Lake Okeechobee Performance Measure
Fish Population Density, Age Structure, and Condition

Last Date Revised: March 7, 2007

Acceptance Status: Accepted

1.0 Desired Restoration Condition

Improved density, age structure, and condition of black crappie, largemouth bass, and brim in the littoral and nearshore regions of the lake. Increased diversity and extent of forage fish. Fish are expected to respond directly to changes in habitat structure, caused by more favorable water levels, and changes in resource availability, which will be determined in part by external nutrient inputs. Setting quantitative targets for the fish populations requires further research and data collection.

1.1 Predictive Metric and Target

1.2 Assessment Parameter and Target

Increased recruitment for black crappie and largemouth bass. For forage fish, additional research and data collection are needed to establish quantitative targets.

2.0 Justification

Fish are often the most common vertebrates within water bodies and occupy the upper trophic levels of aquatic food webs where they rely on the same or other trophic level life forms for food (USEPA 1993). Fish can be one of the most sensitive indicators of water quality condition and biological integrity in aquatic environments (Smith 1971, Karr 1981, Fausch et al. 1990, Angermeier et al. 1991, among others). Due to their ecological, recreational, and commercial importance, the literature is filled with data on fish species distribution, life histories, ecology, pollution tolerance, and environmental requirements; for examples see Moyle and Cech (1999) or NISC Fish and Fisheries Worldwide database. Fish are directly and indirectly affected by chemical and physical changes in the environment, and the population or community of fish reflects the state of the health of the aquatic environment or watershed as whole. Water quality conditions that significantly affect the lower levels of food webs (e.g., plankton and benthic invertebrates) will affect the abundance and species composition of the fish population (USEPA 1990). In some cases, fish may exhibit signs of being more sensitive than are lower animals and plants – many species of fish have stringent dissolved oxygen requirements and are intolerant to chemical and physical contaminants. Fish communities are also sensitive indicators of macro-habit disturbances (Rankin 1989).

Surveys from 1987-1999 indicate that black crappie and largemouth bass recruitment has declined (Furse and Fox 1994, SFWMD 2007). Continued excess phosphorous loading and loss of native macrophyte habitat are major stressors contributing to these declines. There is a need to closely monitor recruitment of black crappie and largemouth bass in response to changes in water level schedules, aquatic plant abundance, phosphorus loads, and changes in the zooplankton and macroinvertebrate assemblages. Population dynamics of small forage fish also need to be monitored as a critical food resource for the larger, economically important fish.

3.0 Scientific Basis

3.1 Relationship to Conceptual Ecological Models

The indicator for this performance measure is an ecological attribute (Fish status) in the following conceptual ecological models:

Regional Models

Lake Okeechobee

Ecological Model for Hypothesis Clusters

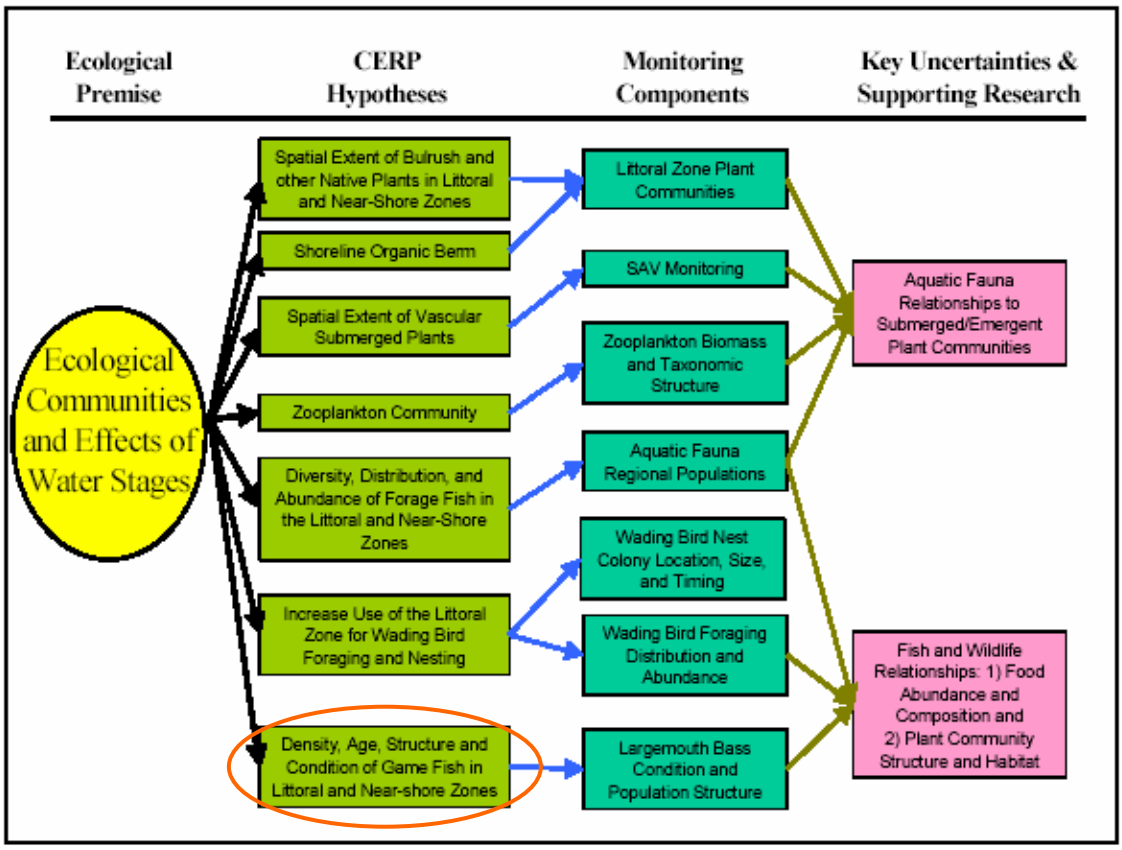
Ecological Communities and Effects of Water Stages Conceptual Ecological Model

