



Living on the Edge:

Evaluating Shallow-Water Habitat in Maine Lakes

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Lake Assessment Section

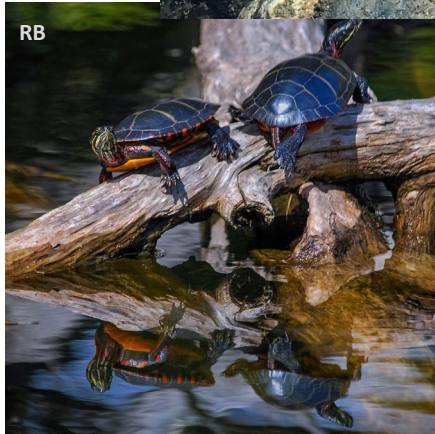
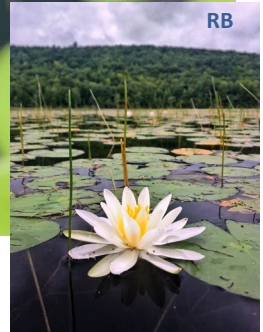
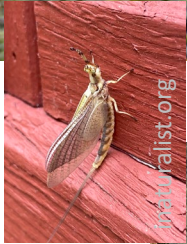
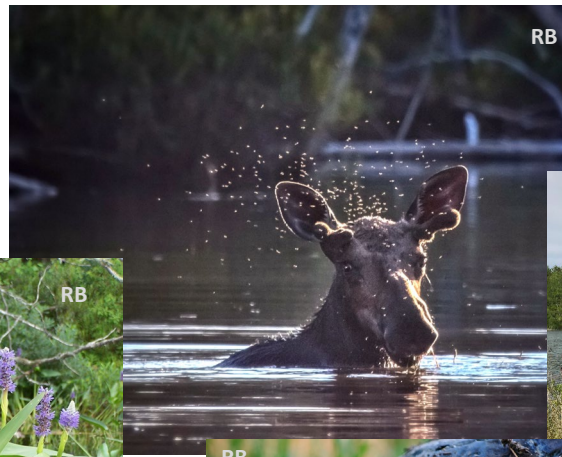
MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Protecting Maine's Air, Land and Water

Where did it
start for you?







RB = ©Ryan Burton



Littoral Zone



- Habitat Protection: It's the law!
 - §465-A. Standards for classification of lakes and ponds
 - A. Class GPA waters must be of such quality that they are suitable ... as habitat for fish and other aquatic life. ***The habitat must be characterized as natural.***

Littoral Zone



- It's important for lake health
 - US lakes with poor lakeshore habitat were 3 times more likely to be in poor biological health

-National Lake Assessment

Riparian Zone Alterations

- Cleared Riparian Areas:
 - Destabilize Shorelines
 - Increase Sedimentation and Nutrient Loading
 - Simplify both shoreland and Littoral Habitat
 - No woody structure
 - Increased erosion
- Leads to change and loss of littoral habitats*

**2007 and 2012 National Lake Assessments (NLA)*

**LakeLine, Vol. 29; Spring 2009*

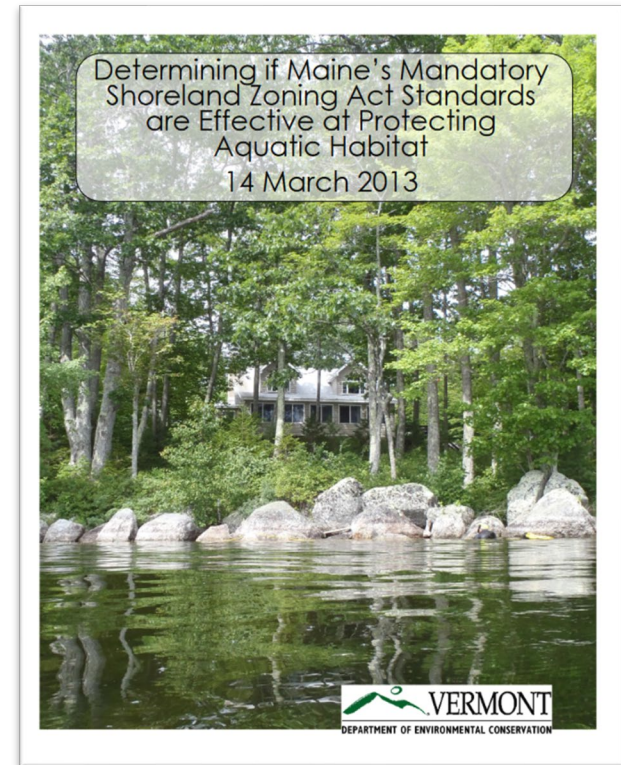


Images: VT ANR



What About Shoreland Zoning?

- Maine Shoreland Zoning Standards are effective at protecting littoral habitat...



What About Shoreland Zoning?

- Maine Shoreland Zoning Standards are effective at protecting littoral habitat...

*when they
are followed*



Littoral Zone



What's
the
plan?

What do we know?

