EFFICIENCY TESTS OF THE PRIMARY LOUVER SYSTEM, TRACY FISH SCREEN 1966-1967

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SUMMARY

The louver-type fish screen at the U. S. Bureau of Reclamation's Tracy fish collection facility was developed by the U. S. Fish and Wildlife Service and the U. S. Bureau of Reclamation, and shortly after being put into operation in 1957, was tested by them to determine its efficiency at deflecting fish. This screen includes a large primary louver system and a much smaller secondary louver system. Test results of the primary louvers in 1957 were inconclusive, but in 1958 and 1959 the efficiency of the secondary louver system was determined to be at least 90 percent, meaning that 90 percent or more of the fish which encountered this system were diverted in the manner desired, and 10 percent or less went through the screen and into the canal. The same figure was assumed to represent the efficiency of the primary system. The validity of this assumption was open to doubt because (1) the secondary louver system includes a double wall of louvers and the primary system is single-walled, and (2) because the fish which are too small to louver or are non-louverable for any other reason are never exposed to the secondary louver system.

In 1966, the California Department of Fish and Game tested the primary louver system by fishing two identical fyke nets, one above and one below the louvers, and comparing their catches. Similar comparisons were also made of the catches from two identical plankton nets which took fish too small to be caught in the fyke nets. These tests involved striped bass (Roccus saxatilis) and several other species but only very small numbers of king salmon (Oncorhynchus tshawytscha).

Fyke nets are quite inefficient gear when used under conditions existing at the Tracy screen, and their efficiency varies with the size of the fish. The very smallest fish are able to go through the webbing and a high proportion do. The nets are most efficient when the fish are just too large to escape through the fine webbing in the lower part of the net. Still larger fish are better able to avoid the nets or to swim upstream and out of them. This means that fyke-net catches do not give a measure of the absolute numbers of fish approaching or going through the louvers, but a comparison of the numbers of any size class taken in the nets above and below the louvers will measure the louver efficiency for that size class. Where the upstream net is above the louvers and the downstream net below them, the formula used to calculate efficiency is:

$$\text{Efficiency} = 1 - \frac{\text{Catch of downstream net}}{\text{Catch of upstream net}}$$

There were two objections to the 1966 tests:

1. They included too few salmon to permit any estimation of louver efficiency on this species.

1/ Marine Resources Administrative Report No. 68-7 (October 1968).

2. The method used included simultaneously fishing two nets, one above the louvers, the other directly downstream from it and below the louvers. If the upper net caught fish that would otherwise have entered the lower net, this would have increased the apparent efficiency of the louver system.

To overcome these objections, the experiment was repeated in 1967. Part of the 1967 tests were made quite early to assure a catch of salmon. The 1966 method was used. It was a wet year, pumping was light, and there had been a poor salmon run in the San Joaquin River System. The number of salmon taken was quite small. Louver efficiency was calculated and an efficiency of 90 percent obtained. The numbers involved are too small to place any confidence in this figure but it does not seem unreasonable; it is a little below the figure obtained for striped bass of about the same size.

Later in 1967, the 1966 tests were repeated on striped bass and other species. To determine the effect of fishing one net directly upstream from the other, we fished the downstream net with and without a net upstream from it. When all species of fish were lumped together, there was no difference in the catches of the downstream net whether or not there was a net directly upstream from it. When striped bass alone were counted, there was a slight difference -- it was statistically significant but of no importance from a biological or engineering standpoint.

In 1966, louver efficiency on striped bass ranged from about 2 percent on fish 6 to 19 mm caught in the plankton net 2/ to almost 100 percent for bass of 70 mm fork-length and over. Near zero efficiency must be expected for fish too small to swim away from the louvers - they go where the water goes. For striped bass of 10 to 24 mm, the primary louver system was calculated to be 64.7 percent efficient in 1966 and 86.1 percent in 1967. We are at a loss to explain this difference but it does not appear to be related to water velocity or to size distribution within the size class. The next larger size class of bass also showed a difference between the two years: 82.6 percent in 1966 and 92.4 percent in 1967.

When 1966 and 1967 data are compared, calculations of louver efficiency at different water velocities showed nothing consistent over the range tested which was 1.6 to 3.9 feet per second in 1966 and 0.8 to 3.6 in 1967. These figures refer to the average velocity during the period when the nets were fishing. Higher and lower velocities were encountered too seldom to permit testing.

Another set of comparisons in 1966 showed louver efficiency on striped bass in daylight to be slightly greater than at night. This was not re-tested in 1967.

The louver system appears to be a satisfactory way of diverting striped bass more than 24 mm long if one encounter with one screen is all that is involved. Smaller bass are less efficiently diverted, and the very smallest sizes are almost totally lost. We do not know what proportion of these fish encounter the screen before they reach louverable size. The problems of American and Threadfin shad appear to be quite similar to those of striped bass. Salmon do not encounter this screen until they are of louverable size. Small white catfish seem to louver very poorly.

(Complete report available upon request.)

2/ Plankton net catches were so small that no real reliability can be placed on efficiencies calculated from them.

INTRODUCTION

When the Delta Mendota Canal was first being considered, it was realized that the fish problems created would be of unprecedented magnitude and complexity. Studies of the screening problems involved led to the development and construction of a louver-type screen. The U. S. Fish and Wildlife Service and the U. S. Bureau of Reclamation did the development work and are to be highly commended.

The screen system includes a primary louver system designed to divert fish into any of four bypasses. The bypasses, of necessity, carry so much water that a secondary louver system is used to get most of this water back into the canal and divert the fish into a collection chamber from which they are transferred to tank trucks and transported to a place where water currents will not take them back to the screen.

To be successfully screened and returned to live in the Delta or to migrate out of it, a fish must:

1. Be diverted by the primary louver system into one of the bypasses.

2. Be diverted by the secondary louver system into the collection system.

3. Survive crowded conditions in the collector -- often with large quantities of trash which also get bypassed.

4. Survive the truck ride.

5. Be released uninjured in a place where it has a good chance to escape predators and find an ecology suited to its needs.

The proportion surviving the entire experience is the product of the proportions surviving each of the individual experiences. The tests described in this paper give estimates of the proportion surviving the first of the five experiences -- the primary louvers. The secondary louver system was tested earlier (Bates, Logan and Pesonen, 1960). The other three problem areas were also tested earlier though the tests were too late in the year to include salmon.

A louver system consists primarily of a series of closely spaced vertical metal slats placed in a diagonal line across a canal. The assembly resembles a venetian blind with vertical instead of horizontal slats. The flat side of each slat is at right angles to the direction of flow, and the slat is long enough to reach from the bottom to above the surface (Figure 1). Most fish which encounter the line of louvers tend to swim parallel to it until they come to an opening. The four bypass openings in the primary louver system are each 6 inches wide and reach from surface to bottom. Fish which could go between the louver slats usually avoid them if they have the swimming strength and desire to do so. Very small fish lack the strength to keep clear and are swept through. Larger fish that have ample strength to avoid the louvers will sometimes go through them. Sometimes they dart through to avoid a predator, sometimes for no apparent reason.

In the spring of 1957, the louver-type fish screen and collecting system was put into operation at the U. S. Bureau of Reclamation's Tracy Pumping Plant. Between 1957 and 1959, the efficiency of the Tracy installation was tested jointly by the U. S. Bureau of Commercial Fisheries and the Bureau of Reclamation. Test results of the primary louver system in 1957 were inconclusive, but in 1958 and 1959 the efficiency of the smaller secondary

louver system was determined to be at least 90 percent, and the same figure was assumed to represent the efficiency of the primary system. The validity of this assumption was open to doubt because:

1. The secondary louver system includes a double wall of louvers and the primary system is single-walled.

2. The fish which are too small to louver or are non-louverable for any other reason are never exposed to the secondary louver system.

Before installing more screens of this type and size, it seemed essential to make a more conclusive evaluation of the primary louver system. To do this, the California Department of Fish and Game conducted a series of tests during June, July, and August 1966 and between March and August 1967. These tests were preliminary in nature, being designed to give a gross estimate of the effectiveness of the primary louver system.

This is a report on the two years of primary louver system testing by the California Department of Fish and Game. It is in two sections - one covering the 1966 tests and the other the 1967 tests. The 1966 section includes a description of the method used to determine primary louver efficiency. The 1967 section is concerned primarily with studies aimed at evaluating the validity of one of the principal test method assumptions but also includes sections which describe primary louver efficiency in 1967.

SPECIFICATIONS OF THE TRACY FISH COLLECTION FACILITY

The Tracy fish screen and fish collection facility is at the entrance to the Delta Mendota Canal, about 9 miles northwest of Tracy. Its purpose is to divert and collect fish that enter the canal with the water pumped by the Tracy Pumping Plant. The water goes through the screen and then flows through 2.5 miles of canal to the pumping plant which lifts it to a higher elevation. As previously mentioned, the screening facility consists of two louver systems and a fish collecting system. The primary louver system includes a single wall of louvers installed diagonally across the canal near its entrance. These louvers divert fish into bypass channels which lead them to the smaller double-walled secondary louver system. From there the fish are diverted into holding tanks, then loaded into tank trucks and hauled to release points in the Delta (Figure 2).

The dimensions of the larger parts of the screen system are as follows:

Channel capacity	- 4,600 cfs plus up to 400 cfs additional during incoming tides.
Spacing of trash rack bars	- 2 inch clear opening
Length of trash rack	- 108 feet
Channel width at primary louvers	- 84 feet
Maximum velocity of flow	- 5.3 feet per second
Alignment of louver system	- Angle of 15° to direction of flow
Alignment of louver slats	- Angle of 90° to direction of flow
Spacing of louver slats	- 1 inch clear opening
Length of primary louver system	- 320 feet
Height of primary louver system	- 25 feet
Number of bypasses	- four spaced 75 feet apart
Width of bypass openings	- 6 inches
Height of bypass openings	- 25 feet
Elevation of channel bottom	- 14 feet below sea level
Average water depth during tests	- 18 feet

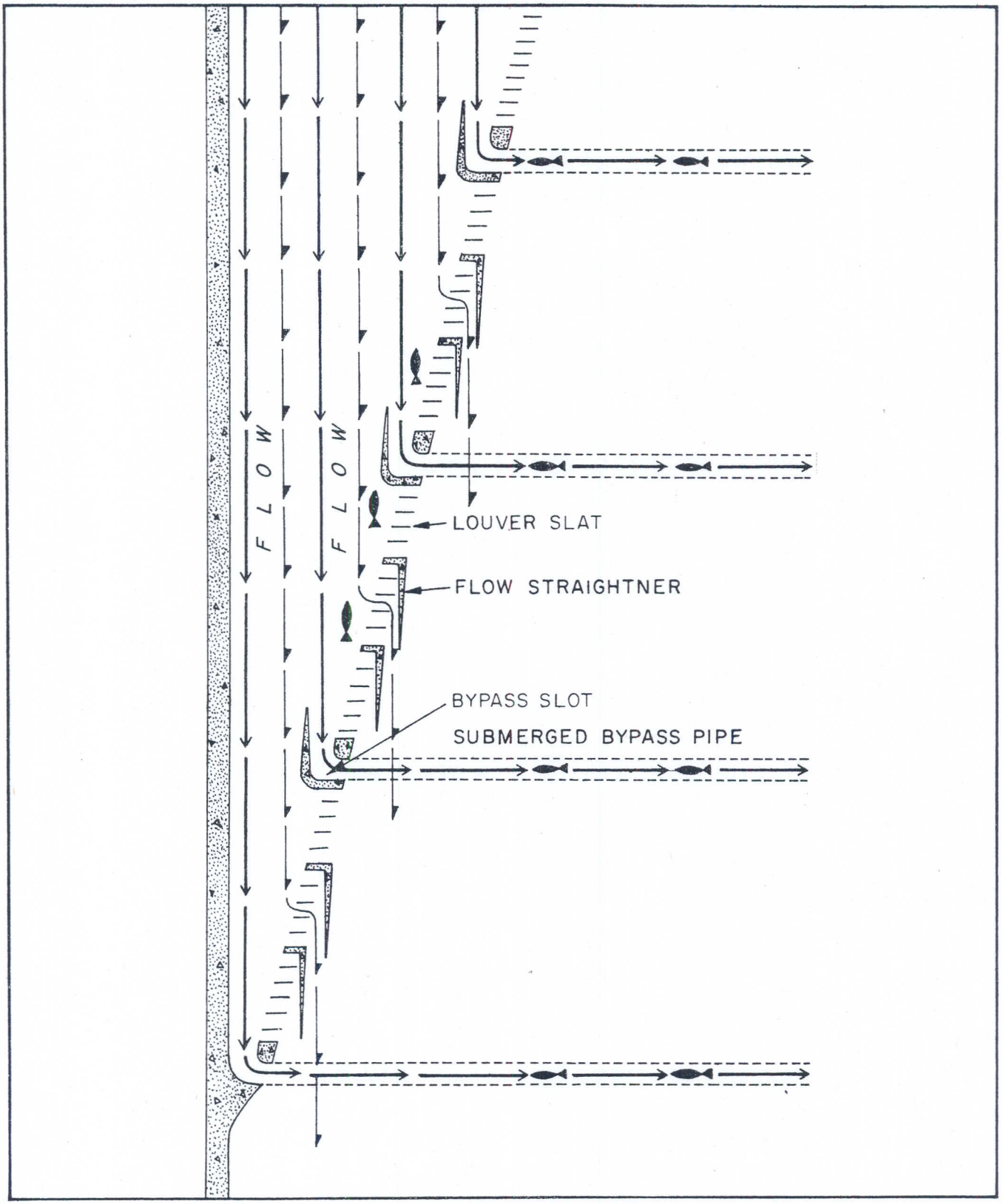

Figure 1. Diagram of a Louver System.

