

FishSET

Fisheries Spatial Economics Toolbox

MSEAS 2024
Yokohama, Japan

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NOAA
FISHERIES



ICES
CIEM

How do policy and environment impact fisher behavior?

Policy

- Marine protected areas
- Offshore wind energy development
- Catch shares
- Bycatch regulations

Environment

- Fish biomass
- Climate induced species range shifts
- Habitat



Discrete choice models



Location A

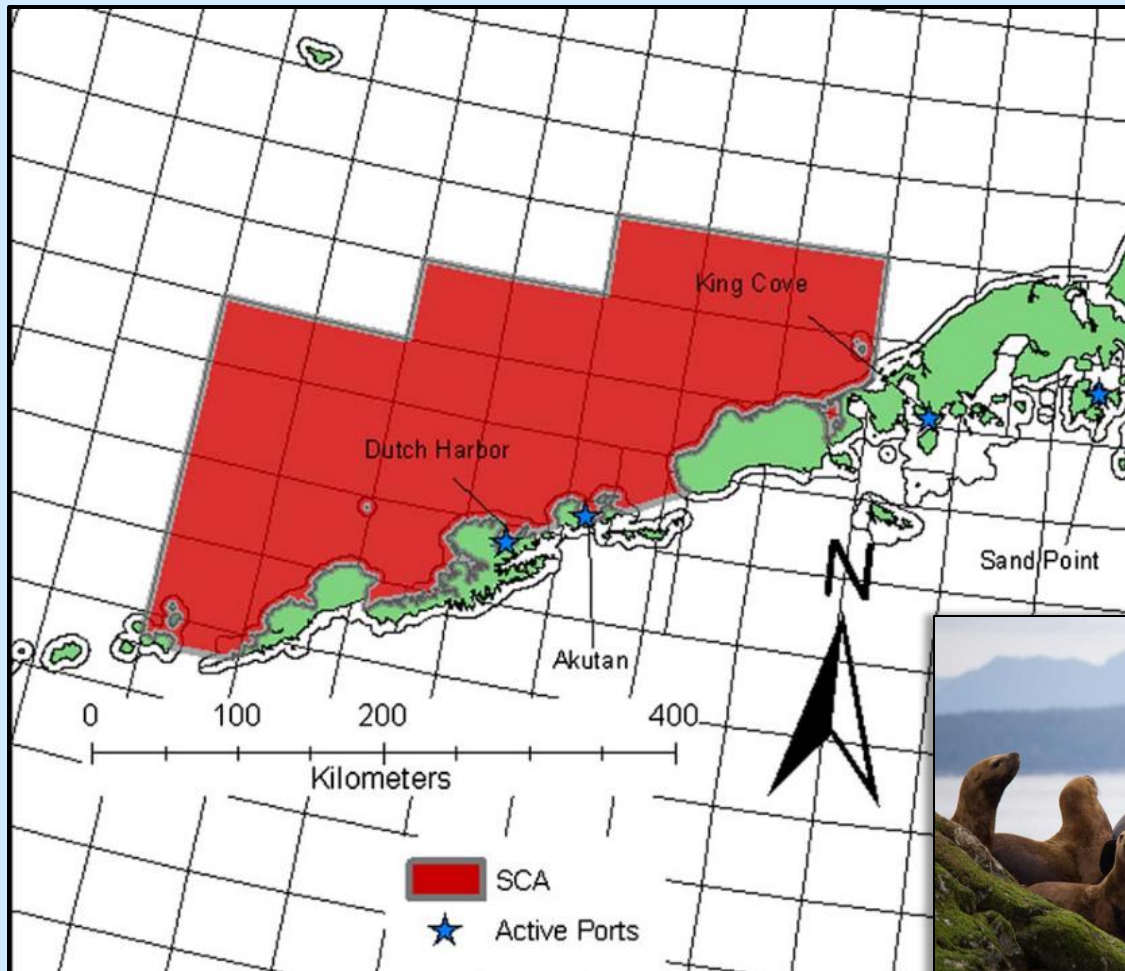
Location B

Location C

- Expected CPUE
- Expected revenue
- Expected costs
- Overall fleet effort
- Variability in catch
- Tradition

