# An integrative model of sea turtle growth based on recoveries and mark-recapture data

Brandon Chasco, Eric Ward, Larisa Avens, Lisa Goshe, Joanne McNeill, Alan Bolten, Karen Bjorndal, Selina Heppell, Melissa Snover, Tomo Eguchi, Eli Holmes, and Howard Coleman


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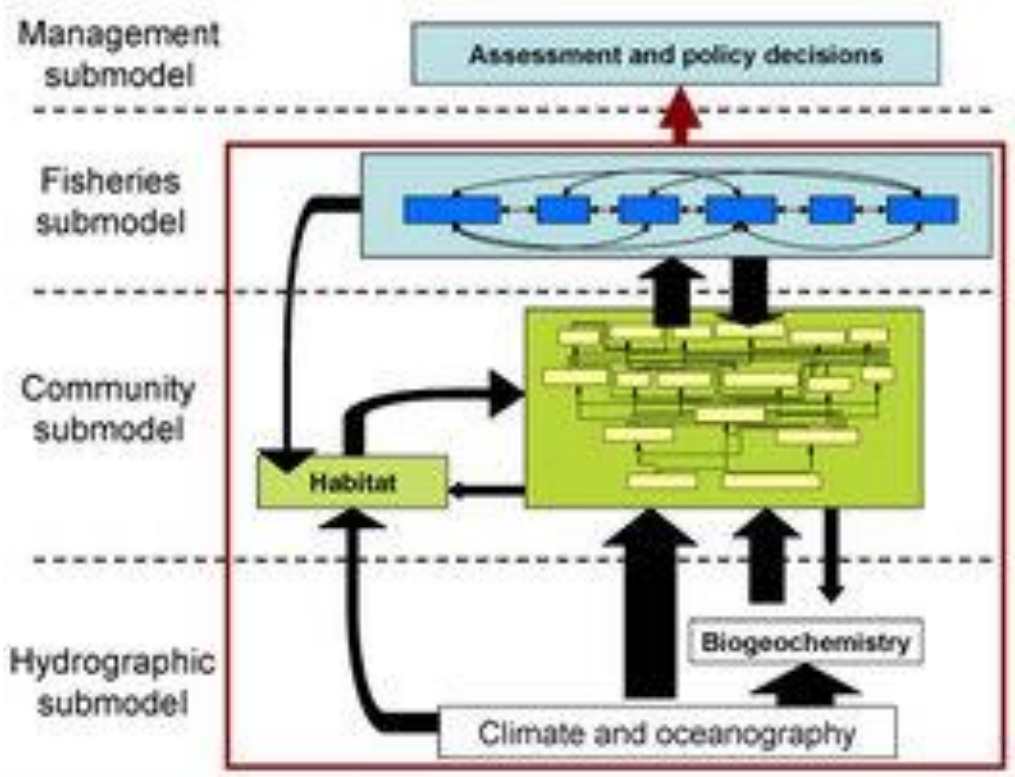
# Evolution in Fisheries and Ecological Modeling

