Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

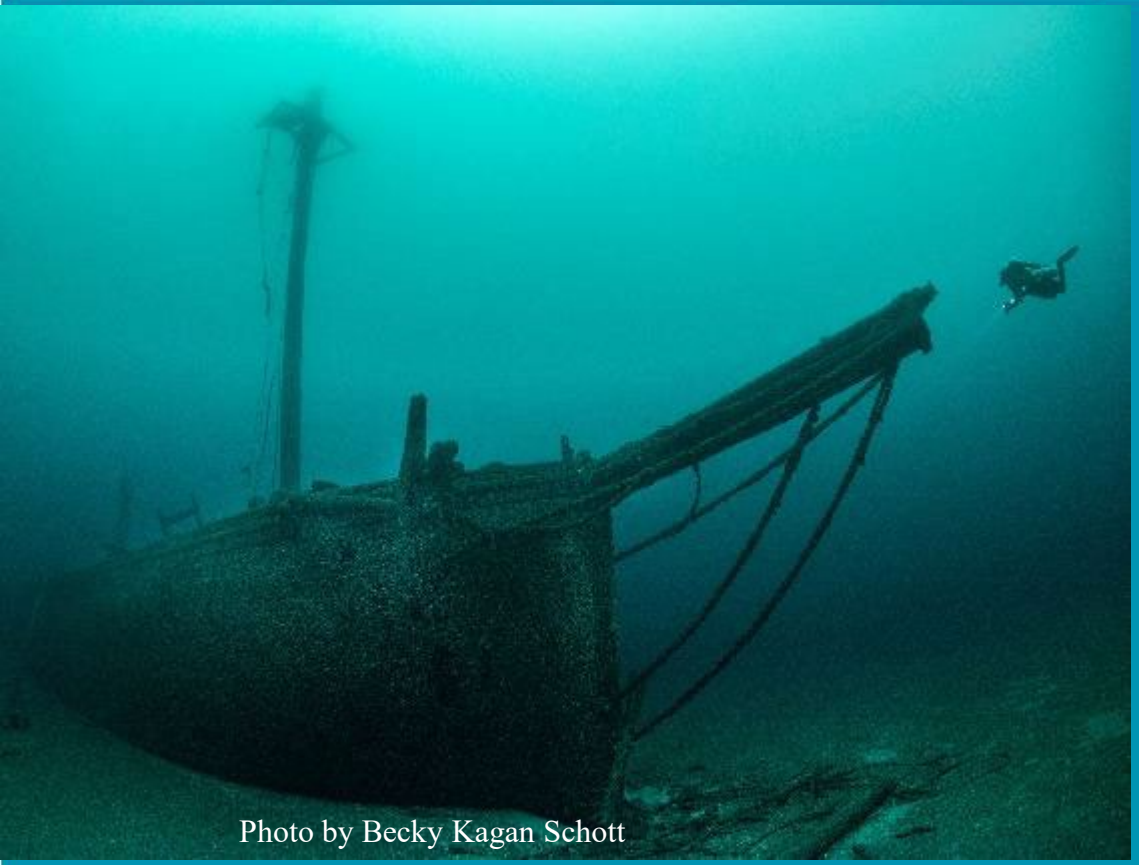
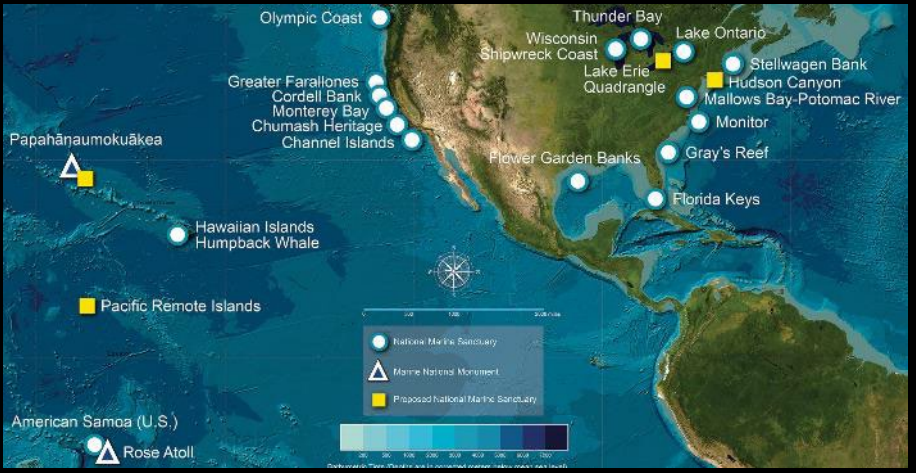


Photo by Becky Kagan Schott

ACES 2024:

A Comprehensive Look at Ecosystem Service Valuation in Sanctuaries and the Great Lakes

Sanctuary System Overview



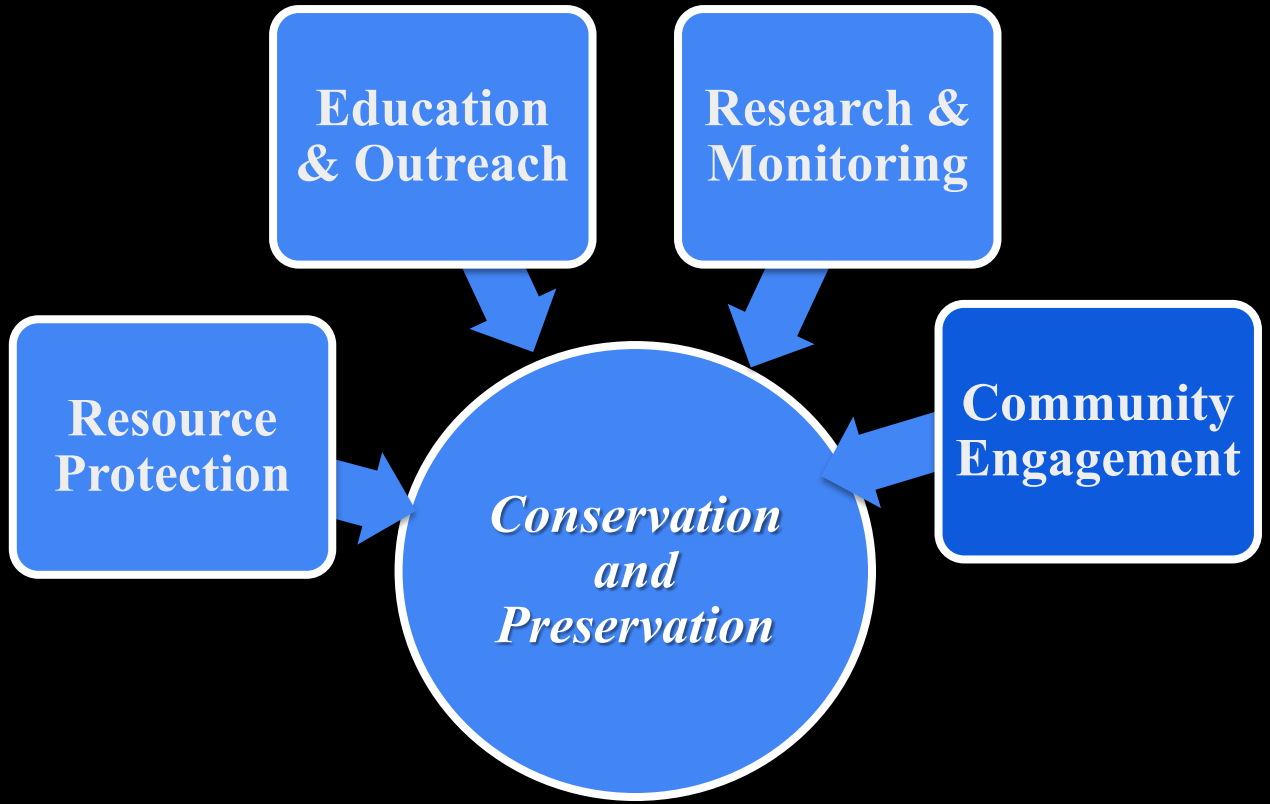
MISSION:

We Protect Treasured Places in the Ocean & Great Lakes

Photo by Becky Kagan Schott

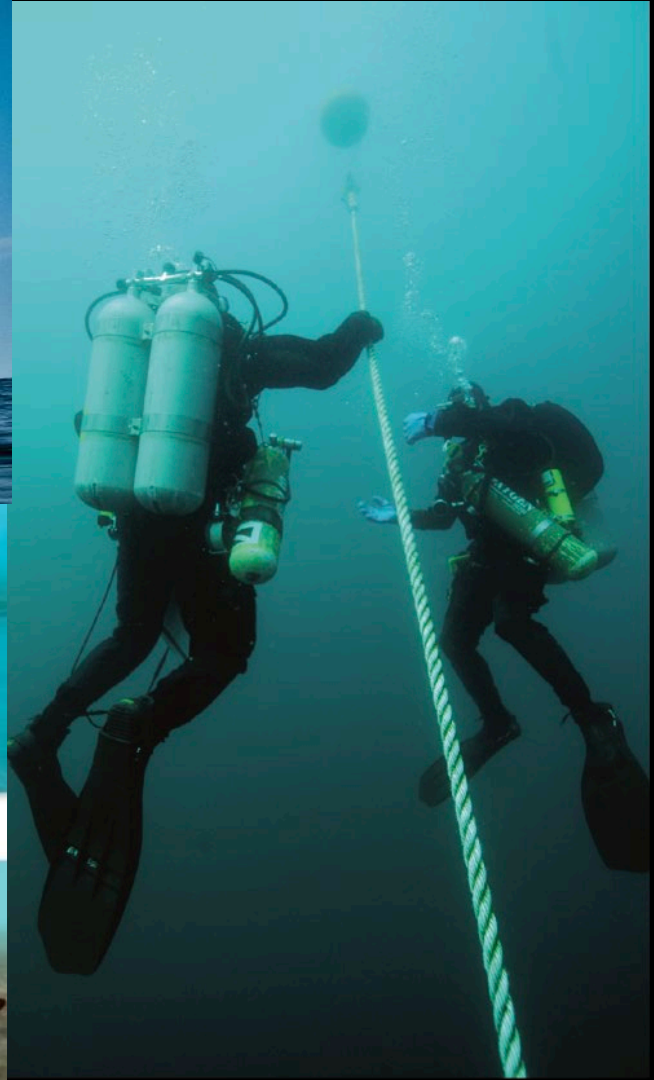
Protecting the Great Lakes and their Rich History

Community-Based Management Through Access & Relevance




DAVID J. RUCK NOAA/ONMS


18ft / 5.4m
1
2
3
4
5
6






DIVER
BELOW


GUARD


WESTERN HOPE
THUNDER BAY
NATIONAL
MARINE
SANCTUARY
National Marine
Sanctuary System

Alpena
MICHIGAN
Sanctuary of the Great Lakes

We value what impacts our lives, and strong personal connections create a greater public will for action.

People protect what they value.

People protect what they love.

VISION: A thriving sanctuary system that protects our nation's underwater treasures and inspires momentum for a healthy ocean.

Role of Socioeconomics in Managing Marine Protected Areas

Socioeconomics in Designation

- Economics is required to inform rulemakings and provide data to the public about the expected impacts and need for the rule
  - National Environmental Policy Act
  - E.O. 12866 - Cost Benefit Analysis
  - Regulatory Flexibility Act
  - Equity and Justice

National Environmental Policy Act

Affected Environment

- Identify the study area
  - Provide a description of this area
- Describe the uses and values people have for the proposed national marine sanctuary
  - Quantify or qualify these uses and value

National Environmental Policy Act

Expected Impacts

- Identify the expected impacts (positive and negative) to the public of the proposed action
  - To the extent possible estimate the monetary impacts of these changes. If not possible, provide a qualitative description.

Executive Order 12866

Cost Benefit Analysis

- Both costs and benefits are expressed in monetary units to the extent feasible
  - Allows you to evaluate different regulatory options with a variety of attributes using a common measure
  - Measuring incremental benefits and costs of different alternatives

Regulatory Flexibility Act

Goal of the analysis is to inform the agency and public of expected economic effects of the proposed rule and to ensure the agency considers alternatives that minimize the expected economic effects on small entities

Distributional Effects

The benefits and costs of a regulation are ultimately experienced by people. For some regulations, different groups of people may be impacted differently. Distributional analysis, whether quantitative or qualitative, can help illustrate these effects.

Distributional Analysis

A “distributional analysis” is an estimate of the likely effects of the regulation on those in specific groups being analyzed.

Great Lakes Socioeconomic Study

To understand the value and contribution of national marine sanctuaries to their communities, Lake and Great Lakes region

1. Local, regional and national context for rulemakings
2. Condition report support for drivers, pressures and ecosystem service valuation
3. Data calls from NOAA, Congress and White House
4. The start of a socioeconomic monitoring program in the Great Lakes for national marine sanctuaries
5. Provide information to managers, stakeholders and rights holders

Primary Components

1. Human use and visitation
2. Economic characterization and assessment
3. Ecosystem services valuation

Characterization and Valuation Studies

Community

Descriptions of people and economic structure of a community. Data provided here informs managers of the people that will be affected by changes to resources and their management and how those changes may impact them.

- Uses of resources across time and place
- Sociodemographic data
- Business composition over time
- Changes to real estate occupation rates

Economy

An economic contribution analysis will provide useful information to the community and management about the level of economic activity sanctuary resources support to both the local and regional economy by sector analyzed (e.g. recreation, education and science).

- Total spending
- Jobs and wages
- Gross Domestic Product
- Tax revenues

Ecosystem Services

People benefits from sanctuary resources - both cultural and natural. Quantification and qualification of the services is an important part of describing how people, sanctuaries and resources interact.

- Recreation (Consumptive, Non-consumptive)
- Education
- Conservation science
- Sense of place and Heritage

Human Use and Monitoring

1. Activity participation rates by location
2. Motivations
3. Expenditures
4. Attitudes and perceptions
5. Socio-demographics of users

Economic Characterization and Assessment

1. Socio-economic profiles of communities
    a. Key industries and employment
    b. Demographics of community
    c. Changes to real estate markets
2. Profiles of industry
    a. Business composition of the community
    b. Description of businesses directly dependent upon sanctuary resources
3. Contribution analysis
    a. Jobs
    b. Income
    c. Sales

Valuing Ecosystem Services

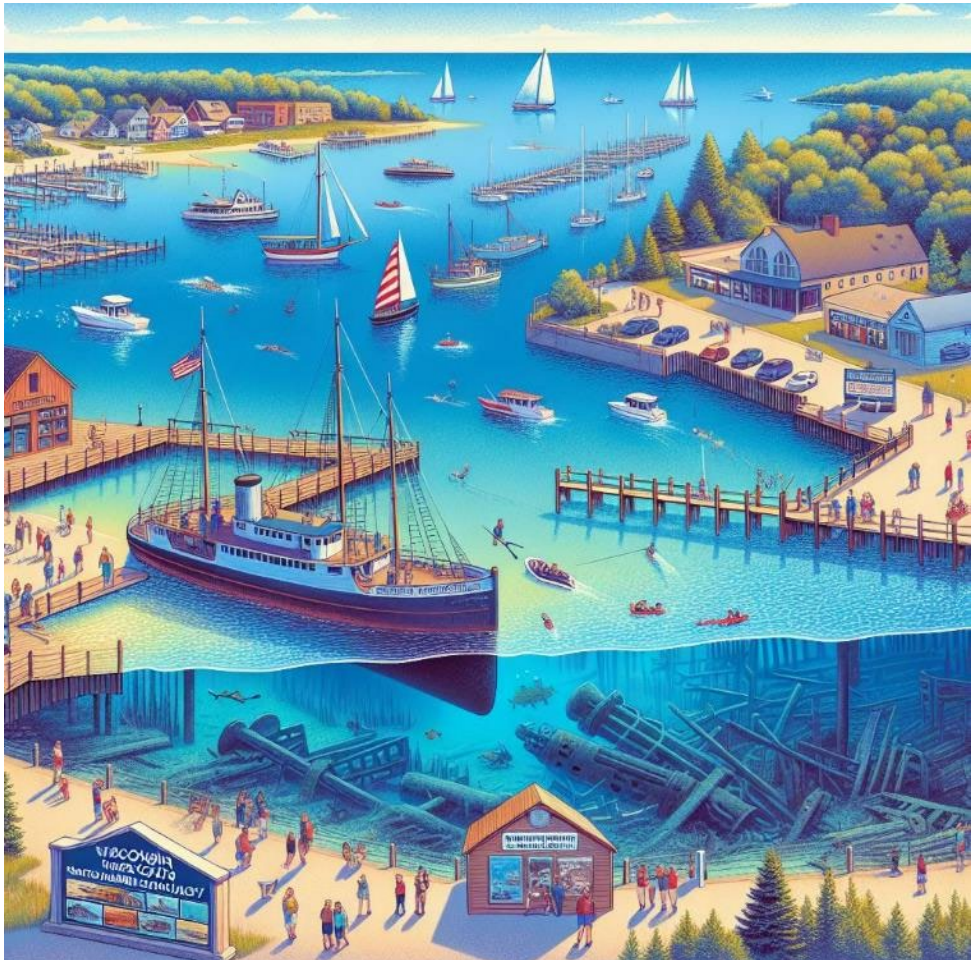
1. Consumptive
2. Non-consumptive recreation
3. Ornamentals
4. Education
5. Science
6. Sense of place
7. Heritage

Developing a Study Area

Study Area Consideration: Geographic Boundaries

Study Area Consideration: Economic Activity

Where are the businesses related to the Sanctuary located?



