Final Project report

Conservation of Sea Turtles along the coast of Peru

APECO

Grupo de Tortugas Marinas-Perú

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Final Project report

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Submitted to:

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&

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Table of contents:

I. Introduction

In order to conserve endangered species, it is highly important to manage information about the biology and ecology of their populations and also about the threats that had caused, and are still causing, their endangered situation. When the endangered species are migratory, the importance of this kind of information is higher due to the fact that conserving migratory species depends not only on one country but also on many countries around the world.

Sea turtles are species highly migratory and they also are in a very endangered situation. In the Peruvian sea five species of sea turtles can be found: Eastern Pacific Green sea turtle (*Chelonia mydas agassizii*), Leatherback sea turtle (*Dermochelys coriacea*), Olive ridley sea turtle (*Lepidochelys olivacea*), Loggerhead sea turtle (*Caretta caretta*) and Hawksbill sea turtle (*Eretmochelys imbricata*). The International Union for the Conservation of Nature (IUCN) classified the green turtle, loggerhead and olive ridley as endangered (EN) and the hawksbill and leatherback turtle as critically endangered (CR) (Hilton-Taylor 2000). The Convention for International Trade of Endangered Species (CITES) listed these 5 species in the Appendix I and the Convention on the Conservation of Migratory Species of Wild Animals (CMS) in the Appendix I and II, due to their critical status. The Peruvian administrative authority, represented by the National Institute of Natural Resources (INRENA) categorized the leatherback sea turtle as critically endangered and the other four species as endangered.

The incidental capture of non-target individuals during fishing activities is one of the worldwide major threats to marine species and especially to the conservation of sea turtles. The individuals that are incidentally captured sometimes die during the fishing operation and if not they end up with injuries from the gear. Those injuries may lead them, eventually, to death. In Peru, the sea turtle interaction with the fishing activities has not been properly documented when this project began.

Another aspect that has not been studied in Peru is the determination of the sea turtles reproductive stocks. It is necessary to find out to which reproductive stock these five species of sea turtles belongs. This kind of information will contribute to coordinate efforts with other nations for the conservation of these species.

This project aim to generate the kind of information mention above in order to use it for the conservation of the sea turtles but also we will work in public awareness because the more information about sea turtles people get the more they will help to their conservation.

II. Project Objectives

General Objective

- To contribute on the conservation of sea turtles aggregations in Peru

Specific Objectives

- To evaluate the impact caused by the industrial fisheries on sea turtles aggregations;
- To determine the genetic variability of the diverse sea turtles species aggregations inhabiting the Peruvian territorial sea through mitochondrial DNA analysis;
- To develop educational campaigns for public awareness to protect sea turtles

Due to the three different objectives of the project this report will explain the project activities conducted and results divided also in three parts: **Fishing activities observation** for the activities conducted to monitor the industrial fisheries impact on sea turtles**, Genetic assessment** for the activities conducted to analyze sea turtles genetic variability and reproductive stocks identification and **Public awareness** for the activities conducted to contribute to the generation of conscience, values and attitudes toward the conservation of sea turtles.

III. Materials and methods

III.I Materials:

Fishing activities observation

- Waterproof clothes
- "Jorge Chavez" sweaters
- Rubber boots
- Thread gloves
- GPS
- 100 Kg. Scales
- Bags
- Ropes
- Metric tapes
- Tag applicators
- Inconel tags
- Waterproof one-use cameras
- Head flashlights
- Batteries
- Toolboxes
- Waterproof notebooks
- Pencils
- Pencil sharpeners
- Locks with keys
- WD-40 lubricant
- Zip-lock plastic bags
- Notebooks
- Pens
- Boards
- First aid kit
- De-hookers

Public Awareness

- Slides
- Slides projector
- PowerPoint presentations
- Data show
- PC computer
- Cameras
- De-hookers
- Sea turtle carapaces
- Inconel tags
- Tag applicator
- Posters
- Stickers
- Diptychs
- Hooks

Genetic assessment

Field materials:

- Alcohol
- Cotton
- Alcohol swaps
- Latex gloves
- Vials
- Tweezes
- Biopsy punches
- Permanent ink pen

Laboratory reagents and supplies:

Glassware:

- Microscope slides
- Flask

Plastic ware:

- Vials
- 1.5 ml Microvials
- 0.2 ml Microvials
- Pipetters
- Parafilm
- Pipet tips
- Electrophoresis tray
- 1.5 ml microvials racks
- 0.2 ml microvials racks
- Micropipettes
- Racks

Chemicals:

- Detergent
- Bleach (clorox)
- Distilled water
- Bi-Distilled water
- Liquid nitrogen
- Ultra pure water
- Alcohol (70%)
- Isopropanol
- Tris
- HCl
- EDTA
- NaCl
- NaOH
- SDS
- PCR buffer 10X
- Chlorophorm Isoamyl alcohol (24:1)
- LTEi9_F primer
- H950_R primer
- TE buffer

- TDE buffer
- Agar agar
- Sowing buffer
- Ethidium bromide
- DNTPs
- MgCl2
- DNA primers
- Taq Gold polymerize
- Proteinase K

Others:

- Towel paper
- Aluminum foil
- Latex gloves
- Scalpel blade
- Scissors
- Mortar
- Tweezes

Equipments:

- PH measurer
- Electronic scale
- Water bath
- Centrifuge
- Water purifier
- Vortex
- Freezer (-20ºC)
- Refrigerator
- Microwave
- Electrophoresis machine
- UV camera
- PCR machine
- Photographic camera
- PC Computer

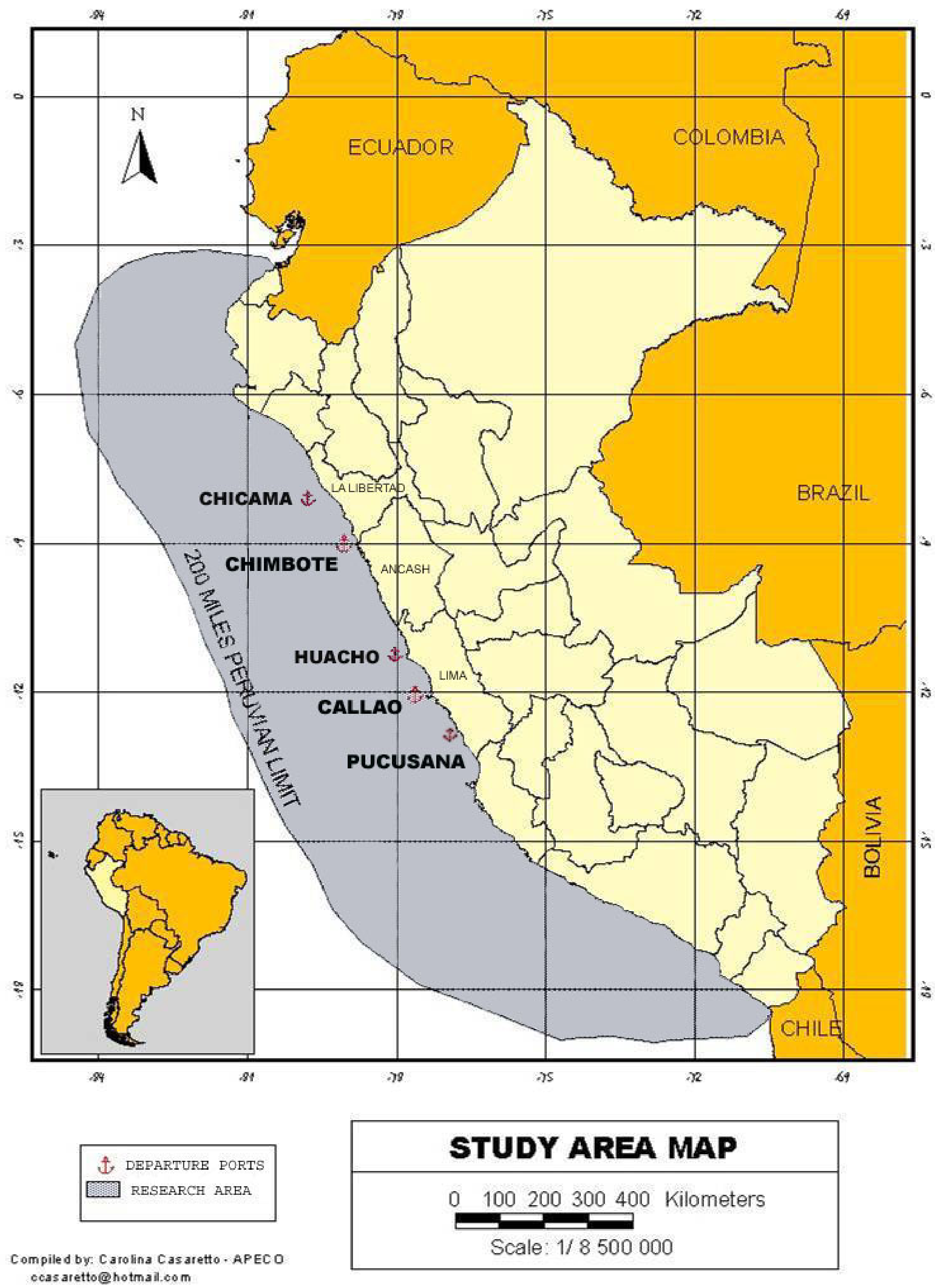
III.II Methods:

Fishing activities observation

The study area for the fishing activities included the Peruvian Exclusive Economic Zone, from the parallel 06° 30' South to the parallel 17° 56' South and from the 5 miles off the Peruvian coast as far as international waters off the Peruvian Coast (map 1).

The observers boarded longline vessels that departed from Callao Port (12º05'S, 77º09'W), and Pucusana Port (12º28'S, 76º48'W) in Lima or from Chimbote Port in Ancash (9º05'S, 78º36'W), and purse seines vessels that generally departed from Chimbote Port (See map

1), but they also departed from Callao Port and Huacho Port (11º07'S, 77º37'W.) in Lima and Chicama Port (8ºS, 80ºW) in La Libertad.



Map 1: Study area and departure ports.

The on board observer took the following information from each longline set: date and time at deployment, geographic position at the beginning and at the end of deployment, speed of deployment, date and time at retrieval, geographic position at the beginning and at the end of retrievement, speed of retrievement, mainline length, mainline material, gangions length, number of hooks deployed, hook type, hook material, distance between gangions, number of floaters, distance between floaters, bait, bait color, superficial sea temperature, total capture of fish.

