FOREWORD

This field survey was designed to document suction dredge mining effort and to subjectively evaluate some of the instream and riparian effects associated with suction dredge mining occurring on public lands in the Mother Lode region of the Sierra Nevada. The work was conducted by staff at the California Department of Fish and Game (DFG) Fish and Wildlife Water Pollution Control Laboratory and was funded by DFG and the U.S. Department of the Interior, Bureau of Land Management (Contract No. CA-950-CT1-5).

INTRODUCTION

During the summer of 1982, California Department of Fish and Game (DFG) biologists conducted a field survey of suction dredge mining in the Mother Lode region of the Sierra Nevada (Figure 1). The increase in the price of gold and technological improvements of both dredges and gold recovery systems have led to rapid expansion of suction dredge gold mining in coastal and Sierra streams of California. The number of suction dredge permits issued by DFG dramatically increased to nearly 13,000 in 1980. Although there has been a decline since then, permit sales approached 10,000 in 1982 which is more than double the number issued each year prior to 1980 (Figure 2).

Many rivers in the state are open to dredging throughout the year while others are closed either seasonally or completely. The closures are annually revised on the recommendations of regional biologists or Wildlife Protection personnel. Because of the large amount of effort expended on suction dredge mining in the state, the potential for damage to streams is appreciable and a cause for concern. However, very little published literature can be found regarding the environmental effects of suction dredge mining. From 1980 through 1982, DFG staff biologists conducted preliminary investigations of the effects, impacts, and conflicts associated with suction dredge mining. Results of field studies on some instream effects have been reported (Harvey et al. 1982) and results of another study are being prepared for publication (Harvey pers. commun.). Additionally, Griffith and Andrews (1981) reported dredging effects on fishes and invertebrates in Idaho streams. Herein we report the results of the 1982 field survey of suction dredge mining, itemize the problems and conflicts associated with this activity, and make certain recommendations to protect the aquatic resources as well as other beneficial uses of state streams.

METHODS

Field surveys were conducted in June and July of 1982. Streams in the southern Mother Lode which had flows favorable for suction dredge mining were surveyed first. As the summer progressed and the snow-melt flows declined, the remainder of the Mother Lode streams were examined.

Streams and survey sites were selected by several methods. Bureau of Land Management (BLM) maps were used to identify public lands accessible to suction dredge miners. Personnel from the U.S. Forest Service (USFS) and DFG wardens were consulted for locations of dredging operations in their areas. Priority was given to assessing BLM lands, but because of limited access to these lands due either to rugged terrain or enclosure by private land, the majority (61 of 94 or 65%) of the sites surveyed were on public lands other than BLM.

