CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Seventeenth meeting of the Conference of the Parties
Johannesburg (South Africa), 24 September – 5 October 2016

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Listing in Appendix II of *Holacanthus clarionensis*, in accordance with Article II, paragraph 2 a) of the Convention and in line with criterion A of Annex 2 a of Resolution Conf. 9.24 (Rev. CoP16), owing to the levels of international trade and demand relative to the population densities reported and projected in the areas of the species' distribution.

B. Proponent

Mexico[*]:

C. Supporting statement

1. Taxonomy

1.1	Class:	Actinopterygii	
1.2	Order:	Perciformes	
1.3	Family:	Pomacanthidae	
1.4	Genus:	*Holacanthus*	
1.5	Species:	*Holacanthus clarionensis* (Gilbert, 1890)	
1.6	Scientific synonyms:	None	
1.7	Common names:	Spanish:	Ángel de Clarión
		French:	Demoiselle de Clarion
		English:	Clarion angelfish

This taxonomic classification is consistent with the standard nomenclature for CITES set forth in Resolution Conf. 12.11 (Rev. CoP16; Eschmeyer and Fricke, 2011)

2. Overview

As a result of a forward-looking analysis of international trade in Mexican species, carried out between 2005 and 2010, the Scientific Authority of Mexico (CONABIO) and TRAFFIC determined that the international trade in in the Clarion angelfish (*Holocanthus clarionensis)* needed to be analyzed in greater detail. To that end, CONABIO (Mexico's CITES Scientific Authority) financed the project "Current

[1] *This document has been provided in these languages by the author(s).*

[*] *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

situation of the endemic fish *Holacanthus clarionensis* (Clarion angelfish) and prospects for conservation in Mexico", entrusted to Dr. Héctor Reyes Bonilla and María Martínez Torres, MSc (Reyes-Bonilla and Martínez, 2016), national experts in the species at the Autonomous University of Baja California Sur; who in cooperation with various colleagues[2] compiled information on the species in accordance with the format of Annex 6 of Resolution Conf. 9.24 (Rev. CoP16).

Based on growth parameters obtained from FishBase, population doubling time and vulnerability (27/100, Musick, 1999; Cheung, et al, 2005), the species is considered to have an intermediate productivity (FAO, 2016).

Specifically, Reyes-Bonilla and Martinez (2016) estimated an area of 13,365 km^2 based on a model of potential distribution (MaxEnt). Using density information (as well as its associated probability as output of the model), *H. clarionensis* total population consists of approximately 60,700 individuals (effective population size of 25.954 adults) with an overall density of 0.00000454 ind/m^2 with values of 0.00000116 ind/m^2 for the costs of Baja California Sur and 0.00001215 ind/m^2 for the Revillagigedo Archipelago.

In Baja California Sur, Reyes-Bonilla and col (2016) have made specific samples in the range of fish clarion recognized by the IUCN (Pyle et al., 2010) including Loreto, Cabo San Lucas, Isla Espiritu Santo and Bahia Magdalena, where he did not have found a single individual (121 samples, 1,456 transects in total 2005-2015); similarly, in this region they have documented the decrease in density in Cabo Pulmo from 1998 to date (548 samples) and La Paz (1993-2013, 459 samples) to report zero observed individuals. In the Revillagigedo Archipelago, based on data from Chavez et al. (2010) we have estimated that the density in Socorro Island (representing the largest population of the species) was 0.079 ind/m^2 in 2010. If this is compared with the density of 0.031 ind/m^2 estimated in 2015 in the same island (17 samples with an average of 3.8 ind/120m^2; Reyes-Bonilla and Martinez 2016), this indicates a decrease of 61% in the population for this island, which in turn represents 66% of the total area of the Revillagigedo Archipielago.

Considering the above, the species was located at about 11 locations and has disappeared in at least six of them (Loreto, Cabo San Lucas, Isla Espiritu Santo, Magdalena Bay, Cabo Pulmo and La Paz), in this sense it is estimated that iin the last 10 years it has lost a range of 6,603 km^2 (48.4% of total range of estimated species with Maxent) and 25.861 individuals (42.6% of the corresponding population estimated by Maxent) (see **Section 4.2**). There is little information on the status of stocks prior to the last decade. Almenara and Ketchum (1994) reported anecdotally that on trips lasting one week, the populations of the species in the collection sites suffered an observed decrease of 95% in the early 90s as a result of illegal trade in sport fishing boats that they captured 1,000 copies per trip (FAO, 2016).

The guidance regarding the application of the definition of "decline" for exploited aquatic species for commercial purposes of Resolution Conf. 9.24 (Rev. CoP16) suggests that for inclusion in Appendix II a decrease of about 25% is considered for species with intermediate productivity (range 10-15% of the baseline plus a "near" approximation of 5-10%). It also indicates that some species may fall outside these ranges and a recent rate of decline is important only if it is ongoing, or may resume, and it is expected that as a result from this, the species will meet Appendix I decrease levels within the next 10 years. When sufficient data are available, the recent rate of decline should be calculated over a period of approximately 10 years, but if less is available, annual rates can be used over a shorter period. The species is considered "vulnerable" according to IUCN and "Subject to special protection" under Mexican law (see **Section 7.1**).

