

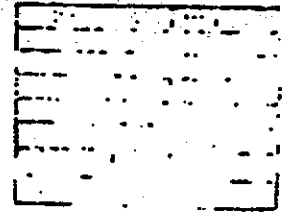
# Memorandum

Date : November 18, 1988

To : Fred Meyer

From : Department of Fish and Game

Subject: South Yuba-Brophy Diversion Study



Yes, here it is!!! I have only presented the results. Since I am no longer in the region, I did not discuss conclusions. Sorry for the inconvenience.

### INTRODUCTION

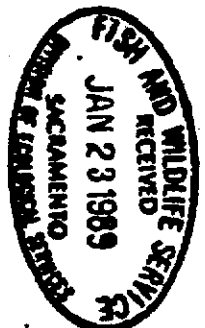
On March 9th, 1984 the Department of Fish and Game (DFG) and Brophy Water District (Brophy) entered into an agreement concerning the South Yuba-Brophy River Diversion Project located on the Yuba River above Daquerre Point Dam. DFG has also entered into a companion agreement with South Yuba Water District. Prior to the above mentioned agreements, Brophy and South Yuba Water Districts entered into an agreement dated July 21, 1983 ("South Yuba-Brophy Agreement") to convey and distribute water to both the Brophy and South Yuba Water Districts.

Exhibit D of the companion Agreements with DFG and the Water Districts outlines the alternatives for fish protection devices to be constructed along with the diversion facilities. Exhibit D states that "The choice of the alternative shall be solely the District's; provided however, if District should elect to construct the Alternative No. 2 or Alternative No. 4, then the screening effectiveness of such Alternative shall be subject to the following criteria:

#### Evaluation Criteria for Gravel or Gabion-type Screen

1. Such screen shall have a 95 % or greater effectiveness in preventing entry into the canal system of salmon and steelhead of one inch or greater length, as evaluated over a three-year period.

South Yuba-Brophy Water Districts built Alternative No. 4. Additional criteria for Alternative No. 4 states that "c. A return diversion will provide for returning at least 10% of the quantity diverted back into the river." Under the Agreement, DFG had a three-year period after completion of the diversion facility and first irrigation season to evaluate the



effectiveness of the rock screen. If during this three-year period, DFG found the screen to be ineffective, and upon notification to the South Yuba-Brophy Water Districts, the Districts shall have three seasons to correct the facility to meet the effectiveness criteria.

The objectives of this study were:

- a. To evaluate the effectiveness of the graded rock fish barrier.
- b. To determine if bypass flows were at least 10 % of the diverted quantity.

#### METHODS

##### Survival of Migrating Juvenile Salmon

Three fyke traps were installed in the South Yuba-Brophy diversion canal (SYBDC). The wings of the fyke traps were constructed of one-fourth inch hardware cloth, secured in the canal by t-bar fence posts. One fyke trap was installed at the mouth of the diversion (Figure 1), and designated the Intake Fyke (IF). The Intake Fyke was used to trap all fish migrating into the SYBDC. Two additional fyke traps were installed 20 feet apart in the bypass canal (Figure 1), to trap fish that migrated past the rock screen. The fyke traps installed in the bypass canal were designated as Upper Bypass Fyke (UBF) and Lower Bypass Fyke (LBF).

Juvenile salmon trapped at the Hallwood-Cordua Canal fish trapping facility were anesthetized with MS-222 and marked with either an upper or lower caudal clip. A control group of 25 fish of each marked group were placed in a live car in the Yuba River. Marked fish were released just downstream of the Intake Fyke. Marked fish were released in two groups 1) a daylight release and, 2) a night release. Traps were fished for 72 hours after release of the last marked group. Both the day and night release treatments were repeated twice. The first mark and recapture treatment began on May 11 and the second on May 23, 1988. Table 1 shows the release time and number of marked fish released during each treatment.