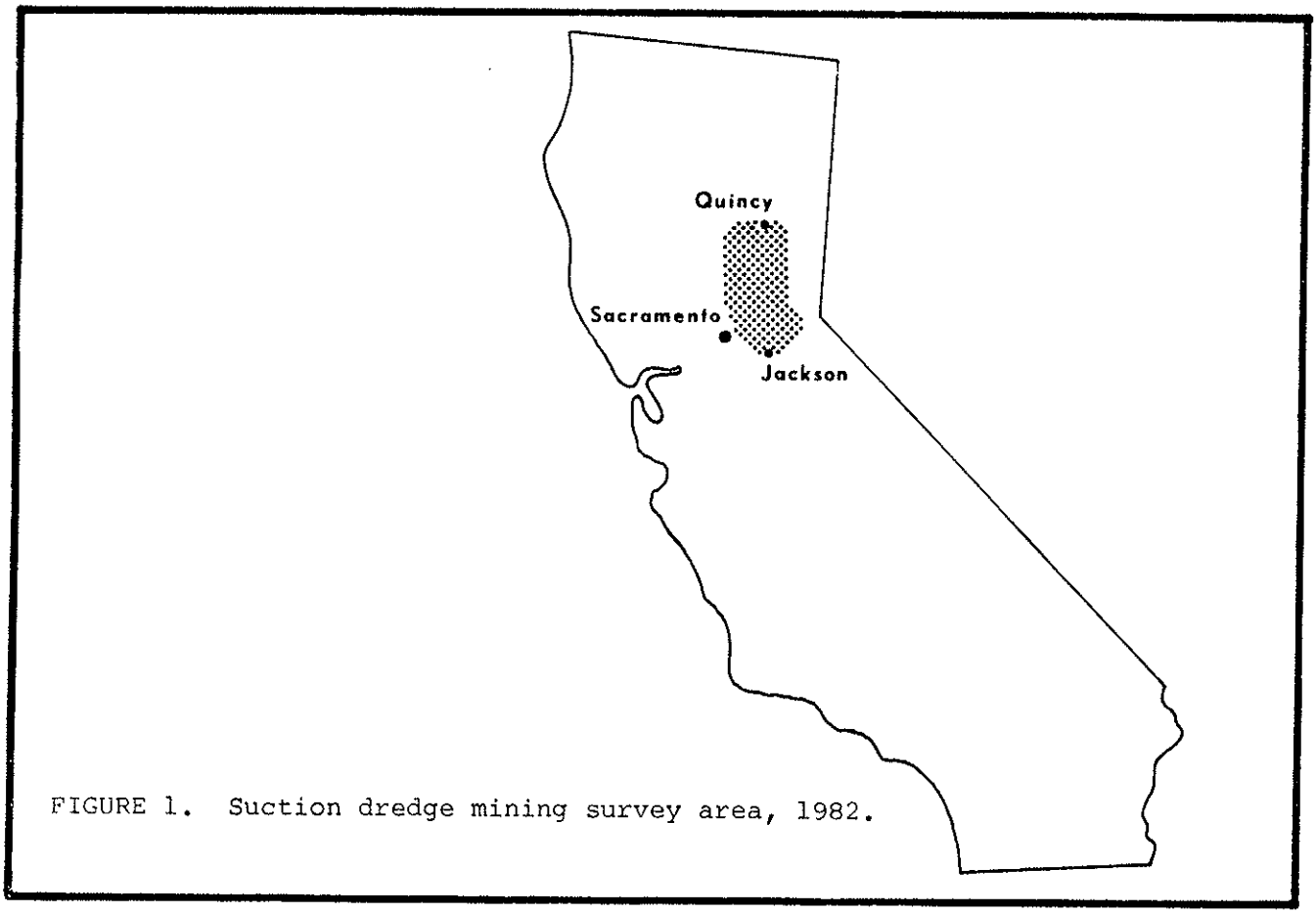


FIGURE 1. Suction dredge mining survey area, 1982.

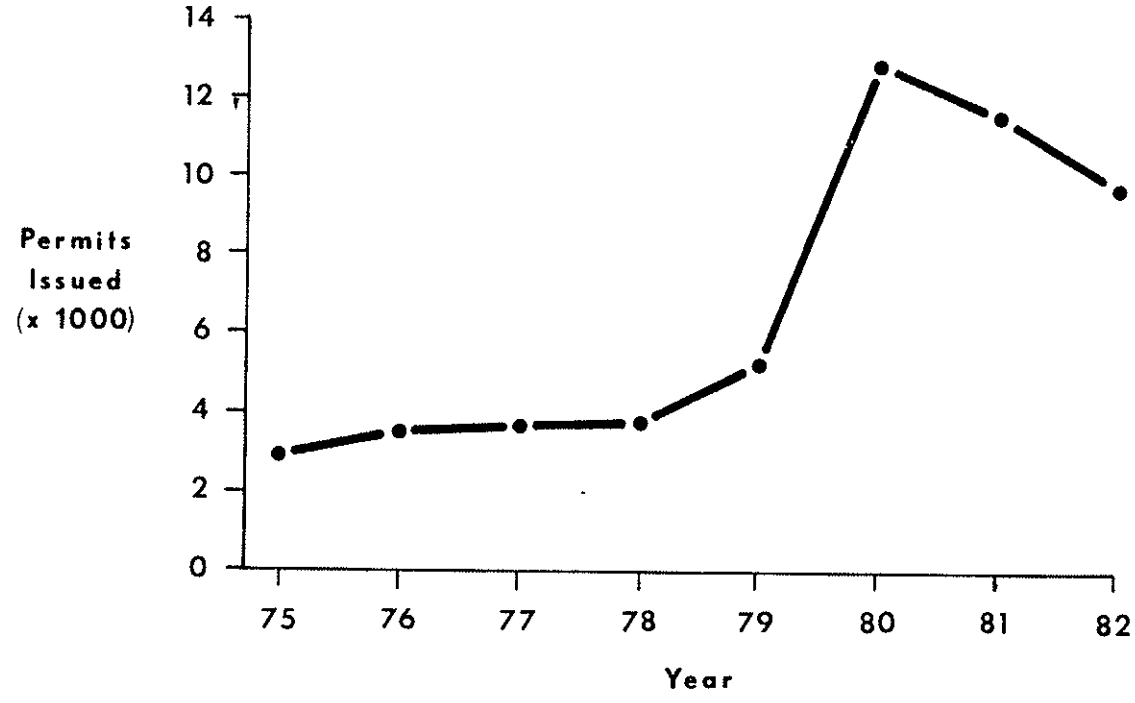
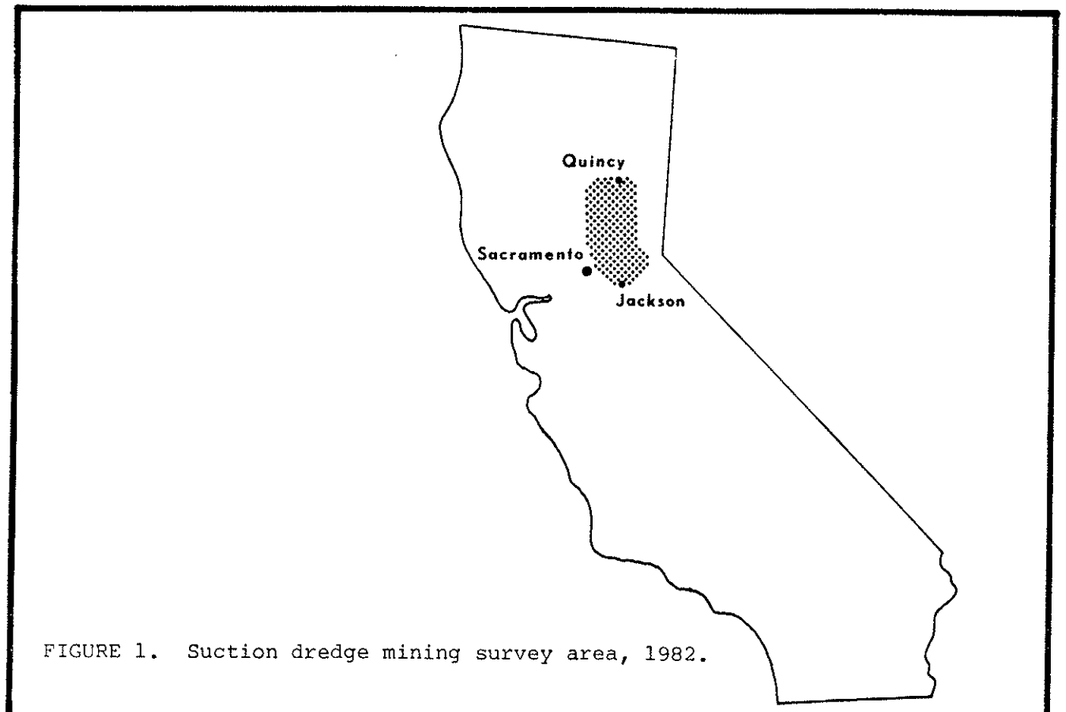


