# What's The Score? Considerations for Developing Metrics and Indices

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Volunteer Water Quality Monitoring National Facilitation Project

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*Used with permission of presenters* at*

# Got Data? Cool Tools for Effective Data Management

Friday, November 16th, 2007

EPA New England Regional Laboratory
11 Technology Drive, North Chelmsford, MA



* In particular: Jerry Schoen, Sue Flint, Tony Williams

# A few definitions…

## Environmental Parameter

- defining characteristic
- a measurement
- a test

**Examples?**

**Temperature, pH, dissolved oxygen, nitrogen, phosphorus**

## Indicator

- measurable feature that provides *useful* evidence of system quality
- a sign, symptom or index of …
- provides evidence of something else
- Something used to show visually the condition of a system

**Examples?**

**Housing starts, fecal coliform, percent impervious surface**

# Useful bacterial indicators

- Present whenever intestinal pathogens are present
- Alive longer than the hardiest intestinal pathogen
- Found in a warm-blooded animal's intestines
- Analyzed with an easy testing method
- Directly correlated with the degree of fecal contamination
- Useful in fresh and marine waters

Volunteer Estuary Monitoring: A Methods Manual
http://www.epa.gov/owow/estuaries/monitor/documents/manual.pdf

# A few more definitions…

**Metric**

- a standard of measurement
- a measure of (a biological) attribute.
- an attribute with empirical change in value along a gradient of human disturbance.
- data analysis summary

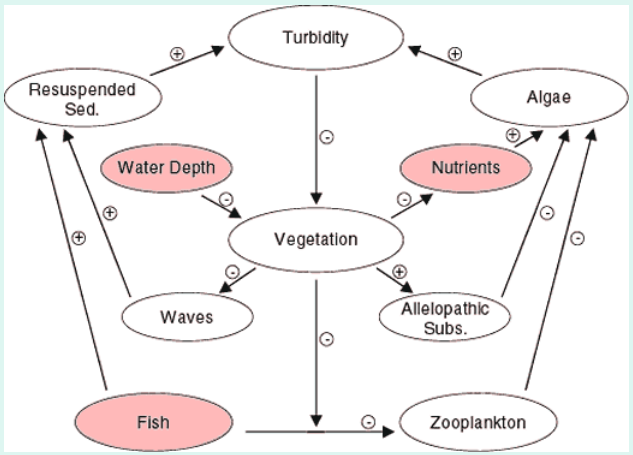
**Examples?**

| Biological | Chemical | Physical |
|---|---|---|
| EPT | pH | (river) channel length, sinuosity |
| % Sensitive Diatoms | Temperature | (land use type) area, density |
| plant/animal condition | DO ppm or %Sat | |

# (Water Quality) Index

- **An aggregated number used to judge condition (e.g. IBI, RBP, TSI, GDP )**

- **A summary of large amounts of information**
  - simple terms (e.g., good, fair, poor)
  - consistent
  - easily understood by your audience (and you): consider the 3 P's



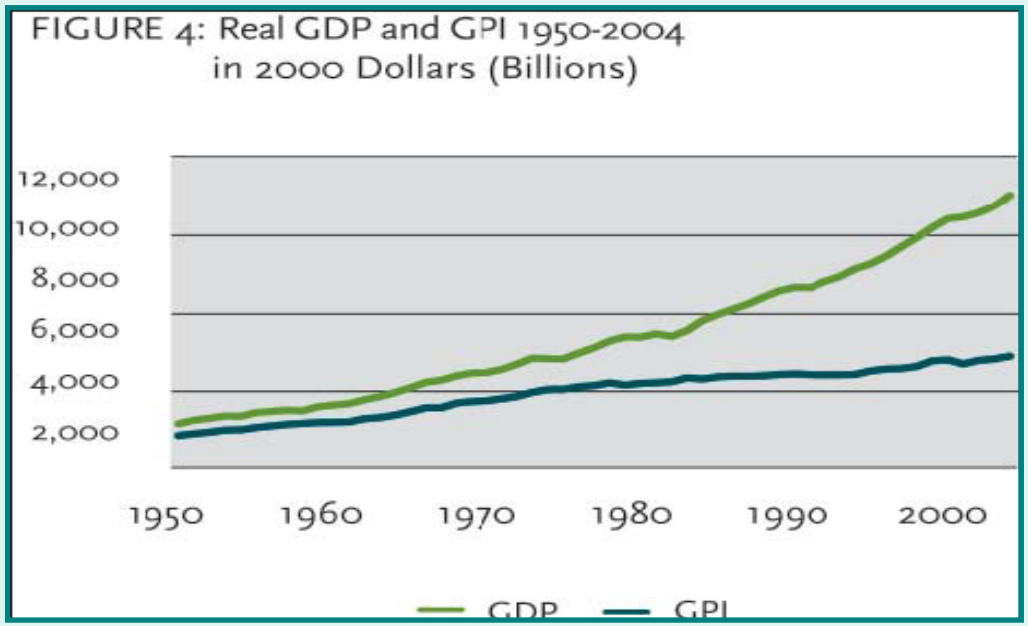

- **Public,**
- **Policy makers,**
- **Politicians**

# Advantages of an index

- Represent  a number of variables in a single number,
- Combine various measurements in different measurement units in a single metric
- Convey relative differences in water quality between sites (or at one site) over time
- Effective as a communication tool.

# Disadvantages

- Not always easy to understand its basis
- Effect of missing parameters
- Components & weighting can be judgmental




Talberth, Cobb and Slattery. The Genuine Progress Indicator 2006
http://www.rprogress.org/publications/2007/GPI%202006.pdf

# Air Quality Index (AQI)

| Air Quality Index Levels of Health Concern | Numerical Value | Meaning |
|---|---|---|
| Good | 0-50 | Air quality is considered satisfactory, and air pollution poses little or no risk. |
| Moderate | 51-100 | Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution. |
| Unhealthy for Sensitive Groups | 101-150 | Members of sensitive groups may experience health effects. The general public is not likely to be affected. |
| Unhealthy | 151-200 | Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects. |
| Very Unhealthy | 201-300 | Health alert: everyone may experience more serious health effects. |
| Hazardous | > 300 | Health warnings of emergency conditions. The entire population is more likely to be affected. |

AIRNOW Quality of Air Means Quality of Life

http://airnow.gov/index.cfm?action=static.aqi

# AQI caveats:

**How AQI Calculated:**

Daily concentrations of major pollutants at many locations

- **ground-level ozone**
- **particle pollution**
- **carbon monoxide**
- **sulfur dioxide**
- **nitrogen dioxide**

formula used to convert raw values into numeric scale.

100 ~ air quality standard for that pollutant

**Highest – rated pollutant becomes AQI for that day.**

E.g. ozone = 90, Sulfur dioxide = 68;  AQI = 90.

**Problems.** *If you are*

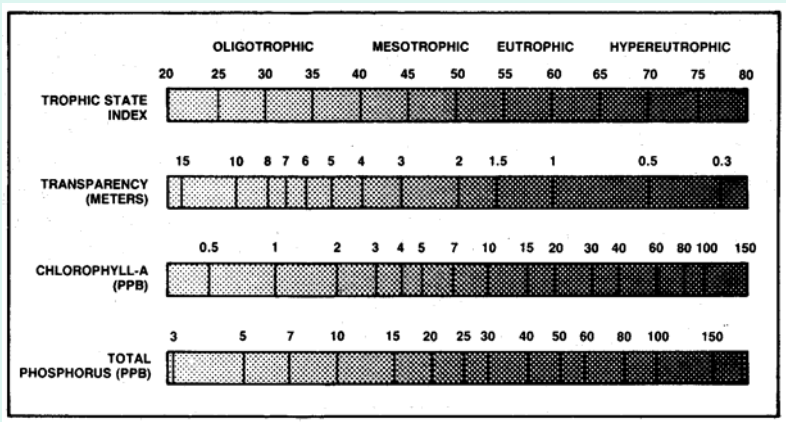
- Sensitive to one type of pollution.
- need to know where pollution types are coming from

# Trophic State Indices

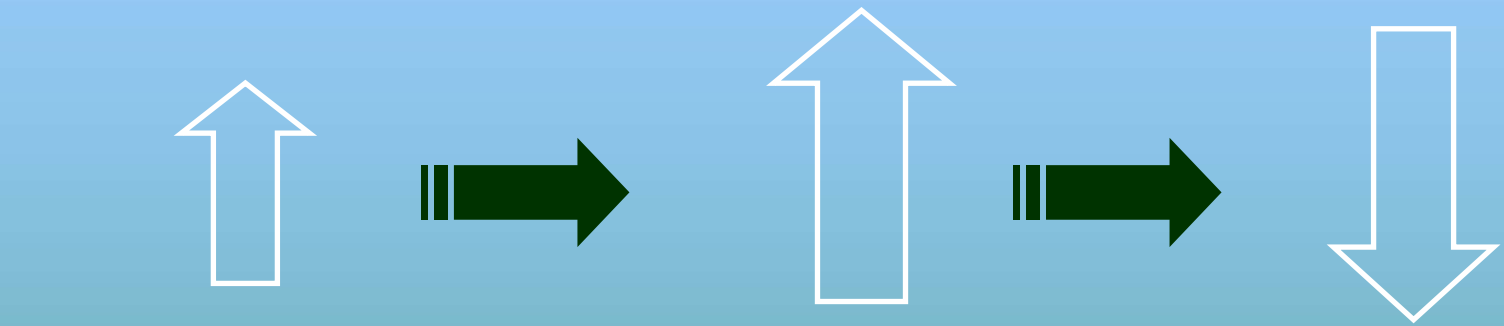
Attempt to provide a single quantitative index for the **purpose of classifying and ranking lakes, from standpoint of nutrient influence on water quality** .

