

Three BUIs will remain impaired on the United States (U.S.) side of the St. Clair AOC: Restrictions on Fish and Wildlife Consumption, Restrictions on Drinking Water Consumption or Taste and Odor Problems, and Loss of Fish and Wildlife Habitat.

History

According to the Stage 1 Remedial Action Plan (RAP), the reason for the Bird or Animal Deformities or Reproduction Problems BUI in the St. Clair River was chironomid mouth part deformities. The Stage 1 states the existence of “an abnormally high number of mouth-part deformities” in “some chironomid species along the Ontario side of the river below the Sarnia Industrial Complex.” The Stage 1 continues indicating that “no other evidence of reproductive problems or deformities have been noted in the wildlife populations in the Area of Concern” (OMOE and MDNR 1991).

The Stage 2 reiterated that “chironomid mouth part (ligula) deformities” are the basis for the beneficial use impairment (MDEQ 2008).

In the 1995 document *Water Use Goals, Remedial Measures, and Implementation Strategy*, the intent was to remove this impairment “when mouthpart anomalies occur at rates similar to incidences in ‘control’ populations” (OMOE and MDNR 1995).

However, in a 1997 memo the OMOE recommended that “the chironomid mouthpart deformities alone should not be used as a basis for impairment status, but should be evaluated as a component of benthic community health” (OMOE 1997c) thereby moving the issue of chironomid mouthpart deformities to be assessed under the Degradation of Benthos BUI and evaluating the issue of Bird or Animal Deformities using a different criteria.

Also using this approach on the Michigan side of the St. Clair River, and again referring to the Stage 1 RAP we find that, “benthic community health is good on the Michigan side of the river,” (OMOE and MDNR 1991) and that the issue with chironomid mouthpart deformities was concentrated in the area adjacent to the Sarnia Industrial Complex. Further, following an extensive literature search and review, the Degradation of Benthos BUI was removed on the U.S. side in 2014 as “the existing macroinvertebrate community structure along the U.S. side of the St. Clair River showed generally good benthic health and stable communities given the available habitat” (MDEQ 2014).

Therefore, we are left to assess the Bird or Animal Deformities BUI using the State of Michigan’s criteria established in 2008 specifically evaluating the vertebrate fish and wildlife species within in the St. Clair River Area of Concern boundary.

Removal Criteria

The Bird or Animal Deformities or Reproduction Problems BUI will be considered restored according to the state’s *Guidance*, as follows:

Restoration of this BUI will be demonstrated using two approaches, depending on availability of data in a particular AOC. The first approach evaluates restoration based on field assessment of birds and/or other wildlife in those AOCs where MDEQ or other State-approved bird and wildlife data are available.

The second approach will be applied in those AOCs where bird and other wildlife data are not available, and uses levels of contaminants in fish tissue known to cause reproductive or developmental problems as an indicator of the likelihood that deformities or reproductive problems may exist in the AOC.

Approach 1 – Observational Data and Direct Measurements of Birds and Other Wildlife

- *Evaluate observational data of bird and other animal deformities for a minimum of 2 successive monitoring cycles in species identified in the RAP as exhibiting these problems. If deformity or reproductive problem rates are not statistically different than inland background levels (at a 95% confidence interval), or no reproductive or deformity problems are identified during the two successive monitoring cycles, then the BUI is restored. If the rates are statistically different, it may indicate a source from either within or from outside the AOC. Therefore, if the rates are statistically different or the amount of data is insufficient for analysis, then:*
- *Evaluate tissue contaminant levels in egg, young, and/or adult wildlife. If contaminant levels are lower than the Lowest Observable Effect Level (LOEL) for that species or are not statistically different than inland control populations (at a 95% confidence interval), then the BUI is restored.*

Data for a comparison study must come from a control site which is agreed to by the MDEQ, in consultation with MDNR. It will be chosen based on physical, chemical, and biological similarity to the AOC and the 2 sites must be within the same U.S. EPA Level III Ecoregions for the Conterminous U.S.

Where direct observation of wildlife and wildlife tissue data is not available, the following approach will be used:

Approach 2: Fish Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems

- *If fish tissue concentrations of PCBs, dioxins, DDT, or mercury (as determined in the RAP) contaminants of concern in the AOC are at or lower than the LOEL known to cause reproductive or developmental problems in fish-eating birds and mammals, the use impairment is restored.*

OR

- *If fish tissue concentrations of PCBs, dioxins, DDT, or mercury in the AOC are not statistically different than the associated Great Lake (at 95% confidence interval), then the BUI is restored. In the connecting channel AOCs, either the upstream or downstream Great Lake may be used for comparison.*

Fish of a size and species to be prey for the wildlife species under consideration must be used for the tissue data.

The attached excerpt from the Guidance (pages 22-26) includes the rationale for the delisting criteria (Attachment A).

Data Review and Analysis

Bald Eagles:

At the time the Stage 1 RAP was written in 1991, there were no bald eagle (*Haliaeetus leucocephalus*) territories within the boundary of the AOC. However, one nesting site was recently established on Harsens Island in the St. Clair River delta. The nest is located adjacent to the DNR Wildlife Division Field Office on the island (Figure 2).

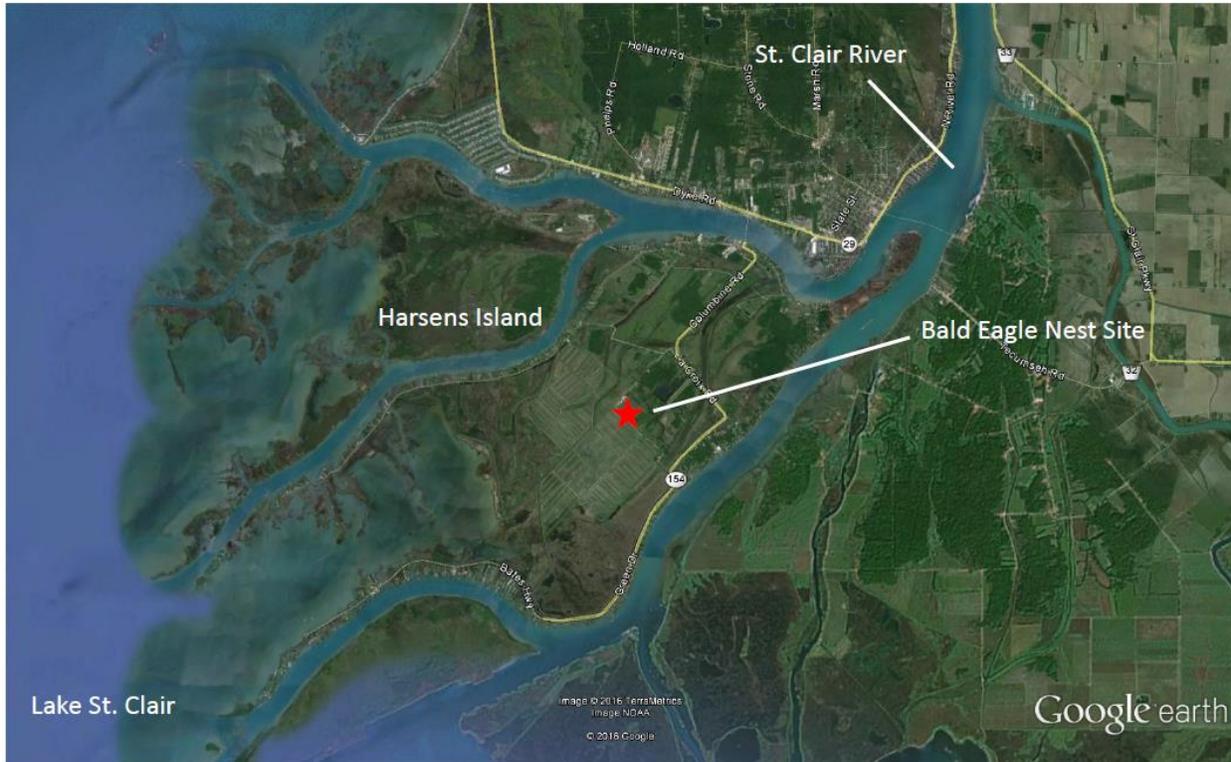


Figure 2: Location of Bald Eagle Nest on Harsens Island.

