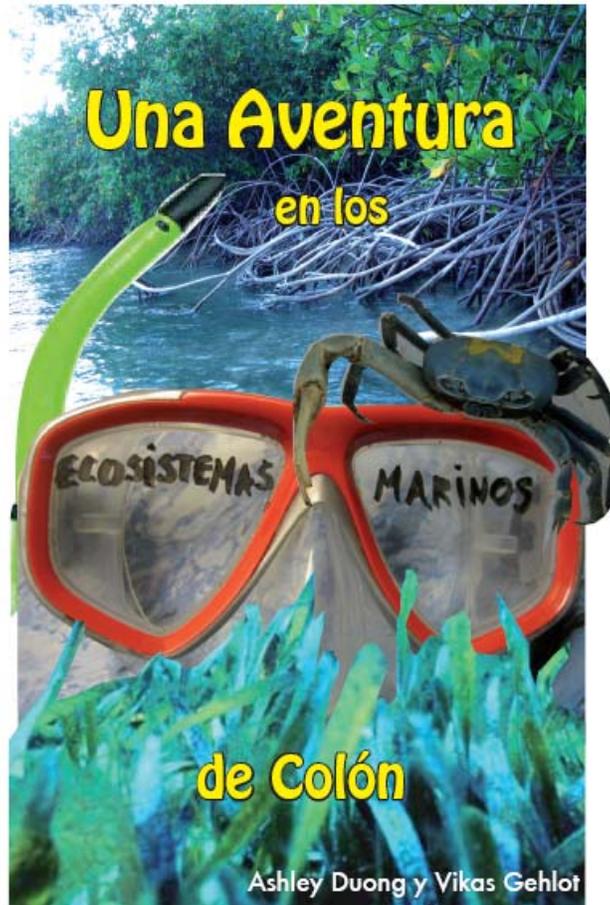


Environmental Education in Colon: Creating a Children's Book about Marine Ecosystems



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Executive Summary- English

Environmental Education in Colon: Creating a Children’s Book about Marine Ecosystems

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In our project, we created an educational booklet for children in Colon about the marine environments around them. In order to write the book appropriately and accurately, we investigated the current status of science education in Colon, as well as the marine ecosystems and environmental problems of the area. Mangroves, coral reefs, and sea grass beds make up a prominent part of the biological and geological context of the city of Colon, which is situated on the Caribbean coast of Panama. As the second largest city nationally, and as an important transit hub globally, Colon’s population and ports exert significant anthropogenic pressure on the ecosystems of the area. Education can play a vital role in regulating environmental degradation by increasing local knowledge and appreciation of natural areas.

Our host organization, Laboratorio de Punta Galeta (Galeta), a station the Smithsonian neotropical research institute (STRI), is committed to promoting science and environmental education in order to work towards its goals of conservation. Galeta runs various science education programs, such as a training programs for public school teachers, tours for children, and volunteer training programs. We used Galeta’s strong ties with the teaching community to do a research of the status of environmental education in Colon. The sources in our cursory research have repeated the same thing: Teachers lack didactic material and often current knowledge about environmental education. The science textbooks used are often out of date and do not focus on the ecosystems relevant to Colon. These findings influenced our decision to create a book for children that focus directly on the coastal environments of Colon.

Our research into the ecosystems of the area allowed us to decide on the goals of the book, and the main themes that we would address. While the book does include information on coastal ecosystems, the goal of this book is not to be an all-encompassing textbook of marine, but an interesting read and that is structured around an investigation narrative. It begins with an encounter with a fisherman of la Playita (a fishing community in Colon), that poses the question: “Why have I been catching less fish lately?” The rest of the book is the investigation of this question that takes

the reader on a journey through coral reefs, mangroves, and sea grass beds. During the adventure, the book emphasizes that these ecosystems are interconnected, and that while humans depend on them, they can also threaten these ecosystems.

We took several steps to research the content of this book, and how to present it stylistically. For inspiration on techniques to write for children, we researched other materials that try to popularize science for children, observed the teaching methods of the Galeta nature guides, and interviewed teachers. To confirm if our description of characters in the book (a diving tour guide, and a fisherman) is realistic, we visited the fishing community and tourism operators, to hear from them first hand about the effects of environmental degradation on their livelihoods. We used several other techniques to make the book relevant and engaging for children, such as including references to popular culture, activities, and creative multi-media illustrations.

In the future, we recommend that other context-specific education materials be created. We recognize the limited resources available, and made sure to design the book to be cheap to produce, and we hope that with a little funding, it can reach the hands of the children of Colon and inspire them to explore and appreciate the environments around them.

Resumen ejecutivo – Español

Educación Ambiental en Colon: Crear un libro para los niños sobre los Ecosistemas Marinos

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En nuestro proyecto, hemos creado un libro sobre el medio ambiente para los niños en Colon. Para crear un libro apropiado investigamos la educación medio ambiental en Colon, también estudiamos la situación del medio ambiente en Colon. Manglares, arrecifes de corales, y los pastos marinos son una parte grande en el contexto biológico y geográfico de Colon, que se encuentra situado en el este Caribe de Panamá. Por las razones de Colon es la segunda ciudad más grande en Panamá y un punto importante del comercio global, la población y los puertos de Colon ponen mucha presión en los ecosistemas locales. Educación puede regular el nivel de degradación del medio ambiente hacia aumentar conocimientos locales y el apreciación de la naturaleza.

