

CHARACTERIZING WATER QUALITY IN THE CHARLOTTE HARBOR ESTUARIES USING A TRAINED VOLUNTEER CORPS:

1998-2003 Results of the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

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This Program Briefly Describes the Charlotte Harbor Estuaries Volunteer Water quality Monitoring Network's:



Diverse Estuaries

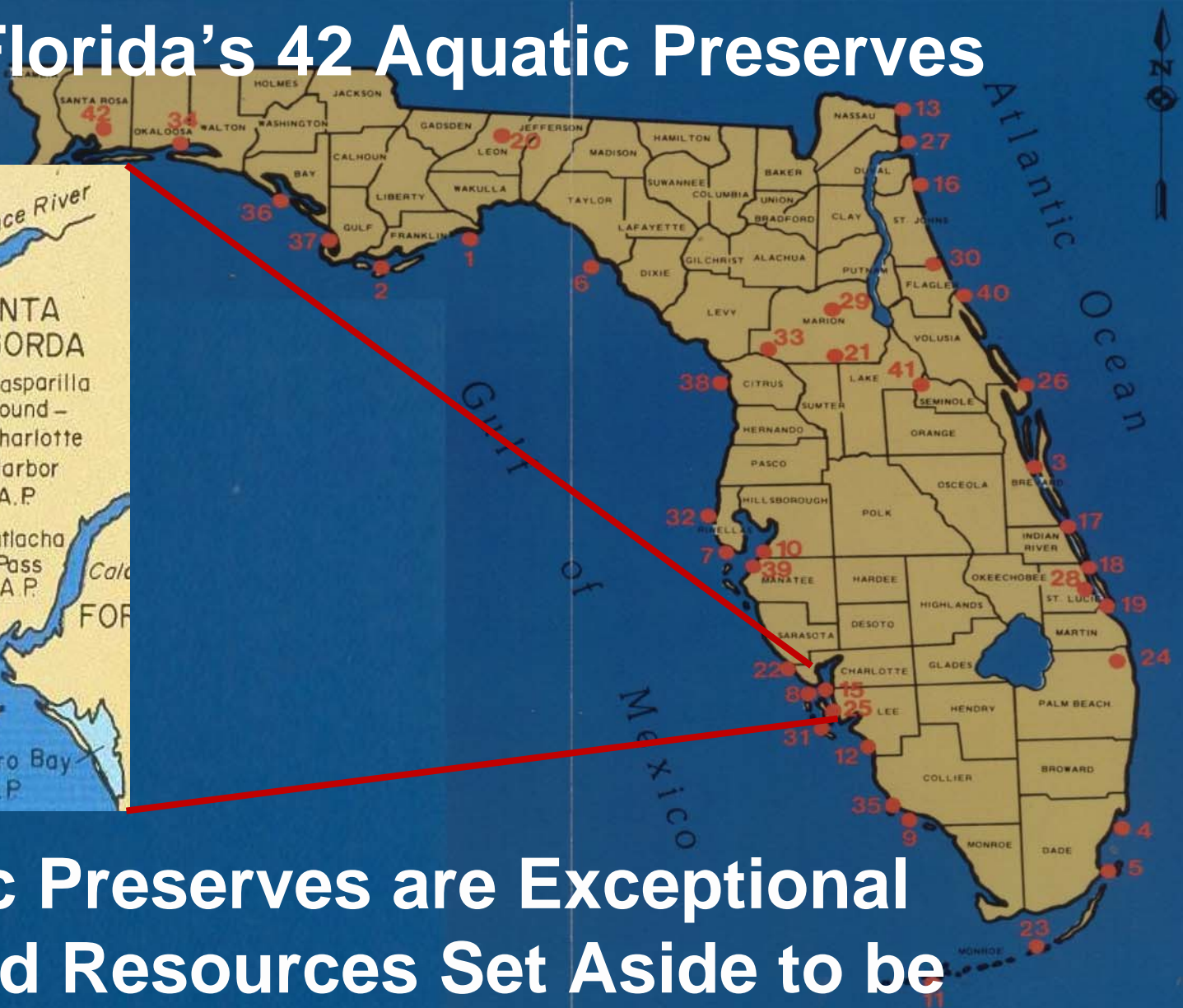
Methods & Procedures

Water Quality Results

Data Conclusions

Program Conclusions

Charlotte Harbor Estuaries include 6 of Florida's 42 Aquatic Preserves

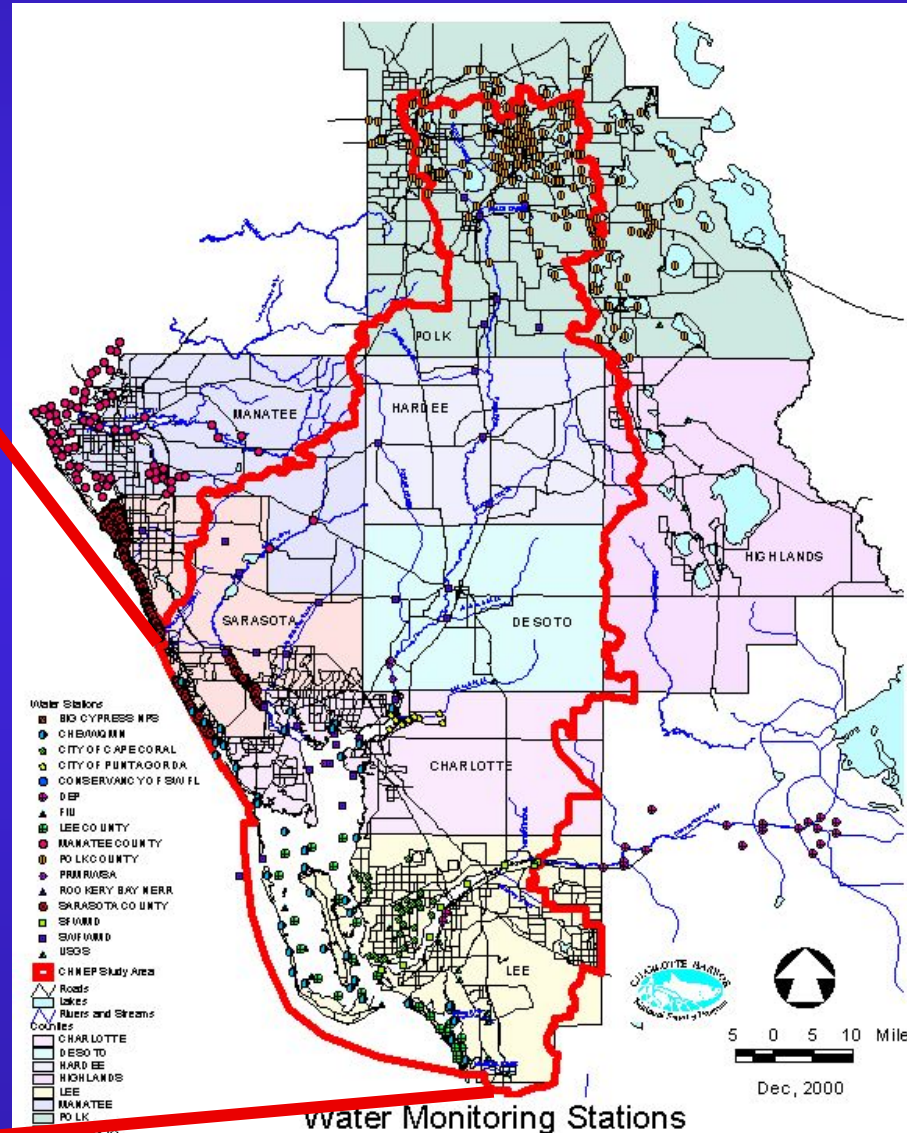


**FL Aquatic Preserves are Exceptional
Submerged Resources Set Aside to be
Preserved for Future Generations to Enjoy**

Charlotte Harbor Estuaries are part of the Charlotte Harbor National Estuary Program

& are the downstream receiving waters of a 4,500 mile² watershed.

± 60 mi



Charlotte Harbor Estuaries include 7 Diverse Interconnected Estuaries



Water Quality in these Estuaries is Monitored Monthly by the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network

CHEVWQMN is a partnership of:

≥75 Citizen Monitors

FL Dept of Environmental Protection

Charlotte Harbor Environmental Center

Charlotte Harbor National Estuary Program



Purposes of the CHEVWQMN:

- Determine Baseline Estuary Health for Managing Charlotte Harbor Aquatic Preserves & CHNEP.
- Compliment Other Resource Monitoring Programs by Filling Gaps & Linking Programs.
- Assist with Developing Consistent Agency Water Quality Monitoring Program throughout Region.
- Enhance Community Understanding & Involvement in Managing Aquatic Preserves & CHNEP.

