ESRI UC 2014, CONFERENCE PRESENTATION

USING MASSIVE AMOUNTS OF MARINE AIS DATA TO EVALUATE MARINE TRAFFIC

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Our team is involved with a number of environmental assessments which propose to add marine commercial traffic to existing routes. Per environmental assessment regulations, we must create a baseline and understand project effects. The defining question is: What is the spatial representation of a marine traffic baseline?
EXISTING DATA IS INSUFFICIENT FOR GIS

- Traditional source is call-in points for large vessels
- Two dimensional window on a complex phenomena.
- Vessels passes between transects
EXISTING DATA IS INSUFFICIENT FOR GIS

What we need to know for our entire study area is:

- how many vessels;
- where they were going;
- how big they are; and
- what they are doing
MARINE AIS DATA

- **AIS** = Automatic Identification System.
- ISO standard that allows vessels to communicate their location, vessel information, heading and speed at regular intervals.
AIS DATA

Fundamentally an xy coordinate with a boat id (MMSI) and a timestamp
**AIS DATA**

- Additionally contains a numerous useful attributes

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- ATTEMPT #1
- ATTEMPT #2
- ATTEMPT #3
- CALIBRATION
AIS DATA: PROS

- Temporal resolution
- Spatial resolution
- Standardization
- Availability
- Automatic
AIS DATA: CONS

THE CHALLENGE

n Spatial-Temporal resolution
n Positional Error
n Big data
n Not complete
n Cost
MARINE TRAFFIC SOLUTION

THE CHALLENGE

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION
ATTEMPT #1 CONNECT THE DOTS

- Locate discrete trips and connect the end points
- Not effective
- Connecting the dots requires bounding conditions
ATTEMPT #1 CONNECT THE DOTS

THE CHALLENGE

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION
Boats must adhere to a network
ATTEMPT #2 NETWORK ANALYSIS

- Three step process to make a marine network
- Step 1 Transform ocean into a raster
ATTEMPT #2 NETWORK ANALYSIS

- Transform the raster into polylines
ATTEMPT #2 NETWORK ANALYSIS

Inegrate the polylines to create natural travel lines
ATTEMPT #2 NETWORK ANALYSIS

- Create a network and run route analysis
ATTEMPT #2 NETWORK ANALYSIS

Results
ATTEMPT #2 NETWORK ANALYSIS

THE CHALLENGE

Validation

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION
ATTEMPT #2 NETWORK ANALYSIS - ISSUES

THE CHALLENGE

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION
Refine the network
ROUTE FINALIZATION

- Each route must be attributed after it has been assigned
ROUTE FINALIZATION

- Coral Amethyst (MMSI: 373948000)
- It was in the study area from Dec 31st, 2012 – Jan 05th, 2013
ROUTE FINALIZATION

- MV HIGGIT (MMSI 316009480)
- In study area from Dec 29th, 2012 – Dec 30th, 2012
RESULTS – TUG, BARGES AND TANKERS

THE CHALLENGE

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION
RESULTS – FERRIES

THE CHALLENGE

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION
Some routes can not be captured with marine AIS methods.
CALIBRATION YIELDS RESULTS

- Data was calibrated to four classes of marine transport vehicle: Tanker, Tug, Passenger Ferry and Merchant Ferry.

- Outcome is density of vessels per day

- Data will be used to calculate impact of additional vessels or to calculate how vessel traffic is changing over time
CALIBRATION YIELDS RESULTS
CALIBRATION YIELDS RESULTS

THE CHALLENGE

THE DATA

PROS

CONS

THE SOLUTION

ATTEMPT #1

ATTEMPT #2

ATTEMPT #3

CALIBRATION

COMMERCIAL VESSEL DAILY TRANSITS

0 - 0.4

0.5 - 0.9

1 - 1.9

2 - 4.9

5 - 9.9

10 - 19.9

20 - 92.3
NEXT STEPS & THANK YOU

- Still some errors
- Always have the possibility of new solutions
- Network can be refined

More info:
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