Universidad de los Andes
Facultad de Arquitectura y Diseño

Bogotá, Mayo 16 de 2017

Señor Arquitecto
Marko Tosic
Medellín, Colombia

Asunto: **Invitación XXXII TALLER INTERNACIONAL DE ARQUITECTURA DE CARTAGENA**

Apreciado **Marko**:

La Facultad de Arquitectura y Diseño de la UNIVERSIDAD DE LOS ANDES, llevará a cabo durante el mes de Julio del 2018, la trigésima segunda edición del Taller Internacional de Arquitectura de Cartagena, denominado ***Resiliencia costera***.

En nombre de la Facultad deseamos darle la bienvenida como parte del equipo del Taller e invitarlo a participar como **Conferencista** durante el periodo comprendido entre el **Lunes 2 y el Miércoles 4 de Julio**. El Taller asumirá la totalidad de los gastos correspondientes a **pasajes, alojamiento y alimentación**.

Le agradecemos confirmar su asistencia antes del próximo **viernes 25 de mayo** y de igual forma le solicitamos, amablemente, nos haga llegar una reseña breve de su currículo al siguiente correo electrónico: cartagena@uniandes.edu.co.

Para mayor información al respecto le recomendamos visitar la página web *http://cartagena.uniandes.edu.co*, o comunicarse con:

Alberto Miani	amiani@uniandes.edu.co
María Elisa Navarro	me.navarro@uniandes.edu.co
Lucas Ariza	l.ariza48@uniandes.edu.co

En espera de su respuesta, reciba un cordial saludo,

Taller Internacional de Arquitectura de Cartagena
Facultad de Arquitectura y Diseño
Universidad de los Andes
http://cartagena.uniandes.edu.co

BASIC

CARTAGENA

BASIN SEA INTERACTIONS WITH COMMUNITIES

INTERACCIONES ENTRE CUENCAS, MAR Y COMUNIDADES

Marko Tosic, MSc

Project Manager – BASIC

EAFIT University

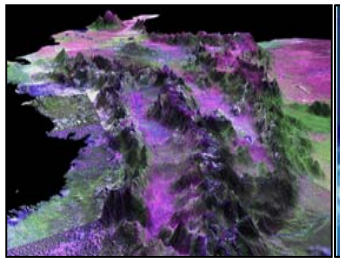
Medellin, Colombia

Doctoral Candidate

Erasmus Mundus PhD Program for Marine & Coastal Management (MACOMA)

University of Cadiz, Spain

University of Algarve, Portugal






IDRC | CRDI

International Development Research Centre

Centre de recherches pour le développement international

Canada

UNIVERSIDAD EAFIT

Universidad de los Andes

UNIVERSIDAD DE CARTAGENA

FUNDACION HERNÁN ECHAVARRÍA OLÓZAGA

CARDIQUE

Erasmus Mundus

MaCoMa

UCA Universidad de Cádiz

UAlg UNIVERSIDADE DO ALGARVE

BASIC

CARTAGENA

BASIN SEA INTERACTIONS WITH COMMUNITIES

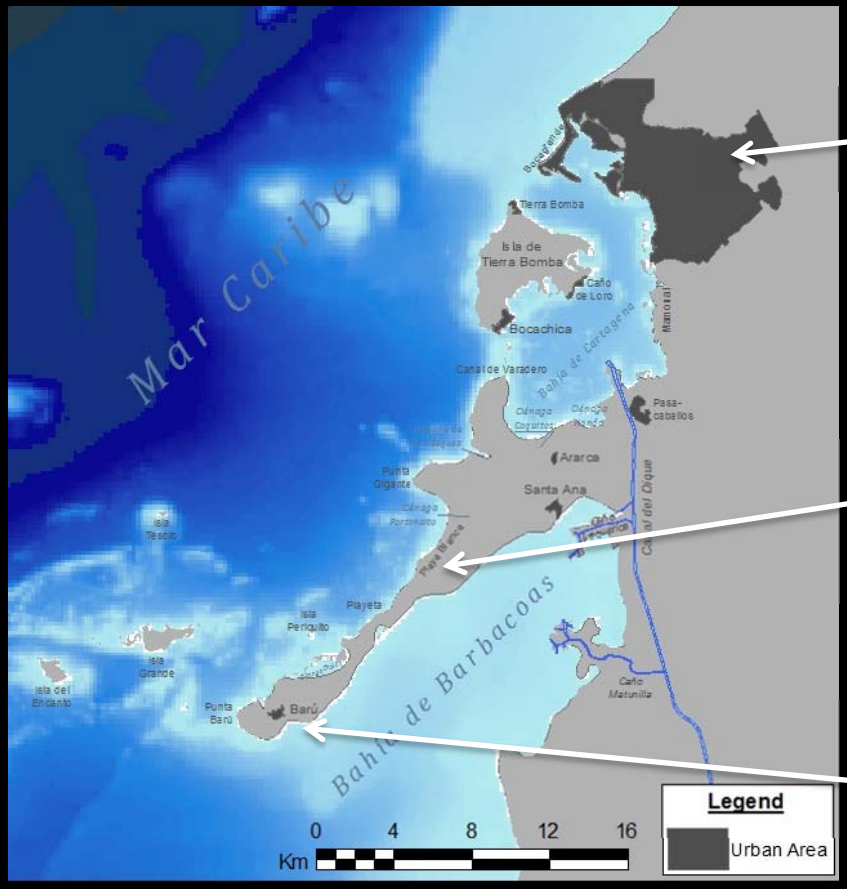
INTERACCIONES ENTRE CUENCAS, MAR Y COMUNIDADES

Presentation Contents

1. Project Overview
2. Water Quality
3. Pollution Issues
4. Pollutions Sources
5. Artisanal Fisheries
6. Socioeconomic Impacts
7. Public Health
8. Ongoing Research

Cartagena, Colombia

- #1 Touristic Destination



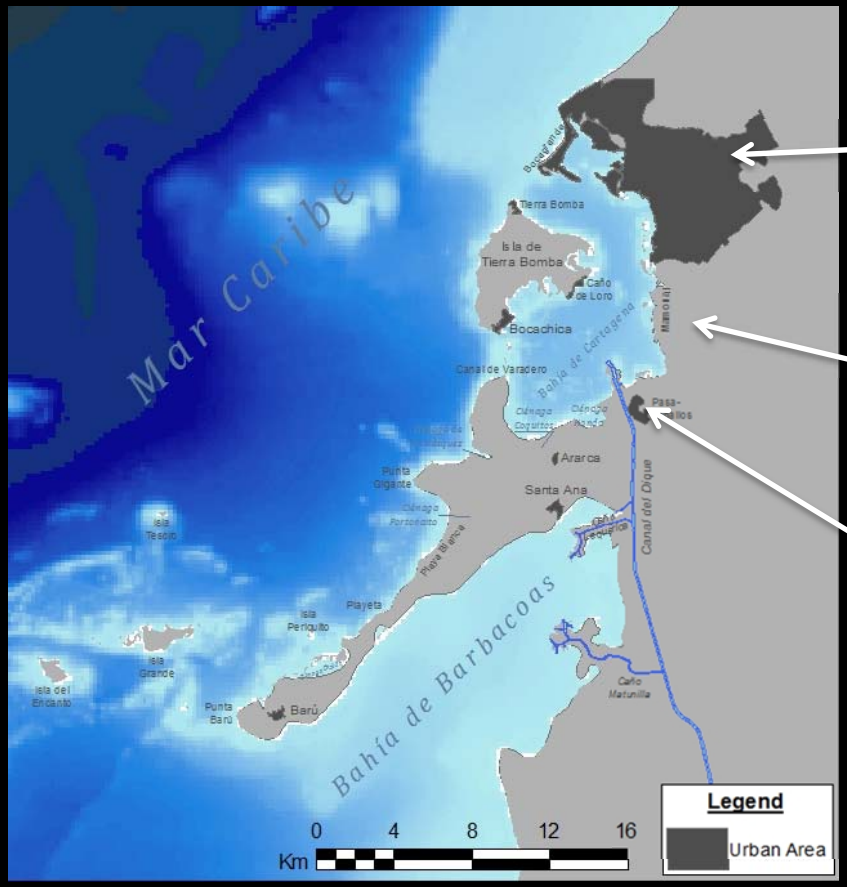
UNESCO World Heritage Site

Tourism & Ecosystems

Fishing Communities

Cartagena, Colombia

- Pollution "Hot-Spot"



Urban Wastewater

Industrial Zone

Watershed Runoff

Future Changes

Climate Change

- Intensification of extreme conditions
  - Dry areas → decreased rainfall
  - Wet areas → increased rainfall
  - Intensification of storms → increased coastal flooding
- Sea-level rise
  - Amplified by local subsistence
- Higher seawater temperature → coral bleaching

Socioeconomic Change

- Population ↑, Tourism ↑ → Domestic Wastewater ↑
- Colombia's peace treaty → Economy ↑ → Industries ↑
- Watershed deforestation / urbanization ↑ increased runoff

BASIC
CARTAGENA
BASIN SEA INTERACTIONS WITH COMMUNITIES
INTERACCIONES ENTRE CUENCAS, MAR Y COMUNIDADES

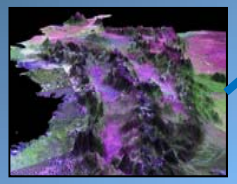
IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international
Canada