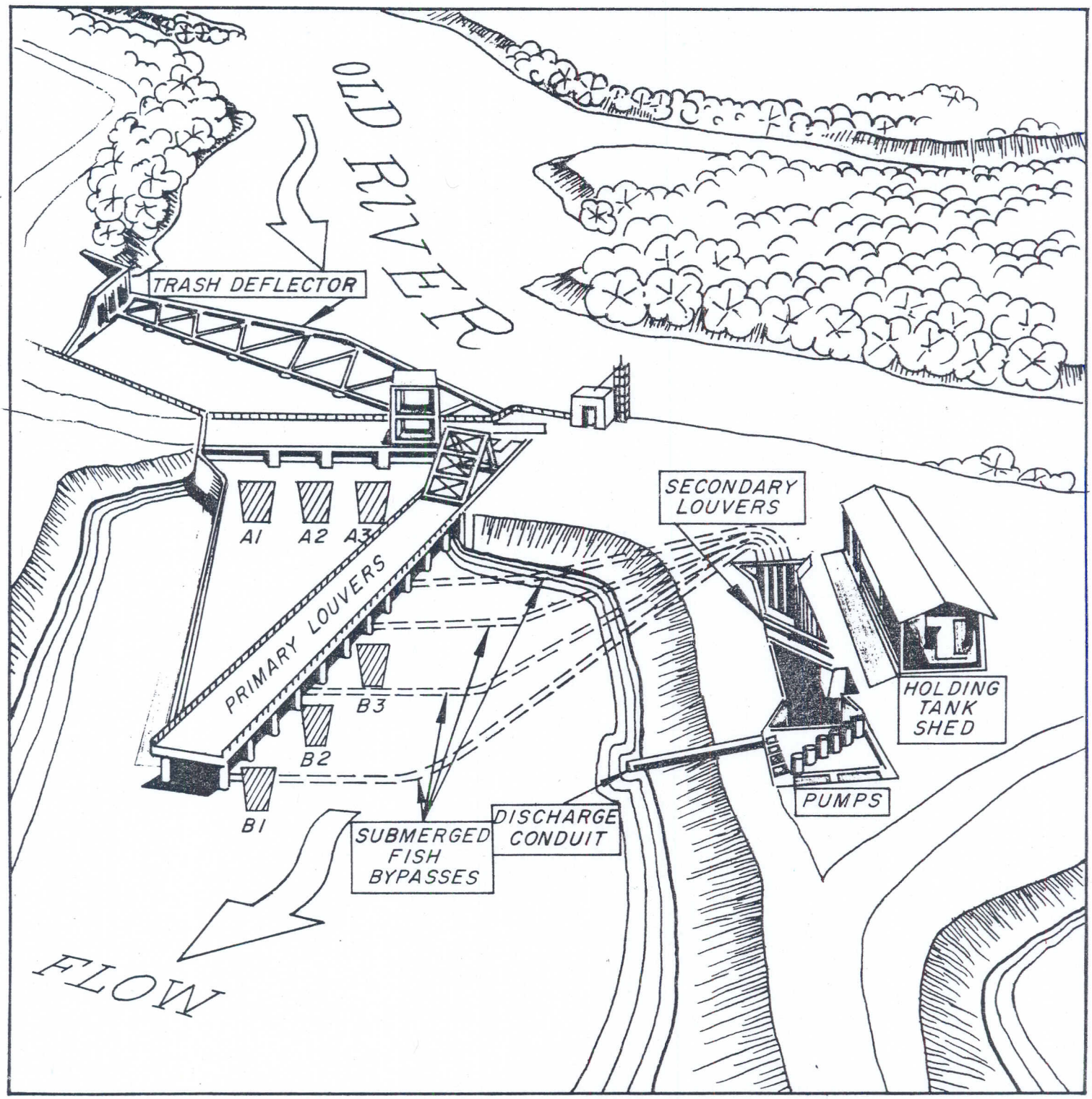

Figure 2. Fish Collection System at Entrance to Delta Mendota Canal. The six fyke-net fishing positions are at A1, A2, A3, B1, B2, and B3.

1966 TESTS

Purpose

The 1966 tests were conducted with one purpose in mind: to estimate the efficiency of the primary louvers on striped bass, salmon, and other species of fish.

Study Method

To determine the effectiveness of the primary louver system at Tracy, two identical fyke nets were fished simultaneously, one above and the other below the primary louver system. During each test period they were fished in line, one net being directly upstream from the other. The nets were fished at three sites above and three below the primary louvers and were spaced as nearly equidistant across the canal as practical. The upper fishing sites were between the trash rack and the primary louvers, and the lower sites just downstream from the primary louvers. The outer nets (A1 and A3) were about 7 feet from the center net (A2), while A1 was about 10-1/2 feet and A3 approximately 14-1/2 feet from the nearest canal wall. Theoretically, the outside nets should have fished more nearly equal distances from the canal walls; presumably their lateral displacement was due to cross currents. The distance between net positions A1 and B1 was about 335 feet.

Because the fyke nets were generally ineffective on fish smaller than one-half inch in length, two identical plankton nets were also fished in a manner similar to that used when fishing the fyke nets to determine the effectiveness of the louvers on larval fishes. The plankton nets were fished at a larger number of sites than the fyke nets. At first, each of the three fyke net fishing positions was divided into two plankton net sites (a and b, tests 1-33) and later in the testing (tests 34-110) the canal width was simply divided equally into five sites (1-5) (Appendix II).

The study method is based upon the premise that a comparison of net catches obtained under similar conditions above and below the primary louvers will reflect the louver efficiency for the size groups captured under the environmental conditions in effect during the test period.

The testing schedule was arranged so there would be no interference with the normal operation and maintenance of the Tracy fish screen and fish collection system. On Mondays, Wednesdays, and Fridays, the testing was limited to afternoon and night testing. On Tuesdays and Thursdays, either day or night tests (or both) were conducted.

Fyke Net Efficiency

Fyke nets are relatively inefficient gear except for certain sizes of fish and certain flow conditions. Most of the very smallest fish pass through the webbing. Some small fish are guided by the wall of netting and end up in the live box even though they could have gone out of the net almost anyplace in its entire length. Somewhat larger fish are guided in the same way but more efficiently; i.e., fewer escape through the webbing; some may be unable to go through the half-inch webbing unless it is hanging so that the meshes are square or nearly so. Fish which are just too large to pass through half-inch webbing are taken with the greatest efficiency. Larger fish are better able to swim against the current and out of the net, or to avoid entering the net at all. The stronger the current, the more difficult it is for a fish to swim out of

the net. Variation of net efficiency with fish size should not affect the tests of louver efficiency for a given size of fish provided the nets used above and below the louvers are identical and are fished identically. However, anything less than 100 percent net efficiency must result in an underestimate of the losses of fish which are too small to be caught in the net, too small to louver, and which pass down the canal almost completely unnoticed. The plankton net gives only a bare hint of the presence of this group of fish.

Description of Fyke Nets

Net Frames

To insure uniform upstream openings in both fyke nets when fishing, the front corners of each net were attached to identical, rectangular-shaped metal frames. The frames measured 14-1/2 feet across the top and bottom and 8-1/2 feet on the sides. They were constructed of 1-1/4 inch square steel tubing. Fyke nets were fastened to the back or downstream face of the frames, at the four corners, with safety hooks. Two net-fishing bridles of one-fourth inch diameter steel cable were connected to the front or upstream face of the frames, one on each side at the top and bottom corners (Figure 3). Blocks of styrofoam, fastened along the top, floated the top of the frame at the water surface when the net was fishing.

A net-pulling bridle, also on one-fourth inch diameter steel cable, was fastened to the top of each frame, at the corners and center. The net-pulling bridles were in turn connected to one-fourth inch diameter steel cables running from power winches mounted on motor vehicles. When moving from one fishing site to another, the nets were in a collapsed position and nearly flat at the water surface, since the strain was then on the top of the net frames (net-pulling bridles) rather than on the four corners of the frames with the net open (net-fishing bridles).

Net Construction

The two fyke nets were made of nylon webbing; they were elongated funnels, had rectangular front openings 8-1/2 feet high and 14-1/2 feet wide, then tapered to 12-inch square openings at the cod end, or end where the live box was attached (Figure 4). Each net was 47 feet long and was constructed of four different mesh sizes. The front 10 feet was made of 3-inch webbing (stretched mesh) followed by 15 feet of 2-inch, 12 feet of 1-inch, and 10 feet of one-half inch stretched mesh [3/], which was attached to the live box. Nylon rope rib lines, with a metal thimble-reinforced loop on the end, extended 12 inches from each corner of the net's front opening. The nets were attached to the steel net frames by snapping these loops into safety hooks on the frames.

Live Boxes

The two live boxes used in 1966 were not identical but were approximately the same size. One box was 37 inches long and the other 27-1/2 inches. The longer box was 18 inches square and the shorter one 24 inches square in cross-section. In 1967, all live boxes were the same size (37" x 18" x 8").

Removable nylon bobbinet (#281 Merion Textile) liners or bags were attached inside the boxes to facilitate removing fish. Each bag had a funnel at the entrance to discourage fish from swimming out.

3/ Stretched mesh measurement is the length of a mesh opening when pulled to its longest -- it is twice the distance from one knot to the next.

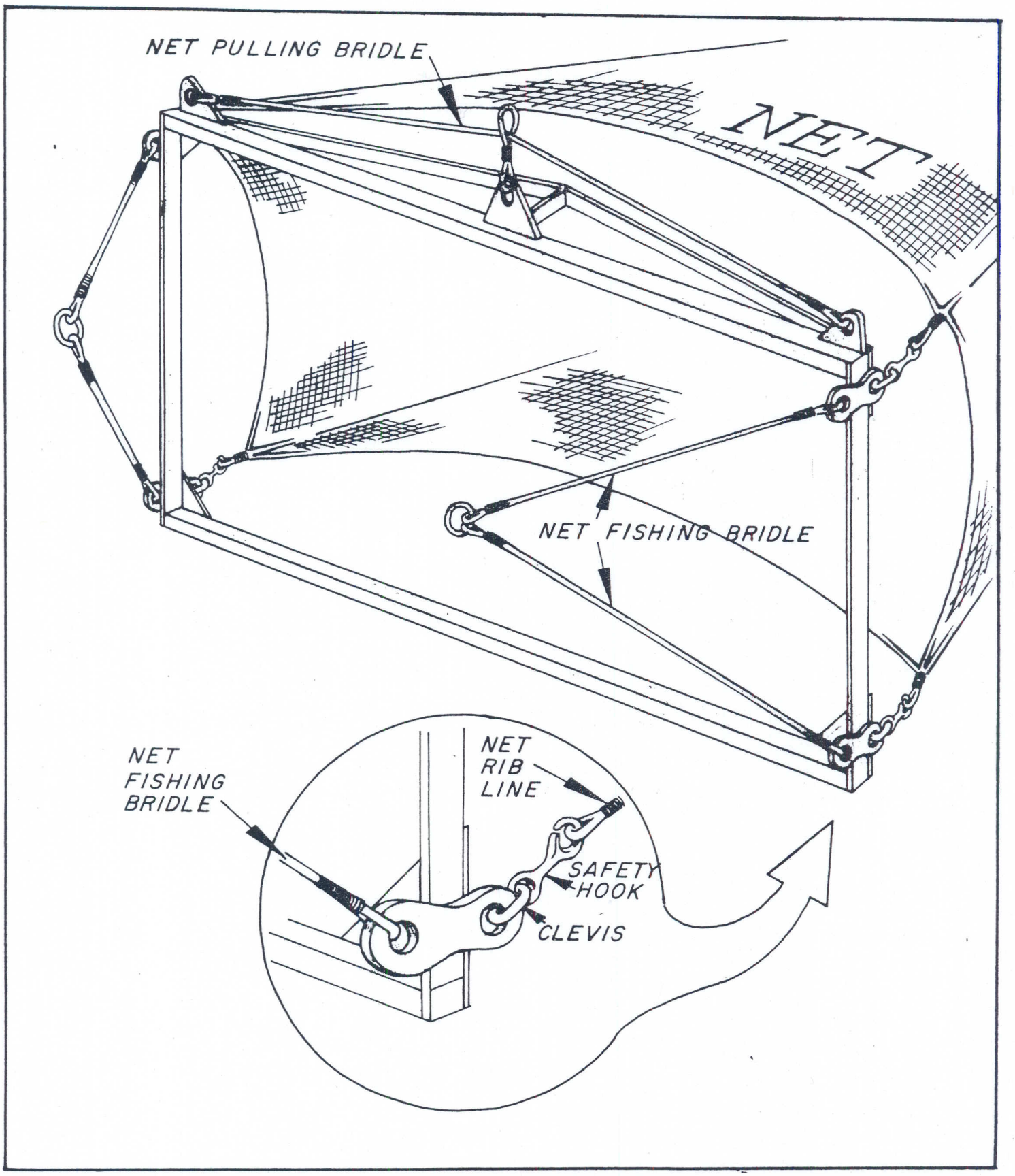

Figure 3. Fyke net frame, bridles, and front of net.

Net Operation

The nets were usually operated each day, or night, through a series of three tests, each test generally being 1-1/2 hours in length but sometimes only one hour. The three net-fishing sites above and three below the louvers were selected nearly equidistant across the louver system's width (Figure 2). Each net fished at the surface and thus strained approximately the top half of water flowing into the canal.

The net fishing procedure was to put the nets in the water above and below the louver system with one net directly upstream from the other, then attach live boxes to each net at the same time, coordinated by using arm signals or two-way radios. At the completion of each test period, the live boxes were also removed from each net at the same time and the catch taken from the live box for counting by removing the bobbinet liner.

While part of the test personnel counted, measured, and recorded the catch, the rest of the crew moved both nets to the next fishing sites and attached the live boxes again. The complete operation of removing the live boxes, moving both nets to the next site, and attaching the live boxes again usually took less than 20 minutes. The length of time required to measure a sample of and count the catch varied with the number of fish caught but never took over one hour.

When the nets were moved from one fishing site to another, a power winch was used, the cable being hooked to the net-pulling bridle on top of the front-opening frame (Figure 5). Pulling on the top bridle collapsed the net and made handling much easier. For handling the net upstream from the louvers, a winch was mounted on a half-ton pickup truck. An "I" beam boom was also constructed and mounted across the back of the truck bed to reach out over the water with the cable when moving the net. This equipment was used to put the net in the water and to remove it. For the net below the louvers, a winch mounted on the front of a jeep furnished power to move the net, but when it was necessary to lift the net out of water, the job was done by hand.

Plankton Nets

Net Construction

Larval fishes and some eggs were collected in cone-shaped plankton nets, 18 inches in diameter at the mouth and 40 inches long (Appendix II). The netting was 20-mesh-per-inch nylon. The catch was collected in a small metal bucket, having several open areas covered with stainless steel screen, 24 meshes to the inch. These nets did not give a good picture of the numbers of small fish present because the netting became clogged with debris after 5 or 10 minutes of fishing.

Primary Louver Efficiency on Striped Bass in 1966

Calculation of Efficiency

In estimating the effectiveness of the primary louver system, it was assumed that the fyke nets fished with equal efficiency above and below the louvers; that the trash rack and primary louvers as well as any difference in velocity above or below these structures did not cause unequal catch opportunity by altering the migration pattern; and that fish entering the canal through the trash rack were either bypassed by the primary louver system into the secondary louver system or moved through the primary louvers.

The other principal assumption made when using this method is that if two nets are fished at the same time, one above the louvers and the other in a direct line below the louvers, the upper net - either by its catches or presence - will not significantly affect catches in the lower net. With these assumptions and for the sizes of fish captured, the efficiency of the primary louver system can be expressed with the following equation modified from Bates, Logan, and Pesonen:

$$E = 1 - \frac{B}{A} \qquad (1)$$

where E = Efficiency, or proportion of fish bypassed by the primary louver system into the secondary louver system.

A = Catch above the primary louver system.

B = Catch below the primary louver system.

During the testing period June 21 through August 18, 1966, a total of 121 comparative tests was completed in which 64,885 striped bass were captured - 53,029 above the primary louver system and 11,856 below (Appendix I).

