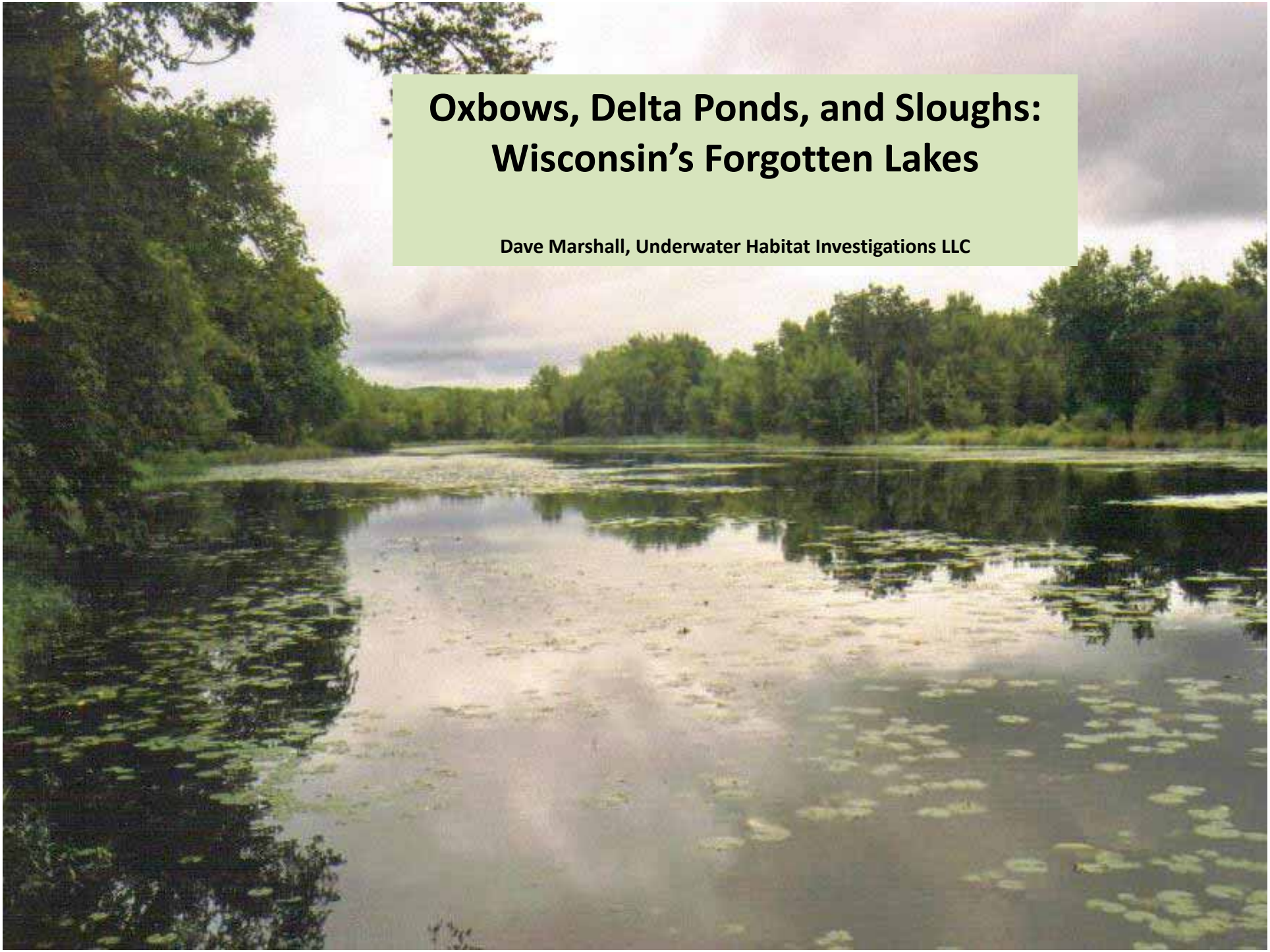
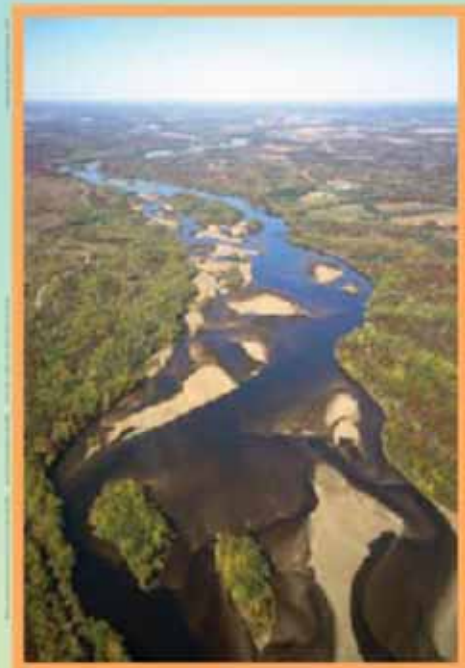


Oxbows, Delta Ponds, and Sloughs: Wisconsin's Forgotten Lakes

Dave Marshall, Underwater Habitat Investigations LLC

Lower Wisconsin River holds scores of off-channel lakes

Rare & Unusual Fishes of the
LOWER WISCONSIN RIVER



RIVER HABITATS CHANGE RAPIDLY as flowing waters build and remove sandbars. Sometimes sandbars survive or become forested islands. Side flow becomes isolated around the islands where fallen trees like the ideal and become magnets for insects, birds, turtles and fish.

HOME TO 98 SPECIES OF FISH, THE **LOWER WISCONSIN RIVER** is one of the most ecologically diverse large river systems in the United States. This section of the river flows from Prairie du Sac west across the unglaciated Driftless Area to the Mississippi River.

THE DIVERSE ARRAY OF FISH AND OTHER ANIMALS in the protected 92 mile **Lower Wisconsin State Riverway** reflects the intricate connections of the free-flowing river with its floodplain lakes.

SHIFTING SAND MAKES A HARSH ENVIRONMENT FOR MANY ANIMALS but important niches for others. The western sand darter dives into the sand to escape predators while the primitive armored mudfly burrows near the sandy shores. The river hosts many unusual and rare fish such as the shovelnose sturgeon.

BACKWATER SLOUGHS AND OXBOWS FORM when braided channels are cut off from the river. They are nurseries for some river fish, and home for others that avoid fast currents. The fishes in the sloughs and oxbows depend on clean waters that come from springs and tributaries far beyond the floodplain.

Wisconsin's Forgotten Lakes

- 2007-2008 SP River PAL River Grant
- 2008 Sauk County LCD - Lakes Grant
- 2009 Dane Co. Dept. LWR - Lakes Grant
- 2009 Crawford Co. LCD - Lakes Grant
- 2009-10 USRWA – River Grant
- 2010 Richland Co LCD – Lakes Grant
- 2010 River Alliance – Lakes Grant
- 2009-2010 State Wildlife Grant - ER
- 2011-2012 (2) State Wildlife Grants - ER

Floodplain River Surveys 2011-12


Pirate perch (*Aphredoderus sayanus*)
State Special concern

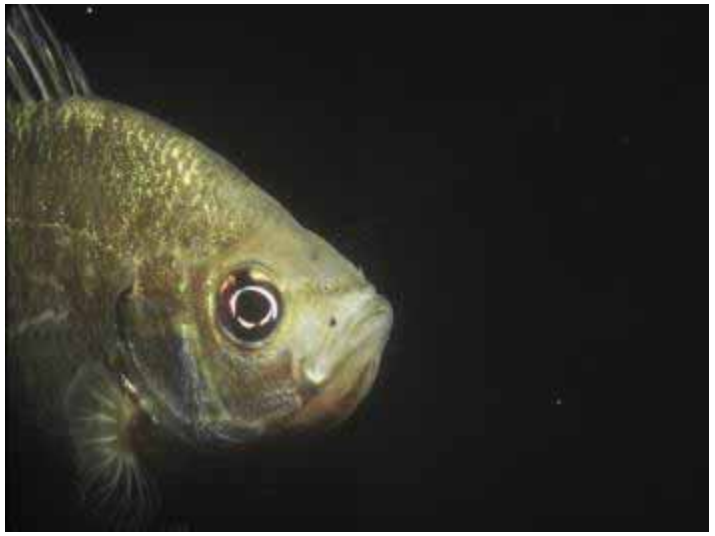
Mud Darter (*Etheostoma asprigene*) State Special Concern

