

**STANDARDIZED METHODS FOR HANDLING FISH IN  
GRAND CANYON RESEARCH**



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## **GENERAL GUIDELINES FOR HANDLING FISH DURING RESEARCH**

Respectful and careful treatment of fish during research is essential to the long-term success of monitoring programs. Traumatized fish can exhibit abnormal physiological, behavioral and ecological responses that defeat study purposes (Nickum 1988). Rough or improper handling of fish is a source of stress that can lead to disease and death. Delayed mortality as a result of improper handling is often not immediately seen by researchers but can occur hours or days later (Stickney 1983). This can cause misleading study results and poor public opinion resulting in loss of permits and cancellation of projects. Researchers should be sensitive to public perception and be prepared to explain sampling activities. All field personnel should be familiar with and strictly adhere to research permit guidelines and limitations. Sampling procedures should leave areas as undisturbed as possible and capture techniques should minimize injury to fish. Although specific fish handling procedures vary from one project to another all sampling should incorporate the following general guidelines:

- Be respectful of all fish regardless of size and species
- Minimize the time that fish are out of the water
- Change water frequently when fish must be held for more than a few minutes or if you see fish surfacing for air. Remember that handling stress increases as water temperature increases
- Don't put more than 8-10 fish in your workup bucket at one time. Leave the rest in a net in the river to avoid stressing fish.
- Be aware that watch straps, lapel badges and jewelry can damage fish
- Do not hold fish tightly around the throat and avoid touching the gills
- Rinse all sunscreen or lotions from hands prior to handling fish
- Always wet hands and equipment such as nets and fish boards before use. Dry hands and equipment cause damage to fish skin by removing coatings that protect fish from disease.
- Equipment such as length boards and scales become hot in the sun and can damage fish if not wetted prior to use

- When sampling with hoop nets, shake nets when removing them from the water. Check carefully for small fish that may have become lodged between the net folds. Fish mistakenly left in nets are a large source of researcher caused mortality.
- Native species accidentally killed should be documented, preserved in ethanol to be deposited as voucher or teaching specimens

## **PROTOCOLS FOR PROCESSING FISH**

Specific procedures for handling fish vary by location and trip. General descriptions of fish handling procedures for the Mainstem Colorado River and the Little Colorado River follow.

### **Mainstem Colorado River**

**Native fish** - Measure Total Length (TL), Fork Length (FL). Examine each fish for external parasites, sexual characteristics and elastomer dye tags. Humpback chub over 150 mm TL should be scanned for the presence of a PIT tag and any fish over 150 mm TL that do not have an existing 134.2 KHz tag (A 3D9 tag) should be tagged with a 134.2 KHz tag (See diagram 1).

**Nonnative fish** - Measure TL of all fish and examine all salmonids for the presence of an adipose clip or a floy tag. Those salmonids that are adipose clipped should be examined for the presence of a pit tag. Brown trout over 150 mm TL that do not have an existing pit tag should be tagged with a 134.2 KHz tag (See diagram 2).