Nuestra organización, Laboratorio de Punta Galeta, una estación de STRI, promueve ciencia y educación sobre el medio ambiente para lograr sus metas de conservación. Galeta hace varios programas de ciencia, giras por los niños, y entrenamientos por los profesores y voluntarios. Hemos usado Galetas conexiones fuertes para investigar la educación medio ambiental en Colon. Encontramos que los profesores faltan materiales didácticos y bastante conocimiento sobre el medio ambiente, específicamente de Colon. Los libros son viejos y no tiene un enfoque del ambiente de Colon. Nuestra investigación nos ha influido en nuestra decisión a crear un libro que enfoca de los ecosistemas marinos de Colon.

Nuestras recomendaciones sobre los ecosistemas del área nos ha ayudado a decidir nuestras metas y los temas principales del libro. Mientras el libro tiene información sobre los ecosistemas marinos, una meta es que el libro no es como un libro ciencia, pero un libro interesante que tiene la estructura con un narrativo informativo. Para hacer el libro más atractivo, el narrativo habla con el niño directamente. Lo empieza con un encuentro con un pescador de la comunidad de La Playita, y le pregunta ‘¿Por que estoy pescando menos peces?’. El resto del libro es la investigación de esta pregunta que tome el lector en una aventura a través de los arrecifes de corales, manglar, y los pastos marinos. Durante la aventura, el libro he subrayado que los

ecosistemas son interconectados, y mientras los humanos dependen sobre ellos, también los ponen en peligro.

Hemos tomado varias etapas a investigar el contenido de este libro, y como a presentarlo en un buen estilo. Para inspirar a los técnicos a escribir para los niños, investigamos otros materiales que prueben a promover ciencia a los niños, hemos observado los métodos que las guías de Galeta usan para enseñar a los niños. Para confirmar la precisión de los personajes que están en el libro, visitamos la comunidad de los pescadores y las guías turísticas, para escucharlos de cómo los cambios ambientales en el Caribe se afectan. Incluimos varios personajes para demostrar a varias personas que el cambio ambiental se afecta.

Usamos varios métodos para crear un libro pertinente y atractivo para los niños, como las referencias a la cultura popular, una actividad, e ilustraciones multimedia creativas. Reconocimos los recursos limitados, y entonces creamos un libro que es barato de producir, y esperamos con un poco de tiempo, los niños de Colon van a leerlo y lo va a inspirarlos a explorar y apreciar la naturaleza que tienen. En el futuro, recomendamos un estudio comprensivo y sistemático sobre la educación en Colon, y producen más materiales ambientales por otros ecosistemas y regiones de Panamá.

1. Introduction

The integrity of mangroves, coral reefs, sea grass beds and other ecosystems of the area are suffering substantially from the increasing pressures of the port city of Colon, Panama. Education can play an important role in regulating environmental degradation by increasing local appreciation of natural areas, especially for younger generations. Although environmental education is technically incorporated into the national public school science curriculum, the reality is that many teachers in Colon lack the didactic material and often the knowledge about environmental issues. The product produced for this internship, a booklet entitled “*Una aventura en los ecosistemas de Colon,*” tries to address this problem directly by contributing to the teaching materials available to teachers about the ecosystems most relevant to Colon. The goal of this short 11 page booklet is not to be a comprehensive look at marine ecosystems; rather, it is to inspire interest in the subject. Colon is sometimes referred to as a “Concrete Jungle,” and according to several of the children the project team interacted with, many inner city children do receive much direct expose to the remarkable ecosystems that surround their city. Therefore this highly visual booklet, strives to bring the natural world a little closer and the plot stresses the importance of these natural systems, and human’s dependency on the services they provide.

In addition to including a discussion and brief description of the book, this report focuses mainly on the contextual research that informed the writing of this book. Before making the end product, the authors needed to gain an understanding of the public education program for the target

age of students (9 to 12 years old) and the intricate factors that are affecting the environment in Colon. Additionally, in order to write effectively and appropriately for children in Colon, the authors also need some knowledge of the cultural and social economic aspects of the area.

1.1 Study site

The city of Colon was our principle study site. Mangroves, coral reefs, and sea grass beds make up a prominent part of the biological and geological historical context of the city of Colon, which is situated on the Caribbean coast of Panama. However, as the second largest city nationally, and as an important transit hub globally, Colon's population and ports exert significant anthropogenic pressure on the ecosystems of the area and . The city has been in serious economic decline for decades and has high unemployment and poverty levels. Paradoxically, the city is situated adjacent to the Panama Canal and the Free Trade Zone. With all the wealth flowing into these international centers, there is high inequality in this city which is a likely factor in the high crime rates of Colon. The socioeconomic problems of the city have strong repercussions on the topics we focus on: the environment of the area, and the public education system.