- Littoral Habitat
- Affected by shoreland development
- We need to measure this
- We can't interview fish

**I'M GOING TO HAVE TO SCIENCE
THE ~~S~~ OUT OF THIS**



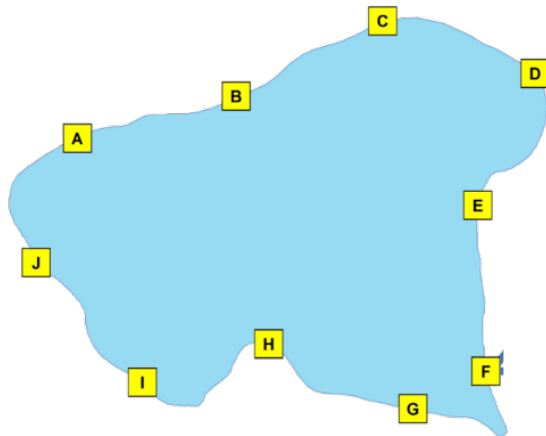
Goals

- Develop measurement techniques
 - Specific to ME
- Define a measurable “natural condition”
- Be able make decisions on littoral habitat conditions for entire lakes
 - Protect & restore lakes that need it most



Littoral Zone Surveys

- Methods adapted from the National Lake Assessments
- Littoral Habitat: Woody structures, substrate composition, macrophyte functional groups, etc.
- Riparian Vegetation: Tree canopy to ground cover
- Human Influences (presence/absence)





*Need to have **objective** decision points*



Need to have objective decision points

*We had to research and model
littoral habitat characteristics
and see if shoreland condition
was associated*

This is how we did it....





**CLA = “China Lake
Association”**
July 25th, 2026
China, ME

Field Trip
(not really)
China Lake
water testing

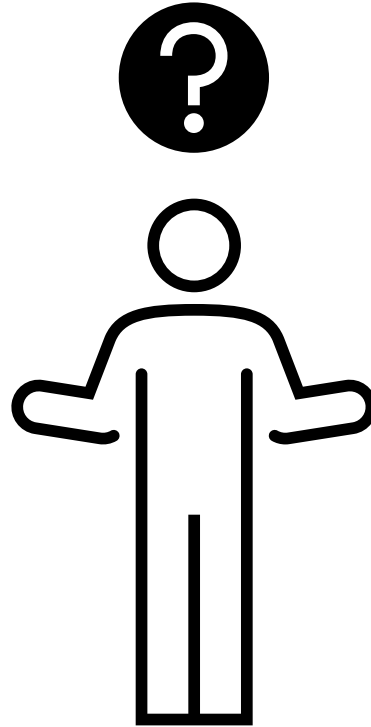
*Imagine
YOU are
in charge
of crowd
control*



**CLA = “China Lawyers
Association”**
July 25th, 2026
China, ME

Field Trip
(probably)
Augusta Courthouse
Light Litigation







What will
you look
for?

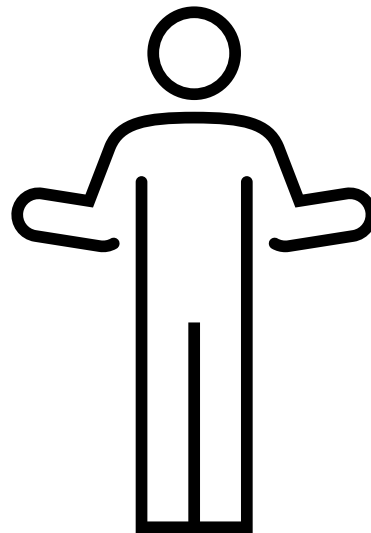


Hat?

*Diameter*_{hat}



Likely



Unlikely





What will
you look
for?



Accessories?

Paddle ✓

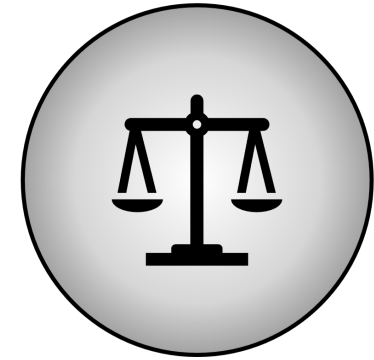


Briefcase ✓





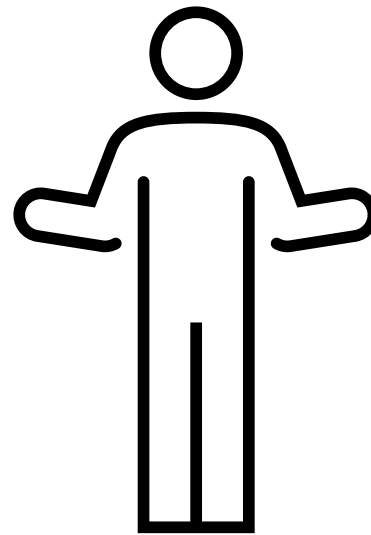
What will
you look
for?



Footwear?



OR



OR





Time to Make Decisions!



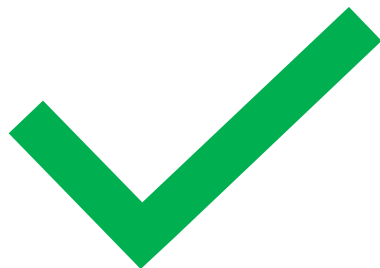
- Hat (wide)
- Accessories (paddle)
- Footwear (sandal/hiker)

- No Hat
- Accessories (briefcase)
- Footwear (formal)





Time to Make a Decision!

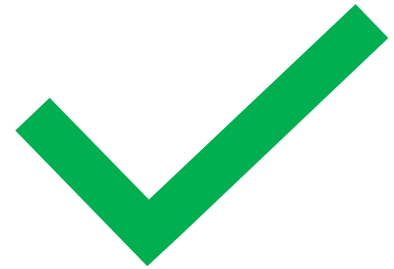




Time to Make a Decision!

