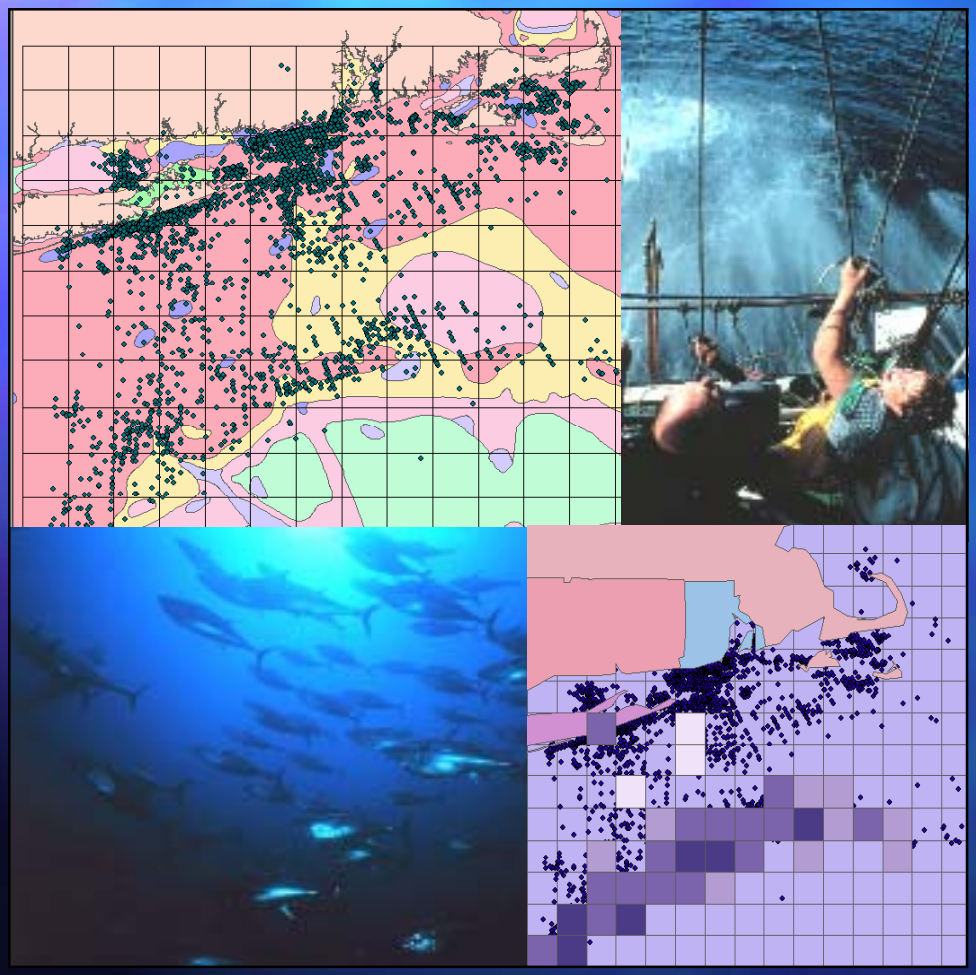
EcoGIS: GIS Tools for Ecosystem Approaches to Fisheries Management



September 25, 2008

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EcoGIS: Tools for EAFM

- Quick “walk-through” of Tech. Memo.
- Background and timeline of EcoGIS
- Developing the Fishery Mapper
- Lessons Learned - key points and emerging themes
- The Way Forward - Role of GIS in EAM, and recommendations

EcoGIS

- A component of the ecosystem pilot projects funded by Congress and developed by the four Fishery Management Councils in the Atlantic and Gulf
- Mission: Develop custom GIS tools that aid fisheries managers and scientists in moving towards a spatially and temporally explicit ecosystem approach to management of living resources.
- Joint project between NMFS and NOS

Background and Timeline

- Sep. 2004 - Workshop in Charleston SC to review needs and set priorities.
- 2005 - Refine user needs, collect needed data, begin developing prototype tools.
- 2006 - Present prototype tool to Councils, NEFSC, etc.
- 2007 - Finish Fishery Mapper tool and deploy with interested users (e.g. NEFSC)
- 2007-2008 – Research into generic functionality; Final report

