BIG MIGRATIONS EXPEDITION

CLIPPERTON ATOLL

N 10° 18' 06" / W 109° 13' 53"

January 28th - February 11th, 2016

www.diveclipperton.n2pix.com

EXPLORERS CLUB FLAG EXPEDITION #213

Michel Labrecque, FI '16

Julie Ouimet, FI '16

Dr. Eric Clua

INTERNATIONAL SCIENTIFIC MISSION

TO CLIPPERTON ATOLL (France)

and

REVILLAGIGEDOS ISLANDS (Mexico)

January 28th - February 11th, 2016

www.diveclipperton.n2pix.com

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This expedition organized by the Canadian entity N2Pix was granted a special authorization from the High-Commissioner of the French Government in French Polynesia to stay in its territorial waters and set foot on the atoll (#HC/1838/CAB/BSIRI/MG - September 11th, 2015).

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Expedition team members (from left to right): Dr. Mauricio Hoyos, Julie Ouimet FI '16, Sandra Bessudo, Michel Labrecque FI '16, Dr. Eric Clua.

EXPEDITION LEADERS

Canadian Michel Labrecque is a full-time explorer and freelance photo journalist. He is published in top international dive magazines. He is also an accomplished scuba instructor, previous owner of a dive center in Quebec where he taught to more than 1000 students in recreational and technical diving. He is a guest speaker in major dive conferences, an Associate member of the Boston Sea Rovers and was recently nominated as a Fellow of the Explorers Club and PADI Ambassador.

Canadian Julie Ouimet is a full-time explorer and short film producer. Her work has been seen in international film festivals. Specializing in Polar Regions, she is a technical deep and wreck diver as well as an instructor. She holds degrees in Law, Public Relations and Communications and is a consultant in marketing for the dive industry. She is a guest speaker in major dive conferences, an Associate member of the Boston Sea Rovers and was recently nominated as a Fellow of the Explorers Club.

SCIENTIFIC TEAM

Dr. Eric Clua is a French Professor at l'École pratique des Hautes Études and a veterinarian. He is specialized in biology and ecology of shark behavior. He works towards conservation of these animals through his studies, by the production of TV network material and by lectures for the general public worldwide.

Mexican Dr. Mauricio Hoyos created the NGO Pelagios-Kakunja with his partner Dr. James Ketchum. He works notably on the behavioural ecology of the Great white sharks of Guadelupe island in the Revillagigedos. Mauricio is a regular contributor for National Geographic TV documentaries to educate the general public. He also works with other sharks like Tigers, Hammerheads and Bull sharks.

Colombian Sandra Bessudo is the counsellor for the Vice-president of Columbia for the Colombian Ocean committee. Founder and director of the Malpelo foundation, she is at the origin of the Malpelo Marine Protected Area. She is an advocate for conservation and the sustainable management of the Ocean. Sandra graduated from École pratique des Hautes Études in France.

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We would also like to thank all the international participants in this citizen-science project:
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*The flag request was submitted by Vincent J. Capone, M.Sc., FN '89, since at the time of submission, Michel Labrecque and Julie Ouimet had not been confirmed as Fellows.

EXPEDITION OVERVIEW

DESCRIPTION OF THE PROJECT

Clipperton Atoll is considered as the most isolated atoll in the world. Many problems arise from this isolation notably accumulation of marine debris, illegal fishing, illegal occupation, visits to the atoll and illegal human activities throughout the centuries.

Furthermore, the present status of shark populations at Clipperton Atoll is unknown, although evidence indicates heavy exploitation by illegal fisheries. It is therefore essential to study the sharks of Clipperton to create a baseline of information for the conservation of the species of this enigmatic island. The primary focus of this mission was to seek to answer questions still unresolved such as migratory pathways and large-scale movements of sharks in this area of the Eastern Tropical Pacific (ETP).

PRIMARY OBJECTIVES

Our main objectives were the following:

1. Examine movements, residency, site fidelity, migratory pathways and large-scale movements of Hammerhead, Tiger, Galapagos, Silvertip and Silky sharks at Clipperton and the Revillagigedos islands by tagging sharks;

2. Analyze the impacts of the establishment of a Marine Protected Area (MPA) at Clipperton Atoll using sharks as conservation tools;

3. Document, for the French Government, the census of species and status of targeted fish populations.

CONCOMITANT OBJECTIVES

We also had the following secondary objectives:

1. Evaluate the population of the endemic Clipperton Angelfish (*Holacanthus limbaughi*) to formulate recommendations to the French Government in order to determine if controlled collection is sustainable;