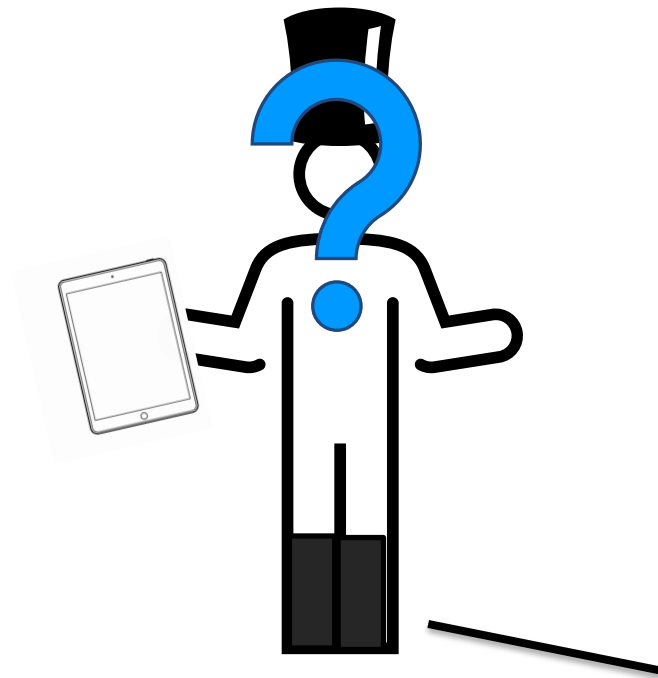


(no hat)



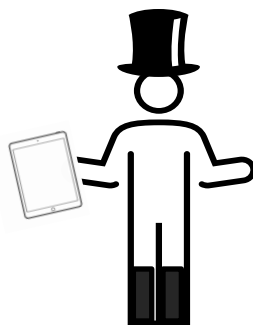


Time to Make a Decision!





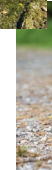
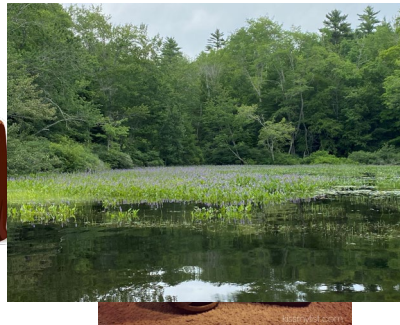
Lakes



Lawyers

➤ *Need to find out what works*





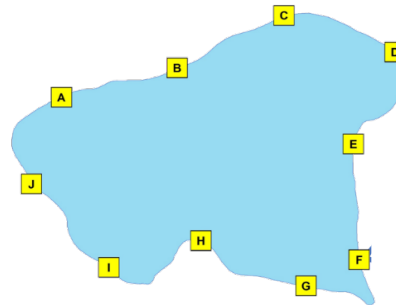
Lakes



Lawyers

➤ *Need to find out what works*





Diminished
Habitat



Natural
Habitat

➤ *Need to find out what works*



Study Design

- Undeveloped lakes vs. highly developed lakes
- Find measurements that show a difference from the 'natural' condition



Diminished
Habitat



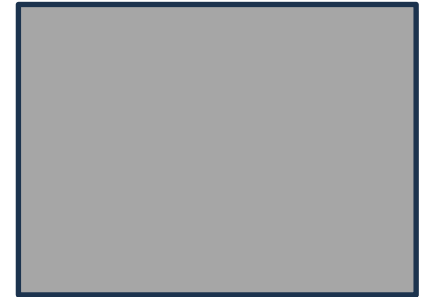
Natural
Habitat

➤ *Need to find out what works*



Study Design – Model Development

- Look for signals in Littoral Habitat: Woody structures, substrate, plants, etc.
- Found metrics that showed measurable differences in habitat, reflected shoreland condition



Diminished
Habitat



Natural
Habitat

➤ *Need to find out what works*



Findings: *Important Measurements*

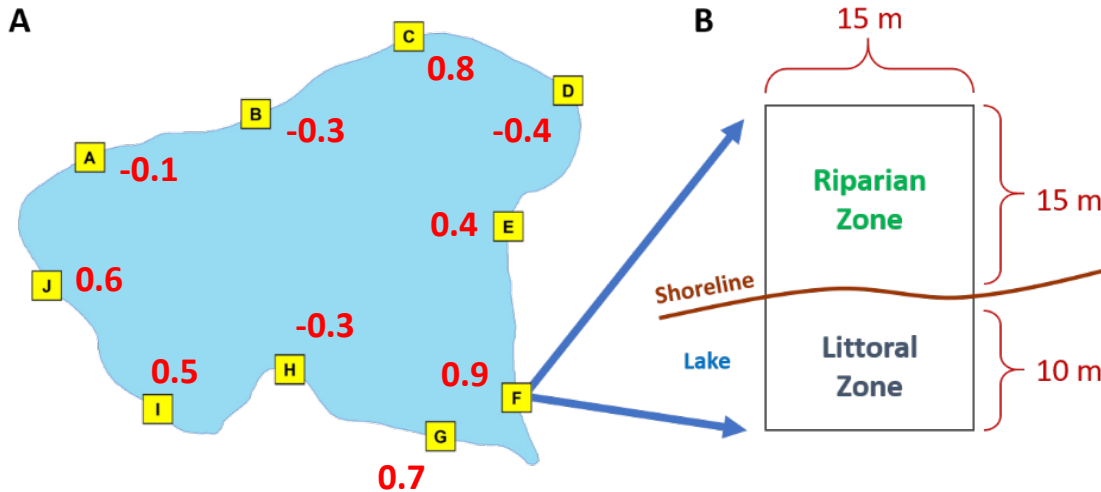
- Percent Sand
- Substrate Particle Size Variability
- Large Woody Habitat
- Floating leaved plant cover
- Littoral Habitat cover
- Habitat Diversity
- Total Plant Cover
- Total Woody Habitat

