STATE WATER RESOURCES CONTROL BOARD
SAN FRANCISCO BAY/SACRAMENTO SAN JOAQUIN DELTA ESTUARY

JUNE 14, 1994 WORKSHOP

COMMENTS OF EAST BAY MUNICIPAL UTILITY DISTRICT

Introduction

East Bay Municipal Utility District ("EBMUD") offers these comments on the subjects listed for discussion in the State Water Resources Control Board's Notice of Public Workshop for June 14, 1994. EBMUD's comments focus primarily on Issues No. 1 and 3.

With regard to Issue No. 1, the question of factors which, independent from diversions, contribute significantly to the decline of Bay-Delta fish and wildlife resources, our comments summarize research findings for the Mokelumne River. Studies conducted on the Mokelumne River document that striped bass predation alone may result in up to 50% mortality of out-migrating salmon. Efforts to address the effects of predation, and other factors discussed here which are not directly related to diversion, can dramatically improve salmon population abundance.

With respect to the effects of upstream water projects on fish and wildlife resources in the Delta (Issue No. 3), it is generally assumed that diversions, other than those by the Central Valley Project (CVP) and the State Water Project (SWP), affect Delta resources. However, these individual project operations may, in and of themselves, have little ability to affect Delta conditions. As discussed below, studies sponsored by EBMUD in the development of its Lower Mokelumne River Management Plan[1] found that, while water project operations can be managed to provide protection and enhancement of habitat for fisheries on the Mokelumne, their effect on Delta estuarine habitat is insignificant. Moreover, upstream diverters' impacts on the Bay-Delta estuary appear to be unique to each project in terms of type and degree. Nonetheless, the cumulative total impact of upstream diversions on the Bay-Delta estuary may be significant.

EBMUD and others are exploring approaches for meeting Delta water quality objectives which encompass the full range of upstream uses. In allocating responsibility for meeting Delta water quality objectives, the State Board must balance proposed operational changes intended to benefit Delta conditions with the potential adverse impacts on upstream beneficial uses and biological resources. Given the stream and project-specific nature of these tradeoffs, the following factors must be considered: the extent to which the assignment of flow-based Delta protection measures can impact biological resources and resource management programs on upstream tributaries; the value of and impact on beneficial uses served by upstream sources; the conservation and drought management practices of upstream users; impacts on drinking water quality;

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[1] EBMUD Exhibit No. 32, Mokelumne River Hearing before the State Water Resources Control Board, November 1992.

impacts on water rights; and the cost, availability, and environmental consequences associated with development of replacement supplies.

The District's comments on Issues No. 1 and 2 are based on information collected and research conducted by EBMUD as part of its own investigations on the lower Mokelumne River, which is an eastside tributary to the Delta, independent from either the Sacramento or San Joaquin River systems. Comments on Issues No. 3 and 4 are based on the District's participation in a collaborative effort of several urban and agricultural water agencies to address Bay-Delta issues.

<u>Issue No. 1</u>: **What factors, excluding diversions, contribute to the decline of fish and wildlife resources in the Bay-Delta Estuary?**

Several environmental factors, in addition to and in combination with hydrologic changes resulting from diversions, have contributed to the high mortality of juvenile chinook salmon and steelhead emigrating through the central Delta and the lower Mokelumne River. These factors include exposure to elevated water temperatures within the Delta during the periods of adult in-migration and juvenile emigration, the presence of introduced predatory species, impacts of commercial and recreational harvest and the absence of effective controls on poaching.

Recent studies on the lower Mokelumne River document the extent to which predation from introduced species such as striped bass negatively impact outmigrating chinook salmon. In May 1993, the District received reports of striped bass sightings in the lower Mokelumne River and, in cooperation with the Department of Fish and Game, sponsored a study to determine the effects of striped bass predation on out-migrating juvenile salmon. The results of this study indicate a significant amount of striped bass predation on chinook salmon smolts. Analytical data from the study suggest that the loss of naturally produced Mokelumne River salmon smolts to striped bass predation ranged from 20,000 to 90,000 fish, or 11% to 51% of the total Mokelumne River in-river production. The findings of the study are reported in Attachment 1.

Another example of the impact of introduced species is the explosive growth of Asian clams (*Potomocorbula amurensis*). These clams are voracious consumers of phytoplankton and zooplankton, which dramatically alters the food chain in the Estuary.

In addition to problems caused by introduced species, harvesting by commercial and recreational anglers and poachers reduces the number of chinook salmon and steelhead migrating into the lower Mokelumne from the Delta, as shown in studies conducted on the Mokelumne River. Adult salmon and steelhead are particularly vulnerable to harvest if delays in fish passage occur and fish accumulate in localized areas such as at entrances to fish hatcheries or in the spawning areas. Illegal harvest has been identified as a potentially significant factor influencing abundance of adult salmon and steelhead spawning in the lower

Mokelumne River. In dry years, poaching may reduce the number of salmon migrating into the lower Mokelumne River to spawn by as much as 50%.[2] Ocean harvest by commercial and recreational anglers is an additional factor which significantly influences population dynamics and abundance of adult chinook salmon returning to spawn in the lower Mokelumne River.