1.2 Host Information

Located in the Province of Colon, on the Caribbean coast of Panama, Punta Galeta Marine Laboratory (Galeta) is a Smithsonian Tropical Research Institute research center established in 1964. The laboratory is situated in an area with highly productive mangrove ecosystems as well as sea grass beds, forests, and coral reef ecosystems. However, it is neighbored by large expanding port areas which are infringing on Galeta's protected area. At Galeta, education is one key strategy of encouraging environmental conservation; therefore, besides its commitment to scientific

research, Punta Galeta also focuses on communicating its results to the public and has various educational programs such as teacher training programs, volunteer training programs, and internship programs. It also receives thousands of visitors a year (mostly from elementary schools). Therefore, with its strong connections with the teaching community in Colon and the large number of children visiting, Punta Galeta served as a extremely suitable base to conduct research on environmental education, and to gather data about how to make the book appropriate. In Punta Galeta, we worked closely with the permanent staff, nature guides, and volunteers.



1.3 Number of Days Spent on Project

Month	# Days- Panama	# Days- Galeta	Total Days	Total Hours
January	1	3	4	28
February	1	7	8	64
March	0	8	8	64
April	6	4	10	80

Total	8	22	30	240
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1.4 Justification

The decision to make a book for children was made after process of learning about the needs of schools in Colon. Although Galeta runs several education programs for primary school aged children, our supervisor, Dr. Standley Heckadon pointed out that Galeta lacked information about the science education background of the children of Colon. With the Dr. Heckadon's suggestion to research the education school children receive about the natural science and the environment, we set off to speak with teachers and the ministry of education, and to review teacher surveys and the textbooks used in schools. All the sources of our preliminary research repeated the same thing: teachers lack didactic material and often current knowledge about the environmental issues relevant to Colon. After discussion with our host institution and with teachers, we decided to address the problem directly; we decided to make didactic materials on environmental education.

The form of our end product also adapted as we received new information about the context of education in Colon. In the begin the product was going to be a film, since we learned, from speaking to children and from talking to teachers and guides, that children in Panama are generally much more interested in watching films than reading books, and since we also have the technical knowledge and the experience to make films (one of the authors of this report majors in Cultural Studies, McGill's film studies program). However, after further research into the education in schools in Colon, we learnt that several of the poorer schools in Colon do not have access to the internet or to televisions; therefore, a film would not be appropriate since it could not

be distributed to certain socioeconomic groups. Our solution was to modify the form of the product into a small booklet that would be easy to produce and simple to disseminate yet, with a little creative, hopefully still be interesting to children.

2. Objectives and Methods

This report focuses on three interrelated objectives. First, to make this book appropriate to the children of Colon, we needed to first research what children are actually learning in schools. In addition, we also needed to research methods to write the book in a way that would appeal to children. Second, in order to write the context of the book, we needed to have a clear understanding about the environments surrounding Colon, and the threats they face. Our third objective was to actually make the book.

For each of the objectives we used a diversity of methods. For researching education in Colon we used conversations, observation, and literature review. As for the learning about the social and environmental problems of Colon, we visited sites, reviewed relevant literatures, and spoke to stakeholders of environmental change. Finally the process of making the book involved studying the genre of children’s writing, and using the information obtained in the above objectives to write the book coherently and appropriately.

Figure 1: Summary of objectives and the methods we used to achieve each objective:

Objectives	Methods
1. Investigating education in Colon	a. interview with ministry of education b. reviewing teacher surveys c. reviewing public school curriculum and science text books d. interview with innovative teacher – Ileana Cotes e. talking to children and testing activities

2. Researching Colon’s Environmental and Social Context	<ul style="list-style-type: none"> a. Site visits (e.g. visiting free trade zone, city, mangroves, reefs etc.) b. literature review c. Verifying information (informal interviews with stakeholders of environmental change)
3. Make the Book	<ul style="list-style-type: none"> a. study the genre by looking at similar materials b. Using the information obtained in the above to objectives to write the book coherently and appropriately

3. Investigating education in Colon

We used informal interviews, interactions with children, observations of children, and literature reviews to investigate education in Colon. This research is important for understanding the background of our audience. We need to know how complex we should write the book so that elementary children in grades 4 to 6 can understand it, and what themes we should emphasize so that the book complements the curriculum of public schools.

3.1 Formal education in the public schools of Colon

The research began with a meeting with Maria Bernal, the science coordinator for Colon’s Ministry of Education. A full curriculum for public elementary schools was obtained. While at the Ministry of Education, we also had the opportunity to discuss our project idea with other teachers, such as Marilyn de Acosta. They explained that grades 4 to 6, ages 9 to 12, would likely be the best target audience for this style of booklet since children at this age, while still retaining their eagerness to learn, are old enough to understand the complexities about environmental issues. We were also given advice what the children were interested in. They told us that the children of Colon often do not like to read. Therefore, we made sure to keep the text to a minimal in our book, and focus instead at teaching through more visual means.

Furthermore, according to the teachers interviewed, the main barrier face by teachers to teach science education is a lack of facilities, equipment, knowledge, and didactic materials. This

sentiment is echoed in the surveys done by Punta Galeta about teachers who attend the teacher training program (Valencia, 2007; Ramos, 2008). The surveys explained that many of the teachers currently teaching science in Colon do not even have a science background, and there is a lack of knowledge of environmental problems, therefore perhaps a consequent lack of interest in environmental problems, that impede them from teaching about this subject. From a cursory glance at some of the public schools in Colon, we noticed that all the ones we saw appeared to be in a state of disrepair and several of them do not have any green spaces. Many of the guides, volunteers, and staff of Punta Galeta, we conversed with attended schools in Colon, and were therefore an convenient and helpful source for us to learn about what condition are in schools in Colon. We learnt that many inner city children to lack exposure to natural environments. Many of the volunteers reported that they had never been to a mangrove forest before coming to Galeta. In addition, there are economic factors that impede some children from going on the few field trips that public schools offer. For example, many parents do not pay the \$1.80 health insurance fee to schools, and this fee is mandatory for children to attend field trips (Castro, 2009).