Monitoring began at the Harsens Island nesting site in 2011 for both productivity and the concentration of p,p'-DDE and PCBs in the plasma of eaglets. The productivity of a bald eagle population can be quantified by dividing the total number of fledged young by the number of occupied nests (Postupalsky, 1974). It has been further demonstrated that a productivity average of at least 0.7 young per occupied nest is considered a stable population while 1.0 young per occupied nest is considered healthy (Sprunt et al. 1973). The five year average productivity for the Harsens Island nesting site is at 0.8 indicating a stable population (Table 1).

Table 1: Bald Eagle Productivity in the St. Clair River AOC (Bohr, personal communication, June 21, 2016).

Year	2011	2012	2013	2014	2015	Average
Number of Fledged Young	1	0	1	0	2	0.8

In 2011 one sample was taken from an eaglet on Harsens Island and analyzed for p,p'-DDE and PCBs. The concentration of p,p'-DDE and PCBs in the plasma can be correlated to productivity (Bowerman et al. 2003). Table 2 shows the eaglet plasma concentrations of p,p'-DDE and PCBs that are associated with health and stable eagle populations (Bowerman et al. 2003). The concentration of p,p'-DDE and PCBs measured in the plasma for the eaglet collected in 2011 would be associated with a stable population.

Table 2: Bald Eagle Plasma Concentration in the St. Clair River AOC (Bush and Bohr 2015).

Contaminant	Plasma Concentrations (µg/kg)		
	Healthy Population	Stable Population	St. Clair River
PCB	35	125	43
p, p'-DDE	11	28	14

Mink:

Mink (*Mustela vison*) are a valuable sentinel species for assessing impacts of contaminants to aquatic ecosystems and as a “piscivorous mammal, mink can bioaccumulate appreciable concentrations of certain pollutants and have been shown to be sensitive to their toxic effects.” (Basu et. al. 2007). Not only can mink be used as an indicator of exposure to contaminants in the environment, but they have been studied extensively and can be used to assess impacts to aquatic ecosystems due to their sensitivity to various contaminants.

In 2013, 15 mink livers were collected from three different zones on Harsens Island (Figure 3).

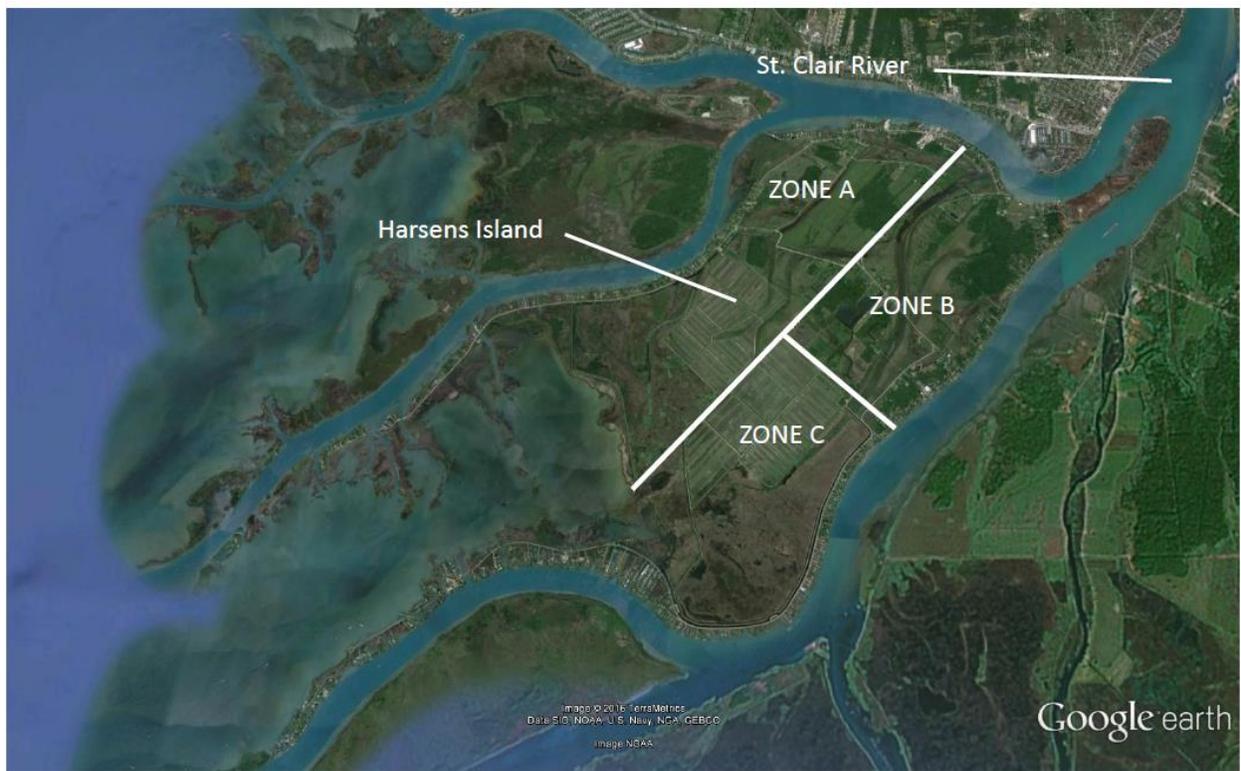


Figure 3: Map of three zones in which mink were collected from Harsens Island.

From these 15 samples, three composite liver samples were processed and analyzed for PCBs by the MDEQ (Table 3).

Table 3: The concentrations of PCBs measured in the livers of mink collected from Harsens Island in 2013 (Bush and Bohr 2015).

Zone	No. of Samples in Composite	Percent Lipid	Total PCB Concentration (mg/kg)
A	2	2.76	0.020
B	7	3.67	0.026
C	6	2.96	0.016

Multiple laboratory studies have documented the reproductive and developmental effects of PCBs on mink. The PCB concentrations found in the mink livers from Harsens Island can be compared to these studies in which mink were fed fish contaminated with PCBs to determine either the concentration at which no adverse effect is found (NOAEC) or at the lowest concentration at which an adverse effect was found (LOAEC). The results of the studies applicable to Harsens Island mink results are found in Table 4. The PCB concentrations in mink livers from Harsens Island are “well below concentrations shown to cause deformities in mink” (Bush and Bohr 2015).

Table 4: Liver concentrations of PCBs associated with reproductive and developmental effects in mink fed contaminated fish (Bush and Bohr 2015).

NOAEC (No Observed Adverse Effect Concentration)	LOAEC (Lowest Observable Adverse Effect Concentration)	Study Location (Reference)
3.1 mg/kg PCBs	3.1 mg/kg PCBs (kit survival at six weeks)	Housatonic River (Bursian et al., 2006a)
0.73 mg/kg PCBs	1.7 mg/kg PCBs (jaw lesions)	Housatonic River (Bursian et al., 2006b)
8.1 mg/kg PCBs	16 mg/kg PCBs (jaw lesions)	Saginaw River (Bursian et al., 2006c)
2.2 mg/kg PCBs	2.9 mg/kg PCBs (kit weight at six weeks)	Hudson River (Bursian et al., 2013a)
0.053 mg/kg PCBs	1.2 mg/kg PCBs (jaw lesions)	Hudson River (Bursian et al., 2013b)
Not Available	2.2 mg/kg PCBs (kit survival and weight at three and six weeks)	Saginaw Bay (Heaton et al., 1995)
6.0 mg/kg PCBs	7.3 mg/kg PCBs	Oak Ridge Reservation (Halbrook et al., 1999b)

Tree Swallows:

From 2010 to 2015, tree swallows (*Tachycineta bicolor*) were sampled throughout the Great Lakes on the U.S. side at 10 non-AOC sites and 59 sites within 27 AOCs for a variety of organic contaminants including PCBs. In the St. Clair River, nesting boxes were placed at two locations, one in the upper river

in the City of Marysville and one in the lower river at Algonac State Park (Figure 4) (Custer, unpublished manuscript/personal communication, April 13, 2016).



Figure 4: Location of Tree Swallow Nesting Box Sites in the St. Clair River AOC.

Tree swallows “tend to forage near their nest (<1 km ±)... so contaminant concentrations in their eggs and nestlings reflect levels of contaminants from the local area” (Custer 2011). Tree swallows also “feed primarily on the aerial stages of benthic aquatic insects and those insects readily accumulate sediment contamination” therefore tree swallows can be a useful indicator of contaminants in the environment (Custer, unpublished manuscript/personal communication, April 13, 2016).