The information taken from the purse seine sets was: date and time at deployment and retrieval, set geographic position, superficial sea temperature, fish total capture, bycatch.

The on board observers took the following information from each sea turtle captured: date and time at encounter, time at liberation, geographic position, number of vertebral scutes, number of lateral scutes, plastron pores, number of plastron inframarginal scutes, number of prefrontal scutes, tags number, flippers marks, hooking place, condition of health, curve carapace length from the notch to the tip (CCLn-t) and curve carapace length maximum (CCLmax), tail length, weight, presence of epibionts, algae in the carapace and tumors.

The adequate techniques included in the Research and Management Techniques for the Conservation of Sea Turtles (Eckert et al. 1999) were used for the identification of the sea turtles individuals, the sea turtles tagging, measuring and weighting (Picture 1). The identification of each individual was conducted by the observers on-board the fishing vessels but also the observers took pictures of each individual. With the pictures developed, the species identification was confirmed by the biologist’s staff of the project (Picture 2). The techniques used to release the sea turtles from the longline gear were the ones suggested by Chacon et al. (2000).

Picture 1: Observer weighting a turtle

Picture 2: Pictures taken to confirm the species identification

With the information about the fishing effort and the turtles captured, the sea turtles CPUE (Capture per units of effort) was calculated using the following formula:

$$CPUE = (N/A) * 1000$$

Where N is the number of sea turtles capture by a longline set and A is the number of hooks during that set. The CPUE is given in turtles captured each 1000 hooks.

The bycatch mortality rate was calculated using the number of all sea turtles captured and the number of sea turtle that were found dead or die during its evaluation on board the vessels.

Interaction with the longline gear was calculated for each species and the following interaction categories: hook in the esophagus, hook in the mouth, hook in the flipper, hook in the plastron, entangled.

Genetic analyses

The on-board observers collected skin samples from the sea turtles, as explained by Dutton & Balazs (1995), that were incidentally captured during the fishing activities

The samples were stored in 70% ethanol at room temperature and taken to the Instituto de Biotecnologia – IBT (Biotechnology Institute) laboratory at La Molina National Agrarian University –UNALM, specifically to the Molecular Biology Laboratory.

The samples were processed in the Animal Molecular Biotechnology IBT laboratory. The isolation of the genomic DNA from the first 20 skin samples followed the proteinase K digestion protocol by Hillis and Davis (1986). The mtDNA from the rest of the skin samples were extracted using the following protocol:

0.25 ml. Proteinase K buffer: 0.5 ug. of proteinase K per ul. of digestion buffer: 100 mM EDTA 10 mM Tris pH 7.5 1% SDS

The protein digestion was conducted on the water bath machine at a temperature of 56°C overnight. The DNA then was cleaned using the Chloroform Isoamyl alcohol (24:1) method, after which the DNA was dried at room temperature for about 14 hours. Later it was suspended again in TE buffer and taken to the water bath machine for one hour at 65°C. Finally, the DNA material was stored at –20°C.

A 740-bp fragment of the mtDNA was amplified by polymerase chain reaction (PCR) with primers LTEi9 and H950 (Abreu pers comm.) designed to target a section of the d-loop of the control region. PCR conditions were as follow for a reaction of 10 ul: 1X PCR Buffer, 0.2 mM dNTP's, 0.5 uM of each primer and 0.05 U/ul of Taq polymerase. Cycling conditions were an initial denaturation for 5 min at 95ºC followed by 30 cycles at 94ºC for 30 s, an optimal annealing temperature of 52ºC for 30 s and 90 s at 72ºC, followed by a final extension of 5 min at 72ºC. Along with the samples, positive and negative controls were included in the reaction to confirm the success of the reaction and to reject contamination of the master mix. Amplified fragments and the positive and negative controls were run in 1.5% agarose gels to confirm the targeted size. We removed single-stranded DNA and primers from PCR reactions by digesting 5µl of PCR product with 3µl of a combined *Exonuclease I* and *Shrimp Alkaline Phosphatase* solution. This solution consisted of 6000 U of *Exonuclease I* and 0.46 U of *Shrimp Alkaline Phosphatase*. The reaction was incubated for 20 minutes step at 37ºC, followed by 10 minute incubation at 85ºC to inactivate the two enzymes.

Both forward and reverse strands were sequenced using a DYEnamic™ ET Terminator Cycle Sequencing Kit (Amersham Biosciences) and analyzed with an automated DNA sequencer (MegaBACE 500 Amersham Bioscience) at the Sequencing Facilities of the University of Puerto Rico, Rio Piedras. We used Sequencher 4.2 (Gene Code Corporation) to generate a single strand from the merge of the forward and reverse strands and the trimmed sequences were aligned by eye.

Unique haplotypes were identified by collapsing sequences using COLLAPSE 1.2 (available from http://darwin.uvigo.es) and each haplotype was compared to previously assigned haplotypes. We renamed all mtDNA haplotypes using the standardized nomenclature in previous studies. All new haplotypes were named in order of their discovery. We estimated gene (haplotype) diversity (*h*) and nucleotide diversity (π, Nei 1987) using in ARLEQUIN ver. 3.0 (Excoffier *et al.* 2005).

IV. Activities conducted:

This Conservation of Sea Turtles along the coast of Peru project had two complementary sources of funding. The U.S. NMFS funds came before the ones from CMS. Due to that, some of the activities of the project started earlier. The on-board observations on longliners started in January 2003. In this final project report, the whole activities conducted and results will be included.

Fishing activities observation

- *Elaboration of manuals for on board observers.*

From October to December 2002, we worked in the elaboration of the "Manual for the identification and manipulation of sea turtles in Peru". This manual includes general information about sea turtles in the world and in Peru, a key for the species identification, techniques for: measuring and weighting sea turtles, tagging sea turtles, releasing individuals hooked or entangled in the longline gear, resuscitation of sea turtles, taking of pictures and also equipment maintenance. (See Annex 1)

Besides the Manual, we elaborate a waterproof quick-guide for species identification (Annex 2) and the on-board observation data sheets for:

- Sea turtles incidentally captured
- Information about the vessel and longline gear and fishing trip
- Information about each longline set
- Information about each picture taken by camera
- Information about other incidental capture (not sea turtles) or observations.

During April and May 2003 we updated the Manual and added information about a new specie reported in Peru (*Caretta caretta*) and also about trawling and purse seines activities. We also had to update the waterproof quick-guide for species identification and elaborate new data sheets for:

- Information about the purse seine vessel and fishing trip.
- Information about the gear (neat and others)

- Information about each purse seine fishing set

All this material was elaborated to be use by the on-board observers.

- *On board observers qualifying:*

From October to December 2002, we received Resumes and Cover letters from Fisheries Engineer students who wanted to work as on-board observers. After had review this information, personal interviews with the applicants were conducted. Based on the applicants' skills and personal recommendations, we selected six of them for the first qualifying workshop.

The First Qualifying workshop was conducted on December 2002. Five students assisted to the workshop (Picture 3) and were trained to be sea turtles on-board observers. The workshop was dictated by the biologist's staff of the project (Shaleyla Kelez, Camelia Manrique and Ximena Velez-Zuazo) and by the M. Sc. Carlos E. Diez. The students trained received the manual, and the quick identification guide.

Picture 3: First sea turtle on-board observers' workshop

From April to May 2003, we looked for new people interested in work as on-board observer. Following the same procedure specified above, we selected 6 people. Five of them were Fisheries Engineers and the other a student of the same major. A Second Qualifying workshop was dictated on the 17^{th} of May 2003 by the biologist's staff of the project and Ms. Sc. Carlos E. Diez.

- *On board observations*:

In order to conduct the on-board observations the following activities were accomplished:

Permits: In October 2003 we presented to INRENA all the requirements to get a permit to conduct scientific research, out of protected natural areas, with *in-situ* temporal capture and tagging of sea turtles individuals along the Peruvian coast (Annex 3) and other permit to conduct scientific research and collect skin samples from the sea turtles species present in the Peruvian sea (Annex 4). The permits were given to us on December 2002 and had a validity period of one year (until December 2003). The 11th of July, 2003 was approved by INRENA the inclusion of *Caretta caretta* within the permits of the project.

During January 2004, the required documents to get both new permits were elaborated. The documents were submitted to INRENA the 21st of January 2004. The permits were approved the 10th of February (Annex 5 & 6)

Fishing vessels: Since October through December 2002, we contacted fishing companies that worked with longline vessels targeting on common dolphinfish *Coryphaena hippurus*, banded toadfish *Xiphias gladius*, shortfin mako *Isurus oxyrinchus*, smooth hammerhead *Sphyrna zygaena*, blue shark *Prionace glauca*, and thresher shark *Alopias vulpinus* (Picture 4). During April 2003 we contacted other fishing companies that worked with purse seines vessels targeting on Peruvian anchovy *Engraulis ringens*, Inca scad *Trachurus picturatus murphyi* and chub mackerel *Scomber japonicus*. All the owners of the companies accepted to collaborate with the project taking the observers on-board of the vessels and also giving them accommodation for sleep and food during the trip without charging for it.

Picture 4: "Belissa", one of the longline fishing vessels.

Insurance: Due to the high risk of accidents that exist during fishing activities, we acquired an insurance against accidents for the 11 on-board observers. This insurance covered the observers during all the time the observations were conducted.

Fishing trips: The on-board observers made a total of twenty-five (25) longline fishing trips: Ten (10) from the 14th of January to the 12th of May 2003, two (2) from the 13th of February to the 6th of April 2004, and thirteen (13) from the 27th of October 2004 to the 18th of July 2005. From the 3rd of July 2003 to the 23th of March 2004, the observers conducted a total of thirty-four (34) fishing trips on the purse seines vessels.

- *On board observers supervising*:

The biologists of the project conducted the on-board observers supervising. The supervising was done before, after and during the on-board observation trips. We were available for the observers 24 hours a day, 7 days a week. The fishing trips were very random and the observers needed our supervising any time any day during the whole year.

Public Awareness

- *Public Awareness*

During May 2003 we elaborated audiovisual material, as Power Point presentations and others to be used effectively to transmit in an interesting way the sea turtles' facts. We organized the program and elaborated the contents of a sea turtle workshop. It was specially elaborated for the Peruvian coastguards. The workshop subjects were the biology and ecology of the sea turtles in the world and in Peru, the Peruvian legislation about sea turtles, the identification technique for the 5 species of sea turtles presented in the Peruvian sea and the principal threats that affect them.