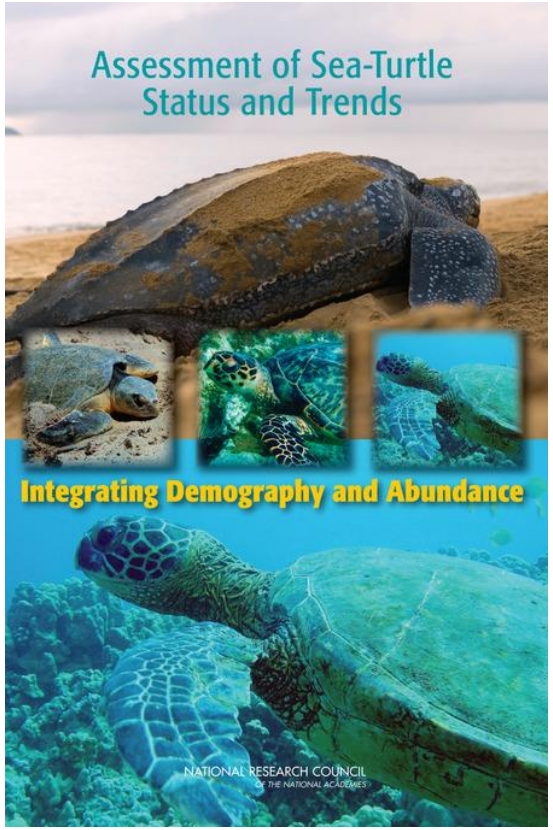



Isaac Kaplan

Integrated modeling

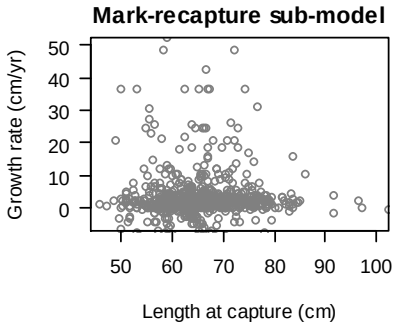
Stochastic processes

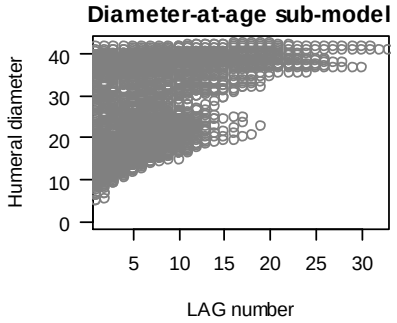
# Focus of Current Turtle Research

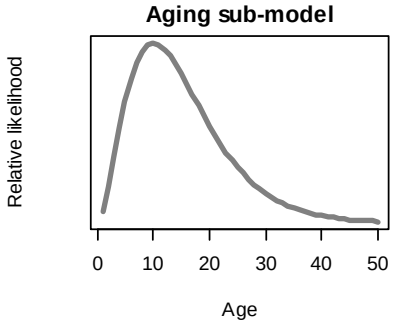


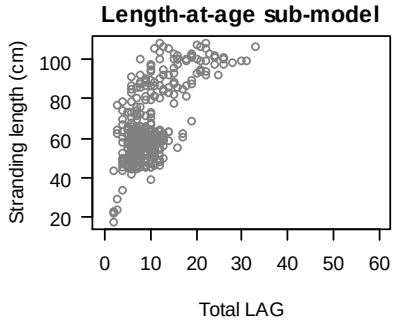

Integrated modeling

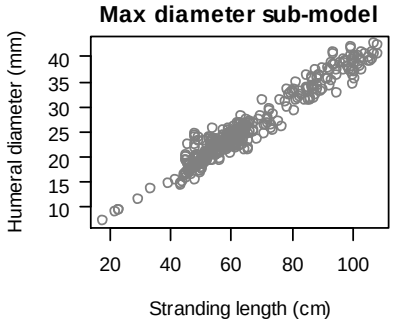
Stochastic processes



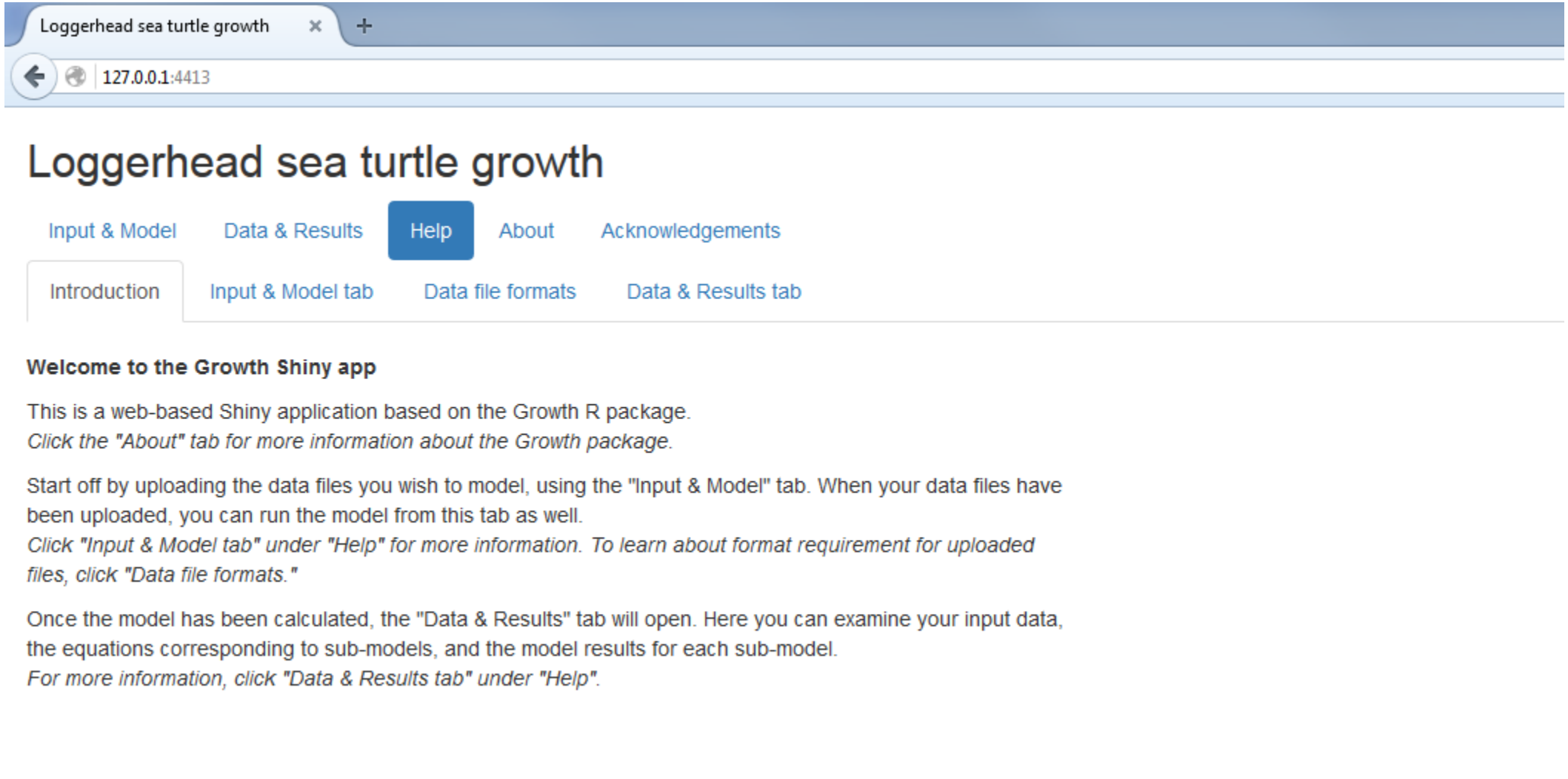



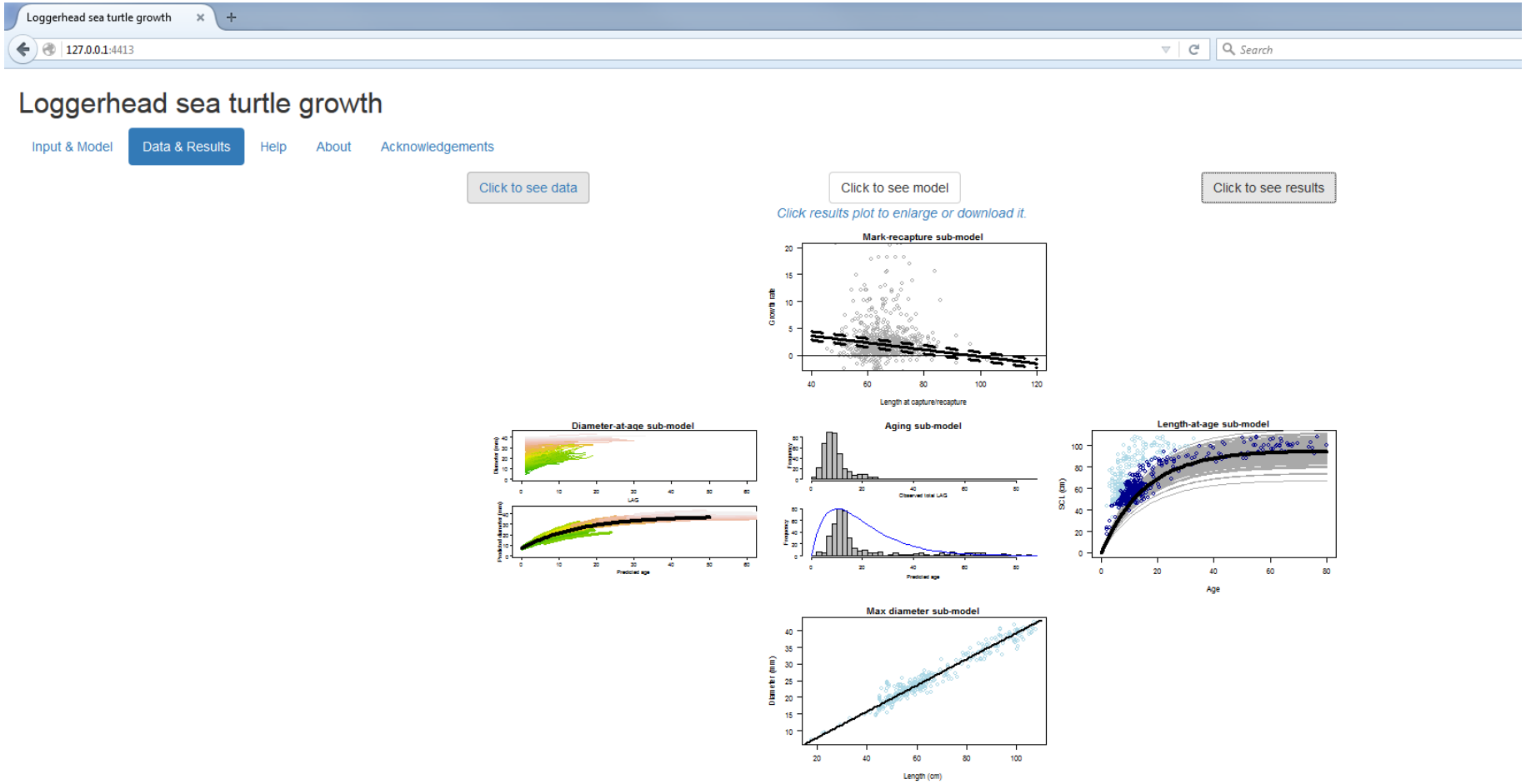




# Integrated modeling

# Stochastic processes

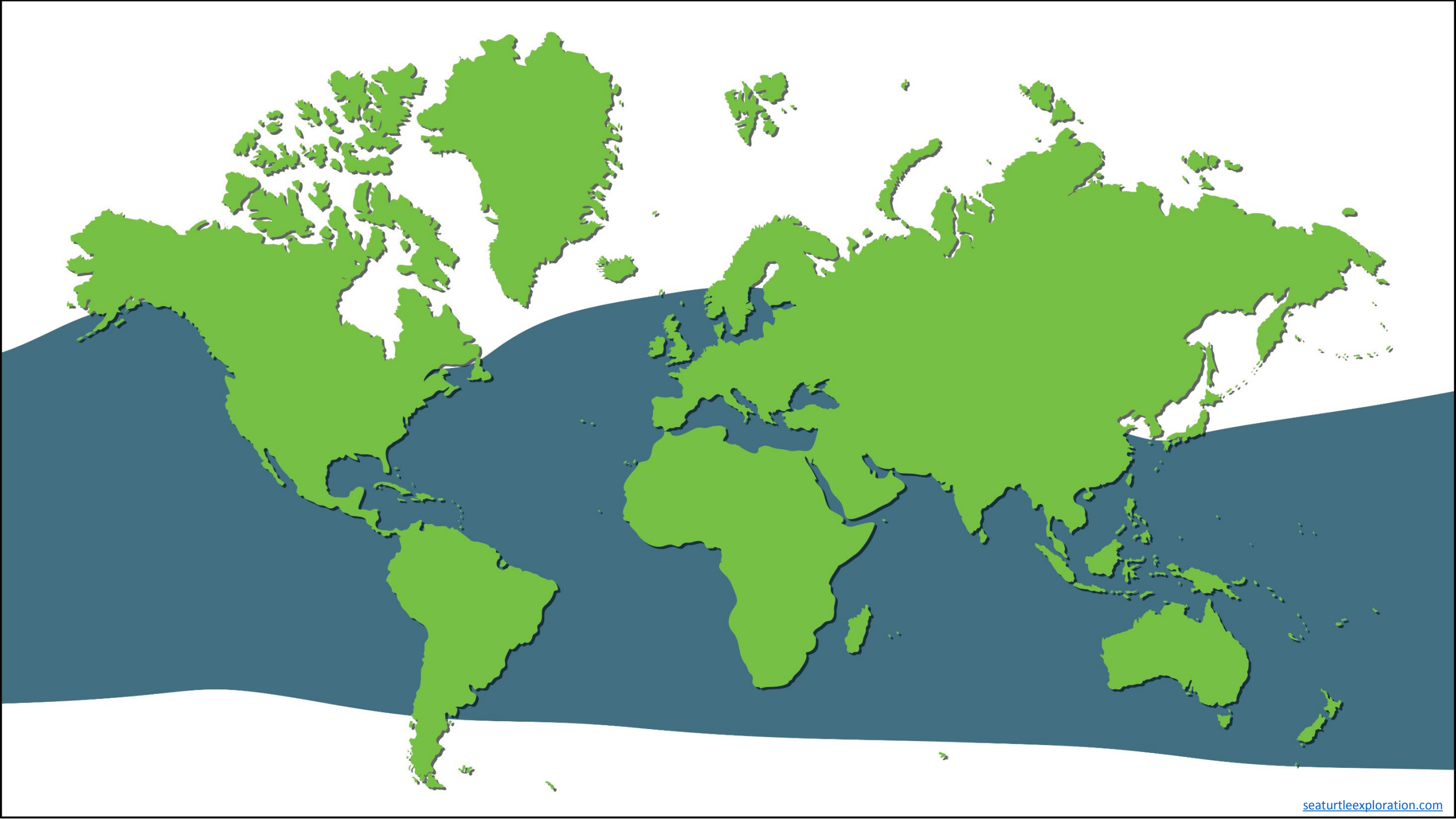



Shiny interface