- Predict redistribution of fishing effort
- Estimate welfare loss (or gain)

Example: Steller Sea Lions and the Bering Sea pollock fishery



Haynie and Layton 2010

- Estimated 13% profit loss per trip (~\$7000/trip)
- Evaluated effects of closure on profit for different-sized vessels (length, HP, tons)

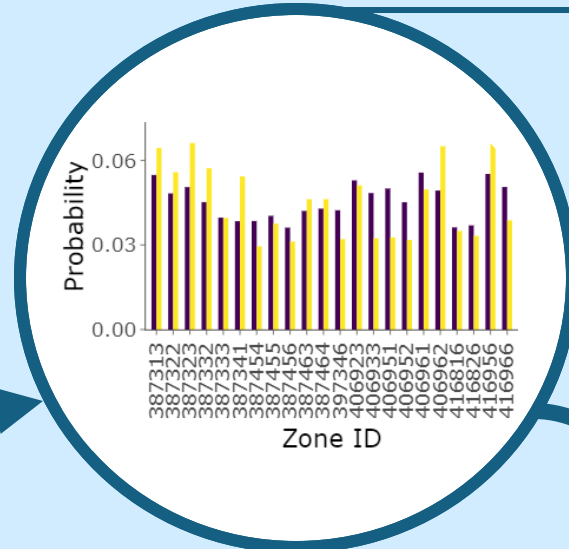


What is FishSET?