In samples from the St. Clair River, the median PCB concentration for the individual sites was 0.23 and 0.17 mg/kg, respectively, with a median concentration for the two sites combined of 0.20 mg/kg. This median concentration is much lower than the concentration of 20.0 mg/kg associated with reproductive effects in tree swallows. (Custer 2015).

Carp:

Since 1990, whole carp (*Cyprinus carpio*) have been collected and analyzed by the MDEQ for PCBs, total DDT, and mercury from 26 locations throughout Michigan. In the St. Clair River AOC, as in much of the Great Lakes, the concentrations of all three contaminants have been trending downward. The graphs showing these trends can be found in Attachment D. The concentrations of these three contaminants from sampling efforts in 2011 (Lake St. Clair) and 2012 (St. Clair River) are very similar, suggesting that these contaminants are not elevated in the wildlife of the St. Clair River AOC compared to a non-AOC site (Lake St. Clair) (Table 5).

Table 5: Mean concentrations of PCBs, total DDT, and mercury in whole carp collected from Michigan waters. Means are based on results from the most recent samples (year in parenthesis) (Bush and Bohr 2016).

Location	Total PCB (mg/kg)	Total DDT (mg/kg)	Mercury (mg/kg)
St. Clair River (2012)	0.90	0.10	0.09
Lake St. Clair (2011)	0.69	0.08	0.09

It is important to note that although the carp used in this analysis are probably larger than fish that would normally be consumed by piscivorous wildlife, “the average PCB concentration of 0.90 mg/kg for 2011 exceeds the low end of the range of fish tissue TRVs (Tissue Residue Value)” (Bush and Bohr 2015). Due to the large size of the carp, a subsequent sampling effort was undertaken for collection of forage fish or fish of an appropriate size that would be consumed by wildlife. The forage fish findings are discussed below.

Forage Fish:

Forage fish were collected by MDEQ in 2013 from the St. Clair River AOC and analyzed for PCBs, p,p'-DDE and mercury. The fish collected are known to be the size and species of fish consumed by gulls, terns and mink. Figure 5 shows the size of fish typically consumed by bald eagle, otter, mink, common tern and herring gull compared to the much larger size of the carp evaluated and discussed above.

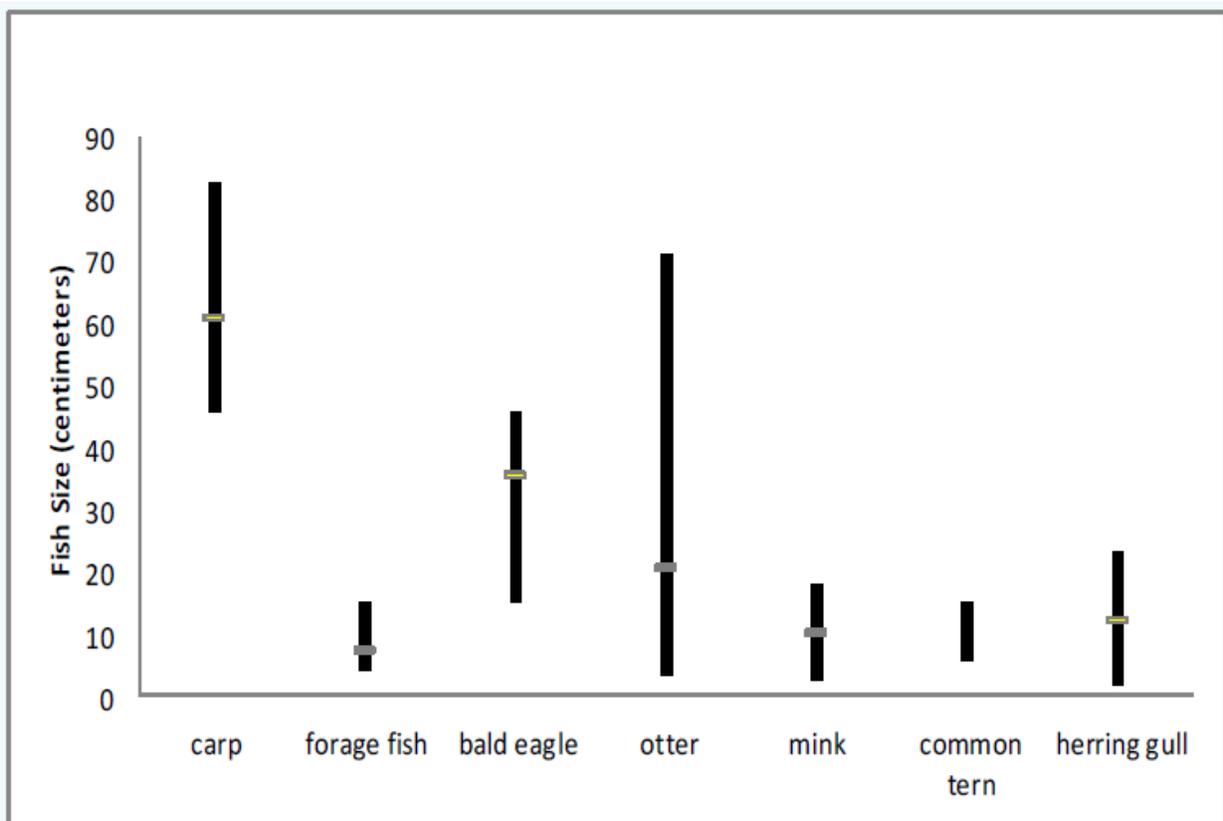


Figure 5: Size ranges and means of carp and forage fish collected by the MDEQ and the size of fish consumed by various piscivorous wildlife (Bush and Bohr 2015).

In the St. Clair River AOC, ten bluegill, 36 yellow perch, and 38 bluntnose minnows were collected from the area around Harsens Island. The fish were prepared and combined into composite samples and analyzed. The full results are shown below in Table 6. These results can be compared to a non-AOC site, the Les Cheneaux Islands in Lake Huron.

Table 6: Contaminant concentrations in composite forage fish samples from the St. Clair River AOC and the reference site (mean concentrations are in bold) (Bush and Bohr 2015).

Location		Species	N of Fish in Composite	Length (cm)			Concentration (mg/kg)		
				Min	Mean	Max	Total PCB	Total DDT	Hg
St. Clair River	Harsens Island	Bluegill	10	8.1	9.9	11.1	0.004	0.003	0.026
		Yellow Perch	36	6.0	8.8	12.5	0.003	0.002	0.027
		Bluntnose Minnow	38	4.7	6.7	8.6	0.019	0.006	0.02
		Mean Concentrations:				0.009	0.004	0.024	
Lake Huron	Les Cheneaux Islands (reference site)	Bluegill	12	5.2	6.0	7.0	0.004	0.002	0.034
		Yellow Perch	92	5.2	6.4	7.5	0.006	0.003	0.029
		Common Shiner	4	8.6	9.6	10.5	0.016	0.006	ND
		Mean Concentrations:				0.009	0.004	0.021	

The results of the forage fish analysis suggest that “the concentration of PCBs in forage fish collected from the St. Clair River AOC are below levels that would be expected to impact mink and colonial nesting birds” and that “the concentrations of PCBs, total DDT, and mercury in forage fish... were similar to concentrations found in forage fish collected from the St. Marys River and near the Les Cheneaux Islands” (Bush and Bohr 2015). In total “PCBs, DDT, and mercury concentrations in the forage fish samples are all well below their respective Lowest Observed Effect Levels (LOELs).” The levels in samples from the St. Clair River were “essentially the same as in the samples from the Les Cheneaux Islands”, (Bohr, personal communication, June 23, 2015).

Canadian Efforts:

The St. Clair River is a binational AOC sharing a boundary with Canada. While the U.S. and Canadian governments use separate criteria to evaluate and remove Beneficial Use Impairments, it is important to note that the recent studies completed by the Canadian Wildlife Service using leopard frogs (*Rana pipiens*) and snapping turtles (*Chelydra serpentina*) indicate that these species are also not being adversely impacted. Environment Canada is currently drafting a recommendation to redesignate the Bird or Animal Deformities BUI to “not impaired” (White, personal communication, June 23, 2016).

Conclusion and Recommendation

Removal of the Bird or Animal Deformities or Reproductive Problems BUI using the State of Michigan criteria can follow two approaches: (1) evaluation of observational and fish contaminant data in birds or other wildlife or (2) evaluation of fish tissue contaminant levels as an indicator of deformities or

reproductive problems. Recent studies conducted in the St. Clair River AOC provide data allowing an assessment of this BUI using each approach. Studies on wildlife including mink, bald eagles, and tree swallows indicate the reproduction and development of these species is not being adversely impacted. In addition, “contaminant levels in carp and forage fish suggest that wildlife would not be impacted and that contaminants” in the St. Clair River AOC “are not higher than comparison populations” (Bush and Bohr 2015).