During September 2003 we worked in the text and pictures about the project that are now published in APECO's web page: www.apeco.org.pe. The direct link to the project web page is the following: http://www.apeco.org.pe/programas/gtm/

Throughout October 2003 we contacted a graphic designer to elaborate posters, stickers and diptychs for the public awareness campaigns (Annex 7). The objectives of these support materials were to inform about the sea turtles species inhabiting Peruvian waters, to explain their threats and why they are in danger of extinction and to involve fishermen with sea turtles so they can help to the conservation of theses species.

The design of the poster and sticker was conducted during November and December 2003. INRENA's opinion about the poster and sticker design was asked and their suggestions were included. On February 2004 these materials were printed and the design of the diptych started. These were ready and printed at the end of May 2004.

From April to September 2004, several ports' authorities were contacted to get their support performing the calling of the fishermen and helping with the auditory finding.

Previous to the talks, approximately during April 2004, a sea turtle power point presentation was elaborated. This presentation was specially designed for fishermen. The content of the presentation was: interesting aspects about the biology and ecology of sea turtles (to get fishermen attention), information about the 5 sea turtles species that inhabit Peruvian waters, the endangered situation of sea turtles, all the threats that sea turtles have during their entire life cycle and how they can help to their conservation. This presentation was elaborated not only to inform fishermen but also to sensitize them about sea turtle state.

Due to the rustic conditions in some ports we did not have a Data Show to perform the presentation, so we had to make slides for the talks and carry a slide projector with us.

Genetic analyses

- *DNA analysis*:

From June to August 2003 we had different meetings with the director of the IBT's molecular biology area in order to plan the work schedule and to coordinate the work with the person that was going to supervise us. The molecular biology area director selected Ms. Sc. student Giancarlo Iannacone to supervise our work.

During August 2003 we revised different protocols of DNA extraction, tested some of them and adapted one to get the better results. During September 2003 we tested the amplification protocols and during October 2003 we bought the entire laboratory supplies and reactives needed for the genetic analyzes.

The isolation of genomic DNA from a total of 66 skin samples was conducted in different occasions from December 2003 to August 2004.
During October 2004 the amplification of the mtDNA D-loop fragment was conducted for ten (10) samples.

We experienced some problems with the amplification process because the concentration of DNA samples where unknown. The lack and impossibility to get a mass ladder was the principal reason of it. Due to that during January 2005 a DNA extraction test was conducted for all samples, later and following the luminescence intensity of the samples we chose 3 samples and prepared dilutions (1:10, 1:100 & 1:1000). The dilutions were amplified and, using the results as a guide, the rest of the samples were diluted.

The mtDNA target fragment amplification of all the samples were conducted on March 2005 and these amplifications were sent to Ximena Velez at the University of Puerto Rico-Rio Piedras for the sequencing process.

V. Results and discussion

Fishing activities observation

1. On-board observations conducted

Longline

Twenty-five (25) fishing trips were conducted. Seventeen of them were targeting on common dolphinfish and the other eight on sharks (shortfin mako, smooth hammerhead, blue shark and thresher shark). The observation began with 10 trips conducted from January to May 2003, after May the fishing vessels we were working with stopped fishing so the longline on board observations also stopped. Then we start again with two (2) trips from February to April 2004. Our observations stopped in May 2004 due to the fishing vessel changed their target species. We continued the observations with three (3) trips from October to December 2004, and ten (10) trips from February to July 2005. The days monitored during each month varied from 6 to 27 days (Table 1). A total of 257 fishing days were observed.

	Year			
Month	**2003**	**2004**	**2005**	**Days**
Jan	17	-	12	29
Feb	19	10	27	56
Mar	11	6	14	31
Apr	19	6	14	39
May	13	-	20	33
Jun	-	-	18	18
Jul	-	-	17	17
Oct	-	7	-	7
Nov	-	17	-	17
Dec	-	10	-	10
Total	79	56	122	**257**

Table 1: Total of fishing days observed per month and per year onboard of different longline vessels

Purse seine

The on board observers conducted a total of thirty-four (34) fishing trips on the purse seines vessels. Fifth teen (15) of they were targeting on Peruvian anchovy and the other nineteen (19) on Inca scad and chub mackerel. The principal target of the vessels was the Peruvian anchovy but when a biologic closure occurred all boats target on Inca scad and chub mackerel. A total of 147 fishing days were observed. The total days observed per month varied from 6 to 30. (Table 2)

Month	Jul 03	Aug 03	Sep 03	Oct 03	Nov 03	Dec 03	Jan 04	Feb 04	Mar 04	total
Days	21	6	26	8	30	11	25	14	6	147

Table 2: Total days observed per month in different purse seine vessels

The days per month observed on board the purse seines vessels had a high variation due to the quantity of fishing closures that the Fishery Vice-Ministry decreed. These decrees were related to the abundance of the resources (Annex 8).

2. Catch rate

During the 34 purse seine fishing trips, a total of 157 sets were observed. Zero (0) sea turtles were captured. Although the crew of one vessel told one of the observers that during one fishing trip (without observer) one sea turtle was captured. These results show that the purse seine industrial activities are not a treat for sea turtles in the Peruvian waters. On the other hand, some sea lions were incidentally captured (Picture 5).

Picture 5: Sea lions inside the purse seine net during a fishing set.

During the 25 longline trips observed 340 402 hooks were deployed in 197 sets. In 82 sets, 121 sea turtles were captured. Twenty-three of these turtles got free when the gear was being hauled back and one turtle was liberated without evaluation because of the rough conditions during those moments. The other 97 turtles were identified, measured and tagged (See Annex 9).

The average CPUE for the 25 pelagic longline fishing trips of 197 sets observed is 0.355 (SD ±0.209) turtles but 0.348 (SD ±0.193) for the common dolphinfish fishery (132 sets observed) and 0.370 (SD ± 0.254) for the 65 sets observed in the shark fishery.

The difference among the catch rates for the two fisheries is minimal and is significantly different (Student's t-test, P=0.930). The global catch rate 0.355 is very low comparing it with, the Spanish swordfish fishery in the Mediterranean, the tuna, dolphinfish, and billfish fishery in the Pacific of Costa Rica and the swordfish and tuna fishery in the Southwest Atlantic. On the other hand, if we compare it with the catch rate from the dolphinfish fishery in the Pacific of Costa Rica during 1999-2000, the values are pretty close but our value is higher than the catch rate of the pelagic fishery in the western Atlantic Ocean and than the tuna and billfish fishery in Australia seas (see Table 5).

Table 3: CPUE for the fishing trips targeting on common dolphinfish.

Trip code	days	# sets	# hooks	# turtles	CPUE
b103	7	9	12090	2	0.165
b203	9	9	11160	5	0.448
b303	11	11	18700	4	0.214
j103	7	6	7800	5	0.641
r103	3	6	7250	1	0.138
r203	6	10	13470	4	0.297
s103	4	3	5400	2	0.370
je104	10	9	16200	10	0.617
je304	14	9	18000	6	0.333
r104	10	8	19800	3	0.152
r204	10	11	28700	11	0.383
je105	9	8	17150	8	0.466
je205	9	9	14750	1	0.068
je305	7	4	6150	1	0.163
mi105	8	8	7347	5	0.681
me105	14	8	9880	5	0.506
r105	6	4	7600	4	0.526
total (17 trips)	**144**	**132**	**221447**	**77**	**0.348**

Table 4: CPUE for the fishing trips targeting on sharks.

Trip code	days	# sets	# hooks	# turtles	CPUE
b403	11	8	15000	8	0.533
b503	13	6	10700	1	0.093
r303	8	4	6200	3	0.484
je204	12	9	17955	12	0.668
jr105	14	8	10700	6	0.561
je405	21	8	14400	0	0.000
d105	18	11	22000	11	0.500
d205	17	11	22000	3	0.136
total (8 trips)	**114**	**65**	**118955**	**44**	**0.370**

Table 5: CPUE's longline fisheries comparative table. lo= *Lepidochelys olivacea*, cm= *Chelonia mydas*, cc= *Caretta caretta*, dc= *Dermochelys coriacea*, ei= *Eretmochelys imbricata*

Longline fishery	**Location and year**	**CPUE**	**sea turtle species**	**Source**
Billfish & shark	Costa Rica Pacific sea 1997	19.42	lo, cm	Arauz *et al*. 2000
Spanish swordfish	Western Mediterranean sea 1991	4.464	cc, dc	Aguilar *et al*. 1995
Dolphinfish & tuna	Costa Rica Pacific sea 1991-1992	3.0	lo, cm	Segura & Arauz 1995
Swordfish & tuna	Southwest Atlantic sea 1994-1996	1.8	cc, dc	Achaval *et al*. 2000
Swordfish & tuna	Southwest Atlantic sea 1994-1996	1.23	cc, dc	Achaval & Marin 1998
Dolphinfish & shark	Peruvian sea 2003 - 2005	0.355	cc, cm, lo, dc	This report
Dolphinfish	Costa Rica Pacific sea 1999-2000	0.305	cm	López & Arauz 2003
Pelagic	Western Atlantic Ocean 1992-1993	0.144	dc, cc	Witzell 1996
Tuna & billfish	Australian seas 1997-2001	0.004	dc, cc, ei, cm	Robins *et al*. 2002

It is important to notice that the CPUE obtained in this study is higher than the CPUE from the Dolphinfish fishery in the Pacific of Costa Rica because Peru does not have nesting beaches and Costa Rica does, so this would mean than Peruvian waters are very important habitats for foraging and development of sea turtles, as well as they serve as migratory corridor for some species.

3. <u>Mortality rate</u>

All the turtles captured in the longline gear were alive when the gear was hauled back, this means that none of them drowned. The ones that were evaluated on board of the vessels were returned to the sea alive; likewise the ones that got free from the gear when it was hauled back were alive as well. Post-release mortality was not evaluated during this project. Although, the turtles were tagged before their liberation making possible the collection of information if the turtles appear stranded on a beach or if they are recapture in the future. It is necessary to mention that some of the turtles presented injuries. One olive ridley captured presented the supracaudal scutes and part of the last vertebral scute broken (Picture 6). Nine turtles were liberated with the hook in the esophagus and some turtles presented little injuries in the carapace as consequence of the lifting tools used to get them on-board.