**Carlson TSI useful for**

- **comparing lakes within a region**
- **assessing changes in trophic status over time**.
  - Scale is 0 to 100
  - Higher values correspond to increased trophic state.
  - 10 unit increase = halving of Secchi depth & doubling of P concentration.



# Carlson's Trophic State Index



Phosphorus, Nitrogen

Algae

Water Clarity


*Important to emphasize the continuum not compartmentalize*

The Great North American Secchi Dip-in
http://dipin.kent.edu/index.htm

# Carlson TSI Formulae:

TSI = 9.81 Ln Chlorophyll a (ug/L) + 30.6
TSI = 14.42 Ln Total phosphorus (ug/L) + 4.15
TSI = 60 - 14.41 Ln Secchi disk (meters)

Because these are interrelated by linear regression models, any one of the variables can be used to derive a TSI score.

- CHL>TP>Secchi
- For northern temperate lakes
- Lakes with few rooted aquatic plants
- Little non-algal turbidity

**Does trophic state = water quality?**

NO! Trophic state is based on an absolute scale, water quality describes a condition in relation to (human) needs and values

**A list of possible changes that might be expected in a north temperate lake as the amount of algae changes along the trophic state gradient.**

| TSI | Chl (ug/L) | SD (m) | TP (ug/L) | Attributes | Water Supply | Fisheries & Recreation |
|---|---|---|---|---|---|---|
| **<30** | <0.95 | >8 | <6 | **Oligotrophy:** Clear water, oxygen throughout the year in the hypolimnion | Water may be suitable for an unfiltered water supply. | Salmonid fisheries dominate |
| **30-40** | 0.95-2.6 | 8-4 | 6-12 | Hypolimnia of shallower lakes may become anoxic | | Salmonid fisheries in deep lakes only |
| **40-50** | 2.6-7.3 | 4-2 | 12-24 | **Mesotrophy:** Water moderately clear; increasing probability of hypolimnetic anoxia during summer | Iron, manganese, taste, and odor problems worsen. Raw water turbidity requires filtration. | Hypolimnetic anoxia results in loss of salmonids. Walleye may predominate |
| **50-60** | 7.3-20 | 2-1 | 24-48 | **Eutrophy:** Anoxic hypolimnia, macrophyte problems possible | | Warm-water fisheries only. Bass may dominate. |
| **60-70** | 20-56 | 0.5-1 | 48-96 | Blue-green algae dominate, algal scums and macrophyte problems | Episodes of severe taste and odor possible. | Nuisance macrophytes, algal scums, and low transparency may discourage swimming and boating. |
| **70-80** | 56-155 | 0.25-0.5 | 96-192 | **Hypereutrophy:** (light limited productivity). Dense algae and macrophytes | | |
| **>80** | >155 | <0.25 | 192-384 | Algal scums, few macrophytes | | Rough fish dominate; summer fish kills possible |

# Multimetric Indices (IBI, RBP)

- integrate several biological metrics to indicate condition.
- designed to be sensitive to a range of physical, chemical, and biological stressors.
- are relatively easy to measure and interpret.

## Indices - Multimetric approach

each metric is given a rating according to whether its value

- approximates,
- deviates ***somewhat*** from, or
- deviates ***strongly*** from

values measured in *least-disturbed ecosystems* of a particular type within a region.

These ratings (e.g., excellent, moderate, fair, and poor) can be **used to make decisions about how well aquatic life is being supported by the water body .**

# To make multimetric biological indexes effective you must:

- **Classify environments** to define homogeneous sets within or across ecoregions (e.g., streams, lakes, or wetlands; large or small streams; warm-water or cold-water lakes; high- or low-gradient streams).
- **Select measurable attributes** that provide **reliable and relevant signals** about the biological effects of human activities.
- **Develop sampling protocols** and designs that ensure that those biological attributes are measured accurately and precisely.
- Devise analytical procedures to **extract and understand relevant patterns** in those data.
- **Communicate the results** to citizens and policymakers so that all concerned communities can contribute to environmental policy.

**Multimetric Indices to Prepare and Analyze Data**
http://www.epa.gov/bioindicators/html/multimetric.html

# Selecting/Creating metrics and indices

**Good Metrics:**

- **Sensitive to change**
- **Predictable, consistent**

**Metrics vary in their scale--they can be:**

- integers
- percentages
- dimensionless numbers
- qualitative observations (e.g. grassland vs. forest).

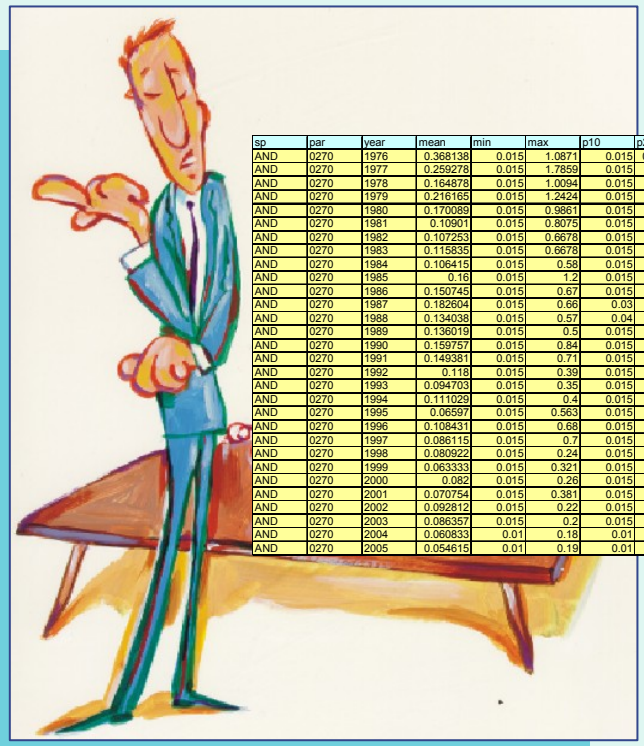
**Translation into unitless scores must address this.**

**Standardization assumes that each metric**

- **has the same value and importance (i.e., they are weighted the same), and that**
- **a 50% change in one metric is of equal value to assessment as a 50% change in another.**

