

DWR WASHINGTON
97 JUL 29 PM 12:33

**Evaluation of Increasing Tagging Levels for Chinook Salmon and Steelhead and a
Demonstration Project on Mass Marking
Executive Summary**

a. Applicant Name: Northwest Marine Technology, Inc., Shaw Island, WA

b. Project Description and Primary Biological/Ecological Objectives

This project consists of two integrated components. The first component consists of three tasks designed to evaluate existing coded wire tag and recovery data from the Central Valley, look at hatchery produced salmon contribution to commercial and recreational harvest, and develop the parameters associated with constant fractional or mass marking programs for fish harvest. This report will also evaluate the potential for selective fisheries covering various geographic areas.

This project is also intended to demonstrate the feasibility of marking large number of fish for release into Central Valley waters. This project will coded wire tag and fin clip all chinook salmon smolt at the Merced River Fish Facility and Nimbus Hatchery, increase the percentage of chinook salmon tagged at Coleman NFH from 8% to 25%, and tag all yearling steelhead at Merced, Coleman, Nimbus, Feather River and Mokelumne hatcheries. This tagging will happen in 1999 and 2000 at 8.5 million fish per year. Tagging will be accomplished by using the automated, mass marking and tagging machines manufactured by NMT. Having large numbers of fish marked, provides numerous opportunities to change hatchery management and harvest management practices. In addition, inland selective harvests could occur on Nimbus Hatchery bound chinook salmon and steelhead from five hatcheries. Increasing the tagging levels will provide a much greater definition of juvenile salmon inland distribution, migration rates, growth rates and origin of fish captured in the multitude of sampling programs and diversion facilities. Uncertainties about endangered species take will be lessened.

c. Approach/Tasks/Schedule

Completing this project will consist of the development of a report which will compile and analyze existing hatchery and tagging information, as well as available statistics and computer models. The report will address tagging and sampling rates, tagging techniques and costs, and the pros and cons of selected fisheries. This approach will also use input from state and federal fishery managers and stakeholders.

Northwest Marine Technology will construct two mass marking machines, based on design of the current prototype machine that NMT developed for the Washington Department of Fish and Wildlife. A total of 8.5 million fish will be tagged each of two years. Tagging will occur at the facilities, at the levels, and on the schedules provided in the Scope of Work.

d. Justification for Project and Funding by CALFED

This project will provide a tremendous increase in the amount of information available to assess the effects of CALFED's ecosystem restoration activities. Increasing the number of fish marked in the system will also provide additional data to support CALFED's adaptive management program. Development of the report with respect to constant fractional marking and mass marking options will provide managers with the scientific basis to evaluate various potential selective fishery options.

Having additional fish, of known origin, available will allow many of CALFED's ecosystem restoration objectives to be assessed and or implemented. This type of project has been identified by both CALFED, in their ERPP, and by CVPIA's CAMP program as needs in the Central Valley. Category III is the logical funding source for this project since it is managed by a consortium of agencies involved in salmon and steelhead management in California.

e. Budget Costs and Third Party Impacts

The total cost for this three year project is \$1,875,500. Beneficial third party impacts will accrue to commercial and recreational fishermen, various sampling programs, and water project operations.

f. Applicant Qualifications

Northwest Marine Technology is uniquely qualified to accomplish this project since they have proprietary rights to the only automatic fish handling machine for marking and tagging, in the world.. They have assembled a team of cooperators that have extensive experience in dealing with salmon and steelhead management and the data associated with Central Valley salmon and steelhead populations.

g. Monitoring and Data Evaluation

Monitoring and data evaluation will be accomplished using existing agency programs for tag recovery. The report on constant fraction marking and mass marking feasibility will use accepted statistical and data analysis procedures.

h. Local Support/Coordination with other Programs/Compatibility with CALFED Objectives

This project is supported by CDFG and USFWS, whose hatcheries and tag recovery laboratories are involved. This project is fully compatible with all CALFED objectives.

