006)

Table 1: List of example biomes, sub-biomes, and features (modified from Williams et al.,2011)

Biome	Sub-biome	Feature
Coast (0-25 m) Shelf (25-200 m) Slope (200-2,000 m) Abyss (>2,000 m)	Coastal margin (<25 m) Inner shelf (25-100 m) Outer shelf (100-200 m) Upper slope (200-700 m) Mid-slope (700-1,500 m)	Seamounts Canyons Abyss Shelf break (~150-300 m) Sediment plains Sediment terraces Escarpments Plains of scattered reef Large rocky banks

Table 2. SGB habitat nomenclature (modified from Williams et al., 20113).

Substratum	Geomorphology	Biota
Fine (mud, sand) Mud (0.1 mm) Fine sediments(0.1-1 mm) Coarse sediments (1-4 mm)	Flat Simple surface structure Unrippled/flat Current rippled/directed scour Wave rippled	Large erect Dominated by: Large and/or erect sponges Solitary large sponges Solitary sedentary/sessile epifauna (e.g. ascidians/ bryozoans) Crinoids Corals Mixed large or erect communities
Medium Gravel/pebble (4-60 mm)	Low relief Irregular topography with mounds and depressions Rough surface structure Debris flow/rubble banks	Small erect/ encrusting/burrowing Dominated by: Small, low-encrusting sponges Small, low-standing sponges Consolidated (e.g. mussels) and unconsolidated bivalve beds (e.g. scallops) Mixed small/low-encrusting invertebrate communities Infaunal bioturbators
Large Cobble/boulders (60 mm - 3 m) Igneous, metamorphic, or sedimentary bedrock (>3 m)	Outcrop Subcrop (rock protrusions from surrounding sediment <1 m) Low-relief outcrop (<1 m)	No fauna or flora No apparent epifauna, infauna, or flora
Solid reef of biogenic origin Biogenic (substratum of biogenic calcium carbonate) Depositions of skeletal material forming coral reef base	High relief High outcrop (protrusion of consolidated substrate >1 m) Rugged surface structure	Flora Dominated by: Seagrass species

Table 3. Unit of assessment

Gear type	Biome	Sub-biome	Feature	Habitat type	Depth (m)
Suripera	Coast	Coastal margin	Sediment plains	Sand / mud	0-25 m

2. Consequence attributes

The consequence attributes are divided into two groups: Habitat-productivity attributes and gear-habitat interaction attributes. Each group contains, in turn, several attributes that will receive a specific score.

Table 4. Consequence attributes (modified from Williams et al., 2011)

Habitat-productivity attributes	Gear-habitat interaction attributes
1. Regeneration of biota	1. Removability of biota
2. Natural disturbance	2. Removability of substratum
	3. Substratum hardness
	4. Substratum ruggedness
	5. Seabed slope

2.1 Habitat Productivity

2.1.1. Regeneration of Biota

This attribute receives a score according to the recovery rate of the biota associated with the habitat using available data about age, growth and recolonization. In the case of absence of specific data, as in this case, scores are assigned using proxies as suggested by the standard. Studies have been performed to identify the fauna related to the coastal lagoon bottoms where the Blue shrimp catch takes place. Some of the most recent information was collected from the fishing logs covered 1,987 fishing trips and 3,820 fishing sets using the Suripera between 2020 and 2022 (DPS 2021). From the more than 3,800 reported sets, a total of 31,935.2 kg of total catch was observed consisting of more than 32 species. Penaeid shrimp species were the highest group caught by weight (49.3%), followed by finfish (45.3%), crustaceans other than penaeid shrimp (4%), and invertebrates (1.3%). Blue shrimp was by far the most important species in terms of weight, representing 45% of the total catch. Some of the most important species were the swimming crab (*Callinectes bellicosus*) 4%, finescale triggerfish (*Balistes polylepis*) with 3.6%, white mullet (*Mugil curema*) 3.4%, Pacific sierra (*Scomberomorus sierra*) 3.4%, Dark spot mojarra (*Eucinostomus entomelas*) 3.4%, Peruvian mojarra (*Diapterus peruvianus*) 3.3%. These were identified as the main bycatch species of the current Suripera commercial shrimp fishery. Brown shrimp and white shrimp were also present in the catch with a 1.9 and 2.4% of the catch. Other 10 species were grouped as others, and represented ~7.4% of the total catch..

