Final report

Current level of compliance fishing rules in the stone crab fishery (Metacarcinus edwardsii), Los Lagos Region.

30/03/2020

CONTENIDOS

Acrónimos

TURF	Territorial Use Rights for Fishing
MP	Management Plan
MC	Management Committee
MLS	Minimun Legal Size
AFR	Artisanal Fishing Register
SERVICE	National Fishing and Aquaculture Service
ALO	Accreditation of Legal Origin
UNDERSECRETARY	Undersecretary of Fisheries and Aquaculture
INSTITUTE	Institute of Promotion Fishery
OFC	Ovigerous Female Closure
MSC	Monitoring, Control and Surveillance
IUU	Illegal, Unreported and Unregulated fishing
IPOA-IUU	International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing

1. Introduction

Illegal, Unreported and Unregulated (IUU) fishing practices have been considered the main obstacle to achieve sustainable fisheries, and constitute a threat to food security, directly compromising livelihoods of many coastal communities, in addition to having detrimental effects on the environment (FAO, 2014). Unfortunately, these practices have increased mainly due to globalization of the fishing industry and the increased demand for fish products.

To face this problem, FAO (2001) adopted the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU). Among other topics, the IPOA-IUU provides recommendations regarding the elements that the Monitoring, Control and Surveillance (MCS) must contain, in order to discourage and avoid IUU fishing. One of the most important recommendations is to carry out comprehensive and effective monitoring, which should start in the landing points to the final destination.

In Chile, the MCS system integrates inspection operations at different points of the supply chain and operates based on a protocol for defining risk areas or agents that are identified by the Fishery Intelligence Analysis Units established in all Regional Fisheries Directorates. To systematize information on MCS activities, the National Fisheries and Aquaculture Service (SERVICE) has implemented a system to manage the information. For this, the supervising agents collect the information in forms designed for this purpose and with the aim of subsequently entering this data into the management system (from which processed information on the MCS activity is obtained). Among the data collected is the number of control actions, types of agents controlled (fishermen, fishing vessels, transporters, merchants, etc.), man-hours and the support equipment used, violations carried out and seizures, among others (MINECOM, 2004).

Although there is available information regarding the MCS system on all national fisheries, the level of compliance with current management rules in the stone crab fishery has not yet been analyzed. So, due to the importance that this aspect has in the fishing sustainability, the objective has been set to evaluate the current compliance levels with the fishing rules in this fishery. For this, the information processed by the SERVICE regarding the actions of MCS and complementary information from the Institute for Fisheries Development (INSTITUTE) will be used.

2. Background

Landings and fishing effort of the stone crab fishery

Among the Chilean crab fisheries, the stone crab (Metacarcinus edwardsii) stands out as the most important species in terms of extraction volume. Indeed, this species has contributed around 60% of the national landings of crabs in the last 5 years (www.sernapesca.cl). Regarding its historical landings, there are records associated with the species since 1994, prior to this date a landing declaration was made including all crab species exploited in the country. In the history of the landings of the species, it can be seen that between 1994 and 1997 there was stable landings around 2,000 tons per year. However, in subsequent years a constant increase is observed until 2002, where the records registered a historical pick of landings slightly over 7,000 tons. After this year, landings decreased slightly and stabilized with values between 4 and 5 thousand tons until 2017 (Figure 1).

The capture of this species is carried out in the reserve area for artisanal fishing (first 5 nautical miles) mainly through the use of traps, and a minority percentage in diving operations (Olguín and Mora, 2018). At the geographical level, the catch takes place between the southern regions of Maule and Magallanes, but it is mainly concentrated in the Los Lagos and Aysén regions, in fact, in 2017 these regions landed more than 97% of the total national volume (**Figure 1**).