FIGURE 2. Number of suction dredge permits issued by California Department of Fish and Game, 1975-1982.



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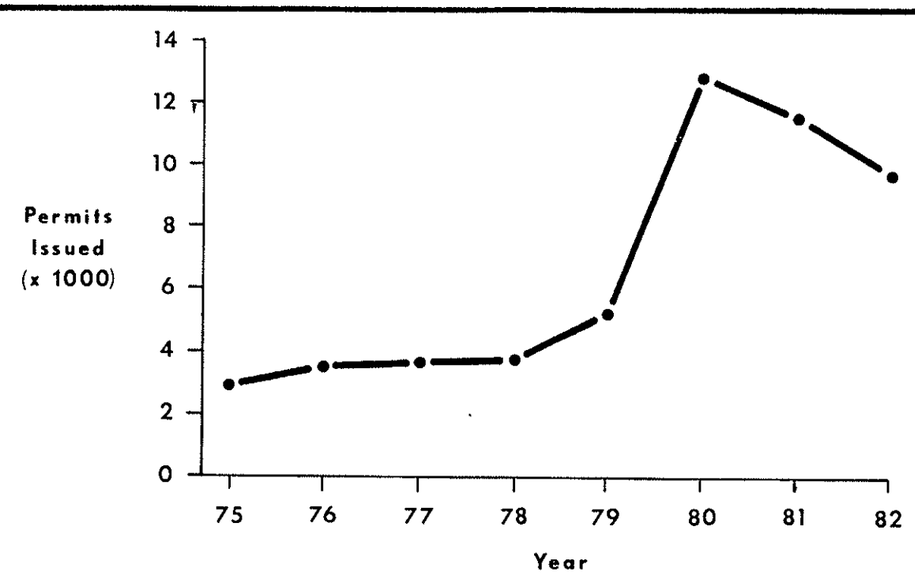

FIGURE 2. Number of suction dredge permits issued by California Department of Fish and Game, 1975-1982.

Typically, all miners were interviewed and dredge sites were inspected for one mile upstream and downstream of an access point. Usually, no stream survey was conducted at those access points where there were no parked vehicles or dredges. Dredgers were asked to present their permit, whether they considered themselves recreational or professional miners, and to estimate the number of days per calendar year they spent actively dredging. A survey form was completed for each interview and observations made at the dredge site were noted. Damage estimates recorded were based on subjective determinations made by the authors, both professional biologists.

FIELD SURVEY RESULTS

Data from interviews, dredge site inspections, and habitat assessments are summarized (Table 1). Generally, most suction dredge miners were found near points of relatively easy access to a stream although many dredgers reach remote locations by foot, trail bike, or helicopter transport services. A total of 94 locations were visited on 54 Sierra streams (Appendix I); 34 locations had suction dredge operations. A total of 317 miners were contacted and 200 interviews were conducted (most dredges were operated by more than one person). Additionally, mining operations involving 270 suction dredges at 200 different sites were assessed for instream and riparian habitat impact.

The distribution of dredge sizes in the Mother Lode is controlled by several factors. The DFG annually publishes suction dredge mining regulations which dictate the size of dredge that can be used in a particular stream or stream section as well as the dates the stream is open for dredging. The physical characteristics of the stream also regulate dredge size to some extent. Stream bed substrate is probably the most selective parameter. Relatively shallow foothill streams will generally exclude the larger dredges. Large dredges are preferred when the gravel is big and the over-burden (gravel above bedrock) is deep.

Permit compliance, dredge sizes used, and seasonal effort by both professional and recreational suction dredge miners is summarized (Table 2). Approximately half of the 317 miners interviewed claimed to be recreational and the other half professional. A total of 39 miners lacked the DFG suction dredge permit; the majority were recreational miners. Although the number of recreational and professional miners was nearly equal, recreational miners accounted for only 20% of the total effort and used smaller dredges than did professional miners.

Dredge permits issued by DFG for the period 1980 through 1982 averaged about 11,200 annually. Assuming some 11,000 permits are issued by DFG each year, the lack of permits by miners (12%) is estimated to result in lost revenue of about $6600 annually. This is a conservative figure; 15% of the miners interviewed in remote areas surveyed did not have a permit.

