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 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

* *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[1] compiled information on the species in accordance with the format of Annex 6 of Resolution Conf. 9.24 (Rev. CoP16).

The species 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 Clipperton Island (France) where there are records of transient sightings. The potential range of the species is estimated at 13,365 km^2 (see **Section 3.1**).

Chávez Comparán *et al*. (2010) state that the average density obtained in Baja California Sur is less than 0.0001 ind/m^2, while in the Revillagigedo Archipelago it is 0.0049 ind/m^2. Reyes-Bonilla and Martínez (2016) estimated a population size total of approximately 60,700 individuals, of which around 10,700 are found off the coasts of Baja California Sur. Given that the estimated potential range of the species is approximately 13,365 km^2, the general average density was estimated as 0.00454 ind/m^2 (**see Section 4.2**).

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**). This represents the principal threat to the species.

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 3,171 specimens was taken between 2007 and 2015. Mexico authorized the export of 2,751 specimens between 2007 and 2015. On the other hand, PROFEPA (CITES Enforcement Authority) indicates that from 2009 to May 2014, there were actual exports of 833 live specimens from Baja California Sur to the United States. Also, the U.S. Fish and Wildlife Service reports a total of 2,484 fish exported from Mexico between 2008 and 2013 (**see Section 6.2**).

Almenara and Ketchum (1994) record on an anecdotal basis that the populations of the species suffered a 95% decline at the end of the 1990s as a result of the illegal trade based on sport fishing boats that took 1,000 specimens per trip. 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 of capture of 800 specimens a year. The results of this model show an estimated decline in population longevity from 10 to 4 years, with a resultant drop in population size and individual specimen size (**see Section 4**).

In the light of 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 by requiring the issue of Non-Detriment Findings and 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

[1] *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.*

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.

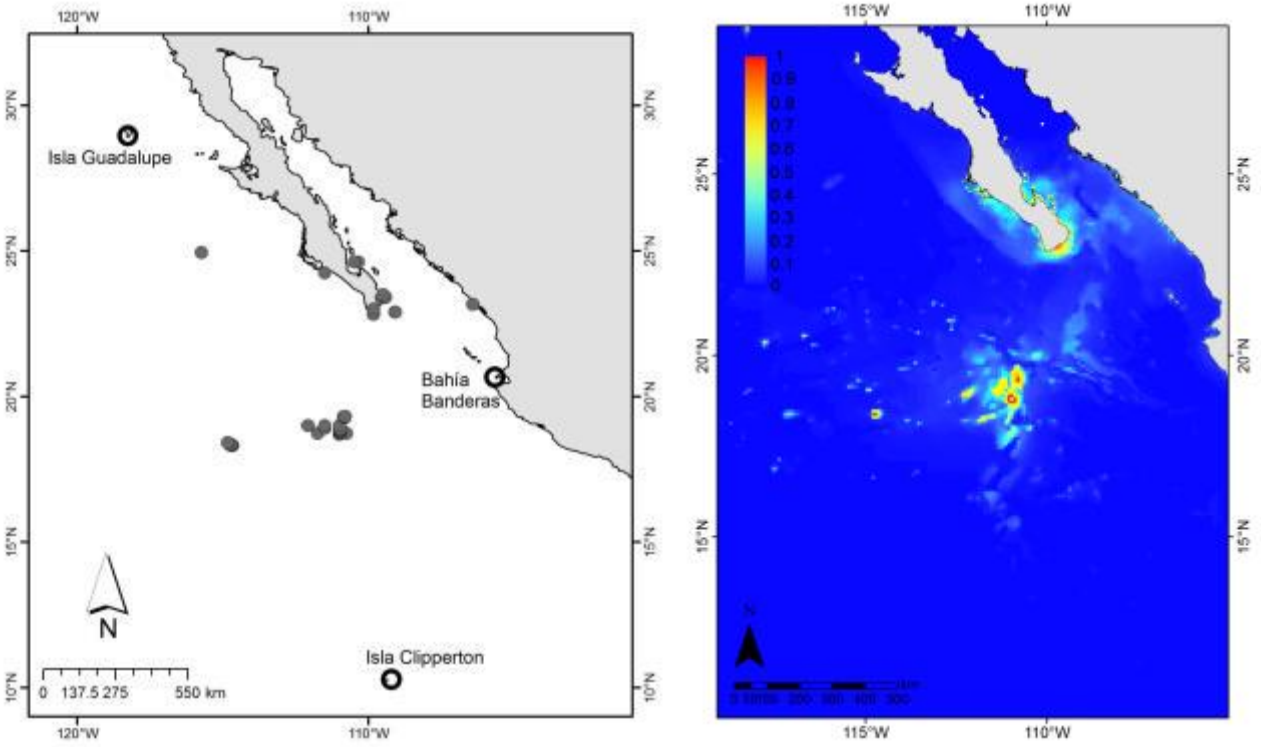


Figure 1. **Left:** Current occurrence data of the species *H. clarionensis* (solid circles) and records of specimens passing through (empty circles). **Right:** Map of probability of current occurrence of the species *H. clarionensis* (cut-off at 0.5 probability). From: Reyes-Bonilla and Martínez (2016)

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).