Study Area Consideration: Employment Traffic Flows

Where are employees coming from?

Study Area Consideration: Economic Linkages

Where do the substantial linkages to the direct economic activity occur?

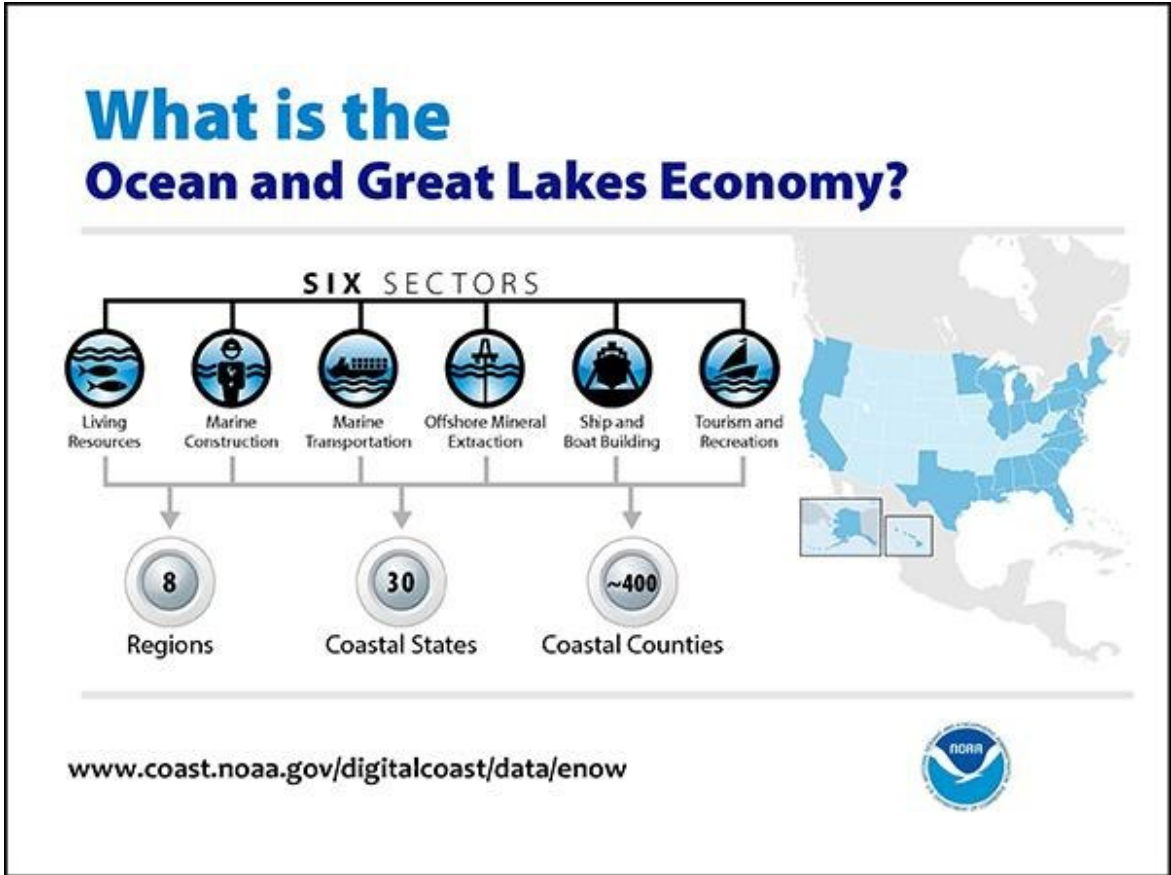
Socioeconomic Profiles

Socioeconomic Profiles: Overview

- Characterize community economies and demographics
- Better understand how they are connected to existing and proposed sanctuaries
- Evaluate trends over time both inside, near, and outside of sanctuary areas
- Viewable through metrics like population, GDP, wages, # businesses, employment, and more

Socioeconomic Profiles: Example Data Sources

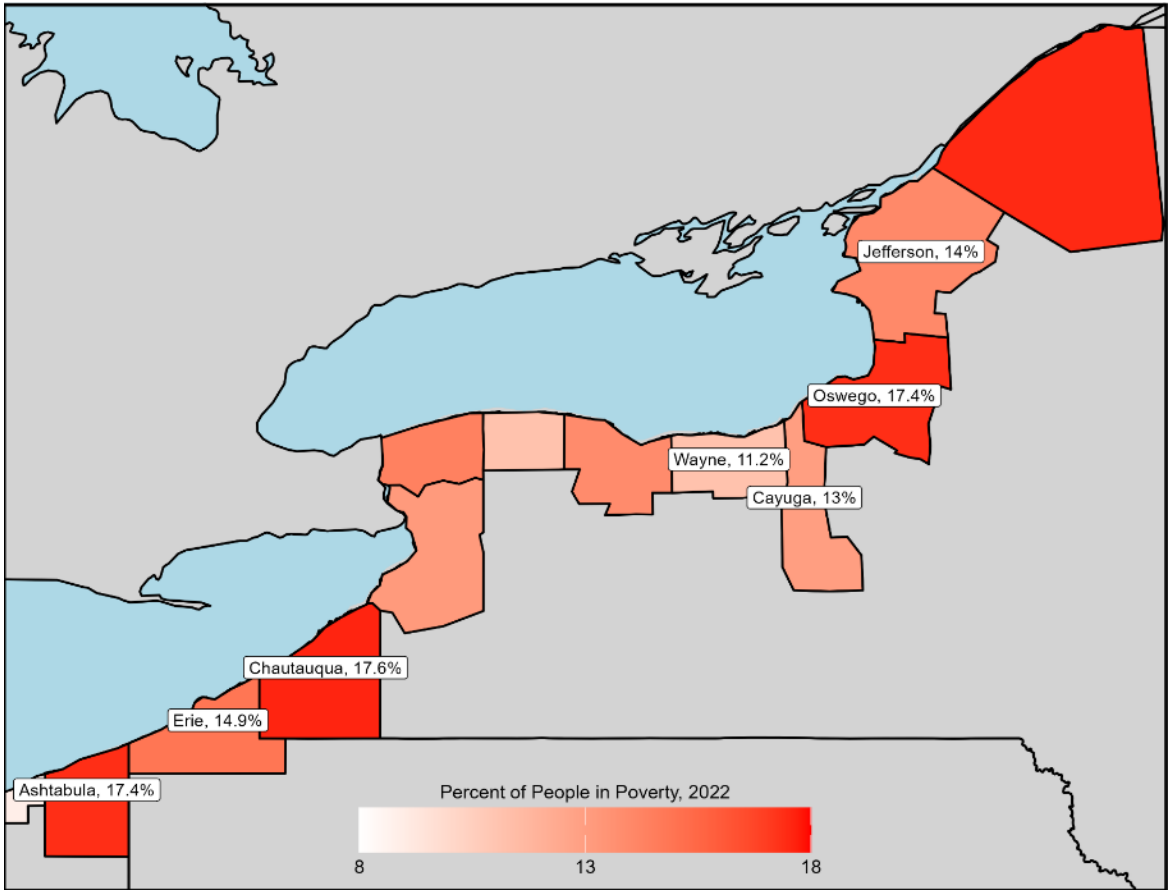
- Economics: National Ocean Watch (ENOW)
- Bureau of Labor Statistics (BLS),
- Census County Business Patterns (CBP)
- Statistics of U.S. Businesses (SUSB)
- American Community Survey
- Private datasets where necessary