2. Measure and document the erosion of a portion of the island that encloses the lagoon, a unique characteristic of this atoll;

3. Observe the evolution of the biotope and biota on land.

DESCRIPTION OF THE SOLUTION AND ACTIVITIES

The project includes a telemetric study to evaluate residency patterns, extent of use, and site fidelity of sharks at Clipperton Atoll, an unprotected island, and at the Revillagigedo Archipelago, a moderately protected group of islands. This project will provide a model for the design and implementation of new marine reserves by assessing the effectiveness of current protected areas (e.g. Revillagigedos) for the conservation of sharks. This will help understand the necessary and minimal requirements of a particular area to protect and conserve sharks and large pelagic fish species. Due to the nature of this work, we will collaborate closely with other research institutions, government agencies, and NGOs in Mexico, France and South-America. The study could provide essential information for the establishment of an MPA at Clipperton and will help enact collaborative legislation to protect threatened sharks as well as other important members of the open ocean assemblages such as tunas and billfishes.

EXPLORERS CLUB FLAG #213 IN THE FIELD

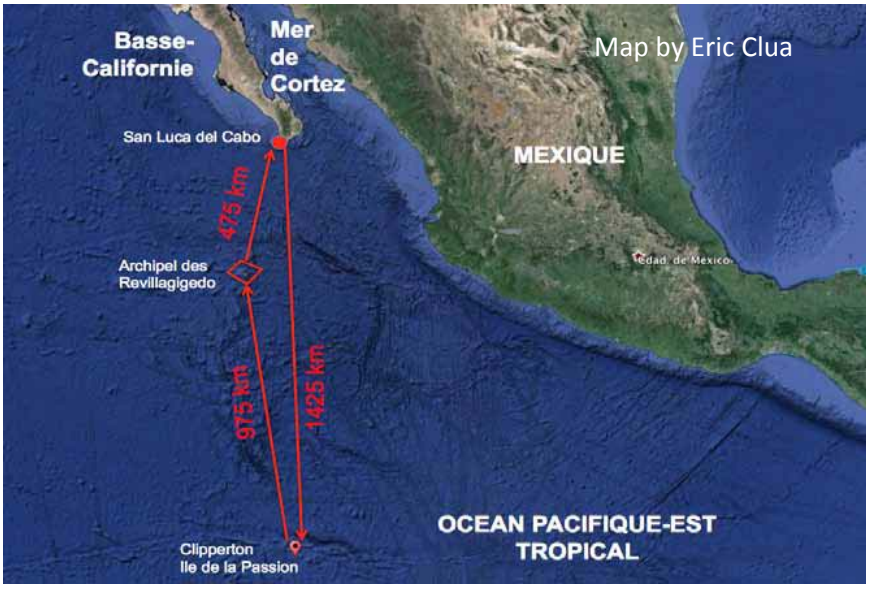
Michel Labrecque, FI '16 and Julie Ouimet, FI '16 celebrating a successful journey to Clipperton Atoll.

CLIPPERTON ATOLL

Clipperton Atoll is located 768 nautical miles south of Cabo San Lucas, Baja California Sur, Mexico which was the departure point of the expedition. The closest landmass is a point located between Mazatlan and Acapulco in Mexico and it is located at 583 nautical miles from the atoll. The vessel we used sailed at an average speed of 6 knots so a total of 120 hours was needed to access the atoll on the way in.

The sovereignty of the atoll has been disputed several times, notably by the Mexicans, at the beginning of the 1900's, when they were exploiting guano in Clipperton. In 1931, the sovereignty dispute was settled through international arbitration. After a long and thoughtful process, the King of Italy, Victor Emmanuel III, pronounced his verdict and declared Clipperton Island (also known as "Ile de la Passion") to be a French territory. It is now governed by the High-Commissioner of the French Republic in French Polynesia. A special authorization is required to disembark on the island or to stay in its territorial waters (12 nautical miles).

The island is low-lying with most of it rising no more than 4 meters above sea level, save its highest point, a rock outcrop known as "Clipperton Rock" that reaches 29 meters. The atoll measures approximately 4 kilometers in length by 3 kilometers in width and its circumference is roughly of 12 kilometers. It has been uninhabited since 1945 and no drinkable fresh water source is available on the island. It is estimated that 110 000 Masked boobies colonize the island, ranking as the largest colony of this species in the world. The enclosed lagoon has no inlet connecting it to the ocean. It is composed of a top layer of fresh water and, at around 10 meters, a layer of hydrogen sulphide that becomes toxic to humans.



A volcanic outcrop, "Clipperton Rock", is the highest point on the island at 29 meters above sea level. Also seen the great number of Masked boobies.

