Valuing the Economic Benefits of Maine’s Great Ponds in the 21st Century

Dr. Jianheng Zhao, Dr. Adam Daigneault, Dr. Keith S. Evans, Melissa Genoter, University of Maine
Susan Gallo, Maine Lakes,
Linda Bacon, Maine Dept. of Env. Protection
Introduction

• Ecological, Economical, and Social Value
  — Ecological services: water filtration, flood control, climate regulation
  — Critical wildlife habitats
  — Recreational value: swimming, boating, fishing, hunting

• Econ Value of ME Great Ponds study in 1990s:
  — $5 billion/yr in direct and indirect sales
  — $11 billion/yr in net economic value
25 years later, much has changed…

- Climate change
- Invasive species
- Housing demands
- Recreation interests

How have these changes affected the value of ME lakes?
Drivers
- Nutrients
- Invasive Species
- Climate Change
- Lake Management

Water Quality
- water clarity

Economic Values (Secondary data)
- shorefront home value, drinking and industrial water consumption, youth camp revenue, etc.

Economic Values (Primary data)
- Perception, recreation use and expenditures

Stakeholder Outreach
- website, factsheets, presentations
- public meetings

Current Project Framework

Policymaker and Individual Action
Measuring Water Quality /Clarity
Demand rising for lakefront houses

- Net migration: 2.7% population rise (2019-2023), sales price (>14% rises)
- COVID-19 impacts: value high on privacy, space, and natural setting
- Recreation opportunities
- Convenient life (travel efficiency, network, etc.)

Zoning and Development

Economic factors: interest rates, inflation, insurance

Lake quality
## Regional Lake Analysis

<table>
<thead>
<tr>
<th>Original Groups (1990s)</th>
<th>New Groups (Today)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewiston/Auburn Area</td>
<td>Lewiston/Auburn Area</td>
</tr>
<tr>
<td>Augusta Area</td>
<td>Winthrop Lakes Region</td>
</tr>
<tr>
<td>Waterville Area</td>
<td>Belgrade Lakes Region</td>
</tr>
<tr>
<td>Newport/Dexter Area</td>
<td>Newport/Dexter Area</td>
</tr>
<tr>
<td>Ellsworth Area</td>
<td>Ellsworth Area</td>
</tr>
<tr>
<td>Northern Maine</td>
<td>Northern Maine</td>
</tr>
<tr>
<td>Camden</td>
<td>Camden</td>
</tr>
<tr>
<td></td>
<td>Greenville</td>
</tr>
<tr>
<td></td>
<td>Sebago</td>
</tr>
<tr>
<td>36 lakes</td>
<td>150 lakes</td>
</tr>
</tbody>
</table>

![Map of Maine lakes](image_url)
Hedonic Pricing Models

Hedonic pricing estimates economic value of ecosystems that are linked to market goods.

Logic: people pay more for goods associated with high environmental quality.
Data Collection

Key variables
- Property prices
- Property characteristics
- Indicator for water quality

Sources: Redfin, Zillow, Maine DEP, VLMP
- Time range: 2017-2022
- Lakefront single-family properties
- Over 3,800 housing transactions
- Around 150 lakes
**Housing Attributes**
- # Rooms, Lot Size
- Fireplace, Garage, Private water
- Water frontage, Site characteristic

**Location Attributes**
- School district ratings
- Population density
- Household income
- Geographic information: Zip code, Census tract

**Lake Attributes**
- Shoreline length
- Lake area
- Secchi depth
Finding: Lake related variables
- Secchi depth (+), Private water (+),
- Water frontage length, Lake area no effect,
  Intersection terms with Secchi depth (+)

Results:
Prices much higher with higher Secchi depth
Water quality $↑$ brings more add values
- property with longer water frontage or near larger lake area.
- property located to Lewiston/Auburn Area, Ellsworth Area, Augusta Area

<table>
<thead>
<tr>
<th>($2023$ dollars)</th>
<th>Net economic value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake-front Properties</td>
<td>$13.3$ billion</td>
</tr>
<tr>
<td>1 foot water quality (+)</td>
<td>$1.1%$</td>
</tr>
</tbody>
</table>
Recreation Demand

- Collected using survey-based estimates
- Activities include boating, fishing, swimming, hunting
- Estimates based on travel cost
  - Higher quality or better amenities $\rightarrow$ willing to travel farther

Travel cost: the value of a recreational site can be estimated from the number of visitors and the cost of travelling there

- $5\, \text{km} = $10$
- $10\, \text{km} = $20$
- $15\, \text{km} = $30$
Survey results

- 768 residents selected at random
- 77% residents visited lakes

Visited respondents

- Trips frequency & Expenditure up to 5 lakes (150 lakes)
  - 2022 actual trips (13.3 trips/person/yr)
  - Anticipated trips – water quality changes (2 less trips/person/yr)

- Access and barriers of Maine’s lakes uses
- Perceptions of environment and water quality
- Socio-demographic data
• 77% residents visited lakes
• 22% visited Sebago lake
• 13% visited Moosehead
## Net Economic Estimates

<table>
<thead>
<tr>
<th></th>
<th>Sebago Lake</th>
<th>Moosehead Lake</th>
<th>All lakes in Maine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per trip per capita per lake</td>
<td>$29.88</td>
<td>$43.48</td>
<td>$33.80</td>
</tr>
<tr>
<td>Predicted Trips /yr</td>
<td>4.6</td>
<td>3.3</td>
<td>13.3</td>
</tr>
<tr>
<td>Visit rates</td>
<td>15.8%</td>
<td>6.4%</td>
<td>76.7%</td>
</tr>
<tr>
<td>Net economic value ($/yr)</td>
<td>$31 million</td>
<td>$13 million</td>
<td>$501 million</td>
</tr>
<tr>
<td>EPA water quality ladder (2 degree degrade)</td>
<td></td>
<td></td>
<td>6% ↓ or $33 mil ↓</td>
</tr>
</tbody>
</table>
Drinking Water

- 2020-21 Annual Reports to ME Public Utilities Commission
- ~ 45 ME water districts with surface water source
  — Serves a population of ~435,000
- Data on total water consumption and revenue
  — Residential, industrial & commercial users
- Mean net value: $765/p/yr = $334 million/yr
- Mean expenditure: $290/p/yr = $126 million/yr
Summer Camps

91 summer camps on lakes and ponds
~48,000 campers/yr
• Net value = $311/camper/wk
• Tuition cost = $2,262/camper/wk
• Travel + Visit cost = $1,304/camper/wk

• Net econ value: $15 mil/yr
• Direct expenditure: $170 mil/yr
<table>
<thead>
<tr>
<th>Type of Use</th>
<th>Net Economic Value ($/yr)</th>
<th>Direct Expenditures/Sales ($/yr)</th>
<th>Total Direct and Indirect Sales ($/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation Uses</td>
<td>$501,076,953</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Consumption</td>
<td>$333,844,580</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Camp Uses</td>
<td>$14,820,008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake-front Properties</td>
<td>$13,304,850,817</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Net Economic Values</strong></td>
<td><strong>$14,154,592,359</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreation</td>
<td>$1,010,457,930</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Consumption</td>
<td>$126,056,224</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Camps</td>
<td>$169,683,283</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake-front Properties</td>
<td>$780,535,539</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Direct Expenditures</strong></td>
<td><strong>$2,086,732,977</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Direct and Indirect Sales</strong></td>
<td><strong>$3,028,715,531</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Acknowledgements