Table 1. Release Time and Number of fish Released  
South Yuba-Brophy Diversion Study, 1988

<u>Date</u>	<u>Released Time</u>	<u>Number Released</u>	<u>Mark</u>
May 11	2140 (night)	413	upper caudal
May 12	0623 (day)	492	lower caudal
May 23	1645 (day)	517	lower caudal
May 23	2155 (night)	506	upper caudal

The fyke traps were checked for captured fish and cleaned every two hours. Captured fish were checked for marks, counted, recorded and released either into the Yuba River downstream of the mouth of the SYBDC or downstream of the Lower Bypass Fyke. Water temperatures were measured and recorded to the nearest degree F when traps were checked.

Underwater direct observations were conducted to 1) assess effectiveness of the fish traps, 2) determine fish species and life stages present, and 3) survey location and behavior of the fish in the diversion canal. Underwater direct observations were conducted by snorkeling the SYBDC and the South Yuba-Brophy Diversion Pond (SYBDP) (Figure 2). Divers were William Somer, DFG, Gerry Big Eagle, U.S. Fish and Wildlife Service (USFWS).

The SYBDP was snorkeled from 1115 to 1230 on May 25, 1988. The SYBDC was snorkeled from 1500 to 1600 the same day.

The SYBDP was electrofished by boat to determine the species composition. The SYBDP was electrofished at night on May 11, 13 and 26.

The bypass canal was electrofished on May 27, to determine if any marked fish were present. Electrofishing was conducted using a small boat electroshocker.

#### Determination of Bypass Flows

Flow measurements were taken by Sid Taylor, WRC Engineer, State Water Resources Control Board; and assisted by Richard Flint and Fred Meyer, DFG and Tom Richardson, USFWS. Water flow was measured at the following locations:

- 1) The inflow to South Yuba-Brophy Canal (downstream of the intake fyke),
- 2) The return flow to the Yuba River in the bypass canal (just downstream of the upper bypass fyke).

#### RESULTS

A total of 7,430 juvenile salmon were captured in the intake fyke on their migration into the SYBDC. During the first treatment which began on May 11, a total of 4,746 salmon were captured. A total of 2,684 salmon were captured during the second treatment period.

Table 2 shows the return rate for marked fish after a 72-hour trapping period. The day release group had a slightly higher return

rate (average = 57.5%), than did the night release group (average = 43.7%). The numbers of recaptures vs time is shown in Figures 3 and 4. The recapture rate after 72 hours approached zero. The results of this mark-recapture study showed that less than 95% of the marked fish made it through the bypass canal. One major problem that juvenile salmon must surpass is the large predator (squawfish) populations that exists in the diversion and bypass canals. During this study, squawfish were observed feeding on juvenile salmonids as they attempted to migrate out the bypass canal.

Table 2. Return Rate of Marked Salmon After 72 Hour Period

<u>Release Date</u>	<u>Mark Group</u>	
	<u>Upper Caudal (night)</u>	<u>Lower Caudal (day)</u>
May 11, 12	41.4%	52.0%
May 23	46.4%	63.1%

One hundred percent of the control group from the first treatment groups (lower caudal mark) survived. One mortality was observed from the upper caudal group (96% survived). The average length for the first treatment group of the upper caudal marked fish was 68.1 mm, the average length of the lower caudal marked group was 67 mm. There were four mortalities (20.8%) from the upper caudal marked group in the second treatment, average length was 69.7 mm. The lower caudal marked group from the second treatment had a 100% survival rate, average length was 73.3 mm.

Results of the diving survey can be found in the appendix in a memo from William Somer, dated June 10, 1988.

The results of the electrofishing survey of the diversion pond are shown in Table 3. Salmonids were not captured when the pond was electrofished. Juvenile salmonids have been found in the pond behind the rock screen prior to this study. In a memo from Larry Preston to Pat O'Brien dated April 2, 1987, Larry states that he captured three young chinook salmon during an electrofishing survey of the diversion pond on March 9, 1987.

