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Using DNA/RNA Metabarcoding-based Techniques to Study Cyanobacterial Blooms, Planktonic Diversity, & Fecal Becterial Source in the San José Lagoon

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September/27/2019

Cyanobacteria episodic blooms in Laguna San José (Harmful algal blooms or HABs)

Fish Mass Mortality

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Spirulina (cyanobacteria)

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Water quality assessment during mass mortality events

Parámetro de calidad de agua	Laguna San José	Canal Suárez
Oxígeno disuelto (mg/L)	2.4	1.4
Aceites y grasas (mg/L)	BDL	BDL
Nitrógeno total (mg/L)	4.94	4.87
Nitratos y nitritos (mg/L)	0.02	0.02
Fósforo total (mg/L)	BDL	0.023
Amonio (mg/L)	0.340	0.029
Carbón orgánico total (mg/L)	16.1	12.8
Clorofila a (mg/m^3)	463	558
Sólidos suspendidos totales (mg/L)	17.2	22.8
Demanda bioquímica de oxígeno (mg/L)	17	19
Coliformes fecales (CFU*/100mL)	26	10
Enterococcus (CFU*/100 mL)	< 10	< 10

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Identification of many cyanobacterial genera is difficult using morphology-based methods.

q = Dolichospermum planctonicum
r = Dolichospermum sp.
s = Nostoc sp.
t = Nodularia moravica

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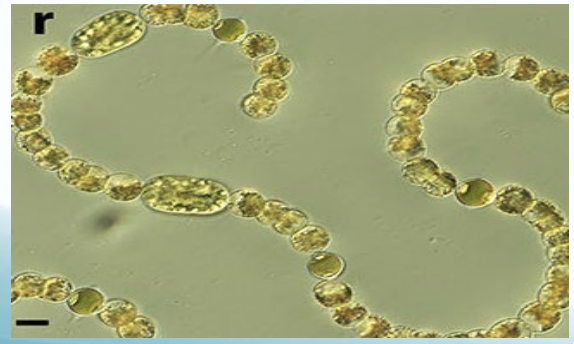

Project Goals:

- Identification of cyanobacterial species, their population dynamics and levels of activity in the San José Lagoon using 16S and 18S rRNA gene sequencing approaches
- Determine other planktonic biota that is associated with cyanobacterial blooms
- Use of qPCR assays for the detection of cyanobacteria and their toxins in environmental waters
- Identification of fecal bacterial sources in the lagoon
- Detection on nitrogen cycling genes

Collaborators: Jorge W. Santo Domingo, NRMRL, santodomingo.jorge@epa.gov; Evelyn Huertas, CEPD, Huertas.evelyn@epa.gov

Example of Experimental Design/Flow

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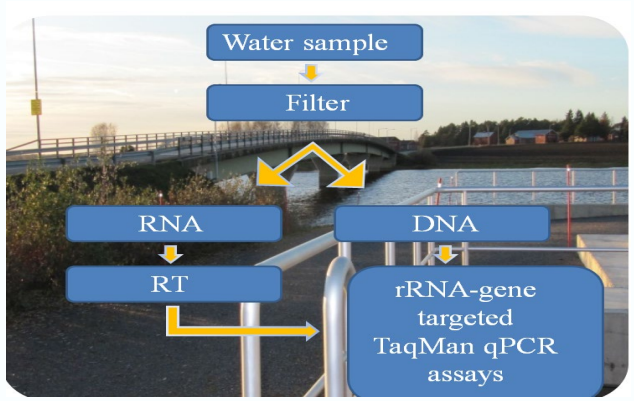