Table 5. Scoring regeneration of biota based on age, growth, and recolonization of biota (modified from Williams et al., 2011)

Sub-biome	Using available data			Using surrogate when data are not available					
	Annual	Less than decadal	More than decadal	No epifauna	Small erect/ encrusting	Large erect (sponges)	Large erect (ascidians and bryozoans)	Seagrass communities/ mixed faunal communities/ hard corals	Crinoids/ solitary/mixed communities/ hard and soft corals
Coastal margin (<25 m)	1	2	3	1	1	1	1	2	1
Inner shelf (25-100 m)	1	2	3	1	1	2	2	2	2
Outer shelf (100-200 m)	1	2	3	1	1	3	2	3	3
Upper slope (200-700 m)	1	2	3	1	1	3	3	3	3
Mid-slope (700-1,500 m)	1	2	3	1	2	3	3	3	3

The coastal margin sub-biome: there is presence of small low-encrusting biota, the category corresponds to “small erect/ encrusting” in the table. Therefore, it receives a **score of 1.**

2.1.2 Natural disturbances

Biota susceptible to natural disturbances, typical of the associated habitat, has the intrinsic capacity of recovering at a faster or slower rate. Such disturbances are due to factors such as tides, local currents, storms or waves. The habitat depth is the key factor that determines to what extent the biota could be affected. The coastal lagoons are considered “sediment traps”, due to the huge hydraulic energy produced by the action of the wide tides that influence the region. Heavy load sediment transport take place along the eastern coast of the Gulf of California, interacting with several coastal lagoons, where the sediment dynamics plays a crucial role in the conservation issue of marine species (Carbajal et al., 2018). Carbajal et al. (2018) revealed that the coastal lagoons behave as exporter of sediment to the Gulf of California. The coastal zone of the Gulf of California is under the influence of currents that flow between the northern and southern Gulf, north to south (Lavin et al., 2014).

In order to score these factors, we considered again the most recent available information that includes the importance of these coastal bodies for local fauna, as well as the details on the coastal dynamics.

Table 6. PF13: Scoring natural disturbance. Pg. 94. (MSC, 2014)

Attribute	Score		
	1	2	3
Natural disturbance	Regular or severe natural disturbance	Irregular or moderate natural disturbance	No natural disturbance
Natural disturbance (in absence of information)	Coastal margin and shallow inner shelf (<60 m)	Deep inner shelf and outer shelf (60-200 m)	Slope (>200 m)

In this case, we scored natural disturbances in the coastal margin as follows: **Natural disturbance:** Considering the nature of the coastal dynamics described by Carbajal et al., (2018) and Lavin et al., (2014) we scored this factor with a **2.**

2.2 Interaction of habitat with the fishing gear

2.2.1. Removability of biota

This attribute receives a score depending on the likelihood of the attached biota receiving an impact, being removed or killed due to the interaction with the fishing gear. The biota’s vulnerability to the fishing gear depends on features such as its weight, size, robustness, flexibility and species complexity. Thus, those organisms that are big, erect, inflexible or delicate are more vulnerable to removability or to physical damage than small, flexible or burrowing organisms.

Table 7. PF14: Scoring the removability of biota and substratum. Pg. 95. (MSC, 2014)

Gear type	Removability of biota			Removability of substratum		
	Low, robust, small (<5 cm), smooth, or flexible biota OR robust, deep-burrowing biota	Erect, medium (<30 cm), moderately rugose, or inflexible biota OR moderately robust, shallow-burrowing biota	Tall, delicate, large (>30 cm high), rugose, or inflexible biota OR delicate, shallow-burrowing biota	Immovable (bedrock and boulders >3 m)	<6 cm (transferable)	6 cm - 3 m (removable)
Hand collection	1	1	1	1	1	2
Demersal longline	1	1	2	1	1	1
Handline	1	1	2	1	1	1
Trap	1	2	2	1	1	1
Bottom gill net or other entangling net	1	2	3	1	1	1
Danish seine	1	2	3	1	2	3
Demersal trawl (including pair, otter twin-rig, and otter multi-rig)	1	3	3	1	3	3