**Evaluation of Increasing Tagging Levels for Chinook Salmon and Steelhead and a
Demonstration Project on Mass Marking**

- b. Name of applicant:** Northwest Marine Technology, Inc.
Guy Thornburgh
P.O. Box 427 Ben Nevis Road
Shaw Island, Washington 98286
(360) 468-3375 Voice
(360) 468-3844 Fax
office@nmt-inc.com
- c. Type of Organization and Tax Status:** Corporation, State of Washington
- d. Tax Identification Number:** 22 1935793
- e. Technical and Financial Contacts:** Guy Thornburgh Technical
Marlyn Hoffman Fiscal
(Same address as above)
- f. Participants/Collaborators in Implementation**
- Northwest Marine Technology, Bailey Environmental, University of Idaho (Ken Newman), Jud Monroe, Alison Britton
- g. RFP Project Group Type:** Other Services

III. PROJECT DESCRIPTION

a. Project Description and Approach

This project consists of two integrated components. The first is the preparation of a report that evaluates: 1) tagging of hatchery produced steelhead and chinook salmon to assess their historical contribution to marine fisheries, inland fisheries, and spawning escapement, 2) based on the results of 1 above, assesses the alternatives for a constant fractional marking program, and 3) the feasibility of mass marking and/or tagging to: increase the knowledge about juvenile salmon and steelhead distribution in inland and marine waters, assess the effects of increased marking and/or tagging levels on water project operations and diversion losses, and to provide the conditions that would allow the creation of selected fisheries in both the inland and marine environments.

This report would be prepared by a consortium of Northwest Marine Technology scientists, Randy Bailey of Bailey Environmental, and statistician Ken Newman of the University of Idaho, with assistance from Jud Monroe and Alison Britton. This team, in cooperation with the California Department of Fish and Game, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and others would compile and analyze available information regarding:

- hatchery production throughout the Central Valley including the numbers of fish released by time and area, their anticipated distribution, previous tagging rates, their contribution to fisheries, etc;
- the statistics of tagging and sampling rates required for all hatchery stocks to accomplish various goals;
- tagging techniques and costs;
- an evaluation of selected fisheries, based in part on the use of computer models already in use in the Pacific Northwest.

The product of this effort is a written report evaluating hatchery tagging and the implications of selected fisheries as a harvest management tool.

The second integrated component of this proposal is a demonstration project consisting of large scale coded wire tagging (CWT) of juvenile hatchery fish at five state and federal facilities. Tagging will be accomplished using a newly developed automatic marking and tagging machine capable of handling very large numbers of fish (millions) in less time and for lower unit cost than current hand marking methods. This new technology has a number of distinct advantages over past tagging techniques in that the fish do not need to be anesthetized or handled by humans prior to tagging. Being able to tag the fish in

large quantities, more quickly, allows the fish to be larger when tagged and reduces the probability of improper tag placement and mortality due to the stress of handling needed for current techniques.

Northwest Marine Technology (NMT) will build two "mass marking machines" during calendar year 1998, for use at five hatcheries to mark (adipose fin clip) and coded wire tag fish, commencing in the spring of 1999. Existing sampling programs will serve as the tag recovery mechanism and any tags recovered will be processed by the state and federal tag reading laboratories. Some enhancement to detection and reading equipment at the two state and federal tag laboratories is required. A similar marking and tagging demonstration project will occur again in the spring of 2000 with an attempt to tag fish as small as 50 mm at Coleman National Fish Hatchery (this new technology was developed to handle 60 mm fish as the minimum length specified by contractors, the Washington Department of Fish and Wildlife and Bonneville Power Administration). Some detection equipment will be required at the hatcheries by the end of the project to assist in detection of tags in adult fish returning to the facilities.

This component is based on the following tagging schedule each year:

- 4,000,000 chinook salmon at Nimbus Hatchery;
- 1,000,000 chinook salmon at Merced River Fish Facility;
- 2,000,000 fall-run chinook at Coleman National Fish Hatchery;
- 1,500,000 steelhead (combined) at five facilities (Nimbus, Merced, Coleman, Feather River and Mokelumne hatcheries).