Aerial view of the atoll and the fresh water lagoon. Palm trees were introduced by humans at the beginning of the 20th century.

METHODS

Ultrasonic tags used on sharks

Signature transmitters emit uniquely pulsed ultrasonic signals that identify a particular tagged individual. They have a life of three to five years and are detected by automated receivers (or listening stations) moored at 3 different sites. They are surgically implanted within the abdominal cavity of the shark.

Satellite tags

We used PAT type tags using a tether and dart affixed to the dorsal musculature of the shark. A dart was inserted in a specially developed tool to attach the tag to the animal. This type of tag is programmed to release after a specified length of time (>6 months). It then floats to the surface and transmits all the collected data such as position, temperature and depth respectively. The transmissions are relayed by passing satellites to a land-based station which re-transmits to scientists via email or a website. The Argos system was used for these tags. Future analysis of the data will reveal the long-range movements and home range of sharks at Clipperton and Revillagigedo as soon as the tags detach and the data becomes available. This will allow scientists to compare these two different areas characterized by differing levels of shark conservation in the northern ETP.

Automated listening stations

Automated listening stations or receivers have been used to detect fish tagged with the signature transmitters and monitor their behaviour (Klimley and al. 1998). These devices are moored at 3 different locations around the atoll where fish aggregate. Peaks of a seamounts or escarpments of oceanic island are preferred locations. The receivers register data whenever tagged fish swim by within the range of detection of said receivers. More specifically, the automated receivers installed recognize individual sharks carrying a transmitter by its unique signal. They store the date and time of detection and a numeric code into an electronic memory. After a period of time (>6 months) the receivers will be retrieved, connected to a computer and interrogated for records of fish attendance at the site. Monitoring devices typically have a limited detection range of 300-500 meters, but this reception range is sufficient to record the presence of tagged sharks in the vicinity of the receivers. There is a large array of receivers in the Mexican Pacific and in the ETP islands. They belong to a greater network of ~100 receivers deployed to monitor and track sharks and other pelagic species throughout the region, from Mexico to Ecuador. The network is known as the Migramar network.

Surgery and tagging operations

The sharks we tagged in Clipperton were caught by hook and line and brought to a platform located on the stern. Two participants held the shark to keep it immobile. One participant held the head while the other held the tail. As a backup, a rope noose, attached to the boat, was placed around the shark's caudal peduncle. The hook was carefully removed from the shark's mouth before the tagging operations began. Extreme care was taken to keep the sound level very low and a towel was placed on the shark's eyes to keep its stress level at a minimum. A saltwater pump and a tube were inserted in the shark's mouth to ensure a constant water flow throughout the mouth and gills, allowing the shark to breathe. An acoustic tag was inserted and surgery performed to close the incision. After completion of the tagging process, the sharks were detached from the backup rope and slowly brought to the water's edge. The sharks were completely released as soon as they demonstrated sufficient ease to breathe and swim off. All sharks were successfully tagged and released within less than 10 minutes.

The specially designed tool used to attach the satellite tags to the shark's dorsal fin.

Documentation of the Clipperton angelfish census

To estimate the population of Clipperton angelfish, the belt transect method was used, combined with a visual count. Each transect measured 50 meters in length and 5 meters in width (2.5 meters each side of the median line). By swimming at a constant pace, Dr. Eric Clua counted the individuals by classifying them into 4 different sizes : <10 cm, 10-15 cm, 16-20 cm and >20 cm. The transects were repeated at: 4 m, 12 m, 16 m, 20 m, 24 m and 28 m in depth.

Documentation of the fish species

Participants in the citizen-science program as well as expedition leaders and scientists joined their efforts to document all the fish species encountered. All types of camera were used, from the portable to the professional systems and from still photos to videos footage. All the images gathered were carefully inspected to identify individuals and species and compare them to the list of known species to date in Clipperton's waters (Fourriére and al. 2014).

Documentation of the evolution of the atoll

Michel Labrecque, Dr. Éric Clua and Sandra Bessudo circumnavigated the whole island. Two measurements were taken with a calibrated measuring tape to evaluate the potential erosion of the old inlets that were showed on an 1840 map by Sir Edward Belcher. Also, they were in search of clues that could confirm if the eradication attempts of the rats during previous missions had been successful.

RESULTS

Documentation of the fish species

After careful analysis of the images gathered, most of the species encountered (see Appendix "A") were already known to inhabit Clipperton's waters. One thing that however stood out is the documentation of a new species that had never been recorded in Clipperton, the Giant Trevally (*Caranx ignobilis*). Dr. Éric Clua successfully photographed it. An ichthyological note has been published by Dr. Éric Clua and al. 2016 (Sandra Bessudo, Michel Labrecque and Dr. Mauricio Hoyos-Padilla).