3.2 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.

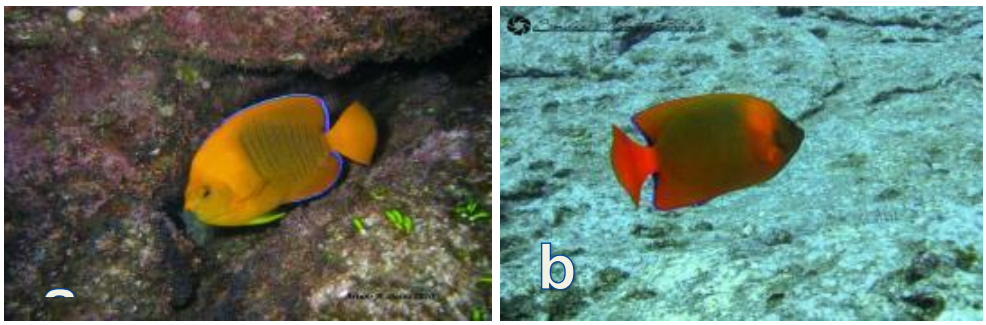
In the Revillagigedo Archipelago, the adults release sexual cells at the surface in the spring and the autumn, from which it has been concluded that the species reproduces twice a year (Weiss, 1986). It is probable that the mating system is polygynous (Moyer *et al.*, 1983). The juveniles are solitary 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 10% juveniles, indicating that recruitment occurs in shallow zones or deeper than the main body of the reef.

3.3 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**).

3.4 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).



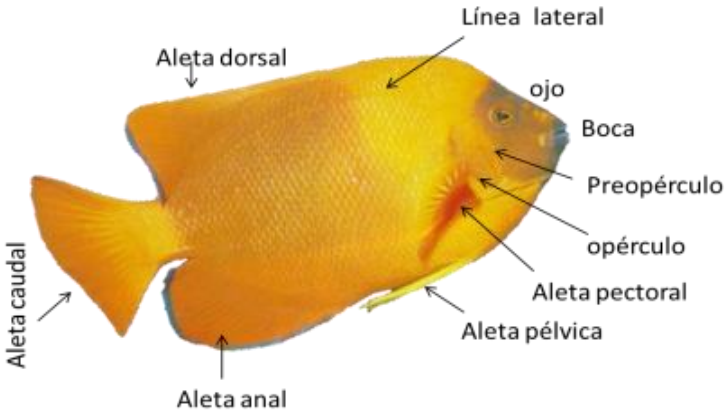


Figure 2. Top: Morphology of *Holacanthus clarionensis*, (a) juvenile and (b) adult. **Bottom:** [2] Morphological characteristics of *H. clarionensis*

4. Status and trends

4.1 Habitat trends

No detailed information is available on the current state of the habit where the species is found.

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). Chávez Comparán *et al*. (2010) calculated an average density of under 0.0001 ind/m^2 for Baja California Sur, while that for the Revillagigedo Archipelago was 0.0049 ind/m^2.

Based on 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**) and applying a stratification (Krebs, 2014) of the occurrence probabilities from the MaxEnt model generated (**Section 3.1**), Reyes-Bonilla and Martínez (2016) estimated a total of 60,701 individuals, of which 10,668 live off the coasts of Baja California Sur. Given that the range is approximately 13,365 km^2, a general average density of 0.00454 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.

[2]

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

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 - 0.33	0.137

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 on the growth rate (k), the maximum size of the individual (L*inf*), and empirical models for estimating the natural mortality rate (M= 0.825) (Froese and Pauly, 2014), it is considered that by the second year of the session between 20% and 30% of individuals will survive (Reyes-Bonilla and Martínez, 2016). If the information on population size (60,701 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 actual population size of *H. clarionensis* is fewer than 21,244 pairs (Nunney, 1993).