The specimens of *H. clarionensis* are very brightly coloured, and the species is currently recognized as one of the economically most significant ones on the market for ornamental aquarium fish. The species is principally sold on the international market (it is estimated that it accounts for 99% of the catches), primarily comprising the United States (especially California) (**see Section 6.1**).

Based on data from the Directorate-General for Wildlife (the CITES Management Authority in Mexico), it is only permitted to exploit the species off the coasts of Baja California Sur, where a total of 3,371 specimens was taken between 2007 and 2015. Mexico authorized the export of 2,751 specimens between 2007 and 2015 (about 650 individuals in average per harvested/exported year). Also, the U.S. Fish and Wildlife Service reports a total of 2,705 fish exported from Mexico between 2008 and 2013 (**see Section 6.2**).

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[2] *Ayala Bocos A., Balart Páez, E., Calderón Aguilera L.E., Cupul Magaña, A.L., Fernández Rivera Melo F.J., Hernández Velasco A., Ketchum, J.T., López Pérez, R.A., Medina Rosas P., Melo Merino S.M., Navarro Sánchez M.J., Palacios Salgado D.S., Ramírez Valdez A., Robertson D.R., Rodríguez Zaragoza, F.A., Sánchez Ortiz C.*

The fishery model developed by Reyes-Bonilla and Martínez (2016) using annual census data from the Baja California Peninsula between 2003 and 2013 incorporated scenarios with different harvest rates. The results of this model show an estimated decline in population longevity up to 4 years, with a harvest of 200 and 800 individuals, along with a drop in population size and individual specimen size (**see Section 4**).

Finally, bearing in mind that there have been decreases of 61-100% in 7 out of 11 localities, and that this proposal aims to ensure legal and sustainable international trade in the species, and that given the current levels of international trade in the species relative to the population densities reported and projected in those areas where the species is distributed, it is proposed to list the species *Holacanthus clarionensis* in Appendix II, in line with the stipulations in Article II, paragraph 2 (a) of the Convention.

Listing of the species in Appendix II will significantly strengthen the current measures of international trade control and the international cooperation activities by requiring the issue of Non-Detriment Findings (NDFs) and associated CITES documentation both from Mexico and from the importing countries, and will provide more exact statistics on the levels of international trade in *H. clarionensis*, among other considerations.

3. Species characteristics

3.1 Distribution

The greater part of the population is established in the Revillagigedo Archipelago (islands of Socorro, Clarión, San Benedicto and Roca Partida). There are also small populations in Baja California Sur: Bahía de la Paz (24.6°N, 110.5°W) and Rocas Alijos (24.9°N, 115.7°W). Also, there is occasional presence (individuals outside their normal range) in Bahía de Banderas, Jalisco-Nayarit (20.7°N, 105.7°W), at Clipperton Island (France, 10.3°N, 109.2°W), and even at Guadalupe Island, Baja California (28.9°N, 118.3°W) (Froese and Pauly, 2014; Robertson and Allen, 2014) (**Figure 1, left**). Based on a MaxEnt model, Reyes-Bonilla and Martínez (2016) estimated a potential range for *H. clarionensis* of 13,365 km^2. The model was built using data from original information gathered in the field by Reyes-Bonilla and Martínez (2016) in 2010 and 2014, Fishbase, Fishnet2, GBIF, OBIS, SFTEP, REEF and Vertnet. In order to eliminate possible georeferencing errors, redundant records and/or those that related exclusively to on-land locations were excluded. The area accessible to the species (M) was delimited using a quadrant that includes the entire known range for the species (Robertson and Allen 2014). The model was built using average temperature and range variables, average values for phosphates, nitrates, silicates, dissolved oxygen, photosynthetically active radiation, pH, primary productivity, depth of the euphotic zone and salinity, in addition to bathymetry and sea-bed type (MODIS-Aqua, 2002-2012; WOA09-NOAA, 2015; GEBCO, 2015; Moreno et al., 1998; Ocean Productivity, 2015; van Heuven et al., 2011). The model was run using randomSeed with 25% of records under test and the results indicated that analysis of the area under the curve of operating characteristics (AUC) was greater than would be given by chance, showing that the performance of the model was adequate (Reyes- Bonilla and Martínez, 2016). Figure 1 (right) shows the logistic map resulting from this modelling exercise.

3.2 Habitat

The species is found in a demersal marine environment, associated with coral and rocky reefs, as well as blocks, walls and cliffs. The specimens are normally found within the first 30 m of depth (Pyle et al., 2010a). They generally appear some 3-5 m above the bottom, in the so-called “cleaning stations” where they approach the giant manta rays (*Manta birostris*) to consume their external parasites (Michael, 1993).

3.3 Biological characteristics

At the present time the ecology of *H. clarionensis* is unknown. According to Froese and Pauly (2014), the individual growth rate (k) of *H. clarionensis* is 0.46 and its maximum length (L*inf*) is 211 mm. On the basis of these data, the trends in the family Pomacanthidae, a sex ratio of 1:1 and a maximum length of 20 cm, Bailly (2014) drew a growth curve where it was determined that the Clarion angelfish reaches sexual maturity at between 1.5 and 2.5 years of age (lengths of 10 to 13 cm), and its expected longevity is 10 years.