TABLE 1. SUMMARY OF SUCTION DREDGE MINING INTERVIEWS AND HABITAT ASSESSMENTS RELATED TO MINING OPERATIONS IN SELECTED STREAMS OF THE MOTHER LODE

Stream	Number of Dredging Operations	Total Dredges	Dredge Sizes ≤2½"	3"	4"	5"	6"	8"	10"	Dredging Effort (hrs/Season)	Description of Dredge Operations: Operating According to Regulations	Undercutting Bank	Sluicing Bank	Channelizing Stream	Riparian Damage	Campsite in Riparian
N.F. Feather	2	3			1	1		1		1,400	1	1*			1*	
Shippe Cr.	1	2	1		1					400	1					
N.F. Feather	8	9		2	1	2		4		4,280	6	2*			2*	2
"	4	5			1	1	1	2		2,160	4					1
Indian Cr.	1	1				1				240	1					
N.F. Feather	14	15	1	4	10					4,832	13	1				1
Butte Cr.	6	12	1	1	10					3,275	2	2*	1*	3*		
N.F. Yuba	6	9		1	1	5	1	1		1,795	6					1
"	29	48	7	12	7	15	5	2		13,237	26	1		3*		5
"	2	3		1	1	1				1,240	2					
"	8	10	1		4	1		4		4,490	7	1				3
N.F. Yuba	7	8		1	3	2	2			2,230	7					1
"	1	1				1				—	1					1
N.F. Yuba	4	6	2	1	2	1				2,640	4					1
"	2	3	1		1			1		239	2					
Nevada Cr.	1	1		1						10	1					
N.F. Yuba	4	4		1		3				2,280	4					1
"	5	6	1	2	1	1		1		2,160	5					
Bear R.	7	8		3	5					2,290	7					2
N.F. American	25	30	8	5	8	7	2			5,875	25					1
Mutterall Cr.	11	12	2	2	8					3,402	11					2
N.F. American	4	6	1				3	1	1	1,950	4					
"	4	6	2	1			3			2,820	4					
"	5	10		3	2	2	3			2,170	4	1*		1*		2
N.F. American	7	12		4	2	2	3	1		1,070	4			2*	2*	
"	3	5	2	1	1	1				1,350	3					1
"	4	4	1	1	1			1		905	4					
Gas Cr.	2	2		1			1			180	2					
N.F. American	6	6	2		1	2	1			905	4			1	1	
Robinson R.	1	2	1		1					90	1					
Weber Cr.	1	1			1					100	1					
Dry Cr.	6	8	1	4		2	1			2,110	5	1				
Tributary N.F. Calaveras	1	1	1							150	1					
N.F. Calaveras	8	11	1	1	7	2				2,340	3	4*		2*	1*	
TOTALS	200	270	37	53	81	53	26	19	1	74,616	176	14*	1*	12*	7*	25

Mining operation was involved in more

TABLE 1. SUMMARY OF SUCTION DREDGE MINING INTERVIEWS AND HABITAT ASSESSMENTS RELATED TO MINING OPERATIONS IN SELECTED STREAMS OF THE MOTHER LODE

Station Number	Stream	Number of Dredging Operations	Total Dredges	Dredge Sizes ≤2½"	3"	4"	5"	6"	8"	10"	Dredging Effort (hrs/Season)	Description of Dredge Operations: Operating According to Regulations	Undercutting Bank	Sluicing Bank	Channelizing Stream	Riparian Damage	Campsite in Riparian
2	N.F. N.F. Feather	2	3			1	1		1		1,400	1	1*			1*	
3	Chipps Chipps Cr.	1	2	1		1					400	1					
4	N.F. Feather	8	9		2	1	2		4		4,280	6	2*			2*	2
5	"	4	5			1	1	1	2		2,160	4					1
6	Indian Cr.	1	1				1				240	1					
8	M.F. M.F. Feather	14	15	1	4	10					4,832	13	1				1
9	Butte Cr.	6	12	1	1	10					3,275	2	2*	1*	3*		
10	N.F. N.F. Yuba	6	9		1	1	5	1	1		1,795	6					1
11	"	29	48	7	12	7	15	5	2		13,237	26	1		3*		5
12	"	2	3		1	1	1				1,240	2					
13	"	8	10	1		4	1		4		4,490	7	1				3
14	M.F. M.F. Yuba	7	8		1	3	2	2			2,230	7					1
15	"	1	1				1				—	1					1
16	S.F. S.F. Yuba	4	6	2	1	2	1				2,640	4					1
18	"	2	3	1		1			1		239	2					
20	Rosree Mosquito Cr.	1	1		1						10	1					
22	S.F. S.F. Yuba	4	4		1		3				2,280	4					1
25	"	5	6	1	2	1	1		1		2,160	5					
30	Bear Bear R.	7	8		3	5					2,290	7					2
42	N.F. N.F. American	25	30	8	5	8	7	2			5,875	25					1
44	Shirttail Shirttail Cr.	11	12	2	2	8					3,402	11					2
46	N.F. N.F. American	4	6	1				3	1	1	1,950	4					
48	"	4	6	2	1			3			2,820	4					
49	"	5	10		3	2	2	3			2,170	4	1*		1*		2
50	M.F. M.F. American	7	12		4	2	2	3	1		1,070	4			2*	2*	
51	"	3	5	2	1	1	1				1,350	3					1
52	"	4	4	1	1	1			1		905	4					
53	Gas Gas Cr.	2	2		1			1			180	2					
55	M.F. M.F. American	6	6	2		1	2	1			905	4			1	1	
57	Rubicon Rubicon R.	1	2	1		1					90	1					
68	Weber Weber Cr.	1	1			1					100	1					
80	Dry Dry Cr.	6	8	1	4		2	1			2,110	5	1				
93	Tributary Tributary N.F. Calaveras	1	1	1							150	1					
94	M.F. M.F. Consumnes	8	11	1	1	7	2				2,340	3	4*		2*	1*	
	TOTALS	200	270	37	53	81	53	26	19	1	74,616	176	14*	1*	12*	7*	25

