Fisheries Management Techniques FT 211

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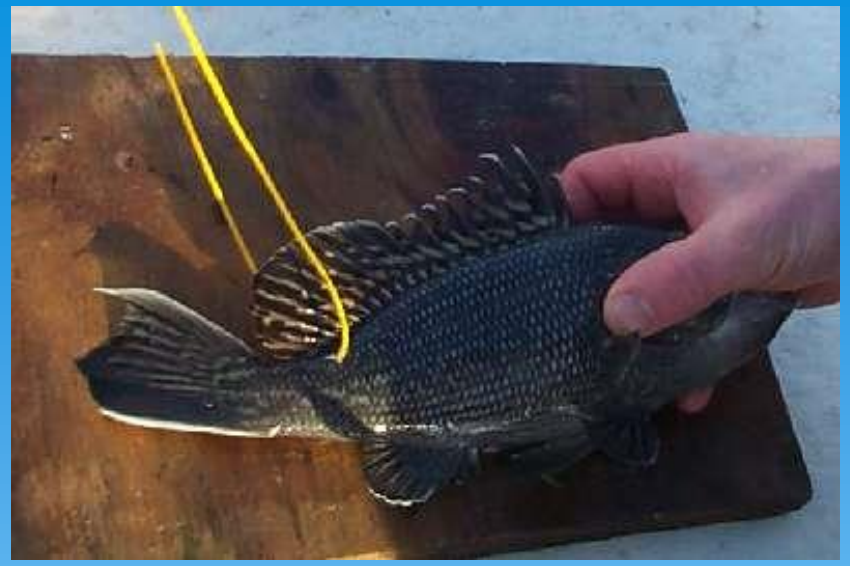
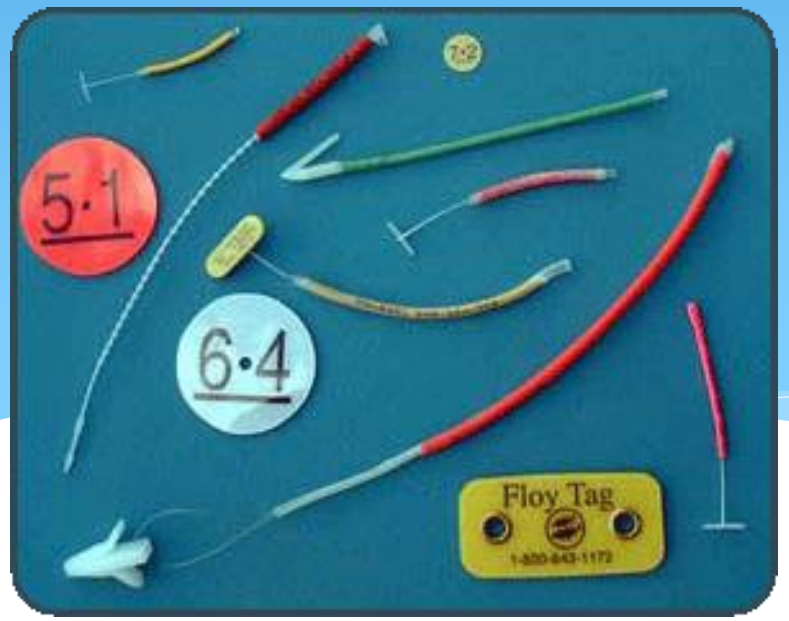
Fisheries Technology



Chapter 12

Tagging and Marking



Outline

This Module will Contain 6 Main areas:

Marks and Tags

External Marks & Tags

Internal Marks & Tags

Chemical & Elemental Marks

Marking & Tagging other fisheries species

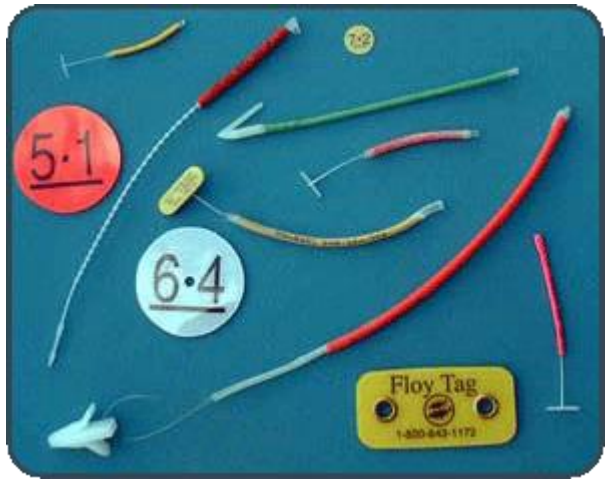
Mark Recapture

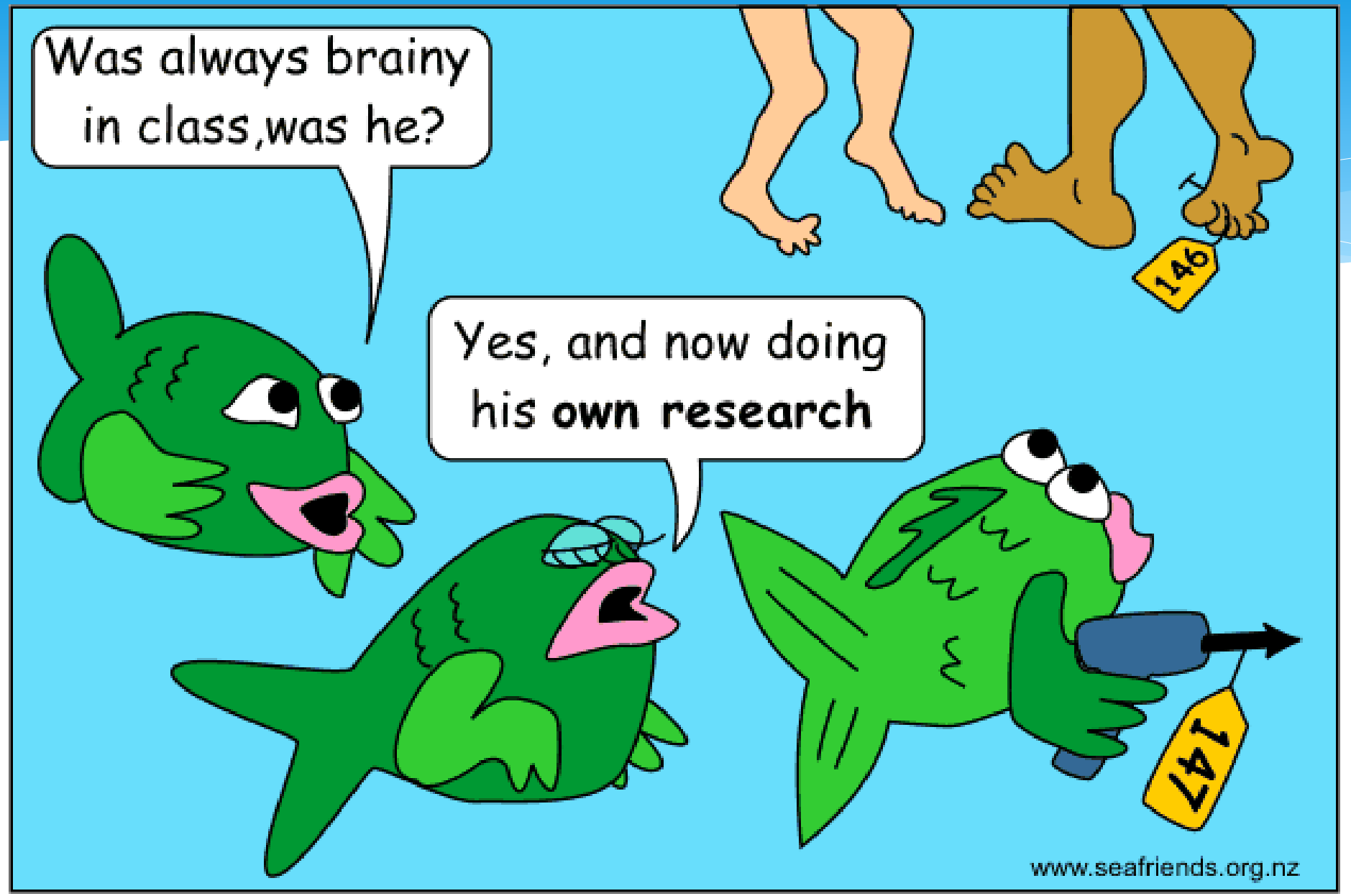
Student Learning Outcomes

Students will be able to:

- Describe marking and tagging and differentiate between them and the types of information that can be obtained from each
- Summarize external marking and tagging techniques
- Summarize internal marking and tagging techniques
- Describe Chemical & Elemental Marks and how they are used in fisheries
- Compare other species tagging and marking and associated challenges
- Explain mark/recapture and how it is used in fisheries

Marking and Tagging




Was always brainy in class,was he?
Yes, and now doing his **own research**
146
147
www.seafriends.org.nz

Introduction

- **Marks** = anything used for general recognition
  - Part of body tissue
  - External
  - Internal
- **Tags** = contain specific id information
  - External attachment
  - Internal attachment

Information obtained from mark/tag studies

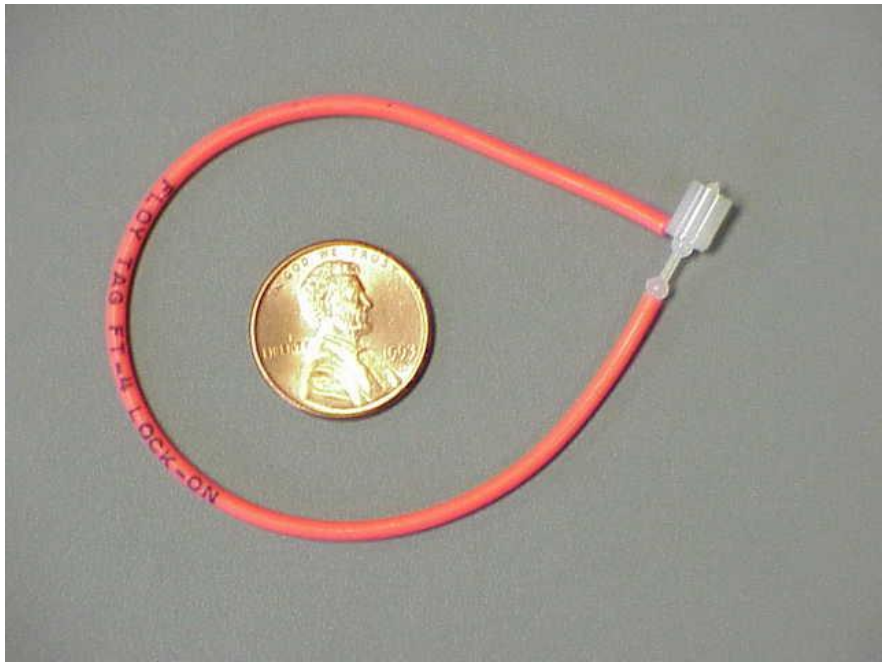
- Label animal for special handling
  - Hatchery / wild
  - Reward
- Movement and migration studies
- Population statistics
  - Growth
  - Exploitation
  - Natural Mortality

Assumptions

- A tagged or marked fish looks like a tagged fish!
- Tagged fish keep tags!
- Tagged fish are recognized and reported!