# Shiny interface

# An integrative model of sea turtle growth based on recoveries and mark-recapture data



seaturtleexploration.com

Direct



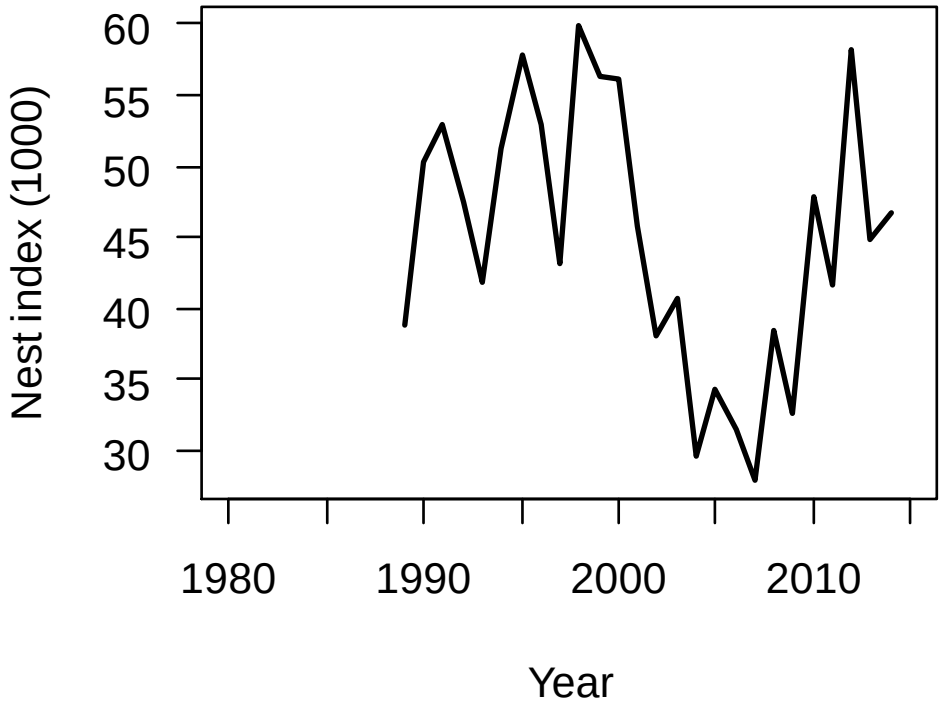
# Mortality

In-direct


# Adult females

Nesting

# Time series of nest counts



## Adult females

Nesting

## Growth and maturation

Hatching

Pelagic/ Juvenile

Neritic/ Juvenile

Adult

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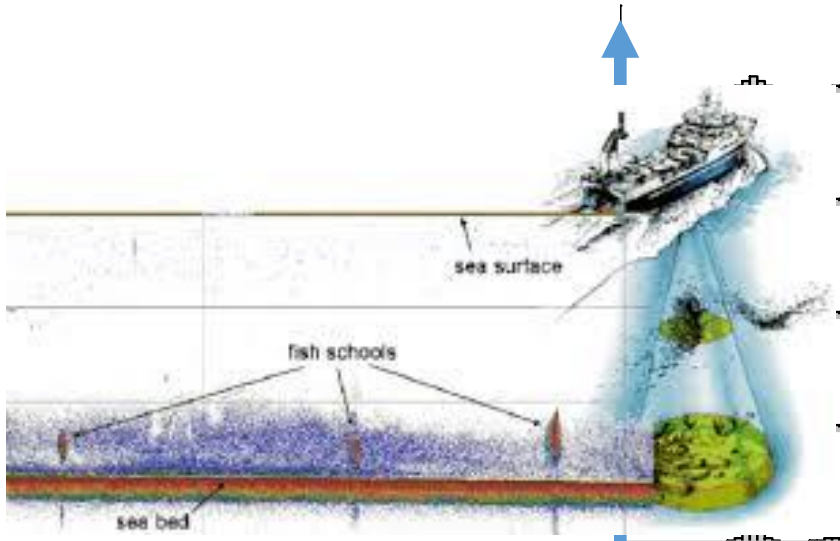
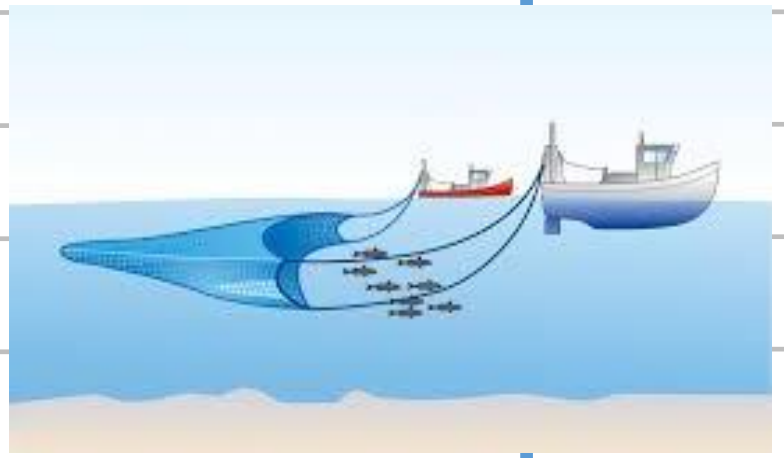
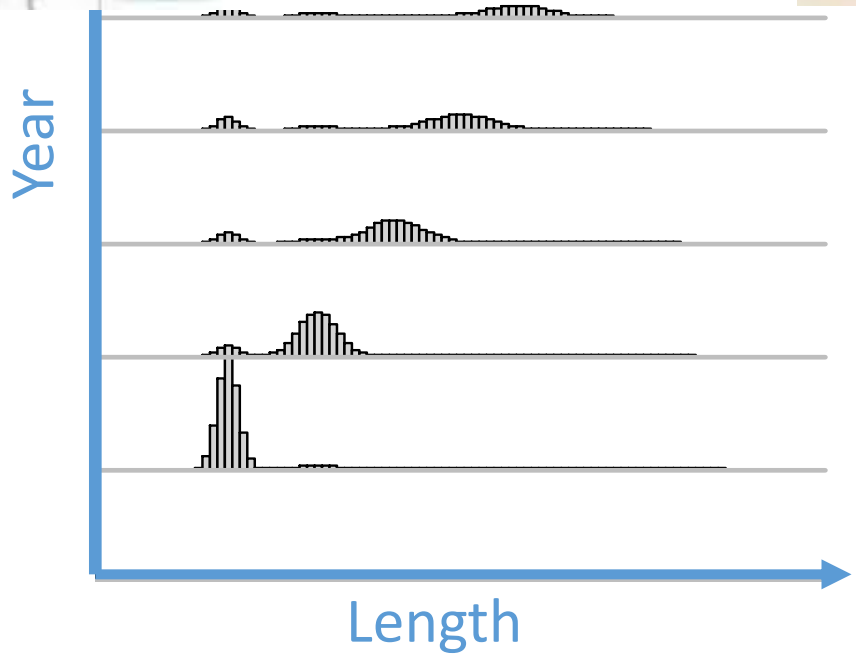
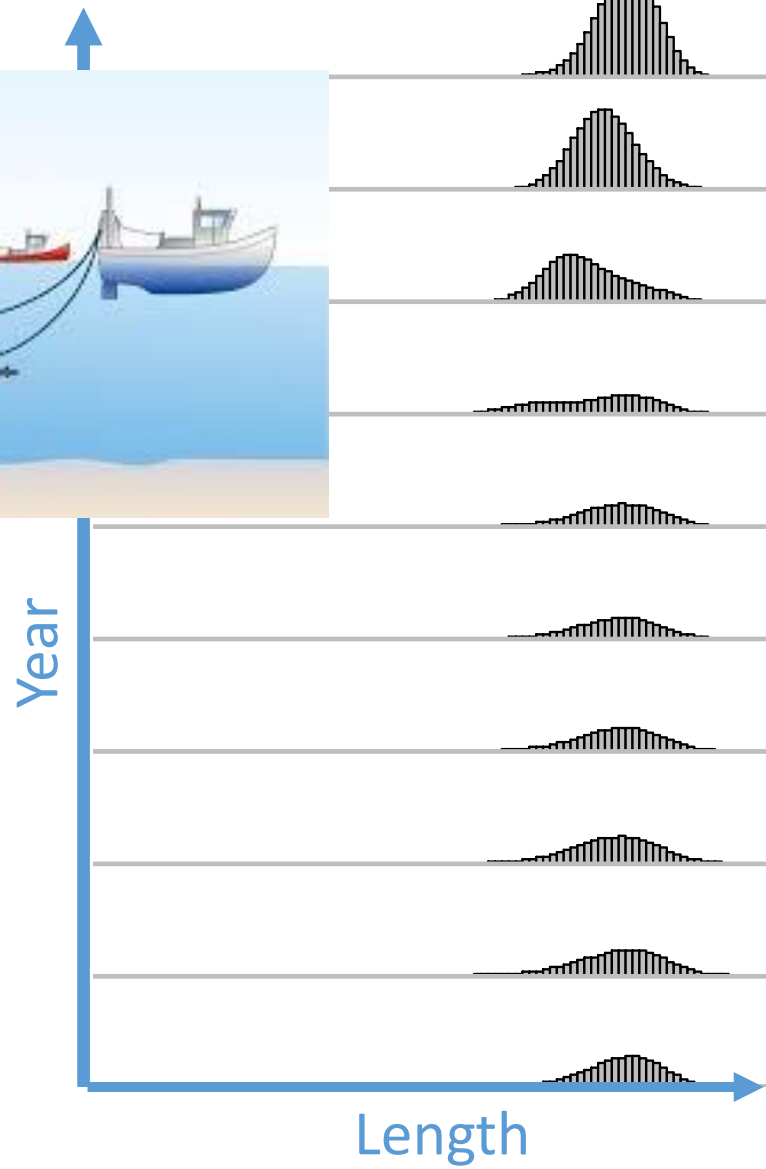
# Motivation for Current Turtle Aging Models Based on Fisheries Model





