

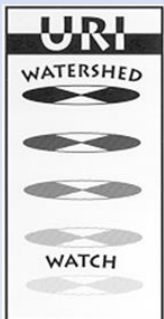
Narrow River and Its Watershed: Twenty-five Years in Review



Photo by John McNamara

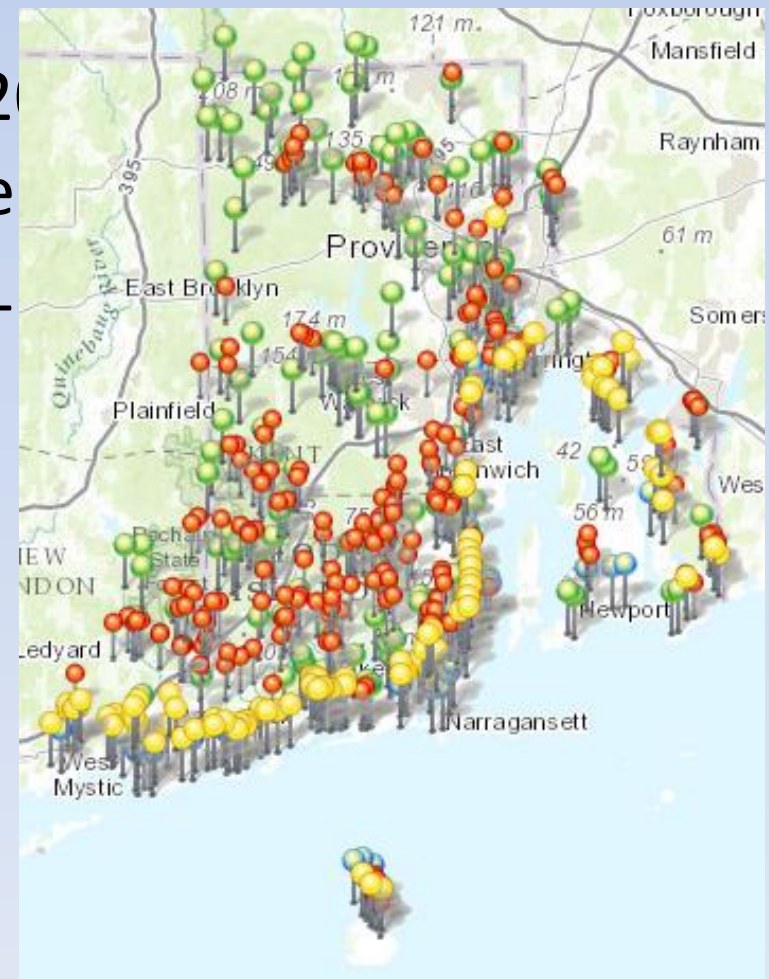
**Linda Green, URI Watershed Watch
On Pettaquamscutt, March 25, 2018**

Veronica M. Berounsky, Ph.D. & Annette DeSilva
Narrow River Preservation Association Annual Meeting
October 3, 2017



URI Watershed Watch (URIWW)

- 🔹 Begun in 1988 with 14 lakes
- 🔹 Now monitors +250 sites on +120 waterbodies with ~400 volunteers
- 🔹 Provides ~90% of RI's lake multi-year baseline data
- 🔹 Comprehensive program adaptable to local needs



URI Watershed Watch: Essential Ingredients

- science-based
- involve local organizations & the public
- educational, not regulatory
- provide good, useful information
- sufficient funding





Program Sponsors

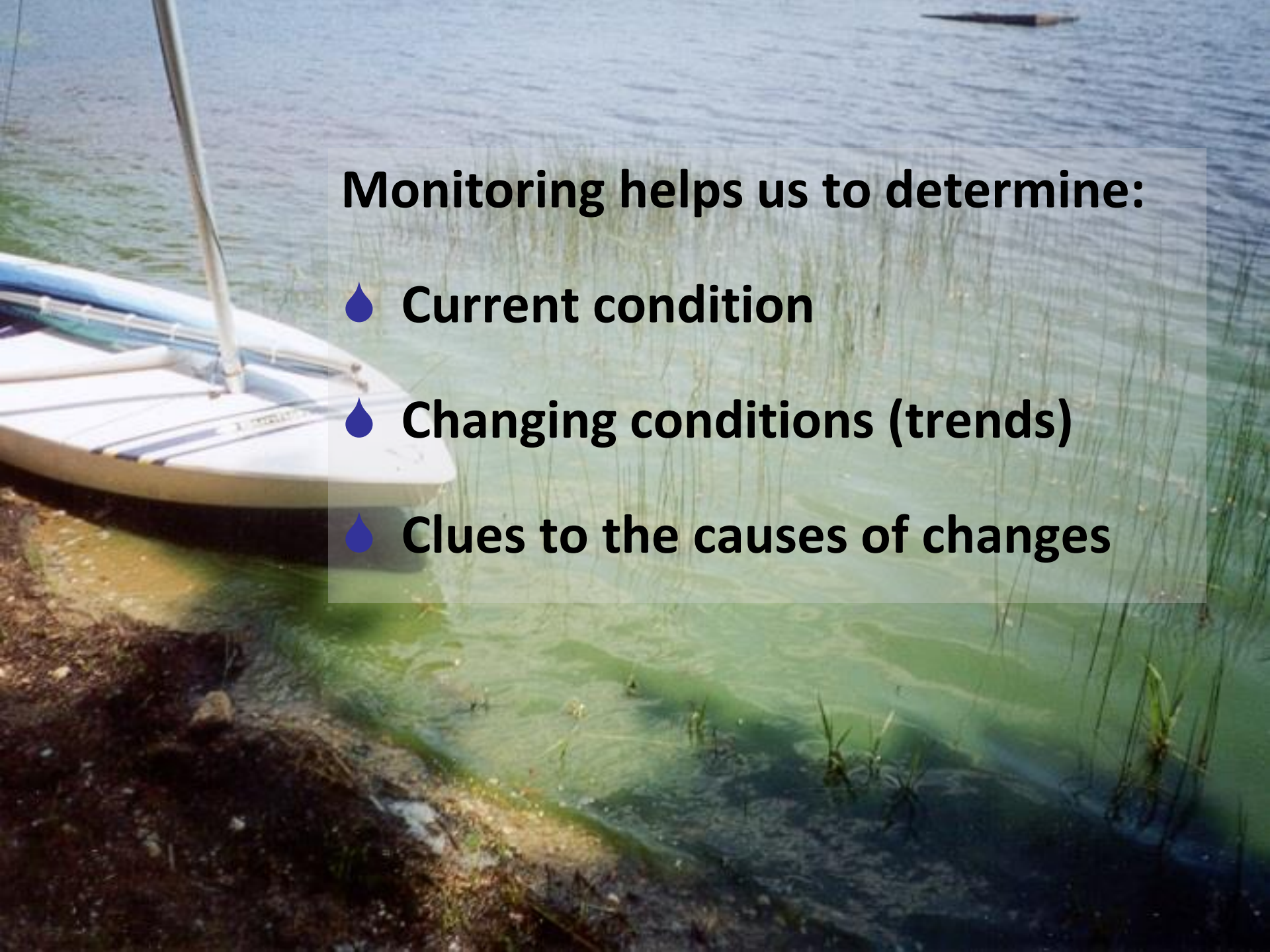


- Lake/watershed Associations
- Municipalities
- Narragansett Indian Tribe
- Environmental Organizations
- Sporting Organizations
- Fire Districts
- Businesses (QDC, RIAC, AAS)
- Hurley Endowment
- Sharpe Family Foundation



>90
since
1988

50+
currently

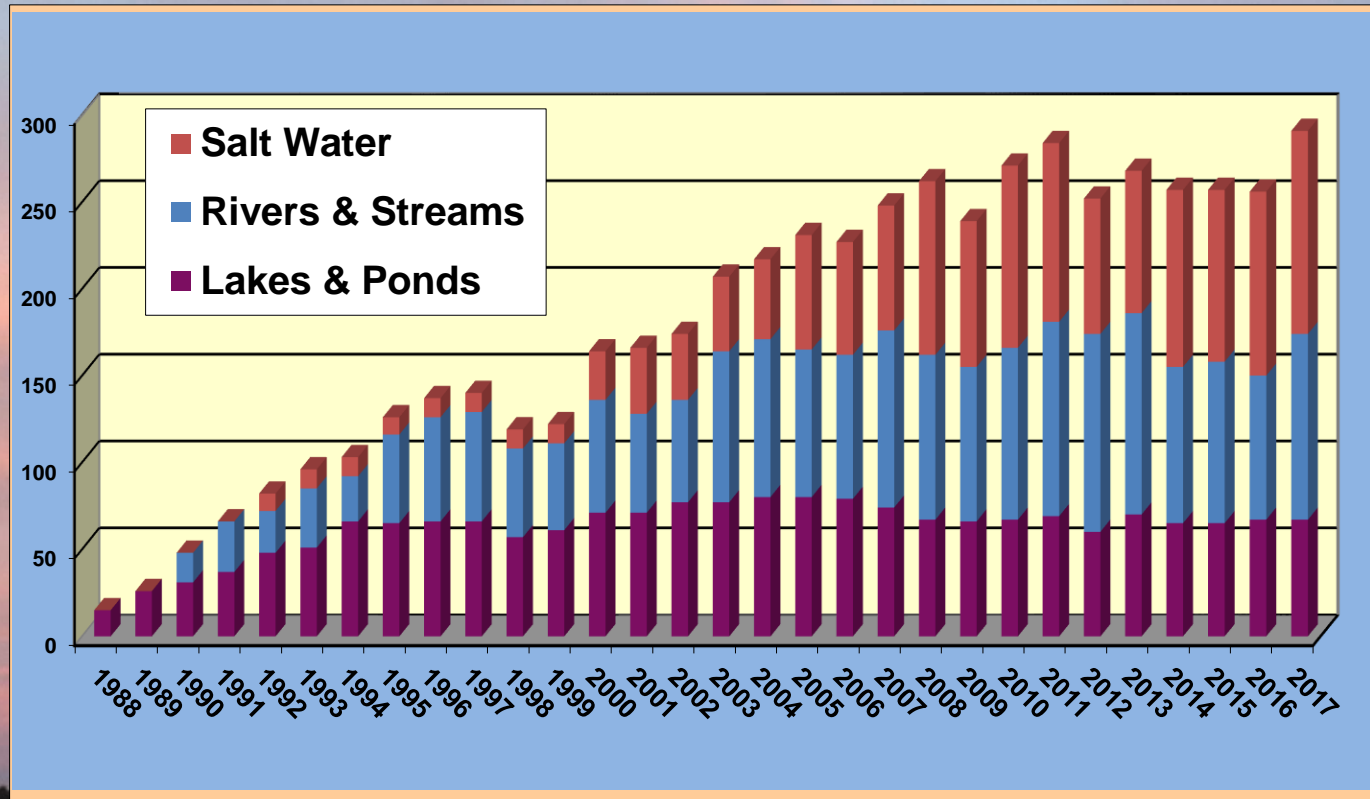


Monitoring helps us to determine:

- 💧 **Current condition**
- 💧 **Changing conditions (trends)**
- 💧 **Clues to the causes of changes**

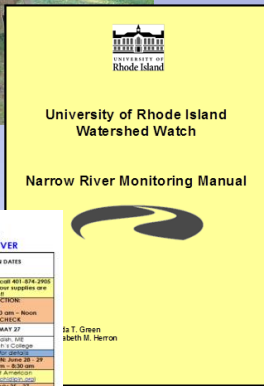
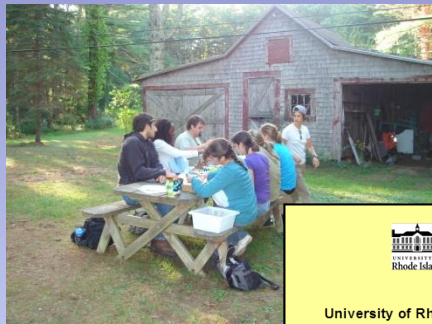
More than 650 sites have been monitored since 1988

178 lakes, 288 streams, 188 salt



2017: 67 lakes, 107 streams, 117 salt

Watershed Watch Provides Volunteers:



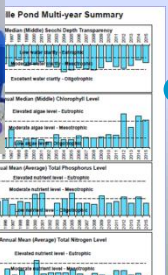
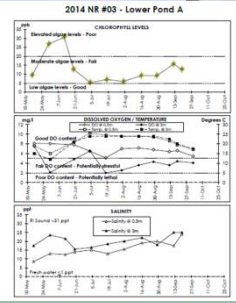
URI WATERSHED WATCH
2013 WATER QUALITY MONITORING SCHEDULE
RIVERS & STREAMS, Including NARROW RIVER

Week Ending	Activities	WATER COLLECTION DATES
May 4	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	Reference volunteers, please call 401-874-2903 in advance to ensure 'volunteers' are ready to assist on the day of collection.
May 18	X - plus water collection	NR Collect samples 8:00 am - Noon CHLOPHYLL a COLLECTION
June 1	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	MONITORING DAY 18 MAY '13
June 15	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	NR Collect samples 8:00 am - 7:00 pm
June 22	X - plus water collection	SECOND NARROW RIVER COLLECTION June 28 - 29
June 29	X - plus water collection	NR Collect samples 8:00 am - 7:00 pm
July 13	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	THIRD COLLECTION July 24 - 27
July 27	X - plus water collection	NR Collect samples 8:00 am - 7:00 pm
August 10	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	AUGUST 12 IS VICTORY DAY
August 24	X - plus water collection	FOURTH COLLECTION Aug. 23 - 24 NR Collect samples 8:00 am - 7:00 pm
September 7	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	SEPTEMBER 2 IS LABOR DAY
September 21	X - plus water collection	FIFTH COLLECTION September 27 - 28 NR Collect samples 11:00 am - 3 pm
September 28	X - plus water collection	SIXTH COLLECTION September 27 - 28
October 12	Temperature, DO, pH, Dissolved Oxygen, Turbidity, Chlorophyll a, Secchi depth, etc. (see manual for details)	OCTOBER 14 IS COLLABORATION DAY
October 24	X - Return all supplies	SEVENTH COLLECTION Oct. 24 - 26 NR Collect samples 11:00 am - 3:00 pm

to T. Green
Beth M. Herron

- Classroom & field training
- Monitoring manual
- Monitoring equipment and supplies
- Schedule
- Analytical Services (sample testing)
- Monitoring Results

Monitoring is scheduled for every other week, but you may monitor weekly if you choose to. Monitor between 8 AM and 7 PM, except on the water quality day. One time for when there is a storm or other event that would affect the water quality. If you are unable to monitor the water quality on the day of collection, please call the office in Kingston, RI. The URI Watershed Watch has professional analytical services available. Please notify us if there is a change in the availability of water samples to a different date or other than designated collection period. There is a great website!