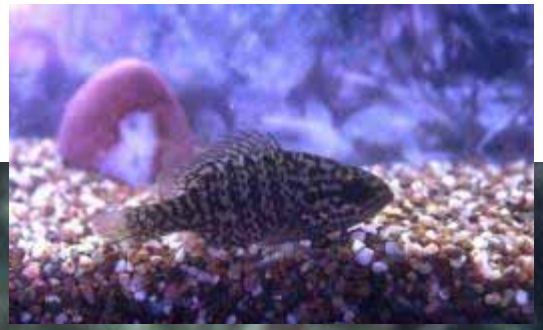

Starhead topminnow (*Fundulus dispar*)
State Endangered


Lake chubsucker (*Erimyzon sucetta*)
State Special concern


Weed shiner (*Notropis texanus*)
State Special concern

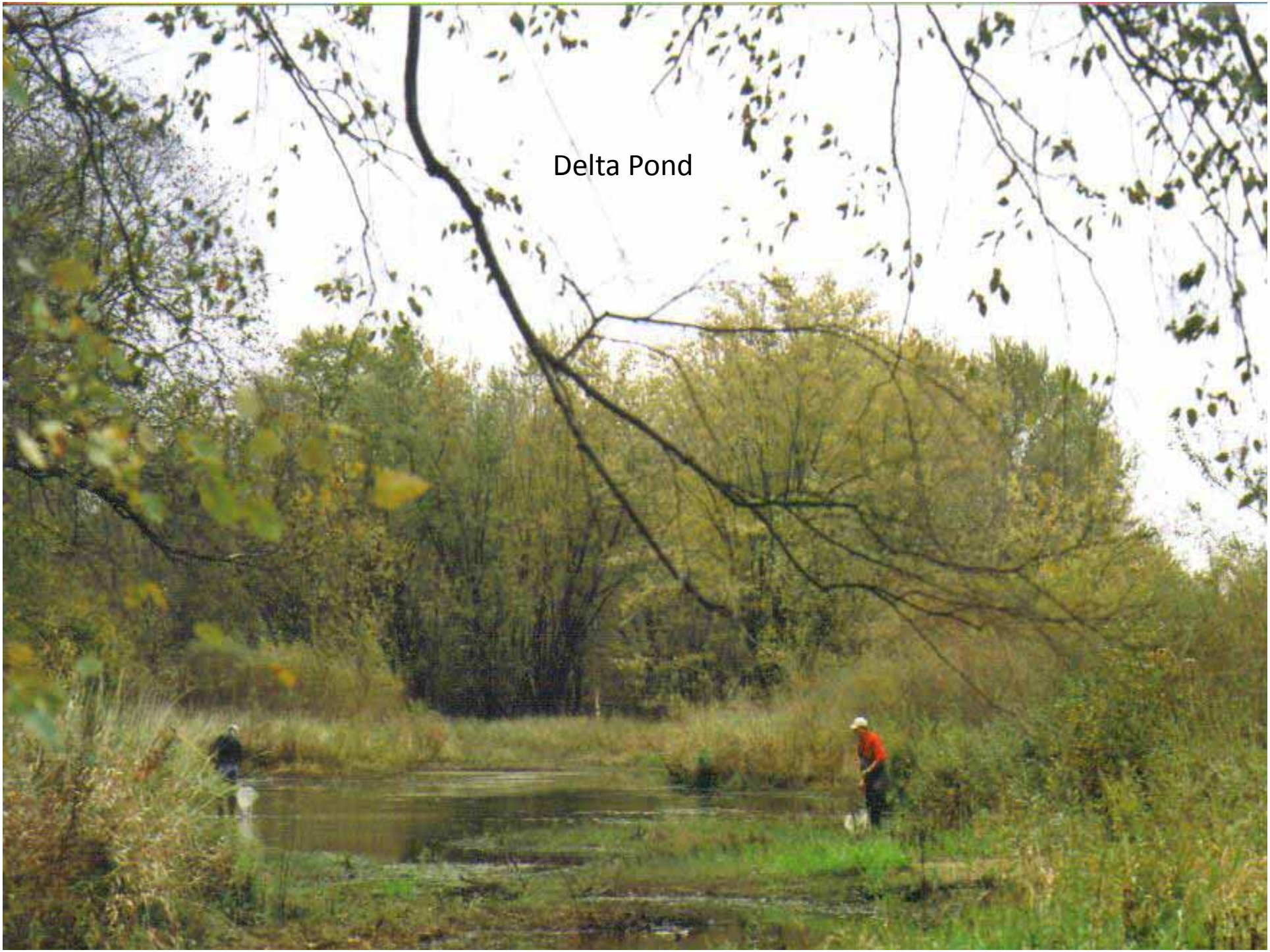
Slough Fish Assemblage





Slough Shocker

Beavers are slough builders


Delta Pond


Cut-off Channel Oxbow

Floodplain lakes associate species

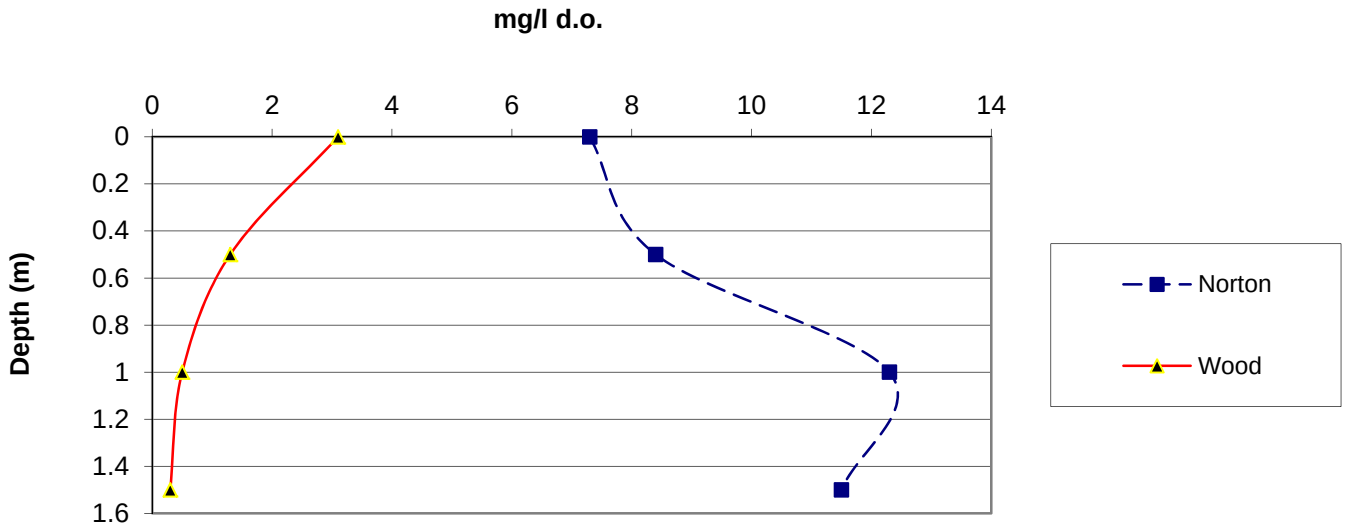
	2011	2012
1	Largemouth bass	Bluegill
2	Bluegill	Largemouth bass
3	Grass pickerel	Mudminnow
4	Mudminnow	Grass pickerel
5	Mud darter	Starhead t. m.
6	Starhead t. m.	Yellow bullhead
7	Warmouth	Mud darter
8	Yellow bullhead	Tadpole madtom
9	Green sunfish	Warmouth
10	Tadpole madtom	Green sunfish
1	Bluegill	Bluegill
2	Largemouth bass	Largemouth bass
3	Grass pickerel	Mudminnow
4	Pirate perch	Grass pickerel
5	Mudminnow	Green sunfish
6	Warmouth	Pirate perch
7	Starhead t. m.	Starhead t. m.
8	Green sunfish	Pumpkinseed
9	Warmouth	Yellow bullhead
10	Yellow bullhead	Brook silverside
1	Largemouth bass	Bluegill
2	Bluegill	Largemouth bass
3	Grass pickerel	Mudminnow
4	Pirate perch	Grass pickerel
5	Mudminnow	Pirate perch
6	Mud darter	Mud darter
7	Warmouth	Warmouth
8	Yellow bullhead	Green sunfish
9	Lake chubsucker	Yellow bullhead
10	Johnny darter	Lake chubsucker

Pirate perch

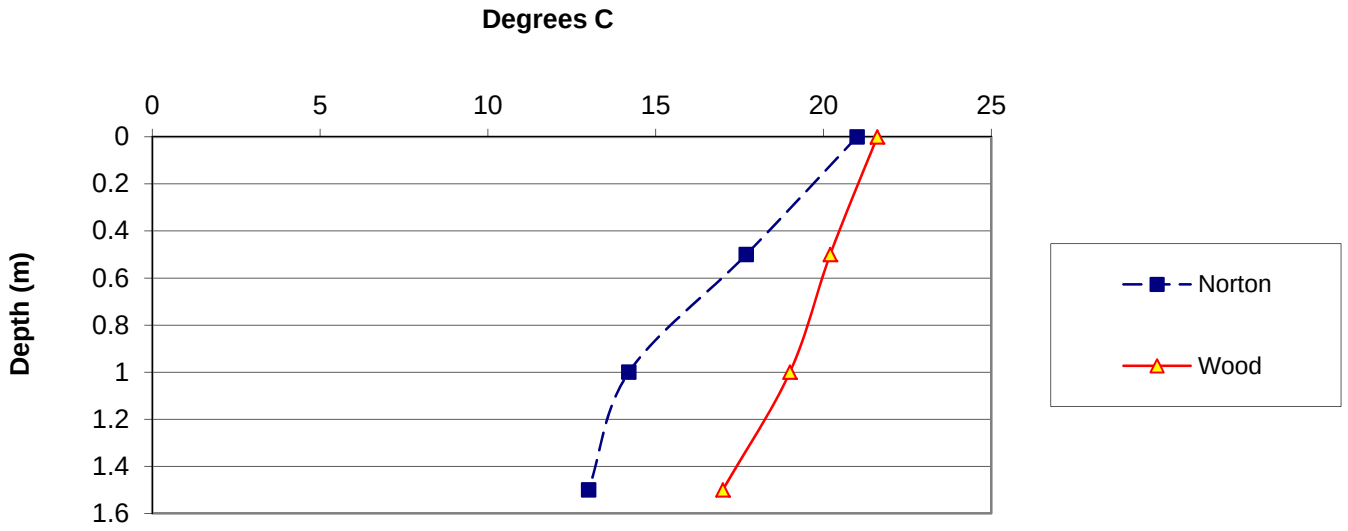
Mud darter

Starhead topminnow

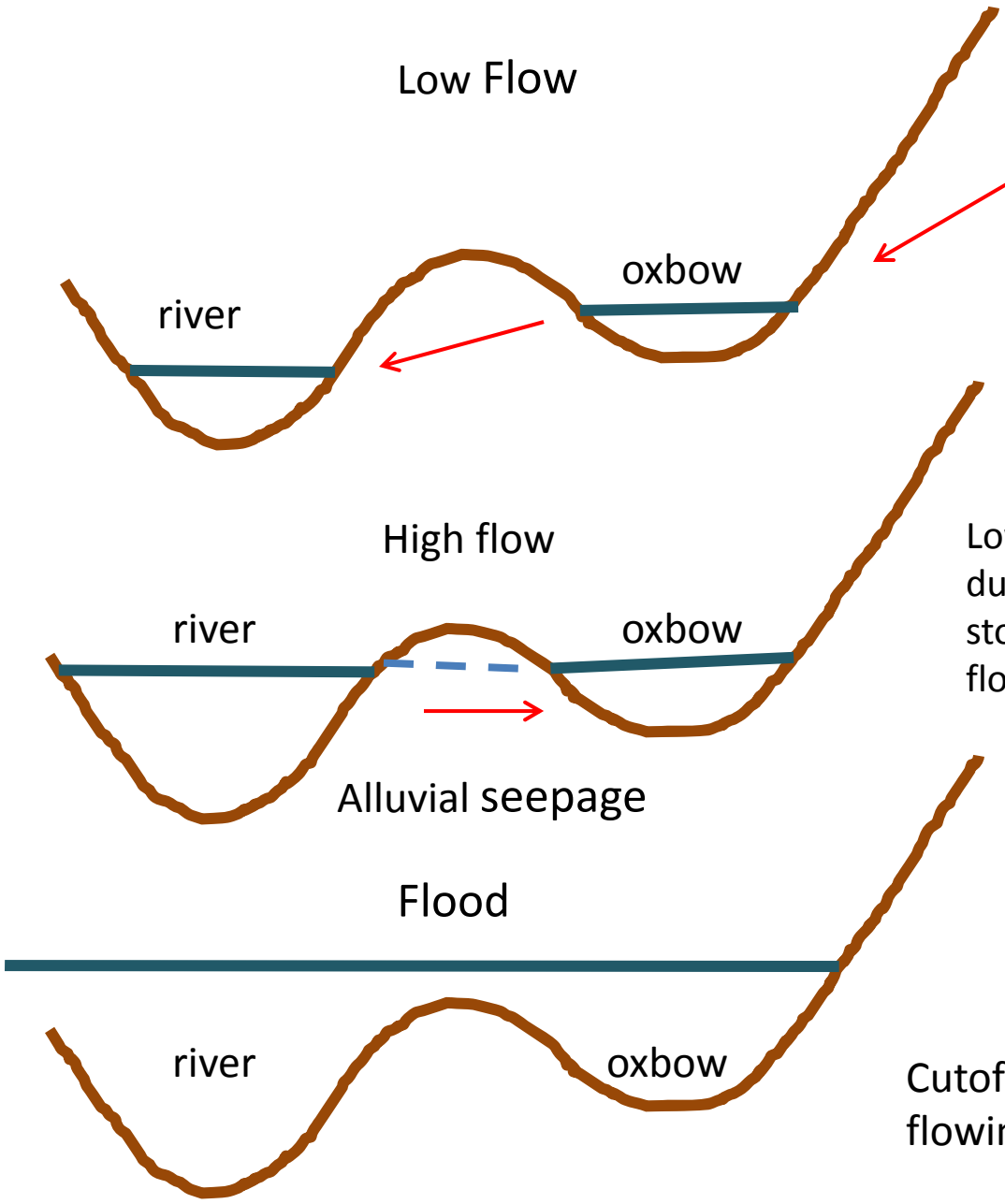
Wood - Norton Slough Dissolved Oxygen Profiles