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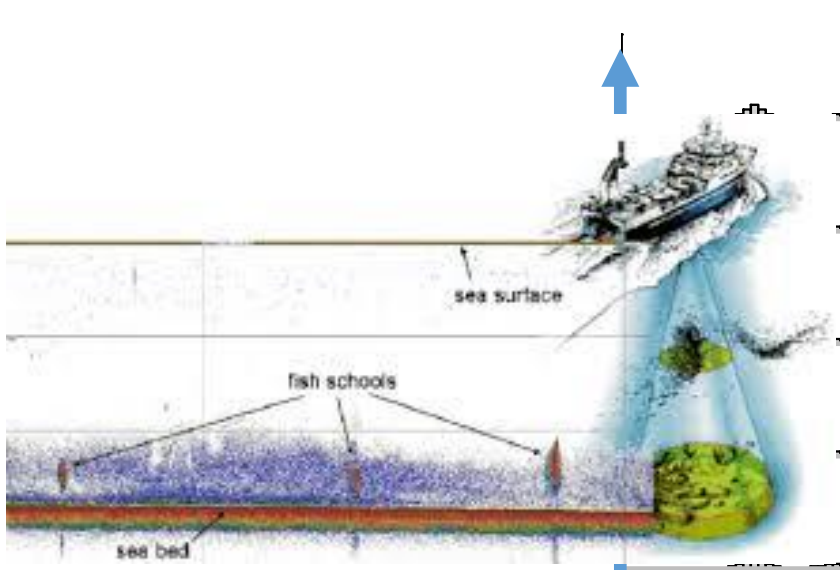
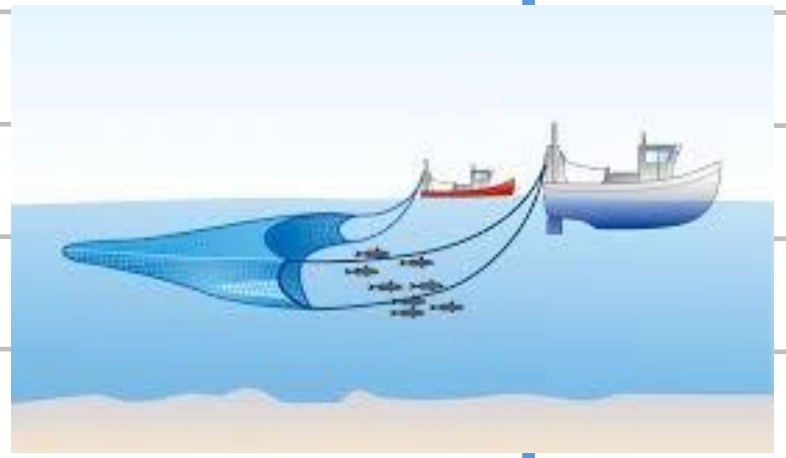
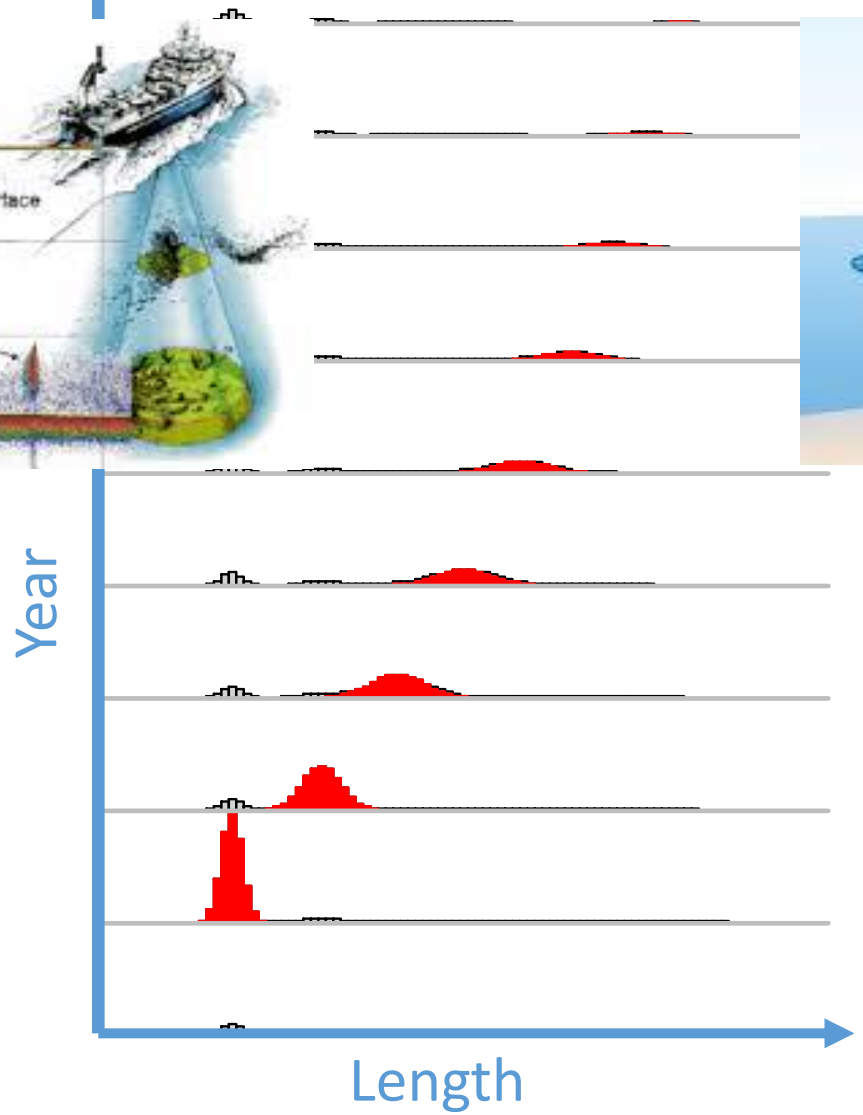
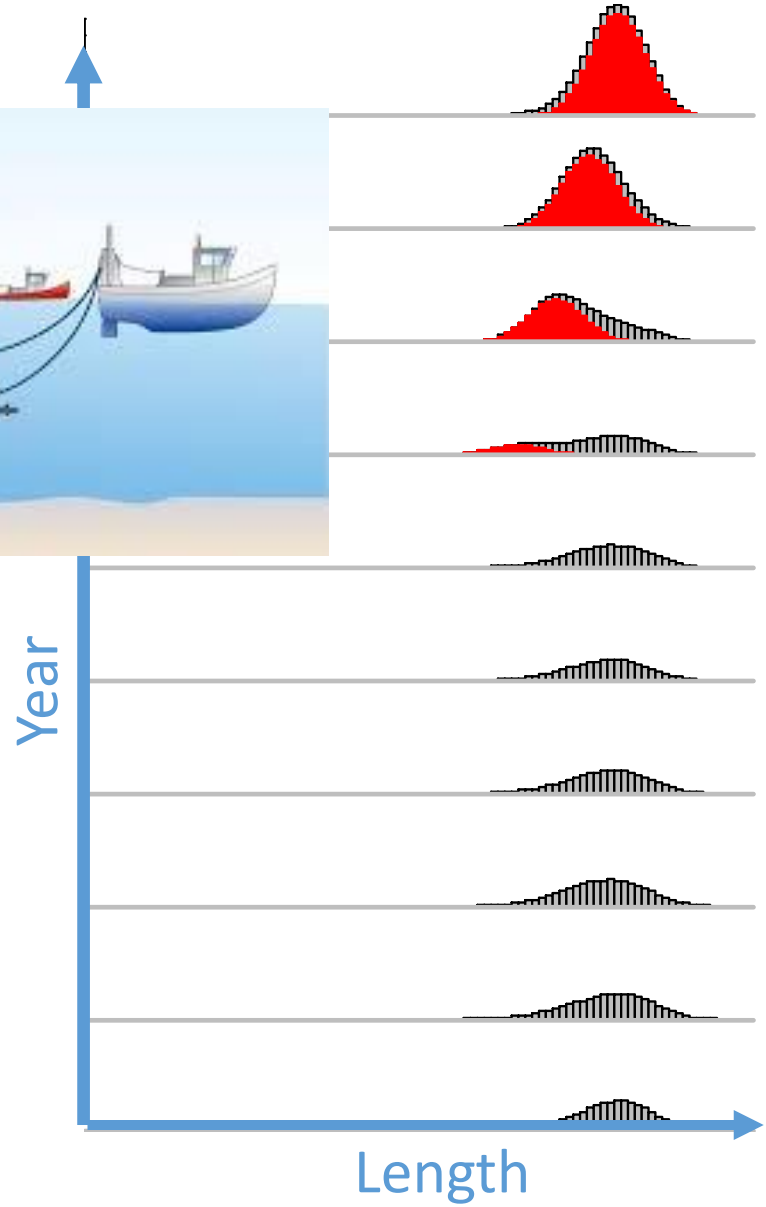
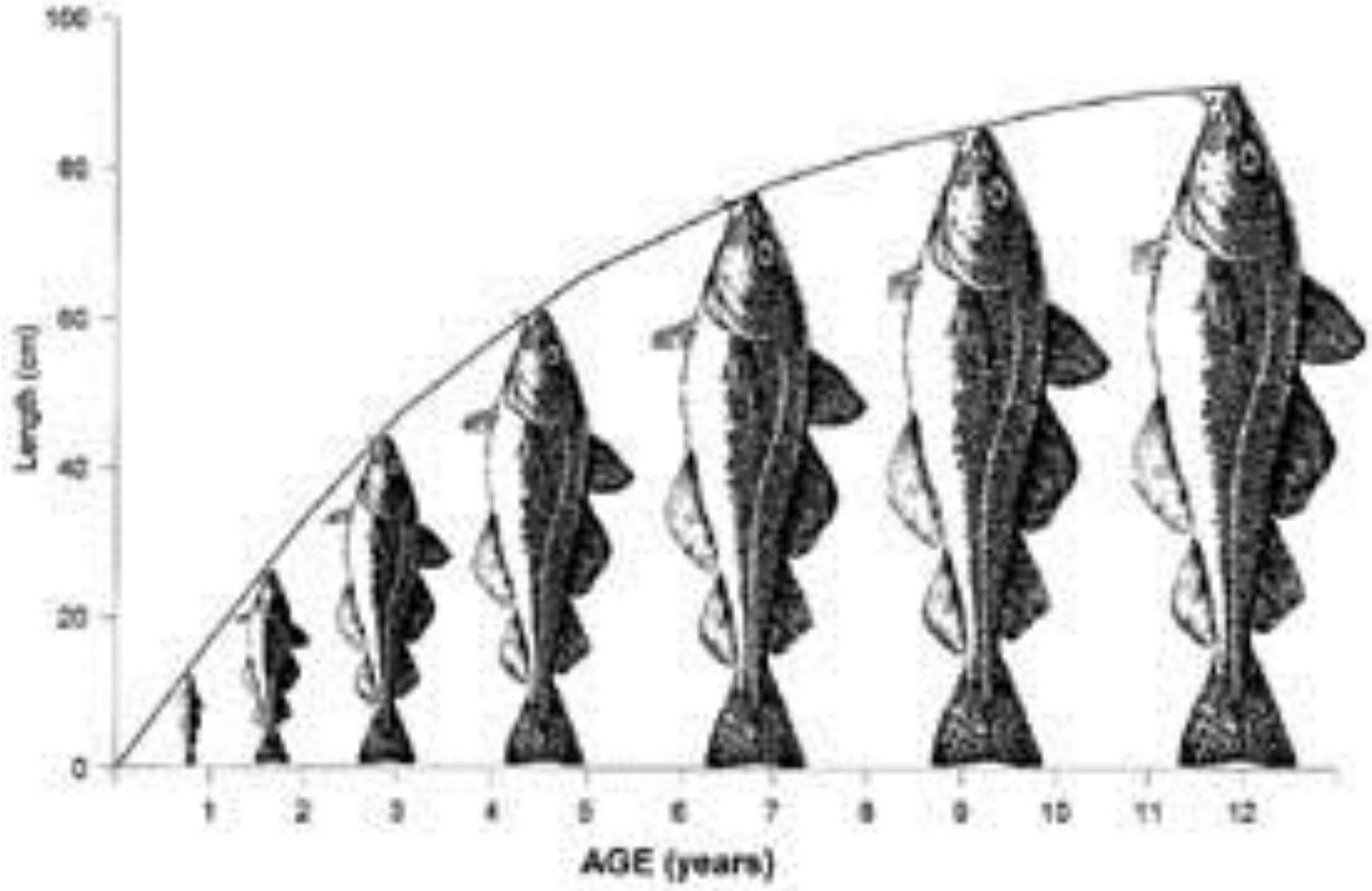