Research Components

UNIVERSIDAD EAFIT
Abierta al mundo

Universidad de los Andes

Basin Hydrology



Coastal Hydrology

Socio-Economics

Artisanal Fishing

Management Plans

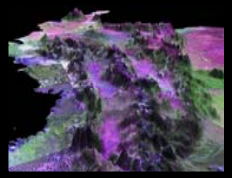
Public Health

CARDIQUE

Universidad de Cartagena

FUNDACIÓN HERNÁN ECHAVARRÍA OLÓZAGA

Impacts and Applications



Basins

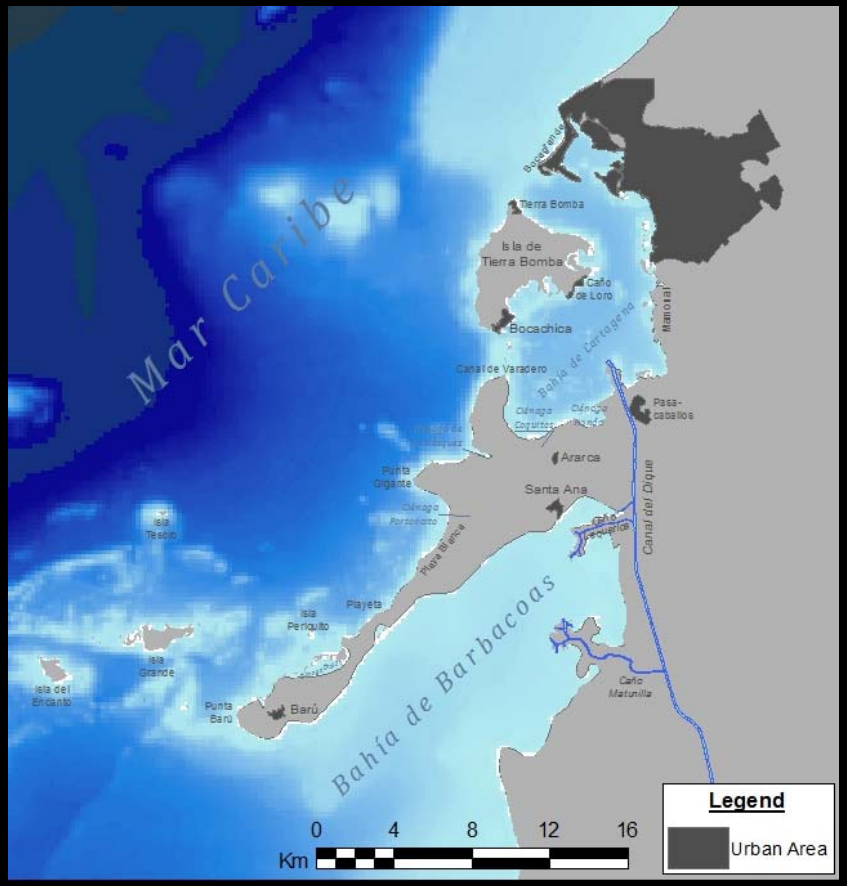
Coast

Health

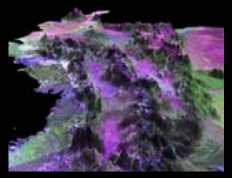
Fish

Economy

Plans



BASIC CARTAGENA
BASIN SEA INTERACTIONS WITH COMMUNITIES


Cuencas


Costa


Salud

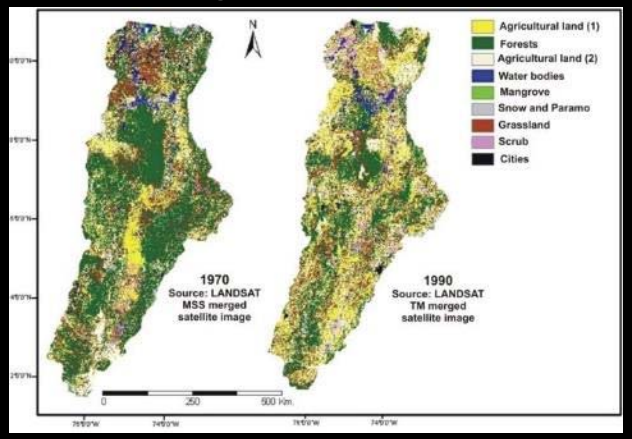

Pesca


Economía

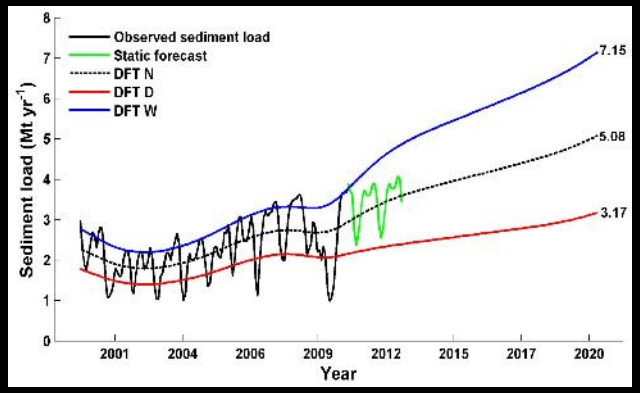

Planes

Hallazgos

Desforestación en la Cuenca Magdalena

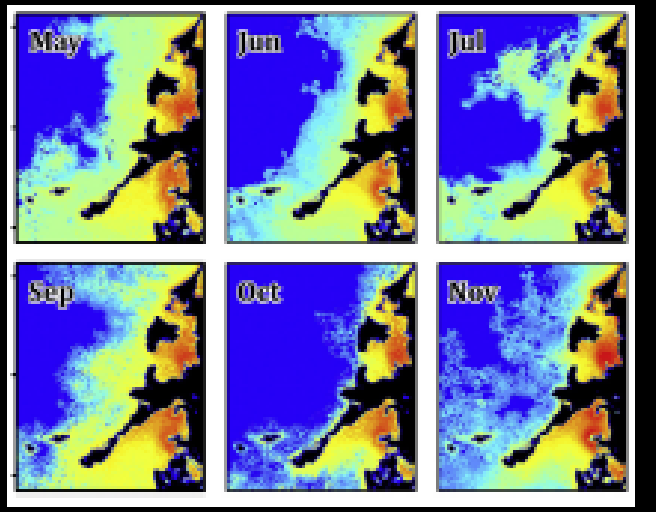


Incremento de Sedimentos Proyectado para la Bahía



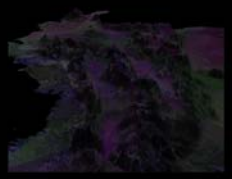
Soluciones

Identificación de Patrones de Dispersión de Sedimentos



Modelación del Flujo de Sedimentos hacia la Bahía

BASIC CARTAGENA
BASIN SEA INTERACTIONS WITH COMMUNITIES


Cuencas


Costa


Salud

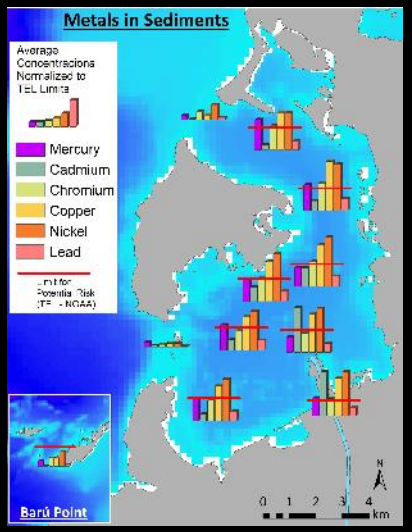

Pesca


Economía

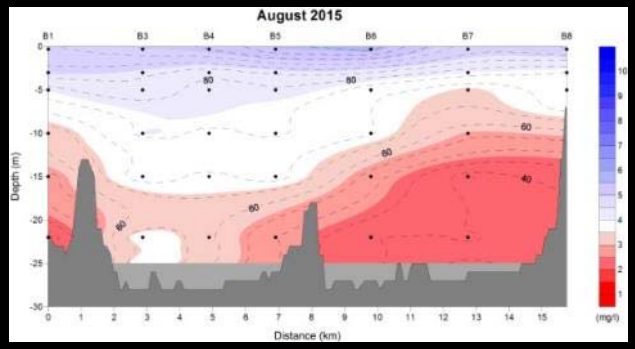

Planes

Hallazgos

Contaminación por Metales



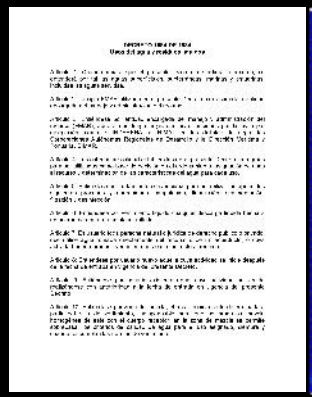
Deficiencia de Oxígeno

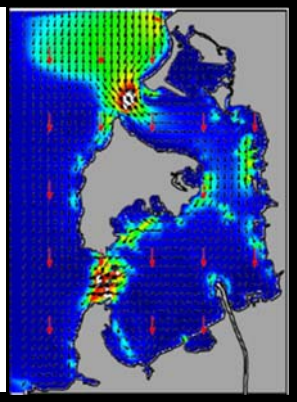


Soluciones

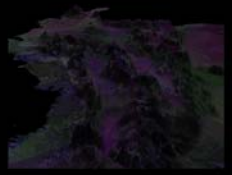
Identificación de Riesgos

Apoyo al Desarrollo de Políticas





BASIC
CARTAGENA
BASIN SEA INTERACTIONS WITH COMMUNITIES


Cuencas


Costa


Salud


Pesca

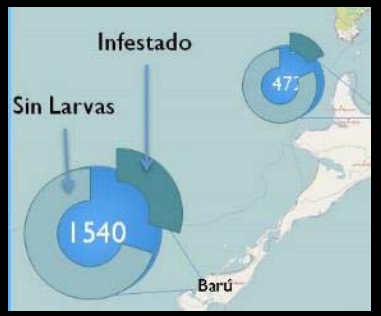

Economía


Planes

Hallazgos

Agua Comunitaria Inadecuada

Enfermedades Vectoriales

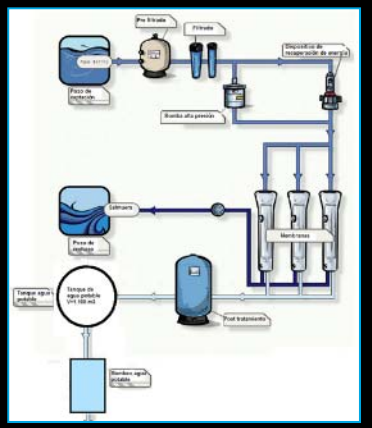


Prácticas de Manejo de Aguas

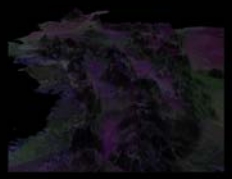
Soluciones

Campaña Comunitaria para Educación de Salud Pública

Proyecto Piloto de Aguas Potables



BASIC
CARTAGENA
BASIN SEA INTERACTIONS WITH COMMUNITIES


Cuencas


Costa


Salud


Pesca


Economía


Planes

Hallazgos

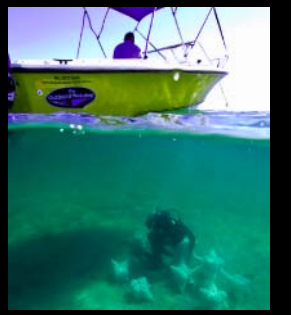
Metales Encontrados en Peces

Disposición Comunitaria para Conservación y Diversificación

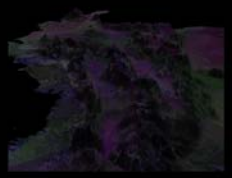
Soluciones

Estrategia de Adaptación Comunitaria con Pescadores

Proyecto Piloto para Ecoturismo & Restauración de Corales



BASIC
CARTAGENA
BASIN SEA INTERACTIONS WITH COMMUNITIES


Cuencas


Costa


Salud

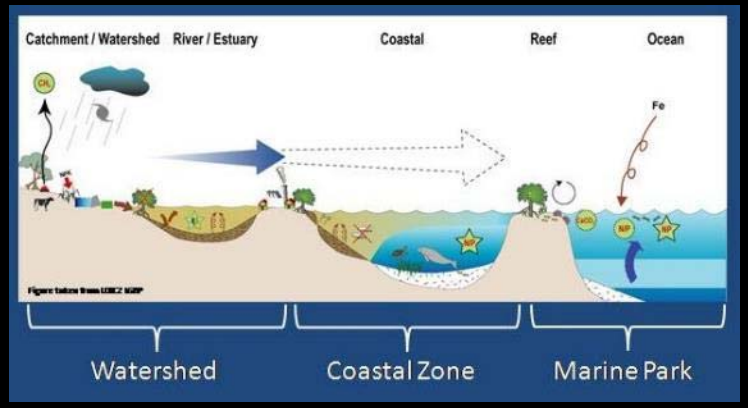

Pesca


Economía


Planes

Hallazgos

Múltiples Planes de Manejo que Necesitan Articulación



Soluciones

Marco para un Distrito de Manejo Integrado

PROPUESTA DE DMI SEGÚN ARTÍCULO 310 DEL DECRETO-LEY 2811 DE 1974
DECRETO REGLAMENTARIO 1974 DE 31 DE AGOSTO DE 1989

- SOCIALIZACIÓN Y PRECONCERTACIÓN CON AUTORIDADES MUNICIPALES, GREMIOS Y COMUNIDAD EN GENERAL
- PRESENTACIÓN DE LA PROPUESTA DE DMI AL CONCEJO DIRECTIVO DE CARDIQUE PARA DISCUSIÓN Y APROBACIÓN
- AJUSTES AL DMI Y ANÁLISIS DE VIABILIDAD PARA SU IMPLEMENTACIÓN POR PARTE DE CARDIQUE

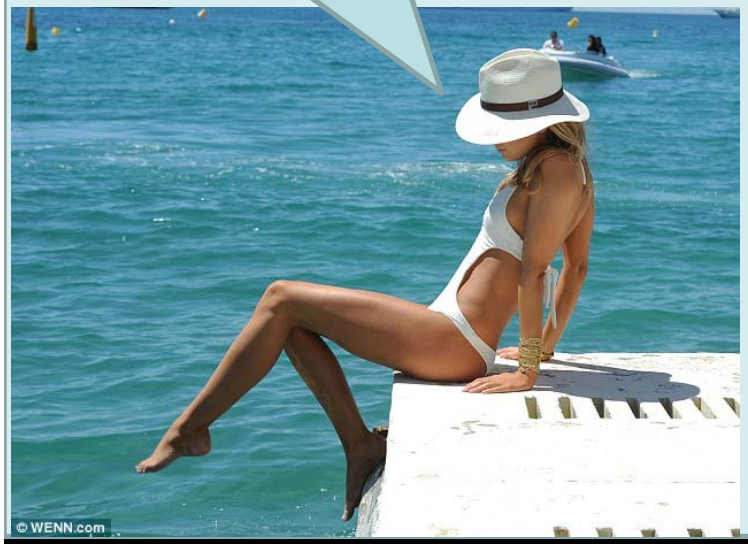
- EL ACUERDO DEBE CONTENER LA VERIFICACIÓN DEL CUMPLIMIENTO PARCIAL O TOTAL DE LOS REQUISITOS PARA DECLARA EL DMI DECRETO 1974 DE 1989 CAPÍTULO IV
- ACUERDO DEL CONSEJO DIRECTIVO DE CARDIQUE DECLARANDO EL DMI DE CONFORMIDAD CON LA LEY 99 DE 1993, ARTÍCULO 31 NUMERAL 16
- EL ACUERDO DEBE TENER CLARAMENTE DETALLADOS LOS LINDEROS DEL DMI Y LA ZONIFICACIÓN INTERNA YA QUE ES EN ESE ESPACIO ESPECÍFICO EN EL QUE SE VA A REALIZAR LA AFECTACIÓN DE USO DERIVADA DE LA CATEGORÍA DMI.

Water Quality

¿How do we define water quality?

¿How´s the water?

Great!



okay

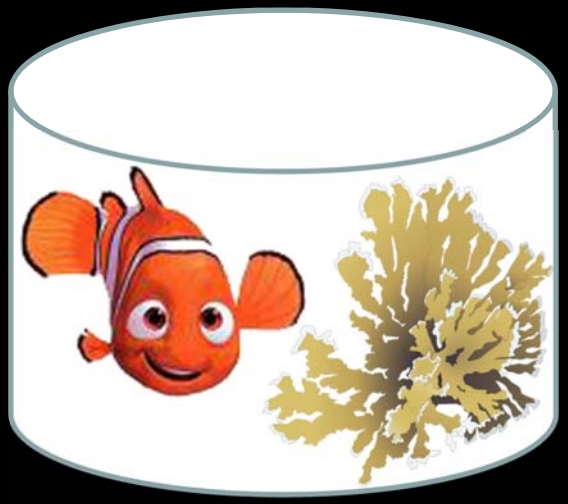
Cold.
Don´t like.

→ Water quality is defined according to its “adequacy”

The water is adequate, ¿but for what purpose?

~~Temperature = 15°C~~
Temperature = 27°C

~~Salinity = 0 ‰~~
Salinity = 34 ‰



Adequate for
~~Human consumption~~
Marine fish
Tropical coral

→ “adequacy” depends on the use

Uses of marine waters

Sanitary

Aesthetic

Ecosystems

- Fish
- Corals

Analytic determination

Parameter	Sanitary	Aesthetic	Fish	Corals
Coliformes	√			
E. Coli	√			
Enterococci	√			
Sólidos suspendidos		√		√
Turbidez		√		√
Temperatura				√
Salinidad				√
Oxígeno disuelto			√	
pH			√	√
Nitrógeno				√
Fosforo				√
Clorofila		√		√
Hidrocarburos		√	√	√
Plaguicidas			√	√
Metales trazas			√	

Threshold Values

Parameters	Reference Value	Criteria	Indicator
Coliformes Fecales	200 NMP/100mL	Contacto Primario	Calidad Sanitaria
Sólidos Suspendidos	20 mg/L	Valor definido	Calidad Estética
Temperatura	30°C	Blanqueamiento	Salud Ecosistemas
Salinidad	32-40 ppt	Resistencia corales	Salud Ecosistemas
pH	6.5-8.5	Flora y fauna	Salud Ecosistemas
Oxigeno Disuelto	4 mg/L	Flora y fauna	Salud Ecosistemas

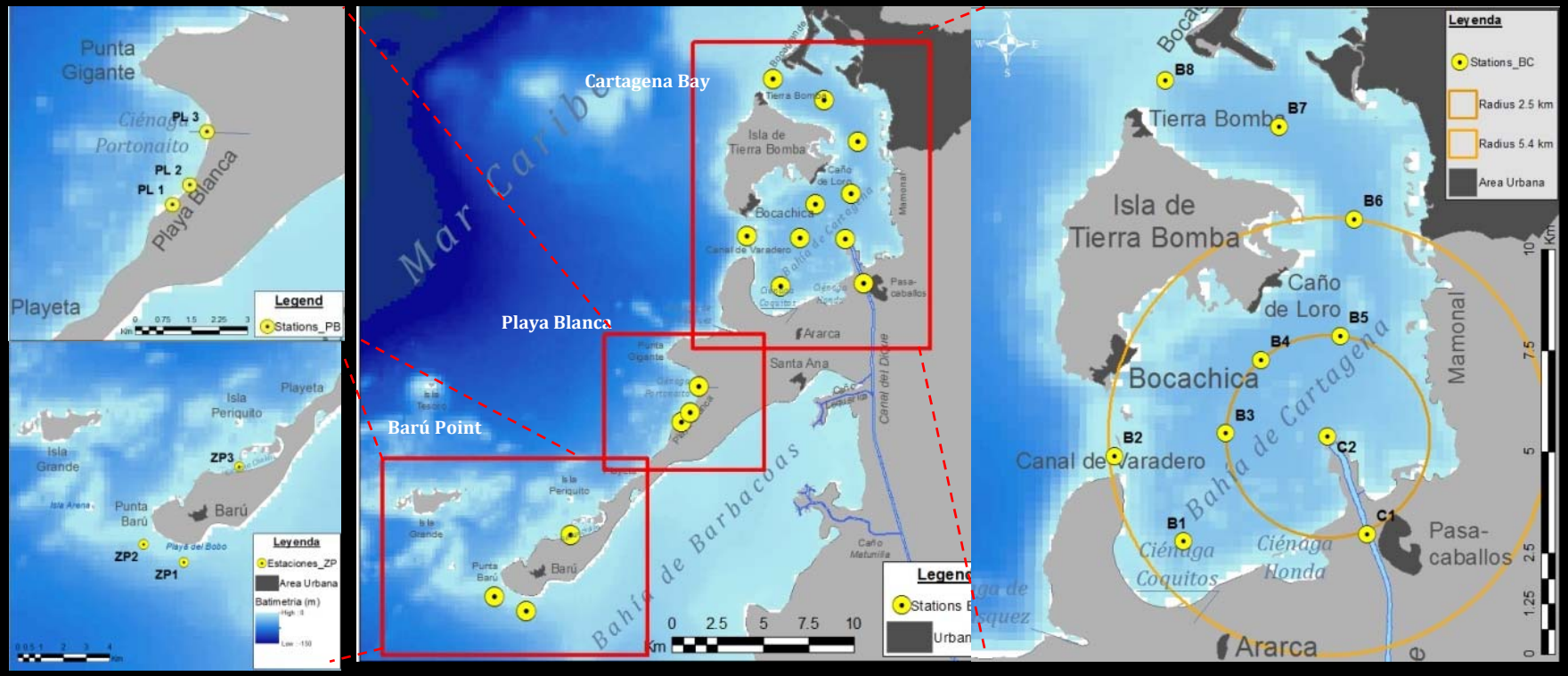
Pollution Research

Objectives:

1. Assess the area's water and sediment quality
2. Identify potential sources of pollution
3. Apply hydrodynamic and water quality models

Monitoring Program

Water Quality – monthly
Sediment Quality – 4 / year



Methods – Laboratories

Medium	Parameter	Code	Unit	Method	Lab Methodology	Method Reference (S.M.)	Detection Limit	Depth
Water	Temperature	Temp	°C	CTD Castaway In situ	In Situ	-	0.01	Multiple (every 1m)
	Salinity	Sal	ups			-	0.01	
	Dissolved Oxygen	OD	mg/L	YSI Pro 1020	In Situ	-	0.01	0.3, 3, 5, 10, 15, 22m
	pH	pH				-	0.01	
	Turbidity	Tur	NTU	Analite meter		-	0.01	
	Chlorophyll-*a*	Chl-a	µg/L	Turner Cyclops		-	0.1	
	Turbidity	Tur	NTU	Lab Cardique	Turbidometry	2130-B	0.07	0.3m & 22m
	Total Suspendid Solids	TSS	mg/L		Filtration	2540-D	4.21	
	Biological Oxygen Demand	BOD_5	mg/L		Membrane electrode	5210-B, 4500-O-G	0.46	
	Nitrate-Nitrogen	NO_3	µg/L		Colorimetry - Cd reduction	4500-NO3-E	0.0104	
	Orthophosphates	PO_4	µg/L		Colorimetry - ascorbic acid	4500-PO4	0.026	
	Total Phosphorus	TP	µg/L		Acid digestion, Colorimetry - ascorbic acid	4500-P-E	0.032	
	Chlorophyll-*a*	Chl-a	µg/L		Spectrophotometry	10200-H	0.25	
	Phenols	Phen	µg/L		Direct photometric method	S.M 5530 D	-	Surface
	Fecal Coliforms	FC	MPN/100mL	Lab AguaCar	Multiple tube fermentation	9221-B	1.8	
	Enterococcus	ETC	CFU/100mL		Membrane filtration	9230-C	1	
Sediment	Arsenic	As	ppb	Lab UniCordoba	Gaseous hydride atomic absorption spectrometry	EPA 3015 A - HFAAS	30	Surface Sediments
	Cadmium	Cd	ppb		Graphite furnace atomic absorption spectrometry	EPA 3051-A - GFAAS	25	
	Chromium	Cr	ppb		Graphite furnace atomic absorption spectrometry	EPA 3051-A - GFAAS	100	
	Copper	Cu	ppb		Atomic absorption spectrometry	EPA 3051-A	1000	
	Mercury	Hg	ppb		Direct Mercury Analysis (DMA-80)	EPA 7473	0.1	
	Methyl Mercury	MeHg	ppb		Thermal decomposition, amalgamation, and atomic absorption spectrophotometry	EUR 25830 EN - 2013	2	
	Nickel	Ni	ppb		Atomic absorption spectrometry	EPA 3051-A	5000	
	Lead	Pb	ppb		Graphite furnace atomic absorption spectrometry	EPA 3051-A - GFAAS	100	
	Tin	Sn	ppb		Graphite furnace atomic absorption spectrometry	EPA 3051-A - GFAAS	500	



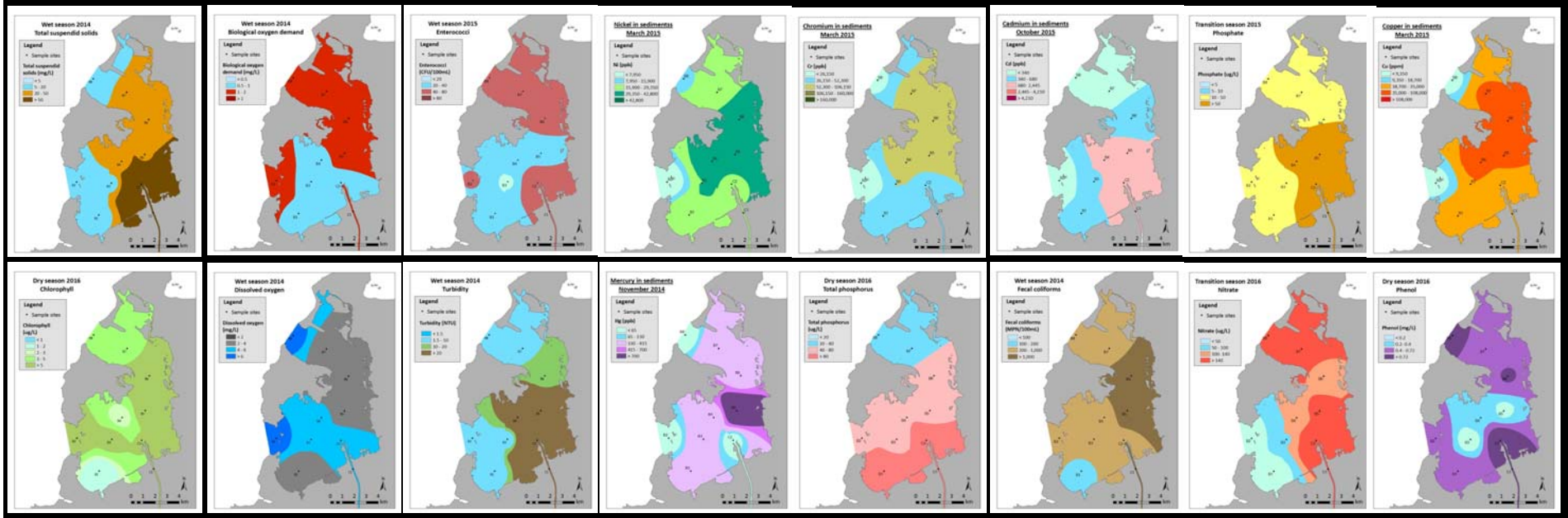



IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

Canada

BASIC
CARTAGENA

What did we find?