Socioeconomic Profiles: Poverty Rates by County, 2022

- **Pennsylvania: 11.8%**
- Erie County, PA: 14.9%

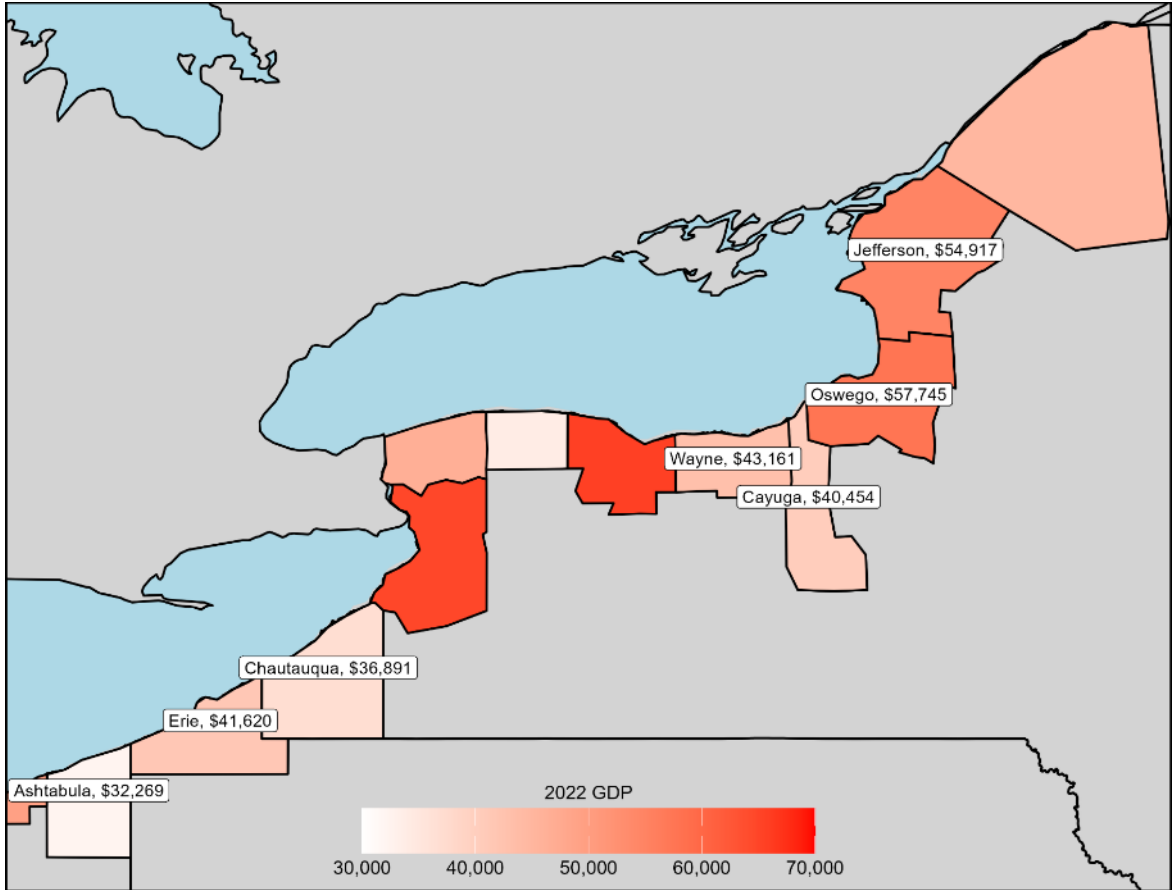
- **New York: 14.2%**
- Lake Ontario NMS Counties (avg): 13.9%



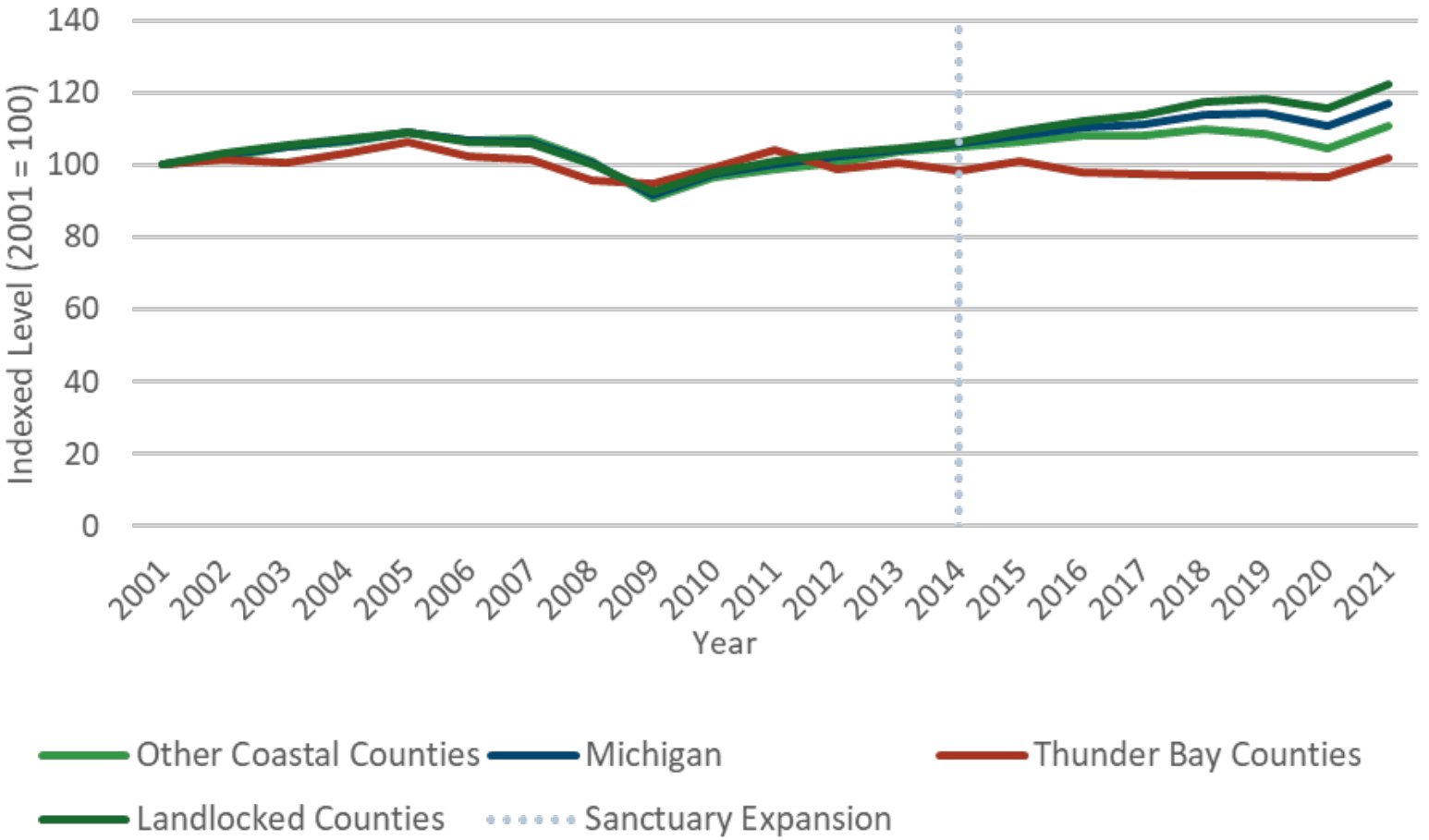
Socioeconomic Profiles: Per Capita Real GDP, 2022 (2017 dollars)