Picture 6: sea turtle with injured carapace

4. <u>Season of capture</u>

The on-board observers monitored the longline fisheries from January to May 2003, from February to May 2004, and from October 2004 to July 2005. In Figure 1 can be observed that the highest number of sea turtles incidentally captured occurred in February (summer time) during the common dolphinfish fishing activities and the lower in July during the shark fishing activities. But, due to the fact that the effort was not the same during each month, we have calculated the CPUE per month and per fishery (Figure 2).

The highest monthly CPUE observed occurred in March during shark sets (CPUE = 0.902), and the lowest one occurred in July during shark sets as well (CPUE = 0.136). Due to the fact that in March both fisheries, dolphinfish and sharks, were operating; the real monthly CPUE will be as high as 1.242. However, even though the higher CPUE was during shark sets, it has to be noticed that the overall shark fishery effort in Peru is much lower that the overall dolphinfish fishery (CPPS – FAO 2003), so it is possible that the higher numbers of sea turtle captures will occur during the dolphinfish fishing sets.

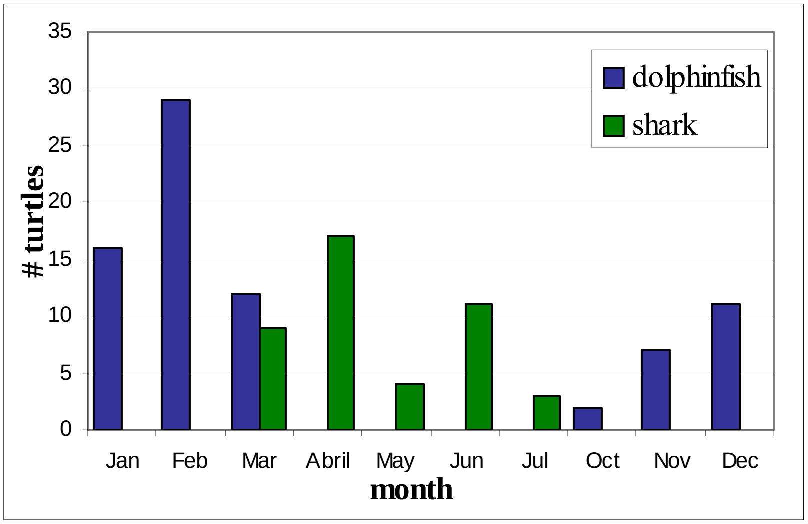


Figure 1: Quantity of turtles captured per month during 2003, 2004 and 2005 longline fishing activities.

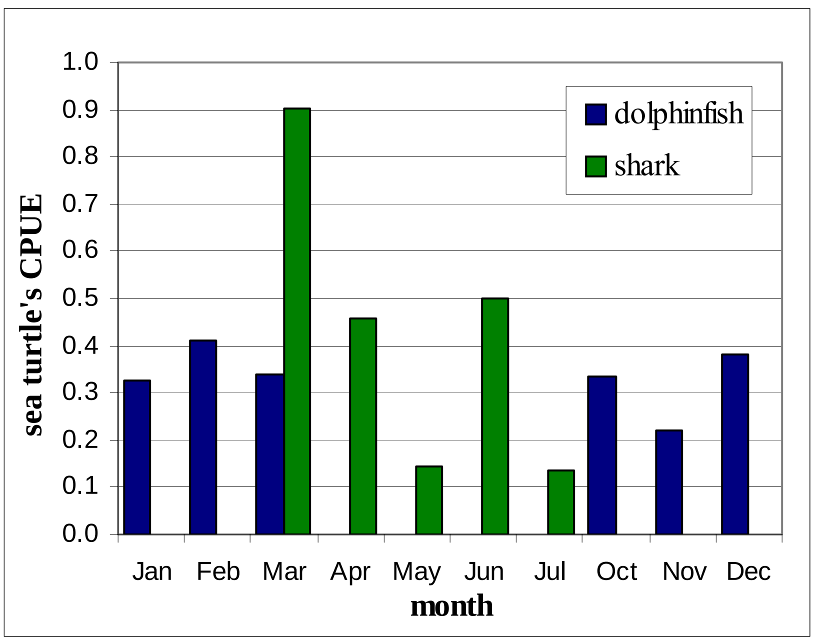


Figure 2: Sea turtle CPUEs per month during dolphinfish and shark longline sets in 2003, 2004 & 2005.

5. Area of capture

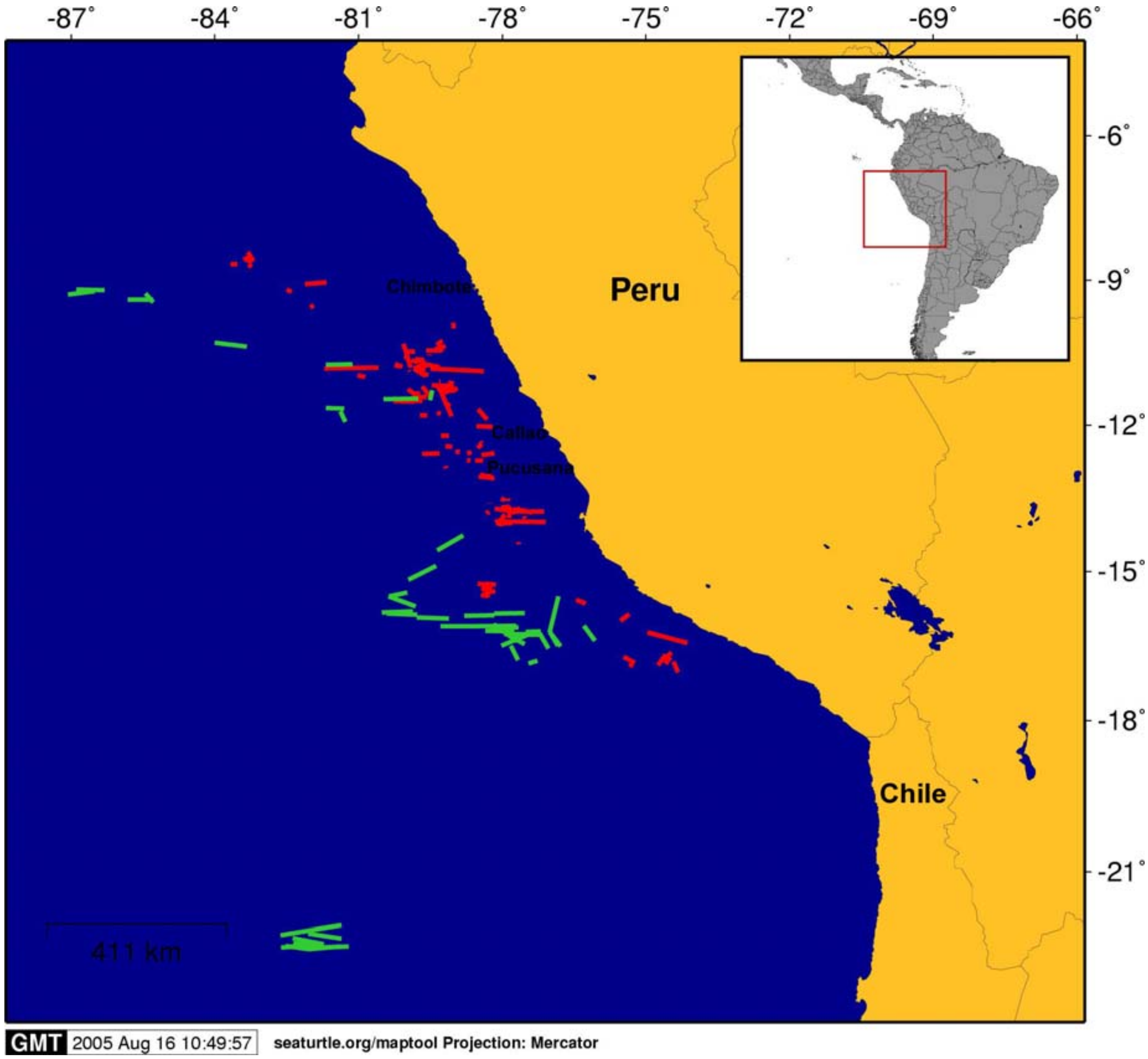
The fishing zone for dolphinfish and sharks are between the 8 and the 23 degrees south latitude and between the 73 and 87 degrees west longitude. Dolphinfish fishing activities were conducted between the 44 km and the 440 km offshore the coast line but the sharks fishery were conducted much farther away than the dolphinfish fishery, between the 146 km and the 1174 Km offshore the Peruvian coastline (Map 2). As it can be observed in the map 2, the sharks set are conducted farther away from shore. This is because the shark fishery is conducted mainly during the winter and the warm oceanic waters tend to go farther because the cold water of the Humboldt current get stronger in that season.

Sea turtles were mostly captured between 114 Km and 681 Km offshore in the Northern Peruvian Ocean and between 91 Km and 511Km in the Southern Peruvian Ocean (Map 3). It can be seen some differences in the distribution of the species. Greens appear to be well distributed along the entire area; olive ridley seems to be more frequently present in the north while loggerheads are more abundant in the south. Both leatherbacks were captured around the parallel 14 S.