Maria Bernal explained that another barrier to teaching environmental education is that the environmental issues stretch across disciplines, and are not easily covered just in science classes. She argued that environmental education should be integrated in other classes taught in school too such as in the religion and ethics classes.

3.2. Alternative teaching methods of Environmental Education

In addition, we visited Illeana Cotes, the science coordinator of Colegio Brader College, a private in Panama City that excels in the sciences. Dr. Heckadon suggested that we talked to her because she was a leader in innovate science education in Panama. The most immediate

impression was that the economic disparity between Brader College and the schools we visited in Colon. Ileana Cotes helped us decipher the ministry of education's curriculum, and learn exactly what children in public school should be learning between the ages of 9-12. We also learned what she thought was especially neglected in environmental education in the schools of Panama. For example, she explained that children respond well to creative ways of teaching, and these teaching methods are not adopted by many teachers in Panama. In addition, she explained that we should focus on the relationship between organisms and stress how all the ecosystems are connected.

The meeting with Ileana Cotes provided us with many ideas about interesting and creative activities for teaching environmental education. However, this meeting also made it clear that we needed to adapt our material to the conditions of children in Colon, since many of the activities Ileana discussed needed access to computers, internet, computer software, printing facilities, and field trips, all of which might not be readily available to the children we are targeting in public schools of Colon.

3.3. Learning from Children and testing activities

In order to understand the attitudes of children about learning about the environment, and therefore have some indications about how to present our information appropriately, we observed and interacted with the children of Colon and elsewhere in Panama. We attended and helped out with several of the tours done by Galeta. For example, on March 7th, we spent the day with 36 children from Colon who were visiting Punta Galeta from a church organization. Their ages varied from 5-15. We followed the tour groups and assessed the children's interest levels, knowledge, and engagement.

At the end of the tour we led a revision activity, which required participation. We noticed on the tour that the children observed did not like answering questions directly and rarely raised their hand to participate even if they did know the answer. For example, when the children as a group were asked “what are mangroves?” at the beginning of the tour, none of the children answered. However, we had earlier asked one boy if he had been to mangroves before, and he told us that he was very familiar with mangroves because there were some where he lived. The guides asked us to lead the revision session at the end of the tour; therefore, we needed to think of creative ways to encourage participation.

The game was a contest between groups of 6 students to answer questions about the information covered in the tour. It was originally designed to be a relay race, but the rain did not permit us to do the activity outside. The children then became eager to participate with the competitive atmosphere of the game. In addition to acting as a revision for the children, this activity performed the dual purpose of giving us an idea at how much the children knew and retained about coastal ecosystems, so that we could better gauge what complexity of information to include in our book,

On a separate tour with another group of children visiting Galeta, we had the opportunity to test out the activity included in our book, the *botella-scopio*. The children participated and seemed interested in the activity (or perhaps just the novelty of having foreign look students teaching them strange activities in broken Spanish).

Additionally, we also had the opportunity to gather information from other children of Colon outside of Punta Galeta. For example, when we went to Isla Grande for the weekend, we meet a group of children who age ranged from 8 to 14 coming from Colon. They told us that some children were fortunate enough to visit with their families places rich in natural beauty, like Isla

Grande; however, schools do not provide many fieldtrips. One youth recounted that he had only gone on one field trip the entire time he was in elementary school in Colon. Furthermore, the children mentioned that what they learned in sciences had little focus on environmental conservation, especially not marine environments relevant Colon.

4. Researching Colon's Environmental and Social Context

This objective was accomplished through a preliminary assessment of the situation. Throughout all the time we spent in Colon, we tried to learn about the cultural, social, and environmental factors that influence environmental change. The learning was greatly facilitated by the staff of Punta Galeta who took us to festivals and tours of Colon, took us snorkeling, as well as to guide us through various coastal ecosystems. By going on the tours of the areas they gave us a visual sense and an appreciation of the situation of these fragile ecosystems as well as enhancing our knowledge of them. These tours also gave us an opportunity take photos to use for the book. Most importantly, was the general conversations and exchanging of ideas we had on relevant topics with the staff at Punta Galeta. They shared with us the messages they felt were most important to get across to the children, and gave us ideas in how to do this (e.g. using the blue crab reference). To learn about coastal ecosystems, we also utilized the Punta Galeta Library extensively.

Another source of information was the other courses of the Panama Field Study Semester. For example, we visited the Free Trade Zone, and discussed its social and environmental implications in Uli Locher's Sociology class, and we learnt about the importance of including stakeholders and the basics of a situation analysis in Thomas Meredith and Ciara Raudsepp-Hearne's Geography class.