Two Levels of Monitoring:

1) *Field monitoring*

Weekly – lakes & ponds - water clarity

Biweekly – rivers, salt ponds, harbors

- water temperature
- chlorophyll (algae)
- dissolved oxygen



LOCATION: Super Salt Site #1 MONITOR(S): Sea-Star family
 DATE MONITORED: 07/25/10 TIME: 0800
 (military) (military)
 SECCHI DEPTH (measure 4 times): _____ meters

DEPTH TO BOTTOM: 3 meters. Is Secchi visible on bottom? yes or no
 CHLOROPHYLL SAMPLES: FILTERED and FROZEN (yes or no)

Record actual sampling depth

DEPTH MONITORED (meters)	Surface	1 meter	2.5_m deep	2.5_m deep
WATER TEMPERATURE (deg. C)		28	28	25
DISSOLVED OXYGEN (mg/L) (Measure twice at each depth)	N/A	8.0	4.3/4.2	4.4/4.1
SALINITY (ppt)	N/A	31	31	31

(for better, see best description, see monitoring manual for details)
 LIGHT: 1= Diffuse (cloudy) 2= No shadows 3= Vary overcast
 WIND: 0= Calm 1= Light 2= Gentle 3= Moderate 4= Strong
 RAIN WIN 48 Hrs. 1= None 2= Light 3= Moderate 4= Heavy
 STATE OF TIDE: EBB ___ FLOOD ___ HIGH X LOW ___ N/A ___



Two Levels of Monitoring

2) Water Collections

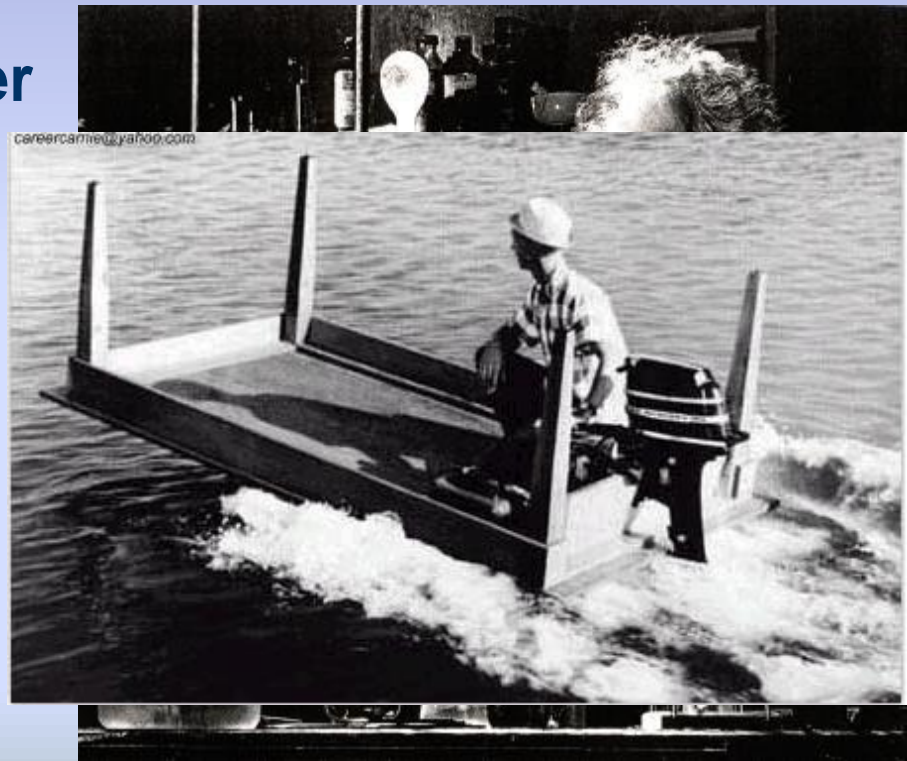
Monthly- rivers, salty sites

May, July, Sept., Oct – lakes and ponds

You collect a set of water samples & bring them to WW lab

We analyze for

- **Acidity level**
- **Nutrients**
- **Bacteria**
- **Chlorophyll**



2018 Training

- Classroom: Thursday April 5, 6-9 pm
- Classroom: Sunday April 8, 1-4 pm

Weaver Auditorium, URI

- Field: Saturday April 14, am & pm
- Field: Saturday April 28, am & pm

Yawgoo Pond, West Kingston

www.uri.edu/watershedwatch/ to register

NRPA matches volunteers to sites





Gilbert Stuart Stream

Photo by Richard Benjamin 2007



NRPA's River Watch – Background Information




Watershed Watch & River Watch Goals:

- 1991 - The Narrow River Stormwater Management Project - As part of this project, funds were allocated for citizen water quality monitoring.
 - 1992 - “River Watch” officially begins with 10 monitoring locations and is part of the URI Watershed Watch Program
 - 2016 – Completed 25 years of volunteer monitoring of the Narrow River! – 14 sites
- To promote active citizen **participation** in water quality protection.
 - To **educate the public** about water quality issues.
 - To obtain **multi-year surface water quality information** in order to ascertain current conditions and to detect trends.
 - To encourage **sound management programs** based upon water quality information.



Where's my Watershed?

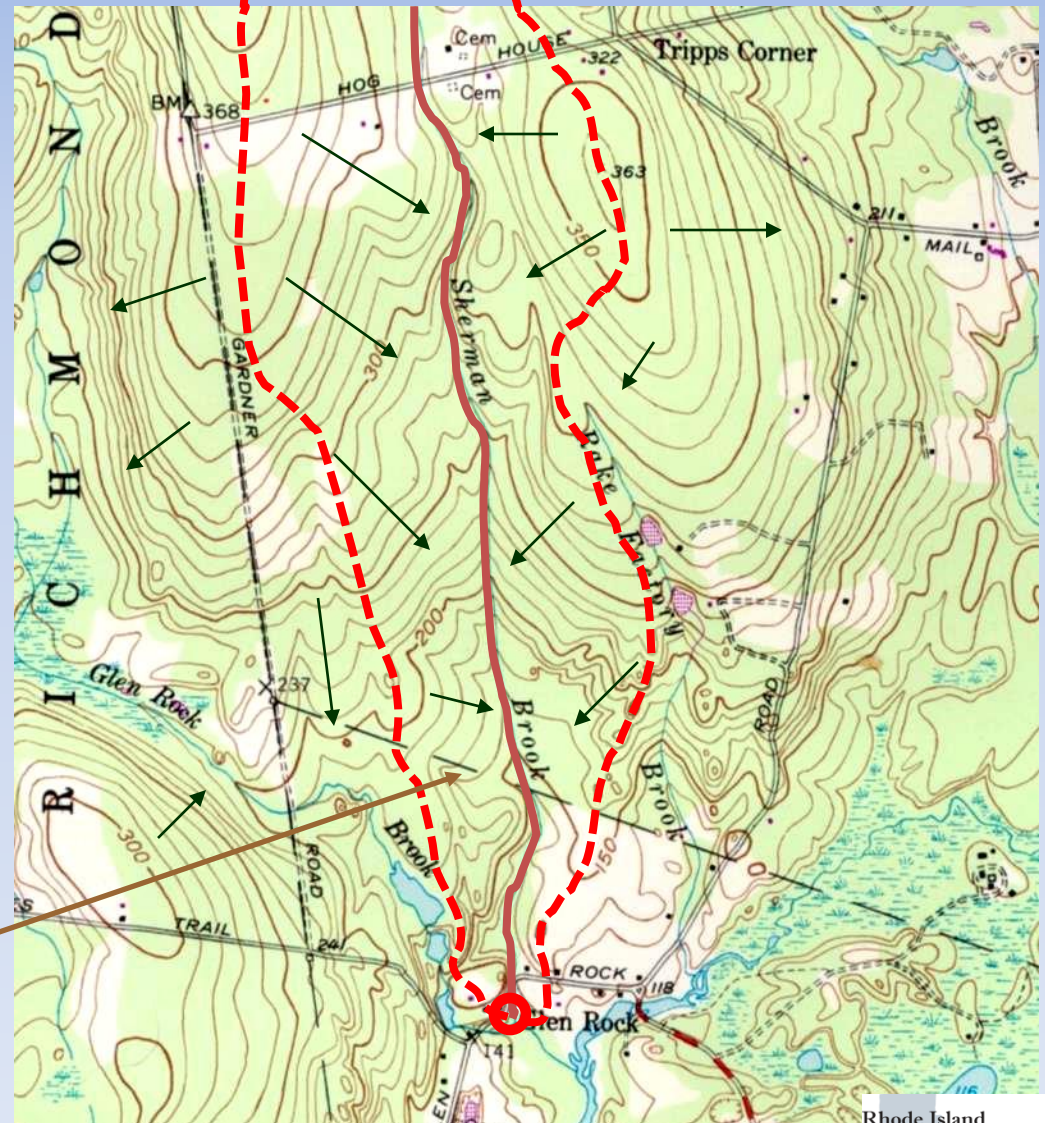
A watershed is the land area draining to a common outlet, marked here with 

Watershed boundaries follow the highest points of land from the outlet.

All rainwater falling within the watershed boundary flows towards the outlet.

All land is in one watershed or another.

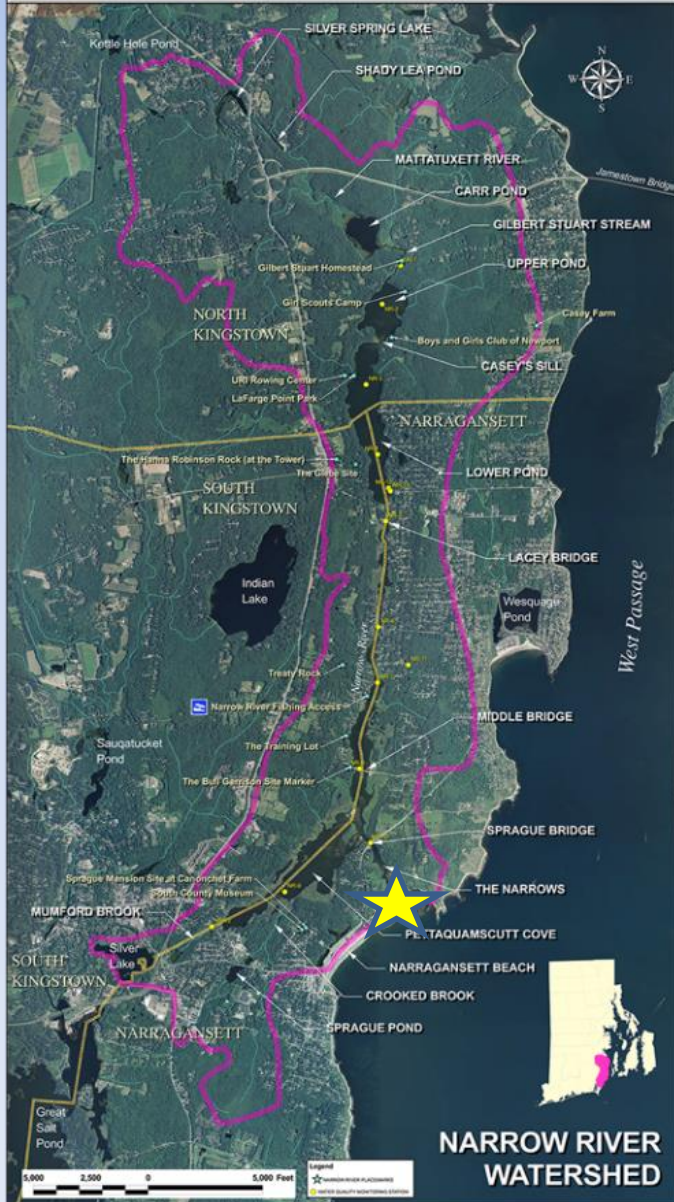
Watersheds don't follow town boundaries.



NARROW RIVER PRESERVATION ASSOCIATION

Working since 1970 to preserve, protect, and restore
the Narrow River and its watershed.

www.narrowriver.org



NARROW RIVER
WATERSHED

Monitoring Locations

(started in 1992 unless other year given):

- NR1 - Gilbert Stuart Stream
- NR2 - Upper Pond
- NR3 - Lower Pond A
- NR4 - Lower Pond B
- NR5 - Lacey Bridge
- NR6 - Mettatumet Beach
- NR7 - End of the Narrows
- NR8 - Middlebridge
- NR9 - Pettaquamscutt Cove
- NR10 - Sprague Bridge
- NR11 - Mettatumet Brook (1996)
- NR12 - Mumford Brook (2000)
- NR13 - Lakeside Dock (2004)
- NR14 - Lakeside Outfall (2004)

**Narrow River is 7 miles long and its watershed
is located in North Kingstown, South Kingstown
& Narragansett**



What is monitored?