Similarly, recent studies conducted on the Canadian side of the St. Clair River show reproductive and developmental effects have not been observed in leopard frogs and snapping turtles.

MDEQ, AOC Program staff request approval of the recommendation to remove the Bird or Animal Deformities or Reproductive Problems BUI from the St. Clair River AOC.

This removal recommendation was discussed with the St. Clair River BPAC during their regular meeting on July 13, 2016. The St. Clair River BPAC submitted a formal letter of support for removal of the BUI dated July 25, 2016 (Attachment C).

In accordance with the Four Agency Letter of Commitment, Environment and Climate Change Canada (ECCC) and the Ontario Ministry of the Environment and Climate Change (OMOECC) were consulted on the removal recommendation. The removal recommendation was also discussed during the Four Agency Managers teleconference meeting on July 28, 2016. ECCC and OMOECC did/did not have any comments or objections to the removal of the BUI.

The proposed action was published for public notice in the MDEQ Calendar on August 8, 2016. Comments received/not received.

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 Office of the Great Lakes
 Michigan Department of Environmental Quality
 July 28, 2016

Attachments

A – Bird or Animal Deformities or Reproduction Problems, pages 22-26 of the Guidance for Delisting Michigan’s Great Lakes AOCs

B – St. Clair River BPAC Meeting Minutes

C – St. Clair River BPAC Letter of Support for the Removal of the Bird or Animal Deformities BUI

D – Trends in Carp Collected in the State of Michigan for PCBs, Mercury, and DDT

References

Basu, N., A.M. Scheuhammer, S.J. Bursian, J. Elliot, K. Rouvinen-Watt and H.M. Chan. 2007. Mink as a Sentinel Species in Environmental Health. *Environ. Res.* 103: 130-144.

Bohr, J., personal communication, June 21, 2016

Bohr, J., personal communication, June 23, 2016.

Bowerman, W.W., D.A. Best, J.P. Giesy, M.C. Shieldcastle, M.W. Meyer, S. Postupalsky, and J.G. Sikarskie. 2003. Associations Between Regional Differences in Polychlorinated Biphenyls and Dichlorodiphenyldichloroethylene in Blood of Nestling Bald Eagles and Reproductive Productivity. *Environ. Toxicol. Chem.* 22:371-376.

Bush, D., Bohr, J., 2015. Assessment of the Bird or Animal Deformities or Reproductive Problems Beneficial Use Impairment in Michigan's Great Lakes Areas of Concern. Lansing, Michigan. MI/DEQ/WRD-15/047.

Bursian, S.J., C. Sharma, R.J. Aulerich, B. Yamini, R.R. Mitchell, D.J. Beckett, C.E. Orazio, D. Moore, S. Svirsky, and D.E. Tillitt. 2006b. Dietary Exposure of Mink (*Mustela vison*) to Fish from the Housatonic River, Berkshire County, Massachusetts, USA: Effects on Organ Weights and Histology and Hepatic Concentrations of Polychlorinated Biphenyls and 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin Toxic Equivalence. *Environ. Toxicol. Chem.* 25(6):1541-1550.

Bursian, S.J., K.J. Beckett, B. Yamini, P.A. Martin, K. Kannan, K.L. Shields, and F.C. Mohr. 2006c. Assessment of Effects in Mink Caused by Consumption of Carp Collected from the Saginaw River, Michigan, USA. *Arch. Environ. Contam. Toxicol.* 50:614-623.

Bursian, S.J., J. Kern, R.E. Remington, J.E. Link, S.D. Fitzgerald. 2013a. Dietary Exposure of Mink (*Mustela vison*) to Fish from the Upper Hudson River, New York, USA: Effects on reproduction and offspring growth and mortality. *Environ. Toxicol. Chem.* 32:780-793.

Bursian, S.J., J. Kern, R.E. Remington, J.W. Link, and S.D. Fitzgerald. 2013b. Dietary Exposure of Mink (*Mustela vison*) to fish from the Upper Hudson River, New York, USA: Effects on Organ Mass and Pathology. *Environ. Toxicol. Chem.* 32(4):794-801.

Custer C.M. 2011. Swallows as a sentinel species for contaminant exposure and effect studies. In: Elliott JE et al. eds, *Wildlife Ecotoxicology: Forensic Approaches, Emerging Topics in Ecotoxicology 3*, Springer, New York, pp 45 – 91.

Custer, C.M. 2015. E-mail from Dr. Christine Custer to Dennis Bush on July 16, 2015.

Custer, C.M. 2016, unpublished manuscript/personal communication, April 13, 2016.

Halbrook, R.S., R.J. Aulerich, S.J. Bursian, and L. Lewis. 1999b. Ecological Risk Assessment in a Large River-reservoir: 8. Experimental Study of the Effects of Polychlorinated Biphenyls on Reproductive Success in Mink. *Environ. Toxicol. Chem.* 18(4):649-654.

Removal Recommendation

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Heaton, S.N., S.J. Bursian, J.P. Giesy, D.E. Tillitt, J.A. Render, P.D. Jones, D.A. Verbrugge, T.J. Kubiak, and R.J. Aulerich. 1995. Dietary Exposure of Mink to Carp from Saginaw Bay, Michigan. 1. Effects on Reproduction and Survival, and the Potential Risks to Wild Mink Populations. *Arch. Environ. Contam. Toxicol.* 28:334-343.

Michigan Department of Environmental Quality. 2008. Stage 2 Remedial Action Plan for the St. Clair River Area of Concern. Office of the Great Lakes, Michigan Department of Environmental Quality, Lansing, Michigan

Michigan Department of Environmental Quality. 2014. Removal Recommendation for the Degradation of Benthos Beneficial Use Impairment. Office of the Great Lakes, Michigan Department of Environmental Quality, Lansing, Michigan

Michigan Department of Environmental Quality. 2015. Guidance for Delisting Michigan's Great Lakes Areas of Concern, revised. MI/DEQ/WB-06-001(Draft)

OMOE 1997c. Untitled; unpublished memorandum to Dr. B. Warwick, Environment Canada, Regina, regarding review of assessing chemical contamination in the St. Clair River using Morphological Deformities in Chironomid Larvae, Introduction by Ontario Ministry of Environment and Energy, Sarnia, March 7, 1997, 11p.

Ontario Ministry of the Environment and Energy and Michigan Department of Natural Resources. 1995. The St. Clair River Area of Concern Water Use Goals, Remedial Measures and Implementation Strategy: Stage 2 Recommended Plan.

Ontario Ministry of the Environment and Michigan Department of Natural Resources. 1991. The St. Clair River Area of Concern Environmental Conditions and Problem Definitions: Stage 1 Remedial Action Plan.

Postupalsky, S. 1974. Raptor Reproductive Success: Some Problems with Methods, Criteria, and Terminology, Management of Raptors, Hamertrom, F.N. Jr., Harrell, B.E., and Ohlendorff, R.R. (eds). *Proc. Conf. Raptor Conser. Tech.*, Raptor Res. Report No. 2, pp. 21-31.

Sprunt, A., IV, W.B. Robertson, Jr., S. Postupalsky, R.J. Hensel, C.E. Knoder, and F.J. Ligas. 1973. Comparative Productivity of Six Bald Eagle Populations. *Trans. N. Am. Wildl. Nat. Res. Conf.* 38:96-106.

Attachment A

2015 Guidance for Delisting Michigan's Great Lakes Areas of Concern

Bird or Animal Deformities or Reproductive Problems

Significance in Michigan's Areas of Concern

Seven of Michigan's AOCs have been listed as either impaired or unknown status for bird and animal deformities (e.g., crossed bills) or reproductive problems (e.g., egg shell thinning), including: River Raisin, St. Clair River, Detroit River, Saginaw River/Bay, St. Marys River, Deer Lake, and Kalamazoo River.

In Saginaw River/Bay, Deer Lake, and Kalamazoo River, past studies have indicated elevated toxic chemical concentrations (e.g., mercury or PCBs) and/or some deformities in birds and other animals. In the other AOCs which list this BUI, the status is either unknown or inconclusive. In most cases, studies on bird and animal deformities have not been done. The species historically impacted are fish eating birds or animals such as bald eagles, herring gulls, common terns, mink, or otter. The contaminants associated with these impacts are primarily the persistent bioaccumulative toxics: PCBs, dioxins, DDT, and mercury.