# Management is not too bright...

## …and has the attention span of a hamster



| sp | par | year | mean | min | max | p10 | p25 | p50 | p75 | p90 | n | oag | pniawr | pnamvb | pnkrw | tr95 | tr95w | tr80 | tr80w | fiawr | famvb | fkrw | pal80 | pal95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AND | 0270 | 1976 | 0.368138 | 0.015 | 1.0871 | 0.015 | 0.073725 | 0.24845 | 0.629 | 0.91549 | 50 | 0.03 | 30 | 30 | -9999 | false | 0 | false | 0 | 5.4355 | 5.4355 | 0 | | roneve |
| AND | 0270 | 1977 | 0.259278 | 0.015 | 1.7859 | 0.015 | 0.015 | 0.0776 | 0.3106 | 0.83858 | 51 | 0.03 | 19 | 19 | -9999 | false | 0 | false | 0 | 8.9295 | 8.9295 | 0 | | roneve |
| AND | 0270 | 1978 | 0.164878 | 0.015 | 1.0094 | 0.015 | 0.0427 | 0.1009 | 0.2213 | 0.396 | 49 | 0.03 | 17 | 17 | -9999 | false | 0 | false | 0 | 5.047 | 5.047 | 0 | | roneve |
| AND | 0270 | 1979 | 0.216165 | 0.015 | 1.2424 | 0.015 | 0.0388 | 0.132 | 0.229025 | 0.6981 | 40 | 0.03 | 15 | 15 | -9999 | false | 0 | false | 0 | 6.212 | 6.212 | 0 | | roneve |
| AND | 0270 | 1980 | 0.170089 | 0.015 | 0.9861 | 0.015 | 0.0311 | 0.09705 | 0.20385 | 0.47986 | 46 | 0.03 | 12 | 12 | -9999 | false | -0.02176 | false | -0.02176 | 4.9305 | 4.9305 | 0 | | roneve |
| AND | 0270 | 1981 | 0.10901 | 0.015 | 0.8075 | 0.015 | 0.015 | 0.0621 | 0.1398 | 0.26947 | 50 | 0.03 | 8 | 8 | -9999 | false | -0.01926 | true | -0.01926 | 4.0375 | 4.0375 | 0 | | roneve |
| AND | 0270 | 1982 | 0.107253 | 0.015 | 0.6678 | 0.015 | 0.015 | 0.0388 | 0.1398 | 0.2873 | 49 | 0.03 | 7 | 7 | -9999 | true | -0.02004 | true | -0.02004 | 3.339 | 3.339 | 0 | | rodove |
| AND | 0270 | 1983 | 0.115835 | 0.015 | 0.6678 | 0.015 | 0.015 | 0.06 | 0.14 | 0.36808 | 51 | 0.03 | 8 | 8 | -9999 | true | -0.0819 | true | -0.07326 | 3.339 | 3.339 | 0 | | rodove |
| AND | 0270 | 1984 | 0.106415 | 0.015 | 0.58 | 0.015 | 0.015 | 0.06 | 0.14 | 0.322 | 53 | 0.03 | 8 | 8 | -9999 | false | -0.01713 | false | -0.01399 | 2.9 | 2.9 | 0 | | roneve |
| AND | 0270 | 1985 | 0.16 | 0.015 | 1.2 | 0.015 | 0.04 | 0.1 | 0.2 | 0.386 | 43 | 0.03 | 10 | 10 | -9999 | false | 0.011582 | true | 0.01175 | 6 | 6 | 0 | | roneve |
| AND | 0270 | 1986 | 0.150745 | 0.015 | 0.67 | 0.015 | 0.03 | 0.1 | 0.22 | 0.39 | 47 | 0.03 | 13 | 13 | -9999 | false | 0.020775 | true | 0.024748 | 3.35 | 3.35 | 0 | | roneve |
| AND | 0270 | 1987 | 0.182604 | 0.015 | 0.66 | 0.03 | 0.06 | 0.13 | 0.2575 | 0.474 | 48 | 0.03 | 15 | 15 | -9999 | true | 0.033502 | true | 0.033502 | 3.3 | 3.3 | 0 | | roupve |
| AND | 0270 | 1988 | 0.134038 | 0.015 | 0.57 | 0.04 | 0.06 | 0.105 | 0.1875 | 0.271 | 52 | 0.03 | 9 | 9 | -9999 | false | 0.016987 | false | 0.016987 | 2.85 | 2.85 | 0 | | roneve |
| AND | 0270 | 1989 | 0.136019 | 0.015 | 0.5 | 0.015 | 0.05 | 0.1 | 0.18 | 0.306 | 103 | 0.03 | 22 | 22 | -9999 | false | -0.00451 | false | -0.00451 | 2.5 | 2.5 | 0 | | roneve |
| AND | 0270 | 1990 | 0.159757 | 0.015 | 0.84 | 0.015 | 0.04 | 0.12 | 0.25 | 0.328 | 103 | 0.03 | 33 | 33 | -9999 | false | -0.01785 | false | -0.01651 | 4.2 | 4.2 | 0 | | roneve |
| AND | 0270 | 1991 | 0.149381 | 0.015 | 0.71 | 0.015 | 0.03 | 0.13 | 0.22 | 0.336 | 113 | 0.03 | 32 | 32 | -9999 | false | -0.01476 | false | -0.01476 | 3.55 | 3.55 | 0 | | roneve |
| AND | 0270 | 1992 | 0.118 | 0.015 | 0.39 | 0.015 | 0.03 | 0.11 | 0.16 | 0.277 | 100 | 0.03 | 12 | 12 | -9999 | false | -0.005 | false | -0.005 | 1.95 | 1.95 | 0 | | roneve |
| AND | 0270 | 1993 | 0.094703 | 0.015 | 0.35 | 0.015 | 0.04 | 0.07 | 0.14 | 0.208 | 101 | 0.03 | 10 | 10 | -9999 | false | -0.0085 | false | -0.0085 | 1.75 | 1.75 | 0 | | roneve |
| AND | 0270 | 1994 | 0.111029 | 0.015 | 0.4 | 0.015 | 0.03 | 0.1 | 0.15 | 0.227 | 102 | 0.03 | 13 | 13 | -9999 | false | -0.00875 | false | -0.00875 | 2 | 2 | 0 | | roneve |
| AND | 0270 | 1995 | 0.06597 | 0.015 | 0.563 | 0.015 | 0.015 | 0.03 | 0.083 | 0.169 | 100 | 0.03 | 4 | 4 | -9999 | true | -0.01425 | true | -0.01425 | 2.815 | 2.815 | 0 | | rodove |
| AND | 0270 | 1996 | 0.108431 | 0.015 | 0.68 | 0.015 | 0.04 | 0.08 | 0.16 | 0.218 | 51 | 0.03 | 6 | 6 | -9999 | false | -0.0045 | false | -0.0045 | 3.4 | 3.4 | 0 | | roneve |
| AND | 0270 | 1997 | 0.086115 | 0.015 | 0.7 | 0.015 | 0.01875 | 0.045 | 0.1 | 0.207 | 52 | 0.03 | 5 | 5 | -9999 | false | -0.0065 | false | -0.0065 | 3.5 | 3.5 | 0 | | roneve |
| AND | 0270 | 1998 | 0.080922 | 0.015 | 0.24 | 0.015 | 0.03 | 0.06 | 0.13 | 0.178 | 51 | 0.03 | 3 | 3 | -9999 | false | -0.005 | false | -0.005 | 1.2 | 1.2 | 0 | | roneve |
| AND | 0270 | 1999 | 0.063333 | 0.015 | 0.321 | 0.015 | 0.015 | 0.04 | 0.09 | 0.147 | 102 | 0.03 | 4 | 4 | -9999 | false | -0.002 | false | -0.002 | 1.605 | 1.605 | 0 | | roneve |
| AND | 0270 | 2000 | 0.082 | 0.015 | 0.26 | 0.015 | 0.015 | 0.0595 | 0.13375 | 0.18 | 64 | 0.03 | 4 | 4 | -9999 | false | -0.00475 | false | -0.00475 | 1.3 | 1.3 | 0 | | roneve |
| AND | 0270 | 2001 | 0.070754 | 0.015 | 0.381 | 0.015 | 0.015 | 0.06 | 0.097 | 0.1416 | 65 | 0.03 | 2 | 2 | -9999 | false | -3.1E-08 | false | -3.1E-08 | 1.905 | 1.905 | 0 | | roneve |
| AND | 0270 | 2002 | 0.092812 | 0.015 | 0.22 | 0.015 | 0.0425 | 0.096 | 0.1375 | 0.1731 | 16 | 0.03 | 1 | 1 | -9999 | false | 0.0035 | false | 0.0035 | 1.1 | 1.1 | 0 | | ronewe |
| AND | 0270 | 2003 | 0.086357 | 0.015 | 0.2 | 0.015 | 0.02925 | 0.0685 | 0.145 | 0.195 | 14 | 0.03 | 0 | 0 | -9999 | false | 0.008501 | true | 0.008501 | 1 | 1 | 0 | | genewe |
| AND | 0270 | 2004 | 0.060833 | 0.01 | 0.18 | 0.01 | 0.01 | 0.04 | 0.1075 | 0.168 | 12 | 0.02 | 0 | 0 | -9999 | false | -0.00125 | false | -0.00125 | 0.9 | 0.9 | 0 | | genewe |
| AND | 0270 | 2005 | 0.054615 | 0.01 | 0.19 | 0.01 | 0.01 | 0.03 | 0.11 | 0.17 | 13 | 0.02 | 0 | 0 | -9999 | false | -0.00498 | false | -0.00605 | 0.95 | 0.95 | 0 | | genewe |