Considering that the biota associated to fishing grounds both in the coastal margin as well as in the inner shelf includes a mix of small low-encrusting invertebrate communities, and the fact that the catch is performed using demersal trawls, the score for this attribute is: **score of 1.**

2.2.2. Removability of substratum

The scoring of this attribute relates to the fragments of rock or grain that result from the breaking of larger rocks, and the likelihood of the substratum being moved. Fine sediments are more vulnerable to impacts because they are easier to be moved at the time of the impact; however, their resilience is bigger than those substratums that include rock fragments and sessile fauna that can be more easily affected. The cumulative capacity of the fine substratum seabeds and the presence of endobenthos fauna (buried) makes them more resistant.

Studies carried out on sandy substrates show that trawling could continually impact this type of habitat (Jones, 1992; Brusca et al., 2005; Padilla-Arredondo et al., 2012), but trophic relationships and biodiversity are not affected greatly and recovery is achieved after a reasonable period (De Biasi, 2004; Diamond et al., 1999; Gordon et al., 2002; Jennings et al., 2001). To this end, the most extensive review of shrimp trawl net impacts on habitats in the Gulf of California was undertaken by López-Martínez and Morales-Bojórquez (2012) who found that the trawling activity occurs along flat to gently sloping sandy marine substrates. The fishery's impacts to benthic communities of organisms living on theses sandy surfaces is not irreversible as their populations rejuvenate in as little time as a year or less if left undisturbed.

Trawling activity, according to these same authors' review, also removes sediments, including organic material, from the local substrate leaving it devoid of these particles. The passing of a trawl net over sandy marine floors creates a plume of sediment in the water column that is subject to currents until it settles out of the water column and back onto the sea floor in 24-48 hours. According to Padilla Arredondo et al. (2012), simulations suggest that after one hour of trawling 92.5% of the fine sand is deposited within the trawling area, while the remaining 8.5% is deposited outside the trawling area. The limited evidence available (Amezcua et al 2006)(Amezcua and Amezcua-Linares 2014) suggested that suripera nets do not harvest significant bycatch, have no effect on ETP species, and have only a minimal effect on soft sediments. Therefore, it is unlikely that they disrupt ecosystem structure and function, for these reasons, the scoring of this attribute is: **score of 3.**

2.2.2. Substratum Hardness

The scoring of this attribute depends on the substratum composition. Here we consider if the seabed will degrade or not when it interacts with the fishing gear. It is to be expected that those substratum's with hard/rocky seabed's will be more resistant to the impact. The Sinaloa coastal lagoons present fine and medium sand and muddy bottoms. Therefore, these are soft beds where molluscs, polychaetes, and crustaceans are abundant. In the area corresponding to Santa Maria La Reforma coastline, sand is predominant, favoring the establishment of benthic fauna with the predominance of bryozoans, sponges and coelenterates.

Table 8. Scoring the substratum hardness, substratum ruggedness, and seabed slope attributes (modified from Hobday et al., 2007)

Gear type	Substratum hardness			Substratum ruggedness			Seabed slope		
	Hard (igneous, sedimentary, or heavily consolidated rock types)	Soft (lightly consolidated, weathered, or biogenic)	Sediments (unconsoli-dated)	High relief (>1 m), high outcrop, or rugged surface structure (cracks, crevices, overhangs, large boulders, rock walls)	Low relief (<1.0 m), rough surface structure (rubble, small boulders, rock edges), subcrop, or low outcrop	Flat, simple surface structure (mounds, undulations, ripples), current rippled, wave rippled, or irregular	Low degree (<1): Plains in coastal margin, inner or outer shelf or mid-slope OR terraces in mid-slope OR rocky banks/ fringing reefs in coastal margin, inner or outer shelf, or upper or mid-slope	Medium degree (1-10): Terraces in outer shelf or upper slope	High degree (>10): Canyons in outer shelf, or upper or mid-slope OR seamounts/ bioherms in coastal margin, inner shelf, or upper or mid-slope
Hand collection	1	2	3	3	3	1	1	2	3
Bottom gill net or other entangling net	1	2	3	2	3	3	1	2	3
Danish seine	1	2	3	1	1	3	1	2	3
Demersal trawl (including, pair, otter twin-rig, and otter multi-rig)	1	2	3	1	3	3	1	2	3