Scope

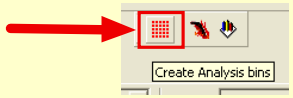
- Functional scope - tool development:
  - **Fishery catch and effort mapping and displacement analysis**
  - Area characterization
  - Bycatch hotspot identification
  - Fishing gear / bottom habitat interaction
- Geographic scope: Northeast for pilot
- Tools should be expandable to other regions

EcoGIS Fishery Mapper

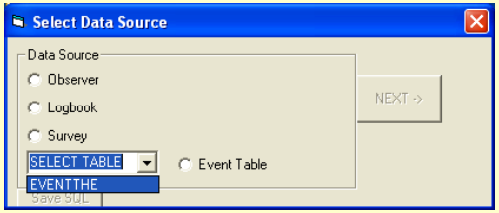
- Desktop tool connects to Oracle, Access, and any ArcGIS supported tabular format
- No Spatial Analyst or SDE required
- Select data source (logbook, observer, survey)
- Choose gear, species, time period and time step
- Define or select spatial analysis “bins”
- Tool summarizes selected data over space and time
- Use “slicer” tool to create map layers: one time step/all variables, or all time steps for one variable

Case Example - Fishery Mapping Tool applied to New England VTR data: Define query conditions

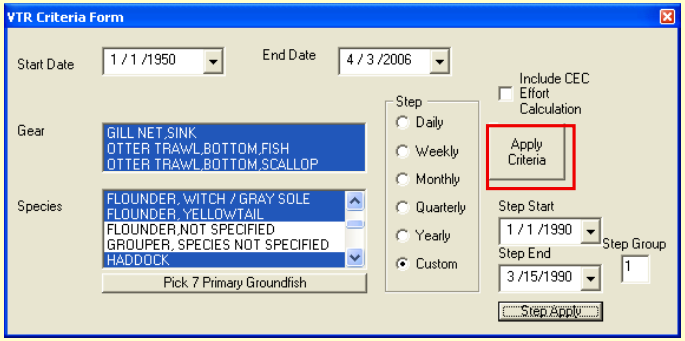
1. Launch DLL with first button on toolbar.



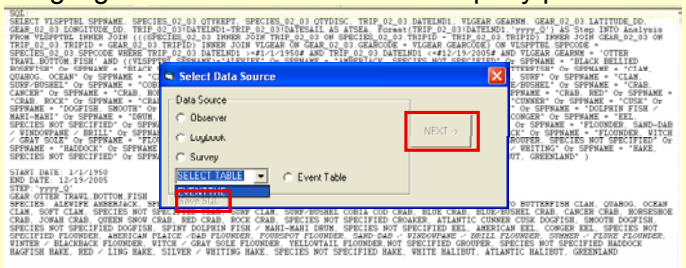
2. User selects data set of interest - in this case, logbook. Users may also import other data sets and specify fields.



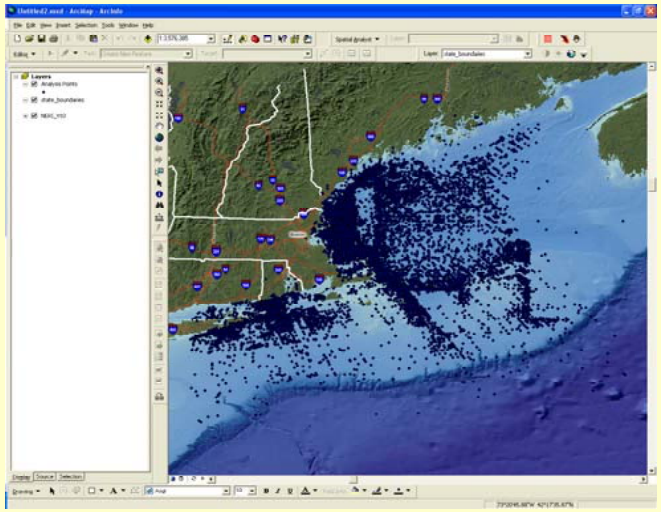
3. User chooses the time period, time step, one or more gear, and one or more species.



