



FIELD REPORT

Project Title: Tracking Baja's Black Sea Turtles

Principal Investigators: Dr. Volker Koch, Dr. W. J. Nichols, Dr. William Megill

Research Area: Laguna San Ignacio and near-shore Pacific, Baja California Sur, Mexico

Protected Area Status: Vizcaino Biosphere Reserve (UNESCO)

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Period Covered by This Report: May 2009 to Apr 16 2010

Report Completed by: Rianna Burnham, William Megill, Jesse Senko, Agnese Mancini

Dear Volunteers:

This document is intended to keep you up to date with the progress of our research at San Ignacio Lagoon, on how all the work has been collated, on the results we have extracted from it and on how we hope to build on it in the future. In 2009, our research took place over two research seasons, each about a month in duration: a spring session in June and an autumnal season in October-November. Week to week progress may have seemed a bit bumpy – indeed some might like to compare it to the road to the lagoon – but, thanks to the contributions of all of our volunteers, we triumphed in the end, and are working, now that we have returned from the field, on the processing and analysis of the mountain of data we were able to collect!

2009 saw continuation of projects on tracking black sea turtles (*Chelonia mydas*) in the lagoon and describing their feeding ecology within it. An exciting addition was ‘turtle-cam’ which, although in its infancy, has produced some stunning footage with the turtle as both the ‘star’ and director. We hope that in the 2010 seasons we will be able to build on this and develop the project further by optimising the housing design and data collection.

In June we captured and marked nineteen turtles in total, in collaboration with the Grupo Tortuguero de las Californias, a grass-roots organisation focused on sea turtle conservation throughout the Baja Peninsula. We tracked 4 turtles successfully within that month and attached the camera to two lucky ones! Although November saw only six turtles caught and tracked as part of the monitoring, there was no shortage of work as volunteers helped collect and sift through benthic samples to allow a comprehensive study of both bottom composition and benthic invertebrates present, as well as continuing to add data to our stable isotope study. Results from ongoing analysis will add to our previous findings of the two diet types of turtles, herbivore and omnivore, and allow us to make further conclusions within this study. We are moving towards a more encompassing, ecosystem-based protection policy for the lagoon based on the data. Finally we are able to report success of the work undertaken within the mortality study - evidence of deaths due to by-catch from the illegal guitar fishery from the 2008 season led to greater enforcement action by the authorities, and no dead turtles were found during the same period in 2009!

In addition to gaining insight into the projects we are working on, I’m sure many of you have had an eye-opening experience into life as a researcher in the field. Everyone involved in the projects would like to thank you all for your hard-work, motivation, and most of all your patience – for all the time we waited for the weather, tides, and turtles! The input from volunteers is invaluable – whether it be carrying turtles up the beach; tagging and launching them back into the water; beach-walking; combing the coast for oranges; listening for beeps while tracking; having binoculars at the ready looking for buoys; whittling balsa wood, or even being elbow deep in mud looking for benthic invertebrates. All of this simply wouldn’t have been possible without your help! Hopefully the importance of your efforts will be apparent in the rest of this document, and reports that follow in the future, where each of your data-points become integrated into a set of results that will go towards informing the conservation plans for the Black Sea Turtle in Baja California. Thanks also go to everyone who has joined us in the adventure over the last couple of years – you have all made a real contribution in shaping the future for the Black Sea turtle.

Thank you for your support of Earthwatch and its programmes, and we hope to see you in the field again some day.

All the best,
The Baja's Black Turtles Team (Rianna, Rob, Agnese, Clara, Volker, William & J)

SECTION ONE

Top Highlight from the Past Field Season

The biggest buzz this year has definitely come from the 'turtle-cam'! Although its results were not Hollywood material, we did get some footage from 2 black sea turtles (*Chelonia mydas*) and we have a lot to build on for future seasons. Following the beeps on the radio tags has a slightly different feel to it when you know it could produce a 'movie-night'! Recovering the camera from the turtle Triki did mean an afternoon of tracking, wading, and scrambling to find that the camera and its housing had been washed up onto the beach and become trapped under the rocks. Once retrieved we couldn't get back to our computers at camp quickly enough to download the results. There was an audible gasp from everyone when, for the first time, we saw the turtle swim up through the water column, brake the surface of the waters with his head, take a breath and then dive back to depths! Pretty cool stuff.