Efficiency by Size Group

We determined the efficiency of the primary louver for five size groups of striped bass. The number of stripers in each size class in each net haul was determined from its measured sub-sample. The numbers taken above and below the screen were then compared (Table 1).

TABLE 1

Primary Louver Efficiency on Striped Bass
1966 Tests

	Range fork-length (mm)	Above Louver (A)		Below Louver (B)		Percent efficiency
		Number measured	Calculated number caught	Number measured	Calculated number caught	
Plankton net catches	6- 19	60	60.0	59	59.0	1.67
Fyke-net catches	10- 24	1,184	17,881.4	1,812	6,317.1	64.67
	25- 39	3,892	26,787.3	1,719	4,660.4	82.60
	40- 54	1,549	5,388.9	241	418.5	92.23
	55- 69	188	375.8	5	6.4	98.30
	70-300	141	380.0	2	1.0	99.74

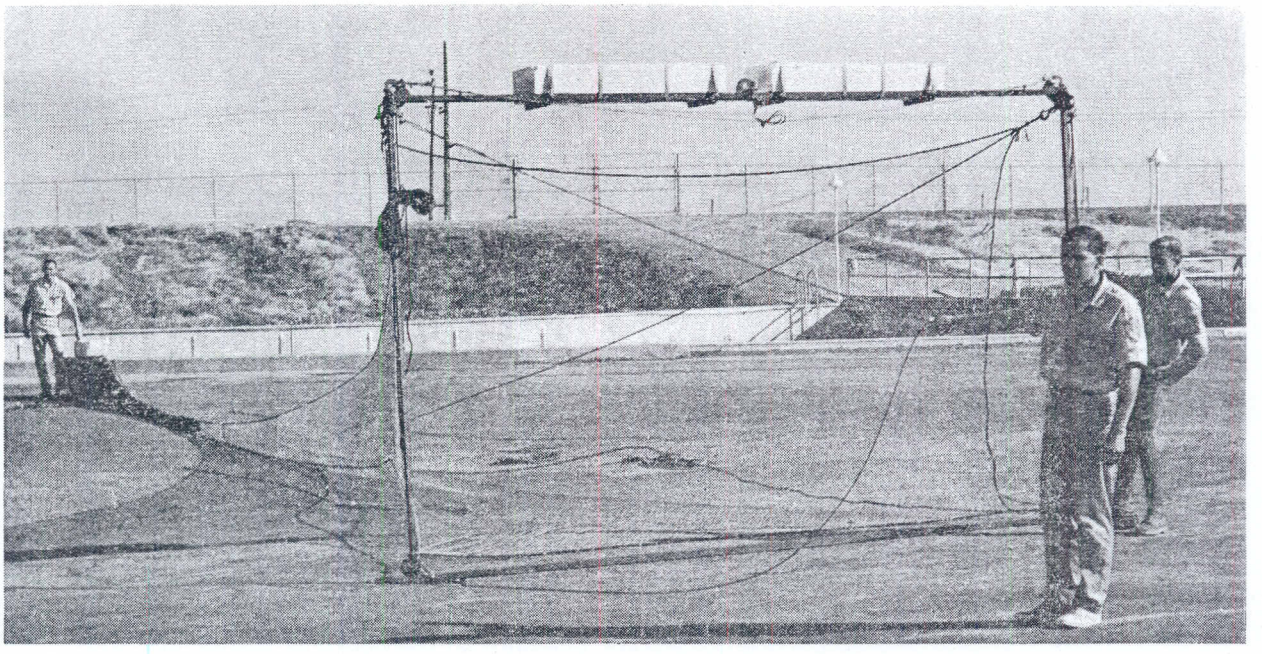

Figure 4. Fyke net and frame. Note styrofoam blocks at top and live box at far end of net.

Figure 5. Fyke net in canal just upstream from primary louvers. Net is being pulled ashore by cable attached to net-pulling bridle.

Louver efficiency for striped bass taken in the fyke nets varied directly with the size of the fish at all velocities tested. While the louver efficiency was only about 65 percent on striped bass averaging 20 mm fork-length, it was nearly 100 percent on fish averaging 120 mm fork-length.

Therefore, when striped bass average between 16 mm and 120 mm in length, a higher proportion of the larger ones are deflected by the primary louver system into the secondary system. Conversely, a higher proportion of the smaller ones pass through the primary louvers into the canal.

We conducted 100 plankton net tests, most of which were one hour in duration. During these tests, 119 striped bass under 20 mm fork-length were taken; they ranged from 6 to 19 mm and averaged 16 mm in length; 60 were taken above the primary louver and 59 below (Appendix II). This would indicate a louver efficiency of less than 2 percent for striped bass of this size.

The numbers captured in the plankton nets are too small to place any real reliability in the efficiency calculated from them. However, the results do indicate the possibility of a sharp decrease in louver efficiency for striped bass averaging less than 20 mm in length, and also the possibility that losses of these small fish through the louvers may be very high during periods when they are abundant in the river.

Effect of Water Velocity on Louver Efficiency

Water velocities in front of the primary louver system during the entire test period ranged from 1.6 to 4.4 feet per second. Comparisons were made to determine the effect, if any, of water velocity on louver efficiency at velocities between 1.6 and 3.9 feet per second. Comparisons at velocities over 3.9 feet per second were precluded by the shortage of tests at these higher velocities and the small numbers of fish handled.

The effect of water velocity on louver effectiveness was determined by dividing the velocities encountered into five ranges and then computing the louver efficiency for each velocity range for four sizes of striped bass.

Although the 1966 results (Table 2) appear to indicate higher efficiencies at lower velocities, it must be noted that the results on the smallest fish are inconsistent and that the 1967 results (to be described later) are so different that no dependence can be placed on a relationship between velocity and efficiency.

Day vs. Night

During preliminary studies to develop the louver screen, it had been observed that at night fish screen deflection efficiencies were generally higher than during daylight. Tests at Tracy in 1958 also showed slightly greater efficiencies at night for 1.5 to 3-inch striped bass when the velocity was less than 2.5 feet per second (Bates, Logan, and Pesonen 1960).

The present tests on striped bass appear to show the reverse; i.e., slightly higher efficiency during daylight hours (Table 3). However, only 21 of the 121 tests were night tests, and the results are thought to be inconclusive.

TABLE 2

Effect of Water Velocity on Primary Louver Efficiency
Striped Bass, 1966 Tests

Size range of striped bass (fork-length)	Velocity range (f.p.s.)	Above Louver (A) calculated number caught	Below Louver (B) calculated number caught	Percent efficiency
10-24 mm	Under 2.2	7,457.6	1,394.5	81.30
	2.2 - 2.4	1,296.1	655.1	49.46
	2.5 - 2.9	2,865.2	1,066.7	62.77
	3.0 - 3.4	4,402.3	2,462.8	44.06
	3.5 - 3.9	1,859.2	738.0	60.31
25-39 mm	Under 2.2	2,241.2	116.8	94.79
	2.2 - 2.4	2,455.3	349.8	85.75
	2.5 - 2.9	5,011.3	819.4	83.65
	3.0 - 3.4	10,643.4	1,772.6	83.35
	3.5 - 3.9	6,247.6	1,585.2	74.63
40-54 mm	Under 2.2	144.7	2.7	98.13
	2.2 - 2.4	635.9	19.8	96.89
	2.5 - 2.9	1,898.7	78.9	95.84
	3.0 - 3.4	1,688.3	154.3	90.86
	3.5 - 3.9	998.3	162.8	83.69
55-69 mm	Under 2.2	0.0	0.0	-
	2.2 - 2.4	49.5	1.0	97.98
	2.5 - 2.9	188.3	1.0	99.47
	3.0 - 3.4	110.7	2.4	96.83
	3.5 - 3.9	21.3	1.0	95.31

TABLE 3

Efficiency of Primary Louvers during Daylight and Darkness.
Striped Bass, 1966 Tests *

	Size range of striped bass (fork-length)	Above Louver (A) calculated number caught	Below Louver (B) calculated number caught	Percent efficiency
DAY	10-24 mm	16,178.3	5,513.1	65.92
	25-39 mm	21,979.4	3,496.0	84.09
	40-54 mm	3,770.3	246.4	93.46
	55-69 mm	184.6	4.0	97.83
	70-300 mm	108.9	1.0	99.08
NIGHT	10-24 mm	1,703.1	804.0	52.79
	25-39 mm	4,807.9	1,164.4	75.78
	40-54 mm	1,618.6	172.1	89.37
	55-69 mm	191.2	2.4	98.74
	70-300 mm	271.1	0.0	100.00

* These tests were not repeated in 1967.

Striped Bass Loss through Primary Louvers due to Cleaning

The efficiency of the primary louver system for a given size group was somewhat less than the calculated percentage since there were periods each week when the louvers were raised for cleaning and fish of all sizes were free to move into the canal. The screen is in four sections of nine panels each. At the downstream end of each of these there is a bypass. Whenever a panel is removed, it seems probable that any fish in the area would use that opening instead of the much smaller bypass opening; therefore, whenever a panel is open it would be logical to assume that one entire section (one-fourth of the screen) is ineffective. The primary louver system was cleaned on Mondays, Wednesdays, and Fridays. To do this, each of the 36 louver sections was lifted separately. The cleaning cycle requires about 1.7 minutes at 32 of the 36 louver sections, and 4.7 minutes at each of the remaining four sections which are the ones nearest the bypasses and require additional cleaning. As a result of this cleaning procedure, there is an opening in the primary louver system equivalent to the area screened by one louver section for a period of 74 minutes each cleaning day, or 222 minutes per week. Using the assumptions given above, this would be the equivalent of one-fourth of the screen being open 222 minutes or the entire screen being open 55.5 minutes out of the 10,080 minutes in a week. This is roughly one-half of one percent of the time and does not seem serious.

Primary Louver Efficiency on Species other than Striped Bass

The principal species captured, other than striped bass, were American shad, Alosa sapidissima, Threadfin shad, Dorosoma pretenense, white catfish, Ictalurus catus, and king salmon, Oncorhynchus tshawytscha. The efficiency of the primary louver system in deflecting different sizes of these species of fish could not be determined because of the small numbers handled.

King Salmon

Only 22 king salmon were captured during the 1966 tests, 19 above the louvers and three below. These fish averaged 83 mm in fork-length and ranged between 70 mm and 100 mm fork-length. The tests were made too late in the year to intercept any appreciable part of the downstream salmon migration.

American Shad

A total of 1,224 American shad was captured - 1,122 above the louvers and 102 below. These were all fish of the year. Fish length data gathered were inadequate to compute efficiencies by size group but overall efficiency for the sizes encountered was 91 percent.

Threadfin Shad

A total of 160 threadfin shad was captured during the tests - 144 above the louvers and 16 below. These were principally fish of the year but included many adults. Fish length data gathered were inadequate to compute efficiencies by size group but overall efficiency for all sizes captured was 89 percent.

White Catfish

About 90 percent of the catfish captured were fish of the year, being between one-half and 1- inch in length with the remainder being in the 4- to 12-inch

size range. Again, fish length data are insufficient to compute means for the two principal size groups. A total of 1,343 catfish was captured; however, the general pattern was reversed since more were captured below the louver than above (470 above the louvers and 873 below). This gives an efficiency of less than zero, an obvious impossibility. No reason for this reversal in numbers is known but it was caused by catfish in the one-half to 1-inch size group. The larger catfish were caught almost entirely in the net fishing above the louvers, indicating a high efficiency for the larger fish. It is possible that the small catfish were moving close to the bottom or close to the bank and swam close to the louvers far enough to bring them in front of a net, then slipped between the louvers and were caught. Whatever the reason for this apparent "negative efficiency", it seems that losses of white catfish are probably severe.

1967 TESTS ON KING SALMON, MARCH THROUGH JUNE

Purpose

The primary purpose of the testing in early 1967 was to determine the efficiency of the primary louver system on king salmon fingerlings. Insufficient numbers of salmon had been captured for this purpose in 1966. Testing commenced early in the spring of 1967 to include the major period of fingerling salmon migration.

Primary Louver Efficiency on King Salmon

Seventy-four comparative tests were conducted between March 9 and June 28, 1967 to determine the efficiency of the primary louvers on fingerling king salmon (Appendix III). Only 197 salmon fingerlings were captured during the entire period - 179 above the louvers and 18 below. This is far too few to permit making a reliable estimate of louver efficiency, but the calculated efficiency (90 percent) is reasonable. It is slightly below the figure for striped bass of similar sizes.

The salmon caught in net A in these tests averaged 91 mm in fork-length, with a range of 46 mm to 162 mm.

The small numbers of salmon captured during the test period do not necessarily reflect abundance of the outmigration since the Tracy pumping schedule was very light and runoff from salmon spawning streams to the sea relatively high during the spring of 1967. Estimated numbers of salmon fingerlings deflected by the two louver systems into the collection tanks at Tracy in the spring of 1967 were smaller than any year since 1963.

1967 TESTS, JULY AND AUGUST

Purpose

In 1967, the young striped bass did not appear until July, about one month later than in 1966. After their arrival, testing was started and continued into August to measure primary louver efficiency for striped bass and to check the validity of one of the assumptions upon which the efficiency evaluation method in 1966 and 1967 is based; i.e., that a net fishing above the louvers does not have a significant effect on catches in a net fishing at the same time in a direct line below the louvers. If this was not a valid assumption, it was essential to measure the effect so adjustments could be made in the efficiency calculations.

Study Method

In the period July 12 to August 17, 1967 we made 64 individual tests (Appendix IV). Each of these tests included a time period when two identical fyke nets were fished with one above the louvers and the other directly downstream from it below the louvers. In addition, the lower net was also fished for an equal and adjacent period of time with no net upstream from it. Fishing the two nets simultaneously with one upstream from the other was the same procedure used in 1966 and in the spring of 1967. Fishing with the upper net removed served as a check on the validity of the method.

Plankton nets were not used in the 1967 tests.

The six test positions used in the 1966 louver efficiency studies were also used in the 1967 tests. A comparison between catches in the lower net with and without a net fishing above should reflect the mean effect of the upper net on lower net catches if the sample is large or random (or both). This method assumes a fairly consistent but not necessarily identical rate of migration past the netting site during the two adjacent periods of time. It also requires that the two parts of each test be conducted under nearly identical environmental conditions such as tidal stages, water velocity, and daylight or darkness.

In the descriptions and formulas given below, "A" refers to a net above the louvers, "B+" to a net below the louvers when "A" is fishing directly above, and "B-" to a net below the louvers when no net is fishing above.

Comparisons between the B+ and B- catches in individual tests showed quite large differences. Chi-square analysis demonstrated that these differences were statistically significant. Presumably fish were going through in schools so that catches in one time period might be quite different from those in the period adjacent to it. However, even though there is variation among the individual samples, the total sample is thought to be accurate since it was large and complete with respect to environmental conditions and size of fish.

Comparison of Catches below the Louvers

All Species Combined

During the test period, a total of 23,820 fish of several species was taken: 20,068 in A, 1,873 in B+ and 1,879 in B- (Appendix IV).