Michigan Restoration Criteria and Assessment

Restoration of this BUI will be demonstrated using two approaches, depending on availability of data in a particular AOC. The first approach evaluates restoration based on field assessment of birds and/or other wildlife in those AOCs where MDEQ or other State-approved bird and wildlife data are available.

The second approach will be applied in those AOCs where bird and other wildlife data are not available, and uses levels of contaminants in fish tissue known to cause reproductive or developmental problems as an indicator of the likelihood that deformities or reproductive problems may exist in the AOC.

Approach 1 – Observational Data and Direct Measurements of Birds and Other Wildlife

- Evaluate observational data of bird and other animal deformities for a minimum of 2 successive monitoring cycles in species identified in the RAP as exhibiting these problems. If deformity or reproductive problem rates are not statistically different than inland background levels (at a 95% confidence interval), or no reproductive or deformity problems are identified during the two successive monitoring cycles, then the BUI is restored. If the rates are statistically different, it may indicate a source from either within or from outside the AOC. Therefore, if the rates are statistically different or the amount of data is insufficient for analysis, then:
- Evaluate tissue contaminant levels in egg, young, and/or adult wildlife. If contaminant levels are lower than the Lowest Observable Effect Level (LOEL) for that species or are not statistically different than inland control populations (at a 95% confidence interval), then the BUI is restored.

Data for a comparison study must come from a control site which is agreed to by the MDEQ, in consultation with MDNR. It will be chosen based on physical, chemical, and biological similarity to the AOC and the 2 sites must be within the same U.S. EPA Level III Ecoregions for the Conterminous U.S.

Where direct observation of wildlife and wildlife tissue data is not available, the following approach will be used:

Approach 2: Fish Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems

- If fish tissue concentrations of PCBs, dioxins, DDT, or mercury (as determined in the RAP) contaminants of concern in the AOC are at or lower than the LOEL known to cause reproductive or developmental problems in fish-eating birds and mammals the use impairment is restored.

OR

- If fish tissue concentrations of PCBs, dioxins, DDT, or mercury in the AOC are not statistically different than the associated Great Lake (at 95% confidence interval), then the BUI is restored. In the connecting channel AOCs, either the upstream or downstream Great Lake may be used for comparison.

Fish of a size and species to be prey for the wildlife species under consideration must be used for the tissue data.

Rationale

Practical Application in Michigan

Bird and other animal deformities and reproductive problems have a particular challenge related to criteria for restoration:

- Most of the species involved are only part year residents in an AOC, or have a home range that may include locations outside an AOC. This makes it difficult to attribute deformities or reproductive problems to a specific location. The two approaches of the criteria address this.
- There is also a wide variation in how this use impairment was originally determined in Michigan's AOCs. Some AOCs had empirical data and some had anecdotal information.
- Many fish-eating birds and animals such as eagles are long-lived birds. Long after remedial actions have occurred and a site is restored, it is possible for reproductive effects to remain apparent.
- It is very difficult to determine actual prevalence of deformities and reproductive problems. Fox and Bowerman (in press), provide examples of this last point and detail issues with assessments of this BUI.

- In some AOCs with this BUI, the species monitored under MDEQ's wildlife monitoring program do not reside there, so no direct wildlife data are available.

Given the above practical considerations, the statewide criteria for this BUI uses two approaches – one for AOCs where wildlife data are available, and a second approach where direct wildlife information is not available. In the latter case, contaminant levels in fish tissues are used as an indicator of potential deformities or reproductive problems in the fish-eating species which have historically been impacted by contaminants (e.g., eagles, herring gulls, mink, and otter). Even in the absence of direct wildlife data, if contaminant levels in fish tissue are high, it indicates that the possibility for deformities or reproductive problems in fish-eating wildlife may be higher.

The contaminants of concern are PCBs, dioxins, DDT, and mercury and each AOC with this BUI may have one or more contaminants present. Assessment in each AOC will be based on the relevant contaminant(s).

1991 IJC General Delisting Guideline

When the incidence rates of deformities or reproductive problems in sentinel wildlife species do not exceed background levels in inland control populations.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation plan according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds is sampled at selected sites defined by the NPDES Permitting Program for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every 5 years (see Appendix 1 for maps of the basin rotations). One element of the strategy is wildlife contaminant monitoring.

Wildlife plays an important role in monitoring water quality and ecosystem health and can be used to monitor for spatial and temporal trends in contaminant concentrations. Specific life stages may be sampled to provide discrete time units for determination of temporal trends. Specific geographic regions or watersheds may be targeted for the determination of spatial trends.

The specific objectives of the wildlife contaminant monitoring are to:

1. Determine contaminant levels in wildlife that may be exposed to contaminants from surface waters of the state.
2. Assess whether contaminant levels in fish are changing with time.

3. Evaluate the overall effectiveness of MDEQ programs in protecting wildlife from toxic contaminants.

4. Determine whether new chemicals are bioaccumulating in wildlife.

The wildlife contaminant monitoring element currently consists of two components that, in combination, provide data necessary to achieve these objectives. These components include bald eagle and herring gull egg monitoring. The bald eagle project began in 1999 and has continued each year since then. Sample collection and analysis of herring gull eggs began in 2002. Wildlife are analyzed for bioaccumulative contaminants of concern, including mercury, PCBs, and chlorinated pesticides (e.g., DDT/DDE/DDD). Data are reviewed each year to determine whether there are additional new parameters of concern for which wildlife should be analyzed.

Another element of the State's monitoring strategy applicable to this BUI is enhanced and improved Fish Contaminant Monitoring Program (FCMP). Fish contaminant data are used to determine whether fish from waters of the state are safe for human and wildlife consumption, and as a surrogate measure of bioaccumulative contaminants in surface water. Fish tissues are analyzed for bioaccumulative contaminants of concern. These include mercury, PCBs, chlorinated pesticides (e.g., DDT/DDE/DDD), dioxins, and furans. More recently, some fish tissues have been analyzed for polybrominated biphenyl ethers (PBDEs) and perfluorooctane sulfonate (PFOS).

Fish contaminant studies needed for the assessment of this BUI restoration will be arranged by MDEQ as part of the Michigan FCMP. Timing and study design will be determined by the MDEQ based on available resources.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the MDEQ for review. If the MDEQ determines that the data appropriately address the restoration criteria and meet the quality assurance and control requirements, they may be used to demonstrate restoration success.

Attachment B

St. Clair River BPAC Meeting Minutes

ST. CLAIR RIVER BINATIONAL PUBLIC ADVISORY COUNCIL
(BPAC)

Minutes - Draft
Meeting 2016-4

Wednesday, July 13, 2016
Lambton Public Health
160 Exmouth Street
Point Edward, Ontario

ATTENDEES:

Donna Strang
Terry Burrell
Kris Lee
April White
Naomi Williams
Fred Kemp

Kathy Watts
John Jackson
Theresa Warren
Melanie Foose
Patty Hayman

Peter Westfall
Patty Troy
Ted Briggs
Marina Plain
Darrell Randell

REGRETS:

Lori Eschenburg

Fred Fuller

Call to Order and Introductions – K. Lee

The meeting was called to order by Kris Lee at 6:30 pm.

Adoption, Additions or Corrections of Draft Agenda – All

The draft agenda was reviewed and additions or corrections were solicited from BPAC members.

Moved by Terry Burrell and seconded by Fred Kemp that the draft agenda be accepted as prepared.

CARRIED

Approval of May 10, 2016 Draft Minutes and Actions – All

Actions arising from the last meeting on March 30, 2016 were reviewed along with the draft minutes.

- A correction was noted on page 2 of the minutes regarding microplastics in the Great Lakes. John Jackson advised that in Canada, the use of microplastics (i.e., microbeads) has not been banned as was stated in the minutes. Recently however, the government of Canada identified them as a toxic substance.
- Kris Lee advised BPAC members that she hadn't received any articles for the Lake Erie Forum blog and asked that BPAC members let her know the status of these articles so she could inform her contact for the blog.

ACTION – BPAC members will forward articles for the Lake Erie Public Forum to John Jackson (jjackson@web.ca).

Moved by Fred Kemp and seconded by Theresa Warren that the draft minutes of May 10, 2016 be accepted with the modification identified.

