American Fisheries Society
Western Division

ABSTRACTS

FISHERIES TECHNICAL SESSIONS

ANNUAL MEETING

PORTLAND, OREGON

JULY 20-23, 1986

July 22, Tuesday
10:30 a.m. - 12:30 p.m. - Session A
1:30 p.m. - 3:00 p.m. - Session A

STATUS AND MANAGEMENT OF CUTTHROAT TROUT: ARE WE PHASING OUT A VALUABLE RESOURCE? Jack Griffith, Moderator, Idaho State University.

A Western Division American Fisheries Society Special Publication is available for purchase.

10:30 a.m. - 12:30 p.m. - Session B

THE PROS AND CONS OF UPRIVER STOCKS. Bill Platts, Moderator, USDA, Forest Service - Research.

Speakers:

Doug Dettant, The Federal Perspective (No abstract submitted)

Don W. Chapman, The Consultant Perspective

RE: Subversive thoughts on mixed-stock mitigation.

Abstract: I reviewed some biological costs and benefits of mixed-stock mitigation using summer spill as an example. I suggest biologically cost-effective alternatives to summer spill.

Bill Currie, the Economic Realities. (No abstract submitted)

Tim Wapato, Indian Nation's Perspective. (No abstract submitted)

Terry Holubetz, The State's Perspective. (No abstract submitted)

July 22, Tuesday
1:30 p.m. - 3:00 p.m. - Session B

ETHICS OF FISH AND WILDLIFE PROFESSIONALS. Peter Bisson, Moderator, Weyerhaeuser Company.

Fish and wildlife professionals face an increasingly complex working environment. As members of a profession with little external or internal regulation (compared with other professions, e.g., physicians and attorneys), both scientists and administrators must confront situations that may require moral and/or ethical judgement without well-established guidelines and rigidly enforced codes of ethics. Decisions are often based on individual biases, however well intentioned. In this session, we will explore some of the more common problems involving the etics of fish and wildlife professionals, and attempt to identify some realistic solutions. We will attempt to focus on situations in which ethical choices are not easily identified as black or white, but rather the "gray" choices that we all make daily.

Participants in the session are grouped into a panel of experts and a panel of questioners. The experts (Don Chapman, Jim Hall, and Bill Platts) have been selected based on the breadth of their professional experience. The questioners (David Hoopes, Don Martin, Hiram Li, and Paul Hanson) also represent a broad spectrum of scientific interests. Both the experts and questioners have been told that any aspects of ethical scientific behavior is fair game for the discussion. If time permits, questions from the audience will be encouraged.

July 23, Wednesday
8:30 a.m. - 10:00 a.m. - Session A

LIMITING FACTORS ON SMOLT PRODUCTION. Fred Everest, Moderator, USDA, Forest Service - Research.

IDENTIFICATION OF FACTORS LIMITING SMOLT PRODUCTION: THE KEY TO SUCCESSFUL HABITAT MANAGEMENT. Peter A. Bisson, Weyerhaeuser Company, Tacoma, WA 98477

Increased production of salmonid fishes is the desire goal of many western stream enhancement projects. Where the species of interest is anadromous, greater smolt yield from a watershed is the ultimate measure of the success of habitat restoration. Stream enhancement projects are often not followed by critical evaluations of their effectiveness in achieving desired goals. As a result, we have relatively little knowledge of the benefits derived from widespread habitat management programs. Some follow-up studies have shown that increased smolt production has not occurred following stream restoration. In order to engage in cost-effective habitat management, it is necessary to accurately recognize the key factors limiting smolt production. Where such factors are not successfully identified, enhancement projects risk failure. There are currently several barriers to identifying important limiting factors: (a) excessive reliance on professional judgement in the absence of sound data, (b) errors in extrapolating findings from limited reach surveys to entire drainages, (c) oversimplification of complex ecological situations, (d) focusing exclusively on one aspect of freshwater life history (e.g., restoring spawning gravel), and (e) failure to consider the importance of certain critical factors (e.g., food availability) that are not directly linked to the condition of physical habitat. There is no a priori reason to believe that the same limiting factors apply equally over a broad geographical area. Therefore, recognition of key constraints on smolt yield will require detailed and accurate information from the area of concern, knowledge of the life history patterns of the species of interest, an appreciation of the complexity of the system, and a perspective that is basis oriented. This kind of information will not be easily obtained. Short cut approaches to habitat management should be applied with caution and with an understanding of their limitations.