Comparing the B+ and B- catches (1,873 and 1,879) indicates that for all practical purposes the presence of net A had no effect on the catch of net B. Almost exactly half of the fish caught below the louvers were taken with and half without a net fishing directly upstream. Stated mathematically:

$$P = \frac{\Sigma B+}{(\Sigma B+) + (\Sigma B-)}$$

$$= \frac{1,873}{1,873 + 1,879}$$

$$= .4992$$

Using the method of Spiegel (1961), upper and lower confidence limits for P = .4992 were determined to be .5152 and .4832. In other words, P = .4992 is not significantly different from .500, and we cannot demonstrate any decrease in the catch of the lower net as a result of fishing a net directly upstream from it.

Striped Bass

Included in the 23,820 fish captured during the 64 comparative tests were 10,630 striped bass: 9,176 in A, 684 in B+ and 770 in B- (Appendix IV).

These results indicate that for striped bass alone, the upper net (A) has a slight depressing effect upon catches made in the net fishing directly below it (B+) since the total catch in B+ is smaller than the total catch in B-.

Stating these results mathematically, slightly less than one-half of the total striped bass captured below the louvers were caught with a net fishing directly above:

$$\frac{\Sigma\ B+}{(\Sigma\ B+) + (\Sigma\ B-)} = .4704$$

The difference between this value and .5000 is statistically significant at the 95 percent level, is not significant at the 99 percent level, and is of very little importance in terms of screen evaluation.

Confidence limits for the proportion $P = \frac{\Sigma\ B+}{(\Sigma\ B+) + (\Sigma\ B-)} = .4704$ were calculated and resulted in upper and lower 95 percent confidence limits of .4959 and .4449 respectively.

Primary Louver Efficiency on Striped Bass in 1967

Efficiency by Size Group

Size-group efficiencies were calculated by the same methods used in 1966. The calculated numbers of fish and efficiencies for each size group are shown (Table 4).

A comparison with efficiencies measured in 1966 (Table 1) shows some unexpectedly large differences, particularly in the small size groups. The 10-24 mm and 25-39 mm groups are 21 percent and 10 percent higher, respectively, in 1967 than in 1966. We have no explanation for this difference but we can say that it does not appear to be related to water velocity or to size distribution within the size classes.

Water Velocity

Water velocities approaching the primary louver system in July and August 1967 were generally less than during the same period in 1966; mean velocities during individual tests ranged from 0.8 to 3.6 feet per second (Appendix IV). In 1967 efficiency tests of size groups within velocity groups (Table 5) failed to show the higher efficiency at lower velocities that had been noted in 1966. The 1967 data by itself would indicate that there was no consistent relationship between velocity and louver efficiency within the range of velocities tested.

COMMENTS AND CONCLUSIONS

A louver system such as that of the Tracy pumping plant appears to be a satisfactory way to screen striped bass longer than 24 mm. It would be less satisfactory if additional pumping plants were so located that each surviving fish would be likely to encounter more than one screen while still small and relatively vulnerable.

TABLE 4

Primary Louver Efficiency on Striped Bass
1967 Tests

	Range fork-length (mm)	Above Louver (A)		Below Louver (B+)		Percent efficiency
		Number measured	Calculated number caught	Number measured	Calculated number caught	
Fyke-net	10- 24	156	796.8	106	110.8	86.09
	25- 39	866	4,890.0	324	372.8	92.38
	40- 54	557	2,732.0	173	182.4	93.32
	55- 69	80	374.3	17	17.0	95.46
	70-300	79	383.0	1	1.0	99.74

TABLE 5

Effect of Water Velocity on Primary Louver Efficiency
Striped Bass, 1967 Tests

Size range of striped bass (fork-length)	Velocity range (f.p.s.)	Above Louver (A) calculated number caught	Below Louver (B+) calculated number caught	Percent efficiency
10-24 mm	Under 2.2	31.1	7.0	77.59
	2.2 - 2.4	176.2	28.3	83.94
	2.5 - 2.9	314.4	47.5	84.89
	3.0 - 3.4	275.1	31.0	88.73
	3.5 - 3.9	0.0	0.0	-
25-39 mm	Under 2.2	106.0	11.0	89.62
	2.2 - 2.4	720.8	22.7	96.85
	2.5 - 2.9	1,989.8	95.9	95.18
	3.0 - 3.4	1,982.2	207.2	89.55
	3.5 - 3.9	91.2	26.0	71.50
40-54 mm	Under 2.2	122.0	6.0	95.08
	2.2 - 2.4	642.1	15.0	97.66
	2.5 - 2.9	651.1	47.6	92.69
	3.0 - 3.4	1,052.6	85.8	91.85
	3.5 - 3.9	116.5	17.0	85.41
55-69 mm	Under 2.2	17.7	1.0	94.35
	2.2 - 2.4	48.3	1.0	97.93
	2.5 - 2.9	122.2	6.0	95.09
	3.0 - 3.4	179.0	7.0	96.09
	3.5 - 3.9	0.0	1.0	-

Striped bass less than 24 mm long are not diverted as efficiently, and those much below 19 mm appear to be almost totally lost although the tests on the smallest sizes are not at all adequate. It must be kept in mind that every striped bass lives first as a free-floating egg, then hatches as a small larva about 6 mm long. In these stages and for some time thereafter, a bass receives no protection whatever from a louver screen. These experiments give no hint of the proportion of the young bass which will be exposed to the Tracy screen before they have reached louverable size, but without the peripheral canal or something similar, an additional large pumping plant in the same general area will increase net velocities through the delta and in all probability will increase the proportion of bass which reach the screen before they have reached louverable size.

The problems of American and threadfin shad seem to be quite similar to those of striped bass. All three have free-floating eggs and hatch as almost helpless larvae. The larger sizes seem to louver satisfactorily although we did not take enough shad of either species to permit meaningful calculations of louver efficiency by fish size. It should be added that the 1957-59 tests showed that the total screening, bypassing, holding and transporting experience caused high mortality among American shad (Bates, Logan and Pesonen, 1960).

King salmon will be of louverable size before they are exposed to the Tracy screen. Our data on this species are not adequate, but it appears that losses at one louver-screened diversion will not be excessive. Working against the salmon are its relatively low reproductive potential (compared to striped bass) and migratory habits which will take it past a whole series of irrigation diversions before it gets to the Tracy Pumping Plant. Proper bypassing is of upmost importance with this species. The system used at Tracy presumably gets salmon to a place from which they are not at all likely to return to the screen, but there should be a test of the mortality due to holding and trucking.

Small white catfish (fish of the year) appear to be essentially non-louverable; losses of this species will be serious if a substantial part of the fish of the year are exposed to the screen.

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APPENDIXES

APPENDIX I

Fyke Net Fishing Test Data and Net Catches
Tracy Fish Screen Tests
June 21 - August 18, 1966

Date	Test number 1/	Net placement	Time Net in	Time Net out	Gage Height(ft.) Net in	Gage Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Smelt	Catfish	Salmon	Other
June 7	1	A3	1220	1620	4.6	2.3	1.8	2.5	3,004	-	1	35	2	2	1
" "	"	B3	"	"	"	"	"	"	655	-	-	2	-	-	-
June 9	2	A1	1045	1320	5.5	4.6	2.3	1.9	1,852	-	-	27	-	3	-
"	"	B1	"	"	"	"	"	"	161	-	-	3	-	-	-
June 9	3	A2	1430	1535	4.0	3.4	1.6	1.6	616	-	-	6	-	2	-
"	"	B2	"	"	"	"	"	"	46	-	-	-	-	-	-
June 14	4	A1	1000	1200	2.8	2.0	2.4	2.8	1,441	-	-	16	-	2	-
"	"	B1	"	"	"	"	"	"	238	-	-	-	-	2	-
June 14	5	A2	1320	1520	2.6	3.6	2.7	2.3	774	-	-	7	-	2	1
"	"	B2	"	"	"	"	"	"	215	-	-	-	-	-	-
June 16	6	A1	0930	1100	4.6	3.8	2.0	2.1	1,258	1	-	54	-	3	-
"	"	B1	"	"	"	"	"	"	19	-	-	1	-	-	-
June 16	7	A2	1150	1320	3.4	2.8	2.0	2.1	1,400	-	-	23	-	-	1
"	"	B2	"	"	"	"	"	"	41	-	-	-	-	-	-
June 16	8	A3	1400	1550	2.8	3.7	2.6	2.3	1,498	-	-	19	-	-	2
"	"	B3	"	"	"	"	"	"	104	-	-	-	-	-	-
June 21	9	A1	0935	1105	6.4	5.5	2.2	2.2	1,252	-	-	4	-	-	1
"	"	B1	"	"	"	"	"	"	293	-	-	3	-	-	-
June 21	10	A2	1205	1405	4.8	3.7	2.1	1.9	1,498	5	-	3	-	1	-
"	"	B2	"	"	"	"	"	"	525	-	-	2	-	-	-
June 22	11	A3	1630	1800	2.6	2.0	3.1	3.2	1,544	2	3	11	3	-	1
"	"	B3	"	"	"	"	"	"	545	-	-	1	-	-	-
June 27	15	A1	1550	1720	4.4	4.0	3.2	2.1	1,414	-	1	3	-	-	2
"	"	B1	"	"	"	"	"	"	204	-	-	-	-	-	-
June 28	16	A1	0900	1030	3.6	2.7	3.0	2.9	1,242	1	-	3	2	-	1
"	"	B1	"	"	"	"	"	"	151	-	-	-	-	-	-
June 28	17	A2	1100	1230	2.4	2.2	2.9	3.1	981	3	2	-	-	-	1
"	"	B2	"	"	"	"	"	"	104	-	-	-	-	-	-
June 28	18	A3	1300	1430	2.4	3.3	3.8	3.5	2,264	-	1	25	-	-	3
"	"	B3	"	"	"	"	"	"	821	-	-	1	-	-	-
June 28	19	A3	2100	2200	3.5	3.1	2.1	2.5	1,145	10	-	7	16	-	2
"	"	B3	"	"	"	"	"	"	353	1	-	-	35	-	-
June 30	20	A1	1030	1200	3.6	2.8	2.9	3.2	1,043	-	-	1	1	-	1
"	"	B1	"	"	"	"	"	"	821	-	-	-	-	-	-
June 30	21	A2	1245	1415	2.4	1.8	2.9	3.1	566	4	-	3	-	-	1
"	"	B2	"	"	"	"	"	"	295	-	-	4	-	-	-
June 30	22	A3	1445	1615	2.4	3.0	3.9	3.8	1,162	-	-	7	-	-	1
"	"	B3	"	"	"	"	"	"	635	-	-	2	-	-	-
July 5	23	A1	1430	1530	3.2	2.7	3.1	3.1	503	-	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	223	-	-	-	-	-	-
July 5	24	A2	1555	1655	2.4	2.0	3.2	3.2	446	1	-	-	-	-	1
"	"	B2	"	"	"	"	"	"	45	-	-	-	-	-	-
July 5	25	A3	1740	1840	1.9	2.5	3.8	3.7	508	2	-	1	3	-	-
"	"	B3	"	"	"	"	"	"	210	-	-	-	-	-	-
July 6	26	A1	1520	1620	2.9	2.4	3.0	3.1	750	2	-	-	-	-	1
"	"	B1	"	"	"	"	"	"	76	-	-	-	1	-	-
July 6	27	A2	1640	1740	2.2	1.9	2.9	3.0	575	8	4	4	2	-	-
"	"	B2	"	"	"	"	"	"	52	1	-	-	1	-	-

1/ Tests conducted June 23 (tests #12, 13, and 14) were not used due to inequality of fishing gear.

APPENDIX I (page 2)

Date	Test number	Net placement	Time Net in	Time Net out	Gage Height(ft.) Net in	Gage Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Smelt	Catfish	Salmon	Other
July 6	28	A3	1810	1910	2.0	2.5	3.7	3.8	670	8	2	1	4	-	-
"	"	B3	"	"	"	"	"	"	67	2	-	1	1	-	-
July 7	29	A3	0855	0955	5.4	5.6	3.0	2.9	228	-	1	-	-	-	13
"	"	B3	"	"	"	"	"	"	141	-	-	-	-	-	4
July 7	30	A2	1030	1130	5.6	5.2	2.6	2.6	365	-	-	1	-	-	20
"	"	B2	"	"	"	"	"	"	177	-	-	-	4	-	5
July 7	31	A1	1205	1305	5.0	4.3	2.6	2.7	422	-	5	-	-	-	16
"	"	B1	"	"	"	"	"	"	110	-	-	-	-	-	1
July 7	32	A1	2110	2210	3.2	3.7	3.4	3.0	1,745	11	3	3	39	-	25
"	"	B1	"	"	"	"	"	"	618	4	-	1	80	-	15
July 7	33	A2	2230	2330	4.0	4.5	2.7	2.7	551	16	3	3	56	-	4
"	"	B2	"	"	"	"	"	"	293	3	-	-	232	-	1
July 7	34	A3	2400	0100	4.8	5.0	2.9	2.7	576	28	3	-	21	-	4
"	"	B3	"	"	"	"	"	"	218	3	-	-	15	-	7
July 11	35	A1	1405	1505	3.8	4.6	3.2	3.2	476	-	-	-	-	-	40
"	"	B1	"	"	"	"	"	"	35	1	5	-	6	-	5
July 11	36	A2	1530	1630	3.9	3.5	2.8	2.5	520	1	1	1	-	-	33
"	"	B2	"	"	"	"	"	"	64	1	-	-	2	-	7
July 11	37	A3	1655	1755	3.2	2.8	2.7	2.9	557	3	-	2	2	-	31
"	"	B3	"	"	"	"	"	"	54	-	-	-	-	-	4
July 12	38	A3	0840	0940	2.8	2.3	3.1	3.2	399	4	-	1	-	-	5
"	"	B3	"	"	"	"	"	"	86	-	-	-	-	-	1
July 12	39	A2	1010	1110	2.1	2.2	2.9	3.5	254	5	-	-	-	1	1
"	"	B2	"	"	"	"	"	"	54	-	-	-	16	-	-
July 12	40	A1	1140	1240	2.4	2.8	3.7	3.6	1,172	4	-	-	-	-	16
"	"	B1	"	"	"	"	"	"	97	-	-	-	14	-	3
July 12	41	A1	2100	2200	2.6	3.0	3.7	3.5	1,108	30	3	2	20	-	12
"	"	B1	"	"	"	"	"	"	108	5	-	-	28	-	2
July 12	42	A2	2230	2330	3.2	3.6	3.1	3.0	540	25	3	-	63	-	1
"	"	B2	"	"	"	"	"	"	111	1	-	-	136	-	-
July 12	43	A3	2350	0050	4.0	4.4	3.5	3.1	708	34	1	3	26	-	1
"	"	B3	"	"	"	"	"	"	167	6	1	-	45	-	-
July 13	44	A3	1420	1520	2.8	3.2	3.9	3.6	690	3	1	-	-	-	3
"	"	B3	"	"	"	"	"	"	135	-	-	3	6	-	-
July 13	45	A2	1550	1650	3.7	3.9	3.3	3.0	467	2	-	-	1	-	-
"	"	B2	"	"	"	"	"	"	112	-	-	-	14	-	-
July 13	46	A1	1705	1805	4.0	4.1	3.7	3.0	779	4	1	2	3	-	3
"	"	B1	"	"	"	"	"	"	48	-	-	-	4	-	-
July 14	47	A1	0845	1015	3.6	2.8	2.9	3.6	1,187	5	-	-	1	-	5
"	"	B1	"	"	"	"	"	"	145	-	-	-	1	-	-
July 14	48	A2	1035	1205	2.6	2.0	2.9	3.5	405	7	-	1	1	-	-
"	"	B2	"	"	"	"	"	"	95	-	-	-	1	-	-
July 14	49	A3	1215	1345	1.8	2.1	3.6	4.1	416	28	-	1	1	-	3
"	"	B3	"	"	"	"	"	"	84	-	-	1	1	-	-
July 18	50	A1	1435	1535	2.2	1.8	2.9	2.9	276	7	-	-	5	-	2
"	"	B1	"	"	"	"	"	"	86	-	-	1	1	-	-
July 18	51	A2	1600	1700	1.8	2.2	2.8	3.3	247	6	-	1	6	-	1
"	"	B2	"	"	"	"	"	"	77	-	-	1	14	-	-
July 18	52	A3	1720	1820	2.4	2.9	3.6	3.4	431	20	1	1	2	-	-
"	"	B3	"	"	"	"	"	"	169	1	-	4	2	-	-
July 19	53	A3	0835	1005	6.2	5.5	1.9	2.2	221	-	2	-	-	1	1
"	"	B3	"	"	"	"	"	"	67	-	-	-	-	-	-