### **Little Colorado River**

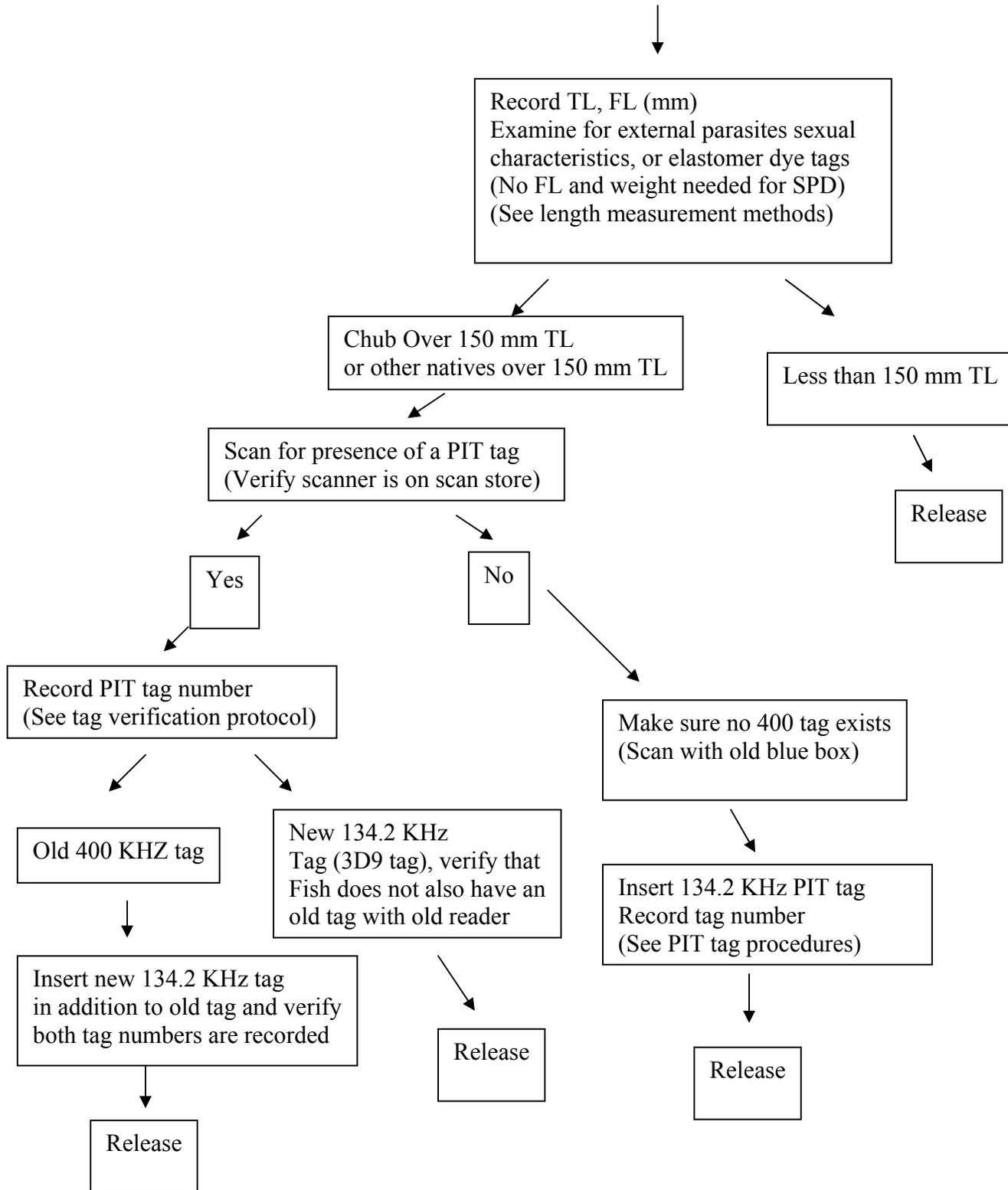
**Native fish** - Record TL, FL. Examine each fish carefully for fin clips, external parasites, sexual characteristics, and elastomer dye tags. Humpback chub over 150 mm TL should be scanned for the presence of a pit tag. Any fish over 150 mm TL that does not have an existing 134.2 KHz tag (A 3D9 tag) should be tagged with a 134.2 KHz PIT tag.

**Nonnative fish** - Measure TL and weight. Scan adipose clipped trout for the presence of a pit tag, and examine for floy tags. Examine stomach contents of all piscivorous fish and identify and record any fish found in stomach (See diagram 4).

