INTEGRATED ASSESSMENT OF CISCO *Coregonus artedi* RESTORATION IN LAKE MICHIGAN

FACT SHEET: STATUS AND TRENDS

Great Lakes Commercial Harvest

Cisco, historically one of the most abundant native forage species in the Great Lakes, supported large commercial fisheries. Yields reached unsustainable levels and by 1970, populations and fisheries had collapsed in all of the Great Lakes (Figure 1). Annual commercial yield and averaged 12 million kg during 1910–1955 and peaked at 33.9 million kg in 1918 but by 1992 declined to 0.35 million kg. Declines are primarily attributed to overfishing, habitat degradation, and invasive species. Populations and fisheries have failed to recover to historic levels in all Great Lakes but have staged a recovery in Lake Superior.

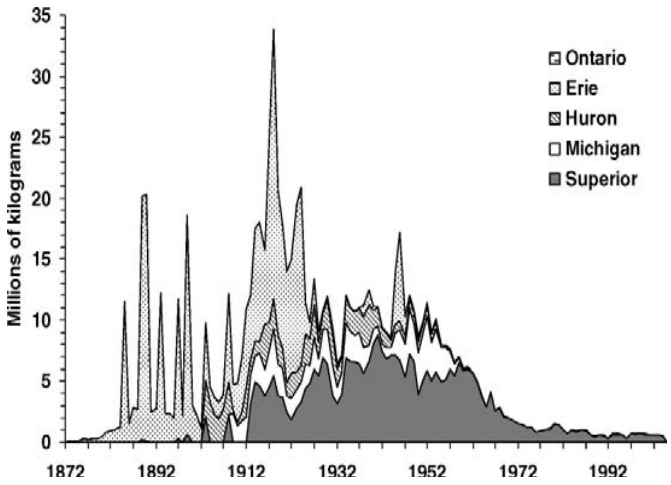

Figure 1: Reported annual commercial yield of ciscoes from the Great Lakes 1872-2004 from Stockwell et al (2009).

Lake Michigan Harvest

The Lake Michigan Cisco commercial fishery crashed in the early 1960s (Figure 2). In recent years, the majority of Cisco are harvested by recreational fishers licensed by the state of Michigan and to a lesser extent Cisco are harvested as bycatch by CORA licensed fishers targeting Lake Whitefish. Ciscoes are increasingly present in recreational and commercial fisheries in northern Lake Michigan (see fishery summaries below).

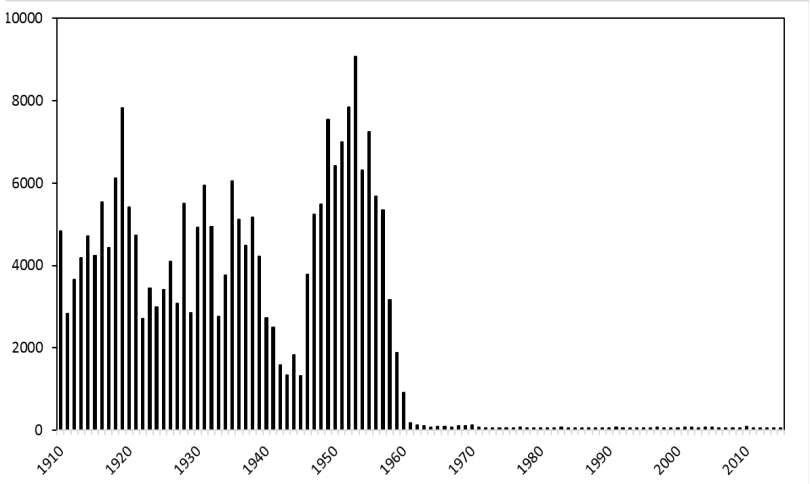

Figure 2: Commercial landings of Cisco (thousands of pounds) in Lake Michigan 1910 - 2015 (from Broadway et al 2017 with data from Baldwin et al 2009, CORA and MDNR harvest).

Lake Michigan Contemporary Distribution and Trends

Cisco distribution is expanding. Fish have been detected in locations previously unknown throughout northern Lake Michigan in surveys and commercial fisheries (Figure 3).

