

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

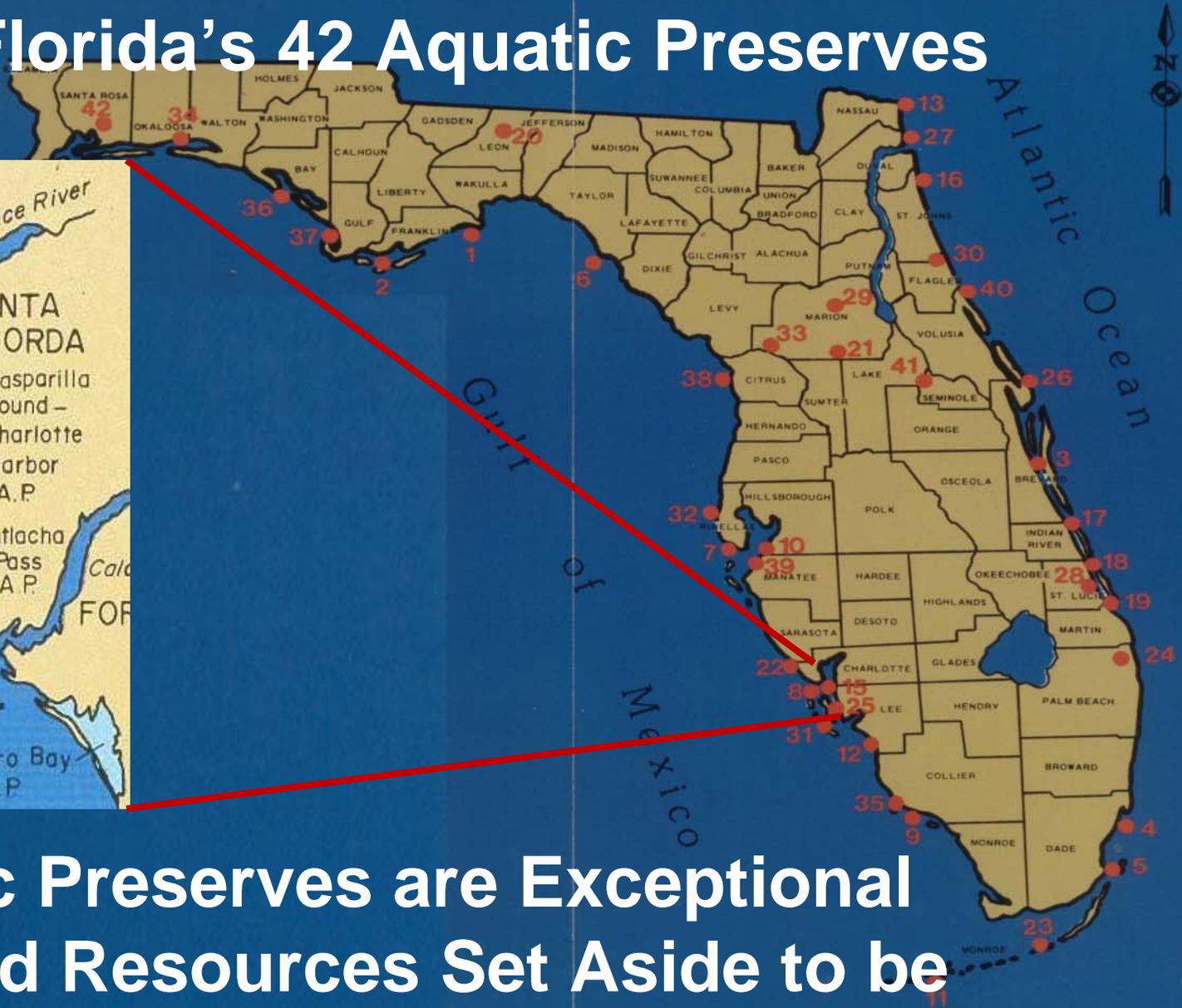
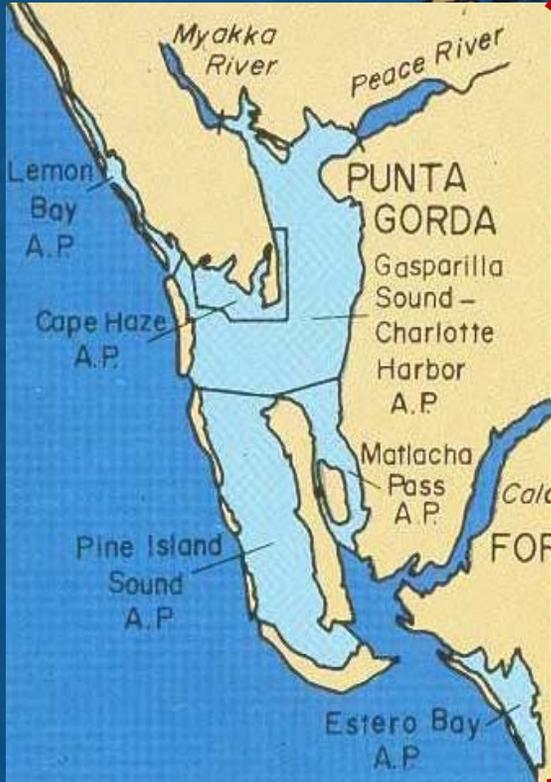
Methods & Procedures

Water Quality Results

Data Conclusions

Program Conclusions

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

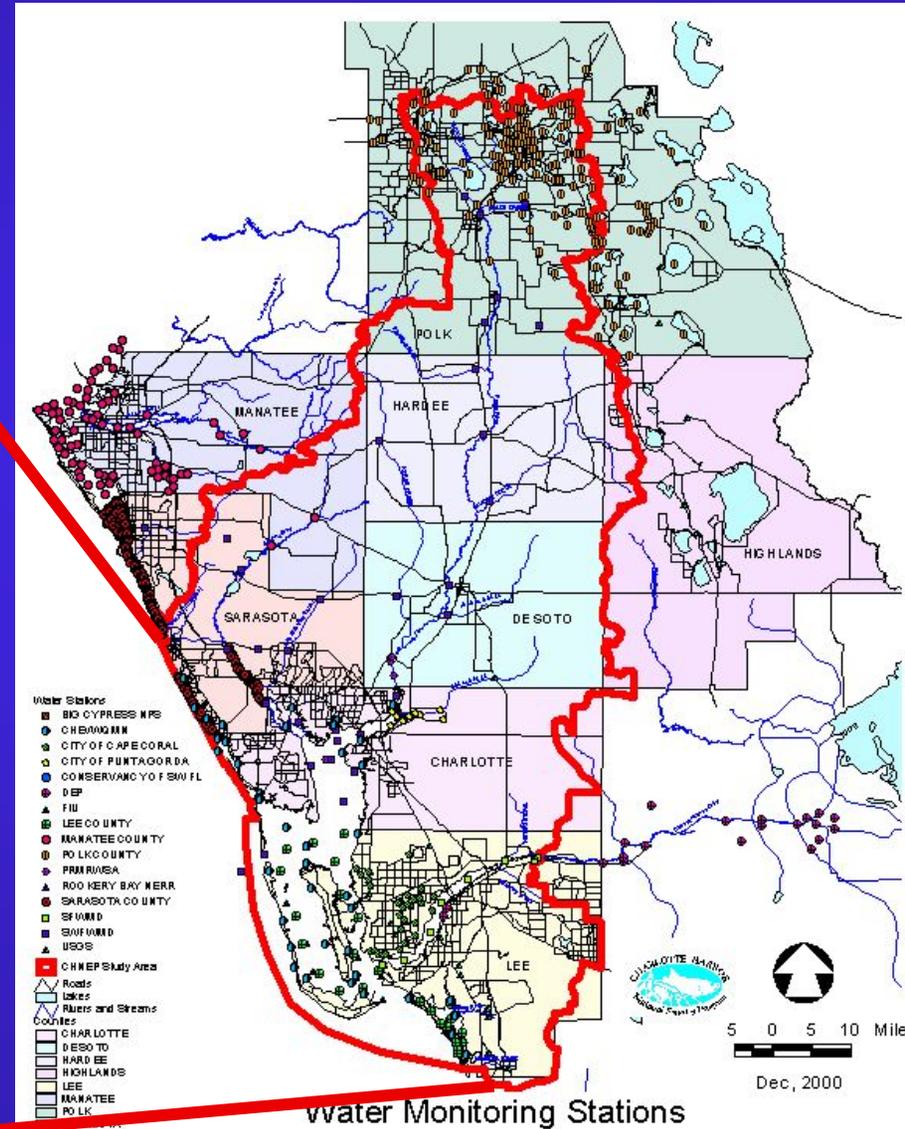


FL Aquatic Preserves are Exceptional Submerged Resources Set Aside to be Preserved for Future Generations to Enjoy

