The BASIC Cartagena Project is an applied research project on Basic Sea Interactions with Communities focused on the generation of adaptation tools for integrated coastal water resource management in the coastal zone of Cartagena, Colombia. Started in July 2014, this 3-year multidisciplinary project is financed by the International Development Research Centre (IDRC) of Canada. Implementation of the project is led by EAFIT University, in collaboration with the University of Los Andes, University of Cartagena, the Foundation H.E.O., and the Regional Corporation CARDIQUE.

**Editorials**

The lack of oxygen in the marine life of Cartagena Bay

Like any animal, fish require oxygen for respiration, growth and reproduction. But in Cartagena Bay, the marine life lacks the adequate levels of oxygen that it needs. Results from the BASIC Project’s water quality monitoring program have registered low concentrations of oxygen in the waters of the bay, below the minimum value of 4 mg/l stipulated by the Colombia legislation (Decreto 1594 del 1984) as well as the scientific literature for the protection of flora and fauna in marine and estuarine waters. This condition of low oxygen levels, also known as “hypoxia”, is nothing new in the bay as it has been documented since the 1990s. Hypoxia in coastal waters is typically caused by the influence of human activities which modify the marine environment with pollution coming from domestic and industrial waste as well as continental runoff. The effects of hypoxia can include the inhibition of growth and reproduction of animals, and consequently the reduction of marine populations. Ultimately, given that the human communities around the bay have traditionally depended on artisanal fisheries, these hypoxic conditions also impact the well being of the people of Cartagena.

Testimonies from artisanal fishermen of the Ararca community on the degraded state of today’s fisheries

The Ararca community is located in the south part of Cartagena Bay, about 15 km from the city. Traditionally, this community has depended on artisanal fishing from the bay. However, in recent years fishermen have noted a marked reduction in the productivity of their fishing efforts, affecting both their well-being and the cultural traditions of their community.

With the collaboration of the Foundation H.E.O., we asked some of Ararca’s fishermen about the current state of artisanal fisheries and the presumed causes of its degradation, and their responses were all related to impacts caused by the bay’s industrial sector. Here we relate some of their perceptions concerning this problem, their views on pollution, and the solutions they hope for. (Continued on page 6)
Research Activities

Satellite-based estimations of fluvial discharge in the Dique Canal

As part of a collaboration between the University of Colorado and the BASIC Project (see page 5), a PhD student from Eafit University (Rogger Escobar) conducted a 3-month internship at the Dartmouth Flood Observatory (DFO) in Boulder, USA. With the support of DFO researchers Albert Kettner and Robert Brackenbridge, the internship focused on applying advanced techniques for the estimation of discharge from the Dique Canal with satellite data. Research activities included: 1) Selection of suitable areas for satellite analysis with Advanced Microwave Scanning Radiometer for EOS (AMRS-E), 2) Processing of AMRS-E satellite information, and 3) Preliminary estimation of water discharge for selected calibration points using the Global Water Balance Model (WBM) and the River Watch platform of DFO. Further research will continue to improve the calibration of regression models towards increasing the accuracy of discharge estimations.

Water velocity measurements in Cartagena Bay and Magdalena River

The project’s marine water and sediment monitoring program implemented by researchers from EAFIT University continued monthly during 2015. Field activities of the second semester of 2015 began with a new focus on water velocity measurements in both the currents of Cartagena Bay as well as the discharges of the Dique Canal and Magdalena River. This work was carried out with new equipment acquired for the project called an acoustic Doppler current profiler (ADCP). Fastened to the side of a boat, this Mini-ADCP 1.5 MHz from Sontek measures water velocities along the water column, permitting precise calculations of water flows in rivers as well as in shallow coastal waters. The collected data will be used to calculate the flows discharged to the coast of Cartagena, to estimate the corresponding pollutant loads, and to calibrate a hydrodynamic model for Cartagena Bay.
Research Activities

Training of native fishermen in techniques for fish monitoring

Researchers from Los Andes University made an introduction of monitoring techniques to fishermen during 2-6 December 2015. Fishermen learned how to measure fish length and weight. Data collected by fishermen will help to verify if fishermen are respecting laws of not fishing animals below the minimum length of sexual maturity, which in the long-term could lead to a reduction of fish populations and of fishing economical activities. Information on fishermen diet was also collected, in order to evaluate potential risks of heavy metal accumulation in fishermen, depending on their diet, which could affect fishermen health in the long-term.