Another highlight is the demonstration that the work we are doing at the lagoon can make a difference, as shown by the significant drop in mortality in the lagoon with NO deaths found to be of un-natural causes throughout the year. It shows that the work of the last years' teams has heightened the attention of the authorities to the cause and made them take action.



Triki, the black sea turtle (*Chelonia mydas*), outfitted with the TurtleCam Mk1. (The duct tape was removed before "launch"). (c) Robert Templeton

Non-technical Overview of Results

Our twin goals are to contribute towards the on-going monitoring of black sea turtles (*Chelonia mydas*) being conducted by Grupo Tortuguero, and to develop an understanding of turtle behaviour within the lagoon. Over the spring and autumn season we were able to follow the movements of nine turtles, creating a unique track for each. These tracks have shown the turtles moving throughout the lagoon and their ability to travel great distances in relatively short periods of time.

Now that we have returned from the field, the data is being further analysed to distinguish the movements of each individual turtle in greater detail. The use of smaller Global Positioning System (GPS) units used in November proved better in the field and more reliable than those used previously, but has left us sifting through a lot of 'noise' to distinguish the true route of the turtle after release. In the coming seasons, we hope to continue to move towards optimal design, both experimentally and mechanically, to further this data and its usefulness.

Although the orange throwing seemed like a bizarre experiment, the data gained, as well as other work conducted by Agnese and Volker, has significantly reduced the number of mortalities of the turtles within the lagoon, especially those due to the illegal guitar fishery. Three lots of oranges were deployed (once in June with one hundred oranges; once in October with 50 oranges and once in November with 50 oranges), each with their own identification number so that the data could be used to establish tide and current movement within the lagoon. This was done to try and establish the site of turtle mortality from stranding location, as well as the likelihood of stranding, previously calculated to be sixteen percent. After release, a period of twenty-four hours was allowed before starting daily beach walks of at least 10km for at least 4 days out of 7.



Volunteers help Dr. Agnese Mancini (bottom) measure the carapace length of a black sea turtle (*Chelonia mydas*).

The benthic sampling conducted in the autumn season generated samples from thirty-five sites throughout the lagoon. The work done in the field has made it possible to map the topography and substrate composition of the bottom of the lagoon, showing distinct regions within the lagoon (including a lot of regions composed of mud!), thanks to the use of the ponar grab and the underwater WANDA camera. The more in-depth analysis of each site sample is still ongoing, as is the work on the stable isotope analysis. This latter part of the project will mean making comparisons of the elemental composition of food sources in the lagoon (namely eelgrass and invertebrates) to skin and barnacle samples taken from turtles caught as part of the monitoring programme within the lagoon. We expect that the results will corroborate past findings with evidence of there being two distinct diet patterns of turtles within the lagoon, and possibly allow us to identify a factor that would indicate why an individual would follow one feeding regime over the other. Previous results have shown that feeding regime may not be as simple as being dictated by the maturity of the turtle sampled. The working hypothesis, based on other people's work, is that turtles 'shift' diet as they mature into adulthood. As we work through the 2009 data, we hope to be able to confirm or challenge this idea, so that we can make more accurate deductions about the feeding ecology of the turtles within the lagoon.

Acknowledgements

Thanks to everyone that made us feel welcome at the lagoon and made working there possible – to Rana and Sabrina at Pachico's camp in June for hosting us at a very busy time, and to everyone from Ecoturismo Kuyima who helped in just making everything run! Special thanks to Emidgio for all the help and, more than anything, the smiles, cheekiness and entertainment! Huge appreciation to Ranulfo and Pedro, for their time, knowledge and patience that allowed us to conduct our research and finally to all the Earthwatch volunteers who joined us in the field, without whom none of this would be possible.

