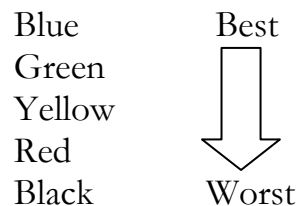# CSLAP Scorecard Criteria

The 2010 CSLAP Scorecard represents an initial attempt to review the results from the Citizens Statewide Lake Assessment Program (CSLAP) sampling at each program lake in a way that provides a quick and simple summary of water quality conditions, lake perception, biological health, and support of lake uses in 2010 and for the "typical" summer results measured since CSLAP sampling began on the lake. The scorecard uses a simple and consistent color scale to evaluate these categories:

Blue   Best
Green
Yellow
Red
Black   Worst

For those categories with insufficient information is available, or for a category that does not apply (such as evaluating potable water use on a lake that is not classified for this use), a white color tab is show. For trends, more significant patterns (intensity and statistical robustness) are represented by larger green or red arrows.

There are many ways to quantify or score conditions related to water quality, lake perception, biological health, and lake usage. The following pages summarize the criteria used to create these scorecards.

It cannot be emphasized strongly enough that this is the first of several attempts to create a lake scorecard. As methods for measuring and evaluating water quality conditions, lake perception, biological condition, and lake usage are identified, and as updated information is received and evaluated, these scorecards (and the scores associated with these categories) will change. It should also be made clear that **water quality assessments and summaries of lake perception provided in these scorecards are limited to information collected through CSLAP, and could be inconsistent with information gathered from other sources.** Biological condition evaluations in particular will change as both CSLAP biological data, particularly macrophytes, macroinvertebrates, and benthic habitat continue to be evaluated, and as additional (non-CSLAP) information gets incorporated into the database for each lake. Water quality assessments are based on data collected from the deepest location in the lake from mostly June through September. Lake perception scores are based solely on responses to the user perception surveys conducted through CSLAP. Lake uses corresponded to the best designated uses identified through the state waterbody classification system, using water quality, lake perception, and biological assessment tools available through CSLAP (and described in the criteria summary).

As these assessments improve, lake scorecards will be updated.

CSLAP Scorecard Criteria

Water Quality Scorecard

General:
The CSLAP water quality dataset is comprised of about a dozen water quality indicators measured biweekly during the summer (June through September). This suite of indicators focuses on lake eutrophication (trophic status), a measure of the greenness of the water and the factors that contribute to or are affected by this greenness. These are measured by total phosphorus, chlorophyll *a* (a measure of a photosynthetic pigment in algae), and Secchi disk transparency. This dataset also includes indicators of general lake characteristics such as lake acidity and ion balance, as measured by pH and conductivity, and deepwater oxygen levels, as "inferred" by phosphorus, ammonia, nitrite, iron, manganese, and arsenic readings collected from the bottom waters of the lake (dissolved oxygen is not measured directly through CSLAP). Future generations of the scorecard may also include some of the other water quality indicators measured through CSLAP.

- **Trophic Status:**
  2010 and All Years Score:
  Mean water clarity, chlorophyll *a,* and total phosphorus each assigned a trophic "score":
  oligotrophic = 3, mesotrophic = 2, eutrophic = 1, based on NYS trophic designations:
  - Eutrophic = Water clarity < 2 meters, Chlorophyll *a* > 8 µg/l, Total phosphorus > 20 ppb
  - Mesotrophic = Water clarity 2-5 meters, Chlorophyll *a* 2-8 µg/l, Total phosphorus = 10-20 ppb
  - Oligotrophic = Water clarity >5 meters, chlorophyll *a* < 2 µg/l, Total phosphorus < 10 ppb
  - **Excellent** = sum of trophic scores > 7
  - **Good** = sum of trophic scores >5
  - **Threatened** = sum of trophic scores >3
  - **Poor** = sum of trophic scores = 3
  - **Not Known** = no trophic data for any of the trophic categories

  Trend Score (five years of data required):
  Annual summer mean water clarity, chlorophyll *a*, and total phosphorus assigned a regression score:
  Regression coefficient: adjusted R^2 >0.5 = 2, adjusted R^2 >0.33 = 1, adjusted R^2 <0.33 = 0;
  P value < 0.01 = 2, P value < 0.05 = 1, P value >0.05 = 0;
  X variable coefficient (direction trend curve): > 0 = 1, < 0 = -1
  - **Highly Improving** =sum of [(R^2 score) * (P value score) * (X variable)] for each trophic indicator > 9
  - **Improving** = sum of [(R^2 score) * (P value score) * (X variable)] for each trophic indicator > 6
  - **Stable** = sum of [(R^2 score) * (P value score) * (X variable)] for each trophic indicator ranges from 6 to -6