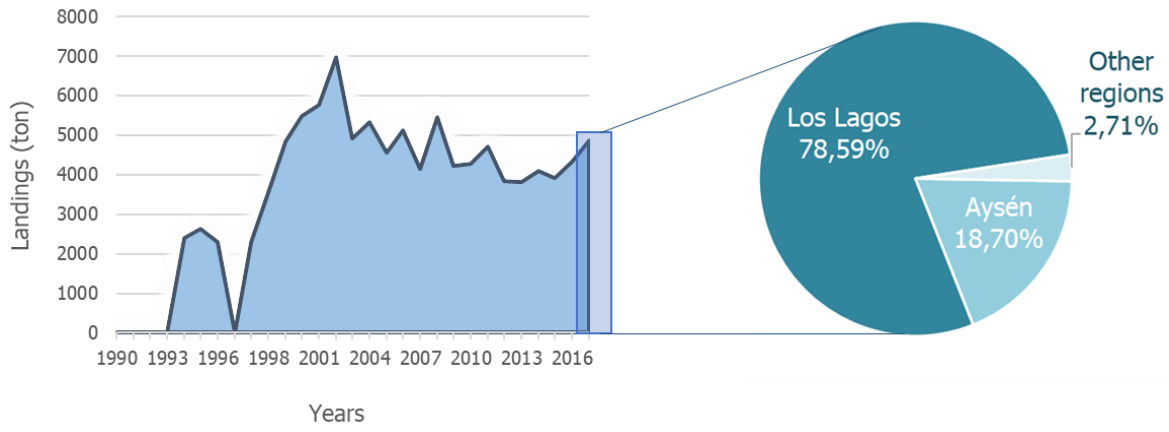

Figure 1. Left side: Historical landings of the stone crab species (Metacarcinus edwardsii), nationwide. Right side: Regional contribution of the landings of stone crab during the year 2017. Source: CPS elaboration based on data from the Statistical Yearbook of Fisheries (www.sernapesca.cl).

Evolution of the governance scheme

Before 2013, fisheries management in Chile was developed, mainly under a centralized governance system, where eventually channels of dialogue with stakeholders were primarily to inform the fundamental decisions related to resource management. However, with the modifications made to the General Law on Fisheries and Aquaculture promulgated in February 2013, a joint administration model was introduced, through the creation of Management Committees (MCs). These MCs are integrated by public and private stakeholders who seek to generate management alternatives to ensure the sustainability of the fishing activity through the design of a Management Plan (MP). This governance scheme can be established for all fisheries, including benthic and pelagic fisheries, as well as industrial, small-scale or mixed fleet fisheries (MINECOM, 1991).

This new governance scheme is closer to the definition of an advised co-management system where stakeholders advise the government on the decisions to be made and the government supports them (Defeo, 2015). Although it is not yet possible to observe important changes in the conservation of resources, the MCs are allowing the integration of local knowledge, the progress of socio-ecological feedback mechanisms and the development of multilevel interactions, which are visualized as the necessary conditions for achieve a polycentric governance system, where different decision-making bodies can coexist (Gelcich, 2014).

In the case of the stone crab fishery, a MC was formed in June 2015, which began to meet periodically from April 22 2016, and plans to present a MP proposal at the end of 2020 to the Undersecretariat of Fisheries and Aquaculture (UNDERSECRETARY). The territorial scope of this MC was restricted to the province of Chiloé in the Los Lagos region. However, it has recently been expanded to a regional scale and the scope of its decisions covers the entire Los Lagos region.

National mechanisms for Monitoring, Control and Surveillance

In Chile, the institution in charge of developing and implementing the MCs mechanisms is the National Fisheries and Aquaculture Service (SERVICE) (MINECOM, 1991). Specifically, these control mechanisms operate on prohibitions or administration measures arranged for the conservation of hydrobiological resources in a fishing area, some examples are:

a) Access: Administrative act by which a natural or legal person is legally permitted to carry out extractive fishing activities with a specific vessel over a specific hydrobiological resource.
b) Quota: Establishment of annual catch quotas by species in a given area, corresponding to a physical volume measured in tons, capable of being caught annually in a given fishery unit.
c) Restriction of fishing gear: Setting the dimensions and characteristics of fishing gear.

d) Legal minimum size: Setting minimum extraction sizes or weights in a given area and their tolerance margins.
e) Ban: Administrative act established by the competent authority, indicating that it is prohibited to capture or extract a hydrobiological resource in a determined area for a determined period of time.

The national control and surveillance mechanism to enforce fisheries management measures is based on a documentary oversight model that uses risk indicators of non-compliance by the different agents in the supply chain (fishermen, transporters, processors, exporters, among others), which allows to focus the audit on places and subjects that have a greater probability of not complying with the established measures (SERNAPESCA, 2019). To execute these actions, the SERVICE has created Fishing Intelligence Analysis Units in all the Regional Fisheries Directorates, in order to implement the documentary inspection model based on risk indicators. In fact, around 20% of the inspections on the fieldwork are focused on controlling high-risk agents, in the understanding that they are the ones that generate the greatest impact with their non-compliance (SERNAPESCA, 2017).