Table 3. Composition of Pond Behind Rock Screen

<u>Date</u>	<u>Species</u>	<u>Number</u>
Evening 5/11/88	BG	4 * Stomach contents of 169 BG = insect matter
	GSF	2 179 BG = empty
	LMB	2 * Stomach contents of 290 mm LMB = one SCP
	SMB	2
	SKR	2 * Stomach contents of 220 MM SKR = empty
	SCP	3

Table 3 (Continued)

Night			
5/13/88	BG	6	
	GSP	18	
	HH	3	
	LMB	8	* Stomach contents of LMB = crayfish
	SCP	1	
	SKR	17	
	SQ	3	* Stomach contents of SQ = empty
	Amocoete	1	

Night  
5/26/88

Same Species composition as above, did not determine numbers, sacrificed four LMB for stomach analysis

LMB(LN)	<u>Stomach content</u>
(MM)	
276	one crayfish 38 MM
280	nothing
387	parasitic round worms
356	two 13 mm centrarchids

The results of the electrofishing survey of the bypass canal after the 72-hour trapping period are shown in Table 4. Only seven marked fish were recaptured (four upper and three lower caudal marks). A total of 116 unmarked juvenile marked salmon were captured during the survey.

Table 4. Electrofishing Data From Bypass Canal

<u>Date</u>	Samplers: JH, KH, TF, DK			Boat: J. Hiscox		
	This was training session			Temp: 64.8°F		
5/23	<u>Salmonids</u>	<u>SKR</u>	<u>SQP</u>	<u>SCP</u>	<u>LP</u>	<u>HH</u>
	0	13	14	6	1	1
5/27 1st Pass	Samplers: KH, TF			Boat: J. Hiscox		
	Begin Time: 1010			End Time: 1100		
	<u>Salmonids</u>	<u>SKR</u>	<u>SQP</u>	<u>SCP</u>	<u>LP</u>	<u>GSF</u>
	NM=39	25	12	9	2	1
	UC=4					107 MM
	LC=3					
	V=1	* 48 MM to 190.5 MM				

Table 4 (Continued)

5/27 2nd Pass	Samplers: KH, TF Begin Time: 1230	Boat: J. Hiscox End Time: 1320				
	<u>Salmonids</u>	<u>SKR</u>	<u>SQF</u>	<u>SCP</u>	<u>LP</u>	<u>GSF</u>
	NM=77	54**	20*	11	0 178 MM	1

\* 47 MM to 248 MM

\*\* 52 MM to 158 MM

Bypass flows exceeded 10% of the diverted quantity of water during both treatment periods (Table 5).

Table 5. Discharge into SYBDC and Out of the Bypass Canal (BC)

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Flow in CFS</u>
May 11	1100	SYBDC	109
May 11	1325	BC	29
May 12	1320	SYBDC	110
May 12	1500	BC	31
May 23	1010	SYBDC	121
May 23	1230	BC	30

Memo from Sid Taylor regarding these results can be found in the appendix.

*Deborah Konhoff*

Deborah Konhoff  
Fishery Biologist

cc: Heidi Bradovich, SWRCB  
Rich Dehaven, USFWS  
South Yuba Water District  
Brophy Water District