The harvest rate of Central Valley chinook salmon stocks, including salmon from the Mokelumne, fluctuates between 50% and 80%. Between 1970 and 1990 the harvest rate averaged 65% of the population.[3] One fisheries expert has stated, in testimony before the State Board, that consideration should be given to cutting the harvest rate in half as a reasonable approach to protecting salmon populations.[4]

Pollution from agricultural, urban, and industrial return flows also impacts aquatic resources in the Estuary. Pollutants such as chlordane, DDT, toxaphene, and rice herbicides have been found in fish tissues and may cause both direct and indirect mortality and lower reproductive success.

The State Board must consider these factors, in addition to and in combination with diversions, which contribute to the decline of fish and wildlife resources in the Bay-Delta Estuary and its tributaries. The relative impact of the

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[2] EBMUD Exhibit No. 27, Mokelumne River Fisheries, Testimony of Chuck Hanson, Mokelumne River Hearing before the State Water Resources Control Board, November 1992.

[3] EBMUD Exhibit No. 27, pp. 5-2 through 6-1.

[4] Testimony of D.W. Chapman, Mokelumne River Hearing before the State Water Resources Control Board, November 12, 1992; Transcripts 22:12-20.

specific factors which limit the various fish populations must be considered and addressed in conjunction with efforts to improve water quality in the Bay-Delta Estuary for fish and wildlife resources.

Issue No. 2: **What modifications have the SWP and CVP made to their operations to protect endangered species and other species of concern?**

At the State Board's May 16 workshop, the District provided comments on the effects of the CVP and SWP operations on fishery resources, particularly as they relate to impacts on Mokelumne River salmon. Briefly stated, operations by the CVP and SWP contribute to redirection of outmigrating juvenile salmon and increase their susceptibility to predation and entrainment. Central Delta mortalities of juvenile salmon average 85%. CVP/SWP operations also impact upstream migration of salmon to the Mokelumne River. In particular, the movement of large volumes of water from the Sacramento River across the Delta contributes to delays in upstream migration and increased straying of adults from one tributary to another.

In evaluating modifications in CVP and SWP operations for the protection of Delta water quality and listed species, the State Board must consider the trade-offs between meeting proposed Delta objectives and potential adverse impacts to upstream fisheries. Requirements imposed to improve Delta water quality for estuarine species or endangered species may have a corresponding detrimental impact on management plans developed for improving conditions for fisheries in upstream tributaries such as the Mokelumne River.[5] The State Board should therefore develop a comprehensive, systematic and balanced approach to evaluating the full spectrum of biological needs, and their relationship to other beneficial uses.

Issue No. 3: **What effect do upstream water projects, other than the CVP and SWP, have on the fish and wildlife resources of the Bay-Delta Estuary?**

It is generally assumed that diversions upstream of the Delta, other than the Central Valley Project and the State Water Project, affect fish and wildlife resources in the Delta. While upstream storage projects are credited with providing carryover storage that enables instream flows to be maintained under dry year conditions, they are also recognized as having affected the Delta system.

However, most studies of upstream project operations and diversions have considered impacts only on the affected tributary. Few have looked at corresponding downstream Delta impacts. As discussed in more detail below, studies conducted on the Mokelumne River have found that while project operations can be managed to provide protection and enhancement of habitat for

[5] As the District noted at the State Board workshop on May 16, changes in operation of the Delta Cross-channel intended to protect the winter-run Chinook salmon could have a detrimental effect on anadromous stocks in the Mokelumne River and the Central Delta.

Mokelumne fisheries, their effect on Delta estuarine habitat is insignificant. Taken as a whole, upstream projects and diversions have been considered generally for their impacts on the Delta, but such impacts have not been quantified. Nevertheless, the District has quantified the fisheries needs on the Mokelumne River in the development of the Lower Mokelumne River Management Plan and is committed to implementation of this Plan as its contribution to a water allocation scheme.

In order to assist the State Board in the development of an equitable allocation method for meeting Delta water quality objectives, EBMUD and others are exploring the development of a coordinated plan for all tributaries. Factors that must be considered and weighed in order to achieve an equitable allocation of responsibility for meeting Delta standards include the range of upstream uses, the multiple project purposes and operations, magnitude of diversions, and water right entitlements. In its efforts to address the effects of upstream water projects and diversions on Delta resources, and to broaden the allocation of responsibility for Delta resource protection, the State Board cannot look simply at rates of diversion, volumes of storage, or instream flow. It must also give recognition to the following:

1. **Ability of Upstream Diversions to Influence Estuarine Habitat.** The State Board must consider the ability of upstream water projects to affect reverse flows or other hydrodynamic conditions that affect

estuarine habitat. For example, projects like the Mokelumne River project can be managed to improve conditions for fall-run chinook salmon and steelhead on the lower Mokelumne River, but the project has a limited ability to affect Delta estuarine habitat. During the Mokelumne River Hearing, the District submitted evidence on the potential impacts of Mokelumne River flows on the Bay-Delta Estuary.[6] That evidence compared the differences in inflow to the central Delta resulting from two alternative proposals for Mokelumne River instream flows, one proposed by CDF&G and the other proposed by EBMUD. The evidence submitted by the District demonstrated that the difference in central Delta inflows between the two plans is negligible in comparison to all inflows to the central Delta. The two plans have even less differential effects on Delta outflow at Chipps Island.

