A Model for Teaching Scientific Writing in an Undergraduate Curriculum

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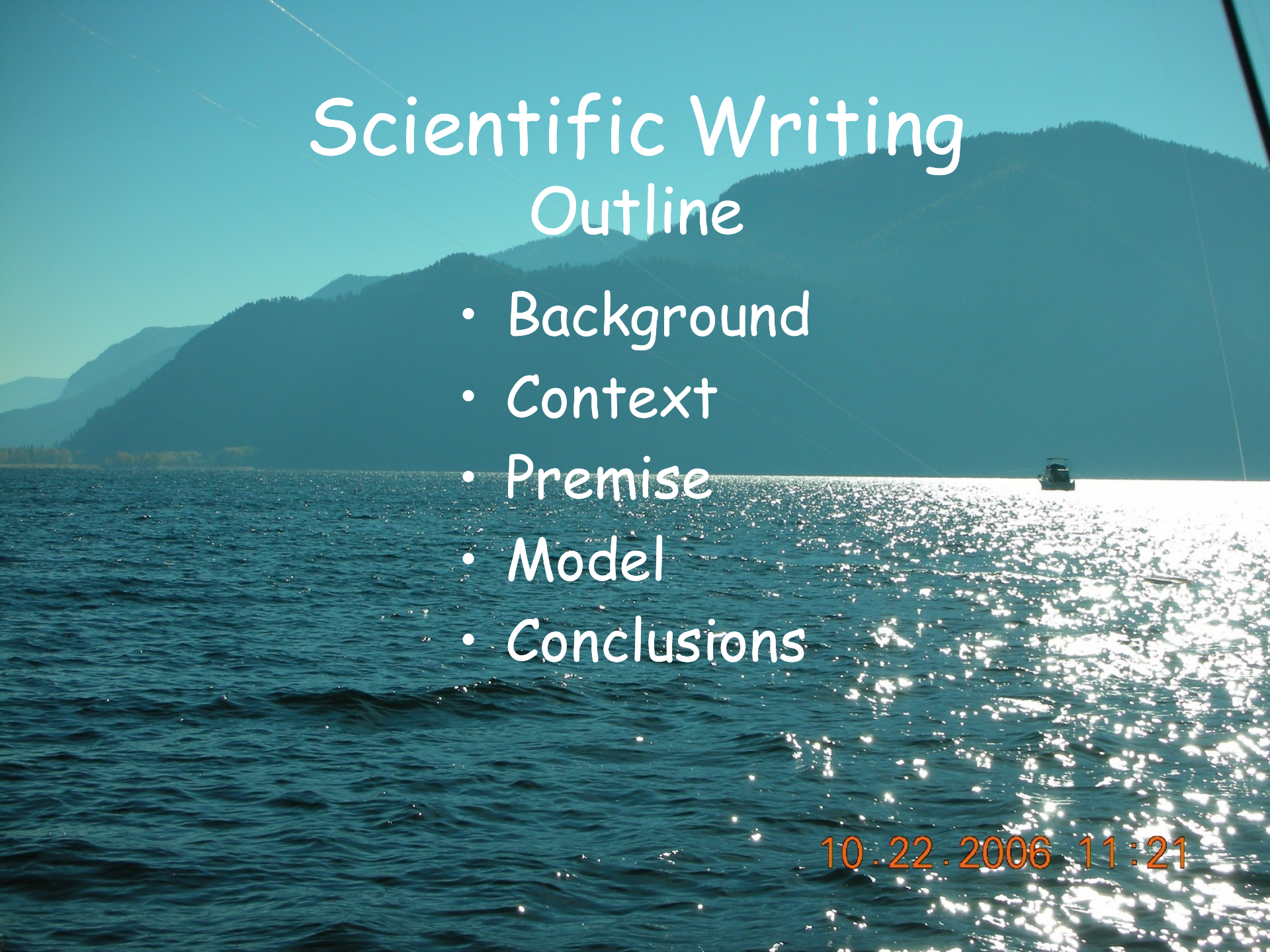