Dr Peter G Stoks, RIWA/IAWR,stoks@riwa.org

2007 Enhancing the States' Lake Managment Programs

2006 NWQMC San Jose' CA

# Lessons from the European Union

## Compliance

above standard

0.8-1.0 of standard

below 0.8 of standard

## Trend

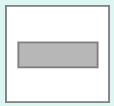
uptrend

downtrend

no trend or
not detectable

## Quantity

n ≥ 20



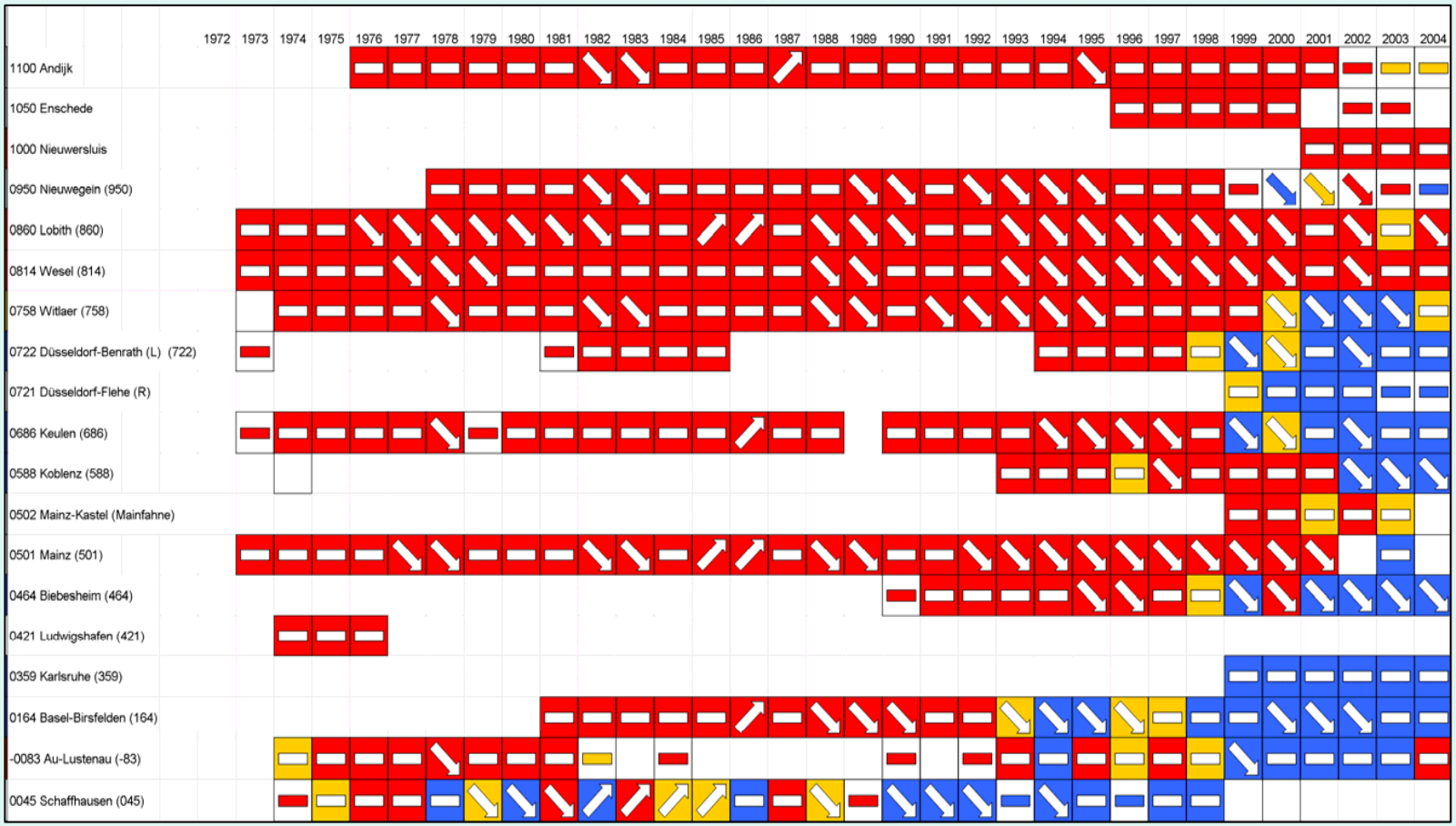
20 > n ≥ 10

n < 10

Dr Peter G Stoks
Assn of Rhine Water Works
RIWA/IAWR
stoks@riwa.org

# What it looks like

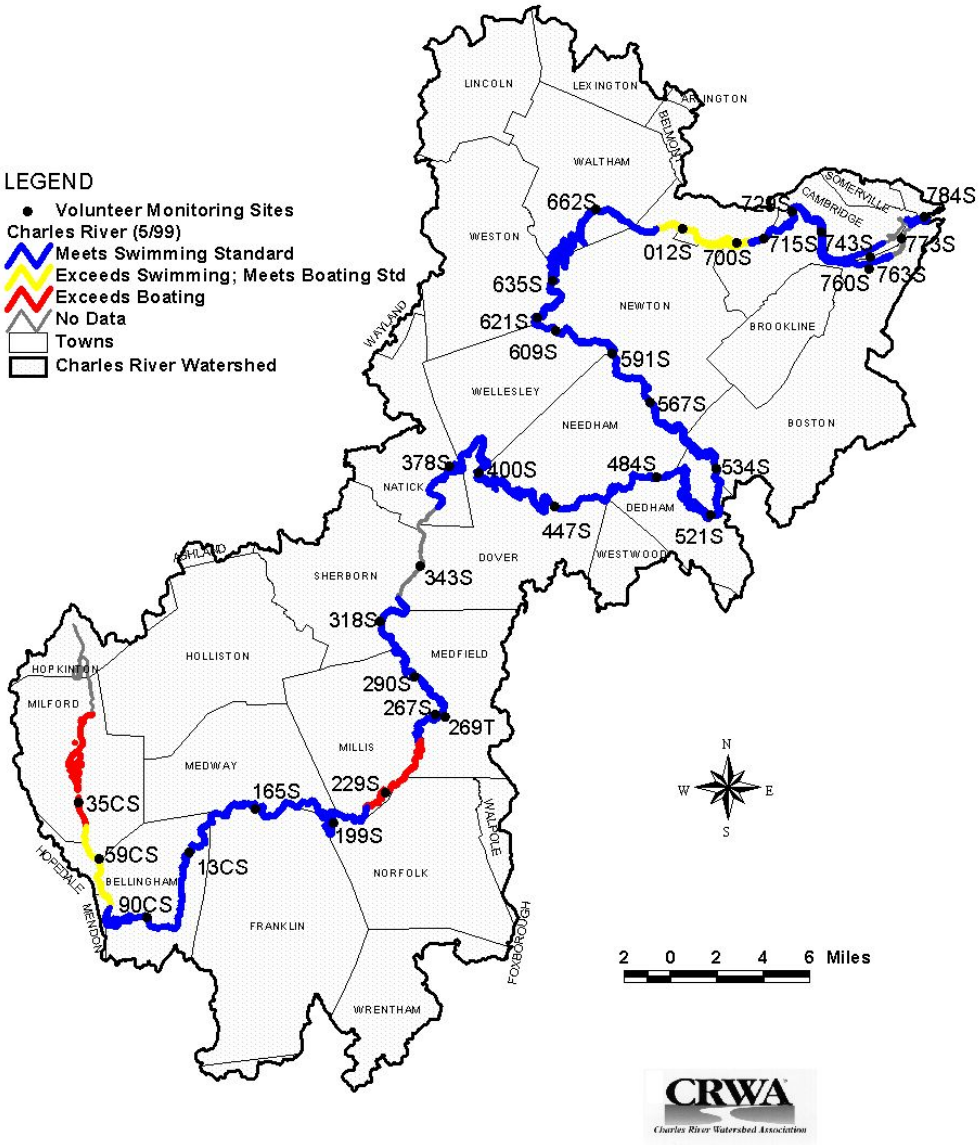
## Ammonia in the Rhine 1972 – 2004




Downstream

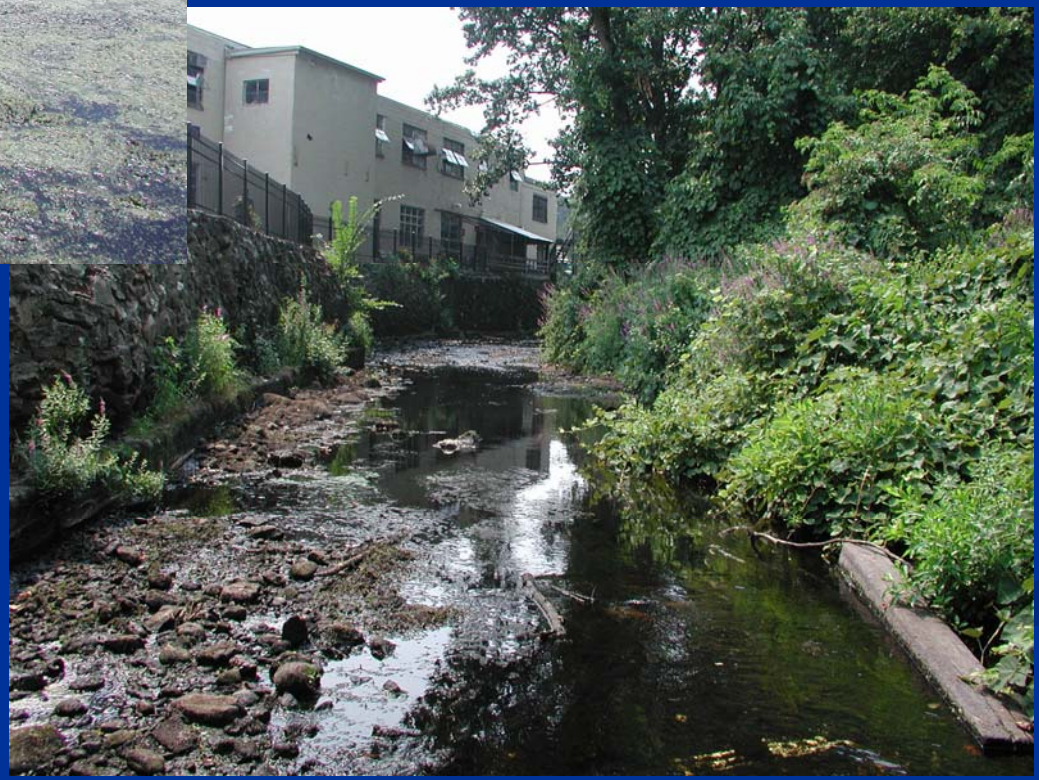
year

# May 1999 Fecal Coliform Results



OAR
Organization for the Assabet River
9 Damonmill Square, Suite 1E
Concord, MA 01742

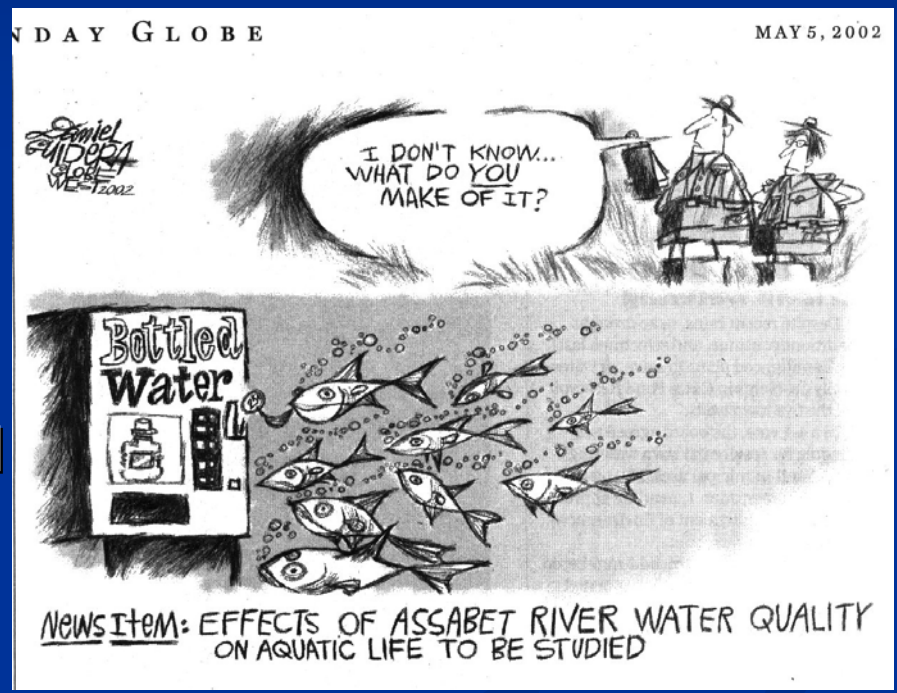
Assabet River in Aug:
Green but flowing



Nashoba Bk. in Aug:
Cleaner but flow-stressed (1.0 cfs)

# StreamWatch Project

- Evaluate streamflow, water quality, and habitat availability.
- Communicate timely, accurate data.
- Raise awareness of the need to protect in-stream flows.