The intent is to mark the total chinook salmon production from Nimbus and the Merced River Fish Facility in each year. Production in excess of these numbers will require additional funding, but these estimates were obtained from the California Department of Fish and Game and U.S. Fish and Wildlife Service.

b. Location and /or Geographic Boundaries of the Project

This project will occur at the five hatchery facilities mentioned above. Recovery of tagged fish will occur throughout the entire Sacramento-San Joaquin-Bay/Delta area. Adult recoveries will occur along the Pacific Coast.

c. Expected Benefits

Primary stressors, species, and/or habitats addressed: Population Management, Human Disturbance, Adverse Fish and Wildlife Harvest Impacts, Artificial Propagation of Fish

and Alteration of Flows and Other Effects of Water Management; Steelhead, Fall-run Chinook Salmon.

Completion of this project will provide a multitude of benefits with respect to accomplishment of CALFED's ecosystem restoration objectives. Tagging large numbers of chinook salmon and all yearling steelhead production from Central Valley hatchery facilities will allow the various sampling programs and places where juvenile fish are collected to increase their understanding of juvenile salmon and steelhead distribution in the system. Having large numbers of chinook salmon tagged will provide better information on inland distribution, travel and migration rates, growth rates, habitat use, better estimates of entrainment, and increased information on oceanic distribution. In addition, estimates of hatchery contributions to the adult and juvenile populations will be improved. Steelhead tagging will increase our understanding of the same factors listed above for this species. By tagging all of the steelhead, it will be possible to implement an inland selective harvest program, should that harvest management option be desirable. Some selective harvest of fall-run chinook salmon stocks could occur (particularly in the American River for Nimbus Hatchery origin stocks) and to a lesser extent on Coleman National Fish Hatchery stocks.

Increasing the percentages of fish tagged at these facilities will allow better and more accurate estimates of the contribution of hatchery produced fish to the various fisheries. In addition, by being able to distinguish a greater percentage of the returning adults, as hatchery origin, we will increase our ability to determine the success of increases in natural production as a result of implementation of CVPIA actions.

By completing this project, new options for determining the origin of fish captured in diversion facilities will now be available. In addition, having large numbers of fish marked and loose in the system, will allow an assessment of the use of new habitats created under CALFED'S and CVPIA's programs.

Completion of the large scale demonstration tagging component will allow an evaluation of the technological and cost advantages of tagging millions of juvenile hatchery fish with an automated machine. Two years of such activity will demonstrate the utility of the machinery, refine its technique for the Central Valley's hatchery facilities and also adequately mark the fish at several of the hatcheries for effective evaluation.

Completion of the report on hatchery contributions, constant fractional marking, and an evaluation of selective fisheries, will provide decision makers with a scientifically and statistically based source of information on which to base future harvest management. This written evaluation will provide policy makers with the requisite information to decide how much tagging should occur throughout the Valley, and its cost. By increasing our level of knowledge about salmon and steelhead distribution and fate, we increase our ability to develop sensible, rational, and defensible management options.

d. Background and Biological/Technical Justification

Naturally produced salmon and steelhead stocks along the Pacific Coast have experienced sharp declines over the past two decades. Many commercial and recreational fisheries have been closed or severely curtailed. All stocks of chinook salmon and steelhead have either been petitioned for listing, been listed, or formally proposed for listing under the auspices of the Endangered Species Act. These species are believed to be key indicators of ecosystem health and their population levels drive management decisions regarding a multitude of other activities. Activities such as power production, water management, logging, grazing, recreational fishing, commercial harvests, etc. are all effected by the status of salmon and steelhead stocks. In the Central Valley, nearly every water management decision is tempered by concerns about the status of salmon and steelhead stocks. The Central Valley Project Improvement Act was passed with a goal of doubling the production of anadromous fish stocks in the Central Valley. The CALFED Bay-Delta program was established to improve the ecological health of the Bay/Delta and the watershed in general.

Fishery managers in the Pacific Northwest, faced with major perturbations to all aspects of the economy as a result of increasingly stringent restrictions necessary to protect wild stocks of salmon and steelhead, decided that the best way to utilize hatchery origin stocks was to mark them in a distinctive way. All coho salmon produced in State of Washington hatcheries are now marked. However, marking all chinook salmon production in the Columbia River Basin was originally deemed to be infeasible, using existing techniques, because of the large numbers of fish (200 million annually) and the short time frame available for marking (usually about 60 days). However, during the past three years, the Washington Department of Fish and Wildlife (WDFW), with funding provided by Bonneville Power Administration (BPA) and the U.S. Fish and Wildlife Service, has taken the initiative to construct a prototype machine that is designed to automatically fin clip and coded wire tag 50,000 fish during an eight hour shift-- without the fish ever being touched by human hands or the use of anesthetic. Northwest Marine Technology is the prime contractor for this project. The machine requires only two people to operate, and the anticipated operational cost is 20 to 50 percent less than the current manual techniques. Most importantly, the machine is capable of marking the large numbers of fish in the short time frames dictated by hatchery production. The first demonstration machine is scheduled for November of 1997 for testing and evaluation by WDFW. The development cost for this prototype machine, is in excess of \$2 million.