4. Clicking *Apply Criteria* executes a SQL query that retrieves all trips and related catch/discard records that meet the criteria. The Save SQL button then becomes highlighted so one can archive the query parameters

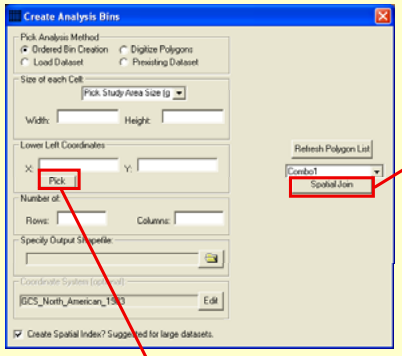


After clicking *Next* a map layer of points is created. Each point represents the location where a species was caught. User is prompted to save this point layer to a shapefile.

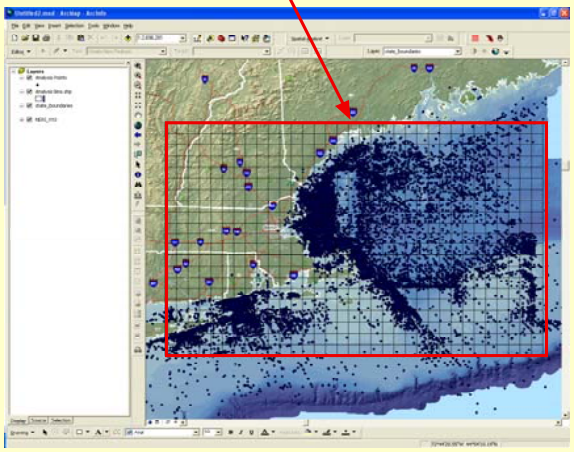


Case Example - New England VTR data:
Create spatial analysis bins and join with points

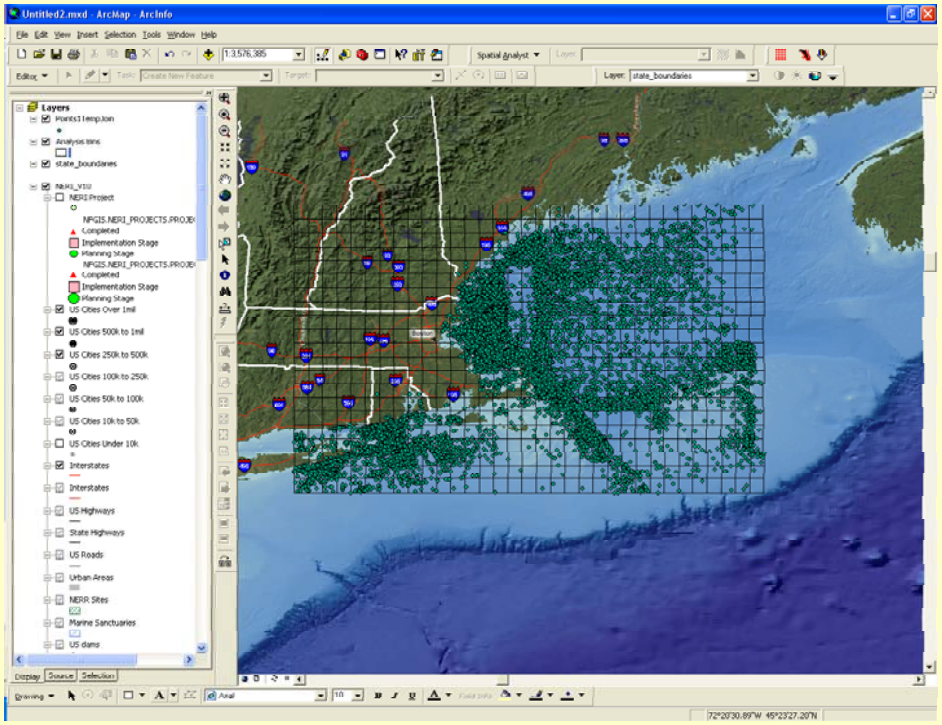
5. Spatial extent and cell size of analysis area are specified.



6. Selected area is autopopulated with specified bins, then saved as shapefile.



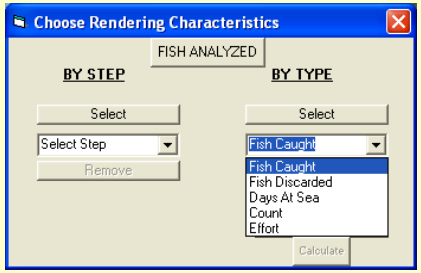
7. Spatial Join of point and bin shapefiles creates stand-alone table, summarizing catch and effort by bin and time-step.