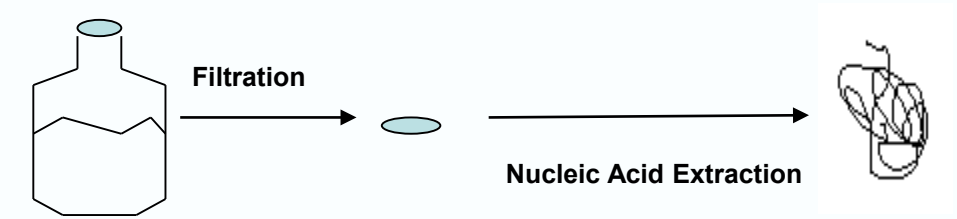

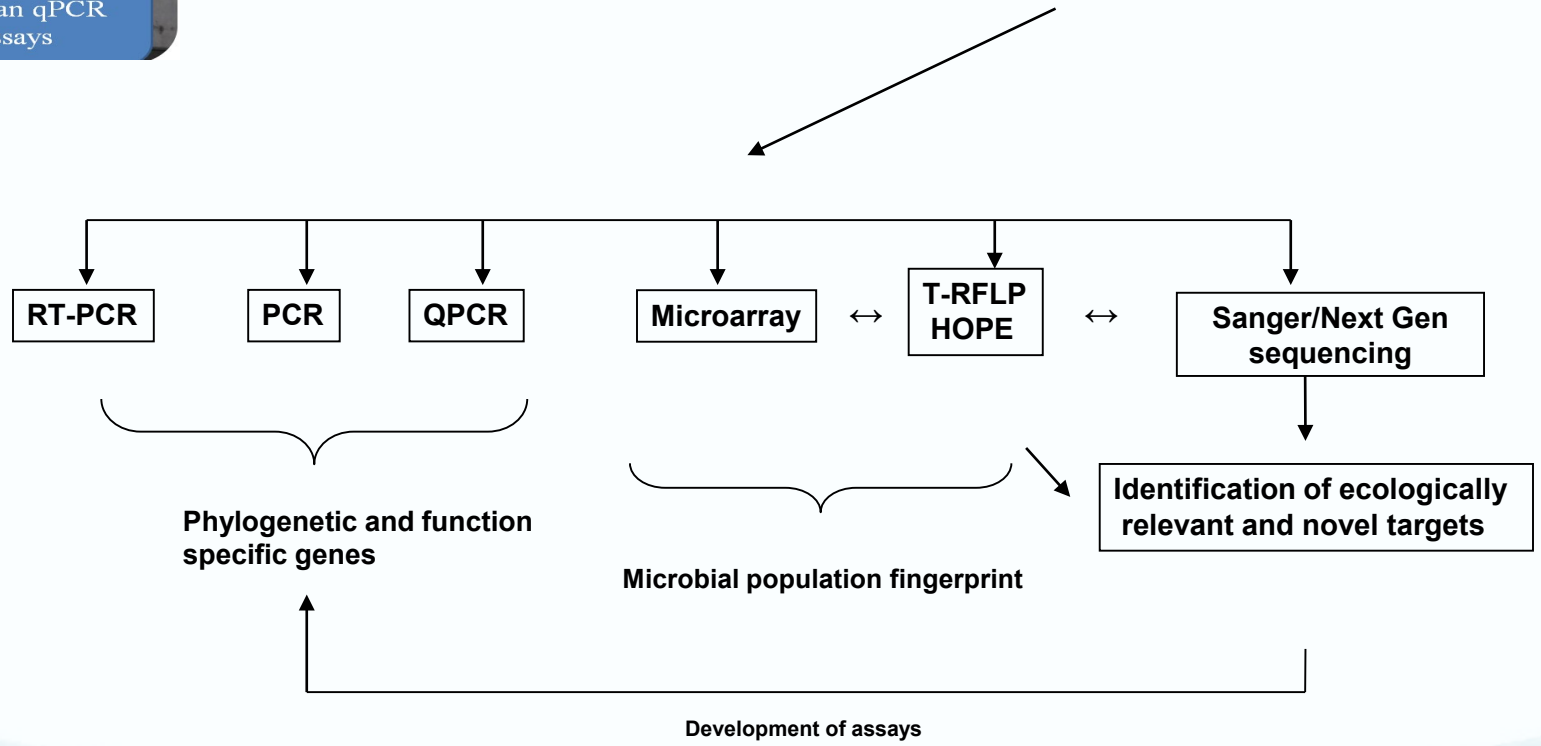

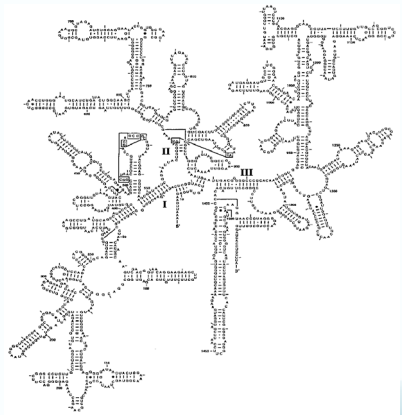

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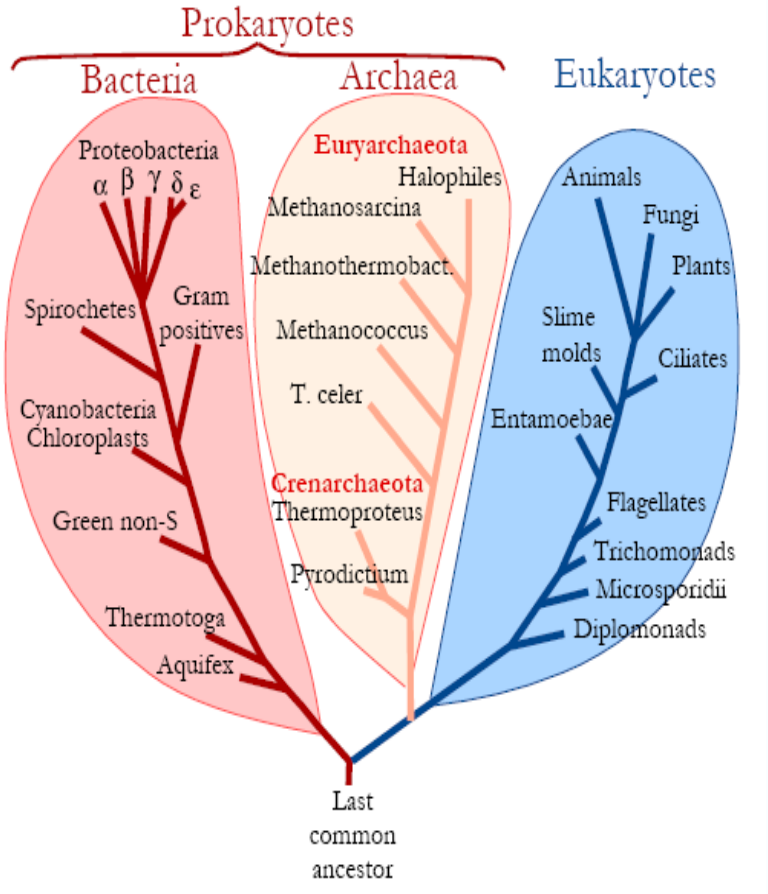
Anticipated products/outcomes



- Identity of cyanobacterial groups of environmental relevance in the lagoon
- Baseline data for pre-, during, and post-blooms
- Determine the presence of a selected number of toxin genes
- Identify cyanobacterial groups that are active (RNA database) and potentially implicated in toxic bloom events
- Determine the levels of fecal pollution and their sources
- First sequence database for multiple microbial groups in PR coastal waters
- Final report and peer-reviewed papers
- Baseline data for future proposals

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The Water Quality of the Estuary in a Decennium
Status, Trends & Forecast

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OCÉANO ATLÁNTICO
CANAL SAN ANTONIO
LAGUNA DEL CONDADO
BOCA DE CANGREJOS
