Opportunities for habitat mapping approaches using bathymetry in fisheries assessment

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Deakin Marine Mapping Group

Canada FISHERIES AND OCEANS





Map the Gaps 2018 Canberra

Overview

Case studies

- Patterns of interaction between habitat and oceanographic variables affecting the connectivity and productivity of fisheries- Victoria, Australia
- Regional seabed mapping with crowd sourced bathymetry- Newfoundland, Canada





A changing climate





Changes in Current Patterns



Increasing Ocean Temperatures



Changes in Wave Environment

Washington Fo





Determine the drivers of spatio-temporal productivity fisheries

ENVIRONMENTAL VARIABLESS

Spatially Variable & Temporally Dynamic



Oceanography



Connectivity



Spatially Variable &

Temporally Static

Depth



Seafloor Structure



Abalone Fishery





20yrs of data ~180 sites 6 Transects/Sites 30 m long, 1 m wide





State Seabed Mapping Coverage





Open access to Victorian marine spatial data

Data Providers

About

Contact

Project Partners

The Victorian Marine Data Portal (VMDP) provides an open access gateway to spatial data collected In the State's rich and diverse marine ecosystems.

Dive into Data! Alternative Access

https://vmdp.deakin.edu.au/



Boosted Regression Tree (BRT) Results



Influence on Model



25%

Biophysical Modelling



Spatial & Temporal Connectivity

200

Kilometres

100

Annual Variability in Connectivity from 1990-2015



Larval connectivity distance of abalone appears to be on the order of less than 50 km (perhaps occasionally up to 100 km).

The primary sources of abalone larvae are from those large populations in the west half of the state, with a few strong sources in the east.

0.51 - 0.7

0.71 - 0.8

Temporal Variation in Biomass







Annual Biomass Predictions

Biomass: Emerging Patterns



38% - No Pattern12% - Hot Spots50% - Cold Spots

Emerging Hot Spot Pattern	Percentage of Victoria
No Pattern Detected	38%
Persistent Hot Spot	< 1%
Diminishing Hot Spot	8%
Sporadic Hot Spot	< 1%
Historical Hot Spot	4%
Oscillating Cold Spot	9%
Sporadic Cold Spot	32%
Consecutive Cold Spot	3%
Intensifying Cold Spot	4%
New Cold Spot	3%

Regional seabed mapping with crowd sourced bathymetry



Newfoundland and Labrador Shelf Case Study

- Need for habitats maps for seabed type, structure and ecosystem based management
- DFO need for spatially explicit models for ESBFM
- Decrease in groundfish linked to overfishing and a changing climate



•Multibeam Sonar coverage limited by cost and effort



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 OLEX crowd sourced bathymetry dramatically improving coverage







- estimating the underlying semi-variogram from hundreds of iterations for error estimation
- 100 x 100km subsets interpolated to speed up EBK process
- Mosaicked post EBK processes

Mosaic subsets



>100x finer resolution bathymetry than previously available for the majority of the study area



690 725 km² of continuous bathymetry and terrain derivatives



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Geomorphology as predictors of substrate type and species distribution.



Boosted regression trees

- Grab samples + crowdsourced bathymetry + GLORYS2 oceanographic data
- CV correlation = 0.81
- CV ROC = 0.945
- Hold-out accuracy = 0.78

Substrate class ~ depth + slope + BPI + rugosity + aspect + current speed + current direction



Fish density ~ depth + slope + BPI + rugosity + current + salinity + temperature

Fish distribution (Autumn 2014)

- Fish distribution models trained on all preceding survey years (1995-2013)
- Predictions generated based on environmental conditions in 2014

Greenland Halibut (Commercial fishery)

- CV correlation = 0.78
- CV ROC = 0.95
- Correlation to 2014 tows = 0.75

Atlantic Wolffish

(Species at Risk)

- CV correlation = 0.61
- CV ROC = 0.87
- Correlation to 2014 tows = 0.57







Conclusions

- Whilst not a replacement for high resolution bathymetry data CROWD SOURCED BATHYMETRY does provide a source for planning, reconnaissance, groundtruthing and modelling
- Opportunity to creatively use existing datasets (collect once use many times) and resources to improve seafloor maps at minimal cost.
- Develop/ adopt a data structure to handle scalable bathymetry, uncertainty and associated metadata

Thanks for listening contact: iero@deakin.edu.au www.marinemapping.org



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IMOS Integrated Marine **Observing** System









TORIA State Government

Environment, Land, Water and Planning

VICTORIA

BUZUKI

Global Ocean Refuge Platinum Award