Addressing Inferential Discrepancies in Monitoring Data Using IPMs

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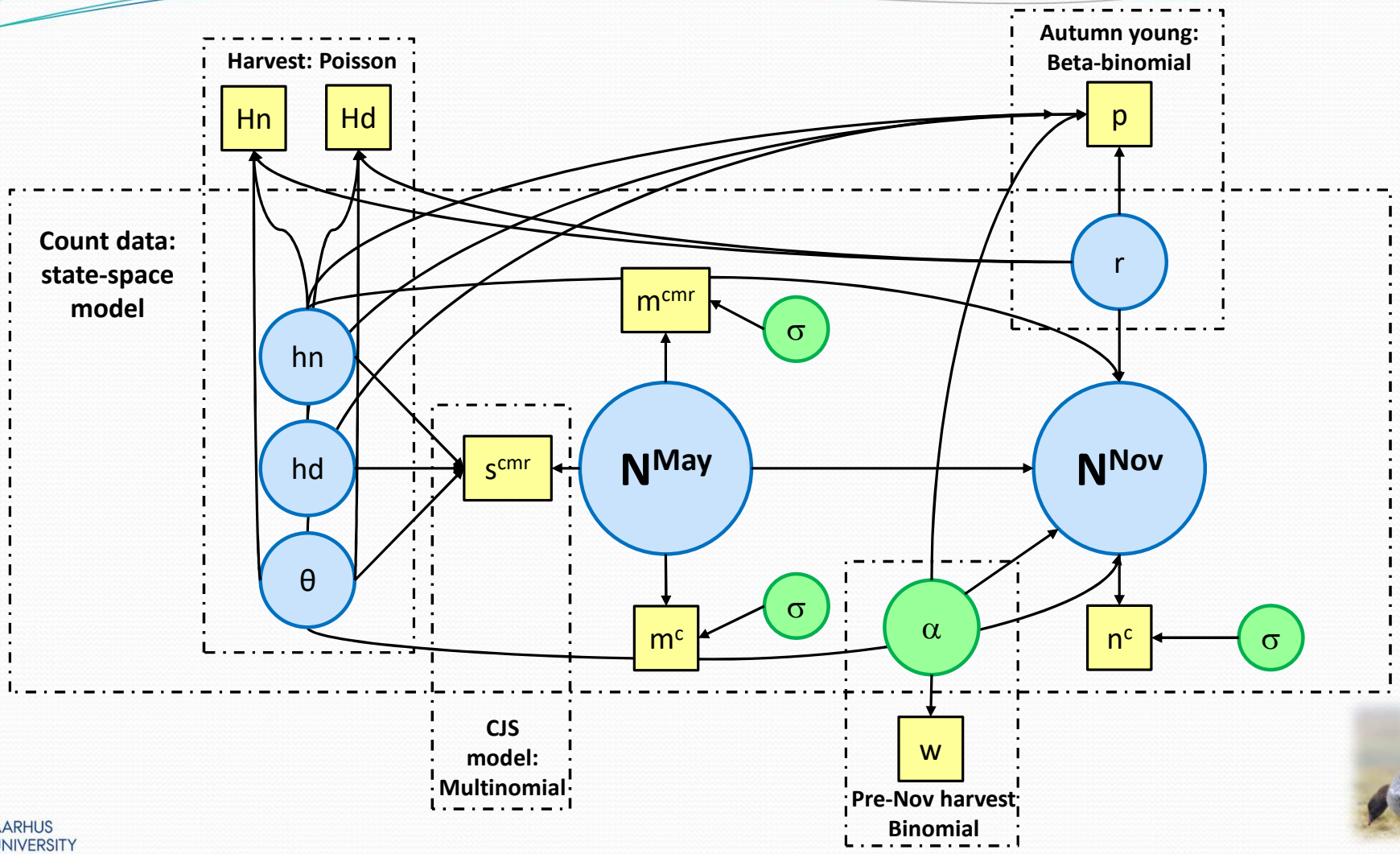
Monitoring data are often are…

- fragmentary (inconsistent in time and space)
- incomplete (missing areas or years)
- biased (imperfect detection)
- provide conflicting inference about population trends or dynamics

Integrated Population Models

- Offer a synthesis of all available data by asking how various data sets could arise from population and observation processes across time and space
- Can partially resolve data discrepancies; IPM parameter estimates represent a weighted compromise among all available data sources
- Cannot precisely estimate the magnitude of any biases without ancillary data (or without assumptions about population processes)
- Can point to data sets that seem inconsistent with synthetic inferences