- **Pennsylvania: $59,538**
- Erie County, PA: $41,620

- **New York: $89,641**
- Lake Ontario NMS Counties (avg): $49,069

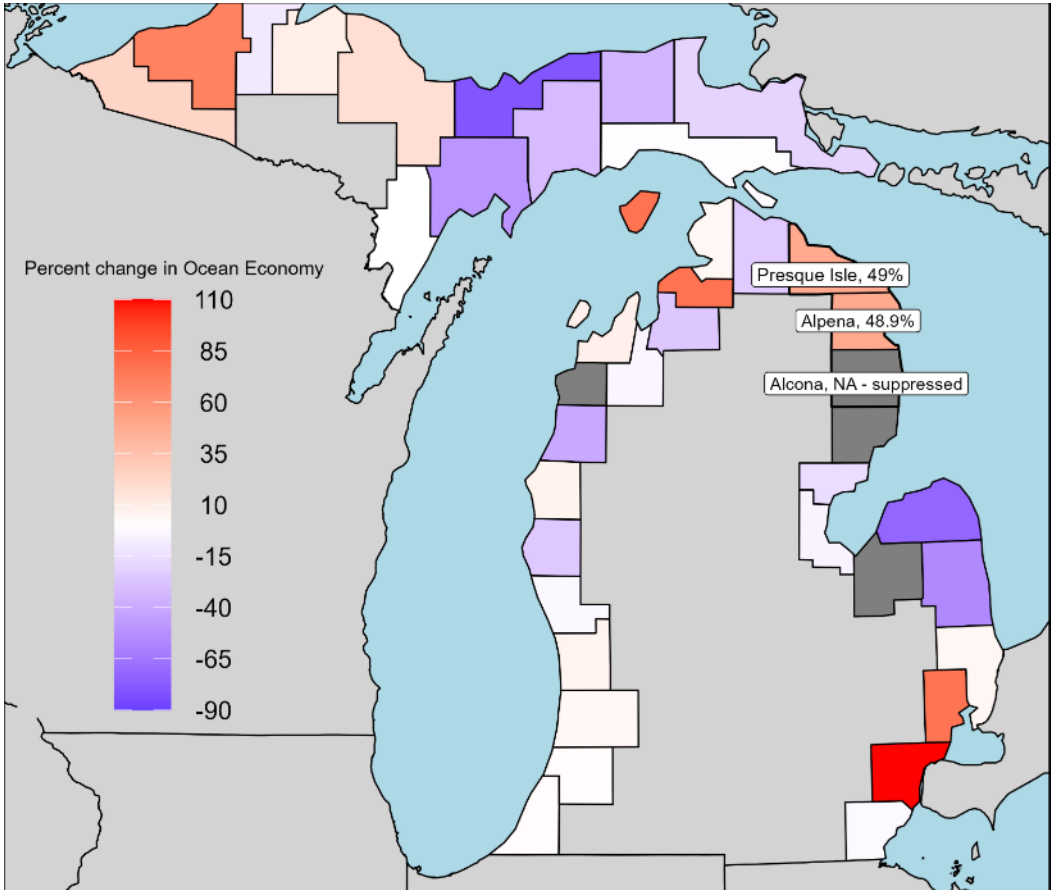


Socioeconomic Profiles: Real GDP over Time



Socioeconomic Profiles: Change in Employment in the Ocean Economy, 2005 - 2021

- Other coastal counties (avg): 7%
- Sanctuary counties (avg): 49%



Socioeconomic Profiles: Limitations

- Why counties?
  - Most granular availability for many data sets
  - If there are more local stories, let us know what to look for
- Why multiple data sets?
  - NAICS self reporting
  - Missing data
  - No individual business data
  - Non disclosure / ranges
- Interpreting data
  - Lots of confounding factors
  - Some indicators alone can lead to the wrong interpretation

Ecosystem Services

Ecosystem Service Values

Benefits people obtain from natural and cultural resources in sanctuaries through use, consumption, enjoyment and/or simply knowing these resources exist

Cultural (non-material benefits) Ecosystem Services

- **Consumptive recreation** — Recreational activities that result in the removal of or harm to natural or cultural resources
- **Non-consumptive recreation** — Recreational activities that do not result in intentional removal of or harm to natural or cultural resources
- **Science** — The capacity to acquire and contribute information and knowledge
- **Education** — The capacity to acquire and provide intellectual enrichment
- **Heritage** — Recognition of historical and heritage legacy and cultural practices
- **Sense of Place** — Aesthetic attraction, spiritual significance, and location identity

Provisioning (material benefits) Ecosystem Services

- **Commercial Harvest — The capacity to support commercial market demands for seafood products**
- **Subsistence Harvest** — The capacity to support non-commercial harvesting of food and utilitarian products
- **Drinking Water** — Providing water for human use by minimizing pollution, including nutrients, sediments, pathogens, chemicals, and trash
- **Ornamentals** — Resources collected for decorative, aesthetic, ceremonial purposes
- **Biotechnology** — Medicinal and other products derived or manufactured from sanctuary animals or plants for commercial use
- **Renewable Energy** — Use of ecosystem-derived materials or processes for the production of energy

Regulating (buffers to change) Ecosystem Services

- **Coastal protection** — Flow regulation that protects habitats, property, coastlines, and other features

More AI pictures… only 1 more

Human Use and ESS

The Millennium Ecosystem Assessment Framework: Applications for cultural uses

- Human well-being is a key consideration
  - Basic material for a good life
  - Health
  - Good social relations
  - Security
  - Freedom of choice and action
- Cultural Services
  - Aesthetic
  - Spiritual
  - Educational
  - Recreational
  - Other potential services

Credibility—extent to which information and decisions are derived from believable and trustworthy sources

Legitimacy—the fairness of the process as perceived by current and potential stakeholders

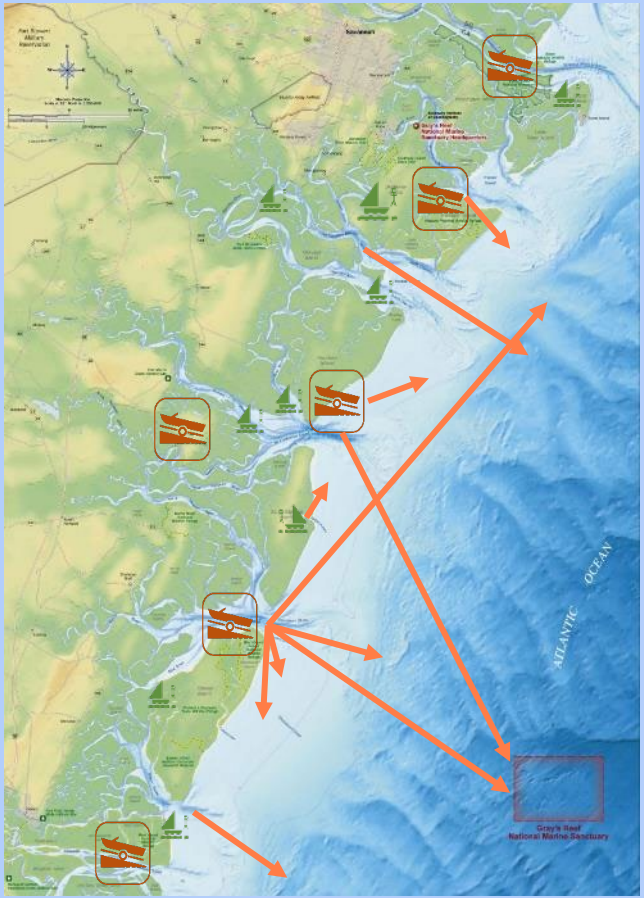
NOAA National Marine Sanctuaries

- What are the key cultural ecosystems related to human uses of a sanctuary?
- Who benefits from them, how valuable are they?
- What is the current condition of these services?
- Will conditions change and why?

- Tourism, recreation, cultural value, fisheries
- Aquaculture, coastal resilience, erosion control, climate regulation

Methods of Assessing NMS Cultural Ecosystem Services

- Participatory approaches and expert opinion
- Remote Sensing and Geographic Information Systems
- Inventories
- Ecological models



Challenges to Sanctuary Use Monitoring

- No gates or roads
- Diversity of entry mechanisms
- Temporal variability
- Sampling design
- Cost

Case Study 1: Participatory Approach

- Baseline data as part of larger monitoring program for ONMS
- Coral reef restoration program (20+ year investment), currently in year 3
- Establishment of a human use monitoring process for ONMS
- Social science to complement the biophysical monitoring pieces
- Spatiotemporal use patterns
- Activity information, carrying capacity limits, human impacts
- Expectations, importance, satisfaction
- Environmental concern, stewardship behavior
- Economic impacts & equitable access understanding (constraints, etc.)