Despite these negligible effects on Delta outflow, the high flow releases called for in the proposal by CDF&G were demonstrated to have devastating urban water supply impacts. The evidence showed that Pardee reservoir (EBMUD's primary source of supply) would be empty in 50% of the hydrologic years modeled.

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[6] EBMUD Exhibit No. 32, Mokelumne River Hearing before the State Water Resources Control Board, November 1992, pp. 5-74, 5-75 and 5-76.

Significant shortages would occur in 60% of the years, and in 10 years out of 70 there would be no water available for the District's 1.2 million customers.[7]

2. **Impacts on Carryover Storage.** Proper management of storage is critical to maintaining water quality conditions downstream of many reservoirs in the Sacramento Valley and adjacent foothills. Reservoir releases to improve instream flow and water quality conditions may not coincide with seasons of concern to improve estuarine habitat in the Delta. In addition, high releases from tributaries in an attempt to improve water quality for estuarine species may adversely affect fishery populations present in storage reservoirs and rearing in those tributaries. In developing an implementation plan to improve Delta water quality the State Board must consider the resulting adverse impacts to fisheries in upstream tributaries and storage reservoirs and the efforts of upstream water users to improve instream conditions. These resources must be balanced with the ability of each tributary to significantly affect Delta water quality.

3. **Impacts on Beneficial Uses.** The State Board must consider all demands made on the water, including the beneficial uses identified

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[7] EBMUD Exhibit No. 29, Testimony of Jon A. Myers, submitted during the Mokelumne River Hearing before the State Water Resources Control Board, November 1992.

in the May 1991 Water Quality Control Plan for Salinity (p. 4-1 to 4-3), and the significant impacts on urban water supplies that can result from proposals to meet Delta standards. As stated above, during the Mokelumne Hearing, it was demonstrated that imposing increased release requirements on Mokelumne Project operations would have very dramatic impacts on water supply availabilities for municipal uses.

4. **Efficiency of Water Use.** The State Board must take into account efficiency of water use by urban water suppliers and their demonstrated commitment to conservation and reclamation. Many urban water suppliers have adopted long-range planning programs to maximize efficient use of a limited water supply.

For example, EBMUD's conservation and reclamation programs were described in detail during the State Board's D-1630 hearings.[8] As a result of the District's water use efficiency programs, EBMUD has not increased average water use since the early 1970s, despite continued population growth within its East Bay service area. In addition, EBMUD has sought to limit new demand for water by relying upon expanded conservation and reclamation as

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[8] Exhibit No. WRINT EBMUD-5, Testimony of John B. Lampe, July 1992.

part of its long-range planning program.[9] The conservation and reclamation programs which EBMUD is undertaking as part of its water resource management efforts are expected to reduce the District's 2020 demand for water from 277 MGD down to 229 MGD. The effect is that in 2020 -- thirty years later -- the District's demand is projected to be only 9 million gallons per day more than the District's normal demand in 1990.

5. **Drought Management Programs.** In addition to conservation and reclamation, the State Board must recognize savings achieved through drought management efforts. It is in the critically dry years when the competing demands for water, both for fishery protection and other beneficial uses, become the most contentious.

Throughout the 1987-1992 drought, EBMUD customers were subject to vigorous water use reduction measures under the District's Drought Management Program. As a result of the substantial water savings achieved, EBMUD maximized efficient use of its limited supply and provided significantly increased flow to the lower Mokelumne River to mitigate effects of drought conditions. In most of the years, customers exceeded the District's rationing goals. For

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[9] EBMUD Exhibit No. 37, Mokelumne River Hearing before the State Water Resources Control Board, Testimony of Andrew Cohen, November 1992.

example, in 1991, EBMUD achieved an overall reduction of 28% in customer demand. Use reduction of this magnitude has a substantial impact on District customers. To achieve an overall reduction of 28%, residential customers reduced demand by 33%. This necessitates a **38%** cut back in use during the summer months. These water use reduction efforts, imposed on EBMUD customers during drought conditions, are *in addition* to the District's ongoing (non-drought) water conservation and reclamation programs previously described. As water use efficiency increases through implementation of new reclamation and conservation programs, it will become increasingly difficult to achieve further water use reductions during times of drought.

6. **Availability of Alternative Water Supplies.** In the State Board's process of weighing and balancing the relative impacts of upstream water projects on Delta biological resources and their respective ability to effect changes in estuarine habitat, the State Board must also consider the feasibility, cost and environmental impacts associated with developing replacement water supplies. Some water agencies may need to develop additional water supplies as a result of the impacts of new Bay-Delta standards.