VACÍA TALEGA
TOA BAJA
SAN JUAN
LAGUNA LOS COROZOS
LAGUNA LA TORRECILLA
CIÉNAGA LAS CUCHARILLAS
CATAÑO
BAHÍA DE SAN JUAN
CAÑO MARTÍN PEÑA
LAGUNA DE PIÑONES
LOÍZA
CAÑO LA MALARIA
LAGUNA SECRETA
CANAL MARGARITA
CANAL SUÁREZ
QUEBRADA JUAN MÉNDEZ
LAGUNA SAN JOSÉ
CANAL BLASINA
RÍO PIEDRAS
RÍO PUERTO NUEVO
QUEBRADA SAN ANTÓN
CAROLINA
BAYAMÓN
GUAYNABO
RÍO GRANDE DE LOÍZA
TRUJILLO ALTO
ALJIBE LAS CURÍAS
REPRESA CARRAÍZO
N
LEYENDA
DELIMITACIÓN DE LA CUENCA
CUERPOS DE AGUA (RÍOS, QUEBRADAS, CANALES Y LAGUNAS)
Estaciones de monitoreo
PROGRAMA DEL
Estuario
de la Bahía de San Juan

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The SJBEP Water Quality Monitoring Program:

- An Approved Quality Assurance Project Plan.
- 24 stations.
- 15 water bodies.
- 12 parameters.
- Provided opportunity to more than 400 volunteers since 2008.
- 305(b)/303(d) Water Quality Assessment Integrated Report.
- Supported students in their instigations and projects.
- Being used by stakeholders, federal & state agencies.