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

LEMON BAY
12 mi²
7 tribs
2 passes

GASPARILLA SOUND
10 mi²
1 tribs
2 passes

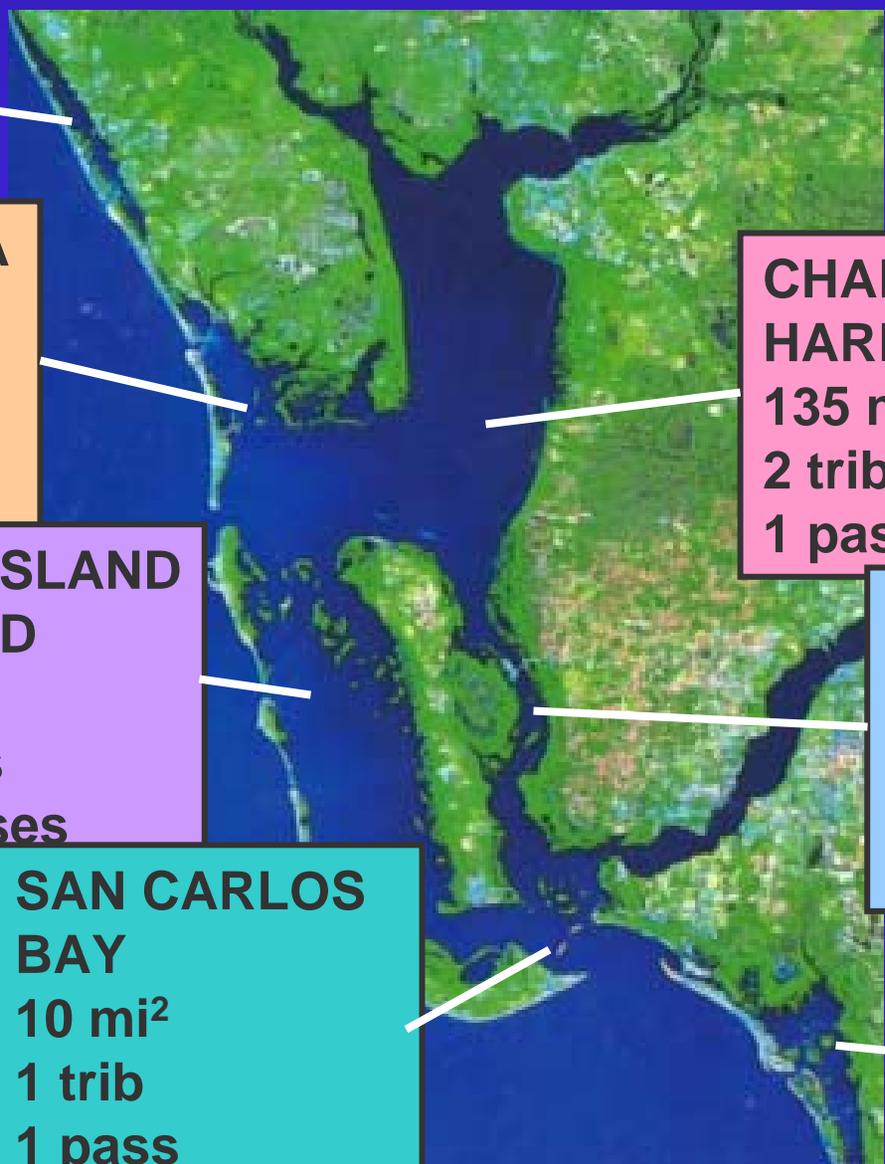
PINE ISLAND SOUND
80 mi²
0 tribs
4 passes

SAN CARLOS BAY
10 mi²
1 trib
1 pass

CHARLOTTE HARBOR
135 mi²
2 tribs
1 pass

MATLACHA PASS
21 mi²
1 trib
1 pass

ESTERO BAY
15 mi²
5 tribs
3 passes



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.

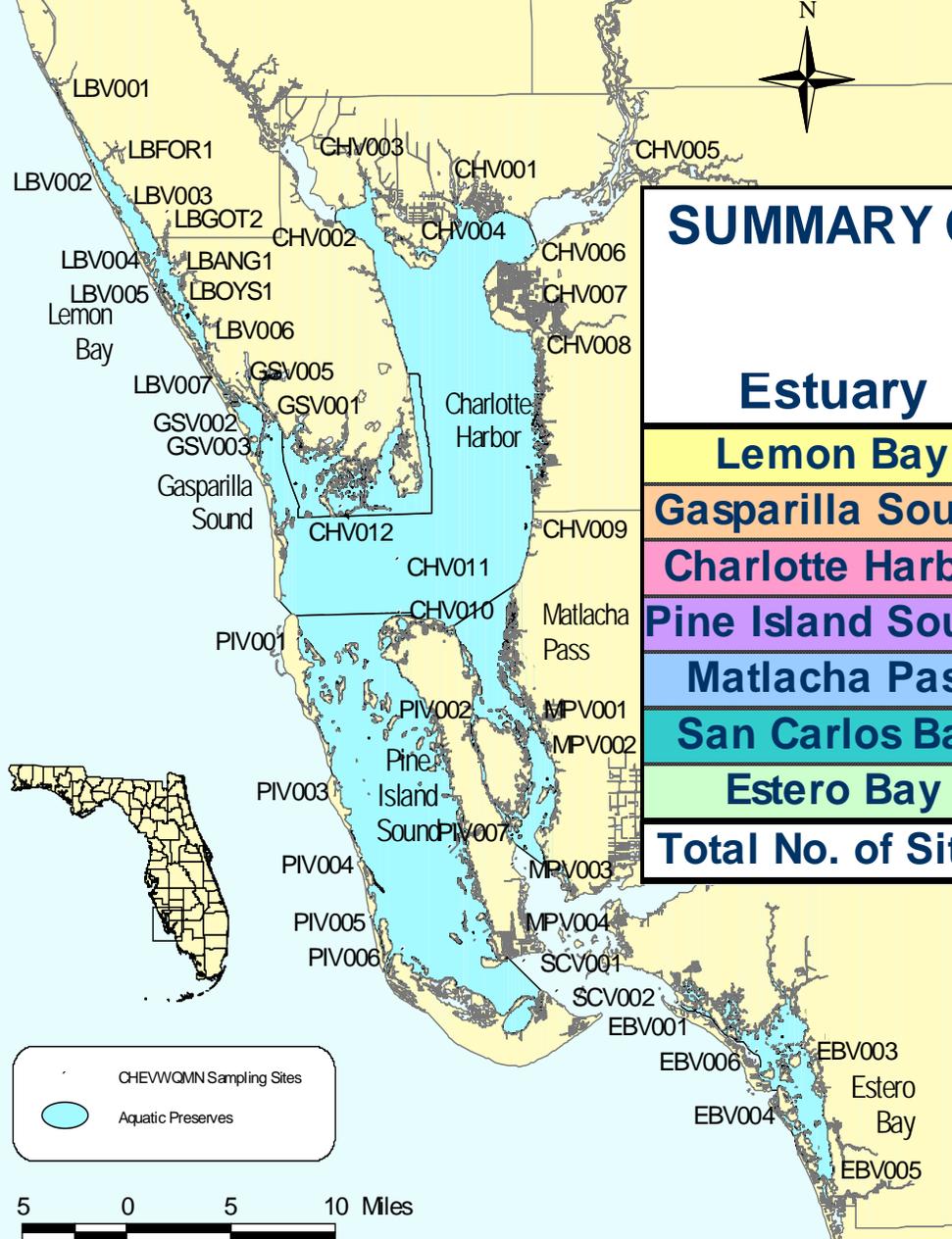


Sampling Protocols of the CHEVWQMN:

- **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.