APPENDIX I (page 3)

Date	Test number	Net placement	Time Net in	Time Net out	Gage Height(ft.) Net in	Gage Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Smelt	Catfish	Salmon	Other
July 19	54	A2	1020	1150	5.2	4.4	2.2	2.1	120	2	1	1	-	-	-
"	"	B2	"	"	"	"	"	"	40	-	-	-	-	-	-
July 19	55	A1	1210	1340	4.2	3.2	2.2	2.5	428	2	1	-	-	-	4
"	"	B1	"	"	"	"	"	"	108	-	-	-	-	-	-
July 19	56	A1	2050	2150	3.9	4.4	2.5	2.6	443	61	4	3	11	-	1
"	"	B1	"	"	"	"	"	"	147	8	-	-	10	-	-
July 19	57	A2	2210	2310	4.6	4.6	2.5	2.6	444	151	2	1	21	-	-
"	"	B2	"	"	"	"	"	"	112	16	3	1	69	-	1
July 19	58	A3	2330	0030	4.5	4.2	2.5	2.6	459	53	17	-	5	-	-
"	"	B3	"	"	"	"	"	"	111	6	3	-	16	-	1
July 20	59	A1	1400	1500	3.6	3.0	2.6	2.5	229	1	1	-	-	-	1
"	"	B1	"	"	"	"	"	"	61	-	-	-	-	-	-
July 20	60	A2	1520	1620	2.7	2.2	2.4	2.5	124	4	-	-	-	-	1
"	"	B2	"	"	"	"	"	"	65	-	-	-	1	1	-
July 20	61	A3	1635	1735	2.0	1.9	2.9	3.3	164	8	-	2	-	-	1
"	"	B3	"	"	"	"	"	"	54	1	2	2	-	-	-
July 21	62	A3	0840	1010	5.6	6.0	2.5	2.3	132	-	-	1	-	-	-
"	"	B3	"	"	"	"	"	"	68	-	-	-	-	-	-
July 21	63	A2	1030	1200	5.9	5.2	2.4	2.1	160	-	-	-	-	-	1
"	"	B2	"	"	"	"	"	"	35	-	-	-	1	-	-
July 21	64	A1	1215	1345	5.0	4.0	2.2	2.2	268	-	-	-	2	-	-
"	"	B1	"	"	"	"	"	"	31	-	-	-	-	-	-
July 25	65	A1	1440	1540	4.4	4.3	2.5	2.5	83	-	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	2	-	-	-	-	-	-
July 25	66	A2	1600	1700	4.1	3.6	2.5	2.5	151	-	-	-	-	-	-
"	"	B2	"	"	"	"	"	"	4	-	-	-	-	-	-
July 25	67	A3	1715	1815	3.4	2.8	2.5	2.8	160	1	-	-	-	-	-
"	"	B3	"	"	"	"	"	"	9	-	-	-	-	-	-
July 26	68	A3	0850	1020	2.6	1.8	3.5	3.2	179	4	1	-	-	-	1
"	"	B3	"	"	"	"	"	"	37	-	-	1	-	-	-
July 26	69	A2	1040	1210	1.8	2.7	3.1	3.8	271	4	-	1	2	-	-
"	"	B2	"	"	"	"	"	"	58	1	-	1	8	-	-
July 26	70	A1	1300	1430	2.7	3.7	3.8	3.3	284	3	-	-	12	-	-
"	"	B1	"	"	"	"	"	"	49	-	-	1	6	-	-
July 26	71	A1	2045	2145	3.0	3.3	2.5	3.1	387	104	3	-	17	-	-
"	"	B1	"	"	"	"	"	"	42	8	1	-	7	-	-
July 26	72	A2	2205	2305	3.5	3.6	2.6	3.4	250	33	-	-	6	-	1
"	"	B2	"	"	"	"	"	"	33	2	-	-	7	-	-
July 26	73	A3	2325	0025	3.8	4.4	3.2	3.0	254	30	1	-	9	-	-
"	"	B3	"	"	"	"	"	"	119	1	-	-	18	-	-
July 27	74	A3	1505	1605	3.6	4.2	3.1	2.9	58	-	-	1	1	-	-
"	"	B3	"	"	"	"	"	"	26	-	-	-	3	-	-
July 27	75	A2	1620	1720	4.3	4.7	2.7	2.4	43	3	-	-	-	-	1
"	"	B2	"	"	"	"	"	"	15	-	-	1	-	-	-
July 27	76	A1	1735	1835	4.8	4.8	2.6	2.3	122	5	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	15	-	-	-	-	-	-
July 28	77	A1	0845	1015	3.9	2.9	2.6	3.0	399	7	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	58	-	-	-	2	-	1
July 28	78	A2	1035	1205	2.8	2.0	2.7	3.0	171	29	1	-	2	-	1
"	"	B2	"	"	"	"	"	"	42	-	-	-	2	-	-
July 28	79	A3	1225	1355	1.9	2.2	3.5	3.8	51	9	-	1	-	-	1
"	"	B3	"	"	"	"	"	"	38	3	-	-	-	-	1

APPENDIX I (page 4)

Date	Test number	Net placement	Time Net in	Time Net out	Gage Height(ft.) Net in	Gage Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Smelt	Catfish	Salmon	Other
August 1	80	A1	1435	1535	2.2	1.8	3.4	3.6	53	12	1	1	1	-	1
"	"	B1	"	"	"	"	"	"	3	-	-	-	-	-	-
August 1	81	A2	1555	1655	1.8	2.4	3.6	3.8	102	4	-	-	1	-	-
"	"	B2	"	"	"	"	"	"	6	-	-	1	16	-	-
August 1	82	A3	1720	1820	2.9	3.0	4.0	3.8	252	13	1	-	1	-	2
"	"	B3	"	"	"	"	"	"	43	-	-	1	5	-	-
August 2	83	A3	0840	1010	6.0	5.3	2.8	2.7	211	1	-	-	-	-	2
"	"	B3	"	"	"	"	"	"	13	-	-	-	-	-	-
August 2	84	A2	1025	1155	5.2	4.2	2.5	3.0	112	5	-	1	-	-	-
"	"	B2	"	"	"	"	"	"	9	-	-	-	-	-	-
August 2	85	A1	1215	1345	4.0	3.0	3.2	3.3	172	24	-	-	1	-	1
"	"	B1	"	"	"	"	"	"	9	-	-	-	-	-	1
August 2	86	A1	2040	2140	4.4	4.9	2.9	2.5	243	88	4	-	15	-	3
"	"	B1	"	"	"	"	"	"	15	12	-	-	3	-	-
August 2	87	A2	2200	2300	5.0	5.0	2.4	2.4	171	52	2	-	9	-	1
"	"	B2	"	"	"	"	"	"	7	2	-	-	-	-	-
August 2	88	A3	2315	0015	5.0	4.5	2.4	2.3	222	19	1	-	-	-	1
"	"	B3	"	"	"	"	"	"	7	-	-	-	1	-	-
August 3	89	A3	1420	1520	3.2	2.6	2.8	2.9	71	4	-	-	-	-	-
"	"	B3	"	"	"	"	"	"	2	-	-	-	-	-	-
August 3	90	A2	1545	1645	2.5	2.3	2.6	3.1	29	4	-	-	-	1	-
"	"	B2	"	"	"	"	"	"	2	-	-	-	-	-	-
August 3	91	A1	1700	1800	2.3	2.9	3.1	3.5	70	3	-	-	-	-	2
"	"	B1	"	"	"	"	"	"	3	1	-	-	2	-	-
August 4	92	A1	0850	1020	5.8	5.6	2.6	2.3	65	-	-	-	-	-	6
"	"	B1	"	"	"	"	"	"	2	-	-	-	-	-	-
August 4	93	A2	1035	1205	5.5	4.6	2.1	2.2	99	1	-	-	1	-	2
"	"	B2	"	"	"	"	"	"	6	-	-	-	1	-	1
August 4	94	A3	1215	1345	4.4	3.6	2.6	2.7	111	-	-	-	-	-	4
"	"	B3	"	"	"	"	"	"	6	1	-	-	-	-	-
August 8	95	A3	1525	1625	3.6	3.1	2.6	2.7	31	1	-	1	-	-	-
"	"	B3	"	"	"	"	"	"	3	-	-	1	-	-	1
August 8	96	A2	1645	1745	3.0	2.7	2.7	2.9	24	-	-	-	1	-	1
"	"	B2	"	"	"	"	"	"	3	-	-	-	-	-	-
August 8	97	A1	1800	1900	2.6	3.1	3.0	3.2	42	21	5	-	5	-	1
"	"	B1	"	"	"	"	"	"	7	-	-	-	-	-	-
August 9	98	A1	0840	1010	2.6	3.2	3.2	3.5	53	5	4	1	7	-	1
"	"	B1	"	"	"	"	"	"	4	-	-	-	1	-	-
August 9	99	A2	1035	1205	3.4	4.0	3.0	3.1	26	2	1	-	1	-	-
"	"	B2	"	"	"	"	"	"	3	1	-	-	3	-	-
August 9	100	A3	1220	1350	4.1	4.6	3.4	2.6	26	-	3	-	-	-	1
"	"	B3	"	"	"	"	"	"	7	1	-	-	-	-	-
August 9	101	A3	2030	2130	3.9	4.4	3.0	3.1	114	16	3	1	5	1	2
"	"	B3	"	"	"	"	"	"	9	1	-	-	2	-	-
August 9	102	A2	2145	2245	4.5	4.9	2.8	3.1	41	2	-	-	6	-	4
"	"	B2	"	"	"	"	"	"	5	-	-	1	6	-	1
August 9	103	A1	2300	2400	5.0	5.6	3.1	3.2	95	7	-	-	18	-	5
"	"	B1	"	"	"	"	"	"	11	-	-	1	7	-	-
August 10	104	A1	1425	1525	4.5	4.8	2.6	2.6	10	-	-	-	1	-	2
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
August 10	105	A2	1545	1645	4.9	4.9	2.6	2.3	12	-	-	-	-	-	-
"	"	B2	"	"	"	"	"	"	3	-	-	-	1	-	-

APPENDIX I (page 5)

Date	Test number	Net placement	Time Net in	Time Net out	Gage Height(ft.) Net in	Gage Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Smelt	Catfish	Salmon	Other
August 10	106	A3	1700	1800	4.9	4.1	2.3	2.5	24	-	-	-	-	-	-
"	"	B3	"	"	"	"	"	"	4	-	-	-	-	-	1
August 11	107	A3	0835	1005	3.7	2.9	3.2	3.2	21	1	-	-	1	-	-
"	"	B3	"	"	"	"	"	"	6	5	-	-	-	-	-
August 11	108	A2	1020	1150	2.9	3.1	3.0	4.2	27	2	-	-	-	-	3
"	"	B2	"	"	"	"	"	"	2	2	-	-	-	-	-
August 11	109	A1	1215	1345	3.2	3.8	3.7	3.4	29	2	-	-	6	-	2
"	"	B1	"	"	"	"	"	"	2	-	-	-	5	-	1
August 15	110	A3	1345	1445	2.6	2.2	3.4	4.3	24	-	-	-	-	-	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
August 15	111	A2	1505	1605	2.3	3.0	3.8	4.4	26	3	-	-	4	-	2
"	"	B2	"	"	"	"	"	"	1	-	-	2	1	-	1
August 15	112	A1	1620	1720	3.1	3.5	4.4	4.2	20	-	-	-	11	-	3
"	"	B1	"	"	"	"	"	"	-	-	-	-	7	-	-
August 16	113	A1	0830	1000	6.1	5.1	2.3	2.2	55	-	-	-	2	-	2
"	"	B1	"	"	"	"	"	"	1	-	-	-	-	-	-
August 16	114	A2	1020	1150	4.9	4.0	2.2	2.6	21	-	2	-	-	-	-
"	"	B2	"	"	"	"	"	"	1	-	-	-	-	-	-
August 16	115	A3	1215	1345	3.8	3.0	2.7	3.1	19	1	-	-	-	-	5
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
August 16	116	A3	2015	2115	4.8	5.0	3.0	2.6	65	13	15	-	-	-	-
"	"	B3	"	"	"	"	"	"	4	-	-	-	1	-	1
August 16	117	A2	2130	2230	5.1	4.7	2.5	2.9	62	3	1	-	2	-	2
"	"	B2	"	"	"	"	"	"	3	-	-	-	-	-	-
August 16	118	A1	2240	2340	4.6	3.6	2.7	3.1	114	6	21	-	1	-	-
"	"	B1	"	"	"	"	"	"	2	-	-	-	-	-	1
August 17	119	A1	1355	1455	3.2	2.7	2.5	2.9	13	-	-	1	1	-	-
"	"	B1	"	"	"	"	"	"	2	1	-	-	1	-	-
August 17	120	A2	1515	1615	2.5	2.3	2.6	3.0	11	1	1	-	-	-	1
"	"	B2	"	"	"	"	"	"	2	-	-	-	-	-	-
August 17	121	A3	1625	1725	2.4	3.1	3.4	3.6	13	2	4	-	-	-	1
"	"	B3	"	"	"	"	"	"	3	-	1	-	-	-	2
August 18	122	A3	0830	1000	5.9	5.9	2.9	2.5	7	-	-	-	-	-	-
"	"	B3	"	"	"	"	"	"	3	-	-	-	-	-	-
August 18	123	A2	1015	1145	5.7	4.8	2.2	2.2	17	-	-	-	-	-	1
"	"	B2	"	"	"	"	"	"	3	-	-	-	-	-	-
August 18	124	A1	1200	1330	4.7	3.5	2.2	2.6	24	-	1	-	1	-	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
		Total	A -						53,029	1,122	144	299	470	19	340
		Total	B -						11,856	102	16	45	873	3	70
		Grand total	-						64,885	1,224	160	344	1,343	22	410