Wood - Norton Slough Temperature Profiles

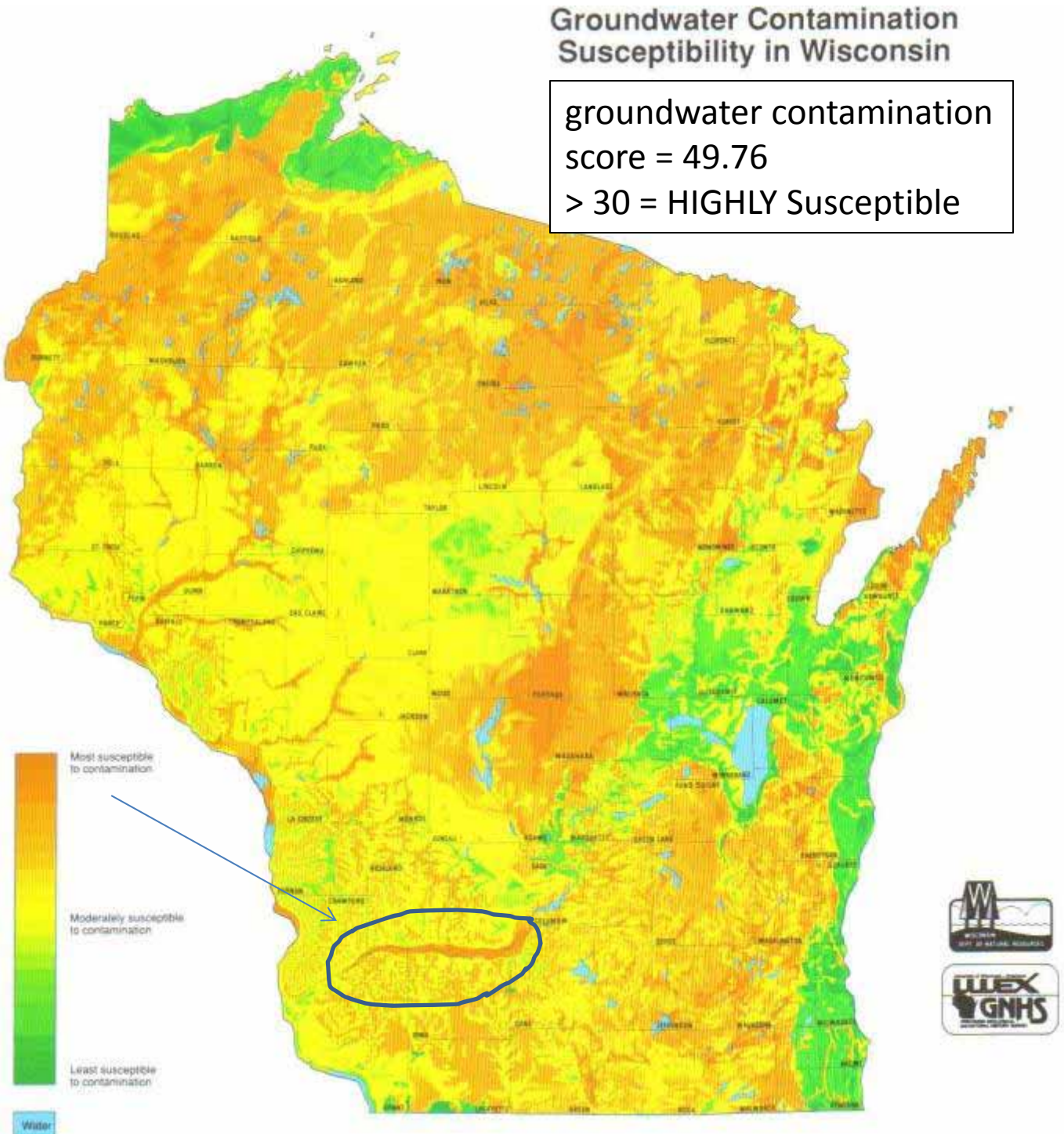


Modified from
Amoros and Bornette 2002



Low oxbow dissolved oxygen occurs during summer high flows, (≥ 1-year storm) and reduced upland groundwater flow

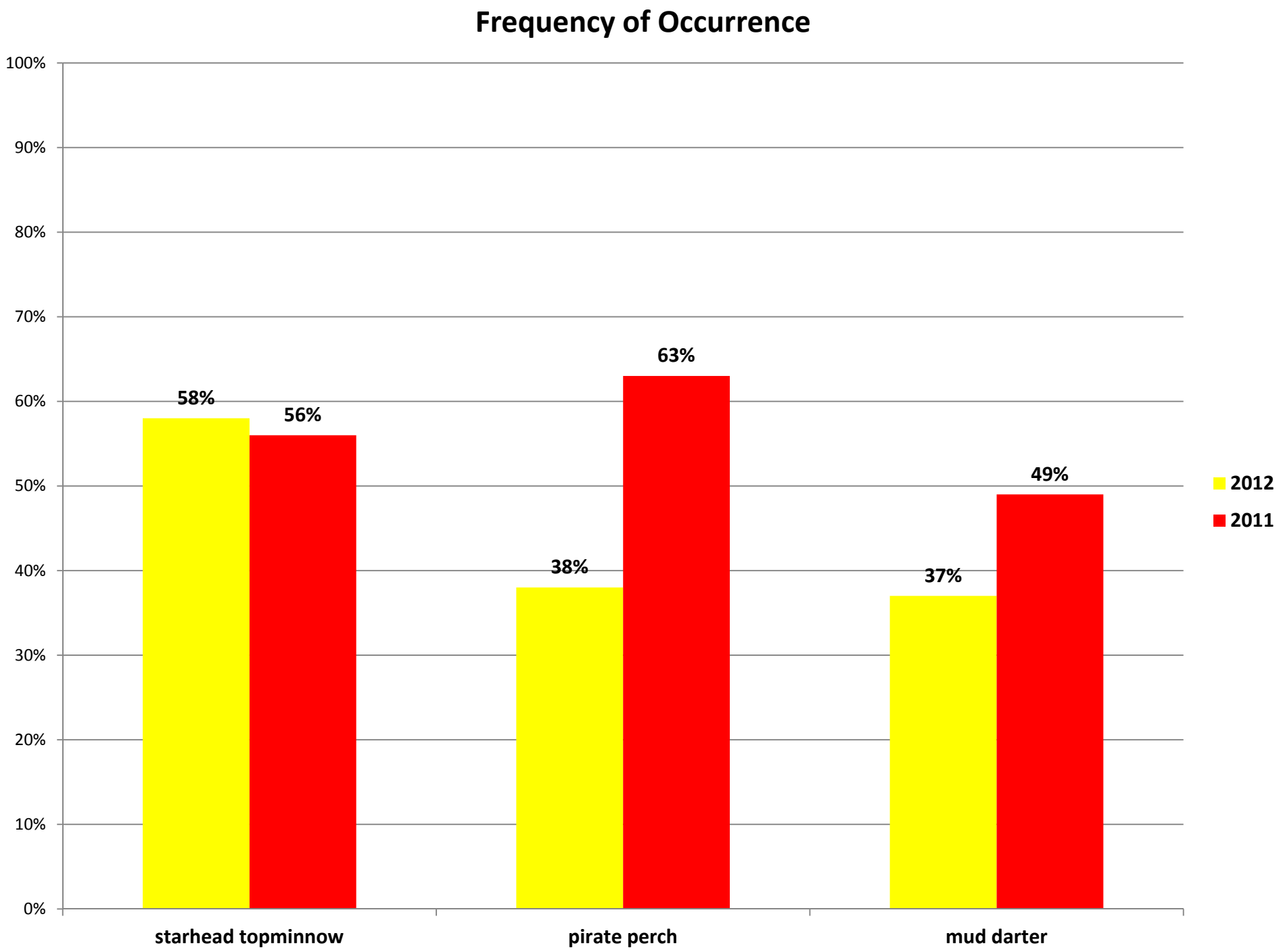
Cutoff channel oxbows become active flowing channels and scouring occurs