4.4 Population trends

Almenara and Ketchum (1994) indicate that the numerical density of the species declined by 95% at the end of the 1990s at Revillagigedo owing to heavy harvesting from sport fishing boats that illegally collected more than 1,000 specimens per trip.

The IUCN evaluation classifies the species in the category of “Vulnerable” in the IUCN Red List, on the grounds that it is facing a high risk of disappearing from the wild, owing to its distribution being restricted to the protected zone of the Revillagigedo Archipelago and owing to the environmental changes of El Niño-Southern Oscillation (ENSO; Pyle *et al*., 2010a). The IUCN evaluation states that the populations of the species are stable following the creation of the Revillagigedo Biosphere Reserve. Although *H. clarionensis* lives within the core zones of the Revillagigedo Archipelago Biosphere Reserve and 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 9.8 ind/ha, and higher in spring to autumn than in winter to spring, probably because there are specimens migrating northwards, in parallel with the invasion of warm water into the Gulf of California in the spring (Trasviña *et al*., 2012; Reyes-Bonilla and Martínez, 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, in Baja California Sur, Balandra, the Espíritu Santo Archipelago marine zone or Cabo San Lucas (Reyes-Bonilla and Martínez, 2016).

Reyes-Bonilla and Martinez (2016) observe that after 2007 and up to 2013, the presence at Cabo Pulmo dwindled to undetectable levels (lower than 1 ind/ha) and specimens of the species have not been observed in recent years, possibly owing to the effect of fishing. In the case of the area of La Paz at Cabo San Lucas between 1993 to 2013, this fish was observed on only 7 occasions, out of a total of 459 surveys. Based on this information, it is possible that at present the population is trending downwards.

The fishery model developed from annual survey data from the Baja California Peninsula between 2003 and 2013 by Reyes-Bonilla and Martínez (2016), considered scenarios in which 800 specimens were harvested per year. The results estimate a drop in population longevity from 10 to 4 years, with a resultant reduction in population size and in individual specimen sizes (Reyes-Bonilla and Martínez, 2016).

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.

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 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.

The species is under severe fishery pressure arising from the combination of legal harvesting (**Table 2**) in three regions of the Gulf of California: Los Cabos, La Paz and Loreto (Legorreta-Ordicia, DGVS, personal communication, 2014), illegal harvesting and its low population density. The lack of continuous population monitoring 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 3,171 specimens between 2007 and 2013, 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. However, these figures do not take account of the loss of specimens resulting from handling during capture and transport. Those numbers have not been quantified, although they are estimated to be high (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 2**), 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 3**). Also, the same report refers to the seizure by the United States of quantities from Mexico in 2009 sent to a company that handles the species.

On the other hand, the Federal Office for Protection of the Environment (PROFEPA) stated that in the inspectorates for the State of Baja California Sur between 2009 and May 2014, the export of 833 live specimens of *H. clarionensis* to the United States had been confirmed, and no seizure had been reported.

Table 2. 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
01-Dec-2007 to 31-Jun-2008 and 01-Sep-2008 to 30-Nov-2008	921	551
17-Mar-2009 to 31-Dec-2009	600	600
20-Feb-2012 to 30-Jul-2012	200	200
15-Nov-2012 to 31-May-2013	250	579
01-Jan-2014 to 31-Dec-2014	600	221
01-Jan-2015 to 31-Dec-2015	600	600
TOTAL	**3171**	**2751**

Table 3. 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).

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 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).

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 Regional Economic Integration Organization. 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).

11. References

Allen, G. R. and Robertson, D. R., 1994. Fishes of the tropical eastern Pacific. University of Hawaii. Honolulu. pp 332.

Almenara-Roldan, S. and Ketchum, J. T., 1994. Forgotten islands of the Mexican Pacific. OFI Journal, 9: 12-14.

Almenara–Roldán, S., 2000. Demanda internacional de especies marinas ornamentales del Golfo de California. En O. Aburto Oropeza y C. Sánchez Ortíz (eds.).Recursos arrecifales del Golfo de California, estrategias de manejo para las especies marinas de ornato. Universidad Autónoma de Baja California Sur, México and Birch Aquarium. Scripps. pp 30–38.

Alva-Campbell, Y., Floeter, S. R., Robertson, D. R., Bellwood, D. R., and Bernardi, G., 2010. Molecular phylogenetics and evolution of Holacanthus angelfishes (Pomacanthidae). Molecular phylogenetics and evolution, 56(1), 456-461.

Bailly, N., 2014. *Holacanthus clarionensis* Gilbert, 1890. Disponible en: http://www.marinespecies.org/aphia.php?p=taxdetailsandid=276013. Consultado 20 Septiembre 2014.