3.2 Relationship to Adaptive Assessment Hypothesis Clusters

Ecological Premise: Sustained lake levels and a reduction of spring recession conditions have resulted in the degradation and reduction of the predrainage fish communities in Lake Okeechobee.

CERP Hypotheses: Providing a reduction in the frequency of extreme high water levels (stage >17 feet and stage >15 feet for more than 12 consecutive months) and low water levels (stage <11 feet and stage <12 feet for more than 12 consecutive months) and an increase in the frequency of spring recessions (yearly stage decline from near 15.5 feet in January to near 12.5 feet in June, with no reversal >0.5 feet) will result in the following changes (see Havens 2002 for details):

- Increase in spatial extent of bulrush along the western lakeshore; increased spatial extent of spikerush, beakrush, and other native plants in the littoral zone is expected to increase fish habitat
- Increase in spatial extent of vascular submerged plants, in particular eelgrass, peppergrass, and southern naiad is expected to increase fish habitat
- Shift in taxonomic structure of zooplankton to better support fishery resources
- Increase in diversity, distribution, and abundance of forage fish in the littoral and near-shore zones
- Improvement in the density, age structure, and condition of black crappie, largemouth bass, and bream in the littoral and near-shore zones



4.0 Evaluation Application

4.1 Evaluation Protocol

4.2 Normalized Performance Output

4.3 Model Output

4.4 Uncertainty

5.0 Monitoring and Assessment Approach

5.1 MAP Module and Section

See *CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research* - Lake Okeechobee Module section 3.4.3.6 (RECOVER 2004a). Pre-CERP implementation monitoring of species specific (black crappie; largemouth bass) and community level fish population dynamics and associated factors by the Florida Fish and Wildlife Conservation Commission (FFWCC) commenced in August, 2005 and summer monitoring will continue on an annual basis through 2008. Adult black crappie abundance is being evaluated using annual otter trawl data. The largemouth bass community is being sampled annually with electrofishing gear. Age and growth statistics for adult black crappie, largemouth bass and all other fish encountered are being determined using appropriate techniques and methodologies. Community level fish population dynamics in emergent and submergent vegetation are being monitored with block nets on an annual basis by a contractor of the SFWMD. This

monitoring is anticipated to be conducted for a five year period (2006-2010), with the base period data being the extensive quantitative data collected during 1989-91 by the FFWCC. An equivalent five-year monitoring program of fish population dynamics in the vegetated littoral zone will be evaluated quantitatively with blocknets and other appropriate sampling equipment using the base period data previously described. The gizzard shad and threadfin shad community will be monitored annually with standardized gill nets and various types of traps and nets for other littoral forage fish will be employed.

5.2 Assessment Approach

6.0 Future Tool Development Needed to Support Performance Measure

6.1 Evaluation Tools Needed

6.2 Assessment Tools Needed

7.0 Notes

This Performance Measure supersedes and addresses LO-13, Lake Okeechobee Fish Population Density, Age Structure, and Condition (Last Date Revised: November 8, 2004), and LO-14, Lake Okeechobee Fish and Aquatic Fauna : Fish and Invertebrates (Last Date Revised:. November 8, 2004).

8.0 Working Group Members

Bruce Sharfstein (SFWMD)
Bob Pace (USFWS)
David Hallac (USFWS)
Greg Graves (SFWMD)
Linda McCarthy (FDACS)
Tom James (SFWMD)
Andy Rodusky (SFWMD)

9.0 References

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