SECTION TWO: TECHNICAL RESULTS

1. REPORTING ON RESEARCH OBJECTIVES

Objective 1

Quantify the autumnal abundance of black sea turtles (*Chelonia mydas*) in and around San Ignacio Lagoon.

Progress towards/against Objective

This objective has been extended with both spring and autumn seasons running during 2009, allowing us to explore the character of the lagoon throughout the year. We aimed, in both seasons, to contribute to the ongoing monitoring conducted under the leadership of Grupo Tortuguero, and to become one of the many institutions working in collaboration to achieve protection for the Black Sea Turtle in Baja California.

As part of the monitoring programme, black sea turtles caught were tagged with unique flipper tags for identification. Measurements of their size and weight (Table 1) were made and submitted to a central database. Skin samples were taken for both genetic and stable isotope analysis, with the genetic work conducted as part of collaboration with researchers at the Universidad Autonoma de Baja California (UABC). During November, epizootic barnacles were collected when possible to determine elemental composition as part of the feeding ecology study. In total we caught twenty-five turtles during our time at the lagoon in 2009 (nineteen in June and six in October/November), and conducted one autopsy in the field during the autumn season. None of the turtles were recaptures from past monitoring sessions. Volunteers participated in both daily netting and 24 hour monitoring.

Turtle ID-ID#LSI	Turtle Name	Date Captured	Capture Location	Carapace Length (cm)	Weight (kg)
01	Myrtle	1 June 09	Surgidero	63.3	31.8
02	Tennessee	1 June 09	Surgidero	61	29.4
03	Leroy	1 June 09	Surgidero	76.2	55.4
01	Obama	2 June 09	La Piedrita	64.4	39.1
01	Fuentes	5 June 09	La Piedrita	66.9	38.4
02	Beau noir	5 June 09	La Piedrita	70.7	53
03	Tolstoy	5 June 09	La Piedrita	84	75.7
01	Triki	9 June 09	La Piedrita	55	26.1
02	Trakes	9 June 09	La Piedrita	57	23.4
01	Da Vinci	11 June 09	El Cantil	46.4	13.6
02	Lenon	11 June 09	El Cantil	51.5	18.2
01	Robi	13 June 09	Las Barrakitas	75.4	57.3
02	Melone	13 June 09	Las Barrakitas	67.1	37.3
01	Muddy Girl	15 June 09	El Romate	55.6	23.9
02	La Chupitos	16 June 09	El Romate	55.6	30.4
03	Mamma Mia	16 June 09	El Romate	57.2	23.2
04	Faviruchi	16 June 09	El Romate	48.4	14.6
05	Sneha	16 June 09	El Romate	44.6	12.9
06	Rafa	16 June 09	El Romate	53.4	17.2
01	Cybil	25 Oct 09	La Pocita	73.2	54.8
02	Basil	25 Oct 09	La Pocita	75.8	59.5
03	Yarrow	26 Oct 09	La Pocita	50.5	15.6
04	Cassidy	26 Oct 09	La Pocita	54.6	19.9
01	Clarita	9 Nov 09	El Surgidero	44.1	11
02	Kraig	9 Nov 09	El Surgidero	46.9	12.1

Table 1: Data from all black sea turtles (*Chelonia mydas*) caught and tagged during the spring and autumn seasons.

Objective 2

Determine habitat utilisation patterns of black sea turtles (*Chelonia mydas*)

Progress towards/against Objective

We are finding that the black sea turtles (*Chelonia mydas*) make selective use of the different parts of the lagoon. The lagoon is primarily a nursery and feeding area (Nichols 2003), although determining prey sources is an ongoing project. By combining results from the tracking and benthic sampling projects we are beginning to determine where turtles reside within the lagoon, what they are doing there, and quantify the importance of each of these areas to further inform conservation knowledge. The addition of the 'turtle-cam' is greatly extending our capability in this area, as there will be more direct correlation between location and usage with less inference from the researchers.