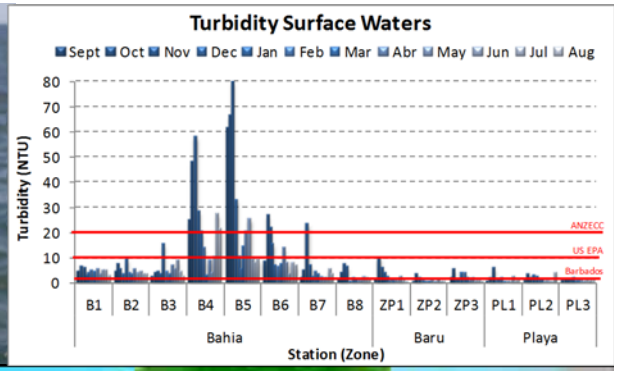


Myth: The bay´s pollution problem is mercury

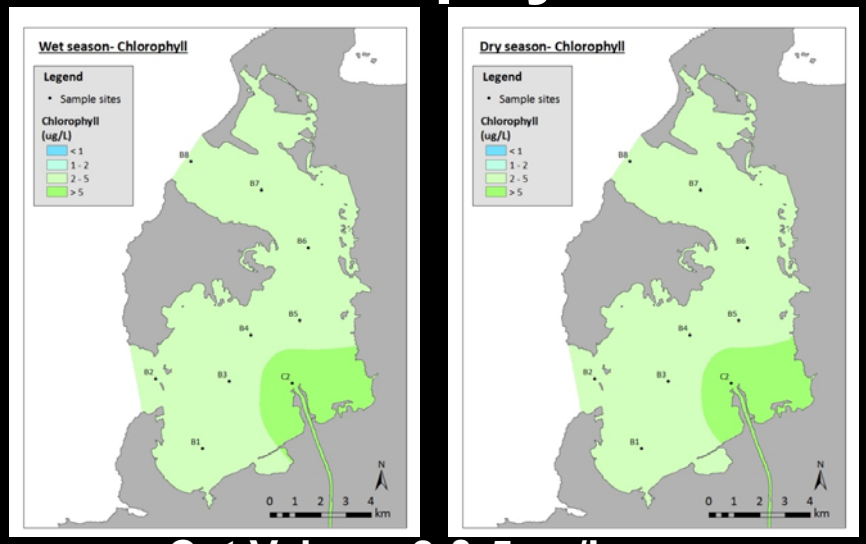
Reality: There are many types of pollution in the bay

Pollution Issues

- Turbid Plumes

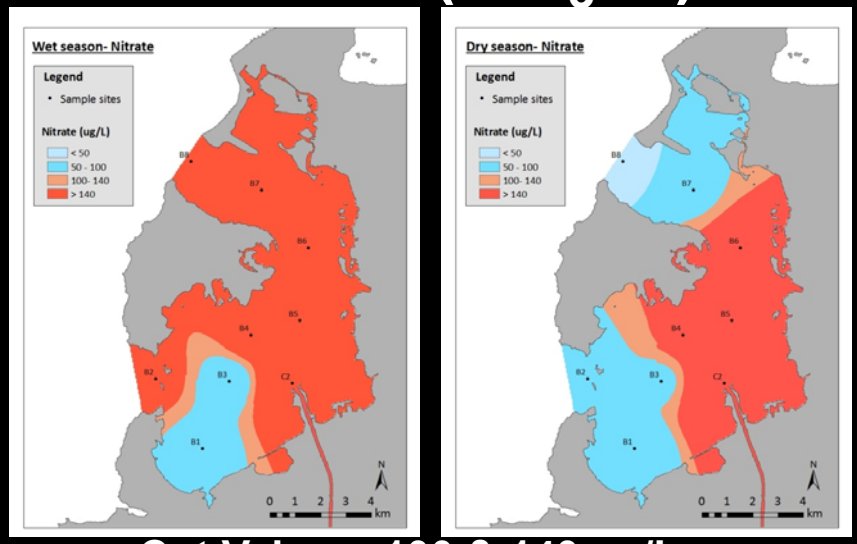


Chlorophyll-a



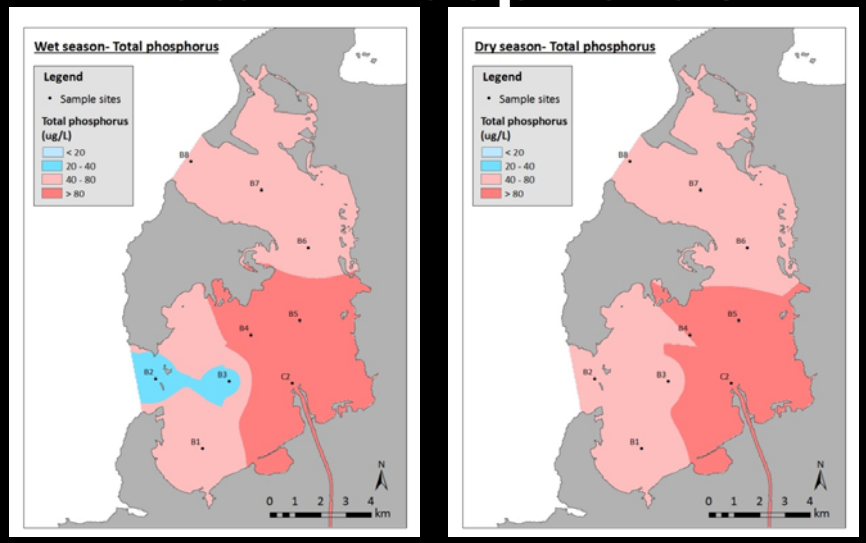
Cut Values: 2 & 5 µg/L

Nitrate (NO_3-N)



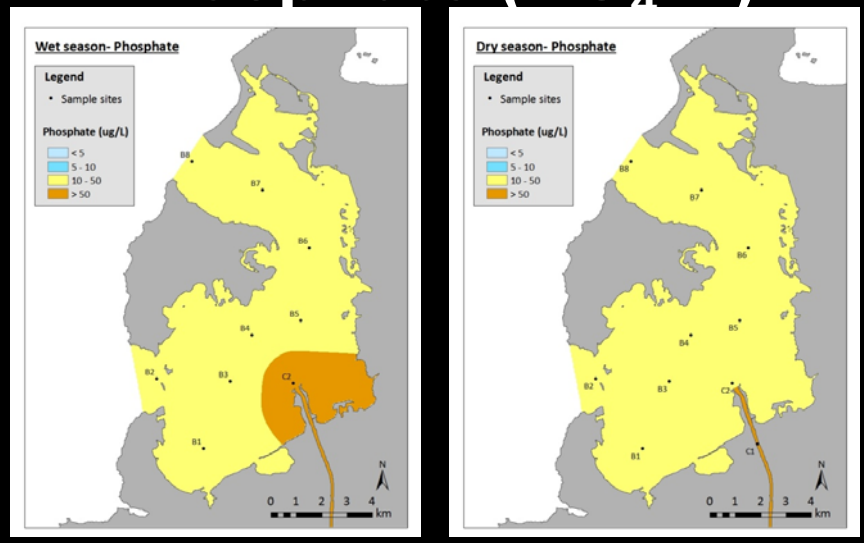
Cut Values: 100 & 140 µg/L
(= 7 & 10 µM)

Total Phosphorus



Cut Values: 40 & 80 µg/L
(=1.3 & 2.6 µM)

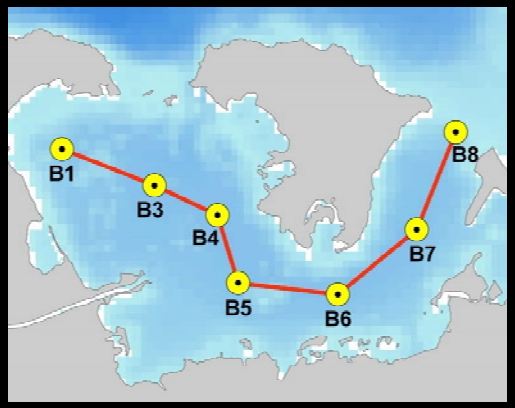
Phosphate (PO_4-P)

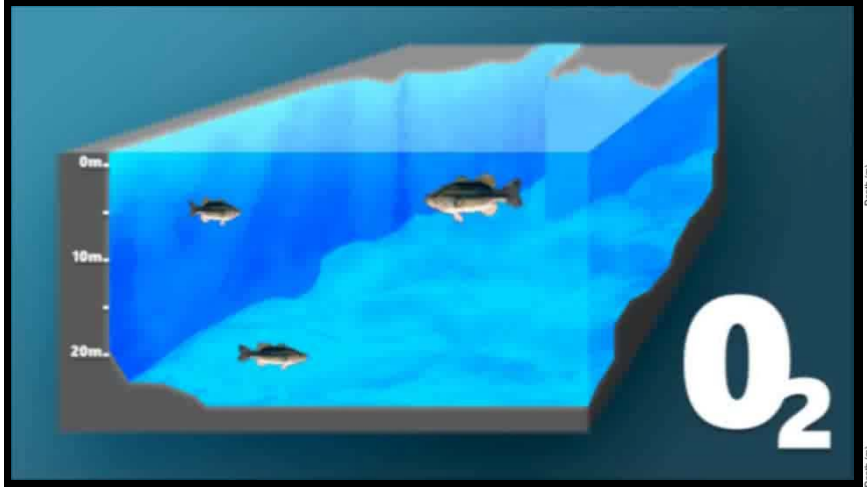


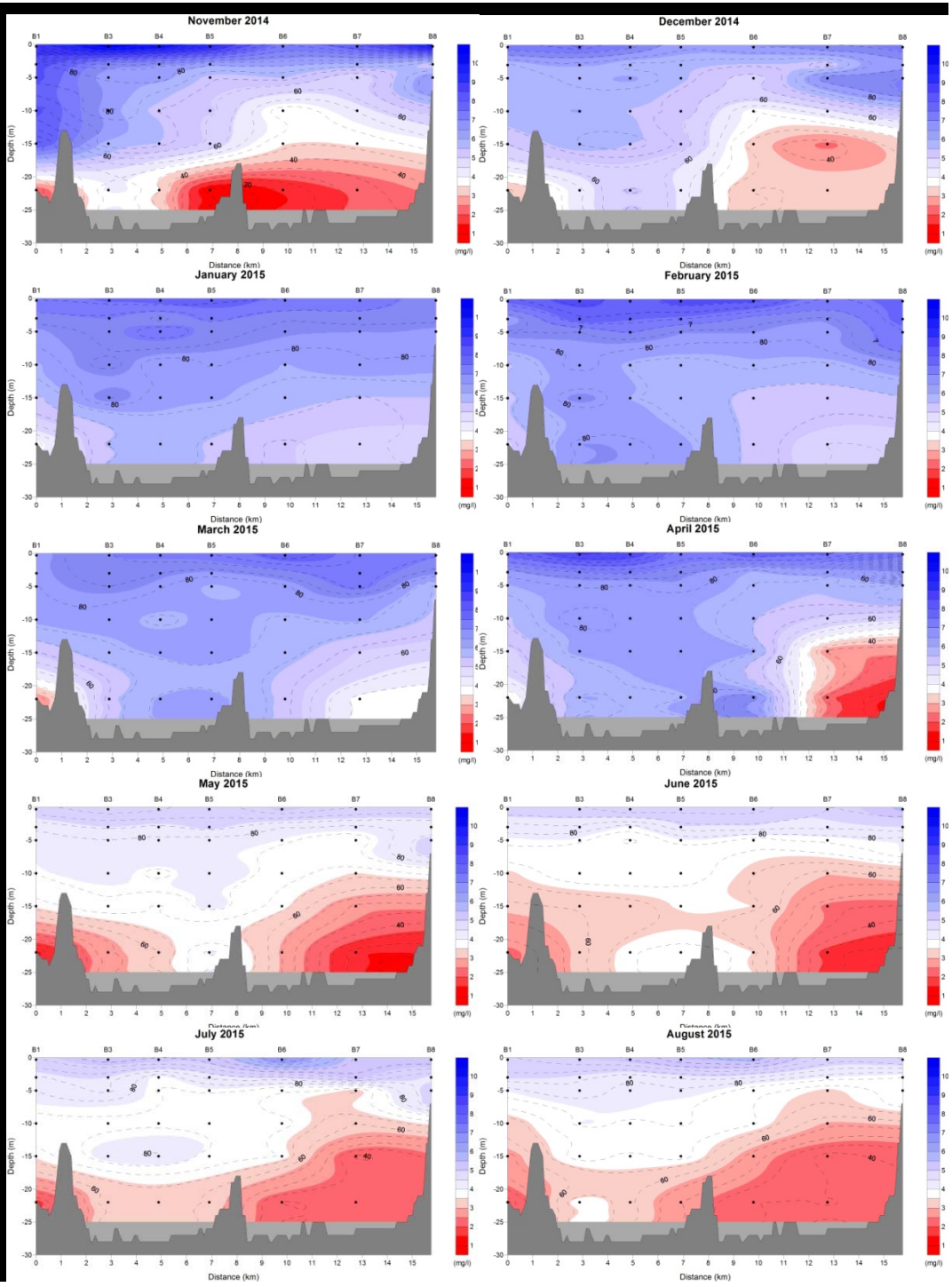
Cut Values: 10 & 50 µg/L
(= 0.3 & 1.6 µM)

Pollution Issues

- Hypoxic Conditions

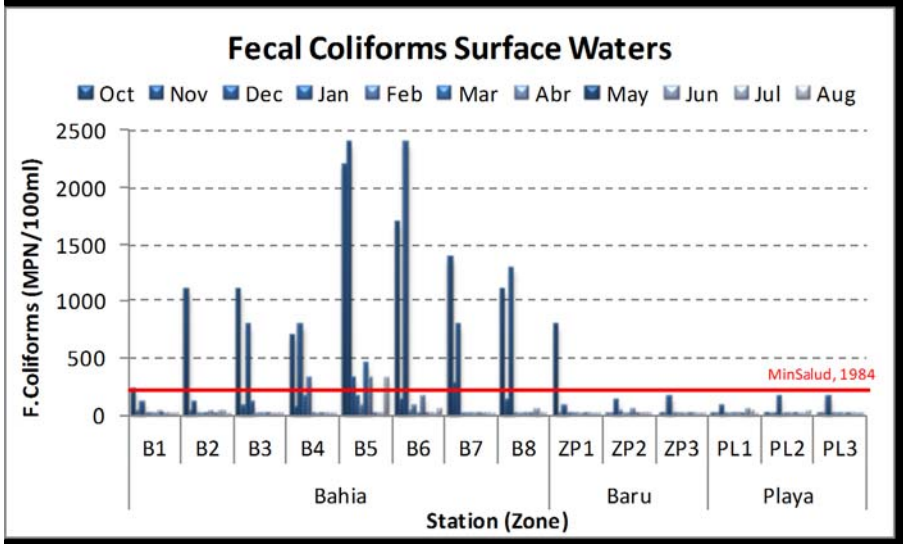


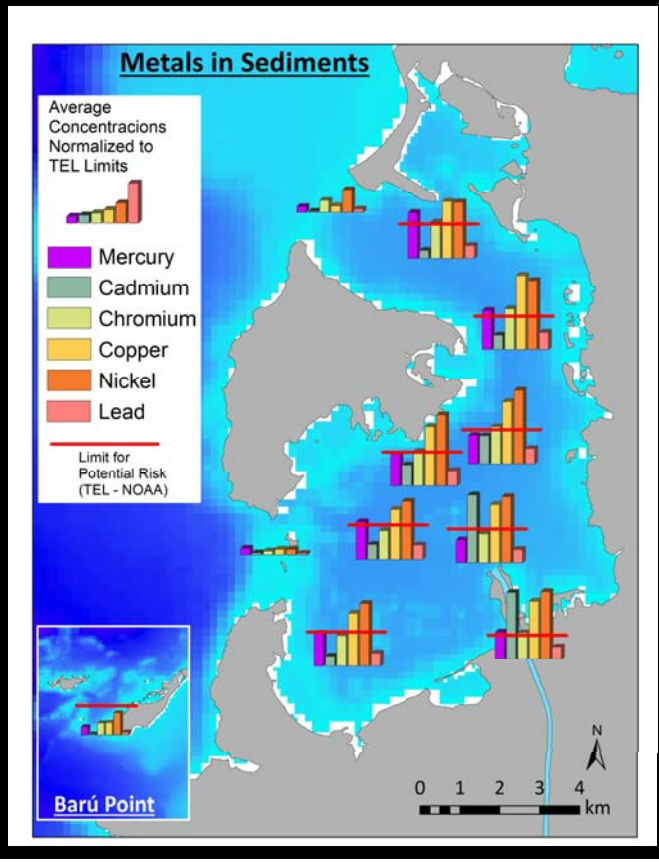




Pollution Issues

- Occasionally inadequate recreational waters
- Metals in sediments and fish





What's the pollution source?