Diminished
Habitat



Natural
Habitat



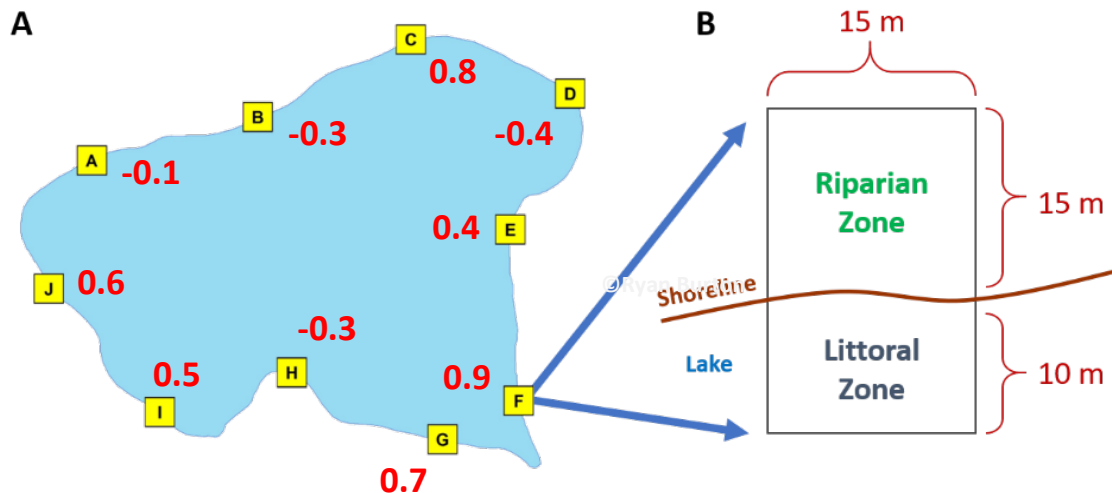


Linear Discriminant Model:

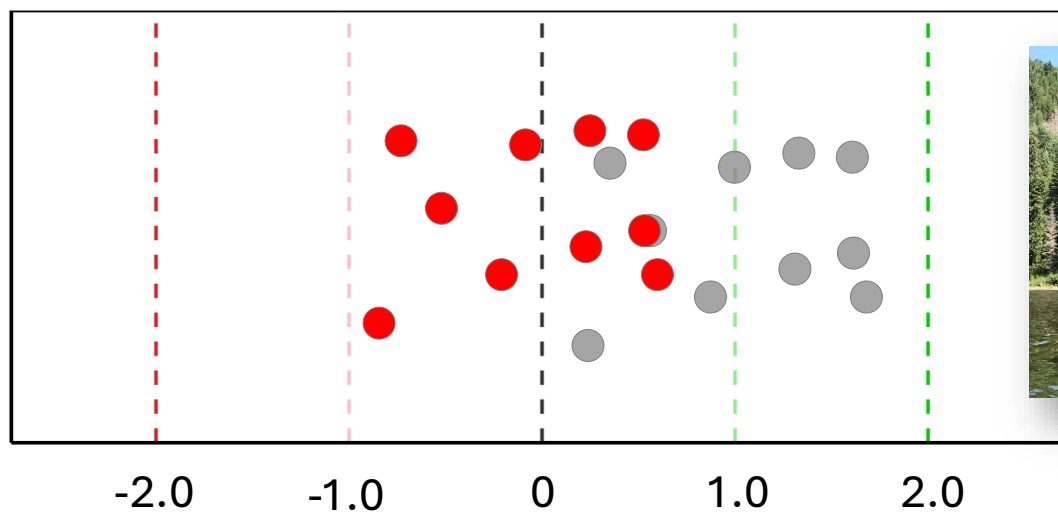
$$\begin{aligned}
 & \text{SUB_SAND} * -1.442 \\
 + & \text{TOTMAC} * -0.738 \\
 + & \text{LK_SMNTCVR} * -0.027 \\
 + & \text{TWH} * -0.231 \\
 + & \text{FLOAT} * 0.517 \\
 + & \text{SUB_VAR} * -5.458 \\
 + & \text{SUB_PSIZE} * -0.197 \\
 + & \text{FC_LWH} * 0.913 \\
 + & \text{SHANNON} * 1.508 \\
 + & \text{LK_LITCVRB} * 4.675
 \end{aligned}$$