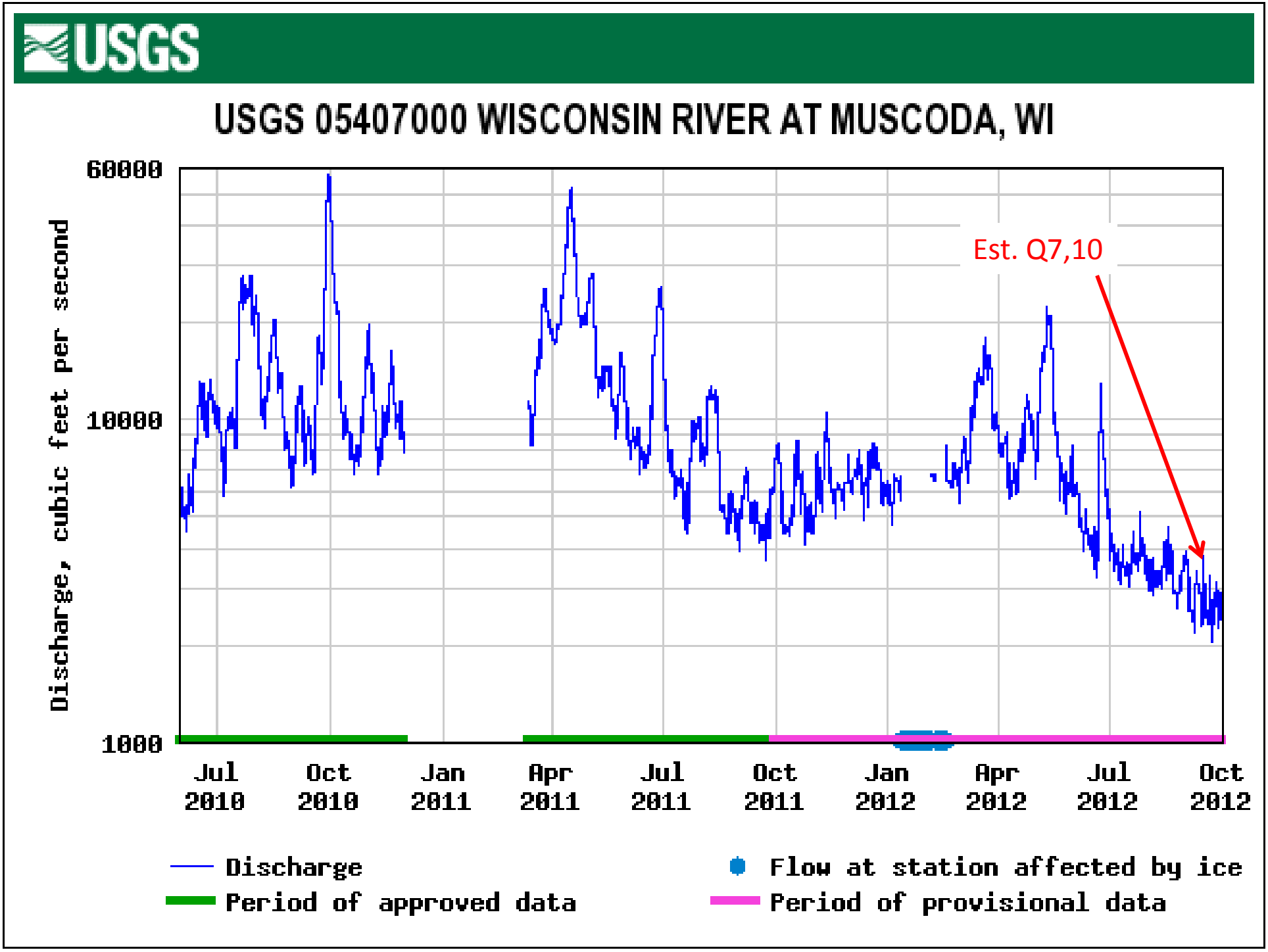

Groundwater Contamination Susceptibility in Wisconsin
groundwater contamination score = 49.76
> 30 = HIGHLY Susceptible
Most susceptible to contamination
Moderately susceptible to contamination
Least susceptible to contamination
Water

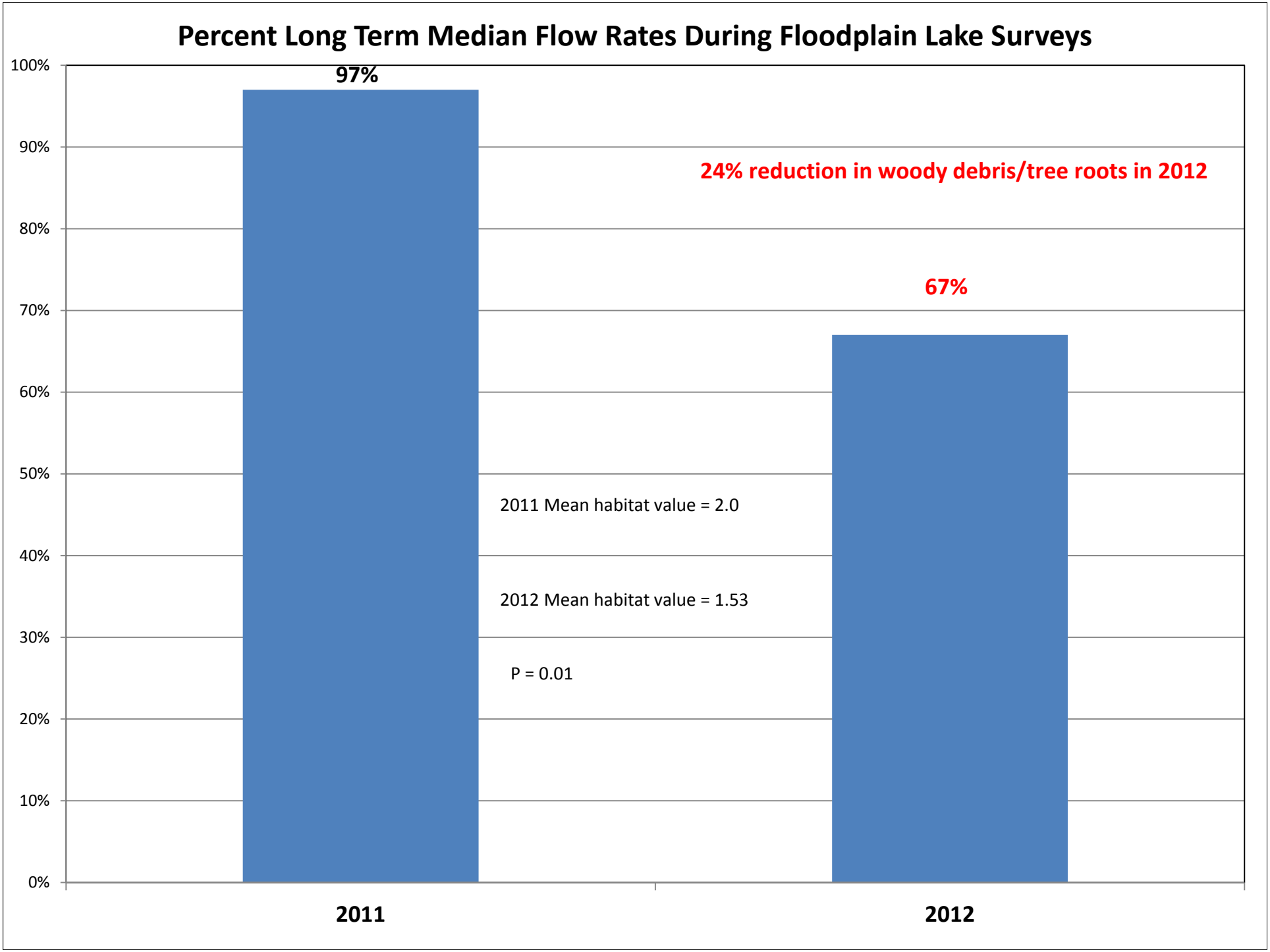

Norton Slough 2008

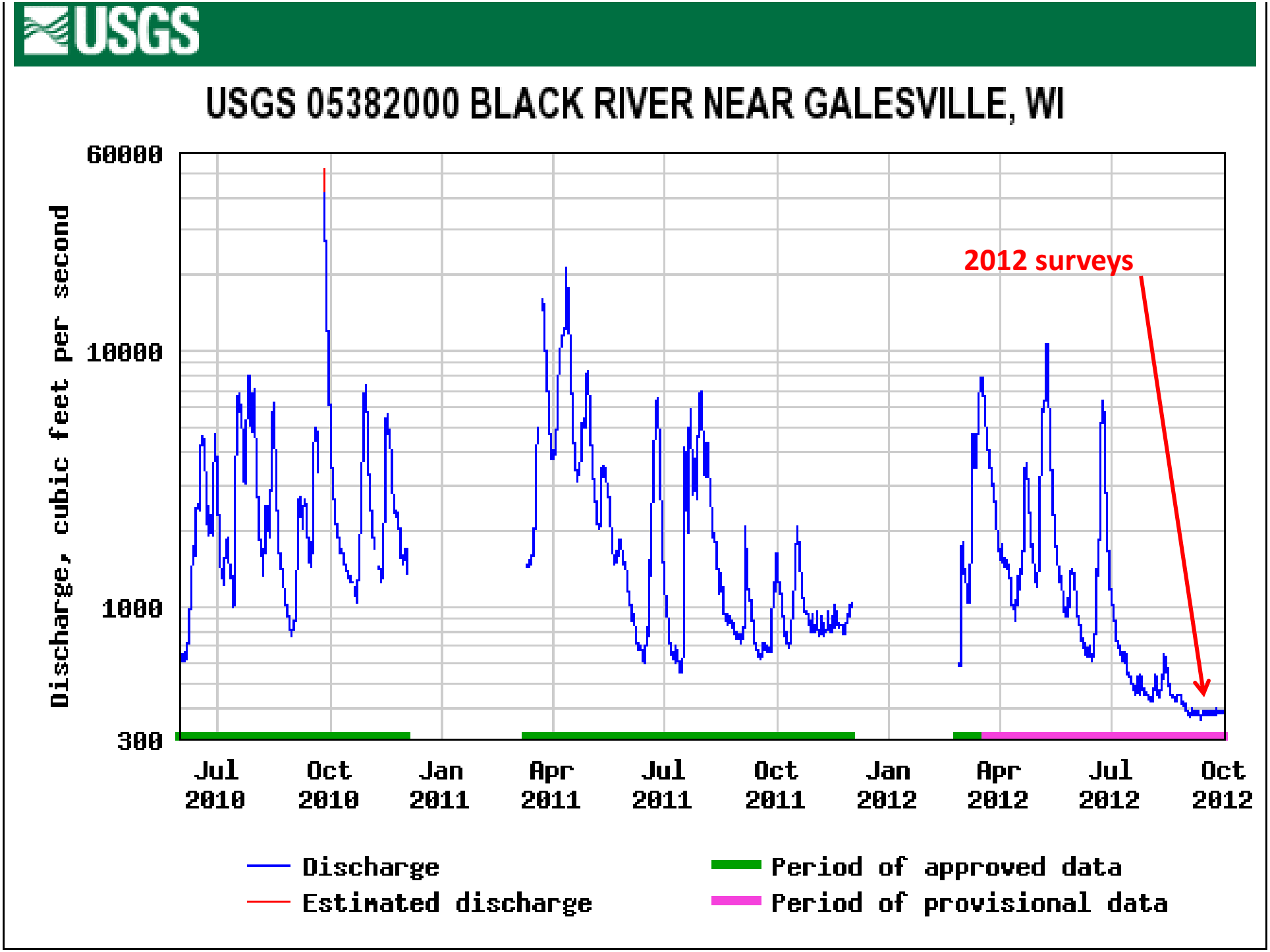

Norton Slough 2011

Sediment deposition was minimal, suggesting scouring during floods and no internal loading.