Finally, we met a few examples of stakeholders of environmental change in order to make sure the characters that appear in our book are realistic. For example, we visited the fisherman community of La Playita in Colon to ask the fishermen if they had experienced a decrease in quantity and quality of their catch. They validated this, as they described to us the increasing difficulties of maintaining their lifestyle. For the fishing community of La Playita, environmental change was undeniable for them. They explicitly stated that they have to fish longer hours and go further out to ocean in comparison to the past. In addition, to check the validity of what we were going to say in regards to Mark, the snorkeling guide character, we conversed with a sailor who runs snorkeling tours. He verified that he had noticed a depletion of the corals, and that this as a major threat to the marine ecosystem. We used the information gathered in this section and represented the information in our result: the book.

5. Description and Discussion of the Book

This section dissects the different elements of *Una Aventura en los Ecosistemas Marinos de Colon*, and the process and ideas that informed these elements:

5.1. Format

The booklet uses a simple format so that it can be easily reproduced: 6 sheets of standard size paper folded in half and stapled down the middle (each page is half a sheet of standard letter size paper (8.5 inches by 11 inches); however, some sections use two page spreads and take up the equivalent of an entire standard letter size sheet of paper.

5.2. Narrative

The book we have created is an adventure storybook that leads the reader, a child, to investigate different ecosystems in order to figure out why there is a decrease in the amount of fish in the area. While the book does include information on coastal ecosystems, the goal of this book is not to be an all-encompassing textbook of marine, but to spark children's interest in scientific exploration; therefore, we structured the book around an investigation narrative. It begins with an encounter with a fisherman of la Playita (a fishing community in Colon) who poses the question: "Why have I been catching less fish lately?" The rest of the book is the investigation of this question that takes the reader on a journey through coral reefs, mangroves, and sea grass beds. During the adventure, the child encounters different characters to illustrate how many stakeholders are affected by changes in coastal ecosystems.

5.3. The Visual and Technical Aspects

We took the majority of the pictures used in the booklet, and all the images (with the exception of the one of Carlos Puyol) were taken on the Caribbean coast of Panama. This was in order provide children with a more accurate description of the surrounding coastal ecosystems. The layout and editing of images was done of Adobe InDesign and Adobe Photoshop.

5.4. Flow of the book

The narrative was also important in continuing the flow of the book, and therefore, keeps the reader engaged throughout the story. For example, to transition between the pages of the coral reefs to the page on the sea grass beds, the narrator comments on the possibility of finding something else out a little closer to the coast. Another example of a transition appears between the

page on sea grass beds and that of mangroves, where the narrator poses the question ‘did you see the blue crab in the mangroves over there’ (with an arrow to the next page).

5.5. *Cultural References*

Besides using the blue crab as a transitional tool in our book, the ‘*cangrejo azul*’ is also an important icon for Colon. As part of the research done before writing the book, we also spent time learning about the culture of Colon and of Panama in general, during our free time with the Galeta staff, in order to make the story more relevant to the children of Colon. Traditionally, the people of Colon collect the blue crabs in May where, in the past, these crabs would fill the streets. The crabs are then used to create seasonal local culinary dishes. However, in recent years, the intensive deforestation of mangroves in the area has decreased the number of blue crabs available.

Therefore, by emphasizing that the culturally important blue crabs need mangroves as their home, the lost of mangroves therefore has a more immediate impression for readers. Additional examples of references to Colon include the specific references to the expansion of the Canal services, and the references to local fishing community of Colon, ‘La Playita.’

Furthermore, through informal conversations with the children visiting Punta Galeta, we learned that many of them, especially the boys, say that their greatest passion is soccer. They also told us that the most popular team is Barcelona. Therefore we made use to include a cultural reference to soccer; we made an analogy of the importance of the protective capabilities of mangroves to be like that of the defender Carlos Puyol to the Barcelona soccer team.

5.6. *Second-person narrative mode*

In this book, the narrator speaks directly to the audience, therefore, placing the reader as the main character of the book. We use second-person narrative in order to encourage active reading. By using “nosotros” we make the reader participate in the investigation. An example of this technique appears on the first page of the book, where the fisherman asks the reader directly if he could investigate why there are less fish.

5.7 Encouraging science exploration

Several methods were adopted to incorporate the theme of science exploration. For example, the narrative is structured around investigating three possible reasons of why the fisherman, Luis, was not catching enough fish. The first ‘hypothesis’ is that Luis is not a good fisherman, the second looks at mangroves as a possible reason for decreasing fish numbers, the third looks into corals. In the end both the second and the third hypothesis are correct. This result leads the book into a discussion about the interconnection between different ecosystems, and ultimately that people too are connected to different ecosystems.

The book also includes informative content of the marine ecosystems relevant to the area of Colon. For each of the marine ecosystems explored (the coral reef, sea grass bed, and mangrove area), the book gives a brief explanation of the important functional roles played by these ecosystems, as well as the threats and causes of their degradation.

We also designed the ‘*bottela-scopio*’ as is an activity where children can create their own tool to facilitate looking at shallow coastal ecosystems. The activity also demonstrates, for the teachers that might read this book, that activities to explore the environment do not need expensive and complicated materials.

6. Limitations

Throughout this project we faced certain limitations; however, we overcame these limitations by adapting to the conditions and by looking for new opportunities. For example, when we began the project in January, we planned to do a more in-depth research into the schools of Colon. However, we quickly learnt that schools were closed for summer vacation and would not be in session for the majority of the project time span, which severely restricted our ability to gather field data about schools and our accessibility to students and teachers. Therefore, we had to adjust the focus and objectives of our project, and capitalize on the time we did have with teachers and students (for example, during visits from children to Punta Galeta).