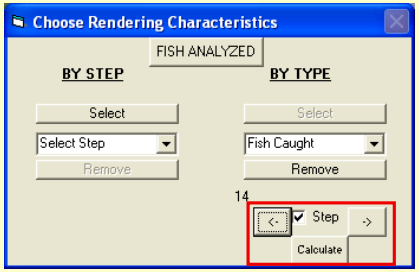
Case Example - New England VTR data: Render catch and fishing effort through time

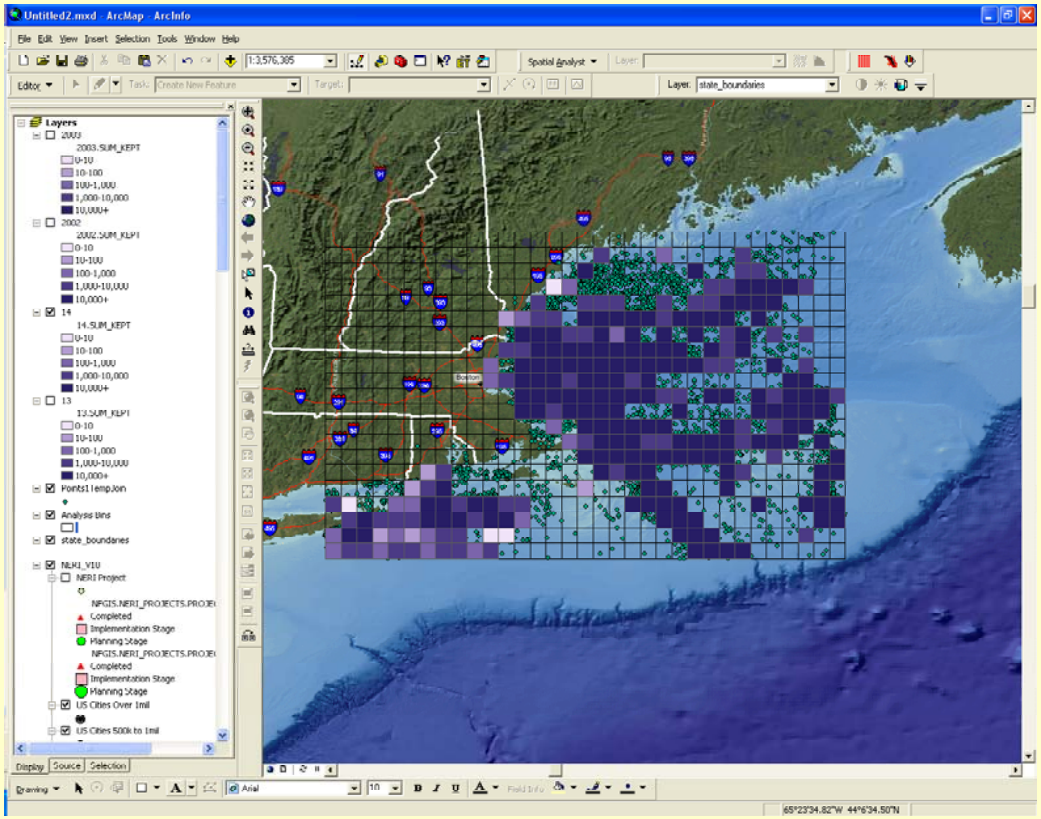
8. Second button on EcoGIS toolbar launches renderer, a ŅdataÓ tool that allows the user to examine all variables for one time step, or one variable for all time steps.

9. Time step is specified (e.g. month, quarterly, or custom), and analysis parameter (e.g. catch, days-at-sea, calculated effort).



10. ŅForwardÓ and ŅBackwardÓ buttons may be used to move rendered data through time steps. ŅCalculateÓ button applies map algebra to sum or subtract results between time steps.