Like many other urban water users, despite ongoing conservation and reclamation programs maximizing efficient use of water, the District's existing water supplies are not sufficient to meet demand. In order to supply prior water rights of Mokelumne River users through the year 2020, provide additional flow which it has allocated for the protection of Mokelumne fisheries, and meet customer demand within the EBMUD service area (even after considering up to 25% reductions during droughts), the District projects a shortfall during droughts of up to 130,000 acre-feet of water.[10] The District hopes to meet this projected shortfall through development of a conjunctive use, groundwater storage project in San Joaquin County.

In every way it can, the District is attempting to utilize the Mokelumne River resource as efficiently as possible. If additional flows are required of the District above and beyond those contemplated in the Lower Mokelumne River Management Plan in order to comply with Bay-Delta standards, the District may have to develop supplemental supply alternatives. Supplemental supply alternatives that may be available to the District, such as

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[10] EBMUD Exhibit No. 25, Testimony of John Lampe, submitted during the Mokelumne River Hearing before the State Water Resources Control Board, November 1992, pp. 8-10.

implementation of its American River contract or increased storage capacity on the Mokelumne River, while presenting fewer environmental impacts than a supplemental supply source from the Delta, nevertheless present new environmental issues which must be considered in the balance.

7. **Water Right Priorities.** The ability of urban water agencies to develop projects that produce dependable water supplies has been made possible by California's adherence to a consistent set of rules governing the appropriation of the State's waters. The existing beneficial uses within the service area of many municipalities were made possible because of California's system of appropriative rights. This seniority system of appropriative rights provides a reliable foundation on which considerable financial commitments have and can be made. Without such reliability, alternatives such as water transfers between entities to mitigate impacts for complying with Bay-Delta standards, can be undermined.

EBMUD is working both independently and in collaboration with others to develop an approach that balances all the factors described above in equitably allocating responsibility for compliance with Bay-Delta standards. We urge the Board to consider these issues carefully. At the same time, we urge the Board to move expeditiously to address the many non-flow factors discussed in response to Issue No. 1, which have contributed significantly to the decline of the health of the Bay-Delta system.

Issue No. 4: **What are the status and trends of biological resources in the Bay-Delta Estuary?**

With respect to status and trends of biological resources in the Bay-Delta Estuary system, the District requests that the State Board consider the findings contained in the technical studies conducted by the California Urban Water Agencies, submitted to the Environmental Projection Agency (EPA) on March 11, 1994 and to the State Board on April 26, 1994. The District participated in the development of those studies and was a signatory to the letter transmitting the findings to EPA and the State Board.

Attachment 1

Report on Striped Bass

Predation on Fall Run Chinook Salmon Smolts

Below Woodbridge Dam in the Mokelumne River

May 24, 1994

May 24, 1994

MEMO TO: Joe Miyamoto, Superintendent of Fisheries and Wildlife

F R O M: Steve Boyd, Fisheries Biologist

SUBJECT: Striped bass predation in the Woodbridge Dam afterbay

In April and early May of 1993, my office received three reports that striped bass were present in the afterbay of Woodbridge dam. The reports were made by local anglers, Woodbridge Irrigation District (WID) staff, and the field crew working for Vogel Environmental, a District consultant. I was able to confirm these reports on May 5 when I watched an angler catch an adult striped bass in the afterbay. These reports coincided with the beginning of the main outmigration of fall run salmon smolts in the lower Mokelumne River (figures 1,2,and 3). Arrangements were made with the California Department of Fish and Game (CDFG) to survey the area as a means to determine if predation on salmon smolts was a problem.

Eight angling surveys were conducted by CDFG with assistance from East Bay Municipal Utility District (EBMUD) staff on May 27, and June 3,4,10,13,15,16 and 19 of 1993. A total of 158 striped bass (<u>Morone</u> <u>saxatilis</u>) were caught (no other fish were caught). The average fork length was 40cm (n=157). The stomach contents of 153 fish were analyzed by EBMUD Fisheries and Wildlife staff.

Food items were found in 120 (78.4%) of the stomachs. Salmon smolts were by far the most important food item (by frequency of occurrence). Salmon smolts were positively identified in 79 (51.6%) of the stomachs, and partially digested fish found in another 9 stomachs were strongly suspected of being salmon smolts as well (this could increase the number of stomachs with smolts to 88 (57.5%)). In all, 250 salmon were positively identified (average= 1.77 smolts/bass), 214 more were unidentified fish, strongly suspected of being salmon (combined average= 3.29 smolts/bass). The number of smolts per stomach ranged from 0 to 28.

Crayfish (<u>Procambarus</u> <u>clarkii?</u>) were the next most important food item with parts of 57 crayfish being found in 28 (18.3%) stomachs. A total of 14 Centrarchids were found in 9 (5.9%) stomachs, and 13 unidentified fish were recovered from 8 (5.2%) stomachs (these were identified as non-salmon). A total of 7 sculpin (<u>Cottus</u> <u>asper</u>?) were found in 6 (3.9%) stomachs. In addition, eighteen ants, 5 caddisflies, 1 damselfly, and 1 unidentified larvae were each found in 1 (<1%) stomach.