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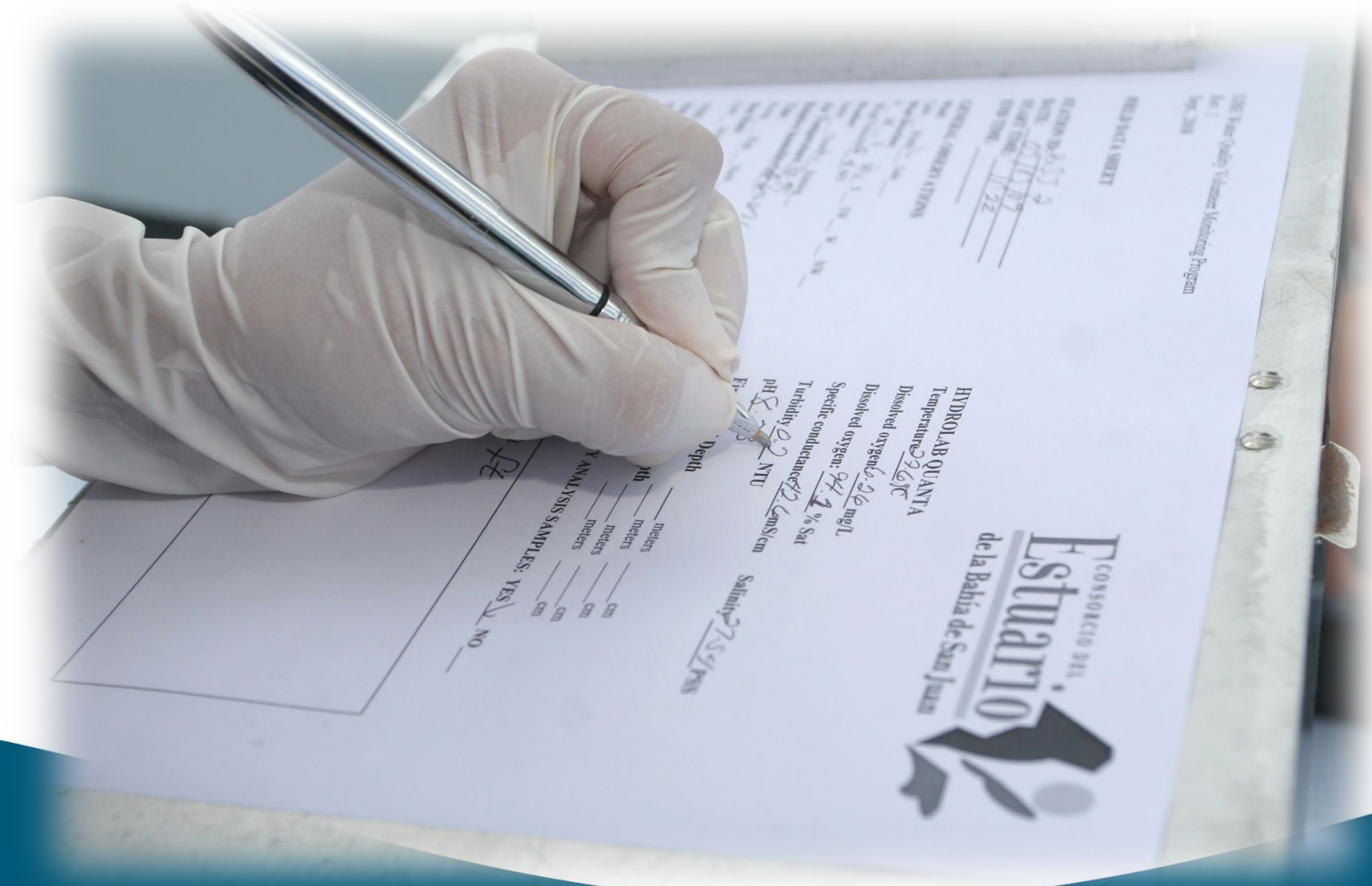
Estuario
de la Bahía de San Juan
HYDROLAB QUANTA
Depth
meters
meters
meters
meters
cm
cm
cm
cm
YES
NO

