Proposed Operations of the Delta Cross Channel Gates to Protect Downstream-Migrant Chinook Salmon Based on Real-Time Monitoring in the Sacramento River

Testimony Presented on Behalf of Delta Wetlands to the California State Water Resources Control Board

October 7, 1994

David A. Vogel
Fisheries Biologist
Natural Resource Consulting Scientists, Inc.
21600 Wilcox Road
Red Bluff, CA 96080

Introduction

Closure of the Delta Cross Channel (DCC) gates for specific, long durations has been proposed as a means of minimizing entrainment of young chinook salmon into the interior Sacramento - San Joaquin Delta (Delta) where the fish may experience high mortality. This paper describes the components of a real-time monitoring program which could be rapidly developed and implemented to allow for daily operations of the DCC gates (opened or closed) depending on the presence or absence of high numbers of young downstream-migrant salmon approaching the DCC. This type of a program could be quickly implemented and could be adopted by the California State Water Resources Control Board (SWRCB) in December 1994 as one important element in the formulation of standards to improve protection for Delta fishery resources. Ultimately, a DCC monitoring program could be used as the keystone for a comprehensive, Delta-wide real-time monitoring program that would be of significant value in protecting Delta fishery resources and providing for efficient water management in the Delta.

Real-Time Monitoring Program

Although the concept of real-time fishery resource monitoring has been proposed in a variety of forums related to protection of Delta fishery resources, few specifics of such monitoring have been presented to the SWRCB to date. During the SWRCB workshop held on September 21, 1994, the SWRCB staff indicated that the SWRCB was primarily interested in fish protection measures which could be adopted by December 1994. The SWRCB staff suggested that large-scale, Delta-wide real-time monitoring programs could not be developed and integrated with real-time water management throughout the Delta by December 1994. Therefore, the following program specifically focuses on a smaller-scale monitoring program which could be developed and adopted by December 1994. This program would provide substantial protection to Sacramento River chinook salmon and concurrently provide for efficient water management in the Delta.

The following discussion presents an example of a real-time monitoring program conducted during the 1980s to determine downstream migratory patterns of young chinook salmon in the Sacramento River. This example is presented to demonstrate that real-time monitoring to determine trends in relative abundance of young downstream-migrant chinook salmon can be effectively performed on a daily basis and has utility in protecting young salmon from entrainment into the DCC. The attached graphs display the results of this program. The methodologies associated with this monitoring program are given in Vogel et al. (1988).

Daily Data Acquisition

Real-time monitoring to determine the relative abundance of downstream migrant chinook salmon should be conducted on a daily basis. As shown in the attached graphs, daily relative fish abundance indices can vary substantially in the Sacramento River. Without the resolution of daily fish abundance indices, the usefulness of a monitoring program for fish protection or water management would be negated. For example, from one day to the next, the relative daily magnitude in numbers of young salmon can change from thousands to millions of young fish.

If such wide fluctuations in relative fish abundance are not measured on a daily basis, the value of fish protection resulting from opening or closing the DCC on a daily time scale is significantly diminished.

Select Monitoring Sites to Allow Reaction Time

Downstream migrant chinook salmon can move relatively rapidly toward the Delta. For example, during a pulse flow released from Keswick Dam in 1985, the rate of juvenile hatchery salmon downstream migration was estimated at approximately 1.7 to 1.4 miles per hour, depending on the specific reach of the Sacramento River (Myshak 1985). If the DCC gates are operated on a daily basis to minimize entrainment of young salmon into the interior Delta, sufficient response time has to be allowed in between the time when a "pulse" in the downstream movement of young salmon is determined and the time when the DCC gates can be closed to prevent entrainment. It is suggested here that a monitoring station should be established sufficiently far upstream from the DCC to allow for response time to open or close the DCC gates. This distance can be easily determined from prior investigations in the downstream migration timing of Sacramento River chinook. Variations in factors such as river flows, water temperatures, time of day, season, fish size, etc. should be accounted for in determining a monitoring location. Two existing daily monitoring stations for downstream migrant salmon are currently in operation near Red Bluff and Hamilton City which would be valuable to incorporate with a lower river monitoring site.