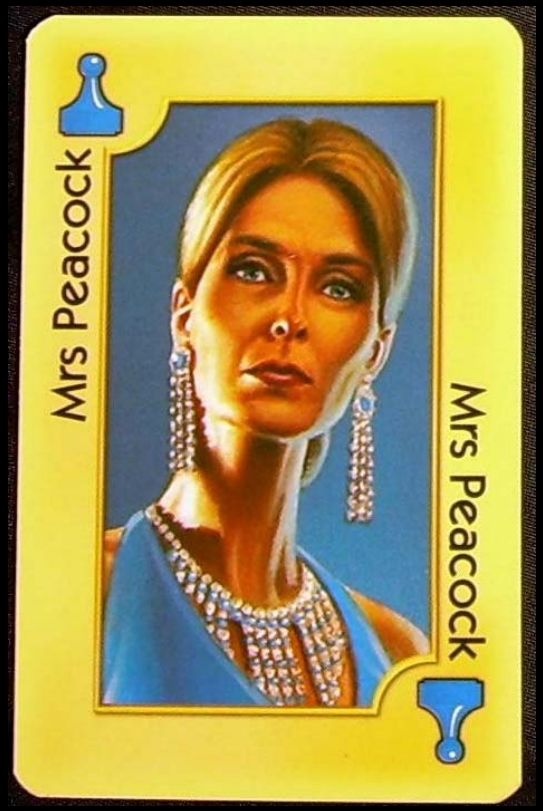
?

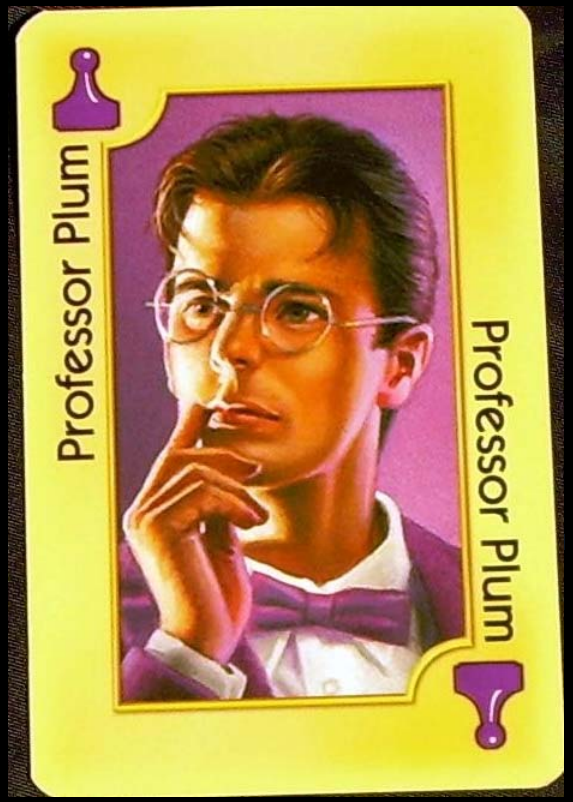
?

?

Who done it?


Colonel Mustard
Colonel Mustard


Mrs Peacock
Mrs Peacock

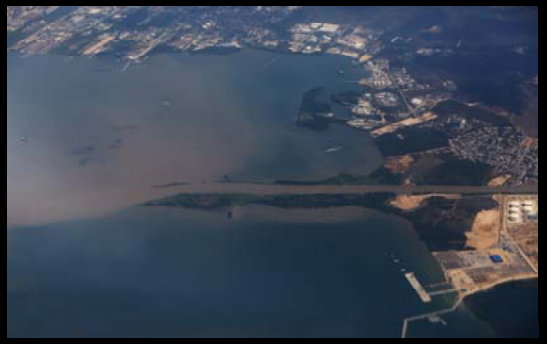

Professor Plum
Professor Plum

Who done it?

Domestic Wastewater

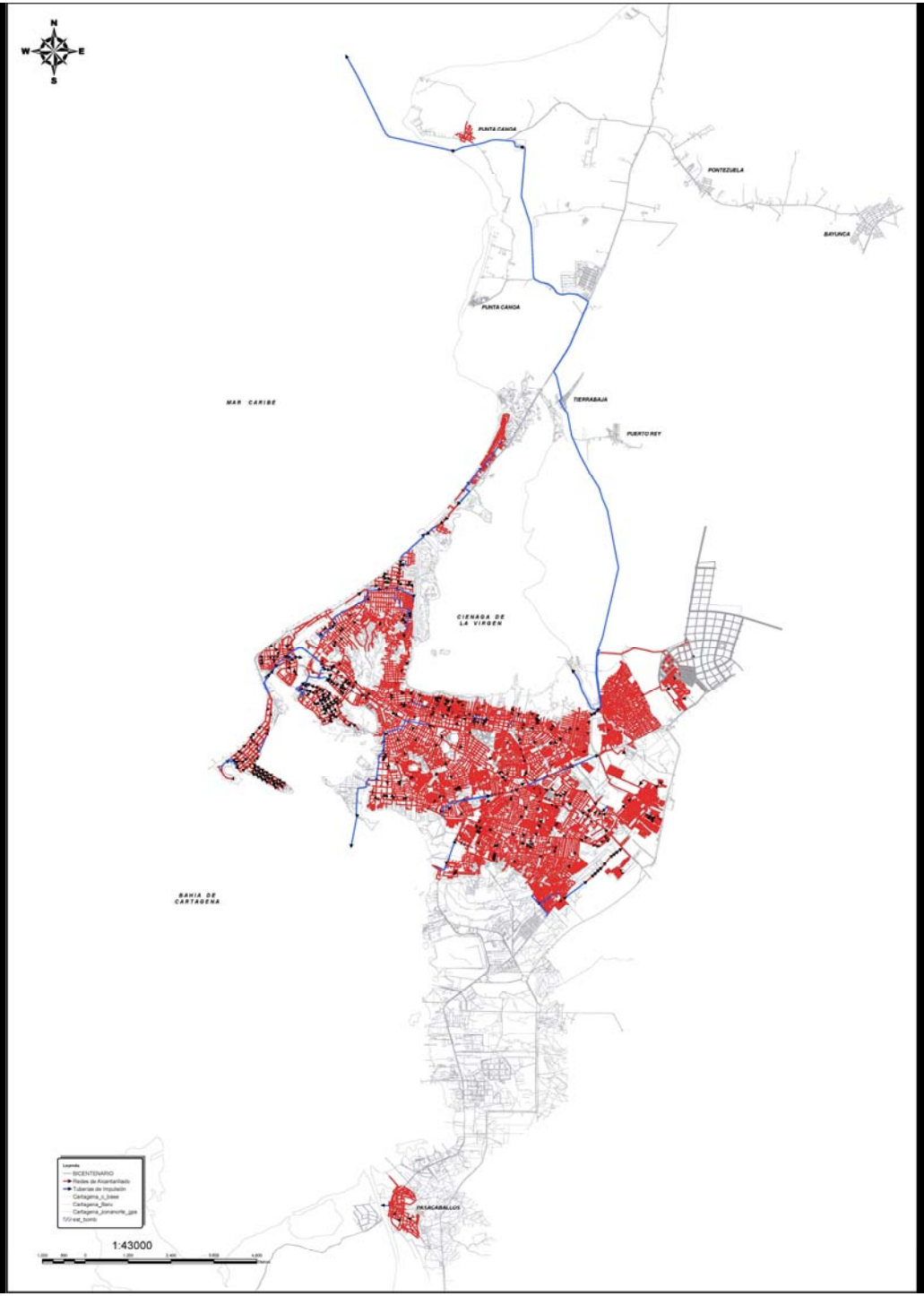
Industrial Zone

Watershed Runoff



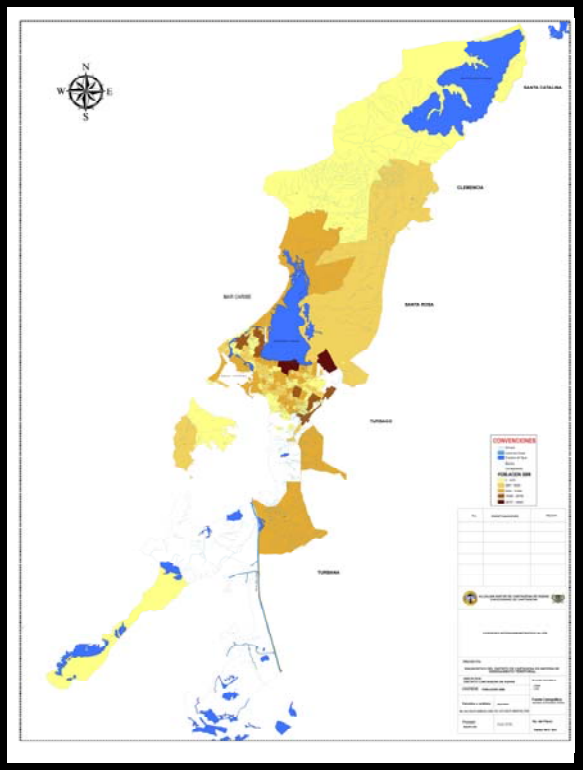
Research Question: What are the principal land-based sources of pollution responsible for these pollution issues?

Sewage System (~86%)



Source #1: Domestic Wastewater

Total Population



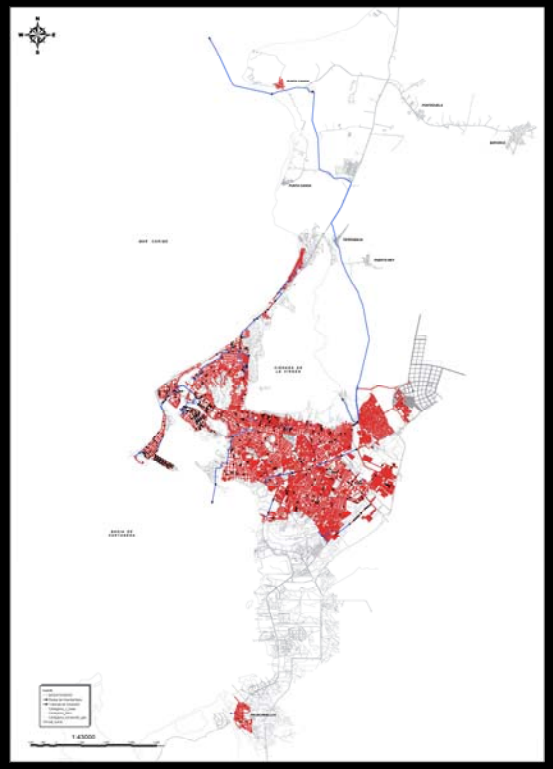
1,001,755

2015 projection (DANE, 2005)

Projections: ± 10,694

GIS polygons: ± 35,037

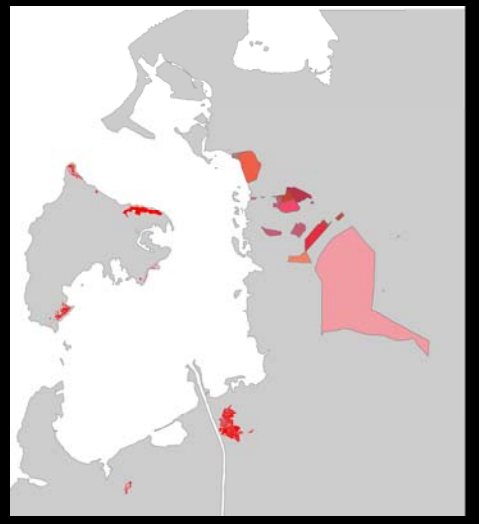
Sewage System (~86%)



~86% Pop. serviced

± ??? *

Non-covered or Untreated Population



140,361

± 45,731 *

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

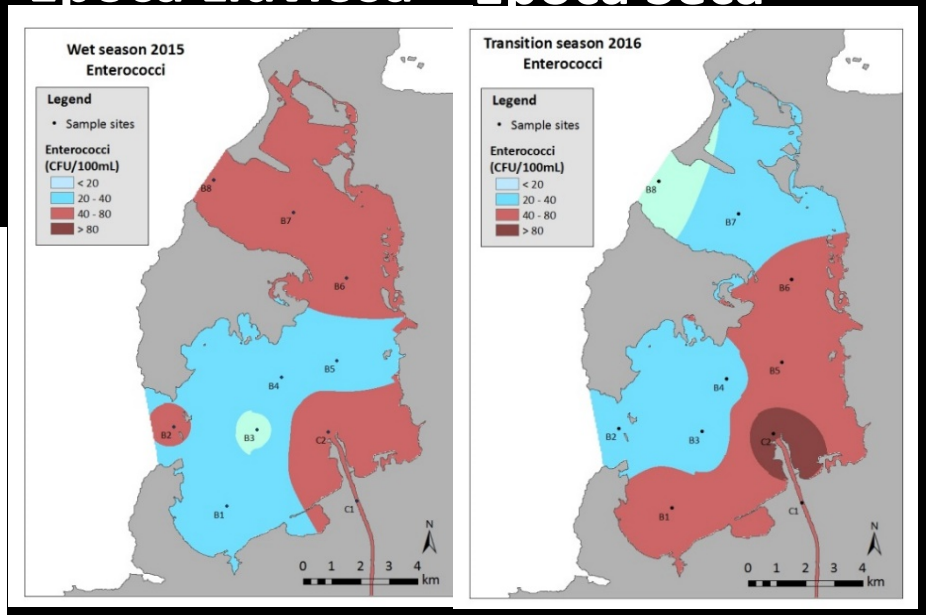
Canada

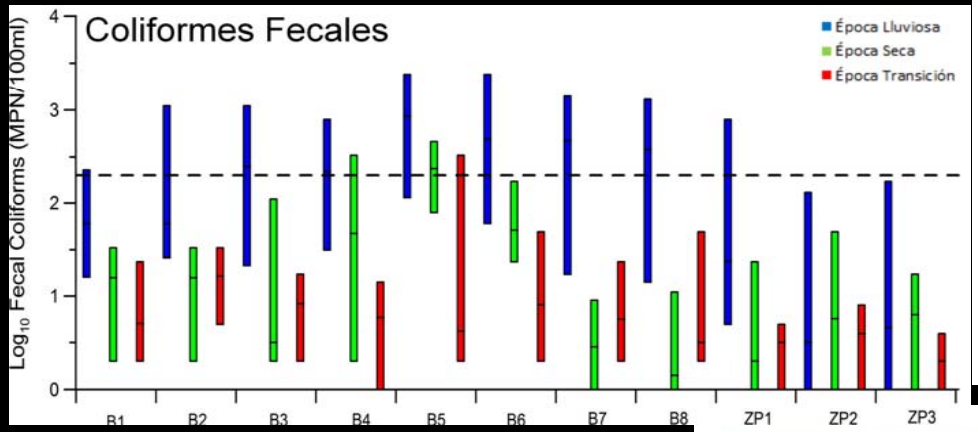
BASIC CARTAGENA

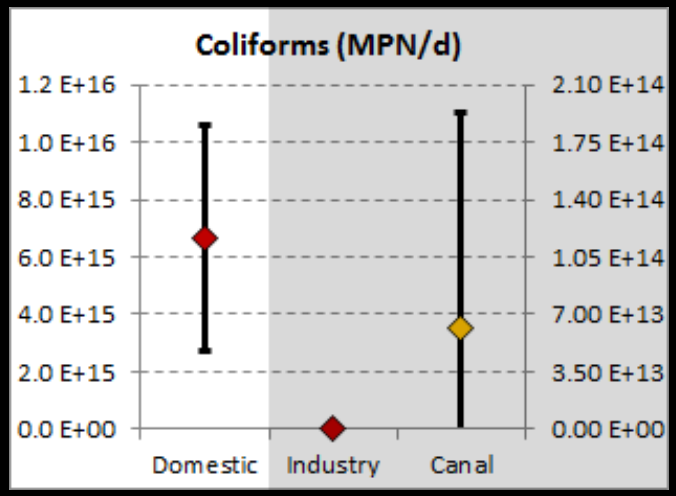
Qué se encontró?

