Getting Students To Think Critically Through Undergraduate Research

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GMU Lunch and Learn series

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My approach

- Critical thinking is an important skill for many jobs after college
- Curiosity is a natural trait in all people
  - On average, 2 year olds ask 200 questions a day
  - For some, curiosity gets lost along the way
- Problem solving is a great way to practice critical thinking

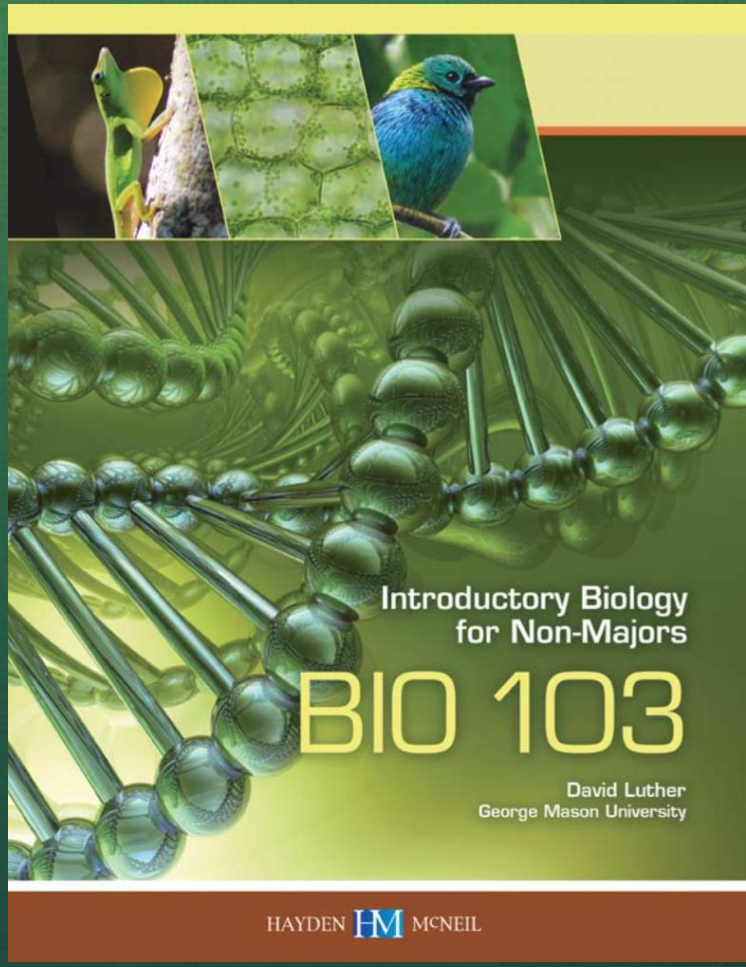
My approach

- Research is a combination of curiosity and problem solving
- I attempt to engage students' curiosity and problem solving skills through research
  - In class
  - Out of class
  - Beyond class