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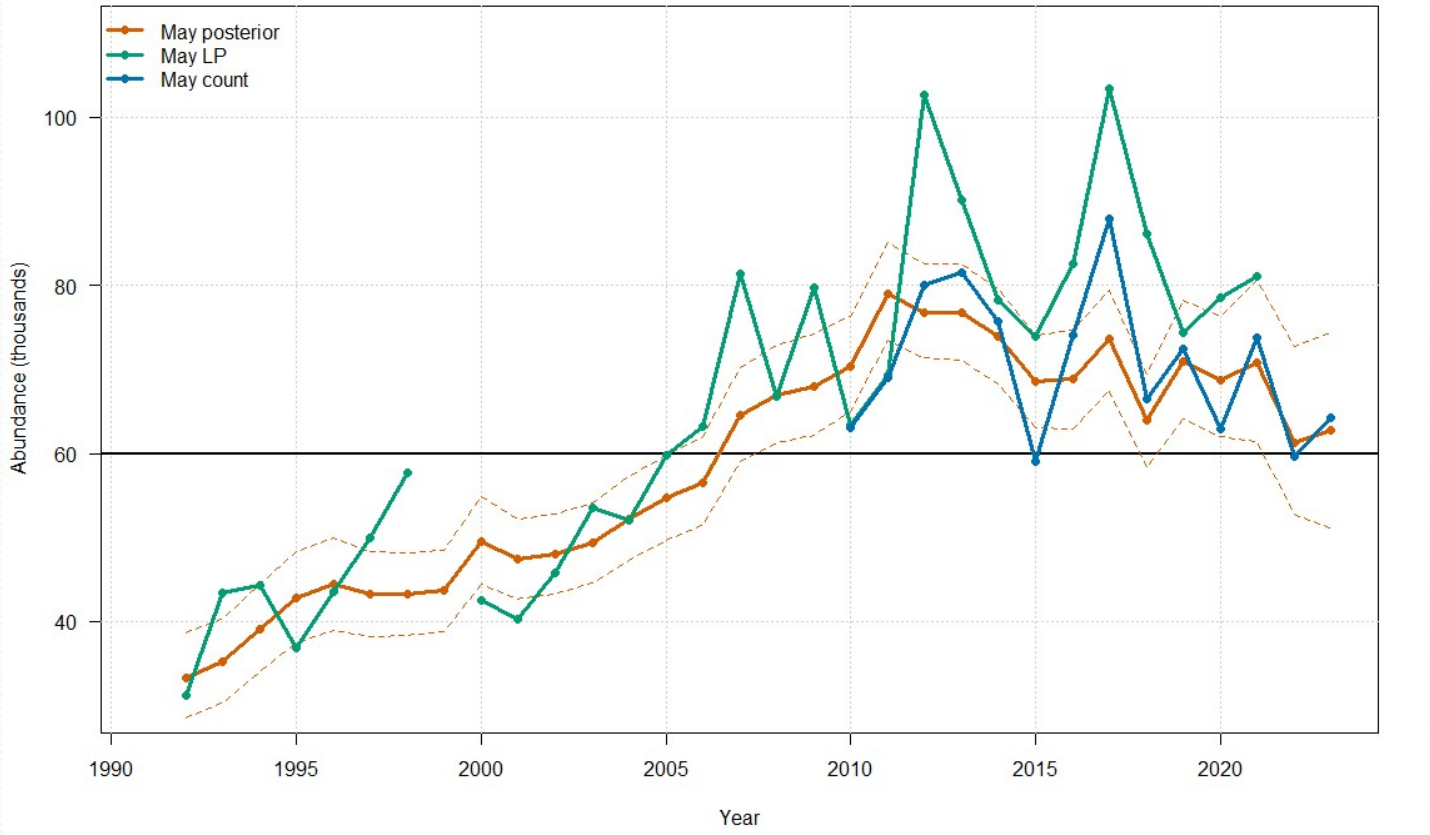
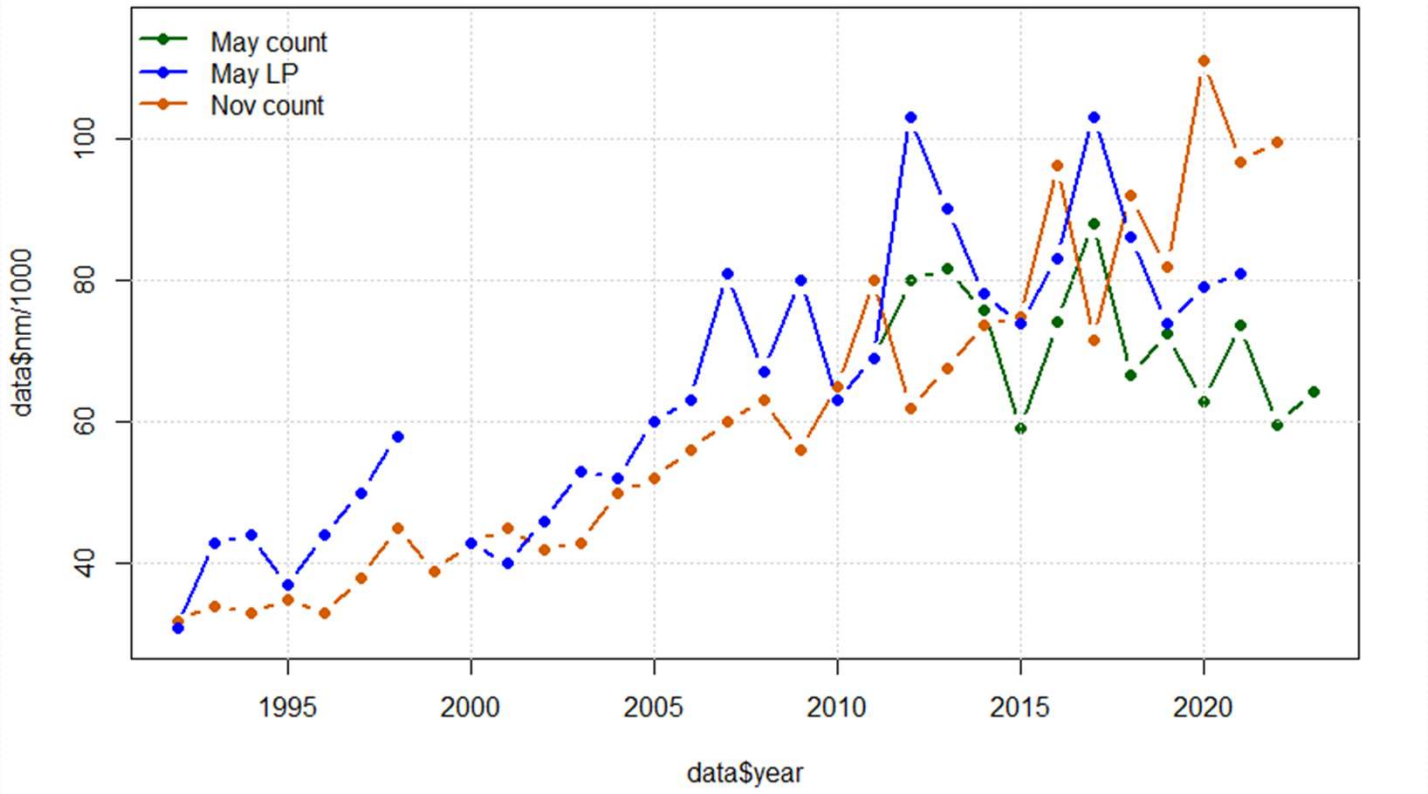