Lessons Learned - key points

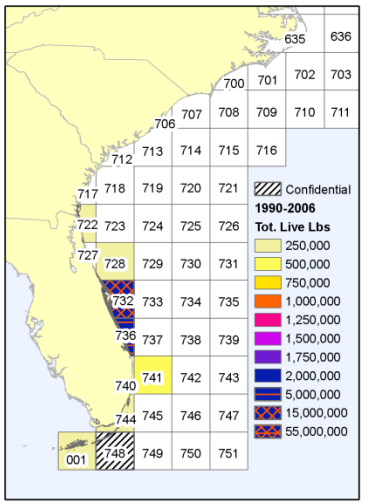
- *Data quality* – Fishery Mapper most useful in regions where location of catch is accurate and precise
- *Calculation of fishing effort* - no universal method, varies among fisheries - days absent vs. empirical formulas.
- *Data confidentiality* - must be ensured with fishery-dependent data (VTR, observer, VMS).
- *Coordination* - with other projects to avoid duplication.
- *Flexibility* – tool should work with any data source (local or remote) that has a georeference (e.g. point coordinates or statistical area)
- *Interoperability* - break tool into components.
- *Efficiency* – less time on search/processing; more analysis
- *Platform* – Science: desktop; Management: web

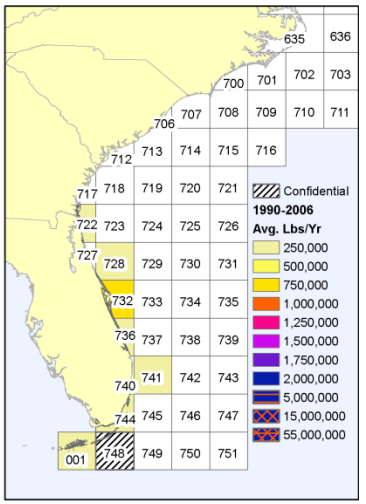
Fishery Mapper - proposed improvements

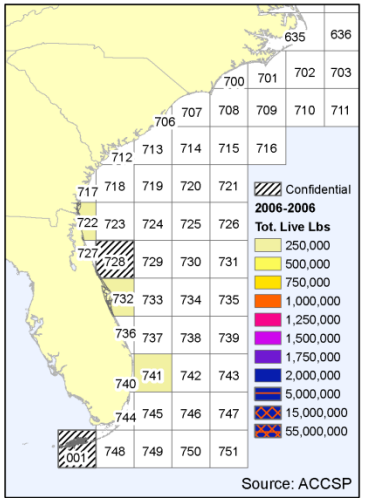
- Work with any georeferenced data
- Data profiling and query building.
- Tool broken into “scriptable” components to automate spatial / temporal summarization.
- Component tools can be re-assembled in in a custom modeling procedure.
- Animation capabilities will enhance visualization through time.

Example scenarios for Fishery Mapper

- *Fishing Effort Displacement*
- *Oceanography and fishery interactions*
- *Species distribution and abundance mapping*







Logbook Catch: MENHADEN, ATLANTIC
1990-2006
Pounds in Thousands

Area	Tot. 90-06	Avg. 90-06	Tot. 2006
001	0.23	0.01	Conf.
722	195.37	11.49	22.69
728	168.43	9.91	Conf.
732	8,727.39	513.38	80.27
736	3,510.46	206.50	0.00
741	351.31	20.67	3.73
744	13.39	0.79	0.00
748	Conf.	Conf.	0.00

Web-based vs. desktop tool development

- *Advantages of desktop*: complete user control, powerful analytical features, flexible data sources, compatible with pre-and post-processing tasks.
- *Disadvantages of desktop:* Users must have software installed and be proficient.
- *Advantages of web-based*: can serve large datasets to many users, basic mapping capabilities available to users without desktop GIS, easier maintenance of existing apps.
- *Disadvantages of web-based:* limited analytical power, less user autonomy, higher infrastructure costs.

Lessons Learned - emerging themes

- *There is no single "uber-tool"* to meet all needs - individual tools must be interoperable with "scriptable" components.
- *Access to quality data* - Regional Ecosystem Spatial Databases are prerequisite to Integrated Ecosystem Assessments.
- *Ecosystem modeling* - is becoming more spatially refined, and GIS will provide pre-and post-processing capability.

Summary of Recommendations

- Further develop EcoGIS Fishery Mapper as a desktop tool.
- Develop additional tool for assessing fishery-habitat interaction using confidential VMS data.
- Develop Regional Ecosystems Spatial Databases, with access through web-based portals for IEAs.
- Develop tools to be interoperable with input/output of spatial ecosystem modeling platforms.
- Develop features of tools as components that can be used separately to customize workflows.
- Coordinate with parallel efforts and engage with groups such as NOAA GIS users, EBM Tools network, etc.
- Continue to develop IOOS to provide real-time compatible data for ecological forecasting.

Thanks!

Tusen Takk!

Mahalo Nui Loa!