As a result of this inspection strategy, the number of annual inspections on a fishery, in this case the stone crab fishery depends not only on the human resources and inspection materials of the SERVICE, but also on the existing risk levels in the stone crab supply chain, with regard to the risk observed in other fisheries.

As for the field inspection effort, approximately 85 thousand inspection activities are carried out per year at a national level, of which 41% are carried out at landing points (considered the main place to verify compliance with the main regulations, relating them directly to the extractive agent). The rest of the audits correspond to inspections of transportation facilities (26%), marketing centers (18%), processing plants (9%) and other points (6%) (SERNAPESCA, 2019).

3. Metodology

Two independent information sources have been used to review the levels of compliance with the current catch rules. One of the sources is the data of inspections and infractions carried out annually by the SERVICE. The second source corresponds to the scientific monitoring that is of the stone crab fishery that is carried out by the INSTITUTE. This last source gathers information related on the number of specimens under the Minimum Legal Size (MLS) and the percentage of females carrying eggs in the landings.

Inspection and sanction actions carried out by the SERVICE

The control actions carried out by the SERVICE on the stone crab fishery during the last 10 years were requested through the national transparency system. This information details the number of annual audits controlled on the capture, transport or processing of the stone crab resource, as well as the number of infractions carried out in these operations. The SERVICE uses different categories to systematize information on infractions, which have a specific sanction defined by Law (**Table 1**).

Based on this information, the main types of non-compliance observed in the stone crab fishery, the percentage of infractions carried out based on the number of control operations, and their dynamics over time was analyzed.

Table 1. Categories of infractions for non-compliance with artisanal fishing regulations, with the respective sanctions.

Tipo	Descripción	Sanción
Breach of Minimun Legal Size (MLS)	Existence of specimens below the legal minimum size at landings	Fine equivalent to four times the result of the multiplication of the sanction value of the respective species1. In this case it applies only to the percentage of specimens landed under MLS
Non-compliance with females carrying eggs	Existence of female specimens carrying eggs in landings	Fine equivalent to four times the result of the multiplication of the sanction value of the respective species. In this case it applies only to the percentage of the females carrying eggs of the landing

Breach in TURF	In the case of TURF, the MP considers an annual catch quota, in these cases non-compliance could be the breach of the quota or the general catch measures (MLS or ban of females carrying eggs)	Fine equivalent to four times the result of the multiplication of the sanction value of the respective species
Access	Not having the right to carry out extractive fishing activities with a certain vessel, over a certain hydrobiological resource	Fine equivalent to four times the result of the multiplication of the sanction value of the respective species
Legal Origin Accreditation (ALO)	Impossibility to prove, in a documentary way, the legal origin of the resource, whether in its transportation, processing and / or commercialization	Fine of 30 to 300 monthly tax units (UTM)2, and confiscation of the hydrobiological species and means of transport used, when appropriate, and, in addition, with the closure of the establishment or premises in which the infringement was committed for a period not less than 3 to no more than 30 days

Percentages of specimens under MLS and females carrying eggs Ban (Ovigerous Female Closure - OFC) observed in landings by biological monitoring of the fishery

To determine the level of non-compliance with MLS measures and the Ovigerous Female Closure (OFC), an analysis of the data from the biological monitoring program carried out by the INSTITUTE at three landing points in the Los Lagos Region was carried out. In this program samples are taken to record size information of the landings for research, which is kept in reserve and is not used for sanction purposes. However, this information makes it possible to show the percentages of non-compliance with the MLS and female ovigerous measures.

The positive aspect of analyzing this information is that unlike the inspection actions that are carried out directed at the highest risk agents, in this case the samples are taken randomly, allowing it to contrast the observed results of these two information sources.

El aspecto positivo de analizar esta información es que a diferencia de las acciones de fiscalización que son realizadas de manera dirigida a los agentes de mayor riesgo, en este caso las muestras son tomadas de manera aleatoria, lo que permite contrastar los resultados observados de estas dos fuentes de información.

4. Current management measures

Currently, a series of management measures are in force in the stone crab fishery in order to protect the reproductive capacity of the resource. These measures include regulating the access, the extraction of specimens below the average length of sexual maturity, and the extraction of females carrying eggs.