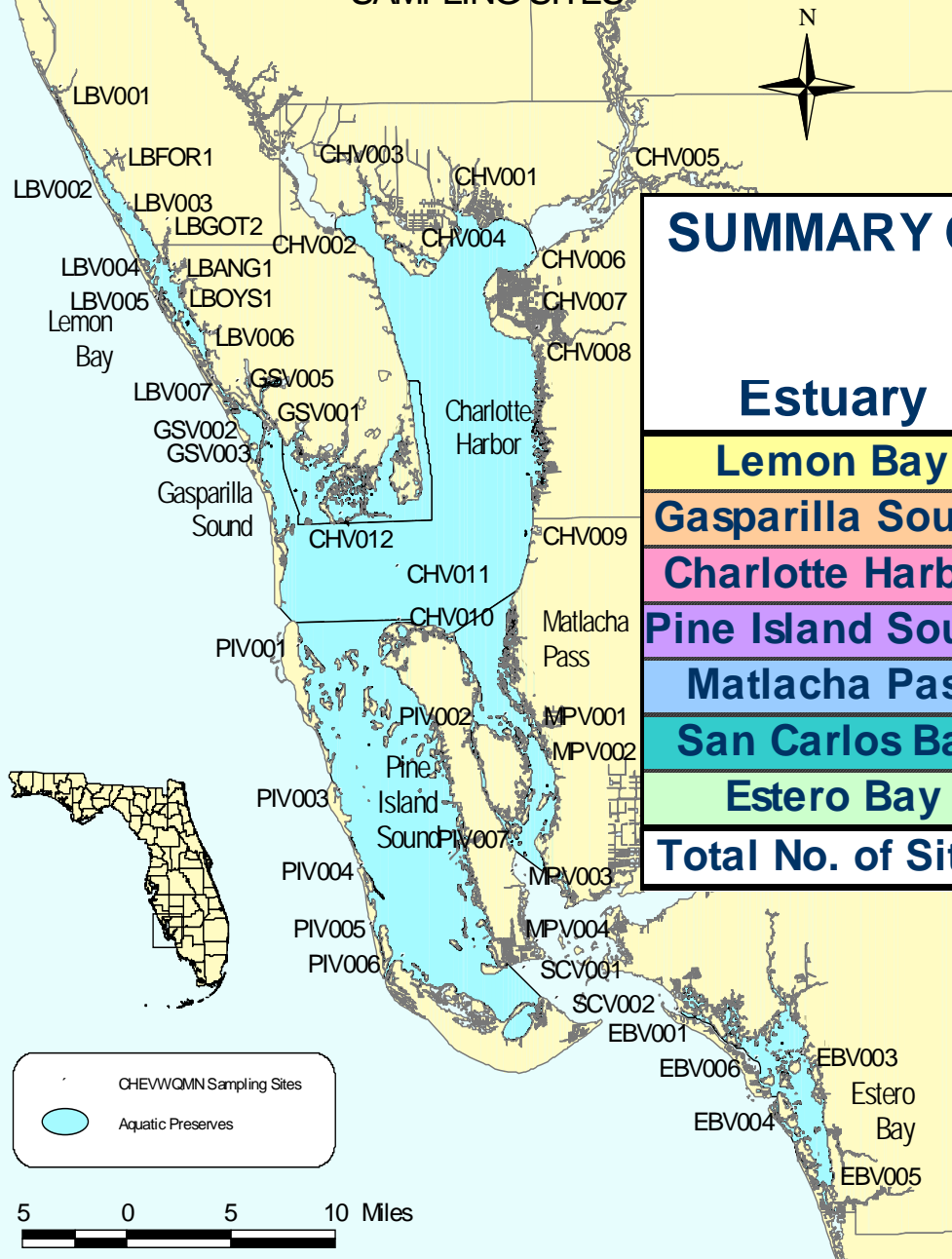


Sampling Protocols of the CHEVWQMN:

- **Time:** 1st Monday of Month at Sunrise.
- **Locations:** 46 Fixed Sites.
- **Sample Collection:** Surface Grab.
- **Parameters:** 13 Measured In Field
& 6 Collected for Lab for Analysis.
- **Monitors:** >75 Well Trained & Equipped Reliable
Volunteers Assigned to Specific Sites.
- **Lab Analyses:** By Certified Lab.
- **Quality Assurance:** Approved Plan & Standard Field
& Lab Methods.
- **Data Management:** Verify Data, Access, Excel.
- **Biases:** Sunrise, Surface Only, Near Shore.



CHARLOTTE HARBOR ESTUARIES VOLUNTEER WATER QUALITY MONITORING NETWORK SAMPLING SITES



Sampling Locations of CHEVWQMN:

- 41 Estuary & 5 Tribs.

SUMMARY OF CHEVWQMN SAMPLING SITES

Estuary	# Estuary Sites	# Trib Sites	# Total Sites	Field Start Date	Lab Start Date
Lemon Bay	9	2	11	Jul-98	Jul-98
Gasparilla Sound	3	1	4	Jan-98	Jul-98
Charlotte Harbor	11	1	12	Jan-98	Jul-98
Pine Island Sound	6	0	6	Feb-98	Jul-98
Matlacha Pass	4	0	4	Feb-98	Jul-98
San Carlos Bay	2	0	2	Feb-98	Jul-98
Estero Bay	6	1	7	Mar-98	Jul-98
Total No. of Sites	41	5	46		

- Widely Distributed & Representative.
- Well Documented & Described w/Lat/Long.

Parameters & Methods Used: 13 Field + 6 Lab

CHARLOTTE HARBOR ESTUARIES VOLUNTEER WATER QUALITY MONITORING NETWORK FIELD DATA SHEET

Site # _____ Date _____ Time Start _____ Time End _____
 Sunrise Time _____
 Monitor's Names _____
 Waterbody Name _____ Estuary Region _____

Wind Speed & Direction (see Beaufort Scale): N, NE, E, SE, S, SW, W, NW 0-1 mph 8-12 mph 25-31 mph 1-3 mph 13-18 mph 32 mph 4-7 mph 19-24 mph		
Weather: 1= Sunny 3= Overcast 5= Drizzle 7= Other 2= Partly Cloudy 4= Fog/Mist 6= Rain		
Precipitation: Amount in last 24 hours in inches		
Air Temperature: in °F & °C		
Water Surface Conditions: 1= Calm 2= Ripples 3= Waves 4= White Caps		
Tide Stage: 1= Incoming 2= Outgoing		
Water Depth in ft		
Secchi Depth in ft		
Water Temperature: in °F & °C		
Dissolved Oxygen: Test #1 _____ Average _____ pH: _____ Salinity in ppt: _____		
Water Color Obs: 1= Mud Brown 2= Dark Brown 3= Red Brown Water Color Meas: Collect & Inc. Chl Collect & Inc. Fec Collect & Inc. Ph General Conduc: 1= Dead Fish 3= Erosion 4= Other Observat		



SAMPLING METHODS, EQUIPMENT, PRESERVATIVES & ANALYSIS METHODS USED BY THE CHEVWQMN

PARAMETER or ACTION	SAMPLING METHOD & EQUIPMENT	HOLDING TIME & PRESERVATIVE	ANALYSIS METHOD
Data Recording	Data Sheet & Clip Board	Immediate	N/A
Wind Speed & Direction	Observation & Beaufort Wind Scale	immediate	N/A
Percipitation (24 Hrs)	Rain Guage LaMotte #1047	Immediate	N/A
Water Surface	Observation	Immediate	N/A
Tide Stage	Observation & Tide Chart	Immediate	N/A
Water Depth	Calibrated Line & Weight	Immediate	N/A
Water Clarity	Secchi & Calibrated Line LaMotte #0171	Immediate	N/A
Collect Water Sample	Plastic Bucket & Line	Immediate	N/A
Water Temperature	Thermometer (Armored) LaMotte #1066	Immediate	N/A
Water Color	Observation, Color Test Kit	Immediate	N/A
Salinity	Hach # 2234-00 Hydrometer LaMotte #30025	Immediate	N/A
pH	Colorimetric test kit Cresol Red, LaMotte #2111	Immediate	N/A
Dissolved Oxygen	Winkler Titration Test Kit LaMotte #7414	Immediate	N/A
Sample Transport	Small Cooler & Ice Packs	Immediate	N/A
Total Phosphorus (TP)	Surface GrabSample 500 ml Polyethylene, Pre-cleaned	Preserve with H ₂ SO ₄ Run within 28 Days	EPA 365.4 Colorimetric Auto- Block Digester
Total Kjeldahl Nitrogen (TKN)	Surface Grab Sample Include in TP Sample Bottle	Preserve with H ₂ SO ₄ Run within 28 Days	EPA 351.2 Colorimetric Semi-auto Block Digester
NO ₂ /NO ₃	Surface Grab Sample Include in TP Sample Bottle	Preserve with H ₂ SO ₄ Run within 28 Days	EPA 353.2 Colorimetric Auto- Cd Reduction
Chlorophyll a	Surface Grab Sample 1 L Amber Bottle	Put on Ice Run within 24 Hours	SM 9222 10200 H Spectrophotometric
Fecal Coliform Bacteria	Surface Grab Sample Sterile Whirl Pack - 18 oz	Put on Ice Run within 6 Hours	SM 922 D Membrane Filter Method
Waste Disposal	Plastic Jug with Kitty Litter	N/A	N/A

Quality Assurance Methods of CHEVWQMN:



- Standard Field Collection & Analyses.
- Standard Sample Preservation & Transport.
- Standard Lab Procedures.
- 4 Field Duplicate Samples Each Month.
- 4 Field Blank Samples Each Month.
- 2 DO Samples Each Month at Each Site.
- 2 Network Wide Quality Assurance Practice Sessions Each Year.
- Volunteer Training in Classroom & Field.
- Site Specific Monitors & Equipment.
- 2 Monitors per Site.