- Monitoring Season: May – Oct
- Temperature
- Salinity
- Dissolved Oxygen
- Chlorophyll
- Bacteria
- Nutrients
- pH



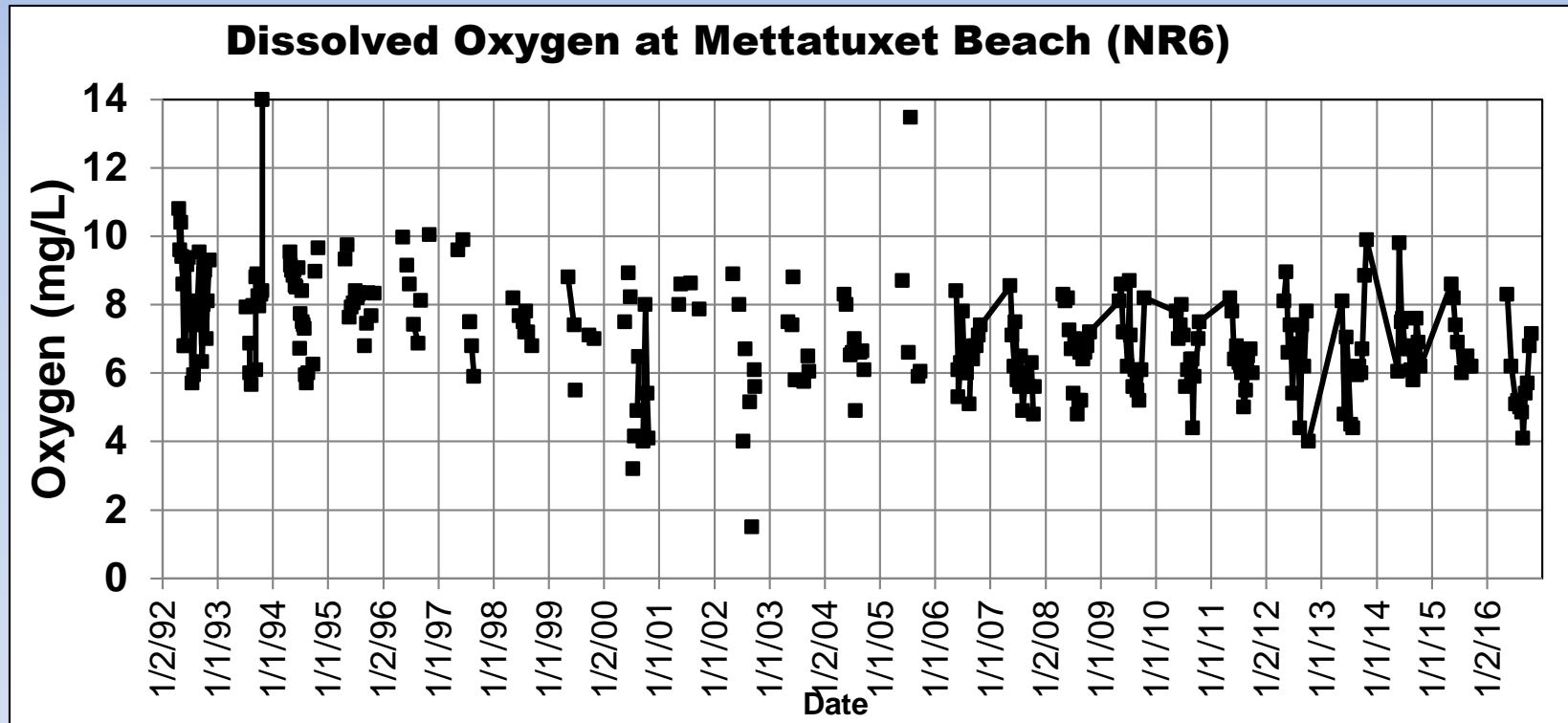
Photo by NRPA

Over Twenty Five years:

- **325** monitoring days
- Total Field Measurements = ~ **42,250**
- Total Lab Analyses = ~ **12,250**



How do we present 25 years of data?



The example above plots all of the oxygen data for one site for 25 years.

Averages!

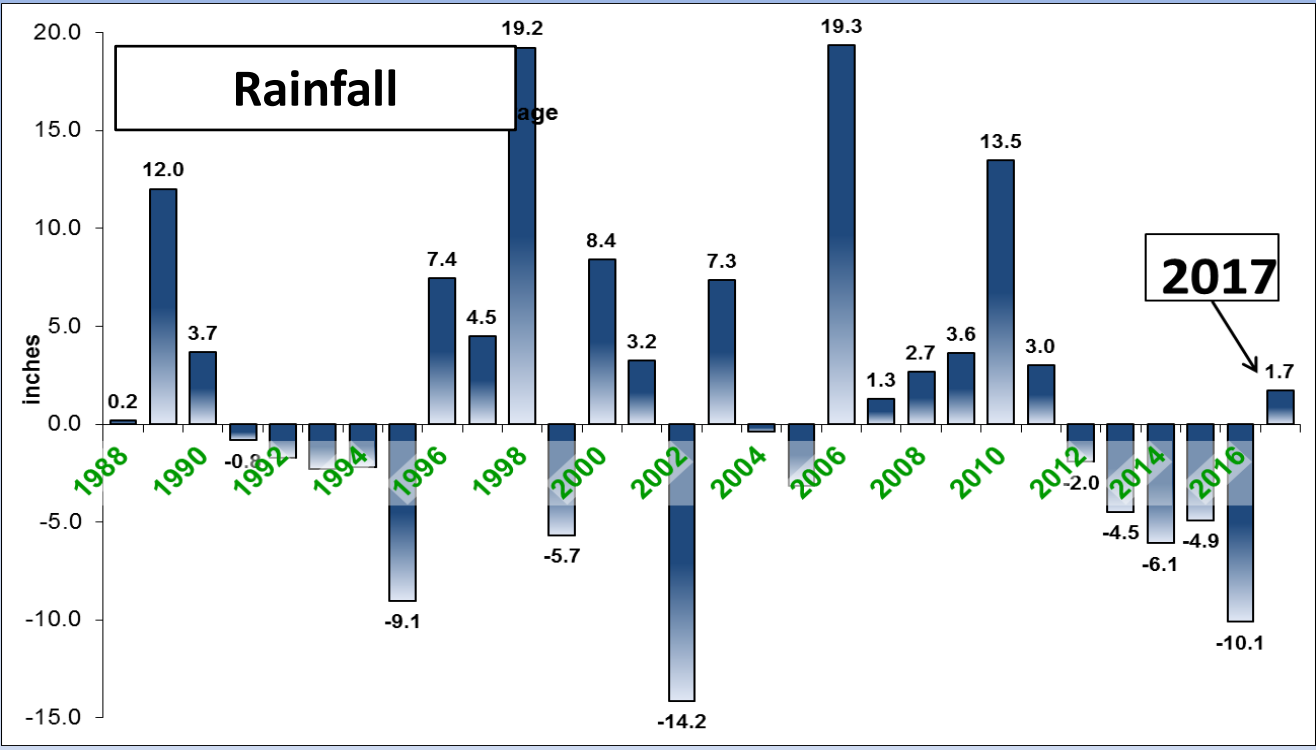


We'll look at 25 years of

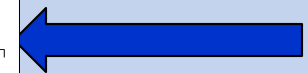
- Weather
- Bacteria
- Nutrients
- Algae
- Dissolved Oxygen



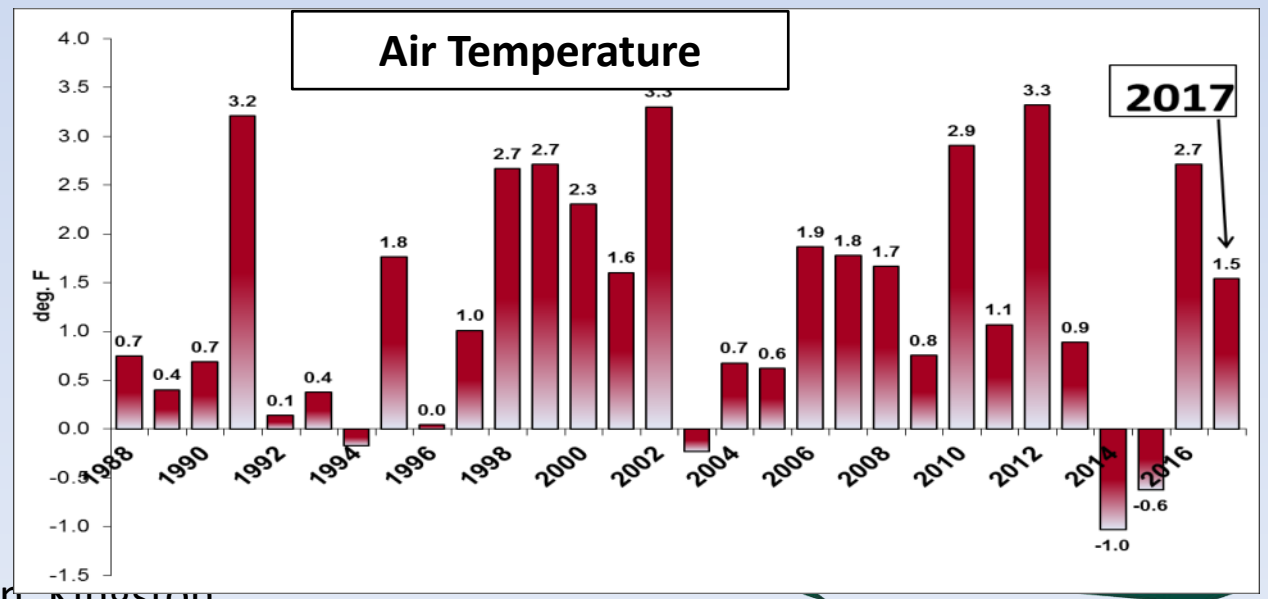
Weather



Normal = 53"



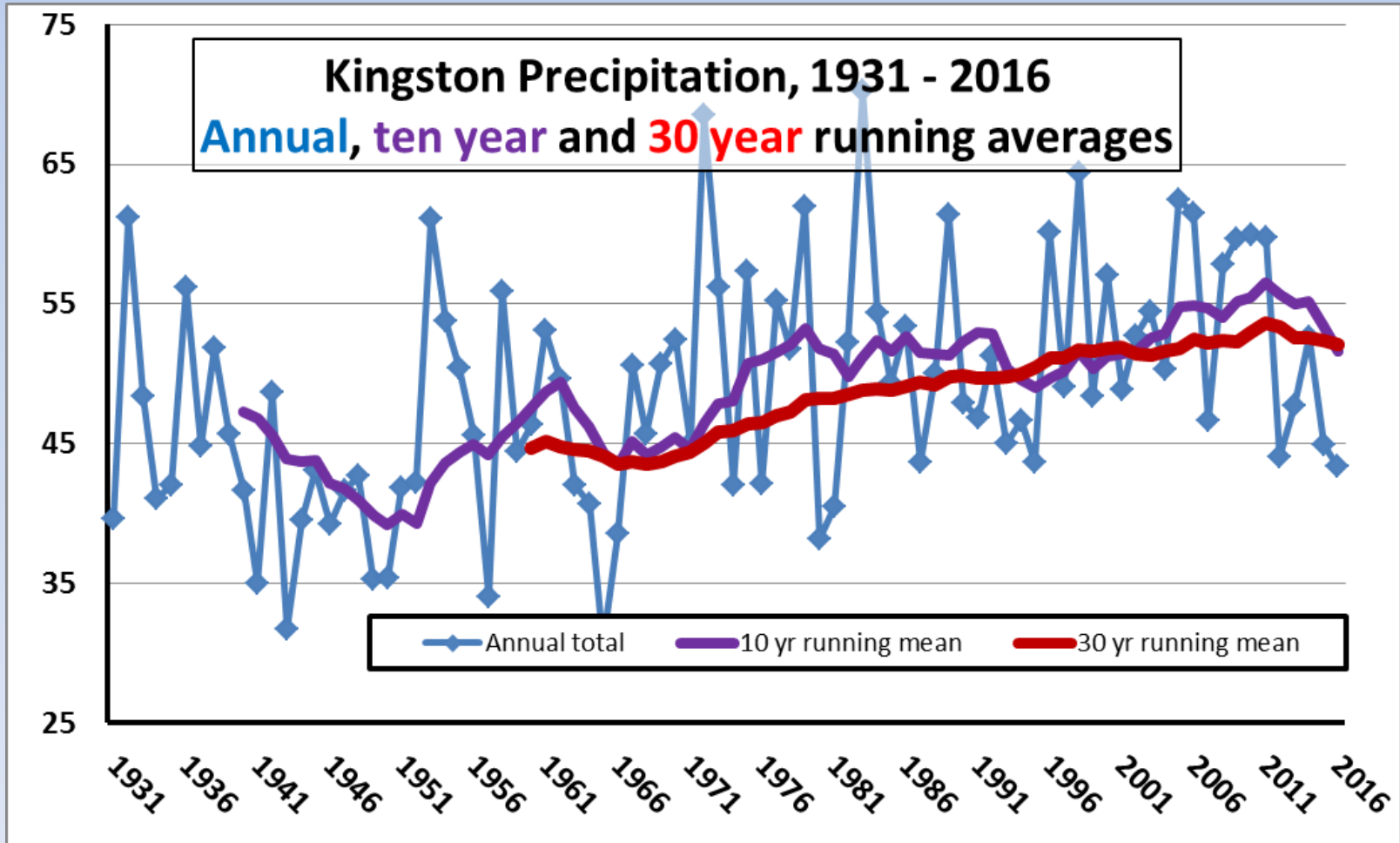
Normal = 51 deg F.



80 Years of Precipitation Data

10+ inches increased precipitation

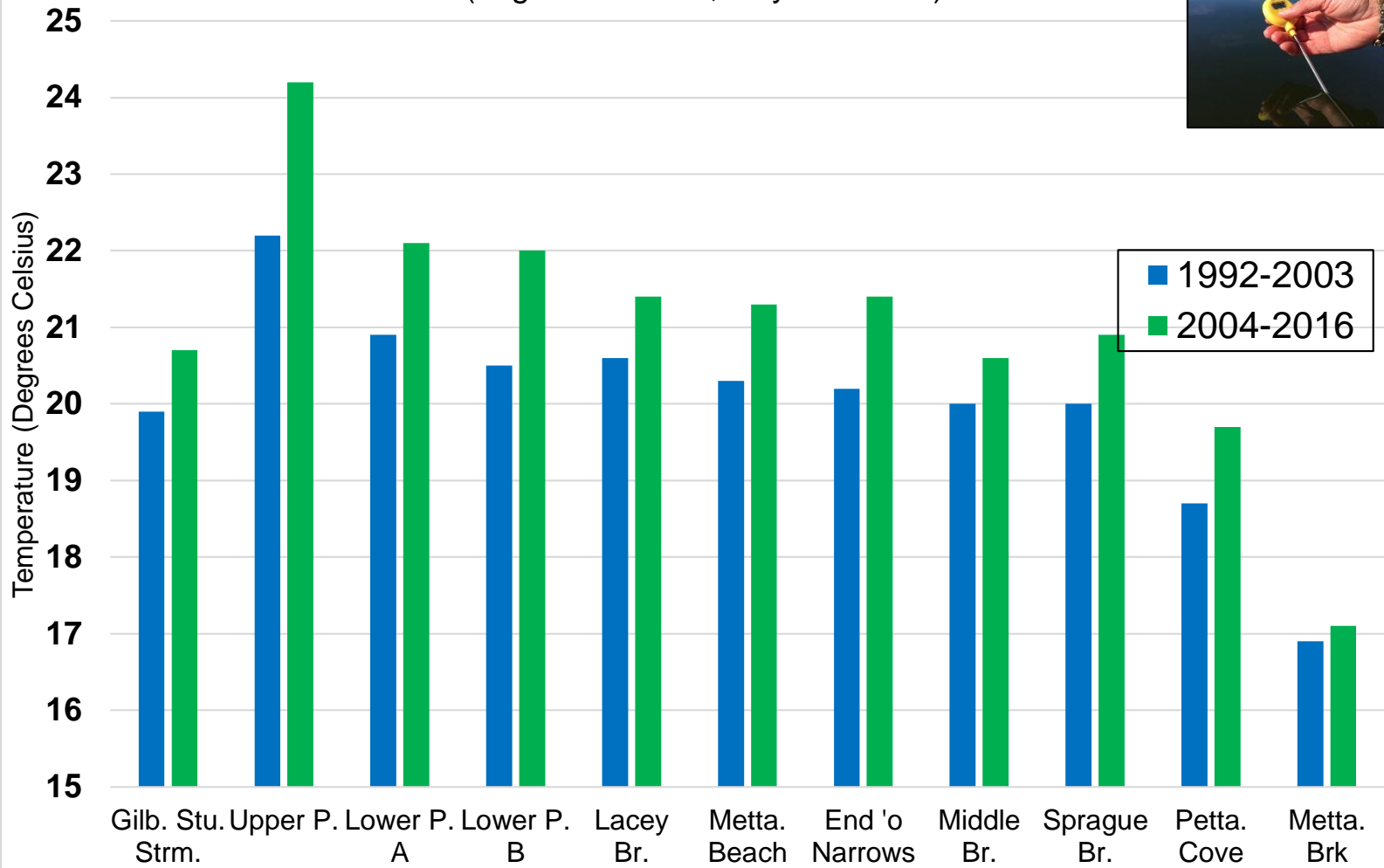
(30 year running mean)