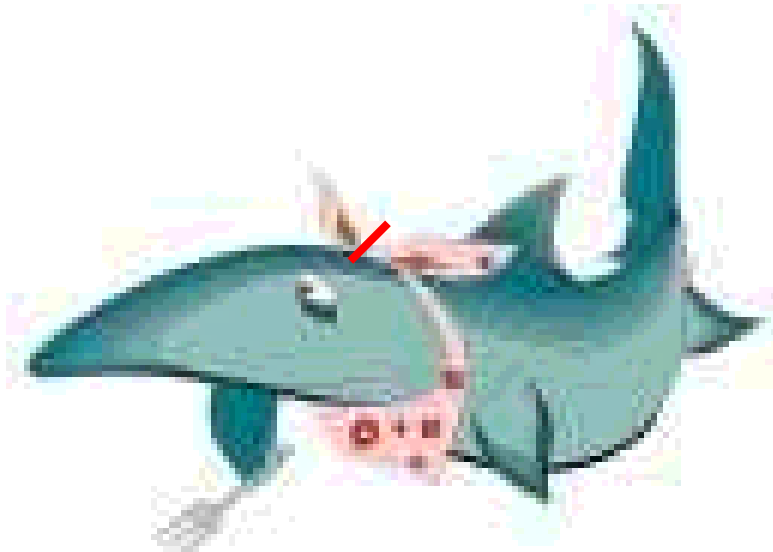
Tag Retention

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



Other Assumptions

- Mortality rates of marked = unmarked fish
  - Handling leads to post-tagging mortality
- Tagging doesn't reduce growth
  - Interfere with consumption
  - Interfere with swimming
  - Increase chances of predation
- Tagging doesn't alter behavior



Self Check

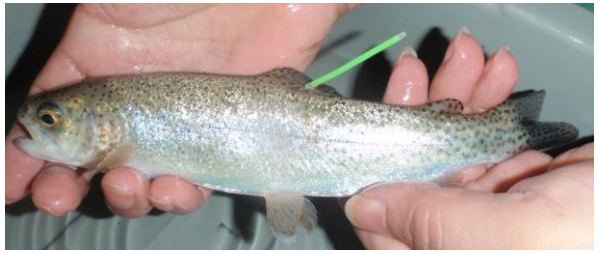
- A tag is anything used for general recognition of a fish or group of fish
  - True
  - False

- There are numerous assumptions that need to be met when marking and tagging fish and include all of the following EXCEPT
  - Mortality rates of marked = unmarked fish
  - Tags are all uniform size
  - Tagging doesn't reduce growth
  - Tagging doesn't alter behavior

External Tags and Marks

Externally visible or extrude from the fish

- Body Tissue
- Anchor tags
- Transbody Tags
- Jaw Tags
- Branding
- Pigment
- Dye
- Tatoo



External Tags and Marks

Fin Clips

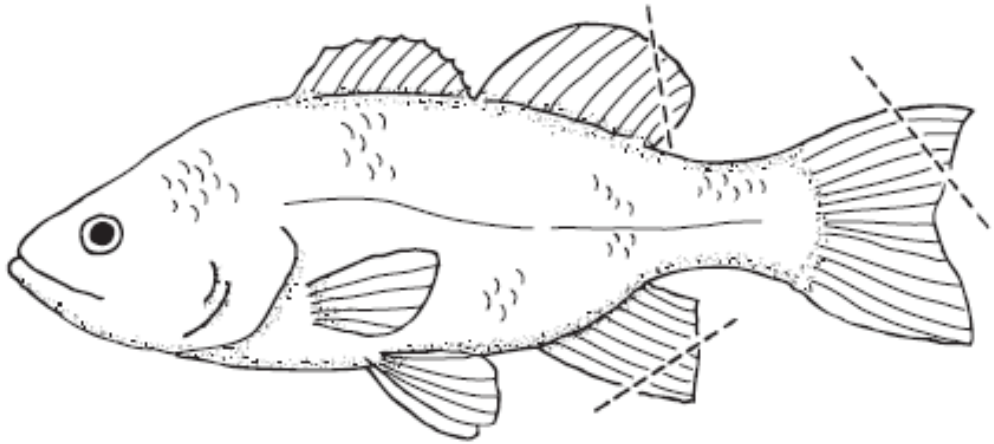
- soft dorsal, anal, caudal fin
- Fin clips on pectoral or pelvic fins
  - Still recognizable after regeneration
- Hole-punched or notched in fin

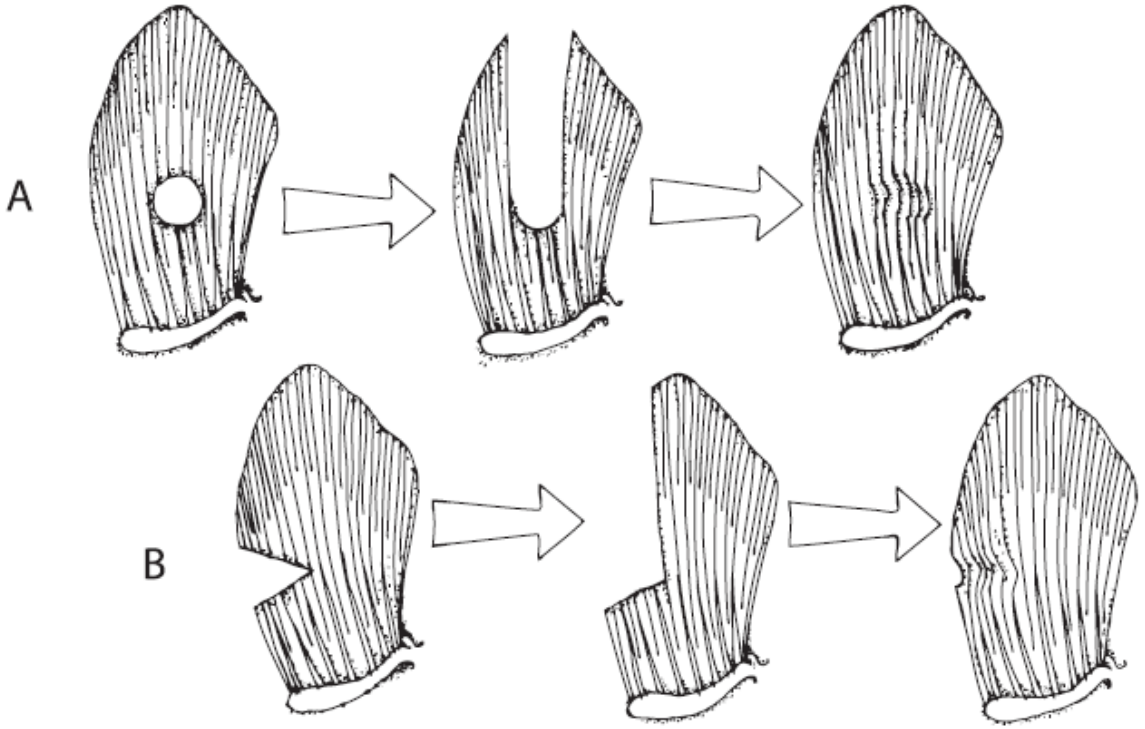
Operculum Punch

- Hole-punched in operculum

Fin Clips

- Scissors work best
- Hole punch



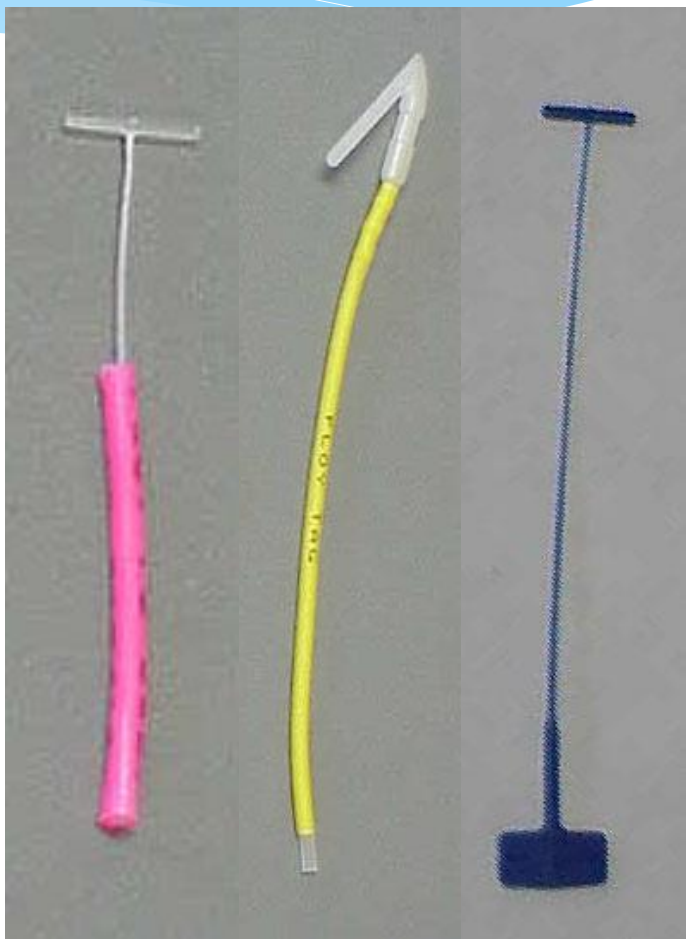


Operculum Punch

- Use a standard hole punch
- Punch hole in one operculum
- Typically done on spawning salmon