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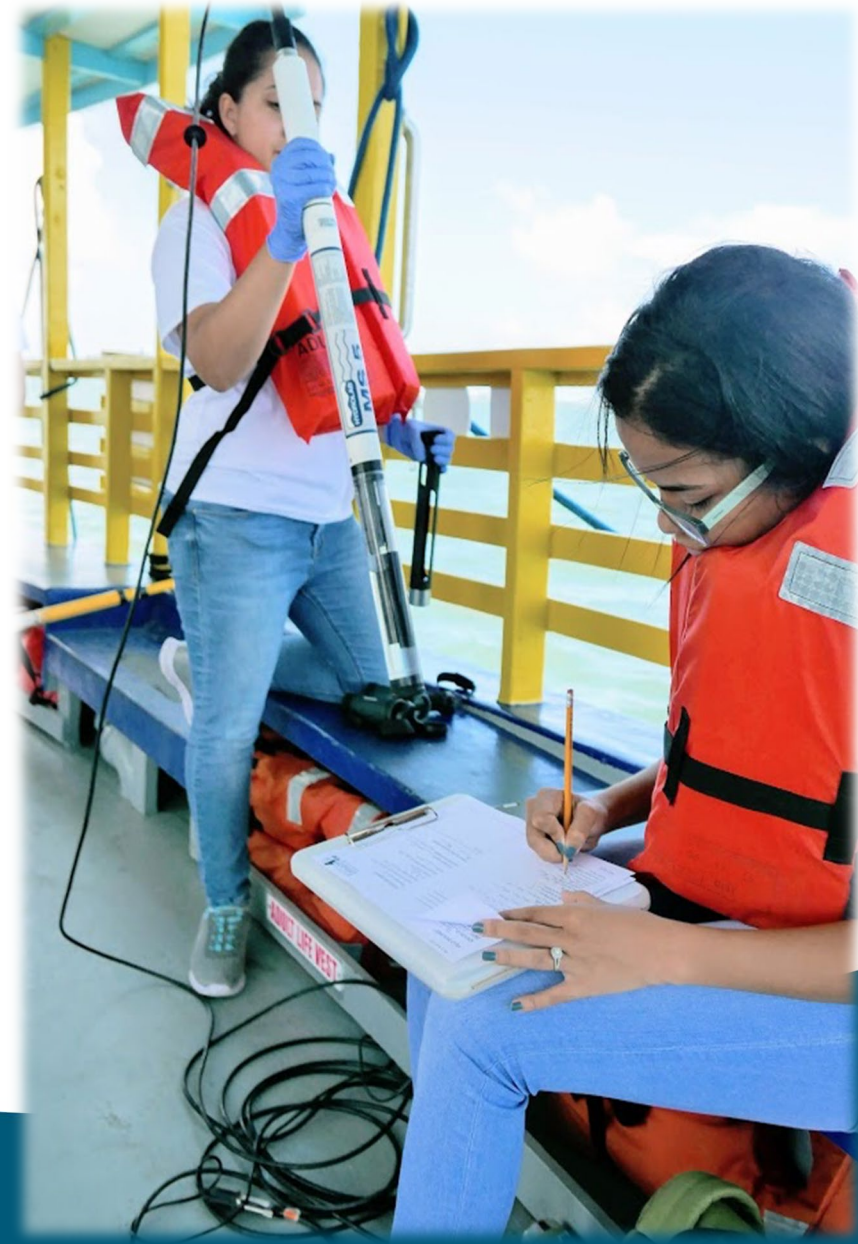
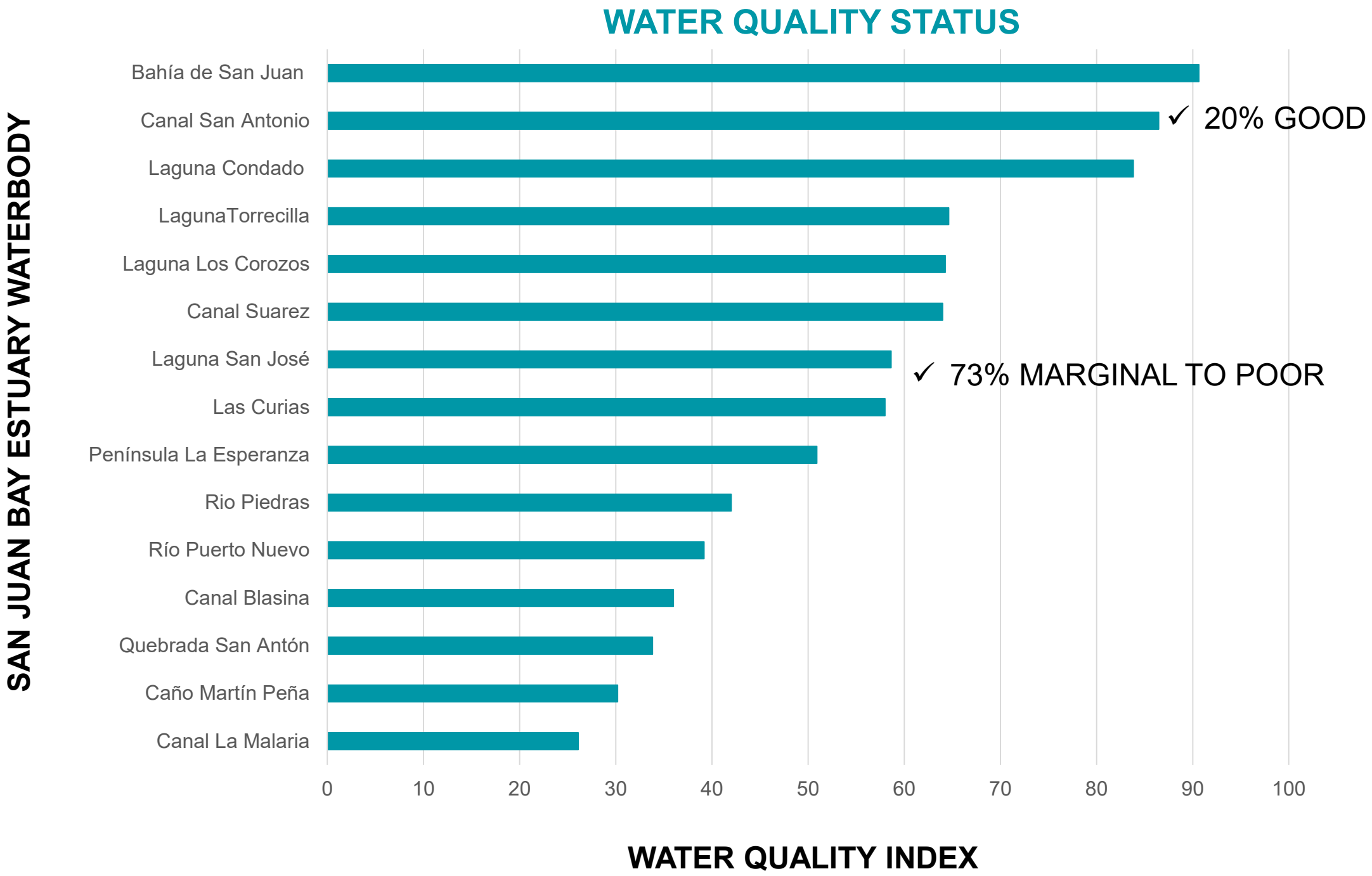


