Fisheries Management Techniques
FT 211 Final Review

Age and Growth

Age vs. Growth -know the difference between these
- What are primary functions that regulate fish populations?
- Determinate Growth
  - Mammals, Birds
- Indeterminate Growth
  - Fishes
- 3 Primary Metrics for fish Growth
  - Length
  - Wet Weight
  - Dry Weight
- Great variability in Growth (between species, Populations, Individuals)
  - Environmental factors influencing growth
    - Temperature
    - Food and Nutrient Availability
    - Light Regime
    - Oxygen Concentration
    - Salinity
    - Pollutants
    - Predator Densities
    - Intraspecific Social Interactions
    - Genetics

Estimates of Growth (3 primary ways "in wild populations")
- **Length Frequency Analysis** (know what these look like and in general how to interpret)
  - Catch lots of fish and record lengths in bins
    - Pros: non-destructive, archived lengths
    - Cons: have to catch lots of fish, unknowns are high, easy to bias sample with gear, time, or location
- **Recaptures of individually marked fish**
  - Catch fish, measure, mark, then recapture and record growth
    - Pros: understand the variability in individual growth
    - Cons: tag loss, tagging may influence growth, behavior, or mortality, can't read tag
- Back calculation from calcified structures
  - **Scales** – Most common
    - Know general mounting process
    - Know where scales come from (on the fish and very basically)
    - Fish grow faster in ????

- o **Otoliths** (what is this?)
    - What are these?
    - Where are they located (roughly)
    - Know the general process to age (Whole otolith, clean and dry, Measured, Weighed, Broken, Burned, Oiled, Specimen ready)
    - We can also use otoliths for
        - Species identification
        - Paleoclimate studies (O18)
        - Life history studies (elemental tracers)
- o **Cleithra** – Esocidae
- o **Opercula**
- o **Vertebrae** – Sharks (no spines, teeny otoliths)
- o **Fin Rays** – anything where scales don't work and you don't want to kill the fish
- o What about other species? Clams, Octopus, crabs…

Marking and Tagging

Marks vs. Tags

Marks - anything used for recognition

Tags - contain specific id information

Marking and tagging allow us to:

- Label animal for special handling
    - o Hatchery / wild
- Movement and migration studies
- Population statistics
    - o Growth
    - o Exploitation and Natural Mortality

Know the assumptions associated with marked or tagged fish

Tag Retention – Depends on:

- Type of tag (design, size, shape)
- Color - Red, Orange, or Yellow are best colors
- Attachment location
- Species being tagged
- Individual doing the tagging

External Tags or Marks (Know what these look like)

- Body Tissue
    - o Fin Clips, Dorsal, Anal, Caudal, Adipose, Pectoral, Pelvic
    - o Fin Punch – Simple hole puncher
    - o Operculum Punch
- Dart and T-Bar Anchor (Floy) Tags
    - o Anchor - Plastic or wire arrow (dart) or t-shaped (internal)
    - o Shaft - vinyl tube with unique information (external)
    - o T-Bar (Floy)
        - T-bar inserted with special "gun" (clothing in a retail store)

- Anchor loaded into hollow metal tube
- Know the general tagging procedure
  - Internal Anchor Tag (Like dart or T-Bar, but anchored internally)
    - Into body cavity (usually abdomen)
    - Advantage
      - High retention rate
    - Disadvantages
      - Abrasions internally and externally
      - Difficult to tag
      - Requires experience
      - Time consuming
  - Transbody Tags
    - Peterson Disc Tag
      - 2 round plastic tags
      - Either side of body
      - Wire through tag, muscle and second tag and back again
      - Know the general tagging procedure
    - Spaghetti Tag
      - Loop of thin vinyl tubing
      - Cannula through dorsal muscle
      - Pass tube through cannula, remove cannula
  - Jaw Tags
    - Highly visible
    - Can limit Growth
    - Can interfere with feeding
  - Branding Scar on Fish
    - Hot, Cold, Chemical
  - Pigment Marks
    - Applied by: Immersion, Spraying, Injection, Tattooing
    - Types of mark: Dyes. Stains, Inks, Paints, Microscopic plastic chips