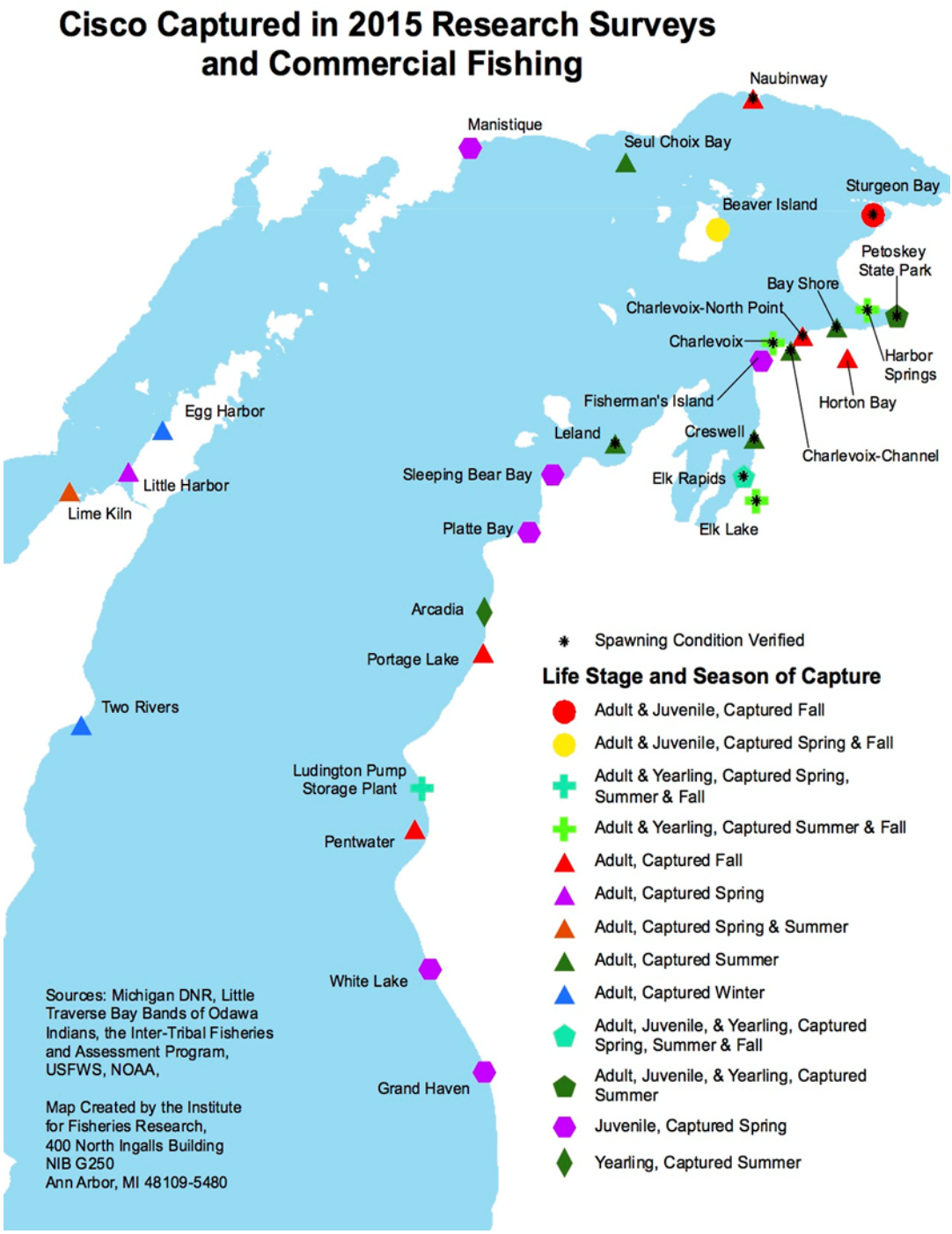

Figure 3. Location of Cisco captured in Lake Michigan in 2015

Trends in Contemporary Fisheries

Increased catches are observed in recreational and commercial fisheries. Recreational fisheries harvested nearly 25,000 kg in 2016 (Figure 4), most of which occurred in Grand Traverse Bay. The harvest of Cisco in recreational fisheries is expanding and occurred in ports as far south as Muskegon. Harvest by charter boat fisheries also occurs however data are not available as Cisco are currently not a listed species on standardized Charter fishery harvest report forms. Harvest of Cisco by Tribal commercial fisheries has increased during the last four years reaching 3,000 kg in 2015 (Figure 4). Most of the commercial harvest is from gillnet and trap nets operations in Grand Traverse Bay (Figure 5).