**Mainstem Colorado River**

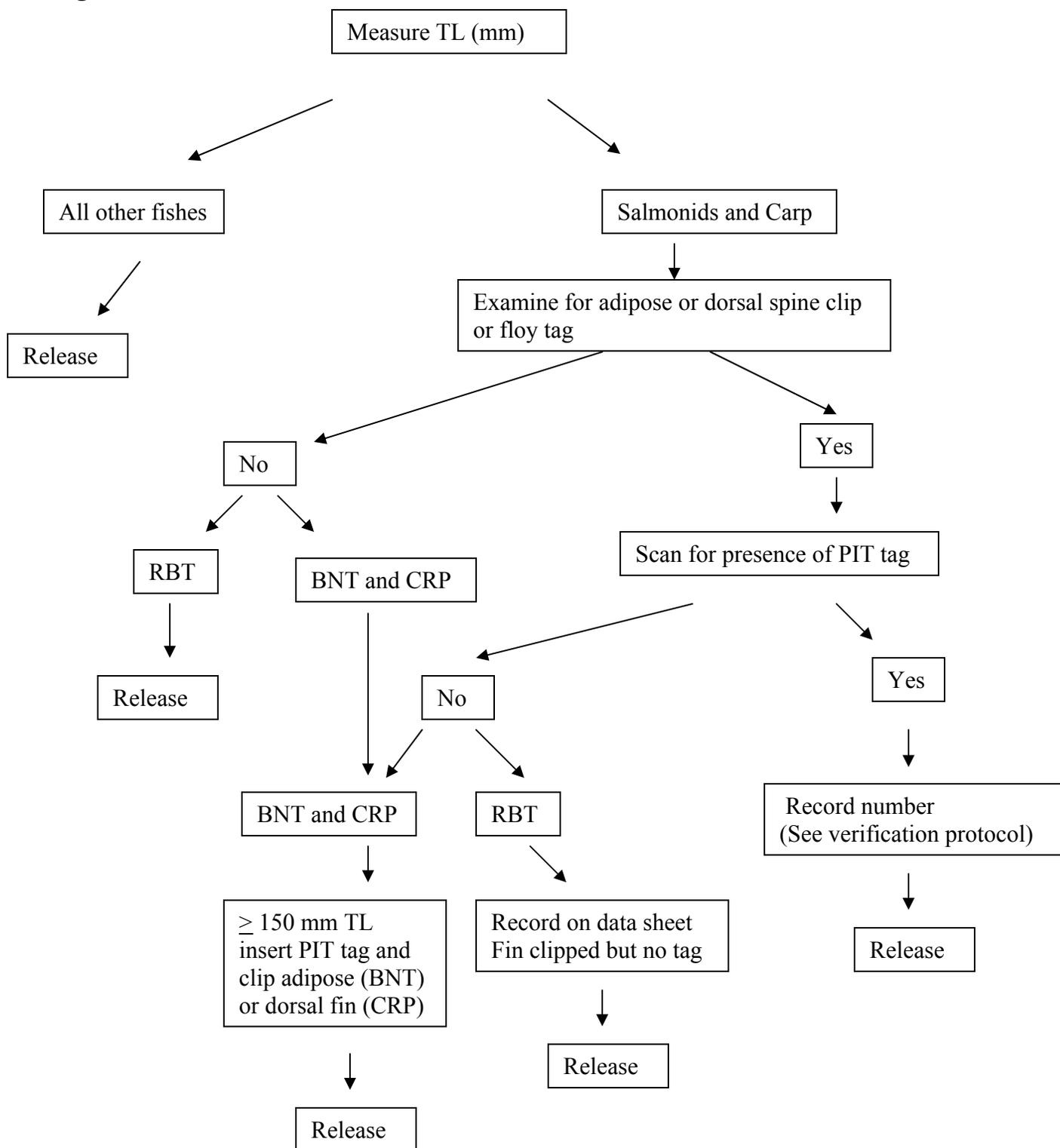
**Diagram 1**

**Native fish in Colorado River**



## Nonnative Fishes in Colorado River

Diagram 2



# Little Colorado River

Diagram 3

## Native Fish in LCR

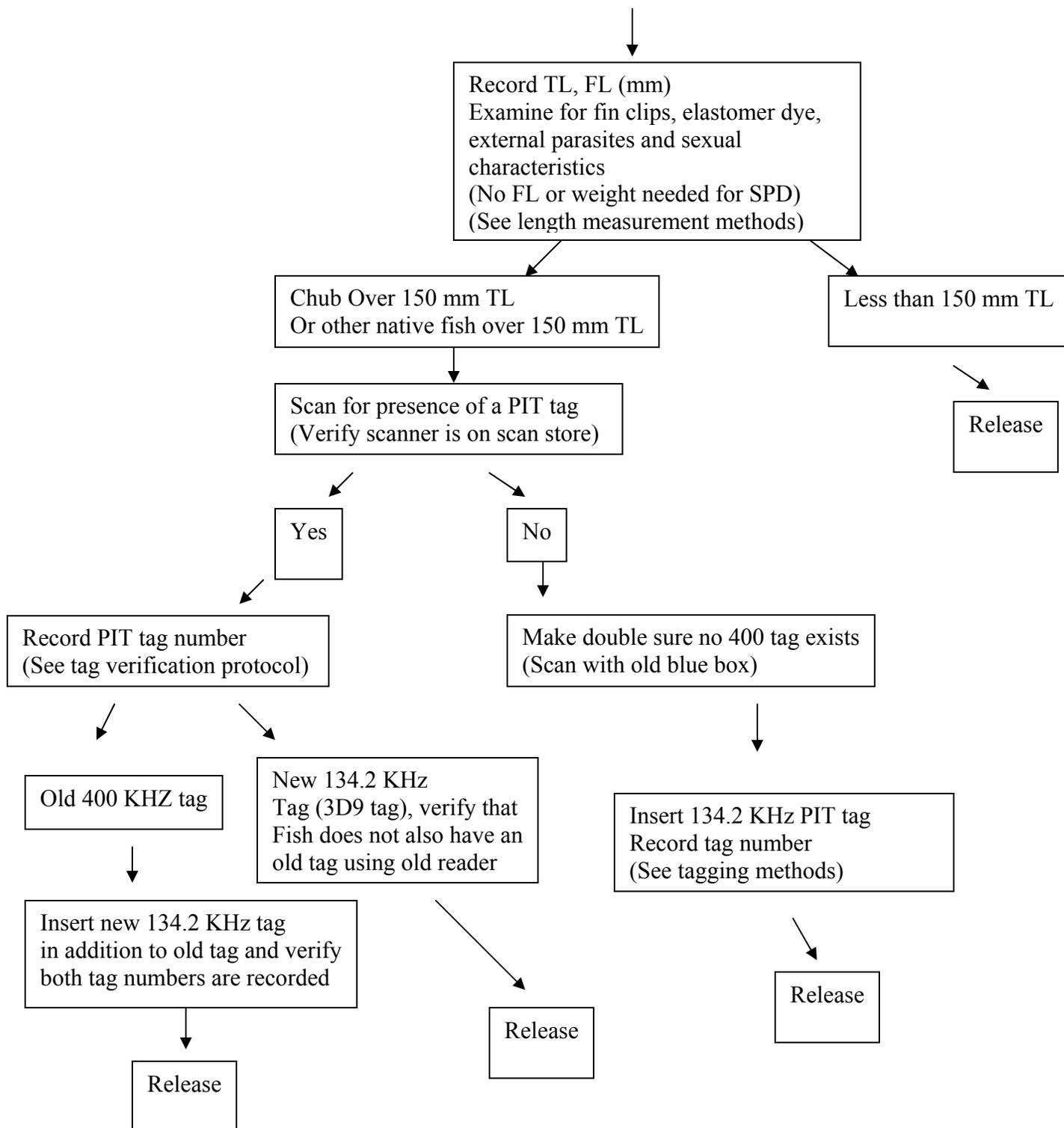
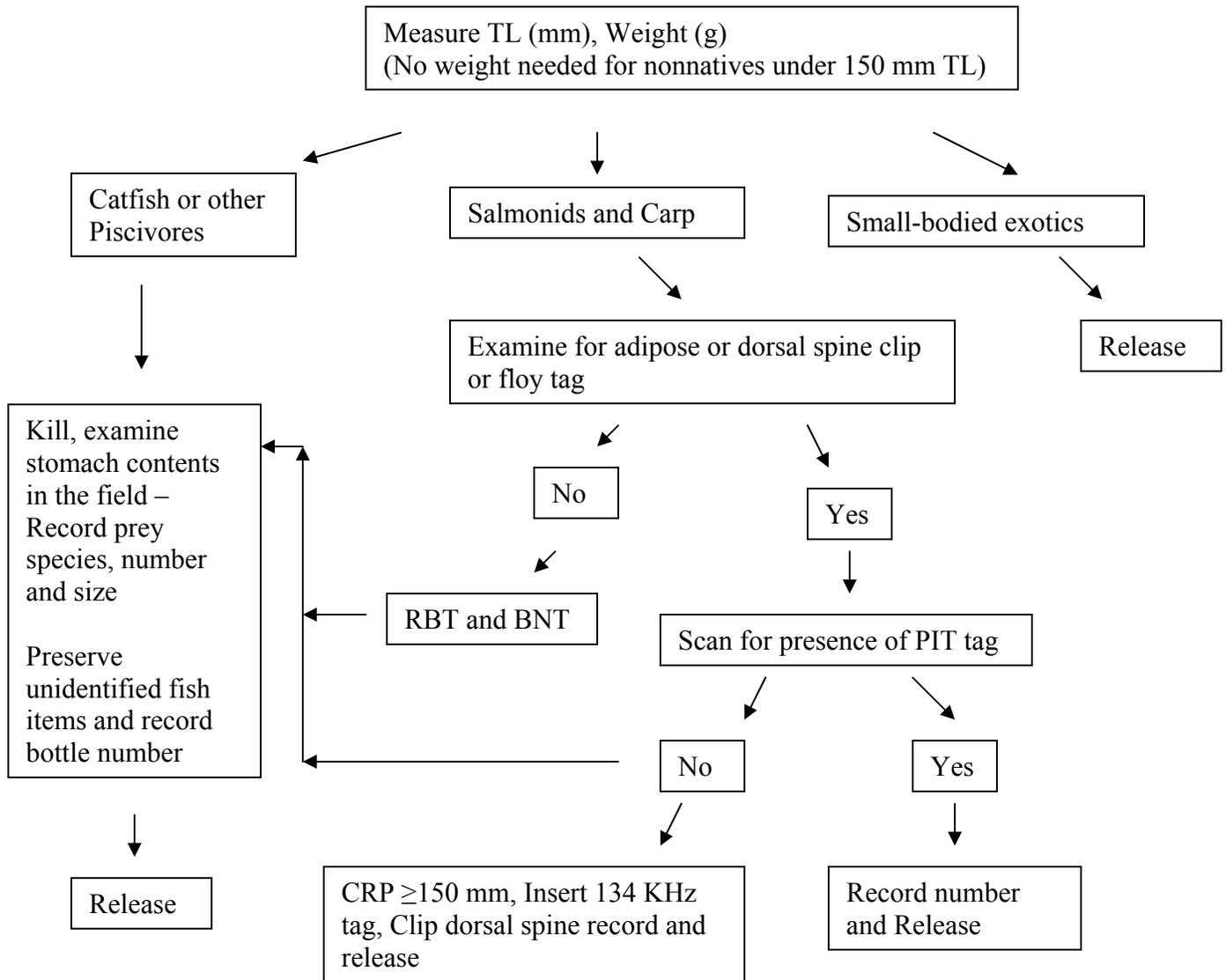


Diagram 4

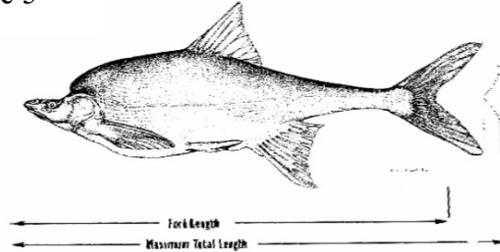
Nonnative Fishes in LCR



## LENGTH MEASUREMENT

Total Length (TL) – Measure from anterior most part of the fish to the tip of the longest caudal fin ray with the **lobes of the caudal fin compressed together** (See figure 5)  
Fork Length (FL) – Length from the most anterior part of the fish to the tip of the median caudal fin ray.