We also needed to be resourceful to find the technical equipment to make our book. We wanted to include our own underwater pictures from the Caribbean; however, we did not have an underwater camera. Fortunately, we took opportunities as they arose: during our vacation time in Bocas del Toro, we met a tourist snorkelling with an underwater camera, and she was generous enough to allow us to borrow her camera to take pictures.

Another limitation that exists is that our research relates to the use of informal conversations and interviews, which produce results that are inherently not objective. Measures were taken to cross-reference and triangulate information. However, the non-objectivity of the responses is not necessarily a limitation since, for many interviews, our goal was to learn the perspectives and opinions of those interviewed.

7. Conclusion: Lessons Learnt and outlook for the future

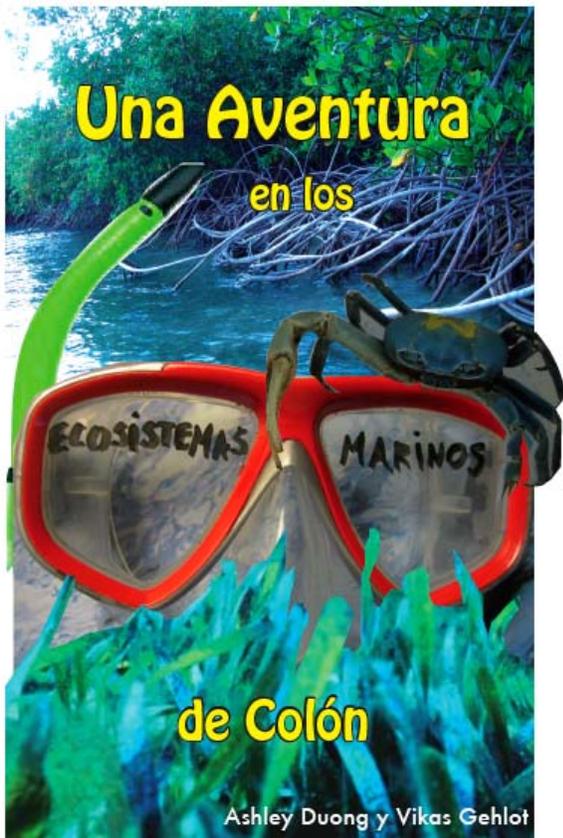
One of the most important lessons we learnt on this internship, and in our Panama experience in general, is that learning is a holistic process, that takes place not only during work hours. For example, our idea to include stakeholders happened during our vacation time, when we chatted with our catamaran tour operator, and he told us about how environmental degradation affects the tourism business. Even simple interactions can provide information and inspirations. We also learnt that the importance of understanding the context of a situation in order to better communicate the results. For example, we needed to learn about our audience (the children of Colon) in order to write appropriately to them. The very format of the project changed from a film to a booklet as we learnt that internet and video equipment is not readily available to schools in Colon.

In the future, we recommend that other context-specific education materials be created. We recognize the limited resources available, and made sure to design the book to be cheap to produce, and we hope that with a little funding, it can reach the hands of the children of Colon and we hope it achieves its goal of inspire them to explore and appreciate the environments around them.

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Appendix A: The Product



¿Qué tal amigo? Estamos en La Playita para encontrar un amigo. Él es un pescador.

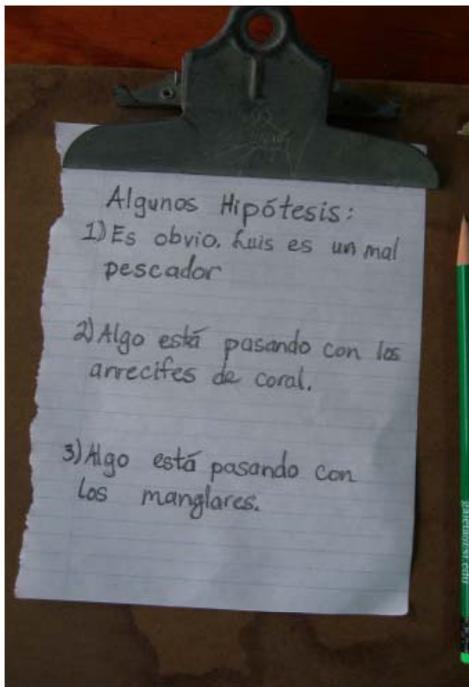
Te presento a Luis.

Hola joven, hace muchísimo tiempo he estado pescando aquí y he visto muchos cambios. La calidad y cantidad de peces a disminuido.

Ayer estuve todo el día pescando, aún así regresé a casa con poco pescado para cenar. ¡Que pena!

Por favor investiga ¿Porqué hay menos peces? Cómo estamos cambiando nuestra madre naturaleza?





La Investigación

hipótesis 1: ¿Luis es un mal pescador?



Fuimos a La Playita y hablamos con otros pescadores. Varios pescadores nos dijeron que están teniendo el mismo problema del Sr. Luis.

(Tal vez hay otras razones de porque Luis no a conseguido muchos peces y no es porque el es un mal pescador. Vamos a investigar las otras hipótesis)

La Investigación hipótesis 2: ¿Algo está pasando con los arrecifes de coral?