Blank, B., 2013. Quality Marine brings aquacultured Clarion Angel to US market. reef builders. Disponible en: http://reefbuilders.com/2013/08/08/quality-marine-clarion angelfish/#ixzz3VkSwB8E3 . Consultado 28 febrero 2015.

Chávez-Comparán, J. C., Patiño-Barragán, M., Calderón-Riveroll, G., Lezama-Cervantes, B., IbarraCasillas, M. y Bautista-Laureano, S., 2010. Listado de Peces Generado por Censos Visuales 63 Submarinos en la Isla Socorro, México. Revista Cubana de Investigaciones Pesqueras, 27(1):72-78.

Cheung, W. W. L., Pitcher, T. J. and Pauly, D., 2005. A fuzzy logic expert system to estimate intrinsic extinction vulnerability of marine fishes to fishing. Biol Conserv 124: 97–111.

CO2SyS. 2015. (http://cdiac.ornl.gov/ftp/co2sys/CO2SYS_calc_XLS_v2.1/)

De La Cruz-Agüero, J., Arellano M. M., Cota V. M. y De La Cruz-Agüero G., 1997. Catálogo de los Peces Marinos de Baja California Sur. IPN – CONABIO. D.F. pp 346.

De la Torre Bermejo J., 2014. Artes de Pesca. Los peces Clarión. Disponible en: http://tintorero-wwwartesdepesca.blogspot.mx/2014/03/los-peces-angel_24.html. Consultado 12 marzo 2015

Endoh, K., 2007. Angelfishes of the World. Two Little Fishies. Inc., Florida. pp 168.

Eschmeyer, W., y Fricke, R. 2011. Catalog of Fishes, an online reference [http://www.calacademy.org/scientists/projects/catalog-of-fishes]

Fernández-Rivera Melo, F.J. y Sáenz-Arroyo, A., 2007. Plan de Manejo Regional para el Aprovechamiento de las especies de interés ornamental incluidas en la NOM-ECOL-059 como especies bajo protección especial. SEMARNAT. pp 54.

Froese, R. y D, Pauly., 2014. Fishbase. Disponible en: http://fishbase.org. Consultado 3 diciembre 2014.

GEBCO. 2015. Carta Batimétrica Global de los Océanos [www.gebco.net]

Gilbert, C. H. 1890. A preliminary report on the fishes collected by the steamer Albatross on the Pacific coast of North America during the year 1889, with descriptions of twelve new genera and ninety-two new species. Proceedings of the United States National Museum v. 13 (no. 797): 49-126.

Glynn, P.W. and Ault, J.S., 2000. A biogeographic analysis and review of the far eastern Pacific coral reef region. Coral Reefs. 19(1): 1-23.

Guerrero Izquierdo, T. P. 2014. Impacto económico potencial de la pesquería de especies arrecifales de ornato en el Golfo de California y el Pacifico mexicano. Tesis de Licenciatura. UABCS. La Paz B.C.S. pp 65.

Holmlund, C. M., and Hammer M., 1999. Ecosystem services generated by fish populations. Ecological Economics. 29(2): 253-268.

Krebs, C.J. 2014. Ecological methodology. Benjamin/Cummings Menlo Park, California.

Martínez Torres M. 2014. Evaluación a la susceptibilidad de la pesca y pérdida de hábitat de peces arrecifales del Pacífico mexicano. Tesis de Licenciatura. Universidad de Guadalajara. Guadalajara Jal. pp 70.

Michael, S.W., 1993. Reef sharks and rays of the world. A guide to their identification, Behaviour, and ecology. Sea Challengers. Monterey. pp 107.

MODIS-Aqua. 2002 – 2012. Base de datos consultada en el 2015 [http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=ocean_month].

Moreno-Casasola, P., Espejel, I., Castillo, S., Castillo-Campos, G., Durán, R., Pérez-Navarro, J. J., ... & Trejo-Torres, J. (1998). Flora de los ambientes arenosos y rocosos de las costas de México. Halffter G.(Comp.). La Diversidad Biológica de Iberoamérica, 2, 177-258.

Moyer, J. T., Thresher, R. E., and Colin, P. L., 1983. Courtship, spawning and inferred social organization of American angelfishes (Genera Pomacanthus, Holacanthus and Centropyge; Pomacanthidae). Environmental Biology of Fishes, 9(1), 25-39.