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 _____
 Monitors Names _____
 Waterbody Name _____ Estuary Region _____

Wind Speed & Direction (see Beaufort Scale): N, NE, E, SE, S, SW, W, NW	50.....10.0 51.....10.3 52.....11.0 53.....11.5 54.....12.0 55.....13.0 56.....13.5 57.....14.0 58.....14.5 59.....15.0 60.....15.5 61.....16.0 62.....16.5 63.....17.0
1-3 mph 4-12 mph 13-18 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= Water Depth in 1'	
Secchi Depth in Disappear	
Water Temperature in °F & °C	
Dissolved Oxygen Test #1	
Average pH:	
Salinity in ppt:	
Water Color Obs: 1= Most Brown 2= Dark Brown 3= Red Brown 4= Other Observations	
Collect & Ice Chk	
Collect & Ice Fec	
General Conduc:	
1= Dead Fish 3= TP, TKN, NO ₂ /NO ₃	
2= Erosion 4= Other Observations	



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 Hach # 2234-00	Immediate	N/A
Salinity	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 Grab Sample 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.**

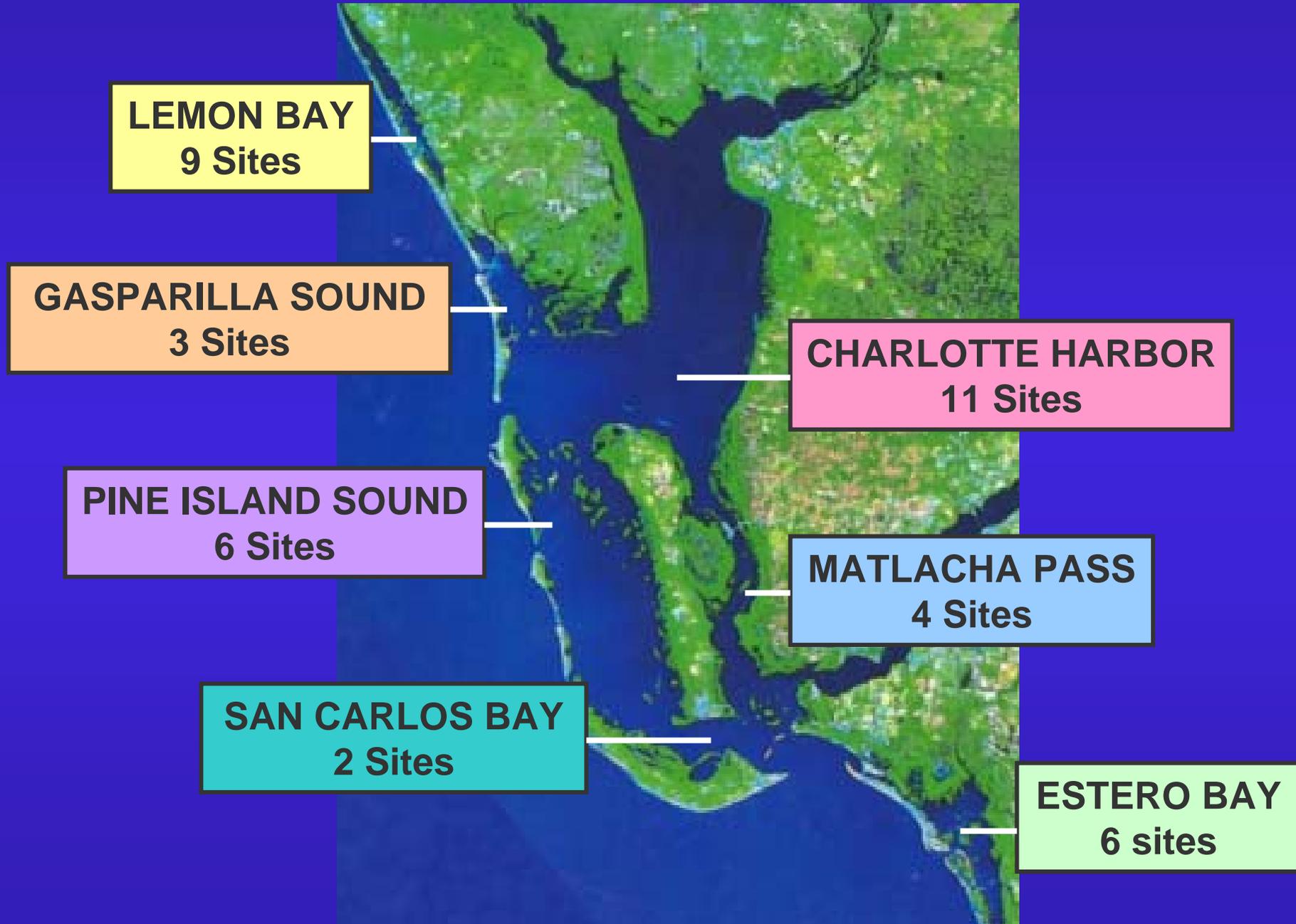
- **Data Continues to Accumulate Rapidly!**

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

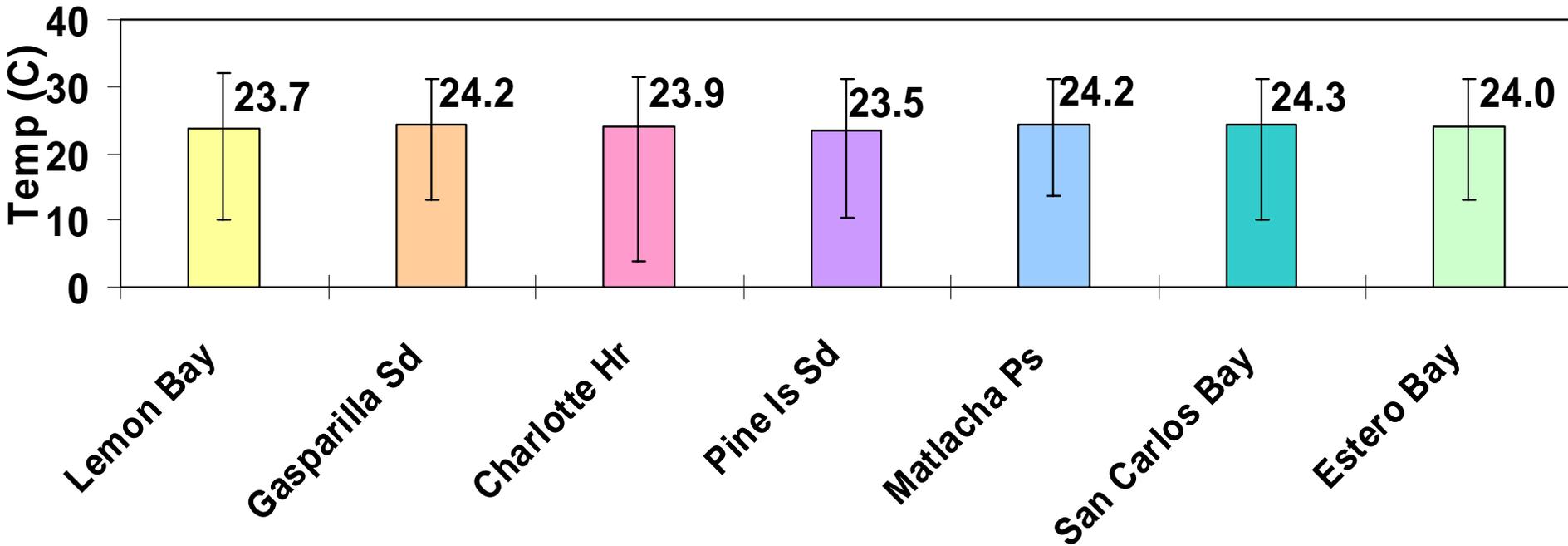
DO ¹ (mg/l)	Secchi ² (m)	Color ² (PCUs)	Chl ² & ³ (ug/l)	TN ² (mg/l)	TP ² (mg/l)	FC Bacteria ⁴ CFUs/100 mls	ESTUARY ⁵ HEALTH
≥ 5.0	≥ 1.5	≤ 12	≤ 5	≤ .6	≤ 04	Ave ≤ 199 Max ≤ 799	Above Ave (≤ 30%)
2.1 - 4.9	1.1 - 1.4	13 - 29	6 - 10	0.7 0.8	0.05 0.13		Average (31-59%)
≤ 2.0	≤ 1.0	≥ 30	≥ 11	≥ .9	≥ .14	Ave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

Remember the 7 Charlotte Harbor Estuaries:



Temperature:

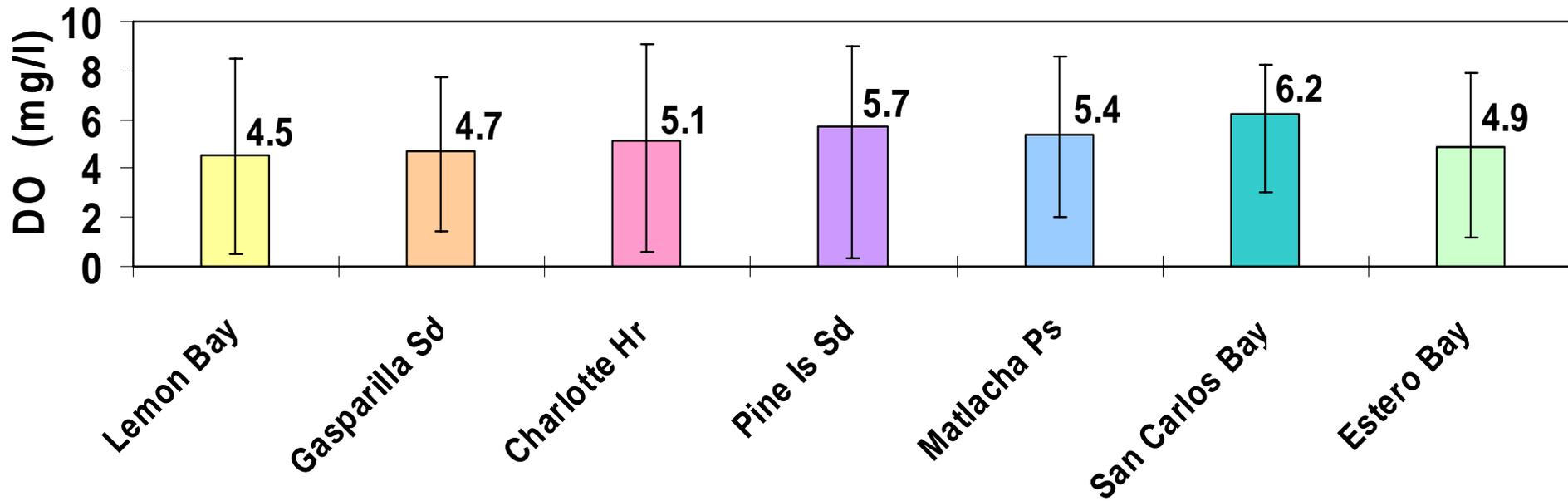
TEMPERATURE AVERAGE FOR EACH ESTUARY (C°)



- 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:

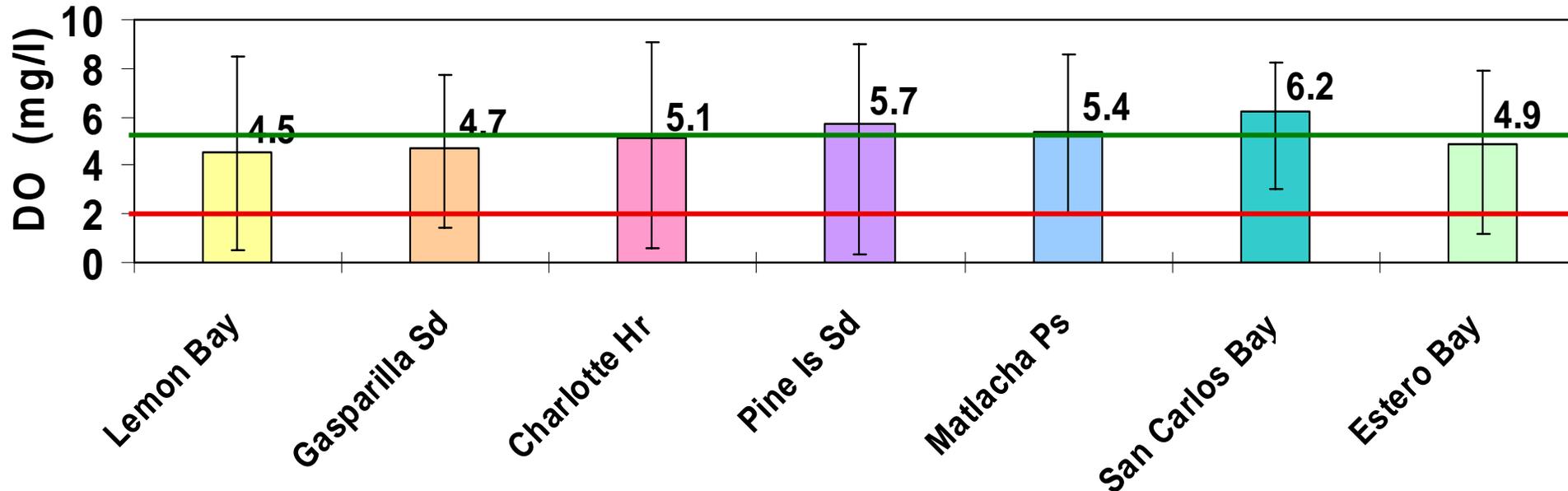
DISSOLVED OXYGEN AVERAGE FOR EACH ESTUARY (mg/l)



- 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:

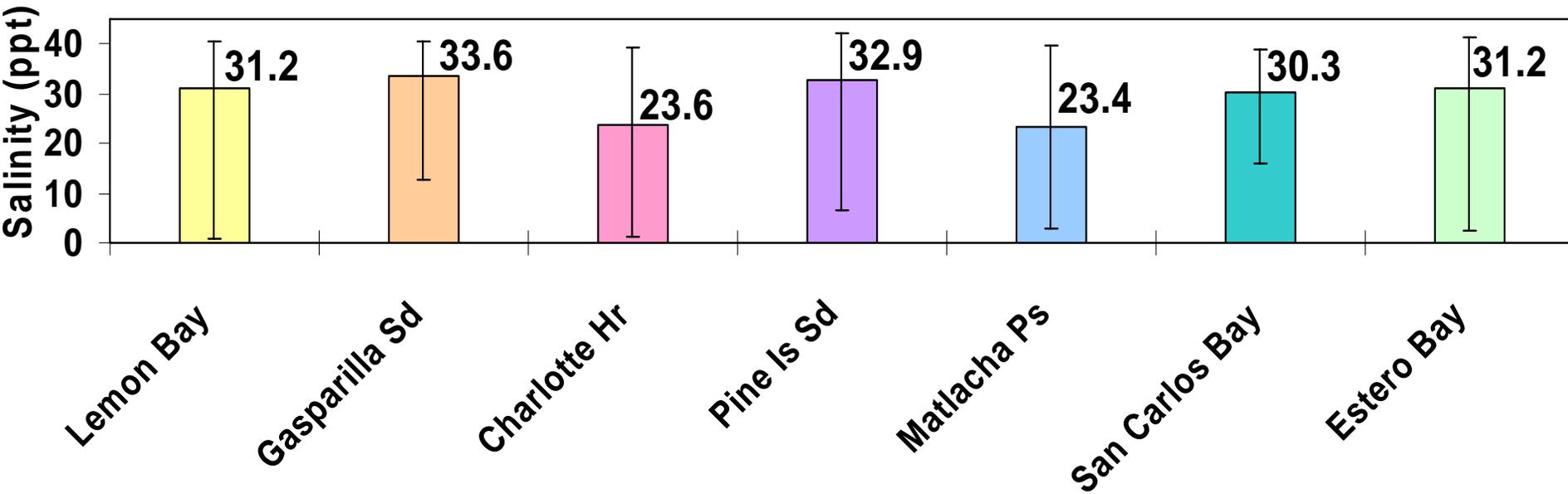
DISSOLVED OXYGEN AVERAGE FOR EACH ESTUARY (mg/l)



- 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:

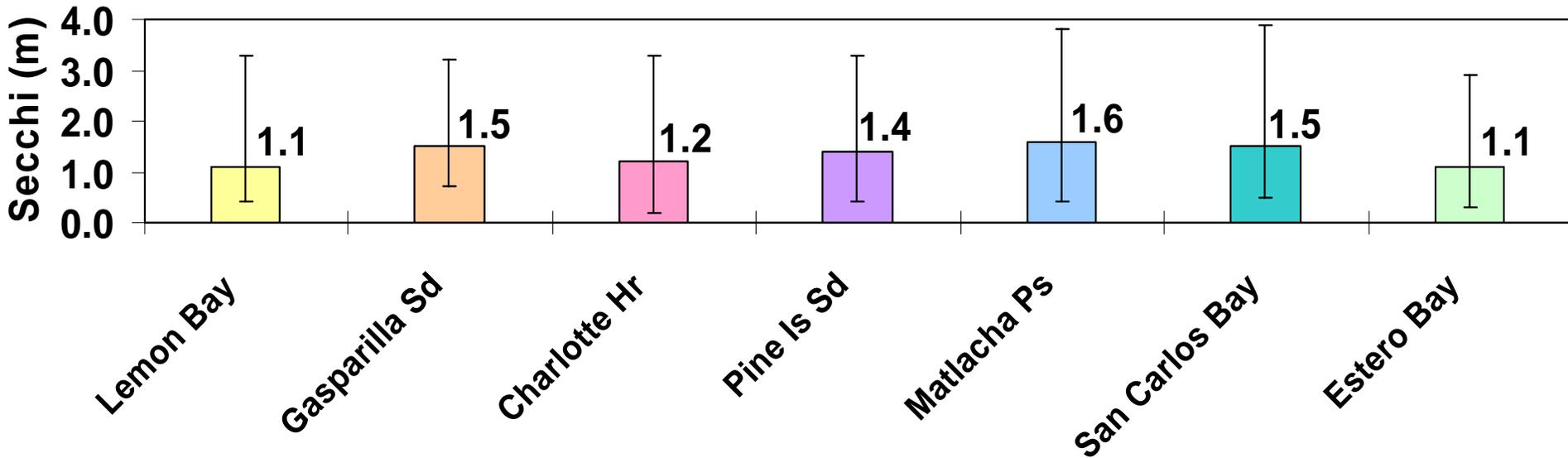
SALINITY AVERAGE FOR EACH ESTUARY (ppt)



- 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:

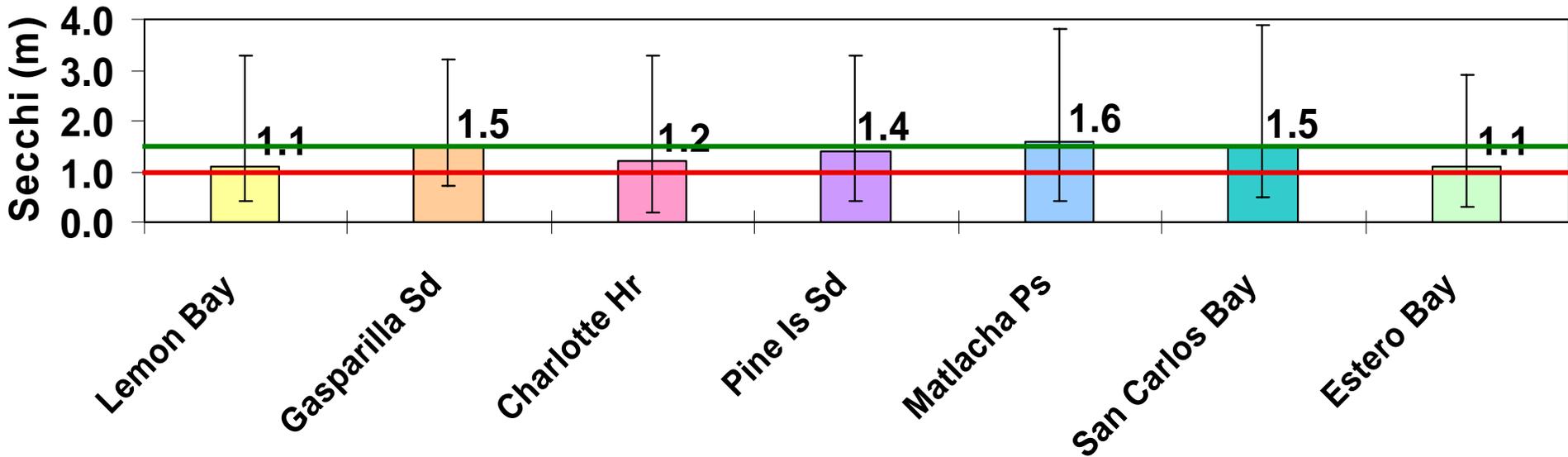
SECCHI AVERAGE FOR EACH ESTUARY (m)



- 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:

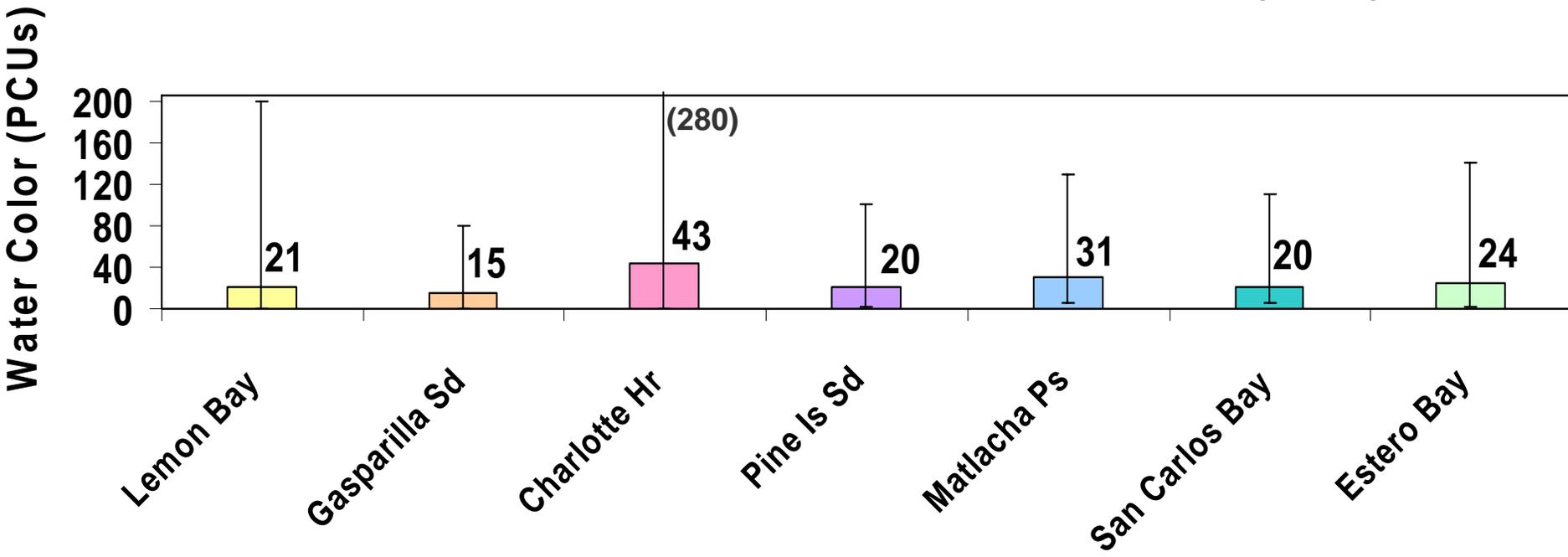
SECCHI AVERAGE FOR EACH ESTUARY (m)



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

Water Color:

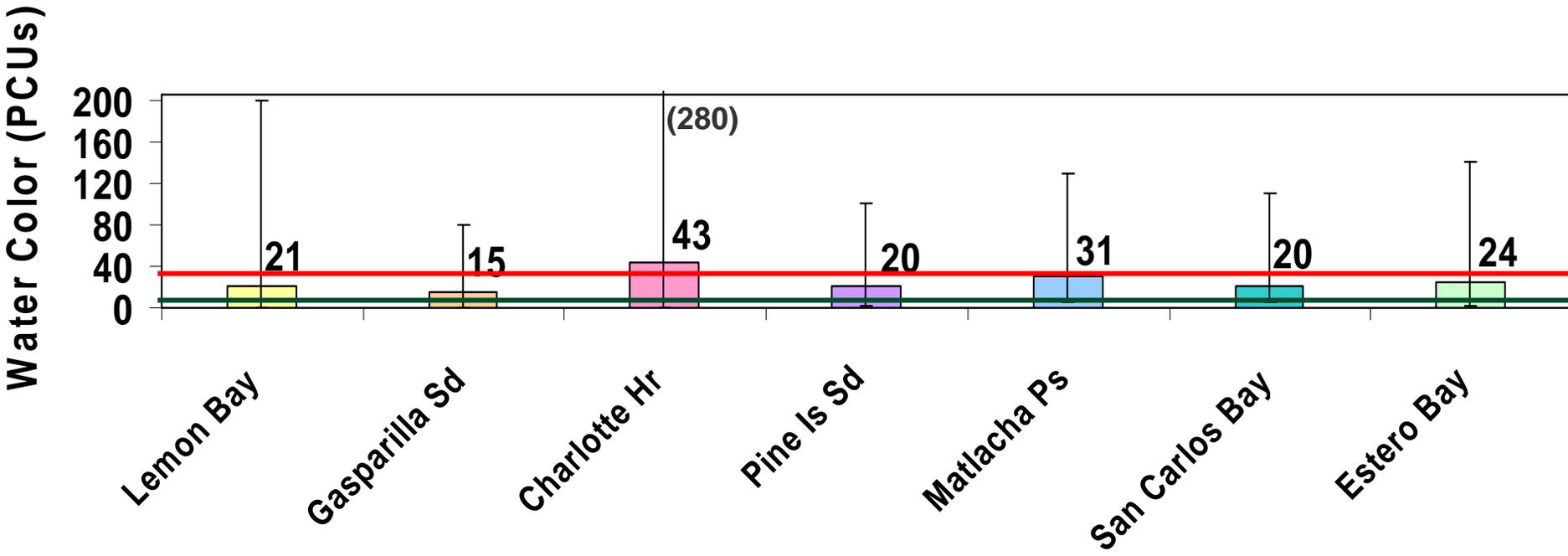
WATER COLOR AVERAGE FOR EACH ESTUARY (PCUs)



- 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:

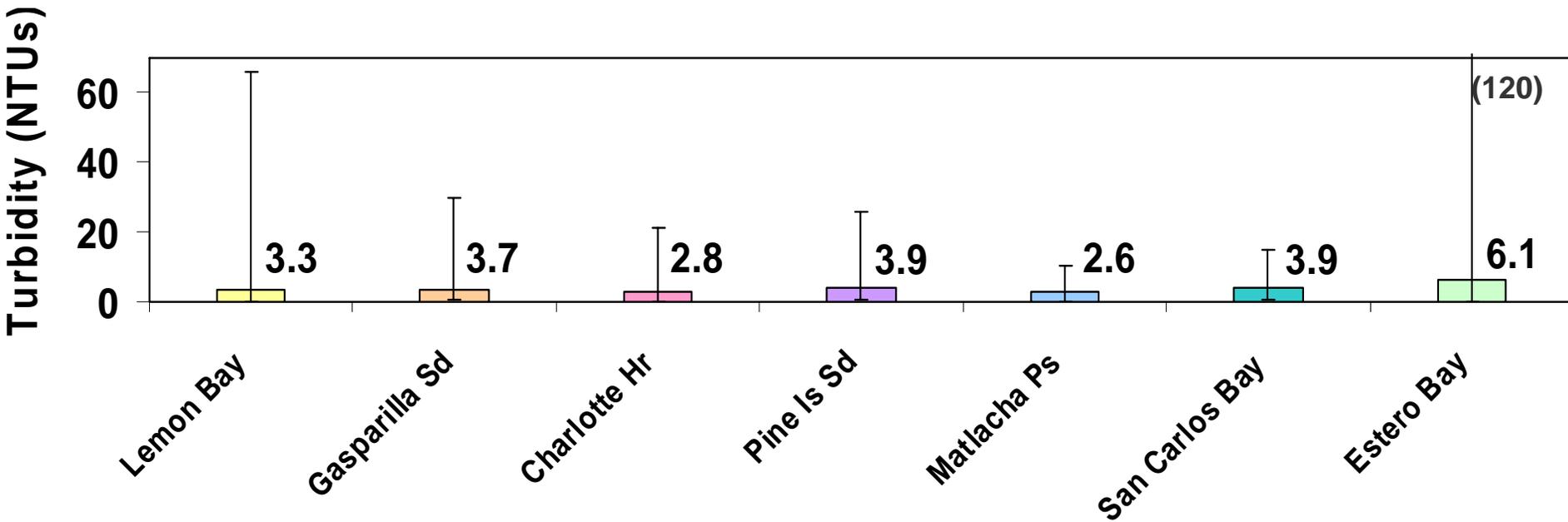
WATER COLOR AVERAGE FOR EACH ESTUARY (PCUs)



- 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:

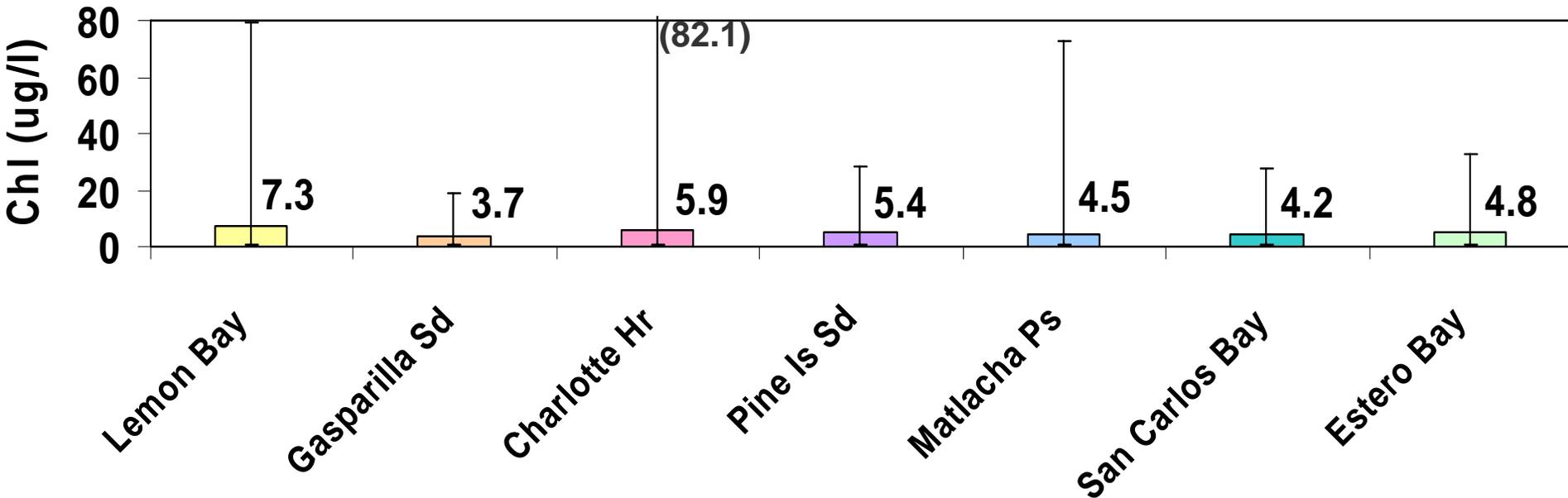
TURBIDITY AVERAGE FOR EACH ESTUARY (NTUs)



- 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:

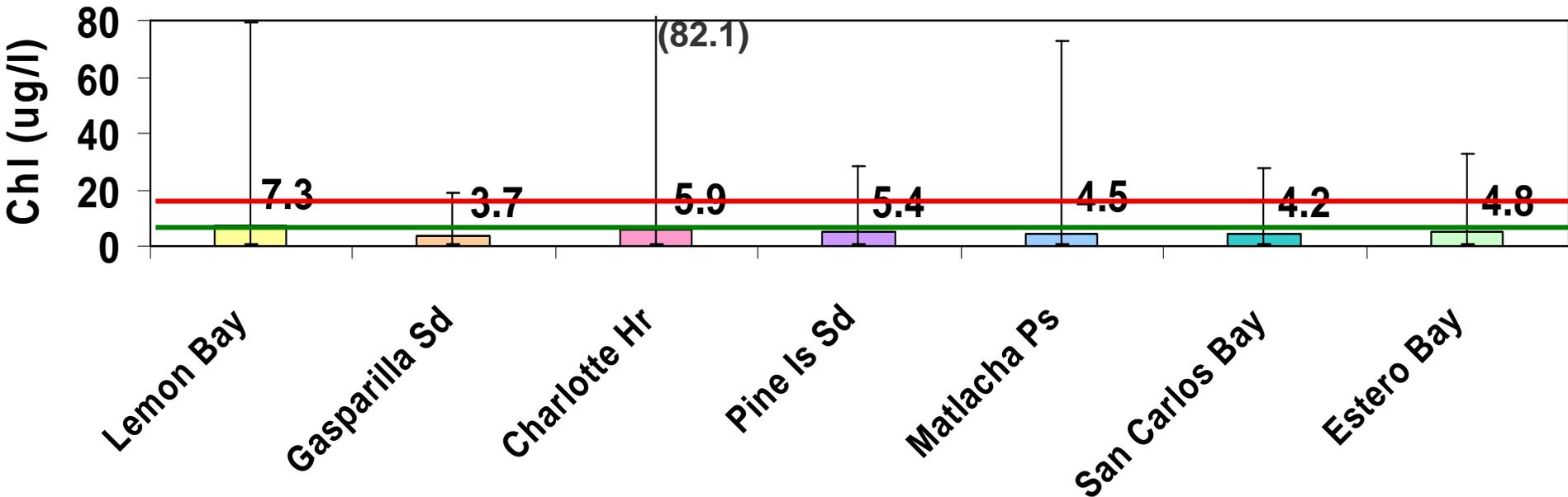
CHLOROPHYLL AVERAGE FOR EACH ESTUARY (ug/l)