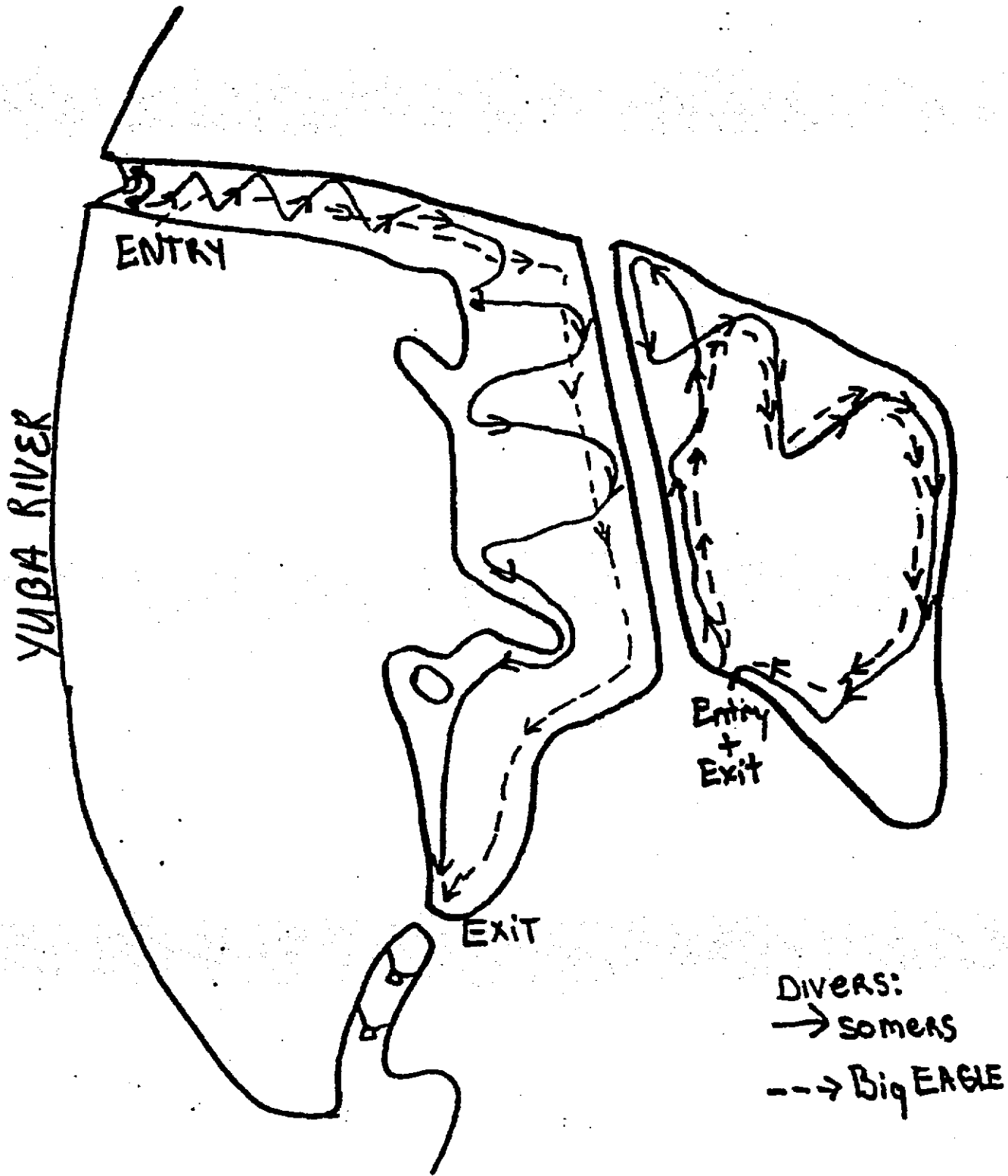


Figure 2. Map of diving plan.