Dredging

*Dredging operation was involved in more than one violation.

TABLE 2. Summary of permit compliance, dredge size, and effort by recreational and professional miners.

	MINERS SURVEYED	PERMIT LACKING	DREDGE SIZE	HOURS EFFORT
RECREATIONAL	154 (49%)	26 (17%)	74% ≤ 4"	14,734 (20%)
PROFESSIONAL	163 (51%)	13 (7%)	80% ≥ 4"	59,882 (80%)
TOTAL	317	39 (12%)	---	74,616

The effort (hours per season) expended by recreational and professional miners is summarized (Table 3). Dredging effort for all miners surveyed totaled 74,616 hours or about 235 hours per miner per season. Using this, the total annual dredging effort in California is estimated to be 2,600,000 hours which is equivalent to about 1,300 man-years. Survey data on dredge sizes, their number, and use by recreational and professional miners is summarized (Table 4).

TABLE 3. Effort in hours per season as reported by recreational and professional miners surveyed.

HOURS PER SEASON	NUMBER OF MINERS	RECREATIONAL MINERS	PROFESSIONAL MINERS
<100	51	50	1
100-199	38	33	5
200-299	18	9	9
300-399	17	9	8
400-499	19	3	16
500-999	40	1	39
>1000	17	1	16
TOTAL	200	106	94

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300-399	17	9	8
400-499	19	3	16
500-999	40	1	39
>1000	17	1	16
TOTAL	200	106	94

TABLE 4. Summary of dredge sizes, numbers, and use by recreational and professional miners.

DREDGE SIZE	NUMBER OF DREDGES	RECREATIONAL DREDGES	PROFESSIONAL DREDGES
1 1/2"	1 (<1%)	1 (<1%)	0
2"	11 (4%)	7 (5%)	4 (3%)
2 1/2"	25 (9%)	20 (16%)	5 (4%)
3"	53 (20%)	34 (27%)	19 (13%)
4"	81 (30%)	33 (26%)	48 (33%)
5"	53 (20%)	18 (14%)	35 (25%)
6"	25 (9%)	10 (8%)	15 (11%)
7"	1 (<1%)	0	1 (<1%)
8"	19 (7%)	5 (4%)	14 (10%)
10"	1 (<1%)	0	1 (<1%)
TOTAL	270	128 (47%)	142 (53%)

Dredging damages observed (as a percent of total dredges) which were judged to adversely affect the stream and its resources were as follows:

7% undercutting bank
6% channelizing stream
4% causing riparian damage
<1% sluicing bank

Subjective instream and riparian assessments of habitat damage revealed that few suction dredge miners surveyed caused adverse impacts. However, although our investigation showed that the majority of miners (88%) were operating according to DFG regulations (Fish and Game Code, Sec. 5653, 1982), the damage that does occur is cause for concern because of the total annual amount of dredging effort expended in California streams. This effort is documented by the number of dredging permits issued each year and the survey results reported herein. Consequently, there may be significant impacts on stream habitat that were not measured or quantified in either this limited subjective survey or in previous studies.

The riparian damage observed during the study as a result of suction dredge mining was primarily due either to miner activity supporting a dredging operation or camping in the riparian. Thirteen percent of the suction dredge miners camped in the riparian while the majority (87%) either camped away from the stream or commuted to their dredge site.

Small placer mining operations were also examined incidentally during the study although these do not use a suction dredge nor do they apparently require a permit of any kind. Few commercial placer mines remain in California because of the strict laws and discharge permits with which the operators must comply. Placer mining at most sites observed by us was of a recreational nature and employed the use of hand tools (pick, shovel, pry bar, etc). Gold recovery was accomplished with either a pan, a sluice box placed in the stream, or a power sluice box on the bank near the prospecting site. A power sluice box uses a gasoline engine driven water pump that supplies water via a hose to the sluice box which can be located some distance from the stream. Survey observations showed that placer mining of the stream bank can damage the riparian and stream more than suction dredge mining. Some of the most significant stream bank damage observed during the study was due to placer mining operations.

DISCUSSION AND RECOMMENDATIONS

Permit Compliance

About one out of every eight (12%) miners checked did not have a suction dredge permit. This represents a considerable loss of revenue to DFG. The vast majority of miners reported that they had never been checked for a suction dredge permit. Also, a number of miners reported that many dredge equipment retailers do not inform their customers that a DFG permit is required for suction dredge mining. Frequently, novice miners are surprised to find that suction dredge permits cannot be locally purchased. Furthermore, Wildlife Protection personnel have suggested that dredge registration and identification would aid enforcement. DFG could improve permit compliance by taking certain actions. The following recommendations are offered for consideration:

1) Field inspection of permits be made more frequently;

2) Supply equipment retailers with blank permit applications;

3) Supply equipment retailers with posters notifying prospective dredgers that a DFG permit is required;

4) Consider authorizing field agents to sell standard suction dredge mining permits;

5) Examine the practicality of dredge registration and identification.