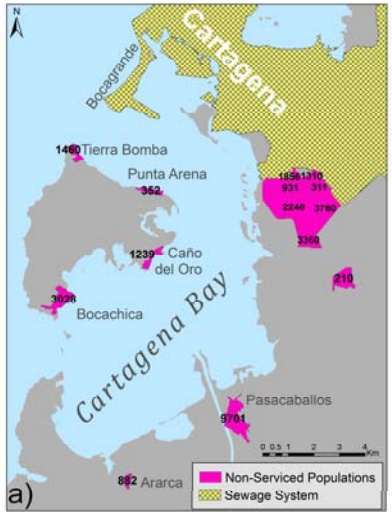
➡ Aguas inadecuadas para recreación

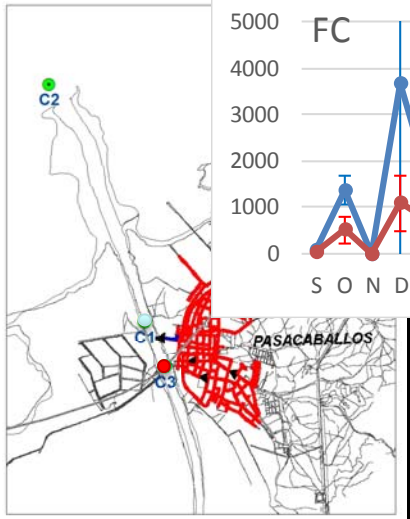
Época Lluviosa Época Seca

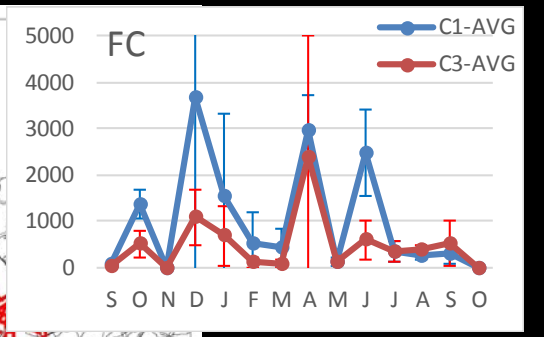




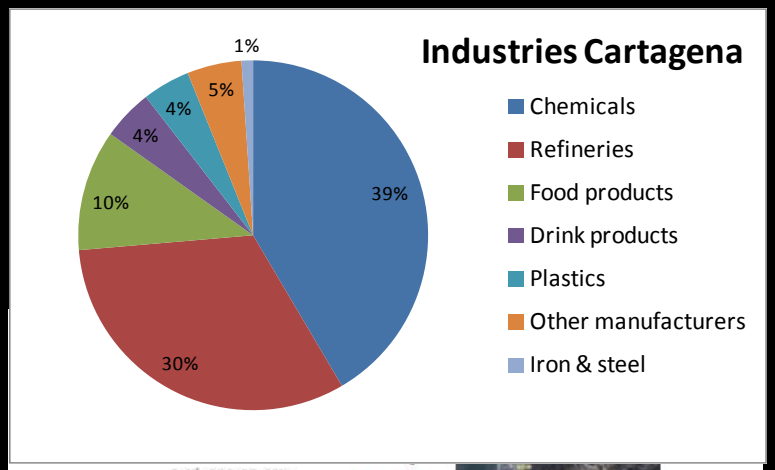


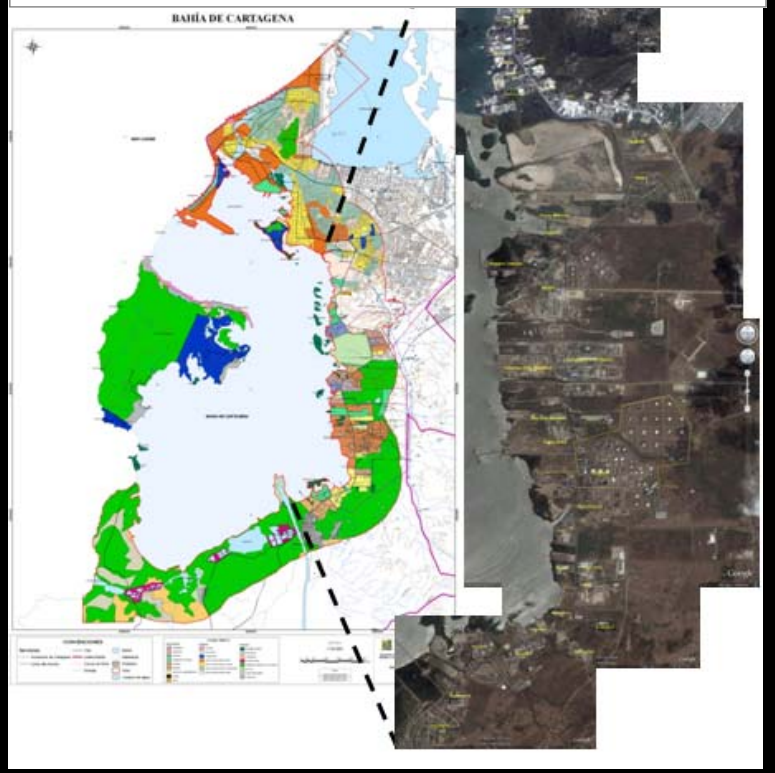






Source #2: Industrial Effluents



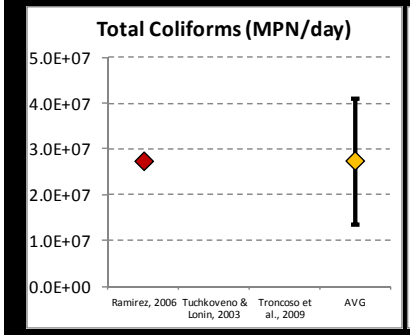


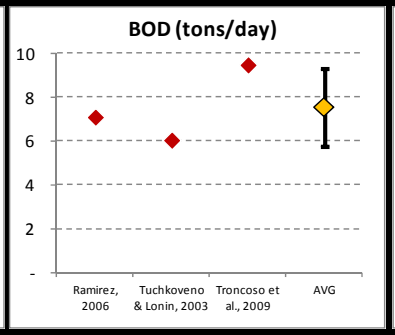
Economic Activity	Company	Potential Pollutants
Aquaculture	C.I. Antillana S.A. C.I. Océanos S.A. Seatech International Inc.	Compuestos Nitrogenados (Nitrógeno Total (NT), Nitrógeno Amoniacal (N-NH_3), Nitratos (N-NO_3^-), Nitritos (N-NO_2^-), Fósforo Total (PT), Fosfatos (P-PO_4), Color, Coliformes.
Fish products and processing	C.I. Océanos S.A. C.I. Comexa Ltda	Fenoles, Yodo, Compuestos Nitrogenados (Nitrógeno Total (NT), Nitrógeno Amoniacal (N-NH_3), Nitratos (N-NO_3^-), Nitritos (N-NO_2^-)), Fósforo Total (PT), Fosfatos (P-PO_4), Coliformes, Color.
Lacteous products	Coolechera Ltda Proleca Ltda	Fenoles, Yodo, Compuestos Nitrogenados (Nitrógeno Total (NT), Nitrógeno Amoniacal (N-NH_3), Nitratos (N-NO_3^-) Nitritos (N-NO_2^-)), Fósforo Total (PT), Fosfatos (P-PO_4), Coliformes, E.coli.
Drink products	Postobón S.A.	Fenoles, Yodo, Nitrógeno Total (NT), Fosforo Total (PT), Color.
Leather	Curtiembre Mateucci Ltda	Fenoles, Yodo, Sulfuros (S^{2-}), Cromo (Cr), Cromo Hexavalente (Cr^{6+}), Cobre (Cu), Níquel (Ni), Mercurio (Hg), Color.
Petroleum refinery	Exxon Mobil de Colombia S.A.	Fenoles, Yodo, Hidrocarburos Totales del Petróleo (HTP), BTEX, Sulfuro de Carbono (CS_2), Arsénico (As), Bario (Ba), Cadmio (Cd), Cromo (Cr), Cromo Hexavalente (Cr^{6+}), Plomo (Pb), Vanadio (V), Hierro (Fe).
Chemical substances	Agafano S.A. Biofilm S.A	Fenoles, Hidrocarburos Totales del Petróleo (HTP), BTEX, Compuestos Nitrogenados (Nitrógeno Total (NT), Nitrógeno Amoniacal (N-NH_3), Nitratos (N-NO_3^-), Nitritos (N-NO_2^-)), Fósforo Total (PT), Fosfatos (P-PO_4), Residuos de Ingredientes Activos de Plaguicidas, Cianuros (CN^-), Sulfuros (S^{2-}), Arsénico (As), Cadmio (Cd), Calcio (Ca), Cobalto (Co), Cromo (Cr), Mercurio (Hg), Níquel (Ni), Plomo (Pb), Selenio (Se), Zinc (Zn), Hierro (Fe).
Fertilizer production	Abocol - Planta norte	Hidrocarburos Totales del Petróleo (HTP), Cianuros (CN^-), Compuestos Nitrogenados (Nitrógeno Total (NT), Nitrógeno Amoniacal (N-NH_3), Nitratos (N-NO_3^-), Nitritos (N-NO_2^-)), Fósforo Total (PT), Fosfatos (P-PO_4), Sulfuros (S^{2-}), Arsénico (As), Cadmio (Cd), Plomo (Pb), Cobre (Cu), Hierro (Fe), Manganeso (Mn), Cromo (Cr), Mercurio (Hg), Níquel (Ni), Zinc (Zn), Vanadio (V).
Plastic fabrication	Dow química de Colombia S.A., Mexichem resinas de Colombia S.A.S	Fenoles, Hidrocarburos Totales del Petróleo (HTP), Cadmio (Cd), Cobre (Cu), Cromo (Cr), Mercurio (Hg), Níquel (Ni), Plomo (Pb), Hierro (Fe), Zinc (Zn).
Cement factory	Cementos Argos S.A.	Fenoles, Aluminio (Al), Cobre (Cu), Cromo (Cr), Estaño (Sn), Hierro (Fe), Plomo (Pb), Níquel (Ni), Zinc (Zn), Vanadio (V).
Electricity generation	Proelectrica S.A.	Hidrocarburos Totales del Petróleo (HTP), Cadmio (Cd), Níquel (Ni), Plomo (Pb), Zinc (Zn), Cobre (Cu), Cromo (Cr), Estaño (Sn).
Poultry products and processing	Indupollo S.A	Fenoles, Yodo, Hidrocarburos Totales del Petróleo (HTP), Compuestos Nitrogenados (Nitrógeno Total (NT), Nitrógeno Amoniacal (N-NH_3), Nitratos (N-NO_3^-), Nitritos (N-NO_2^-)), Fósforo Total (PT), Fosfatos (P-PO_4), Plaguicidas, Coliformes, Color

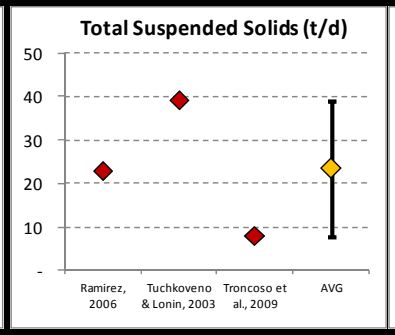
Loads: Industrial Effluents

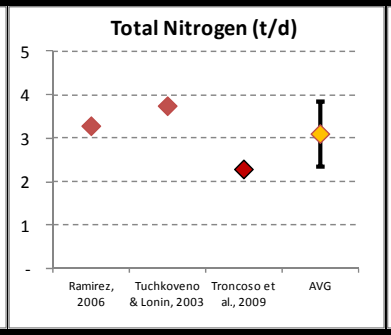
Load Calculations

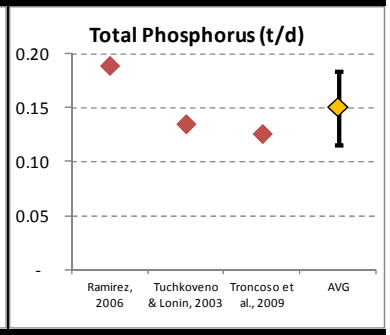
	Discharge (m3/s)	DBO (t/d)	TSS (t/d)	TN (t/d)	TP (t/d)	Tot Coliforms (MPN/d)	Fec Coliforms (MPN/d)
Ramirez, 2006	2.54	7.09	23.04	3.29	0.19	2.7E+07	2.7E+06
Tuchkoveno & Lonin, 2003	15.8	6.04	39.3	3.75	0.14		
Troncoso et al., 2009		9.47	7.96	2.28	0.13		
AVG	**9.17**	**7.54**	**23.4**	**3.11**	**0.15**	**2.7E+07**	**2.7E+06**
Conf Int	9.37	1.76	15.7	0.75	0.03	1.4E+07	1.4E+06





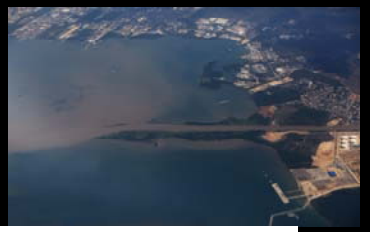


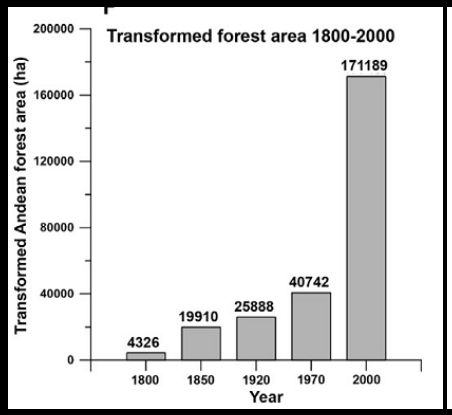


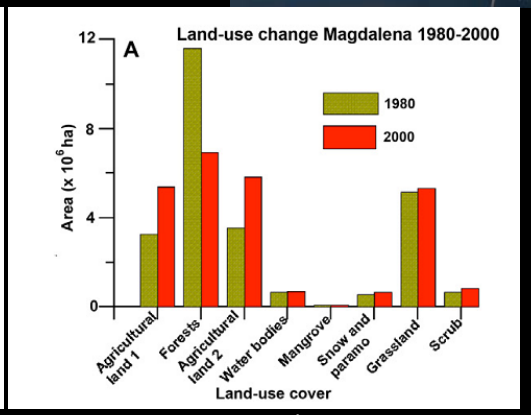


- **Are all industries reporting? ***
- **Temporal variability?**

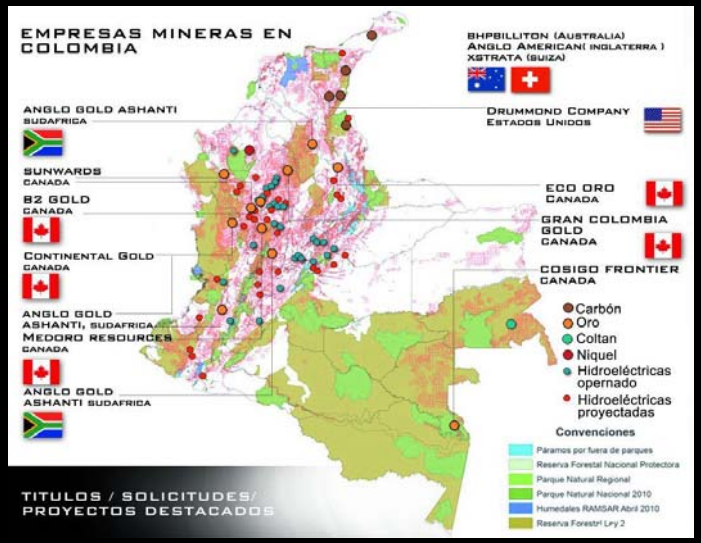
Source #3: Watershed Runoff







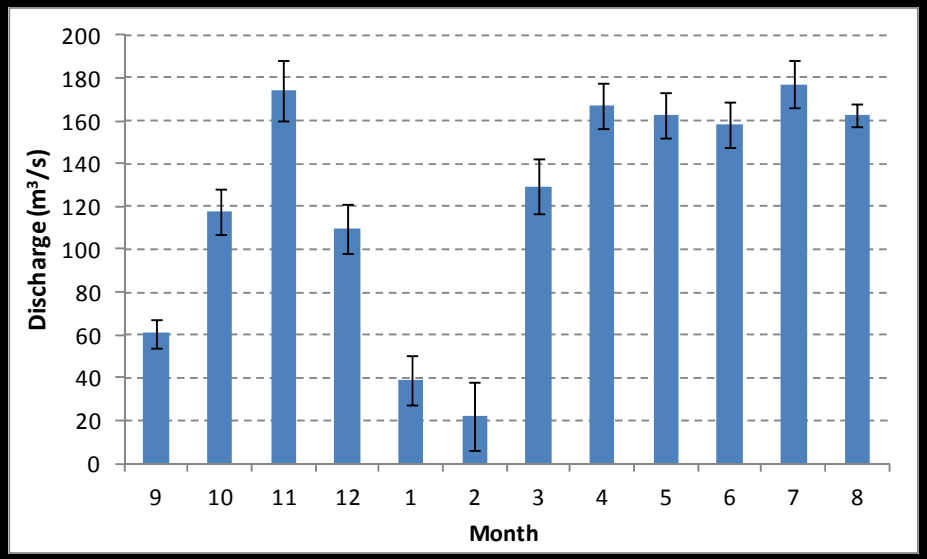
(Restrepo et al., 2015)



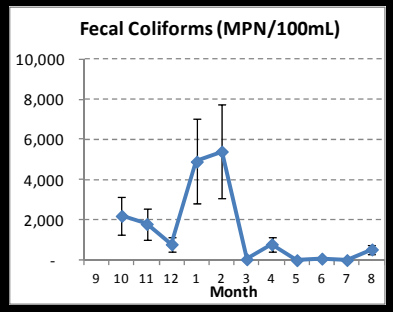
- 25% national land area
- 80% national population
  - ~38 million
  - Density: 108 hab/km^2)
- Deforestation: 274,000 ha/y ➡ Agriculture/live stock
- Mining: 4.5% of national territory (high % illegal)