APPENDIX II

Plankton Net Fishing Data and Catches, Tracy Fish Screen Tests
June 15 - July 26, 1966

Date	Test number	Net placement	Time		Depth net fished (ft.)	Velocity (ft./sec.)	Gauge height (ft.)	Striped bass size (mm)	Total striped bass
			Net in	Net out					
June 15	1	A3b	1001	1031	-	2.0	4.0	11, 9	2
June 15	2	B3b	1049	1132	-	2.0	3.8	-	-
June 15	3	Ala	1143	1213	-	2.0	3.6	31, 17, 22, 22	4
June 15	4	Bla	1222	1252	-	2.0	3.0	21, 17, 16, 11, 15	5
June 15	5	Blb	1335	1405	-	2.0	3.0	20, 17, 15	3
June 20	8	A3a	1548	1618	-	2.0	-	-	-
June 21	10	B3b	1013	1043	-	2.2	6.2	-	-
June 21	11	A3b	1030	1100	-	2.1	6.0	30	1
June 21	12	B3a	1045	1115	-	2.4	5.8	-	-
June 21	13	A3a	1105	1135	-	2.1	5.6	-	-
June 21	14	Blb	1355	1425	-	2.0	3.8	25, 10	2
June 21	15	Blb	1415	1515	-	2.0	3.6	19, 17, 15, 14, 11, 9	6
June 21	16	Ala	1430	1530	-	2.0	3.5	14, 14, 22, 18, 27, 19, 20, 23, 16, 14	10
June 22	17	B3b	0823	0923	-	2.6	6.0	17, 10, 10	3
June 22	18	A3b	0830	0930	-	2.6	6.0	21, 12	2
June 22	19	B3a	0936	1036	-	-	6.4	18	1
June 22	20	A3a	0944	1044	-	-	6.4	6	1
June 22	21	A2b	1050	1155	-	-	6.0	21, 24	2
June 22	22	B2b	1055	1155	-	-	6.0	-	-
June 22	23	A2a	1335	1435	-	3.0	4.4	19, 23, 26, 18, 22, 18, 16, 20, 16, 17, 16, 15, 15, 16	14
June 22	24	B2a	1335	1435	-	3.0	4.4	16	1
June 22	25	Ala	1445	1545	-	2.9	3.6	22, 26, 16, 22, 18	5
June 22	26	Blb	1445	1545	-	2.9	3.6	15, 24, 21, 23, 22, 27, 20, 20, 32, 16, 16, 16, 16, 24	14
June 22	27	Alb	1600	1700	-	3.1	3.0	39, 21, 18, 17, 24, 21, 23, 20, 23, 19, 19	11
June 22	28	Bla	1705	1805	-	3.1	2.2	21, 14, 12, 25, 18, 28	6
June 22	29	A2a	1715	1815	-	3.1	2.2	24, 18, 17, 17	4
June 23	30	Ala	0845	0945	-	3.1	5.2	18	1
June 23	31	Bla	0845	0945	-	3.1	5.2	-	-
June 23	32	Alb	1000	-	-	3.3	5.6	-	-
June 23	33	Blb	1000	-	-	3.3	5.6	-	-
June 27	34	A-4	1555	1655	bottom	3.1	4.6	-	-

APPENDIX II (page 2)

Date	Test number	Net placement	Time		Depth net fished (ft.)	Velocity (ft./sec.)	Gauge height (ft.)	Striped bass size (mm)	Total striped bass
			Net in	Net out					
June 28	35	B-5	0915	1015	surface	2.9	4.6	-	-
June 28	36	B-4	1020	1120	surface	3.1	3.0	9	1
June 28	37	A-3	1010	1110	2.0	3.1	3.0	13	1
June 28	38	A-2	1120	1220	5.0	2.9	2.4	18, 19, 34, 30, 15, 42, 35, 18, 16	9
June 28	39	B-1	1133	1233	-	3.0	2.4	20	1
June 29	45	A-2	1525	1625	5.0	3.1	3.4	-	-
June 29	46	B-2	1600	1700	5.5	3.2	3.8	26, 11	2
June 30	47	A-5	0950	1050	9.5	2.8	3.6	11, 10, 11, 15, 12, 11, 9, 11	8
June 30	48	B-5	0950	1050	6.5	2.8	3.6	10, 35, 14, 20, 11, 12, 13, 10, 13, 16, 11, 13, 10	13
June 30	51	A-1	1415	1515	4.5	3.1	2.2	-	-
June 30	52	B-2	1415	1515	5.0	3.1	2.2	-	-
June 30	53	A-2	1530	1700	6.5	3.8	3.0	13	1
June 30	54	B-1	1530	1700	8.5	3.8	3.0	-	-
July 5	55	A-5	1315	1415	9.5	2.8	4.0	26	1
July 5	56	B-5	1315	1415	6.5	2.8	4.0	18, 18	2
July 5	57	A-4	1500	1600	7.5	3.0	3.0	-	-
July 5	58	B-4	1500	1600	6.5	3.0	3.0	18, 19, 9	3
July 5	59	A-2	1605	1705	5.5	3.4	2.6	34, 19	2
July 5	60	B-2	1605	1705	7.0	3.4	2.6	20	1
July 7	61	A-1	0935	1035	3.5	2.6	5.6	-	-
July 7	62	B-1	0935	1035	7.5	2.6	5.6	14	1
July 7	63	A-2	1045	1145	4.5	2.8	5.6	22	1
July 7	64	B-3	1045	1145	10.0	2.8	5.6	19, 10	2
July 7	65	A-1	2115	2215	2.5	3.1	3.6	15	1
July 7	66	B-1	2115	2215	5.5	3.1	3.6	-	-
July 7	67	A-1	2140	2240	bottom	2.8	4.0	-	-
July 7	68	B-1	2140	2240	6.5	2.8	4.0	19, 14, 12, 14, 15, 13, 19	7
July 8	69	A-3	0005	0105	bottom	3.0	4.8	15, 15, 19, 14, 16	5
July 8	70	B-3	0005	0105	6.5	3.0	4.8	-	-
July 11	71	A-5	1420	1520	4.0	3.3	4.2	-	-
July 11	72	B-5	1420	1520	5.5	3.3	4.2	18, 9	2
July 11	73	A-2	1545	1645	4.5	2.8	4.0	15, 18, 23	3
July 11	74	B-2	1545	1645	8.0	2.8	4.0	20, 21, 20	3
July 11	75	A-1	1700	1800	5.0	2.8	3.2	18, 21	2
July 11	76	B-1	1700	1800	10.0	2.8	3.2	36	1
July 12	77	A-5	2139	2239	surface	3.6	3.2	49, 34, 35, 34, 35, 29, 22, 19, 32, 23, 18	11

APPENDIX II (page 3)

Date	Test number	Net placement	Time Net in	Time Net out	Depth net fished (ft.)	Velocity (ft./sec.)	Gauge height (ft.)	Striped bass size (mm)	Total striped bass
July 12	78	B-5	2139	2239	surface	3.6	3.2	23, 14	2
July 12	79	A-5	2320	0020	9.0	3.0	3.8	-	-
July 12	80	B-5	2320	0020	8.0	3.0	3.8	11	1
July 13	81	A-5	0030	0130	bottom	3.3	4.6	18	1
July 13	82	B-5	0030	0130	bottom	3.3	4.6	-	-
July 13	83	A-2	1433	-	surface	3.9	3.0	39, 33	2
July 13	84	B-2	1433	-	surface	3.9	3.0	-	-
July 14	85	A-4	0900	1000	middle	3.0	3.6	-	-
July 14	86	B-4	0900	1000	middle	3.0	3.6	-	-
July 14	87	B-4	1008	1108	bottom	3.3	3.0	11	1
July 14	88	B-4	1008	1108	bottom	3.3	3.0	-	-
July 18	89	A-5	1445	1545	surface	2.9	1.8	-	-
July 18	90	B-5	1445	1545	surface	2.9	1.8	-	-
July 18	91	A-5	1615	1715	bottom	3.0	1.8	-	-
July 18	92	B-5	1615	1715	bottom	3.0	1.8	-	-
July 19	93	A-5	0840	0940	middle	2.0	6.4	-	-
July 19	94	B-5	0840	0940	middle	2.0	6.4	-	-
July 19	95	A-4	1025	1125	surface	2.0	5.4	-	-
July 19	96	B-4	1025	1125	surface	2.0	5.4	-	-
July 19	97	A-4	2055	2155	bottom	2.5	4.2	-	-
July 19	98	B-4	2055	2155	bottom	2.5	4.2	-	-
July 19	99	A-4	2220	2300	middle	2.6	4.4	-	-
July 19	100	B-4	2220	2320	middle	2.6	4.4	-	-
July 21	101	A-1	0920	1022	surface	2.5	4.8	29	1
July 21	102	B-1	0922	1022	surface	2.5	4.8	-	-
July 25	103	A-5	1450	1550	surface	2.7	4.4	16	1
July 25	104	B-5	1450	1550	surface	2.7	4.4	-	-
July 25	105	A-1	1650	1750	bottom	2.4	3.4	-	-
July 25	106	B-1	1650	1750	bottom	2.4	3.4	-	-
July 26	107	A-3	0900	1000	surface	3.5	2.6	-	-
July 26	108	B-3	0900	1000	surface	3.5	2.6	-	-
July 26	109	A-3	1110	1210	middle	3.6	1.9	-	-
July 26	110	B-3	1110	1210	middle	3.6	1.9	-	-
					Total striped bass in net A			=	107
					Total striped bass in net B			=	84
							GRAND TOTAL	=	191

APPENDIX III

Fyke Net Fishing Test Data and Net Catches
Tracy Fish Screen Tests
March 9 - June 28, 1967

Date	Test number	1/ Net placement	Time		Gauge Height(ft.)		Velocity (ft./sec.)		Striped bass	American shad	Threadfin shad	Catfish	* Minnows	Salmon	** Other
			Net in	Net out	Net in	Net out	Net in	Net out							
March 9	1	A1	1000	1100	4.2	3.8	1.5	1.7	-	-	1	-	-	1	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
March 9	2	A2	1330	1430	4.2	4.8	2.0	2.0	1	-	7	-	-	-	5
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
March 9	3	A3	1500	1600	5.0	5.6	2.0	1.9	-	2	-	-	-	-	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
March 13	4	A3	1450	1535	3.6	3.7	1.0	1.5	-	-	1	-	-	-	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
March 13	5	A2	1600	1645	3.9	4.4	1.5	1.3	1	-	1	-	-	-	3
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
March 13	6	A1	1700	1745	4.5	4.9	1.4	1.2	-	-	-	-	-	-	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
March 14	7	A1	0905	1035	6.3	5.8	0.9	0.0	-	-	-	-	-	-	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
March 14	8	A2	1105	1235	5.5	4.7	0.0	0.0	-	-	-	-	-	-	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
March 14	9	A3	1255	1425	4.5	3.8	0.0	0.2	-	-	-	-	-	-	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
March 14	10	A3	1840	1940	4.8	5.3	0.5	0.6	-	-	-	-	-	-	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
March 14	11	A2	2007	2107	5.5	5.9	0.5	0.0	-	-	-	-	-	-	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
March 15	12	A1	1815	1915	3.8	4.3	0.8	0.6	-	-	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
March 28	13	A1	1920	2020	5.7	6.2	2.0	2.0	-	-	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
March 28	14	A2	2052	2152	6.4	6.5	1.9	1.3	-	-	-	-	-	-	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
March 29	15	A3	2343	0043	5.3	4.8	2.9	3.0	-	19	-	-	-	1	3
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
March 30	16	A1	0119	0219	4.5	4.1	3.2	3.2	1	-	1	-	-	1	3
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	1
April 4	17	A1	1110	1240	4.9	5.8	1.6	1.2	-	-	-	-	-	-	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
April 4	18	A2	1310	1440	6.0	6.6	1.3	0.0	-	-	-	-	-	-	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
May 22	19	A1	1507	1607	4.1	5.1	3.3	3.6	-	-	-	-	-	-	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
May 22	20	A2	1630	1730	5.4	6.0	3.0	3.0	-	-	-	-	-	-	1
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	1
May 22	21	A3	1755	1855	6.3	6.7	3.0	2.8	-	-	-	-	-	2	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
May 23	22	A3	0940	1010	6.8	6.7	2.0	2.0	-	-	-	-	-	1	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
May 23	23	A2	1140	1310	6.7	5.0	1.8	2.2	-	-	-	-	-	1	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
May 23	24	A3	1330	1515	4.8	4.9	2.2	1.7	-	-	-	-	-	1	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
May 24	25	A1	1555	1910	4.2	6.1	2.6	2.6	-	-	1	-	-	21	8
"	"	B1	"	"	"	"	"	"	-	-	2	-	-	7	-

APPENDIX III (page 2)

Date	Test number	1/ Net placement	Time Net in	Time Net out	Gauge Height(ft.) Net in	Gauge Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Catfish	* Minnows	Salmon	** Other
May 24	26	A2	1950	2315	6.4	5.8	2.0	3.1	-	-	1	-	-	4	1
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	1	-
May 24-25	27	A3	2335	0915	5.8	7.9	3.4	0.9	2	-	46	1	-	10	17
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	1
May 25	28	A3	0915	1045	7.9	7.2	0.9	1.2	-	-	1	-	-	4	2
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
May 25	29	A2	1115	1245	7.1	6.3	1.2	1.4	-	-	-	-	-	3	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
May 25	30	A1	1315	1445	6.1	5.3	1.2	1.4	-	-	1	-	-	7	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	3	-
May 29	31	A1	1555	1855	5.5	4.5	1.4	1.7	-	-	4	-	-	2	6
"	"	B1	"	"	"	"	"	"	-	-	1	-	-	-	-
May 29	32	A2	1920	2255	4.1	5.3	1.6	3.8	1	-	33	-	-	5	9
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	3
May 29-30	33	A3	2325	0905	5.5	5.5	3.8	1.7	-	-	26	-	-	25	23
"	"	B3	"	"	"	"	"	"	-	-	2	-	-	-	7
May 30	34	A2	0927	1057	5.7	6.1	2.0	1.9	-	-	1	-	-	-	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
May 30	35	A1	1115	1248	6.4	6.4	2.0	1.8	-	-	1	-	-	-	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
May 30	36	A3	1316	1446	6.2	5.8	1.4	1.4	-	-	-	-	-	1	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
May 31	37	A3	1540	1710	5.6	5.1	1.5	1.5	-	-	1	-	-	-	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	1	-
May 31	38	A2	1735	1905	5.0	4.5	1.4	1.6	-	-	-	-	-	3	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
May 31-June 1	39	A1	1933	0845	4.5	5.4	1.6	1.6	1	-	22	-	3	12	14
" "	"	B3	"	"	"	"	"	"	-	-	3	-	-	-	-
June 1	40	A1	0855	1025	5.4	5.1	1.6	1.6	-	-	2	-	-	2	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
June 1	41	A2	1055	1225	5.0	5.3	1.6	2.1	-	-	1	-	1	1	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 1	42	A3	1245	1415	5.4	5.7	2.1	1.7	-	-	1	-	-	2	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 5	43	A3	1525	1625	4.9	5.5	2.1	2.1	-	-	2	-	1	-	1
"	"	B1	"	"	"	"	"	"	-	-	1	-	-	-	-
June 5	44	A2	1647	1747	5.8	6.3	2.1	1.8	-	-	-	-	2	2	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 5	45	A1	1805	1905	6.4	6.6	1.8	1.3	-	-	3	-	-	-	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	1	-
June 6	46	A2	1255	1555	4.8	4.3	1.2	2.1	-	-	-	-	-	2	1
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 6	47	A3	1615	1915	5.5	6.5	1.7	0.0	-	-	1	-	2	3	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 7	48	A3	0920	1110	6.5	5.9	1.2	1.2	-	-	-	-	1	-	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 7	49	A1	1125	1255	5.7	5.0	1.1	1.2	-	-	4	-	-	-	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
June 14	50	A3	1505	1705	5.8	4.8	1.3	1.4	-	-	6	-	-	1	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 14	51	A2	1725	1925	4.8	4.3	1.4	1.6	-	-	4	-	-	1	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-