LDA SCORE





*More
Natural*



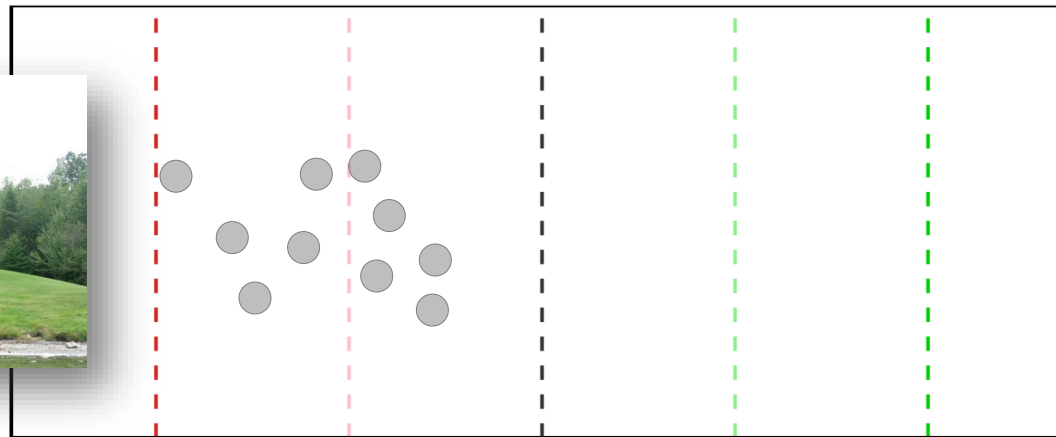
Diminished
Habitat



Natural
Habitat



*Less
Natural*



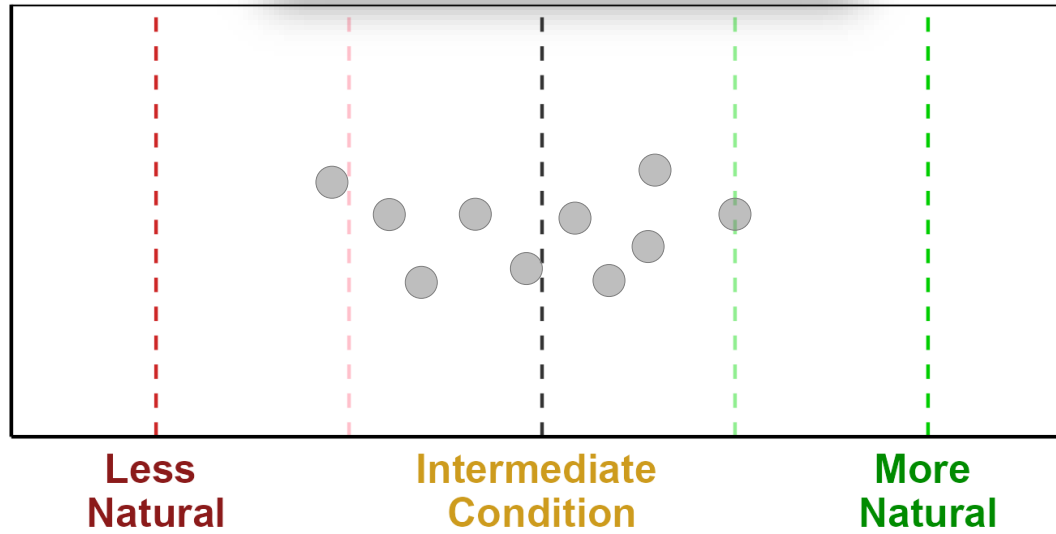
**Less
Natural**

**Intermediate
Condition**

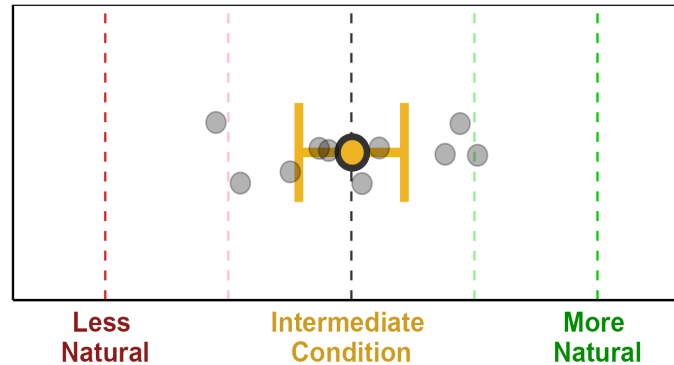
**More
Natural**



Intermediate



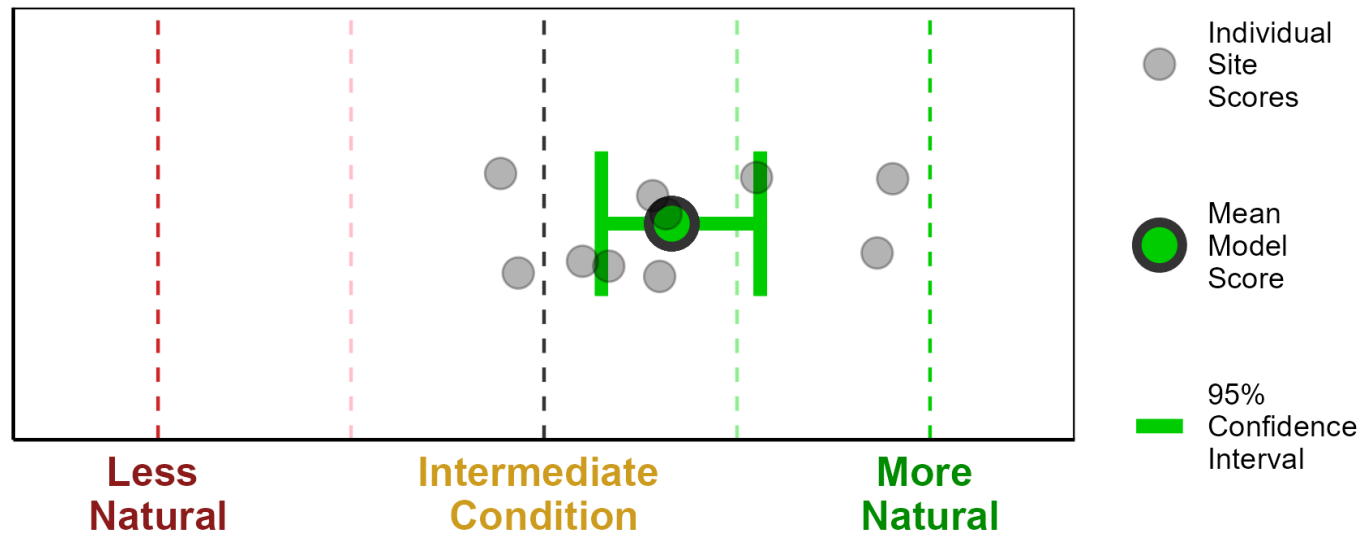