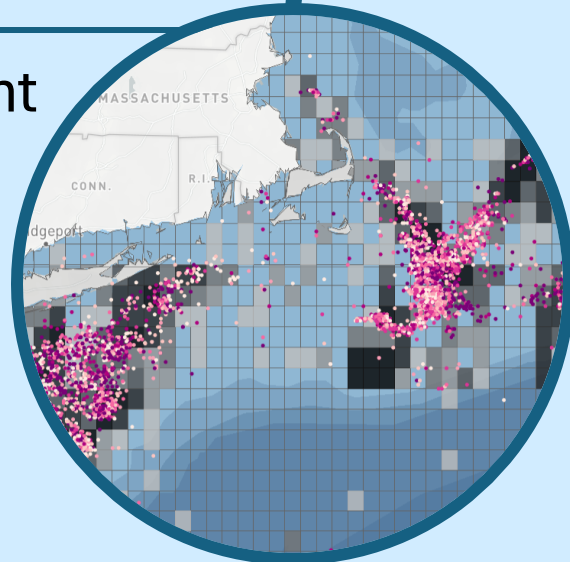
Modeling Tools

- Model design
- Model comparison
- Model robustness



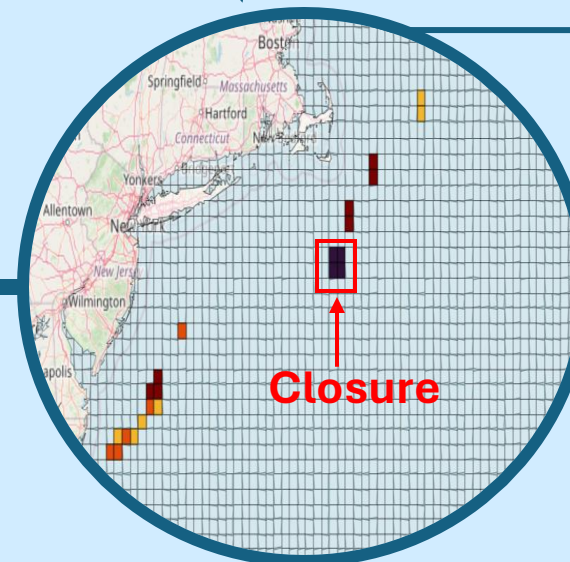
Data Tools

- Data management
- QAQC
- Visualization



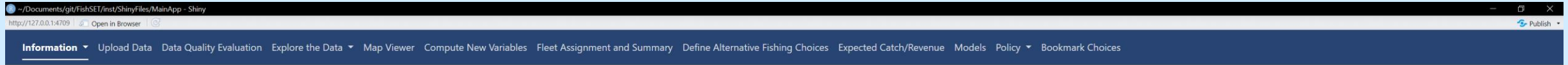
Policy Tools

- Policy simulation
- Welfare analysis

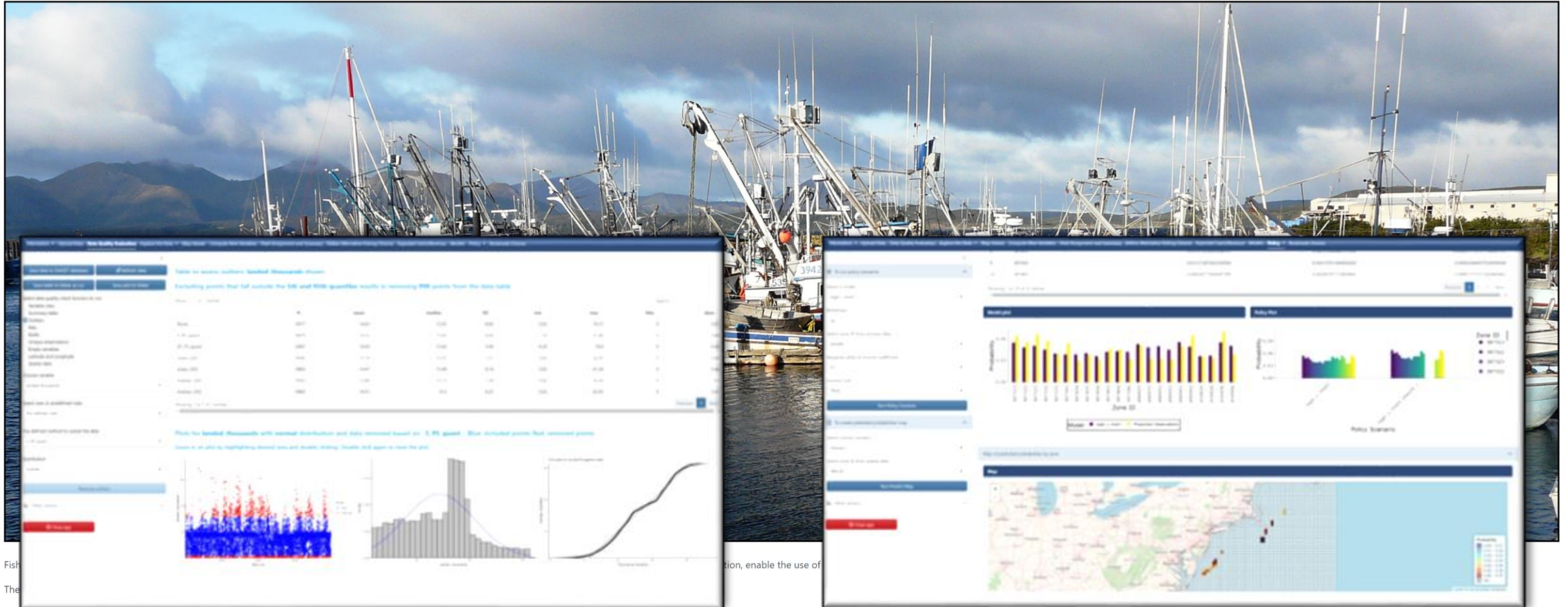




Graphical user interface (GUI)



FishSET - Spatial Economic Toolbox for Fisheries



FishSET GUI is divided into tabs to guide users through the steps of creation, from uploading and exploring data to developing and evaluating models. Tabs can be navigated in any order. All data is automatically saved to a SQL database called the FishSET database when first loaded. The database is housed in the projects directory within the

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Data requirements

Primary dataset

- Date/time
- Port (depart and/or landing)
- Catch
- Fishing location
- **Rows are unique observations**

Spatial file

- Boundaries of fishing zones
- Zone identifier variable that can be linked to fishing location
- File format flexible (rds, shp, json, geojson)

The screenshot displays the 'Upload Data' section of the FishSET application. The interface includes a navigation menu at the top with options like 'Information', 'Upload Data', 'Data Quality Evaluation', 'Explore the Data', 'Map Viewer', 'Compute New Variables', 'Fleet Assignment and Summary', 'Define Alternative Fishing Choices', 'Expected Catch/Revenue', 'Models', and 'Policy'. Below the navigation, there are instructions for uploading data in four steps. The main area contains several form fields and buttons for configuring the upload process. Two orange boxes highlight specific sections: one for 'Source primary data from:' and another for 'Source spatial data from:'. Arrows point from the text boxes on the left to these highlighted sections in the application interface.