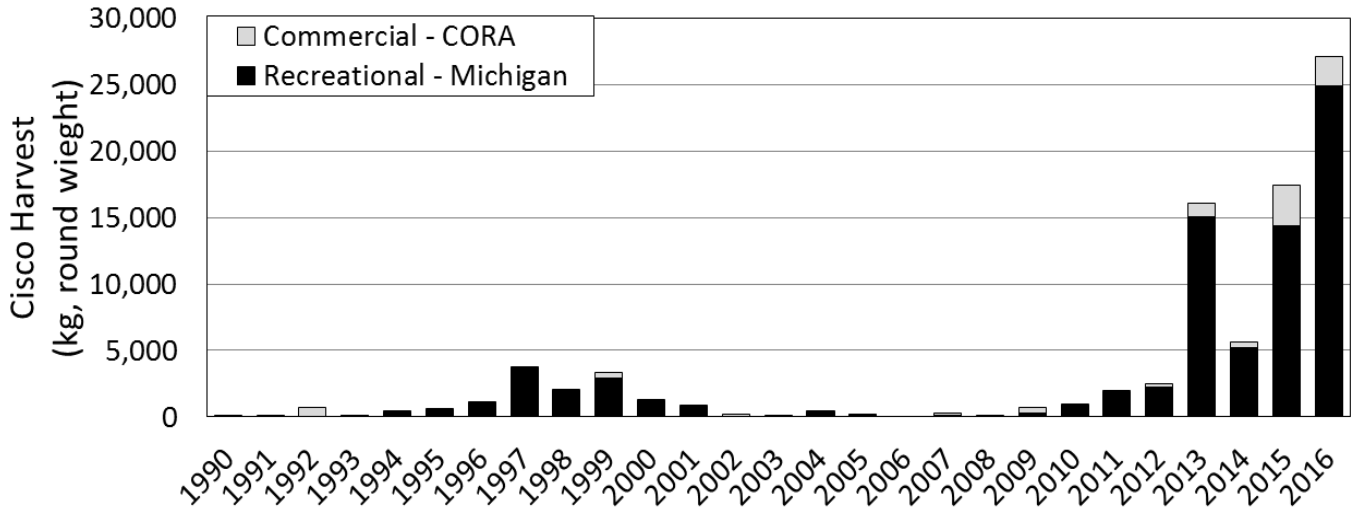

Figure 4: Cisco catch (in kg) in Lake Michigan fisheries 1990-2016. Tribal data are from the CORA database (provided by Donner LTBB); recreational data are from the Michigan Creel Database (Kolb 2017).

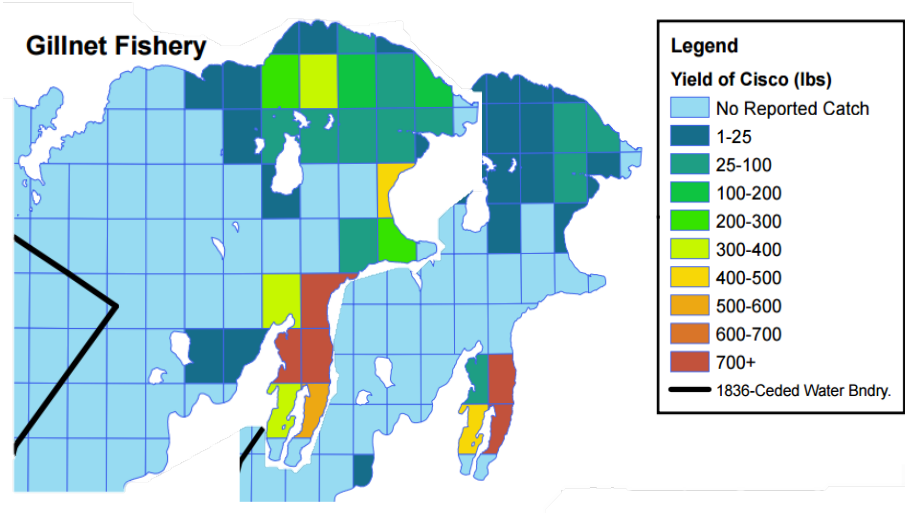

Figure 5: Spatial distribution of aggregated 2011-2016 Cisco commercial catch (in lbs) in gillnet and trapnet fisheries in northeastern Lake Michigan.

Trends in Fishery Independent Surveys

In general, surveys conducted in Lake Michigan show an expanding Cisco distribution and abundance. Independent gill net surveys of spawning Cisco in Grand Traverse Bay in the fall show increasing catch rates (Figure 6) (Claramunt et al In Review). Additional signs of recovery are evident in Coregonid recruitment surveys. Larval densities have increased in the Coregonid Neuston net survey, conducted in spring at the Elk Rapids reef complex in east Grand Traverse Bay (Figure 7). In addition, catch rates of Cisco in gillnet surveys at the Ludington Pump Storage Plant increased nearly 10-fold from 2009 to 2015 (Broadway et al 2017).