Scientific Writing

Outline

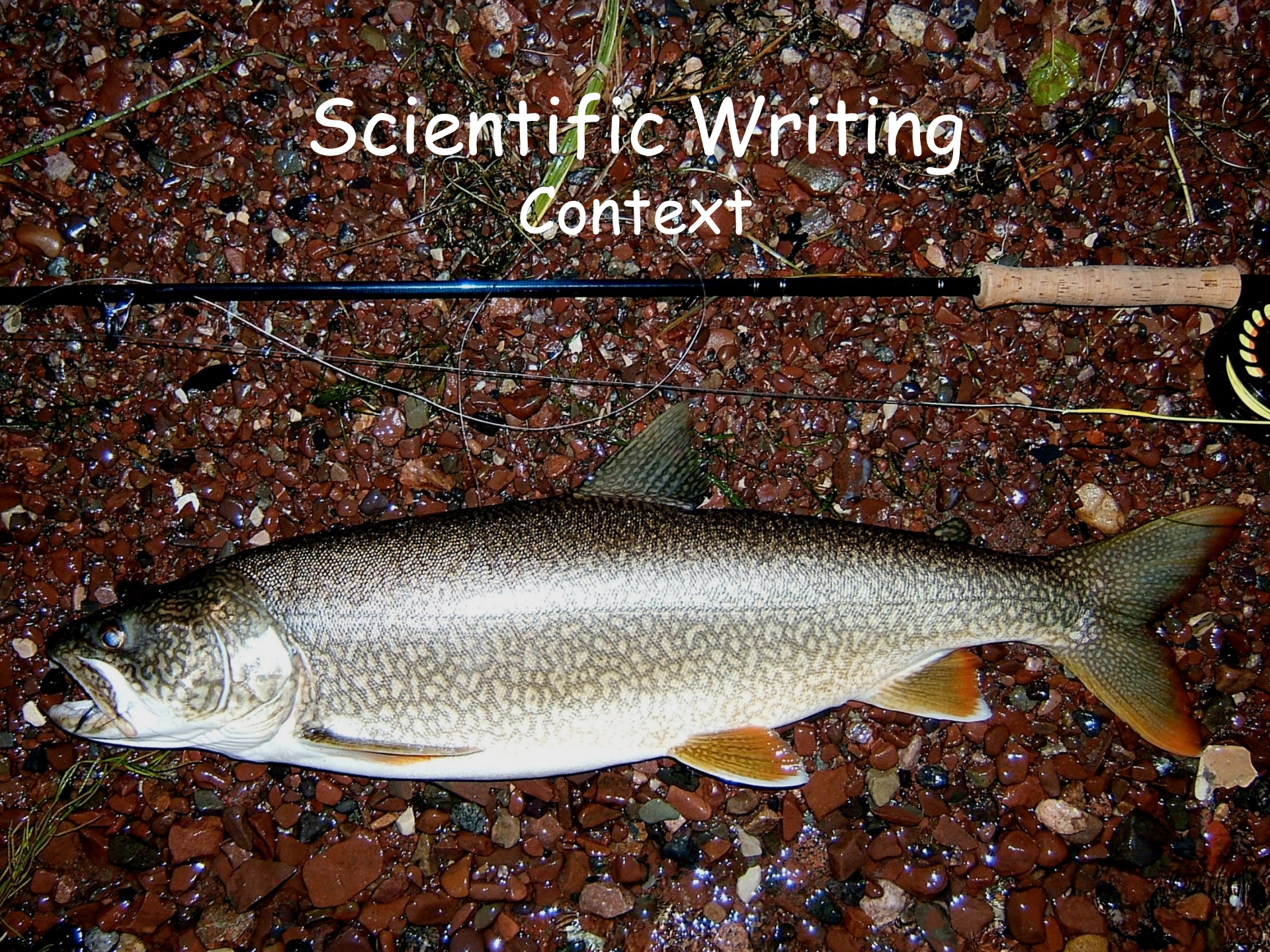
- Background
- Context
- Premise
- Model
- Conclusions

Scientific Writing
Background

- UWSP tries to hire teachers with "real life" agency experience, presumably to give students "real life" classroom experience.
- UWSP hired me *at least partly* for my mix of private sector, state agency, and federal agency experience.
- Therefore, I teach my senior-level courses using "real life" examples (illustrations) and "real life" exercises (no exams).

Scientific Writing

Context



Scientific Writing
Context – Professional

- AFS Certification Program:
  - Communications: 9 semester hours, of which 3 may be communication intensive courses:

    Courses whose primary subject matter is not communications, but which have intensive communications requirements and are officially designated as such by the university.

Scientific Writing
Context – University

- UWSP General Degree Requirement:
  - Verbal Skills: 6 credits (English 101 + 102)
  - Writing Emphasis: 6 credits:

    Courses designed to provide instruction needed to develop skills for appropriate and successful writing within a discipline or profession.