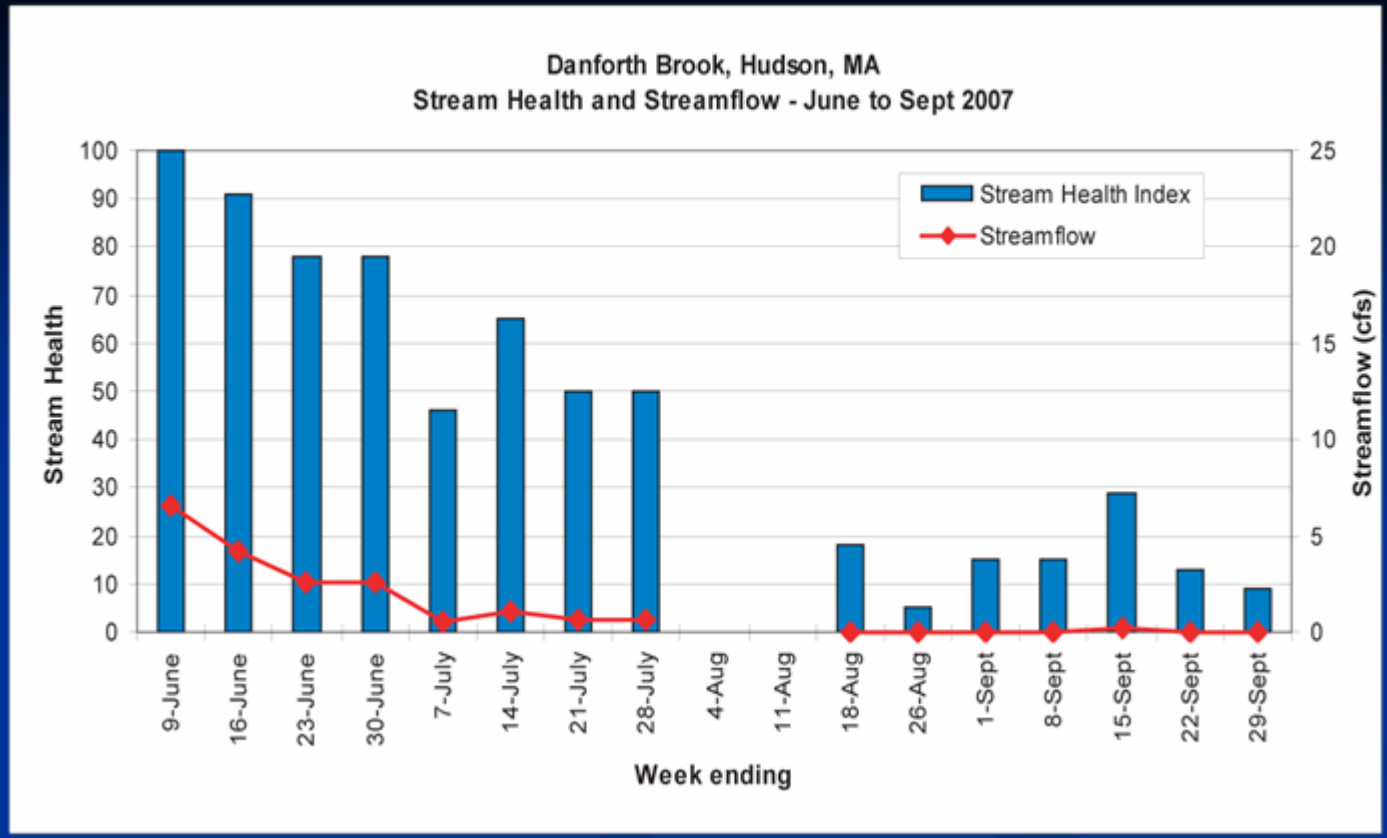



OAR
Organization for the Assabet River
9 Damonmill Square, Suite 1E
Concord, MA 01742

# Reporting Ranges

| Index Score Ranges | Range Description | Stream Health Index Graphic |
|---|---|---|
| 81-100 | Excellent *(optimal conditions)* |  |
| 61-80 | Good *(some effects observed)* |  |
| 41-60 | Fair *(light habitat impairment)* |  |
| 21-40 | Poor *(moderate habitat impairment)* |  |
| 1-20 | Very Poor *(severe habitat impairment)* |  |

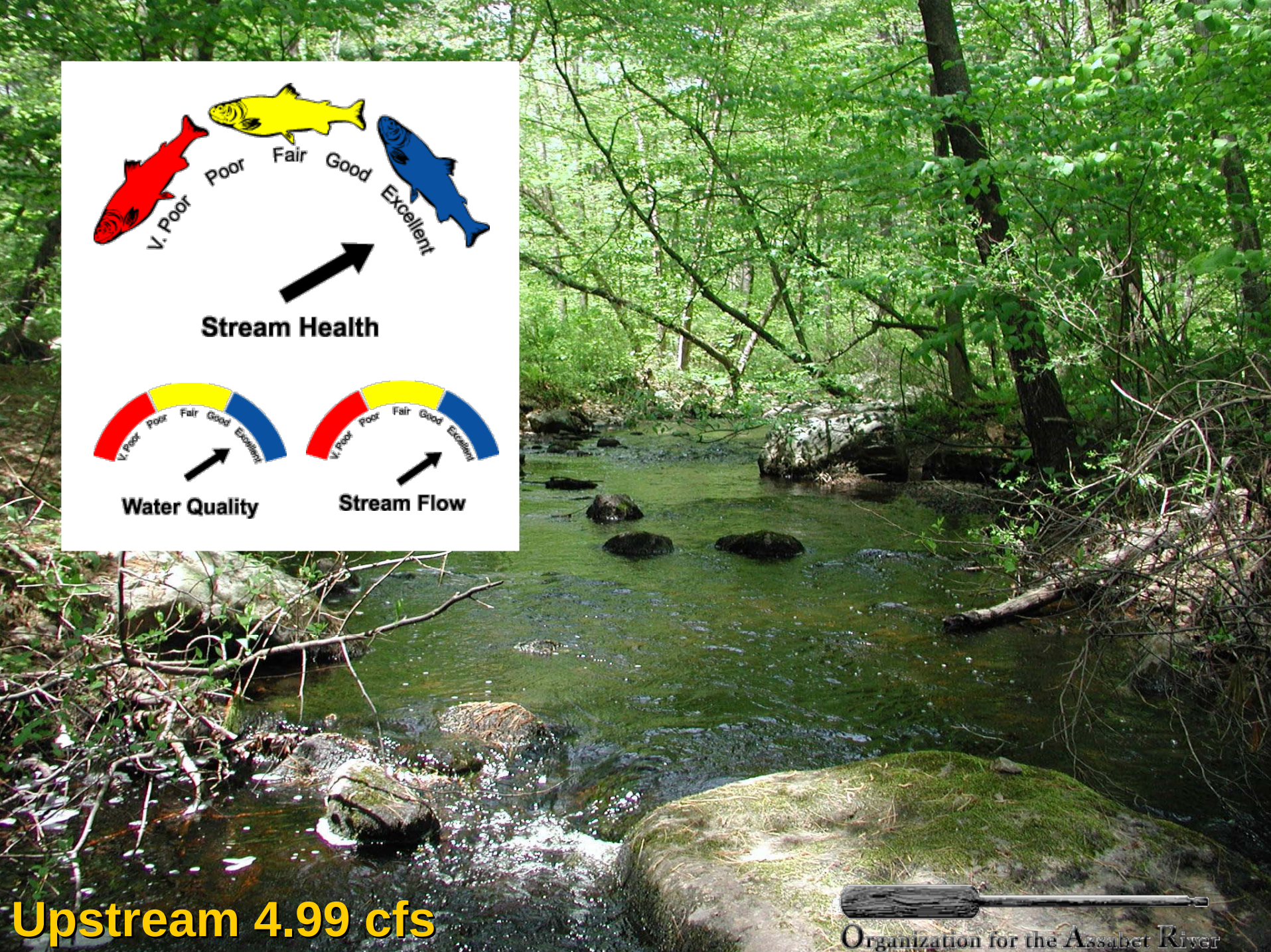
| | |
|---|---|
| 81 -100 | Excellent |
| 61 - 80 | Good |
| 41 - 60 | Fair |
| 21 - 40 | Poor |
| 1 - 20 | Very Poor |