The first aim within this objective was to track black sea turtles with a surface tethered VHF/GPS buoy. For June, a set of tags, the 'barges', were built from balsa wood and sealed with a waterproof resin. The Very High Frequency (VHF) transmitters were encased within these tags completely and made watertight by being dipped in a plasticising solution before use in the field. The 'turtle-cam' was made with a similar design and housed a 'Hero Surf Cam' underwater camera. The 'barges' were plagued with electronic failures, and so for the autumn season a new set of smaller GPS tracking devices were acquired and a remodelling of the tags commenced. These 'canoes' were also carved from balsa wood and sprayed with a resin to make them water tight. The GPS units were made waterproof using rubber balloons. The reduced size of the GPS units and batteries needed for operation meant the tags themselves became smaller and more streamlined. Volunteers become involved in making further tags to house the GPS and VHF units in the latter weeks of the autumn season and these are expected to be used, at least initially, for 2010 seasons. The technical difficulties in June meant we only were able to track four turtles successfully. The tracks downloaded from the GPS units used in the autumn have a lot of background noise that had to be filtered before we were able to conduct further analysis. Turtles were trapped at various locations within the lagoon, taken to a landing sight close to the netting position, either camp or an island within the lagoon to be tagged, measured and fitted with the tags and/or camera, and then either released from the beach or in their capture location once the net had been brought in. Data obtained is being analysed using Google maps and GPS software to be able to superimpose a line of movement of each of the turtles after release onto a map of the lagoon. This gives a temporal and spatial depiction of the data rather than a list of coordinates.



Volunteers processing an eelgrass sample in San Ignacio Lagoon, spring 2009.

Two distinct patterns of behaviour have been found: some turtles exhibited roundabout movements with high fidelity to their capture-release location while others exhibited meandering movements with no fidelity at all to their capture-release location. This may be explained by the apparent diet split we reported last year from our stable isotope analysis, namely that some turtles appear to be requisite eelgrass feeders, while others display a more diverse diet. Turtles spent most (59%) of their tracking duration in the 0 to 5 meter (m) depth class, followed by the 5 – 10 m depth class (34%) and the 10+ m depth class (7%), with 69% of their tracking duration occurring over areas of seagrass. When we examined habitat selection by comparing the proportion of each habitat used to the proportion of each habitat available, the Ivlev's Electivity index suggested positive selection for areas of seagrass and moderate water depth (5 to 10 m), neutral selection for shallow water (0 to 5 m) and avoidance of deep water (10+ m). Turtles showed stronger selection for shallow water at night, stronger selection for moderate water during the day, stronger avoidance for deep water at night, and slightly stronger selection for areas of seagrass during the day.

Work from this and previous seasons has shown that turtles move throughout the whole lagoon, and can do this in short time periods. It has therefore been shown that it is important to extend our conservation efforts to the entire coastal ecosystem, rather than focusing on a few locations within the lagoon.

The turtle-cam has, so far, displayed limited success, but throughout the seasons the design has been revised to perfect weighting and attachment of the equipment to the turtles' carapace, as well as the data collected by a device with limited storage capacity. The initial camera was thought to be slightly positively buoyant which may have induced a greater amount of breathing behaviour. The footage lacked any feeding behaviour from the period it recorded. It was hoped

that this problem could be overcome by the use of a counter-weighted camera in November, but this resulted in the camera not being recovered. A new highly buoyant camera with a spring loaded separating counterweight design is under development to overcome the problems experienced so far. The recording schedule trialled so far has been two minutes recorded every twenty minutes. We will be looking to develop a schedule for 2010 that allows the study of the turtles' recovery from the trapping and tagging, and then their natural behaviour, which will hopefully capture, amongst other things, feeding behaviours.

Objective 3

Measure and map benthic biodiversity throughout the lagoon and near-shore Pacific.