Internal Tags or Marks (know what these look like)
  - Advantages
    - Does not require mutilation
    - Does not protrude from body
    - Very high retention
  - Disadvantage
    - Not visible
  - Tags should be:
    - Made of bio-compatible material
    - Placed in non-obtrusive locations
    - Small in relation to host 2% body weight
  - **Visible implant tags (VIP)** "Next to eye of fish"
    - On un-pigmented tissue

- o Alphanumerically coded
- **Coded wire tags (CWT)**
  - o Most popular in the world
  - o Magnetized stainless steel "spool" then cut by machine
  - o Fin clip to identify presence of tag!!
- **Passive integrated transponder tags (PIT)**
  - o Electronic identification system
  - o Computer chip and antenna in glass tube
  - o Injected into animal (reader reads tag number)
  - o Expensive
- **Acoustic Tags**
  - o Acoustic signal emitted from tag
  - o Hydrophone listens for tag presence
  - o Better in deeper water (saltwater) where radio tags are not applicable
- **Radio Tags (VHF)**
  - o Radio or VHF signal emitted from tag
  - o Radio receiver listens for tag presence
  - o Better in shallow water (10m of depth) (great for rivers)
- **Scale and Otolith marks**
  - o Advantages
    - ▪ Naturally produced
    - ▪ No stress
    - ▪ Less handling and injury
    - ▪ Nearly all fish carry mark
  - o Disadvantage
    - ▪ Scales and otoliths have to be removed
  - o Thermal Marking (most common)
    - ▪ Warming or cooling environment fish is in (typically in hatcheries)
  - o Chemical marking
    - ▪ Not as common
- **Other Species Marking** (have some ideas of how to do this)

Visual Observation of Fishes and Aquatic Habitat
Sometimes the best way to figure out what is happening is to take a look

Direct Observation (know what these techniques look like "weirs vs tagging vs snorkel etc")
- Best when other methods not effective
- Only effective in clear water
- Limited to visibility eg, cannot tell weights

Collects information on_____ that might otherwise be attainable using standard techniques
- Composition
- Distribution

- Abundance
- Behavior

Above Water
- Stream Surveys
  - Stream Walking
  - Estimate # of fish in the stream
- Aerial Surveys
  - Fly around and count fish
  - Estimate large groups of fish
  - What are the biases?
  - What are the benefits?
  - What are the disadvantages? **(THE BBD's)**
- Counting Towers
  - Fish Viewed and counted by observers in towers
  - Unobstructed View
  - What are the BBD's?
- Weirs
  - Fixed vs. Floating
  - Force fish to swim in one area
    - Count fish as they pass
    - Block at night
  - What are the BBD's?

Below Water
- Snorkel
  - Simple and requires little equipment
  - Good for looking at??? Spawning locations, behavior etc…
  - In deep water move upstream in shallow - downstream
- SCUBA Dive Surveys
  - More specialized equipment required
  - Remain submerged for longer periods of time
  - Protocol similar to snorkeling
  - Noisier than snorkeling and may frighten fish
  - Know some safety concerns (contaminants, marine life, cold water etc)
- Remotely Operated Vehicle (ROV) / Submersible
  - Tethered underwater robot
  - Cameras & Lights
  - Pilots Drive ROV's

Factors Affecting Direct Observations
- Depth – restricts snorkelers & Divers
- Temperature – limits dive or snorkel time
- Cover – can make it hard to see / identify fish

Types of Direct Observation Surveys
- Direct Enumeration

- o   Count all of the organisms you see
- o   Can increase precision with multiple passes
- – Mark -Recapture Estimates
  - o   Marked with visible tags
  - o   Recaptured
  - o   Use marked and unmarked to get population estimates
- – Line Transect Estimates (Swath Transects)
  - o   Divers travel along well defined line
  - o   Divers identify fish on either side of lines (out to specific distance)
- – Habitat Use Estimates
  - o   Unbiased information on habitat use
  - o   Can be used to study life stages
  - o   Develop estimates of fish habitats

The final will be comprehensive with 1/4 material from exam 1, 1/4 Exam 2, and 1/2 New Material (Last three lectures).

Multiple choice, matching, fill in the blank, and short answer.

Good luck and study hard