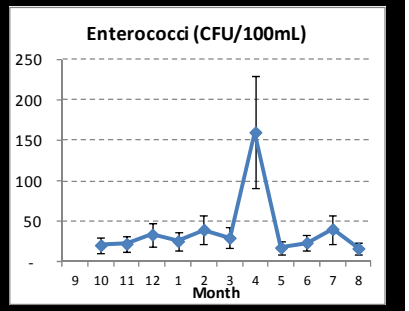
Loads: Watershed Runoff

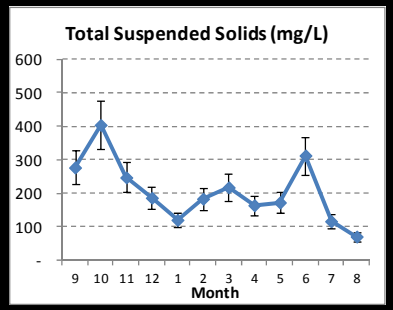
ADP Discharge Measurements

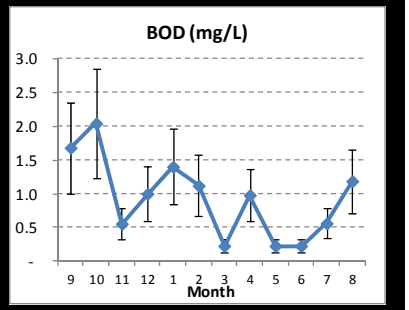


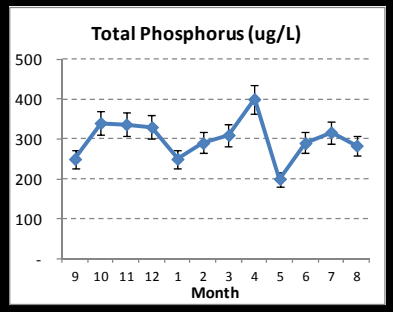
Water Quality Analyses

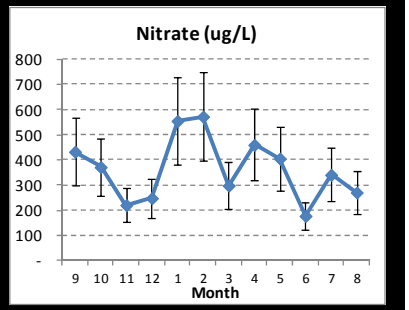






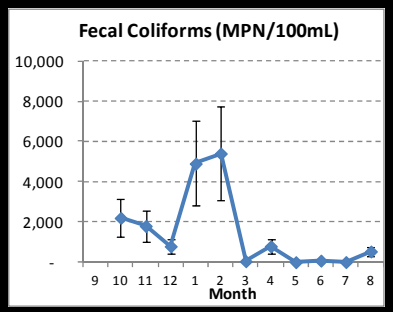


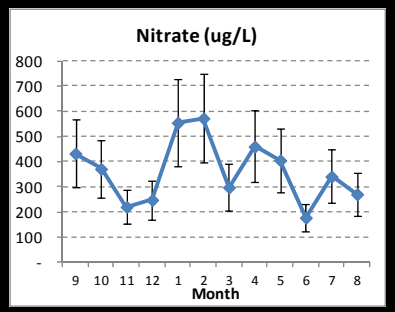


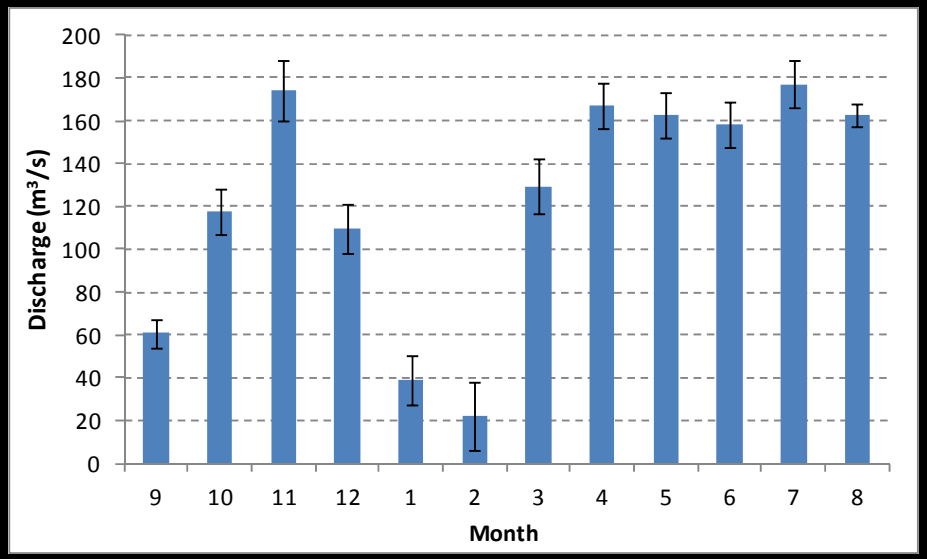


Loads: Watershed Runoff

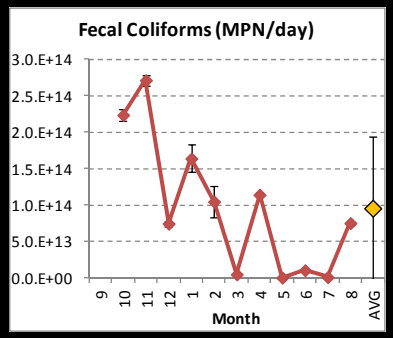
Discharge & Water Quality

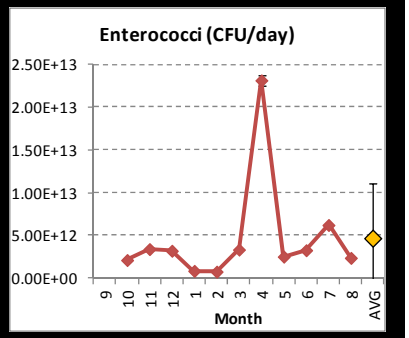


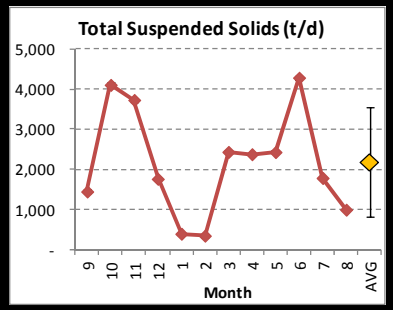


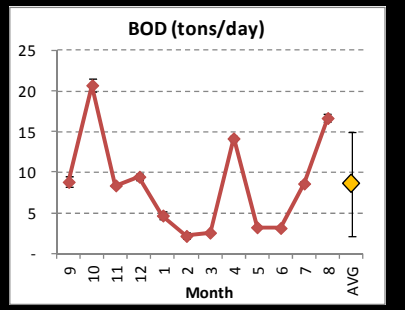


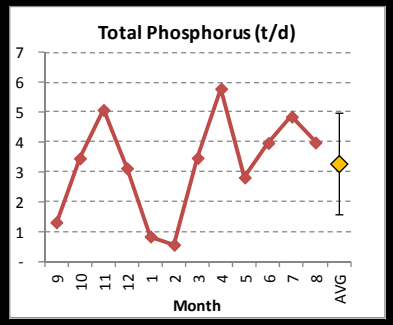
Load Calculations

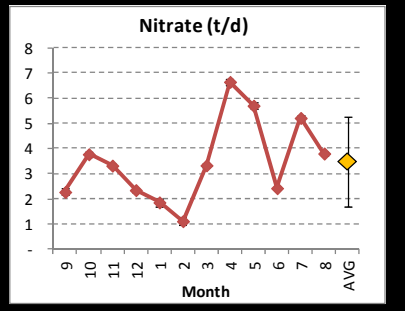




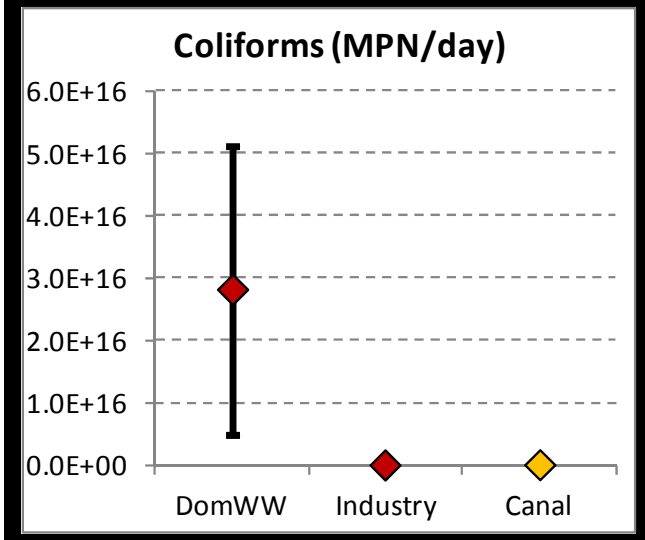


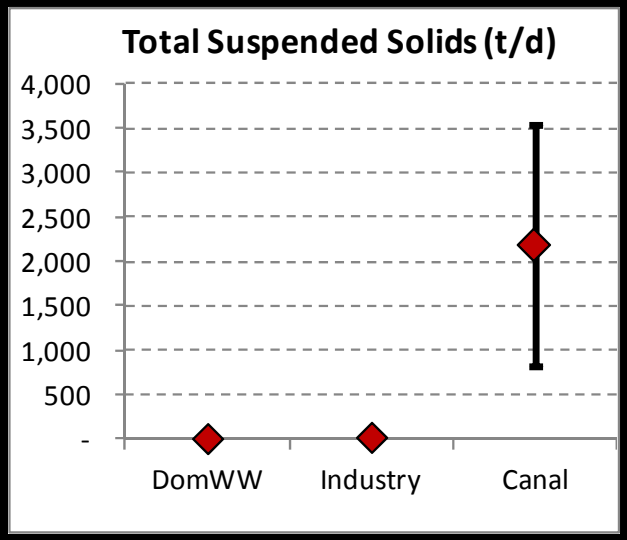


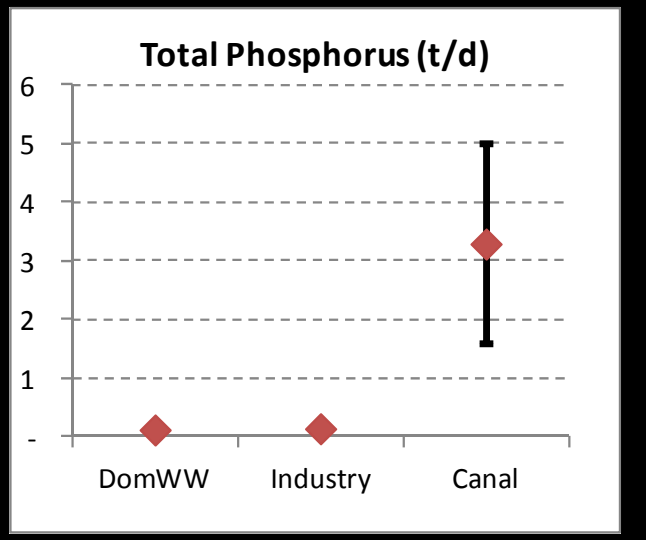


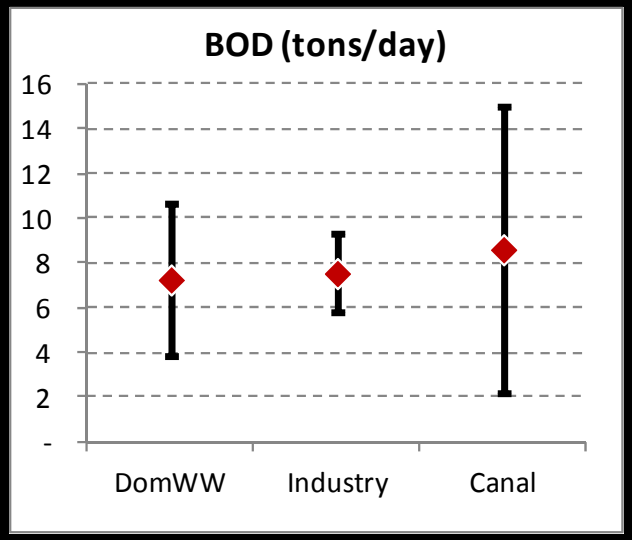


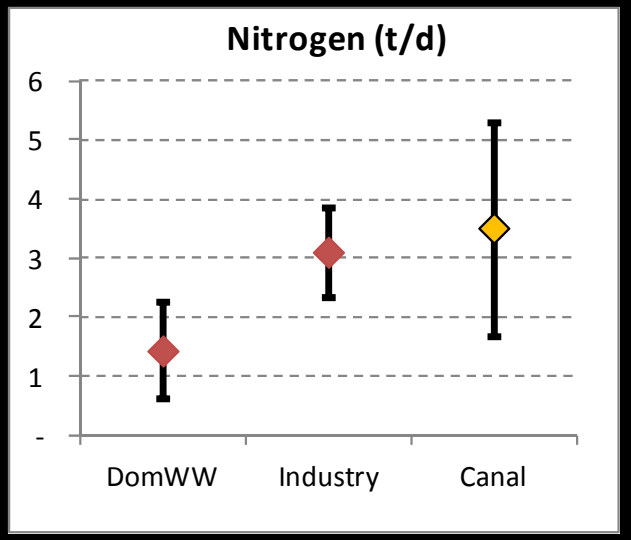
Load Comparison







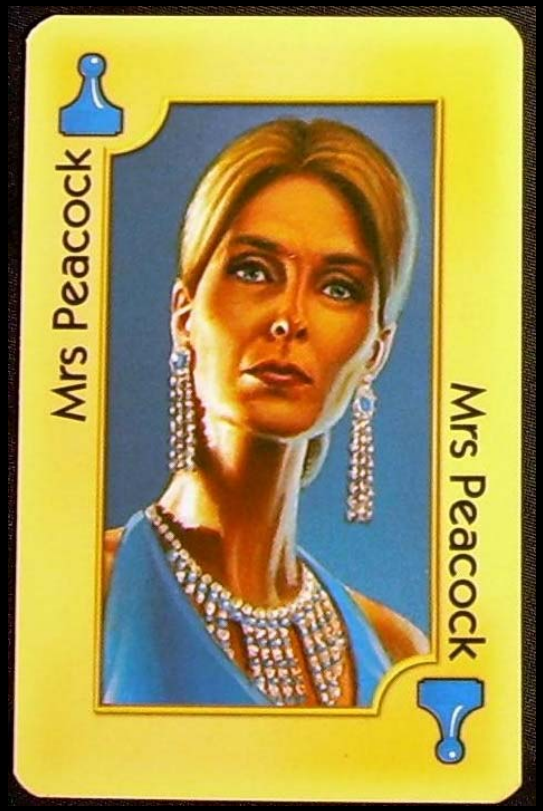


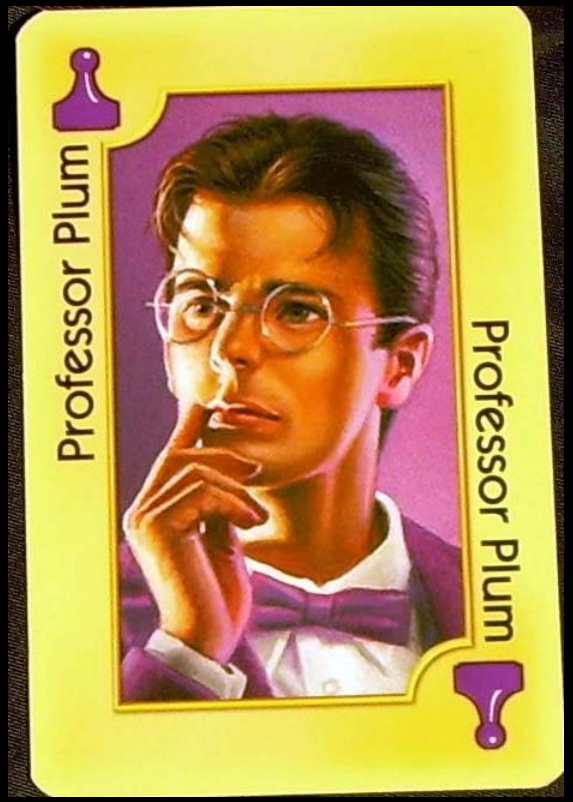


*

Who done it?


Colonel Mustard
Colonel Mustard


Mrs Peacock
Mrs Peacock


Professor Plum
Professor Plum

They all done it!

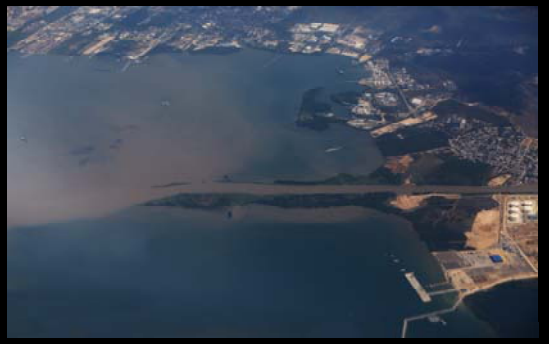
Domestic Wastewater

- **Coliforms**
- **BOD**

Industrial Zone

- **Nitrogen**
- **BOD**

Watershed Runoff



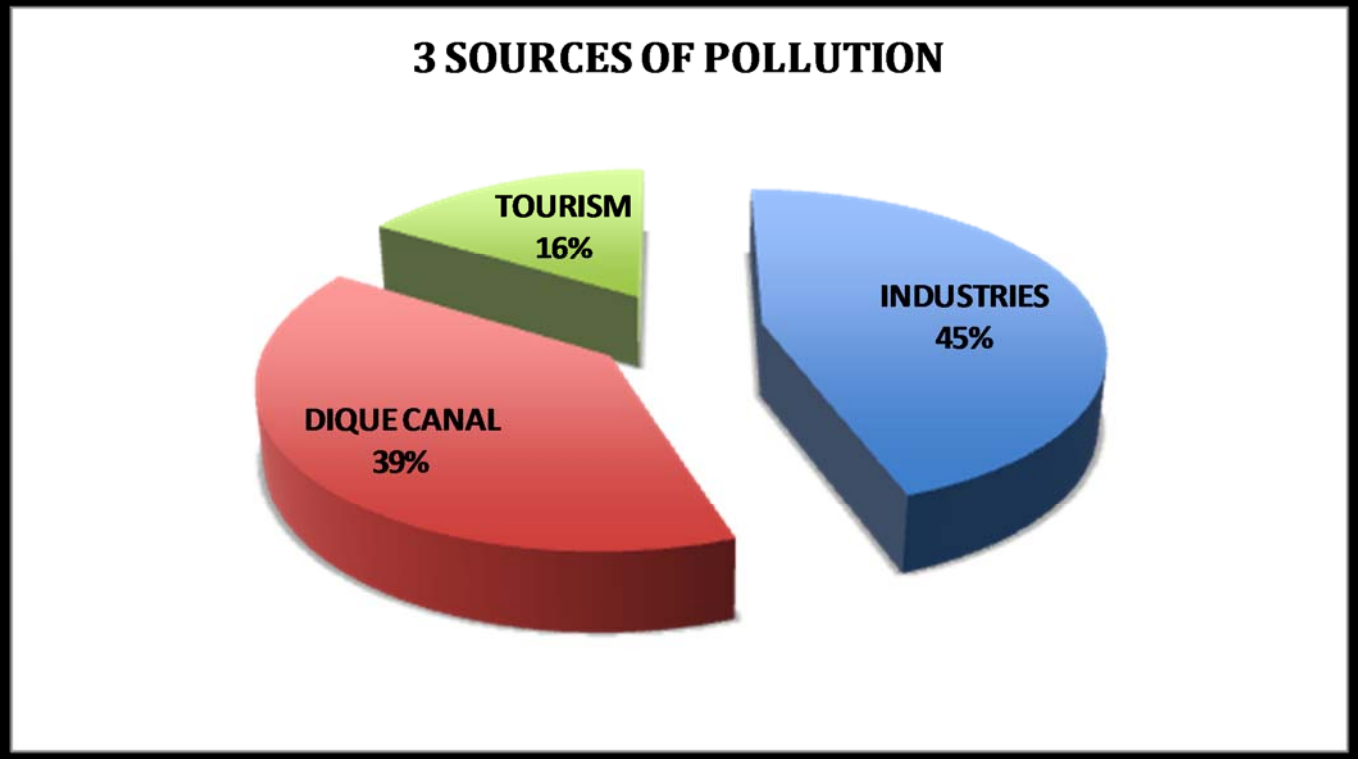
- **TSS**
- **Phosphorus**
- **Nitrogen**
- **BOD**

Research Question: What are the principal land-based sources of pollution responsible for these pollution issues?