In terms of access, the inscriptions that grant the right to work in the fishery are temporarily suspended until 2024, because the fishery is considered to be in a state of full exploitation (MINECOM, 2019). In addition, there is an indefinite closure at the national level for female carrying eggs, which implies that you cannot reach the port with female carrying eggs. Another measure is the MLS, which at the national level has been set at 120 mm carapace width (MINECOM, 1990), except in the maritime area of the Los Lagos Region, where a minimum extraction size of 110 mm carapace width has been set (MINECOM, 2011). These last two measures are possible to implement because the most frequently used fishing gear is the trap, and on board the specimens that are carrying eggs or are below the minimum legal size are easily identifiable and are returned during operations at sea.

Regarding the transport of this species, the regulation establishes that, throughout the national territory, the transport of crab in its natural state may only be carried out with live specimens. In the case of transporting crab meat, the transport has to be done with the corresponding "Free Transit Guide".

5. Results and discussion

Analysis of the information on control and sanction actions carried out by the SERVICE

According to the inspection reports made by the SERVICE, it can be seen that the number of inspection actions between different years has a high variability, from 117 inspection actions in 2009 to 2,182 inspection actions in 2016. This may obey to the strategy of focusing operations on higher risk agents. Despite the increase in inspections, there is no significant difference between the numbers of infractions carried out per year.

In the 10 years analyzed, an average of 22.6 ± 12.8 infractions per year can be observed, which constitutes a very low proportion with respect to the total number of enforcement actions (3.24% ± 2.48%) (**Table 2**).

Table 2. Control actions carried out by the SERVICE per year, during the capture, transport and processing of the stone crab (*Metacrcinus edwarsii*). It includes number of infractions carried out and proportion of the infractions with respect to the number of control actions. Source: CPS elaboration based on data provided by the SERVICE.

Year	Inspection Actions	Infractions	Proportion of infractions
2009	127	1	0,8%
2010	208	8	3,8%
2011	424	39	9,2%
2012	887	24	2,7%
2013	861	33	3,8%
2014	1282	40	3,1%
2015	1818	18	1,0%
2016	2182	12	0,5%
2017	1138	19	1,7%
2018	658	34	5,2%
2019	553	21	3,8%
Average	**921,6**	**22,6**	**3,24%**
Standard deviation	**646**	**12,8**	**2,48%**

Regarding the types of infractions, it is possible to assert that between 2010 and 2014, the measure that showed the greatest non-compliance was the violation of the OFC, which had a non-compliance pick in 2012 equivalent to 31 infractions, this situation decreased significantly to become practically irrelevant from 2015 onwards. This phase of non-compliance, of a specific measure, could be related to the lack of knowledge from a part of the stakeholders of the fishery (**Figure 2**).

On the other hand, from 2015 to 2019, the highest number of infractions carried out was due to the inability to prove the legal origin (AOL) by the agents (**Figure 2**). This type of infraction is not associated with a particular fishing measure. However, it is assumed that the lack of documentation is the product of an illegal origin of the catch. This increase in AOL infractions may be the result of the implementation of the risk-based control system, where the sanctions executed probably correspond to the control of transport, processing or marketing agents.