LIMITING FACTORS--THE NEED FOR A BASIN FISH HABITAT PERSPECTIVE. J. R. Sedell, F. H. Everest, and G. H. Reeves, USDA Forest Service, Pacific Northwest Research Experiment Station, Corvallis, OR

Forest land managers and fisheries biologists are information poor when cutting units or enhancement projects are placed in a basin fishery context. They have examined fish habitat, fish species distribution, population estimates, and smolt outmigrants in four basins ranging from 60 to 300 km^2 in size. These basins have different geologies, land use, and natural disturbance histories. It was found that small habitat areas for both summer and winter juvenile salmonid rearing were disproportionately more productive. Many subbasins which had been initially considered to be productive by professional biologists were not. Areas of high densities often have the potential to yield very few smolts when considered

from a basin perspective. Smolt output patterns also indicate the importance of a few areas within a drainage. Fisheries resource and timber land managers are engaged in a give and take within a basin for the same resources. Information of fish utilization of habitats and smolt outputs help focus the discussions in order to prioritize the fisheries needs within a basin. Such information is a necessity when considering the type and location of fish habitat restoration and maintenance projects within a basin. A premium is placed on detailed past and present stream habitat inventory information.

FACTORS LIMITING PRODUCTION OF OUTMIGRANT SALMONIDS FROM CARNATION CREEK BEFORE AND AFTER LOGGING. L. Blair Holtby and Gordon F. Hartman, Pacific Biological Station, Dept. of Fisheries and Oceans, Nanaimo, B.C. Canada. V9K 5K6.

Sufficient life history data for coho salmon have been collected from Carnation Creek, British Columbia (15 years or 13 complete life cycles) to have enabled us to put together a detailed empirical model of smolt production. This model was used to examine the relative importance that variability in: 1) climate (e.g., temperature and discharge); 2) biological variables (e.g., spawner density); and 3) physical stream configuration (e.g., gravel quality and stream stability) have had in determining the observed variations in smolt production. The most important limit to smolt production is the over-winter survival of sub-yearlings. Their survival rate is strongly size dependent, and is therefore determined by density dependent processes over the preceding summer and by variations in the length of the growing season. Logging related changes in winter and spring temperatures through their effect on coho emergence timing, account for most of the nearly two-fold increase in smolt production that has been observed in the aftermath of logging. Effects of summer flow conditions on smolt production appear to be indirect. Prolonged summer low flows reduce the growth rates of sub-yearlings over the summer, leading to higher over-winter mortalities and reduced smolt production the following spring. The production of smolts is strongly buffered against variations in biological variables through density-dependent growth and mortality at various life stages. With stable stream conditions and constant climate, smolt production was not sensitive to large changes in spawner density. The empirical models were developed before there were marked changes in stream stability. Logging-related degradation of the stream is accelerating, and there is some evidence that our models are now over-estimating smolt production.

RESPONSES OF JUVENILE STEELHEAD TROUT AND COHO SALMON TO THE ENRICHMENT OF THE KEOGH RIVER WITH INORGANIC FERTILIZER. C. J. Perrin(1), and P. A. Slaney(2)

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Research was initiated in 1981 in experimental stream sections to investigate the role of inorganic nutrients on salmonid production in coastal streams. In 1984 and 1985, the entire Keogh River, with the exception of and upstream control, was enriched with regulated additions of phosphorus and nitrogen. Concentrations of soluble reactive phosphate (SRP) and dissolved inorganic nitrogen (DIN) were increased ten and five times, respectively, to 10 ug.L^{-1} SRP and 100 ug.L^{-1} DIN during April to September. Periphyton accumulation rates increased substantially aside from a month during early summer. Compared to the control, the mean size of underyearling coho salmon and steelhead trout doubled by autumn in 1984 and 1985 in the upper and middle reaches, but increased only marginally in a lower reach. Mean weight of yearling steelhead parr was marginally increased over the control in 1984, but approximately doubled in 1985. Effects on salmonid smolt production can be predicted, but remain uncertain until enumerations are completed in 1986 and 1987.

July 23, Wednesday
8:30 a.m. - 10:00 a.m. - Session B

AN ALTERNATIVE TO PRESENT COHO AND CHINOOK SALMON MANAGEMENT. Bob Phillips, Moderator USDA, Forest Service

Current management is described. The difficulty is discussed of allocating the harvestable surplus among the fisheries: Indian and non-Indian, recreational and commercial, Oregon and other states, US and Canada. Current management is complicated by nonselective harvest of mixed stocks, small average size of fish harvested, loss from hooking mortality, and high cost of harvest. As an alternative, a terminal fishery is proposed that would harvest coho and chinook at the mouths of the rivers or in estuaries. Advantages of a terminal fishery are presented. The reaction of representatives from the Indian fishery, the commercial fishery and the recreational fishery is given.