A marking fact of the expedition is the lack of adult sharks observed. We were hoping to encounter important numbers of sharks. In 1997 and 2001, some exploratory dives had been conducted (Pauly 2009). The sharks seemed scarcer then in the early 80's. The thesis that sharks could have been heavily fished for the lucrative market of shark fin had been put forward.

During the course of 6 dives, Dr. Eric Clua made a visual count. A total number of only 28 sharks have been counted. Only one Silvertip shark (*Carcharhinus albimarginatus*) of important size (250 cm LT) and only one Galapagos shark (*Carcharhinus galapagensis*) of medium size (120 cm LT) was seen. The average sizes of the 26 other sharks were 90 cm (± 10 cm) indicating that most of them were juveniles. From the juveniles, 82% were Silvertips and 18% were Galapagos. These numbers are extremely disturbing but slightly offset by the fact that the island could serve as a nursery. In addition to the scientific count, 3 Scalloped hammerheads (*Sphyrna lewini*) were observed by Julie Ouimet and Jenni Whiteley.

It is possible, that the results yielded by the visual count method could be affected by a concentration of the dives on the west side of the island which is the protected side. Usually, protected zones are less prone areas for concentration of predators. Only one dive was conducted on the east side and no concentrations of sharks were observed, so the situation is nonetheless alarming. This theory could be substantiated by the presence of many long lines incrusted in the coral.

A Silvertip shark.

Long line evidence on every dive.

Also no Whitetip reef sharks (*Triaenodon obesus*) were observed by divers over the course of 100 dives. This species, vassal of the reef and extremely resilient, can only be caught by specific methods and not as bycatch like pelagic sharks.

Shark tagging operations

The main objective of this scientific expedition was the study of sharks and more accurately the spatial and genetic connectivity of these animals on a regional scale. From the spatial point of view, the Eastern Tropical Pacific ranges from Baja California (north) to Ecuador (south). The ETP is characterized by the presence of islands and distant archipelagos that serve as oasis for a large quantity of marine life and for migratory mega-fauna like sharks and marine mammals but also for turtles and birds. The most intensely studied sites are the Revillagigedos and Galapagos archipelagos as well at the islands of Malpelo, Coïba and Cocos.

All these sites have taken measures to protect their waters by the creation of Marine Protected Areas (MPA), national parks or, more recently, UNESCO heritage site designations. In 2004, Columbia, Ecuador, Panama and Costa Rica founded the "Eastern Tropical Pacific Corridor" named "CMAR". This governmental agency puts respective environment Ministers in relation and regularly meets to implement diverse scientific committees. One of them concentrates on migratory mega-fauna (sharks and turtles) studied through the MIGRAMAR network which uses acoustic and satellite telemetry to study the animals. In 2010, the network integrated Revillagigedos and Clipperton. So far, at least one silky shark (*Carcharhinus falciformis*) tagged in the Galapagos was tracked in Clipperton. This first result confirms the hypothesis of animal exchange on this regional scale.

In this context, the Clipperton Big Migrations Expedition 2016 had the task of recovering the previously installed receivers and replacing them with new ones. Two out of these 3 receivers were successfully retrieved and replaced.

Accoustical receiver installed.

Accoustical tags used.

The first receiver, located at the GPS coordinate N 10° 17' 36" / W 109° 13' 42" at a depth of 27.4 m, was replaced on February 3rd, 2016. For the second receiver, the conditions were too rough to have all divers aboard the tender boats so a delegation composed of Michel Labrecque and the scientific team went at the known GPS coordinate N 10° 18' 48" / W 109° 12' 15" on February 4th, 2016. They located the receiver at a depth of 26 m. They were successful in swapping it for a new one. As for the third and last receiver, after an assessment of the meteorological conditions, it was decided to not attempt a recovery. The conclusions from the data analysis of the two retrieved receivers will be available later this year.

Another task related to the shark studies was the tagging of sharks. The sharks that we hoped to tag were adults as they migrate further than juveniles. The fact that only one large shark was seen during the dives was of significant importance. Accordingly, our tagging operations were less successful than expected. We had at our disposal 20 acoustical and 3 PAT tags. The tagging operations were held during the evenings of February 3rd and 4th when sharks are more active to hunt for food. In addition to the tagging, we took DNA samples, measurements, noted identification marks and characteristics, sex, GPS coordinates, timing, serial numbers and location of the implanted tags, all consigned in a report sheet.