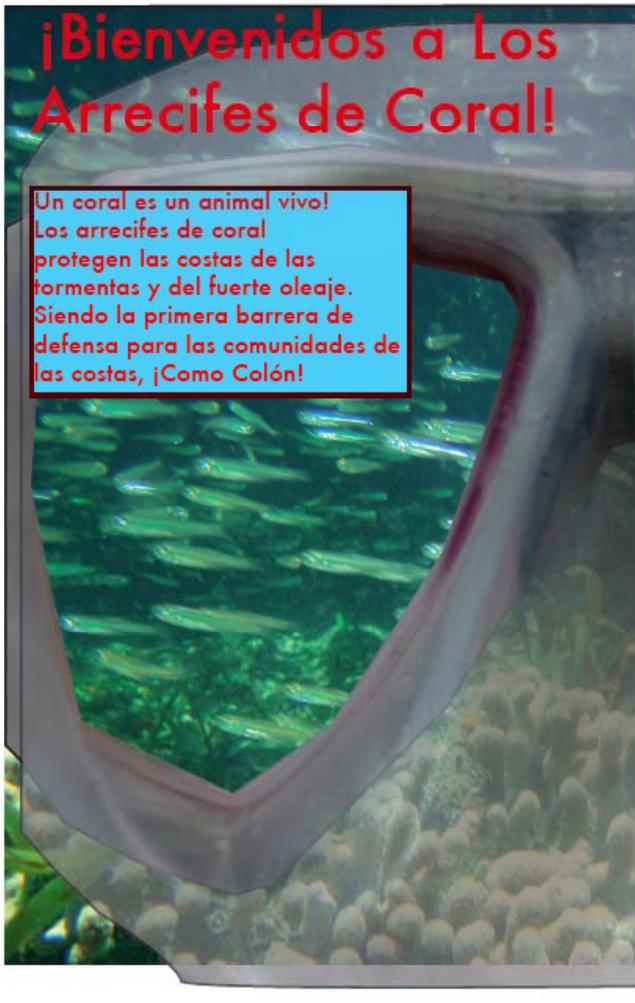


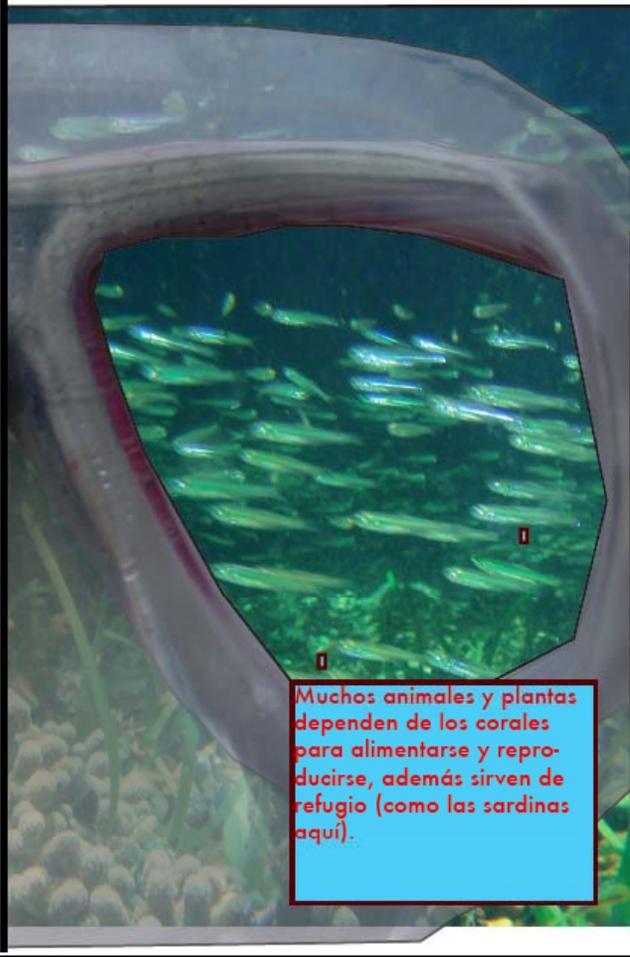
Mi empresa de snorkel, también está sufriendo. He navegado en muchas partes del mundo en mi barco y es claro que hemos estado destruyendo los arrecifes.

Pero todavía hay algunos, ¡vamos a verlos!

¡Bienvenidos a Los Arrecifes de Coral!

Un coral es un animal vivo!
Los arrecifes de coral protegen las costas de las tormentas y del fuerte oleaje. Siendo la primera barrera de defensa para las comunidades de las costas, ¡Como Colón!

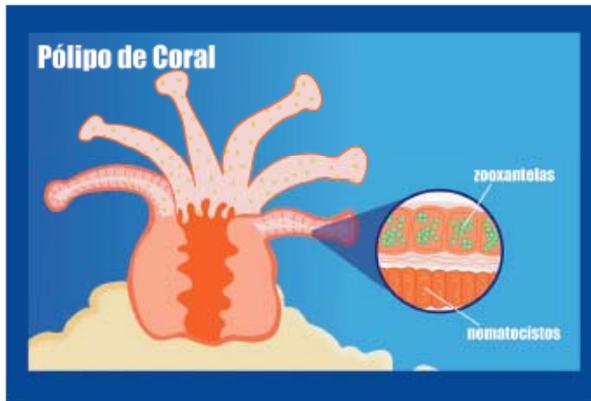




Muchos animales y plantas dependen de los corales para alimentarse y reproducirse, además sirven de refugio (como las sardinas aquí).