Examples – in class

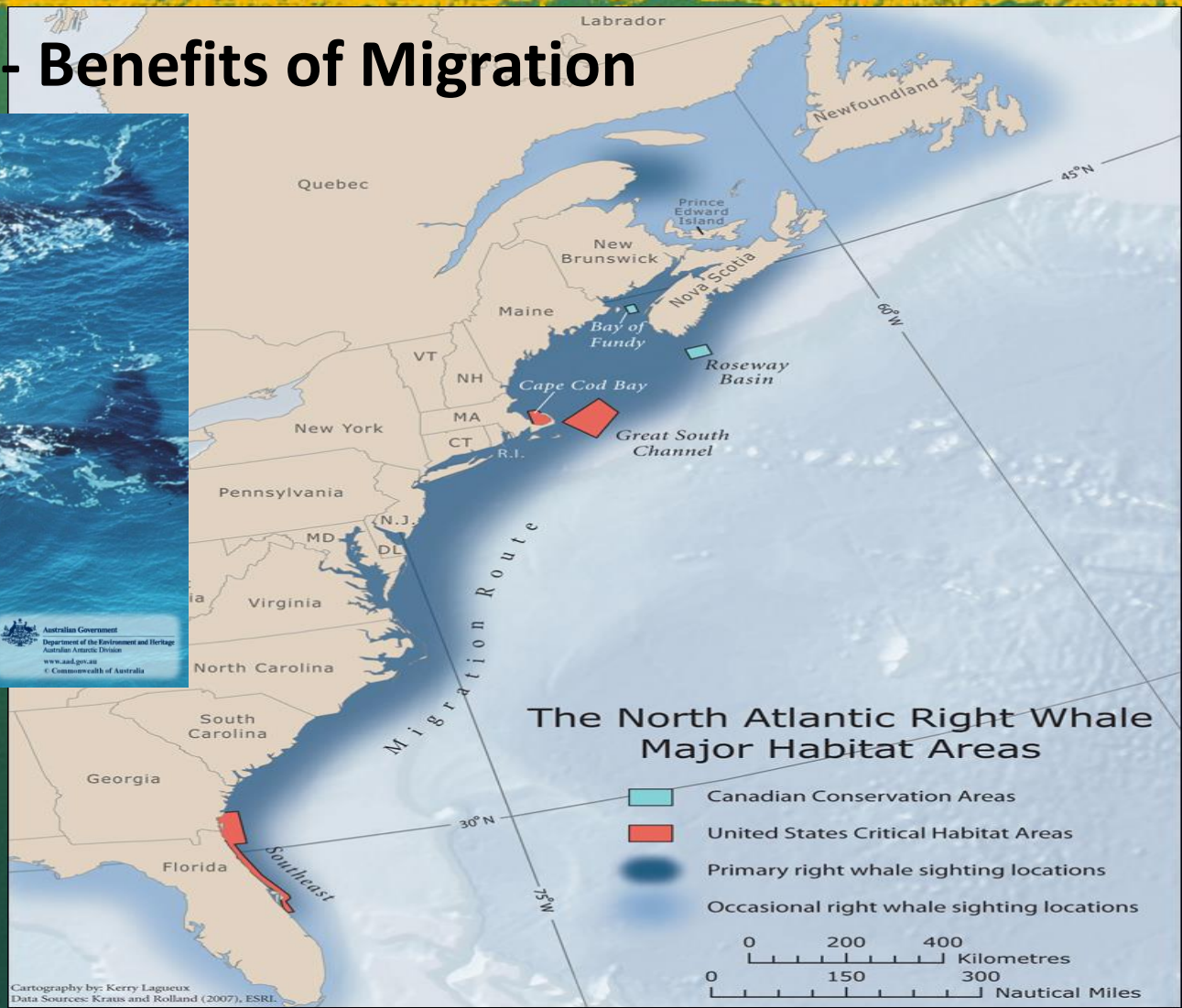
Biology 103 and 104 for non-majors

- All labs inquiry based & students develop research questions, hypotheses, predictions, and graph predicted results
- Then the experiments begin