Directory is currently set to C:/Users/Paul.Carvalho/Documents/FishSETFolder

Name of project
Required to load data

Source primary data from:
 Upload new file FishSET database
Choose primary data file
Browse... Required data

Source spatial data from:
 Upload new file FishSET database
 Upload single file Upload shape files
Choose spatial data file
Browse... Suggested data

Source gridded data from:
 Upload new file FishSET database
Choose data file that varies over two dimensions (gridded)
Browse... Optional data
Additional arguments for reading in data
c(header=T, sep=';', skip=2)

Source auxiliary data from:
 Upload new file FishSET database
Choose auxiliary data file that links to primary data
Browse... Optional data
Additional arguments for reading in data
c(header=T, sep=';', skip=2)

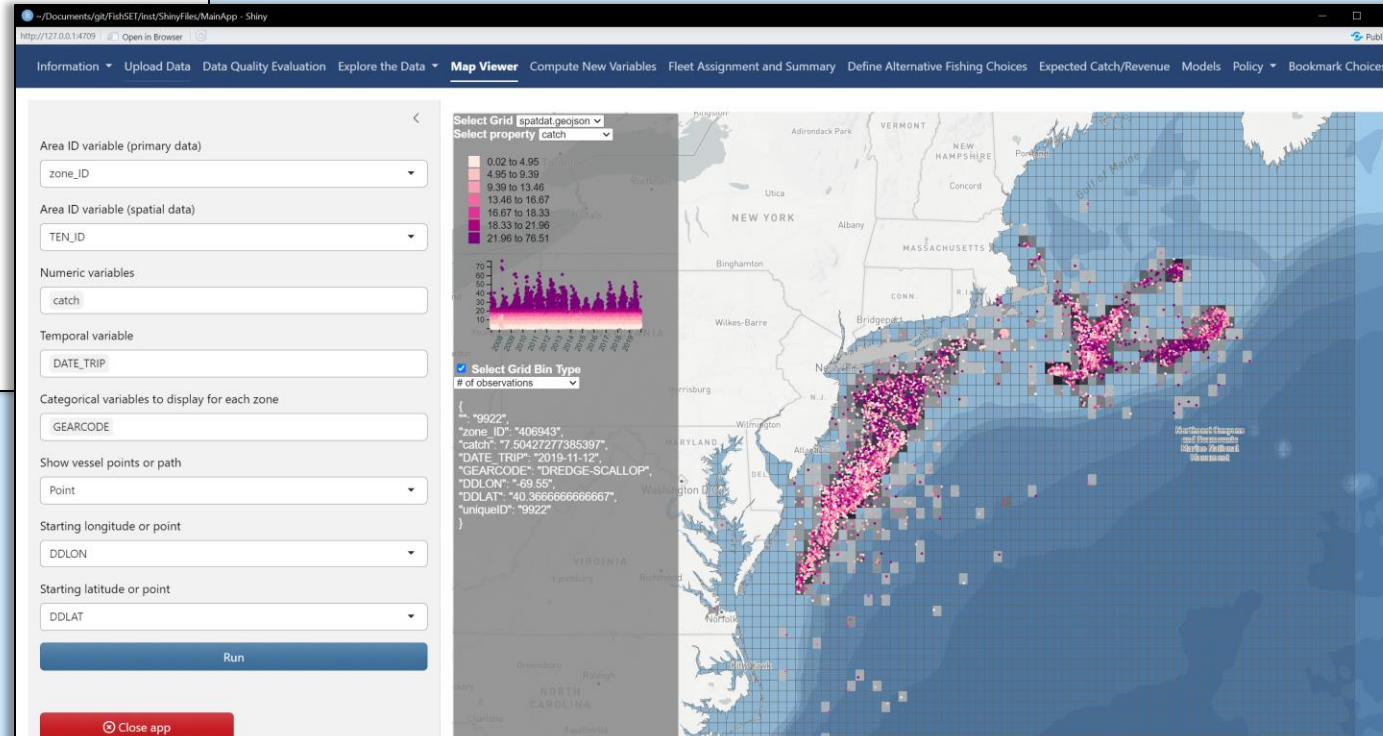
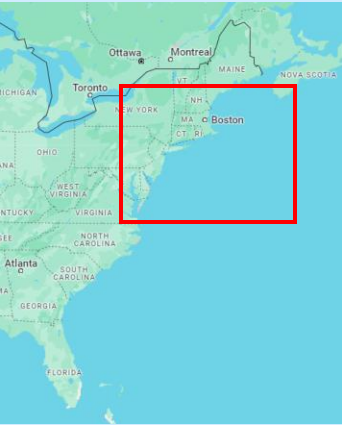
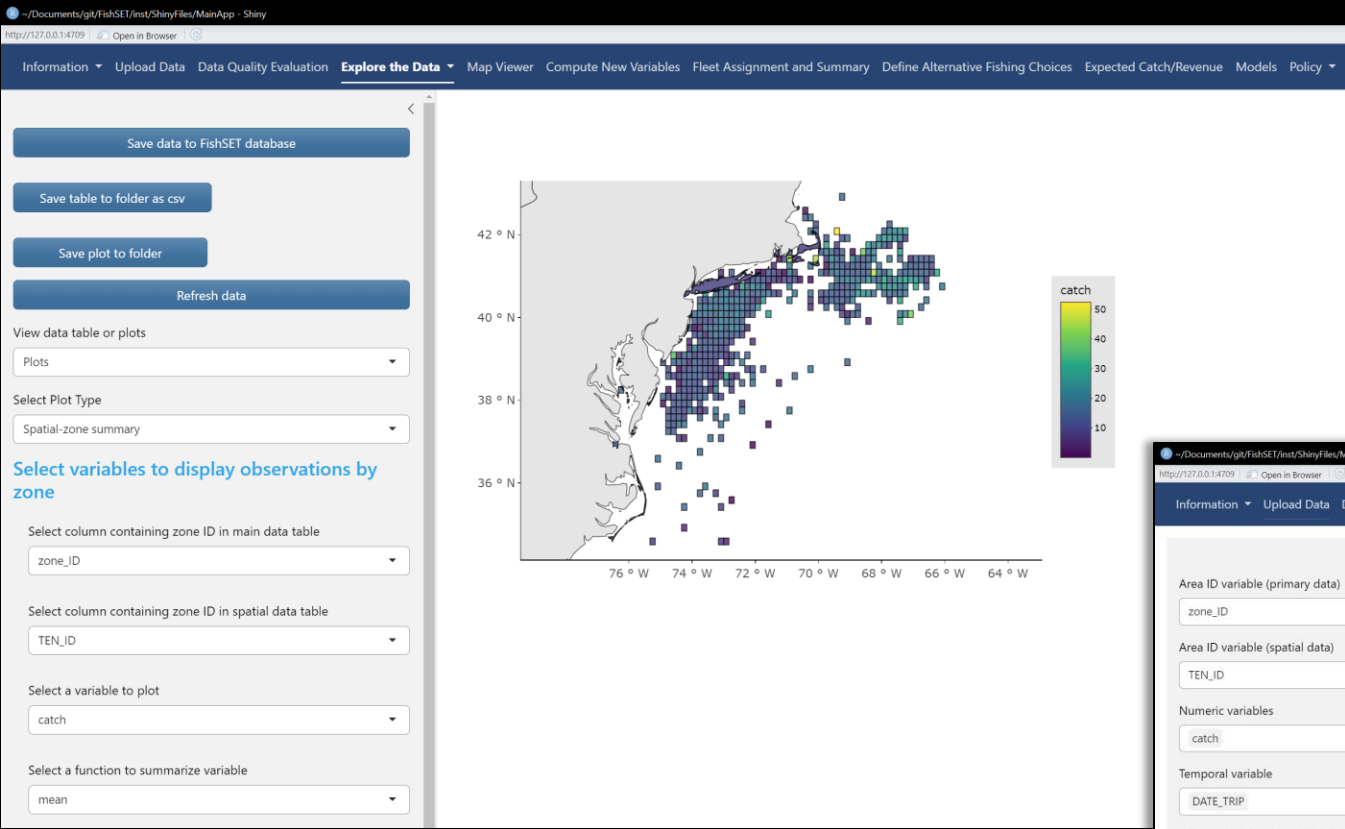
QAQC

- Outliers
- Remove rows with missing data
- Duplicate data
- Lat/lon format
- Spatial data checks
 - On land?
 - Outside of study area?