°A Review of Present Management

Mac Zirges, Ocean Salmon Management Program
Oregon Dept. of Fish and Wildlife — 15 Minutes

°A Rational Alternative (Terminal Fishery)

Carl Bond, Prof. of Fisheries (Ret.)
Oregon State University — 15 Minutes

°Reaction of User Groups to Alternative:

Recreational Fishery --
Frank Warrens, Charterboat Operator — 10 Minutes

Commercial Fishery --
David Schlip, Commercial Salmon Troller — 10 Minutes

Indian Fishery --
(To be arranged) — 10 Minutes

July 23, Wednesday
10:30 a.m. - 12:00 p.m. - Session A

CAN FISHERIES SURVIVE NONPOINT SOURCE IMPACTS?
Donald M. Martin, Moderator, US Environmental Protection Agency.

CAN FISH HABITAT (SUBSTRATE) BE USED AS A MEASURE OF ENVIRONMENTAL CHANGE, OR HOW MUCH CAN YOU CLOSE THE REDDROOM DOOR BEFORE THE FISH POPULATION IS GONE? Donald M. Martin, US EPA, Region 10, Idaho Operations Office, Boise, Idaho.

Fisheries and water quality in Idaho have suffered severely from the impacts of sediment from nonpoint sources such as agriculture, logging, and mining activities; such impacts are not unique to any state in the Northwest. Yet all states are required by the regulations of the Clean Water Act to have and implement an antidegradation policy in their water quality standards, and such a policy should provide for adequate protection of designated beneficial uses (i.e.; fisheries) from point and nonpoint sources of pollution. Recent activities in Idaho may indicate a new trend toward quantifying acceptable levels of impact to fish habitat from nonpoint source activities as a viable use of the antidegradation concept. These efforts have taken the form of using the degradation of fish habitat (spawning, summer or winter rearing) as a measure of impact on fish populations. Fisheries is a designated benefical use, who's protection serves as the basis for state's water quality standards and the Clean Water Act.

RELATIONSHIPS AMONG FISH POPULATIONS, SEDIMENT DEPOSITION, GEOMORPOHOLOGY AND LAND MANAGEMENT PRACTICES IN THE SOUTH FORK SALMON RIVER, IDAHO. Russ Thurow, Idaho Dept. of Fish and Game; Rick Edwards, and Dave Burns, Payette National Forest, USFS.

Embeddedness and salmonid densities were measured independently by different groups of workers in the same stream reaches. Embeddedness and maximum densities of steelhead trout, cutthroat trout and chinook salmon in 10% embeddedness increments were significantly related ($P=0.01$, $r=-0.99$). Steelhead, cutthroat and chinook densities for all locations were significantly related to embeddedness ($P=0.01$, $r=-0.62$). Bull trout densities were significantly related to embeddedness ($P=0.01$, $r=-0.49$). The relationship of embeddedness to fish density was similar to that described by other researchers. Embeddedness was related to various watershed characteristics, such as watershed size and steram gradient, land disturbance, such as acres of road, and modeled sediment yield. Road acreage and modeled sediment yield could both independently account for about two-thirds of the observed variation in mean embeddedness. When geomorhphic characteristics, such as land types were averaged together during sediment modeling, significant loss of model credibility occurred.

CURRENT EFFORTS TO BETTER DEFINE FISH HABITAT RELATIONSHIPS AND THE USE OF MODELING IN THE U. S. FOREST SERVICE. Paul Brouha, USDA Forest Service, 605 RPE, P. O. Box 2417, Washington, D.C. 20013

Efforts to define nonpoint source pollution impacts to fisheries from

forest development projects have centered on sediment produced from road construction, timber harvest, and fire activities. Recent limiting factor analysis indicate other habitat factors (temperature, lack of large woody debris) may be limiting fish populations in certain areas. In addition, other activities such as livestock grazing, hydropower development, and mining are being recognized as having major potential impacts to fisheries in certain areas. Presently, new habitat models addressing these habitat factors are under development to enable resource managers to predict and demonstrate substantial changes in stream habitat quality from development activities. These models will be used in decision-making processes to address project-level tradeoffs as well as cumulative effects of many projects in third order and larger stream drainages.