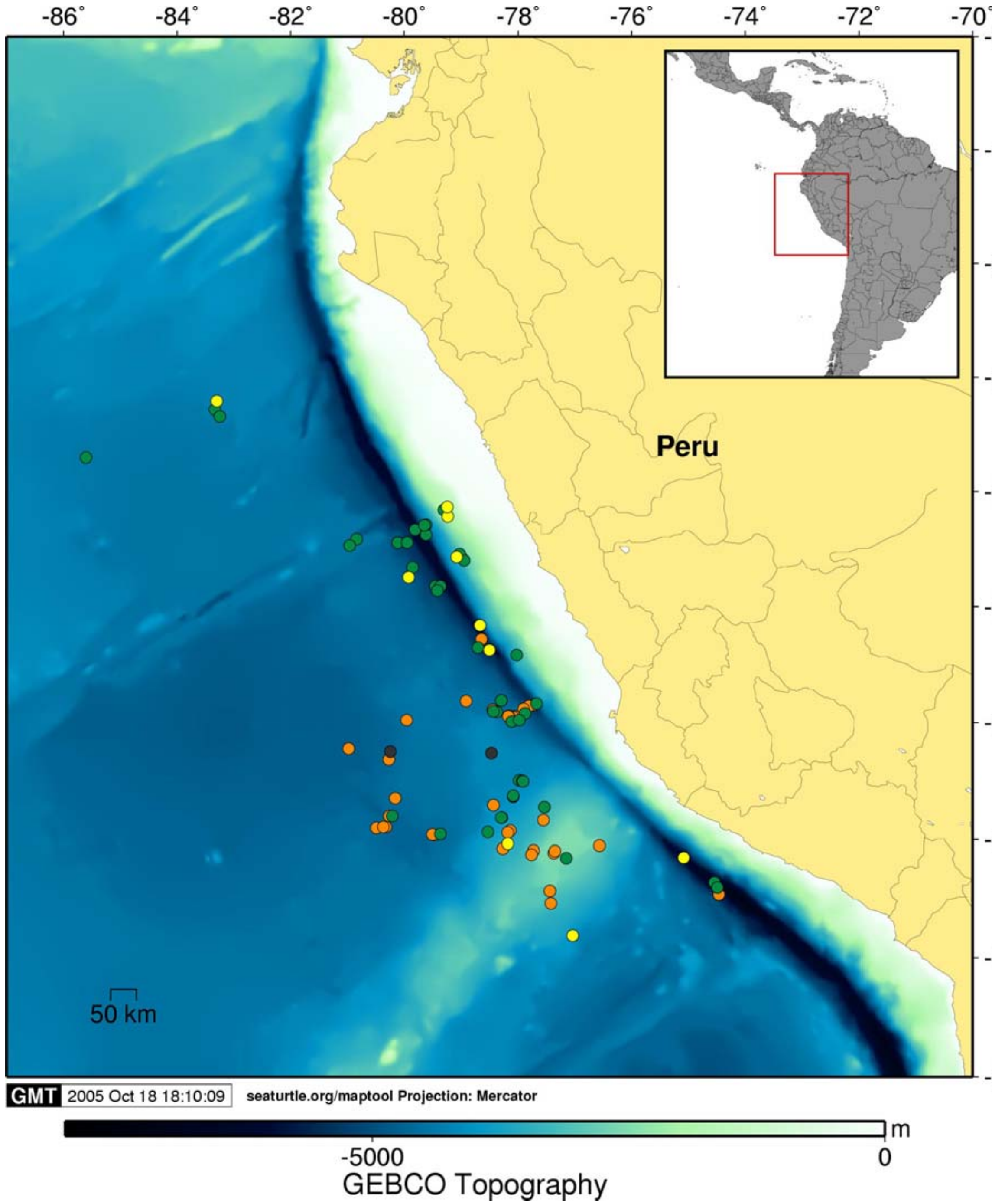
Purse seine activities were conducted between the 6 and 18 degrees South and between the 8 and 300 kilometers off shore the coastline (Map 4). It is obvious that in these area sea turtles do occur but did not interact with purse seine fishery.

6. Species frequencies

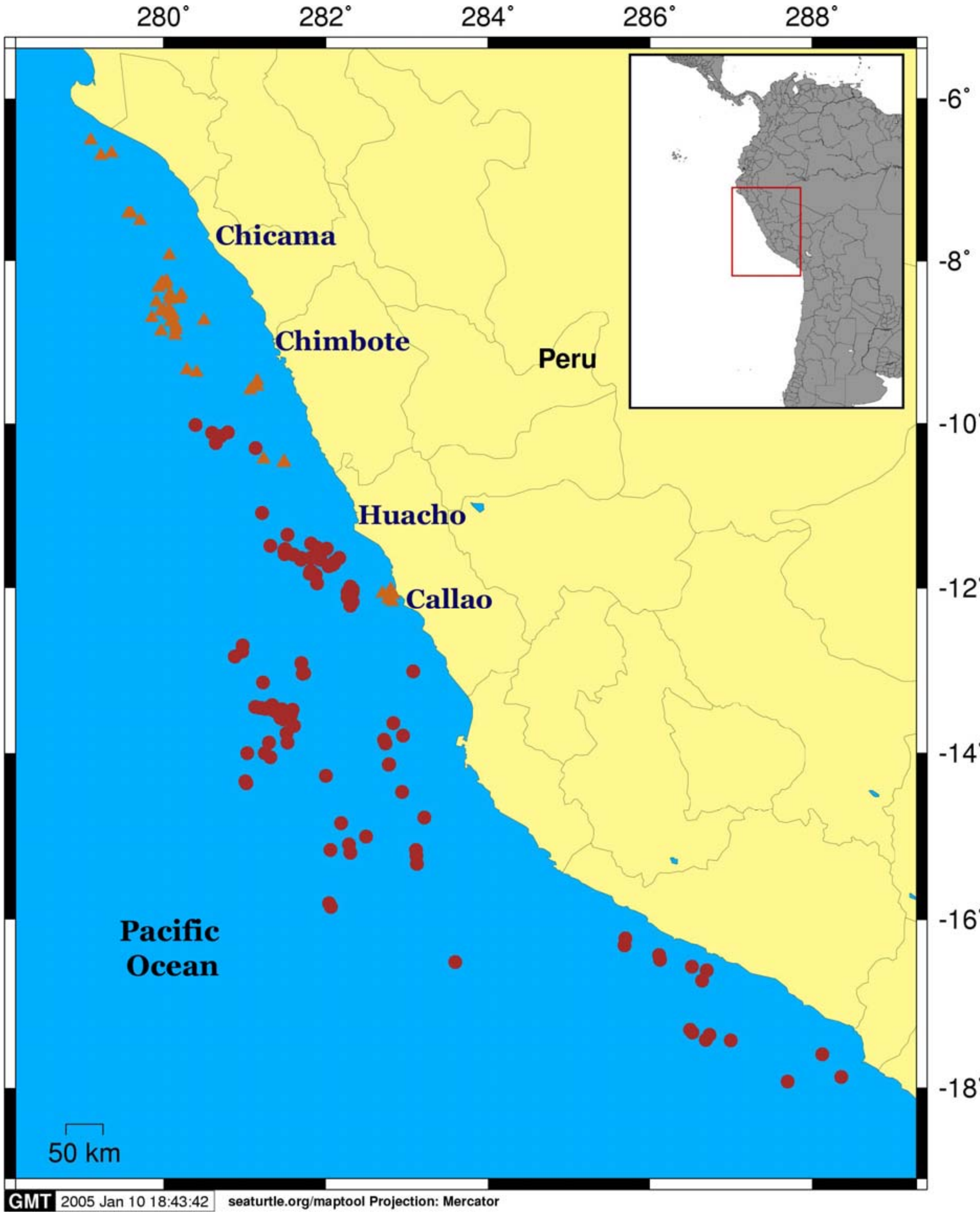
Of the 121 sea turtles captured during the longline sets, 23 turtles that got free when the gear was being hauled back and 1 turtle that could not be evaluated completely were all identified as hard-shelled sea turtles. Only 97 were evaluated completely, but the observers could not identify 6 individuals, just qualified them as hard-shelled sea turtles. The species frequencies of the 91 turtles identified is shown in the Figure 3. Green turtles (Picture 9) and loggerheads (Picture 7) were the two species more frequently captured (46.2% and 40.7% respectively). Olive ridleys (Picture 8) represented the 11% of the individuals captured and leatherback turtles were the less frequent accounting for only the 2.2% of the total (Picture 10).



Map 2: Map showing in green lines shark longline sets and in red lines dolphinfish longline sets observed during 2003, 2004 and 2005.



Map 3: Map showing the geographic position where each sea turtle was captured during the longline sets observed. Turtles species: Green ●, loggerhead ●, olive ridley ●, and ● leatherback.



Map 4: Map showing the geographic position of the purse seine sets observed. Orange triangles for inca scad and chub mackerel sets and red circles for Anchovy sets.

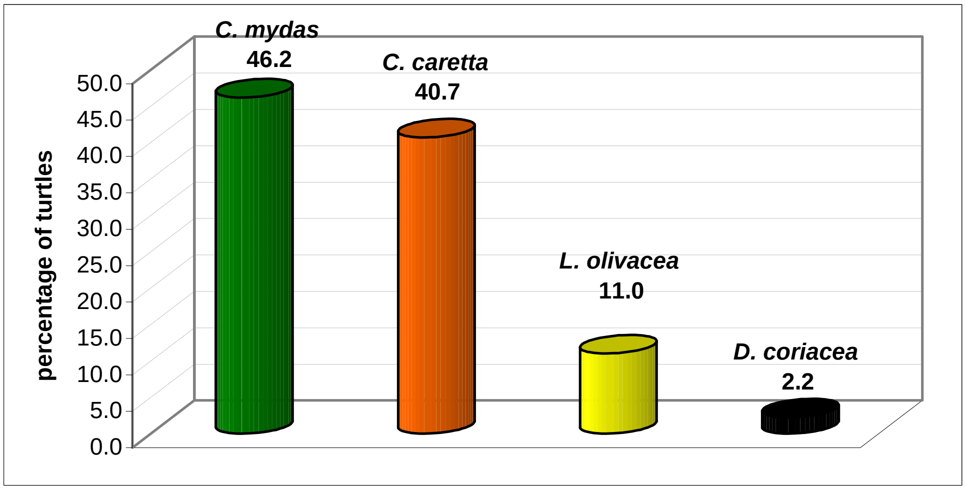
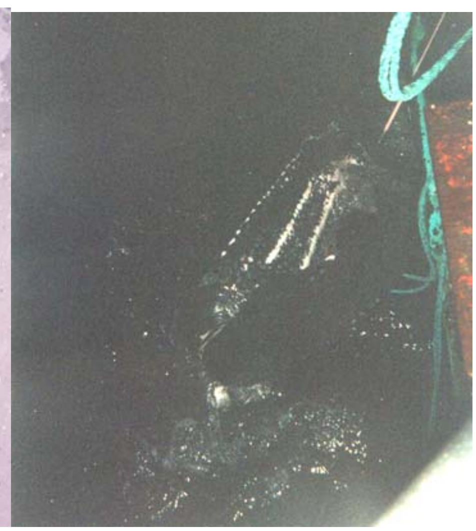


Figure 3: Percentage of sea turtle species captured during longline sets observed.

Picture 7: Loggerhead sea turtle catch

Picture 8: Olive ridley sea turtle catch

Picture 9: Green sea turtle catch



Picture 10: Leatherback sea turtle catch

The quantity of loggerhead sea turtles captured is surprising because the presence of this species in the Peruvian sea was not confirmed during the last 20 years (Hays-Brown & Brown 1982, Marquez 1990, Carrillo & Icochea 1995, Morales & Vargas 1996). What is more, the initial captures of loggerheads during this project and some findings of carapaces in fishermen villages in the Southern Peruvian Coast proved its presence (Kelez et al. 2003a). Only two Leatherback turtles had been captured at the end of the longline fishing activities evaluated during the project. This species is commonly captured in the longline gear in other areas of the Pacific (Balazs 1982, Frazier & Brito 1990, Nishemura & Nakahigashi 1990, Skillman & Balazs 1992). However, the Pacific populations of Leatherbacks are in a high decline (Spotila et al. 1996, Reina et al. 2002, Crouse 1997) and this low capture of leatherbacks captured during this research might be related to this reason.