1998-2003 Results of the CHEVWQMN:

- **10 Parameters Presented:**

Temperature	Turbidity	Tot Nitrogen
Dissolved Oxygen	Secchi	Tot Phosphorus
Salinity	Chl a	FC Bacteria
Color		

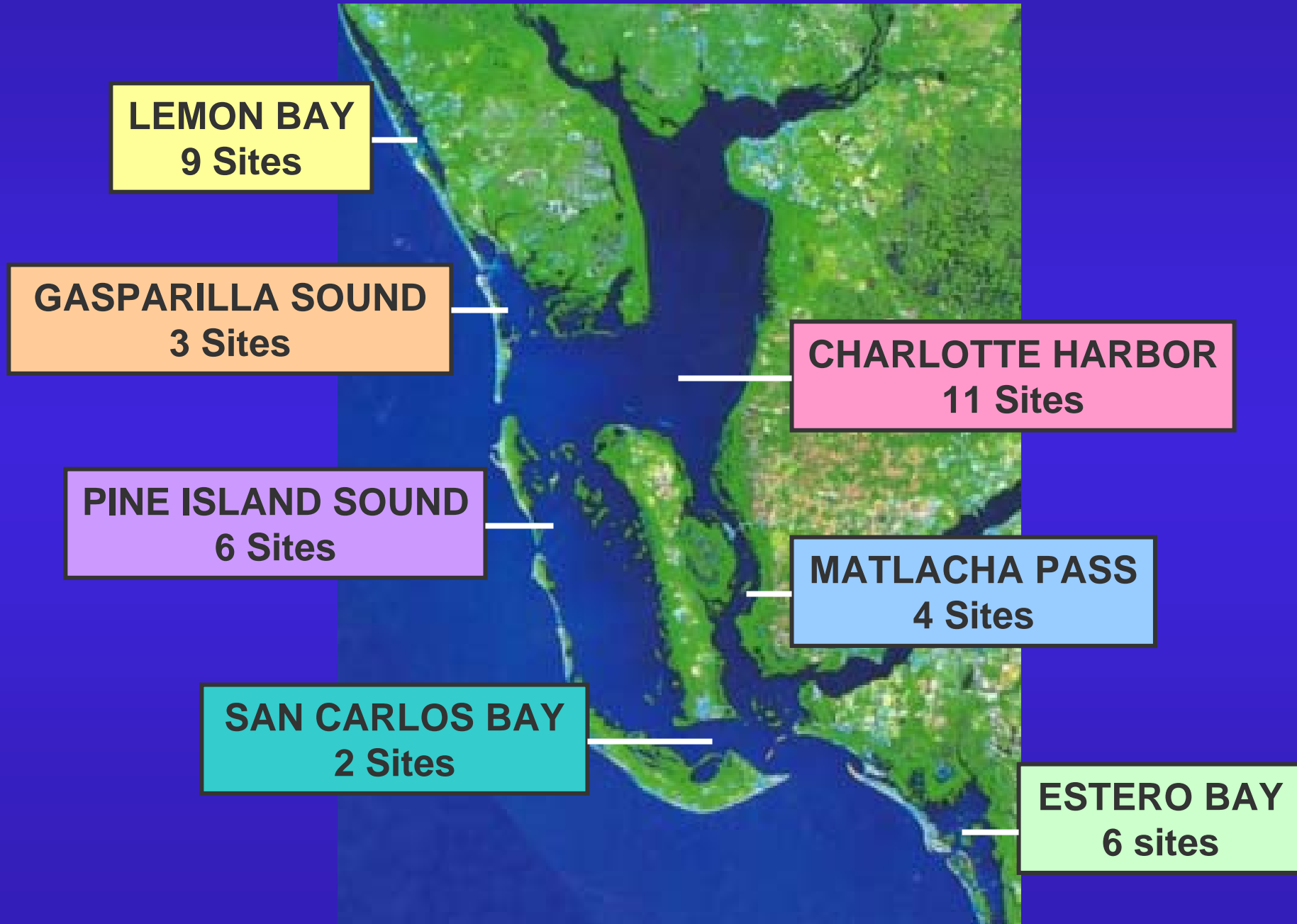
- **72 Months Averaged.**
- **7 Estuaries Summarized.**
- **Includes Only Small % of Possible Data Analyses.**
- **Data Continues to Accumulate Rapidly!**

Guidelines for Interpreting Results:

- 1 Dissolved Oxygen: Fish & Wildlife Standard
- 2 Secchi, Color, Turbidity, TN & TP: FDEP Typical Water Quality Values for FL Estuaries (lowest 30%, middle 31-59% & highest 40% of FL Estuaries)
- 3 Chlorophyll: FDEP Impaired Waters Standard
- 4 Fecal Coliform Bacteria: Public Health Std
- 5 Suggested Ranges: Based on Typical FL WQ Values & FL TSI for Estuaries

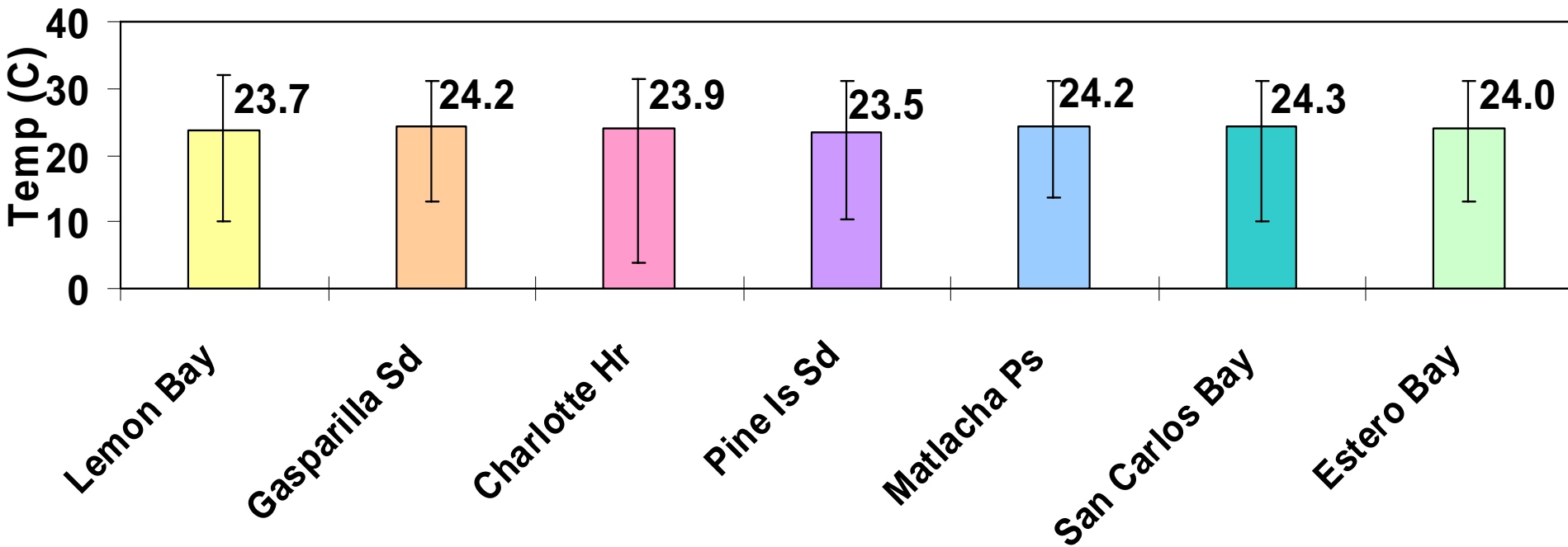
DO ¹ (mg/l)	Secchi ² (m)	Color ² (PCUs)	Chl ² & 3 (ug/l)	TN ² (mg/l)	TP ² (mg/l)	FC Bacteria ⁴ CFUs/100 mls	ESTUARY ⁵ HEALTH
≥ 5.0	≥ 1.5	≤ 12	≤ 5	≤ .6	≤ .04	Ave ≤ 199 Max ≤ 799	Above Ave (≤ 30%)
2.1 - 4.9	1.1 - 1.4	13 - 29	6 - 10	0.7 0.8	0.05 0.13		Average (31-59%)
≤ 2.0	≤ 1.0	≥ 30	≥ 11	≥ .9	≥ .14	Ave ≥ 200 Max ≥ 800	Below Ave (≥ 60%)

Remember the 7 Charlotte Harbor Estuaries:



Temperature:

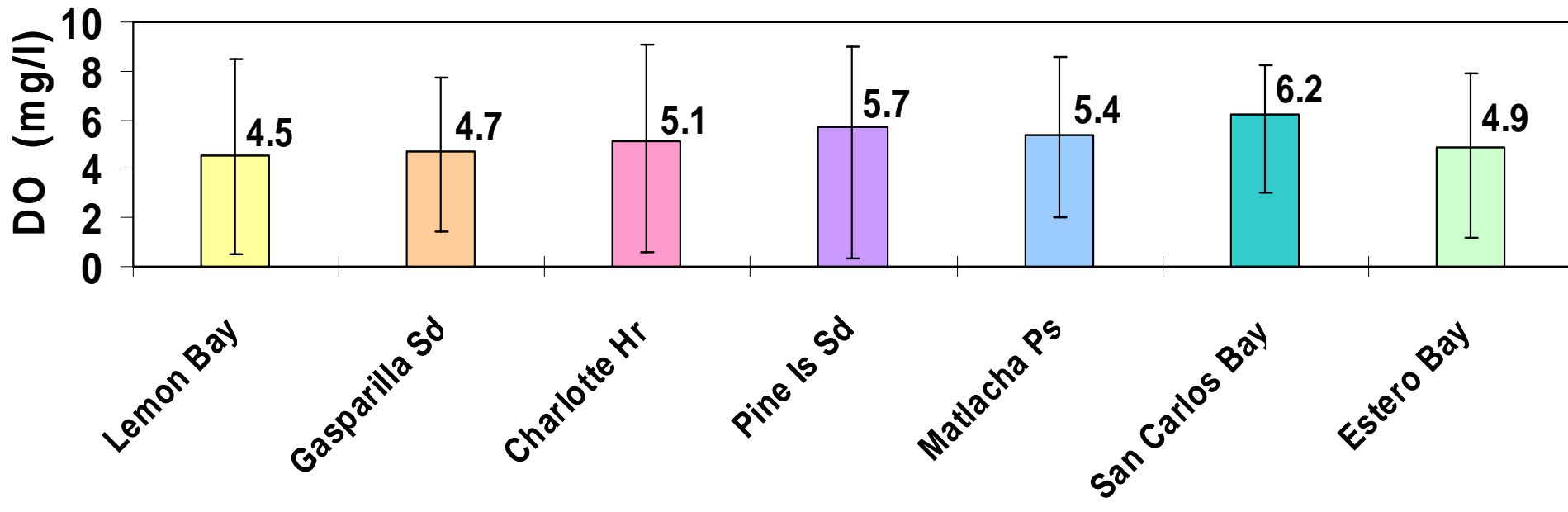
TEMPERATURE AVERAGE FOR EACH ESTUARY (C°)