Progress towards/against Objective

There are two parts to our benthic research. The first was to continue the work which began during the Grey Whale Migrations project which was to map the lagoon, its bottom composition and describe species assemblages in detail. Benthic biodiversity work within the lagoon and our findings so far was reported by Kurth et al. (2008). We have not specifically focused on this aspect of the research during the current reporting period. The second was to further investigate the stable isotope link between turtle predator and eelgrass/invertebrate prey. This is detailed in Objective 5 below.

Objective 4

Determine black sea turtle (*Chelonia mydas*) mortality rates and causes of mortality in the San Ignacio area.

Progress towards/against Objective

The work undertaken in the 2008 season, and previous work (Mancini & Koch 2009), has really brought the attention of the authorities to the mortality problem, predominantly caused by the illegal guitar fishery during the spring. As a result, the lagoon and the activities within it, have been policed more heavily with regular patrols during the summer and there were no recorded gillnets during June. Of the two black sea turtle mortalities recorded during the year, a volunteer team was present for an autopsy of one in November, with the turtle found to have died of natural causes, with no evidence of net trauma. Despite this success, we continued to work on the tides and currents within the lagoon to allow us to determine if the organisms found stranded on the beaches are a true reflection of the number of turtles killed. Beach walks of ten kilometres or more were undertaken frequently by the teams; islands within the lagoon were also surveyed. Marked drift indicators (oranges) were used three times within the two seasons to track tidal and current movements. This has allowed further data to be added to an existing study and hopefully will lead to a more realistic depiction of mortalities and strandings.

Objective 5

Determining the diet of black sea turtles (*Chelonia mydas*) in San Ignacio Lagoon.

Progress towards/against Objective

Samples of the benthos were taken to investigate the invertebrates present, which Lewis (2009) suggested may represent prey species for the black sea turtle within the San Ignacio Lagoon. Samples from eelgrass beds throughout the lagoon were also taken. From each turtle caught as part of the monitoring programme a skin sample was taken and as well barnacle samples if the opportunity arose. There were slight modifications to the methodology used previously due to the limitations of working with the conditions in the field, but we still hope that the data can be incorporated with that collected in previous seasons. From these samples the elemental composition, specifically carbon and nitrogen, will be compared and these results used to make conclusions on the feeding behaviour of the turtles. Samples collected in November are currently being stored in Ensenada, and stable isotope analysis will be conducted following the 2010 spring season when a sufficient number of samples have accumulated. Previous research has shown that the turtles display two distinct diet types, herbivorous eelgrass eaters and those that exploit both eelgrass and invertebrates in a more omnivorous diet. It remains unclear what determines the diet an individual will follow, after samples taken last year showed that turtle diet was not based on the maturity of the individual which, up until that point, was the accepted school of thought.

Objective 6

Create GIS model of turtle movements within San Ignacio Lagoon.

Progress towards/against Objective

Knowledge of the San Ignacio Lagoon, bottom composition and topography has been built upon, especially as a result of the benthic sampling in the autumn season. The first GIS results are now appearing on-line, with black sea turtle tracks plotted on a map of the lagoon.

Software such as ArcGIS was used to convert and refine data, with the distance-moved and area-occupied calculated. The tracks, analysed by Senko (2009), suggest that the turtles within the lagoon demonstrate complex and variable spatial use, traverse multiple habitats and move relatively large distances, all over short temporal durations. This has led to suggestions that future conservation strategies should aim to encompass the entire lagoon rather than purely focusing on foraging areas.

Objective 7

Development of "turtle-watching" as an alternative economic activity.

Progress towards/against Objective

Ecotourism at the San Ignacio Lagoon is thriving during the whale watching season, and popularity of the black sea turtle projects has increased, with two seasons run in 2009. Travel to Mexico however has been hampered by occasional bad press generated by politics and the drug trade, especially in the Tijuana area. More predominantly in the last year, swine flu had an obvious effect on project attendance.