Water Quality Index/Score Card Guidelines

- The water quality index is a number between 0 (Poor) and 100 (Excellent).
- The numbers are divides into five (5) descriptive categories to simplify presentation.
- Incorporated scope, frequency, and amplitude.

ÍNDICE DE CALIDAD DE AGUA	DESCRIPCIÓN	CALIFICACIÓN
95-100	**EXCELENTE:** la calidad del agua se encuentra protegida. La condición del cuerpo de agua se acerca a condiciones prístinas y naturales.	A
80-94	**BUENO:** la calidad del agua se encuentra protegida. El cuerpo de agua exhibe un grado de contaminación menor y con poca frecuencia.	B
65-79	**REGULAR:** la calidad del agua es usualmente protegida. El cuerpo de agua ocasionalmente exhibe niveles de contaminación.	C
45-64	**MARGINAL:** la calidad del agua está poco protegida. El cuerpo de agua se encuentra frecuentemente amenazado y contaminado.	D
0-44	**POBRE:** la calidad del agua no está protegida. El cuerpo de agua se encuentra constantemente amenazado y contaminado.	F


WATER QUALITY STATUS
SAN JUAN BAY ESTUARY WATERBODY
Bahía de San Juan
Canal San Antonio
Laguna Condado
LagunaTorrecilla
Laguna Los Corozos
Canal Suarez
Laguna San José
Las Curias
Península La Esperanza
Rio Piedras
Río Puerto Nuevo
Canal Blasina
Quebrada San Antón
Caño Martín Peña
Canal La Malaria
✓ 20% GOOD
✓ 73% MARGINAL TO POOR
0
10
20
30
40
50
60
70
80
90
100
WATER QUALITY INDEX

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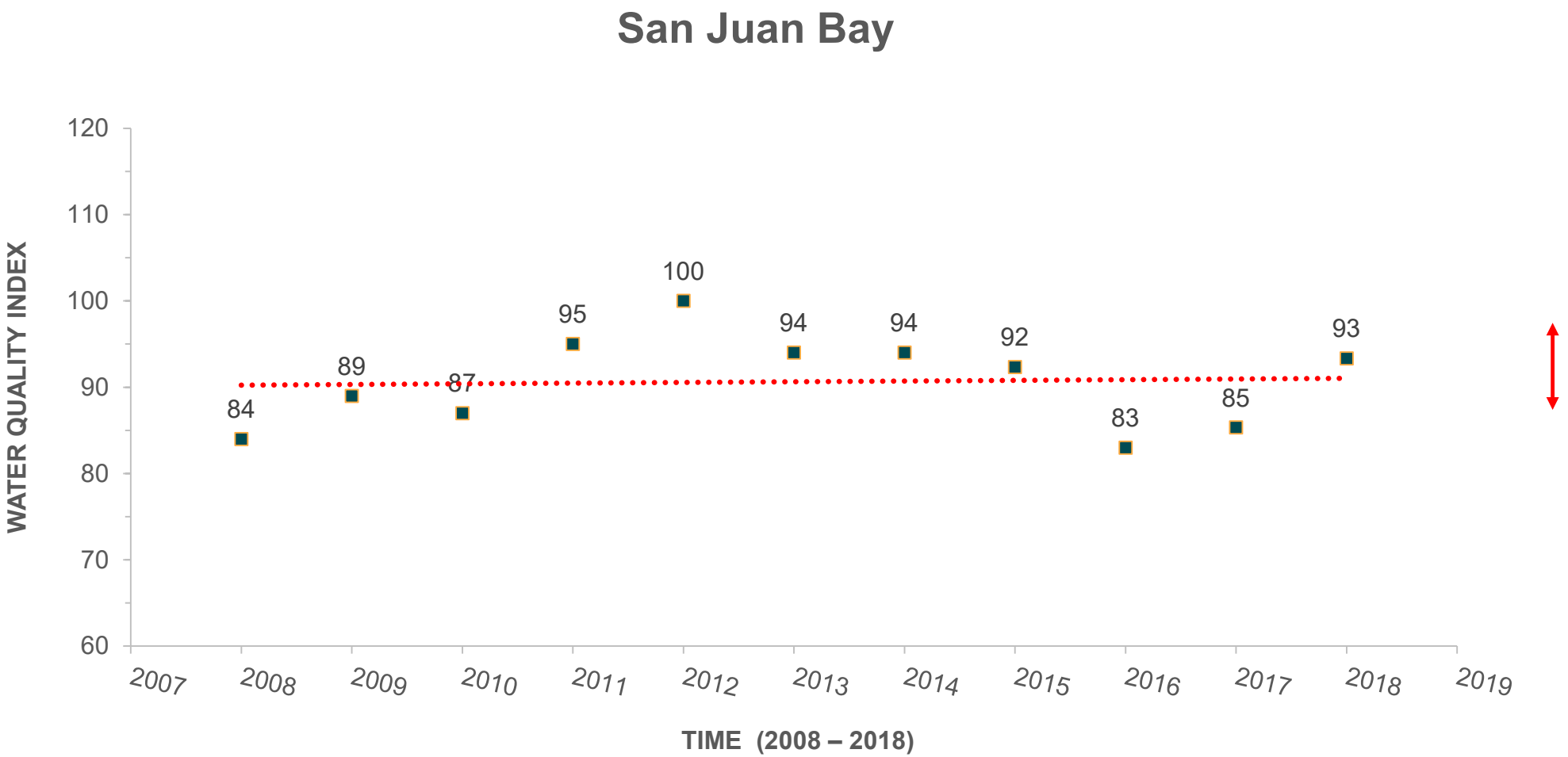
WATER QUALITY TREND