Scientific Writing
Context – Major

- Fisheries Major Degree Requirement:
  - Fisheries Sciences:
    - NRES 250 – Introduction to Fishery, Forestry and Wildlife Resources (4 cr.)
    - BIOL 374 – Ichthyology (4 cr.)
    - BIOL 375 – Fish Ecology (3 cr.)
    - WATR 353-354 – Wildlife & Fish Population Dynamics (4 cr.)
    - ***WATR 483 – Fishery Research (3 cr.) WE***
    - WATR 484 – Fishery Management (3 cr.)

Scientific Writing
Context – Course

- Water 483: Fishery Research; 3 credits = 2 lecture hours + 2 lab hours per week:
  - ***A scientific paper written in the format of the North American Journal of Fisheries Management (40% of total grade);***
  - An oral presentation in the format of a meeting of the American Fisheries Society (30% of total grade); and
  - An oral defense of the research to mimic a thesis defense (10% of total grade).

Scientific Writing
Context – Course Objective

- The course will introduce students to the scientific research process, including:
  - formulating a hypothesis,
  - designing and conducting a study,
  - writing a scientific paper,
  - giving an oral presentation, and
  - providing an oral defense of the project.

Scientific Writing
Context – Course Objective

- The student will become familiar with
  - principles of what makes a hypothesis testable,
  - how to design a study to address the hypothesis,
  - how to organize and write a scientific paper,
  - how to plan, deliver, and defend a scientific presentation.

Scientific Writing

Premise

Scientific Writing
Premise

- Writing is not easy or natural for most of us, so must be learned and then practiced.
- Writing style must conform to a selected audience (all styles are not appropriate).
- Scientific writing is a particular form of writing aimed at a scientific audience.
- Scientific writing must focus on accuracy and precision, so "style" is unimportant.

Scientific Writing

Model

Scientific Writing
Model

- Introductory lectures.
- Laboratory discussion.
- Feedback on writing.

Scientific Writing
Model

- Introductory lectures:
  - The research process (7 steps).
  - Writing a scientific paper (overview).
  - Presenting science to peers (examples).
  - Defending your work (thesis defense).
- Remaining lectures cover topics in *Fisheries Techniques* textbook.

Scientific Writing
Model

- Discussions (1st half of lab periods).
  - Overall concepts of clarity and content.
  - Critique recent publications (examples).
  - Writing is rarely perfect.
  - We all make mistakes that cloud clarity.
- Labs (2nd half of lab periods) cover exercises in fishery data analysis.

Scientific Writing
Example - Clarity

- *Do all parts of the manuscript build consistently from one to another?*

  Word choices ➔

  Sentence structure ➔

  Paragraph organization ➔

  Section organization ➔

  Manuscript order

Scientific Writing
Example – Word Choices

- Accuracy – Use definitive nouns, rather than ambiguous pronouns:
  - Pronouns form very weak openings to sentences.
  - Never begin a sentence or phrase with "it" or "there" (*English 101*).
    - "It" obscures the subject of the sentence.
    - "There" invariably results in an inverted sentence.
  - Avoid jargon (e.g. "aged" and "aging" do not mean what you intend!)

Scientific Writing
Example – Sentence Structure

- Order – Hiding the subject at the end, not the beginning, of the sentence (inverted = *Yoda Speak!*).
  - Bad – There was no significant difference in growth of largemouth bass after imposition of the minimum length limit in West Blue Lake.
  - Good – Growth of largemouth bass did not change significantly after imposition of the minimum length limit in West Blue Lake.