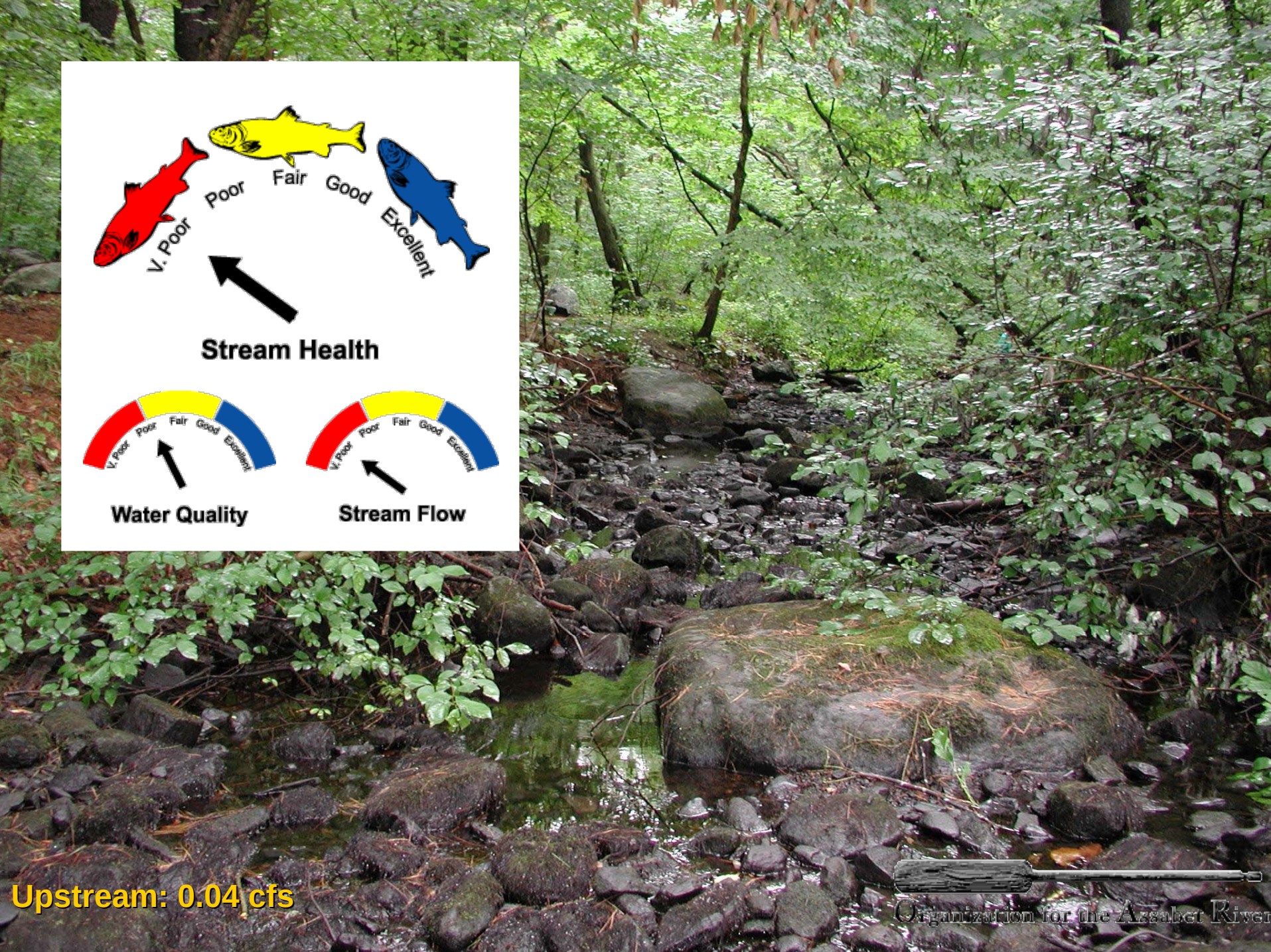


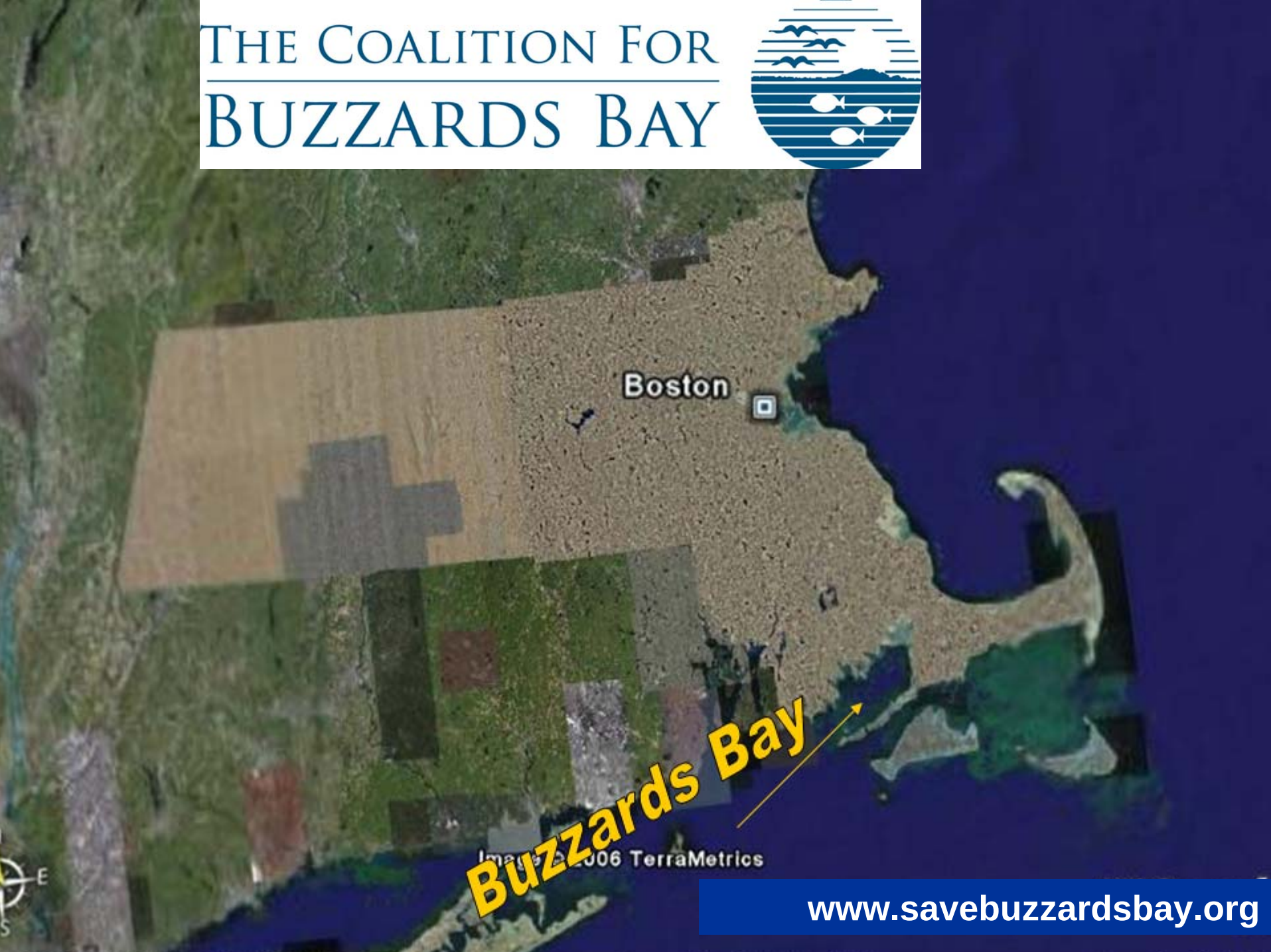

**Danforth Brook Index Readings - Summer 2007**

**for the week ending**

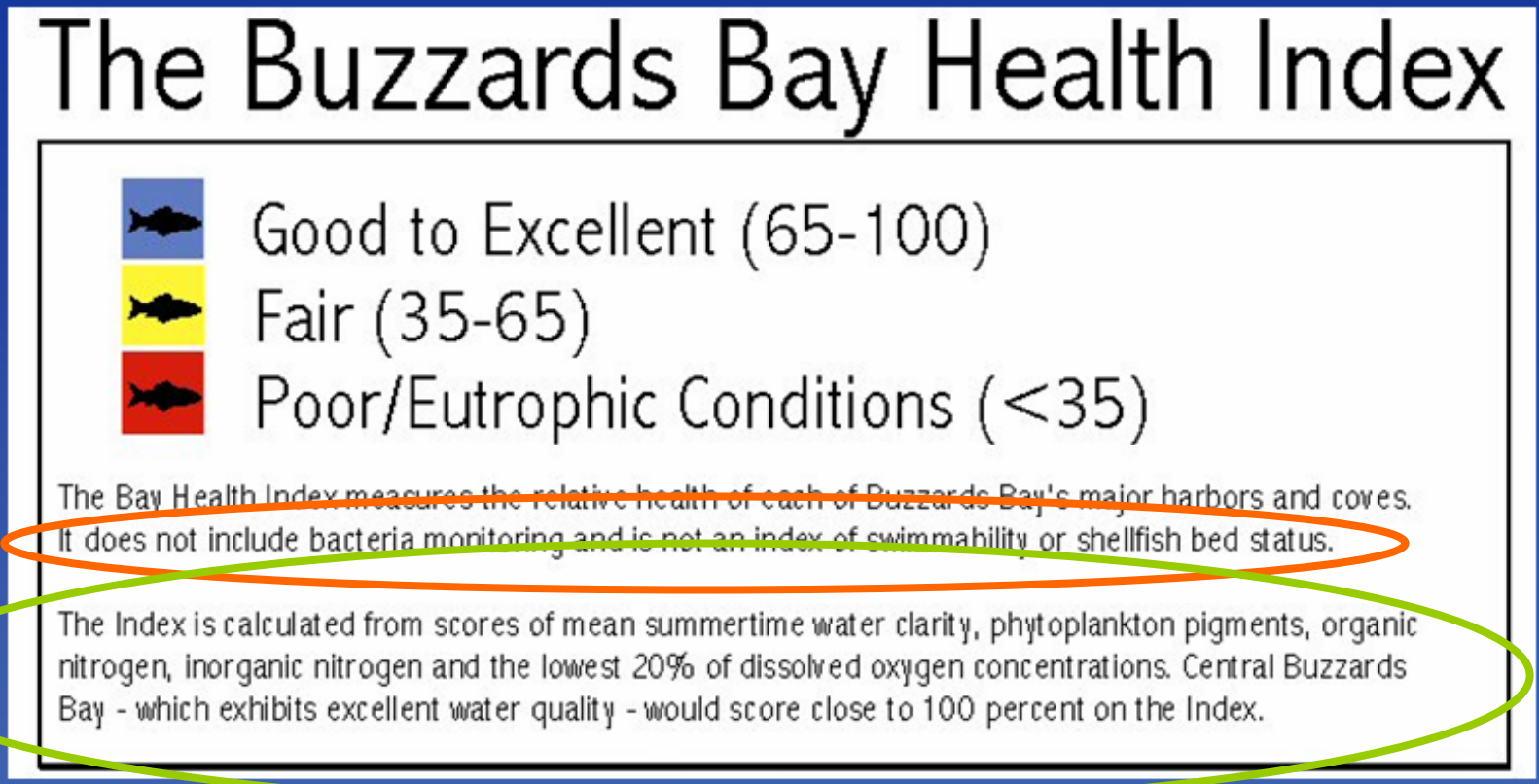
| | 9-Jun | 16-Jun | 23-Jun | 30-Jun | 7-July | 14-July | 21-July | 28-July | 4-Aug | 11-Aug | 18-Aug | 26-Aug | 1-Sep | 8-Sep | 15-Sep | 22-Sep | 29-Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WQ** | 100 | 93 | 93 | 93 | 93 | 80 | 73 | 73 | nr | nr | 63 | 63 | 63 | 63 | 63 | 85 | 85 |
| **Flow** | 100 | 96 | 82 | 81 | 34 | 51 | 39 | 38 | nr | nr | 10 | 9 | 9 | 9 | 17 | 9 | 7 |
| **Habitat** | 100 | 85 | 65 | 65 | 40 | 70 | 50 | 50 | nr | nr | 20 | 15 | 15 | 15 | 35 | 10 | 5 |
| **Stream Health** | 100 | 91 | 78 | 78 | 46 | 65 | 50 | 50 | nr | nr | 18 | 15 | 15 | 15 | 29 | 13 | 9 |