Dart and T-Bar Anchor Tags

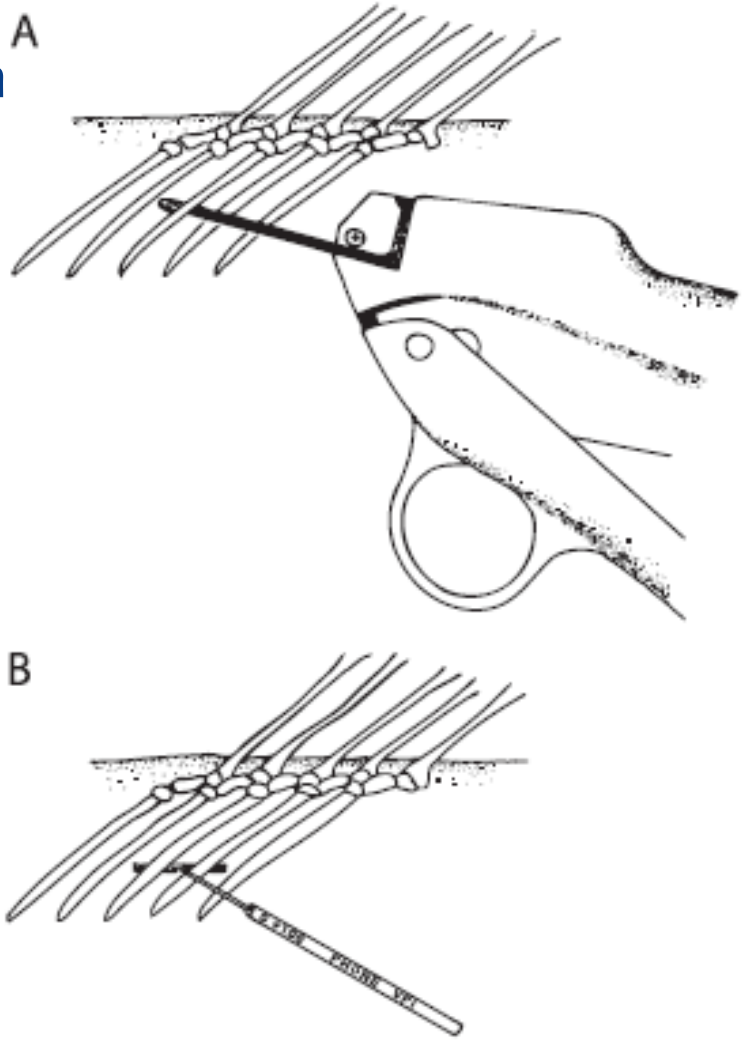
- Anchor - Plastic or wire arrow (dart) or t-shaped (internal)
- Shaft - vinyl tube with unique information (external)
- **Most popular!**
- **Floy Tag**



T- Bar (Floy)

Anchor tag between bones that support the dorsal fin

- Pterygiophores



Dart and T-Bar Anchor Tags (cont.)

- T-bar inserted with special "gun" (clothing in a retail store)
- Anchor loaded into hollow metal tube

ADFG Southeast Rockfish Tagging

- A total of 4,590 black rockfish were tagged and released with dart tags from 1996–2002. The majority of these fish were released around the north side of Kruzof Island. A total of 47 fish were recovered with an average distance of 4 km between release and recovery locations. Fish were recovered at distances of less than 1 km to 15 km from their release locations
  - Exactly 1% recapture rate

Dart and T-Bar Anchor Tags (cont.)

- Tug tag to ensure retention
- Don't re-tag fish, poor survival
- Hold sample for estimate of tagging mortality
- Double tag a fraction to examine tag loss rate

- **Tagging Videos**
- http://www.youtube.com/watch?v=1vyLrsXcgrM

Tagging Location

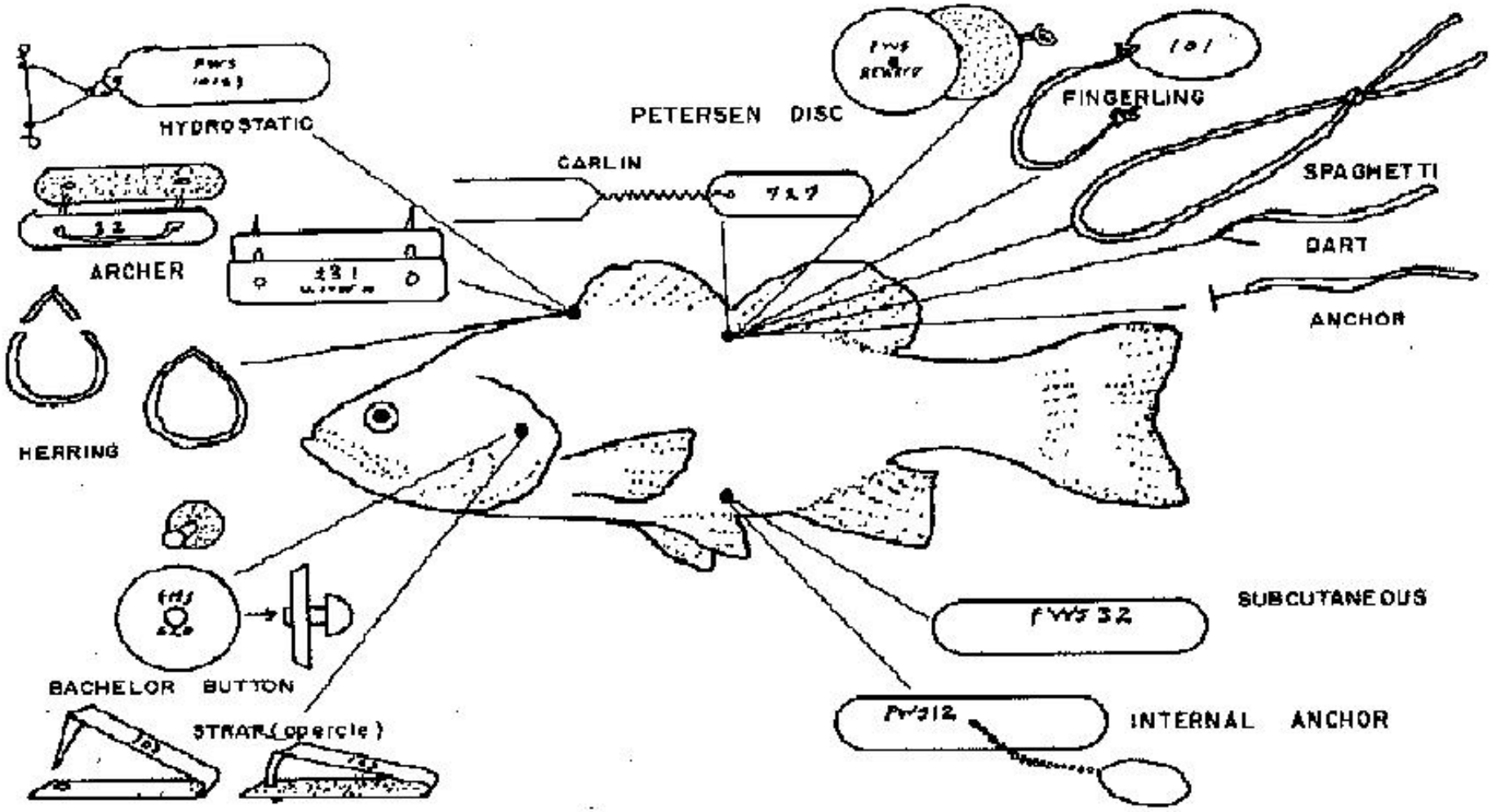
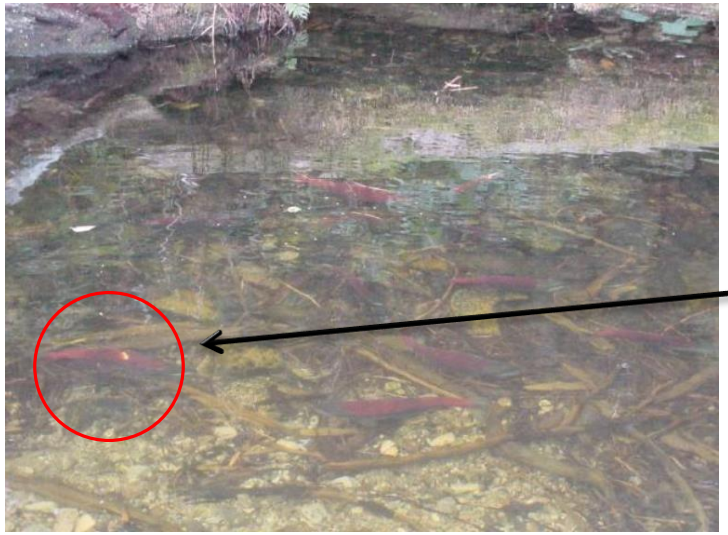


FIGURE 3.—Principal types of external tags and anatomical sites for attachment on fish.

Transbody Tags
- Peterson Disc Tag

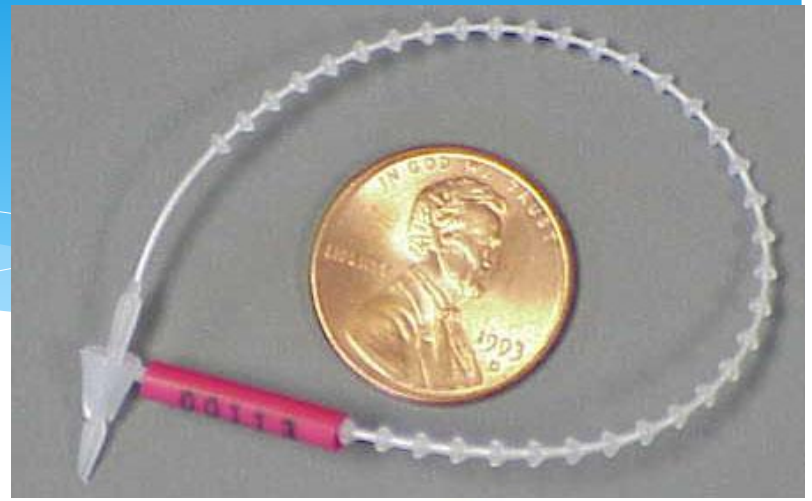
- 2 round plastic tags
- either side of body
- wire through tag, muscle and second tag and back again
- minimizes growth between tags



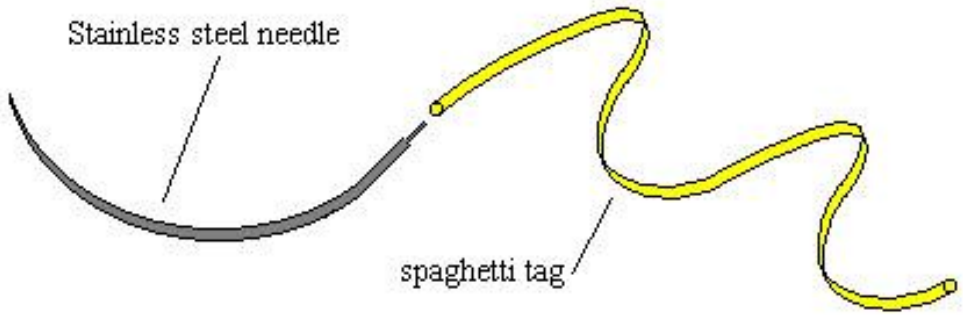
Transbody Tags
- Carlin Tag (a dangler tag)

- Cannula is hollow hypodermic needle
- Cannula inserted through dorsal musculature
- U-shaped wire fed through the cannula
- Cannula removed, wire pulled tight, crimped
- Info on plate attached to side of fish

Transbody Tags - Spaghetti Tag



- Loop of thin vinyl tubing
- Cannula through dorsal muscle
- Pass tube through cannula, remove cannula
- Tube tied in a knot trailing behind fish