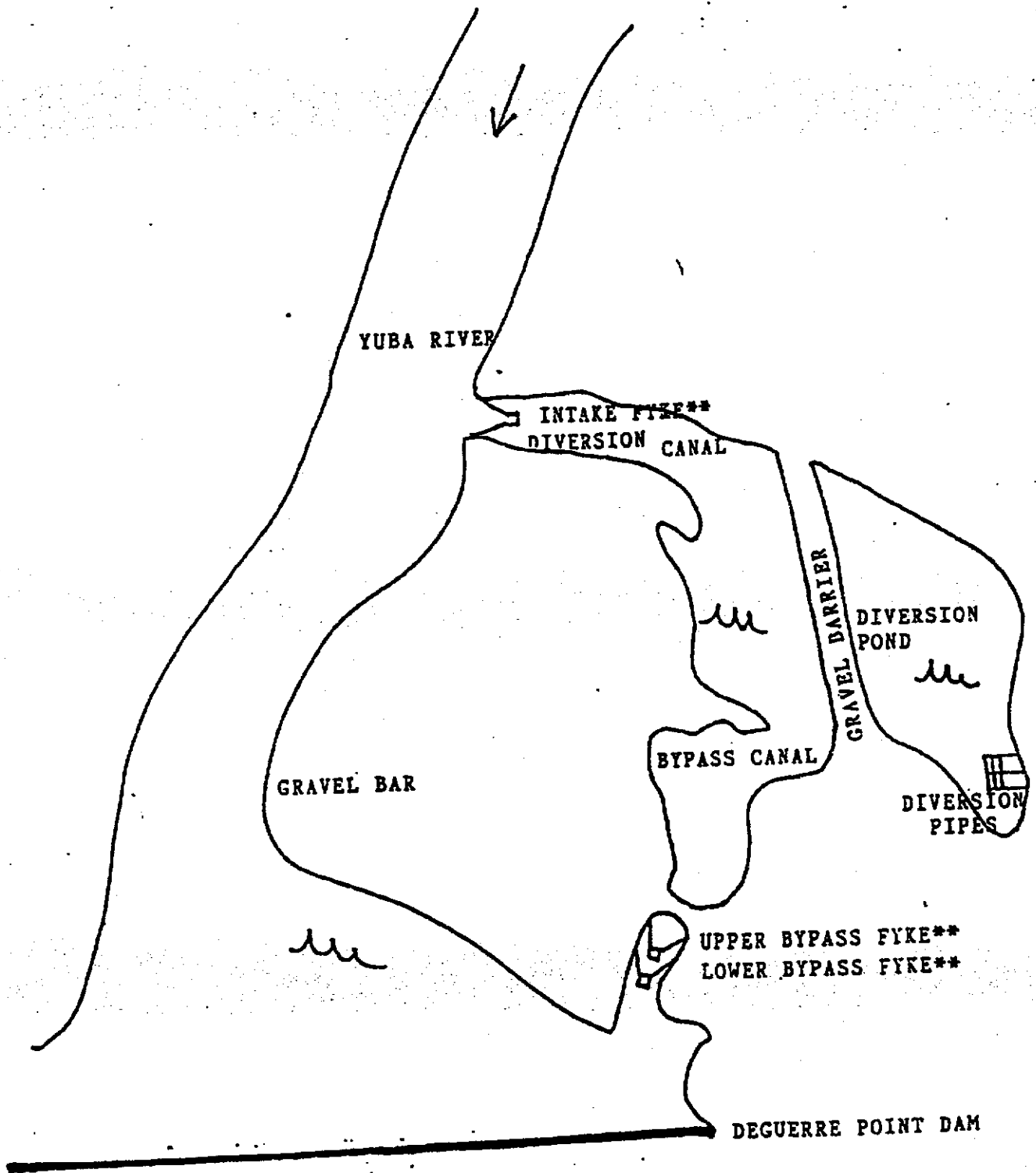


Figure 1. Map of south Yuba-Brophy Diversion Study.