Source: URI Weather Station, Kingston

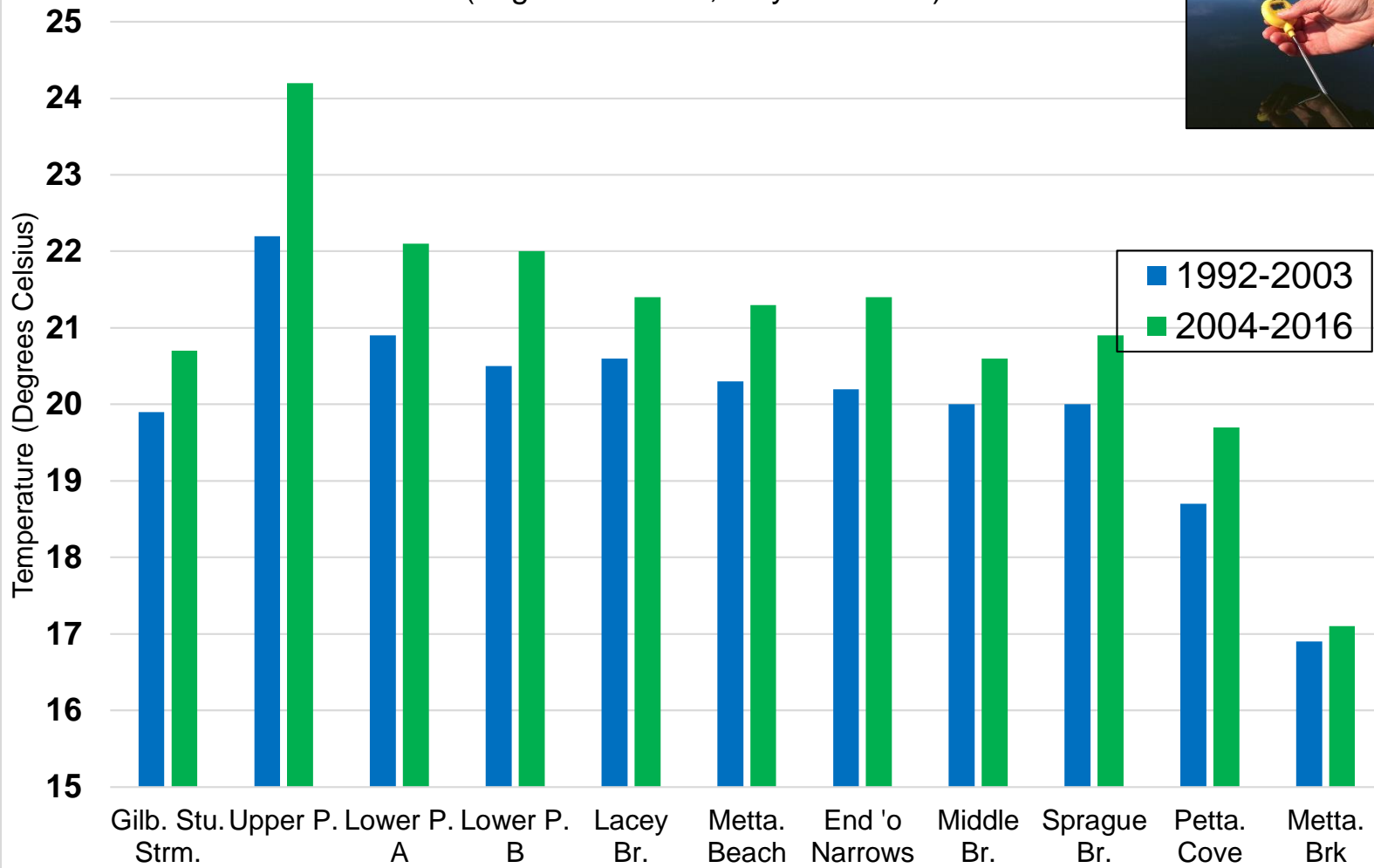
Average Temperature

(degrees Celsius, May - October)



Average Temperature

(degrees Celsius, May - October)



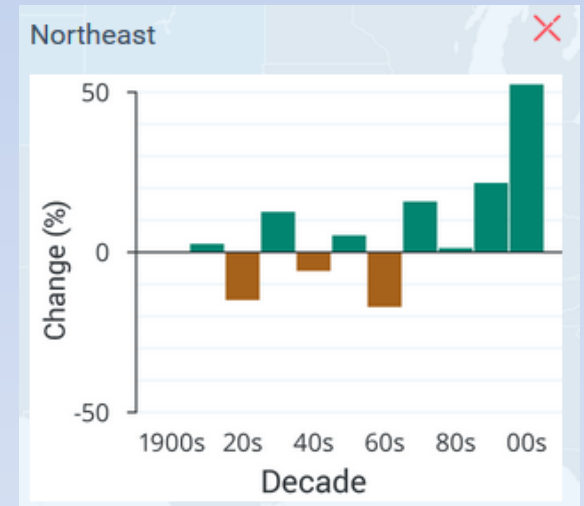
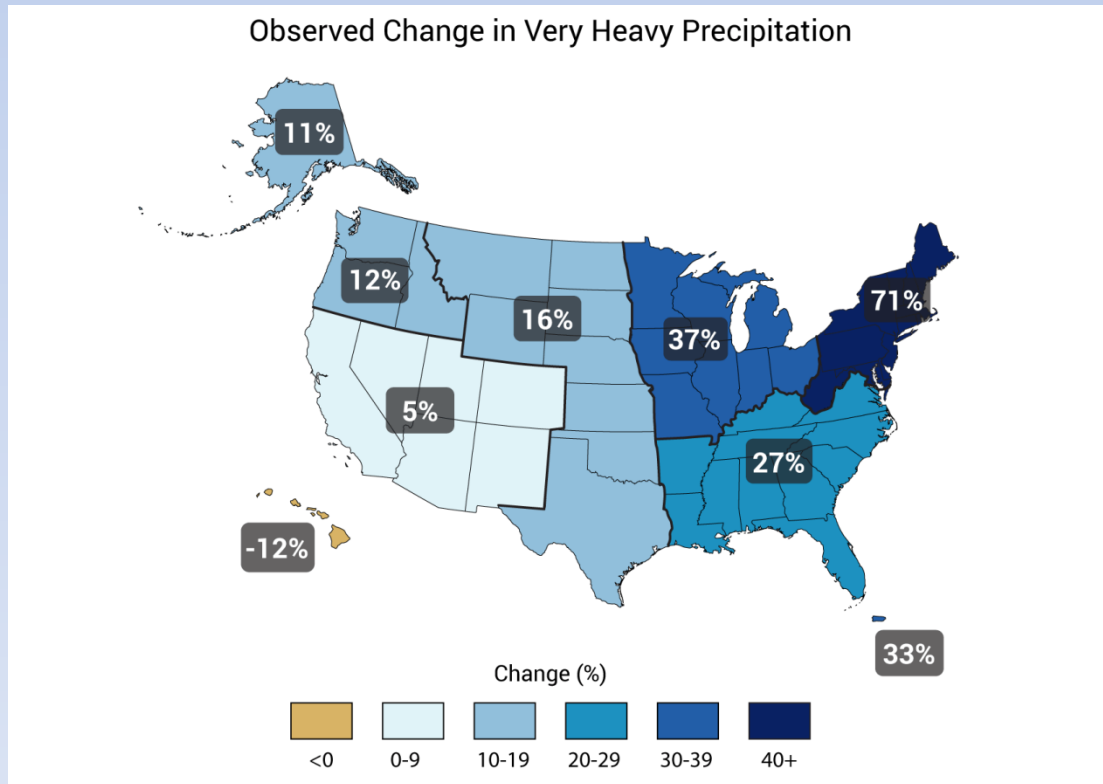
77 deg. F

68 deg. F

59 deg. F



Heavy Storms are Increasing



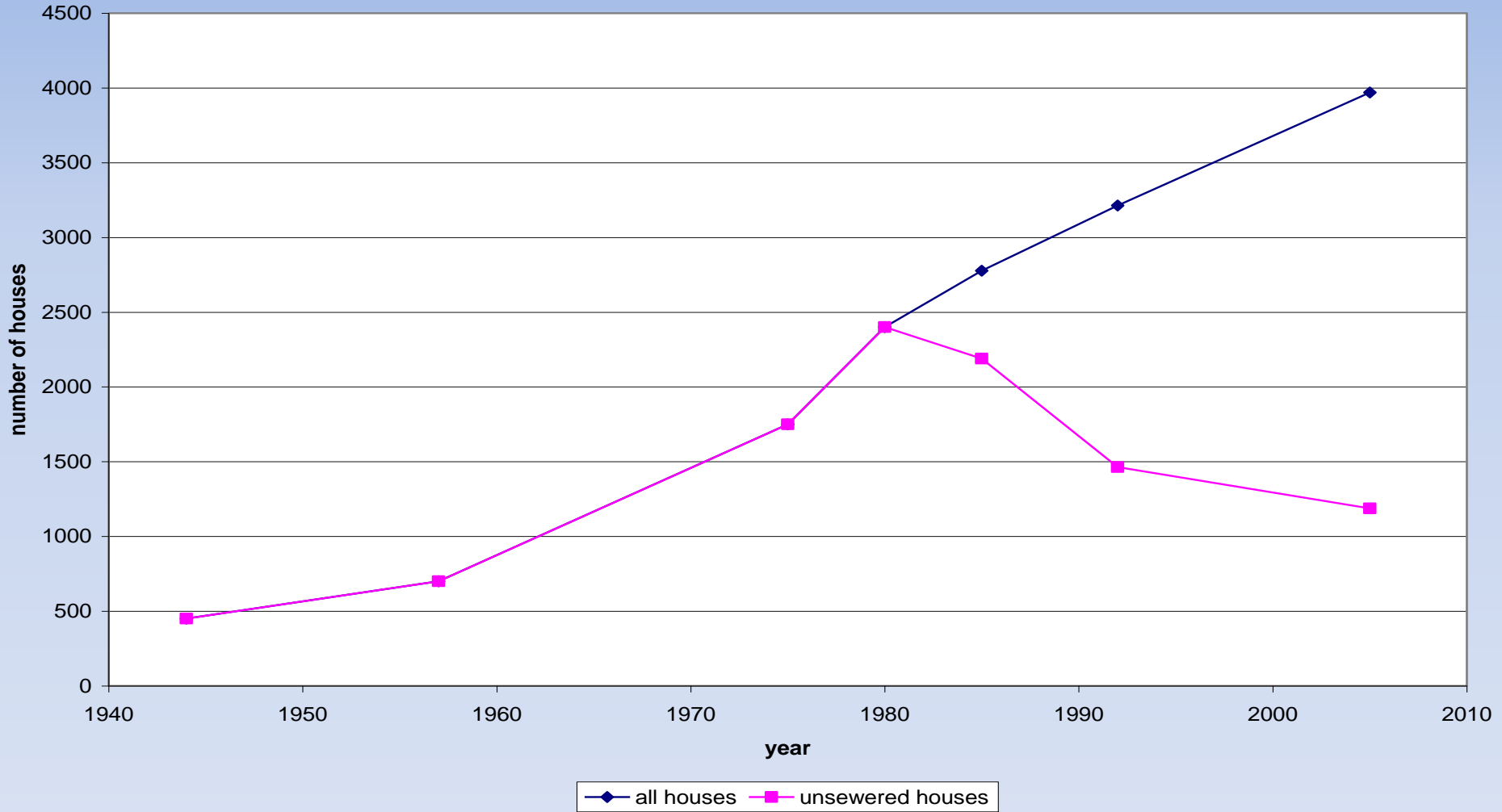
Source: 2014 National Climate Assessment report
www.globalchange.gov

Hard surfaces do not soak up rain

The #1 water quality
problem in the U.S.