Frequency of Occurrence
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
58%
56%
38%
63%
37%
49%
starhead topminnow
pirate perch
mud darter
2012
2011


USGS
USGS 05407000 WISCONSIN RIVER AT MUSCODA, WI
Discharge, cubic feet per second
60000
10000
1000
Est. Q7,10
Jul 2010
Oct 2010
Jan 2011
Apr 2011
Jul 2011
Oct 2011
Jan 2012
Apr 2012
Jul 2012
Oct 2012
Discharge
Flow at station affected by ice
Period of approved data
Period of provisional data


Percent Long Term Median Flow Rates During Floodplain Lake Surveys
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
97%
67%
24% reduction in woody debris/tree roots in 2012
2011 Mean habitat value = 2.0
2012 Mean habitat value = 1.53
P = 0.01
2011
2012

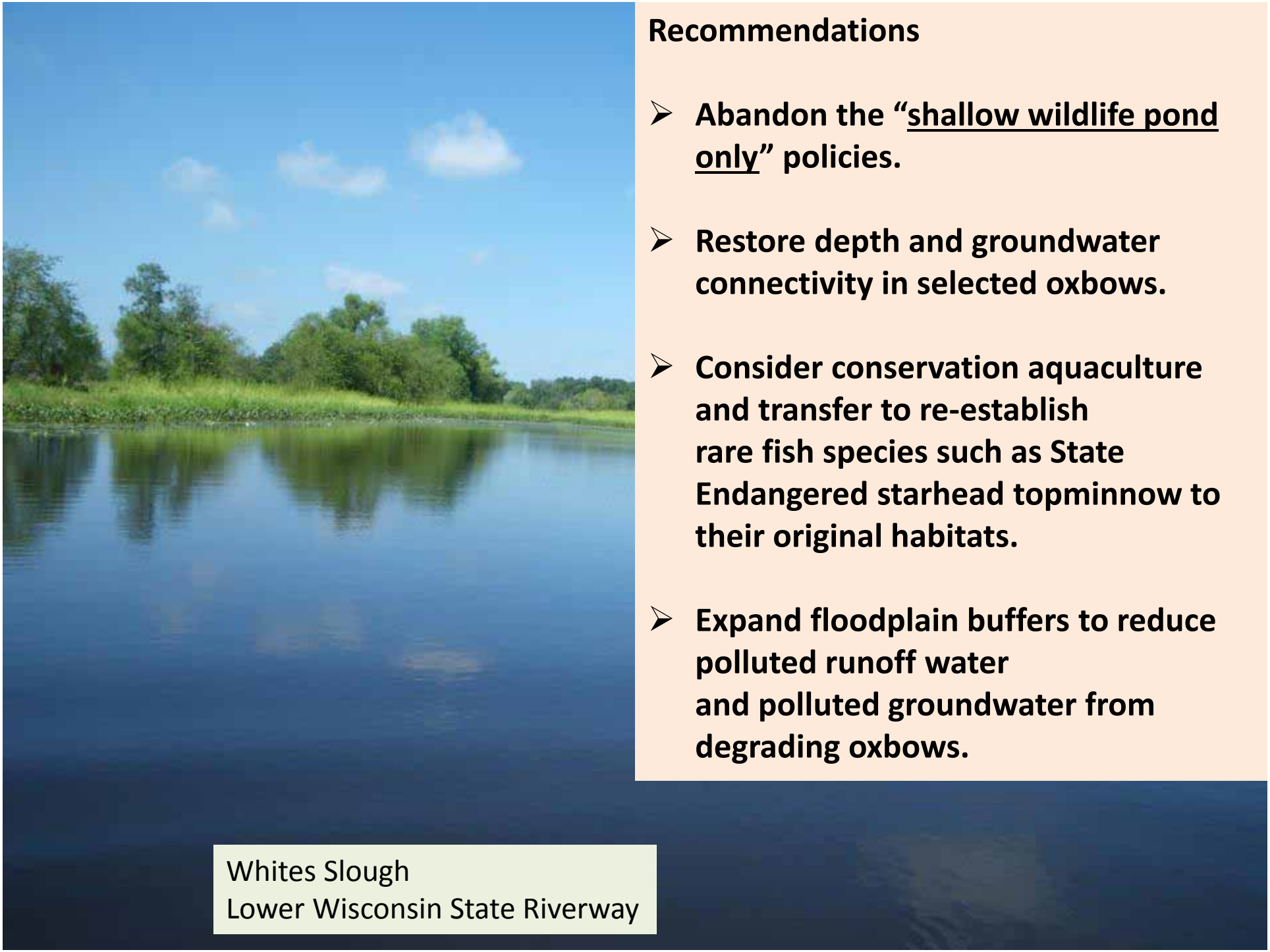

USGS
USGS 05382000 BLACK RIVER NEAR GALESVILLE, WI
Discharge, cubic feet per second
60000
10000
1000
300
2012 surveys
Jul 2010
Oct 2010
Jan 2011
Apr 2011
Jul 2011
Oct 2011
Jan 2012
Apr 2012
Jul 2012
Oct 2012
Discharge
Estimated discharge
Period of approved data
Period of provisional data

Black River Oxbow Lake

2010

2012 drought

Drought impacts most along rivers with aggrading floodplains



Whites Slough
Lower Wisconsin State Riverway

Recommendations

- **Abandon the "<u>shallow wildlife pond only</u>" policies.**
- **Restore depth and groundwater connectivity in selected oxbows.**
- **Consider conservation aquaculture and transfer to re-establish rare fish species such as State Endangered starhead topminnow to their original habitats.**
- **Expand floodplain buffers to reduce polluted runoff water and polluted groundwater from degrading oxbows.**

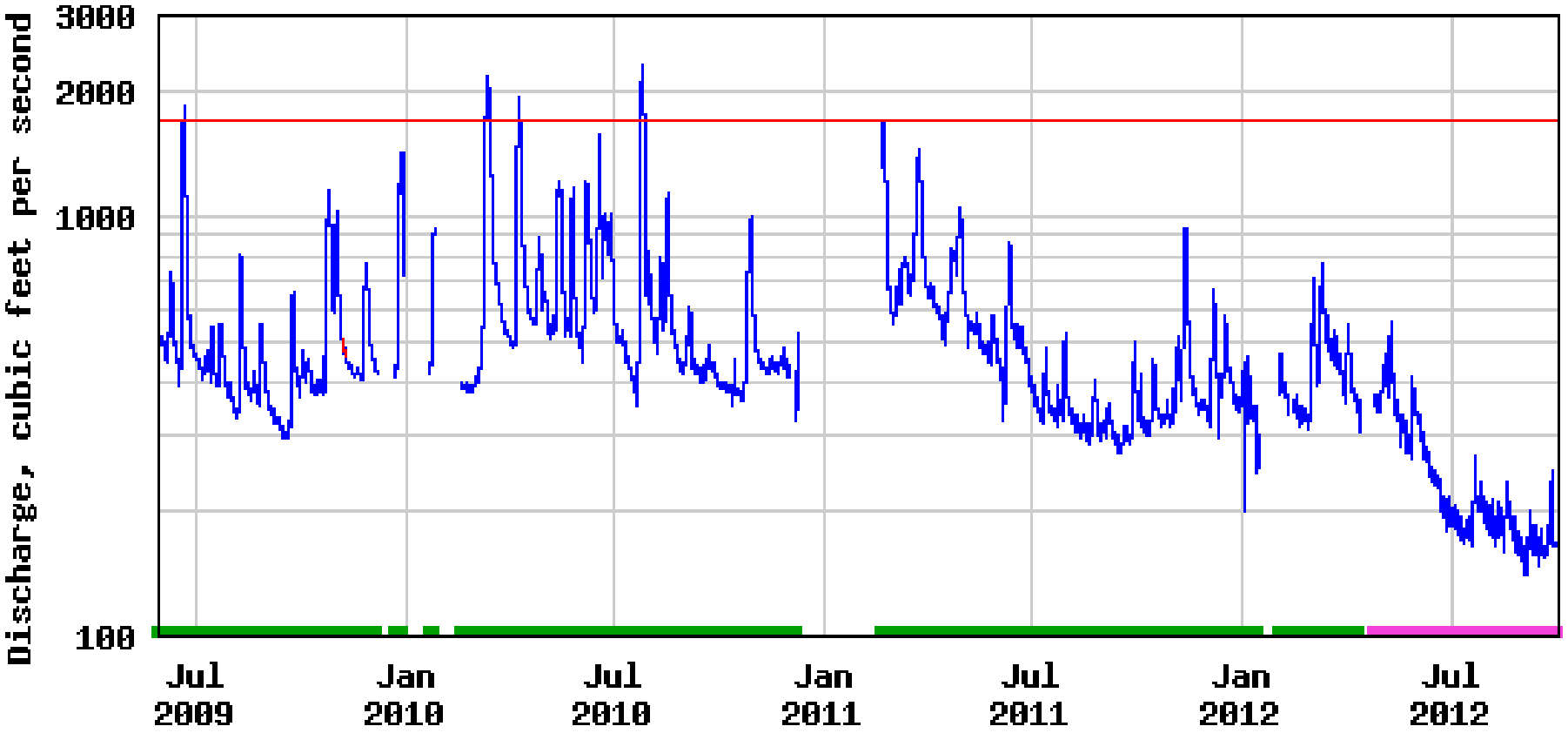
Case Studies

1. Sugar River oxbow restoration
2. Baraboo River off-channel lake construction
3. Lake Belle View restoration (watershed diversion around former millpond)