- Entanglement Issues
  - Tuna

Jaw Tags

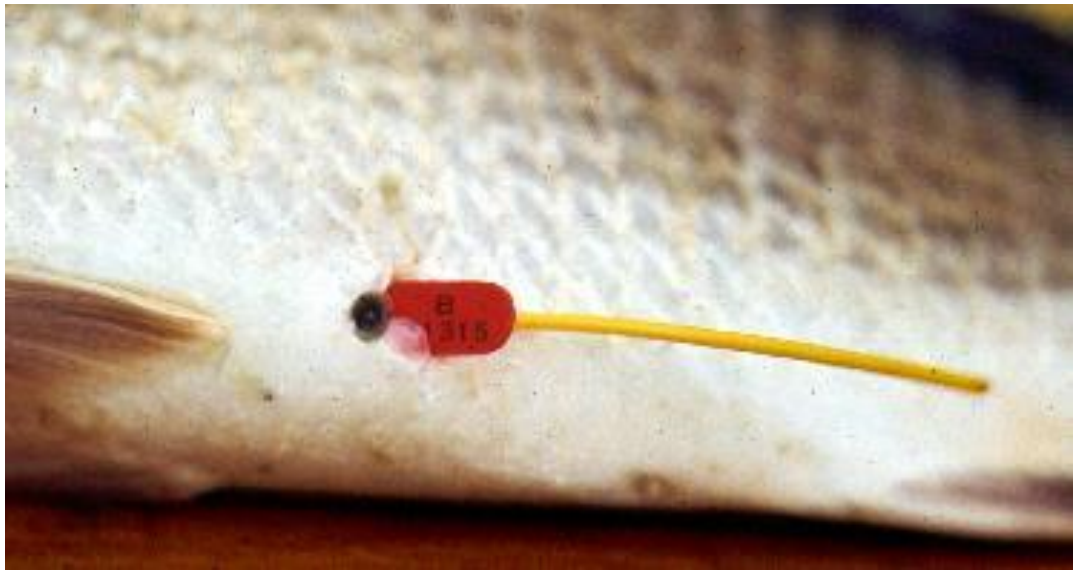
- Highly visible
  - Especially to anglers
- Can limit Growth
- Can interfere with feeding

Internal anchor tag

- Prototype for all anchor tags
- Into body cavity (abdomen)
  - Small incision
  - Insert tag

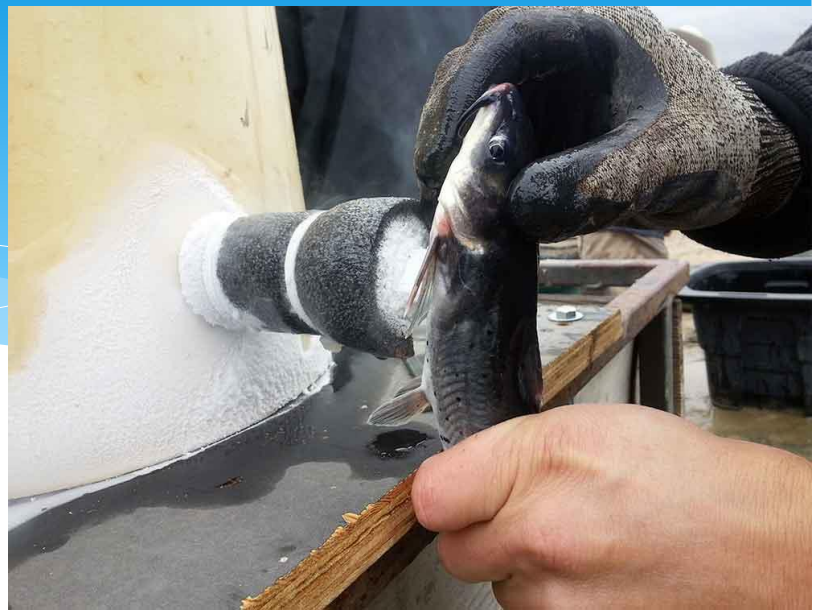
Internal Anchor Tag

- Advantage
  - High retention rate
- Disadvantages
  - Abrasions internally and externally
  - Difficult to tag
  - Requires experience
  - Time consuming



Branding

- Scar on fish
- Hot and cold
- Chemical



Cold branding (Preferred)

Technique

- Liquid nitrogen
- Pressurized carbon dioxide

Pros

- Inexpensive
- Quick

Cons

- Can be hard to read
- Limited patterns/Brands

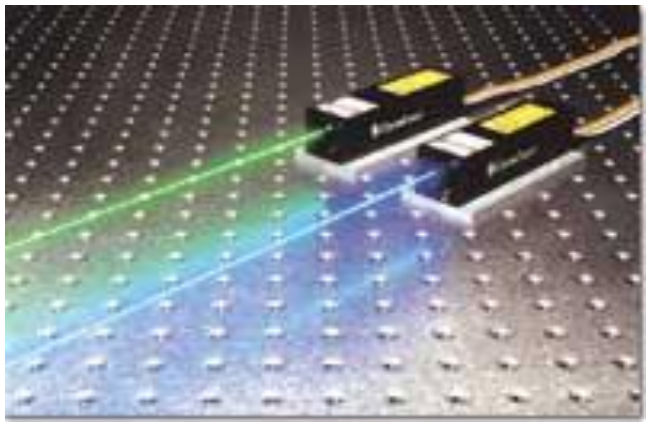
Hot branding

Technique

- Soldering iron
- Lasers

Works best on

- Scale less or small scaled fish



Branding

- Advantages -
  - Quick
  - Body surface not penetrated
  - Mortality low
  - On any size fish
- Disadvantage
  - Short term mark

Pigment marks

- Dyes
- Stains
- Inks
- Paints
- Microscopic plastic chips

Applied by

- Immersion
- Spraying
- Injection
- Tattooing

Dye Submersion

- Nile blue sulphate, Alizarin, Methylen blue, Trypan blue, Gentiana violet, Janus green, Litium-carmin, Neutral red and **Bismarck brown**

Pros

- Lots of fish at once
- Small and large

Cons

- Only groups not individuals

Tattoo (photonic marking)

Pros

- Cheap & Fast
- Easy to apply
- Little affect on Growth or behavior
- Many Sizes

Cons

- Hard to see
- Limited marks avail
- Only so many colors

Self Check

- The tag depicted in the above image represents what kind of tag
  - Jaw tag
  - **T-bar anchor tag**
  - Spaghetti tag
  - Carlin tag
  - Peterson tag
- Jaw tags can limit growth and interfear with feeding
  - **True**
  - False

Internal Tags and Marks

Within or beneath epidermis of animal

- VIP
- CWT
- PIT
- Acoustic
- Radio

Marking Natural tissues

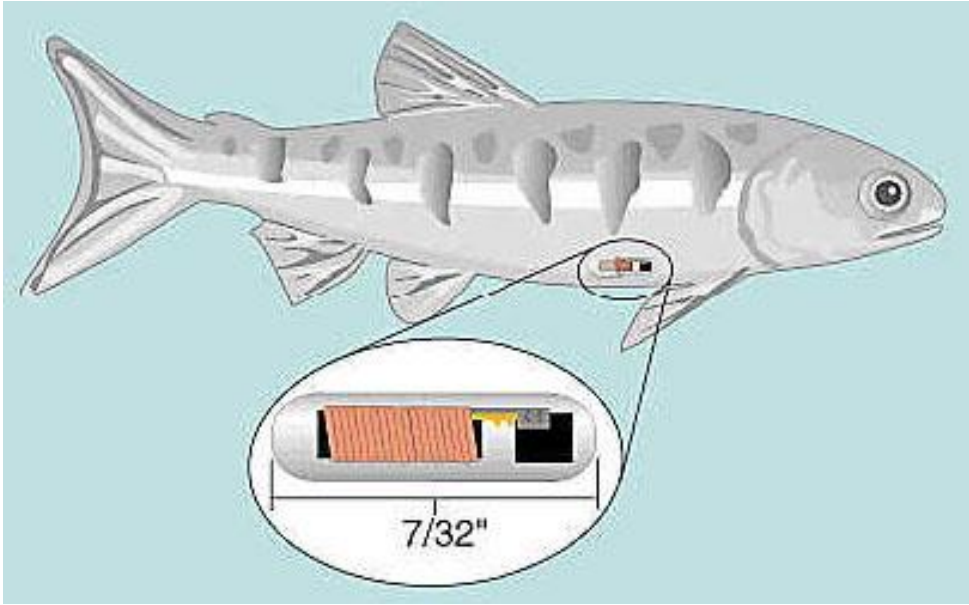
- Otoliths
- Bones
- Scales

Internal Tags and Marks

- 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



Types of internal tags

- Visible implant tags (VIP)
  - Alphanumerically coded
  - Polyester and diazo film
  - On un-pigmented tissue

Types of internal tags (cont.)

- Coded wire tags (CWT)
  - Most popular in the world
  - Magnetized stainless steel
  - Used widely in salmonids

CWT Tagging

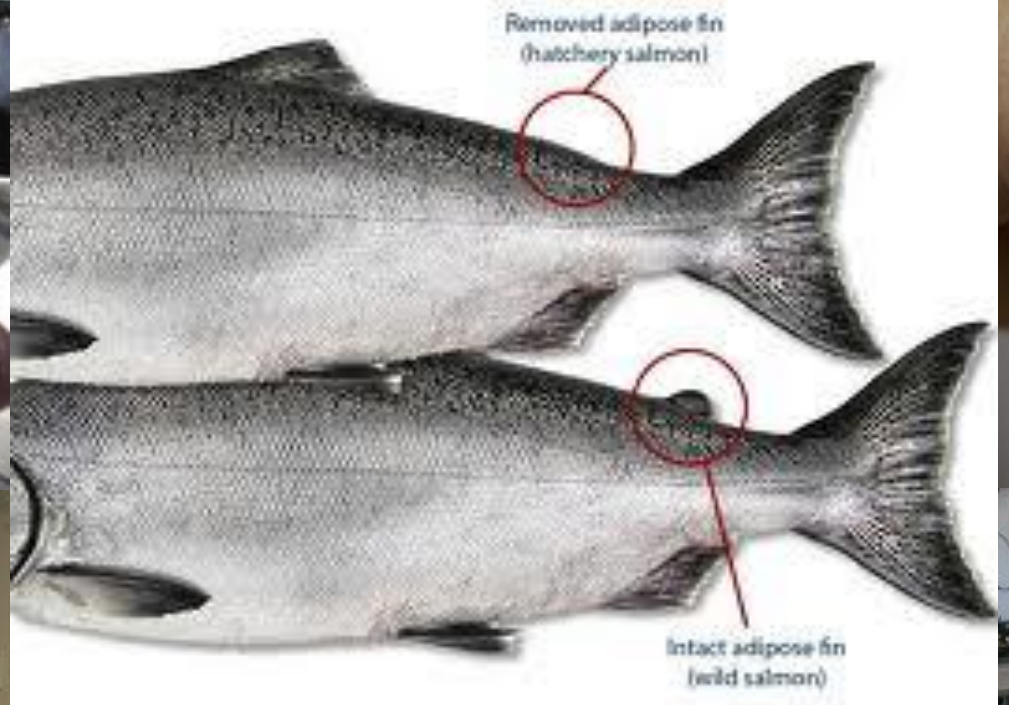
* Anesthetize
* Measure & Weigh
* Pull Scales
* Clip Add
* CWT
* Read
* Recovery
* Release
* Tag Retention / Trap Efi


ESC

CWT

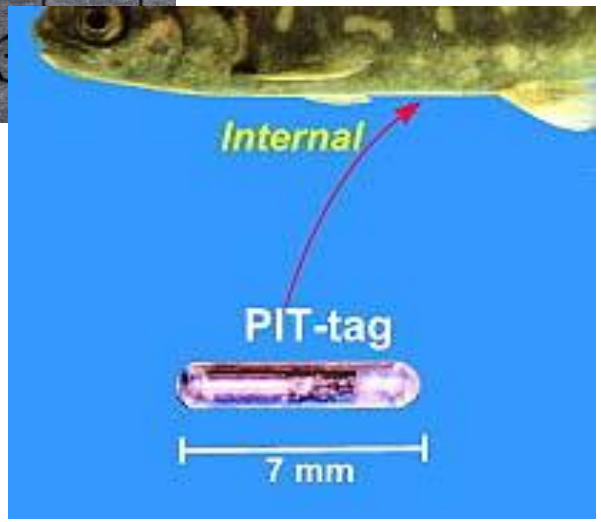
- Expensive
- Labor Intensive
- Mark
  - Only identifies group

Fin Clipping!