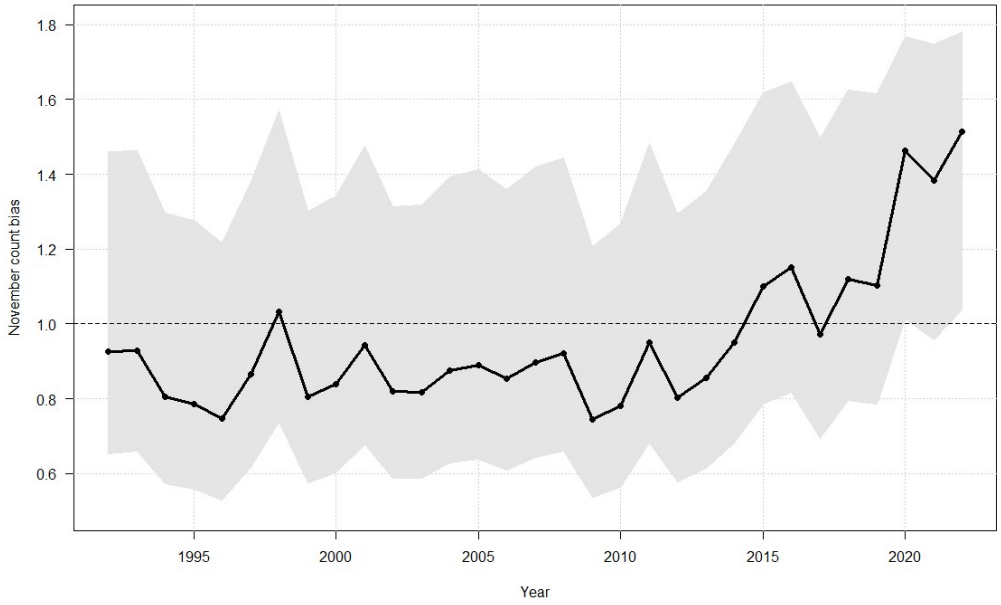
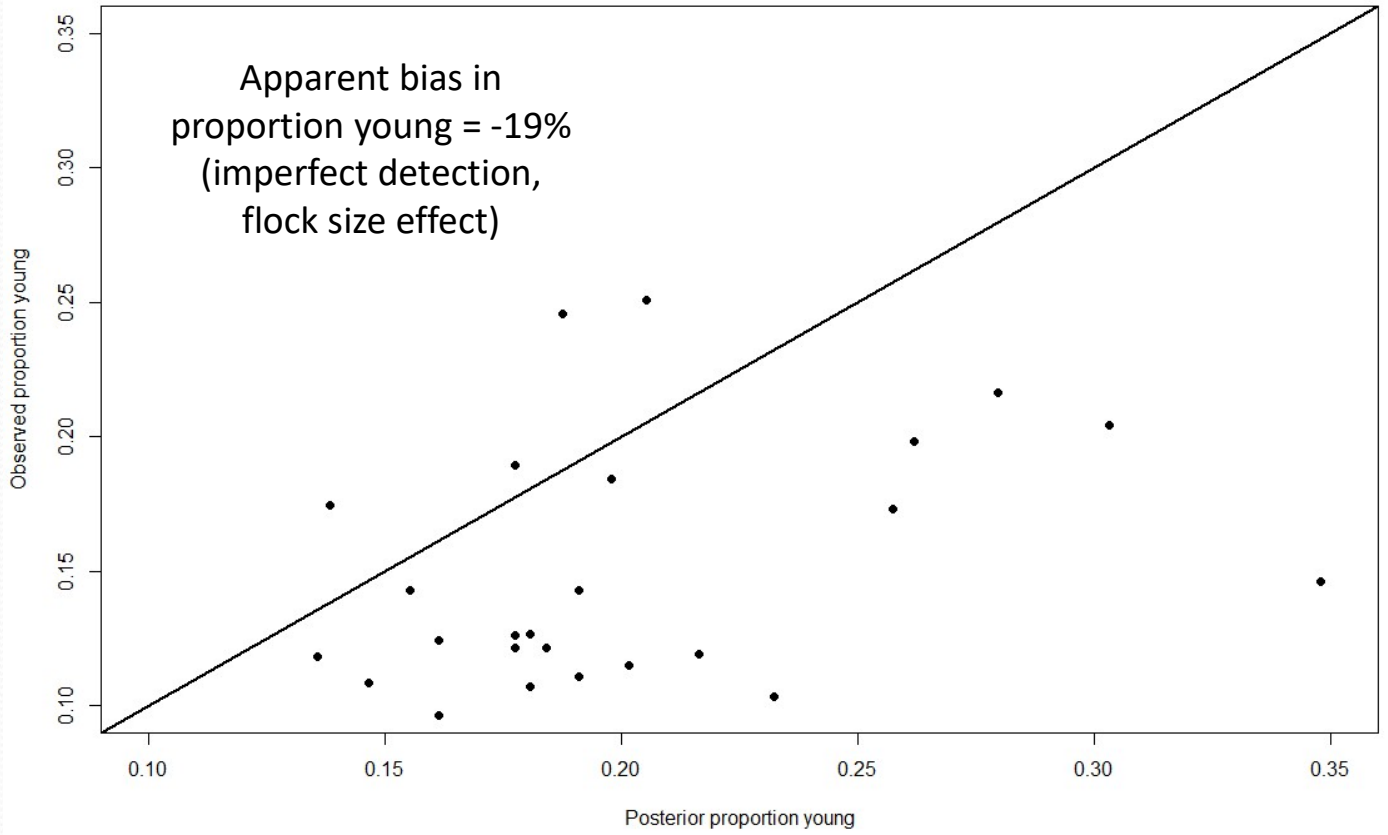