V. Poor
Poor
Fair
Good
Excellent
Stream Health
V. Poor
Poor
Fair
Good
Excellent
Water Quality
V. Poor
Poor
Fair
Good
Excellent
Stream Flow
Upstream 4.99 cfs
Organization for the Assabet River


V. Poor
Poor
Fair
Good
Excellent
Stream Health
V. Poor
Poor
Fair
Good
Excellent
Water Quality
V. Poor
Poor
Fair
Good
Excellent
Stream Flow
Upstream: 0.04 cfs
Organization for the Assabet River

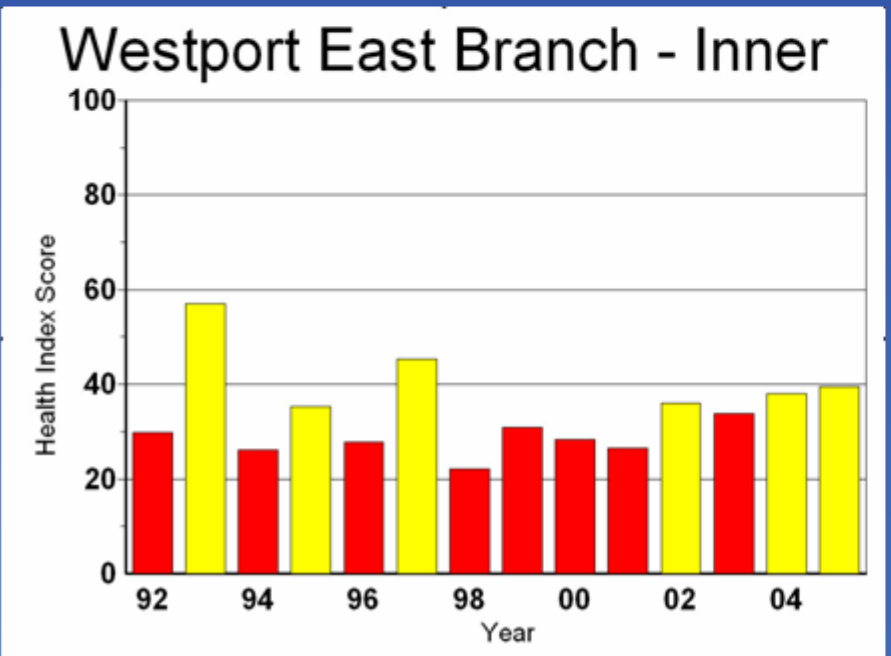

THE COALITION FOR
BUZZARDS BAY
Boston
Buzzards Bay
TerraMetrics
www.savebuzzardsbay.org

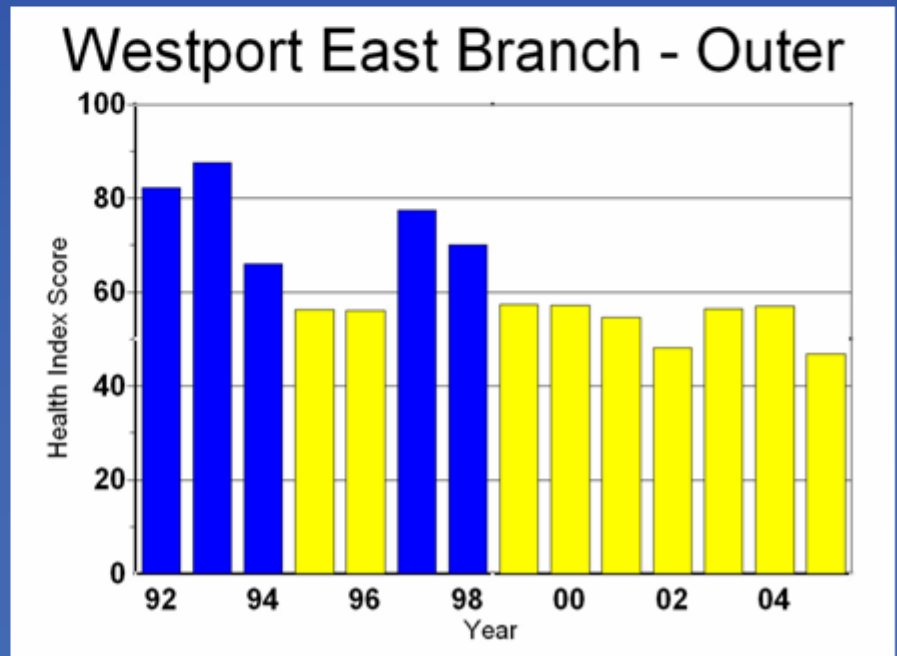
simple, short, educational…



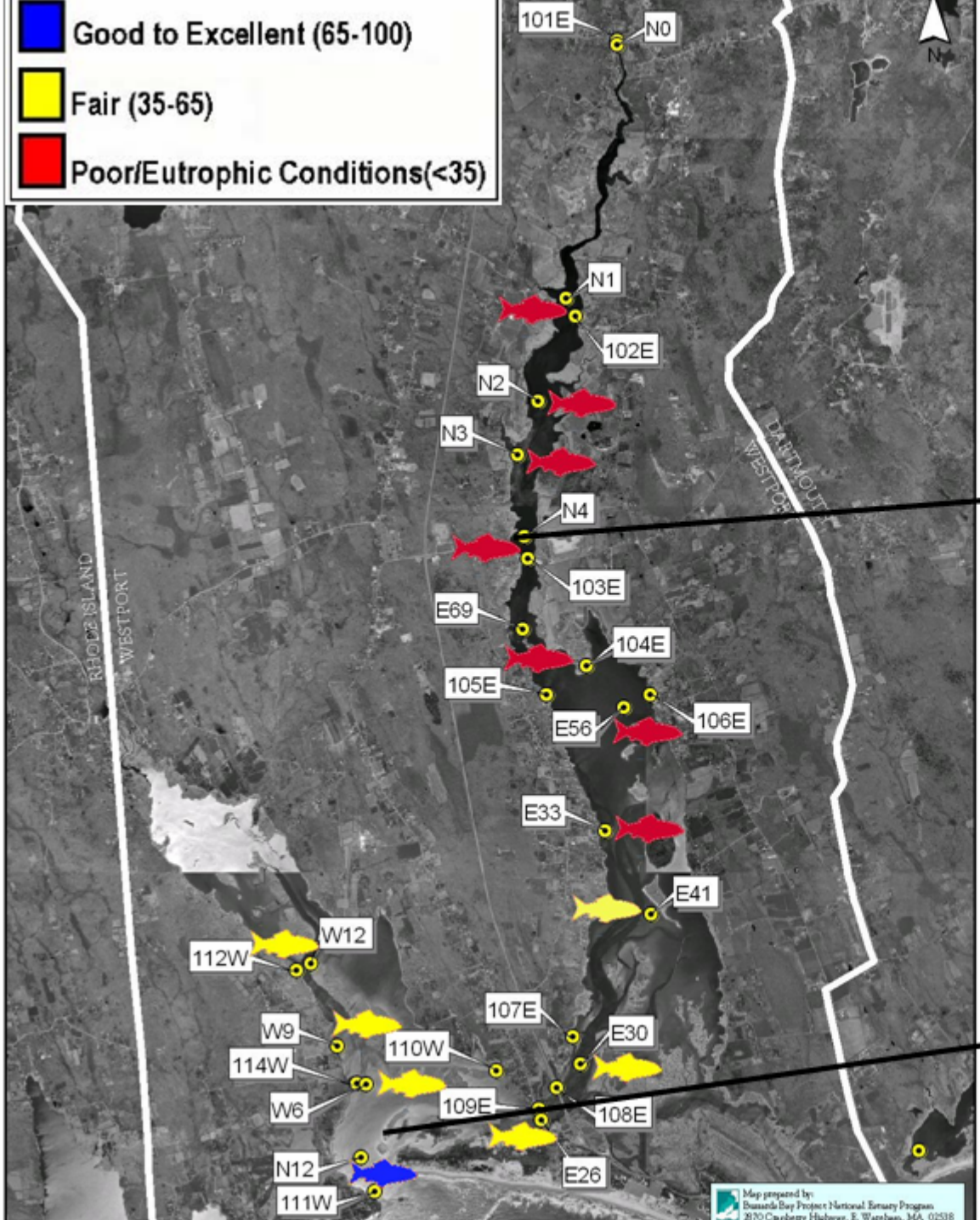

…show long-term ecological trends and as a method to improve the public and town elected officials understanding of local water quality