- Temperature Ranged from 4.0°C – 32.0°C
- Highest Ave = Gasparilla S & Matlacha P (24.2°C)
- Lowest Ave = Pine Island Sound (23.5°C)
- Widest Range = Charlotte Harbor (4.0°C – 32.0°C)

Dissolved Oxygen:

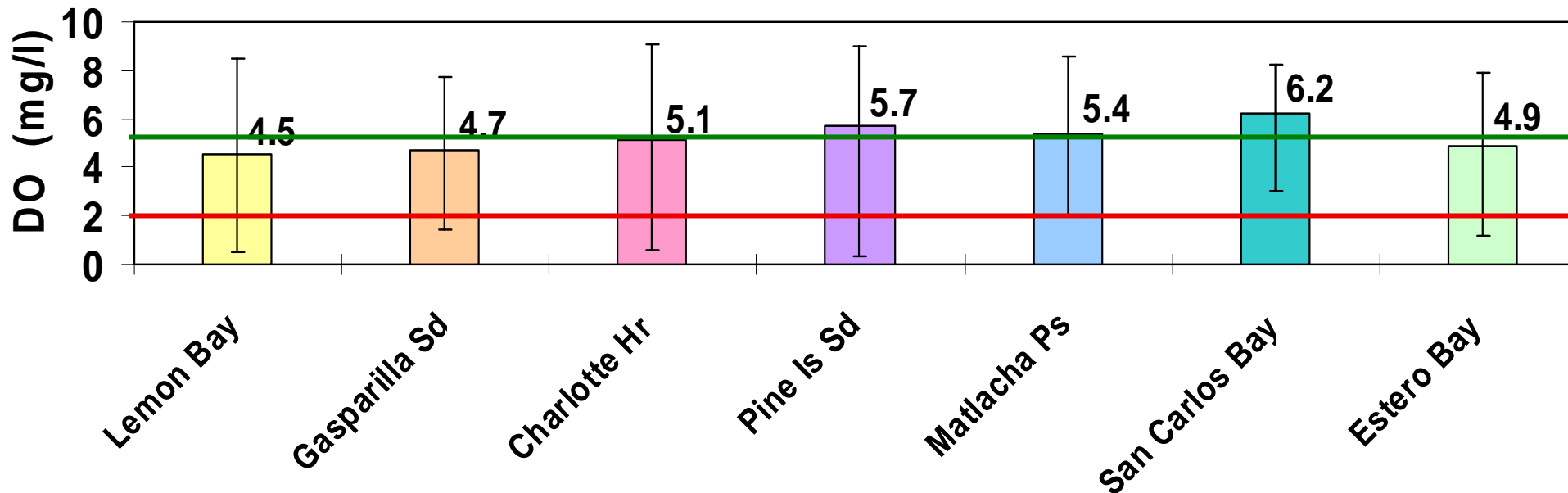
DISSOLVED OXYGEN AVERAGE FOR EACH ESTUARY (mg/l)



- Dissolved Oxygen Ranged from 0.3 mg/l – 9.1 mg/l
- Highest Ave = San Carlos Bay (6.2 mg/l)
- Lowest Ave = Lemon Bay (4.5 mg/l)
- Widest Range = Pine Island S (0.3 mg/l – 9.0 mg/l)

Dissolved Oxygen:

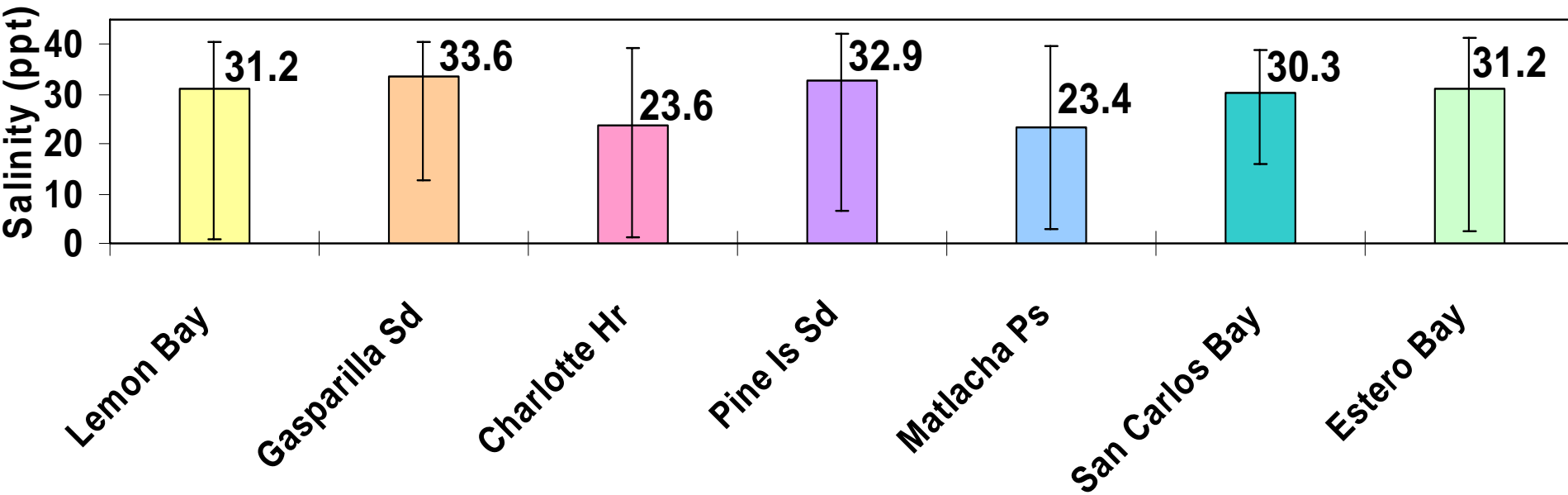
DISSOLVED OXYGEN AVERAGE FOR EACH ESTUARY (mg/l)



- 4 Estuaries > DO Standard of 5.0 mg/l (Charlotte H, Pine Island S, Matlacha P & San Carlos B)
- 3 Estuaries < DO Standard of 5 mg/l (Lemon Bay, Gasparilla Sound & Estero Bay)

Salinity:

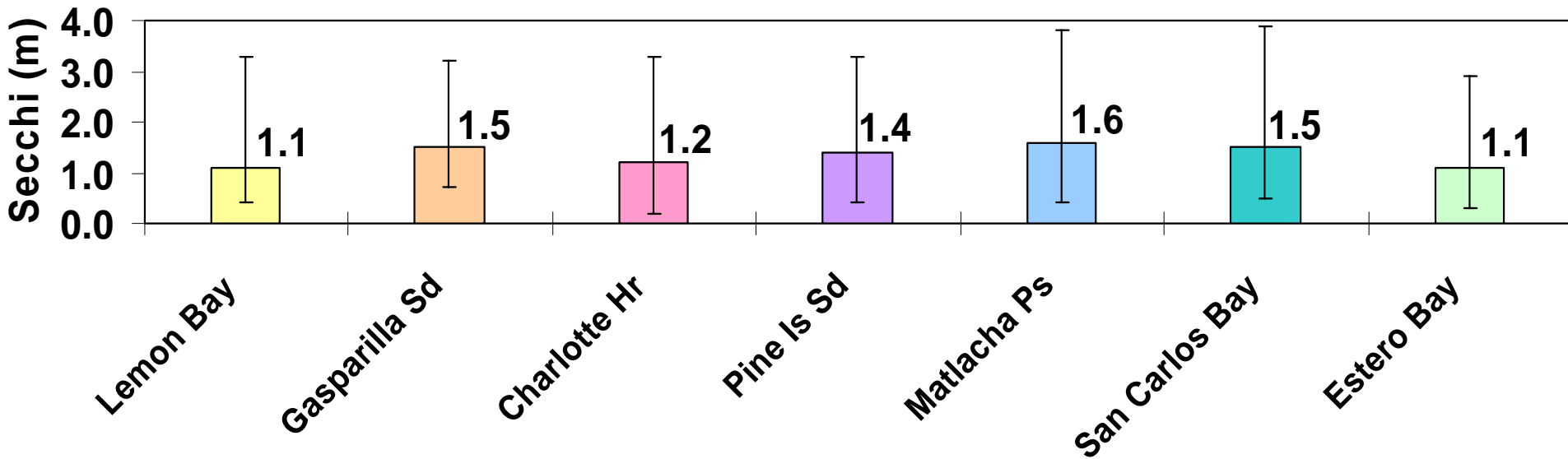
SALINITY AVERAGE FOR EACH ESTUARY (ppt)



- Salinity Ranged from 1.0 ppt – 42.0 ppt
- Highest Ave = Gasparilla Sound (33.6 ppt)
- Lowest Ave = Matlacha Pass (23.4 ppt)
- Widest Range = Charlotte Harbor (1.1 – 39.1 ppt)

Secchi:

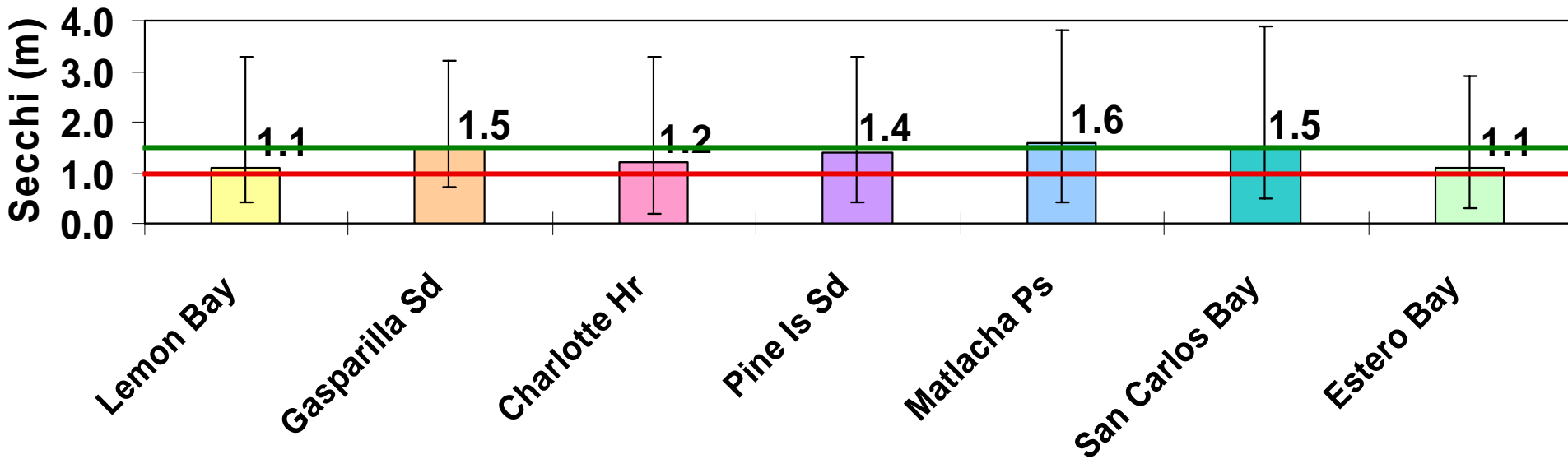
SECCHI AVERAGE FOR EACH ESTUARY (m)



- Secchi Depths Ranged from 0.2 m – 3.9 m
- Highest Ave = Matlacha Pass (1.6 m)
- Lowest Aves = Lemon Bay & Estero Bay (1.1 m)
- Widest Ranges = Matlacha Pass (0.4 m – 3.8 m) & San Carlos Bay (0.5 m – 3.9 m)

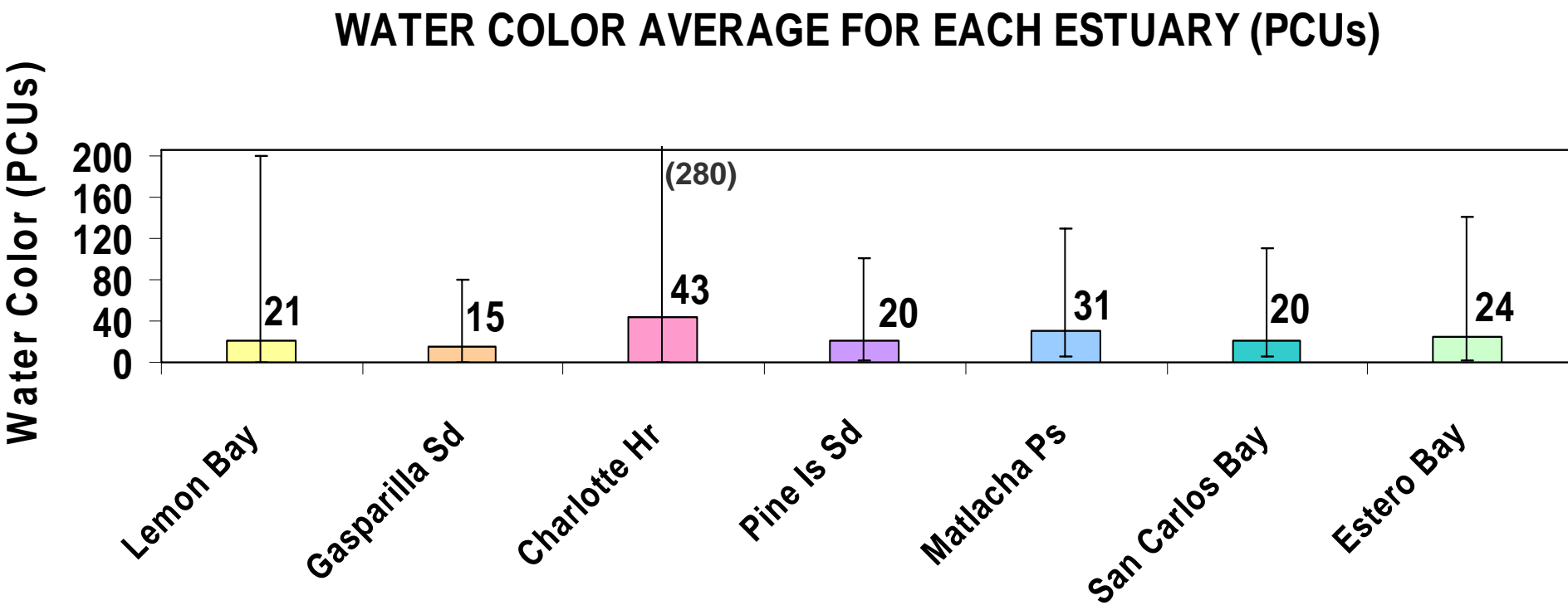
Secchi:

SECCHI AVERAGE FOR EACH ESTUARY (m)



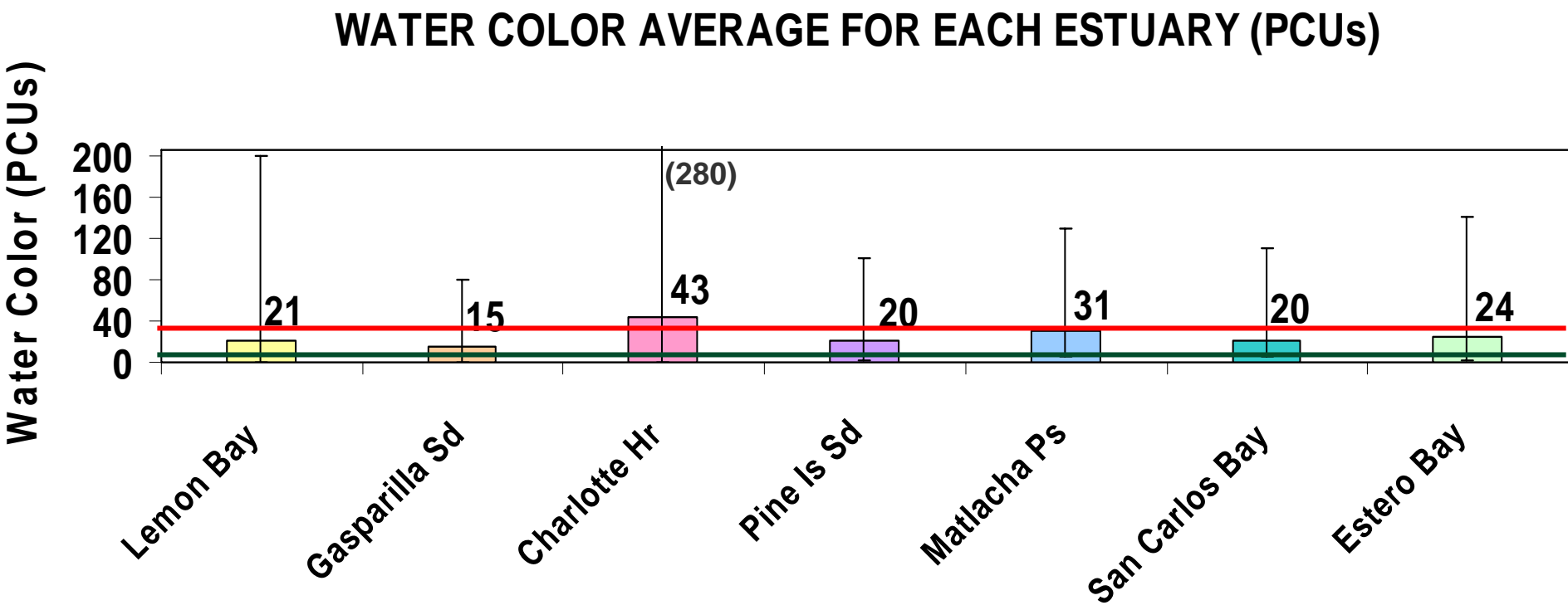
- 1 Estuary > “Above Average” Value of 1.5 m (Matlacha Pass)
- 0 Estuaries < “Below Average” Value of 1.0 m

Water Color:



- Water Color Ranged from 0 PCUs – 280 PCUs
- Highest Ave = Charlotte Harbor (43 PCUs)
- Lowest Ave = Gasparilla Sound (15 PCUs)
- Widest Range = Charlotte Harbor (0 – 280 PCUs)