Community visits and choice experiment for the economic valuation of pollution and biodiversity in artisanal fisheries

Recent activities of researchers from Los Andes University have been focused on the application of a choice experiment for the economic valuation of pollution and biodiversity in artisanal fisheries. In order to do this, meetings were held in the communities of Barú, Caño del Oro and Ararca on Sept. 7-10, 2015, where researchers met with several groups of fishermen. In these meetings, fishermen were asked about their daily fishing activities, such as labor time, fishing gear and current availability of fishery resources. Afterwards, the choice experiment for valuating pollution and biodiversity was applied, which consisted in showing the fishermen a series of cards representing possible fishing scenarios and asking them to organize the cards from the most to the least preferred. The results obtained in the workshop will be analyzed to calculate the economic valuation of pollution and biodiversity in artisanal fishing communities. Finally, in December a visit to Barú was done in order to document social and work activities of the community fishermen, such as fishing outings, association meetings, and the organization and sale of marine resources.
Research Activities

Identification of congenital malformations in Ararca community

During 2015, researchers of the UNIMOL group of the University of Cartagena studied the presence of congenital malformations in the community of Ararca. Presumably, the frequency of such malformations may possibly be related to human exposure to industrial contamination, whether it is through the consumption of polluted waters, bioaccumulation through the food chain, direct contact or inhalation of suspended particles in the air. In this context, the researchers identified possible cases of malformations and congenital diseases present in the population of Ararca. With the informed consent of the subjects and their families, the researchers proceeded to conduct domestic visits with the affected persons in order to collect detailed medical and family information, as well as blood samples for subsequent molecular analyses. The collected data will complete the description of health conditions in Ararca and will establish a baseline for continued longitudinal studies on the impact of environmental changes on community well-being.

Events

9th Symposium of River Coastal and Estuarine Morphodynamics (RCEM)

The 9th RCEM Symposium was held in Iquitos, Perú between August 31st and September 3rd, 2015. This international event focused on themes such as tropical rivers, sediment transport mechanics, human impacts, remote sensing, and numerical simulation of rivers and coastal hydrodynamics. Research from the BASIC project exhibited through an oral presentation and two posters by Prof. Juan D Restrepo and PhD student Rogger Escobar of EAFIT University. The topic of this research was human influence on sediment transport of the Magdalena River and its effects in Cartagena Bay. Participants at the event had the opportunity to receive feedback on their work and observe recent state of the art research from around the world. www.crearamazonia.org/rcem2015

XVI Latin American Congress of Ocean Sciences (COLACMAR)

The XVI Latin American Congress of Ocean Sciences and XVI National Seminar of Ocean Sciences and Technology was held between Oct. 17-22, 2015 in Santa Marta, Colombia. COLACMAR constitutes one of the principal events in the region of Latin America for the exposition of recent advances in scientific research and the development of technologies in the marine and coastal sector. On behalf of BASIC, Prof. Susana Caballero presented recent research from the project on seawater quality and fish diversity in the two artisanal fishing zones of Barú and Ararca. This research showed that Ararca’s fishing zone within Cartagena Bay has poorer water quality and smaller fish size than Barú’s fishing zone outside the bay. These results suggest that human activities around the bay are impacting the waters, fishing and well-being of the communities in the bay such as Ararca. www.colacmar-senalmar2015.com
International Collaboration

Collaboration with the Dartmouth Flood Observatory at the University of Colorado

A new project recently approved by the US National Academy of Sciences under the PEER Program will use geospatial data to investigate river flow impacts on coastal systems. This collaboration between the Dartmouth Flood Observatory (DFO) at the University of Colorado and the BASIC Project will serve as a joint effort in strengthening the capacity of regional stakeholders to integrate geospatial and satellite products into tools for the environmental management of Cartagena Bay. Activities will include 1) estimation of river discharge, 2) historical analyses of flows, climate variability and human impacts, 3) making satellite-based data available for end-user decision-support systems, and 4) capacity building for the incorporation of these techniques in local environmental decision-making. Thanks to DFO’s near real-time satellite observing system, this joint effort will generate reliable estimates of water flux and floods, a capacity which is instrumental to the environmental management of Cartagena Bay.

