

Introduction to the course and Lecture 1: Ecology and Fish Fundamentals

Introduction

- Welcome; distribute syllabus and Fish Facts; take the survey
- Meet your instructor
- Structure of the course: read through syllabus; discuss readings and research paper
- Disclaimer about prerequisite knowledge

Ecology and Fish Fundamentals – laying a foundation for the class

I. Meet the fish

A. What is a fish?

1. Characteristics and exceptions

chordate / vertebrate
aquatic
poikilothermic
gills
fins

2. The basic body plan

overhead

paired fins
unpaired (medial) fins
endoskeleton (bone, cartilage)
internal gills
floatation device (gas bladder, liver oil)

3. Fish versus fishes

overhead

fish \rightarrow 1 sp
fishes \rightarrow \geq spp
"minnow" \neq small fish

B. Evolutionary history of fishes, in brief

1. Beginnings

overhead

first fossils from Ordovician marine deposits, 500 mya
jaws, great diversification of fins, gas bladders, mouth-forms over next 100 mya

2. Endings

Most spp ever evolved now extinct
perhaps bec. s. environ. Δ s, adaptations became maladaptive

3. Surviving lineages

most extant groups arose w/in last 300 Myrs
>100^{spp} Jawless (Class = Agnatha), >500 sharks + rays + chimaeras; >23000 bony fishes (teleosts)

C. Modern fish diversity, and where it occurs

1. Diversity comparisons with other taxa

overhead

\sim 25,000 described spp
incl. smallest ~~vertebrate~~
known vertebrate sp.
45-60% of all vertebrate spp
 \sim 2x as many as bird spp
more functionally diverse than other vert. classes

2. Diversity patterns within the group

overhead

(food, reproduction, behavior)
Within teleost fishes 4 orders (of 38):
cypriniformes siluriformes } 36% spp
characiformes perciformes }

3. Where fish live - biogeographic zones

anywhere there's water...
~3m above sea level - ~7m below sea level
more fishes in shallow than deep
warm > cold

- springs
- streams
- rivers
- ponds/lakes
- estuaries
- oceans

4. The marine/freshwater disparity

more spp in marine environ. but

freshwater: shallow, productive, pop's easily isolated → speciation
41% of fishes live in < 0.01% of world's water

D. The value/importance of fishes

fishing (\$100 B in US)
• food
• recreation

fish as predators (surfers) ecological processes
beauty culture (salmon, eels)

II. Fish ecology as a discipline

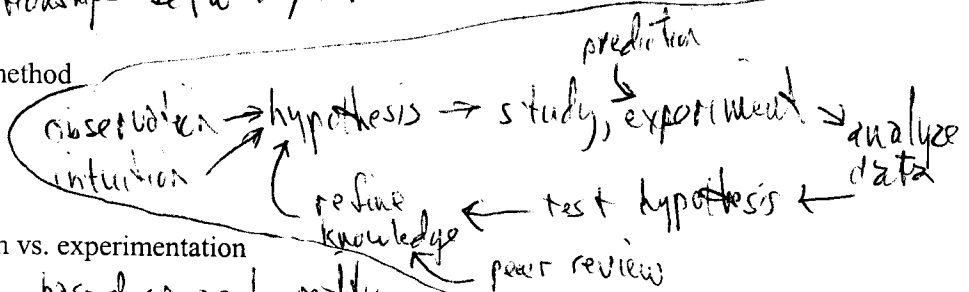
A. Fundamentals of ecology

1. Definition

Oikos (house) logos (study)
scientific study of relationships betw organisms and environ. (biotic/abiotic)

2. Approaches

a. Scientific method



b. Observation vs. experimentation

observation - widely applicable, based on real reality

experimentation - replicability, most vars controlled?

c. Models

overhead

simplified version of how something works; useful for presenting hypotheses, driving factors, knowl. gaps

words
pictures
math. formulae

d. Laws, theories, and hypotheses

Law: invariable phenomenon, given certain cond's (bigger waters have more spp)

Theory: repeatedly confirmed general explanation (coloniz., speciation rates are higher)

Hypoth: working explanation to guide specific study (disrupt coloniz. → ↓ spp in bigger waters)

3. Levels of biological and ecological organization

overhead

course focus: indiv., pop., comm.

4. Emergent properties

whole > sum of parts; tension betw holism & reductionism

No Prediction: growth of cells → growth of individ → growth of pop.

B. Areas of emphasis within fish ecology

1. Molecular ecology

rapid recent growth but little focus in this course

1) DNA, genes

2) molecular signatures (mineral ratios) in skeletons record major habitats occupied

2. Ecotoxicology

huge field but not focus here
biotic responses to toxic substances, conds
mostly focused on organs, individuals

3. Ecology of individuals (includes behavioral ecology)

growth, movement, habitat/food selection

4. Population ecology

changes in abundance, distribution

wide range of spatio-temporal scales (mosquitofish vs Am. eel)

5. Community ecology

spp interactions

spatial-temporal variation in spp composition

6. Ecosystem ecology

typically doesn't focus on organisms but on transport of nutrients, energy
organisms are merely vehicles/agents of transport/deposition

C. Contrasts with other disciplines

1. Ichthyology (zoology, natural history)

description of taxa, evolutionary relationships, taxa
geographic distrib., natural history, morphology

2. Fish biology (nutrition and health, toxicology, physiology)

focus on individual fish

3. Environmental science

focus refers to human impacts on environ (incl. fishes); can use
"fish ecology" ≈ "environ. biol. of fishes"

4. Fisheries management

focus on understanding/controlling
dynamics of harvest (lethal or non-lethal)

fishes as indicators of environmental quality

overlap among all

What is a "fishery"?
human-biota-ecosystem

fish ecology ≠ fishery ecology

course focus