Types of internal tags (cont.)

- Passive integrated transponder tags (PIT)
  - Electronic identification system
  - Computer chip and antenna in glass tube
  - Injected into animal
  - Expensive



PIT Tagging

Acoustic Tags

Advantages:

- Individual can be detected repeatedly without handling
- Preferred in saltwater and estuarine environments where radio telemetry is not applicable

Disadvantages:

- The receiver (hydrophone) must be in water for detection
- Noise may reduce signal strength

Radio Tags (VHF)

Advantages:

- The fish only needs to be handled once for tag attachment

Disadvantages:

- Radio tags are typically only detected within the **first 10m** of the surface
- Signal transmission is reduced in salt water and at depth

Self Check

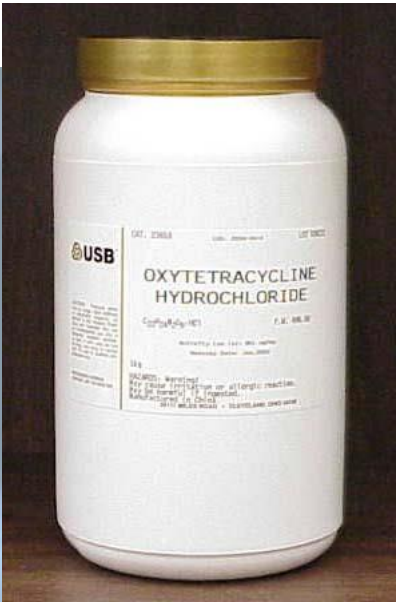
- The tag depicted in the above image represents what kind of tag
  - PIT
  - **VIP**
  - ESP
  - Acoustic
  - Sonar

- It is important to size the head mold to the fish when inserting Coded Wire Tags CWT
  - **True**
  - False

Chemical Marks

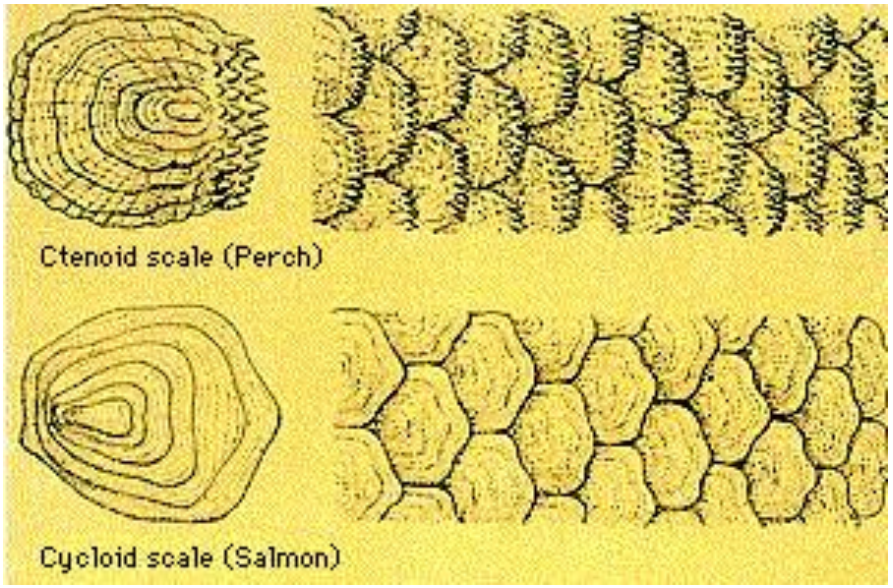
Induced by

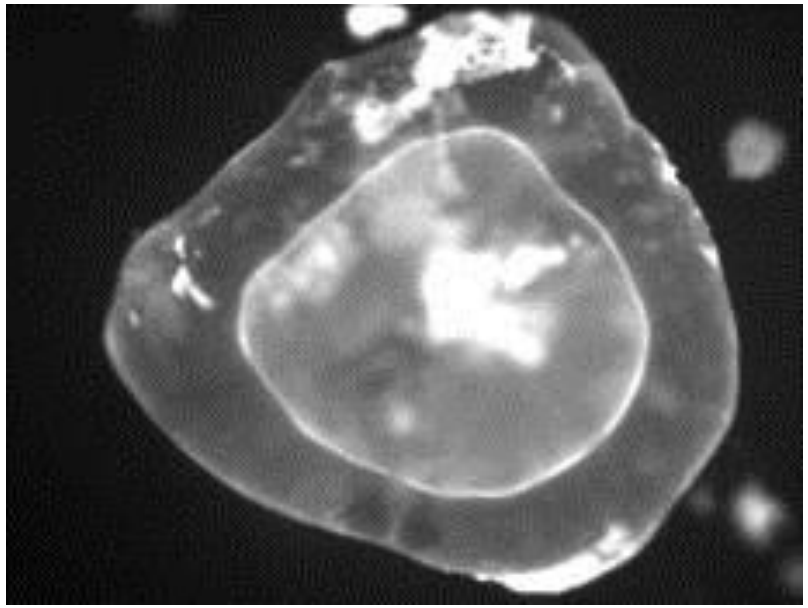
- Immersion
- Injection
- Ingestion



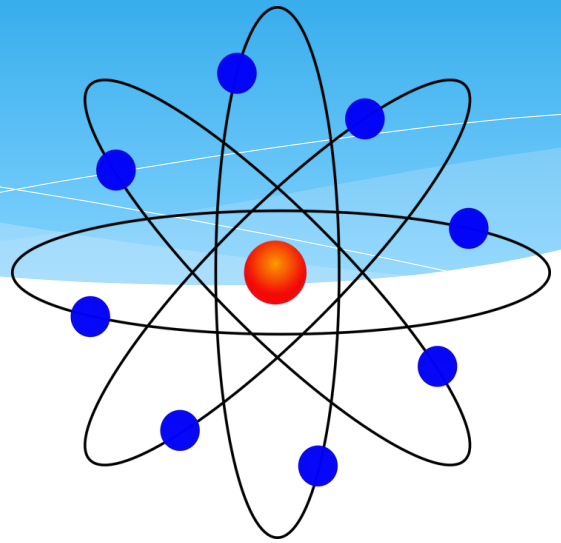
Chemical Marks

- Tissues
  - Otoliths
  - Bones
  - Scales
- Types
  - Elemental
  - Fluorescent





Elemental Marks



Fish naturally incorporate elements from their surroundings

Advantages

- Marks come from Nature

Disadvantages

- Expensive lab equipment required
- Time consuming tissue preparation
- Expensive

Elemental Analytical Techniques

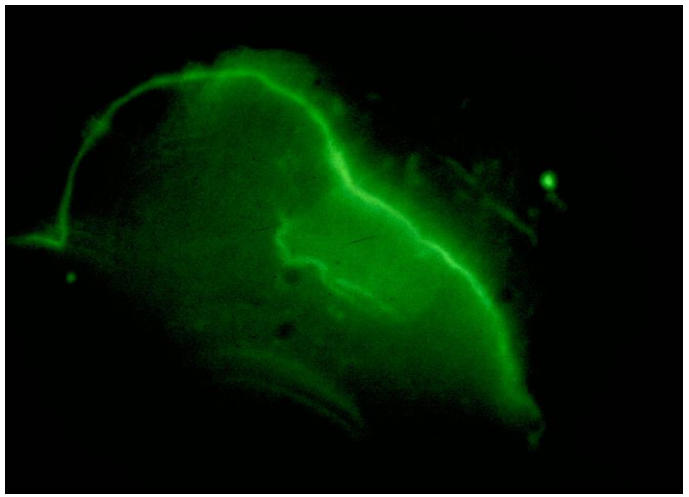
- Atomic absorption spectrometry
- Inductively coupled plasma mass spectrometry
- X-ray fluorescence spectrometry
- Neutron activation analysis

Fluorescent compounds

- Tetracycline
- Calcein
- Seen under UV light

Advantages

- Large numbers marked easily
- Quick
- Inexpensive
- Long lasting



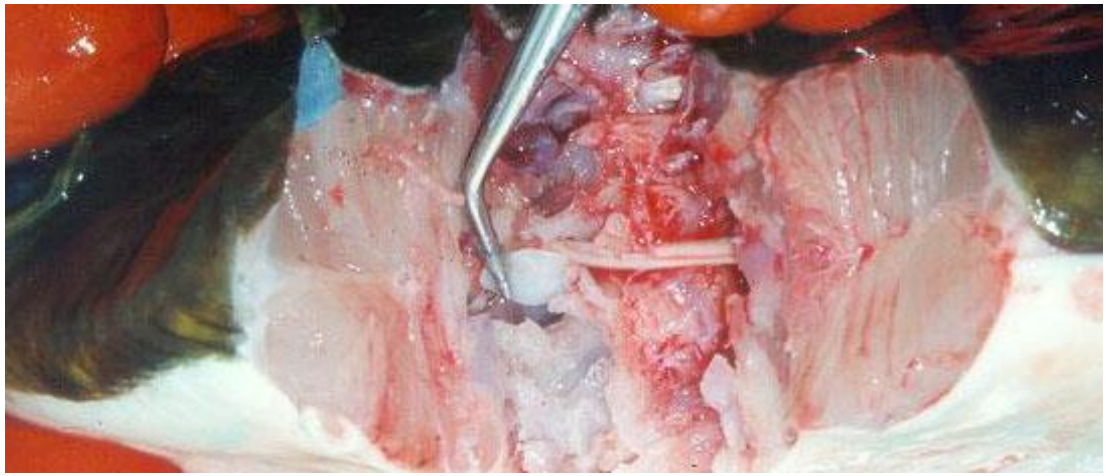
Scale and otolith marks

Advantages

- Naturally produced
- No stress
- Less handling and injury
- Nearly all fish carry mark

Disadvantage

- Scales and otoliths have to be removed



How is a thermal mark laid down?