There is huge support from local ecotourism operators and residents in the local village to the project, and discussions on how to expand the project are ongoing. There will be a trial of the possible extension of the project to bigger groups. Also, further programmes will be conducted

on a student group in spring 2010, conducted by a local guide and Grupo Tortuguero member as part of his monthly 24 hour monitoring.

Objective 8

Contribution to information at interpretation centers

Progress towards/against Objective

Posters of work being conducted and their findings will be displayed in the future within the Palapa (common area) of the camp owned by Ectourismo Kuyima. The first posters will depict work carried out as part of a masters programme completed by J. Senko on the GPS tracking of black sea turtles within the San Ignacio Lagoon, as well as the ongoing tracking, mortality and feeding ecology projects. Additional copies of the posters will be made available to the other whale-watching camps later in the year.

2. PARTNERSHIPS

The collaborations with colleagues, Dr. Sharon Herzka at the Centro Interdisciplinario de Ciencias y de Educacion Superior de Ensenada (CICESE) and Jose Cariquirri at the Universidad Autonoma de Baja California, both in Ensenada, Mexico, will be instrumental in completing the stable isotope analysis work. Clara Soriano has joined the project from the Universidad Nacional Autonoma de Mexico (UNAM) in Mexico City to work on the biological side of the 3D tracking project. We are continuing to build our relationship with the Grupo Tortuguero de las Californias, and with the Laguna San Ignacio Wetlands Ecosystem Science Project. Finally, our partnerships with Ecoturismo Kuyima and Pacheco's Ecotours make the logistical side of all of this possible. Further, it is through their directors and employees that we are making our connections with the local community.

3. PROJECT DEVELOPMENT

3.1. Removed or Modified Objectives

The scope of objective 1 has extended to encompass both the spring and autumn season. The short field seasons limit the extent to which we are able to gain a comprehensive picture of ecology of the San Ignacio Lagoon, with the data we collect being more of a 'snap-shot'. Having said that, it is hoped that the collaborations made with other Mexican universities and institutions such as Grupo Tortuguero, as well as a research team spending more time in the field maximising time and tides, will allow the work conducted to make contributions to long-term and systematically conducted studies within the lagoon and monitoring of the black sea turtle throughout the year.

The tracking of the turtles within the lagoon has been extended with the addition of 'turtle-cam', and we hope to work through the challenges experienced by this project in 2009 to be able to gain more detailed information on behaviour in future seasons. Work has been started well in advance of the 2010 summer season to optimise equipment, building on last year's experiences

and the data that can be gained. The addition of a new partner, the Italian Institute of Technology, will ensure that the electronics we field are adequate and reliable.

Throughout all projects, the limitations imposed by working in an environment such as the lagoon have to be remembered when designing and conducting studies. This was particularly prevalent in the benthic investigation, where the drying and storage of samples was a challenge. Last year's methodology has been adapted to find a more successful alternative.

We have had to scale back the scope of Objective 3, to map the biodiversity of the lagoon. Identification of individual species is a specialist task, and beyond the ability of our current staff to complete. Once we have managed to recruit a new staff member to replace Svenja Kurth, we will refocus the objective back on species biodiversity. In the meantime, we intend to focus our intention in this area at the sort of scale which matters to the turtles, so that we can more usefully provide a context for the exciting stable isotope results.

3.2. New Objectives

N/A

4. DISSEMINATION

Printed:

Mancini, A., & Koch, V. (2009) Endangered species or local delicacy? Sea turtle consumption and black market trade in Baja California Sur, Mexico. *Endangered Species Research* 7:1-10.

Senko, J., Koch, V., Megill, W.M., Carthy, R.R., Templeton, R.P., & Nichols, W.J. (in review) Fine scale movements and habitat use of East Pacific green turtles at a shallow coastal lagoon in Baja California Sur, Mexico. *Journal of Experimental Marine Biology and Ecology*.

Senko, J., Lopez-Castro, M.C., Koch, V., & Nichols, W.J. (2010) Immature East Pacific Green Turtles (*Chelonia mydas*) use multiple foraging areas off the Pacific Coast of Baja California Sur, Mexico: First evidence from mark-recapture data. *Pacific Science* 64(1): 125-130.