The screenshot displays the QAQC application interface. The top navigation bar includes options like 'Information', 'Upload Data', 'Data Quality Evaluation', 'Explore the Data', 'Map Viewer', 'Compute New Variables', 'Fleet Assignment and Summary', 'Define Alternative Fishing Choices', 'Expected Catch/Revenue', 'Models', 'Policy', and 'Bookmark Choices'. Below the navigation bar, there are buttons for 'Save data to FishSET database', 'Refresh data', 'Save table to folder as csv', and 'Save plot to folder'. A central panel titled 'Select data quality check function to run:' lists several options: 'Variable class', 'Summary table', 'Outliers' (selected), 'NAs', 'NaNs', 'Unique observations', 'Empty variables', 'Latitude and Longitude', and 'Spatial data'. Below this panel, there are dropdown menus for 'Pre-defined method to subset the data' (set to 'none') and 'Distribution' (set to 'weibull'), along with a 'Remove outliers' button. The right side of the interface shows a table titled 'Table to assess outliers. catch shown.' with columns for 'N', 'mean', 'median', 'SD', 'min', 'max', 'NAs', and 'skew'. The table lists various statistical checks for the 'catch' variable. Below the table, there are three plots: a scatter plot of 'catch' vs 'Data row', a histogram of 'catch' with a Weibull distribution fit, and a Q-Q plot of 'weibull fit against data'. A legend indicates that blue points are 'Kept' and red points are 'removed'.

	N	mean	median	SD	min	max	NAs	skew
None	10000	14.82	15.64	8.86	0.02	76.51	0	0.87
5_95_quant	9000	14.31	15.64	6.64	1.6	31.45	0	0.06
25_75_quant	5000	14.65	15.64	3.09	8.27	18.8	0	-0.49
mean_2SD	9567	13.73	15.07	7.27	0.02	32.51	0	0.05
mean_3SD	9892	14.46	15.47	8.18	0.02	41.28	0	0.44
median_2SD	9615	13.83	15.13	7.37	0.02	33.34	0	0.1
median_3SD	9908	14.51	15.49	8.25	0.02	42.05	0	0.47

US Atlantic Sea Scallop Fishery



Model design

Statistical functions for maximum likelihood estimation

Explanatory variables

- Variables that interact with distance
- Variables specific to each fishing location

The screenshot displays a Shiny web application interface for model design. The main content area is divided into several sections:

- Likelihood function:** A dropdown menu is open, showing options: Conditional logit (selected), Zonal logit, Logit Dahl correction, EPM normal, EPM lognormal, and EPM Weibull.
- Select variables to include in model:** Two input fields are present: "travel-distance variables" and "alternative-specific variables".
- Model Run Options:** Includes a "select" dropdown, "Explore starting parameters" (set to TRUE), and "Return first valid parameters" (set to TRUE).
- Model parameters:** Includes "Add expected catch entry" and "Reset" buttons, "Select matrices" (with "exp1" selected), and "EPSG code" (with "e.g. 4326" entered).
- Optimization options:** Includes "max iterations" (100), "tolerance of x" (0.0000001), "report frequency" (1), and "detailed report" (1).
- Initial parameters:** Includes a "Choose parameter set" radio button.

Two orange arrows point from the text on the left to the "Likelihood function" dropdown and the "Select variables to include in model" section.