On the first session on February 3rd, we were successful in tagging an adult Galapagos shark (*Carcharhinus galapagensis*) of a total length (FL) of 220 cm. An acoustical tag was inserted in its abdominal cavity. The acoustical tag (Type VR16 from Vemco) was inserted by way of a 5 to 8 cm incision in the abdomen. It was then closed with absorbable suture material. The shark was subsequently turned over to attach a PAT tag on its dorsal fin. On February 4th, the same process was repeated on another shark of the same species of a total length (FL) of 160 cm. Due to the lack of adult size sharks, the decision was taken to tag a juvenile Silvertip shark (*Carcharhinus albimarginatus*) of a total length (FL) of 85 cm with an acoustical tag only.

An acoustical tag is being inserted in the abdomen of a Galapagos shark.

The same operation performed on a juvenile Silvertip shark.

Documentation of Clipperton angelfish and census

During the course of 6 dives, 21 transects were completed; 17 on the west side of the atoll and 4 on the east side. A total number of 74 individuals were counted which represents an average density of 0.014 fish/m^2 distributed as follow: 36% in the category <10 cm, 31% between 10-15 cm, 22% between 16-20 cm and 11% were >20 cm. This preliminary result shows a density of less than 0.1 individuals/m^2 and seems to compromise it as a sustainable resource for commercial purposes. A detailed study is underway to more accurately calculate its sustainability by using the Maximum Sustainable Yield (MSY) method. The results of this study will be published later this year. The MSY method is an interesting indicator and will help French authorities in their decision process regarding the proposed authorized limited captures and sales of the highly collectible fish.

Documentation of the atoll's evolution

The team members and the participants disembarked on the island in 2 separate groups on February 2nd, 2016 at approximately 11:00. They then met up at the French monument and flag pole for a short ceremony where the official flag was replaced by a new one. The group separated to visit the south portion of the atoll, while Michel Labrecque, Dr. Eric Clua and Sandra Bessudo started the tour of the island in a clockwise direction.

The first task of this small group was to measure 2 points on the atoll to quantify the erosion rate of 2 previous inlets. The first measurement was taken at the GPS coordinate N 10° 18' 44.70" / W 109° 12' 40.69". The measurement read 39 m. The second point was at N10° 17' 31.36" / W 109° 12' 22.83". The 2nd measurement read 14 m compared to 20 m in 2015, thus indicating strong erosion and an imminent re-opening of the inlet to the ocean within the next years.

The group photo after the French flag replacement ceremony. We can see here some of the nationalities represented.

Measurements taken at the first site where it is wider. The second measurement taken indicates clear signs of erosion.

The second task was to document the evolution of the atoll. The first fact that no one who disembarks on the atoll can ignore is the enormous quantity of marine debris and trash that litter the island. The trash that originates from previous expeditions and periods of occupation was well documented but the quantity of modern marine debris coming from the ocean has not. A previous mission geo-referenced 169 kg of trash. With the limited time we had, we proceeded by random verification. Items systematically came from Central America (in particular Costa Rica and Panama) which coincides with the dominant current in this zone.

In these marine debris, we noted a significant amount of fishing gear (presumably by illegal fishing activities). We found nets, buoys, Fish Aggregating Devices (FAD), seine floats, etc. On a side note, we found long lines during most of the dives.

Ammunitions left by Americans troops during their illegal occupation in WW2.

Seine float, FAD and a portion of a net.

Another type of FAD.

Marine debris litter the ground.

The observation of the fauna included a focus on crabs (*Johngarthia planatus*) and rats (*Rattus rattus*). The last accurate census of crabs dates back to 2005 with 1.25 millions of individuals (Bouchard and Poupin 2009). The first impression is that the crab population would have suffered a dramatic decrease, its numbers now being estimated at no more than a few hundred thousand individuals. This preliminary conclusion could be distorted by the fact that observations were made during daylight. While this is a lucifugous species and could hide underground, they were some indicators that the theory on the decrease of the population size could be plausible.

The first indicators concern the vegetation. The progression of creeping flora was previously limited by the crabs. It now seems very healthy and is gaining terrain. There is also a general absence of consumption of palm tree seedlings. If some cases of consumption were observed around the Bougainville camp, the vast majority of coconut seedlings that have sprouted were intact, in particular on the west side of the atoll. The second indicator is the presence of animal cadavers that lack traces of predation as systematically noted during previous missions.

As for the rats, their presence was observed notably at the south of Bougainville camp. Rat holes were also observed in palm trees; some had crab claws still visible inside confirming the predation of crustaceans by rats.