WATERSHED/STREAM CLASSIFICATION FOR MANAGEMENT OF ANADROMOUS FISH STOCKS AND THEIR HABITATS IN SOUTHWESTERN OREGON. Christopher A. Frissell, William J. Liss, and Charles E. Warren, Oak Creek Laboratory of Biology, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331.

Following over two decades of serious decline and local extinction of native runs of fall chinook, coho, and steelhead in coastal rivers of southwest Oregon, Oregon Department of Fisheries and Wildlife in 1985 initiated a planning effort for protection and restoration of these populations. Because of the region's complex variation in geology, topography, and stream characteristics, a comprehensive classification system--which identifies key links between watersheds and streams, and maps zones of similar habitat potential--could provide a framework for organizing and integrating many aspects of planning, management, and research. Such aspects include estimating present and potential production, reconstructing causes of stock declines, determining escapement needs, identifying watershed management practices necessary to protect habitat quality, and planning enhancement activities.

Our strategy is to apply a hierarchical classification system that relates variation in site-specific habitat features to watershed characteristics. In the study area, bedrock geology strongly controls topography, soils, vegetation, groundwater, and mass erosion processes. Resistance and weathering patterns or rock types likewise determine drainage density, valley width, stream gradient, channal shape, and bed composition. Floods, clear-cut loggins, farming, and development have severely impacted fish habitat, but these impacts vary between different geologic/geomorphic zones and land types. These zones also differ in historic productivity of anadromous fish. As the study progresses, geologic maps, historic photo interpretation, and field data will be synthesized in reports and maps delineating watersheds, land types, and corresponding stream habitat units. Allied research may examine life history density of local stocks in relation to habitat patterns in space and time.

ANALYSIS OF FISH HABITAT IMPACTED BY MINING, AND OPPORTUNITIES FOR RESTORATION IN THE PANTHER CREEK DRAINAGE OF IDAHO. Dudley W. Reiser, Michael P. Ramey, Janet M. Peters, and Paul DeVries, Bechtel, Inc., San Francisco, California.

Panther Creek, a tributary of the Salmon River, historically supported large runs of chinook salmon and steelhead trout. The runs were eventually

eliminated in the early 1960's, and today the drainage remains largely uninhabitable due to toxic conditions in Panther Creek imposed by mine drainage. Although much of the toxic materials can be linked directly to specific point sources (e.g., mine adits, isolated waste rock piles), a substantial amount of the contaminants are unaccounted for and can be attributed to nonpoint source contamination. Sources of this material are likely the exposed waste rock piles, tailings dam, and underground seepage.

In 1984, Bechtel National, Inc., was contracted by the Bonneville Power Administration (BPA) to conduct a multi-disciplinary study focused on eliminating the sources of toxic effluent entering Panther Creek. As part of this project, the fisheries habitat was quantified above the sources of mine contamination (to serve as an index to what could be restored should the contaminant problem be controlled), and engineering alternatives were formulated and costed for eliminating the source of the toxic problem.

This paper presents a summary of both of these facets. From an engineering prospective, it is felt that both point and nonpoint source contaminants can be controlled to a sufficient degree to allow the restoration of anadromous fish runs into the Panther Creek drainage. However, the cost for this effort is high, ranging from $3.7 to 8.1 million depending upon the various alternative.

EFFECTS OF DOMESTIC LIVESTOCK GRAZING ON AQUATIC MACROINVERTEBRATES IN A MONTANE STREAM, NEW MEXICO. John N. Rinne, Rocky Mountain Forest & Range Experiment Station, Forestry Sciences Laboratory, Arizona State University, Tempe, Arizona 85282.

Aquatic macroinvertebrate populations were examined within and outside grazing exclosures extant for a decade on a montane stream (elevation 2,600 m) in northern New Mexico. Density of macroinvertebrates varied significantly among years and between grazed and ungrazed reaches of stream. Biomass also exhibited great variation, but was not significantly different between the two differently-managed areas. Biotic Condition Indices (BCI), however, were significantly greater in the ungrazed reaches of stream. The results of study will be discussed relative to viability of research on National Forest Streams, fencing of streams, watershed effects, and the use of aquatic macroinvertebrates and BCI for studying the effects of domestic livestock grazing on stream habitats and biota.