Examples – in class

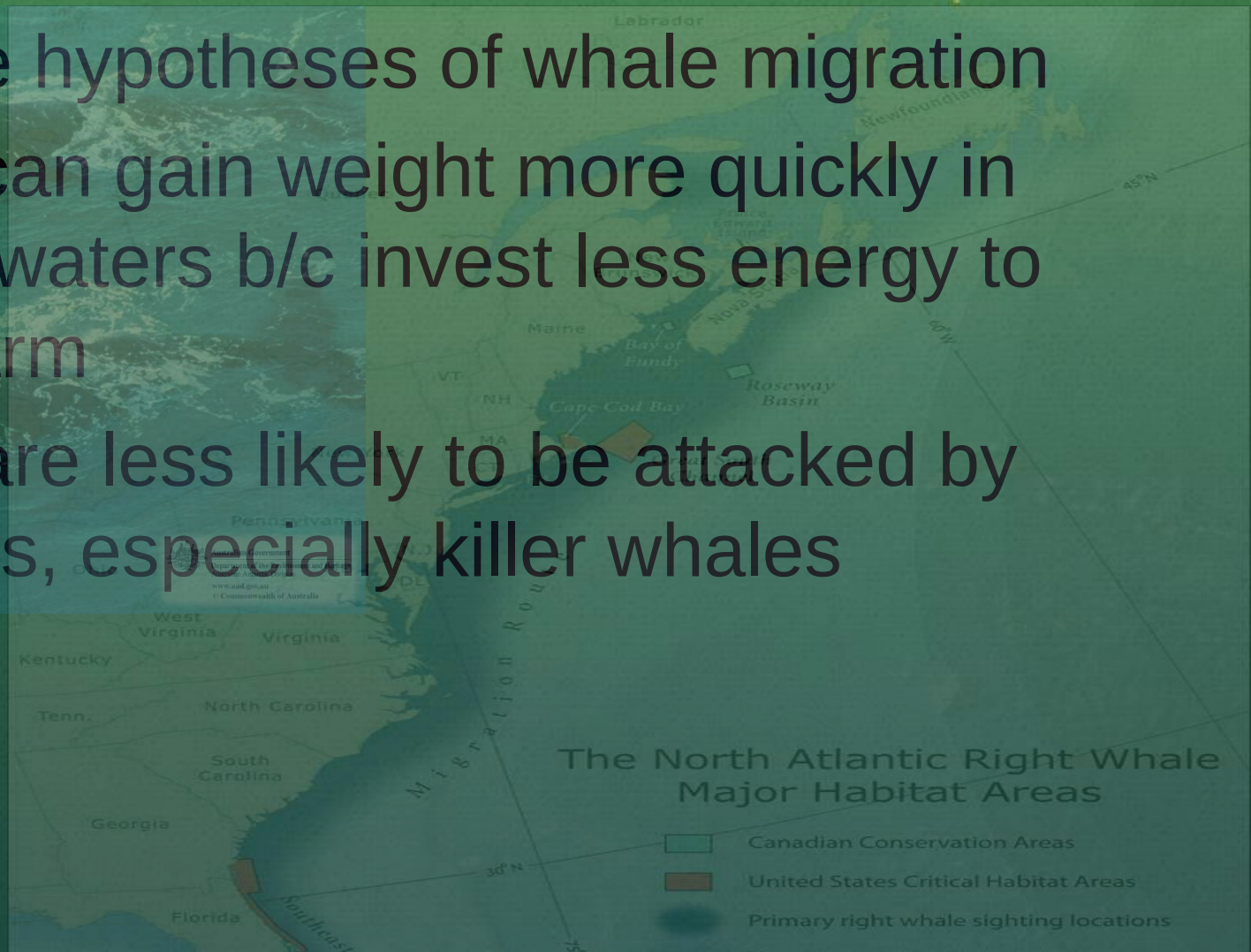
BIO 472 Lecture - Benefits of Migration



Examples – in class

Alternative hypotheses of whale migration

- Calves can gain weight more quickly in warmer waters b/c invest less energy to keep warm
- Calves are less likely to be attacked by predators, especially killer whales



Examples – in class

Alternative hypotheses of whale migration

- Calves can gain weight more quickly in warmer waters b/c invest less energy to keep warm
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How would you test these hypotheses, given the difficulties of directly measuring whale metabolism and observing killer whale attacks on whales in the wild?

Examples – in class

BIO 472 Lecture – Written Assignment

Research Proposal

- Use primary literature to pose and defend an original research question in animal behavior

- Develop a research proposal with methods to study the research question and justification for the study

Examples – in class

Biology 473 Bioacoustics and Animal Communication Lab

SIGNAL

Examples – in class

BIO 473 Bioacoustics and Communication Labs

As part of the designation of a Research and Scholarship course, Students as Scholars oscar.gmu.edu, students engage in scholarly inquiry:

- Research project for 5 weeks of labs
- Read primary literature
- Observe animal behavior and developing hypotheses to explain the behavior
- Collect and analyze data to support the hypotheses
- Present and defend their results to peers and instructors

Examples – out of class

- OSCAR URSP projects
  - 10 students over 3 years
  - Students bring the research questions
  - Variety of topics from influence of finances in endangered species conservation to differences in swimming distances of male and female polar bears
- Internships and Independent Study
  - 11 students over 3 years

Examples – beyond class

- Off campus opportunities
  - Use relationships with local NGOs and government agencies to offer internships
    - Natureserve in Ballston
    - American Bird Conservancy in The Plains
    - Manassas National Historic Battlefield in Manassas
    - Smithsonian Migratory Bird Center in DC

Summary

- Research strengthens critical thinking and ability to apply information to new situations
- Opens new career interests
- Employment opportunities
- Internal curiosity about world
- For me, strengthens my own research skills because to teach it I have to truly know it