Project participation in UNEP-CEP’s Working Group for Monitoring and Assessment of Land-Based Sources of Pollution

Over the past year, the BASIC Project has contributed technical and advisory support to the Caribbean Environment Program of the United Nations Environment Programme (UNEP-CEP). Specifically, this contribution has been in support of UNEP-CEP’s interim working group for monitoring and assessment activities under the Cartagena Convention’s Protocol concerning Pollution from Land-based Sources and Activities. This collaboration began with a presentation about BASIC made at CEP’s 16th Inter-Governmental Meeting for the Action Plan of the Caribbean Environment Programme in Cartagena on 13 December 2014. Key activities of the Working Group in 2015 focussed on providing technical input regarding standard methods for coastal and marine water quality monitoring, national water classification systems, and a regional assessment of laboratory capacity, amongst other emerging issues. These inputs will be built upon in 2016 towards the development of the first State of the Convention Area Report (SOCAR) for the Wider Caribbean Region.
Testimonies from artisanal fishermen of the Ararca community on the degraded state of today’s fisheries

After 25 years dedicated to fishing, Wilfrido Julio Villero worries about the difficult struggle that is currently involved in this work, even for the purposes of self-sustenance. This fisherman tells how some years ago his fishing outings were so fruitful that they not only allowed him to sustain his family but also allowed him to share the fruit of his labour with other people. However, Wilfrido Julio affirms that starting some time ago, this productivity has suffered a noted reduction in terms of quantity as well as quality due to the pollution coming from nearby industries around Cartagena Bay. Nevertheless, and despite the difficult conditions throughout the community of Ararca, this fisherman remains optimistic in hoping for a solution to the problem presented.

Dionisio Torres Arévalo, who affirms to have always sustained his 4 children exclusively thanks to fishing, tells of a fertile past and an arid present in the practice of artisanal fishing. According to Dionisio, this activity has experienced notable changes in recent years in terms of quantity, quality and thereby efficiency. The 64-year-old fisherman reminisces of times when it was possible to catch 8 kilos of fish after 2-3 hours of fishing with bait, along with abundances of species like sea bass, lebranche mullet, and tarpon in years past. On the other hand, Dionisio claims that due to industrial waste polluting the bay, currently it is normal to return home after a night of fishing with less than 1 pound of catch. In turn, these outcomes have also been reflected economically in his earnings, which have been reduced by as much as 95%.

When asked about the current situation of artisanal fishing in Cartagena Bay, Teobaldo Villero highlights the fruitless efforts of his community’s fishermen, amongst them his father, in dedicating many nights to this activity in vain. According to the 29-year-old Villero, not only have species like sea bass and tarpon disappeared from the fishing panorama, but every day it becomes more common that fishermen return home empty-handed after a day’s work. Teobaldo points to the bay’s pollution and inadequate management of waste coming from nearby industries as the triggers causing the current conditions. He fears that there is little promise for the future of artisanal fishing as a sustainable means of provision.

Similar to his colleagues, Miller Berrio Morales tells of today’s unfavourable fishing conditions in Cartagena Bay. This 26-year-old fisherman states that due to the development of construction activities; the noise, industrial waste and the cutting of mangroves have all had an enormous negative impact on the culture of fishing by driving fish away from the coast. Miller not only states his own worries but those of all of his fellow fishermen in going from 15 kilos of catch to zero catch per fishing outing over the past 5 years. Likewise, he explains that his community’s hope is that someone will come to Ararca and guide them to develop strategies and/or alternatives that permit them to maintain the artisanal fisheries as the basis of their sustenance.