Figure 5



Adapted from Neilson and Johnson 1983

## WEIGHT MEASUREMENT

Measure weights to the nearest gram. Only take weights if it is not windy or raining and the equipment is functioning properly. **Poor weight data is worse than no data at all so do not collect weights if you are not confident of its accuracy.**

## PIT TAGGING

Passive integrated transponder (PIT) tags allow long-term unique marking of individual fish. There are two frequencies of PIT tags in use in the Colorado River system (400 KHz tags, which are the old 10 digit tags and 134.2 KHz tags, which have 12 digits and begin with 3D9.). **All fish that do not have a 134.2 KHz tag should receive a new tag even if they already have an old 400 KHz tag. Make sure to scan all fish for both tags (using both old and new readers) and record both numbers on the data sheet.** Location of PIT tag insertion varies by species. Use a test tag to verify scanners are working before each use.

### PIT Tagging humpback chub

1. Verify that needle is sharp and clean (Biomark guidelines recommend that needles be changed every 20 fish)
2. Sterilize the needle and tag in Ethanol or Isopropyl alcohol
3. Hold the fish with the abdomen up and the tail pointing toward you
4. Insert the needle just posterior to the pelvic fin (See figure 6)
5. The insertion should be on the abdomen of the fish to the right of the mid-ventral line with the tag placed posterior to the left pelvic girdle. The forward position of the pelvic fins on humpback chub allows the tag to be inserted higher on the abdomen than on other species.
7. The depth of needle penetration should be only deep enough to place the tag within the body cavity. Preliminary data from laboratory studies suggests inserting the needle too far and perforating the intestine is the main cause of PIT tag mortality. (Adapted from Biomark guidelines)

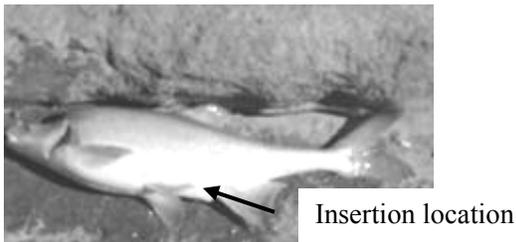


Figure 6

### **PIT tagging trout**

Use the same procedures as for humpback chub. The insertion should be on the abdomen of the fish to the left of the mid-ventral line under the pelvic girdle (See figure 7). The spleen lies on the right side of the body so insertion on the left side will cause less chance of injury to the spleen.

Figure 7

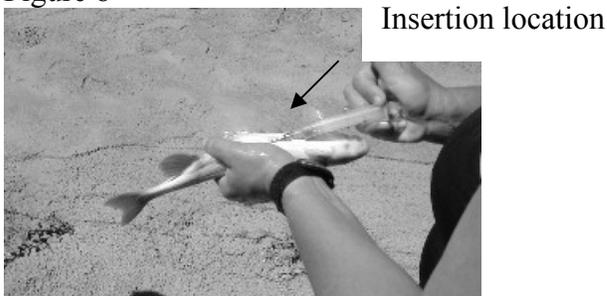


### **PIT tagging suckers**

Use the same procedures as for humpback chub or tags can be inserted toward the tail of the fish under the left pelvic girdle of the fish. (See figure 8)

The needle should be directed posterior so the tag is injected away from the heart and other vital organs. Figure 9 illustrates differences in mouth structure between flannelmouth and bluehead suckers.

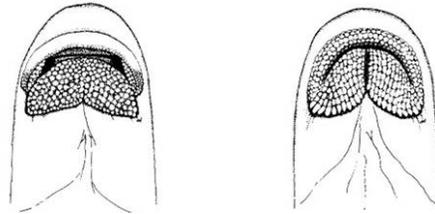
Figure 8



**Pit tagging Carp**

PIT tag Carp in the Dorsal musculature between the lateral line and the dorsal insertion on the left side of the fish. The dorsal spine must be clipped on all carp that receive a PIT tag.

Figure 9



Sublette et al

Bluehead sucker

Flannelmouth sucker

**Verifying PIT tag numbers**

The error rate when transcribing and entering PIT tag numbers is very high. The following procedures help to minimize errors that occur when transcribing and entering pit tag numbers.

1. Verify that the scanner is in Scan Store mode and says “working” on the display when the trigger is pulled. If scanner is not in Scan Store mode press the menu button several times.

2. Scan the fish

3. Read and record the entire 10-digit code using words instead of letters to avoid confusion of letters and numbers that sound alike.