# DIVERSION STUDY, MAY 11-15, 1988

## RECAPTURES VS TIME

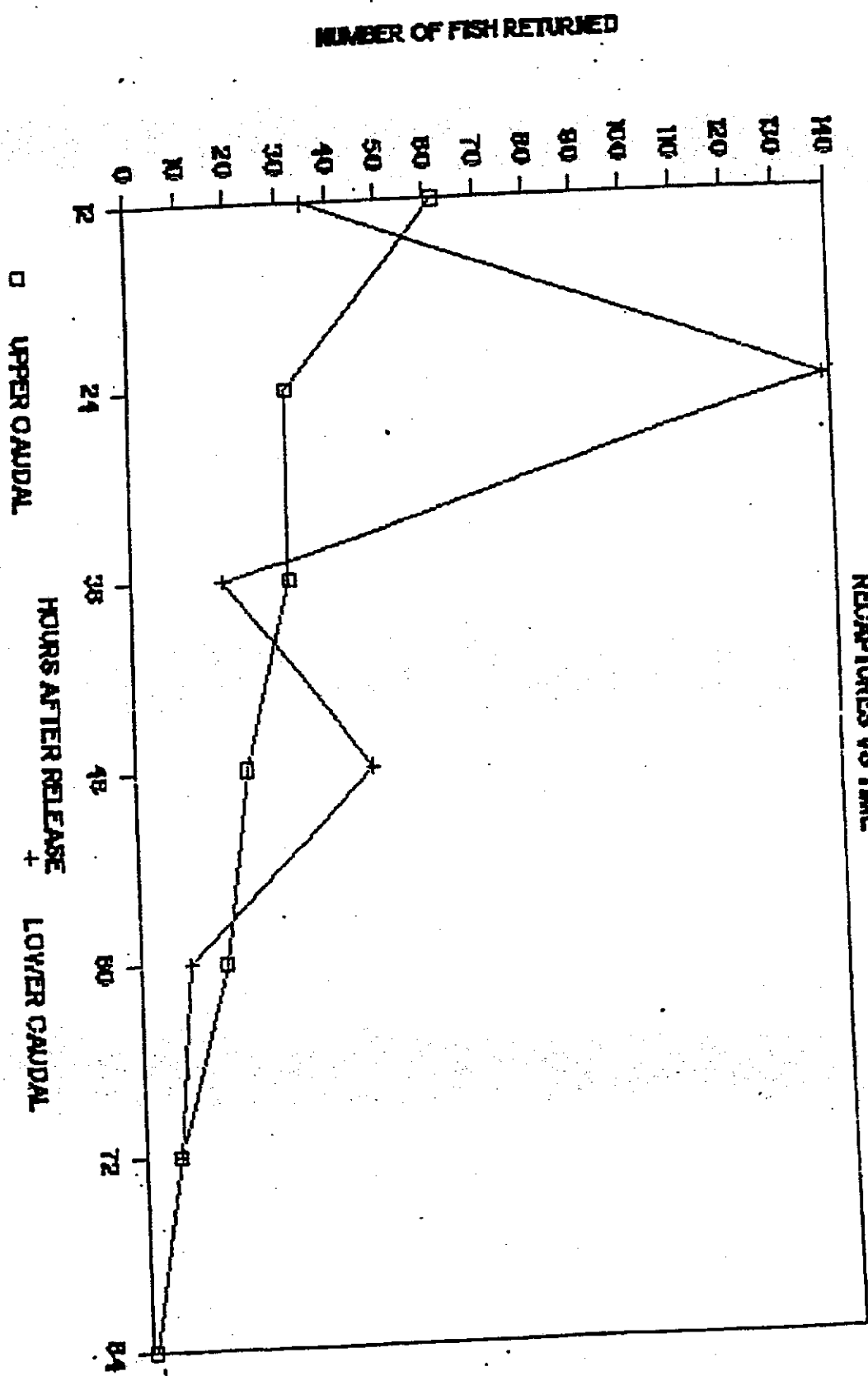


Figure 3. Recaptures vs Time, May 11-15, 1988.  
Attachment "8", page 9 of 10 pages