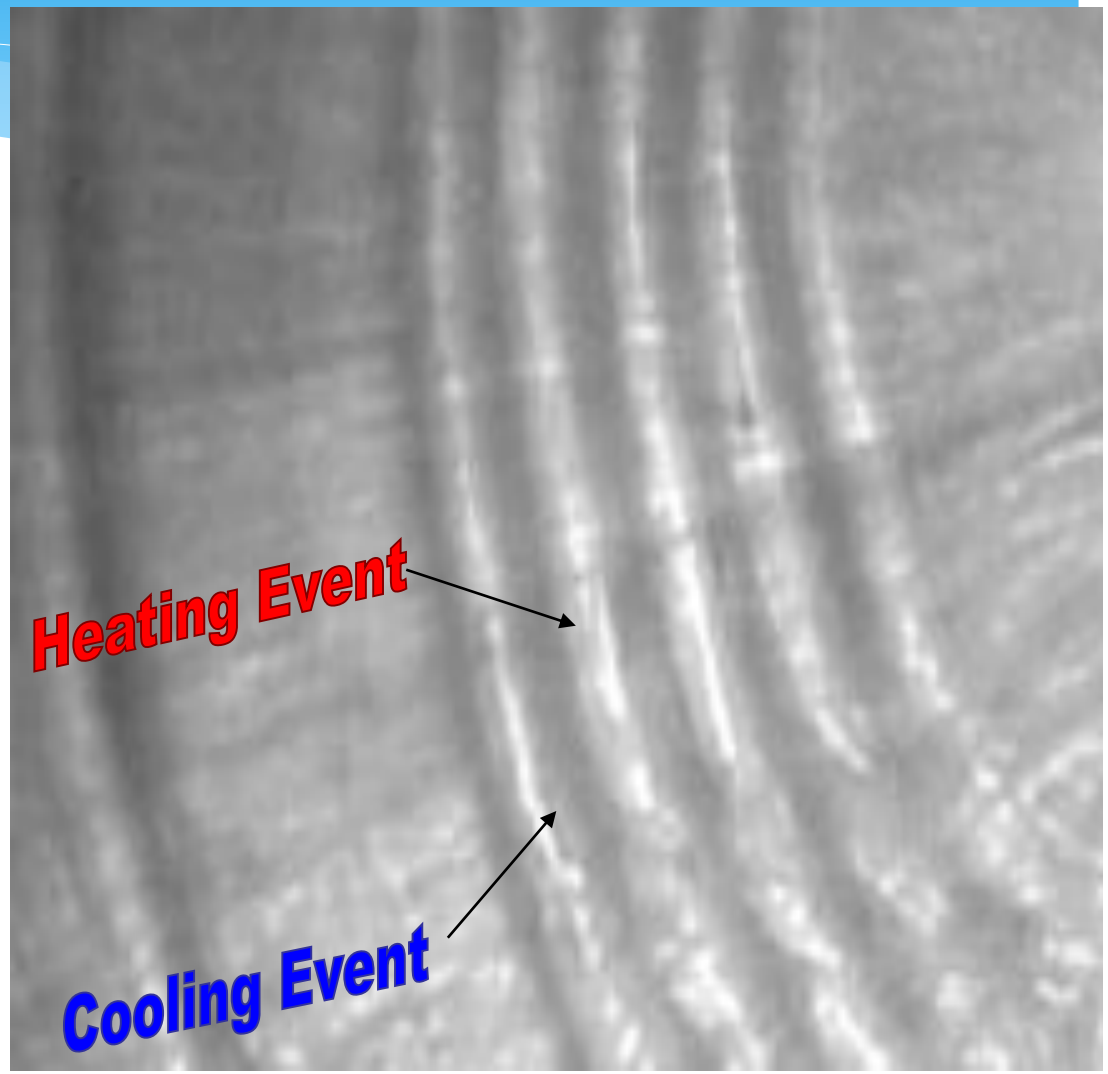
- Heated vs. ambient
- Chilled vs. ambient
- Combination of both
- Different methods
  - Dual freshwater intakes
  - Heat water with boilers, electricity, natural gas
  - Chill water with electricity
  - Reuse/recirculate to save energy

Thermal Mark Close Up
(heating system)

Calcium
- lighter band
- heating event

Protein
- darker band
- cooling event

Only so many marks
- We're running out



Self Check

- Thermal Otolith marking is primarily used in
  - Fish diet studies
  - **Hatcheries and Aquaculture facilities**
  - By the state to identify stocks of Alaska origin
  - Everyone because of its ease of use
- It may be possible to know where a fish comes from by looking at the elements that it has incorporated into its tissues and knowing something about the environment
  - **True**
  - False

Other Species?

- Octopus - VIE
- Crabs (molt)
- Cucumbers
- Urchins
- Shrimp
- Abolone
- Clams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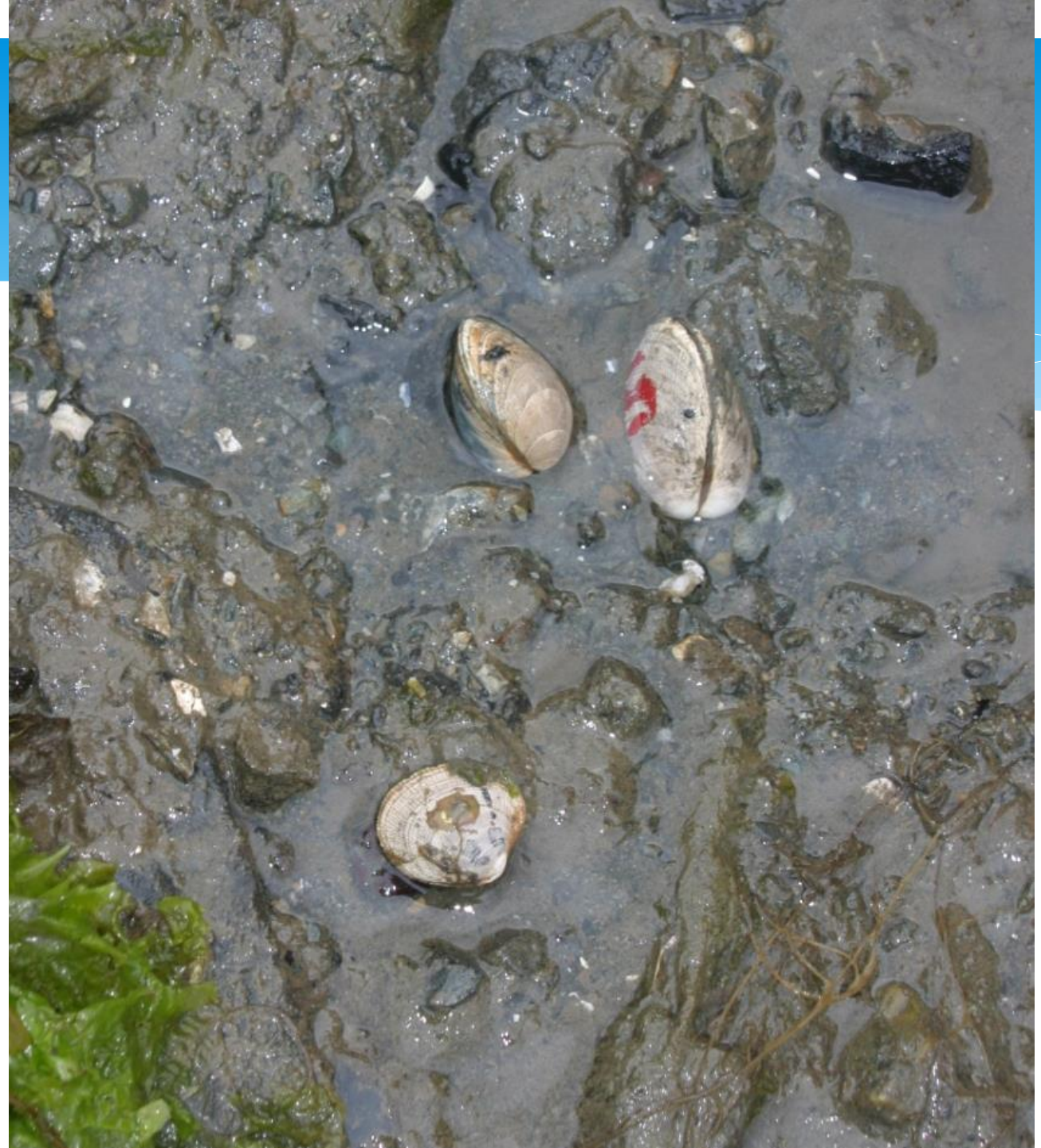
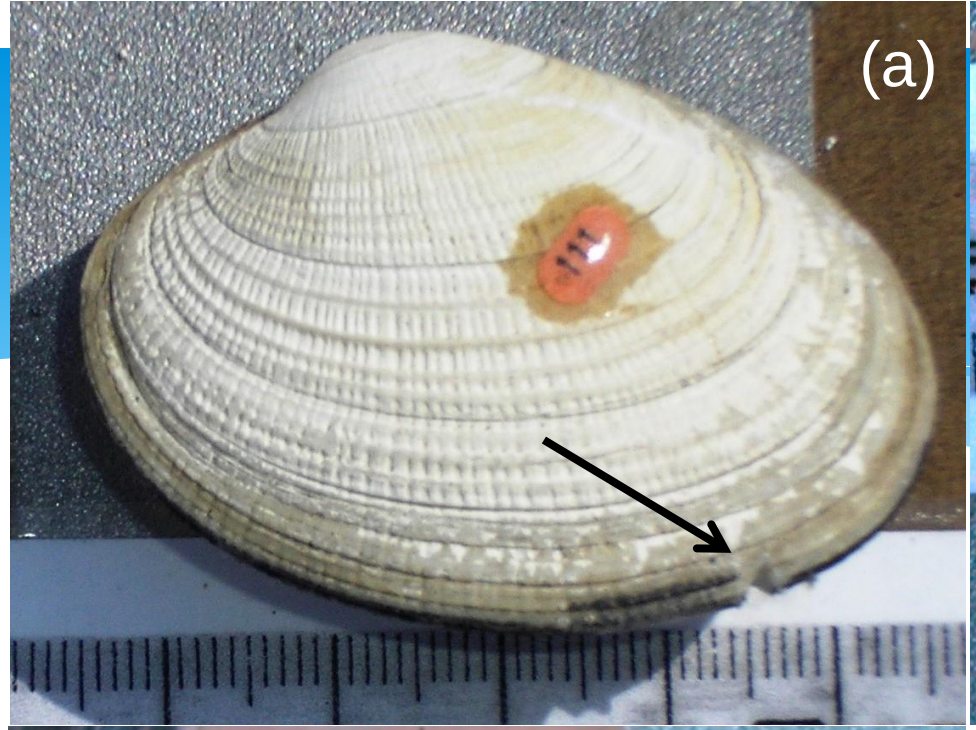
228
Sharpie
FINE POINT
Permanent Marker