In the Revillagigedo Archipelago, the adults release sexual cells at the surface in the spring and the autumn, from which it has been concluded that the species reproduces twice a year (Weiss, 1986). It is probable that the mating system is polygynous (Moyer *et al.*, 1983). The juveniles are solitary

and territorial, the adults are vagile and are seen in groups of up to 30 specimens (De la Torre, 2014). The field observations of Reyes and Martínez (2016) between 2010 and 2014 indicate that the population of the Revillagigedo Archipelago has fewer than 30% juveniles. It is worth noting that the sampling methodology is not designed to track juveniles, which usually ocurr in shallow zones or deeper than the main body of the reef.

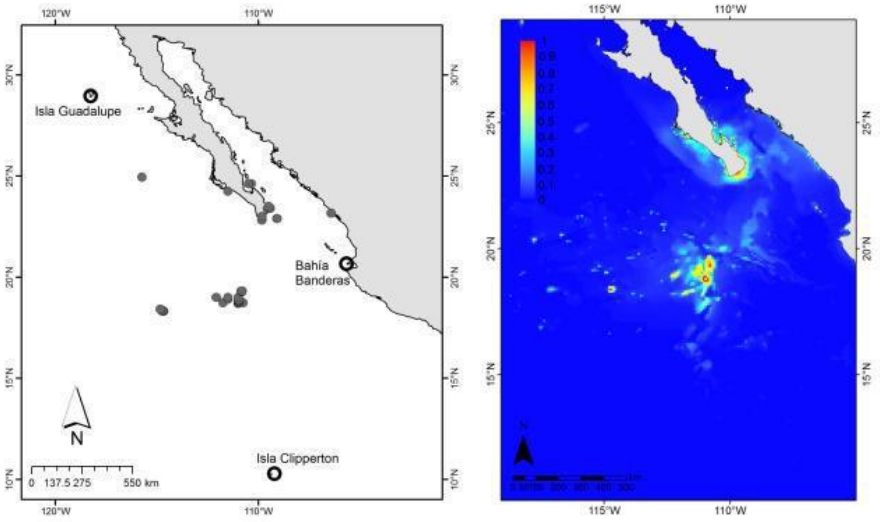

Figure 1. **Left:** Current occurrence data of the species *H. clarionensis* (solid circles) and records of specimens passing through (empty circles). **Right:** Map of probability of current occurrence of the species *H. clarionensis* (cut-off at 0.5 probability). From: Reyes-Bonilla and Martínez (2016)

3.4 Morphological characteristics

The body of *H. clarionensis* is compressed; the juveniles are orange/coffee-coloured with narrow blue lines on one side of the body, and two more on the head, bright blue, that disappear as the individual grows. The bodies of the adults are bright coffee-coloured/orange, the head is of a darker coffee colour and behind it is an area of very bright orange colour. The spots are orange/yellow, the dorsal and pelvic fins have blue edges, while the pectoral fin is an intense yellow. Females are larger and more rounded than males, and have less intense colours (Bailly, 2014; Froese and Pauly, 2014; Robertson and Allen, 2014; **Figure 2, top**). They have a small mouth (1 cm wide), with teeth that look like brush bristles. The preoperculum has a serrated vertical edge, and there is a spine at the edge between the preoperculum and the operculum. Dorsal radii XIV, 17-19; anal radii III, 18-19; pectoral radii 17-18. The dorsal and anal fins end in a filament; the caudal fin has a straight edge, a weakly developed lateral line that ends under the base of the dorsal. Large scales (50 in a lateral series), regularly distributed, that are rough and have distinctive protuberances on the exposed part (De la Cruz-Agüero, 1997; Allen and Robertson, 1994; **Figure 2, bottom**).

3.5 Role of the species in its ecosystem

Based on with its feeding habits, it is an importer and exporter of energy and material within reefs (Holmlund and Hammer, 1999). It is possible that, being so abundant in the Revillagigedo Archipelago, it may be controlling the density of algae on the substrate, making a contribution to preventing phenomena such as phase change (Waldie *et al*., 2011). It is the principal cleaning fish for giant manta rays (*Manta birostris*). The species is considered omnivorous (trophic level 2.6) and feeds on sponges, tunicates, hydrozoans, crustaceans, molluscs, zooplankton and some algae. Its consumption/biomass ratio amounts to 26.0, which means that the quantity of food that the fish must consume every year to remain alive is almost 30 times its weight (Froese and Pauly, 2014; Sala *et al.*, 1999).

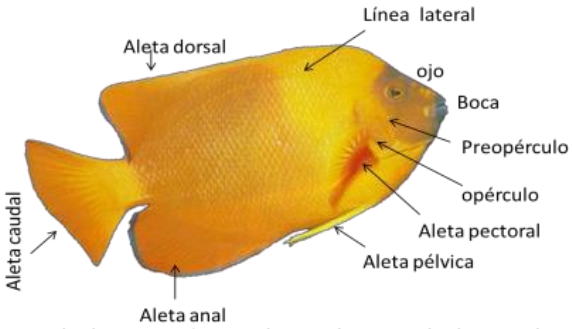

Figure 2. Top: Morphology of *Holacanthus clarionensis*, (a) juvenile and (b) adult.
Bottom: [3] Morphological characteristics of *H. clarionensis*

4. Status and trends

4.1 Habitat trends

Unkown

4.2 Population size

According to the International Union for Conservation of Nature (IUCN) 99% of the total of this species is found within the Revillagigedo Archipelago, while 1% occurs in the remainder of the zones (Pyle *et al*., 2010a).