Water Quality Scorecard (cont)

- **Trophic Status (cont):**
  - **Degrading** = sum of [(R^2 score) * (P value score) * (X variable)] for each trophic indicator < -6
  - **Highly Degrading** =sum of [(R^2 score) * (P value score) * (X variable)] for each trophic indicator < - 9

- **pH Balance**
  2010 and All Years Score:
  NYS water quality standards are pH < 6.5 and pH > 8.5
  - **Excellent** = not applicable
  - **Good** = mean pH 6.5-8.5
  - **Threatened** = mean pH >8.5 or conductivity < 50 μmho/cm
  - **Poor** =mean pH < 6.5
  - **Not Known** = no pH data available

- **pH Balance (cont)**
  Trend Score (five years of data required):
  Annual summer mean pH and conductivity assigned a regression score:
  Regression coefficient: adjusted R^2 >0.5 = 2, adjusted R^2 >0.33 = 1, adjusted R^2 <0.33 = 0;
  P value < 0.01 = 2, P value < 0.05 = 1, P value >0.05 = 0;
  X variable coefficient (direction trend curve): > 0 = 1, < 0 = -1
  - **Highly Improving** =[(R^2 score) * (P value score) * (X variable)] for pH > 3
  - **Improving** = [(R^2 score) * (P value score) * (X variable)] for pH >1 or [(R^2 score) * (P value score) * (X variable)] for conductivity >1
  - **Stable** = all other scores
  - **Degrading** = [(R^2 score) * (P value score) * (X variable)] for pH < -1 or [(R^2 score) * (P value score) * (X variable)] for conductivity < -1
  - **Highly Degrading** =[(R^2 score) * (P value score) * (X variable)] for pH < -3

- **Dissolved Oxygen**
  2010 and All Years Score:
  "Inferred" oxygen assigned an oxygen "score": 6 = if deepwater ammonia or TP > (10* surface ammonia or TP); 5 = if deepwater ammonia or TP > (5* surface ammonia or TP); 4 = all other situations
  - **Excellent** = not applicable
  - **Good** = all unstratified lakes without evidence of oxygen deficits, if ammonia score = 4 or (ammonia + TP) score <10
  - **Threatened** = if ammonia score = 5, (ammonia + TP) score = 10, or DO profiles show any DO measurements > 1ppb but < 5 ppb
  - **Poor** = if ammonia score = 6 or DO profiles show any DO measurements < 1 ppm
  - **Not Known** = if thermally stratified with no deepwater chemistry data
  Trend Scores = not available in general; trends assessed only if site specific data are available about historic and present dissolved oxygen levels or "management" of hypolimnetic oxygen (with associated data)

CSLAP Scorecard Criteria

Lake Perception Scorecard

General:
The CSLAP lake perception dataset is generated from a standardized *Field Observations Form* completed by all sampling volunteers during each sampling session. These forms include four questions related to lake water quality perception in the open water sampling site, aquatic plant community evaluation in unmanaged nearshore areas (if possible), recreational perception in "areas where people swim and boat", and factors influencing this recreational perception. Responses to the first three questions are offered on a five point scale, with 1 representing the most favorable response and 5 representing the least favorable response. These forms are completed prior to water sample collection to minimize bias toward measured conditions. The water quality and recreational use questions are identical to those used in volunteer lake monitoring programs throughout the country.

- **Water Quality Perception**
  2010 and All Years Score:
  Annual water quality perception score = mean of ordinal scores; (1) = crystal clear; (2) = not quite crystal clear; (3) definite algal greenness, yellowness, or brownness; (4) = high algae levels; (5) severely high algae levels
    - **Excellent** = mean water quality perception score < 1.5
    - **Good** = mean water quality perception score = 1.5 – 2.5
    - **Fair** = mean water quality perception score = 2.5 – 3.5
    - **Poor** = mean water quality perception score = > 3.5
  Trend Scores(five years of data required):
  Annual summer mean water quality assessment assigned a regression score:
  Regression coefficient: adjusted R^2 >0.5 = 2, adjusted R^2 >0.33 = 1, adjusted R^2 <0.33 = 0;
  P value < 0.01 = 2, P value < 0.05 = 1, P value >0.05 = 0;
  X variable coefficient (direction trend curve): > 0 = 1, < 0 = -1
    - **Highly Improving** =[(R^2 score) * (P value score) * (X variable)] > 3
    - **Improving** = [(R^2 score) * (P value score) * (X variable)] > 1
    - **Stable** = [(R^2 score) * (P value score) * (X variable)] = -1 to 1
    - **Degrading** = [(R^2 score) * (P value score) * (X variable)] < -1
    - **Highly Degrading** =[(R^2 score) * (P value score) * (X variable)] < - 3