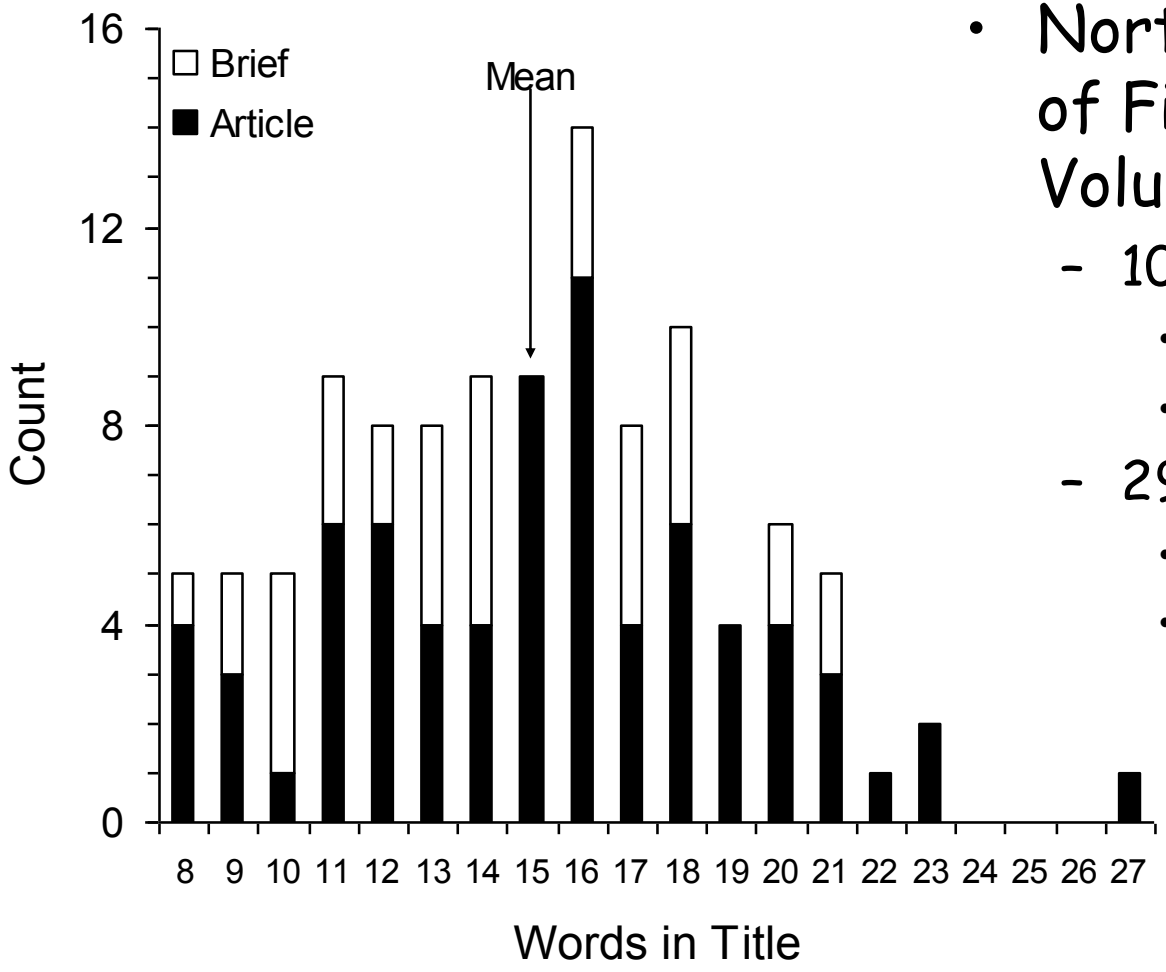
Scientific Writing
Example – Content

- Title
- Abstract
- Introduction
- Methods
- Results
- Discussion
- Tables
- Figures

Scientific Writing
Example – Title

- The title is read by more individuals than any other part of the manuscript, so must be carefully crafted (*short and sweet*).
- Write the title first, and then review each word for precision and accuracy:
  - Does the title accurately reflect the focus and content of the paper?
  - Is the title stated precisely, preferably in 12 words or less?

Scientific Writing
Example – Title



- North American Journal of Fisheries Management, Volume 26 (Issues 1 – 4):
  - 109 Titles
    - 73 Articles
    - 36 Management Briefs
  - 29% of Titles ≤ 12 Words
    - 27% for Articles
    - 33% for Briefs

Scientific Writing
Example – Title

- Longest original title = 27 words:
  - A Bayesian Analysis of Biological Uncertainty for a Whole-Lake Fertilization Experiment for Sockeye Salmon in Chilko Lake, British Columbia, and Implications for the Benefit-Cost Ratio

Scientific Writing
Example – Title

- Longest original title = 27 words:
  - A Bayesian Analysis of Biological Uncertainty for a Whole-Lake Fertilization Experiment for Sockeye Salmon in Chilko Lake, British Columbia, and Implications for the Benefit-Cost Ratio
- Revised title = 12 words:
  - Biological Uncertainty of Fertilization for Sockeye Salmon in Chilko Lake, British Columbia

Scientific Writing
Model

- Feedback on writing:
  - Research project (summer experience).
  - Research objective (face-to-face, email).
  - Manuscript parts (one/week, free pass).
  - Manuscript critique (written, graded).

Scientific Writing

Conclusions

Scientific Writing
Conclusions

- Time-consuming to teach because of time spent critiquing papers.
- Students mostly react favorably to the class (student evaluations).
- Many students later claim this course was their best course in college.


The End!
Questions?
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