Alternative & Multiple Fish Sampling Devices

Various downstream migrant fish traps or fish monitoring devices are available to employ in a Sacramento River real-time monitoring program. Recently, the most effective fish sampling gear in the upper river reaches has proven to be rotary fish traps which are in operation near Red Bluff and Hamilton City. However, other effective fish sampling devices are also available and could be utilized in lower river reaches. Selection of the most effective gear type or types should be based on the sampling gear's ability to collect sufficient numbers of young salmon to determine relative abundance, allow for minimal gear avoidance by young salmon, sample fish with minimal mortality, and allow for daily processing of fish samples. It may be most effective to utilize two or more types of sampling devices and more than one of any specific sampling device to maximize sample sizes.

Perform Gear Calibrations

Because a real-time monitoring program to protect young salmon from entrainment into the DCC would necessitate computations of relative abundance of downstream migrant salmon, periodic fish sampling gear calibrations would have to be performed to quantify relative daily fish abundance. A simple means of calibration would be to release known numbers of marked fish upstream of the sampling site on a regular basis (e.g., weekly) or during changing riverine conditions. Marking calibration fish with a dye such as Bismark brown Y dye as described by Mundie and Traber (1983) would allow for rapid and easy calibration of fish sampling gear(s).

Ensure Data Uniformity

Special efforts should be made to ensure uniformity in data collected in any real-time monitoring program. Uniformity in data collected will allow for universal use of the data by any individual or agency. For example, representative samples of fish collected in the real-time monitoring program should be measured for fork length to help differentiate between salmon runs (e.g., fall run, late-fall run, winter run, spring run). A subjective reporting of only run designation without length-frequency discrimination may not allow for universal use of the data in Delta water management.

Night-Time Sampling

Prior research has demonstrated that the downstream migration of young Sacramento River chinook salmon primarily occurs at night (Vogel et al. 1988). For this reason, and because night-time sampling minimizes gear avoidance by fish, most, if not all, of the real-time sampling efforts should be performed during the night.

Universal Data Accessibility Each Day

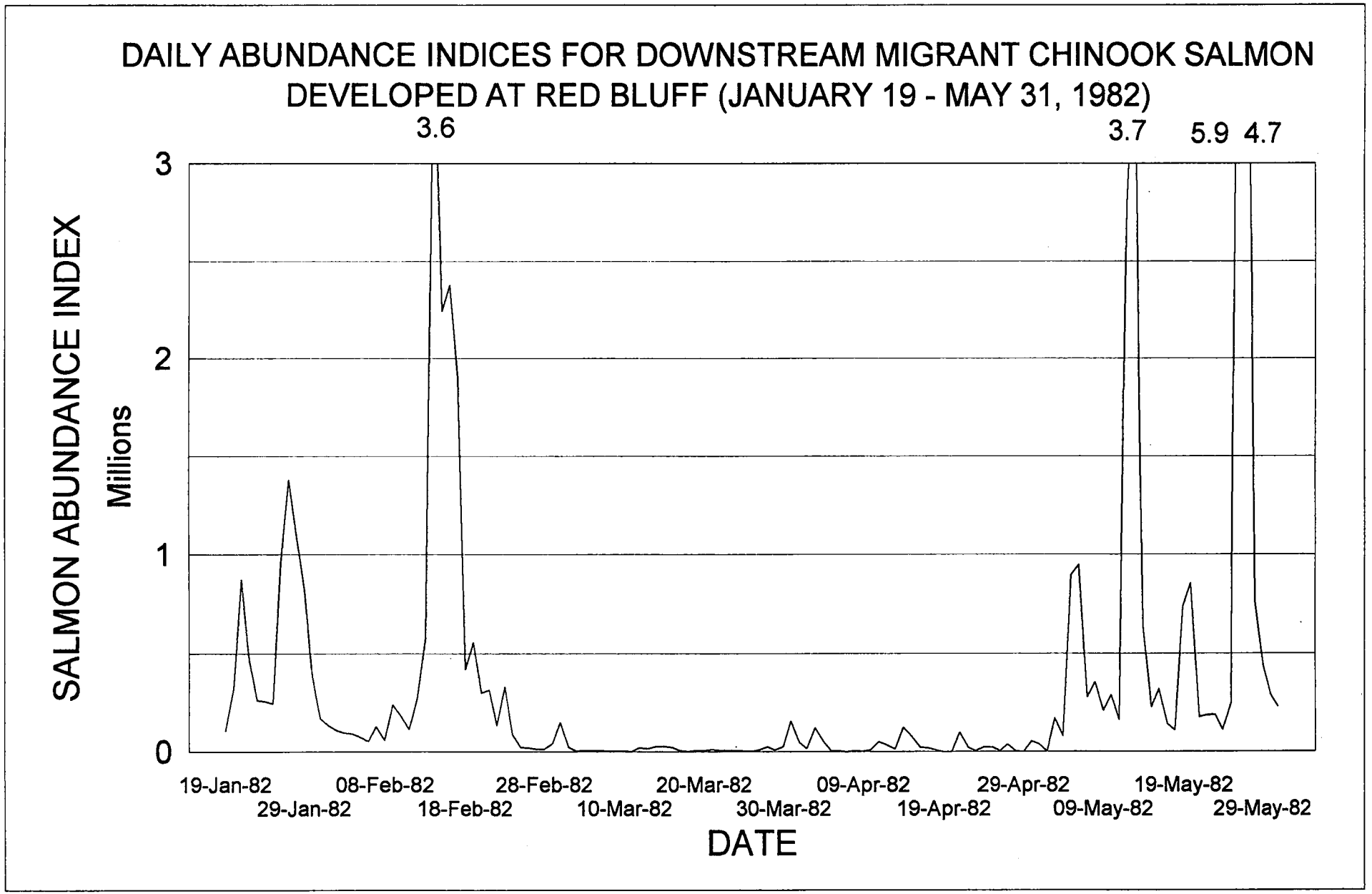
The data collected in a real-time monitoring program are only valuable in the context presented here if the data are reported in a format which can be rapidly accessed on a timely basis by individuals or agencies responsible for protecting and managing fishery and water resources. The California Data Exchange Center (CDEC) is proposed as a medium in which the biological data could be reported and accessed by any individual. Monitoring data collected during a previous night-time sampling period would be entered into CDEC early the following morning and made immediately accessible to individuals or agencies. These agencies could then use the information to determine daily DCC operations, closing the DCC to protect outmigrating salmon and opening the gates when salmon are not present.