July 23, Wednesday
10:30 a.m. - 12:00 p.m. - Session B

CONTRIBUTED PAPERS. Allan Thomas, Moderator, USDI - Bureau of Land Management

IMPACT OF ORGANIC LOADING ON FISH PRODUCTION AND PREDATOR-PREY RELATIONSHIPS IN NEW MEXICO. Richard A. Cole, Rober A. Deitner, Robert Tafanelli, Gabriel Desmare, and Paul Turner, Dept. of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces, New Mexico.

Three years of study at six New Mexico reservoirs were conducted to estimate organic loadings from watersheds, reservoir primary production, and secondary productions of zooplankton, zoobenthos, detritivorous fish, and carnivorous fish (mostly sport fish). Conversion efficiencies among

trophic levels were calculated. Watershed loading of organic matter from the watershed contributed 57 to 85% of the total mean-annual organic loading (primary production plus watershed sources) to the resevoirs. Fish production in the six reservoirs averaged over 700 kg/ha/yr, but over two thirds was production of detritivorous fish (clupeids, catastomids, and Cyprinus carpio) in reservoirs where they occurred. Detritivorous fish production was inversely correlated with invertebrate production, indicating that production of invertebrate--feeding fishes (Lepomis, Ictalurus) was reduced by detritivores. Piscivorous fishes (Stizostedion, Morone, Micropterus) were more efficient converting the total fish-food resource into piscivore production in reservoirs without detritivorous fishes. Among reservoirs where detritivorous fish occurred, piscivores most efficiently consumed their prey when prey growth rates and mean lengths were relatively low.

Dominance by detritivorous fishes and inefficiency of predation on them appear to be fostered by year-to-year fluctuations in organic loading. During years of high organic loading, young detritivorous fishes grow rapidly, and large numbers survive to reproductive size within one year. Once this size is reached, the detritivorous fish are invulnerable to most predators and have larger reproductive potentials. During years with low organic loads, zooplankton are scarce and competition between the abundant clupeid larvae and sportfish larvae results in restricted gamefish recruitment. Thus, instability in organic loading causes low densities of rapidly growing piscivores incapable of complete use of the detritivorous forage.

THE USE OF HYDRAULIC SIMULATION TO EVALUATE HABITAT-IMPROVEMENT STRUCTURES
Timothy S. Hardin, Ph.D., Hardin-Davis, 2910 NW Miller Lane, Albany, Oregon 97321.

Proposals for instream habitat-improvement structures rarely attempt to quantify benefits before constructon begins. In a study on St. Vrain Creek, Colorado, Physical Habitat Simulation (PHABSIM) techniques were used to predict the effects of three common types of habitat-improvement structures. These were: boulders, check dams, and wing deflectors. The water-surface profile (WSP) program was used to simulate channel change, hydraulic changes, and the effects onm trout habitat at 6 sites. Structures were evaluated using a benefit-cost ratio based on construction and maintenance costs, increase in weighted usable area, and flood hazard.

SELENIUM CONTAMINATION OF FISHES AND THEIR FOODS FROM AGRICULTURAL TILE DRAIN WATER IN THE SAN JOAQUIN VALLEY. Michael K. Saiki, U. S. Fish and Wildlife Service, CNFRL Field Research Station, 6924 Tremont Road, Dixon, CA 95620.

This study documented high concentrations of selenium in water, sediment, forage organisms, and fishes inhabiting the Kesterson Reservoir, (a 1,200-acre storage and evaporation facility in Merced County), and the San Luis Drain [conveys title (subsurface) drainage from about 5,000 acres of farmland in Fresno County to Kesterson Reservoir]. Selenimum concentrations in biota from the reservoir and drain (referred to collectively as Kesterson) exceeded 300 ppm (dry weight basis) in some samples of algae, submergent vegetation, chironomids, and mosquitofish. Furthermore, selenium concentrations in Kesterson averaged about 100-fold higher than those in samples

from the Volta Wildlife Area, a nearby site that does not receive tile drainage. Fish samples from canals and sloughs in the Grassland Water District (located adjacent to Kesterson; receives tile drainage mixed with higher quality irrigation water) also contained elevated concentrations of selenium (up to 23 ppm dry weight in green sunfish from Mud Slough), indicating that the contamination was not confined to Kesterson.

Studies by other investigators have shown that selenium is an essential element, required in trace quantities of 0.05 to 0.3 ppm (dry weight basis) in the diet; however, dietary levels exceeding about 10 ppm are toxic to poultry, rainbow trout, and other animals. Thus the levels of selenium in forage organisms from Kesterson are probably toxic to sensitive animals; this may explain the recent observations of dead and deformed embryos of aquatic birds nesting in the reservoir. The elevated concentrations observed in fishes from the Grassland Water District also suggest potential selenium toxicity to fish-eating animals. However, it is not known whether the elevated body burdens of selenium impair reproduction and survival of these fishes.