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5) Examine the practicality of dredge registration and identification.

Permit Form Inadequacies

Data acquisition. Presently, the Department only totals the number of standard and special permits issued by each region. No information is collected, for example, on the size and number of dredges the permittee intends to use, whether a powered winch will be used to move boulders in the stream, or the county where dredging will take place. The Department has not taken advantage of the permit process to gather the data necessary to track various temporal, spacial, and equipment trends of suction dredge mining. A comprehensive investigation of the physical and biological effects of suction dredge mining (discussed later in this report) should include current, pertinent effort and equipment details in order to (i) plan appropriate scientific studies of the effects of suction dredge mining and (ii) to document whether or not additional regulations are required for fish and wildlife protection. Moreover, a questionnaire is more cost effective than field surveys. We recommend the following:

1) The Department design a questionnaire to be attached to the permit application and completed by the applicant that would provide such information as equipment details, county of operation, months of operation, etc.;

2) The information gathered be compiled, summarized, and evaluated annually for use in field studies of effects and/or regulation revision.

Personal identification information. Presently, the permit form contains no personal identification information which would minimize permit transferal between individuals. We recommend the following be considered:

1) Personal identification information such as year of birth, height, hair and eye color, weight, and sex be included on the permit application.

Dredge use defined. Currently, some confusion exists within the dredging community regarding who is required to have a permit. Section 5653 of the DFG Code states in part "Before any person uses any vacuum or suction dredge...". The public does not clearly understand what is meant by "uses". The Department should clarify who is required to have a permit then interpret and enforce this uniformly statewide. We recommend the following clarifications be considered for inclusion on the permit application:

1) Define "uses" as holding (operating) the intake nozzle of the suction dredge;

2) Each user (operator) must have a permit.

Age limit. Currently, no age limit is specified for suction dredge permits. This too, has lead to confusion among the public. DFG should establish a statewide age criterion for suction dredge use. Two alternatives to consider are (i) no one under age 14 need have a permit (age of legal liability), or (ii) no one under age 16 need have a permit (same as for fishing license). We recommend the following:

1) Persons 16 years of age or older must have a valid suction dredge permit in their possession if they intend to "use" a dredge;

2) Persons under age 16 need not have a permit but may "use" a dredge only when a responsible adult with a valid permit is present at the dredge site.

Repeal of Sec. 228, Title 14, CAC. Section 228, Title 14, of the California Administrative Code (which covered suction dredge mining) was repealed effective November 4, 1981. Listed below are the regulatory limitations lost with repeal of this section:

B7--Suction or vacuum dredge equipment may not be used as a hydraulic monitor to wash dirt or gravel above the water surface.

B8--No change may be made in the bed, bank, or channel of any river, stream or lake which adversely effects the environment of fish.

B9--The permit and equipment shall be available for inspection at any time a suction or vacuum dredge is being operated in any stream, river, or lake of this State upon demand of any employee of the Department or any peace officer.

We recommend the Department consider adding these items to the regulations on the suction dredge permit application.

Dredging limits defined. Most miners interviewed believed that they had the right to work the river bed up to the high water mark regardless of whether the bank was covered with water or not. The consequences of this belief are damaging to the stream and near-stream environment. Undercutting banks can destabilize them causing further erosion and course changes during high flows. Also, dredging into banks causes increased turbidity and sedimentation in the stream (with concommittant adverse effects on stream resources and beneficial uses). Furthermore, riparian vegetation and habitat can be destroyed. Of those different violations listed previously, undercutting stream banks occurred most frequently (7% of all the dredge operations observed). We recommend the Department consider taking the following actions:

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1) Place in the permit application a regulation stating that all dredging must be done within the limits of the existing water level;

2) Place in the permit application a regulation stating that no undercutting of stream banks by any means will be allowed.

Further Investigation of the Effects of Suction Dredge Mining

The survey showed that each miner (permit) represents an average of about 225 hours of dredging effort per year. Assuming this figure is representative for all dredgers statewide and that the DFG will continue to issue approximately 11,000 permits annually, then the total annual effort expended on suction dredge mining is 2,600,000 hrs/yr or about 1300 man-years. With this level of effort there is considerable potential for stream damage. The problems associated with suction dredge mining are further complicated by the diversity of stream types, substrate compositions, flows, and aquatic biota (to name a few) with which we must deal. These considerations underscore the need for the Department to fully examine the effects associated with suction dredge mining. It is reasonable that the user group should fund the necessary investigations, but income derived from the current $5.00 permit fee does not provide adequate funds to support both additional studies and administration of the program. Therefore, the fee for both standard and special suction dredge permits should be increased in order to support thorough field investigations to identify effects on fish and wildlife resources and other beneficial stream uses. However, in order to change the fee schedule, DFG Code Sec. 5653 must be amended by an act of the Legislature. Also, there would be considerable opposition to a fee increase from the suction dredge miners. Consequently, other funding sources should be thoroughly researched and requested in order to provide interim funding for the much-needed comprehensive studies on the physical and biological effects of suction dredge mining. If a decision is made to revise the DFG Code section with respect to permit fee rates, the following changes are suggested.