# YUBA-BROPHY STUDY, MAY 23-27, 1988

## RECAPTURES VS TIME

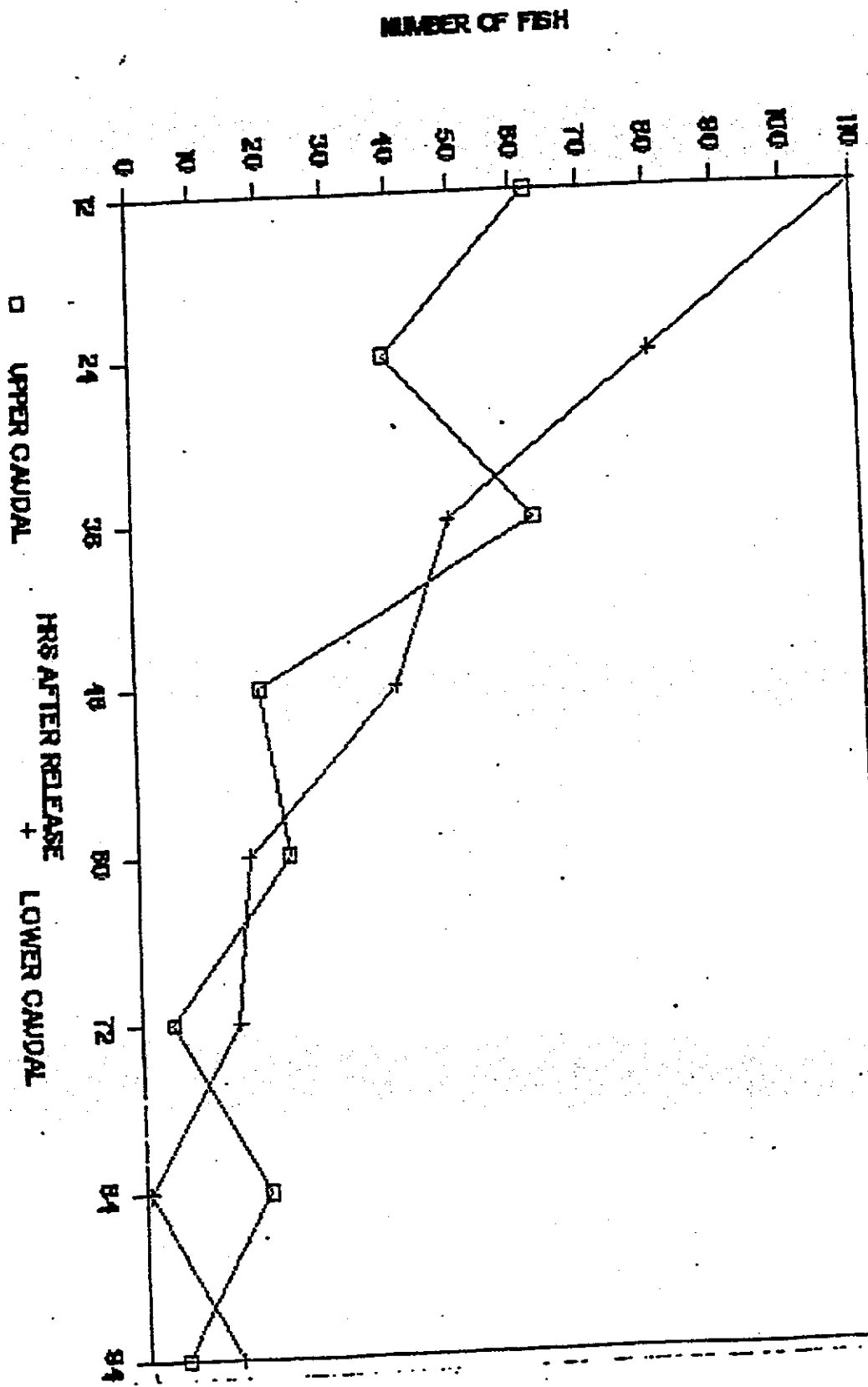


Figure 4 Attachment 6, page 10 of 10 pages  
 May 23-27, 1988.