APPENDIX III (Page 3)

Date	Test number	1/ Net placement	Time Net in	Time Net out	Gauge Height(ft.) Net in	Gauge Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Striped bass	American shad	Threadfin shad	Catfish	* Minnows	Salmon	** Other
June 14-15	52	A1	1945	0845	4.3	5.4	1.6	1.8	1	-	13	-	48	5	5
"	"	B3	"	"	"	"	"	"	-	-	-	-	2	-	-
June 15	53	A1	0900	1100	5.4	6.2	1.8	2.3	-	-	-	-	1	2	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	1	-	1
June 15	54	A2	1120	1320	6.2	6.6	2.3	1.4	-	-	1	-	2	1	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 15	55	A3	1340	1540	6.6	5.8	1.4	1.3	-	-	1	-	1	1	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 19	56	A3	1505	1705	5.1	6.5	2.6	2.2	-	-	2	-	8	1	7
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	1	-
June 19	57	A2	1715	1915	6.5	6.6	2.2	1.4	-	-	6	-	2	2	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	1	-
June 19-20	58	A1	1930	0905	6.6	6.5	1.4	1.3	23	-	65	1	4,222	23	28
"	"	B3	"	"	"	"	"	"	-	-	-	-	109	3	-
June 20	59	A2	0915	1045	6.5	5.8	1.3	1.3	-	-	3	-	2	1	-
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 20	60	A3	1105	1235	5.8	5.0	1.3	1.3	-	-	5	-	1	-	-
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 20	61	A1	1240	1410	5.0	4.3	1.3	1.8	-	-	8	-	5	-	-
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
June 20-21	62	A1	1430	0700	4.3	8.2	1.8	2.0	36	-	192	1	4,484	13	52
"	"	B3	"	"	"	"	"	"	-	-	9	-	54	-	4
June 21	63	A1	1610	1810	4.4	6.0	2.5	2.2	-	-	10	-	43	-	7
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	1
June 21	64	A2	1815	2015	6.0	6.8	2.2	1.8	-	1	6	-	35	-	4
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	1
June 21-22	65	A3	2020	0835	6.8	7.8	1.8	1.3	13	-	280	-	2,616	9	73
"	"	B1	"	"	"	"	"	"	1	-	20	-	55	-	5
June 22	66	A3	0840	1040	7.8	6.5	1.3	1.3	-	-	5	-	2	-	6
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 22	67	A2	1045	1245	6.5	5.6	1.3	1.2	-	-	3	-	6	-	2
"	"	B2	"	"	"	"	"	"	-	-	-	-	-	-	-
June 22	68	A1	1250	1450	5.6	4.5	1.2	1.8	-	-	19	-	9	-	6
"	"	B3	"	"	"	"	"	"	-	-	-	-	-	-	-
June 26	69	A1	1930	2030	4.4	5.2	2.2	2.2	-	3	31	-	107	-	9
"	"	B2	"	"	"	"	"	"	-	-	1	-	-	-	-
June 26-27	70	A3	2035	0830	5.2	6.5	2.2	1.9	-	-	1,636	-	2,670	1	213
"	"	B3	"	"	"	"	"	"	-	-	91	1	44	-	12
June 27	71	A3	0835	1035	6.5	7.1	1.9	1.2	-	-	3	-	10	-	1
"	"	B3	"	"	"	"	"	"	-	-	-	-	2	-	-
June 27	72	A2	1040	1210	7.1	6.6	1.2	1.2	-	-	2	-	3	-	2
"	"	B2	"	"	"	"	"	"	-	-	-	-	1	-	1
June 27	73	A1	1210	1340	6.6	6.0	1.2	1.2	-	-	13	-	9	-	6
"	"	B1	"	"	"	"	"	"	-	-	-	-	-	-	-
June 27-28	74	A1	1340	0700	6.0	5.1	1.2	1.2	-	-	333	-	2,986	1	158
"	"	B1	"	"	"	"	"	"	-	-	41	-	47	-	6
	Total	A -							80	25	2,810	3	17,282	179	688
	Total	B -							1	-	171	1	315	18	44
	Grand Total	-							81	25	2,981	4	17,597	197	732

1/ Live box in tests 1-24 fished at surface with bobbinet liner; in tests 25-62 at 4½ foot depth with hardware cloth liner; and tests 62-74 at 4½ foot depth with bobbinet liner.

* Hardhead, blackfish, splittail, carp.

** Crappie, bluegill sunfish, largemouth black bass, steelhead trout, smelt, tule perch.

APPENDIX IV

Fyke Net Fishing Test Data and Net Catches
Tracy Fish Screen Tests
July 12 - August 17, 1967

Date	Test number	1/ Net placement	Time Net in	Time Net out	Gauge Height(ft.) Net in	Gauge Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Salmon	Striped bass	2/ Minnow	Threadfin shad	American shad	Crappie	Catfish	Carp	3/ Other
July 12-13	75	A1	2320	2350	6.2	6.6	3.3	3.0	-	2	130	28	-	29	35	727	2
"	"	B1(+)	"	"	"	"	"	"	-	-	-	-	-	-	-	1	-
"	"	B1(-)	0025	0055	6.6	6.7	3.0	2.9	-	-	15	1	-	-	4	21	-
July 12-13	76	A3	0020	0050	6.6	6.7	3.0	2.9	2	2	198	13	-	54	8	195	2
"	"	B3(+)	0020	0050	6.6	6.7	3.0	2.9	-	-	13	1	-	2	7	1	-
"	"	B3(-)	2325	2355	6.2	6.6	3.3	3.0	-	-	17	3	-	3	31	2	1
July 13	77	A3	1025	1125	6.2	6.5	2.6	2.2	-	2	76	15	-	30	2	13	-
"	"	B3(+)	"	"	"	"	"	"	-	-	2	-	-	2	-	6	-
"	"	B3(-)	1150	1250	6.5	6.0	1.6	1.5	-	-	-	1	-	1	-	-	-
July 13	78	A1	1145	1245	6.5	6.0	1.6	1.5	-	3	75	6	-	27	-	5	-
"	"	B1(+)	"	"	"	"	"	"	-	-	1	-	-	-	-	1	-
"	"	B1(-)	1030	1130	6.2	6.5	2.6	2.2	-	-	5	2	-	1	1	-	-
July 13	79	A2	1325	1425	5.7	5.2	1.4	1.4	-	-	19	5	-	22	1	1	-
"	"	B2(+)	"	"	"	"	"	"	-	-	-	-	-	-	3	-	-
"	"	B2(-)	1445	1545	5.1	4.4	1.5	1.5	-	-	-	-	-	-	-	-	-
July 18	80	A1	0915	1015	4.5	4.0	1.5	1.5	-	-	164	748	-	8	2	108	5
"	"	B1(+)	"	"	"	"	"	"	-	-	4	122	-	2	-	3	-
"	"	B1(-)	1220	1320	3.4	3.2	1.6	2.0	-	-	45	85	-	-	-	35	1
July 18	81	A3	1215	1315	3.4	3.2	1.6	2.0	-	-	52	41	-	16	-	42	1
"	"	B3(+)	"	"	"	"	"	"	-	-	4	5	-	-	-	14	-
"	"	B3(-)	0920	1020	4.5	4.0	1.5	1.5	-	-	1	2	-	2	-	4	-
July 18	82	A2	1400	1600	3.4	4.4	2.1	2.2	1	64	170	542	-	218	12	54	-
"	"	B2(+)	"	"	"	"	"	"	-	0	9	23	-	5	-	15	1
"	"	B2(-)	1520	1620	4.4	5.0	2.2	2.0	-	1	6	3	-	13	1	19	-
July 19	83	A2	2055	2125	6.0	5.6	0.9	0.9	-	-	20	13	-	11	-	4	-
"	"	B2(+)	"	"	"	"	"	"	-	-	2	-	-	1	-	-	-
"	"	B2(-)	2010	2040	6.2	6.0	1.0	0.9	-	-	-	-	-	-	-	2	-
July 19	84	A1	2200	2300	5.4	4.8	1.5	1.5	-	14	849	577	-	381	35	46	7
"	"	B1(+)	"	"	"	"	"	"	-	1	167	18	-	1	-	10	1
"	"	B1(-)	2325	0025	4.6	4.5	1.4	1.9	-	-	70	13	-	2	3	26	-
July 19	85	A3	2320	0020	4.6	4.5	1.4	1.9	1	22	491	426	-	435	31	112	6
"	"	B3(+)	"	"	"	"	"	"	-	1	24	8	-	21	8	26	-
"	"	B3(-)	2205	2305	5.4	4.8	1.5	1.5	-	4	13	7	-	13	4	16	-
July 20	86	A3	1020	1120	5.3	4.5	0.7	0.8	-	-	1	8	-	4	1	4	2
"	"	B3(+)	"	"	"	"	"	"	-	-	1	-	-	5	1	-	-
"	"	B3(-)	1145	1245	4.5	4.0	0.8	0.9	-	-	-	1	-	-	1	1	-
July 20	87	A1	1140	1240	4.5	4.0	0.8	0.9	-	-	8	8	-	19	1	1	1
"	"	B1(+)	"	"	"	"	"	"	-	-	-	1	-	-	-	1	-
"	"	B1(-)	1025	1125	5.3	4.5	0.7	0.8	-	-	3	4	-	3	-	1	-
July 20	88	A2	1315	1415	3.8	3.3	0.9	1.0	-	1	7	4	-	17	-	5	1
"	"	B2(+)	"	"	"	"	"	"	-	-	-	-	-	4	1	-	-
"	"	B2(-)	1430	1530	3.3	3.0	1.0	1.0	-	-	-	2	-	3	-	1	-
July 24	89	A2	1815	1845	2.8	3.5	2.6	3.0	-	113	50	107	-	48	365	98	5
"	"	B2(+)	"	"	"	"	"	"	-	15	3	10	-	4	110	5	-
"	"	B2(-)	1715	1745	2.0	2.8	3.2	2.6	-	10	8	3	-	3	76	4	1
July 24	90	A1	2005	2035	4.0	4.3	3.4	3.3	-	71	41	61	-	43	194	239	1
"	"	B1(+)	"	"	"	"	"	"	-	7	7	10	-	-	56	13	1
"	"	B1(-)	2100	2130	4.3	4.8	3.4	3.1	-	6	5	11	-	2	47	19	1
July 24	91	A3	2055	2125	4.3	4.8	3.4	3.1	1	118	62	104	-	47	102	225	2
"	"	B3(+)	"	"	"	"	"	"	-	20	1	14	-	4	71	20	-
"	"	B3(-)	2010	2040	4.0	4.3	3.4	3.3	-	18	7	12	-	1	38	14	-
July 25	92	A3	1040	1140	5.8	5.2	2.8	2.3	-	109	14	6	-	1	2	2	2
"	"	B3(+)	"	"	"	"	"	"	-	-	-	-	-	-	1	-	-
"	"	B3(-)	1205	1305	5.0	4.4	2.3	2.5	-	3	2	-	-	-	1	2	-
July 25	93	A1	1200	1300	5.0	4.4	2.3	2.5	-	76	22	4	3	4	1	8	3
"	"	B1(+)	"	"	"	"	"	"	-	5	4	3	-	-	1	1	-
"	"	B1(-)	1045	1145	5.8	5.2	2.8	2.3	-	2	-	2	-	-	6	-	-

APPENDIX IV (page 2)