DAILY FOOD CONSUMPTION AND DETERMINATION OF ORIGIN OF JUVENILE CHINOOK SALMON DURING THE SEAWARD MIGRATION. Michael L. Gross and Dennis W. Rondorf, U. S. Fish and Wildlife Service, National Fishery Research Center, Willard Substation, Cook, WA 98605.

Scale characteristics and step wise discriminant analysis were used to classify juvenile chinook salmon, (Oncorhynchus tshawytscha) from the Columbia River as subyearling, hatchery yearling, or wild yearling for subsequent analysis of food consumption. Accuracy of classification of hatchery yearling and wild yearling scales ranged from 82% to 94% correct. Daily food consumption (mg dry weight food.fish^{-1}.day^{-1}, daily caloric intake (cal.fish^{-1}.day^{-1}), and daily ration (food as percent of body weight) were estimated for each group classified by scale analysis. Daily caloric intake at 14C was 912 cal.fish^{-1}.day^{-1} (3.8% daily ration) for yearling salmon (hatchery and wild) and 1,170 cal.fish^{-1} day^{-1} (9.6% daily ration) for subyearling salmon. Daily caloric intake of yearling chinook salmon collected at 9.5C was 306 cal.fish^{-1}.day^{-1} (1.2% daily ration). The lower food consumption by yearling chinook salmon compared to subyearling fish was attributed to the tendency of subyearling fish to migrate near shore where insect drift is more abundant, and to migrate more slowly, allowing more time to actively search for food. Separation of hatchery from wild smolts by discriminant analysis of scale characters should prove useful in studies examining physiological or behavioral differences, particularly in small river systems where higher accuracy could be expected.

RESTORATION OF THE "ENDANGERED" GILA TROUT AT STAGE 3 AND HOLDING. Paul R. Turner, Department of Fishery and Wildlife Sciences, New Mexico State University.

The restoration program for the Gila trout (Salmo gilae), has gone through several distinct stages since it was first officially recognized as endangered in 1966. Initial restoration efforts in 1970-72 consisted of transplants of Gila trout from the type locality into three small streams which were historically barren of trout. Passage of the Endangered Species Act and creation of the Gila Trout Recovery Team initiated

the second stage in the restoration process and led to systematic survey of the Gila National Forest, New Mexico to determine which streams still supported genetically pure populations of S.gilae and to evaluate potential restoration streams. Indigenous populations of pure S.gilae were found in five widely separated headwater streams.

Completion of the Gila Trout Recovery Plan in 1979 signaled the third stage in the recovery of S.gilae by the cooperating agencies. The prime objective of the Plan was to insure the maintenance of viable populations in the wild of all five morphotypes (from indigenous streams). The process of accomplishing this objective has required antimycin treatments to eliminate hybric and exotic trouts and transplants of pure S.gilae from three of the four unreplicated morphotypes into headwater reaches of three relatively large streams. A transplant from the fifth indigenous stream is scheduled for 1987, and the Fish and Wildlife Service has begun work on the downlisting package. Completion of the third stage of the recovery plan also requires evaluation of the Gila trout's desirability as a sport species, and an aggressive public relations campaign to encourage public acceptance of the next stage in the restoration process. Assuming satisfactory resolution of the stage three objectives and downlisting to threatened status, the next stage will be the staged, downstream expansion of reintroduced S.gilae populations into the lower reaches of several drainage systems.

REACTIONS OF BROWN TROUT TO ULTRAVIOLET AND VISIBLE LIGHT. W. T. Helm and T. H. Lee, Utah State University, Logan, Utah.

Brown trout (Salmo trutta) demonstrated an avoidance respose to an average value of 3,500 u watts cm $^{-2}$ of artificial ultraviolet and 646 foot-candles of artificial visible light. These values represent about 25 percent of full incident natural ultraviolet, and six percent of full incident natural visible light. Field measurements made in the open and under a variety of riparian canopies in a mountain river indicate both ultraviolet and visible light may be present at avoidance levels for resting trout in many locations. Resting residence time ranged from 27 to 100 percent for ultraviolet, and 9 to 100 percent for visible light at seven stations, and feeding residence time range from 64 to 100 percent at the same locations. The onset of avoidance response levels of the two wave bands was similar; visible light intensities reached avoidance values at the same time or prior to and lasted until the same time or later than ultraviolet light. To estimate the value of riparian vegetation for providing shaded daytime resting habitat, the height of cover above the stream bed is suggested for use, rather than the height of cover above water.