Discussion

Community Perception

- 110 local fishermen interviewed
- What do you think is the principal source of water pollution?



Next steps

Other types of pollution

- Metals (Mining runoff, Industries)
- Hydrocarbons (Maritime activities, Petroleum industry)
- Pesticides (Agricultural runoff)

Future increases in pollution

- Population ↑ , Tourism ↑ → Domestic Wastewater ↑
- Colombia's peace treaty → Economy ↑ → Industries ↑
- Runoff: Future Projections ↑ , Upstream mitigation project ↓
  - **- Watershed deforestation**
  - **- Urbanization**
  - **- Climate Change**

Other Research

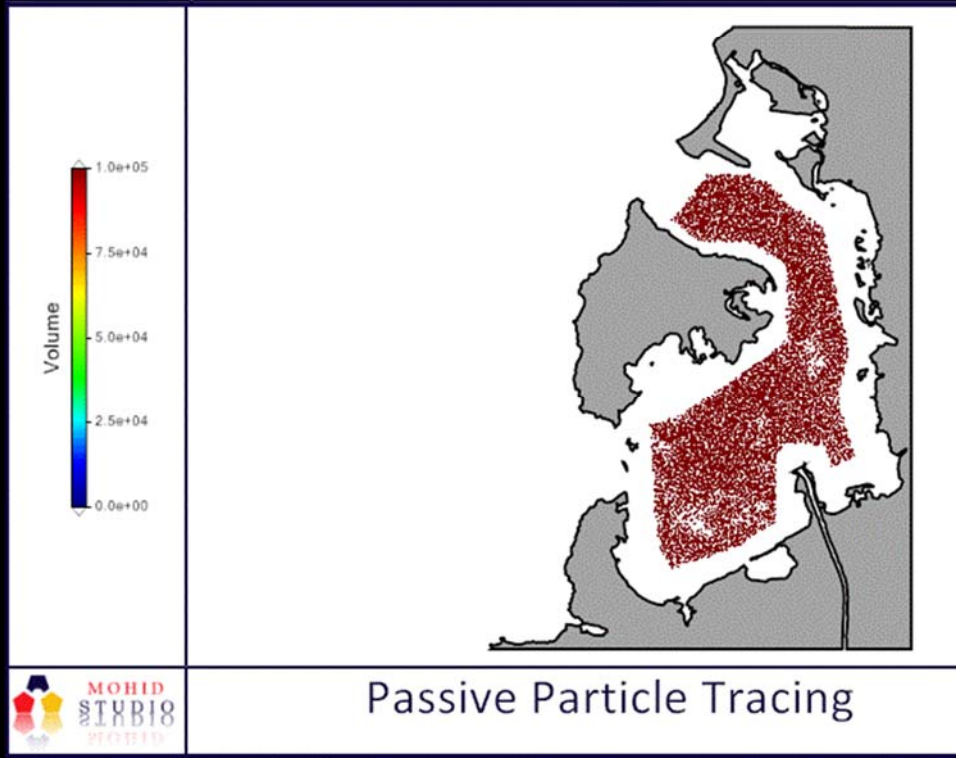
Hydrodynamic Modelling

- Water residence time

Water quality modeling

- Dispersion processes

MOHID modelling system

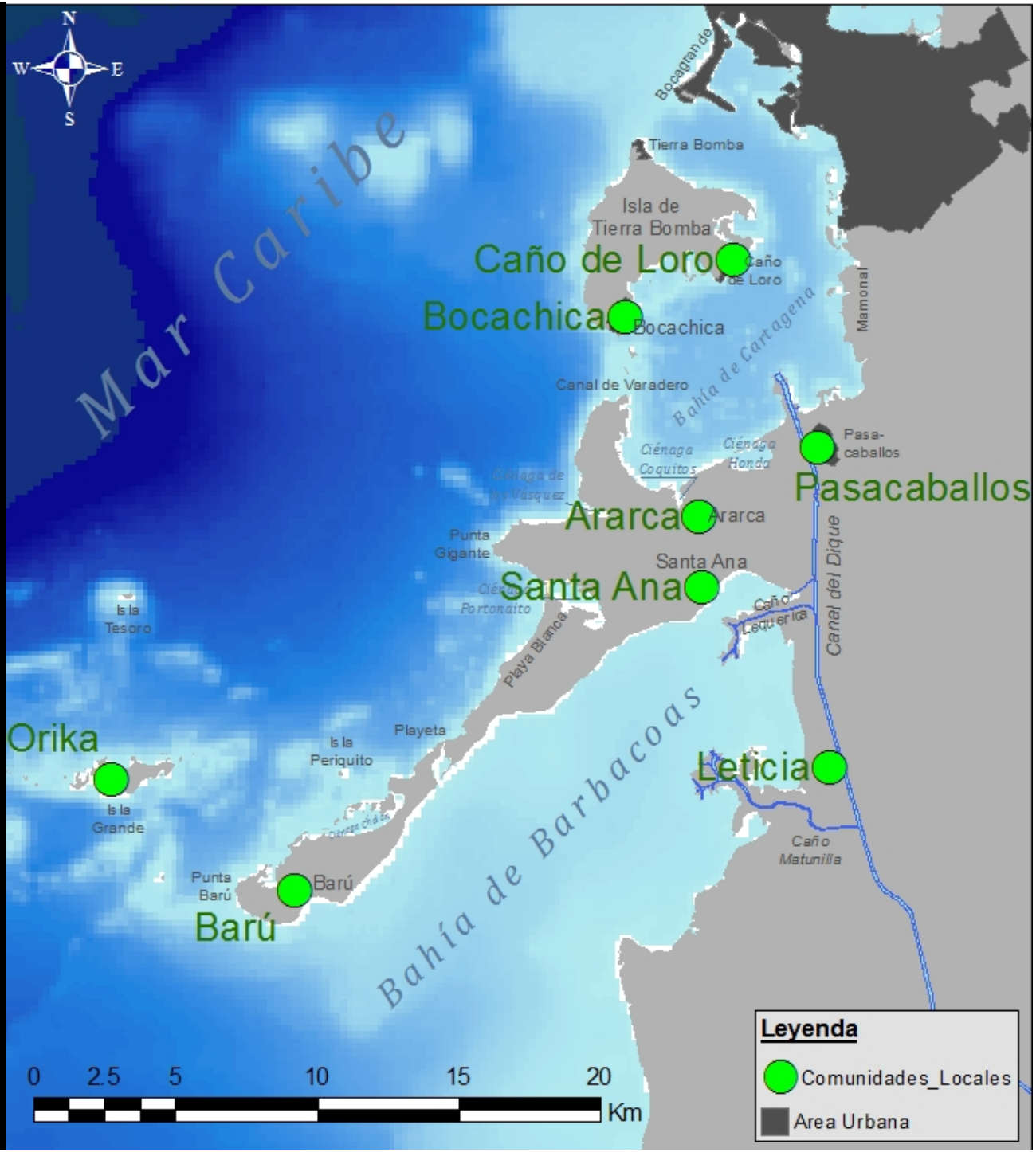


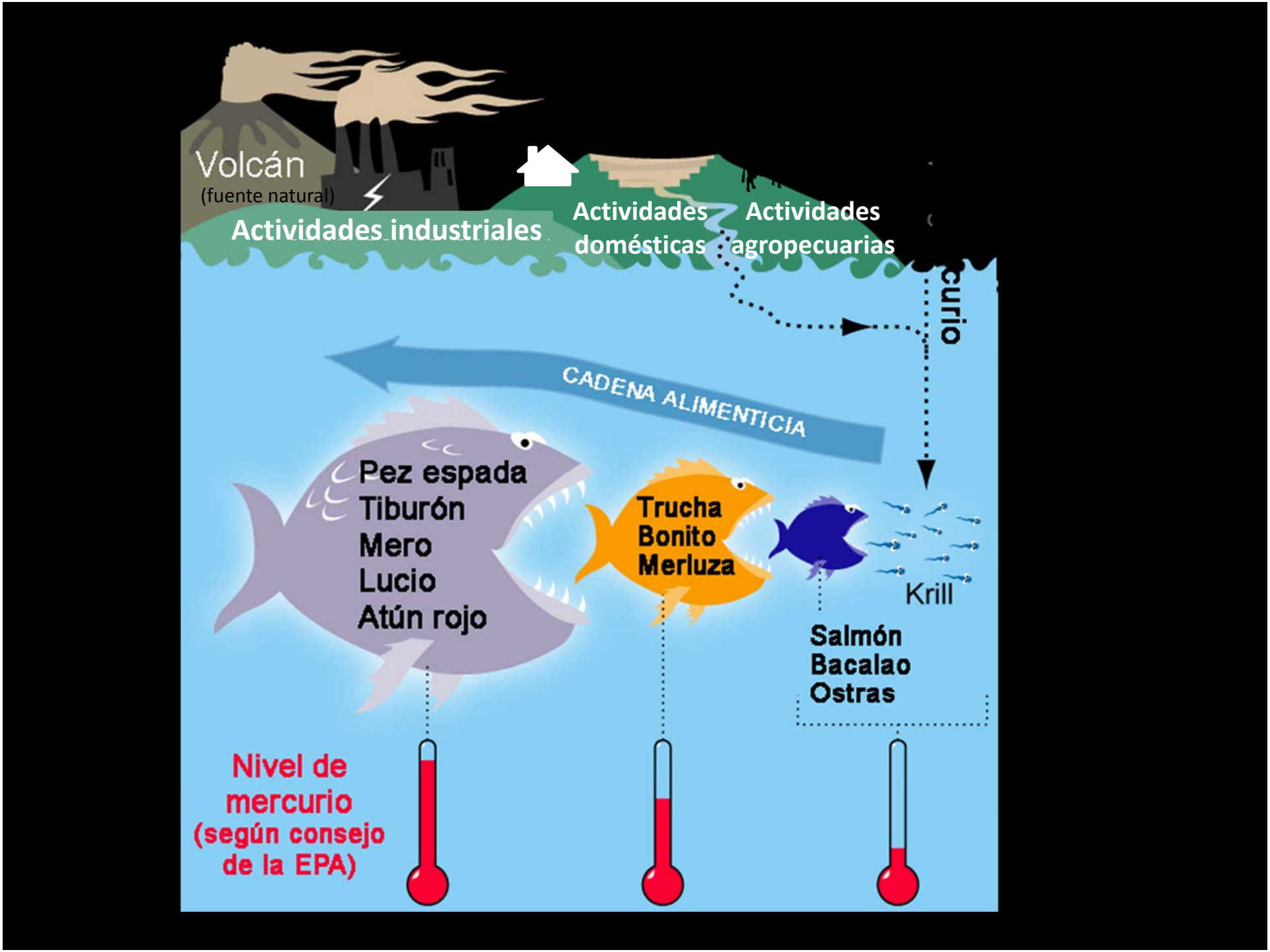
Passive Particle Tracing

Video - Pollution

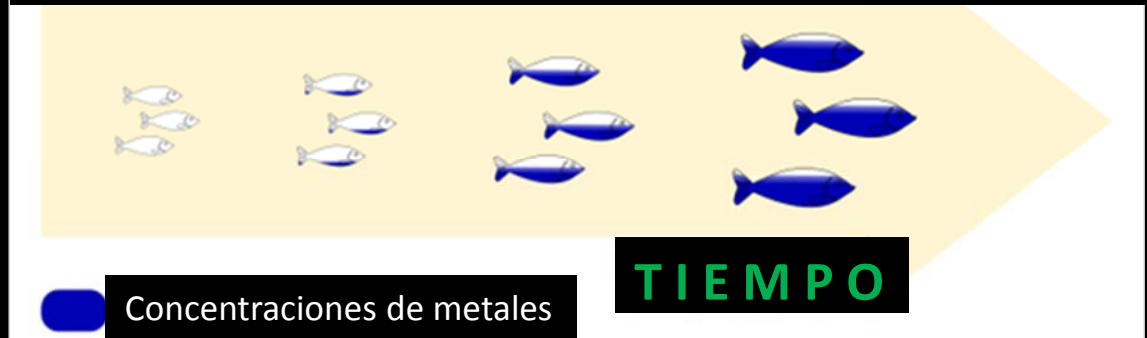
COMMUNITY IMPACTS

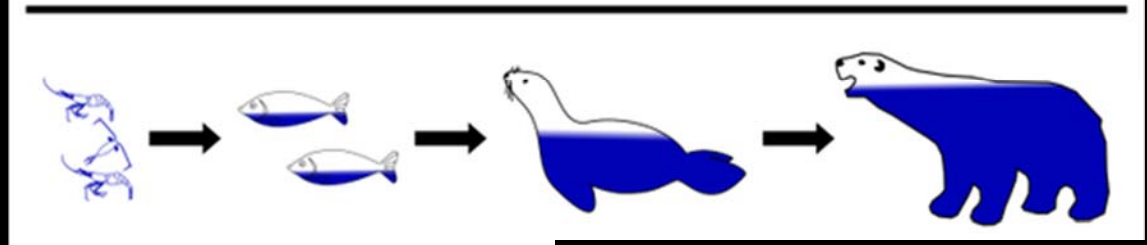
COASTAL COMMUNITIES OF CARTAGENA




Volcán
(fuente natural)
Actividades industriales
Actividades domésticas
Actividades agropecuarias
curio
CADENA ALIMENTICIA
Pez espada
Tiburón
Mero
Lucio
Atún rojo
Trucha
Bonito
Merluza
Krill
Salmón
Bacalao
Ostras
Nivel de mercurio (según consejo de la EPA)

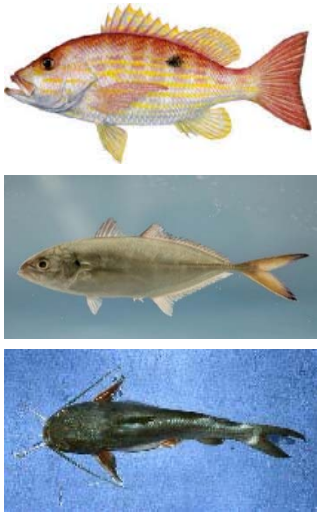
Bioaccumulation (Cromo, Plomo, Mercurio)



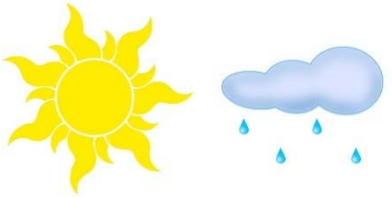


Biomagnifitation (Mercurio)

PECES



EPOCAS



METALS

Aluminio	Cobalto	Hierro	Estroncio	Vanadio
Arsénico	Cromo	Mercurio	Plomo	Zinc
Cadmio	Cobre	Níquel	Estaño	

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international
Canada
BASIC CARTAGENA

Economic evaluation of impacts on artisanal fisheries and tourism.

- An adaptation strategy was developed with fishermen of Barú island.
  - Local fishery management
  - Conservation and restauration
  - Alternative Economic activities

Out of 109 fishermen, 82% reported monthly income of less than COP $ 600,000, and 51% reported monthly income of less than COP$ 300,000.

Playa Blanca

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

Canadá

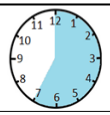
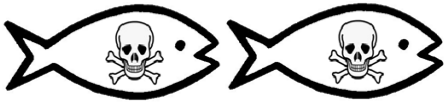
BASIC
CARTAGENA

- **A través del componente socio-económico se exploraron elementos comportamentales, económicos y ecológicos de las comunidades.**

- **Sesiones de juegos experimentales, experimentos de elección, encuestas socio-económicas, discusión y trabajo etnográfico con los pescadores y organizaciones sociales.**

Los pescadores asignan un valor económico negativo a la contaminación del pescado y un positivo al aumento en la diversidad de especies

La disponibilidad a pagar por una disminución de 10% en el nivel de contaminació es de $2,710 aprox por kg capturado.

0	Pescar 5 kg de pescado	
Tiempo de la faena de pesca	7 horas	
Gasolina consumida	1 galón y medio	
Nivel de contaminación	Contaminación actual	
Precio del pescado	8000 pesos por kilo	$ $ $ $
Variedad y abundancia de peces	Media	

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

Canadä

BASIC
CARTAGENA

¿Qué se encontró?

•Alto desempleo detectado entre los jóvenes de la península de Barú, igual a trampa de pobreza.

•La sobre explotación pesquera lleva a bajos ingresos por la "tragedia de los comunes", menores capturas y tallas menores a las ideales económica y ecológicamente.