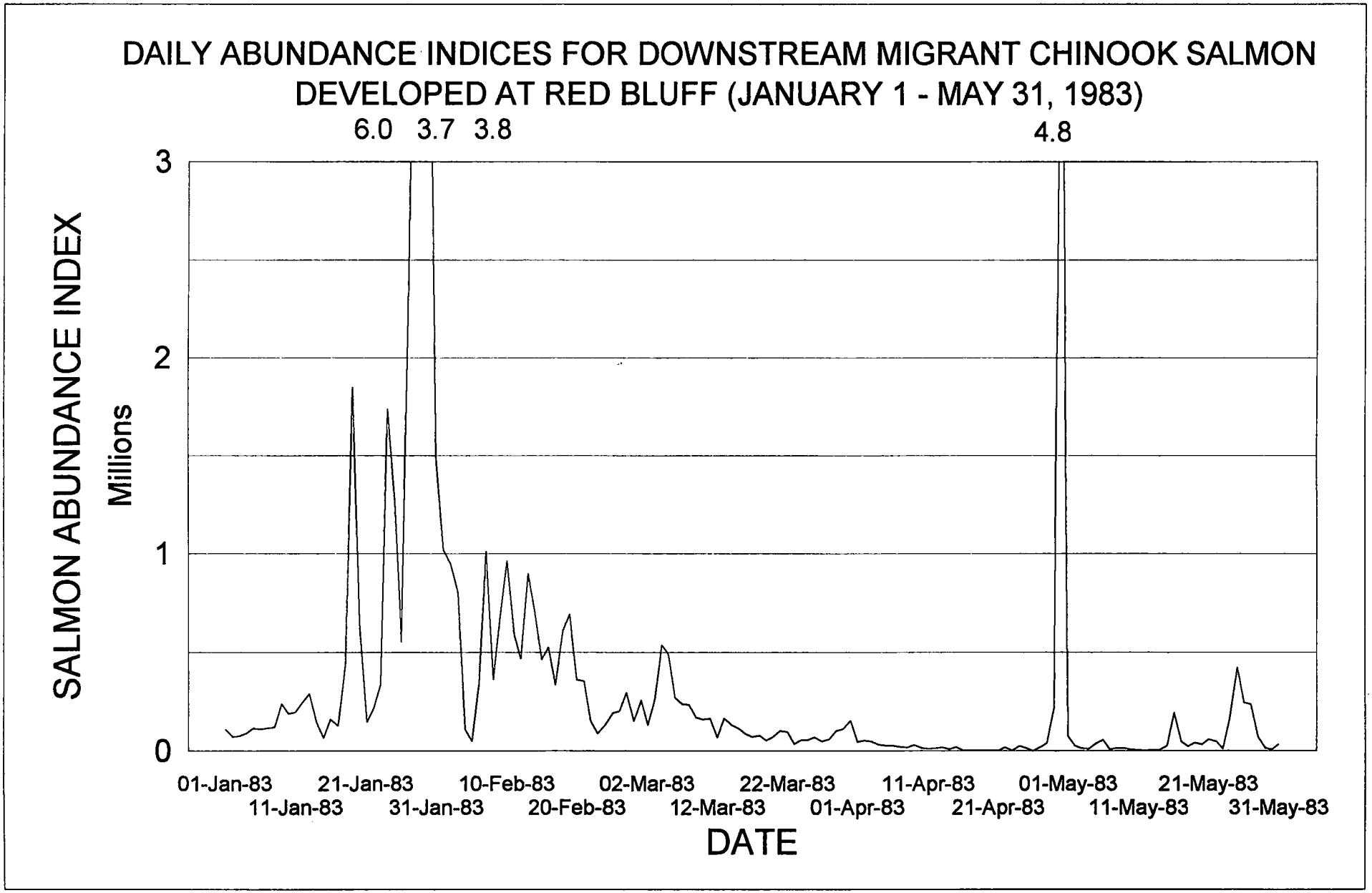
References

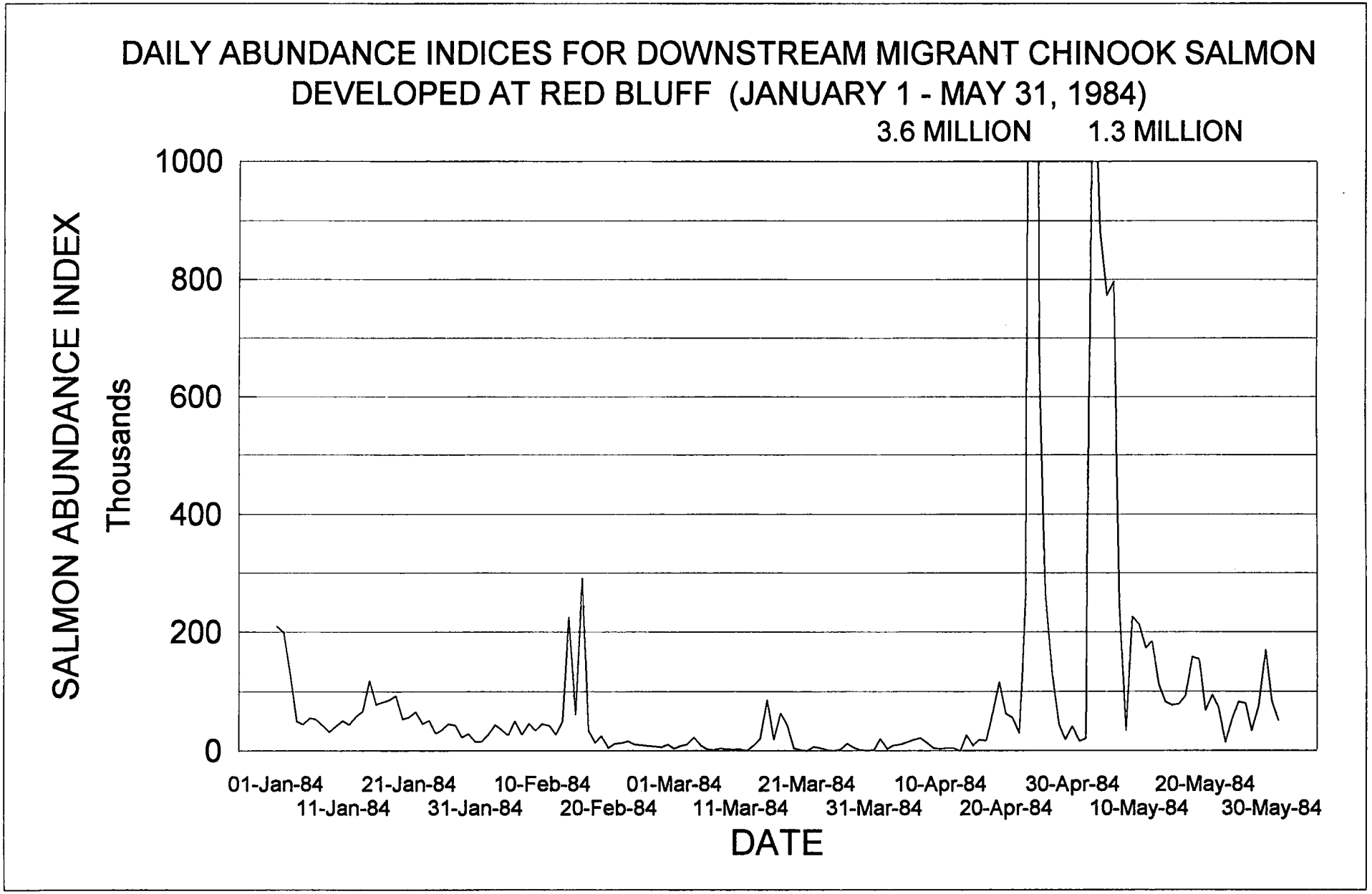
Mundie, J.H. and R.E. Traber. 1983. Movements of coho salmon (*Oncorhynchus kisutch*) fingerlings in a stream following marking with vital stain. Can. J. Fish. Aquat. Sci. 40: 1318-1319.