The suripera shrimp catch takes place using modified cast nets in the coastal sub-biome. The plains contain fine particle sediments (see sections 1.1 and 1.2). Therefore, the scoring for this attribute is: **score of 2.**

2.2.3. Substratum Ruggedness

The scoring of this attribute is based on the features of the ruggedness of the bottom where the artisanal Blue shrimp fishery takes place. The simple topography that is found within the shallow (less than 25 m depth) depth, presents undulations in areas where sands are predominant and less ruggedness in comparison with the shelf outside the lagoon, where more relief types are to be found (Montaño-Ley and Soto-Jimenez, 2019). As blue shrimp catches take place in coastal lagoons without slope – categorized as *sediment plains,* the scoring for this attribute in the coastal margin and inner shelf is: **score of 3.**

2.2.4 Seabed Slope

The scoring of this attribute considers the impact on the habitat resulting from the slop steepness and mobility of the substratum after the interaction with the fishing gear. The degree of slope is taken into account. In the case of the Gulf of California coastal lagoons are reported to have smooth slopes, with small changes in depths, with the exception of some channels created mostly due to the tides (Lavin et al 2014). As the shrimp catch occurs in the coastal margin, where there is no slope in the continental shelf, the scoring for this attribute in the sub-biomes mentioned here above is: Low degree of slope in the seabed (<1), plains in the coastal margin. It receives a **score of 1.**

3. Spatial attributes

3.1 Fishing gear footprint

The scoring of this attribute considers the fishing gear and the number of encounters needed to cause impact on the habitat.

Based on the table below (see table 9) from the MSC standard, the gear's potential for disturbance and the number of encounters required to produce an impact on a habitat, are taken into account based on the size, weight, and mobility of individual gears and the footprint of the gears. Although the suripera is not a gear that uses heavy weights (particularly compare with industrial trawlers), it was considered a trawl for this evaluation, using a precautionary approach. According to Amezcua et al., (2006) the use of the suripera inside the systems should be promoted, in order to reduce the amount of bycatch and recommended an ecosystem approach to fisheries management, because the suripera net does affect the systems.

Table 9. Scoring the gear footprint attribute (modified from Hobday et al., 2007)

Gear type	Gear footprint score
Hand collection	1
Handline	1
Trap	1
Demersal longline	2
Bottom gill net or other entangling net	2
Danish seine	2
Demersal trawl (including pair, otter twin-rig, and otter multi-rig)	3 ●
Dredge	3

According to the standard and considering the suripera a demersal trawl, the scoring for this attribute would be: **Coastal margin**: Suripera net (modified light trawl) - **score 3.**

3.2 Spatial overlap

The scoring of this attribute considers the spatial overlap between habitat distribution and the extension of the areas where the Unit of Assessment (UoA) operates, in this case, the fleet operates along the whole coastal lagoon (Amezcua et al.,2006), although some of the effort concentrates in "historical" spots (known by locals as "caladeros") it is estimated that in general, the overlap among the habitats is >75%.

The scoring for this attribute is: **Coastal margin**: UoA overlap with habitat is ≤75% - **score 2.5**