Standard Permit. Standard permits comprise most (approx. 98%) of dredge permits issued by DFG. A fee increase should be enacted to provide sufficient funds for necessary studies of the effects of suction dredge mining and proper administration of the program. We recommend that:

1) The standard permit fee be increased commensurate with the cost of conducting necessary field studies and administration of the program.

Special Permits. Currently, DFG issues special permits which allow dredging either in areas otherwise closed to this activity or use of a dredge size greater than that allowed in a specified area. The special permit fee is from $5.00 to $75.00, depending on whether or not a DFG warden or biologist must make a site inspection. Issuing a special permit may be contrary to the reasons for establishing the closure or dredge size limitation which provide either full or partial protection from dredging impacts. Furthermore, although many special permits are issued each year, few applicants are charged the full fee; most are approved for the minimum fee of $5.00. Consequently, in many cases the special permit fee charged does not realistically reflect the actual cost to the Department for permit review and/or site inspection. We recommend the Department consider taking the following actions:

1) Establish consistent criteria state-wide for review and approval of special permit applications;

2) Charge adequate special permit fees to fully offset Department costs for permit review and/or site inspection;

or,

3) Eliminate the practice of issuing special permits and instead seek a streambed alteration agreement (Sec. 1603) for those operations that cannot meet the conditions and requirments for a standard permit.

Problems of Concern

Dredging and stream bed alteration. DFG Code Sec. 1603 requires (i) notification for streambed alterations and (ii) a mutually accepted agreement between DFG and the applicant prior to initiating instream work. Suction dredge use does not require a 1603 permit although dredging can markedly alter the streambed. We recommend that:

1) The Department investigate and resolve the question of applicability of Section 1603 to suction dredge mining.

Powered winches. Currently, there are no special regulations regarding the use of powered winches and no permits are required. Many serious miners use powered winches or "rock pullers" to remove large boulders from the dredge site. Some of these rocks are estimated to weigh as much as 10 tons. Movement of these large boulders, which would not normally be moved even during flood flows, constitutes streambed alteration. Additionally, winches are sometimes used to move boulders from the stream to the bank (and vice versa). We recommend the Department consider taking the following actions:

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1) Determine which of the following is appropriate: (i) winch use merely be noted on the standard permit application, (ii) a special permit be required, or (iii) a 1603 agreement be required;

2) Place in the permit application a regulation stating that powered winches may not used to move boulders from the stream to the bank (or vice versa).

Posted mining claims. Many mining claims on public land are posted with "No Trespassing" signs. Mining law gives the owner of a prospecting claim the right to prevent mining activity on his claim but does not allow the owner to prevent others (i.e. fishermen, hunters, hikers, etc.) from using the claim for purposes other than mining (patented and private lands excepted). The legal rights of miners and other user groups should be clarified. We recommend the following:

1) The responsible agency be notified of DFG concerns regarding posted claims on public lands;

2) Place in the permit application a section which cautions the permittee that individuals (i.e. hunters and fishermen) have access rights to public lands and waterways.

Placer mining. Survey observations showed that placer mining (including panning, sluice box and/or power sluice operations) of the stream bank often causes more damage than does suction dredge mining. Some of greatest stream bank damage observed during the survey was due to placer mining operations. We recommend that:

1) The Department continue to use and enforce DFG Code Section 5650 in order to minimize adverse environmental effects from placer mining operations.

2) Pursuant to DFG Code Section 5651, the Department consider requesting that the Regional Water Quality Control Board examine small placer mining in general to determine if discharge requirements apply.

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APPENDIX I

Streams Surveyed for Impacts
Related to Suction Dredge Mining

Section Number	Stream	Location
1	N.F. Feather River	T22N R5E S18 — T25N R6E S26
2	"	T25N R6E S23 — T25N R6E S24
3	Chips Creek	T25N R6E S23
4	East Branch N.F. Feather River	T25N R7E S19 — T25N R7E S21
5	"	T25N R7E S22 — T25N R9E S9
6	Indian Creek	T25N R9E S9
7	Spanish Creek	T25N R9E S9 — T25N R9E S15
8	M.F. Feather River	T23N R10E S15
9	Butte Creek	T24N R3E S26 — T24N R3E S23
10	N.F. Yuba River	T19N R8E S24 — T19N R9E S18
11	"	T19N R9E S17 — T19N R10E S6
12	"	T19N R10E S5 — T20N R10E S35
13	"	T20N R10E S36— T20N R12E S32
14	M.F. Yuba River	T18N R9E S15 — T18N R9E S14
15	Kanaka Creek	T18N R9E S14
16	S.F. Yuba River	T17N R9E S17 — T17N R9E S16
17	Spring Creek	T17N R9E S17
18	S.F. Yuba River	T17N R10E S1 — T17N R11E S4
19	Poorman Creek	T17N R10E S12
20	Roscoe Creek	T17N R10E S2
21	S.F. Yuba River	T17N R12E S20
22	"	T17N R8E S23
23	"	T17N R8E S33
24	Shady Creek	T17N R8E S20
25	S.F. Yuba River	T17N R7E S32 — T17N R7E S33
26	Deer Creek	T16N R8E S18
27	"	T16N R7E S13
28	Bear River	T17N R12E S30
29	"	T17N R11E S36
30	"	T15N R10E S4 — T16N R10E S34
31	"	T15N R10E S6

APPENDIX I cont.