CARRIED

Restriction on Dredging Activities BUI – Canadian Remedial Action Plan (RAP) Implementation Committee (CRIC) – D. Strang and A. White

At the March 30, 2016, BPAC meeting, Donna Strang presented the status assessment for the Canadian “Restrictions on Dredging Activities” Beneficial Use Impairment (BUI) that recommends re-designation from “Impaired” to “Not Impaired”. At that time, BPAC members requested that a number of revisions be completed and that additional data be collected on the sediment chemistry in Sarnia Harbour. In addition, more time to comment on the draft status assessment was recommended prior to approval of the re-designation recommendation.

At the current meeting, Donna Strang provided an overview of revisions made to the status assessment to address feedback from BPAC members along with major questions received during the comment period. Revisions to the draft status assessment included:

- The inclusion of information about the Environment and Climate Change Canada (ECCC)/Ontario Ministry of the Environment and Climate Change (OMOECC) guidance document that provides guidance on how to properly apply this BUI in Ontario Areas of Concern (AOCs) and outlines different scenarios that justify re-designating this BUI to “Not Impaired”.
- Updated information on dredging projects (e.g., 2015 dredging in the South East Bend Cutoff Channel)
- Additional sediment chemistry data collected by the City of Sarnia from Sarnia Harbour which indicated that:
 - Sediment conditions have improved or remained stable in Sarnia Harbour indicating that the outfall historically connected to the Exmouth combined sewer (that was separated in 2009), is no longer a source of contaminants to the harbour. The proposed dredging of this location in 2016 by the City of Sarnia will further improve conditions by removing sediment where elevated contaminant levels remain.
 - Despite some exceedances of the Provincial Sediment Quality Guidelines (PSQG) Lowest Effect Level (LEL), dredged material from Sarnia Harbour is suitable for soil-like fill on industrial, commercial or community properties based on the OMOECC Soil, Ground Water and Sediment Standards.

The recommendation remained that the “Restrictions on Dredging Activities” BUI be re-designated to “Not Impaired” on the Canadian side of the St. Clair River AOC.

Moved by Terry Burrell and seconded by Darrell Randell that the recommendation to re-designate the “Restrictions on Dredging Activities” BUI to “Not Impaired” on the Canadian side of the St. Clair River AOC be accepted.

TABLED

Discussion, questions and comments from BPAC members included the following:

- Because the revised status assessment was only sent to BPAC members the day before the meeting (July 12, 2016), BPAC members did not have enough time to review the revised report and were not comfortable supporting the re-designation until they had the opportunity to read the report thoroughly.
- Clarification on how the ECCC/OMOECC guidance document was applied in the status assessment is required.

- Patty Troy and Paulette Duhaime provided a list of questions and comments upon their initial review of the status assessment. BPAC members requested that these questions be answered individually with reference to where the revision is located within the report (if required).

ACTION – Donna Strang will revise the “Restrictions on Dredging Activities” BUI status assessment and provide answers to questions prior to the next BPAC meeting.

Bird and Animal Deformities or Reproductive Problems BUI – Status Assessment and Recommendation – MDEQ – P. Duhaime and M. Foose

Paulette Duhaime was unable to attend the BPAC meeting, however, herself, Kirsten Lyons and Patty Troy attended a meeting with Michigan Department of Environmental Quality (MDEQ) scientists where clarification and additional information was provided on the statewide assessment of the “Bird or Animal Deformities or Reproductive Problems” BUI in Michigan.

Melanie Foose provided BPAC members with an overview of the “Bird and Animal Deformities or Reproductive Problems” BUI status assessment for the American side of the St. Clair River AOC. Two different approaches were utilized to determine the status: 1) Examining direct observational productivity data and/or measurements of contaminants in blood and/or tissue and 2) Analysis of fish tissue as an indicator for deformities in wildlife that consume these “forage fish”. Wildlife species studied in support of this assessment in the St. Clair River AOC included bald eagles (*Haliaeetus leucocephalus*), mink (*Neovison vison*), tree swallows (*Tachycineta bicolor*), carp and forage fish (including bluegill (*Lepomis macrochirus*), yellow perch (*Perca flavescens*) and bluntnose minnow (*Pimephales notatus*)).

Results of the status assessment were positive. Bald eagle productivity and contaminant levels (particularly PCB and pp-DDE) in the plasma of eaglets support a stable population. PCB levels in mink livers and tree swallows were well below levels associated with deformities or reproductive impacts and contaminant levels in carp were comparable to areas outside the AOC. Lastly, contaminant concentrations in forage fish were similar to levels found outside of the St. Clair River AOC in the Les Cheneaux Islands in Lake Huron.

Moved by Patty Troy and seconded by Fred Kemp that the recommendation to remove the “Bird and Animal Deformities or Reproductive Problems” BUI on the American side of the St. Clair River AOC be accepted.

CARRIED

Bird and Animal Deformities or Reproductive Problems BUI – CRIC Update - April

April White updated BPAC members on the current status of the “Bird and Animal Deformities or Reproductive Problems” BUI on the Canadian side of the St. Clair River and provided an overview of results. Currently, the status assessment recommendation to re-designate this BUI from “Requires Further Assessment” to “Not Impaired” has been approved by the CRIC. Consultation with Aamjiwnaang First Nation and Walpole Island First Nation (WIFN) will be planned shortly.

The status assessment examines contaminant levels, reproductive success and deformity rates in northern leopard frogs (*Rana pipiens*) and common snapping turtles (*Chelydra serpentina*) in the St. Clair River AOC. These species were chosen as sentinel species to assess this BUI for numerous reasons including their sensitivity to poor water quality, wide geographic distribution and their semi-aquatic characteristics.

Results indicate that hatching success of frog embryos exposed to St. Clair River AOC water and sediment was 98%. In addition, frog deformity rates were lower than the average 5% rate in the wild. Contaminants measured in leopard frogs were low and do not impede reproduction or cause deformities.

Results from the common snapping turtle studies also yielded positive results. In 2011, turtle eggs were collected from multiple sites within the WIFN delta to assess hatching success, hatching deformities and contaminant levels in eggs. Hatching success was above 90% and hatching deformity rate was approximately 7%; lower than the deformity rate observed at the reference site on Lake Huron. Contaminant levels in turtles for organochlorines (including PCBs) were low overall and below concentrations associated with reduced survivability. Mercury levels varied but even the highest concentrations measures were below those that would influence hatching success.

It is hopeful that re-designation of this BUI will be brought to BPAC in the fall for endorsement.

Restrictions on Drinking Water Consumption or Taste and Odour Problems BUI Discussion Paper Open Houses – D. Strang

Donna Strang advised BPAC members that open houses on the “Restrictions on Drinking Water Consumption or Taste and Odour Problems” BUI discussion paper have or will be conducted. To date, open houses have been held at Aamjiwnaang First Nation, Sarnia and Wallaceburg, with one being planned at WIFN. Most comments received have related to spill prevention at industrial facilities. The CRIC is currently finalizing a survey that will be sent out to local industries. The survey will solicit additional information from industries on initiatives that reduce their connection to the St. Clair River.

Kris Lee advised that the survey being developed was initiated through recommendations by the Wallaceburg Advisory Council for a Cleaner Habitat (WATCH) to the CRIC.

BPAC Celebration Event – September 7, 2016 – P. Troy

Patty Troy updated BPAC members on plans for a celebration event on September 7th. Initially, it was anticipated that a binational event could be held, however, BPAC members preferred to delay any Canadian celebration until a BUI was officially re-designated.

On the American side of the St. Clair River AOC, the BUI removals for “Degradation of Benthos” and “Beach Closings” will be celebrated along with the completion of all management actions for the “Loss of Fish and Wildlife Habitat” BUI. The event will take place at 2 pm at the Marysville Golf Course and will include tours of nearby completed habitat projects. Representatives from the MDEQ and the United States Environmental Protection Agency (USEPA) will speak during the ceremony.

OMOECC, ECCC, MDEQ and USEPA Updates on Canadian and American Projects – T. Briggs, A. White, M. Foose and R. Ellison

OMOECC Update:

Ted Briggs was not available to provide an update.

ECCC Update:

April White updated BPAC members on recent ECCC activities. A number of BUI status assessments are currently in different stages of re-designation or will be brought forward to the CRIC in the near future. These BUIs include the “Bird and Animal Deformities or Reproductive

Problems”, “Restrictions on Dredging Activities” and “Beach Closings” BUIs. Draft reports have also been prepared for the “Degradation of Fish and Wildlife Populations” and “Fish Tumours or Other Deformities” BUIs and are currently being reviewed.

