Ways forward

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What does successful monitoring look like?
The sMon project: retroactive integration

• Data is available!
The sMon project: retroactive integration

• Data is available

• Compile and connect heterogeneous data
The sMon project

• Data is available

• Compile and connect heterogeneous data

• Occupancy-detection models
The sMon project: Dragonfly results
What more can we do?
(1) Attribution analysis
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• Data availability on: water quality parameters? land-use over relevant time-period

• Relate temporal changes in environmental data to species occupancies?
  • Need annual data?
  • What lag to use?

• Study spatial variation in trends??
(2) Combining different types of survey data

Data

- Observation Process
  - Observation process – survey 1
  - Observation process – survey 2

- Ecological Process
  - Common covariates
Advantages of combining standardized and unstandardized data

• Upscaling data
  • standardized data usually small-scale, unstandardized data often large-scale

• Accounting for bias and better assessment of detection probability in the opportunistic data

• Standardized freshwater invertebrate data collected during water quality monitoring...
Norway example: Combining standardized and unstandardized data

- Standardized abundance survey data along line transects
- Citizen science opportunistic presence data
- Citizen science total sampling (absence data)
Norway example: Combining standardized and unstandardized data

- Hierarchical model combining both data types
- Predictions of total abundance in Norway
- c. 900,000 individuals
(3) Gap analysis: identify regions lacking data

Predict abundance map

Map of uncertainty in abundance estimate
(3) Gap analysis: identify regions lacking data

Where would increased data likely affect the population estimate and its uncertainty?
(4) Using simulation for more targeted data retrieval
(3) Using simulation for more targeted data retrieval
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Possibilities for sMon

• Attribution analysis
  • Starting ....

• Combining opportunistic data with some standardized survey data
  • Possible for Dragonflies

• Gap analysis
  • Definitely possible and planned

• Simulations to test our approach and the value of different data in different contexts (e.g., different proxies of monitoring effort)