Florida Keys NMS Example

- Fishing and general boating create the most visits
  - 3.6 people/fishing boat trip, 4.4 general boating

- Average trips are 5 days in length
- Seasonal visitation is slightly important (lower season in fall)
- Ocean conditions influence visitation rates greater than anthropogenic factors like events, fuel prices, etc.

Heat Stress Perceptions Survey:
Rapid Assessment

To what extent are you knowledgeable/concerned with the following topics as they relate to ocean and coastal areas within the Florida Keys National Marine Sanctuary?

Perception of:	Knowledge	Concern3
Increasing water temperatures	3.64	3.59
Coral bleaching process	3.61	3.95*
Water Quality	3.58	4.20*
Habitat loss from coastal development	3.56	4.02*
Pollution (contaminants, sewage, pesticides, etc.)	3.52	4.14*
Coral health and disease	3.42	4.01*
Sea level rise	3.39	3.31
Fish and marine animal health and disease	3.29	4.12*
Ocean acidification	2.73	3.46*

*Note: No significant differences in the self-identified divers versus all other respondents

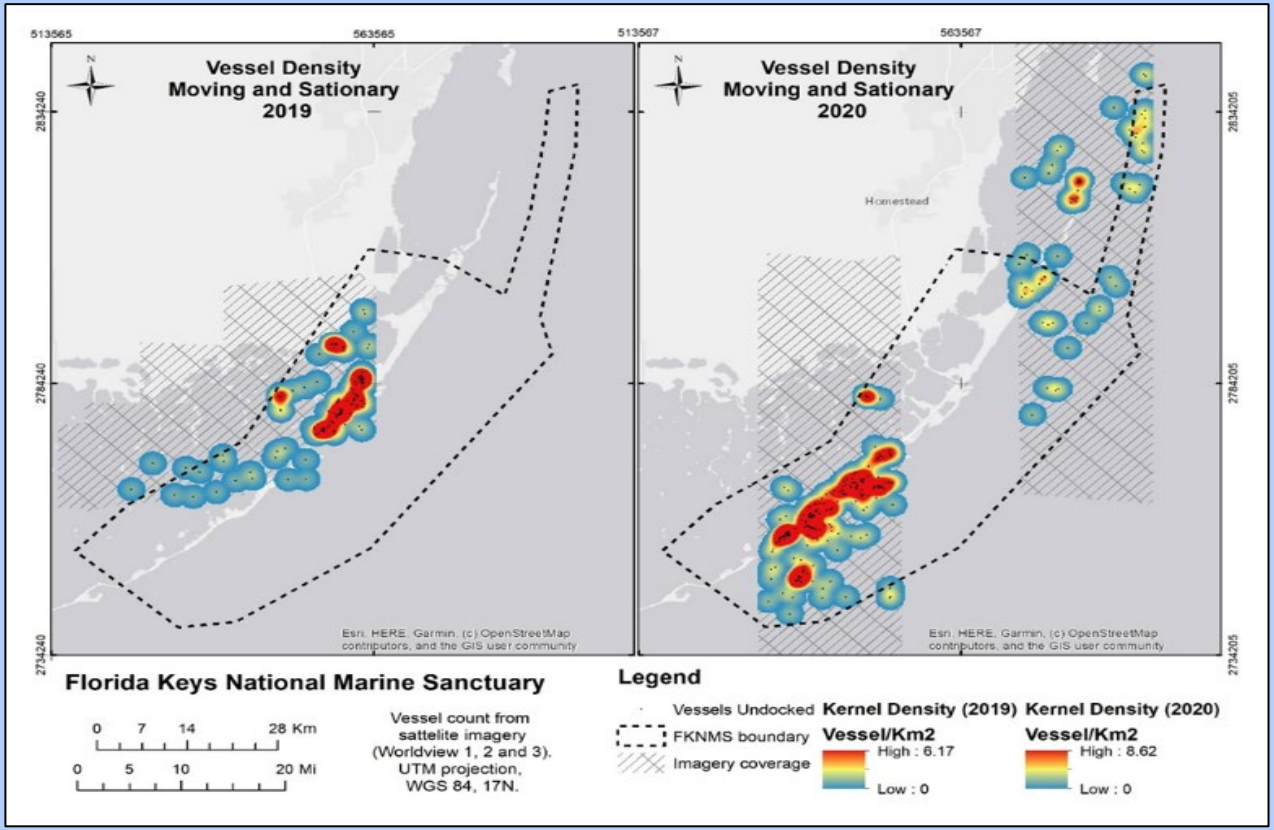
(5-point scale of not at all to extremely knowledgeable/concerned)
**indicates statistically significant difference overall ($p<0.05$)*

Case Study 2: Remote Sensing and GIS

Date	Satellite	Scenes	Area of NMS Covered (%)	All	Docked	Stationary/moving	Density (vessel/km²)
16-Oct-19	WView 2	3	3.57	510	468	42	1.55
29-Sep-19	WView 2	3	1.08	941	809	132	3.04
20-Aug-19	WView 2	1	8.28	0	0	0	0.00
19-May-19	WView 2	1	13.04	1	0	1	0.02
14-May-19	WView 2	2	1.71	131	120	11	0.63
11-May-19	WView 2	1	1.09	1	0	1	0.04
9-May-19	WView 2	1	12.31	2	0	2	0.02
Total	-	-	-	1586	1397	189	-

Date	Satellite	Scenes	Area of NMS Covered (%)	All	Docked	Stationary/moving	Density (vessel/km²)
14-Apr-20	WView 1	6	24.83	365	326	39	0.58
17-May-20	WView 2	12	30.30	1918	1602	316	2.51
Total	**-**	**-**	**-**	**2283**	**1928**	**355**	**-**