7. Size distribution

Mean Curve Carapace Length from notch to tip (CCLn-t), size range, mean weight and weight range of the sea turtles captured are shown in the following comparative table (Table 6). Green turtles had the smaller mean size (54 cm, 26.1 kg), followed by the loggerheads (56.8 cm, 27.6 kg) while olive ridleys had the larger mean size (60.1 cm, 29.2 kg). In general, green turtles presented the wider size range (Figure 4) and the biggest and also the smallest individuals found belonged to this species. The majority of the individuals of the three sea turtles species were in the 50 to 59.9 length class (Figure 4). Leatherbacks were not brought on board of the vessels due to their large size but the on board observers estimated that one was about 130 cm and the other one was about 150 cm. (Both straight lengths from head to caudal projection).

Table 6: Size and weight means and ranges of the sea turtles captured.

	CCLn-t (cm)			Weight (kg)		
Species	n	mean	range	n	mean	range
Green	42	54	20.8-86	42	26.1	10-72
Loggerhead	37	56.8	41-70	36	27.6	12-48.6
Olive Ridley	9	60.1	55.2-69	9	29.2	22-39.6

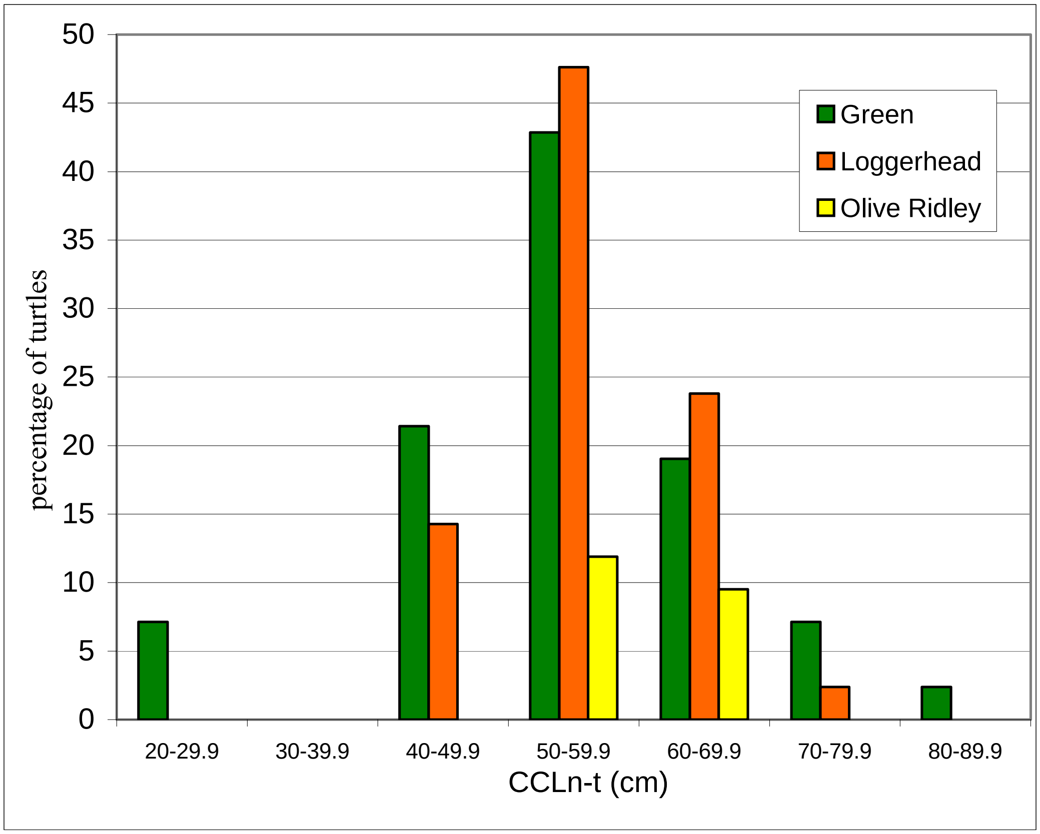


Figure 4: Number of individual per size range per species

The majority of the green turtles (95%) can be considered immature if their size is compared with the size of the females nesting in Galapagos, Ecuador (CCL mean: 80cm & range: 74 –100) from Marquez (1990). In the same way, greater part of them might be considered immature and only the 25% of them can be considered mature when comparing with data from nesting females in Michoacan, Mexico (CCL mean: 82 cm & range: 60 – 102) from Alvarado & Figueroa (1990) in National Marine Fisheries Service and U.S. Fish and Wildlife Service (1998a). It has to be notice that the sex of the individuals could not be determined, but it is likely that both sexes are being captured in the longline gear. Therefore, there might be more adults considering that the green turtles males mature at a smaller size than the females (Green 2000 & Figueroa 1989).

The medium size of the loggerhead sea turtles captured is 56.8 cm (CCLn-t). All these individuals can be considered juveniles or immatures because the worldwide carapace length of adult females is 90 – 95 cm. (Dodd 1988 *in* National Marine Fisheries Service and

U.S. Fish and Wildlife Service 1998b). Moreover, data from Queensland, Australia, the most likely rookery for the loggerhead individuals captured in Peru, show that adult females and males are bigger than 80 cm and 89 cm (CCL) respectively (Limpus 1985). Juvenile loggerheads are present also in the coast of Chile (Frazier & Salas 1982) so this species might be using Peruvian and Chilean seas as developmental areas, due to the fact that, in general, loggerheads recruit in the Australian feeding grounds at a CCL longer than 70 cm. (Limpus & Reimer 1992).

All the olive ridley sea turtles captured can be considered adults when comparing with the data from Guerrero, Michoacan since the smaller female nesting measured 52 cm (mean = 63.5, range = 52-73.5; Marquez *et al.* 1976). When comparing with data from Osa Peninsula, Costa Rica (Silverman 2003, unpublished report) where the mean CCL size is 67.9 cm and the range is between 57.3 and 74 cm 67% of the Olive ridley can be considered adults.

8. <u>Interaction with the longline gear</u>

According to our results, the majority of the sea turtles bit the hook (52%), 36% got hooked up in the mouth and 16% got hooked up in the esophagus (Figure 5). The rest of them got hooked up in the flippers (25%) or in the plastron (1%) and 25% got entangled with the gangions or the main line. However, the interaction between the longline gear and sea turtles seems to be different for each species. The majority of loggerhead sea turtle commonly bit the hook (67%), 37% of loggerheads got hook up in the mouth (tongue, superior or inferior jaw) and 30% got hooked up in the esophagus. Surprisingly, a half of the green turtles bit the hook as well, 48% of the individuals got hooked up in the mouth, 2% got hooked up in the esophagus. This was not expected due to it is known that green turtles do not use to bite the bait but are caught since they play with the gear.

The majority of the Olive ridleys got hooked up in the flipper (40%); but 10% got hooked up in the mouth and 20% got hooked up in the esophagus, so 30% of them did bit the hook. The other 30% got entangled with the gear. Regarding the two individuals of leatherback turtle, one of them was entangled with the main line of the gear by the flipper and the head and the other one got hooked up in the mouth (See Figure 5).

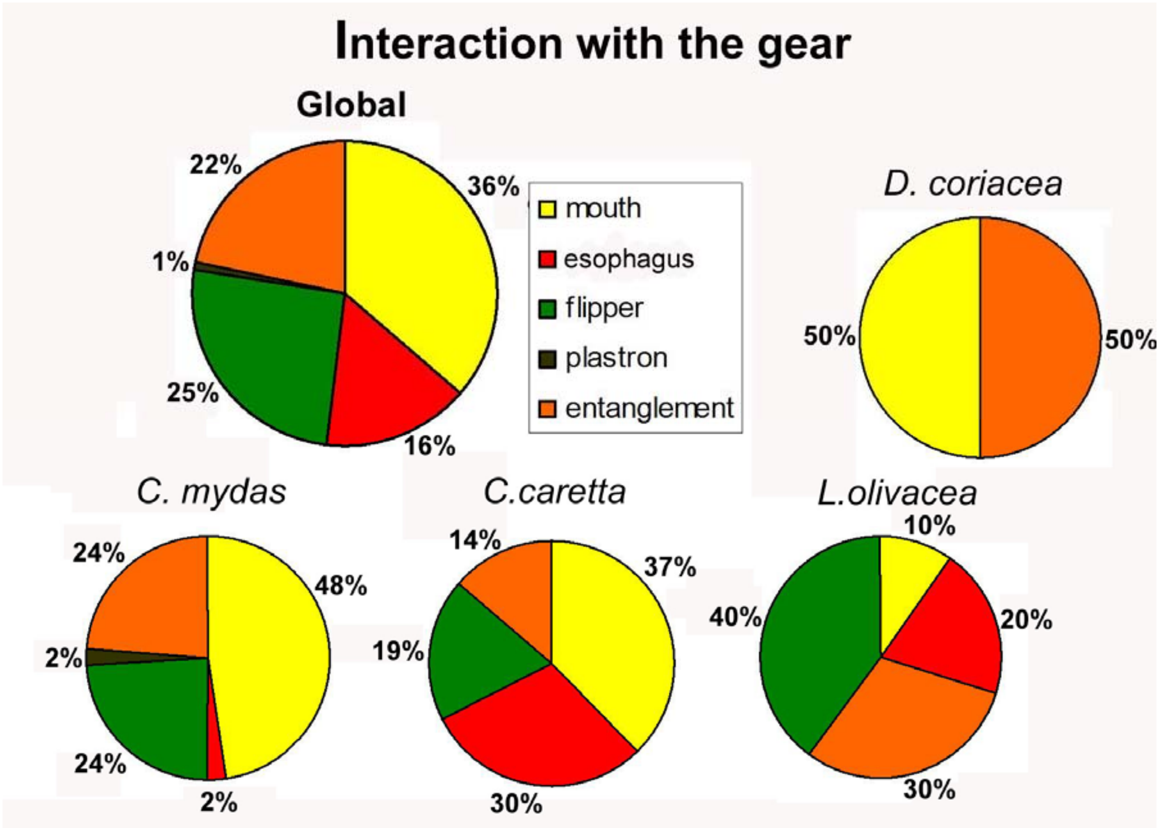


Figure 5: Sea turtles interaction with the longline gear. Green (***C. mydas***), Loggerhead (***C. caretta***), Olive ridley (***L. olivacea***).