Several factors prevented us from getting a precise estimate of striped bass abundance in the afterbay: the transient nature of striped bass, high rates of angling in the afterbay and a maze of logistical constraints that limited the variety and effectiveness of available collection methods. We were able to develop a realistic range for striped bass abundance based on: a SCUBA survey conducted by Dave Vogel and Keith Marine on May 27, the harvest rate recorded during one angling survey, and daily observations made by trained fisheries technicians of local anglers harvesting striped bass in the afterbay. Keith Marine estimated there were over 200 striped bass in the afterbay during the SCUBA survey. The catch rate during the May 27 angler survey was 10 fish/angler/hour. The fisheries technicians estimated that over 2,000 striped bass were harvested from the afterbay by anglers, between May 5 and June 29. From this data and my own personal observations, I estimated the average daily striped bass density to be somewhere between 200 and 500 fish over the 56 day interval, when both adult stripers and juvenile salmon were abundant in the afterbay (figure 3).

To estimate smolt losses due to predation by striped bass I followed the methodology developed by Johnson et al (1992) and Bajkov (1935). Water temperatures were recorded hourly in the afterbay and the daily average was calculated and used to determine "evacuation" (digestion) rates for chinook salmon smolts in striped bass stomachs. This information was combined with the stomach analysis data and used to estimate "daily ration". The daily average temperature was 15C which meant that a striped bass would completely digest a chinook salmon smolt in 33 hrs. (figure 4). This approach was modified to reflect the fact that food item identification ceases to be possible (with available methods) some time before complete evacuation is reached. We estimated the digestion time when a smolt can no longer be identified as a fish to be about 24 hours at 15C.

The results of the analyses are presented graphically in figure 5. Based only on positively identified chinook salmon smolts, the results suggest the loss of naturally produced mokelumne river smolts, to striped bass predation in the afterbay, was somewhere between 19824 fish (11% of the entire estimated Mokelumne river natural production) and 49560 fish (27.5%). Combining the positively identified smolts with the suspected smolts yields loss estimates as high as 92,120 fish (51.1%)

A loss of even 11% of the natural production at any one location in a river system is unacceptably high and requires further investigation. High predation rates on outmigrating salmonids are not uncommon at engineered structures in other river systems tributary to the Sacramento - San Joaquin Delta. These conditions may have been exacerbated by the flood flow schedule in 1993. With non-flood flows there have been no reports of striped bass in the Woodbridge Dam afterbay as of May 24 1994.

REFERENCES

Bajkov, A. D. 1935. How to estimate the daily food consumption of fish under natural conditions. Trans. Am. Fish. Soc. 65:288-289

Johnson, J. H., A. A. Nigro, and R. Temple. 1992. Evaluating Enhancement of Striped Bass in the Context of Potential Predation on Anadromous Salmonids in Coos Bay, Oregon. No. Am. Jour. Fish. Mgt. 12(1):103-108.

Vogel, D. A. and K. R. Marine. 1994. The Mokelumne River Chinook Salmon and Steelhead Monitoring Program. East Bay Municipal Utility District Report. 60pp.