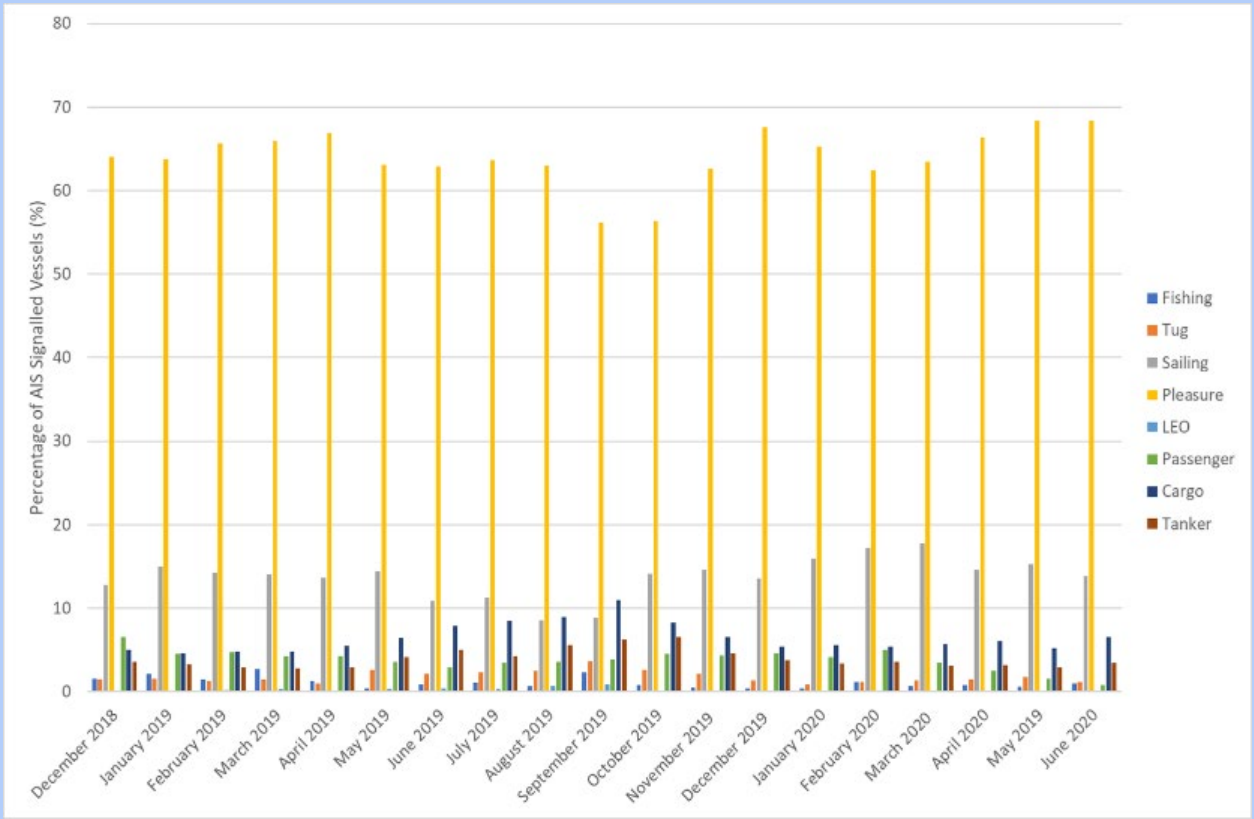
Case Study 2: Remote Sensing and GIS



AIS Data

NAVIGATION CENTER
The Navigation Center of Excellence

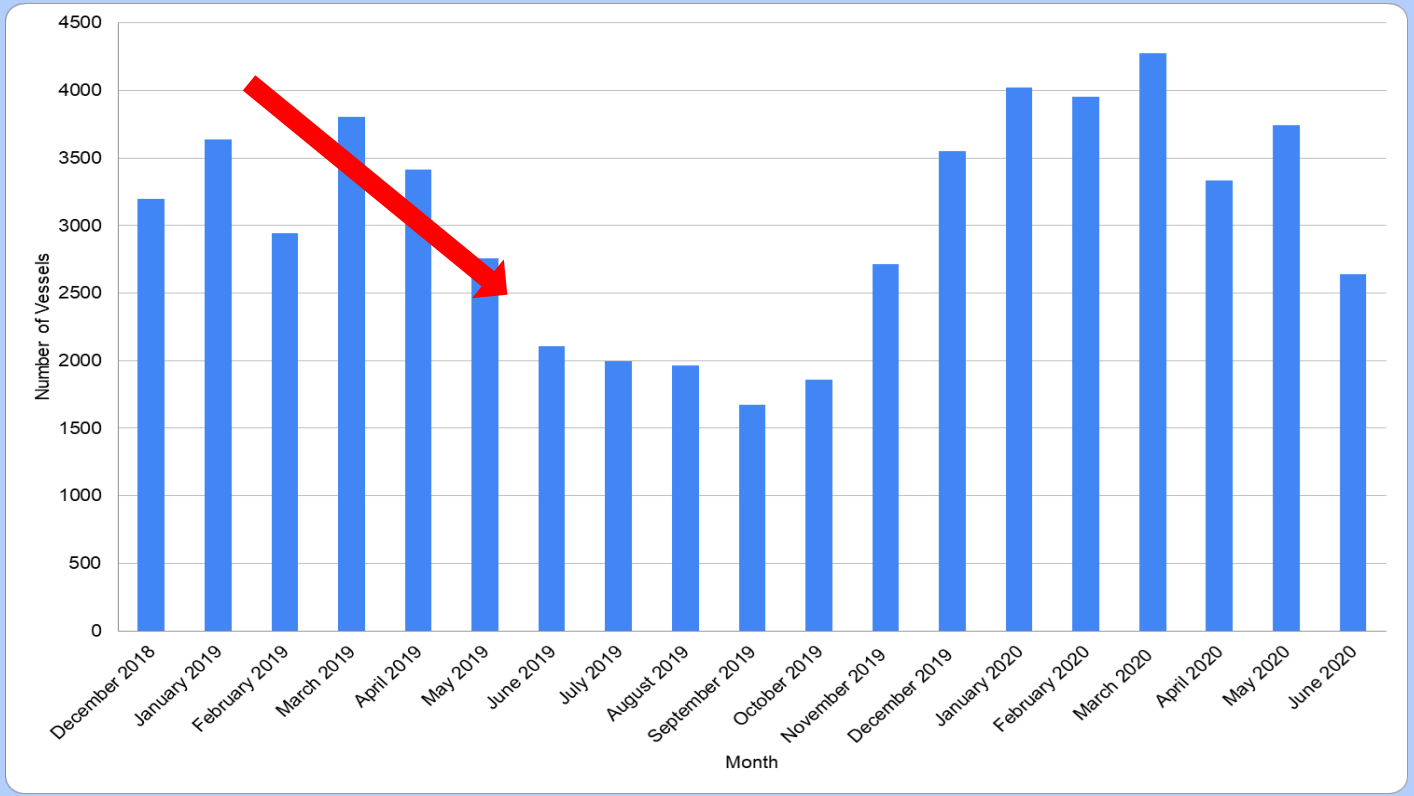
U.S. Department of Homeland Security
UNITED STATES COAST GUARD



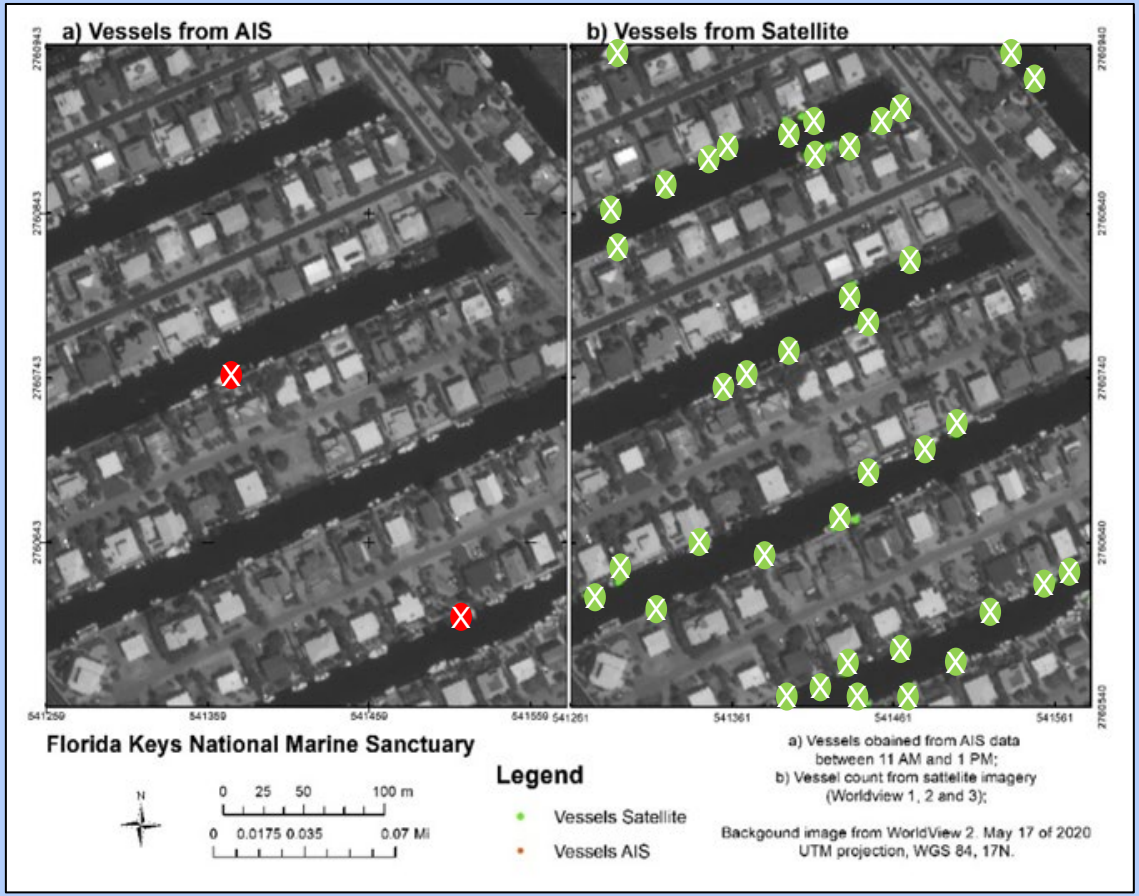
- 64.5% are pleasure craft
- 14.2% sailing

AIS Data

NAVIGATION CENTER
The Navigation Center of Excellence
U.S. Department of Homeland Security
UNITED STATES COAST GUARD



Satellite & AIS Data



Test of highest coverage satellite imagery day vs. AIS data:

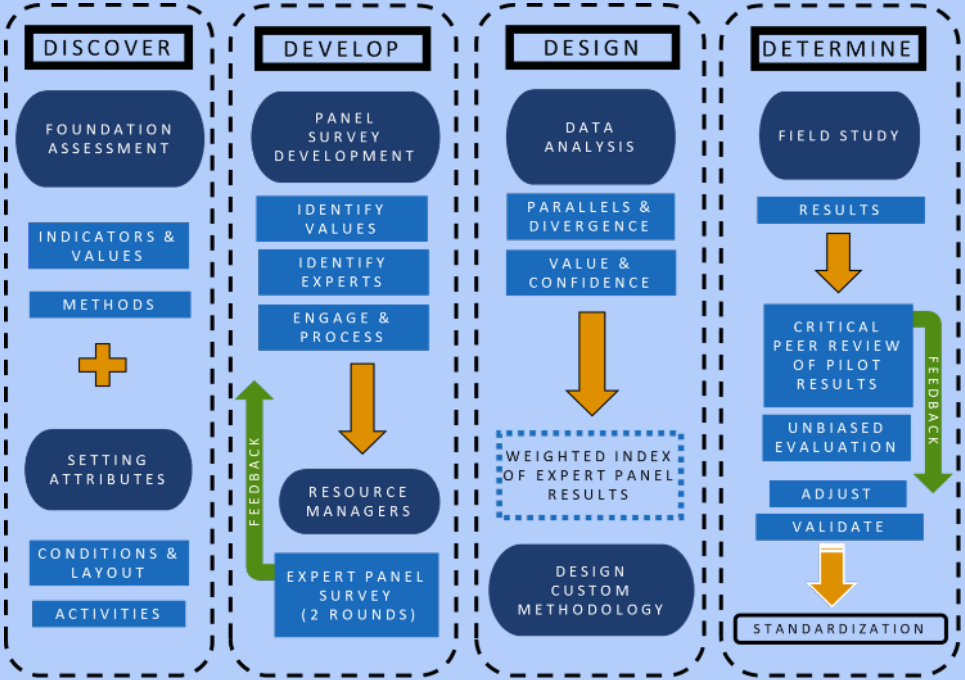
- Time held constant 11am – 1pm

- 91 vessels on AIS
- 1,924 total vessels in satellite imagery
- 322 undocked
- AIS capturing 28.3% of vessels that are undocked

Case Study 3: Modeling

NATIONAL MARINE SANCTUARY USE COUNTING PROCESS (NMS-COUNT)
Workflow Diagram Descriptors:

Phase 1 (Discover): Foundational research identifies possible use indicators, methods, and site attributes.
Phase 2 (Develop): A context-specific expert panel provides local insight and feedback to maximize confidence in methodologies.
Phase 3 (Design): Panel data are analyzed to identify information gaps and develop a tailored system of methodologies specific to a park unit.
Phase 4 (Determine): A field study is conducted. Results are evaluated in an objective peer review process to allow feedback and adjustment to validate/standardize methods and indicators most suitable to a unit.



Burns, R. C., Andrew, R. G., Allen, M. E., Schwarzmann, D., & Cardozo Moreira, J. (2020). Conceptualizing the National marine sanctuary visitor counting process for marine protected areas. *Journal of Ecotourism*, *19*(4), 362-372.

Great Lakes Human Use Plan (2024-25)

Great Lakes Phase 1: Foundation Assessment for Project Scoping, Background, Inventory, and Design

Target Audience(s): Local and regional stakeholders, expert research consultants, government agencies & management staff, non-government groups. Methods: In-person meetings and workshops, virtual meetings, value and thematic surveys, methodology scoping

Great Lakes Phase 2: Sampling and Data Collection

Target Audience(s): Great Lakes aquatic/shoreline-based users, business owners/operators, resource managers, and government agency personnel. Methods: Sampling team development and training, on-site sampling at intercept locations, remote data collection and analyses

Great Lakes Phase 3: Data Analysis & Final Products

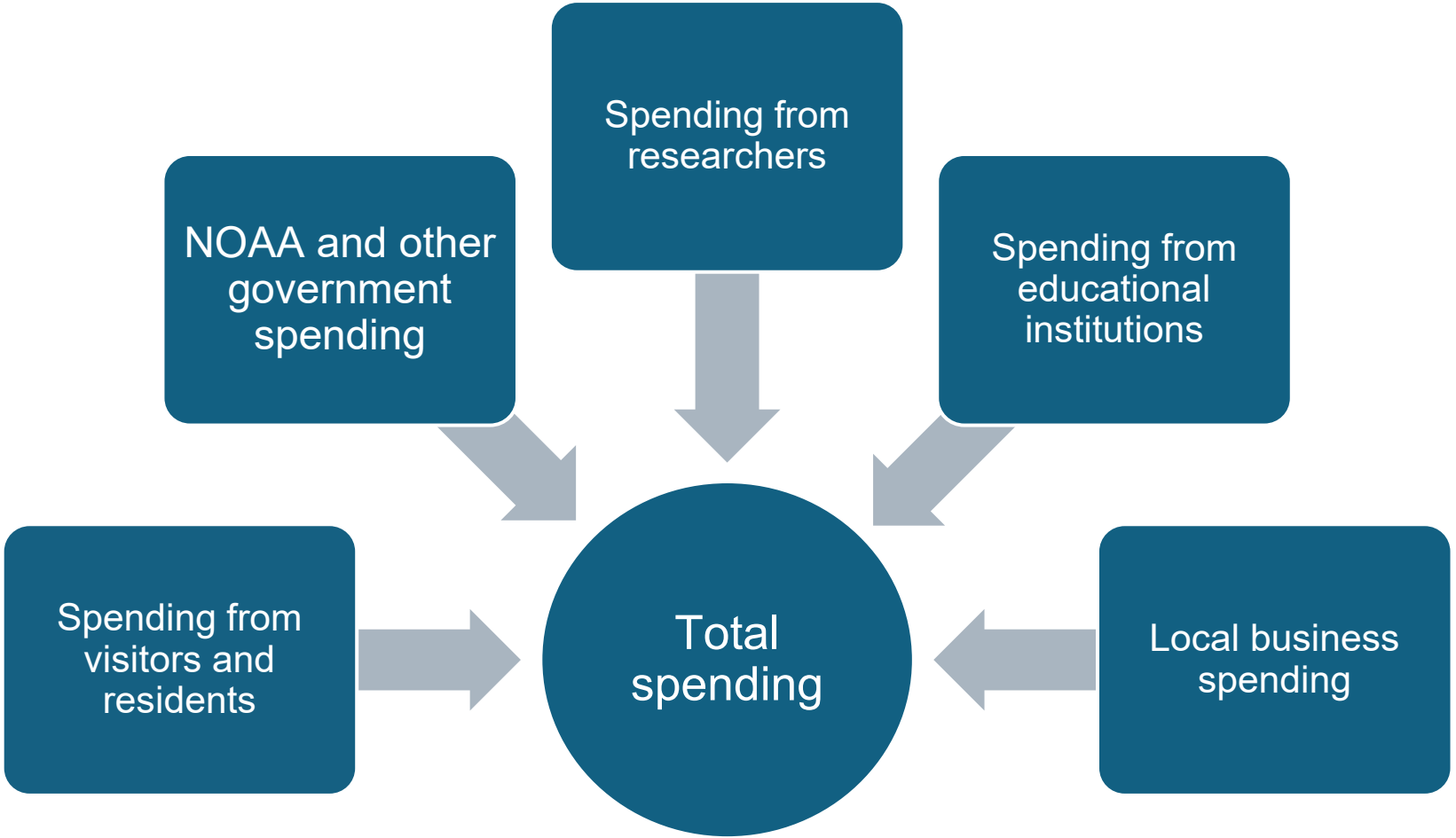
Target Audience(s): Sanctuary resource managers, scientists, and researchers and scientists of the Foundation, NOAA, and the sanctuary designation process. Methods: Data review, cleaning, summary, and analysis, alignment analysis with biophysical data, indicator analysis, product preparation including reports, popular press, educational and outreach materials

Economic Contribution

Economic Contribution: Overview

- How economies are supported by specific programs or events
- **Contribution:** measures the economic activity generated from a pre-existing industry in a regional economy
- **Impact:** measures the impact of new spending caused by a change in a region

Economic Contribution: Direct Spending



Economic Contribution: Indirect and Induced Impacts

- IMPLAN a tool to measure
- Direct: charter fishing
- Indirect: fueling, bait
- Induced: shopping by employees in town