Muchas criaturas tienen mecanismos únicos de supervivencia como el gusano plumero que se esconde cuando siente amenazado.



¿Sabes como los corales tienen sus colores?

El pólipo recibe el apoyo de una pequeñísima alga llamada zooxantela. Estas algas les dan los colores brillantes que vemos en los corales y también los ayudan a construir su esqueleto de calcio. A cambio las zooxantelas reciben un hogar seguro que las protegen de los depredadores. Esta relación especial se llama "simbiosis", y significa que los pólipos y las algas trabajan juntos para sobrevivir.

Algunas causas del porqué los arrecifes están desapareciendo:

- Algunos barcos pequeños arrojan sus anclas sobre los corales matándolos
- Deforestación de los manglares. Porque sus raíces retienen el lodo que va de la tierra al mar; esta tierra cubre los corales, sofocándolos, e impide el paso de la luz solar hasta matarlos.
- Derrames de petróleo. Por ejemplo, en 1986 un gran derrame de petróleo en Bahía Las Minas afectó los arrecifes de Colón por años, ¡incluso hasta hoy día!



De repente podemos encontrar algo un poco más cerca de la costa: **¡Los pastos marinos!**



Botella-scopio



Los Materiales



1. Cortar los extremos de la botellas de plastico.



2. Cortar un cuadro de papel celofán (aprox. 25cm X 25cm)



3. Cubrir un extremo de la botella con el pedazo de papel celofán



4. Asegurar el papel celofán con una liga.

¡Va a explorar Los pastos marinos!



Listo!



Los organismos como se ven en la
botella-scopio:

De derecha a izquierda: Molly una
tortuga carey, tentáculo de estrella
de mar, pastos marinos.



Con un poco de creatividad, es fácil de inventar y
construir tus propias herramientas para explorar
la naturaleza.

Los Pastos Marinos

Los pastos marinos se encuentran normalmente en aguas poco profundas entre los manglares y los arrecifes de coral, y es la casa de una gran diversidad de animales



¿Sabes que los pastos marinos crecen más rápidamente que todas las otras comunidades marinas?

¿Porque los pastos Marinos son tan importante?

- Muchas criaturas del mar como la tortuga verde se alimentan de los pastos marinos.
- Son plantas que dan oxígeno y sacan dióxido de carbono del agua.
- También limitan el sedimento para no llegar a los corales.



Molly una tortuga carey y Trum un pez erizo de Punta Galeta. Estos animales puedes encontrarse en los pastos marinos y los arrecifes de coral.



¿Viste el cangrejo azul allá en los manglares?



La Investigación hipótesis 2:

¿Porque los manglares son importante?

- Muchos animales como cangrejos azules y cocodrilos viven allí
- Son zonas de cría de peces, los cuales ponen aquí sus huevos. Entonces, los peces bebes vienen allí.
- Protegen las costas contra inundaciones. Son la última barrera
- ¡Tiene la misma importancia de Carlos Puyol en la defensa del Barcelona!
- ¡Filtran el agua!

¿Sabes que Colón antes tenía muchísimos manglares?



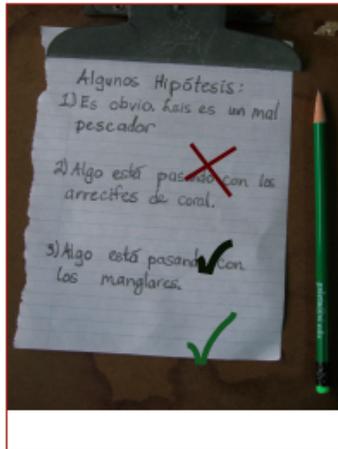
Los Manglares

¿A dónde se fueron los manglares y qué peligros enfrentan?

- La gente los ha estado cortando para construir más infraestructuras como casas y oficinas. Aquí en Colón, muchos han sido cortados para expandir la zona libre y los puertos y todavía hoy día se están expandiendo.



¡Los resultados!



- ¿Porque hay dos repuestas?

Las razones por las que el Sr. Luis está pescando menos, es porque hay una relación entre las hipótesis 2 y 3. Todos los ecosistemas estan conectados.

Desde hace aproximadamente 50 años, los humanos hemos cambiado mucho más nuestro planeta en comparación con el resto de la historia.

Si continuamos cortando los manglares y contaminando los arrecifes de corales:



Bosques de manglares



Manglares deforestados



Corales vivos



Blanqueamiento del coral
(muertos)

¿A dónde los peces y las otras criaturas marinas maravillosas van a vivir?

La mitad de la población humana del mundo viven entre 60km del costa, y la mayoría depende de los servicios que ofrecen estos ecosistemas. Por ejemplo, Luis los necesita para aprovechar la comida, Mark los necesita por la estética bonita de la natura que es necesario para el turismo, y la mayoría de las personas dependen de ellos para protegerse contra las inundaciones.

Entonces,

Necesitamos cuidar nuestra casa, que es nuestra planeta, para que tus hijos puedan verlo y apreciarlo también.