Based on the total area estimated by the Maxent model (13,365 km^2) and applying a stratification (Krebs, 2014) of the occurrence probabilities of the model, average density data from Baja California Sur (Bahía de la Paz, Cabo Pulmo, Cabo San Lucas and Bahía Magdalena) and the Revillagigedo Archipelago (Socorro, San Benedicto and Roca Partida) (**Table 1**) (**Section 3.1**); Reyes-Bonilla and Martínez (2016) estimated a total of 60,700 individuals. Evaluating the proportion of the area represented in the model by Baja California Sur and Revillagigedo Archipielago; a total of 10,700 live off the coasts of Baja California Sur (0.00000116 ind/m^2) and 50,000 live on Revillagigedo Archipielago (0.00001215 ind/m^2) with a general average density of 0.00000454 ind/m^2 was estimated.

Additionally, those working on the project carried out surveys in Loreto (2005-2009; 151 surveys), Cabo San Lucas (2008, 2012 and 2013; 35 surveys), Espíritu Santo island (2005-2015; 950 surveys) and Bahía Magdalena (2010-2013, 320 surveys) in which no specimens were observed.

Recent data (2015) for Socorro Island (the bigger island in Revillagigedo) of 17 samples in transects of 120m^2 with an average density of 3.8 ind corresponds to a density of 0.031 ind/m^2 (Reyes-Bonilla and Martinez, 2016).

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Spanish	*English*	*Spanish*	*English*	*Spanish*	*English*	*Spanish*	*English*
Aleta anal	*Anal fin*	*Boca*	*Mouth*	*Aleta pectoral*	*Pectoral fin*	*Opérculo*	*Operculum*
Aleta caudal	*Caudal fin*	*Linea lateral*	*Lateral line*	*Aleta pélvica*	*Pelvic fin*	*Preopérculo*	*Preoperculum*
Aleta dorsal	*Dorsal fin*	*Ojo*	*Eye*				

Table 1. Average densities of *H. clarionensis* recorded by Reyes-Bonilla and Martínez (2016) in the range of the Clarion angelfish.

Zone	Record year	Number of sites (Number of 100 m^2 transects	Densities (ind/m^2)	
			Min-max per transect	Average
Cabo Pulmo	1998	6 (25)	0 - 0	0.000000
Cabo Pulmo	1999	6 (18)	0 - 0	0.000000
Cabo Pulmo	2002	6 (12)	0 - 0.01	0.000849
Cabo Pulmo	2003	6 (15)	0 - 0.02	0.000707
Cabo Pulmo	2004	6 (54)	0 - 0.01	0.000311
Cabo Pulmo	2005	6 (41)	0 - 0.01	0.000849
Cabo Pulmo	2006	8 (35)	0 - 0	0.000000
Cabo Pulmo	2007	5 (21)	0 - 0	0.000000
Cabo Pulmo	2008	18 (78)	0 - 0	0.000000
Cabo Pulmo	2009	18 (86)	0 - 0.01	0.000187
Cabo Pulmo	2010	18 (80)	0 - 0	0.000000
Cabo Pulmo	2011	18 (83)	0 - 0	0.000000
Isla Revillagigedo	2010	5 (72)	0 - 0.2	0.03808
Isla Revillagigedo	2012	7 (28)	0 - 0.21	0.05571
Isla Revillagigedo	2013	7 (20)	0 - 0.1	*0.071

*Note: This value excludes the site “El boiler” for San Benedicto Island, which showed an abnormal density of 0.2 ind/m^2 in the 2013 (pers. Comm. Reyes-Bonilla, 2016).

Table 2. Estimates based on outputs of the Maxent model and information on density of sampled sites (Reyes-Bonilla y Martínez, 2016)

Site	area (km^2)	% of total área	% of area per region	Estimated population size	Area loss (km^2)	Population loss
Baja California Sur						
Bahia Magdalena	343.0	2.6	3.7	396.9	343.0	396.9
Cabo Pulmo	1712.0	12.8	18.5	1980.8	1712.0	1980.8
La Paz	2740.0	20.5	29.6	3170.2	2740.0	3170.2
Los Cabos	4453.0	33.3	48.2	5152.2		
Subtotal BCS	*9248.0*	*69.2*	*100.0*	*10700.0*	4795.0	5547.8
Archipiélago de Revillagigedo						
Clarion	1027.0	7.7	25.0	12481.8		
San Benedicto	343.0	2.6	8.3	4168.7		
Socorro	2740.0	20.5	66.6	33300.9	*1671.4	*20313.5
Roca Partida	4.0	0.0	0.1	48.6		
Subtotal Revillagigedo	*4114.0*	*30.8*	*100.0*	*50000.0*	1671.4	20313.5
Total	**13362.0**	**100.0**		**60700.0**	**6466.4**	**25861.4**
			Percentaje of total loss		**48.4**	**42.6**

*Taking into account a loss of 61% of the population in Socorro Island.