The crabs (*Johngarcia planatus*) are often found hiding in cracks, underground or under rocks during daytime.

The creeping plant coverage seen here is very healthy and shows no sign of predation by crabs.

A last observation concerns the important number of American coots (*Fulica americana americana*) and their location compared to pre-existing information. They have traditionally been reported west of the Bougainville camp and north, near the atolls of the lagoon. Their density now seems more important on the south-east littoral where the creeping plants are abundant. In this zone, we observed several dozen individuals as well as nests, eggs and many chicks. The number of coot was undeniably larger in this zone compared to the zone around Clipperton Rock, cited (Weimerskirch and al. 2009) as one of the two areas of concentration with Eggs Island.

It must be noted that these impressions and observations are not meant to replace affirmations made by numbers and robust methodology during accurate scientific studies.

OTHER OBSERVATIONS

Marine mammals

After 120 hours of sailing in seas as high as 5 meters, on February 2nd at 07:32 and 2 nautical miles away from the atoll (in sight), we were greeted by a pod of approximately 20 young Common bottlenose dolphins (*Tursiops truncatus*). They escorted us until we anchored on the south-west. They were particularly active when our tenders were in movement.

We sighted a second pod, this time numbering around 60 individuals, while we were motoring to retrieve the receiver on the East side. While underwater, some of the individuals came closer to inspect us. They stayed in the general area and escorted us on our way back to the mother ship until we reached Clipperton Rock.

Common bottlenose dolphins greeting our expedition after a long crossing.

On the east side of the atoll, the dolphins were more numerous.

Violation of territorial waters

During the course of an expedition of this scale, unexpected events usually happen. While we had our share of unforeseen adventures, no accidents occurred. Nonetheless, 2 specific events are worth mentioning.

Late on the evening of February 2nd, at around 23:30, we spotted lights that seemed located a bit over Clipperton Rock. Because Clipperton is an uninhabited island (without electricity) this sight caught our attention. After careful observation with binoculars, we confirmed that another boat was in the vicinity. On the morning of February 3rd, it was clear that it was an illegal tuna fishing boat.

In accordance with Law n° 55-1052 (August 6th, 1955) and the decree of February 3rd, 2008, a special authorization is required from the High-Commissioner of the French Government to disembark on the island or to stay in the territorial waters of Clipperton (this excludes innocent passage inside the 12 nautical miles). On March 29th, 2007 the French Government signed a fishing agreement with the Mexican Government to authorize tuna boats to access the Economical Exclusion Zone, a 200 miles radius around the atoll, to those who applied for a permit. That being said, in accordance with Article n° 19 of the United Nations Conventions on the Law of The Seas, fishing inside the 12 nautical miles poses a threat and "is prejudicial to the peace, good order or security of the coastal State".

The "Conquista" (matriculation number 0701987133-8), a Mexican tuna boat of 60 m, was in violation of France's territorial waters. The exclusion of the 12 nautical miles is clearly stated on the permit they had obtained and in no way does the Franco-Mexican agreement mention permission to disembark on the island.

On the morning of February 3rd at 07:26, the crew of the Conquista deployed its helicopter to investigate our boat. Our captain tried to radio the vessel 3 times but received no answer. At around 09:00, the crew deployed 2 small tenders to approach the atoll in the area between Port Jaouen and Bougainville Camp. While the 2 tender drivers stayed in their boats, at around 100 m from the beach, 6 individuals equipped with mask, snorkel and fins went in the water. Two of them reached shore, while 4 eventually came back to the small boats.

At 10:21, the helicopter was airborne for a second time. This time it flew around our boat but in very close proximity; around 10 m to the side and 5 m above the water to be at eye level. A diver reported that the pilot displayed intimidation gestures before flying off. At 12:10, coming back from a dive, we headed towards the Mexican crew in the small tenders. Dr. Eric Clua engaged a conversation in Spanish to determine the reason of their presence. They were very evasive and so the only thing we learned is that they had been on a fishing campaign for the last 15 days. It is not until around 13:00 that the mother ship decided to lift anchor and disappear.

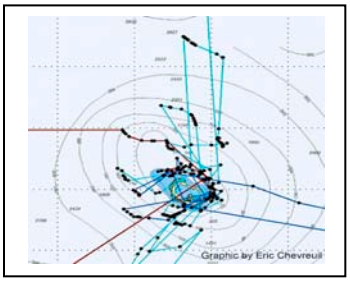
A tuna fishing boat equipped with a helicopter and chase boat.

The Mexican crew onboard the small tenders in proximity of the atoll.

The helicopter flying in close proximity of our boat to better investigate.

2 crew members illegally disembarked on the island.