Tens of millions of hatchery produced salmon and steelhead are reared and released throughout the Central Valley each year. A relatively small percentage are tagged. Lack of knowledge about the origin and timing of hatchery versus naturally spawned stocks is having a major effect on water management and the economy of California. For example, export curtailments are now ordered, based on an inaccurate set of length criteria

that cannot distinguish wild stocks from hatchery origin fish. Ocean and recreational fisheries have been severely restricted recently because of concerns about harvest rates on winter-run chinook salmon. Additional restrictions loom on the horizon with the potential listings of spring-run chinook, steelhead, and some fall-run stocks.

Better information on distribution, growth rates, migration patterns, losses to entrainment, etc. is needed for hatchery origin fish. Only with this information, can sensible management decisions be made. In addition, many potential hatchery and harvest management decisions could be made if better data were available. Also, increasing the percentage of fish marked within the system increases our confidence in evaluating the contribution of hatchery produced fish to the various fisheries. These fish are produced as mitigation for many water project impacts and must be contributing to the populations that have been lost.

Given the overwhelming implications of hatchery management and harvest management practices on accomplishment of CALFED's ecosystem restoration objectives, implementation of this project is absolutely essential. Fishery scientists from federal, state and private organizations have attempted several times to document and describe the tagging needs for hatchery salmon and steelhead; the benefits of such tagging for evaluating restoration efforts; and the pros and cons of using 100 per cent marking of hatchery fish for selected fisheries. However, no written report is yet available for decision makers, even though questions are continually being asked such as: How many fish should be tagged at each hatchery to reliably evaluate the impact of the hatchery production? How much does it cost to tag at various levels? How much labor and equipment is needed to recover and analyze these tags? If fish are mass marked at hatcheries so that these can be selectively harvested, will these fish indeed be available for harvest? How much will it cost to implement such a program? Will a selected fishery actually provide protection for the naturally-produced stocks that are not being marked?

Current information about hatchery production, tagging techniques and equipment, restoration impacts, statistical approaches to sampling, and selected fishery modeling is available for compilation, analysis and reporting. Supporting documentation exists with the agencies that operate the hatcheries, in CALFED reports, and with the Pacific States Marine Fisheries Commission who is the custodian for all tag release and recovery information along the west coast of North America. Information also exist in refereed journals for statistical approaches to tagging and recovery, with the Pacific Salmon Commission Selective Fishery Evaluation Committee, and in the Lawson-Comstock Model of selected fisheries.

Some hatcheries in the Central Valley, such as Nimbus hatchery, are currently not tagging any of the fish released. All scientists agree that it is impossible to evaluate the effectiveness of a hatchery and its relationship to restoration activities and fishery

harvests without adequate tagging. The primary reason for the lack of tagging is fiscal, although some facility managers are also uncertain on how many fish to mark. Further, no large scale program currently exists for the tagging of one hundred percent of the fish at any facility. This is due in part to fiscal restraints, but also due to the impediment imposed by the physical impracticality to manually fin clip (with hand-held scissors) and coded wire tag millions of juvenile fish in a short time.

Implementation of this project will increase the fractional tagging of the Coleman NFH fish production from eight percent to twenty-five percent; mark all hatchery steelhead so evaluation of their distribution throughout the Central Valley can be accomplished and to offer a selected fishery to sport fishers; and to mark 100 percent of the Nimbus and Merced facilities' production to evaluate mass marking techniques for chinook and to prepare for a possible in river selected fishery of these stocks.