Example 12A3F45E6B Read: one, two, alpha, three, fox, four, five, echo, six, bravo

4. Always cross zeros when recording PIT tag numbers. This distinguishes a zero from a “D” in the database. **When recording PIT tags draw a horizontal line above any letters in the PIT tag number.** This will help us distinguish letters from numbers that can often be confused (B and 8, D and 0, S and 5, etc).

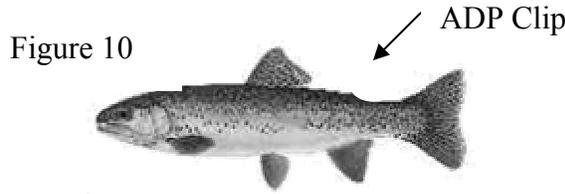
PIT RECAP?	
	PIT #
Y	7̄ F̄ 7̄ F̄ 33 1E 1D
Y	7̄ F̄ 7̄ D̄ 0̄ 7̄ 6 5 5 6

5. The data recorder repeats the number back to verify that it has been recorded correctly

## CLIPPING FINS

An adipose clip on brown trout and a dorsal fin clip on carp are being used as a secondary mark for newly PIT tagged fish to evaluate tag loss. All researchers must be aware of and look for all possible marks (See fin Clip codes).

1. Adipose clip – Clip at base removing entire adipose fin.



### Fin Clip Codes and Locations

RP1 = right pectoral  
RP2 = right pelvic  
LP1 = left pectoral  
LP2 = left pelvic  
ADP = adipose  
UCD = upper caudal  
LCD = lower caudal  
DOR = dorsal  
ANL = anal

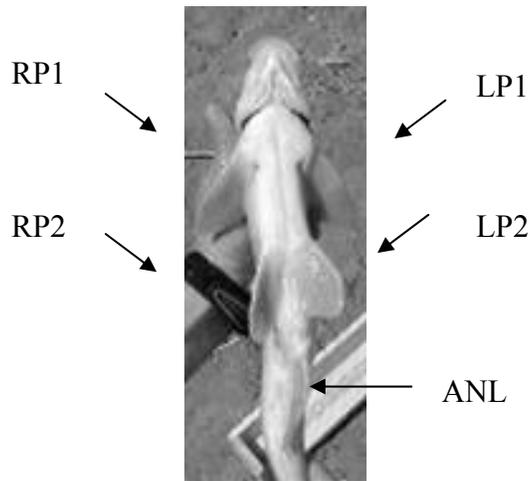


Figure 11

## ELASTOMER TAGS

Pink and Green elastomer implant tags have been used in the head of flannelmouth and bluehead suckers as a secondary mark to evaluate tag loss. Yellow and Pink elastomer is currently used to mark small humpback chub that have been translocated to the area above Chute falls in the Little Colorado River. All chubs in the LCR must be examined for yellow or pink elastomer with the blue light and glasses. Elastomer tags are located in the dorsal musculature near the dorsal insertion on the left side of the fish. Figure 12.

Figure 12



## ANESTHESIA GUIDELINES

AGFD occasionally uses anesthesia for trout to reduce trauma to trout while measuring fish. The standard dosage is 4 ml of 10% clove oil in ethanol per fish cooler (180 quart). Fish should take 1-3 minutes to loose equilibrium and roll onto their sides. Add only the number of fish to the anesthesia solution that you can process in about 5 minutes. Under no conditions should fish be maintained under anesthesia for more than 10 minutes.

When movement of the operculum ceases death is imminent and fish should be placed in fresh water immediately (CBFWA 1999).

## GUIDELINES FOR RECORDING DATA

- If you don't record the data in the field, it is highly unlikely it will be reconstructed in the office. **It is better to write down too much information on a data sheet than to get back to camp or the office and try to reconstruct it. Take your time and take clean data.** It is better to have data that is correct than a lot of data with irresolvable problems.
- Recording data in the field is one of the most important aspects of the research. There is often pressure to work up fish fast, especially when you catch a lot of fish in one net. Remember, **you can only work through fish as fast as your data taker can write down legible data.** If you go too fast processing fish, the data gets sloppy. If we are unable to read your handwriting the data is essentially lost. Keep an eye on your data recorder and ask if you are going too fast. Data recorders, please STOP the fish processor and tell them if they are going to fast.
- **Do not forget to write Y or N in the recap field.** Don't assume that the data recorder is watching to see if you are injecting a tag or not. Each mistake can be very costly during analysis. Slow down in the field and make sure the recap field is filled in. Examine data sheets nightly back at camp to verify that data recording problems are not occurring.
- Record GPS waypoint numbers on the data sheet and the number from the GPS unit being used. If you can't obtain a waypoint make a note of it on the data sheet.
- **A blank data field indicates that the fish was not checked.** Be sure to fill in all columns of the data sheet and indicate if things like parasites or ripeness were checked.  
**Blank = you didn't check**  
**Undetermined = you checked but couldn't make a distinction**

## STANDARD DATA LABEL FOR PRESERVING WHOLE FISH OR STOMACH SAMPLES

Sample

(Fill out with pencil only)

TRIP ID	LC20020622
SAMPLE ID	(Camp and net in LCR)
RIVER	LCR
DATE	June 25, 2002
TIME	1630
MILE	(RKM in LCR)
GEAR	HB (Hoopnet baited)
SPECIES	RBT
LENGTH	85 mm
WEIGHT	35 g
STOMACH #	1 (Order consecutively per trip)

Label all preserved specimens so they can be clearly linked to the data sheet.