9. <u>Involving the fishermen</u>

During the onboard observations, the project observers could notice that the fishermen crew of the vessels started to show interest in their work with the turtles, they showed interest in the tags applied to the sea turtles flippers, in all the body measures that the observer took and also the fishermen began to get excited when a sea turtle was captured and immediately called the observer. What is more, the fishermen started to telling the observers the quantities of sea turtles that they captured incidentally during the others fishing trips (without observer).

The fishermen had told the observers that sometimes they do kill the turtles for their meat but when the observers were onboard the vessels the fishermen never decide to kill a sea turtle. These statements could be showing that the fishermen are starting to change their consciousness about sea turtles. They use to look sea turtles as "fishes" that can be fished and consume but now they are seeing them as animals that are important and that need to be conserve. Without doubt we need to reinforce our public awareness regarding social issue as fishermen.

Public Awareness

Coastguard's Workshops

The 17th of May 2003 a workshop for the coastguard was conducted in the Peruvian Coastguard facilities at the Callao Port. Shaleyla Kelez, Ximena Velez-Zuazo and Ms. Sc. Carlos E. Diez dictated the workshop to twenty (20) coastguards of the Peruvian Navy. Each coastguard received a quick guide for identification of sea turtles species and a document, especially prepared for them, with information about APECO and the CMS sea turtle project, sea turtles general information, national and international legislation about sea turtles and a data sheet about each five sea turtles that occur in Peru (See Annex 2 and 10).

On the 16th of December 2004 a second workshop for the coastguard was conducted in the same facility mentioned above. Shaleyla Kelez dictated the workshop and 25 was the number of participants. The contents of the workshop where the same than the ones from the first workshop. All the participants were coastguards of the Peruvian Navy and each of them received the support material: stickers, posters, and diptychs.

Internet & other media

The information published in APECO's website generated the answer of different kind of people. A reporter from "Rumbos" magazine contacted and interviewed the Principal Investigators (PI's) about the project on the 11th of January 2004. The reporter published this information on "Rumbos News" through Internet. Later on, the producer of a local radio station (RPP, "Radio Programas del Peru") made contact with us in order to perform a live interview, which was conducted on February the 8th and lasted about 20 minutes. During the interview, the information transmitted was about sea turtles' life, threats and things that could be done to reduce the extinction risk that these species face.

Many people had written e-mails to the project e-mail address. In general they asked for more information about the project and about how they can help. Some others have offered themselves as volunteers to work in the project. That kind of response is the one desired and we hope that this interest will continue in time.

Fishermen's talks

The places where the talks were conducted, dates and amount of assistants are showed in Table 8. In Cancas, Paita and Talara the talks were performed right in the docks, almost the whole fishermen community was present, not only because of the talks but some were there just for curiosity. In Chimbote twenty people attended the talk conducted in the facilities of the IMARPE Coastal Laboratory. In Salaverry our talk was performed together with one about tsunamis so not only fishermen were present there but also other members of the community. In Supe Port around thirty people, fishermen and students were present in the talk that was conducted in the auditorium of the Fishermen Association. The port authority of Huacho helped us calling the fishermen: he shut the dock to make sure that the fishermen would come to the talk, so our auditory was full (See pictures 11 to 15).

Table 8: Places, dates and assistants to each public awareness talks conducted

Place (Department)	Date	Number of participants
Paita (Piura)	06/03/2004	80
Talara (Piura)	06/03/2004	20
Cancas (Piura)	06/04/2004	25
Salaverry (La Libertad)	06/05/2004	40
Huacho (Lima)	09/03/2004	80
Chimbote (Ancash)	09/10/2004	15
Supe (Lima)	09/11/2004	30

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During the presentations we talk about the biology and ecology of sea turtles, main threats in nesting beaches as well as in foraging habitats, the importance of fishermen cooperation to improve the conservation of these protected species and also we gave them mitigation measures to reduce the capture and the mortality of sea turtles. Some fishermen were interested about the mitigation measures specially the ones for the longline fishery. They asked about the dehooker devices and the circular hooks. We collected the contact information of some fishermen to be in touch with them in the future if the mitigation devices where available for them.

Picture 11: Huacho's Port Authority

Picture 12: Our poster pasted together with other conservation posters

Picture 13: Fishermen listening to the talk

Picture 14: Given the support materials

Picture 15: Expositor giving one of the talks

Fishermen’s major questions where about turtle nesting process: where they nest, how many eggs they lay, in how many days the eggs are developed, how are eggs incubated, does the mother take care of the eggs. Also they where very interested in all the threats that hatchlings face when they are emerging from the nest and crawling to the sea.

Most of the fishermen commented that they have eaten sea turtle meat. Also they mention that when they find a death turtle on the fishing gear they usually consume it but when the sea turtle is alive they send it back to the sea. They do not only consume the meat, but also blood, liver, heart and kidneys.

Some fishermen told us that when they were about to kill a turtle, this one starts crying when sees the knife. Fishermen think that sea turtles cry asking for merci, so moved for the tears fishermen have very often liberated the turtle. In general, we didn’t tell them that the tears where a mechanism to expulse salt because we did not want to destroy a believing that might benefit sea turtles survival.

<u>School’s talks</u>

Four school’s talks where performed during the project activities. These talks were conducted upon request of school’s teachers or principals. The Schools, places, dates and assistants to the talks can be seen in the Table 9

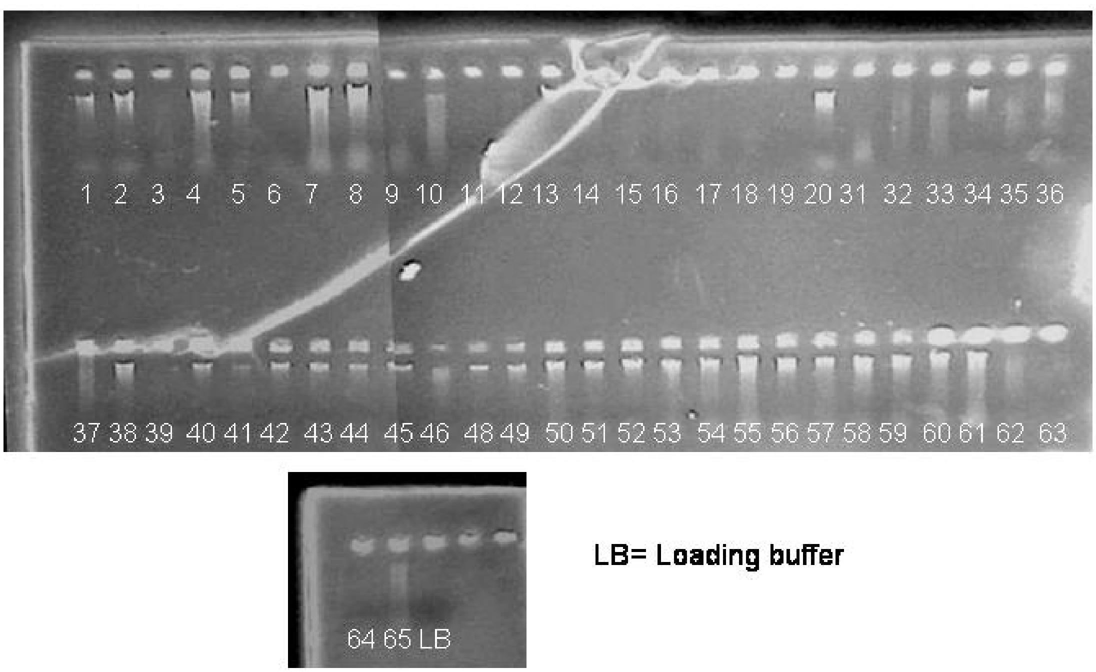
School	Location	Date	Number of students
Roosevelt	Lima	12/3/2004	32
Pierre Laplace	Pucusana	6/14/2005	50
Miguel Grau	Pucusana	6/16/2005	39
Miguel Grau	Pucusana	6/16/2005	30

Table 9: Place, date and assistants to the school's talks

The talks conducted in Pucusana Port were very important due to the fact that most of the student's parents were fishermen, so students will have the opportunity to share the information with their parents and make them aware of the sea turtles endangered situation.

Genetic analyses

The first isolation of genomic DNA was conducted following the protocol previously explained in the methods and run in a 0.8X electrophoresis gel (Figure 16). Most of the samples yielded a good amount of DNA which was used in the next step, while the samples that failed were discarded and storage for future analyses.



Picture 16: Genomic DNA isolation of sea turtles samples.

Dilutions of the genomic DNA were prepared to have a final yield of 50ul at a final concentration of 10ng/ul to proceed with the amplification. A polymerase chain reaction (PCR) amplification was conducted and a 1.5% agarose gel was prepared and run by electrophoresis to confirm amplification of the target fragment (~800bp) and to discard contamination of the PCR master mix (negative control).

A total of fifty four (54) samples (*Chelonia mydas*, n=28; *Lepidochelys olivacea*, n=6; *Caretta caretta*, n=20) were successfully amplified, sequenced and analyzed.
We sequenced a 740-bp fragment that spans most of the mitochondrial control region. This region spans the 380bp and 480bp segment traditionally sampled in regional population genetic analysis of sea turtles (but see Lopes-Castro *et al*. 2006, Velez-Zuazo *et al*. in prep.). In these fragments we observed two variable sites beyond the 380bp, however, for haplotype identification; we truncated the 740bp sequences to a 380bp fragment.

Overall, there were clear differences in the haplotype diversity observed in the three sea turtle species (table 10). In the green sea turtle group, 4 variable sites determined five haplotypes; three of them previously reported (CMP4, CMP17, CMP27) and two new haplotypes. We observe one haplotype in the 20 samples analyzed for the loggerhead sea turtle, and one haplotype for the olive ridleys (see figure 6).
Haplotype and nucleotide diversity were higher in the green turtles (h=0.28 ±0.09, π=0.08 ±0.09), compared to the olive ridley and loggerhead sea turtles.