Reports

Megill, W.M., Koch, V., Templeton, R.P., Mancini, A., Lewis, A.J., Burnham, R.E., & Mayoral, R. (2009) Preliminary report on black sea turtle research activities undertaken by the UABCS/UBath/Earhtwatch team at Laguna San Ignacio, BCS, Mexico, in June 2009. *Report prepared for the Laguna San Ignacio Ecosystem Science Project*.
<http://www.sanignacioecosystem.org>.

Dissertations

Senko, J. (2009) Fine scale diel movements, activity ranges and habitat use of east Pacific green turtles in San Ignacio Lagoon, BCS, Mexico. MSc thesis, *Dept of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL, USA*.

Conference proceedings

Koch, V., & Mancini, A. (2009) Does by catch mortality from artisanal gill-net fisheries present a major threat to endangered sea turtles? *A case study from Northwest Mexico. Galapagos Science Symposium, 20th-24th July, Puerto Ayora, Santa Cruz, Ecuador.*

Senko, J., Carthy, R., Koch, V., Megill, W. M., Templeton, R. P., & Nichols, W. J. (2009) Fine scale diel movement and activity ranges of east Pacific green turtles at a coastal foraging area in Baja California Sur, Mexico. Poster presented to the *2009 International Sea Turtle Symposium, Brisbane, Australia.*

Senko, J., Koch, V., Megill, W. M., Templeton, R. P., Mayoral, R., Carthy, R., Nickerson, M., & Nichols, W. J. (2008) Fine scale movement patterns of immature black turtles, *Chelonia mydas*, at a coastal foraging area in BCS, Mexico: Preliminary results. *2008 International Sea Turtle Symposium, Loreto, BCS, Mexico.*

Visual:

Two laminated posters explaining the importance of turtle biology were prepared and printed, and will be displayed at the main ecotourism palapas at Kuyima & Kuyimita in Laguna San Ignacio starting in May 2010. Additional copies will be printed and shipped to the other whale-watching operators around the lagoon.

Meetings and conferences:

Our staff attended the 2010 annual meeting of the Grupo Tortuguero, held in Loreto, Baja California Sur (BCS), Mexico, in January 2010.

5. CAPACITY DEVELOPMENT AND EDUCATION

All of the team members, both crew members and Earthwatch volunteers, have enhanced their ecological knowledge especially with regards to work in the field and developed team skills to achieve a common goal as a result of participating in this project. Local community members are continually involved with the project and show high levels of interest in the work being conducted, with many expressing a desire to learn more about their local environment. Many realise the potential of the project and want to be a part of the conservation efforts.

It is especially important that we work with young local people as part of the work we are doing at the San Ignacio Lagoon, and tentative plans are being discussed for an education programme where local school children will be able to join the field team and live and work as 'marine biologists' at the lagoon. Trials of university and college groups joining 24 hour monitoring sessions are due in spring 2010.

We make good use of local businesses and services, notably Ecoturismo Kuyima which employs fishermen from the local village as 'on-the-water' guides, and support local craftspeople.

6.1. CONTRIBUTIONS TO INTERNATIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

The black sea turtle (*Chelonia mydas*) is endemic only to Mexico, and so our efforts are consequently primarily focused on national and regional efforts. However, the conservation questions we are asking about the black sea turtle in Mexico are equally relevant to green sea turtles (*Chelonia mydas*), and indeed to sea turtles generally in the rest of the world. It is our hope that our results, communicated through scientific literature and the International Sea Turtle Society, will be incorporated into management plans in relevant locations around the world.

6.2. CONTRIBUTIONS TO LOCAL, NATIONAL AND REGIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

Our turtle capture data has been contributed to the Mexican national and regional authorities, including the Vizcaino Reserve and the Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT), the environmental and natural resource department responsible for implementing the management plans. We have supplemented the monitoring data by members of Grupo Tortuguero so that local management plans can be made in a more informed way, and most importantly, so that the local community has developed a sense of ownership of the recovery plan.