**ALL DEAD HUMPBAC CHUB** must be saved and preserved in ethanol. Humpback chubs too large to preserve can be dried or remove otoliths for aging.

### OTOLITH REMOVAL AND PRESERVATION

**Channel Catfish otolith removal:** Remove otoliths by sectioning through the supraoccipital bone using a hacksaw. Make a cut about 3-5 mm anterior to an imaginary line that would connect the locked pectoral spines (Fig.13). Otoliths are located in the posterior portion of the skull. Remove with forceps. If difficult to locate, remove top of skull with wire cutters to allow better access (Buckmeier et al. 2002).

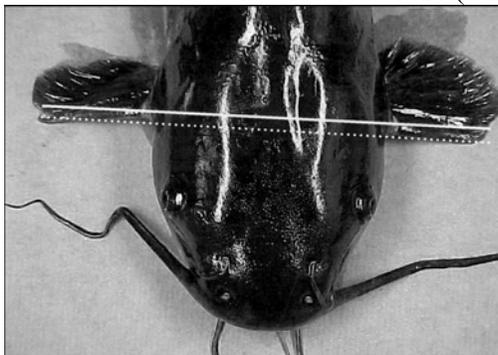


Fig. 13

## FIELD CODES FOR DATASHEETS

### River Codes

BAC	Bright Angel Creek
CAR	Carbon Creek
CLC	Clear Creek
COR	Colorado River
CRK	Crystal Creek
DIA	Diamond Creek (RM 225.7)
DRC	Deer Creek
ELV	Elves Creek
EMF	Emery Falls Creek (RM 274.3)
HAV	Havasu Creek
HER	Hermit Creek
KAN	Kanab Creek
LCR	Little Colorado River
LOS	Lost Creek (RM 248.9)
NAN	Nankoweap Creek
OLO	Olo Creek
ONC	119-Mile Creek
OTC	127-Mile Creek
OTH	Other
PAR	Paria River
PIP	Pipe Creek
QUA	Quartermaster Creek (RM 259.8)
SAL	Salt Creek
SHI	Shinumo Creek
SPE	Spencer Creek (RM 246)
SPR	Spring Canyon Creek (RM 204.1)
STO	Stone Creek
SUR	Surprise Creek (RM 248.4)
TAP	Tapeats Creek
TRA	Travertine Creek (RM 230.5)
VIS	Vishnu Creek

### Turbidity

H	High secchi (< 0.5m)
L	Low secchi (> 0.5m)

### Species Codes

BBH	Black Bullhead
BGS	Bluegill
BHS	Bluehead Sucker
BKC	Black Crappie
BKT	Brook Trout
BNT	Brown Trout
CCF	Channel Catfish
CRP	Carp
CUT	Cutthroat Trout
FHM	Fathead Minnow
FMS	Flannelmouth Sucker
FRH	Flannelmouth/Razorback Hybrid
GAM	Gambusia
GSF	Green Sunfish
GSH	Golden Shiner
HBC	Humpback Chub
LMB	Largemouth Bass
NOP	Northern Pike
PKF	Plains Killifish
RBS	Razorback Sucker
RBT	Rainbow Trout
RGK	Rio Grande Killifish
RSH	Red Shiner
RTC	Roundtail Chub
SDS	Sand Shiner
SHR	Shiner
SMB	Smallmouth Bass
SPD	Speckled Dace
STB	Striped Bass
SUC	Un-identified Sucker
TFS	Threadfin Shad
UID	Un-determined Fish
UTC	Utah Chub
WAL	Walleye
YBH	Yellow Bullhead

**Shoreline Habitat**

BE	Bedrock
TD	Travertine Dams
CB	Cobble Bar
CL	Cliff
DF	Debris Fan
SB	Sand Bar
TA	Talus
BL	Boulder
LE	Ledge

**Hydraulic Units**

BA	Backwater
ED	Eddy (countercurrent)
RI	Riffle
RU	Run
RA	Rapid
PO	Pool (still)
RC	Return Channel
GL	Glide

**Cover Types**

V	Vegetative
B	Boulder
L	Ledge or Lateral Cover
N	None
U	Undetermined

**Hydraulic Units**

BA	Backwater
ED	Eddy (countercurrent)
RI	Riffle
RU	Run
RA	Rapid
PO	Pool (still)
RC	Return Channel
GL	Glide

**Fin Clips**

(Y/N)	Recap, Fin Mark
ADP	Adipose
LP1	Left Pectoral
LP2	Left Pelvic
RP1	Right Pectoral
RP2	Right Pelvic
UCD	Upper Caudal
LCD	Lower Caudal
ANL	Anal Fin