Date	Test number	1/ Net placement	Time Net in	Time Net out	Gauge Height(ft.) Net in	Gauge Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Salmon	Striped bass	2/ Minnow	Threadfin shad	American shad	Crappie	Catfish	Carp	3/ Other
July 25	94	A2	1335	1435	4.0	3.5	2.3	2.6	-	71	28	6	1	5	4	11	2
"	"	B2(+)	"	"	"	"	"	"	-	2	1	-	-	-	-	2	-
"	"	B2(-)	1450	1550	3.5	2.8	2.6	2.9	-	4	1	3	-	-	5	4	-
July 26	95	A2	1650	1720	2.4	2.9	2.9	2.9	-	32	10	3	2	11	9	16	2
"	"	B2(+)	"	"	"	"	"	"	-	-	1	1	-	4	-	-	-
"	"	B2(-)	1600	1630	2.8	2.4	2.8	2.9	-	0	1	1	-	-	1	1	-
July 26	96	A1	1745	1830	2.0	2.6	2.8	3.1	-	43	20	4	2	54	93	44	1
"	"	B1(+)	"	"	"	"	"	"	-	9	4	6	-	2	9	4	2
"	"	B1(-)	1850	1935	2.6	3.2	3.1	3.0	-	15	3	2	-	1	20	6	-
July 26	97	A3	1845	1930	2.6	3.2	3.1	3.0	-	265	20	6	4	27	32	25	-
"	"	B3(+)	"	"	"	"	"	"	-	50	4	-	-	4	18	3	-
"	"	B3(-)	1750	1835	2.0	2.6	2.8	3.1	-	2	1	2	1	10	4	-	-
July 27	98	A3	0840	0940	4.2	4.8	3.2	3.0	-	247	19	17	-	12	4	2	-
"	"	B3(+)	"	"	"	"	"	"	-	21	2	2	-	2	44	-	1
"	"	B3(-)	1010	1110	4.9	5.2	3.0	2.4	-	10	1	1	-	-	7	2	-
July 27	99	A1	1005	1105	4.9	5.2	3.0	2.4	-	155	10	15	-	1	126	21	-
"	"	B1(+)	"	"	"	"	"	"	-	26	2	-	-	-	3	1	1
"	"	B1(-)	0845	0945	4.2	4.8	3.2	3.0	-	5	3	1	-	-	20	1	-
July 27	100	A2	1140	1240	5.3	4.8	3.6	3.0	-	262	4	5	-	-	1	1	3
"	"	B2(+)	"	"	"	"	"	"	-	9	-	-	-	-	2	1	-
"	"	B2(-)	1250	1350	4.8	4.3	2.9	2.5	-	18	1	-	-	-	1	-	-
July 31	101	A1	1700	1745	5.0	5.0	2.9	2.8	-	207	5	1	-	1	11	2	10
"	"	B1(+)	"	"	"	"	"	"	-	17	-	2	-	1	2	-	-
"	"	B1(-)	1810	1855	5.0	4.8	2.7	2.7	-	8	-	1	-	-	1	-	-
July 31	102	A3	1805	1850	5.0	4.8	2.7	2.7	-	454	5	-	-	-	3	2	16
"	"	B3(+)	"	"	"	"	"	"	-	7	2	-	-	-	-	-	-
"	"	B3(-)	1705	1750	5.0	5.0	2.9	2.8	-	8	-	2	-	-	1	-	-
July 31	103	A2	1930	2015	4.6	4.4	2.5	2.7	-	323	4	4	20	8	4	-	8
"	"	B2(+)	"	"	"	"	"	"	-	12	-	1	1	1	-	-	-
"	"	B2(-)	2030	2115	4.4	4.2	2.7	3.9	-	8	1	5	5	-	-	-	1
August 1	104	A1	0940	1040	3.2	2.7	3.2	2.9	-	178	5	6	-	4	3	1	2
"	"	B1(+)	"	"	"	"	"	"	-	-	3	3	-	-	-	-	-
"	"	B1(-)	1105	1205	2.5	2.2	3.0	3.2	-	5	3	-	2	1	-	-	-
August 1	105	A3	1100	1200	2.5	2.2	3.0	3.2	-	105	5	2	2	2	1	-	6
"	"	B3(+)	"	"	"	"	"	"	-	5	4	-	-	-	2	-	-
"	"	B3(-)	0945	1045	3.2	2.7	3.2	2.9	-	9	-	-	-	1	5	-	-
August 1	106	A2	1235	1335	2.2	2.8	3.2	3.4	-	240	13	-	3	13	3	1	-
"	"	B2(+)	"	"	"	"	"	"	-	9	1	-	1	-	7	-	-
"	"	B2(-)	1350	1450	3.0	3.6	3.4	3.1	-	5	-	-	-	1	7	1	-
August 2	107	A1	1620	1650	4.0	4.4	3.1	3.0	-	71	5	1	-	5	6	3	1
"	"	B1(+)	"	"	"	"	"	"	-	7	1	-	-	1	1	-	-
"	"	B1(-)	1725	1755	4.6	5.0	2.9	2.9	-	10	1	-	3	-	-	-	-
August 2	108	A3	1720	1750	4.6	5.0	2.9	2.9	-	169	1	-	4	-	5	1	-
"	"	B3(+)	"	"	"	"	"	"	-	2	-	-	-	-	1	-	-
"	"	B3(-)	1625	1655	4.0	4.4	3.1	3.0	-	1	-	-	-	-	2	-	-
August 2	109	A2	1825	1855	5.1	5.4	2.6	2.7	-	125	1	3	4	1	16	-	-
"	"	B2(+)	"	"	"	"	"	"	-	21	-	-	1	2	2	-	-
"	"	B2(-)	1910	1940	5.4	5.5	2.7	2.7	-	18	-	1	2	-	-	1	-
August 3	110	A3	0910	1010	4.8	4.0	2.5	2.6	-	225	3	3	-	6	3	-	1
"	"	B3(+)	"	"	"	"	"	"	-	4	-	2	-	-	1	-	-
"	"	B3(-)	1035	1135	3.9	2.9	2.7	2.7	-	6	2	-	1	1	-	-	-
August 3	111	A1	1030	1130	3.9	2.9	2.7	2.7	-	230	4	2	-	1	4	-	-
"	"	B1(+)	"	"	"	"	"	"	-	8	1	2	-	-	3	-	1
"	"	B1(-)	0915	1015	4.8	4.0	2.5	2.6	-	15	-	-	-	-	1	-	-
August 3	112	A2	1200	1300	3.0	2.5	2.7	2.6	-	142	2	2	2	4	3	-	1
"	"	B2(+)	"	"	"	"	"	"	-	5	1	1	-	4	2	-	1
"	"	B2(-)	1320	1420	2.4	2.2	2.9	2.4	-	17	-	1	-	-	3	-	-

APPENDIX IV (page 3)

Date	Test number	1/ Net placement	Time Net in	Time Net out	Gauge Height (ft.) Net in	Gauge Height (ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Salmon	Striped bass	2/ Minnow	Threadfin shad	American shad	Crappie	Catfish	Carp	3/ Other
August 7	113	A1	1620	1725	2.3	2.9	3.4	3.7	-	238	7	8	7	8	49	-	1
"	"	B1(+)	"	"	"	"	"	"	-	44	1	1	-	-	16	-	1
"	"	B1(-)	1750	1835	3.0	3.5	3.3	3.1	-	64	1	-	2	-	5	-	-
August 7	114	A3	1745	1830	3.0	3.5	3.3	3.1	-	213	6	3	5	2	4	1	1
"	"	B3(+)	"	"	"	"	"	"	-	27	-	1	1	1	-	-	1
"	"	B3(-)	1625	1730	2.3	2.9	3.4	3.7	-	14	-	4	2	1	4	-	-
August 7	115	A2	1900	1945	3.9	4.4	2.9	3.0	-	418	1	8	13	2	7	2	1
"	"	B2(+)	"	"	"	"	"	"	-	59	-	1	3	-	2	-	-
"	"	B2(-)	2000	2045	4.4	4.8	2.9	3.0	-	77	-	6	21	1	19	-	-
August 8	116	A3	0945	1045	6.4	5.9	2.3	2.4	-	191	1	12	-	-	-	-	1
"	"	B3(+)	"	"	"	"	"	"	-	1	-	-	-	-	-	-	-
"	"	B3(-)	1105	1205	5.8	5.1	2.3	2.3	-	28	-	-	1	-	1	-	-
August 8	117	A1	1100	1200	5.8	5.1	2.3	2.3	-	267	1	4	-	1	4	1	1
"	"	B1(+)	"	"	"	"	"	"	-	-	-	-	-	-	-	-	1
"	"	B1(-)	0950	1050	6.4	5.9	2.3	2.4	-	20	-	1	-	-	-	-	2
August 8	118	A2	1225	1325	5.0	4.0	2.3	2.4	-	145	-	3	-	-	2	-	1
"	"	B2(+)	"	"	"	"	"	"	-	15	-	-	-	-	-	-	-
"	"	B2(-)	1340	1440	4.0	4.0	2.4	2.4	-	-	1	-	-	-	-	1	-
August 9	119	A1	1650	1735	2.7	2.6	2.7	3.3	-	309	5	12	7	2	18	-	3
"	"	B1(+)	"	"	"	"	"	"	-	22	2	3	2	-	-	-	-
"	"	B1(-)	1755	1840	2.7	3.5	3.3	3.1	-	38	-	10	2	-	5	-	1
August 9	120	A3	1750	1835	2.7	3.5	3.3	3.1	-	321	7	15	11	7	15	-	2
"	"	B3(+)	"	"	"	"	"	"	-	37	-	2	4	1	3	-	-
"	"	B3(-)	1655	1740	2.7	2.6	2.7	3.3	-	18	-	1	1	1	1	-	1
August 9	121	A2	1900	1945	3.6	4.0	3.0	2.9	-	323	1	19	17	1	17	-	1
"	"	B2(+)	"	"	"	"	"	"	-	16	6	-	1	-	1	-	-
"	"	B2(-)	1955	2040	4.0	4.7	2.7	2.8	-	41	5	2	-	-	1	-	1
August 10	122	A3	0855	0955	5.1	5.5	2.9	2.9	-	183	2	4	1	-	1	1	-
"	"	B3(+)	"	"	"	"	"	"	-	8	-	1	-	-	-	-	-
"	"	B3(-)	1010	1110	5.5	5.7	2.9	2.6	-	12	-	-	-	-	-	-	2
August 10	123	A1	1005	1105	5.5	5.7	2.9	2.6	-	114	2	3	-	-	4	-	8
"	"	B1(+)	"	"	"	"	"	"	-	15	-	2	-	-	1	-	9
"	"	B1(-)	0900	1000	5.1	5.5	2.9	2.9	-	41	-	1	1	-	1	-	3
August 10	124	A2	1135	1235	5.8	5.2	2.4	2.3	-	118	-	3	-	-	1	-	3
"	"	B2(+)	"	"	"	"	"	"	-	11	-	1	-	-	-	-	-
"	"	B2(-)	1245	1345	5.2	5.0	2.2	2.2	-	32	-	1	-	1	1	1	-
August 14	125	A1	1650	1735	5.0	4.8	2.2	2.0	-	46	1	19	1	-	2	-	-
"	"	B1(+)	"	"	"	"	"	"	-	9	-	3	-	-	-	-	-
"	"	B1(-)	1800	1845	4.8	4.6	2.0	2.5	-	20	-	-	-	-	-	-	1
August 14	126	A3	1755	1840	4.8	4.6	2.0	2.5	-	147	3	3	-	-	-	-	-
"	"	B3(+)	"	"	"	"	"	"	-	-	-	-	-	-	1	-	-
"	"	B3(-)	1655	1740	5.0	4.8	2.2	2.0	-	3	-	1	-	-	-	-	-
August 14	127	A2	1905	1950	4.4	4.0	2.4	2.3	-	175	-	3	6	-	2	-	1
"	"	B2(+)	"	"	"	"	"	"	-	16	-	-	-	-	2	-	-
"	"	B2(-)	2010	2055	3.9	3.6	2.3	2.2	-	18	-	-	2	-	2	-	-
August 15	128	A3	0930	1030	3.4	3.5	2.2	2.6	-	171	3	10	3	2	5	-	1
"	"	B3(+)	"	"	"	"	"	"	-	17	1	2	-	-	-	-	1
"	"	B3(-)	1100	1200	3.5	3.3	2.6	2.6	-	31	-	1	-	-	2	-	1
August 15	129	A1	1055	1155	3.5	3.3	2.6	2.6	-	407	2	4	3	5	9	-	-
"	"	B1(+)	"	"	"	"	"	"	-	27	1	1	-	-	-	-	-
"	"	B1(-)	0935	1035	3.4	3.5	2.2	2.6	-	9	-	1	-	-	1	-	-
August 15	130	A3	1220	1320	2.2	2.8	2.6	2.6	-	181	3	6	5	6	5	1	5
"	"	B3(+)	"	"	"	"	"	"	-	26	-	4	7	1	1	-	-
"	"	B3(-)	1350	1450	3.0	3.7	2.6	2.4	-	9	-	-	3	-	3	-	3

APPENDIX IV (page 4)

Date	Test number	Net placement 1/	Time Net in	Time Net out	Gauge Height(ft.) Net in	Gauge Height(ft.) Net out	Velocity (ft./sec.) Net in	Velocity (ft./sec.) Net out	Salmon	Striped bass	Minnow 2/	Threadfin shad	American shad	Crappie	Catfish	Carp	Other 3/
August 15	131	A1	1345	1445	3.0	3.7	2.6	2.4	-	172	1	5	1	-	16	-	3
"	"	B1(+)	"	"	"	"	"	"	-	15	-	-	-	-	-	-	2
"	"	B1(-)	1225	1325	2.2	2.8	2.6	2.6	-	40	1	-	1	-	3	-	-
August 15	132	A2	1515	1615	4.0	4.3	2.0	1.9	-	141	1	18	2	-	6	-	-
"	"	B2(+)	"	"	"	"	"	"	-	10	1	1	-	-	1	-	-
"	"	B2(-)	1630	1730	4.5	5.0	1.6	1.8	-	4	-	-	-	-	-	-	-
August 16	133	A1	1605	1650	3.9	4.4	2.7	2.1	-	101	1	-	2	2	13	-	4
"	"	B1(+)	"	"	"	"	"	"	-	7	1	-	-	-	-	-	-
"	"	B1(-)	1710	1755	4.6	5.0	2.6	2.3	-	7	-	-	-	1	2	-	1
August 16	134	A3	1705	1750	4.6	5.0	2.6	2.3	-	100	1	1	2	-	2	-	-
"	"	B3(+)	"	"	"	"	"	"	-	2	-	-	-	-	1	-	-
"	"	B3(-)	1610	1655	3.9	4.4	2.7	2.1	-	20	1	1	-	-	1	-	1
August 16	135	A2	1820	1905	5.2	5.5	2.0	1.8	-	74	-	-	6	-	3	-	-
"	"	B2(+)	"	"	"	"	"	"	-	4	-	-	1	-	1	-	-
"	"	B2(-)	1920	2005	5.4	5.4	1.8	1.5	-	5	-	-	-	-	-	-	-
August 17	136	A3	1230	1315	2.7	2.1	2.9	3.1	-	115	1	6	3	1	5	-	2
"	"	B3(+)	"	"	"	"	"	"	-	12	-	5	-	-	-	-	-
"	"	B3(-)	1335	1420	2.1	2.1	3.1	3.2	-	3	-	11	-	-	1	-	-
August 17	137	A1	1330	1415	2.1	2.1	3.1	3.2	-	123	2	-	10	2	4	-	-
"	"	B1(+)	"	"	"	"	"	"	-	11	-	3	1	-	-	-	-
"	"	B1(-)	1235	1320	2.7	2.1	2.9	3.1	-	4	-	1	1	-	-	-	-
August 17	138	A2	1440	1525	2.5	3.2	3.2	2.8	-	243	3	6	1	3	8	-	-
"	"	B2(+)	"	"	"	"	"	"	-	10	-	-	-	-	5	-	-
"	"	B2(-)	1540	1625	3.2	3.5	2.8	2.8	-	4	-	-	-	-	-	-	-
	Total	A							5	9,176	2,668	2,971	153	1,613	1,325	2,025	132
	Total	B(+)							-	684	282	266	23	75	391	128	24
	Total	B(-)							-	770	224	214	51	67	344	188	21
Grand Total									5	10,630	3,174	3,451	227	1,755	2,060	2,341	177

Total	A	all species	20,068
Total	B(+)	all species	1,873
Total	B(-)	all species	1,879
Grand Total		all species	23,820

1/ (+)= Catch in "B" net with "A" net fishing directly above it.

(-)= Catch in "B" net without "A" net fishing directly above it.

2/ Blackfish, hardhead, splittail, Sacramento squawfish.

3/ Smelt, tule perch, bluegill sunfish, largemouth black bass, steelhead trout, starry flounder, sculpin, golden shiner, warmouth bass.