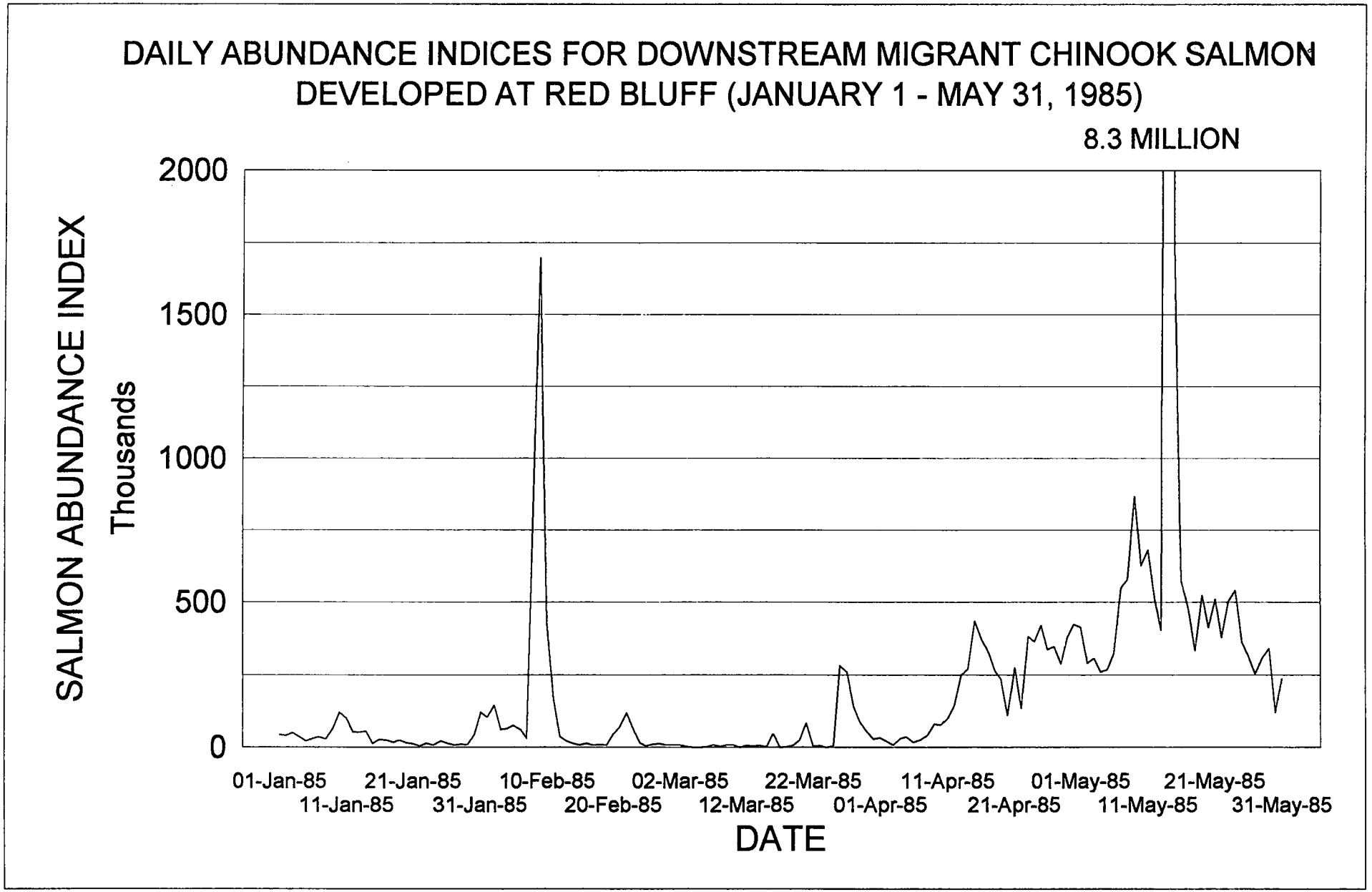
Myshak, R.J. 1985. Memorandum from USFWS Regional Director, Region One, Portland, Oregon, to USBR Regional Director, Mid-Pacific Region, Sacramento, California, re. elevated Sacramento River flow during May 1985 to benefit downstream migrant chinook salmon. July 24, 1985. 5 pp.