**Dominant Substrates**

0	Clay-silt-marl (< .06 mm)
1	Silt-sand (0.07 - 0.10 mm)
2	Sand (0.11 - 2 mm)
3	Gravel (2.1 -15 mm)
4	Pebble (16 - 31 mm)
5	Rock (32 - 100 mm)
6	Cobble (101 - 255 mm)
7	Small Boulder (256 - 1000 mm)
8	Boulder (1 - 3 m)
9	Large Boulder (> 3 m)
10	Bedrock
11	Organic / Detritus

**Sexual Condition**

I	Immature, sex organs not developed
M	Mature, sex organs well developed, eggs distinguishable
N	Not Ripe
R	Ripe, Gametes extrudable in response to light pressure
S	Spent, testes or ovaries empty or red, genital aperture inflamed
U	Undetermined

**Sexual Characteristics**

C	Color
T	Tuberculate
B	Both Colored and Tuberculate
U	Undetermined

**Disposition**

RA	Returned Alive
DR	Dead, Released
DP	Dead, Preserved
DS	Dead, Stomach Contents
SK	Dead, Skeletonized

**Parasite Type**

L	Lernea
A	Asian Tapeworm
U	Unidentified
N	None

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## DOCUMENT REVISIONS

- Fall 2002
- Discontinued baiting hoopnets after laboratory studies revealed PIT tagging fed fish led to high mortality.
  - Native fish over 150 mm TL without an existing PIT tag were tagged and dorsal fin punched as a secondary mark to evaluate tag loss.
  - Native fish between 100 and 149 mm TL caught during the LCR September trip received a left pelvic fin clip. Fish 100 to 149 mm TL caught during the LCR October trip received a left pelvic clip if they did not already have one and a right pelvic clip if the left pelvic was previously clipped to get an early estimate of recruitment.
- Spring 2003
- Started PIT tagging previously untagged native fish with the new 134.2 Khz tags.
  - Started PIT tagging all carp  $\geq 150$  mm TL.
  - Experimented with the use of elastomer dye to mark suckers.
  - Chub translocated above chute falls tagged with elastomer dye.
- Sept. 2003
- Started PIT tagging all chub  $\geq 100$  mm TL, and all other natives  $\geq 150$ mm TL. Fish with old tags double tagged with new 134.2 Khz

- tags.
- Nov. 2003
- Discontinued taking weights on humpback chub to reduce handling
  - The PIT tagging size for any species of fish is  $\geq 150$  mm TL until further notice, but HBC over 100 mm still need to be scanned for the presence of a PIT tag.
  - No weights on fish until further notice. Downstream trout and Lees Ferry will experiment with new types of scales and attempt to find equipment that will work better under field conditions.
  - Old tags will no longer be inserted below Lee's Ferry in any fish. BNT on downstream trips will now be tagged with the new PIT tags at  $\geq 150$  mm TL instead of 120 mm TL as previously. Don't put a new PIT tag into brown trout if they already have an old PIT tag.
  - All chubs in the LCR must be examined for yellow elastomer with the blue light and cool glasses. Elastomer tags are located in the dorsal musculature near the dorsal insertion on the left side of the fish. See photo below.
  - Mainstem trips are not required to use blue light and glasses to look for elastomer in chub.
  - Elastomer dyes will no longer be used as a secondary mark to evaluate tag loss in suckers, but be sure to record if you see pink or green elastomer in the head of suckers.
  - In the event that you catch a HBC over 350 mm TL, you can not get a read with the new scanner, and you do not have a working old scanner **DO NOT** insert a new tag – just record and release.
- Aug. 2004
- All data submitted to GCMRC should include all digits and the period for new pit tag numbers. Example – 3D9.1BF4A3C2E
- March 2005
- It has been 2 years since any fish 100 mm TL have been tagged. It is no longer necessary to scan fish between 100 and 149 mm TL for PIT tags. Any fish previously tagged (in 2003) at 100 mm would now be  $>150$  mm TL.
- Dec. 2005
- Take otoliths from all catfishes and Centrarchid's. Preserve in ETOH, include vial label and record on nonnative data sheet (bottle #).
  - Take 20-30 catfish samples when possible (spines, otolith). If catfish are similar in size take a subsample of spines and otoliths.
  - Check all catfishes stomachs for presence or absence of fish remains (in field).
  - Bring all warm water nonnatives (Bass, etc..) back to office, whole when possible. Preserve in ETOH, cut open stomach cavity to allow internal organs to be preserved.
  - If species is too large to bring back whole, take stomachs (preserve in ETOH), take otoliths (preserved in ETOH). Take scales from the posterior side of pectoral fin below or above lateral line (dry preservation). As well as a fin clip also preserved in ETOH.
  - Disposition DP if preserved.
  - Record all information on data sheets (date, disposition, location (river mile), bottle #'s and what was removed / preserved).