# Length-at-Age Relationships Are The Link In Integrated Fisheries Models



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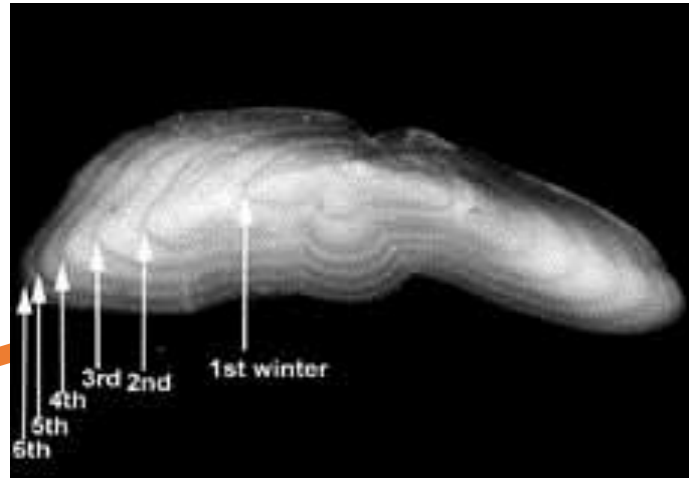
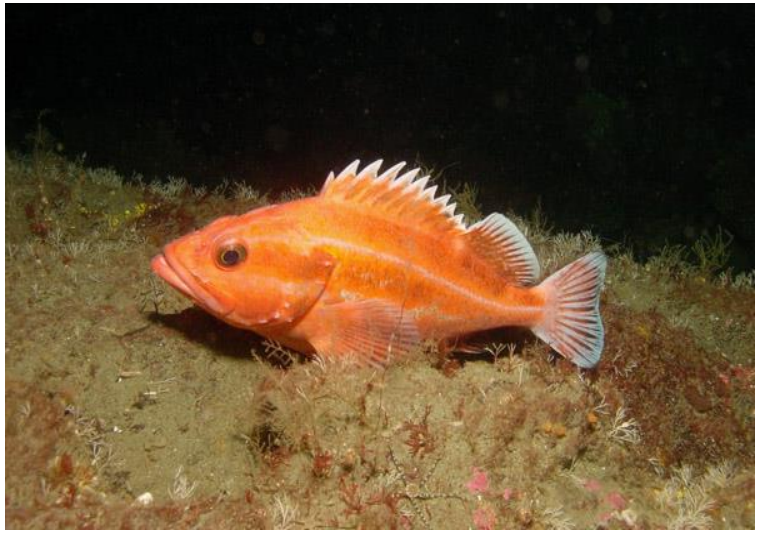
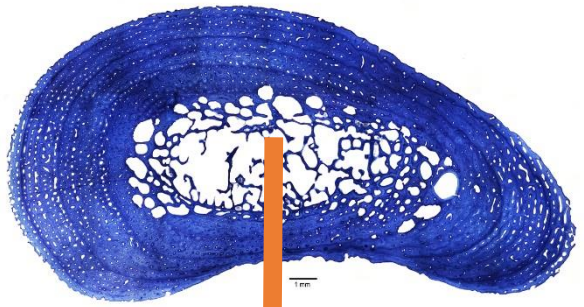
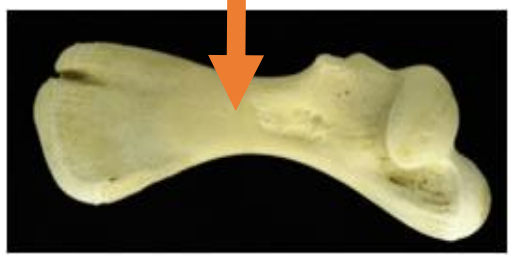
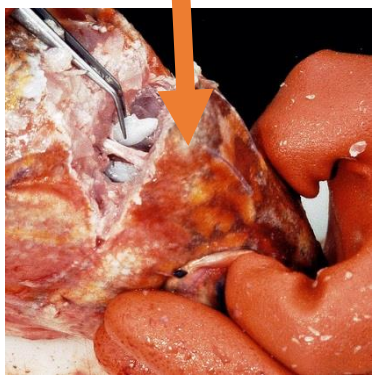