- **Aquatic Plants Perception**
  2010 and All Years Score:
  Annual aquatic plant perception score = mean of ordinal scores; (1) = not visible; (2) visible but not growing to the lake surface; (3) growing to the lake surface; (4) = growing densely at the lake surface; (5) growing densely to the surface in all but the deepest areas of the lake
    - **Excellent** = mean aquatic plants perception score < 1.5
    - **Good** = mean aquatic plants perception score = 1.5 – 2.5
    - **Fair** = mean aquatic plants perception score = 2.5 – 3.5
    - **Poor** = mean aquatic plants perception score = > 3.5

CSLAP Scorecard Criteria

Lake Perception Scorecard (cont)

- **Aquatic Plants Perception (cont)**
  Trend Scores (five years of data required):
  Annual summer mean aquatic plant perception assigned a regression score:
  Regression coefficient: adjusted $R^2 > 0.5 = 2$, adjusted $R^2 > 0.33 = 1$, adjusted $R^2 < 0.33 = 0$;
  P value $< 0.01 = 2$, P value $< 0.05 = 1$, P value $> 0.05 = 0$;
  X variable coefficient (direction trend curve): $> 0 = 1$, $< 0 = -1$
    o **Highly Improving** = sum of (R^2 score) * (P value score) * X variable > 3
    o **Improving** = sum of (R^2 score) * (P value score) * X variable > 1
    o **Stable** = sum of (R^2 score) * (P value score) * X variable $= -1$ to 1
    o **Degrading** = sum of (R^2 score) * (P value score) * X variable < -1
    o **Highly Degrading** = sum of (R^2 score) * (P value score) * X variable < -3

- **Recreation Perception**
  2010 and All Years Score:
  Annual recreational perception score = mean of ordinal scores; (1) = could not be nicer; (2) = minor aesthetic problems but excellent; (3) slightly impaired for recreational use; (4) = substantially impaired for recreational use; (5) lake not usable
    o **Excellent** = mean recreational perception score < 1.5
    o **Good** = mean recreational perception score $= 1.5 – 2.5$
    o **Fair** = mean recreational perception score $= 2.5 – 3.5$
    o **Poor** = mean recreational perception score $= > 3.5$
  Trend Scores (five years of data required):
  Annual summer mean recreational assessment assigned a regression score:
  Regression coefficient: adjusted $R^2 > 0.5 = 2$, adjusted $R^2 > 0.33 = 1$, adjusted $R^2 < 0.33 = 0$;
  P value $< 0.01 = 2$, P value $< 0.05 = 1$, P value $> 0.05 = 0$;
  X variable coefficient (direction trend curve): $> 0 = 1$, $< 0 = -1$
    o **Highly Improving** = [(R^2 score) * (P value score) * (X variable)] > 3
    o **Improving** = [(R^2 score) * (P value score) * (X variable)] > 1
    o **Stable** = [(R^2 score) * (P value score) * (X variable)] $= -1$ to 1
    o **Degrading** = [(R^2 score) * (P value score) * (X variable)] < -1
    o **Highly Degrading** = [(R^2 score) * (P value score) * (X variable)] < -3

CSLAP Scorecard Criteria

Biological Condition Scorecard

General:
Biological condition can only be measured indirectly and incompletely through the CSLAP dataset. Invasive plant collections and identifications have been conducted in some lakes through CSLAP, and through other programs. The presence (and extent) of harmful algae blooms (HABs) are measured directly through the New York State Department of Health HAB project funded by the Centers for Disease Control (as microcystin-LR concentrations) in some lakes, and phycocyanin screening for the potential presence of cyanobacteria (blue green algae) often associated with HABs has been conducted since 2009 through CSLAP. The presence of invasive animals (such as zebra mussels and spiny waterflea) is not measured through CSLAP but has been verified by other programs in a small number of CSLAP lakes. Fisheries quality can be estimated by the relative weight of three indicator fish (yellow perch, smallmouth bass, and largemouth bass) given the length of the fish in fisheries studies, or by an application of a fish index for biotic integrity (IBI) for lakes with reliable historical (late 1980s) netting data in some CSLAP lakes. Plant diversity can be evaluated with the use of a modified floristic quality index (FQI) for lakes with extensive plant survey data; these FQIs will be updated in 2011. Benthic organism health can be predicted by looking at the frequency of highly intolerant macroinvertebrates; these predictions will be revisited as the state develops lake macroinvertebrate IBIs in the coming years.