The adipose fin clip is indeed the preferred mark for mass marking, according to the Pacific Salmon Commission; and the coded wire tag has an unprecedented 30 year history of evaluating Pacific salmon in a very efficient, economical and statistically significant fashion. The new mass marking machine is the only technology that exists for such large scale fin marking and tagging.

e. Proposed Scope of Work

The following scope of work assumes a contract is awarded in October 1997.

- Task 1: Compile and analyze hatchery stocking, tagging, and recovery data. Determine hatchery contribution rates and prepare a report summarizing the results. Report due August 1998
- Task 2: Develop, statistically based, potential alternatives for mass marking and constant fractional marking options including: recommendations for tagging and recovery rates, estimates of the number of fish to tag, sampling/recovery costs, analytical requirements etc. Report due December 1998
- Task 3: Evaluate existing models of selected fisheries and their applicability to the Central Valley. Evaluate the potential for selected fisheries on steelhead and chinook salmon stocks in marine and inland waters. Document the opponents and supporters for this management tool and the implications of current and proposed Endangered Species Act listings of chinook and steelhead on CALFED's objectives May 1999

Task 4: Construct two mass marking machines	January 1998- Dec. 1998
Task 5: Schedule tagging program; purchase 8.5 million coded wire tags; prepare sites for tagging; mark and tag the fish at all facilities; upgrade detection equipment at two recovery labs	July 1998- Dec 1999
Task 6: Schedule tagging program; purchase 8.5 million coded wire tags; prepare sites for tagging; adapt machines to 50 mm fish mark and tag the fish at all facilities; upgrade detection equipment at five hatcheries	July 1999- Dec 2000
Task 7: Prepare final performance report with recommendations	Feb 2001

Quarterly progress reports, covering both the technical and fiscal aspects of the project, will be prepared and cover the activities under each task as appropriate.

f. Monitoring and Data Evaluation

Tasks 1-3 will involve intensive coordination with management and mitigation entities including but not limited to: California Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Water Resources, U.S. Bureau of Reclamation, and various stakeholder groups. In addition, preparation of this report will require coordination with salmon management entities outside of California (Pacific Fisheries Management Council, Pacific States Marine Fisheries Commission, treaty tribes, etc). All entities will be involved in reviewing the report prior to finalization.

Increasing the level of tagging will increase the number of fish with tags recovered both as juveniles and adults. All sampling entities now return coded wire tagged fish to one of the agencies for tag detection and reading. These agencies are the California Department of Fish and Game and the U.S. Fish and Wildlife Service. Both agencies are cooperators in this project and will have their existing detection equipment upgraded as a cost of this project in order to handle the additional work load. We anticipate an increased understanding of juvenile distribution almost immediately after tagged fish are released. These data will be incorporated into the normal reporting procedures of each entity that captures tagged fish.

g. Implementability

All tagging will be performed in compliance with the Pacific Coast's protocol for fin

clipping and coded wire tagging as implemented by the Pacific States Marine Fisheries Commission. Authorization to mark fish has been provided by our two cooperators, CDFG and USFWS. No anesthetics, chemicals, or harmful substances are used in this new process. All tagging will be coordinated with hatchery managers who are responsible for the rearing and release of the fish as well as the recovery of these tagged fish and the collection of the tagging information. U.S. Fish and Wildlife Service and California Department of Fish and Game support the submission of this proposal.

IV. COSTS AND SCHEDULE TO IMPLEMENT PROPOSED PROJECT

a. Budget Costs

Budget costs are detailed in Table 1. Inspection of Table 1 indicates that most of the work will be accomplished through the use of service contracts and direct purchase of materials and tagging costs. Northwest Marine Technology has not added additional labor charges for its staff participation in this project. There is no overhead in this budget.

Table 1. Estimated Costs (\$) for an Evaluation of Increasing Tagging Levels for Chinook Salmon and Steelhead and a Demonstration Project on Mass Marking

BUDGET COMPONENT	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7
Direct Labor (Hours)	0	0	0	0	0	0	0
Direct Salary and Benefits	0	0	0	0	0	0	0
Overhead Labor (General and Administrative Fee)	0	0	0	0	0	0	0
Service Contracts	52,500	40,000	57,000	0	0	0	0
Material and Acquisition Contracts	0	0	0	0	377,300	463,700	0
Miscellaneous and Other Direct Costs (Tagging Costs)	0	0	0	0	442,000	442,000	0
Total Task Cost	52,500	40,000	57,000	0	819,300	905,700	0
CATEGORY III FUNDING REQUESTED	52,500	40,000	57,000	0	819,300	905,700	0
TOTAL CATEGORY III FUNDING REQUESTED	1,875,500						