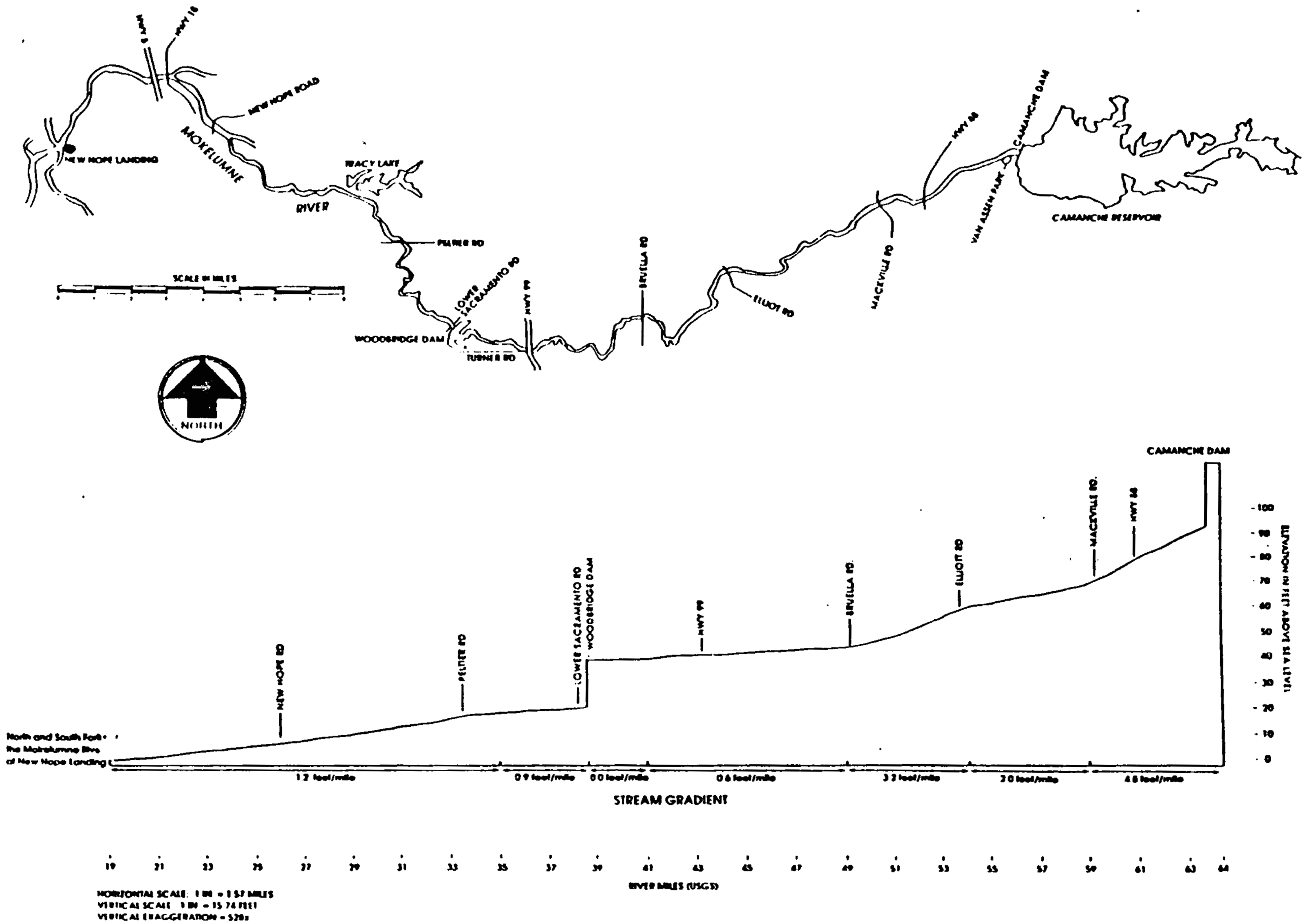


Figure 1. Lower Mokelumne River Elevations and Gradients (from EBMUD, 1991).