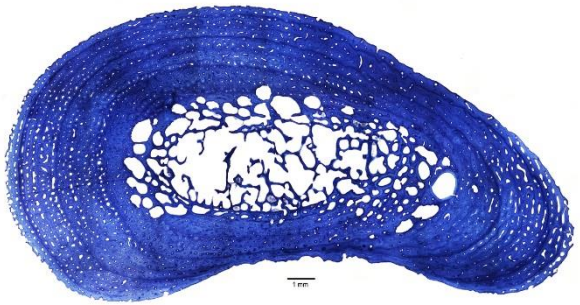


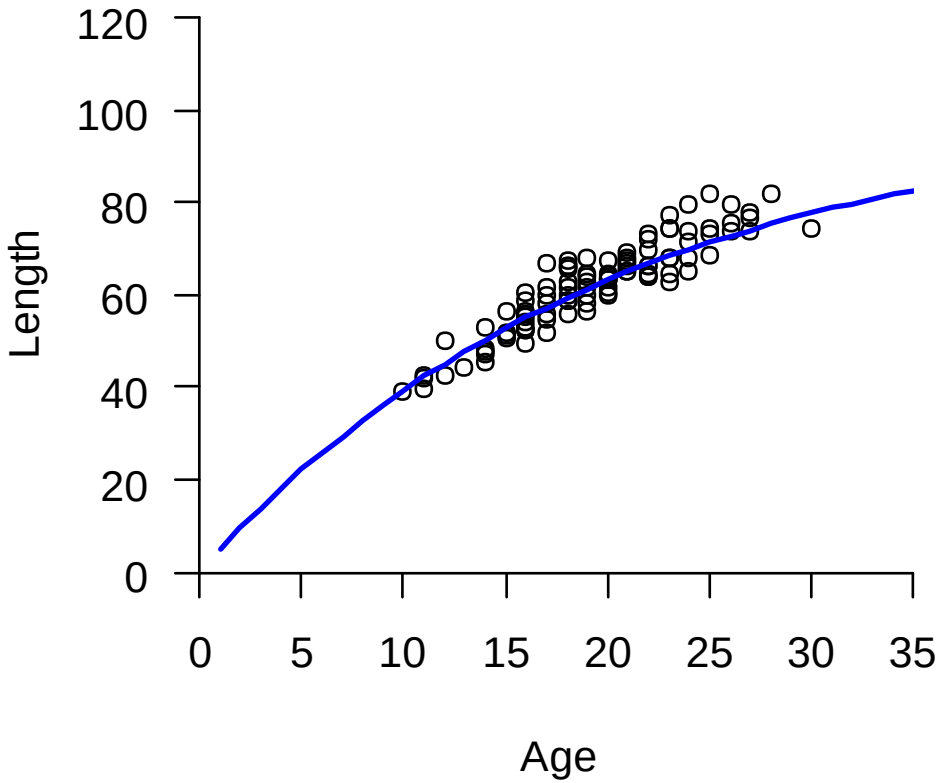


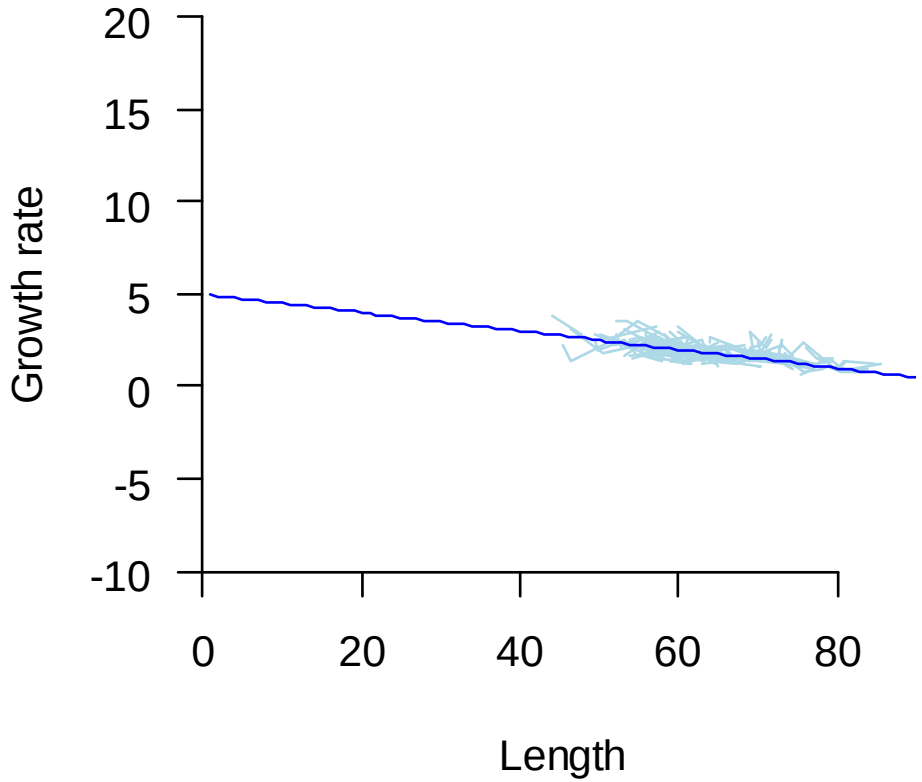


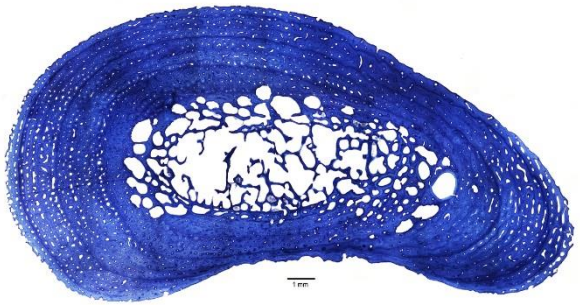

6th
5th
4th
3rd
2nd
1st winte

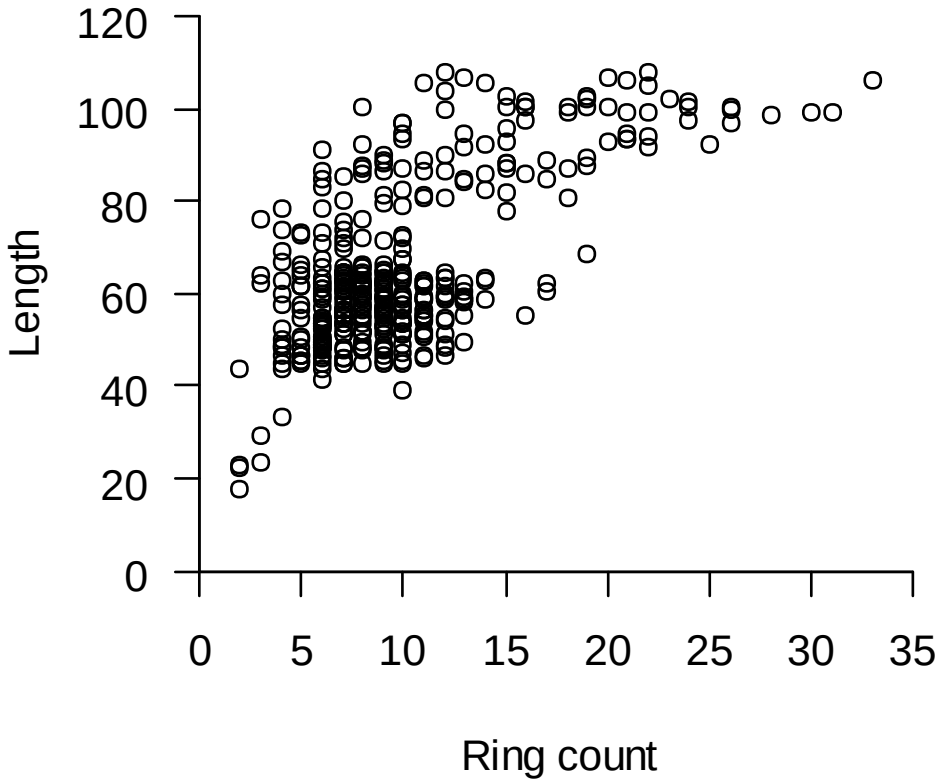


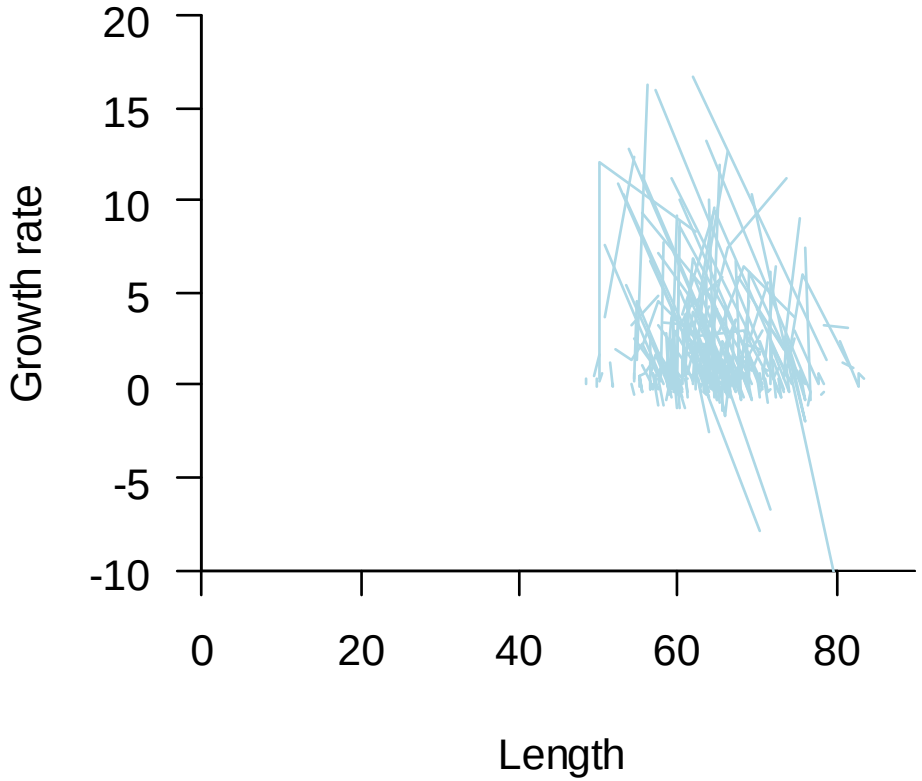


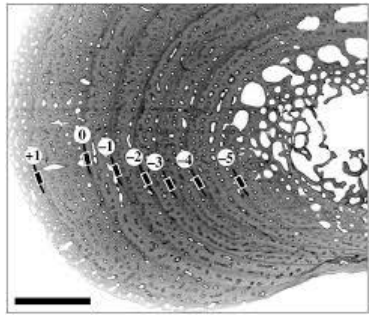

Length
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

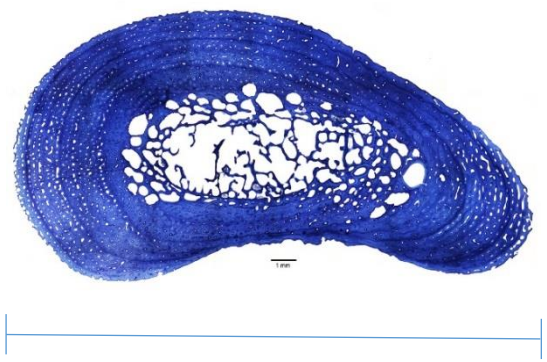

Growth rate
20
15
10
5
0
-5
-10
0
20
40
60
80
Length

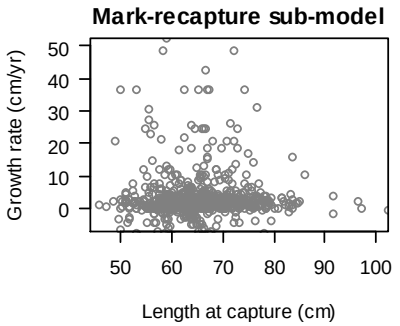


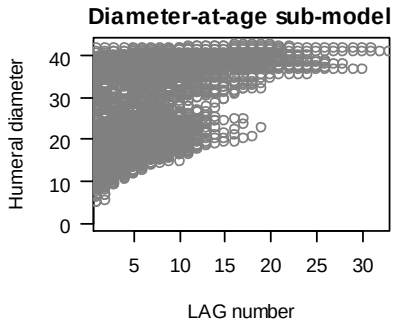

Length
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Ring count

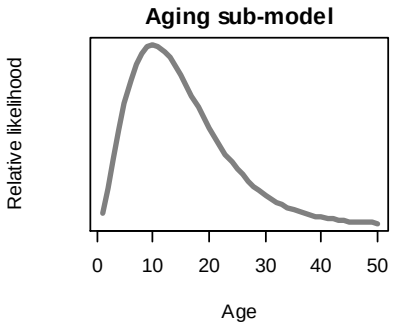

Growth rate
20
15
10
5
0
-5
-10
0
20
40
60
80
Length

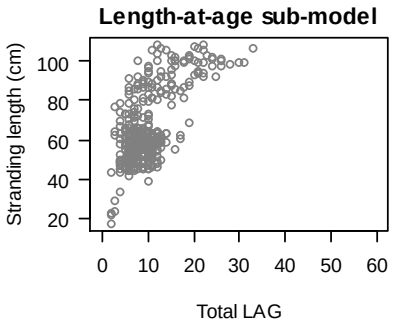

0
+1
-1
-2
-3
-4
-5

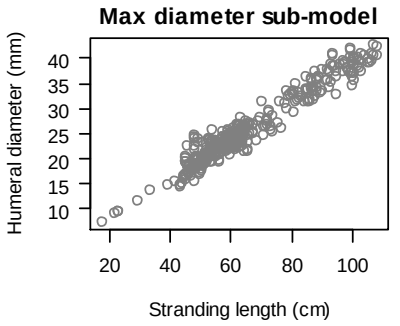



Mark-recapture sub-model
Growth rate (cm/yr)
0
10
20
30
40
50
50
60
70
80
90
100
Length at capture (cm)

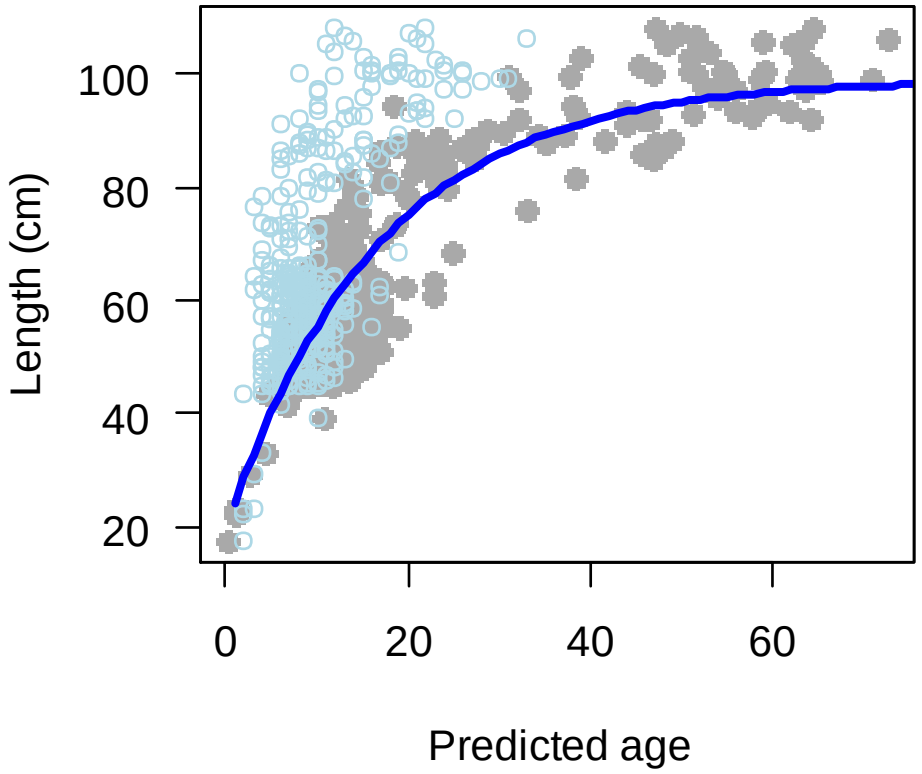

Diameter-at-age sub-model
Humeral diameter
0
10
20
30
40
5
10
15
20
25
30
LAG number