Tasks 1-3 will consist of service contracts to Bailey Environmental (task coordination, technical coordination with other agencies, data analysis, report preparation), University of Idaho (services of statistician Ken Newman), and Alison Britton Data Analysis and Design (data compilation and analysis services), Jud Monroe Environmental Planning, Coordination and Documentation (facilitation, technical report preparation). Service contracts will be time and materials and billed monthly to Northwest Marine Technology.

Coded wire tags will be purchased in advance of the tagging season to receive a discount price and assure the supply is available on time (adequate batches and codes). The tag cost is approximately \$41/1,000 tags.

Additional detection and reading equipment is necessary for the two tag recovery laboratories (CDFG & USFWS) to handle the increased number of tags from smolts, and the future return of adult chinook.

Tag and mark (adipose fin clip) 8.5 million fish (tagging & clipping is \$52/1,000 fish; all equipment and coded wire tags prices reflect a 20% discount from the published list price, and remain the same in 1999 and 2000).

This project will benefit from the several million dollars recently spent by Washington Department of Fish and Wildlife, Bonneville Power Administration, U.S. Fish and Wildlife Service, and Northwest Marine Technology for developing the prototype mass marking machine. All of the initial research and development has already been funded. Other cost saving stem from NMT reducing the costs of its products by twenty percent for this project. The USFWS is currently marking some fish at Coleman NFH and will continue to contribute this amount of money towards continued marking at that level. Previous tagging projects have required large capitol investments toward purchasing of tagging hardware. This project does not require such investment. Instead, all of the tagging equipment is owned by NMT and the price of the tagging is based on a per fish basis, similar to other operational costs for a hatchery such as purchasing fish food. The cost to operate the mass marking machine is at least 20 percent lower than the current cost to tag fish in California.

b. Schedule Milestones

Major schedule milestones are presented in the scope of work presented above.

c. Third Party Impacts

No third party impacts are anticipated. An increase in the number of tagged fish recovered will effect the tag recovery laboratories operated by the Department of Fish and Game and the U.S. Fish and Wildlife Service. However, additional detection and reading equipment has been provided in this project. Beneficial third party impacts include the recreational fishermen who would have the potential to participate in an inland selective fishery on chinook salmon of Nimbus Hatchery origin and all hatchery origin steelhead. In addition, both the California Department of Fish and Game and CVPIA's Comprehensive Assessment and Monitoring Program will benefit because of the increased number of returning adults with tags. Water project operators will benefit, since a larger percentage of the total population will be tagged, by having better information on the origin of fish salvaged at diversion locations.

V. APPLICANT QUALIFICATIONS

a. Northwest Marine Technology

Northwest Marine Technology, Inc. was founded in 1971 by Dr. Keith B Jefferts, formerly of Bell Laboratories. Northwest Marine Technology has numerous invention, innovations and patents for internal fish tags. The company is the sole vendor in the world for coded wire tags and portable detection equipment. Coded wire tag sales exceed 70 million tags per year. The mass marking machine for salmonids is proprietary to NMT.

The project manager will be Guy Thornburgh, CEO of Northwest Marine Technology. Guy has previously worked with the Alaska Department of Fish and Game as a commercial fisheries statistician and spent 7 years as Executive Director of the Pacific State Marine Fisheries Commission which manages the Pacific Coastwide coded wire tag database.