While our time inside Clipperton waters was brief, we nonetheless managed to surprise an illegal fishing boat. Since very few tunas were spotted around the immediate area of the atoll and long lines are present on the reef, we can only speculate that they could have been targeting sharks for their fins. According to data from a new satellite surveillance program implemented in 2015 by the French Government, during the peak months, 3-5 illegal boats trespass Clipperton's territorial waters each month.



Satellite surveillance (screen grab) showing 3 different unauthorized boats within territorial waters.

Discovery of a new Giant pacific manta

On the way back, a stop was planned at the Revillagigedos islands and 3 recreational dives were made on February 8th at Socorro Island. During the night, the boat moved to San Benedicto Island to enable us to be ready to dive the next morning. The first dive of the next morning was at the dive site "El Canyon" and the 2 following dives were at the dive site "El Boiler".

This site is a pinnacle that rises up close to the surface and attracts pelagic animals. The name of the dive site refers to the water that seems to "boil" when it breaks on the surface of the pinnacle. The star attraction of this dive site is the Giant pacific manta (*Manta birostris*). The Pacific Manta Research Group studies the mantas of this site and has, so far, identified over 600 individuals. The vast majority of the identifications of mantas are by visual identification of marks, spots and patterns on the ventral face of the animals. Volunteers, photographers, videographers and diving enthusiasts can submit their finds.

In this context, on February 9th at 14:21, Julie Ouimet spotted a Black manta (*Manta birostris*) without its tail. This manta was very friendly and she was able to capture video footage. After submitting her images to scientists of the research group, it was confirmed that a new individual has been discovered. The same manta was spotted again by Michel Labrecque. As the second person submitting images, he had the privilege of naming the animal. This new manta is now known by science as "Jules", named after Julie who spotted her first.

Ventral identification shown on one side.

The newly discovered individual is now named "Jules".

CONCLUSIONS

Human activity

Human occupation of the atoll, between 1892 and 1917, had already modified Clipperton's ecosystem. Examples of this are the planting of palm trees by early settlers and the accidental introduction of pigs (following the sinking of the British ship Konkora). The pigs had an important impact on the colony of boobies that dropped to only a few hundred birds before a first total eradication of the pigs in 1958. Pigs were accidentally introduced again and eradicated a second time at the end of the 1960's. The colonies of Masked and Brown boobies are now back to their normal levels.

At the end of the twentieth century, another shipwreck brought rats (*Rattus rattus*) on land. These rats now predate on crabs and have no known predators. The recommendation is to quickly assess their population and consider their total eradication.

Another issue documented during our visit is the amount of modern trash found throughout the island. This problem is a direct result of human activity and, as mentioned, originates from different sources. American troops during World War II who left behind military equipment (ammo, ruins of a base camp, vehicles and a shipwreck), not to mention that they modified the ecosystem by building a now disaffected airstrip. The French Navy, between 1966 and 1969, conducted their Bougainville missions 4 months per year. They also left a significant amount of material behind (generators, remains of a base camp, plastic reservoirs, etc.). More recent missions that receive special authorizations are clearly instructed to leave nothing on the island.

Marine debris coming for 3 oceanic gyres, wash ashore and are transported by winds and storms further inside the atoll. Isolation, rare visits and treacherous landing conditions make it difficult to remove the trash present on the island.

A dedicated operation to remove the trash would be warranted. The French Government should regularly send a military convoy to reaffirm its sovereignty on the atoll. An accessory task for it could be to remove trash during each visit, starting with the larger items. Recovering plastics and other materials that are recyclable (aluminum, glass, steel, etc.) could be part of a second step. Even if all expeditions that set foot on Clipperton have the obligation to bring back their waste, a "taxation" system could also be implemented. Expeditions could have to bring back a determined number of kilograms of trash per individual present on the boat. This would help to maintain the cleanliness of the atoll by removing marine debris as it accumulates on the atoll.

Trash from Bougainville missions. Dishes, silverware and nails can be found in this box.

Plastic reservoirs for fuel and water left behind by previous missions.

Generator left in place at the Bougainville camp.

The remnants of the Bougainville camp. Visible are foundation and roofing structures.

A military wreck, the LST-563.

An army vehicle from World War II dating back to the 1944 American occupation.

Commercial fishing around Clipperton

Under the Franco-Mexican agreement, an average of 40 licensed boats per year fish for tuna around Clipperton. They take between 1 000-1 600 tons per trip, for an annual estimated total of 140 000 tons of tuna in 2013 (ref. www.atuna.com) with bycatch of 200-500 tons (ref. IATTC 2012). These estimates only take into account the legal fishing. According to satellite surveillance, during the month of September 2015 alone, 3 illegal boats from Mexico and Japan were fishing in Clipperton's waters. Now that shark fins are valued at over $1 000/kg on the black market and that the price of oil is low, it is no surprise to learn that illegal boats are travelling greater distances for their bounty.