2010 NR
watershed is
7-14%
impervious

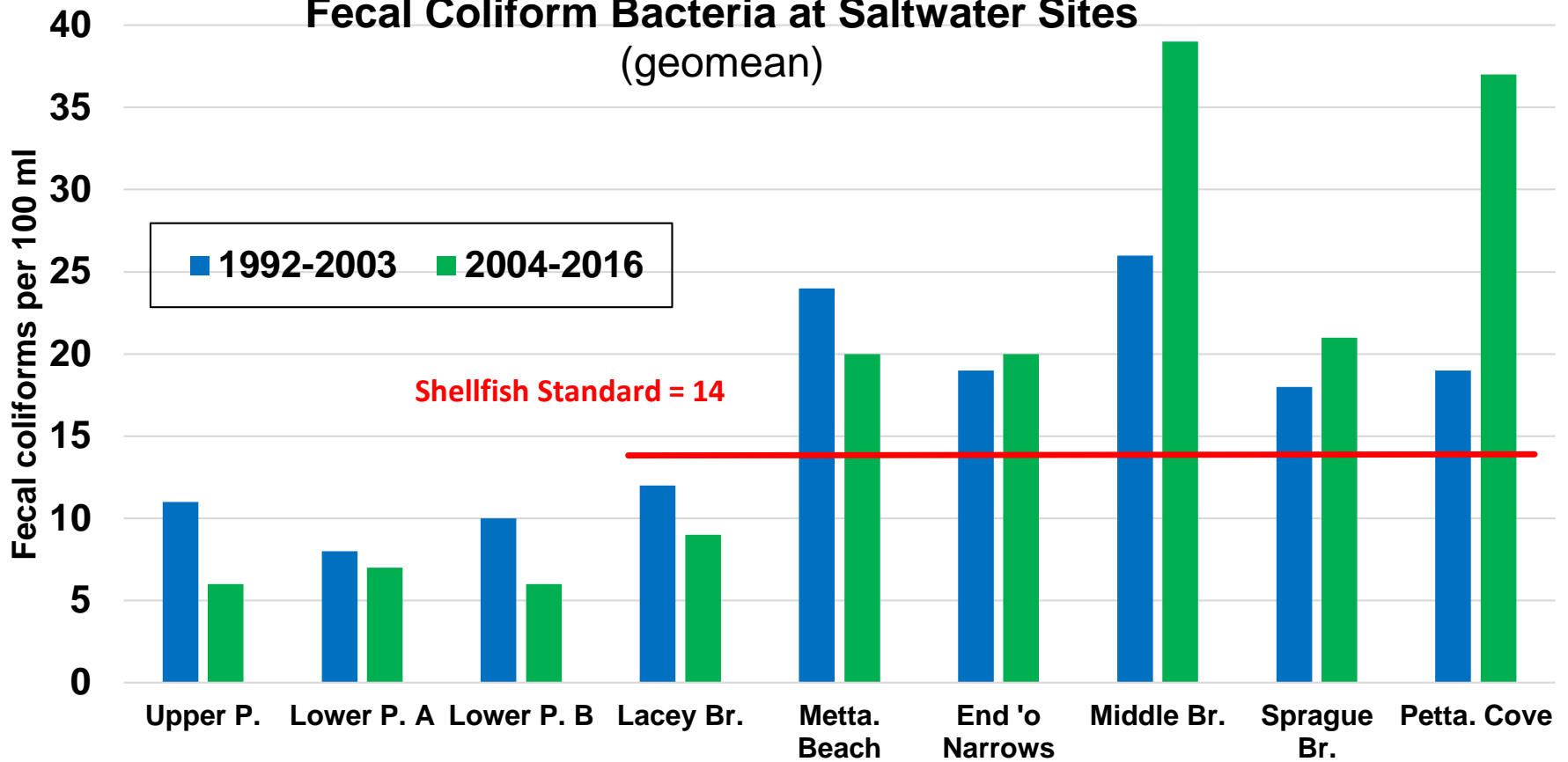
Houses in the Narrow River Watershed



Numbers of houses (both as total and as those not connected to a sewer system) in the Narrow River watershed for 1944, 1957, 1975, 1985, 1992, and 2005.



Fecal Coliform Bacteria at Saltwater Sites (geomean)



	Gilb. Stu.	Lakeside	Metta Bk.	Mumfrd Bk.
1997-2006	50	290	500	4970
2007-2016	15	70	60	950

**Bacteria:
Shellfishing**



Shellfishing Ban due to high bacteria levels



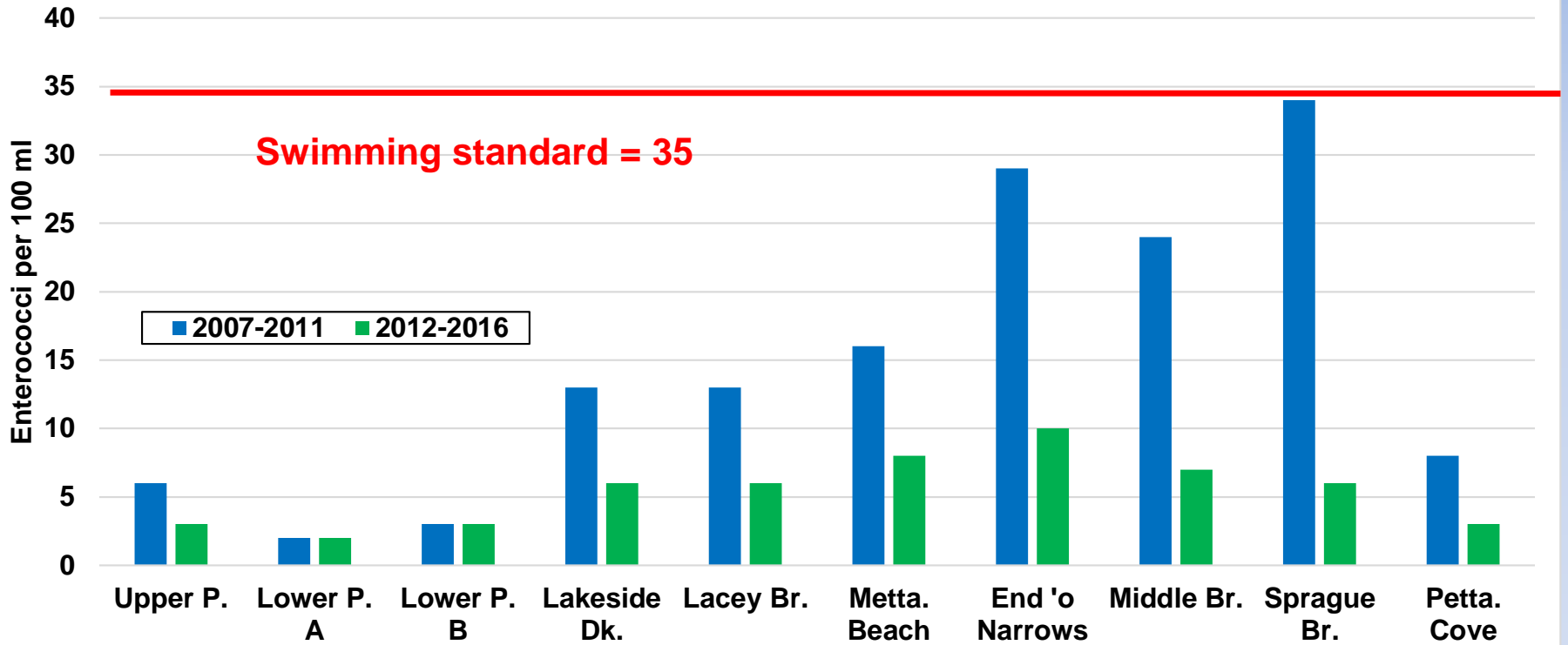
Old Edgewater outfall pipe

- “Since 1959, the Narrow River has failed to meet state standards for total coliform bacteria levels”
- “In 1979, parts of the Narrow River were closed to shellfishing”
- “Beginning in 1994, the entire expanse of the Narrow River was closed to shellfishing and remains closed today due to high coliform bacteria levels.”

*from The Narrow River Special Area
Management Plan, CRMC, April 1999*



Enterococci Bacteria Saltwater Sites (geomean)



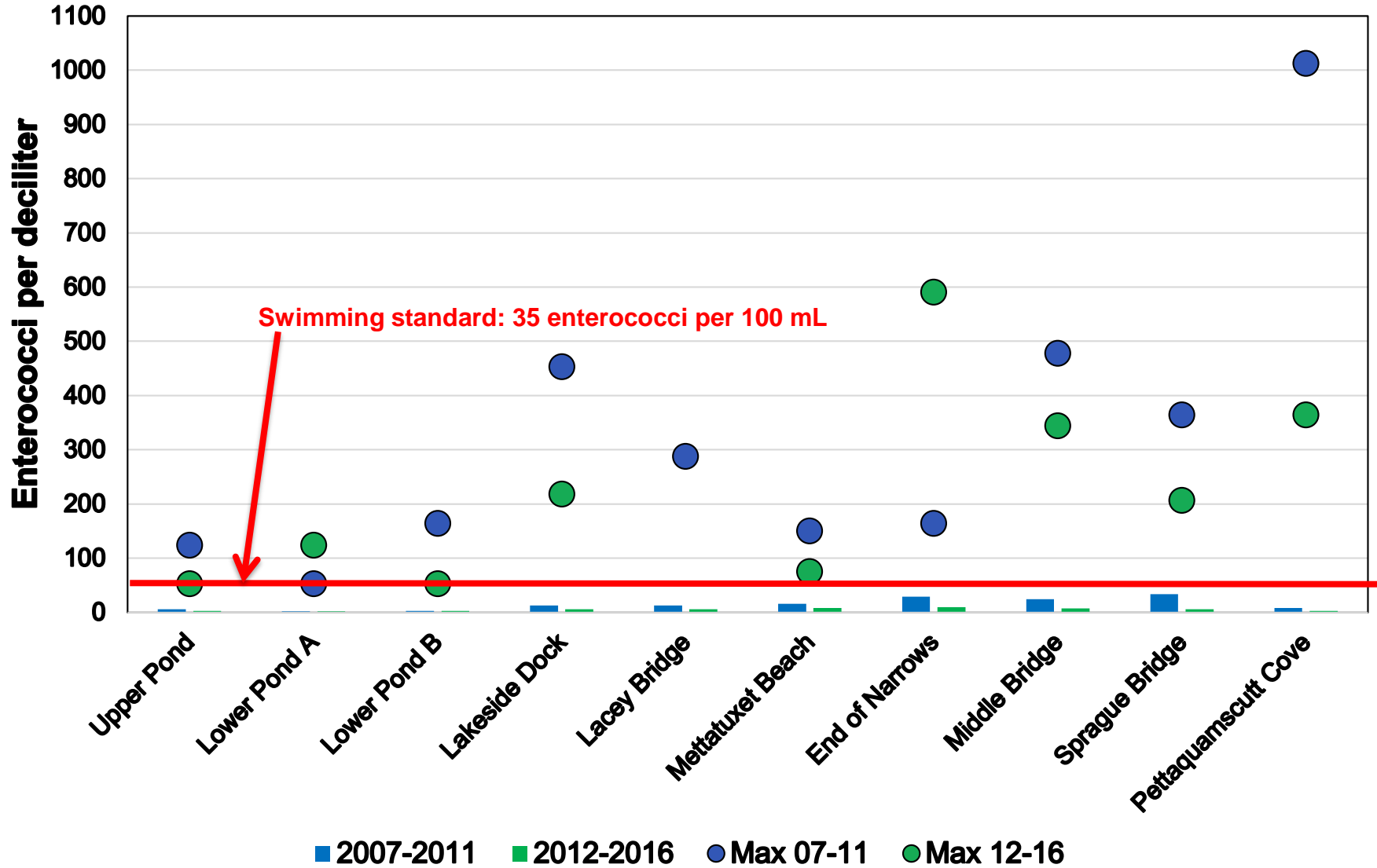
	Gilb. Stu.	Lakeside	Metta Bk.	Mumfrd Bk.
1997-2006	25	335	600	2715
2007-2016	10	110	260	1905