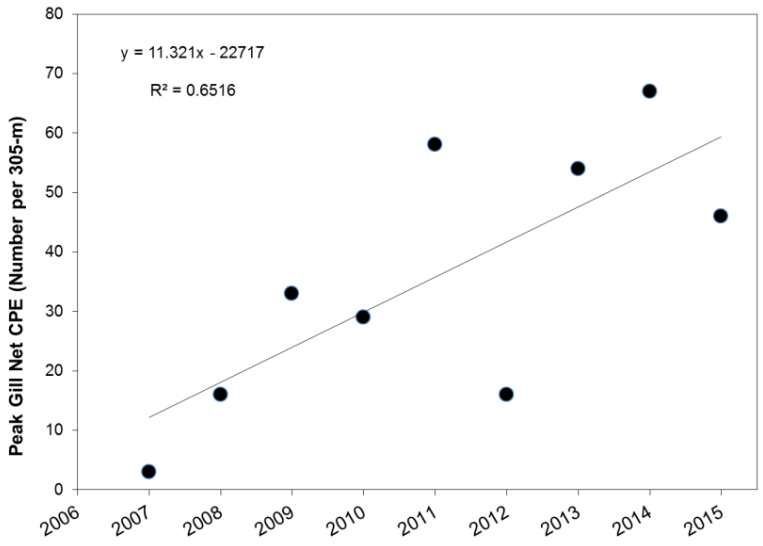

Figure 6: Peak catch rates of spawning Cisco in Elk Rapids reef gillnet surveys, 2007 to 2015.

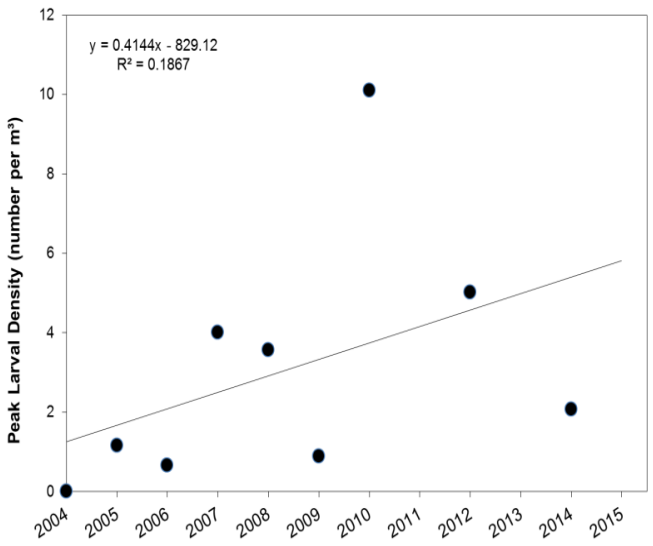

Figure 7. Peak density of Cisco larval Neuston net surveys in Elk Rapids reef, 2004 to 2015

Future Directions

To evaluate distribution and abundance of Cisco in Lake Michigan, consistent and standardized lake-wide surveys would be useful. Current information from surveys specific to evaluate Cisco is limited to particular areas. The extensive interagency surveys, such as the Lake-Wide Assessment Plan and Forage Fish assessments, were not designed to evaluate Cisco populations. There are efforts to establish lake-wide surveys to develop standardized indices of abundance of early life stages and adults to understand recruitment dynamics and to evaluate population trends. This information is necessary to improve Cisco management.

Sources:

Baldwin, N. A., R. W. Saalfeld, M. R. Dochoda, H. J. Buettner, and R. L. Eshenroder. 2009. Commercial fish production in the Great Lakes 1867-2006. A database available from www.glfc.org/databases/commercial/commerc.php [accessed1 April 2017].

Broadway, K., K. Donner, R. Claramunt, and J. Smith. 2017. State of Lake Michigan 2011-2015 Report: Inshore and Benthivore Section – Cisco.

Eshenroder, R. L., P. Vecsei, O. T. Gorman, D. L. Yule, T. C. Pratt, Mandrak, N. E., Bunnell, and A.M. Muir. 2016 Ciscoes (*Coregonus* subgenus *Leucichthys*) of the Laurentian Great Lakes and Lake Nipigon [Online]. Available from: www.glfc.org/pubs/misc/Ciscoes_of_the_Laurentian_Great_Lakes_and_Lake_Nipigon.pdf [accessed 1 April 2017].

Claramunt, R. M., J. Smith, K. Donner, A. Povolo, M. Herbert, T. Galarowicz, and S. DeBoe. *In Review*. Reemergence of a remnant Cisco (*Coregonus artedi*) stock in Lake Michigan.

Kolb, T. 2017. Michigan Creel Database. State of Michigan Creel Database available at https://midashboard.michigan.gov/Quality-of-Life/Michigan-Creel-Data-Harvest/gwqu-7tmg/data.

Stockwell, D.J., Ebener, M.P., Black, J., Gorman, O.T., Hrabik, T.R. Kinnunen, R.E., Mattes, W.P., Oyadomari J.K., Schram, S.T., Schreiner, D.R., Seider, M.J., Sitar, S.P., and D.L. Yule, *2009*. A synthesis of cisco recovery in Lake Superior: Implications for Native Fish Rehabilitation in the Laurentian Great Lakes. North American Journal of Fisheries Management 29:626-652.