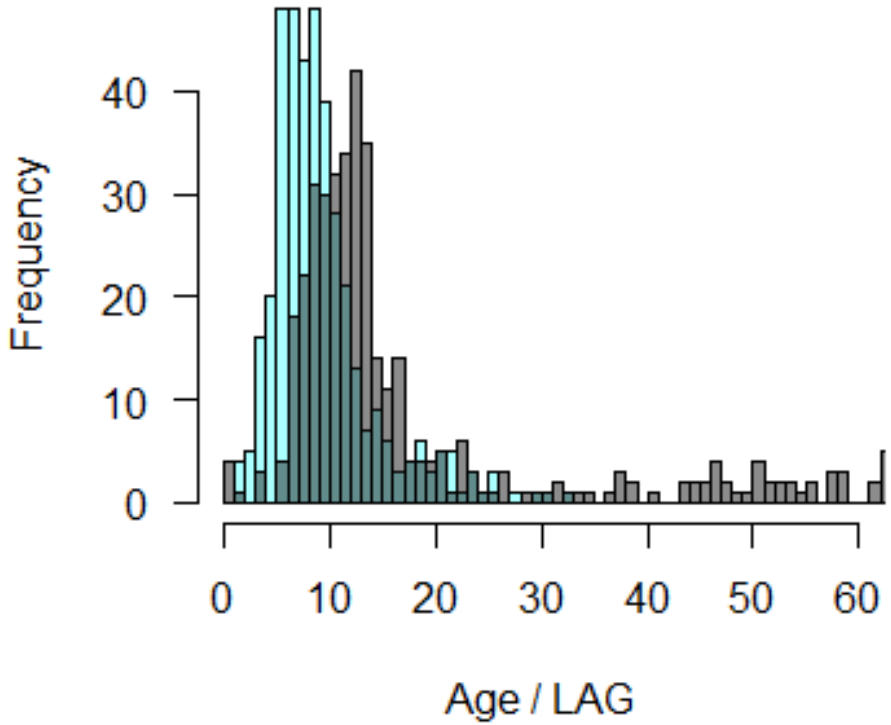

Aging sub-model
Relative likelihood
0
10
20
30
40
50
Age


Length-at-age sub-model
Stranding length (cm)
20
40
60
80
100
0
10
20
30
40
50
60
Total LAG


Max diameter sub-model
Humeral diameter (mm)
10
15
20
25
30
35
40
20
40
60
80
100
Stranding length (cm)

# Estimating The Length-at-Age Relationship And The True Age



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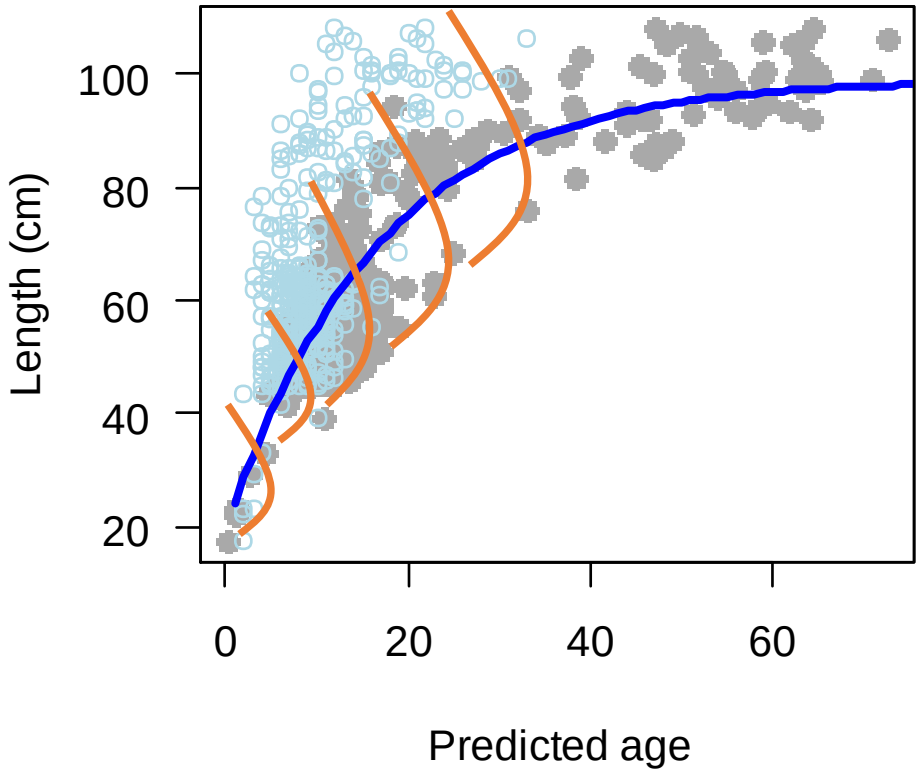
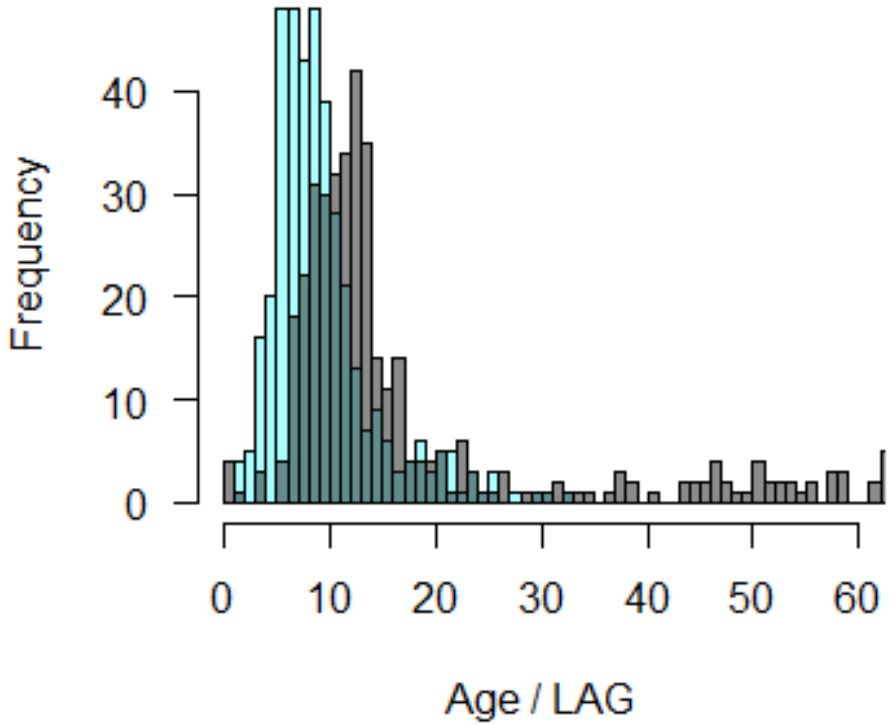
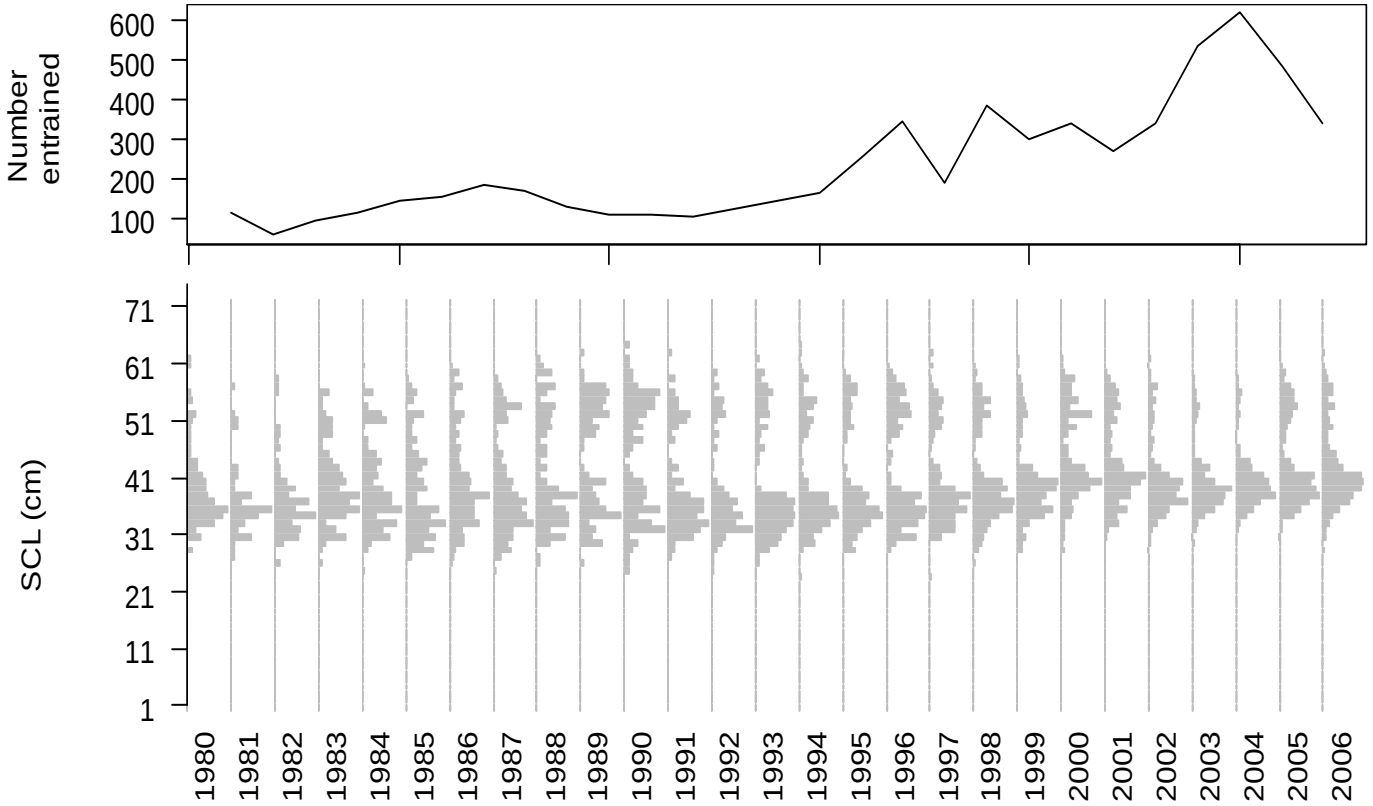