Model output

The screenshot displays a Shiny web application interface with several key components:

- Navigation Bar:** Includes tabs for "Information", "Upload Data", "Data Quality Evaluation", "Define Alternative Fishing Choices", "Expected Catch/Revenue", "Models", "Policy", and "Bookmark Choices".
- Buttons:** "Run model(s)", "Compare models", "Manage models", "Reload model output", "Delete row", and "Save table".
- Model Output Section:** A table with columns "Model_name" and "Coverage". One entry is visible: "logit_c_mod1.exp1".
- Estimates Section:** A table with columns "estimate", "std_error", and "t_value".
- Measures of fit Section:** A table with columns "Model", "AIC", "AICc", "BIC", "PseudoR2", and "Sel".
- Annotations:** A box highlights "Cross-validation" and "Out-of-sample prediction" with an arrow pointing to "Model robustness". Another box highlights the "Estimates" table.

	estimate	std_error	t_value
exp1	0.088	0.001	68.720
V1	-0.006	0.000	-39.925

Model	AIC	AICc	BIC	PseudoR2	Sel
1 logit_c_mod1.exp1	-69325.356	-69325.354	-69311.386	0.983	<input type="checkbox"/>

Policy simulation

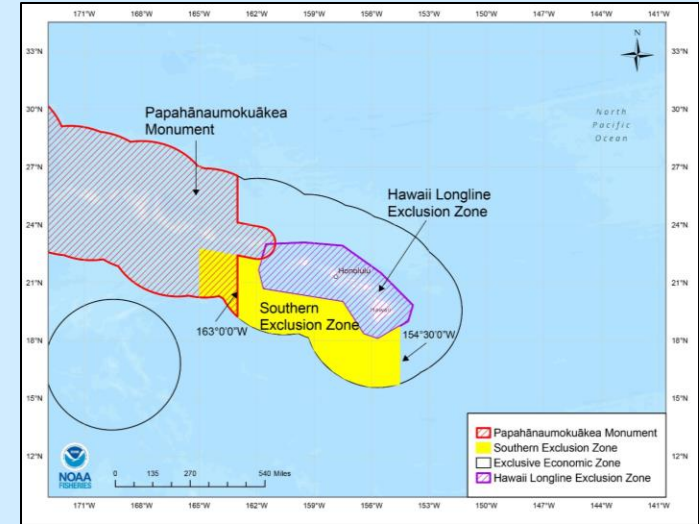
The screenshot displays a Shiny web application interface for policy simulation. The interface is divided into several panels:

- Left Panel:** Contains navigation tabs (Information, Upload Data, Data Quality Evaluation) and a sidebar with instructions: "Click on one or more zones to select closed zones. Press the 'Save closures' button to record choices. Repeat to add more zones. When done, press the 'Save closures' button." It includes input fields for "TEN_ID" and "closure_scenario_1", and buttons for "Plot zones" and "Add closure".
- Central Panel:** Features a "To run policy scenarios" section with a "Select a model" dropdown (logit_c_mod1), a "Betadraws" input (10), and "Select zone ID from primary data" (zone_ID). It also includes a "Marginal utility of income coefficient" dropdown (V1) and an "Income Cost" dropdown (TRUE). A "Run Policy Function" button is present.
- Main Content Area:**
 - Summary text: "Summarize predicted probabilities of fishing per zone for each model"
 - Map of predicted probabilities by zone
 - Welfare figures section:
 - Welfare loss/gain for all scenarios as dollars:** A box plot showing welfare loss/gain for the "closure_scenario_1" scenario. The y-axis ranges from 0 to -30. The mean is approximately -16.32.
 - Welfare loss/gain for all scenarios as percentage:** A box plot showing welfare loss/gain for the "closure_scenario_1" scenario. The y-axis ranges from 0.00 to -0.06. The mean is approximately -0.03.
- Bottom Panel:** A "Supplementary information table" with a search bar and a table of results.

Scenario	mean	2.5%	5%	50%	95%	97.5%
1 closure_scenario_1	-16.32	-37.83	-28.44	-14.67	-10.29	-9.0

How to get involved in FishSET

- Case study: Hawaii deep-set longline fishery
- Join our community of users with your own case study
- Download FishSET from our GitHub repo:
github.com/noaa-nwfs/FishSET
- Demos and “office hours” starting in July
- Help us expand the modeling capabilities with your own models and expertise



Acknowledgements

**Lisa Pfeiffer
Anna Abelman
Min-Yang Lee
Alan Haynie**

**Bryce McManus
Allen Chen
Melanie Harsch
Corinne Bassin
Adam Hayes
Kristy Wallmo**

**Everyone else that has been
involved with FishSET**



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Questions?



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