Nunney, L., 1993. The Influence of Mating System and Overlapping Generations on Effective Population Size. Evolution 47, 1329,Äì1341. doi:10.2307/2410151

Ocean Productivity. 2015. Programa de Productividad Oceánica de la Universidad Estatal de Oregon [www.science.oregonstate.edu/ocean.productivity/index.php]

Piña Espallargas, R. 2004. La Pesquería de especies marinas con fines de ornato en México. El Parque Marino de Loreto, B.C.S., como estudio de caso. Tesis de Maestría. CICIMAR-IPN. La Paz B.C.S. pp 86.

Piña-Espallargas, R., Reyes-Bonilla H., Ortuño-Manzanares G., García-Núñez N. E., Mendoza-Vargas L. y González-Ania L. V., 2001. Especies Marinas De Ornato Del Golfo De California. En: Sustentabilidad y pesca responsable en México: evaluación y manejo: 1999-2000. Instituto Nacional De La Pesca. SAGARPA. pp 875-914.

Pyle, R., Allen, G., Myers, R., Zapata, F., Barraza, E., Robertson, R., Rocha, L.A. y Craig, M.T., 2010b. Pomacanthus zonipectus. The IUCN Red List of ThreatenedSpecies. Disponible en: www.iucnredlist.org>. Consultado 01 septiembre 2014.

Pyle, R., Myers, R., Rocha, L.A. y Robertson, R., 2010a. *Holacanthus clarionensis*. The IUCN Red List of Threatened Species. Disponible en: www.iucnredlist.org. Consultado 20 marzo 2015.

Reyes-Bonilla, H., Martínez M. 2016. Situación actual del pez endémico Holacanthus clarionensis (Ángel Clarión) y perspectivas de conservación en México. CONABIO proyecto MM003.

Rhyne, A. L., Tlusty, M. F., Schofield, P. J., Kaufman, L., Morris Jr, J. A., & Bruckner, A. W. (2012). Revealing the appetite of the marine aquarium fish trade: the volume and biodiversity of fish imported into the United States. PLoS One, 7(5), e35808.

Robertson, D.R. y G.R. Allen., 2014. Shorefishes of the eastern tropical Pacific. Disponible en: www.sftep.org. Consultado 3 de Dic 2014.

Sala, E., Aburto-Oropeza, O., and Arreola-Robles, J. L., 1999. Observations of a probable hybrid angelfish of the genus Holacanthus from the Sea of Cortez, México. Pacific science, 53(2), 181-184.

SEMARNAT, 2013. Plan de Manejo Tipo Para Peces Marinos de Ornato. SEMARNAT. pp 70.

Smith, B., 1996. Helicarion rubicundus. The IUCN Red List of Threatened Species. Disponible en: www.iucnredlist.org. Consultado 29 enero 2015.

Soto, C.G., 2001. The potential impacts of global climate change on marine protected areas. Reviews in Fish Biology and Fisheries 11(3): 181-195.

Stone S., 2013. Outrage over illegal fishing at Socorro to exploit and sell Clarion angel fish for private aquariums. Nautilus at sea. Disponible en: http://nautilusatsea.com/2013/10/22/outrage-over-illegal-fishing-at-socorro/. Consultado 28 febrero 2015.

Trasviña-Castro A., Aburto-Oropeza O., Ezcurra E., and Zaytsev O., 2012. Observaciones de corrientes en el Parque Nacional de Cabo Pulmo, Baja California Sur: mediciones Eulerianas en verano, otoño e inicios del invierno. 32(2):1-20.

van Heuven, S., D. Pierrot, J.W.B. Rae, E. Lewis, and D.W.R. Wallace. 2011. MATLAB Program Developed for CO2 System Calculations. ORNL/CDIAC-105b. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee. doi: 10.3334/CDIAC/otg.CO2SYS_MATLAB_v1.1

Waldie, P. A., S. P. Blomberg, K. L. Cheney, A. W. Goldizen, and A. S. Grutter., 2011. Longterm effects of the cleaner fish Labroides dimidiatus on coral reef fish communities. PloS one 6:7.

Weiss, M., 1986. The Cosmopolitan Clarion. Freshwater and Marine Aquarium. Disponible en: http://www.fishchannel.com/fama_portal.aspx. Consultado 23 enero 2015.

WOA09-NOAA. 2015. Atlas Mundial de los Océanos 2009 de la Administración Nacional Oceánica y Atmosférica [https://www.nodc.noaa.gov/OC5/SELECT/woaselect/woaselect.html]

Wood, E. M., 2001. Collection of coral reef fish for aquaria: global trade, conservation issues and management strategies. Marine Conservation Society, Ross-on-Wye, UK. pp 80.