•Pocas oportunidades de jóvenes y adultos llevan a estrategias de supervivencia (moto – taxismo y venta de artesanías en las playas),

- **Propensión de pescadores a dedicar parte del tiempo de sus faenas marinas a actividades de careteo (snorkeling) con turistas y así reducir la presión sobre el recursos pesquero.**

- **Las disuciones con los pescadores mostraton una actitud positiva hacia:**

1. **Vincularse a actividades de recuperación de los arrecifes coralinos colindantes a la isla y al Parque Nacional Natural Corales del Rosario y San Bernardo.**

1. **A través de la reducción en la presión sobre el stock pesquero al combinar jornadas de pesca con viajes de turistas a visitar un proyecto de conservación.**

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

Canada

BASIC
CARTAGENA

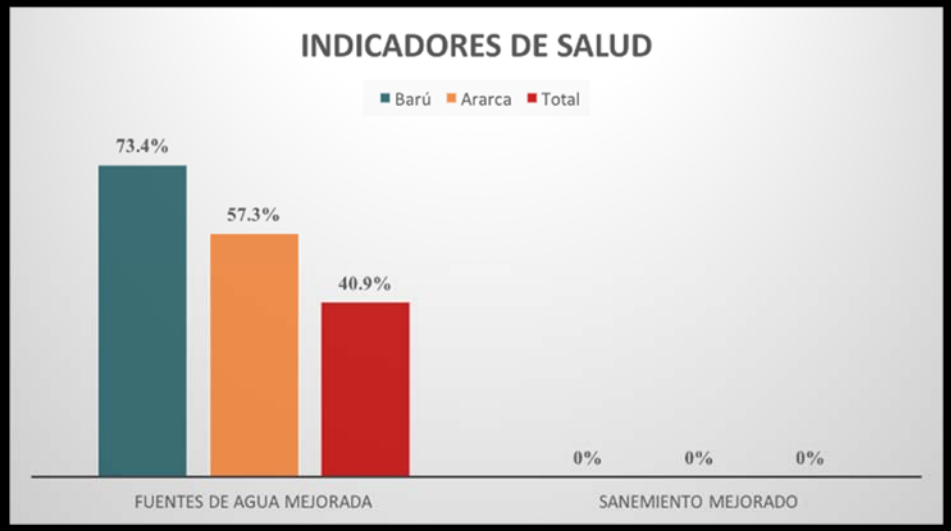
Indices of Public Health

¿Qué se quiso resolver?

- Identificación de enfermedades infecciosas
- Descripción del perfil metabólico de la población
- Identificación de exposición a agentes tóxicos
- Abordaje educativo a jóvenes líderes

Algunos datos previos

ENFERMEDADES INFECCIOSAS



Objetivo:
Identificar la presencia de enfermedades de tipo infeccioso en las comunidades

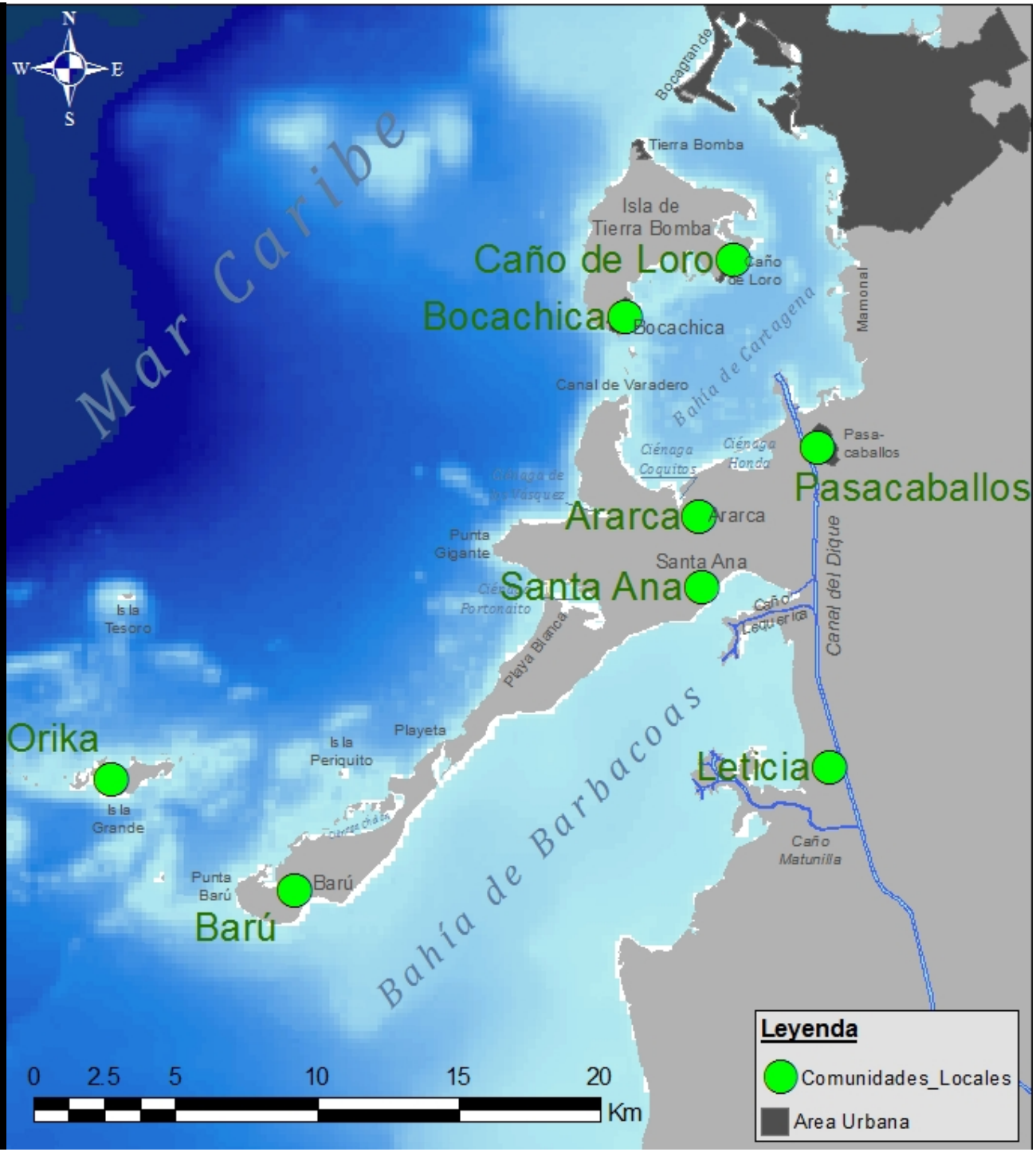
Análisis de fuentes de agua

Qué se encontró?

- **Afecciones dermatológicas**
  - Infecciones fúngicas
  - Picaduras de insectos
  - Poca higiene

  - Infecciones parasitarias (escabiosis)

COASTAL COMMUNITIES OF CARTAGENA



IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international
Canada
BASIC CARTAGENA

¿Qué se encontró?

- **Presencia de microorganismo en agua de consumo**
  - Bacterias
  - Parásitos

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international
Canadä
BASIC CARTAGENA

¿Qué se encontró?

- **Presencia de microorganismo en agua de consumo**

Con Filtro

Tanque tapado y limpio

Hervida

Tanque sin tapar

Filtro de Agua

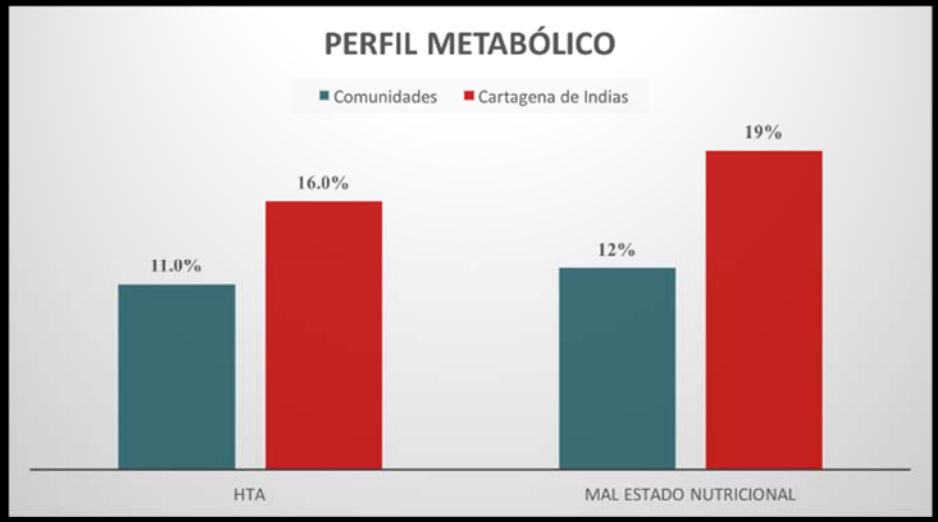
IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

Canadá

BASIC
CARTAGENA

Algunos datos previos

PERFIL METABÓLICO



IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

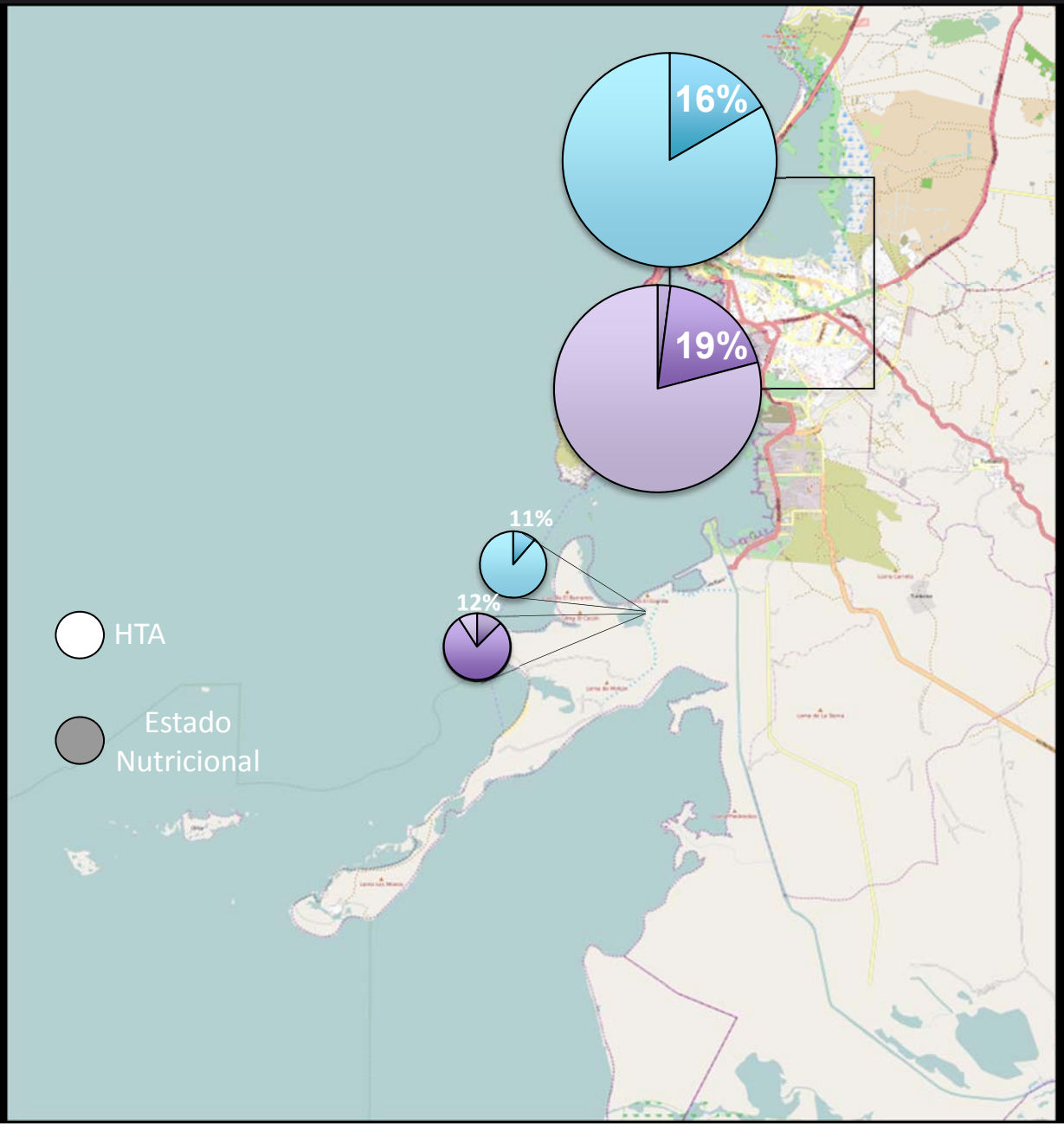
Canada

BASIC
CARTAGENA

¿Qué se encontró?

PELIGROS DE LA TRANSICIÓN NUTRICIONAL

(Obesidad y desnutrición conviven en las familias)



Qué se encontró?

- **Exposición a agentes tóxicos**
  - Presencia de mercurios en muestras de cabello

45% de las muestras

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le developpement international

Canada

BASIC
CARTAGENA

ABORDAJE EDUCATIVO A JÓVENES LÍDERES

- Conciencia sobre la problemática
- Educadores de la comunidad
- Mejoramiento de las condiciones de la institución educativa

Video - Communities

BASIC

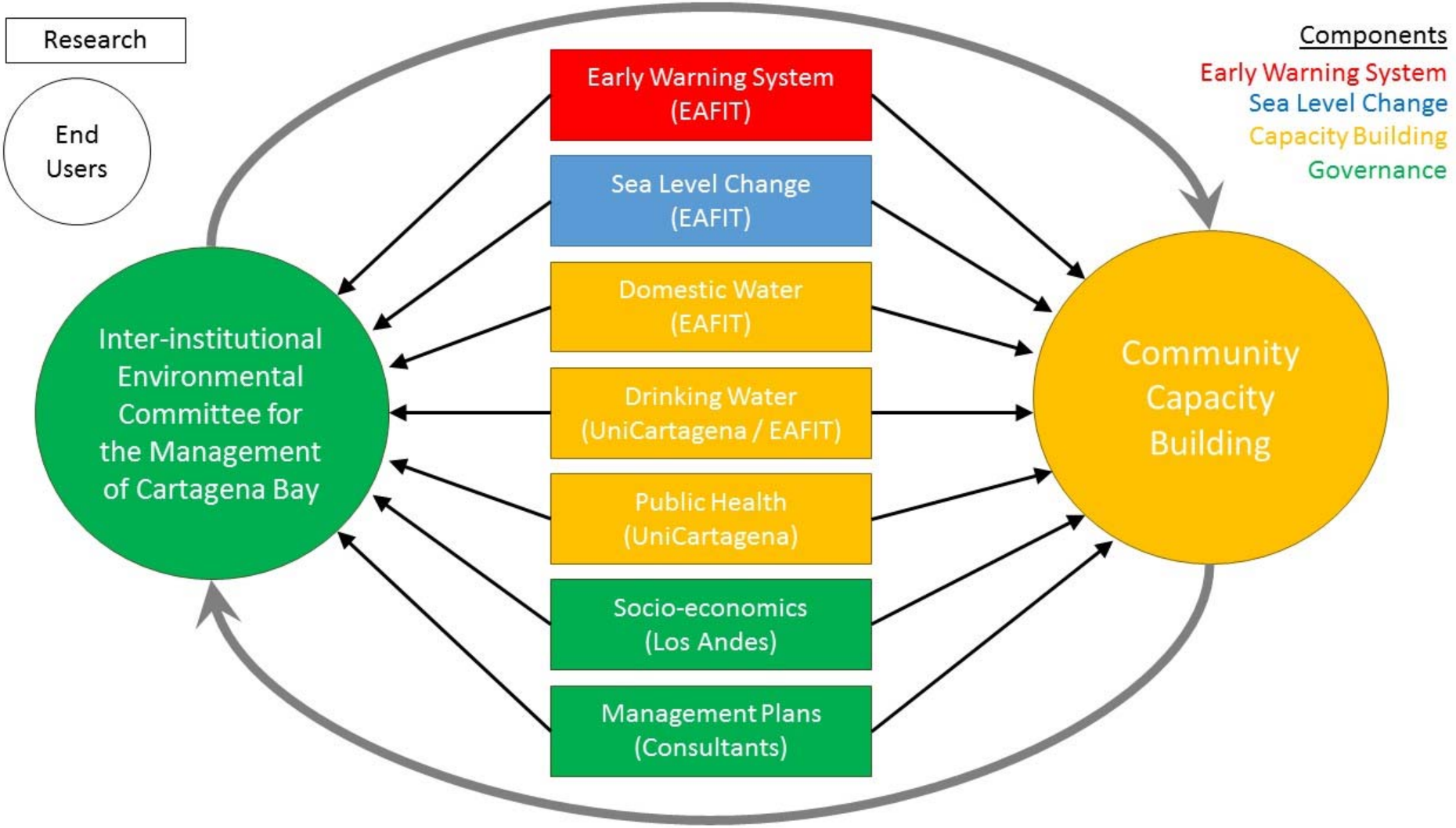
CARTAGENA *RESILIENTE*

BASIN SEA INTERACTIONS WITH COMMUNITIES

INTERACCIONES ENTRE CUENCAS, MAR Y COMUNIDADES

“Construyendo Resiliencia en la Bahía de Cartagena”

2018 - 2020


Research
End Users
Components
Early Warning System
Sea Level Change
Capacity Building
Governance
Early Warning System (EAFIT)
Sea Level Change (EAFIT)
Domestic Water (EAFIT)
Drinking Water (UniCartagena / EAFIT)
Public Health (UniCartagena)
Socio-economics (Los Andes)
Management Plans (Consultants)
Inter-institutional Environmental Committee for the Management of Cartagena Bay
Community Capacity Building

Gracias!

marko.tosic7@gmail.com