- **Invasive Plants**
  <u>2010 and All Years Score:</u>
  - **Favorable** = no evidence of any invasive plants
  - **Threatened** = no evidence of invasive plants, but public launch found in lake or invasive plants found in nearby lake (within 5 miles)
  - **Unfavorable** = documented invasive species found in lake
  - **Not Known** = no aquatic plant information within lake or in nearby lakes

  <u>Trend Scores:</u>
  - **Highly Improving** =active management reduces invasive plant population to scattered individuals for annual plants
  - **Improving** = active management significant reduces invasive plant population of annual or perennial plants
  - **Stable** = no evidence of change
  - **Degrading** = evidence of recent introduction of invasive species
  - **Highly Degrading** =evidence of substantial increase in invasive species populations

- **Harmful Algae**
  <u>2010 and All Years Score:</u>
  - **Favorable** = phycocyanin levels < 100 and microcystin-LR levels < 1
  - **Threatened** = phycocyanin levels > 100
  - **Unfavorable** = microcysin-LR levels > 1 (2010 data not yet available)
  - **Not Known** = no phycocyanin or microcystin-LR data

CSLAP Scorecard Criteria

<u>Trend Scores</u>: score not available

Biological Condition Scorecard (cont)

- **Invasive Animals**
  <u>2010 and All Years Score:</u>
  o **Favorable** = no evidence of any invasive animals
  o **Threatened** = no evidence of invasive animals, but invasive animals found in nearby lake (within 5 miles) and/or calcium levels > 25 mg/l
  o **Unfavorable** = documented invasive animals found in lake
  o **Not Known** = no invasive animal information within lake or in nearby lakes
  <u>Trend Scores</u>: score not available

- **Fisheries Quality**
  <u>2010 and All Years Score:</u>
  o **Favorable** = average relative mean size of collected largemouth bass, smallmouth bass, and yellow perch within 95% of expected or MN fish IBI > 60
  o **Threatened** = average relative mean size of collected largemouth bass, smallmouth bass, and yellow perch 5-10% larger or smaller than expected, MN fish IBI = 40-60, or antidotal information from DEC fisheries evaluation
  o **Unfavorable** = average relative mean size of collected largemouth bass, smallmouth bass, and yellow perch >10% larger or smaller than expected, MN fish IBI < 40, or antidotal information from DEC fisheries evaluation
  o **Not Known** = no information about lake fisheries
  <u>Trend Scores</u>: score not available

- **Plant Diversity**
  Floristic quality index (FQI) calculated based on the average coefficient of conservatism for each plant species and the number of plant species, categorized as "excellent", "fair", "poor" or "very poor"- rating varies based on number of species (minimum five species identified)
  <u>2010 and All Years Score:</u>
  o **Favorable** = FQI = excellent
  o **Threatened** = FQI = fair
  o **Unfavorable** = FQI = poor or very poor
  o **Not Known** = FQI not known or insufficient data to calculate FQI
  <u>Trend Scores</u>: score not available

- **Benthic Organisms**
  Modified macroinvertebrate ordinal quality index (mOQI) calculated using FQI formula, substituting ordinal pollution tolerance value for coefficient of conservatism
  <u>2010 and All Years Score:</u>
  o **Favorable** = mOQI >15 for >12 orders, mOQI > 12 for >8 orders, > 10 for < 8 orders
  o **Threatened**= mOQI >8 and lake not identified as favorable
  o **Unfavorable** = mOQI < 8
  o **Not Known** = no or insufficient macroinvertebrate data
  <u>Trend Scores</u>: score not available