- 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:

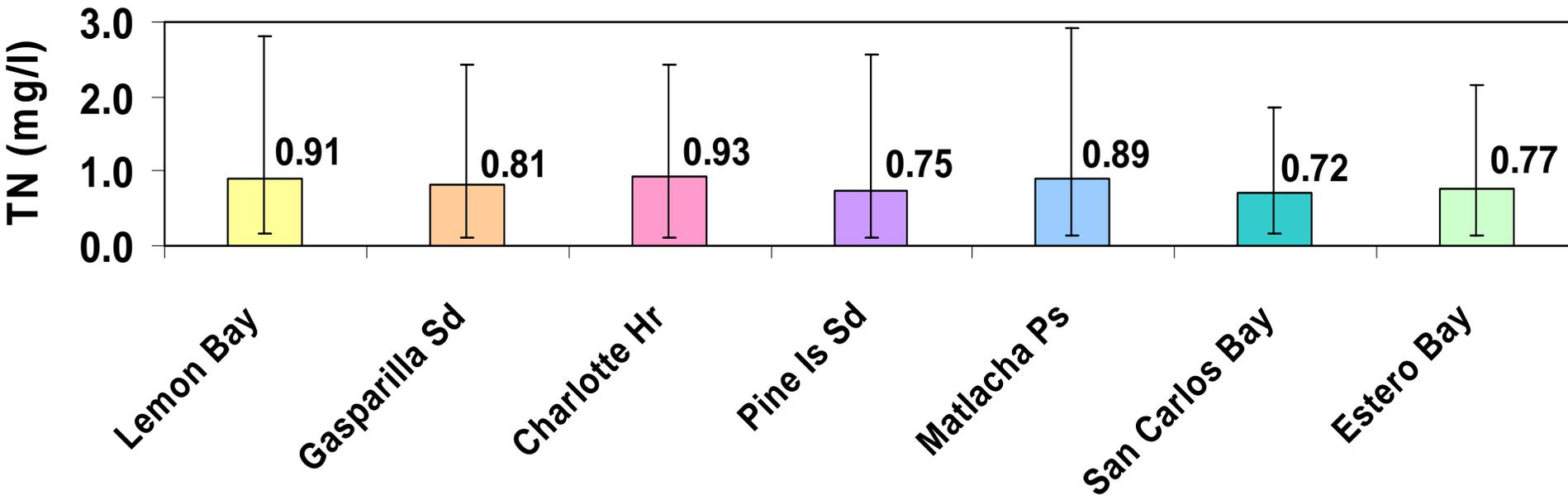
CHLOROPHYLL AVERAGE FOR EACH ESTUARY (ug/l)



- 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:

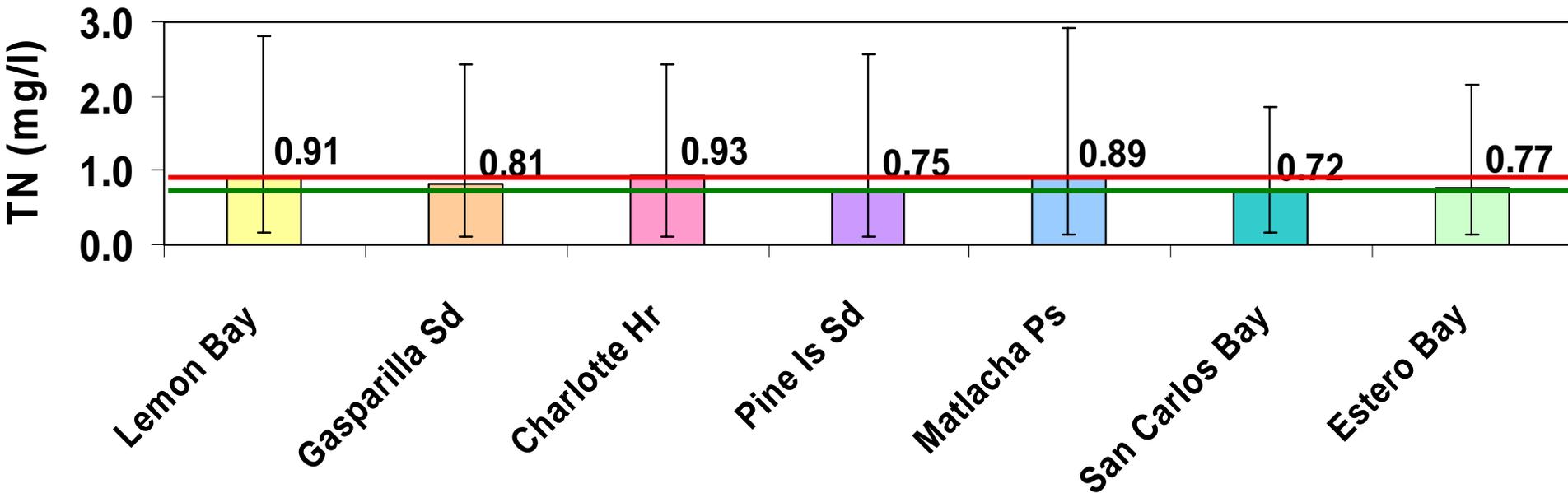
TOTAL NITROGEN AVERAGE FOR EACH ESTUARY (mg/l)



- 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:

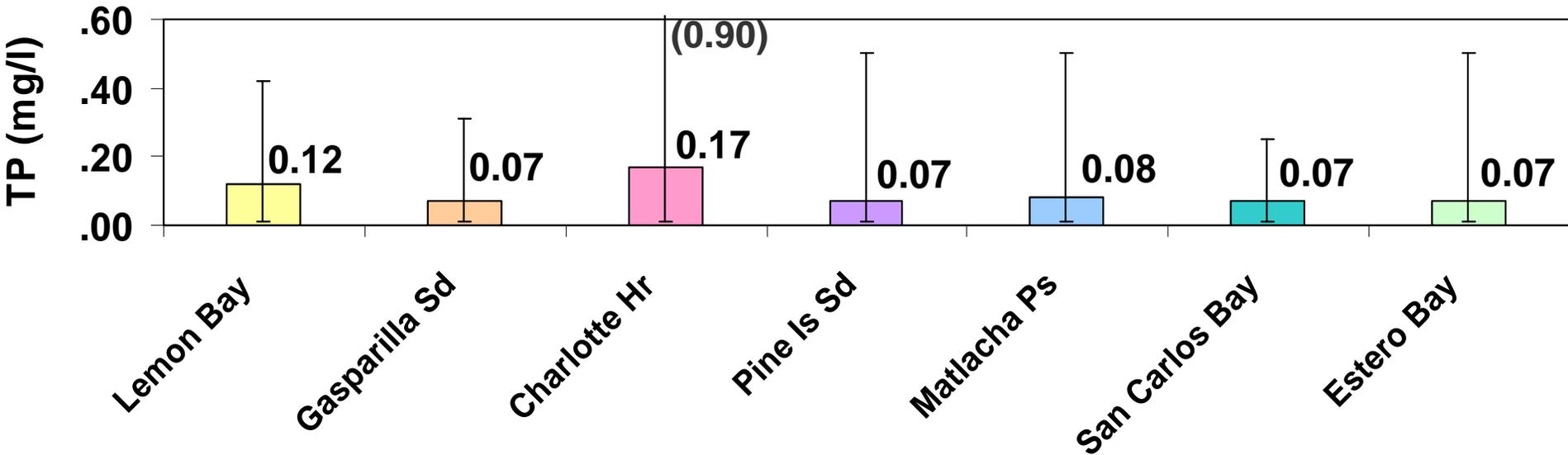
TOTAL NITROGEN AVERAGE FOR EACH ESTUARY (mg/l)