May posterior
May LP
May count
Abundance (thousands)
100
80
60
40
1990
1995
2000
2005
2010
2015
2020
Year

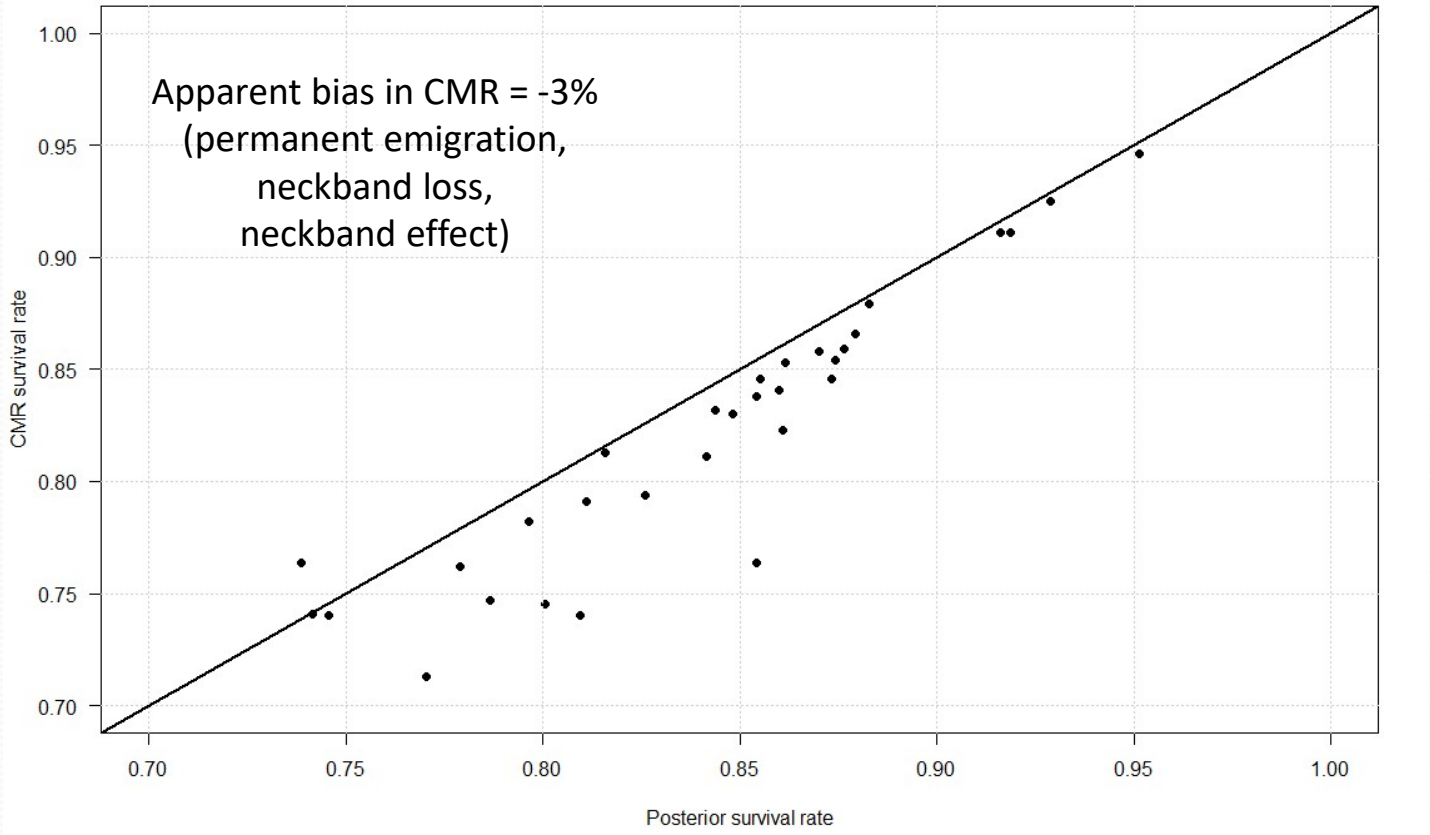

May count
May LP
Nov count
data$nm/1000
40
60
80
100
1995
2000
2005
2010
2015
2020
data$year



- The likelihood of missed birds in November motivated the need to initiate the May count in 2010 (resulting in an apparent negative bias)

- In recent years, the high November count cannot be reconciled with the May count and productivity estimates (resulting in an apparent positive bias)


Apparent bias in proportion young = -19% (imperfect detection, flock size effect)
Observed proportion young
Posterior proportion young
0.10
0.15
0.20
0.25
0.30
0.35


Apparent bias in CMR = -3%
(permanent emigration,
neckband loss,
neckband effect)
CMR survival rate
Posterior survival rate
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.70
0.75
0.80
0.85
0.90
0.95
1.00

IPMs…

- Motivate detailed thinking about how the processes driving population size vary over space and time
- Force an explicit recognition of observation processes so that sampling error is accounted for
- Can focus efforts to improve precision and accuracy of parameter estimates
- Permit an assessment of the cost-effectiveness of various monitoring instruments
- Provide a coherent platform for learning and adaptation