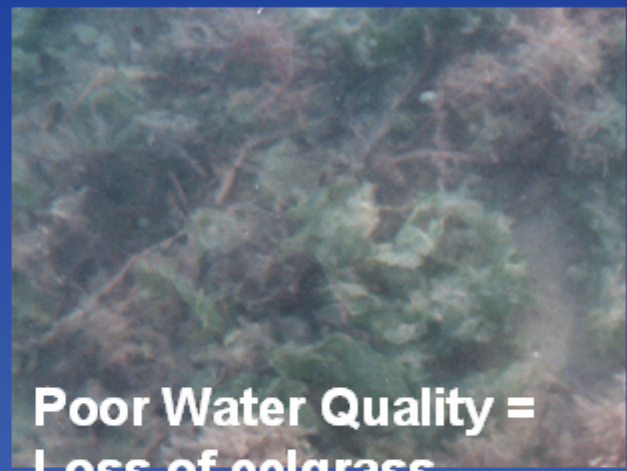
| Parameter | Health Index Score | |
|---|---|---|
| | 0 Point Value | 100 Point Value |
| Lowest 20 % Oxygen Saturation | 40% | 90% |
| Transparency (Secchi) | 0.6 meter | 3.0 meter |
| Chlorophyll | 10.0 µg/L | 3.0 µg/L |
| DIN | .14 ppm | .014 ppm |
| TON | .6 ppm | .28 ppm |



Maps, index color, pictures, text.



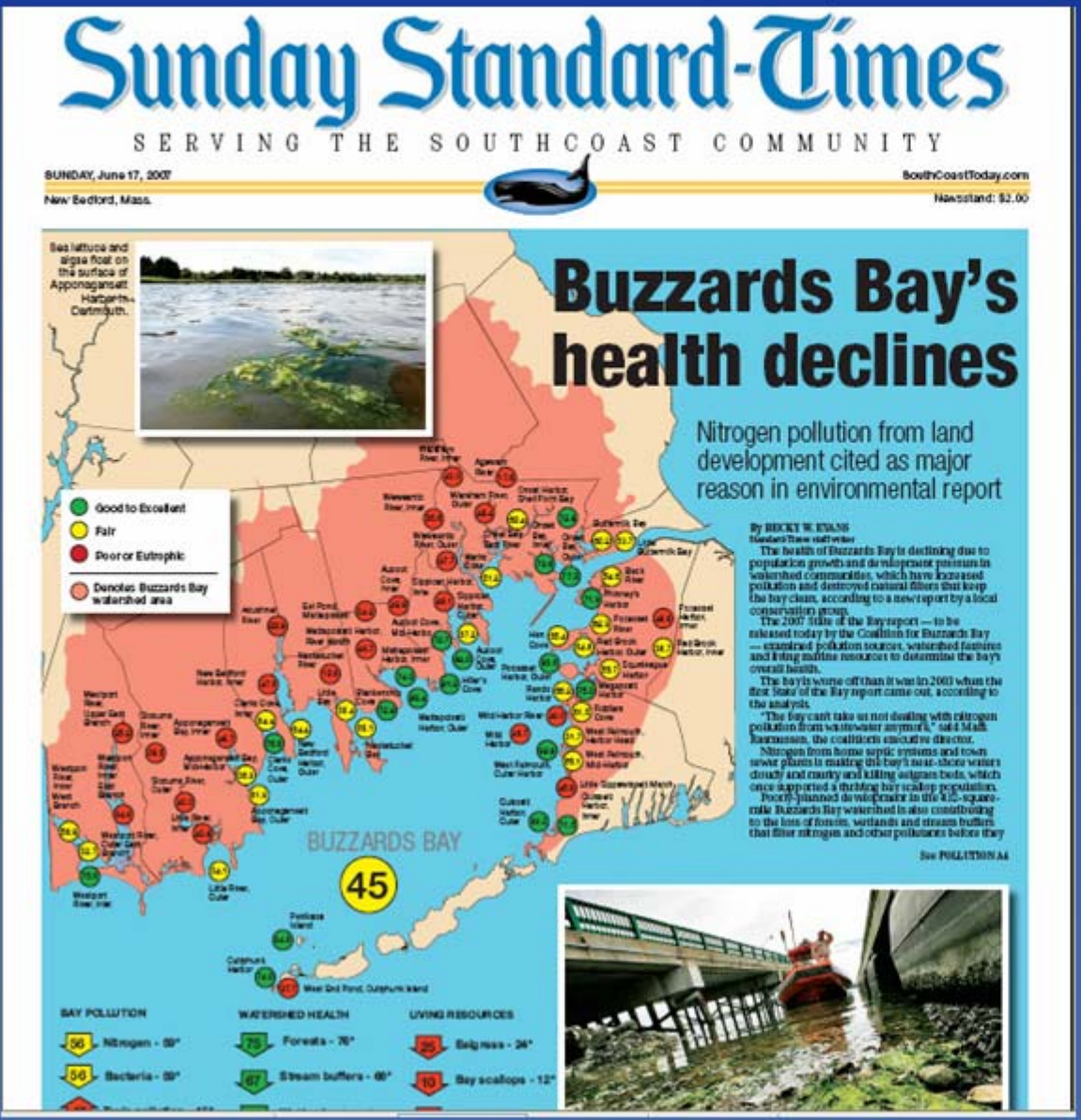



**Poor Water Quality = Loss of eelgrass, fish habitat, species diversity.**


BUZZARDS BAY WATER QUALITY 1992-1998
THE COALITION FOR BUZZARDS BAY • Baywatchers II Report
THE COALITION FOR BUZZARDS BAY

Newspaper articles

Other reports, newsletters



Sunday Standard-Times

SERVING THE SOUTHCOAST COMMUNITY

SUNDAY, June 17, 2007 — SouthCoastToday.com

New Bedford, Mass. — Newsstand: $2.00

Sea lettuce and algae float on the surface of Apponagansett Harbor in Dartmouth.

# Buzzards Bay's health declines

## Nitrogen pollution from land development cited as major reason in environmental report

By BECKY W. EVANS
Standard-Times staff writer

The health of Buzzards Bay is declining due to population growth and development pressure in watershed communities, which have increased pollution and destroyed natural filters that keep the bay clean, according to a new report by a local conservation group.

The 2007 State of the Bay report — to be released today by the Coalition for Buzzards Bay — examined pollution sources, watershed features and living marine resources to determine the bay's overall health.

The bay is worse off than it was in 2003 when the first State of the Bay report came out, according to the analysis.

"The bay can't take us not dealing with nitrogen pollution from wastewater anymore," said Mark Rasmussen, the coalition's executive director.

Nitrogen from home septic systems and town sewer plants is making the bay's near-shore waters cloudy and murky and killing eelgrass beds, which once supported a thriving bay scallop population.

Poorly-planned development in the 432-square-mile Buzzards Bay watershed is also contributing to the loss of forests, wetlands and stream buffers that filter nitrogen and other pollutants before they

See POLLUTION A4

Good to Excellent
Fair
Poor or Eutrophic
Denotes Buzzards Bay watershed area

BUZZARDS BAY

45

BAY POLLUTION
56 Nitrogen - 59*
56 Bacteria - 59*

WATERSHED HEALTH
75 Forests - 76*
67 Stream buffers - 66*

LIVING RESOURCES
25 Eelgrass - 24*
10 Bay scallops - 12*



THE COALITION FOR BUZZARDS BAY

STATE OF THE BAY

2007 SCORE

45

DOWN 3 FROM 48 IN 2003

INCREASING NITROGEN POLLUTION IS DRIVING BAY DECLINE

What's the State of Your Local Harbor or Cove?

56

DOWN 3 FROM 59 IN 2003

BACTERIA

56

DOWN 1 FROM 59 IN 2003

TOXIC POLLUTION

47

UP 2 FROM 45 IN 2003

NITROGEN POLLUTION FUELING DRAMATIC LOSSES OF EELGRASS MEADOWS

25

FORESTS

DOWN 1 FROM 76 IN 2003

75

STREAM BUFFERS

DOWN 1 FROM 68 IN 2003

67

WETLANDS

60

EELGRASS

DOWN 9 FROM 34 IN 2003

1985

2001

RIVER HERRING

DOWN 4 FROM 5 IN 2003

1

LESS EELGRASS, FEWER SCALLOPS

10

BAY SCALLOPS

DOWN 2 FROM 12 IN 2003

# Presenting Indices

**Know your target audience**

- Expertise level
- Particular interest

**Know your objectives**

- Personal: resource use
- Education
- Resource management/regulation
  - Where to target resources
  - Impaired waters designation
  - TMDL development
  - Etc.

# A few general rules…

- The overall “score” is valuable,
- but make supporting detailed information accessible.
- Print score/color on web site home page, familiar icon/box  (like weather info)
- Provide clickable links to more detailed information.

# Create your own indices!

## Jerry Schoen's examples.

- **Trout comfort zone** (Combine DO, temperature, volume of lake containing suitable values. … add duration/frequency of excursions?

- **Boating recreation index** (Number of days when water levels, water quality, weather, etc. (absence of duckweed on lake surface, open channels) combine for "pleasant" boating experiences… add economic impact?)

- **Fishing recreation index** (Similar to boating - # of days when water levels, bug hatches, etc. afford quality fishing)

- **Beach closure days** (see fishing, boating above… for added economic impact, consider extra weight for scores on holiday / high traffic periods).

- **Water clarity / home value index** (Combine Secchi disk data with real estate prices).


Thanks!
Hope this is becoming more clear!
Applying knowledge to improve water quality
Volunteer Water Quality Monitoring
National Facilitation Project
A Partnership of USDA CSREES & Land Grant Colleges and Universities