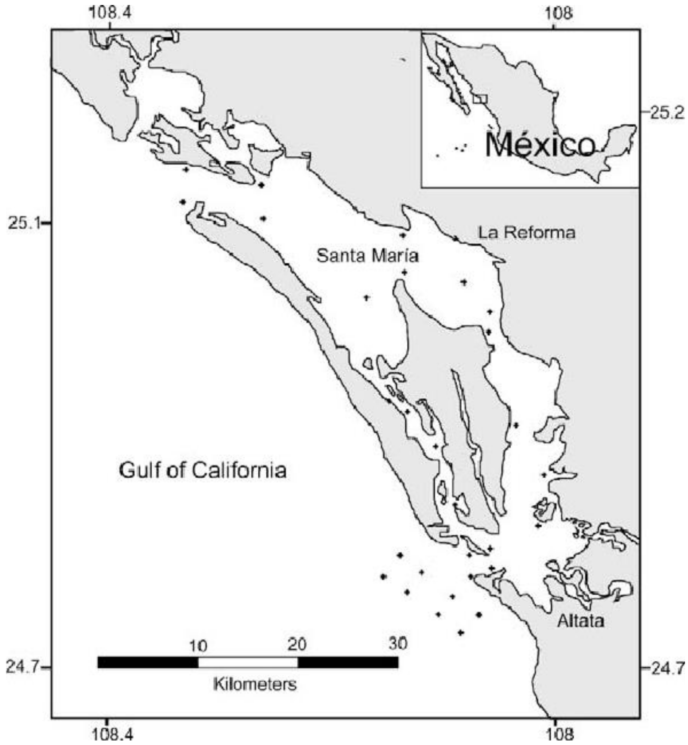


Figure 1 illustrates the most important catch areas inside the coastal lagoon of Santa Maria la Reforma, the area represents around 75% of the total distribution that corresponds to the habitats described here above, composed of sand and mud (Amezcua et al 2006).

3.3. Encounterability

The scoring of this attribute is based on the likelihood of the fishing gear encountering the habitats analyzed during the development of the fishing activity. The likelihood of encounterability is considered ≤75%, because these habitats are sought for setting the suripera nets, since shrimp is a species linked to these soft beds. These soft beds are the most common habitats in the area and considering that with the exception of the shallowest regions are not use, for these reasons, the likelihood of encounterability is considered around ≤75%.

Table 10: Scoring spatial attributes (modified from Williams et al., 2011).

Spatial attribute	Score					
	0.5	1	1.5	2	2.5	3
Spatial overlap	UoA overlap with a habitat is ≤15%	UoA overlap with a habitat is ≤30%	UoA overlap with a habitat is ≤45%	UoA overlap with a habitat is ≤60%	UoA overlap with a habitat is ≤75%	UoA overlap with a habitat is >75%
Encounter-ability	Likelihood of encounter-ability is ≤15%	Likelihood of encounter-ability is ≤30%	Likelihood of encounter-ability is ≤45%	Likelihood of encounter-ability is ≤60%	Likelihood of encounter-ability is ≤75%	Likelihood of encounter-ability is >75%

According to the standard, the scoring for this attribute is: the likelihood of encounterability between the fishing gear and the habitat is ≤75% - **score 2.5.**

4. Final score - PI 2.4.1 CS

As a result of the risk analysis performed, the Performance Indicator (PI) 2.4.1 is found in the range of >80

Table . Final MSC CSA Score

Only main habitats scored?			**Yes**				**Consequence score [1-3]**								**Spatial score [0.5-3]**							
Habitat details							**Habitat productivity**		**Gear-habitat interaction**					**Consequence score**								
Scoring element	**UoA/Gear type**	**Biome**	**Subbiome**	**Feature**	**Habitat type**	**Depth (m)**	Regeneration of biota	Natural disturbance	Removability of biota	Removability of substratum	Substratum hardness	Substratum ruggedness	Seabed slope		Gear footprint	Spatial overlap	Encounterability	**Spatial score**	**CSA score**	MSC CSA-derived score		
1	UoA/Bottom trawling	Coast	Coastal margin	Sediment plains	Fine, simple surface structure,small invertebrate communities (sand, clay, mud)	0-25m	1	2	1	3	2	3	1	1,78	3	2.5	2.5	2.66	3.20	65	Med	60-79

Conclusion

In conclusion, the result of the CSA for the habitat obtained a passing with condition score of 60-79. As a recommendation, more information related to the level of impacts of the gear should be generated, considering that this gear has been identified as a highly selective and limited impact, however, due to the nature of the gear (been a trawling system) the RBF scored with extreme caution.

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