1. Sugar River former oxbow excavated

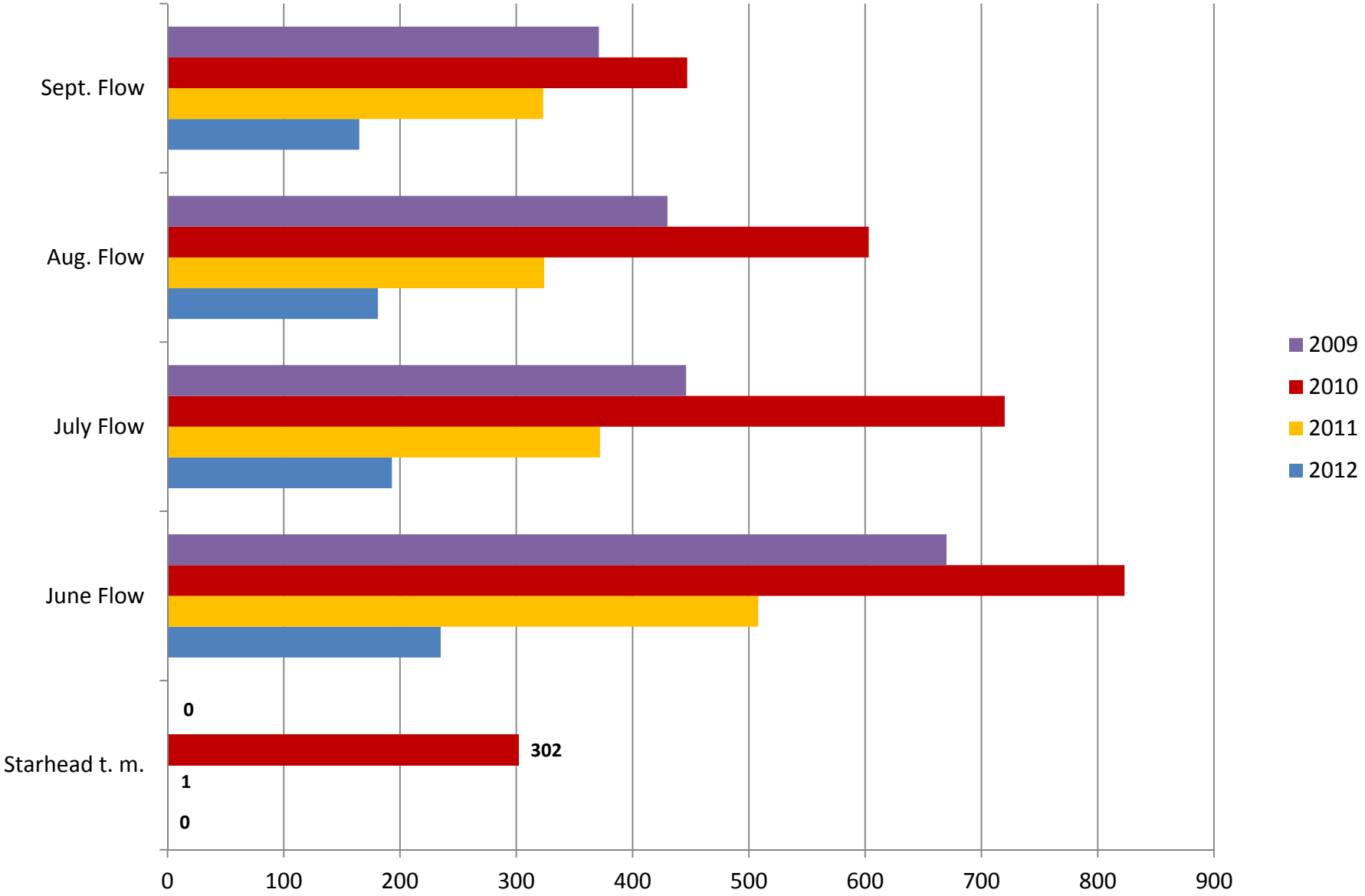
USGS

USGS 05436500 SUGAR RIVER NEAR BRODHEAD, WI



Discharge
Estimated discharge
Period of approved data
Period of provisional data
Discharge at National Weather Service Floodstage

Mean Summer Monthly Sugar River Flows



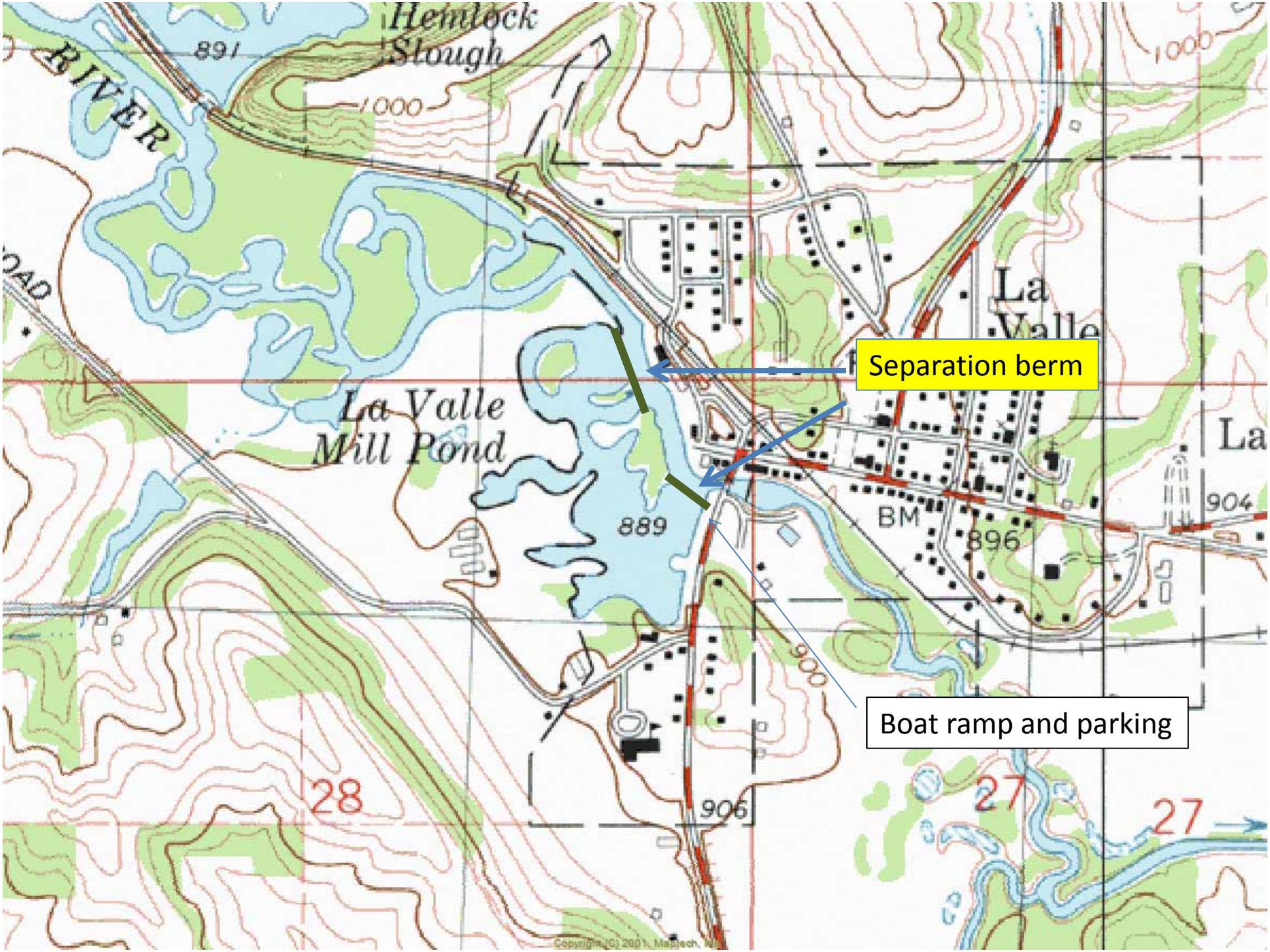
2010

Shallow wildlife scrapes are not sustained during droughts

2012

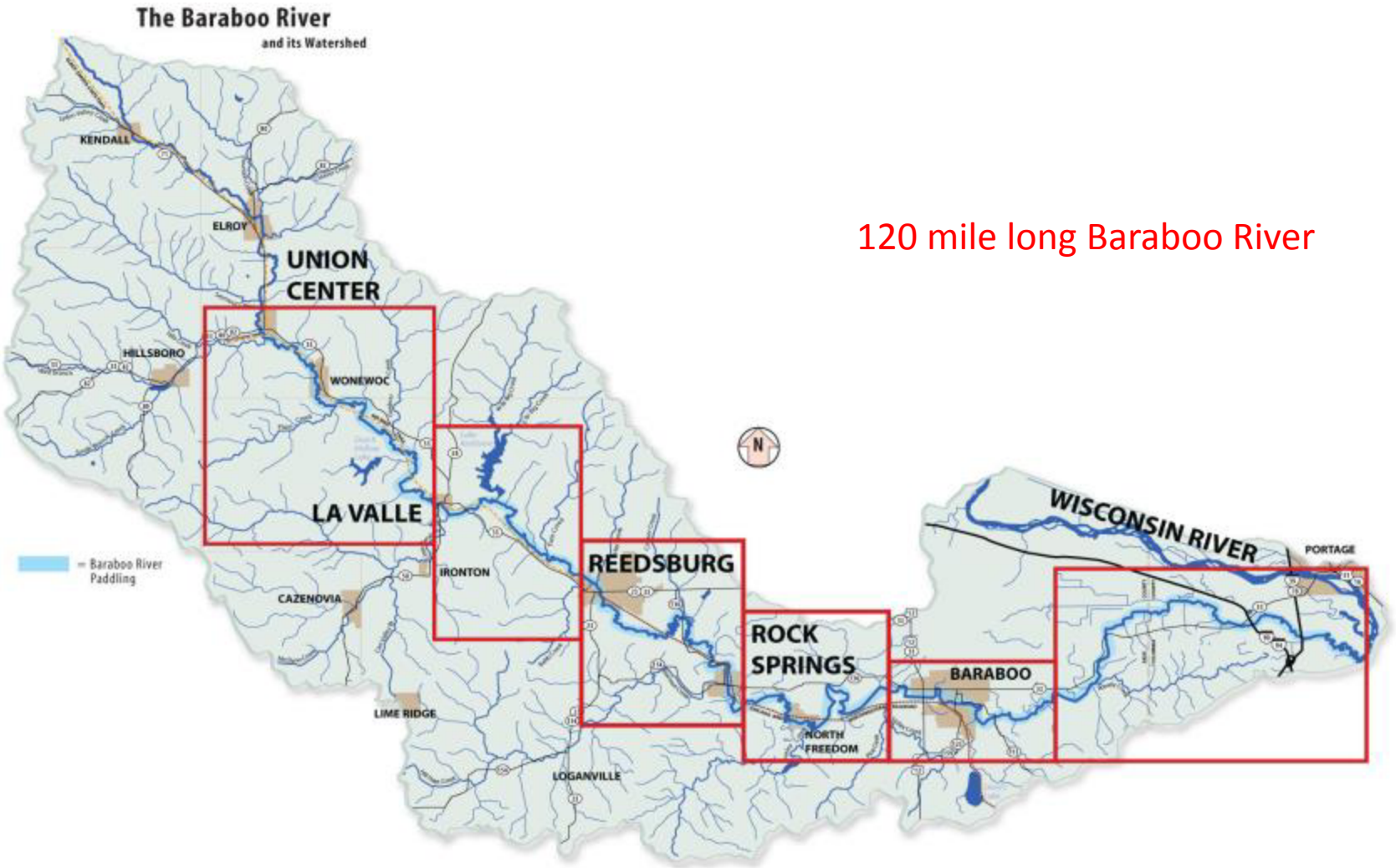
Sugar River oxbow restoration
Unsustainable due to shallow depths