# The Turtle Length Composition Data/Survey

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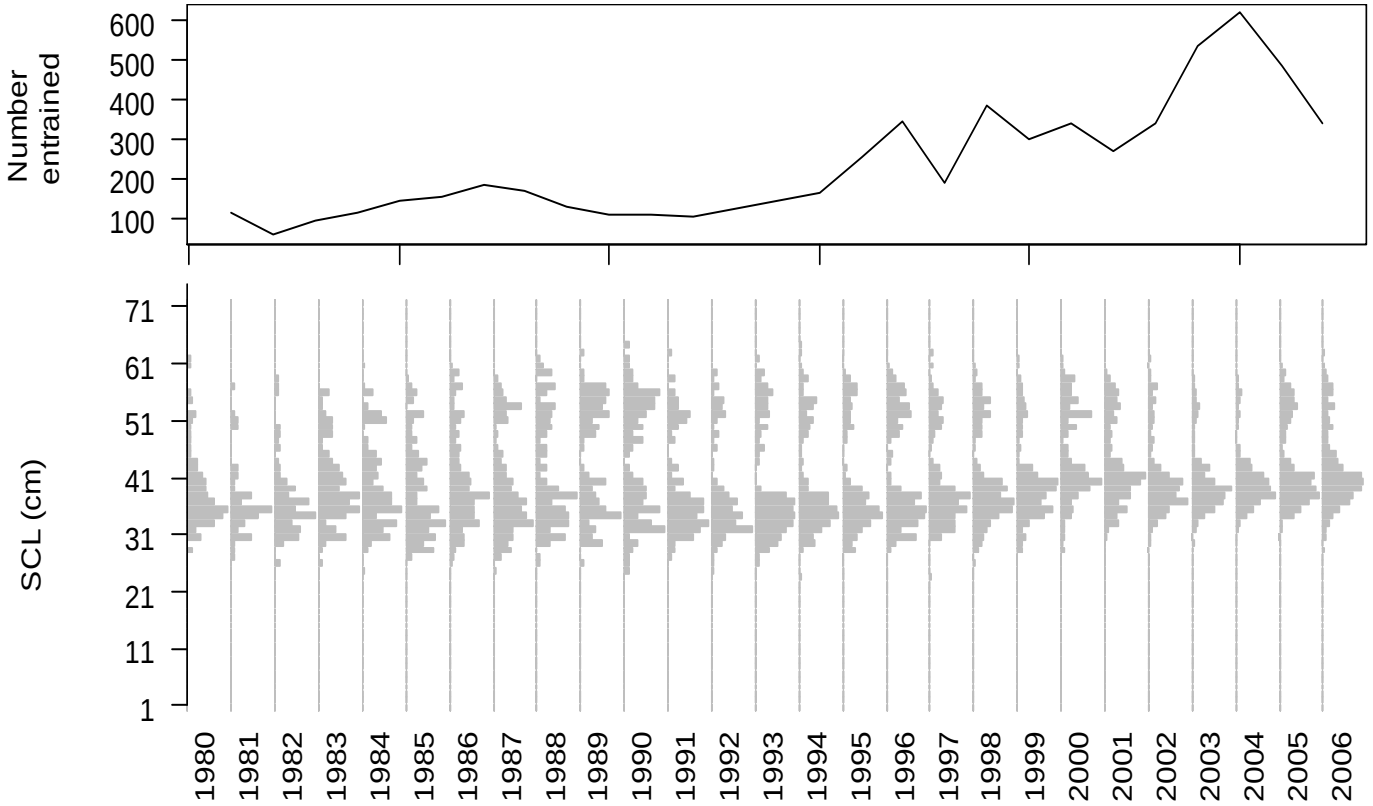


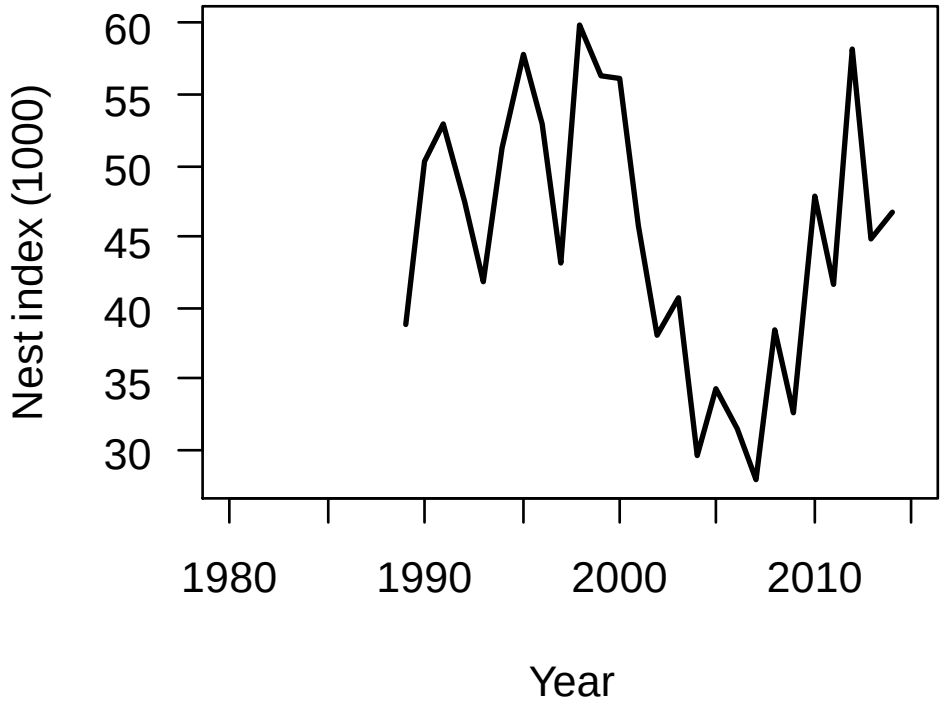

# Conclusions

- Characteristics of wild populations can be difficult to measure

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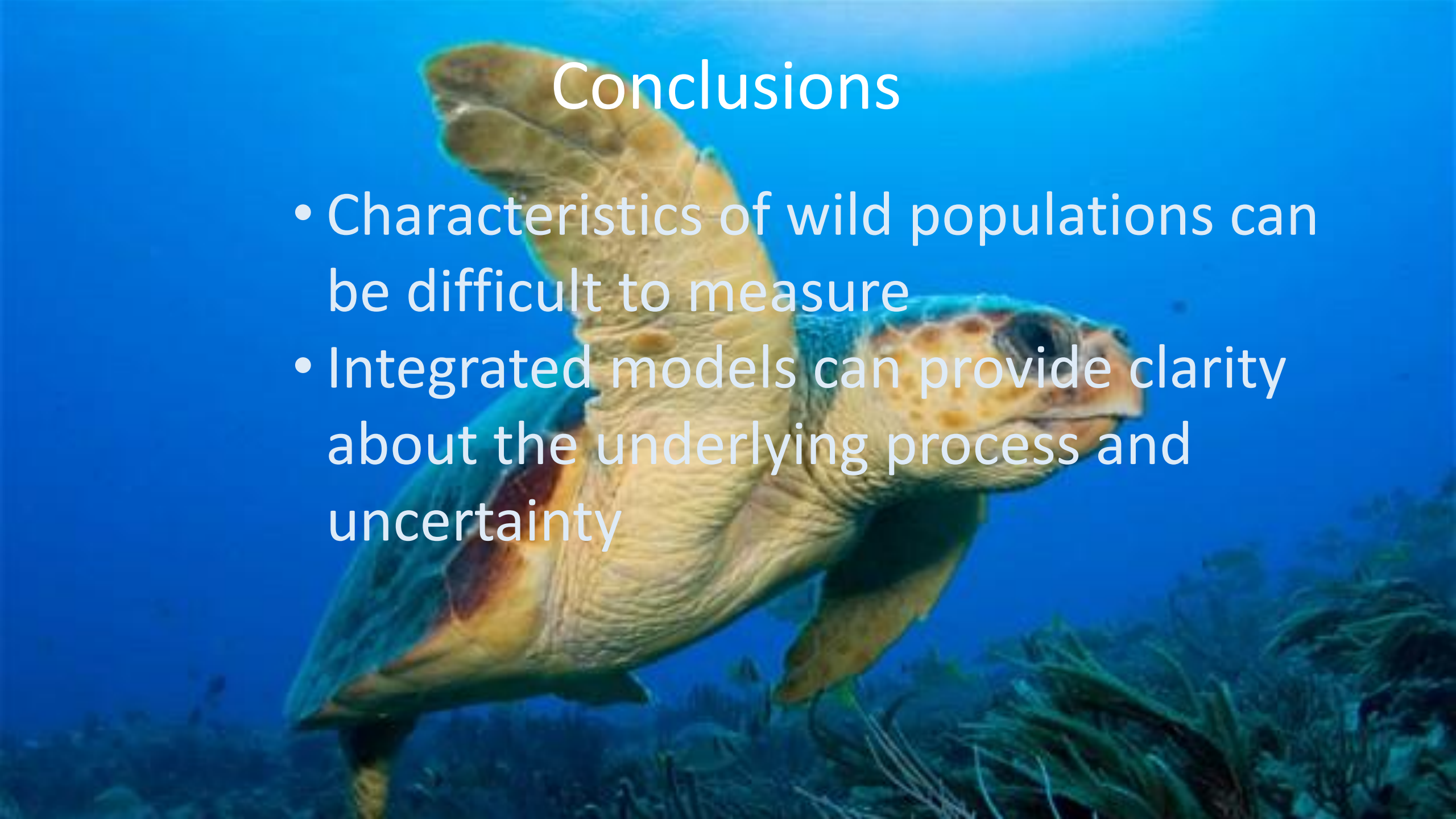
- Integrated models can provide clarity about the underlying process and uncertainty



# Conclusions

- Characteristics of wild populations can be difficult to measure
- Integrated models can provide clarity about the underlying process and uncertainty
- This collaboration can provide additional information to managers and researchers

# Next steps

- Incorporate stable isotope data
- We want to incorporate juvenile length based indices in the tool
  - Fishery dependent
  - Fishery independent

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Questions?