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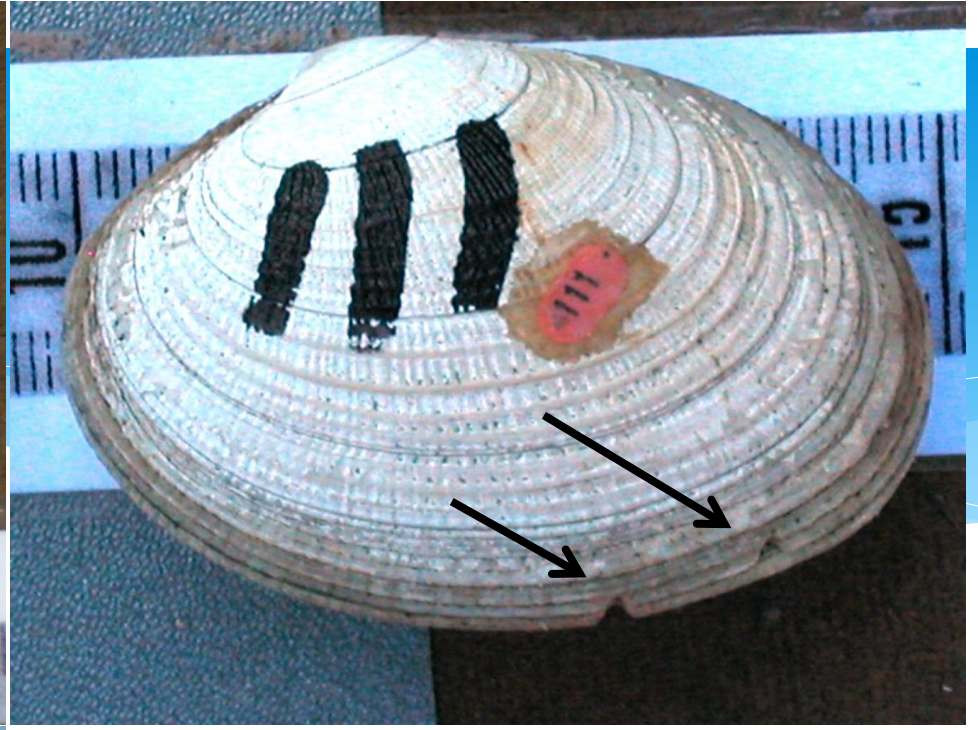


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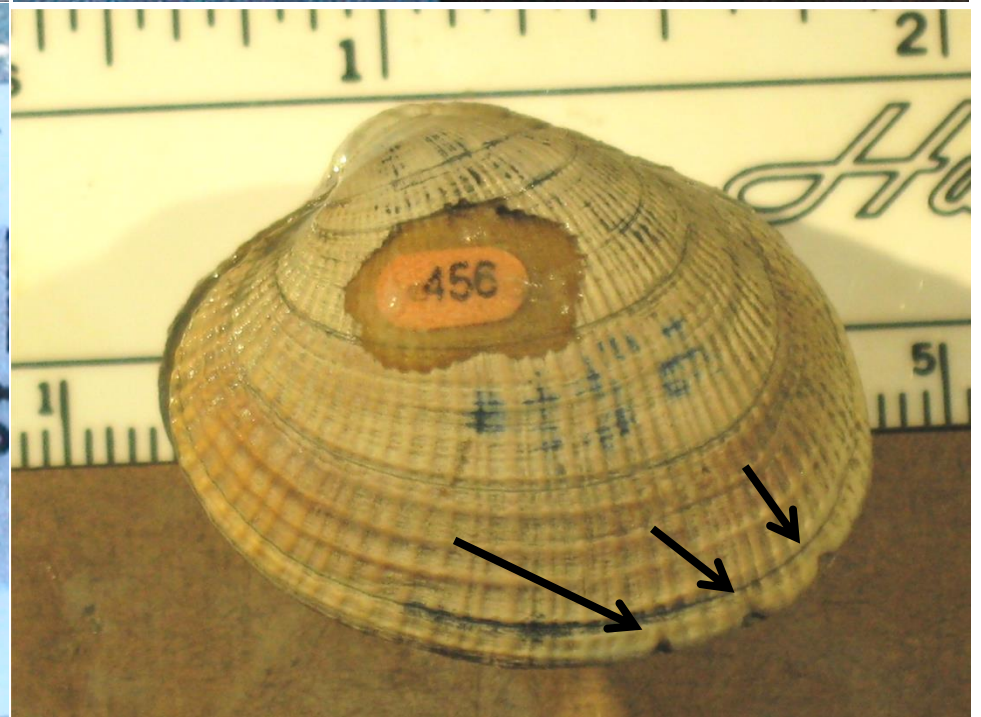
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Self Check

- How do you tag an octopus
  - CWT
  - VIP
  - VIE
  - You Can't

- Why might it be hard to tag a sea cucumber
  - They move around a lot
  - **They do not have hard parts**
  - They regrow their digestive system
  - They are camouflaged

Choice of Technique

Considerations

- Objectives
- Behavior and biological functions
- Mark retention
- Informational capacity
- Tagging requirements
- Recovery requirements

Design of Program

Planning

- Need
- State Goal / objective
- Develop methodology
- Choose tags

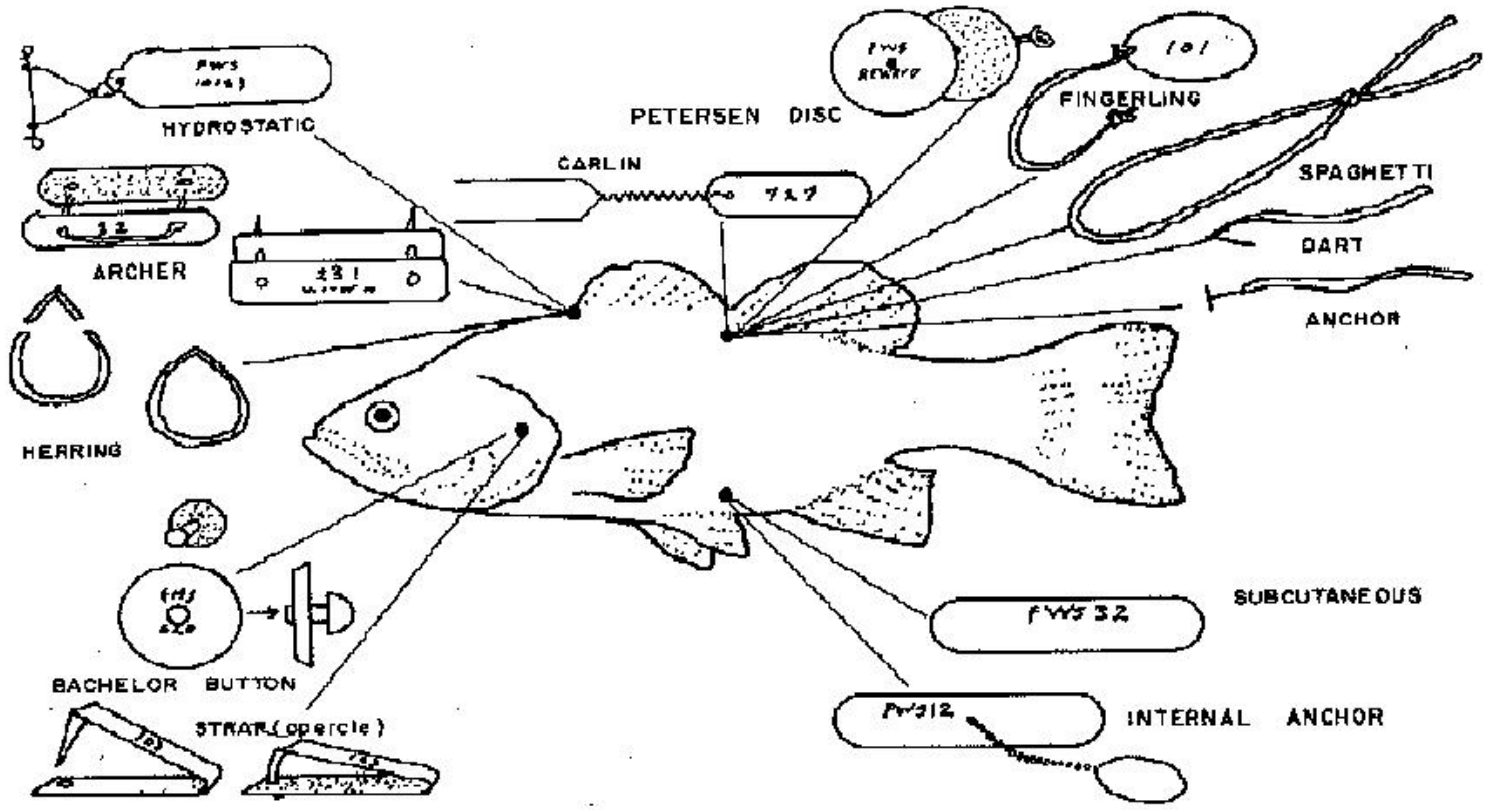
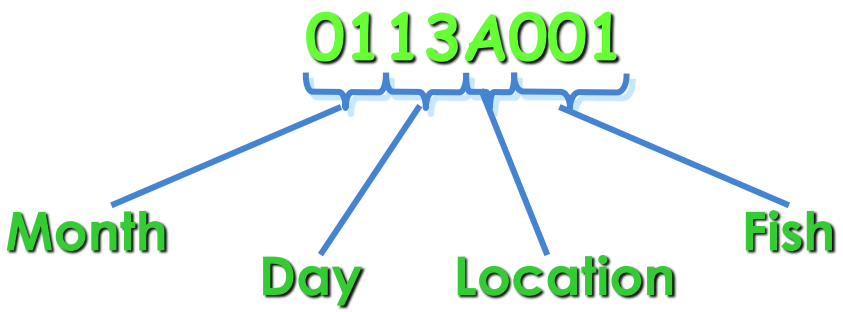


FIGURE 3.—Principal types of external tags and anatomical sites for attachment on fish.

Data management and analysis

Things to consider

- Time
- Location
- Individual



Public relations

Get the word out

Most important part of tagging study

- News releases
- Distribute posters
- Cash rewards ($5, $20, $100)

SEVERAL HUNDRED CRAPPIE HAVE BEEN TAGGED WITH PINK STREAMER TAGS BELOW THE DORSAL FIN AND RELEASED INTO LAKE CHICOT. THIS IS PART OF ONGOING RESEARCH BY THE ARKANSAS GAME AND FISH COMMISSION IN CONJUNCTION WITH THE UNIVERSITY OF ARKANSAS AT PINE BLUFF TO ENHANCE CRAPPIE FISHING IN LAKE CHICOT.