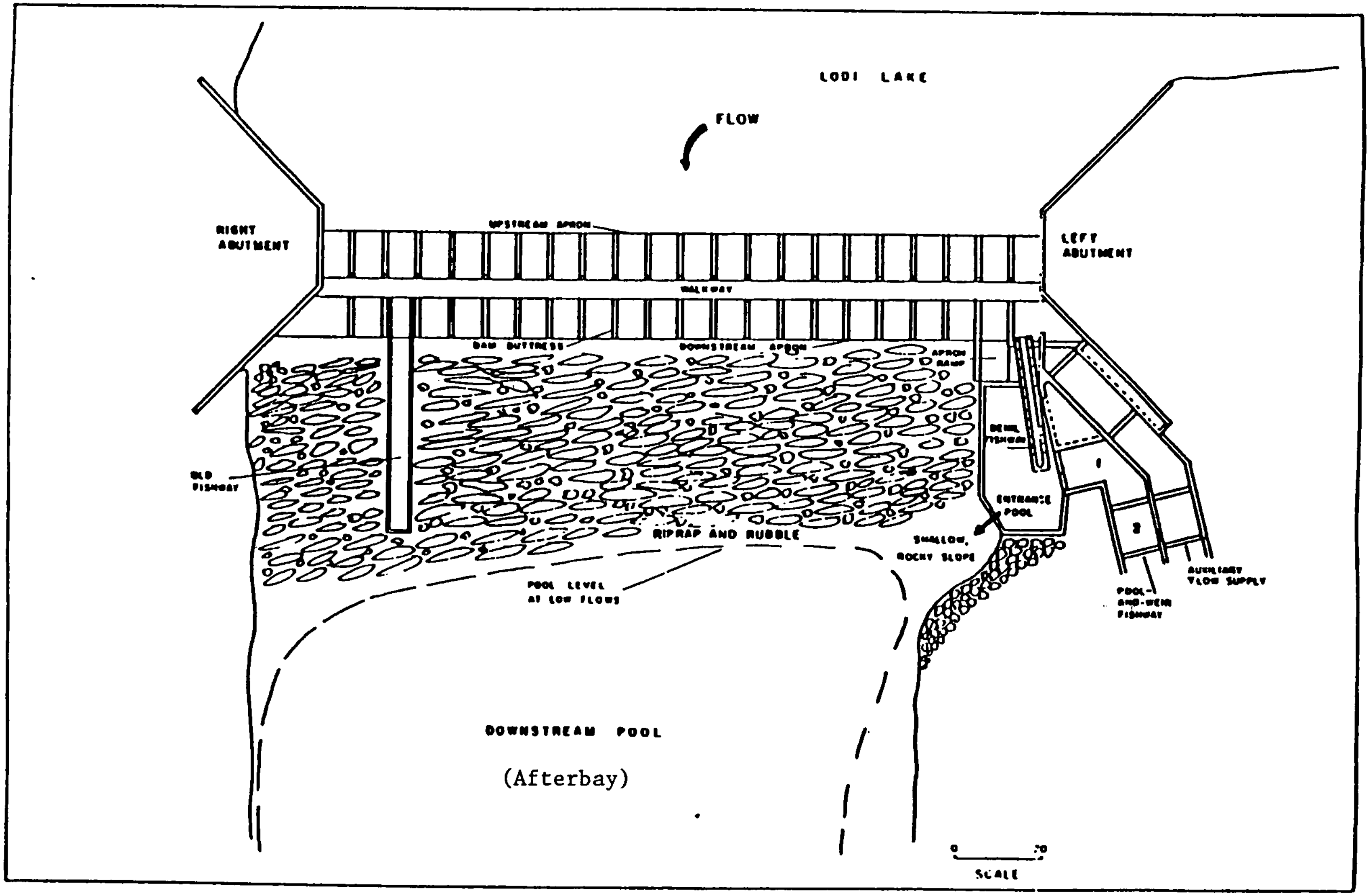
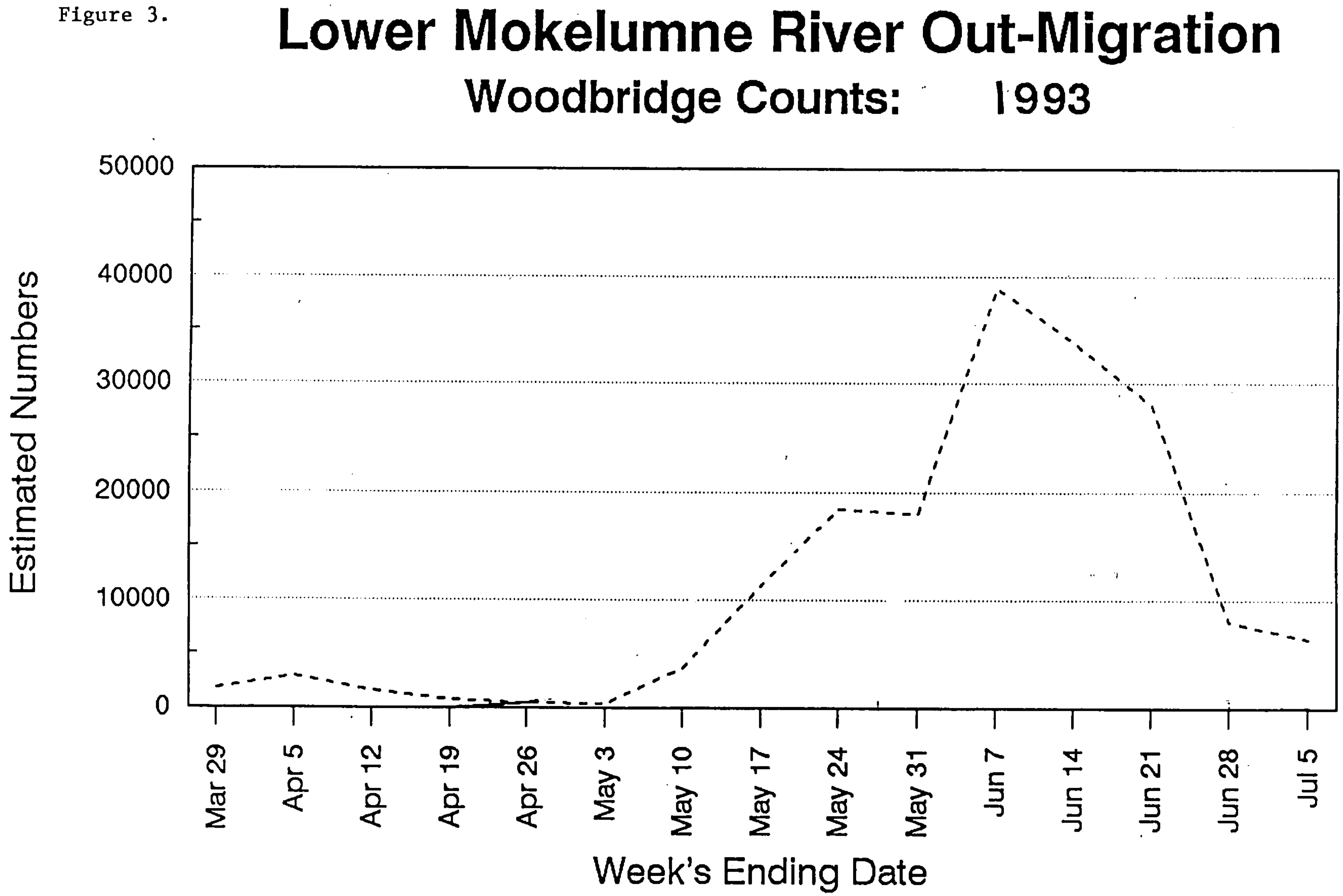


Figure 2. Plan view of Woodbridge Dam, lower Mokelumne River, California (from CDFG, 1991).

Figure 3.