The 2016-17 Great Lakes Sustainability Fund (GLSF) will support four projects in the St. Clair River AOC including: 1) developing a shoreline plan at WIFN, 2) shoreline restoration at Aamjiwnaang First Nation, 3) the installation of riparian buffers by the Rural Lambton Stewardship Network (RLSN) and 4) RAP governance and coordination.

April offered to provide a brief update on the habitat projects on the Canadian side of the St. Clair River at a future meeting.

MDEQ Update:

Melanie Foose reported that monitoring continues at the completed habitat projects along the St. Clair River and will continue until the end of summer. Melanie and Rose Ellison will be presenting at the Healing our Waters Conference hosted by the Great Lakes Coalition in Sandusky, Michigan on September 20-22, 2016.

USEPA Update:

Rose Ellison was unable to attend the meeting. No update was available.

Committee Reports:

Statewide Public Advisory Council (SPAC) – P. Troy and P. Duhaime

The last Statewide Public Advisory Council (SPAC) meeting was held in Sault Ste. Marie, Michigan. A major point of discussion related to the development of AOC specific communications plans. The 2016 AOC Conference is scheduled for March 28-30 in Grand Rapids, Michigan.

Friends of the St. Clair River (FOSCR) – Canada – D. Randell and T. Burrell

There has not been Friends of the St. Clair River (FOSCR) meeting since the last BPAC meeting. Darrell Randell advised that FOSCR members attended the Blue Water Anglers Kids Training Day in Sarnia to teach kids about the St. Clair River and its importance.

Friends of the St. Clair River (FOSCR) – USA – S. Faust

Patty Troy reported for Sheri Faust who was unable to attend the meeting. The Friends of the St. Clair River (FOSCR) BPAC members were unavailable to attend the meeting as they were participating at a parade in Port Huron. Patty reported that the annual Sturgeon Festival held in June was a success with an estimated 6000 people attending. At the BPAC celebration event on September 7th, partnership awards will be presented. The 2016 recipients include: 1) Cargill Salt, 2) Jeff Friedland, St. Clair County Office of Emergency Management, whose efforts brought the CANUSLAK spill exercise to the St. Clair River, 3) Kirsten O’Reilly who was a long time member of the BPAC and chaired the US Habitat Subcommittee and the American FOSCR, 4) Kay Cumbow for alerting the community about the Plains LPG pipeline application and 5) the St. Clair River stewards who maintain the Blue Water River walk.

BPAC Membership Subcommittee – A. Kerr and F. Kemp

No new updates identified.

Canadian RAP Implementation Committee (CRIC) – TBD

Donna Strang advised BPAC members that the last Canadian RAP Implementation Committee (CRIC) meeting was held on June 14, 2016. Highlights from the meeting included CRICs approval for the re-designation of the “Bird or Animal Deformities or Reproductive Problems” BUI to “Not Impaired” and a tour of local coastal wetland projects in the Mitchell’s Bay area.

Four Agency Managers Work Group – T. Briggs

No new updates identified.

Other Business:

- Patty Troy updated BPAC members on the permit violation at Dunn Paper. A notice of violation of their National Pollution Discharge Elimination System (NPDES) permit from the MDEQ was received by Dunn Paper. Dunn Paper has provided a response to the violation that MDEQ staff are currently reviewing.
 - Patty also advised that two complaints had been received regarding discharges from the Domtar facility in June, 2016.

ACTION – Patty Troy will invite representatives from Dunn Paper and Domtar to the next BPAC meeting to discuss the recent permit violations and complaints surrounding discharges to the St. Clair River.
- Patty Troy advised BPAC that Vortex Hydroenergy has deployed their Vivace Converter into the St. Clair River. The location is marked with buoys to alert local boaters.

Next Meeting Date

The next meeting will be held on Wednesday, September 14, 2016 at the St. Clair County Building Auditorium in Port Huron, Michigan.

Adjournment

The meeting was adjourned by Kris Lee at 9:20 pm.

Attachment C

St. Clair River BPAC Letter of Support



July 25, 2016

Mr. Rick Hobrla
Office of the Great Lakes
Michigan Department of Environmental Quality
525 West Allegan Street
Lansing, Michigan 48909-7973

Dear Mr. Hobrla:

On July 18, 2016 the St. Clair River Binational Public Advisory Council (SCRBPAC) for the St. Clair River Area of Concern voted to accept the Removal Recommendation for the St. Clair River Area of Concern Bird and Animal Deformities and Reproductive Problems BUI for the US side of the St. Clair River as presented by Melanie Foose on behalf of the Michigan Department of Environmental Quality.

We are grateful for the efforts of many that have led to the recommendation for removal of this BUI, including the efforts of Melanie, Dennis Bush and Joe Bohr. We request that you initiate the formal review and removal process for this BUI. Thank you for your time and attention to this matter.

Sincerely,

Patty Troy
U.S. Chair SCRBPAC

Attachment D

Trends in Carp Collected in the State of Michigan for PCBs, Mercury and DDT

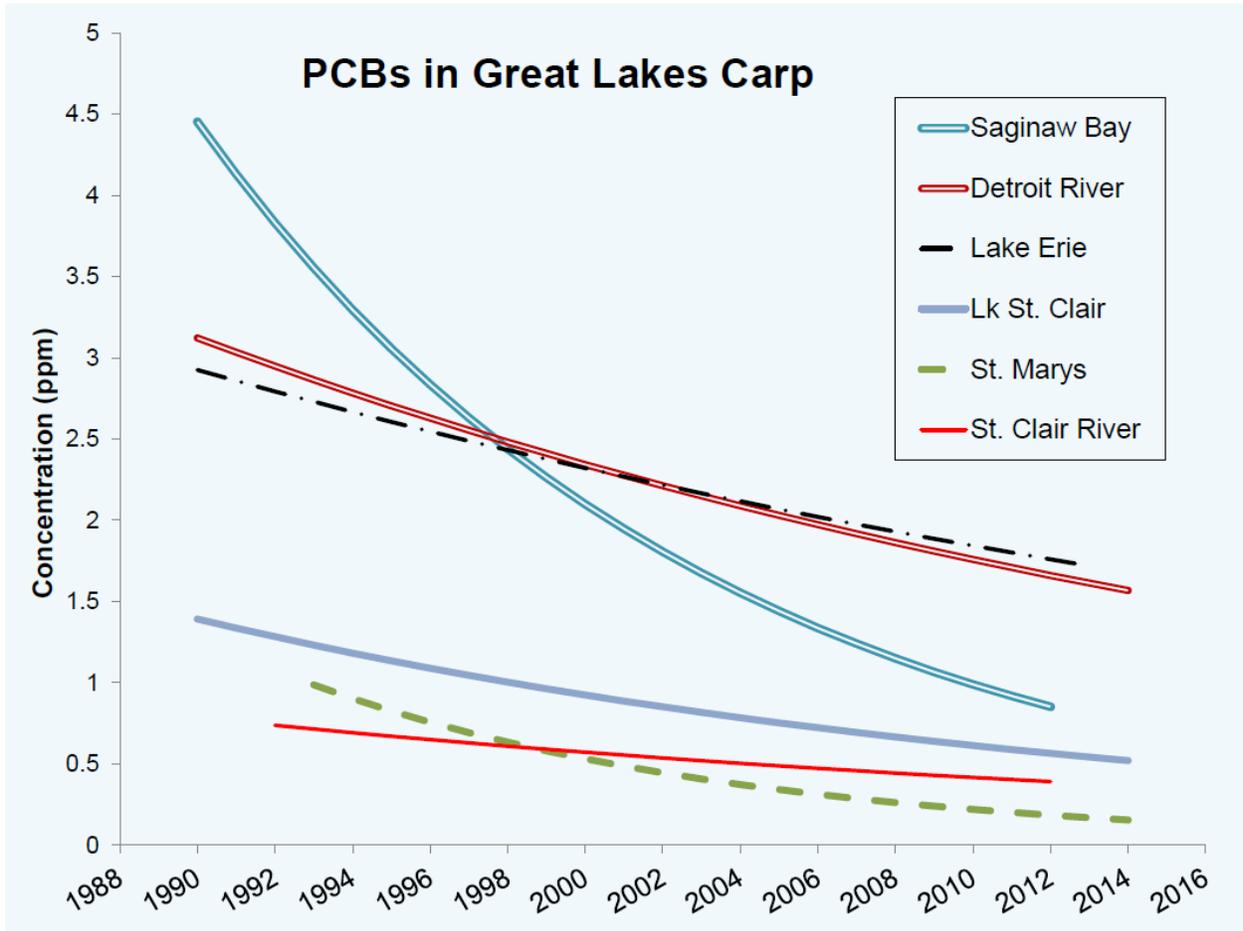


Figure A1: PCBs in Great Lakes Carp (ppm = mg/kg)
(Bohr, Personal Communication, June 21, 2016)