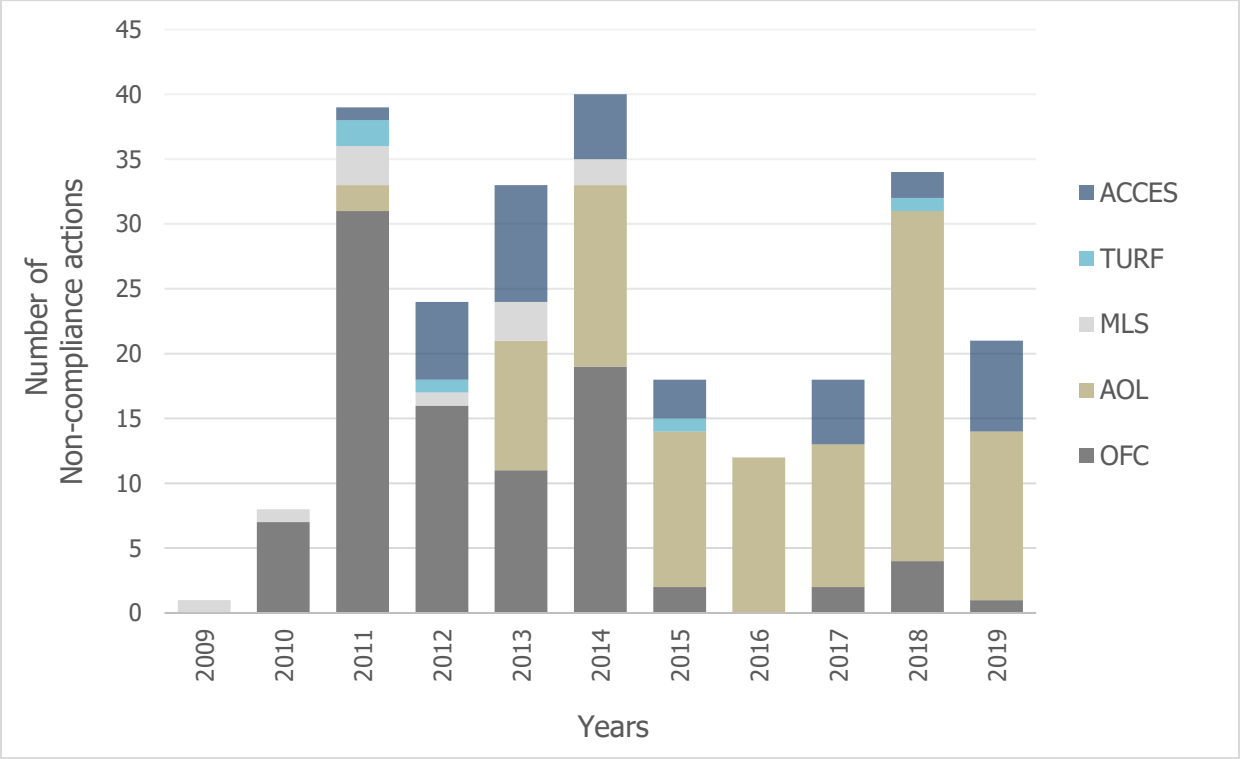

Figure 2. Number of actions of non-compliance with the current fishing rules that have been ordered for the stone crab (Metacarcinus edwarsii) fishery. Source: CPS elaboration based on data provided by the SERVICE.

Analysis of the information originated from the biological monitoring developed by the INSTITUTE

Regarding the information originated from the biological scientific monitoring, it is possible to observe that the percentage of specimens that are under the MLS at landing has progressively been decreasing from 4.2% in 2013 to 0.2% in 2019 (Figure 3). At this point it is important to point out that biological monitoring is only implemented in the Los Lagos Region and, therefore, the MLS measurement corresponds to 11 cm and not 12 cm as it occurs in the rest of the country. Based on the data, it is possible to consider that there is a high level of compliance of the MLS measure by the fishing agents. In fact, between 2015 and 2019 the largest number of specimens sampled is over 12 cm (1 cm greater than the MLS).

Regarding the presence of ovigerous female in the fishery, the INSTITUTE has repeatedly reported the presence of females with eggs during catches, which are returned at sea during the fishing operations. However, in the landing ports there have been no ovigerous female in the samplings between 2013 and 2018 (Daza et al., 2013; Olguín et al., 2013; Daza et al., 2015; Olguín & Mora, 2016, 2018, 2019; Olguín et al., 2017). On the other hand, inspection operations have evidenced non-compliance with this measure, particularly during the years 2013 and 2014 where 11 and 19 infractions were carried out respectively (**Figure 3**). This suggests that the control mechanisms

that have been implemented in the fishery are allowing greater success in the search for illegal fishing instead of carrying out random controls.