- 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:

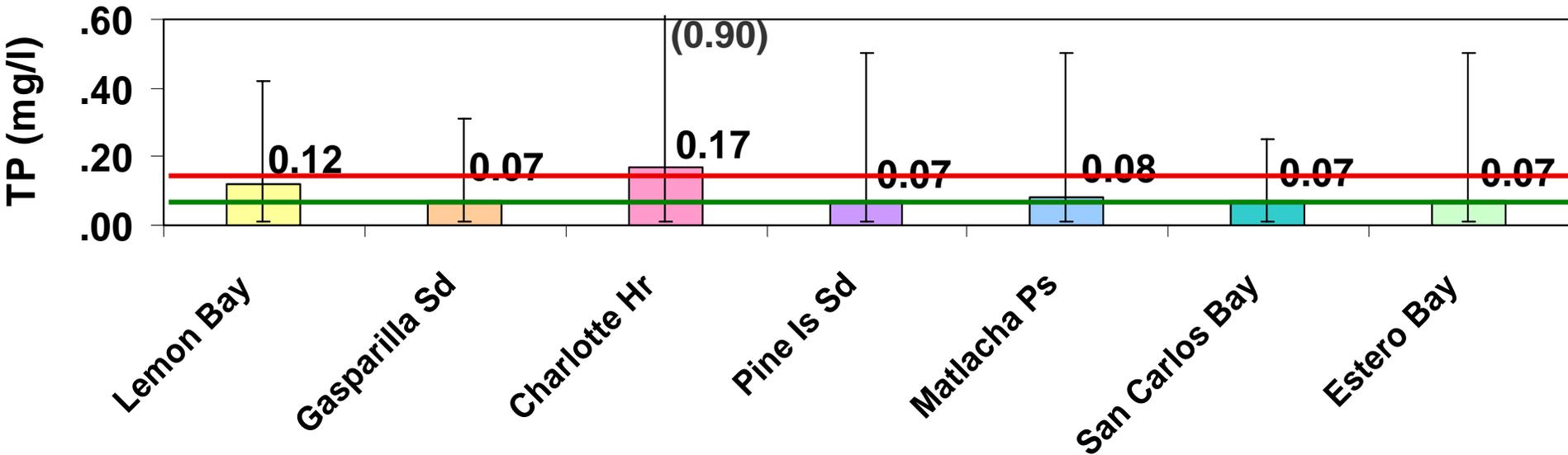
TOTAL PHOSPHORUS AVERAGE FOR EACH ESTUARY (mg/l)



- 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:

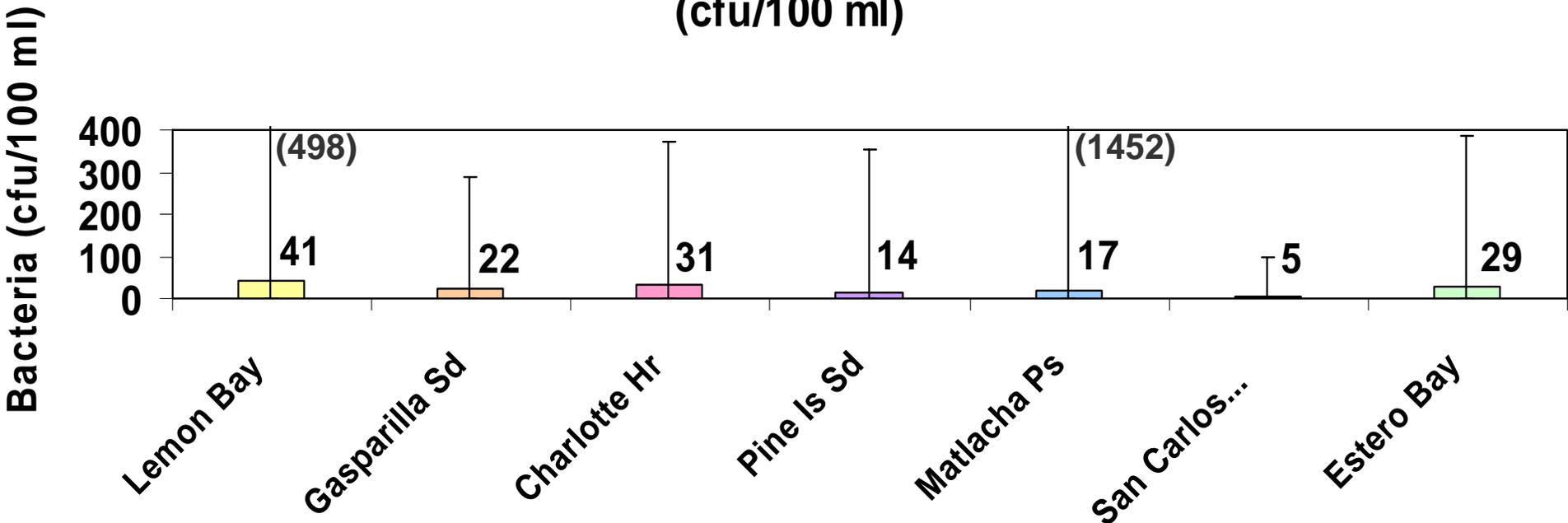
TOTAL PHOSPHORUS AVERAGE FOR EACH ESTUARY (mg/l)



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

Fecal Coliform Bacteria:

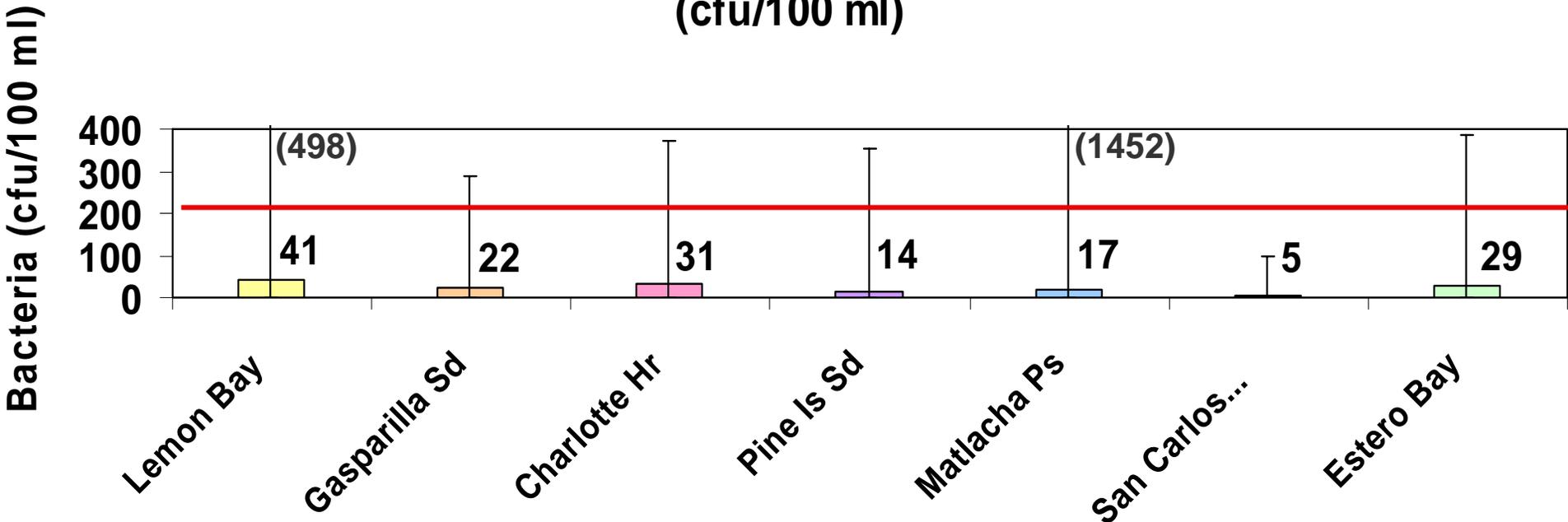
FECAL COLIFORM BACTERIA AVERAGE FOR EACH ESTUARY (cfu/100 ml)



- 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 1,600	Average
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 1,452	Above Ave
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

Continue Monitoring, Managing & Enjoying Our Special Estuaries Wisely.



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