2. Is off-channel lake construction a viable option for millpond communities?


Hemlock Slough
RIVER
La Valle Mill Pond
La Valle
Separation berm
Boat ramp and parking
BM
896
889
904
906
900
28
27
27
1000
1000

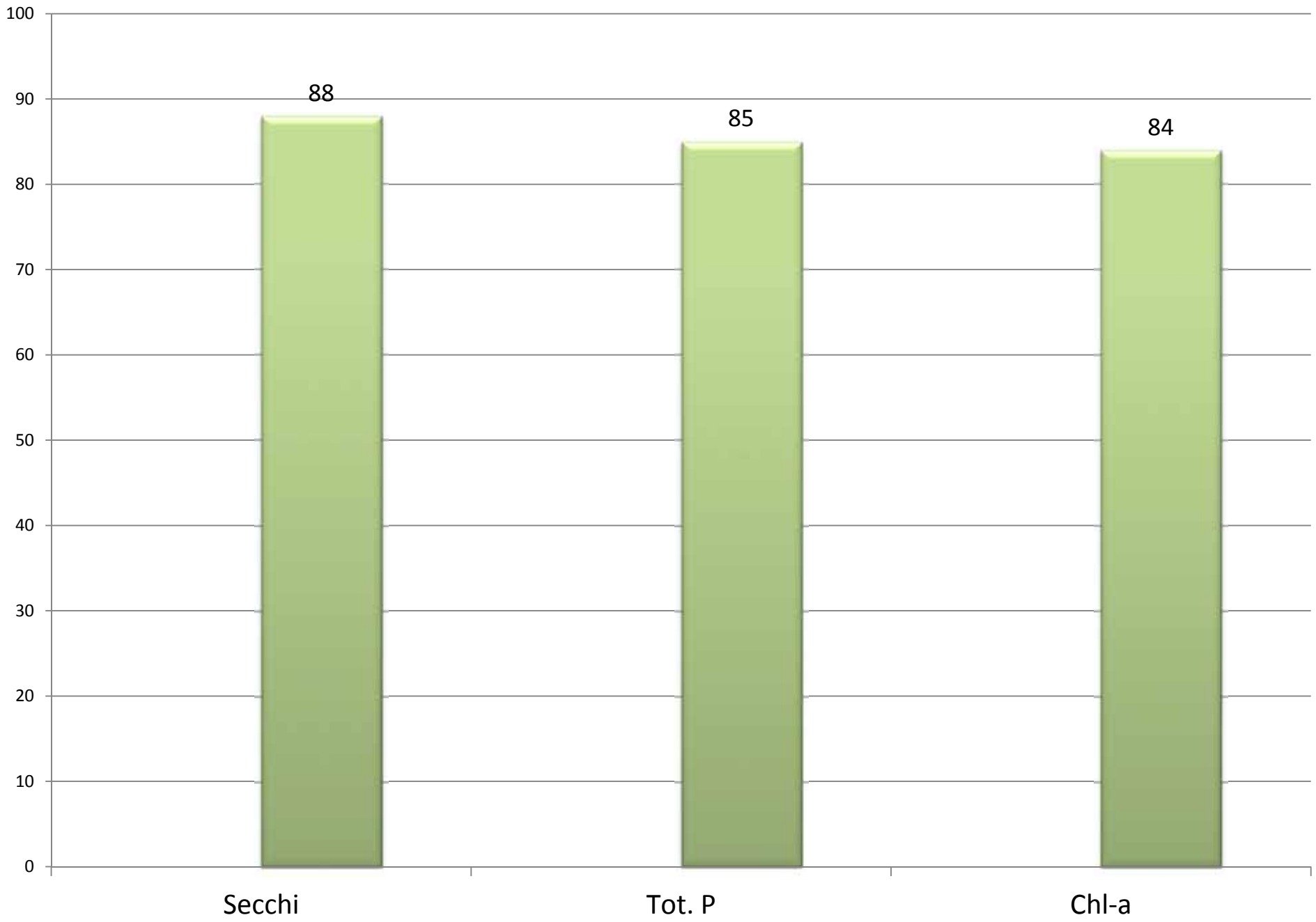

La Valle Slough
(max. depth = 1 meter)
Separation berm

Fish Migration Restored

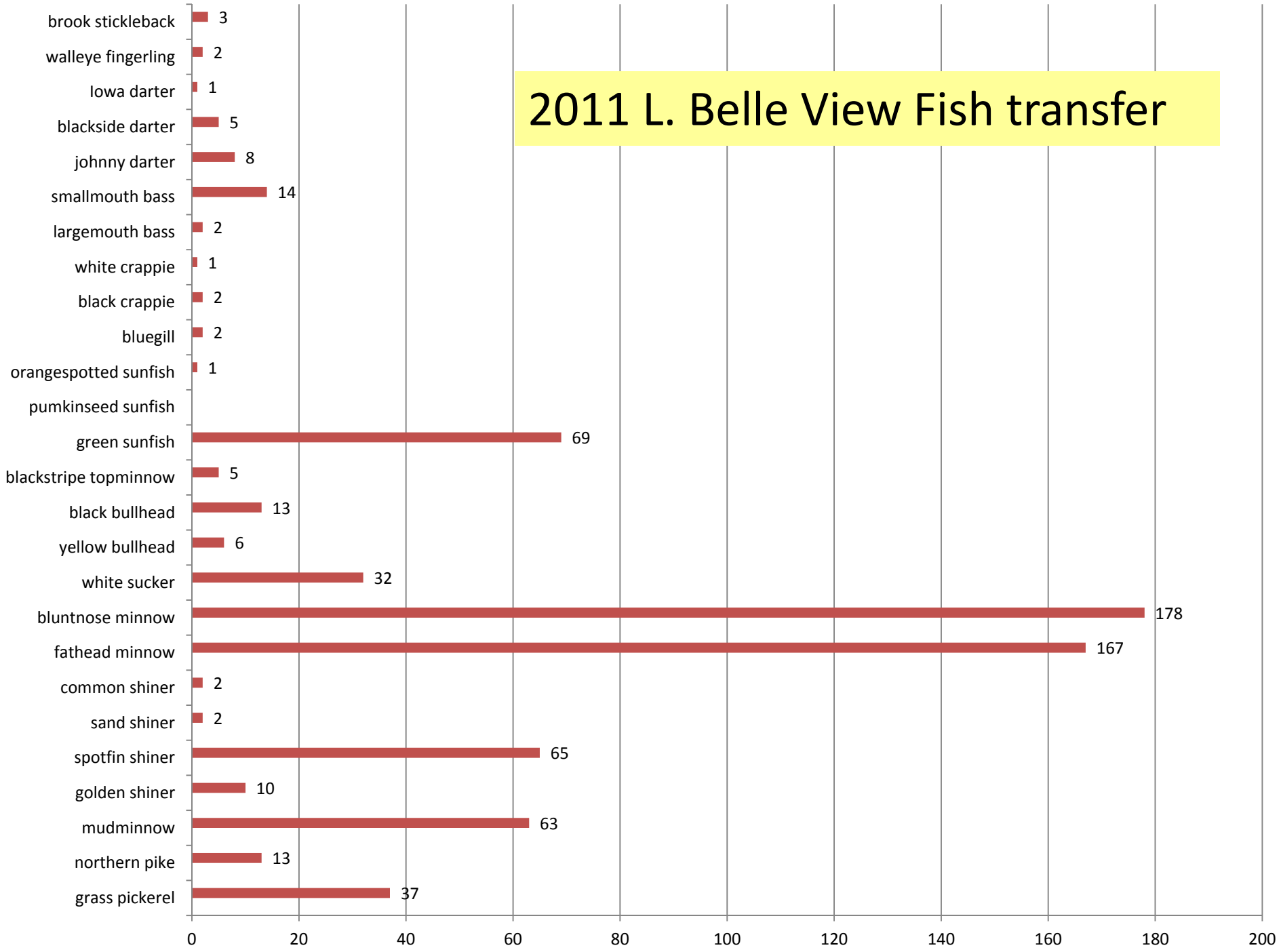


120 mile long Baraboo River

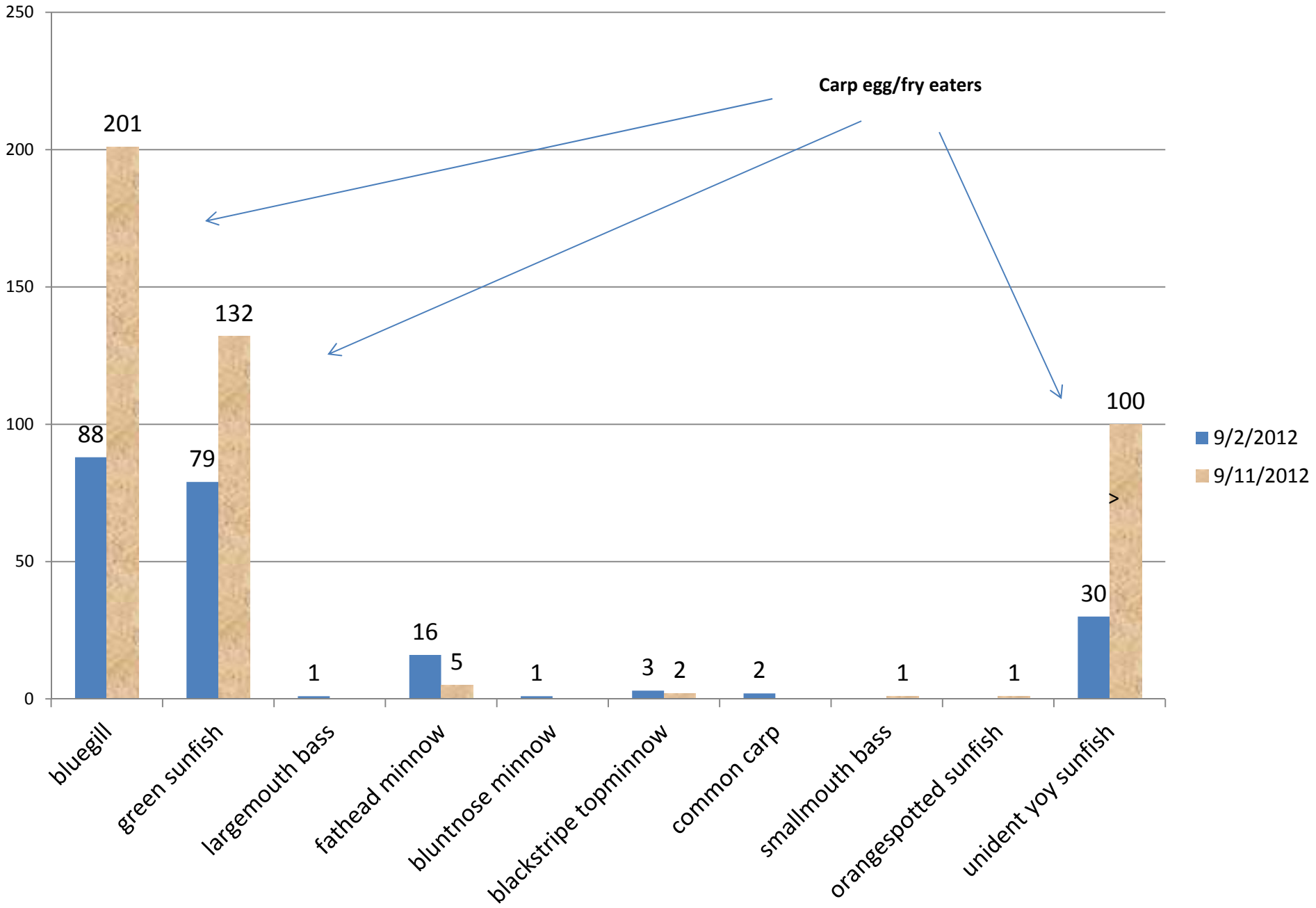
Common carp recruitment in La Valle Slough