Scoring a Lake: Confidence Intervals



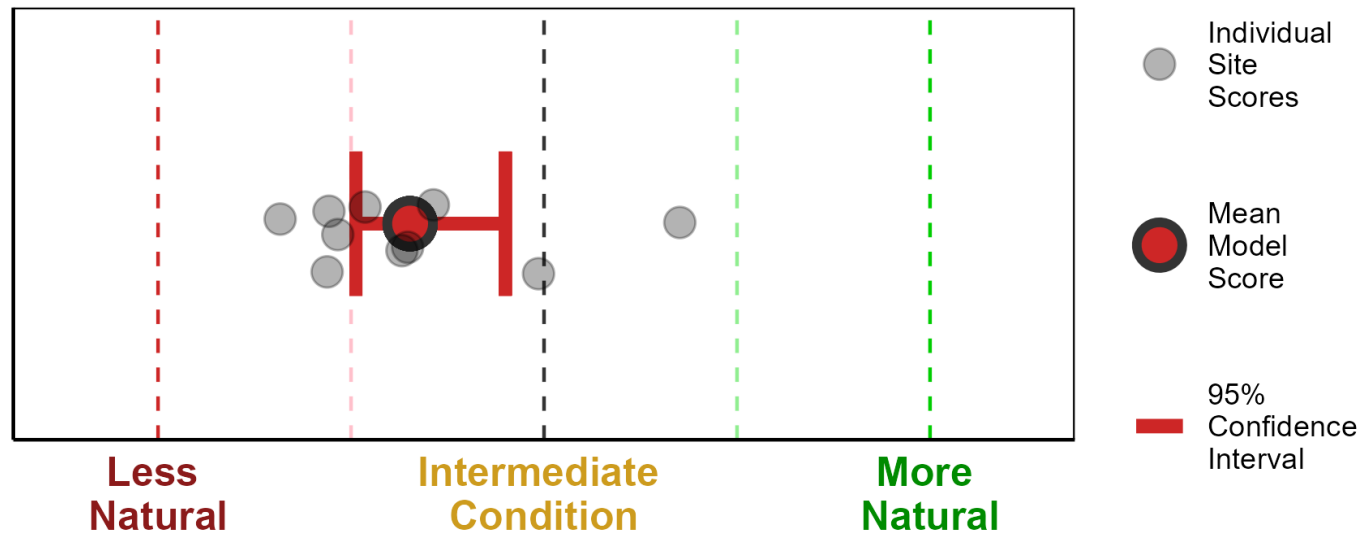
Value falls within this interval 95% of time



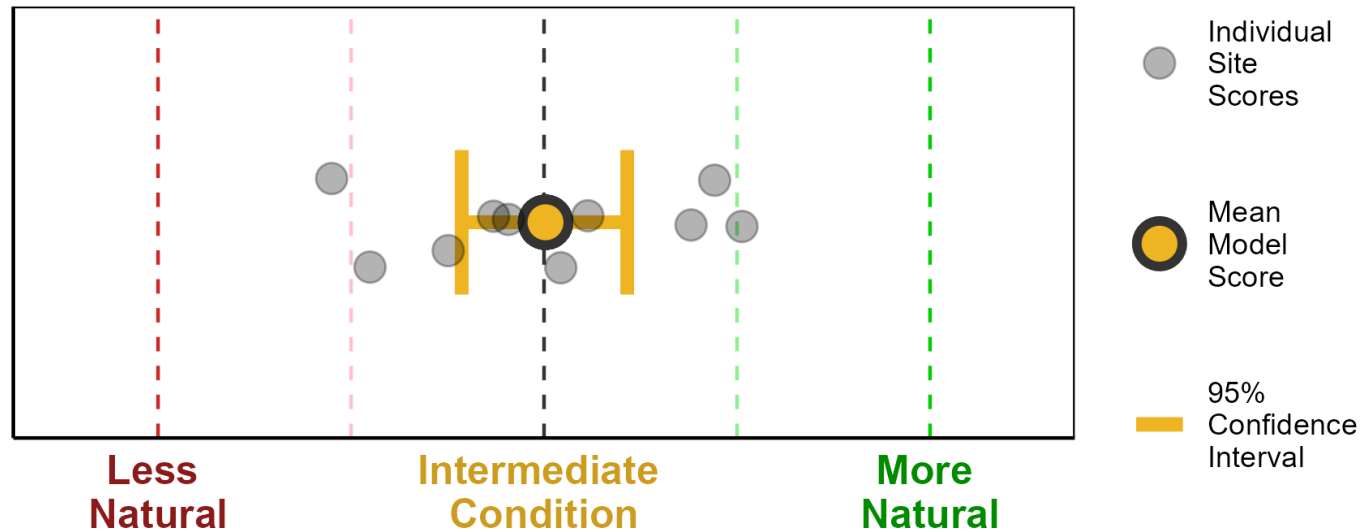
Scoring a Lake



Scoring a Lake



Scoring a Lake



Scoring a Lake

More Natural

Habitat is in good condition – work to keep it that way!