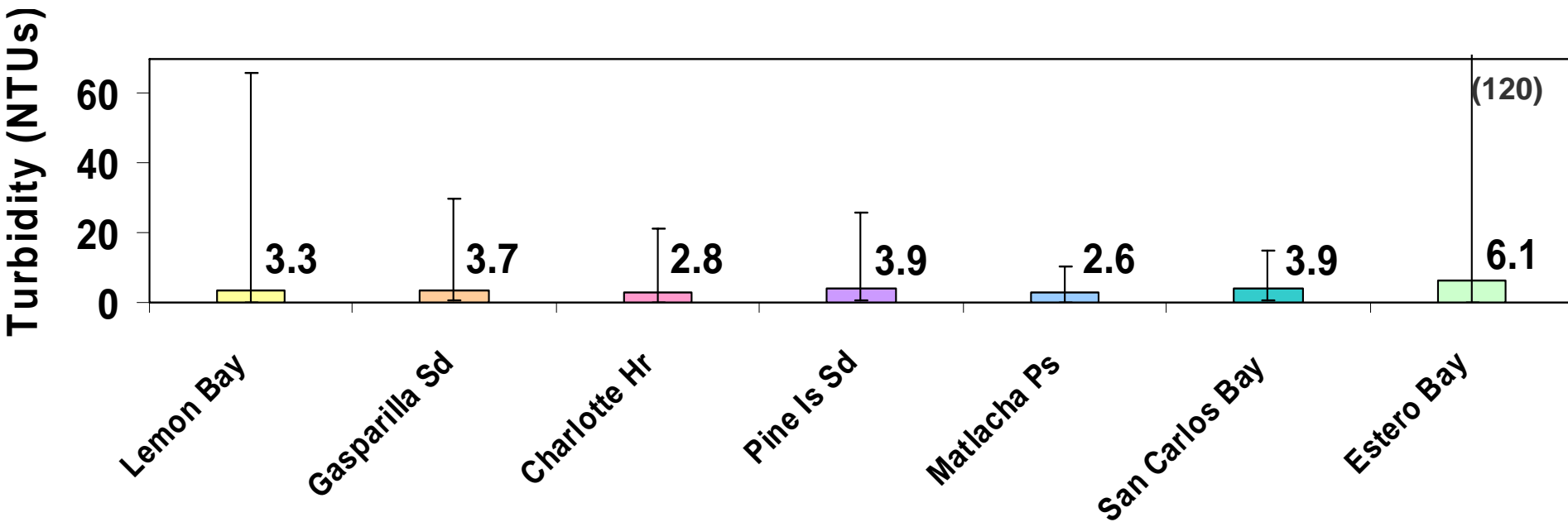
Water Color:



- 6 Estuaries fall within the “Average” Values of 13-29 PCUs
- 1 Estuary falls above the “Above Average” Value of 30 PCUs (Charlotte Harbor)

Turbidity:

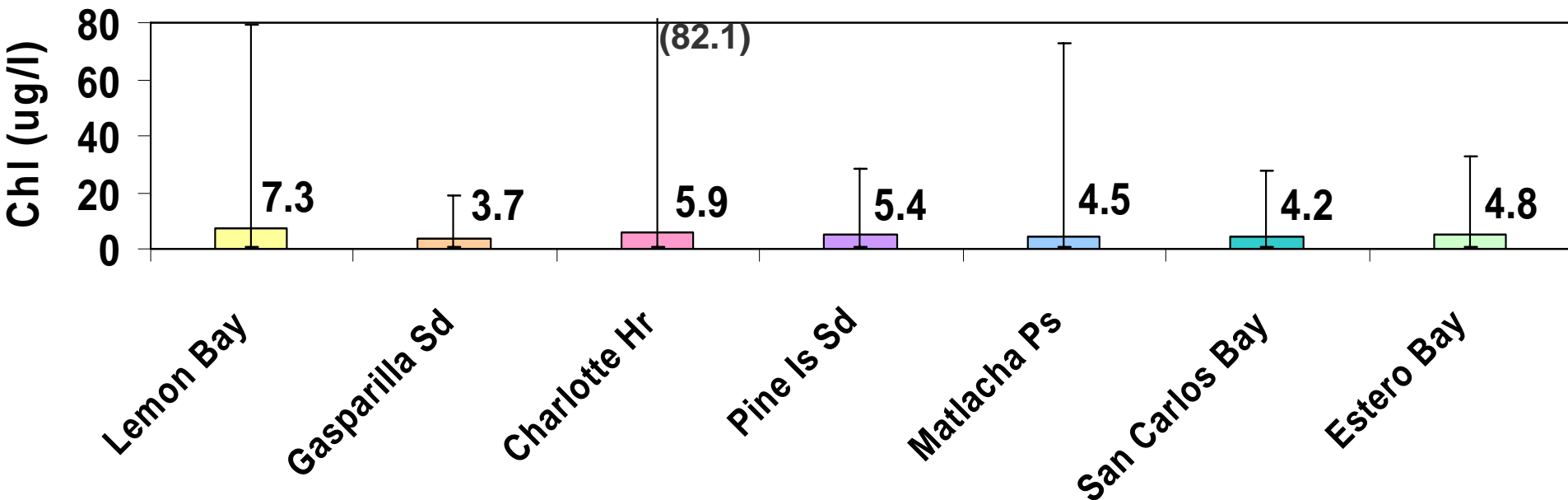
TURBIDITY AVERAGE FOR EACH ESTUARY (NTUs)



- Turbidity Ranged from 0 NTUs to 120 NTUs
- Highest Ave = Estero Bay (6.1 NTUs)
- Lowest Ave = Matlacha Pass (2.6 NTUs)
- Widest Range = Charlotte Harbor (0.2 – 120 NTUs)

Chlorophyll:

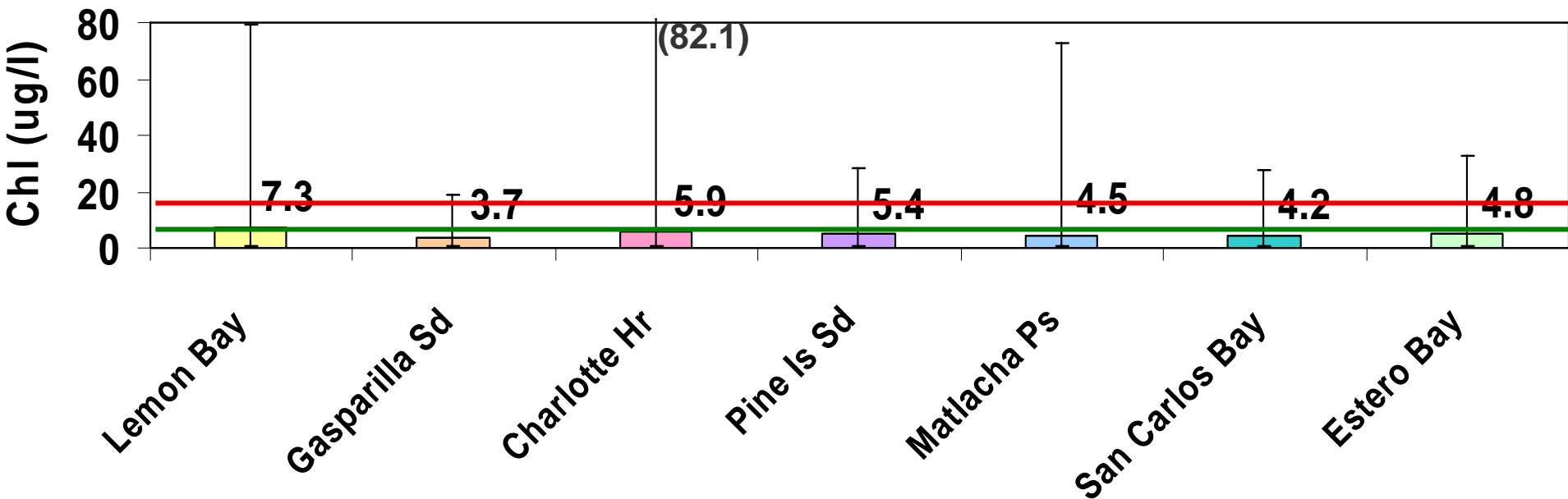
CHLOROPHYLL AVERAGE FOR EACH ESTUARY (ug/l)



- Chlorophyll Ranged from 0.4 ug/l – 82.1 ug/l
- Highest Ave = Lemon Bay (7.3 ug/l)
- Lowest Ave = Gasparilla Sound (3.7ug/l)
- Widest Range = Charlotte Harbor (0.5 – 82.1 ug/l)

Chlorophyll:

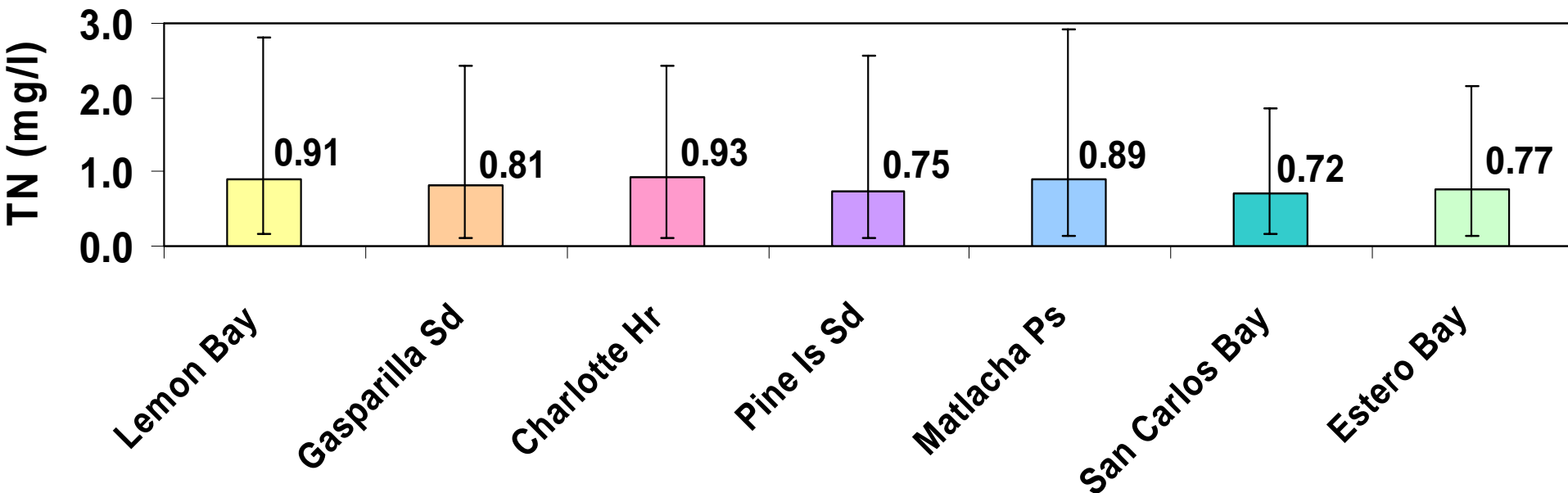
CHLOROPHYLL AVERAGE FOR EACH ESTUARY (ug/l)