CONTRIBUTED PAPERS - POSTER SESSION - ROSE ROOM

BONNEVILLE POWER ADMINISTRATION (BPA) DIVISION OF FISH AND WILDLIFE DISPLAY. Sharon K. Blain, Division of Fish and Wildlife, Department of Energy, P. O. Box 3621, Portland, OR 97208-3621

For years, the Bonneville Power Administration's only job was to market power from the Federal dams on the Columbia River and its tributaries. Now BPA has a new assignment - to repair the damage done by the Columbia's hydroelectric dams to the Basin's fish and wildlife. The 1980 Pacific Northwest Power Act gave BPA these new responsibilities. As a result, BPA is funding over 150 projects throughout the four Columbia Basin states. BAP is committed to balancing the region's need for power production, flood control, recreation, and irrigation with the region's economic and cultural demands for fish and wildlife.

DO NATURALLY SPAWNING HATCHERY STEELHEAD AFFECT THE GENETIC RESOURCES OF WILD STOCKS?: PRELIMINARY FINDINGS FROM THE KALANA RIVER, WASHINGTON. Steven A. Leider and Mark W. Chilcote Washington Department of Game, 600 N. Capitol Way, Olympia, WA 98504.

Preliminary results from summer-run steelhead genetic marking studies in the Kalama River indicate that the success of naturally spawning hatchery fish (Skamania stock) in producing adult offspring is 18% of that for wild fish. Differential mortality occurred within both the freshwater and marine phases. This suggests smolt-to-adult survival for naturally produced offpring of hatchery spawners may be limited by the proportion of "hatchery-type genes" in the offspring population. For rivers where hatchery and wild steelhead are not reproductively isolated, this genetic impact will probably reduce the natural productivity and potential adult returns of subsequent wild generations. Using empirical Kalama River data, this is demonstrated in the form of a relationship between hatchery wild spawner ratios and natural production potential.

HATCHERY-REARED SALMONIDS: FORGOTTEN PREDATORS IN THE COLUMBIA BASIN? D. D. Dauble, R. H. Gray, T. L. Page, Battelle, Pacific Northwest Laboratory, Richland, WA 99352 and W. B. Duke, Oregon Dept. Fish and Wildlife, Enterprise, OR.

The role of juvenile salmonids as predators in naturl ecosystems is well documented, but poorly understood in terms of systems-wide management of native salmonid populations. We collected juvenile chinook salmon, released from upriver locations, in the Hanford Reach of the Columbia River, from 1973-1978 and 1984-1985, to identify feeding habits. Methods of capture included gill net, fyke net, beach seine, electroshocker, and hook-and-line. Juvenile salmon (87-337 mm FL) were opportunistic feeders, consuming a wide variety of terrestial and aquatic insects (>10 orders). Pupal and adult Trichoptera and Diptera were primary components of the diet during all seasons. Age-0 fall chinook salmon were also a major food item following their emergence from redds below Priest Rapids Dam. Incidence of piscivory average 35% during the spring 1975-1978 (n=34), but only 5% in 1984 (n=258). A preliminary model, based on mouth gape of predators (smolts) and body depth of prey (fry), suggests that major hatchery releases of juvenile summer/spring chinook

salmon could influence survival of wild 0-age fall chinook salmon that rear in the Hanford Reach. Results may be applied to management of hatchery releases in other river systems.

AN EVALUATION OF FISH PASSAGE AT THE SUNNYSIDE CANAL FISH SCREENING FACILITY. Duane A. Neitzel, C. Scott Abernethy, E. William Lusty, and Leslie A. Prohammer; Pacific Northwest Laboratory, Richland, Washington.

The Sunnyside Canal Fish Screening Facility is in the Sunnyside Canal, about 500 m downstream of the Sunnyside Dam on the Yakima River (river kilometer 167). The screening facility diverts fish that have entered the canal back into the Yakima River.

We branded and released about 4,000 chinook salmon, Oncorhynchus tshawytscha and 2,000 steelhead, Salmon gairdneri, smolts in front of or within the screening facility. We caught 507 of the steelhead and none were descaled or killed. We caught 3,625 of the chinook salmon and less than 2% were descaled or killed. Our data indicate that fish were safely diverted from the Sunnyside Canal into the Yakima River.