* From Vogel 1994

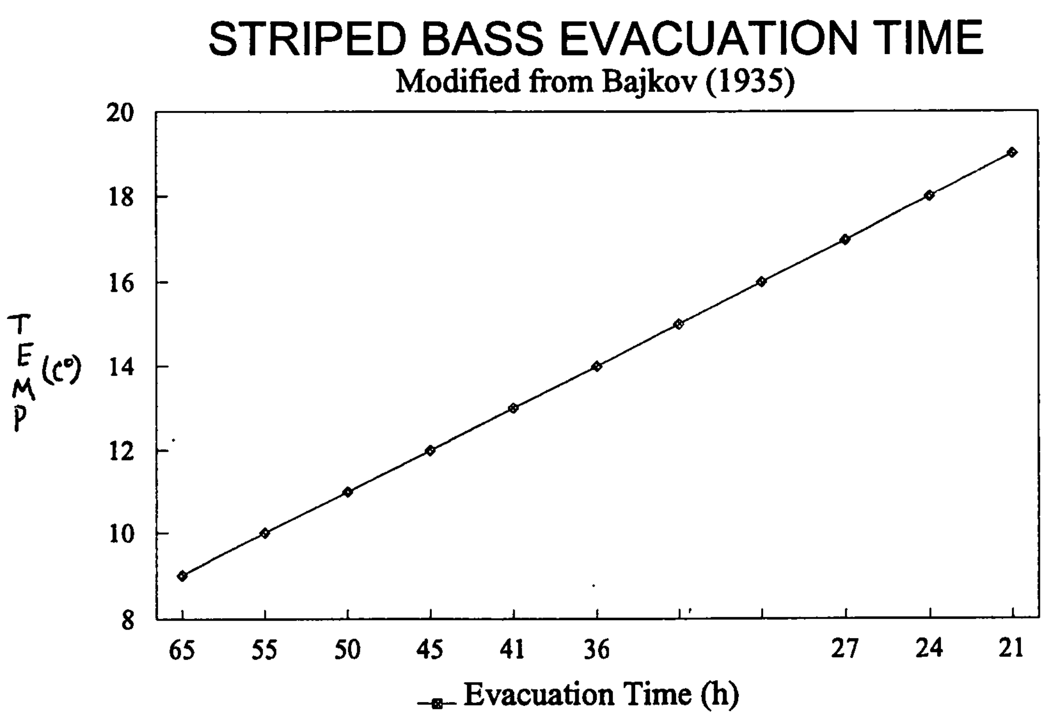
Figure 4.

EVACUATION RATES FOR CHINOOK SALMON SMOLTS IN STRIPED BASS STOMACHS
Modified from Bajkov (1935)

Evacuation Time (h)	Water Temperature (c)
65	9
55	10
50	11
45	12
41	13
36	14
	15
	16
27	17
24	18
21	19

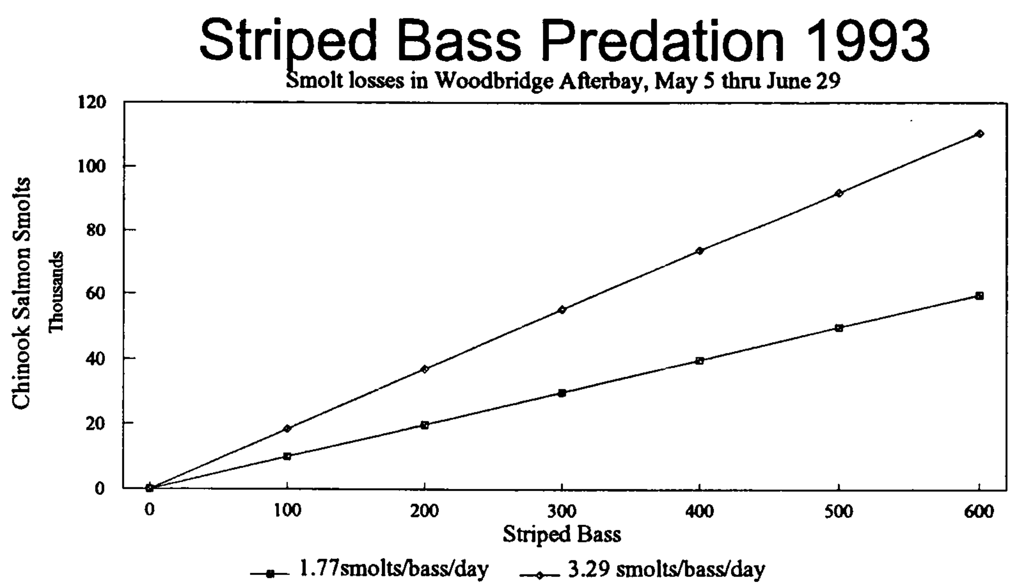
Regression Output:

Constant		23.29075
Std Err of Y Est		0.699285
R Squared		0.967087
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.23796	
Std Err of Coef.	0.016592	



This chart represents complete digestion rates of chinook salmon smolts in striped bass stomachs by temperature figure 5. Striped Bass Predation on Chinook Salmon Smolts in the Woodbridge Dam Afterbay 1993

Bass	Smolts1 (x1000)	Smolts2 (x1000)
0	0	0
100	9912	18424
200	19824	36848
300	29736	55272
400	39648	73696
500	49560	92120
600	59472	110544
700		



* Adjusted total chinook salmon outmigration at Woodbridge for 1993 was 180,195