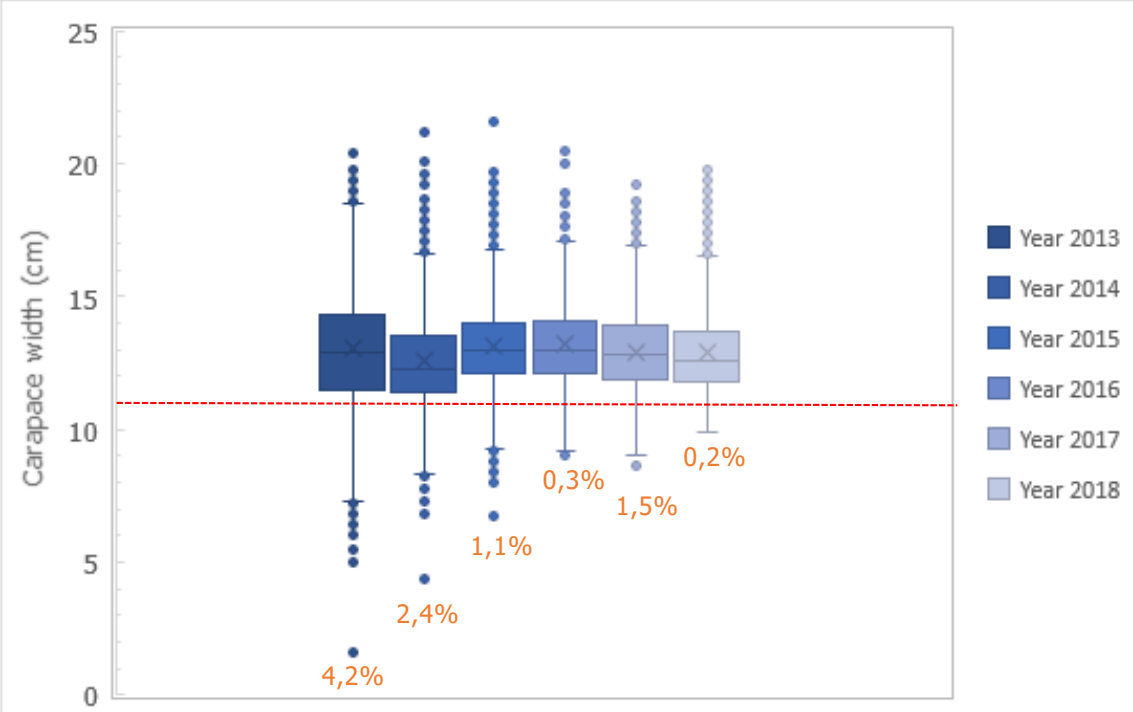

Figure 3. Size structure measured according to the width of the carapace originating from the biological monitoring of landings of stone crab (*Metacarcinus edwarsii*). The red line represents the Minimum Legal Size (MLS) and the percentages under each series represent the fraction of the landing that was under MLS. Source: CPS elaboration based on biological monitoring data carried out by the INSTITUTE.

Development of indicator to measure compliance with the stone crab fishery

From these preliminary results of the analyzed information, it is possible to advance in the development of some simple indicators that allow measuring the level of compliance of the existing rules in the fishery. The number of audit operations and the percentage of operations that culminate in infractions could be considered as an indicator of global non-compliance. Based on this, it is possible to define a baseline of non-compliance with current management measures. Figure 4 shows the variation in the percentage of inspection operations that incurred in infractions, in addition to the average and the confidence interval (95%) observed in this variable, during the last 10 years.

Currently, it is pertinent to consider that the percentage of operations that culminate in infractions is very low, which allows us to conclude that the fishery has a high level of compliance throughout the entire supply chain. However, this scenario could change with the eventual regulatory changes that are imposed in the MP. Therefore, monitoring compliance with the new measures can be

contrasted with this baseline. In this sense, the upper confidence interval (4.78% of non-compliance) could be considered as a Non-compliance Limit Reference Point, where above it should trigger stronger MCs actions.

These MCs actions should be aimed at increasing audits on those fishing measures that are evidenced high, using for this purpose analogous analysis to the one presented in Figure 2. That is to say, if there is a greater non-compliance with the ALO, greater efforts should be devoted to monitoring the transport, processing and marketing links of the supply chain. Otherwise, if the MLS or OFC measures are increased over time, more monitoring efforts should be devoted at the landing ports.

Desarrollo de indicadores para medir el cumplimiento de la pesquería de la jaiba marmola

A partir de estos resultados preliminares de la información analizada, es posible avanzar en el desarrollo de algunos indicadores simples que permitan medir el nivel de cumplimiento de las reglas en la pesquería. El número de operativos de fiscalización y el porcentaje de los operativos que culminan en infracciones podrían considerarse como un indicador de incumplimiento global. A partir de esto es posible definir una línea base de incumplimiento de las medidas de manejo actuales. En la **Figure 4** se muestra la variación del porcentaje de operativos de fiscalización que incurrieron en infracciones, además del promedio y el intervalo de confianza (95%) observado en esta variable, durante los últimos 10 años.

Actualmente, es pertinente considerar que el porcentaje de operativos que culminan en infracciones es muy bajo, lo que permite concluir que la pesquería posee un alto nivel de cumplimiento a lo largo de toda se cadena de suministros. No obstante, este escenario podría cambiar con las eventuales modificaciones regulatorias que se impongan en el MP. Por tanto, el monitoreo del cumplimiento de las nuevas medidas puede ser contrastado con esta línea base. En este sentido, el intervalo de confianza superior (4,78 % de incumplimiento) podría considerarse como un Punto de Referencia Límite de incumplimiento, por sobre el cual debiesen gatillarse acciones de MCS más fuertes.