Bacteria:
Swimming

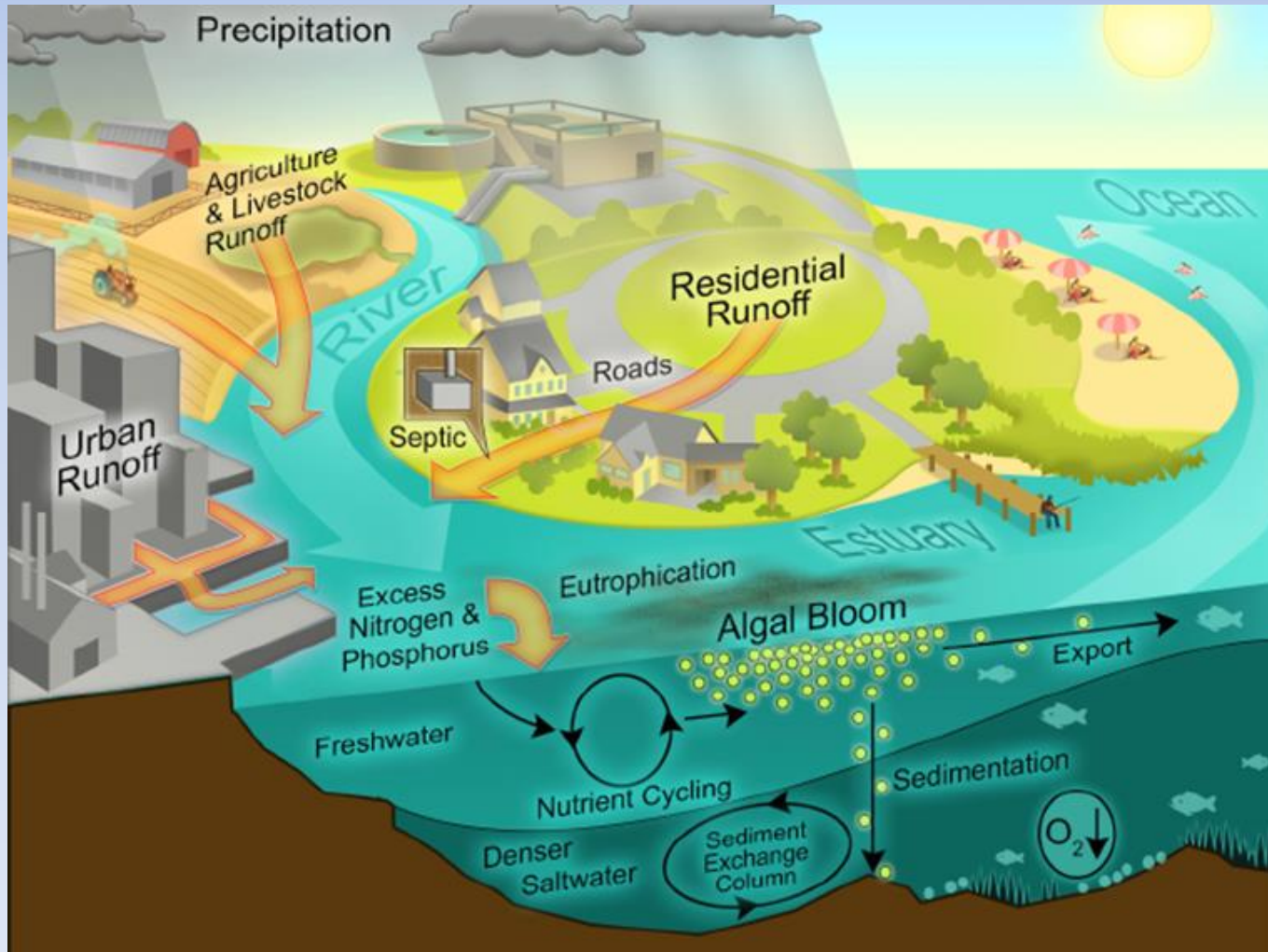




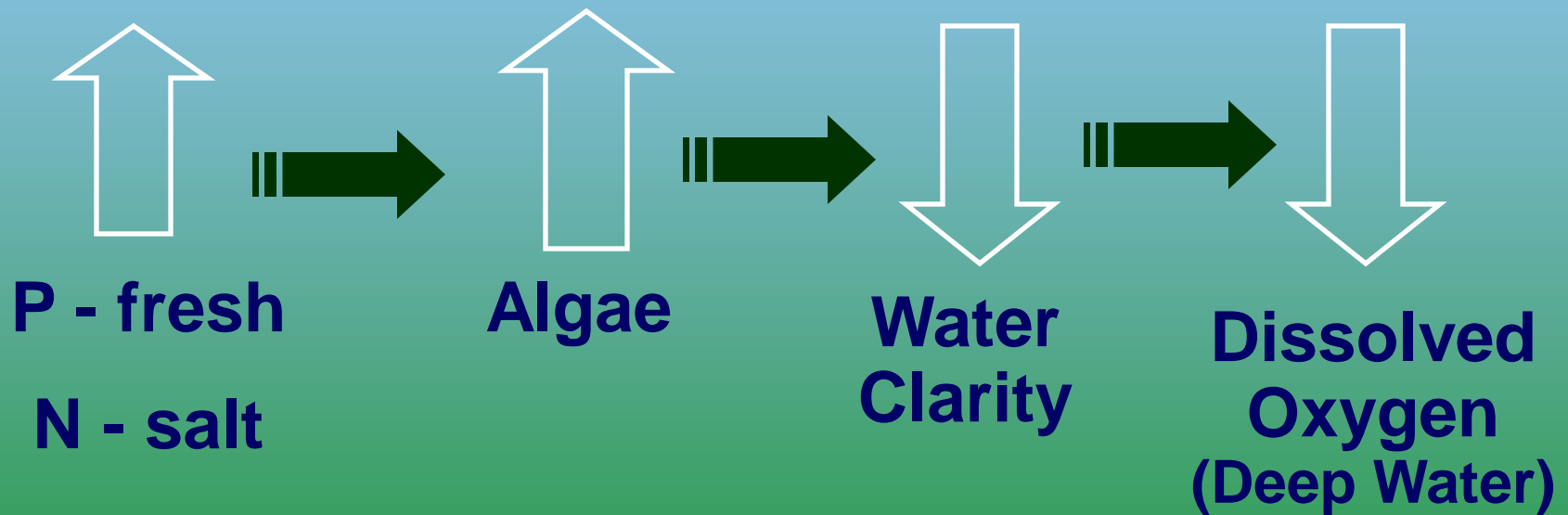
Geometric Mean Enterococci- with maximum measurements



Nutrients in the Coastal Zone



Increase in nutrients





Montponset Pond, MA

National Coastal Condition Report IV

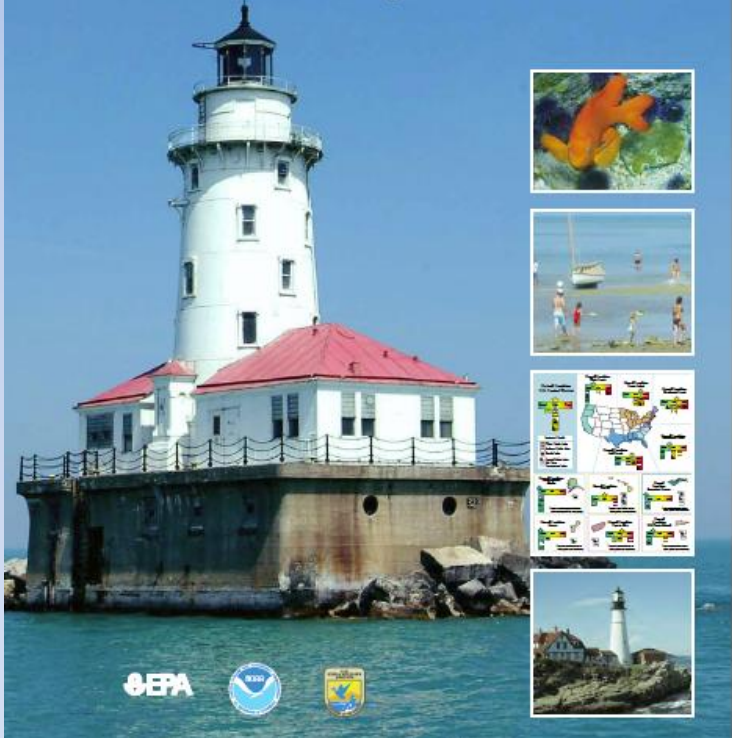


Table I-3. Cutpoints for Assessing Dissolved Inorganic Nitrogen (DIN)^a

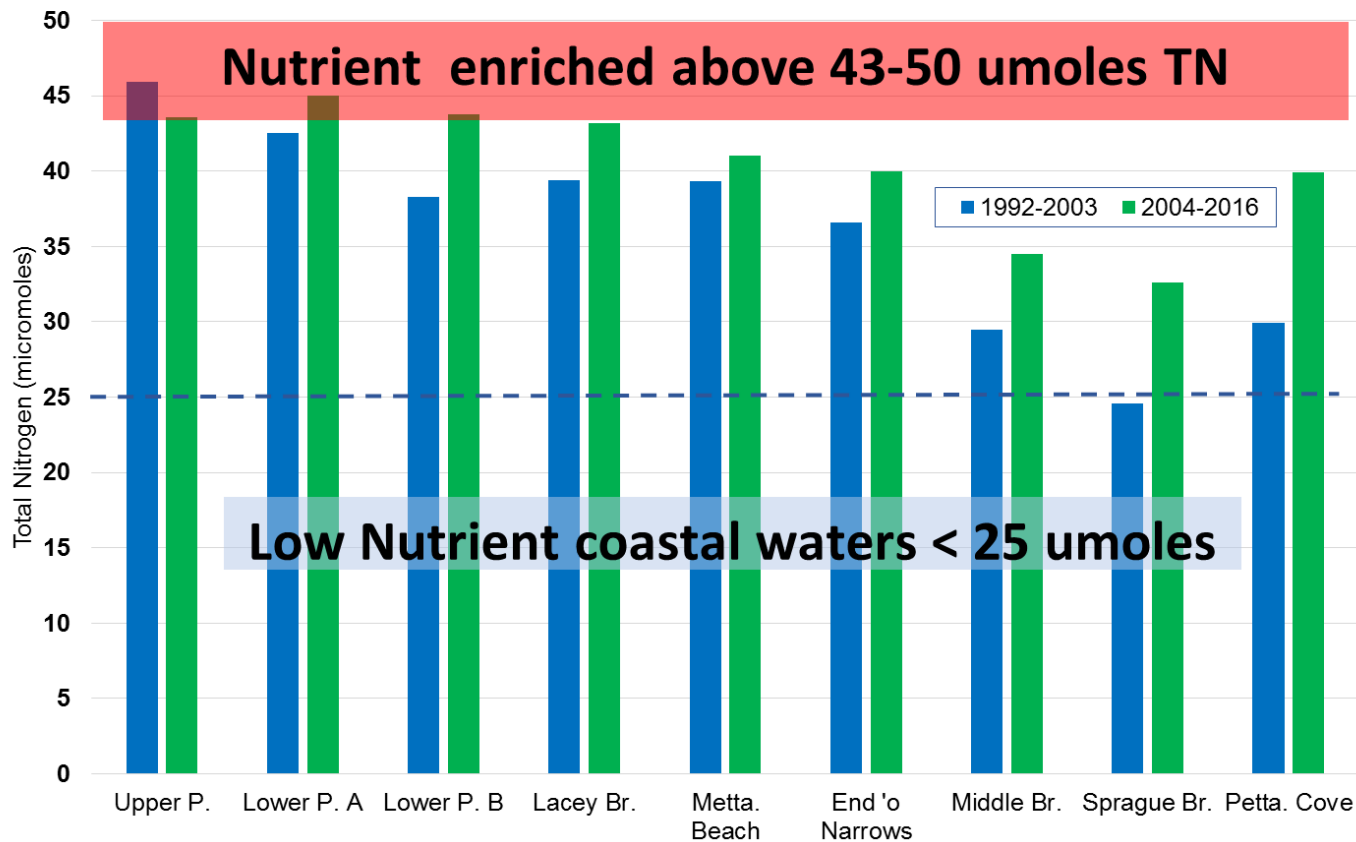
Area	Good	Fair	Poor
Northeast, Southeast, Gulf Coast, and Guam ^a sites	< 0.1 mg/L	0.1–0.5 mg/L	> 0.5 mg/L
West Coast, Alaska, and American Samoa sites	< 0.5 mg/L	0.5–1.0 mg/L	> 1 mg/L
Hawaii, Puerto Rico, U.S. Virgin Islands, and Florida Bay sites	< 0.05 mg/L	0.05–0.1 mg/L	> 0.1 mg/L
Regions	Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition	10% to 25% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.	More than 25% of the coastal area is in poor condition

<http://www.epa.gov/nccr>

September 2012

Total Nitrogen at Saltwater Sites

(umoles)

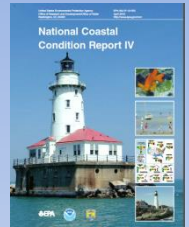
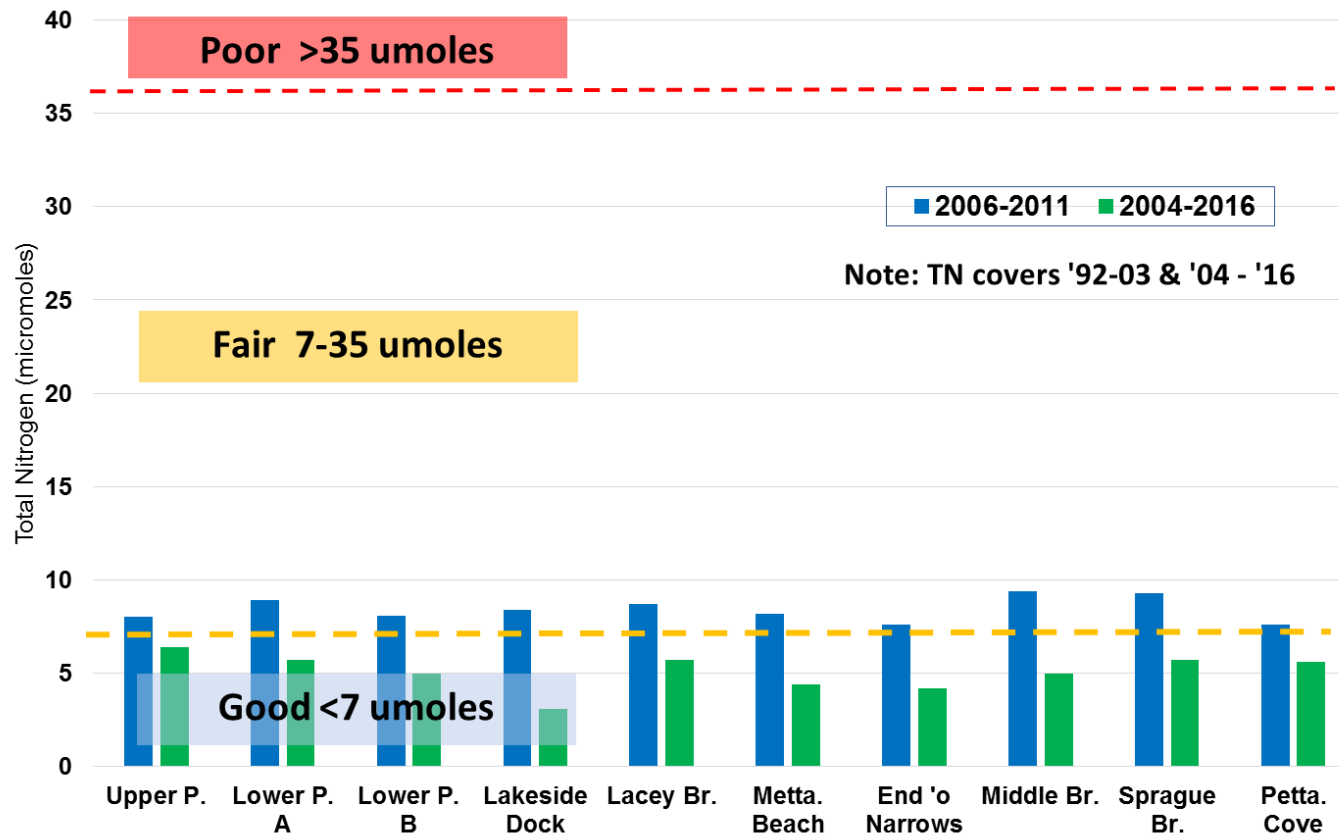


	Gilb. Stu.	Lakeside	Metta Bk.	Mumfrd Bk.
1997-2006	35		124	72
2007-2016	38	145	170	84

**All forms
of
nitrogen**

Dissolved Inorganic Nitrogen

(umoles nitrate-N + ammonia-N)



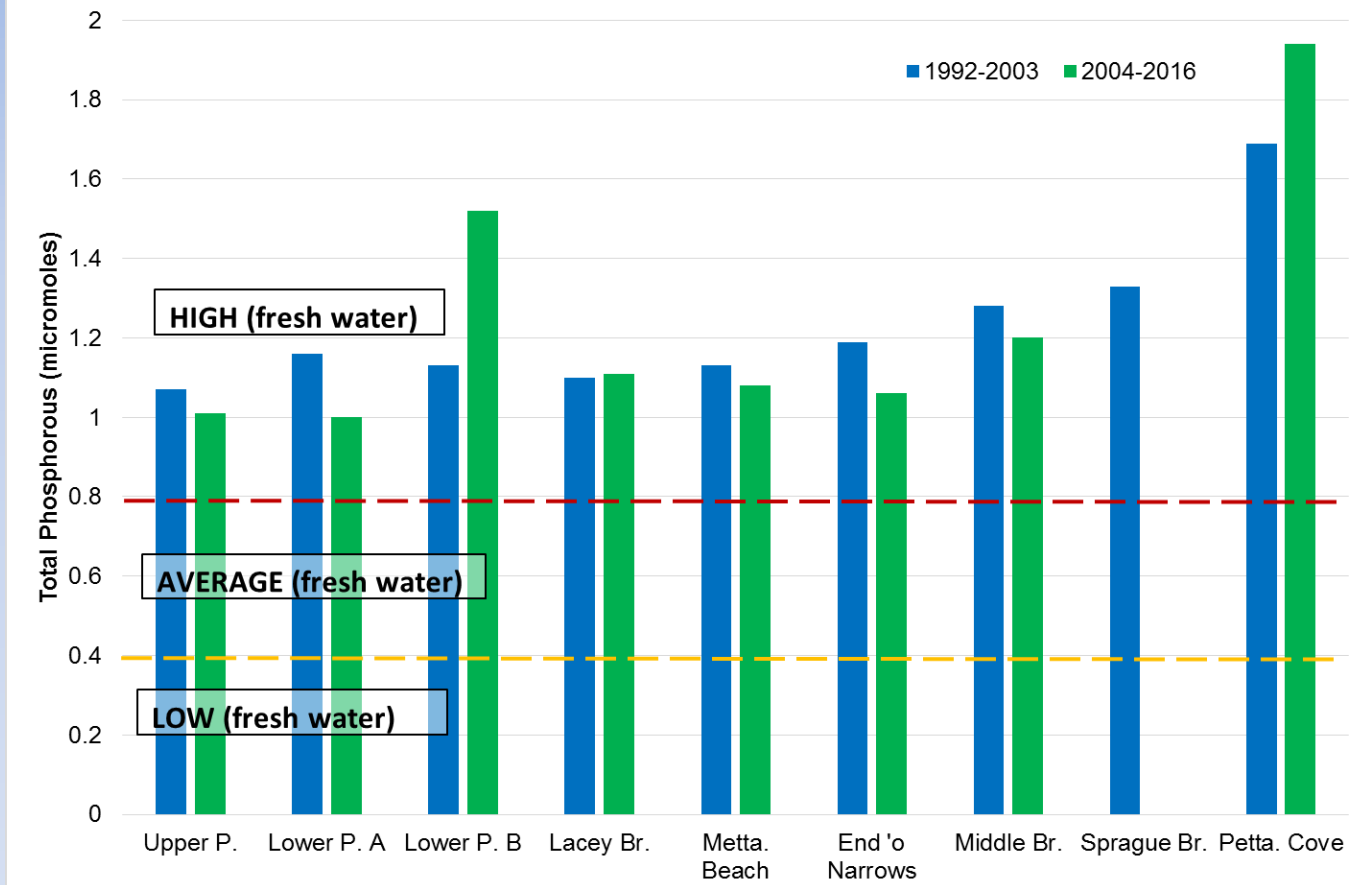
	Gilb. Stu.	Lakeside	Metta Bk.	Mumfrd Bk.
2006-2011	35		124	72
2011-2016	38	145	170	84