CSLAP Scorecard Criteria

Lake Uses

General:
Lakes are evaluated by New York State as to whether they support their best designated uses. These include potable water, swimming, recreation, aquatic life, aesthetics and fish consumption (and shellfishing for saline ponds). Each of these uses is assessed against the pertinent state water quality standards and guidance values for a variety of water quality and use indicators. Many of these are not measured in CSLAP and as such **any use assessments based on CSLAP data alone are incomplete.** The use assessment categories can be broadly summarized as follows on the state Waterbody Inventory and Priority Waterbody List (WIPWL):

Precluded = frequent/persistent conditions prevents designated use
Impaired = occasional conditions periodically prevents, restricts, or limits use
Stressed = uses supported but occasional conditions periodically discourages use
Threatened = designated uses supported but threat to use exists
Supported = designated use supported

The U.S. Environmental Protection Agency identifies the first two categories as "not supporting use", and the second two categories as "fully supporting" with "minor impacts" or "threats" to use, respectively

- **Potable Water**
  2010 and All Years Score:
  Draft nutrient criteria to protect potable water based on lake classification (AA or A)
  o **Supported** = if not impaired, stressed, or threatened
  o **Threatened** = mean phosphorus exceeds 110% of criteria
  o **Stressed**= mean phosphorus exceeds criteria; if mean deepwater Fe > 1 mg/l; if mean deepwater Mn > 0.5 mg/l
  o **Impaired**= mean chlorophyll exceeds criteria; if mean As > 10 ppm
  o **Not Known** = no chlorophyll or deepwater NH_4 , Fe, Mn, As or lake not used as a potable water supply
  Trend Scores: score not available

- **Swimming**
  Draft nutrient criteria to protect swimming based on lake depth and location:
  2010 and All Years Score:
  o **Supported** = violate no criteria
  o **Threatened** = violate one of three pertinent Secchi disk transparency, chlorophyll *a*, total phosphorus criteria; "slightly impaired" recreational assessments > 10% frequency associated with "poor water clarity" or "excessive algae"
  o **Stressed** = violate two of three pertinent Secchi disk transparency, chlorophyll *a*, total phosphorus criteria; "slightly impaired" recreational assessments > 25% frequency associated with "poor water clarity" or "excessive algae"
  o **Impaired** = violate pertinent Secchi disk transparency, chlorophyll *a*, and total phosphorus criteria
  o **Not Known** = no information about trophic status or recreational assessment

CSLAP Scorecard Criteria

Lake Uses (cont)

- **Boating / Fishing**
    <u>2010 and All Years Score:</u>
    - **Supported** = "slightly impaired" recreational assessments <10% frequency associated with "excessive weeds"; mean pH > 6.5
    - **Threatened** = "slightly impaired" recreational assessments > 10% frequency associated with "excessive weeds"; presence of invasive plants; mean pH < 6.5
    - **Stressed** = "slightly impaired" recreational assessments > 25% frequency associated with "excessive weeds"
    - **Impaired** = choice not available
    - **Not Known** = no information about nuisance weeds or pH
    <u>Trend Scores</u>: score not available

- **Aquatic Life**
    <u>2010 and All Years Score:</u>
    - **Supported** = mean pH 7-8, inferred dissolved oxygen > 4, no evidence of invasive species
    - **Threatened**= dissolved oxygen (from 'Water Quality' score above) = 'threatened"; if invasive species present; mean pH > 8 or mean pH < 7
    - **Stressed** = dissolved oxygen (from 'Water Quality' score above) = 'poor"; mean pH > 8.5; invasive plants and animals present
    - **Impaired** = mean pH < 6.5
    - **Not Known** = no information about pH, inferred D.O., or invasive species
    <u>Trend Scores</u>: score not available

- **Aesthetics**
    <u>2010 and All Years Score:</u>
    - **Supported** = not "threatened" or "stressed"
    - **Threatened** = "lake looks bad" reported at frequency of > 10%; maximum chlorophyll *a* > 30 ug/l; "dense weed growth" at frequency of > 25%; presence of invasive plant species
    - **Stressed** = "lake looks bad" reported at frequency of > 25%
    - **Impaired** = choice not available
    - **Not Known** = no information about lake perception or chlorophyll *a* levels
    <u>Trend Scores</u>: score not available

- **Fish Consumption**
    <u>2010 and All Years Score:</u>
    - **Supported** = no fish consumption advisories
    - **Threatened** = choice not available
    - **Stressed** = fish consumption advisory in hydrologically connected waterbody
    - **Impaired** = fish consumption advisory
    - **Not Known** = score not available
    <u>Trend Scores</u>: score not available