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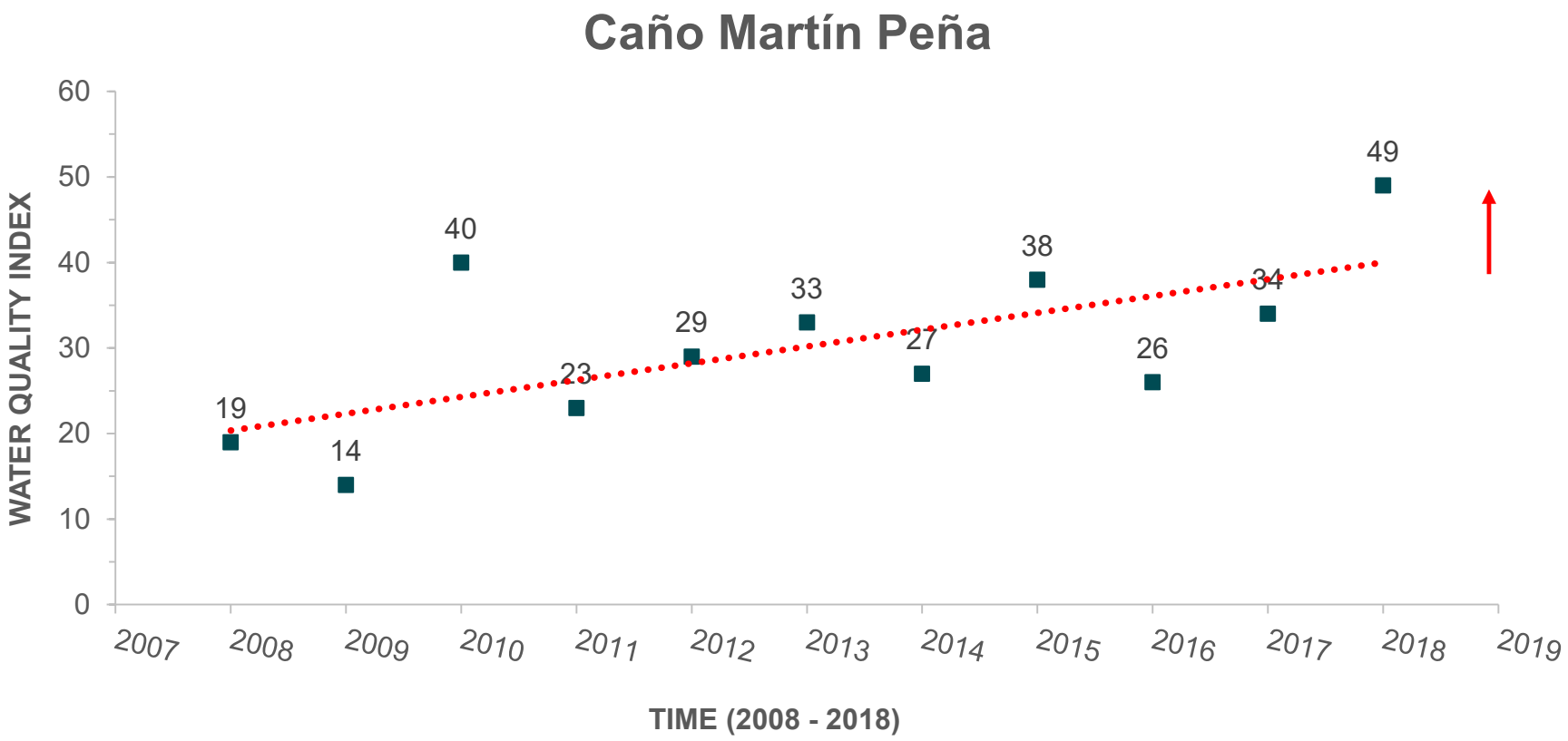
WATER QUALITY TREND