**Nitrate-N plus
Ammonia-N**



Narrow River Total Phosphorous

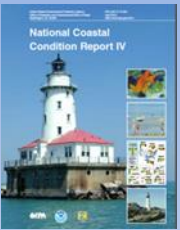
(1 umole = 31 ppb)



	Gilb. Stu.	Lakeside	Metta Bk.	Mumfrd Bk.
1997-2006	0.65		1.93	0.79
2007-2016	0.45	1.44	1.14	1.88

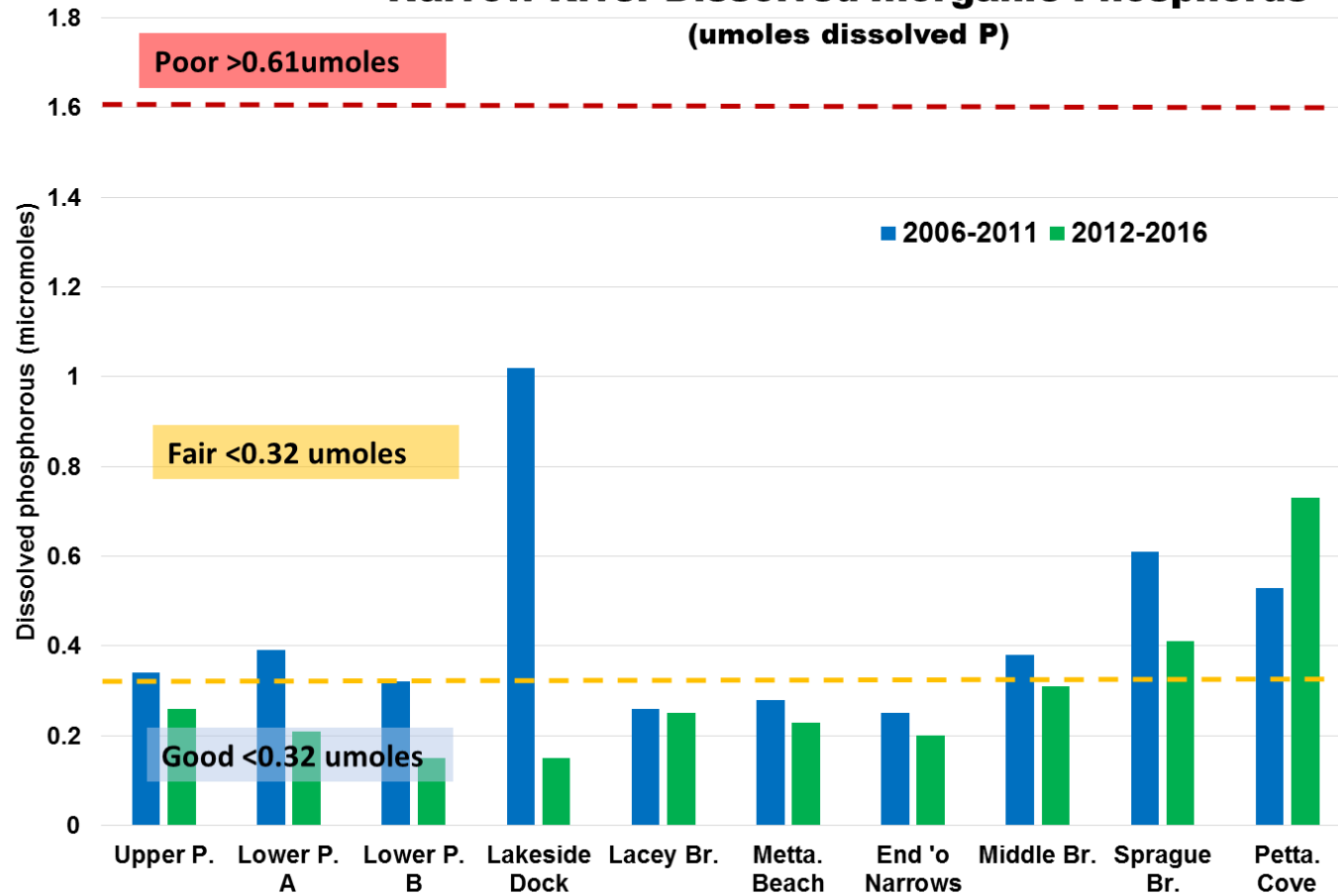
All forms of phosphorus





Narrow River Dissolved Inorganic Phosphorus

(umoles dissolved P)



	Gilb. Stu.	Lakeside	Metta Bk.	Mumfrd Bk.
2006-2011	0.17	0.66	0.41	1.6
2011-2016	0.21	0.47	0.59	0.5

Soluble Phosphorus



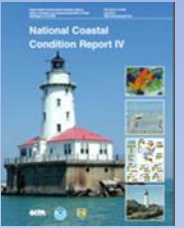
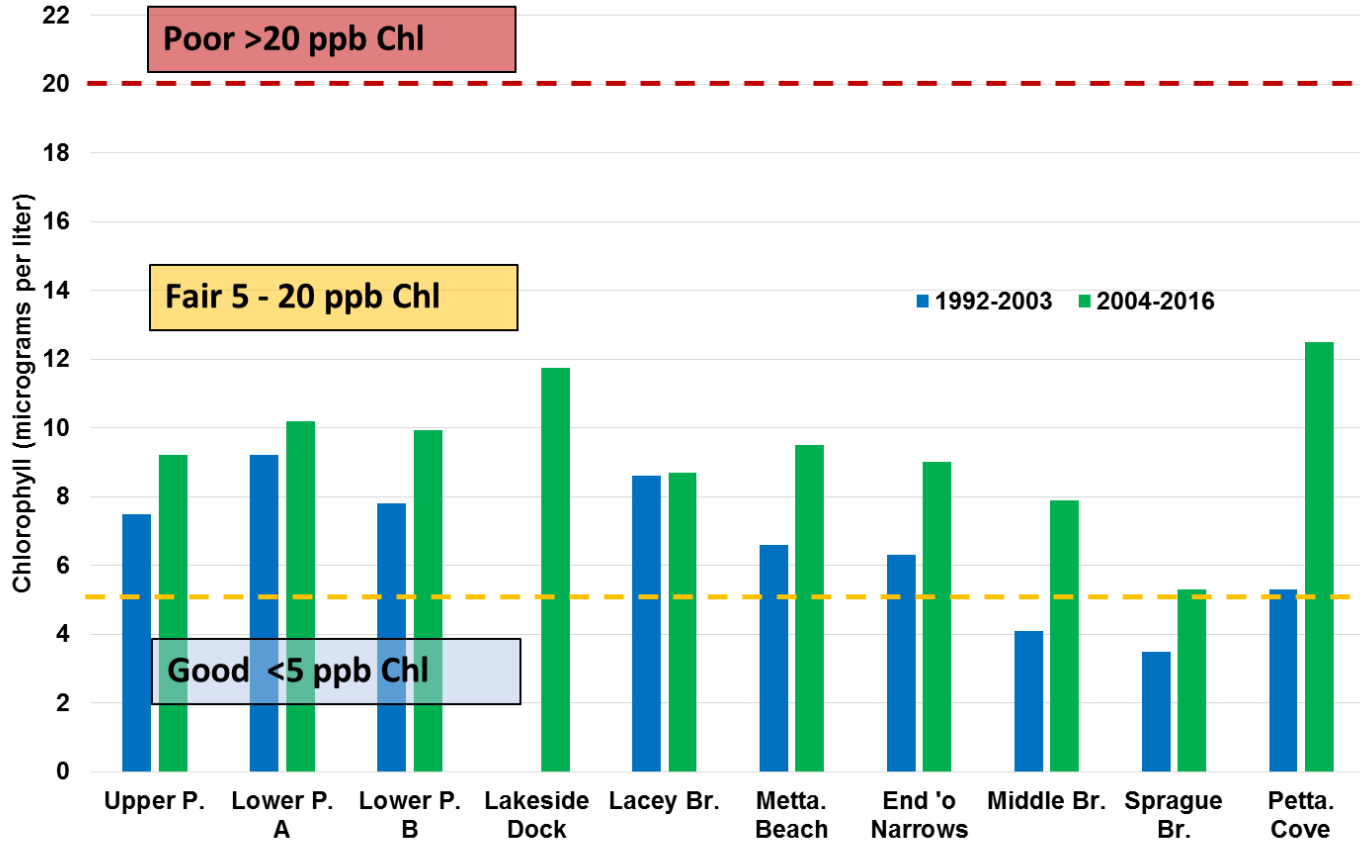
When you fertilize
your lawn,
you're not JUST taking
care of your lawn!



<http://www.slideshare.net/indianawildlife/phosphorus-in-our-lawn-fertilizer-threatening-indianas-water-from-lawn-to-lake>

Narrow River Algae Levels

(parts per billion chlorophyll)



	Gilb. Stu.	Metta Bk.
1992 - 2003	2.4	3.1
2004 - 2016	2.2	4.2



Underwater Dissolved Oxygen Cycle

INPUT: Mixing by wind, waves and currents add atmospheric oxygen to surface water

High oxygen

Phytoplankton

INPUT: Photosynthesis by sea grasses, seaweed and phytoplankton

Mixing with river or ocean water can raise or lower the amount of oxygen

REMOVAL: Respiration: breathing by animals

REMOVAL: Respiration: decay of organic matter on the bottom

Low oxygen

Organic matter: poop and dead phytoplankton cells, plants, and animals that have fallen to the bottom from the surface waters

Photosynthesis:



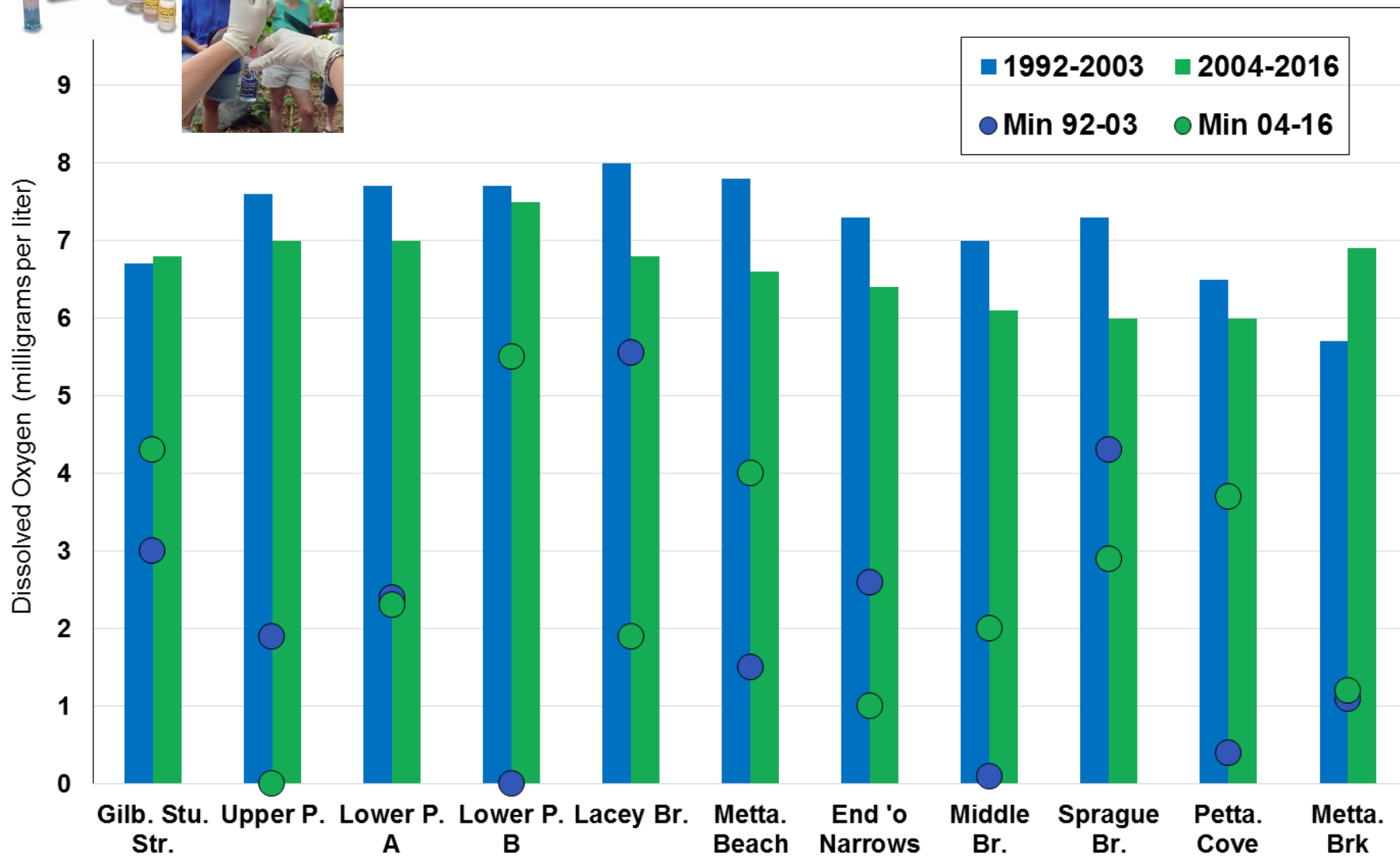
Respiration:





Average Dissolved Oxygen

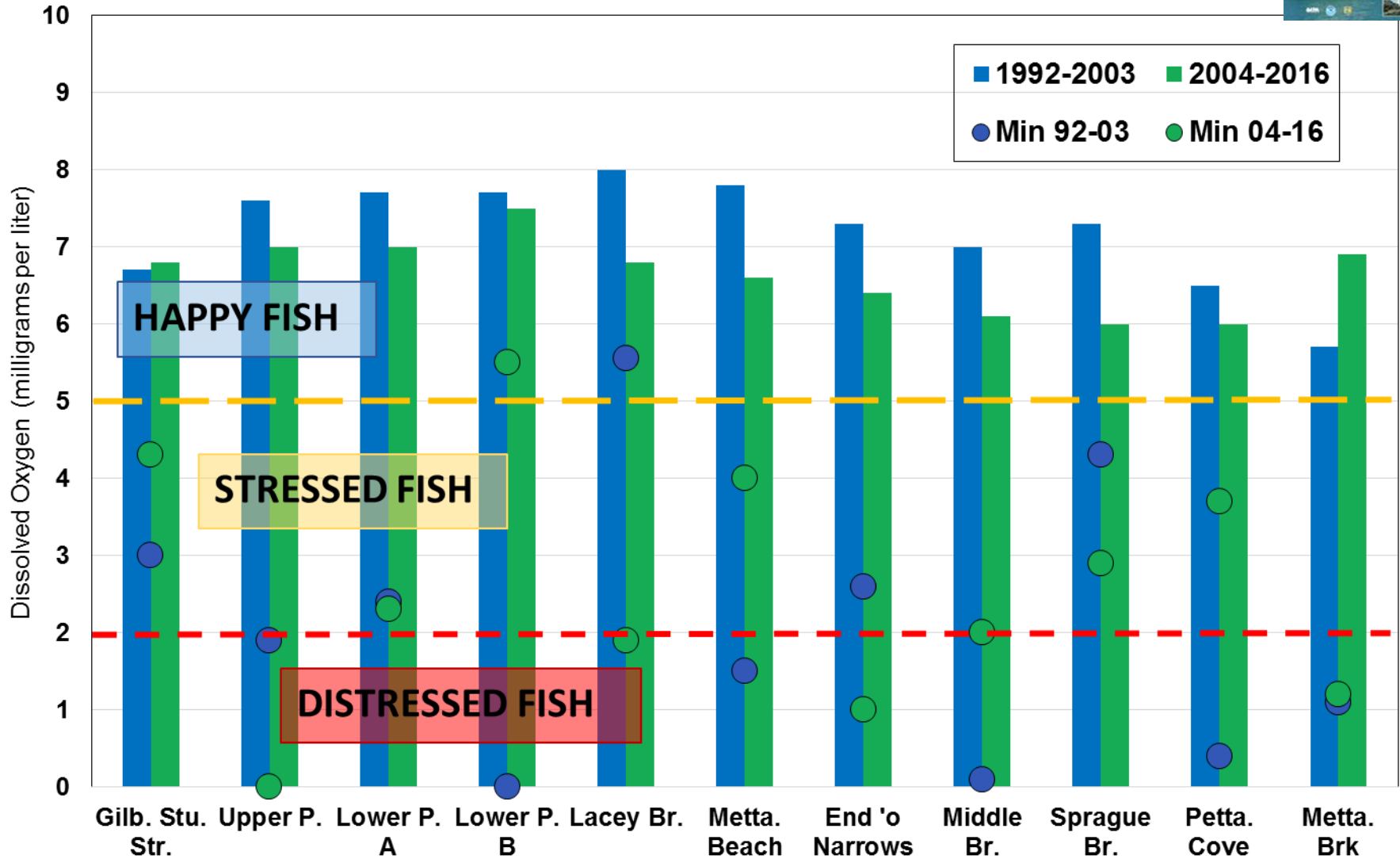
(parts per million)





Average Dissolved Oxygen

(parts per million)



What do these trends mean?

- Temperatures ↑ 😞
- Dissolved oxygen OK 😊
- Salinity sufficient inflow of RI Sound water (and with lower nutrient levels) 😊
- Fecal coliform bacteria levels to Lacey Bridge, streams and outfall are improving 😊, still too high for shellfishing 😞
- Enterococci bacteria lower, improving and swimming OK 😊
- Total nitrogen ↑ in recent years counteracting effects of municipal sewers for organic nitrogen 😞
- DIN (nitrate + ammonia-N) improving 😊 Watch the streams
- Steady total & dissolved phosphorus levels 😊 Watch the streams
- Algae increasing 😞, but averages are OK 😊 Eelgrass has returned
- Stormwater runoff after heavy rains streams and outfalls bring in bacteria and nutrients 😞



Who has used the River Watch data?



THE
UNIVERSITY
OF RHODE ISLAND



How has the data has been used?



Outhouse removed
near Gilbert Stuart
Stream



Circuit Drive Detention
Ponds 2004



Mettatuxet Detention Pond - 2006

Edgewater BMP system outfall. Installed in 2010. The sand filter slows down the flow of stormwater, keeps it in the sunlight, and filters it to reduce the amount of bacteria and nitrogen .



What can we do about nutrients and bacteria entering the River?

- DON'T feed the birds
- DON'T dump trash, waste or lawn clippings into the River or down stormdrains
- Do keep pet waste away from the River



187 Volunteers!

Al Blott
Abby Davis
Abby Moylan
Aiden Capaldi
Alan Tsakares
Alison Chatham
Amanda Smith
Annette DeSilva
Annette LaRosa
Annie Hall
Austin Vierra
Barb Boutin
Barbara Smith
Barry Devine
Barry Martasian
Ben Rauh
Bette Carey
Betty Vanderbilt
Bob Burgess
Bob Palmer
Bob Schelleng
Brent Plante
Brett Cook
Brian Mattiucci
Bridget Peterson

Bruce Smith
Carol Sarubbi
Celia Humphreys
Christopher Wakefield
Claire Hoey
Connie Alexander
Craig Stedman
Craig Wood
Dan Denev
Dana Sarubbi
Daughter Arcand
Dave Abelmar
Dave Hamel
David Cordingly
David Owens
David Poisson
David Smith
Debbie Kaprielian
DeeDee Chatham
Dorothy Mann
Dudley Mann
E. Shanley
Earl Davey
Earl Noblet
Edmond Culhane

Elaine Stedman
Eleanor Earle
Elizabeth Castro
Erin Gaughan
Eric Kohlmaat
Eric Peterson
Ernest Flewwell
Ethan Davey
Evan Sylvia
Flo Abilheira
Fraser Vaughn
George Maris
Harriet Powell
Harry Quan
Hayden Radke
Heather Levin
Heidi Travers
Hossam Zaki
Howard Reed
Ian Gordon
Isabell Abilheira
Jack Hall
Jaimie Holmes
Janie Burke
Jeff Bouton

Jeff Kaprielian
Jeffrey Egan
Jen Temple
Jennifer Carey
Jennifer Kohlmaat
Jerold Ehrlich
Jesse Grande
Jessica Brown
Jessica Greer
Jim Friday
Jim Mathison
Joe Merino
John Dick
John Hall
John Hoey
John Noblet
John Peterson
John Scovel
John Scott
John Wingate
Jora Ehrlich
Joyce Anderson
Judith Paolucci
Judy Wallace
Julie Vincelette

Julie West
Julie Westcott
Karin Palmer
Katherine Estes
Kathryn Grande
Keia Finnigan
Kelly Vaughn
Kelsea Kruger
Ken Kaprielian
Ken McShane
Kevin McCarthy
Larry Radke
Laura Reed
Leigh Stedman-
Riccitelli
Linda Bealer
Linda Oliver
linda Owens
Linda Rivers
Lisa Sisson
Liz Hill
Lynn Arcand
Lynn Ingegn
Lynn Wagleal
Madge McCarthy
Marc Lamson

Marie Hoey
Mark Sullivan
Mark Vincelette
Marty Moran
Mary Burgess
Mary Joyce McAuley
Mary Madden
Maryann Hannigan
Meagan Arcand
Meagan Merlino
Melissa Turner
Melissa Troop
Michael Gardner
Muriel Benjamin
Nancy Flewwelin
Nancy Gibb
Neil Kelly
Norman Waldheger
Omar Zaki
Pam O'Neill
Pat Kreger
Pat Maris
Patricia Federico
Patrick Day
patrick Mus

Paula Bonzagni
Perry Moylan
Pete Curtis
Peter Travers
Peter Vanderbilt
Poisson
Ray Ward
Robert Schelleng
RoseMarie Pomarico
Rosemary Smith
Rozi Moylan
Sam Day
Sandra Skaradowski
Sandy Crevier
Sarah Quan
Sarah Wheaton
Stephen Vincelette
Steve Bonzagni
Steve Boyle
Steve Carey
Steven Denev
Sue Davis

Sue Van Ness
Susan Hall
Susan Lambert
T. Gursky
Taiyo Johnson
Ted Meleney
Thomas Capaldi
Tom Roberts
Veronica Berousky
Victoria Hathaway
Vida Wynne Griffin
Will Cumer
Willa Kammerer
Zachary Benfamin

7800+ Volunteer Hours!



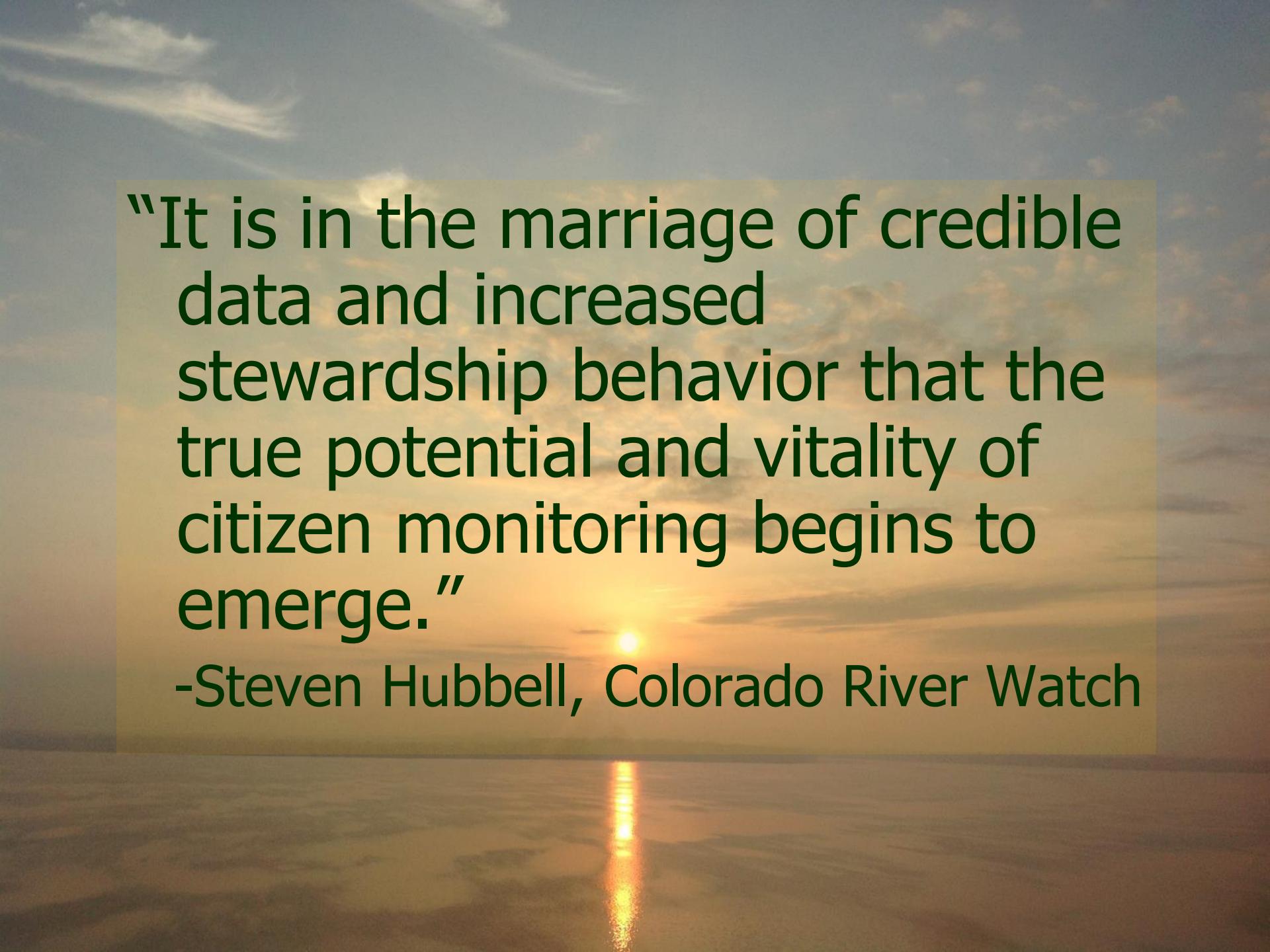
2017 Volunteer Monitors

(# = Years as a Volunteer Monitor)

- Lynn Almond (1)
- Joyce Anderson (5)
- Vanessa Anderson (1)
- Veronica Berounsky (14)
- Melissa Campbell (1)
- Jennifer Carey (20)
- Annette DeSilva (26)
- Jesse and Kathryn Grande (2)
- Enzo Gravante (1)
- The Kaprielian Family (13)
- Eric & Jennifer Kohlsaas (3)
- Marc Lamson (12)
- Shelby & Bob Lefoley (1)
- Abby & Perry Moylan (8)
- John and Eric Peterson (5)
- Carol Sarubbi & Family (11)
- Rosemary (11) and David (5+) Smith
- Rodrigue Spinette (1)
- Christopher Wakefield (3)
- Craig Wood (8)
- Hossam Zaki (3)

Now recruiting for 2018, see
www.uri.edu/watershedwatch/





“It is in the marriage of credible data and increased stewardship behavior that the true potential and vitality of citizen monitoring begins to emerge.”

-Steven Hubbell, Colorado River Watch

Thank you!



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www.uri.edu/watershedwatch/**