Our observations underwater reflect these facts. Nearly no adult sharks, tunas or pelagic species were seen. The fact that we saw many juvenile sharks implies that, at some point, adult females are in the area to give birth. At this point, we can only speculate that they migrate from other islands of the ETP or that they stay in deeper waters, out of the recreational diving range. We could also speculate that since our observations were made during an El Niño year, this could have had an effect on their migration patterns. As data becomes available, we might be able to draw more accurate conclusions on this.

Recommendations are to not renew the 10 year Franco-Mexican agreement on tuna fishing and to continue satellite surveillance on the atoll. Imposing fines to boats that illegally enter the Economic Exclusion Zone (EEZ) without authorisation should also be considered. French military vessels should patrol Clipperton's waters more than once per year to better enforce its sovereignty and protection of the territorial waters. Finally, the creation of a Marine Protected Area around Clipperton would create clear known boundaries and measures for its protection.

FINAL WORDS

When imagining far and remote places, isolation is usually perceived as positive. We harbour images of virgin spaces, trouble free areas, dense vegetation, pure water, intact ecosystems and an abundance of predators underwater. Sadly, Clipperton resembles anything but this. In its case, isolation means that it is left to fend for itself and that no one is there to prevent the pillage of its resources.

A project to establish a permanent scientific base camp is presently underway with M. Philippe Folliot (deputy of Tarn) at its head. This camp could also serve as a surveillance camp like for other MPAs (Cocos and Revillagigedos) in the ETP.

Furthermore, it would be a great addition if France joined the CMAR organization, thus enlarging the protection of all migrating species as they travel between ETP islands.

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APPENDIX "A"
List of marine species

Acanthurus guttatus	Whitespotted surgeonfish
Acanthurus nigricans	Goldrim surgeonfish
Acanthurus triostegus	Convict tang
Arothron meleagris	Guineafowl puffer
Aulostomus chinensis	Chinese trumpetfish
Bodianus diplotaenia	Mexican hogfish
Bothus mancus	Tropical flounder
Canthidermis maculate	Rough triggerfish
Canthigaster punctatissima	Spotted sharpnose pufferfish
Caranx ignobilis	Giant trevally
Caranx lugubris	Black jack
Caranx melampygus	Bluefin trevally
Caranx sexfasciatus	Bigeye trevally
Carcharhinus albimarginatus	Silvertip shark
Carcharhinus galapagensis	Galapagos shark
Cirrhitichthys oxycephalus	Coral hawkfish
Cirrhitus rivulatus	Giant hawkfish
Ctenochaetus marginatus	Bluespotted surgeonfish
Dermatolepis dermatolepis	Leather bass
Diodon hystrix	Porcupinefish
Elagatis bipinnulata	Rainbow runner
Epinephelus clippertonensis	Clipperton grouper
Forcipiger flavissimus	Forcepfish
Gymnothorax dovii	Finespotted moray
Gymnothorax flavimarginatus	Yellowedge moray
Holacanthus limbaughi	Clipperton angelfish
Johnrandallia nigrirostris	Barberfish
Kyphosus elegans	Cortez Sea chub
Lutjanus viridis	Blue-and-gold snapper
Melichtys niger	Black durgon
Mulloidichtchtys dentatus	Mexican goatfish
Myripristis berndti	Bigscale soldierfish
Naso lituratus	Orange spine surgeonfish
Ophioblennius steindachneri	Panamic fanged blenny
Ostracion meleagris	Spotted boxfish

Paranthias colonus	Pacific creole
Scarus rubroviolaceus	Bicolor parrotfish
Sectator ocyurus	Rainbow chub
Sphyrna Lewinii	Scalloped hammerhead
Stegastes Baldwini	Clipperton gregory
Sufflamen verres	Orangeside triggerfish
Thalassoma grammaticum	Sunset wrasse
Trachinotus stilbe	Steel pompano
Tursiops truncatus	Bottlenose dolphin
Xanthichthys mento	Crosshatch triggerfish
Zanclus cornutus	Moorish idol

BIG MIGRATIONS EXPEDITION

CLIPPERTON 2016

EXPLORERS CLUB FLAG #213 IN THE FIELD

Michel Labrecque, FI '16 and Julie Ouimet, FI '16 working on the fish census and documenting population sizes.