4.3 Population structure

Reyes-Bonilla and Martínez (2016) carried out field observations between 2010 and 2014, and indicate that the proportion of juveniles in reef zones of the Revillagigedo Archipelago is lower than 10% of the population, indicating that recruitment occurs in shallow zones or deeper than the main body of the reef (Reyes-Bonilla and Martínez, 2016). Also, they form groups of between 2 and 33 individuals at the Socorro and San Benedicto islands (mode = 3 individuals; median = 5). The average size at Socorro is between 16 and 20 cm, equating to an approximate age of 3 to 4 years. Taking into account the information in Fishbase (Froese and Pauly, 2014) on the growth rate (k=0.46), the death rate is M=0.69 (estimated with the equation of Jensen and Holt, 1996) the maximum size of the individual is 21.1 cm, the age at the first reproduction es 1.7 years and the generational time is 2.3 years, (Reyes-Bonilla and Martínez, 2016). If the information on population size (60,700 individuals) is combined with the foregoing, and if the percentage of juveniles is subtracted (estimated by sight at 30% in the Revillagigedo islands in the project under

consideration), it is anticipated that the adult population size is about 42,490 individuals. Using a sex rate of 1:1, a polygenic mating system, and a generational time of 2.3 years; its effective population size is fewer than 25,494 individuals (60% of N based on Nunney, 1993).

4.4 Population trends

Baja California Sur

Reyes-Bonilla and Martinez (2016) conducted surveys in Loreto (2005-2009; 151 samples), Cabo San Lucas (2008, 2012 and 2013, 35 samples), Isla Espiritu Santo (2005-2015; 950 samples) and Magdalena Bay (2010-2013, 320 samples) in which no individual was observed. In fact in the area of La Paz to Cabo San Lucas in the years 1993-2013, this fish was observed only 7 times in a total of 459 samples by what can be considered virtually extinct in these locations.

Although *H. clarionensis* lives within the core zones of the Cabo Pulmo National Marine Park natural protected areas, in which productive activities are prohibited, including harvesting of fish for ornamental purposes (Chávez-Comparán *et al*., 2010), annual survey data from the Cabo Pulmo National Marine Park between 2003 and 2007 show that the average presence was 0.00098 ind/m^2 (pers. Comm. Directorate of the National Park), Based on recent monitoring (2006-2011), it is considered that in this site presents a population decrease of 93.2% (mean = 0.00003117 ind/m^2) compared to historical densities (1998-2005; mean = 0.00045267 ind/m^2) reaching undetectable levels without any sight of the species in recent years, possibly due to the effect of fishing (Reyes-Bonilla and Martinez, 2016).

Furthermore, potentially, it is found in other natural protected areas operated by CONANP, but no information is available on trends in such areas, such as: Balandra, the Espíritu Santo Archipelago marine zone (Reyes-Bonilla and Martínez, 2016).

Therefore, considering the loss in the area and consequent population of the sites of Magdalena Bay, Cabo Pulmo and La Paz; a loss in Baja California Sur of 36% of the total area is estimated (Revillagigedo Archipelago and BCS) and 9.1% of the total population (4,795 km^2 / 13.362 km^2, 5547.8 / 60,700 individuals; **Table 2**).

Revillagigedo Archipelago

IUCN assessment indicates that this species is considered abundant in Revillagigedo, where it is assumed that the population is stable (Pyle et al., 2010a). Chavez, et al. (2010) conducted a sampling in Socorro Island (which represents 66% of the area of Revillagigedo, **Table 2**). In such sampling a total of 16,312 individuals of several species was recorded in a total of 7,400m^2, and a relative density of 3.5% for *H. clarionensis*. This represents about 587 specimens of *H. clarionensis* (3.5% of 16.312) in 7,400m^2; therefore it is estimated that in such sampling, the density of the species was 0.079 ind/m^2 (587/7,400). In 2015 a density of 0.031 ind/m^2 was found by Reyes-Bonilla (2016), when compared with 2010, the data shows a reduction of 61% in 5 years in the largest population of *H. clarionensis* (**Table 2**).

Additionally, Almenara and Ketchum (1994) reported anecdotally that on trips lasting one week, the populations of the species in the collection sites suffered an observed decrease of 95% in the early 90s as a result of illegal trade in sport fishing boats that they captured 1,000 copies per trip (FAO, 2016).

Therefore, data point towards 12.5% of the total area of the distribution of the species loss in the Revillagigedo Archipelago of (Revillagigedo Archipelago and BCS) and a 33.5% loss of the total population of the main population of *H. clarionensis* located at the Socorro Island is estimated (1,671 km^2/13.362 km^2, 20,313 / 60,700 individuals; **Table 2**).

By adding up the decrements of Baja California Sur and the Revillagigedo Archipelago, a general decrease of 48.45% of the area and 42.6% of the total population of the species is estimated.