The fish screening facility is part of a joint project by the Bonneville Power Administration and the Bureau of Reclamation to construct fish passage and protective facilities at existing irrigation and hydroelectric diversions in the Yakima River Basin. The project is part of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program.

THE APPLICATION OF A DUAL-BEAM HYDROACOUSTIC SYSTEM AS A FISH SIZE CLASSIFIER ON THE KENAI RIVER, ALASKA. Samuel V. Johnston, BioSonics, Inc. 4520 Union Bay Pl. NE, Seattle, WA 98105; David M. Gaudet, Dr. Paul A. Skvorc, Alaska Dept. of Fish and Game Division of Commercial Fisheries, Research Section, Box 3-2000, Juneau, AK 99802.

Recent developments in echosounding technology have made possible the in situ measurement of target strength for individual fish targets as they pass through an acoustic beam. Target strength is a measure of acoustic reflectivity which is related to fish size (R. H. Love, 1971). The measurement of target strength is accomplished using a dual-beam echosounding system (J. E. Ehrenberg, 1978). With this system, it is possible to separate fish on the basis of size and direction of movement. The system combines signal processing hardware and computer software to select acoustic returns from each individual fish target and group them together to allow mean target strength to be calculated from several echoes from the same fish.

The Kenai River in South Central Alaska supports one of the largest king salmon (Oncorhynchus tschawytscha) sport fisheries in the state, as well as a large commercial sockeye salmon (Oncorhynchus nerka) fishery. Managing these two fisheries requires that accurate estimates of each run be made separately. During the summer of 1985, Alaska Department of Fish and Game funded and, with the assistance of BioSonics, Inc., carried out research on the Kenai River to determine if fish targets could be classified as to size using the dual-beam acoustic system. Since the size distributions of the two primary fish species in the Kenai River are non-overlapping, this would allow target classification by fish species as well. Results indicate that the dual-beam acoustic system could separate fish targets into species groups based on size. In addition, target

direction (upstream or downstream) was determined to allow removing downstream traveling debris from the data base.

COMPARATIVE GROWTH AND DEVELOPMENT OF DIPLOID AND TRIPLOID COHO SALMON ONCORHYNCHUS KISUTCH. Orlay W. Johnson (1,2), Walton W. Dickhoff (1,2) Fred M. Utter (1).

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This paper compares growth and gonadal development of triploid coho salmon in three treatment groups. The comparisons were made in fresh and seawater from the time of smoltification at 18 months to the onset of sexual maturity at 37 months. No differences were detected in the ability of triploids to smoltify and to successfully adapt to seawater under normal conditions. Likewise, no differences were observed in growth parameters (length, body weight, or condition factor).

Gonadal development was more severely retarded in female triploid fish than in males. The average gonado-somatic index (GSI) of triploid males at 37 months of age was 80.5% of diploids, and overall male gonadal development suggests that some form of spermiation would occur at the time of malturation in the diploid controls. Triploid females showed an almost complete blockage of gonadal development and oocyte maturation. The average GSI of triploid females was 11.8% that of diploid females. Vitellogenin was undetectable in triploid females, but was present in diploid females; a correlated reduction in the hepato-somatic index was observed in triploid relative to diploid females. Estradiol levels in the plasma of the triploid fish were on the average significantly lower than in the diploid controls after the 30th month.

Abstract

FISH HABITAT INVENTORY AND INFORMATION PROGRAM

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The Department of Fisheries and Oceans (Canada) and the Ministry of Environment (British Columbia) have embarked on a cooperative Fish Habitat Inventory and Information Program. The overall goal of the program is to compile a comprehensive inventory of the quality, quantity and productive capability of fish habitats in freshwater, estuarine and marine environments of British Columbia. To achieve this goal, three main tasks have been identified: (1) gather, organize, file and retrieve **existing** information on fish habitat; (2) develop standard formats and procedures for collecting and recording **new** information on fish habitat; and (3) store information collected by tasks 1 and 2 in a computerized geo-referenced data base system.

The Stream Information Summary System (SISS), developed as part of task 1, stores existing fisheries information on a stream by stream basis. The summaries include information on fish habitat, distribution, escapement, management activities, and an overview of fish production potential. In addition, a key-worded bibliography is produced for each stream. Programs to input, store and output this information have been written on a commercial data base management system (dBASE III) for IBM or IBM compatible personal computers. Some key features of the system include: interactive data entry and edit screens, range and value error checking, hard copy reports and the ability to search and sort by stream name or watershed code.