ANGLERS WHO CATCH ONE OF THESE FISH AND RETURN THE TAG WILL RECEIVE A REWARD OF $5, $20, OR $100.

TO BE ELIGIBLE, ANGLERS MUST PROVIDE THE TAG ITSELF ALONG WITH THE FOLLOWING INFORMATION:
NAME AND ADDRESS OF ANGLER, TAG NUMBER, DATE, TIME, AND LOCATION (BE SPECIFIC) OF CATCH, LENGTH AND WEIGHT OF FISH IF POSSIBLE, AND WHETHER THE FISH WAS KEPT OR RELEASED. TAGS SHOULD BE CLIPPED OFF, NOT PULLED OUT, FROM THOSE FISH YOU WISH TO LIVE RELEASE.
RETURN TAGS AND ABOVE INFORMATION TO:
AQUACULTURE AND FISHERIES CENTER, UAPB
ATTN: MIKE CARLSON
P.O. BOX 4912
PINE BLUFF, AR 71611
OR YOU MAY STOP AT NEARBY STORES OR GAS STATIONS TO PICK UP A RETURN CARD

REWARD

SEVERAL HUNDRED CRAPPIE HAVE BEEN TAGGED WITH PINK STREAMER TAGS BELOW THE DORSAL FIN AND RELEASED INTO LAKE CHICOT. THIS IS PART OF ONGOING RESEARCH BY THE ARKANSAS GAME AND FISH COMMISSION IN CONJUNCTION WITH THE UNIVERSITY OF ARKANSAS AT PINE BLUFF TO ENHANCE CRAPPIE FISHING IN LAKE CHICOT.

ANGLERS WHO CATCH ONE OF THESE FISH AND RETURN THE TAG WILL RECEIVE A REWARD OF $5, $20, OR $100.

TO BE ELIGIBLE, ANGLERS MUST PROVIDE THE TAG ITSELF ALONG WITH THE FOLLOWING INFORMATION:

NAME AND ADDRESS OF ANGLER, TAG NUMBER, DATE, TIME, AND LOCATION (BE SPECIFIC) OF CATCH, LENGTH AND WEIGHT OF FISH IF POSSIBLE, AND WHETHER THE FISH WAS KEPT OR RELEASED. TAGS SHOULD BE CLIPPED OFF, NOT PULLED OUT, FROM THOSE FISH YOU WISH TO LIVE RELEASE.

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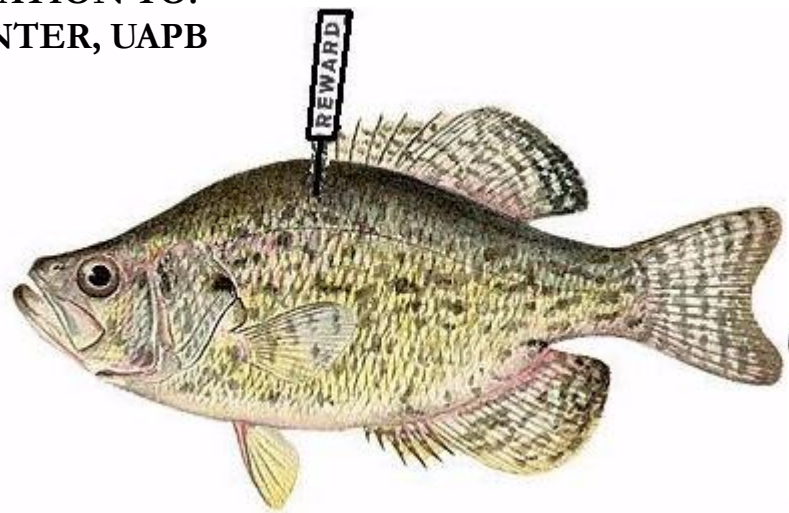


Mark/recapture

Petersen estimate: a simple ratio

$$\frac{M(\text{number released})}{N(\text{total population})} = \frac{R(\text{number of recaps})}{C(\text{number sampled for marks})}$$

$$\hat{N} = \frac{MC}{R}$$

Assumptions of Mark Recapture

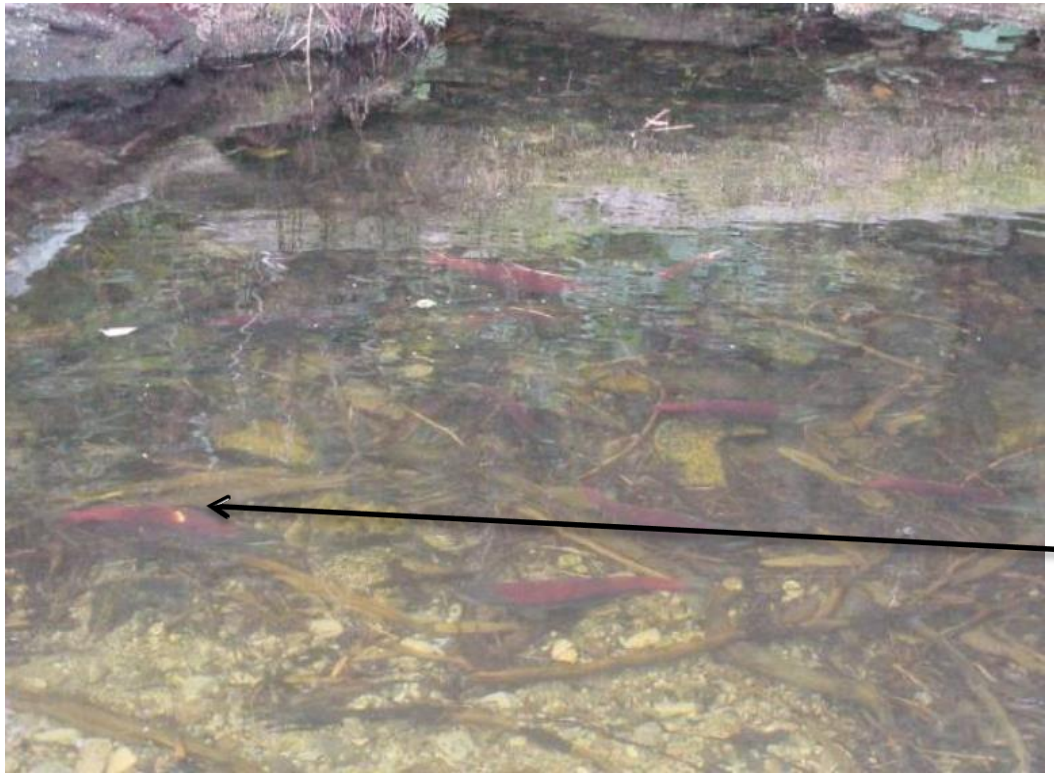
- The population is "closed“ (no births, deaths, or migration).
- All animals have an equal chance of capture.
- Marked animals mix with unmarked animals.
- Animals are not affected by their marks.
- Animals do not lose marks.

Pot Survey

Recapture event

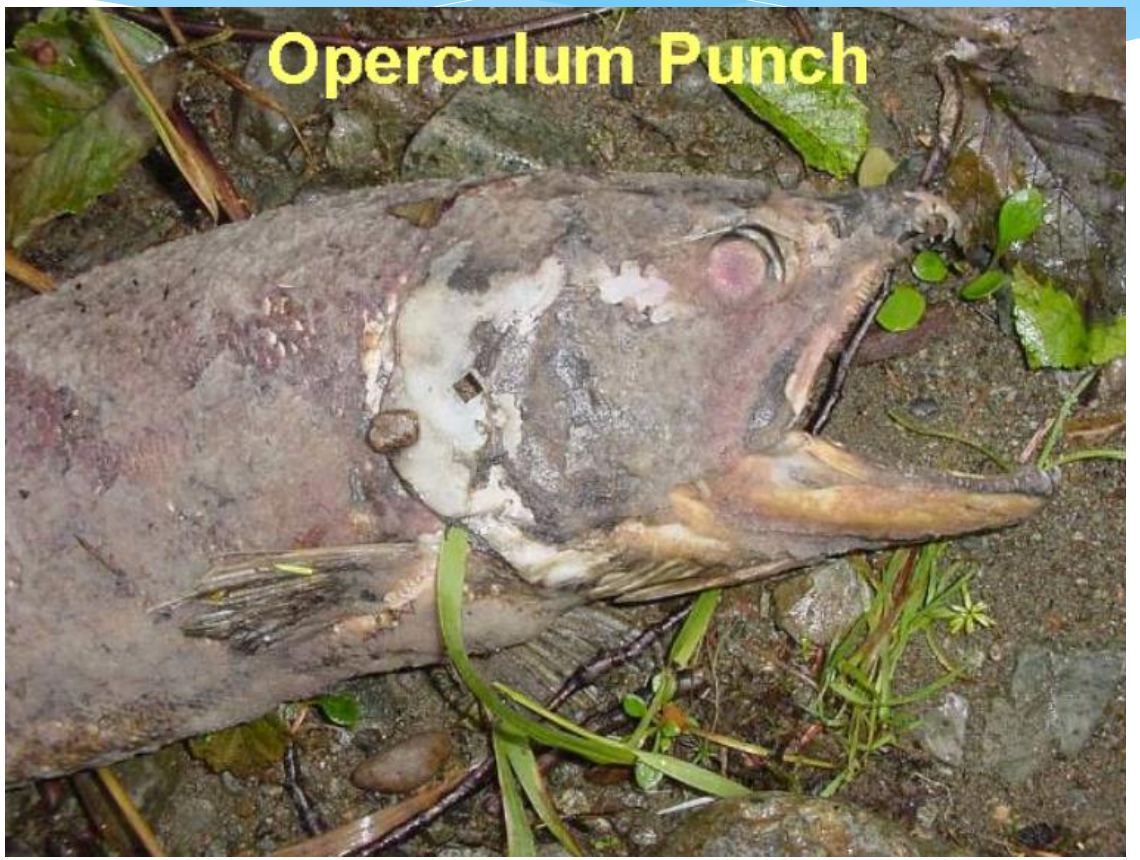
Fin clip for short term study

Longer Term




Peterson Disc

Spawner studies



Self Check

- One of the most important parts of a tagging study is public awareness
  - True
  - False

- You might choose a different type of mark or tag depending on the needed duration
  - True
  - False

Videos regarding various types of tags

- http://www.youtube.com/watch?v=1vyLrsXcgrM Floy tag in trout
- http://www.youtube.com/watch?v=xiBWiI4KUpg Pit tags trout
- http://www.youtube.com/watch?v=d107raqNFRs Radio telemetry tags
- http://www.youtube.com/watch?v=RHMB0n_QB-A Operculum punch on coho, eh? (BC)
- http://www.youtube.com/watch?v=9T-zfGdhw0w Floy tags, esophageal/radio tags