Vogel, D.A., K.R. Marine and J.G. Smith. 1988. Fish Passage Action Program for Red Bluff Diversion Dam, Final Report on Fishery Investigations. U.S. Fish and Wildlife Service Report No. FR1/FAO-88-19. 77 pp. with appendices.


DAILY ABUNDANCE INDICES FOR DOWNSTREAM MIGRANT CHINOOK SALMON
DEVELOPED AT RED BLUFF (JANUARY 19 - MAY 31, 1982)
3.6
3.7
5.9
4.7
SALMON ABUNDANCE INDEX
Millions
3
2
1
0
19-Jan-82
29-Jan-82
08-Feb-82
18-Feb-82
28-Feb-82
10-Mar-82
20-Mar-82
30-Mar-82
09-Apr-82
19-Apr-82
29-Apr-82
09-May-82
19-May-82
29-May-82
DATE


DAILY ABUNDANCE INDICES FOR DOWNSTREAM MIGRANT CHINOOK SALMON
DEVELOPED AT RED BLUFF (JANUARY 1 - MAY 31, 1983)
6.0
3.7
3.8
4.8
SALMON ABUNDANCE INDEX
Millions
3
2
1
0
01-Jan-83
11-Jan-83
21-Jan-83
31-Jan-83
10-Feb-83
20-Feb-83
02-Mar-83
12-Mar-83
22-Mar-83
01-Apr-83
11-Apr-83
21-Apr-83
01-May-83
11-May-83
21-May-83
31-May-83
DATE


DAILY ABUNDANCE INDICES FOR DOWNSTREAM MIGRANT CHINOOK SALMON
DEVELOPED AT RED BLUFF (JANUARY 1 - MAY 31, 1984)
3.6 MILLION
1.3 MILLION
SALMON ABUNDANCE INDEX
Thousands
1000
800
600
400
200
0
01-Jan-84
11-Jan-84
21-Jan-84
31-Jan-84
10-Feb-84
20-Feb-84
01-Mar-84
11-Mar-84
21-Mar-84
31-Mar-84
10-Apr-84
20-Apr-84
30-Apr-84
10-May-84
20-May-84
30-May-84
DATE


DAILY ABUNDANCE INDICES FOR DOWNSTREAM MIGRANT CHINOOK SALMON
DEVELOPED AT RED BLUFF (JANUARY 1 - MAY 31, 1985)
8.3 MILLION
SALMON ABUNDANCE INDEX
Thousands
2000
1500
1000
500
0
01-Jan-85
11-Jan-85
21-Jan-85
31-Jan-85
10-Feb-85
20-Feb-85
02-Mar-85
12-Mar-85
22-Mar-85
01-Apr-85
11-Apr-85
21-Apr-85
01-May-85
11-May-85
21-May-85
31-May-85
DATE

DAILY ABUNDANCE INDICES FOR DOWNSTREAM MIGRANT CHINOOK SALMON DEVELOPED AT RED BLUFF (JANUARY 1 - MAY 31, 1986)