4.5 Geographic trends

H. clarionensis is native to Mexico and is found in the Revillagigedo Archipelago (comprising the islands of Socorro, Clarión, San Benedicto and Roca Partida) and off the coasts of Baja California Sur (at latitudes below 25ºN). This is where the greater part of the population is found, but it is also found off the coasts of other areas of Mexico (Jalisco, Nayarit and Baja California) and at Clipperton Island (France) where there are records of transient sightings. The area of geographical distribution is small. There is no published information on whether its various ranges have

increased or decreased as a result of habitat degradation or climate change. Reyes-Bonilla and Martínez (2016) state that researchers from the civil association *Comunidad y Biodiversidad, A.C.* are preparing a note providing information on new sightings off the western coast of the Baja California Peninsula. Considering the results of potential model generated and the sampling of 1993 to date in Baja California Sur (Reyes-Bonilla and Martinez, 2016); a total area of 13,365 km^2 was estimated. Taking into account the removal in area of 6 locations and a 61% reduction in Socorro Island, a loss of 6,466 km^2 in area is estimated from 1998 to date, representing 48.5% of the global habitat (**Table 2**).

5. Threats

From the point of view of natural threats Pyle *et al*. (2010a) indicate that the events of El Niño may indirectly affect populations, by reducing the quantity of food resources on the reefs, given that the excessively warm water contains few nutrients and may remain in the same location for months (Glynn and Ault, 2000; Soto, 2001).

Furthermore, the greater proportion of the population of *H. clarionensis* inhabits the Revillagigedo Archipelago, and it has being historical target of capture for its international trade (as anecdotal referred by Almenara and Ketchum, 1994; and in a recent times, see **Section 6.4**). In addition, is exposed every year to hurricanes and tropical storms, that reduce salinity in the coastal area, increase sedimentation, and produce changes in the marine environment. Although there is no evidence that such events are affecting *H. clarionensis*, the possibility does exist that it may be so.

International trade of this species constitutes a threat, coupled by its low population density at the main extraction sites (Baja California Sur, Mexico). The lack of continuous population monitoring in all its distribution hampers evaluation of the real effect that fishing has had on the Clarion angelfish, but it is feasible that there should be illegal fishing (Piña, 2004).

Cheung *et al*. (2005) have evaluated the biological characteristics (e.g. age at maturity, loss of life, maximum size, and others) and vulnerability in a heuristic model and consider that the vulnerability of *H. clarionensis* to human use equates to 27 on a 100-point scale. On the other hand, Martínez Torres (2014) evaluated the species' level of vulnerability to fishing and habitat loss by way of its biological characteristics, concluding that *H. clarionensis* has a high vulnerability of 75 out of 100 relating to habitat loss, and 26 relating to fishing.

6. Utilization and trade

6.1 National utilization

The specimens of *H. clarionensis* are very brightly coloured, and this feature has made the species one of the leaders on the international market for ornamental aquarium fish. Various methods are in use in Mexico for catching ornamental fish (Fernández and Saenz, 2007), including free diving, scuba diving and snorkeling. Although there are no specific records for this fish, generally speaking fish species are caught with devices including handheld and other nets, rods and hooks. Once caught, they are taken to hatcheries where they are placed in tanks, for subsequent packaging and outside trade (Fernández and Sáenz, 2007).

Although there are no precise data on *H. clarionensis*, approximately 1% of ornamental fish species caught in the country are sold domestically, in the States of Jalisco, Sonora, Baja California Sur and in Mexico City (Fernández-Rivera Melo. COBI. personal communication, 2012).

Mexico only authorized the utilization of 3,371 specimens between 2007 and 2015, by a federal undertaking called "Buzos del Golfo", under of which umbrella permits for exports of *H. clarionensis* to the United States of America have been granted (Reyes-Bonilla and Martínez, 2016; **Table 2**).

6.2 Legal trade

A total of 99% of the ornamental fish species caught in Mexico is exported to the United States, principally to California (Rhyne *et al*., 2012). The Clarion angelfish is the highest priced on the international market of all the ornamental fish caught in Mexico, exceeding 2,000 USD (and up to 5,000 USD for one captive-bred outside Mexico), while in Mexico the fisherman who caught it is paid between 200 and 500 USD per specimen, and the initial seller receives about 1,000 USD (Weiss, 1986; Piña, 2004; SEMARNAT; 2013; Guerrero, 2014).

Mexico authorized the export of a total of 2,751 specimens of the species, all headed towards the USA, between 2007 and 2013 (**Table 3**), according to the import report submitted by the U. S. Fish and Wildlife Service (USFWS) in 2014. Between 2008 and 2014, the volumes dispatched totalled 2,705 fish exported to the United States from Mexico (Reyes-Bonilla and Martínez, 2016; **Table 4**).

Table 3. Permits and specimens of *H. clarionensis* (Clarion angelfish) utilized and exported between 2007 and 2015 by "Buzos del Golfo" based on information from DGVS-SEMARNAT.

Utilization period	Specimens authorized	Specimens exported
28-Nov-2007	921	551
18-Mar-2009	600	600
28-Feb-2012	200	0
9-Abr-2012	200	200
22-Nov-2012	250	200
27-May-2013	600	600
10-Apr-2015	600	600
TOTAL	**3371**	**2751**

Table 4. Import report submitted by the U. S. Fish and Wildlife Service. All the records concern transactions in live specimens of *H. clarionensis* originating in Mexico for commercial purposes.

Date of issue	Quantity (specimens)
07-Jul-08	251
07-Jul-08	300
23-Apr-09	600
26-Nov-09	333
19-Apr-12	200
04-Dec-12	200
14-Jun-13	600
25-Feb-14	221
TOTAL	**2,705**

6.3 Parts and derivatives in trade

The international trade is focused on live specimens (**see section 6.1**).