Different origins are suggested for the turtles of the three species. For the green turtles, one of the haplotypes identified (CMP4) corresponded to a nesting rookery in the Pacific coast of Mexico (Chassin-Noria *et al*. 2004), while the other two haplotypes (CMP17 and CMP27) were observed during a study of the genetic structure of the green turtles in the Central and East Pacific (Dutton unpublished data). The olive ridleys exhibited also an haplotype reported in Mexico (Lopez-Castro et al. 2006). Distinctively, the loggerheads exhibited a haplotype reported only in the nesting rookeries of Australia (Bowen et al. 1995). The East Pacific coast has been previously recognized as a foraging area for loggerheads recruiting from rookeries in Japan and Australia (Bowen et al. 1995), however, there is a clear dominance of Japanese haplotypes in the northern coast of the East Pacific (Bowen *et al*. 1995) while juvenile loggerheads from Australian rookeries seems to dominate the foraging grounds in the southern coast of East Pacific (Chaloupka *et al*. 2004; see also Donoso *et al*., 2000).

This study is one of the few genetic studies that explored longer fragments of the control region of the mtDNA with the goal of increasing the resolution of each of the haplotypes. In the samples from green turtles we observed two variable sites beyond the 380bp, at position 627 and 629. As a result, the haplotype CMP4 was diversified in three different haplotypes. The potential of more resolution is the possibility to resolve overlapping compositions among rookeries which will increase the power to assign individuals to their original rookeries using a mixed stock analysis with a Bayesian approach (Pella and Masuda 2001)

Species	n	PS	Hp	*h*	π
Caretta caretta	20	-	1	-	-
Chelonia mydas agassizzi	28	6	5	0.28 ±0.09	0.08 ±0.09
Lepidochelis olivacea	6	-	1	-	-

Table 10. Measures of genetic diversity for three species of sea turtles incidentally capture during fishing activities. n=sample size, Ps= polymorphic sites, Hp=number of haplotypes, *h*=haplotype diversity, π=nucleotide diversity.

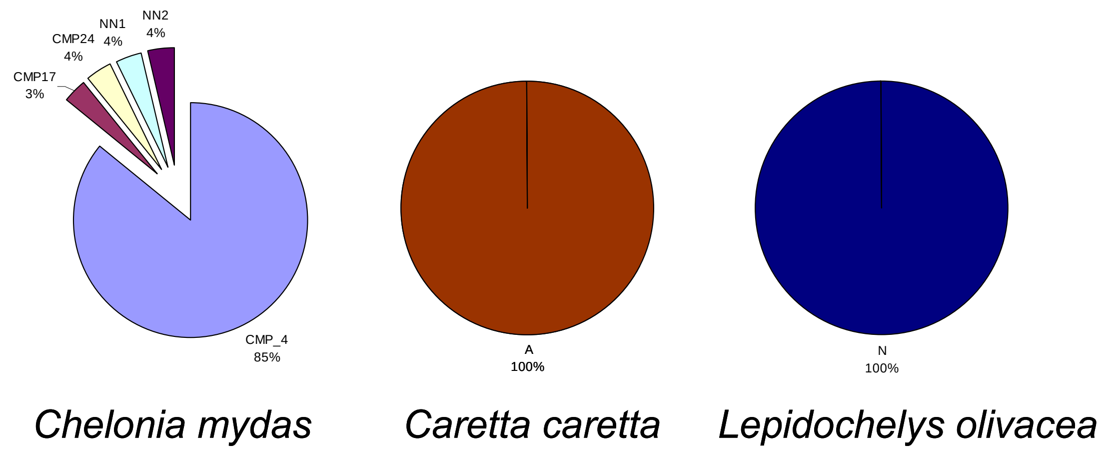


Figure 6. Haplotype composition *of Chelonia mydas, Caretta caretta and Lepidocheys olivacea* turtles bycatched during 2003-2005 fishing activities.

VI. Conclusions

- According to the project results there is no interaction between purse seine fishing activities and sea turtles in the area comprised between the parallels 6S and 18S. Although, fishermen say that a minimum interaction exist.
- Interaction between longline fishing activities and sea turtles do exist and its rate is 0.355 ± 0.209 sea turtles per 1000 hooks.
- In a global context, the bycatch rate of sea turtles during longline fishery in Peru is in a medium-low level, but is enough high to be comparable with longline fisheries in oceans near important sea turtles rookeries as Costa Rica and Australia.
- There is no statistical difference between the bycatch rate during shark fishery and the one during dolphinfish fishery.
- There was no mortality when the sea turtles were captured so all were liberated alive. However, the hook couldn't be removed from many turtles and that will caused negative effects to many individuals.
- It is important to mention that this 0% mortality occurred in vessels with observers, but the majority of longline fishermen do not have the patience and the tools to remove the

hook friendly and also there is a proportion of the fishermen that seems to keep some turtles for their meat.

- There was higher number of sea turtle incidental capture during February but the March was the month with the higher CPUE (1.242).
- Turtles are found in a great area. They were captured between the parallels 9°00'S. and 18°00'S. Greens were very well distributed in the whole area while loggerheads showed a southern distribution and olive ridleys a northern distribution.
- The species most frequently captured were greens (46.2%) and loggerheads (40.7%) whereas olive ridleys and leatherbacks just represented the11% and 2.2% respectively of the individuals captured.
- According to their size, all the olvive ridleys and the majority of green turtles captured might be mature individuals while all loggerheads might be juveniles or subadults. The presence of adults individuals highlight the implications of the bycatch due to the high reproductive values that these individuals have in their populations.
- In general, the majority of sea turtles captured bit the hook. In the species level, most loggerheads and a half of the greens bit the hook, most of olive ridleys got hooked in the flipper and leatherbacks got either entangled or hooked in the mouth. Due to this, loggerhead individuals are the most threaten by the longline fishery if the hooks can not be removed in a friendly way.
- The fishermen crew that interacted with the observers showed interest in sea turtles and it might be lead to a change of attitude towards these species. This kind of activities should continue if we want to reach the conservation of sea turtles species.
- The laboratory analysis of the genetic samples in a Peruvian laboratory is possible and had been a success until now. The mitochondrial DNA has been isolated from 75 skin samples so far
- Low number of haplotypes were observed for *C. caretta* (1 haplotype) and *Lepidochelys olivacea* (1 haplotypes).
- Haplotype A from the loggerhead sea turtle has been reported for the nesting populations of Australia, suggesting that loggerhead turtles by-catched in Peruvian waters are from that origin.

- Studies have reported, at least, 21 haplotypes for *C. m. agassizzi*. Our observation of 3 new haplotypes in just 36 individuals increases the already high diversity for this species.
- The observation of new haplotypes in one of the species analyzed and in such small samples could be an indication that alternate nesting stocks in the Pacific are contributing to the aggregations in the East Pacific.
- The new haplotype reported for *L. olivacea* did not exhibited the 7bp deletion, compared to the olive ridleys from the East Coast of India (Shanker et al. 2004) but is highly similar to the haplotypes reported as commons in the East Pacific (Bowen et al. 1998, Lopez-Castro and Rocha-Olivares 2005)
- This preliminary results confirms that sea turtles, incidentally capture along the Peruvian Sea, are from diverse nesting stocks in the Pacific Ocean and that any conservation initiative for the protection of sea turtles in the high seas needs to be regional effort.
- So far, the sea turtle information published on the website has generated interest, about its conservation, in many people.
- Some fishermen and the children who attend to the talks were interested in the conservation of the sea turtles, showing some concern with what could happen if these species go extinct.
- The success of conservation activities of species threatened, such sea turtles, by incidental capture is related to how well the biology of the species, the fisheries and its interaction is known.

VII. Project difficulties

- The unpredictability of the fishing activities due to the abundance or scarcity of the target species made very difficult the organization of the on-board observations. Due to this problem, the days and trips observed in each month are not uniform.
- Some of the longline vessels that were part of this project are the biggest ones in the Peruvian coast. However, during the longline fishing activities there was not enough space in the boat to evaluate comfortably the sea turtles captured.

- Due to a cultural believe, women can't get on-board the fishing vessels. The fishermen believe that it would bring bad luck for them and the fishing activity. Moreover, the size of the boat do not bring the minimum facilities to women for be on-board.
- Some sea turtles that were captured with the hook in their throat had to be released with those hooks because the observers didn't have the necessary tools to de-hook the turtle.
- Some sea turtles couldn't be brought on-board of the vessels because of their weight and the lack of appropriate tools to bring them on-board in a safe way. Therefore, fishermen just cut the gangion and those turtles did not were evaluated.
- During October 2003 we tried to start conversations with the Environmental authorities from some coastal Provinces in the northern Lima to coordinate sea turtles oral presentation in their coastal ports but they never showed interest in it.
- It was very difficult to coordinate the talks because fishermen were not willing to lose time in such activities because the subject did not appear to motivate them. Many times the turtle talks had to be given together with another activity that were of the interest of the fishermen.

VIII. Recommendations

- Due to the fact that in Peru there is no information about the incidental capture in longline fisheries from previous years, the information collected during this project would be a base line from which future projects should be implemented.
- The longline fishing activities should continue being monitored to obtain more information about seasonal and geographical bycatch rates for future management plans.
- It is necessary that each longline vessel have hook and line removers, hook cutters, line cutters, and also tools for lifting sea turtles in a friendly way.
- It is important to continue environmental education and divulging work not only with the fishermen but also with the children from the fishermen communities.
- There is a necessity for an implementation of mitigation campaigns to demonstrate fishermen the friendly ways to handle and liberating sea turtles in order to contribute to its post release survival.

IX. Acknowledgements

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XI. Annexes:

Annex 1: Manual for the on-board observers (in Spanish).

Annex 2: Quick sea turtle species identification guide (in Spanish).

Annex 3: INRENA's permit to conduct scientific research, out of natural protected areas, with *in-situ* temporal capture and tagging of sea turtles individuals along the Peruvian coast, 2002-2003.

Annex 4: INRENA's permit to conduct scientific research and collect skin samples from the sea turtles species present in the Peruvian sea, 2002-2003.

Annex 5: INRENA's permit to conduct scientific research, out of natural protected areas, with *in-situ* temporal capture and tagging of sea turtles individuals along the Peruvian coast, 2004-2005.

Annex 6: INRENA's permit to conduct scientific research and collect skin samples from the sea turtles species present in the Peruvian sea, 2004-2005.

Annex 7: Poster, Sticker and Diptych

Annex 8: Relation of fishing opening and closure decrees by the Fishery Vice-Ministry (in Spanish).

Annex 9: List of sea turtles tagged specifying tags applied, date of capture and carapace length.

Annex 10: Document prepared for the coastguards workshop (in Spanish).