Station Number	Stream	Location
32	Steephollow Creek	T15N R10E S6
33	Bear River	T15N R9E S22
34	"	T14N R9E S17
35	Wolf Creek	T15N R8E S12
36	"	T15N R8E S22
37	"	T14N R8E S20
38	Bear River	T13N R8E S5
39	Greenhorn Creek	T15N R9E S2
40	"	T16N R9E S25 — T16N R10E S19
41	Missouri Canyon Creek	T16N R10E S31
42	N.F. American River	T15N R9E S36 — T14N R9E S1
43	Indian Creek	T15N R10E S33
44	Shirttail Creek	T14N R10E S30— T14N R10E S9
45	Bunch Canyon	T14N R10E S30
46	N.F. American River	T14N R10E S30
47	"	T13N R9E S1 — T14N R9E S36
48	"	T13N R9E S11
49	N.F. M.F. American River	T14N R11E S35
50	M.F. American River	T13N R11E S4
51	"	T13N R10E S1
52	"	T13N R9E S13 — T13N R10E S19
53	Gas Canyon Creek	T13N R9E S13
54	Todd Creek	T13N R9E S13
55	M.F. American River	T12N R9E S5
56	"	T12N R8E S1
57	Rubicon River	T13N R11E S2 — T13N R11E S11
58	Pilot Creek	T12N R12E S11
59	Bear Creek	T12N R11E S32
60	Coloma Canyon Creek	T12N R10E S19
61	Greenwood Creek	T12N R10E S7
62	S.F. American River	T11N R11E S28 — T11N R11E S31
63	Jaybird Creek	T11N R11E S20
64	Rock Creek	T11N R11E S17
65	S.F. American River	T11N R10E S25
66	"	T11N R10E S18 — T11N R10E S17

APPENDIX I cont.

Station Number	Stream	Location
32	Steephollow Creek	T15N R10E S6
33	Bear River	T15N R9E S22
34	"	T14N R9E S17
35	Wolf Creek	T15N R8E S12
36	"	T15N R8E S22
37	"	T14N R8E S20
38	Bear River	T13N R8E S5
39	Greenhorn Creek	T15N R9E S2
40	"	T16N R9E S25 — T16N R10E S19
41	Missouri Canyon Creek	T16N R10E S31
42	N.F. American River	T15N R9E S36 — T14N R9E S1
43	Indian Creek	T15N R10E S33
44	Shirttail Creek	T14N R10E S30— T14N R10E S9
45	Bunch Canyon	T14N R10E S30
46	N.F. American River	T14N R10E S30
47	"	T13N R9E S1 — T14N R9E S36
48	"	T13N R9E S11
49	N.F. M.F. American River	T14N R11E S35
50	M.F. American River	T13N R11E S4
51	"	T13N R10E S1
52	"	T13N R9E S13 — T13N R10E S19
53	Gas Canyon Creek	T13N R9E S13
54	Todd Creek	T13N R9E S13
55	M.F. American River	T12N R9E S5
56	"	T12N R8E S1
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59	Bear Creek	T12N R11E S32
60	Coloma Canyon Creek	T12N R10E S19
61	Greenwood Creek	T12N R10E S7
62	S.F. American River	T11N R11E S28 — T11N R11E S31
63	Jaybird Creek	T11N R11E S20
64	Rock Creek	T11N R11E S17
65	S.F. American River	T11N R10E S25
66	"	T11N R10E S18 — T11N R10E S17

APPENDIX I cont.

Station Number	Stream	Location
67	Weber Creek	T10N R12E S14 — T10N R12E S20
68	"	T10N R9E S12
69	"	T11N R9E S33
70	Deadman Creek	T9N R10E S12
71	Martinez Creek	T9N R10E S1 — T9N R10E S13
72	N.F. Cosumnes River	T9N R12E S5
73	"	T9N R12E S7
74	"	T9N R10E S35 — T10N R10E S14
75	M.F. Cosumnes River	T9N R12E S19
76	"	T8N R10E S11 — T8N R10E S12
77	Cosumnes River	T8N R9E S26
78	N.F. Dry Creek	T7N R11E S5
79	Deadman Fork Dry Creek	T7N R11E S8
80	Dry Creek	T7N R10E S28 — T7N R10E S33
81	"	T7N R10E S31 — T7N R10E S32
82		Hwy. 104 Bridge Crossing
83	Rancheria Creek	T7N R10E S25 — T7N R11E S17
84	Amador Creek	T7N R11E S31
85	Sutter Creek	T6N R11E S8 — T7N R12E S23
86	N.F. Mokelumne River	T6N R12E S27
87	M.F. Mokelumne River	T6N R12E S26
88	S.F. Mokelumne River	T6N R13E S16
89	"	T6N R13E S13
90	Licking Fork Mokelumne River	T6N R14E S16
91	N.F. Calaveras River	T5N R12E S1
92	"	T5N R12E S16
93	Tributary to N.F. Calaveras	T5N R12E S17
94	M.F. Cosumnes River	T8N R14E S5 — T8N 14E S9