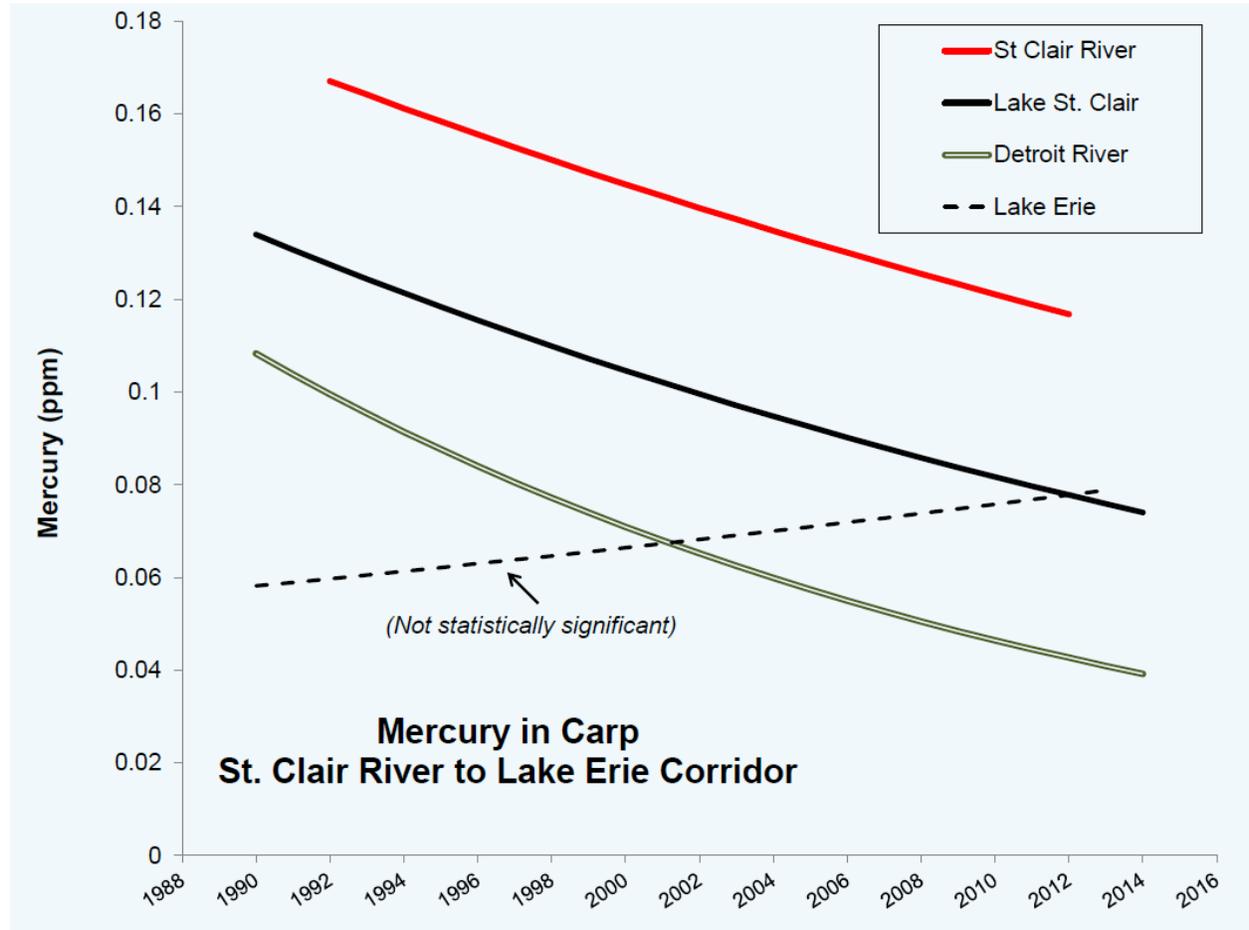


Figure A2: Mercury in Carp in the St. Clair River to Lake Erie Corridor (ppm = mg/kg)
(Bohr, Personal Communication, June 21, 2016)

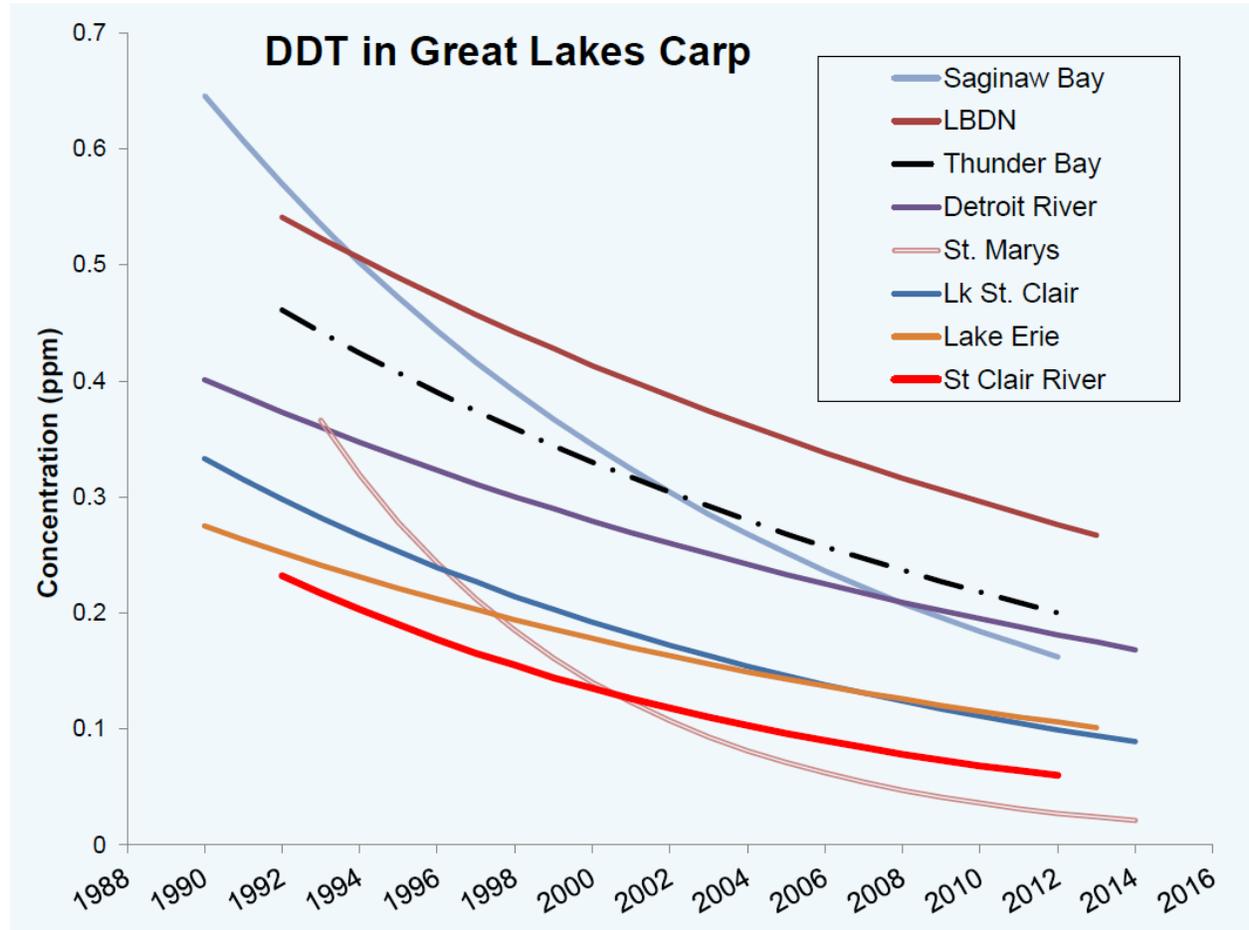


Figure A3: DDT Concentrations in Great Lakes Carp (ppm = mg/kg)
(Bohr, Personal Communication, June 21, 2016)