The most significant contribution we have made here is the complete disappearance of a by catch in the 2009 summer season, due to enhanced enforcement by the authorities, which came as a direct result of our work in the 2008 season.

7. ACTIONS OR ACTIVITIES THAT ENHANCE NATURAL AND SOCIAL CAPITAL

Species management: results feed into a database formed as part of a collaboration between our team, Grupo Tortuguero and the Mexican authorities to enhance the protection of black sea turtles (*Chelonia mydas*).

Education and awareness: conservation issues concerning the black sea turtle are continually being brought to the foreground, with its protection now being seen as valuable, both financially and as part of an ecosystem effort in the Biosphere Reserve. Social capital within the region may increase due to increasing interest in turtle ecotourism, as well as by local people and businesses being able to benefit from the added finance brought to the village by tourists.

Livelihood incentives: The livelihood of several of the local community members has been transformed, from fisherman to local experts and guides. There is also a local cooperative that makes whale, and now turtle-themed art work, craft pieces, and jewellery that are made available to the Earthwatch volunteers and other visitors to the lagoon. This highlights the importance of the turtles there to people who otherwise associate the lagoon only with the whales.

All the information gained as part of the project makes a contribution to the conservation efforts both for the black sea turtle and San Ignacio lagoon, helping to inform actions to be taken in the future. We hope that the Earthwatch volunteers take the knowledge they have acquired with them and spread the message to friends, family, and peers.

8. LONG TERM IMPACT OF PROJECT

Taxa of conservation significance enhanced, restored or maintained

Black sea turtles (*Chelonia mydas*) are listed as endangered on the IUCN Global Red List. They are the only Pacific turtle with both major feeding and breeding areas in Mexico; concerns exist over their welfare and conservation management. Numbers have declined precipitously in the last thirty years due to harvesting for human consumption and by-catch.

Black sea turtles are sub-tropical, near coastal animals with intricate movements and migratory behaviours. They have been frequently observed within the San Ignacio Lagoon and have been the research subject of a locally run organisation, Grupo Tortuguero for a decade with contributions by the Earthwatch project.

Our efforts to census the turtles in San Ignacio Lagoon are contributing to the overall population data for this species.

Most significantly this year, however, is the disappearance of by-catch thanks to enforcement efforts by the local authorities which were put in place as a direct result of our work in the previous year. Several hundred turtles were spared last year thanks to these efforts.

Habitats enhanced, restored or maintained

With the topographical mapping of the San Ignacio Lagoon, the importance of the different areas within the lagoon, especially the eelgrass beds can be realised and action can be taken in the future to protect them.

Ecosystem services enhanced, restored or maintained

Our main enhancement of ecosystem services is the development of turtle ecotourism. Where there has been successful development in businesses for the whale-watching season over the winter period, there are now plans to develop the work with turtles outside of this time so this cultural aspect can flourish throughout the year. This will enhance the protection of the San Ignacio Lagoon as well as the livelihood for the locals.

Cultural heritage enhanced, restored, or maintained

Although we aim not to have any effect, especially detrimental, culturally on the locals of the area, having them involved in the project and becoming aware of the issues surrounding the black sea turtle (*Chelonia mydas*) has led to them lending support to our research work, and a move away from older traditions such as hunting turtles for meat. We hope that opportunities to continue this sort of relationship, where we can learn from each other, will continue to arise.

Livelihoods enhanced, restored or maintained

Several locals are employed throughout the duration of the seasons, with local services utilised regularly, including those of Ecotourismo Kuyima and Pacheco's Ecotours. Arts and crafts products of cooperative sellers within the village are made available to Earthwatch volunteers.

Appendix 1- PHOTOS



The 2009 "Dream Team," before the mud, sand, and turtles! (c) Agnese Mancini



Volunteer listens for the bleeping turtle while radio tracking black sea turtles (*Chelonia mydas*) in San Ignacio Lagoon, Mexico.