Intermediate Condition

Shoreland development is affecting littoral habitat condition. Restoration and enhancement could be highly effective.

Less Natural

Littoral habitat is of diminished quality. Lake should be prioritized for shoreland restoration.



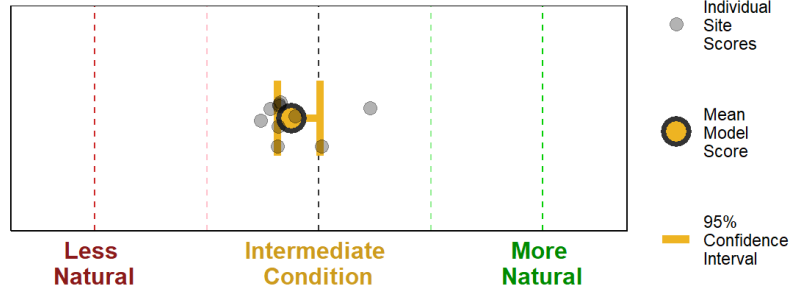
China Lake: A Tale of Two Basins



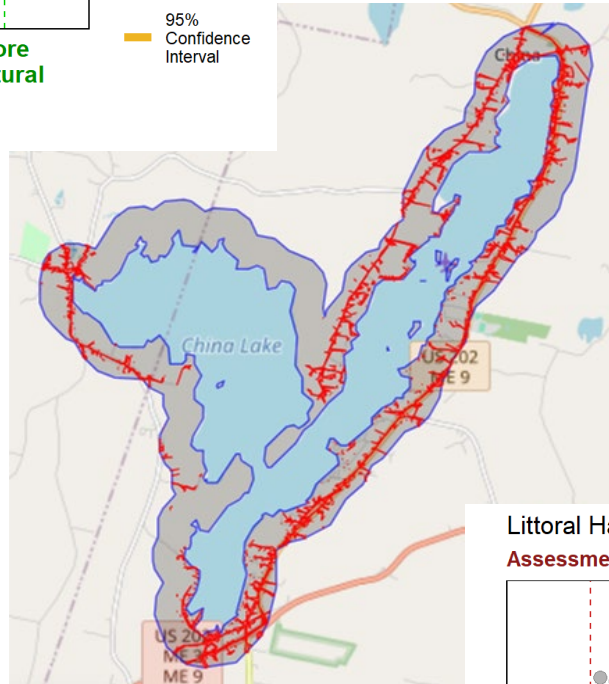
West Basin

Littoral Habitat Assessment: China Lake (West Basin) (MIDAS 5448)