Northwest Marine Technology will use several of its senior scientists, including Drs. Phil Ekstrom, Keith Jefferts, Terje Vold, and Peter Bergman, to construct the machines and develop the necessary components to reduce the minimum tagging size to 50 mm. All have extensive experience and have worked with Northwest Marine Technology for a number of years.

b. Bailey Environmental

Randy Bailey is the principal/owner of Bailey Environmental. Mr. Bailey has over twenty years experience in dealing with salmon and steelhead management. He has experience as a USDA Forest Service forest fishery biologist, served as Regional Fisheries Program Manager for the Forest Service in the California Region specializing in anadromous fish management matters. He also served as Chief of the Fisheries Division, U.S. Fish and Wildlife Service, Alaska Region for 9 years and actively managed preparation of 16 fishery management plans for Alaska national wildlife refuges and approximately 16 major fishery investigations per year. Since 1993, he has been involved in the Central Valley salmon and steelhead issues while working on a variety of projects related to water management and endangered species.

c. University of Idaho (Dr. Ken Newman)

Dr. Newman is an Assistant Professor, Division of Statistics at the University of Idaho. Ken has worked for the Northwest Indian Fisheries Commission, U.S. Fish and Wildlife Service, the Center for Quantitative Science at the University of Washington. His work has focused on statistical analysis of coded wire tagging programs in the Pacific Northwest. Ken has published (11 papers) and presented (9 presentations) extensively on

coded wire tagging, analysis of survival rates, contribution rates of tagged fish, and constant fractional marking.

Over the past two years, he has been involved in an analysis of chinook salmon coded wire tag data for the Central Valley (under contract to the U.S. Fish and Wildlife Service) and has worked with Dr. John Rice, University of California, Berkeley, to develop a model of salmon smolt survival for Sacramento River release groups. This project has been a cooperative effort between the Service and the California Urban Water Agencies. Dr. Newman has worked with Mr. Bailey (Mr. Bailey has been paid to participate in this effort by the Metropolitan Water District of Southern California) on this project.

d. Alison Britton

Ms. Britton is a data analyst who has extensive experience at managing the various databases associated with this project. She has been actively involved in manipulating and summarizing the following databases: Pacific States Marine Fisheries Commission coded wire tag recovery data, California Department of Fish and Game inland tag recovery data, U.S. Fish and Wildlife Service data from Chipps Island and beach seining locations, and salvage data from the Central Valley Project and State Water Project.

e. Jud Monroe

Dr. Monroe is a professional technical writer. He has written numerous technical articles and has conducted over 20 workshops on technical writing for fishery professionals. He has taught technical writing and research design at the University of California, Davis. Jud has been actively involved in Central Valley fish issues for the past four years and is intimately familiar with the data and individuals involved in the area. He also has extensive experience in facilitating technical meetings and reviews. He will assist in preparation of the reports and the review process.

f. California Department of Fish and Game and U.S. Fish and Wildlife Service

Both agencies have agreed to participate if this project is funded. We anticipate that Jim Smith, Project Leader, North Central Valley Fishery Resources Office, will be the Service's representative for this effort. The Department of Fish and Game has designated Alan Baracco, as their primary contact.

VI. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

Northwest Marine Technology agrees to comply with the standard terms and conditions applicable to this proposal and Project Group Type.

Item 85
}

NONDISCRIMINATION COMPLIANCE STATEMENT

NORTHWEST MARINE TECHNOLOGY

COMPANY NAME

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

OFFICIAL'S NAME

GUY N THORNBURGH

DATE EXECUTED

7/21/97

EXECUTED IN THE COUNTY OF

SAN JUAN, WASHINGTON

PROSPECTIVE CONTRACTOR'S SIGNATURE

Guy N Thornburgh

PROSPECTIVE CONTRACTOR'S TITLE

GENERAL MANAGER

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

NORTHWEST MARINE TECHNOLOGY, INC.

Item 12

Agreement No. _____

Exhibit _____

**STANDARD CLAUSES --
SMALL BUSINESS PREFERENCE AND CONTRACTOR IDENTIFICATION NUMBER**

NOTICE TO ALL BIDDERS:

Section 14835, et. seq. of the California Government Code requires that a five percent preference be given to bidders who qualify as a small business. The rules and regulations of this law, including the definition of a small business for the delivery of service, are contained in Title 2, California Code of Regulations, Section 1896, et. seq. A copy of the regulations is available upon request. Questions regarding the preference approval process should be directed to the Office of Small and Minority Business at (916) 322-5060. To claim the small business preference, you must submit a copy of your certification approval letter with your bid.

Are you claiming preference as a small business?

___ Yes* X No

*Attach a copy of your certification approval letter.

NORTHWEST MARINE TECHNOLOGY, INC.

Guy D THORNBURGH

GENERAL MANAGER

7/21/97

[Signature]