Estas acciones de MCS debiesen estar orientadas a aumentar las fiscalizaciones sobre aquellas medidas pesqueras que se evidencian altas, utilizando para ello análisis análogos al que se presenta en la **Figure 4**. Es decir, si existe un mayor incumpliendo en la ALO, debiesen destinarse mayores esfuerzos a monitorear los eslabones de transporte, procesamiento y comercialización de la cadena de suministros. En caso contrario, si las medidas de MLS o OFC se incrementan en el tiempo, debieses destinarse mayores esfuerzos de monitoreo a los puertos de desembarque.

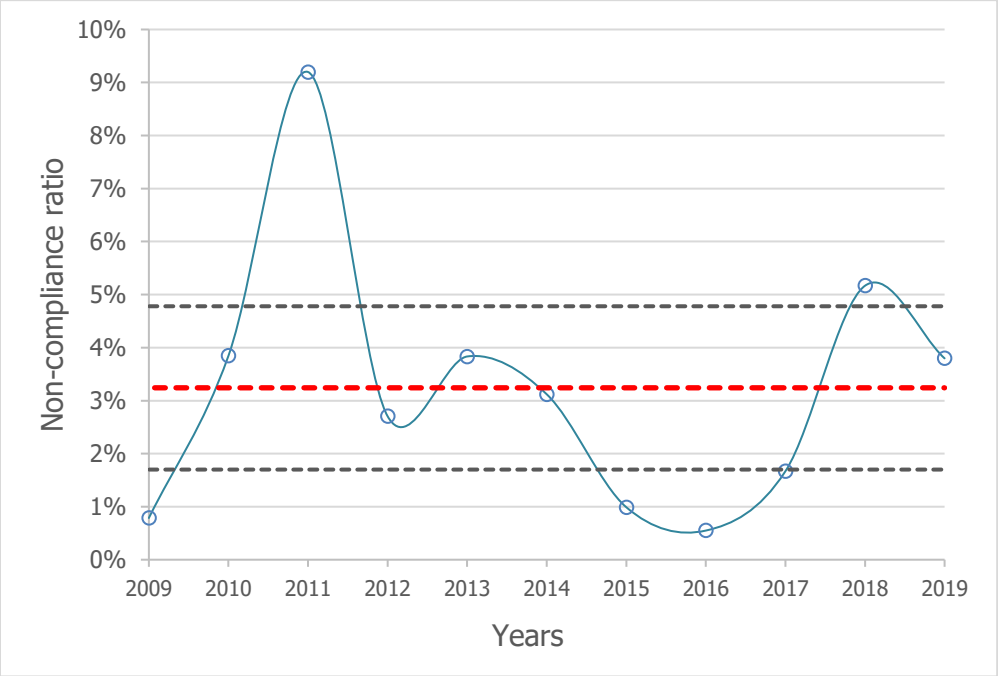

Figure 4. Variation of the non-compliance index with the current management rules of the stone crab fishery (*Metacarcinus edwarsii*). The blue line represents the variation in the default rate; the dotted red line represents the average value of default in the last 10 years and the dotted black lines represent the 95% confidence intervals for this average. Source: CPS elaboration based on data provided by the SERVICE.

6. Conclusion

- The analyzed information, both from the MCs mechanism and the scientific monitoring, allow us to conclude that the stone crab fishery maintains a high level of compliance with current management rules.

- The MCs mechanism appears to be sufficient and effective to prevent, discourage and eliminate illegal and unreported fishing activities in the stone crab fishery throughout all its supply chain.

- The systematized information of the inspection reports carried out by the SERVICE are an important source of information for the design and implementation of a compliance indicator in the stone crab fishery that will allow evaluating compliance with future fishing rules that will be enacted in the MP.

- Based on the information on audits and infringements of the last 10 years, a non-compliance limit reference point of 4.78% was estimated, which means that, for every 100 audit operations, 4.78 cases constitute an action of non-compliance.

- Finally, it is recommended that if in the future, the limit reference point is exceeded, it could be used as an input to trigger stronger enforcement actions, which should be aimed at monitoring those rules that show a greater increase in non-compliance.

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