Assessment Result: **Intermediate Condition**



Survey Year: 2019

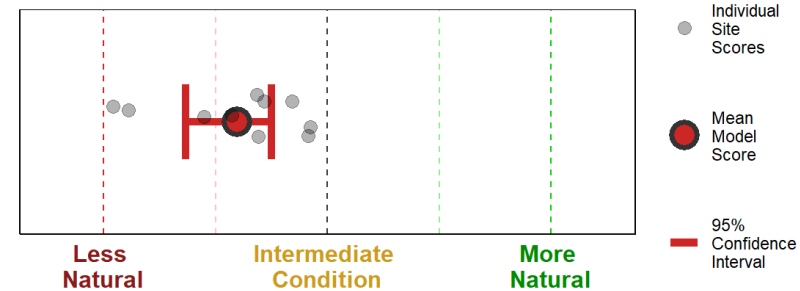


Impervious Surfaces

East Basin

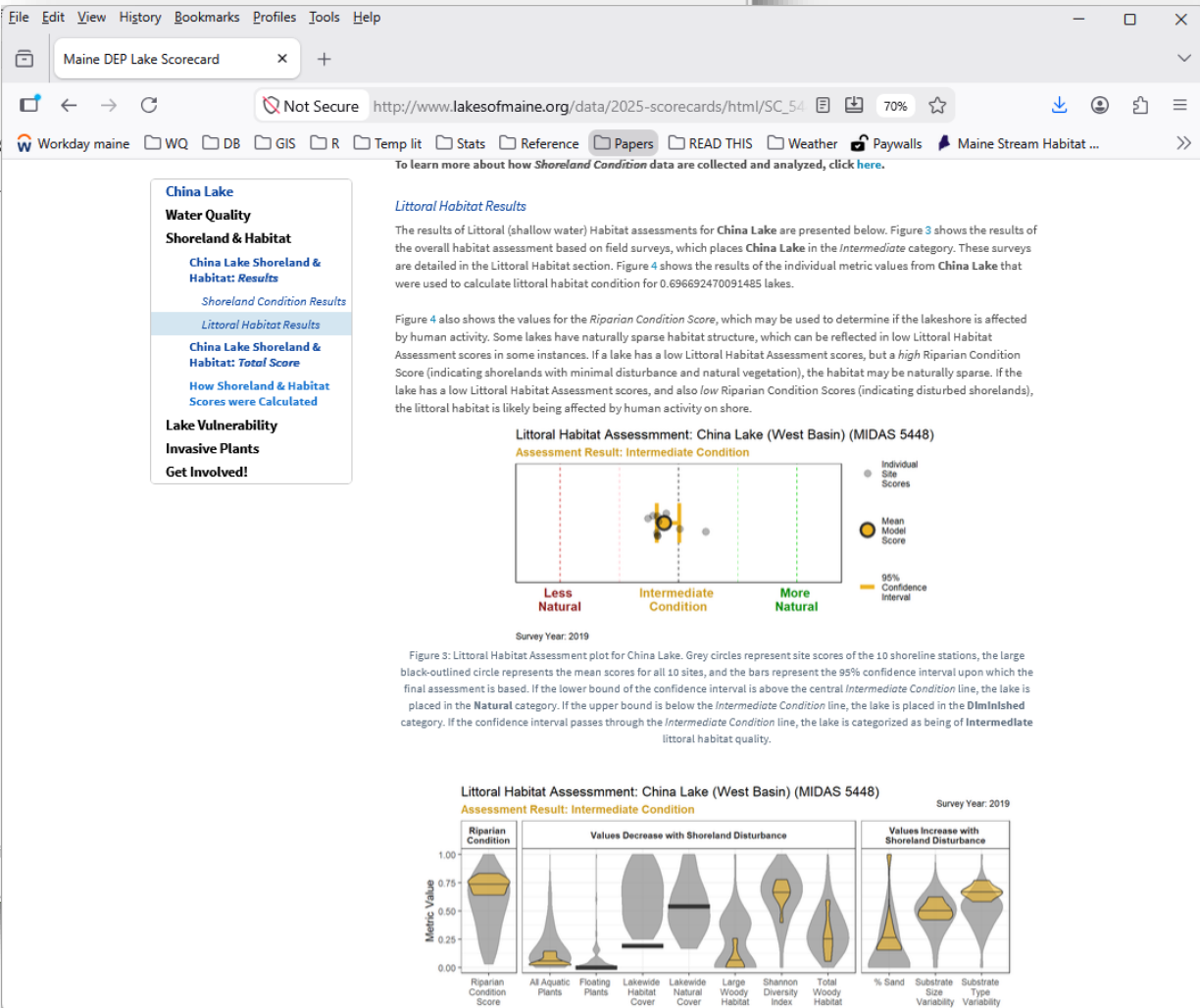
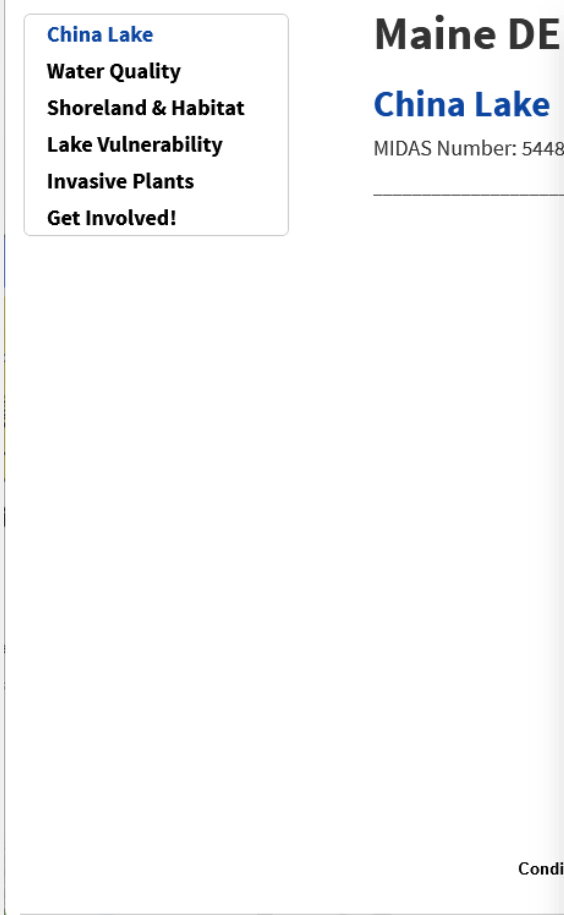
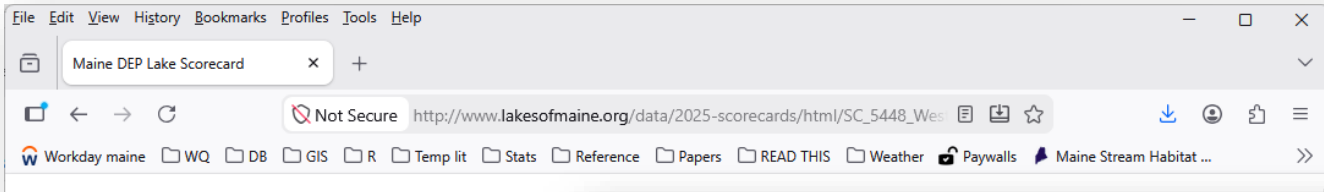
Littoral Habitat Assessment: China Lake (East Basin) (MIDAS 5448)

Assessment Result: **Diminished Condition**



Survey Year: 2019





What's Next?

- These are whole-lake evaluations
- Looking at *lakewide* Habitat Impairment
 - Similar to water quality issues or trophic decline
- Prioritize lakes for shoreland restoration activities
- LakeSmart
- DEP's OUR SHORE



What You Can Do

- Maintain & establish riparian buffers of native vegetation
- Leave littoral habitat in place if not a hazard
- Spread the word within your networks
- LakeSmart & OUR SHORE are great resources



Acknowledgements

- ME DEP: Linda Bacon, Ryan Burton, Josh Noll, Patrick Lind, Tess Gioia, John McPhedran, Denise Blanchette, Doug Suitor, Karen Hahnel, Tom Danielson, Emily Zimmerman, many others
 - Aria Amirbahman & Stephen Norton, UMaine
 - Phil Kaufmann, US EPA





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