La Valle Slough TSI
100
90
80
70
60
50
40
30
20
10
0
88
85
84
Secchi
Tot. P
Chl-a

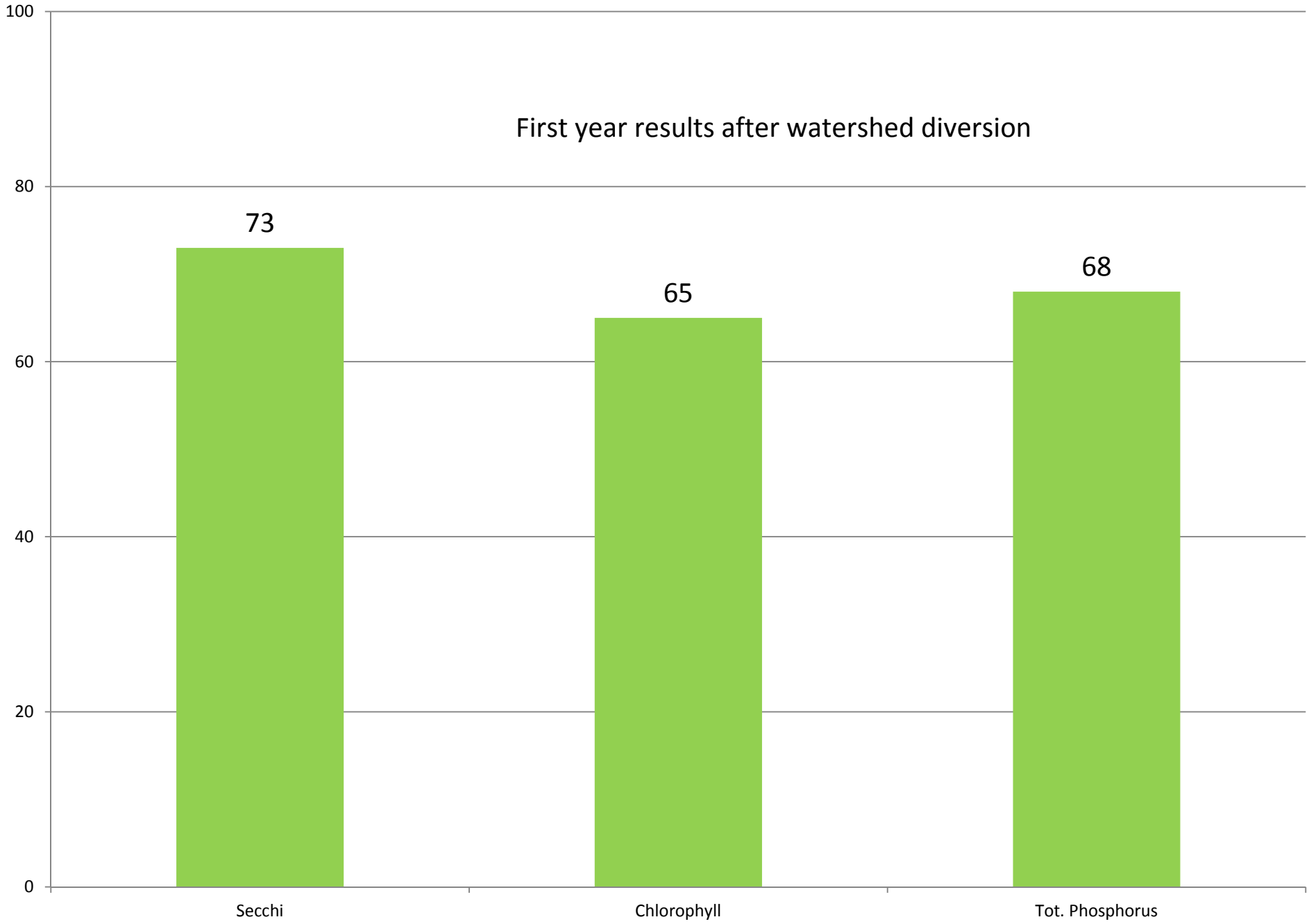
3. Lake Belle View Restoration


2011 L. Belle View Fish transfer
brook stickleback 3
walleye fingerling 2
Iowa darter 1
blackside darter 5
johnny darter 8
smallmouth bass 14
largemouth bass 2
white crappie 1
black crappie 2
bluegill 2
orangespotted sunfish 1
pumkinseed sunfish
green sunfish 69
blackstripe topminnow 5
black bullhead 13
yellow bullhead 6
white sucker 32
bluntnose minnow 178
fathead minnow 167
common shiner 2
sand shiner 2
spotfin shiner 65
golden shiner 10
mudminnow 63
northern pike 13
grass pickerel 37
0 20 40 60 80 100 120 140 160 180 200

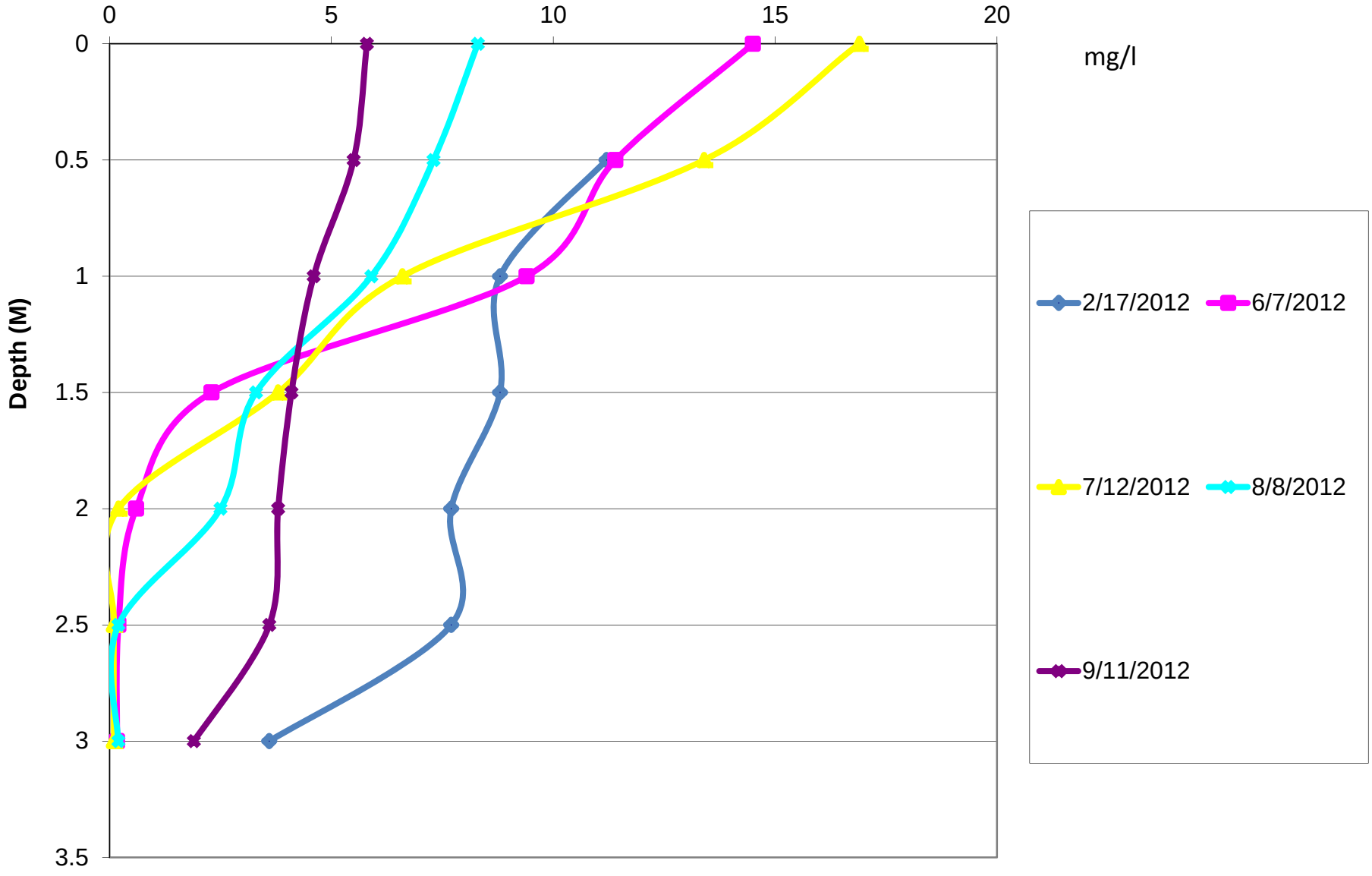
2012 Lake Belle View Nearshore Fish Shocking Results



2012 Lake Belle Ville TSI



2012 Lake Belle View Dissolved Oxygen (mg/l) Profiles



Lake Belle View Turtle Nest Project


04 23 2012