6.4 Illegal trade

The high economic value created by the species, combined with its limited distribution, make it an attractive fish to catch (Almenara, 2000). Reyes Bonilla and Calderón Aguilera (submitted) state that the populations of *H. clarionensis* encountered in the southern part of the Baja California Peninsula have apparently diminished, which may indicate indirectly that the population is small and at present could not sustain being fished. Viewing these results against the historical export records, it is probable that many of the specimens that have been traded from Mexico have been harvested illegally from other places (such as the Revillagigedo Archipelago), and brought to Cabo San Lucas (where trade in the species is legal) (Guerrero, 2014).

According to the report sent by imports Fish and Wildlife Service of the United States (USFWS), which covers the period from 2008 to 2014, in 2009 the US seized shipments to a company that manages the species from Mexico. In addition, there are inconsistencies between the amount authorized for export by Mexico and recorded in imports in the USA. In this regard, an Appendix II listing is expected to strengthen international cooperation and controls on international trade in the species.

Some direct information on illegal fishing has been obtained from websites. In 1994 there were records of vessels from the United States entering the Revillagigedo Archipelago and harvesting not less than 1,000 specimens per trip in sport fishing boats (Almenara and Ketchum, 1994; Wood, 2001). In 1995 a vessel of United States registry was accused of smuggling as it attempted to import an illegal cargo of 160 fish from Mexico to the United States, having already exported 80 specimens to Japan (Blank, 2013).

It is possible that the illegal trade in *H. clarionensis* continues to exist in Mexico, owing to the lack of identifying materials (the more so as it is known that there may be confusion due to its similarity with other fish species) or training for customs personnel about the species, together with pressure from the traffickers themselves. Such is the case as reported by the NGO *Comunidad y Biodiversidad A.C.* in 2010 to the USFWS, providing evidence of exports of *H. clarionensis* to the United States by passing them off as *Hypsypops rubicundus,* the Garibaldi damselfish, on the basis of the similarity between the two species (Stone, 2013). However, the possibility of confusion is minimal if attention is paid to the colouring patterns of the adult specimens (**see Section 9**).

6.5 Actual or potential trade impacts

The history of utilization of the species, and the reductions observed in its density in Baja California Sur, suggest that it is highly probable that the high international demand and trade are affecting the populations of it in the wild (**Sections 4.4 and 6.2.1**).

7. Legal instruments

7.1 National

Fishing for *H. clarionensis* began at the end of the 1980s in the central and northern Pacific, and also in the Gulf of California (Piña, 2004). The legal framework applied was that of "Commercial Fishery Permits" issued by the Fisheries Office of each State (SEMARNAT, 2013). As a result of that system, and because the volume of clarion angel fish was recorded by weight and not by number of specimens, the catching of ornamental species was considered of little significance. For that reason, there are no formal and continuous records. It was not until 1995 that the Official Gazette of the Federation, in accordance with the Fisheries Act and its implementing regulations, implemented a system for utilization of the resource under a regime of "Promotional Fishery Permits", which was targeted at educational aquaria and the market for aquarium fish (Piña *et al.,* 2001).

In 2002, SEMARNAT updated the Official Mexican Regulations on endangered species, and both NOM-059-ECOL-2001 and NOM-059-SEMARNAT-2010 currently in force placed *H. clarionensis* into the category of "Subject to Special Protection". Consequently it is regulated under the General Wildlife Act (1997) and its implementing regulations, compliance with which is the responsibility of SEMARNAT. Applicants to utilize the species must have a Management Plan (**see Section 8.3.2**).

7.2 International

No information

8. Species management

8.1 Management measures

In the year 2002, the Fisheries Act and its implementing regulations (abrogated in 2007 in the Official Gazette of the Federation, 24-07-2007), ceased to apply to the fish species listed in NOM-059-ECOL-2001 (Official Gazette of the Federation, 2002), which meant that the Clarion angelfish passed under the jurisdiction of the General Wildlife Act (LGVS), and consequently the Ministry of the Environment and Natural Resources (SEMARNAT, 2013) is responsible for managing that resource. The DGVS is the body responsible for issuing fishery permits covering the catching of *H. clarionensis* for a period not greater than twelve months, before which deadline the recipients are required to submit periodic reports in which they list data on the capture of and trade in the species (Piña, 2004).

In Mexico, *H. clarionensis* is caught in three zones of the Gulf of California: Isla San Francisquito located in the Alto Golfo (28° N), the Bahía of Loreto located in the centre of the gulf (25° N), and the Bahía de la Paz (24° N) (Reyes et al., 2009). However, to date no utilization permits have been

issued by SEMARNAT for the Isla San Francisquito (DGVS-SEMARNAT personal communication, 2016).

8.2 Population monitoring

At the present time there are no ongoing monitoring programmes for the species. However, in the Cabo Pulmo National Marine Park and the Espíritu Santo Archipelago national park, there are ongoing fish surveys which have been run since 2003 and 2005 by CONANP, civil society organizations and academic institutions and have produced very useful information for understanding the situation of *H. clarionensis* in Mexico.