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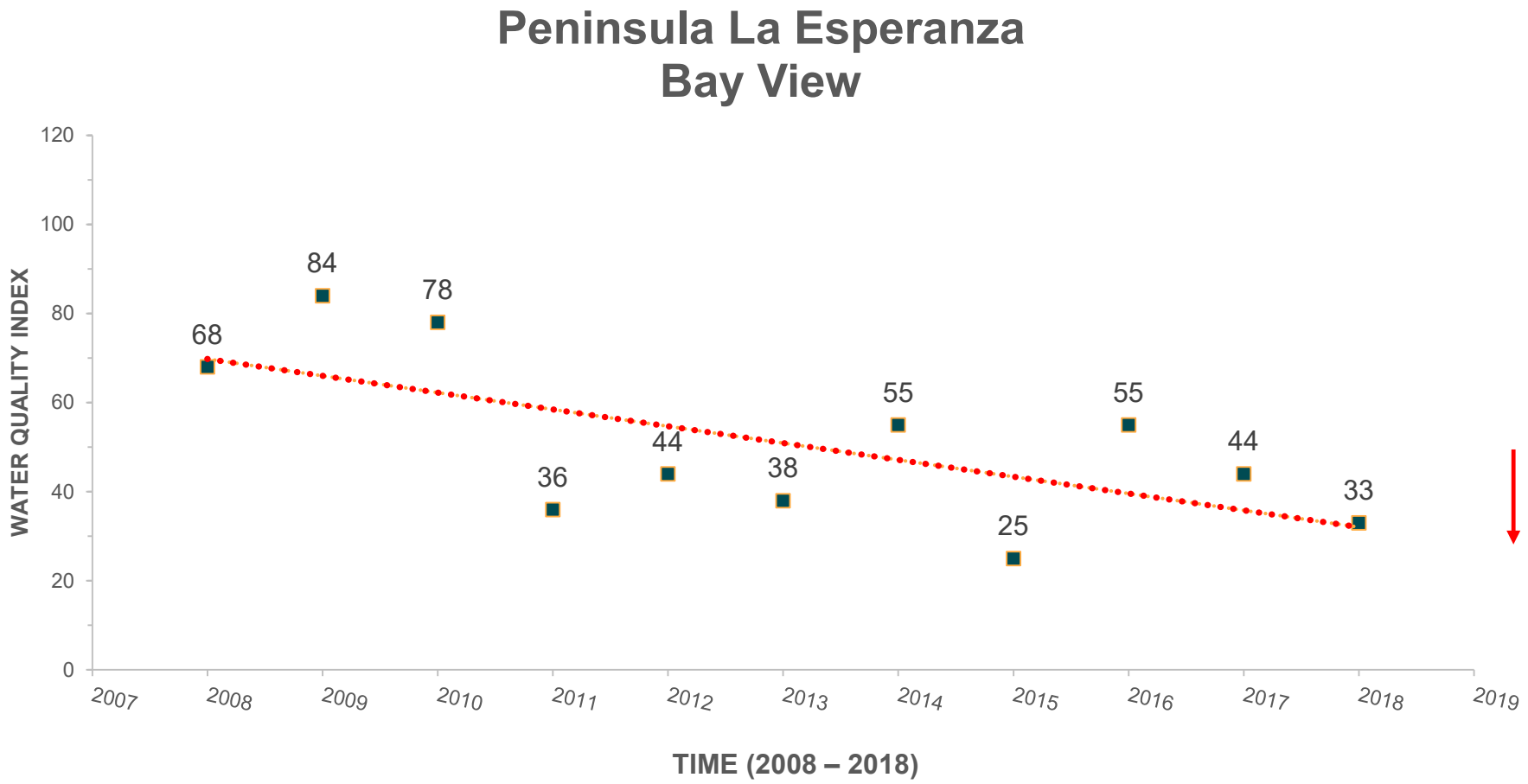
WATER QUALITY TREND



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ILLEGAL DISCHARGES DETECTION & ELIMINATION (IDDE) MULTI-SECTORIAL TASKFORCE

ESTUARIO

STATE TUNED FOR NEXT SATE OF THE BAY REPORT…DECEMBER, 2019