- 4 Estuaries < “Above Average” Value of 5 ug/l (Gasparilla S, Matlacha P, San Carlos B & Estero B)
- 0 Estuaries > “Impaired” Standard of 11 ug/l

Total Nitrogen:

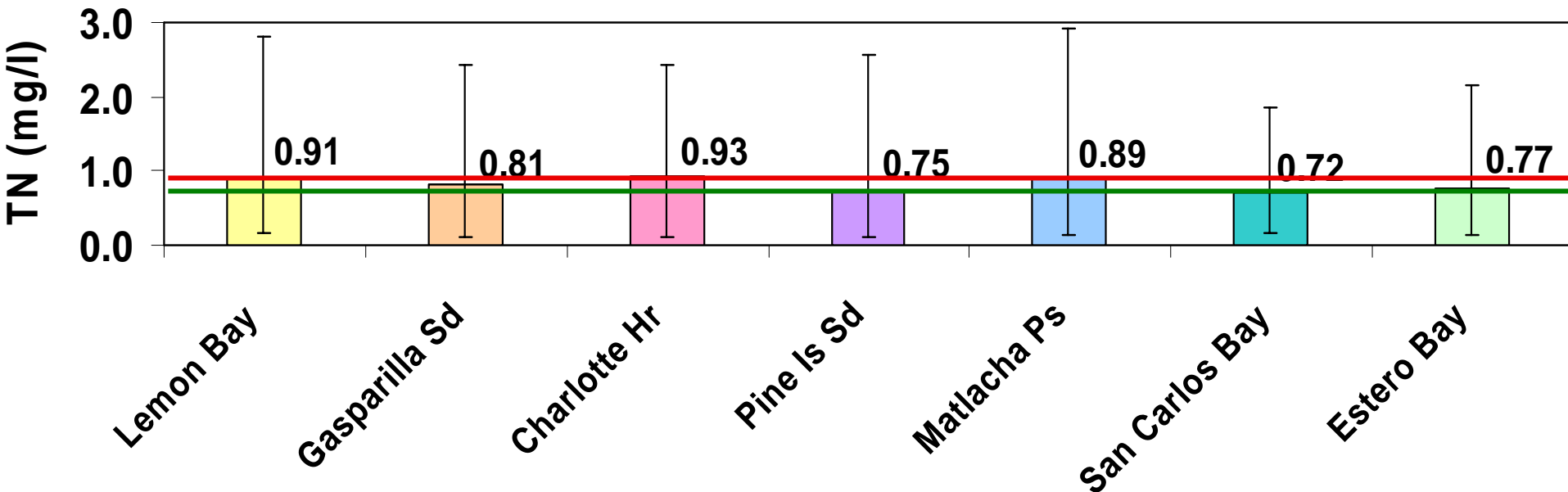
TOTAL NITROGEN AVERAGE FOR EACH ESTUARY (mg/l)



- Total Nitrogen Ranged from 0.11 – 2.93 mg/l
- Highest Ave = Charlotte Harbor (0.93 mg/l)
- Lowest Ave = San Carlos Bay (0.72 mg/l)
- Widest Range = Matlacha Pass (0.14 - 2.93 mg/l)

Total Nitrogen:

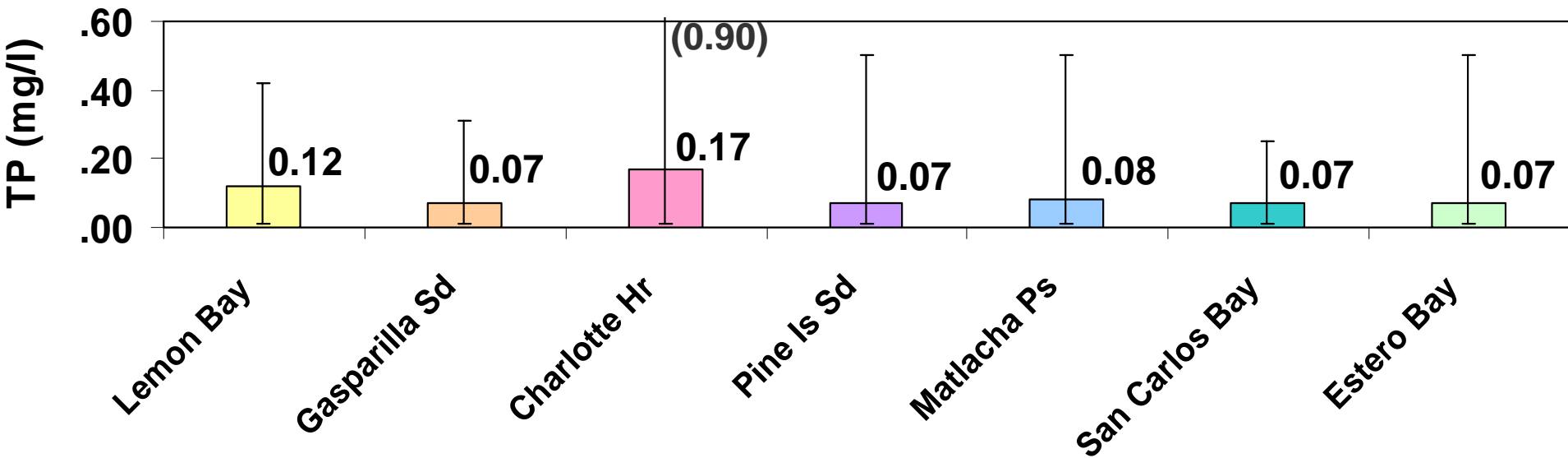
TOTAL NITROGEN AVERAGE FOR EACH ESTUARY (mg/l)



- 0 Estuaries < “Above Average” Value of 0.6 mg/l
- 2 Estuaries > “Below Average” Value of 0.9 mg/l (Lemon Bay & Charlotte Harbor)

Total Phosphorus:

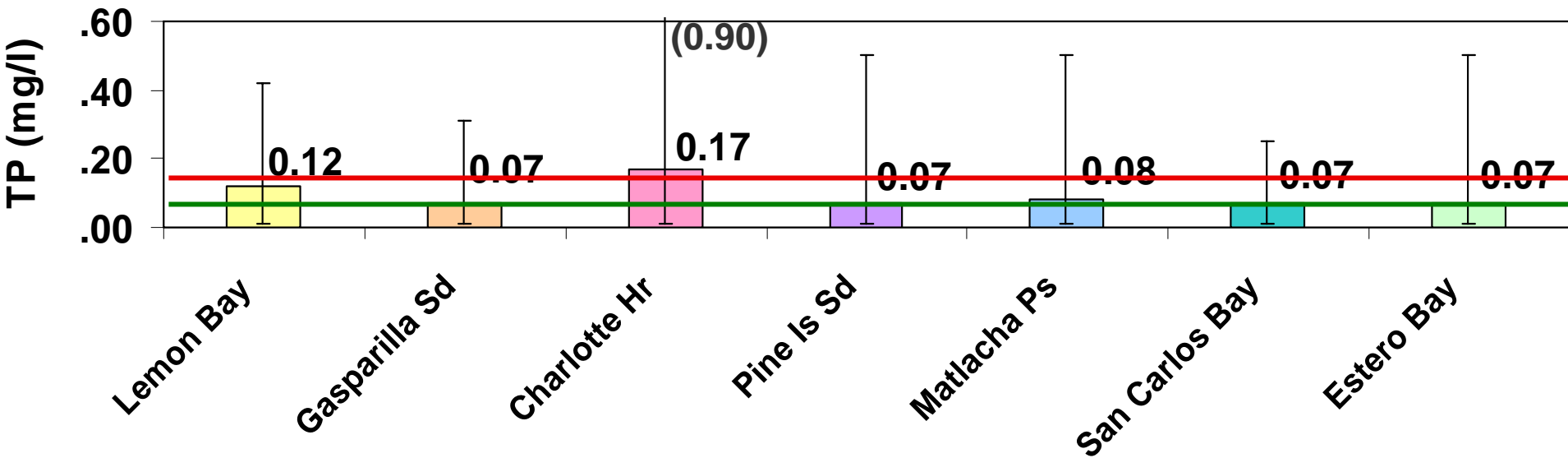
TOTAL PHOSPHORUS AVERAGE FOR EACH ESTUARY (mg/l)



- Total Phosphorus Ranged from 0.01- 0.90 mg/l
- Highest Ave = Charlotte Harbor (0.17 mg/l)
- Lowest Aves = Gasparilla S, Pine Island S, San Carlos B & Estero B (0.07 mg/l)
- Widest Range = Charlotte Harbor (0.01 - 0.90 mg/l)

Total Phosphorus:

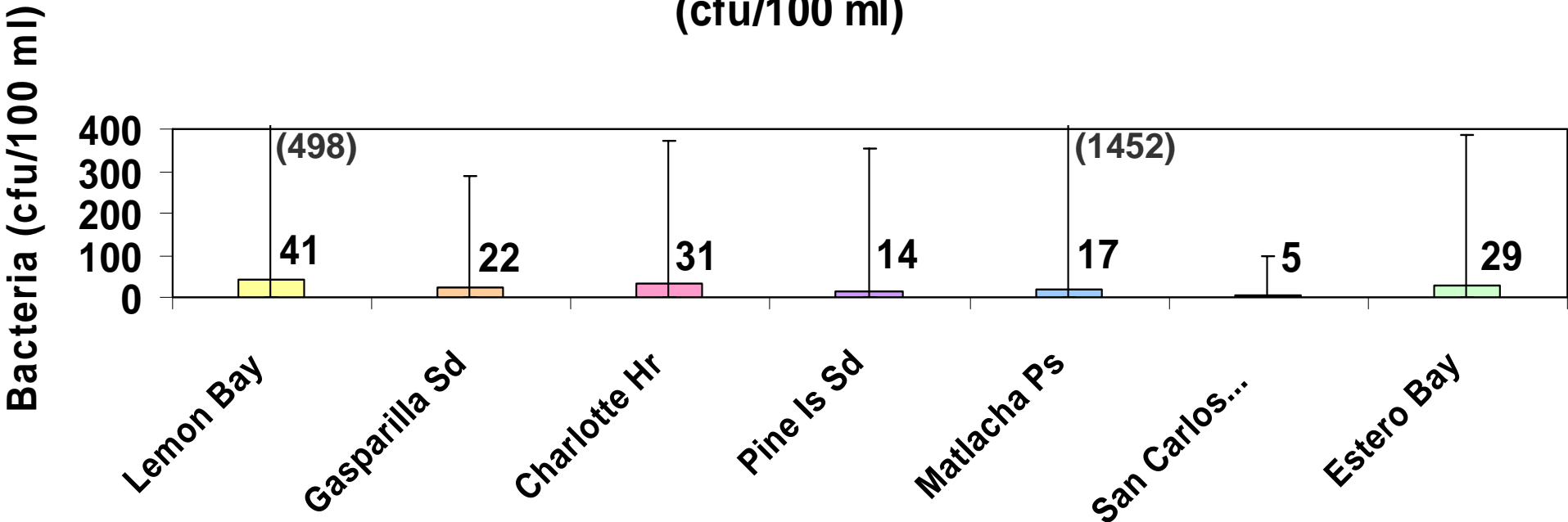
TOTAL PHOSPHORUS AVERAGE FOR EACH ESTUARY (mg/l)



- 0 Estuaries < “Above Average” Value of .04 mg/l
- 1 Estuary > “Below Average” Value of .14 mg/l (Charlotte Harbor)

Fecal Coliform Bacteria:

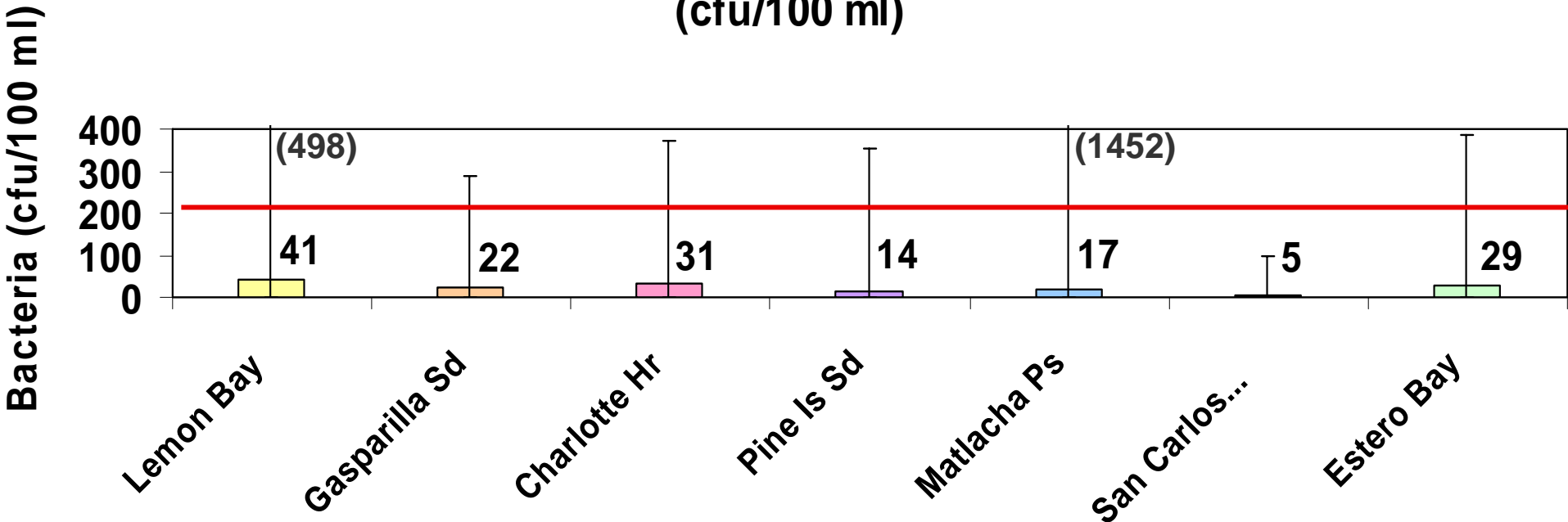
FECAL COLIFORM BACTERIA AVERAGE FOR EACH ESTUARY
(cfu/100 ml)



- FC Bacteria Ranged from 1– 1452 cfu/100 ml (some TNTC, also)
- Highest Ave = Lemon Bay (41 cfu/100 ml)
- Lowest Aves = San Carlos Bay (5 cfu/100 ml)
- Widest Range = Matlacha Pass (1-1462 cfu/100 ml)

Fecal Coliform Bacteria:

FECAL COLIFORM BACTERIA AVERAGE FOR EACH ESTUARY
(cfu/100 ml)



- 7 Estuaries < Health Standard Ave 200 cfu/100 ml
- 15 Samples > Health Standard 1 Time 800 cfu/100ml
(Lemon Bay, Charlotte Harbor & Matlacha Pass)

Interpreting the 1998 - 2003 CHEVWQMN Data:

	DO ¹ (mg/l)	Secchi ² (m)	Color ² (PCUs)	Chl ² (ug/l)	TN ² (mg/l)	TP ² (mg/l)	FC Bacteria ³ (CFUs/100ml)	1998-2003 RESULTS
LEMON BAY (Ave of 9 Sites)	4.5	1.1	21	7.3	0.91	0.12	41 Ave	Average
							1,600	
GASPARILLA SD (Ave of 3 Sites)	4.7	1.5	15	3.7	0.81	0.07	22 Ave 288	Above Ave
CHARLOTTE HR (Ave of 11 Sites)	5.1	1.2	43	6	0.93	0.17	31 Ave 370	Average
PINE ISLAND SD (Ave of 6 Sites)	5.7	1.4	20	5	0.75	0.08	14 Ave 352	Average
MATLACHA PASS (Ave of 4 Sites)	5.4	1.6	31	4.5	0.89	0.08	17 Ave	Above Ave
							1,452	
SAN CARLOS BAY (Ave of 2 Sites)	6.2	1.5	20	4	0.72	0.07	5 Ave 98	Above Ave
ESTERO BAY (Ave of 6 Sites)	4.9	1.1	24	4.8	0.77	0.07	29 Ave 384	Average

CHEVWQMN Data Conclusions:



- “Above Average” to “Average” estuary health estimates show need to reduce human nutrient inputs to the estuaries.

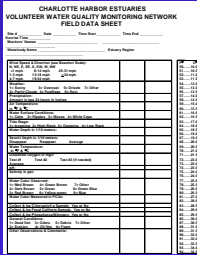
- Watershed management activities should focus on the most critical estuaries & sites including Lemon Bay & Estero Bay, & LBV001, CHV013, PIV001 & EBV005.



- Additional Analysis is needed for
 - ~ Seasonal & Yearly Trends
 - ~ Spatial trends
 - ~ Reference Sites Comparisons

CHEVWQMN Program Conclusions:

- CHEVWQMN Data is useful for
 - ~ managing Aquatic Preserves
 - ~ estimating pollutant load reduction goals
 - ~ evaluating proposed development projects



- Models for estimating estuary health from data need to be improved.

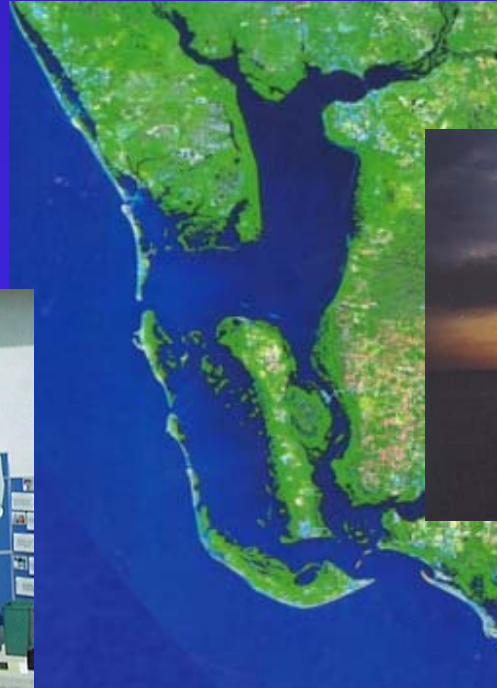


- Value of Volunteer Contributions > \$370,00
(42 hrs/yr/vol + \$200 gas/yr/vol X 75 volunteers)



- Consistent lab support is important for generating reliable data & for allowing the CHEVWQMN to...

Continue Monitoring, Managing & Enjoying Our Special Estuaries Wisely.



**Dedicated to the Memory of
Peter Ordway,
Henry Welter
& Wyatt Hooks.**