8.3 Control measures

8.3.1 International

Apart from CITES, no other measures for the cross-border control of specimens of *H. clarionensis* are known.

8.3.2 Domestic

In Mexico, the General Wildlife Act (LGVS) establishes it as a federal responsibility to regulate the utilization of all the species listed in NOM-059-SEMARNAT-2010, including *H. clarionensis*, which is placed in the category of "Subject to Special Protection" of that instrument.

In Article 82, Title VII "Sustainable Utilization of Wildlife", Chapter I "Extractive Utilization", the LGVS stipulates that extractive utilization may only be practised under the conditions of sustainability laid down in Articles 83 to 85. Among other determinants, the rates requested shall be lower than the rates of natural renewal and it is stipulated that utilization shall not have negative impacts on populations. Likewise, in Article 3, section XXXI calls for the provision to the permit-issuers of information by way of a Management Plan, in which are laid down the specific objectives, goals, success indicators, sampling/monitoring methods, measures for management of habitat, populations and specimens of the species. For the issue of subsequent permits, the holder is required to provide systematic information about indicators on population size, the structure by individual sizes, and the trends in the population concerned, with a view to determining its current status and authorizing sustainable rates of utilization (SEMARNAT, 2013).

8.4 Captive breeding and artificial propagation

In the 1990s, the *Centro Interdisciplinario de Ciencias Marinas del Instituto Politécnico Nacional* [Interdisciplinary Centre for Marine Science of the National Polytechnical Institute] made attempts to achieve captive breeding of *H. clarionensis*, but did not obtain good results. The lack of biological data on the species impedes successful captive breeding in the country in the short term. However, entries found on the Internet indicate that breeding has in fact been carried out, after years of trials, by a company named "Bali Aquarich" which supplies the fish to the aquarium trade at companies such as "Calidad Marina" and sells them in North America (Blank, 2013). Apparently the company has an annual production of 400 individuals (FAO, 2016). The listing of *H. clarionensis* under in Appendix II represents an opportunity for the implementation of Resolution Conf. 13.9 (Rev. CoP16) to promote *in situ* conservation through cooperation with *ex situ* breeding sites.

8.5 Habitat conservation

Although there are currently no programmes directed specifically towards conservation of the species, since it lives in core zones of a biosphere reserve (Revillagigedo Archipelago, Colima) and a national park (Cabo Pulmo, Baja California Sur), its habitat is being indirectly protected (Endoh, 2007). The natural protected areas where *H. clarionensis* is found are: Revillagigedo Archipelago (4,321.46 km^2 of potential range of the fish are located within the natural protected area), Balandra (9.54 km^2), the Espíritu Santo Archipelago marine zone (79.42 km^2), Cabo Pulmo (35.52 km^2) and Cabo San Lucas (38.74 km^2).

8.6 Safeguards

No information

9. Information on similar species

The profile of *H. clarionensis* is similar to that of other species of the same genus, as for example *Holacanthus passer,* distributed from the centre of the Gulf of California to the north of Peru, including the islands of Revillagigedo, Galapagos, Malpelo and Cocos Island (Pyle *et al.,* 2010a), or *Pomacanthus zonipectus that* lives in the southern part of the Gulf of California, down to Peru. (Pyle *et al.,* 2010b); however, the possibility of confusion is minimal if attention is paid to the colouring patterns which are singularly distinct among those species. The adult *H. passer* has a body coloured navy blue with a vertical white stipe on the sides (level with the rear edge of the pectoral fin), while the juveniles have a body that is coffee-coloured/orangish, with 5-6 blue stripes on the sides. The juvenile *P. zonipectus* is black in colour with yellow and blue lines that form curves arranged vertically and running the width of the body, on the head, body and tail. Adults have a greyish colouring, with darker colours on the forehead and the rear part of the body, with a vertical yellow line just behind the head. The dorsal fin is pale yellow, like the caudal fin, while the head is blue. Finally, *H. clarionensis* has a uniform colouring over its entire body, bright orange or with coffee-coloured notes, with small iridescent blue dots (Allen and Robertson, 1994).

There is a possibility of confusion between the Clarion angelfish and the Garibaldi damselfish, *Hypsypops rubicundus*, because there is a stage in the life cycle when both species are iridescent orange with bright blue dots on the body. However, *H. rubicundus* is a damselfish (family Pomacentridae) that as an adult is of a uniform orange colour (without distinct shades as in the case of *H. clarionensis*) and it also has green eyes and a pronounced spine at the preoperculum, which is not found in the Clarion angelfish (Smith, 1996).

Sala *et al*. (1999) describe the colouring of a specimen that is a hybrid between the King angelfish (*H. passer*) and the Clarion angelfish (*H. clarionensis*), observed in the Revillagigedo islands. This discovery indicates that the evolutionary separation of these taxons is still only slight, as is demonstrated by the phylogeny presented by Alva-Campbell and colleagues (2010).

10. Consultations

Within the context of Resolution Conf. 8.21 (Rev. CoP16), the CITES Scientific Authority of Mexico (CONABIO) consulted with France as a range State and the European Union is its capacity as a REIO. The European Union confirmed that it is in the process of evaluating the proposal with a view to deciding whether it can support it at CoP17 (Johannesburg, South Africa, 2016).

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